Appendix H:
Hydrology and Water Quality Supporting Information

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H.1 - Preliminary Drainage Plan

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Kimley-Horn
and Associates, Inc.

PRELIMINARY DRAINAGE REPORT

Proposed Walmart Store No. 3129-00
Southeast corner of Archibald Ave. and Limonite Ave.
Eastvale, California

August 2012

PREPARED FOR:

Wal-Mart Stores, Inc.
2001 SE 10th Street
Bentonville, AR 72716

PREPARED BY:

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

Kimley-Horn
and Associates, Inc.

PRELIMINARY DRAINAGE REPORT

FOR

PROPOSED WALMART STORE NO. 3129-00

EASTVALE, CALIFORNIA

August 2012

Kimley-Horn and Associates, Inc.

TABLE OF CONTENTS

Project Description and Report Purpose

The proposed project is located on an approximately 37.44 acre site located on the southeast corner of Archibald Avenue and Limonite Avenue in the City of Eastvale, Riverside County, California. For reference, see ***Exhibit 1***, *Location Map*.

This project is a commercial development for a proposed Walmart. This proposed development will include the construction of an approximately 180,000 square foot building, parking facilities, driveway entrances connecting to existing roads, three outlots containing three retail shops and a gas station, an underground infiltration system, and one detention basin. Improvements within the site will provide an internal drainage and storm water detention system to convey flows within the site. One detention basin is proposed within the site.

There is an existing 54 in. storm sewer pipe that is part of Riverside County's Master Drainage Plan (MDP) that lines the site along Archibald Avenue. This pipe was designed to hold the stormwater runoff for a Single-Family residential site. Since the proposed site has changed use to Commercial, a detention basin has been designed to hold the difference between what Riverside County Flood District designed the pipe to hold and the proposed runoff for the Walmart site for the 100 year storm event.

The purpose of this report is to provide information about the design of the Storm Water Management System (SWMS) for the proposed project. This investigation was conducted to evaluate the hydrologic and hydraulic conditions of the project described above. The purpose is also to determine the impact that the proposed development has on the local drainage system and to ensure that the post development peak flows will not increase beyond the level at which the Riverside County's Master Drainage Plan designed the storm sewer lateral along Archibald to hold.

Calculation Methodology

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

Runoff calculations were performed using the rational method computer program Advanced Engineering Software (AES), 2009 version. This method calculates time of concentration and runoff rates using criteria as specified in the Hydrology Manual. Intensity values were obtained from National Oceanic and Atmospheric Administration (NOAA) Atlas 14. Loss rates were calculated using soil data obtained from the Natural Resources Conservation Service (NRCS) Web Soil Survey for Riverside County, California, Santa Ana River Area. Existing elevation data for travel flowpaths were obtained from an ALTA/ACSM land title survey completed for the project site February 7, 2011. Results from these calculations are included with this report as ***Appendix B***, *Rational Method Calculation Results*.

Hydrograph calculations were performed using the computer program Advanced Engineering Software (AES), 2009 version. This method calculates a unit hydrograph using lag time, maximum watershed loss rates, low loss fraction, and an S-graph as specified in the Hydrology Manual. Lag was calculated using the time of concentration calculated from the rational method

analysis. The maximum watershed loss rate was obtained directly from the rational method analysis. The low loss fraction was calculated using soil data obtained from the NRCS Web Soil Survey for Riverside County, California, Santa Ana River Area. The Valley: Developed S-graph was used to develop the unit hydrograph. Results from these calculations are included with this report as ***Appendix C****, Hydrograph Calculation Results*.

The computer program Hydraflow Hydrographs Extension for AutoCAD Civil 3D 2009, by Autodesk, Inc. was used to design and model the proposed detention basin and outlet structure for this project. Hydraflow Hydrographs routes a hydrograph through a detention basin according to the requirements specified in the Hydrology Manual. The unit hydrograph was input directly along with proposed stage-storage-discharge information. See **Appendix D**, *Detention Basin Calculation Results*.

Description of Site

Our site is located in the Federal Emergency Management Administration (FEMA), Flood Insurance Rate Map (FIRM) panel number 06065C0677G. The FIRM index for Riverside County indicates "Panel Not Printed – No Special Flood Hazard Area" for the panel where the project site is located. Per conversations with Federal Emergency Management Administration (FEMA) Flood Insurance Rate Map (FIRM) technicians and considering adjacent panels 06065C0681G, and 06065C0679G, it has been determined that the project site is located within Zone X Flood Zone Designation. Zone X is defined by FEMA as the area determined to be outside the 500- year flood and protected by levee from 100-year flood. No portion of the site is within the special flood hazard area inundated by the 100-year flood.

For an exhibit of the adjacent FIRM Panels 06065C0681G, 06065C0679G and Map Index, see ***Exhibit 2,*** *FEMA Flood Insurance Rate Maps.*

Pre-development Condition

The entire existing site is considered as one subbasin and lies within a Master Drainage Plan (MDP). All pre-development runoff sheet-flows into multiple detention basins located at the southwest corner of the site. Flow overtopping the basins drain into an existing concrete channel that runs along the southern property line that drains into an underground storm sewer lateral A-2 located below the southwestern border of the site. Lateral A-2 begins approximately 1300 feet east of Archibald Ave on Cloverdale Rd., runs west on Cloverdale Rd. before turning south on Archibald Ave. and travels 2640 feet to confluence with Line A. Lateral A-2, at the point where site runoff enters the underground pipe, has a diameter of 54 in. and an allowable flow of 148 cfs till it reaches Line A. Line A begins 650 feet north of Cloverdale Rd. on Harrison Ave., runs south on Harrison Ave. for 2600 feet, then east for 5200 feet in Cherry St. before discharging into Cucamonga Creek. Line A is sized with a diameter of 108 in. and an allowable flow of 488 cfs.

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

Post-Development Condition

Initially, the site was proposed as Single Family Residential, and therefore, a storm sewer system was designed and constructed for Single Family Residential with a peak discharge of 43.04 cfs. However, due to a change of use of the site to Commercial Retail, a higher peak flow of 52.27 cfs has been estimated due to the increased "c" value and impervious area. A detention basin shall be implemented into the site design in order to maintain the peak discharge of 43.04 cfs based on the previous Single Family Residential planned use, for which the Master Drainage Plan storm sewer system was designed to hold along Archibald Avenue.

The proposed conditions drainage area is comprised of thirty-one (31) sub-areas. Each sub-area has a corresponding catch basin that it drains to. The catch basins are connected to an underground storm sewer system and the flow is conveyed to an underground infiltration system, which is located near the southwest corner of the Walmart building. Overflow from the infiltration system is drained into the sites detention basin that has been designed to have a maximum outflow of 42.43 cfs discharging into Lateral A-2 at the southeast corner of the site.

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

Table 1 - Post-Development Condition Runoff Summary

Location	Storm Frequency/Duration (cfs)
	100-year 24-hour
Entering Detention Basin	52.27
Exiting Detention Basin	42.43

Detention Basins

One on-site above-ground detention basin is located southeast corner of the Walmart building (see ***Exhibit 4***) and is designed to maintain a peak discharge of 42.43 cfs that will drain via a weir into lateral A-2 which runs along Archibald Avenue. The detention basin has been designed to store 67,894 cubic feet of stormwater runoff to offset peak inflow and outflow discharges of 52.27 and 42.43 cfs, respectively. The time to reach the peak discharge rate is 1.17 hours. The entire site shall drain to the detention basin via the underground storm sewer system before leaving the site.

The detention basin will have a maximum top embankment elevation of approximately 640 ft above the bottom of basin elevation of approximately 634 ft. The bottom of the detention basin is sloped south at approximately 1.6%. The total volume of the basin to the top of the southern embankment is required to hold 67,894 sf, however, the detention basin has been designed to hold up to 91,500 sf. The maximum 100-year elevation in the basin will be 638 ft and will have a surface area of approximately 0.48 acres. The detention basin shall be enclosed by a fence with a gravel path around its top to provide access for maintenance.

Table 2 - Detention Basin Calculation Summary

Detention Basin	Basin Depth (feet)	Volume (ac-ft)	Footprint (acre)
Detention Basin	6	2.1	0.48

The detention basin is designed to control the discharge leaving the site and entering the MDP storm system to maintain a peak outflow discharge of 42.43 cfs for which the MDP storm sewer system was designed for at this location. These flows will exit the southeast corner of the project site into an underground storm sewer system (Lateral A-2 of MDP). The MDP storm sewer system located along the adjacent road to the site was designed for Single Family Residential use. The proposed storm sewer system including the detention basin is designed to mimic the pre-development runoff conditions, with a proposed detention basin to mitigate any additional discharge due to the change in zoning to Commercial Retail.

Results Summary and Discussion

The proposed site will have an underground storm sewer system that will collect stormwater runoff via strategically dispersed catch basins and will covey the runoff to an underground infiltration trench. The underground infiltration system will then drain to a detention basin. The detention basin has been designed to mitigate the impacts of additional runoff that will be generated from the change of land use from Single Family Residential to Commercial Retail. More specifically, the detention basin shall be able to receive an inflow discharge exceeding 52.27 cfs, while still maintaining an outflow discharge of 42.43 cfs, which is the storm sewer design peak discharge. See ***Table 3**, Pre- vs. Post-Development Condition Runoff Summary*.

Table 3 - Pre- vs. Post-Development Condition Runoff Summary

Condition	Storm Frequency/Duration (cfs)
	100-year 24-hour
Pre-Development	42.43
Post-Development	52.27
Difference:	**9.84**

REFERENCES

1) Riverside County Hydrology Manual, April 1978.

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

3) National Oceanic and Atmospheric Administration Atlas 14, volume 6, version 2, 2011.

4) Natural Resources Conservation Service Web Soil Survey for Riverside County, California, Santa Ana River Area, 2008.

EXHIBITS

Exhibit 1: Location Map

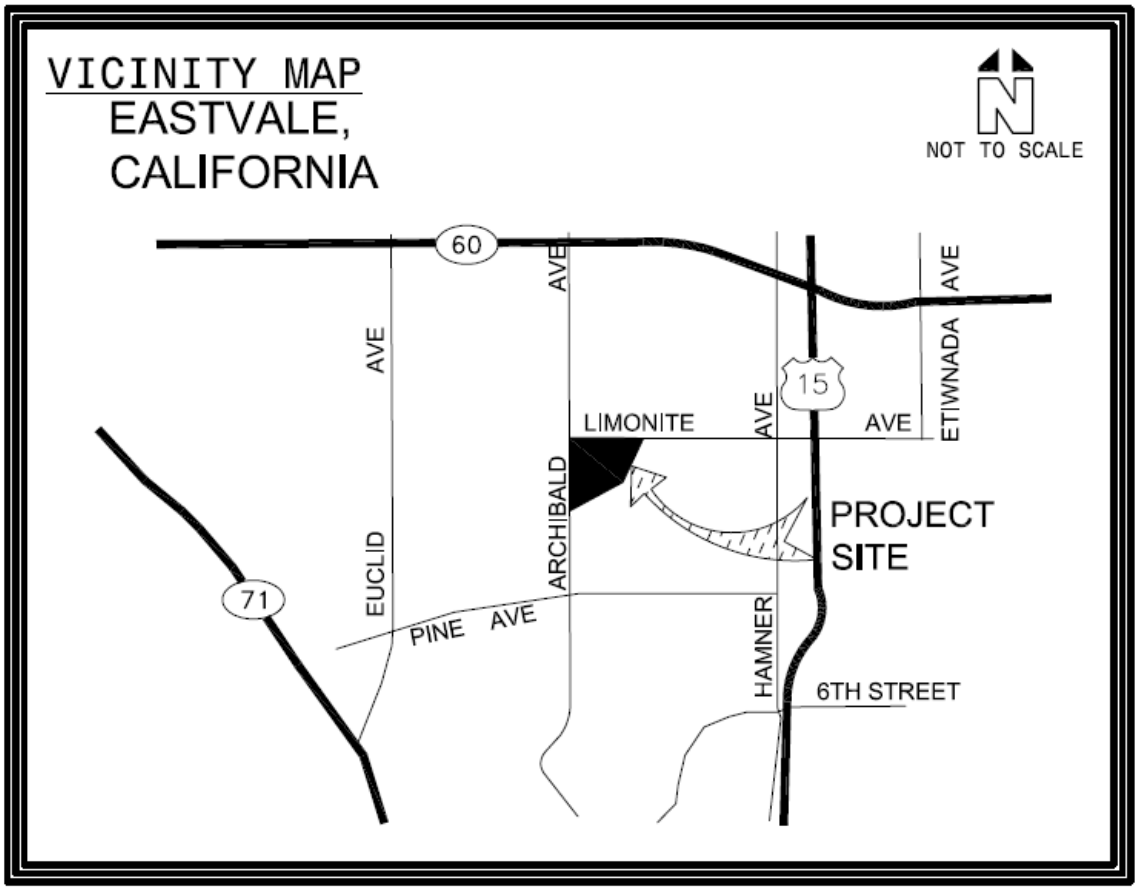
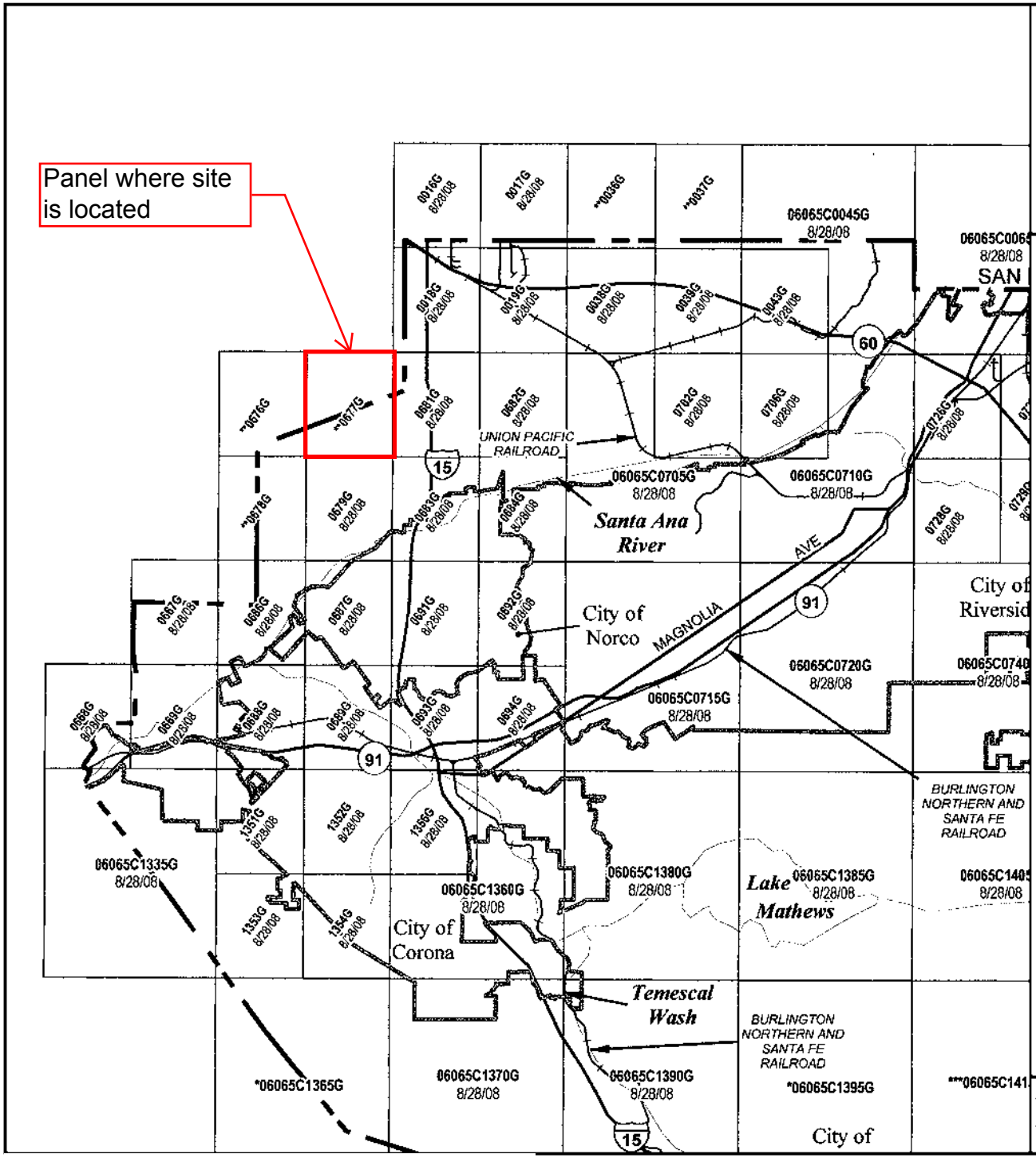


Exhibit 2: Federal Emergency Management Agency Flood Insurance Rate Maps (FEMA FIRM)

Attached in the following order:

- Map Index (Sheet 1 of 2)
- Panel 06065C0679G (South of Site)
- Panel 06065C0681G (East of Site)



NFIP NATIONAL FLOOD INSURANCE PROGRAM

MAP INDEX

FIRM

FLOOD INSURANCE RATE MAP

RIVERSIDE COUNTY, CALIFORNIA AND INCORPORATED AREAS

(SEE LISTING OF COMMUNITIES TABLE)

MAP INDEX

SHEET 1 OF 2

PANELS PRINTED: 16, 17, 18, 19, 38, 39, 43, 45, 65, 70, 90, 114, 118, 143, 144, 215, 220, 667, 668, 669, 679, 681, 682, 683, 684, 686, 687, 688, 689, 691, 692, 693, 694, 702, 705, 706, 710, 715, 720, 726, 727, 728, 729, 731, 740, 745, 753, 755, 760, 761, 765, 770, 785, 790, 795, 803, 805, 806, 807, 808, 809, 811, 812, 816, 817, 819, 828, 829, 835, 836, 837, 845, 855, 865, 870, 880, 885, 890, 895, 905, 910, 915, 920, 1335, 1351, 1352, 1353, 1354, 1356, 1360, 1370, 1380, 1385, 1390, 1405, 1410, 1430, 1435, 1440, 1445, 1455, 1460, 1465, 1470, 1480, 1488, 1490, 1495, 1515, 1535, 1540, 1551, 1552, 1553, 1554, 1556, 1557, 1558, 1559, 1565, 1566, 1567, 1568, 1569, 1576, 1577, 1578, 1579, 1585, 1586, 1587, 1588, 1589, 1595, 1605, 1610, 1615, 1620, 2005, 2006, 2007, 2008, 2009, 2016, 2017, 2019, 2026, 2028, 2029, 2032, 2033, 2034, 2036, 2037, 2038, 2039, 2041, 2042, 2043, 2055, 2060, 2061, 2062, 2070, 2080, 2085, 2105, 2110, 2115, 2120, 2130, 2155, 2165, 2205, 2206, 2207, 2208, 2209, 2220, 2226, 2227, 2228, 2229, 2231, 2232, 2233, 2234, 2236, 2237, 2239, 2241, 2243, 2244, 2251, 2252, 2253, 2254, 2260, 2261, 2262, 2264, 2270, 2681, 2682, 2684, 2705, 2715, 2720, 2740, 2745, 2825, 2830, 2900, 2925, 3285, 3305, 3310

(SEE SHEET 2 FOR ADDITIONAL PANELS PRINTED)

MAP NUMBER
06065CIND1A

EFFECTIVE DATE
AUGUST 28, 2008

* PANEL NOT PRINTED - AREA IN ZONE D
** PANEL NOT PRINTED - NO SPECIAL FLOOD HAZARD AREAS
*** PANEL NOT PRINTED - UNINCORPORATED AREAS ZONE D; OTHER AREAS ZONE X
**** PANEL NOT PRINTED - SANTA ROSA RESERVATION ZONE D; OTHER AREAS ZONE X

MAP SCALE 1" = 500'

250 0 500 1000

FEET

METER

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0679G

FIRM

FLOOD INSURANCE RATE MAP

RIVERSIDE COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 679 OF 3805

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

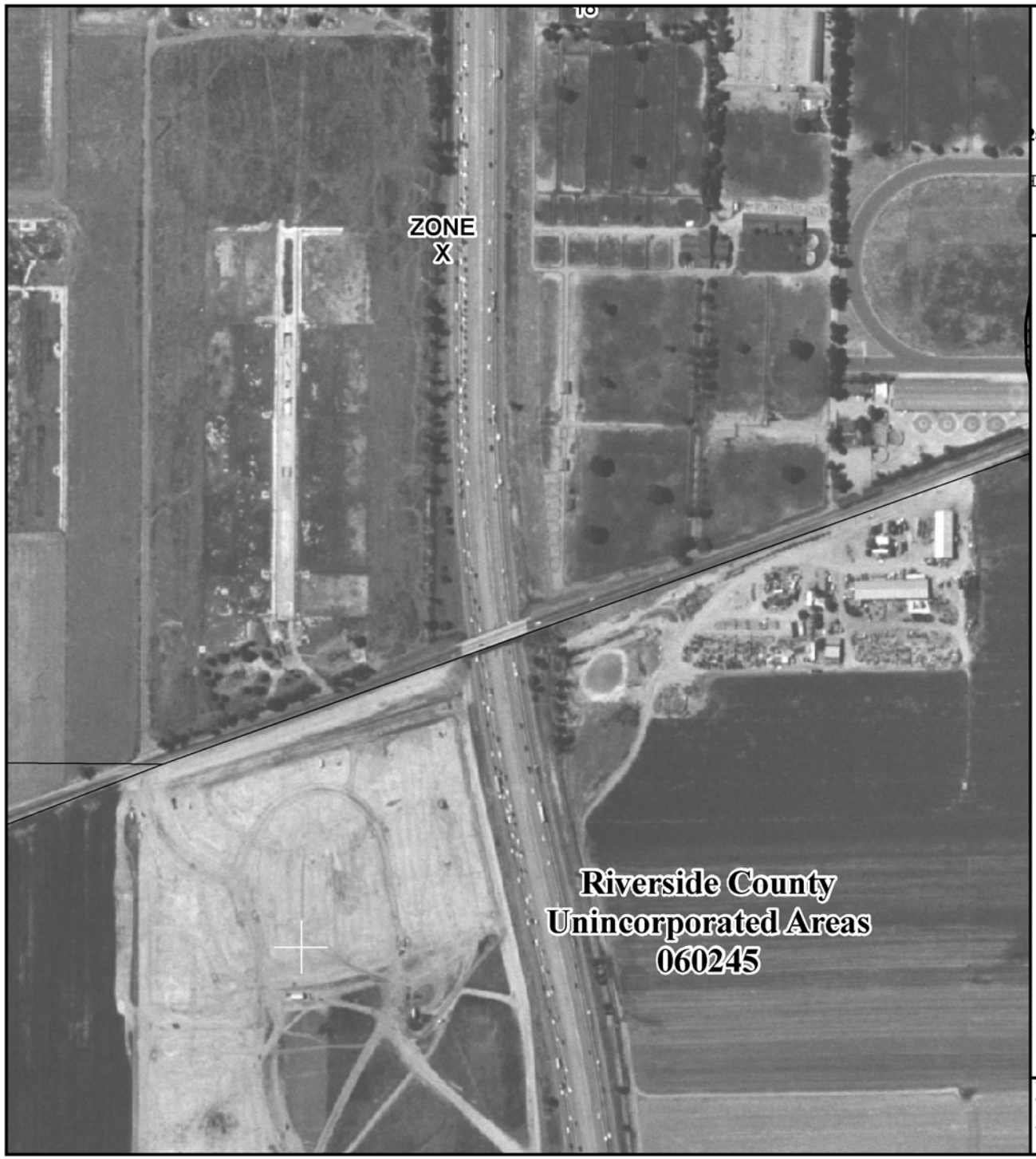
COMMUNITY	NUMBER	PANEL	SUFFIX
NORCO, CITY OF	060256	0679	G
RIVERSIDE COUNTY	060245	0679	G

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

MAP NUMBER
06065C0679G

EFFECTIVE DATE
AUGUST 28, 2008

Federal Emergency Management Agency



MAP SCALE 1" = 500'

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FEET

METER

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0681G

FIRM

FLOOD INSURANCE RATE MAP

RIVERSIDE COUNTY, CALIFORNIA

AND INCORPORATED AREAS

PANEL 681 OF 3805

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
RIVERSIDE COUNTY	060245	0681	G

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

MAP NUMBER
06065C0681G

EFFECTIVE DATE
AUGUST 28, 2008

Federal Emergency Management Agency

Exhibit 3: Pre-Development Drainage Conditions

Exhibit 4: Post-Development Drainage Conditions

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

Appendix

Appendix A - Hydrologic / Hydraulic Reference Material

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


117° 35' 40"
117° 35' 8"
445120
445200
445280
445360
445440
445520
445600
445680
445760
445840
33° 58' 32"
33° 58' 15"
3759600
3759520
3759440
3759360
3759280
3759200
3759120
Cloverdale Rd
HIA
Winchester Cir
Flint Cir
Clear Water Cir
Rolling Meadow St
Buckhart St
Burrage St
Golden Bit St
Northfork Dr
Camp Rock St
Archibald St
117° 35' 39"
Map Scale: 1:3,810 if printed on A size (8.5" x 11") sheet.
N
Meters
0 50 100 200 300
Feet
0 200 400 800 1,200

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

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

MAP INFORMATION

Map Scale: 1:3,810 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:15,840.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 11N NAD83

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

Soil Survey Area: Western Riverside Area, California
Survey Area Data: Version 5, Jan 3, 2008

Date(s) aerial images were photographed: 6/7/2005

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

Map Unit Legend

Western Riverside Area, California (CA679)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
HIA	Hilmar loamy very fine sand, 0 to 2 percent slopes	40.9	100.0%
Totals for Area of Interest		**40.9**	**100.0%**

Group A — Low runoff potential. Soils having high infiltration rates even when thoroughly wetted and consisting chiefly of deep, well to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B — Soils having moderate infiltration rates when thoroughly wetted and consisting chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.

Group C — Soils having slow infiltration rates when thoroughly wetted and consisting chiefly of soils with a layer that impedes downward movement of water, or soils with moderately fine to fine texture. These soils have a slow rate of water transmission.

Group D — High runoff potential. Soils having very slow infiltration rates when thoroughly wetted and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission.

In some cases a dual soil designation such as "B-C" has been assigned to an area. This indicates the infiltration characteristics are too variable either geographically or with time, to assign the soil to a single classification. In such cases the more conservative value is recommended for design hydrology.

The SCS and U. S. Forest Service (USFS) have mapped soil types and assigned hydrologic soils classifications in many areas of the District. Using this information the District has compiled generalized hydrologic soils classification maps. These maps are shown on Figures C-1.01 through C-1.66. In areas which have not yet been mapped, SCS or USFS personnel may be able to supply generalized soils information. The District will update the soils maps as additional information becomes available.

Soil Cover Type - The type of vegetation or ground cover on a watershed, and the quality or density of that cover, have a major impact on the infiltration capacity of a given soil. In consideration of cover type and quality the District uses a system developed by the SCS, whose studies on the affect of cover type on runoff potential are believed to represent the most

comprehensive information available for this region. Detailed descriptions of these cover types grouped in three broad classifications (Natural, Urban, and Agricultural) are given on Plate C-2. Definitions of cover quality are as follows:

Poor — Heavily grazed or regularly burned areas. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.

Fair — Moderate cover with 50 percent to 75 percent of the ground surface protected.

Good — Heavy or dense cover with more than 75 percent of the ground surface protected.

In most cases cover type and quality can be readily determined by a field review of a study watershed. USFS personnel may also be helpful in determining such information in remote mountainous areas of the District.

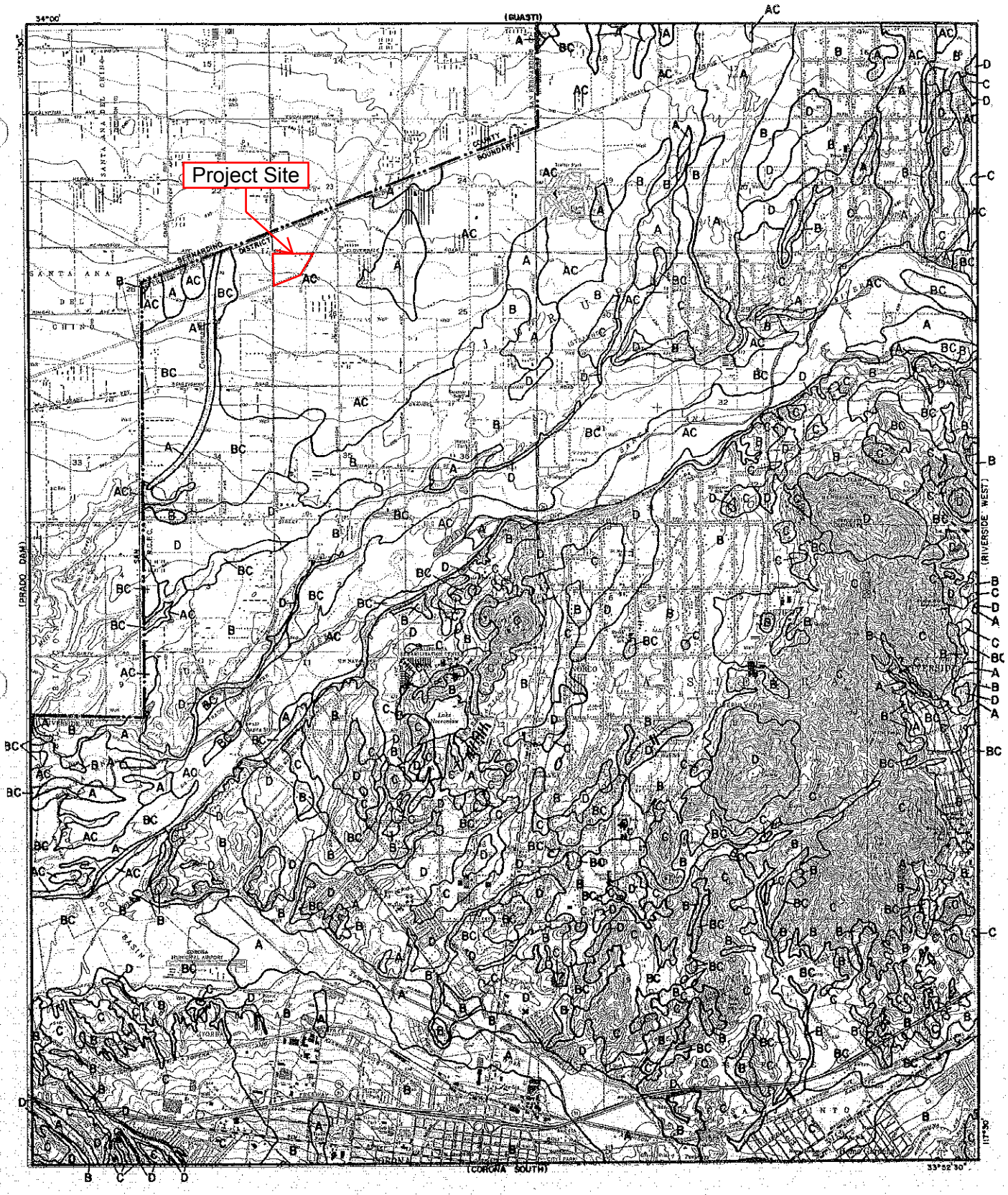
Antecedent Moisture Conditions - Antecedent moisture condition (AMC) has a major effect on the runoff potential of a particular soil-cover complex. AMC can be defined as the relative wetness of a watershed just prior to a flood producing storm event. AMC is sometimes expressed as the amount of rainfall occurring in a specific period of time prior to a major storm. Such evaluations are crude at best due to the importance of the time distribution of rainfall within the antecedent period, etc. For this reason the District uses the following generalized definitions of AMC levels:

AMC I — Lowest runoff potential. The watershed soils are dry enough to allow satisfactory grading or cultivation to take place.

AMC II — Moderate runoff potential, an intermediate condition.

AMC III — Highest runoff potential. The watershed is practically saturated from antecedent rains.

In rainfall based hydrology methods it is normally true that a low AMC index (high loss rates) should be used in developing short return period storms (2-5 year); and a moderate to high AMC index (low loss rates) should be used in developing longer return period storms (10 - 100



LEGEND

—— SOILS GROUP BOUNDARY

A SOILS GROUP DESIGNATION

RCFC&WCD

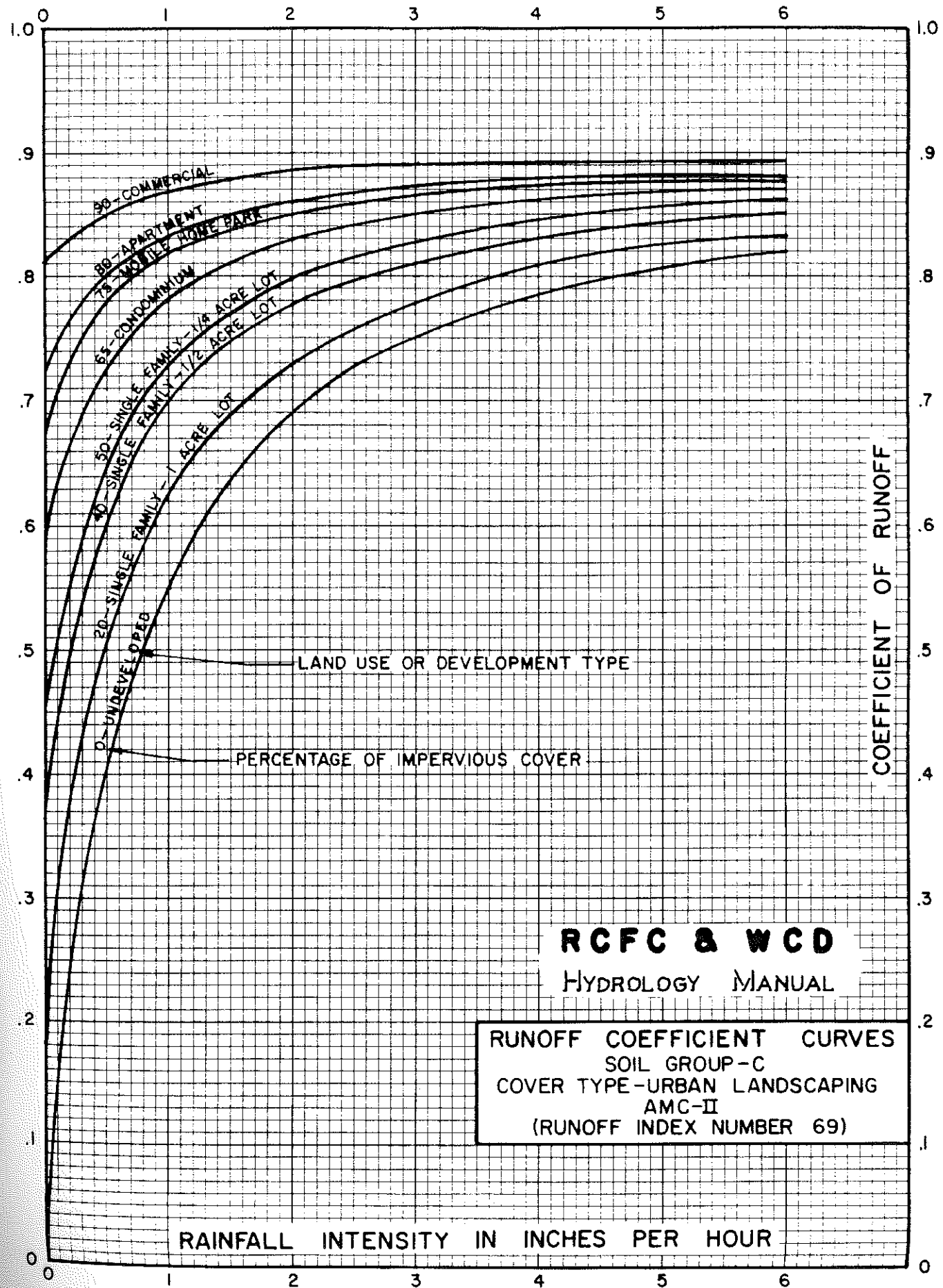
HYDROLOGY MANUAL

N

0 FEET 5000

HYDROLOGIC SOILS GROUP MAP FOR CORONA-NORTH

PLATE C-1.14



RCFC & WCD

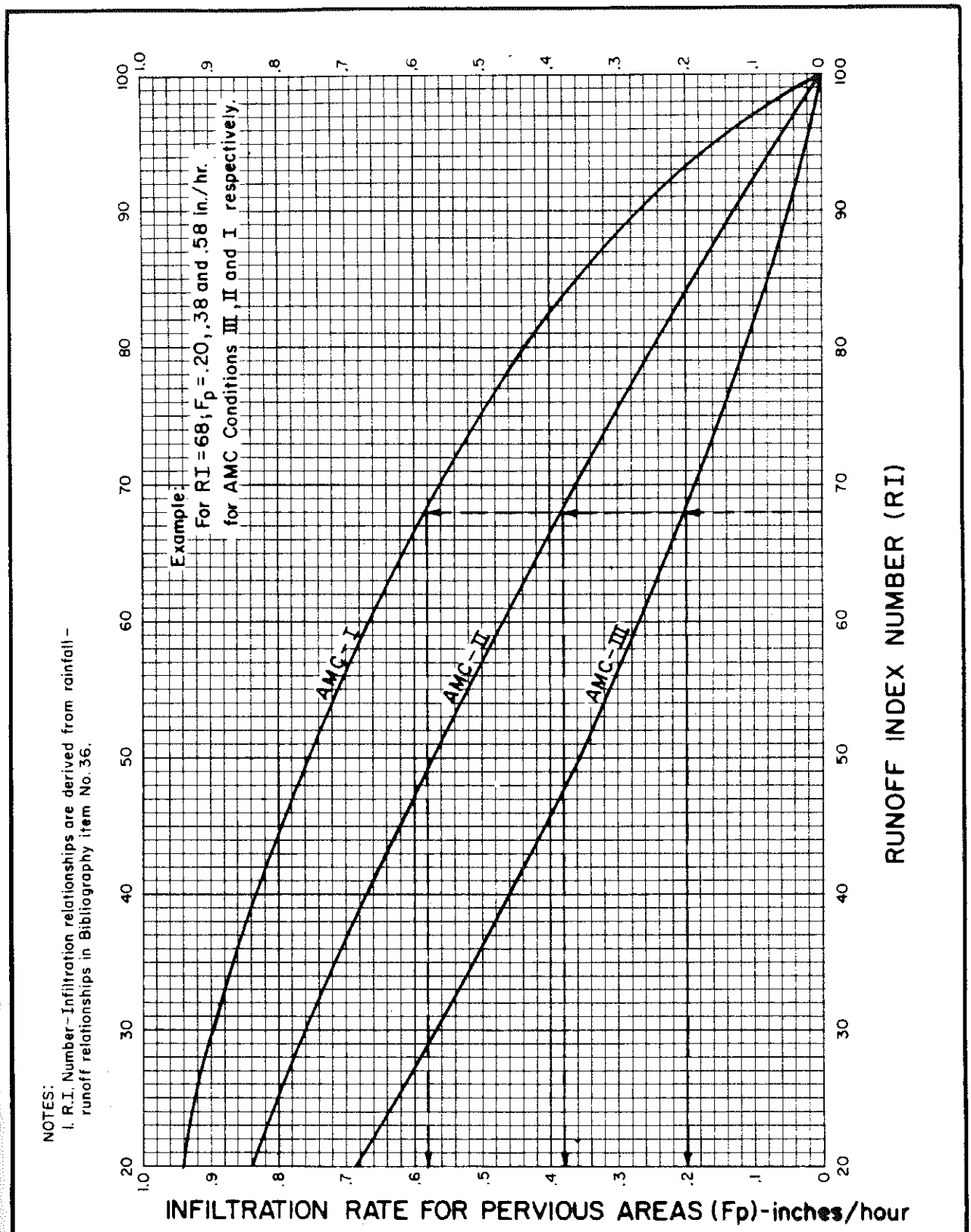
HYDROLOGY MANUAL

RUNOFF COEFFICIENT CURVES
SOIL GROUP-C
COVER TYPE-URBAN LANDSCAPING
AMC-II
(RUNOFF INDEX NUMBER 69)

PLATE D-5.3

RUNOFF INDEX NUMBERS OF HYDROLOGIC SOIL-COVER COMPLEXES FOR PERVIOUS AREAS-AMC II

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



NOTES:
1. R.I. Number-Infiltration relationships are derived from rainfall-runoff relationships in Bibliography item No. 36.

RCFC & WCD

HYDROLOGY MANUAL

INFILTRATION RATE FOR PERVIOUS AREAS VERSUS RUNOFF INDEX NUMBERS

PLATE E-6.2

Appendix B - Rational Method Calculation Results

Runoff Coefficient Calculation

$$C = 0.9\left[A_i + \frac{I-F_p}{I} A_p\right]$$

where:

C = Runoff coefficient

I = Rainfall intensity - inches/hour

F_p = Infiltration rate for pervious areas - inches/hour

A_i = Impervious area (actual) - decimal percent

A_p = Pervious area (actual) - decimal percent

and $A_p = 1.00 - A_i$

Description	Ai[a] [Decimal Percent]	Ap[b] [Decimal Percent]	I[c] [in/hr]	Fp[d] [in/hr]	C
Project Site	0.68	0.32	1.76	0.36	0.84

Notes:

Rational Method Parameters calculated according to Page D-3 of the *Riverside County Flood Control and Water Conservation District Hydrology Manual* (Hydrology Manual), 1978

[a] Impervious Area determined as a weighted average of land uses, 90% of the 24-acre commercial area and 20% of the 11-acre park area were considered impervious: Ai= [(0.9*24)+(0.2*11)]/35

[b] Pervious Area calculated as $Ap=1-A_i$

[c] Rainfall Intensity for the 100-year, 1-hour storm found using Plate D-4.7 of the Hydrology Manual

[d] Infiltration Rate found using Plates E-6.1 and E-6.2 of the Hydrology Manual

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************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
         RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                       (RCFC&WCD)  1978 HYDROLOGY MANUAL
          (c) Copyright 1982-2009 Advanced Engineering Software (aes)
                       (Rational Tabling Version 16.0)
                  Release Date: 04/01/2009  License ID 1499

                           Analysis prepared by:

                        Kimley-Horn and Associates, Inc.
                         765 The City Drive, Suite 400
                                Orange, CA 92868
                                  714-939-1030

 ************************* DESCRIPTION OF STUDY ************************
* Walmart Store No. 3129-00                                            *
* Eastvale, CA                                                         *
* Proposed Conditions - 100 year                                       *
 ************************************************************************

  FILE NAME: EV100.DAT
  TIME/DATE OF STUDY: 11:13 07/27/2012
------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  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) =  1.200
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) =   1.200
  SLOPE OF INTENSITY DURATION CURVE = 0.5500
  SPECIFIED CONSTANT RUNOFF COEFFICIENT = 0.840
  NOTE: CONSIDER ALL CONFLUENCE STREAM COMBINATIONS
        FOR ALL 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   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *PIPE MAY BE SIZED TO HAVE A FLOW CAPACITY LESS THAN
   UPSTREAM TRIBUTARY PIPE.*

************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  22
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
========================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  USER SPECIFIED Tc(MIN.) =   29.770
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.764
  *USER SPECIFIED(GLOBAL):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8400
  SUBAREA RUNOFF(CFS) =     51.87
  TOTAL AREA(ACRES) =     35.00   TOTAL RUNOFF(CFS) =     51.87
========================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       35.0  TC(MIN.) =     29.77
  PEAK FLOW RATE(CFS)   =      51.87
========================================================================
========================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Appendix C - Hydrograph Calculation Results

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

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

ACCORDING TO RIVERSIDE COUNTY FLOOD CONTORL AND WATER CONSERVATION DISTRICT
                    (RCFC&WCD) 1978 HYDROLOGY MANUAL
         (c) Copyright 1989-2009 Advanced Engineering Software (aes)
                 (Synthetic Unit Hydrograph Version 16.0)
                Release Date: 04/01/2009  License ID 1499

                           Analysis prepared by:

                        Kimley-Hoan and Associates, Inc.
                         765 The CIty Drive, Suite 400
                                Orange, CA 92868
                                  714-939-1030

 ************************ DESCRIPTION OF STUDY ************************
* Walmart Store No. 3129-00                                           *
* Eastvale, CA                                                        *
* Proposed Conditions - 100 year                                      *
 **********************************************************************

  FILE NAME: EVUH100.DAT
  TIME/DATE OF STUDY: 11:09 07/27/2012


**************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =   1
--------------------------------------------------------------------------
  >>>>>SUBAREA RUNOFF (UNIT-HYDROGRAPH ANALYSIS)<<<<<
==========================================================================

      (UNIT-HYDROGRAPH ADDED TO STREAM #1)

         WATERSHED AREA =      35.000 ACRES
         BASEFLOW =   0.000 CFS/SQUARE-MILE
         *USER ENTERED "LAG" TIME =    0.320 HOURS
          CAUTION: LAG TIME IS LESS THAN 0.50 HOURS.
          THE 5-MINUTE PERIOD UH MODEL (USED IN THIS COMPUTER PROGRAM)
          MAY BE TOO LARGE FOR PEAK FLOW ESTIMATES.
         VALLEY S-GRAPH SELECTED
         UNIFORM MEAN SOIL-LOSS(INCH/HOUR) =  0.140
         LOW SOIL-LOSS RATE PERCENT(DECIMAL) = 0.800
         USER-ENTERED RAINFALL =  1.20 INCHES
         RCFC&WCD 1-Hour Storm (5-Minute period) SELECTED
         (SLOPE OF INTENSITY-DURATION CURVE = 0.55)
         *USER SPECIFIED PRECIPITATION DEPTH-AREA ADJUSTMENT FACTOR = 1.0000


         UNIT HYDROGRAPH TIME UNIT =   5.000 MINUTES
         UNIT INTERVAL PERCENTAGE OF LAG-TIME =  26.042



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

--------------------------------------------------------------------------
    INTERVAL          "S" GRAPH          UNIT HYDROGRAPH
     NUMBER          MEAN VALUES          ORDINATES(CFS)
--------------------------------------------------------------------------
        1                2.384               10.092
        2               10.310               33.548
        3               24.888               61.707
        4               43.613               79.258
        5               58.553               63.239
        6               67.330               37.150
        7               73.114               24.486
        8               77.315               17.778
        9               80.648               14.109
       10               83.312               11.277
       11               85.555                9.493
       12               87.416                7.878
       13               88.972                6.586
       14               90.394                6.018
       15               91.606                5.130
       16               92.654                4.436
       17               93.617                4.078
       18               94.463                3.580
       19               95.229                3.242
       20               95.963                3.108
       21               96.502                2.283
       22               97.008                2.140
       23               97.513                2.141
       24               97.973                1.945
       25               98.194                0.935
       26               98.381                0.792
```

27	98.568	0.790
28	98.755	0.792
29	98.942	0.791
30	99.129	0.791
31	99.315	0.791
32	99.502	0.791
33	99.689	0.791
34	99.876	0.791
35	100.000	0.524

```
*******************************************************************************
         UNIT             UNIT            UNIT             EFFECTIVE
        PERIOD          RAINFALL       SOIL-LOSS          RAINFALL
       (NUMBER)         (INCHES)        (INCHES)          (INCHES)
-------------------------------------------------------------------------------
           1             0.0466          0.0117            0.0349
           2             0.0495          0.0117            0.0379
           3             0.0531          0.0117            0.0415
           4             0.0594          0.0117            0.0478
           5             0.0632          0.0117            0.0515
           6             0.0733          0.0117            0.0616
           7             0.0881          0.0117            0.0765
           8             0.0981          0.0117            0.0864
           9             0.1569          0.0117            0.1452
          10             0.3789          0.0117            0.3672
          11             0.0807          0.0117            0.0690
          12             0.0522          0.0117            0.0405

         TOTAL STORM RAINFALL(INCHES) =  1.20
         TOTAL SOIL-LOSS(INCHES) =  0.14
         TOTAL EFFECTIVE RAINFALL(INCHES) =  1.06

-------------------------------------------------------------------------------
    TOTAL SOIL-LOSS VOLUME(ACRE-FEET) =       0.4083
    TOTAL STORM RUNOFF VOLUME(ACRE-FEET) =       3.0901
-------------------------------------------------------------------------------
```

1 - H O U R S T O R M
R U N O F F H Y D R O G R A P H

HYDROGRAPH IN FIVE-MINUTE UNIT INTERVALS(CFS)
(Note: Time indicated is at END of Each Unit Intervals)

TIME(HRS)	VOLUME(AF)	Q(CFS)	0. 15.0 30.0 45.0 60.0
0.083	0.0024	0.35	Q . . . .
0.167	0.0131	1.55	VQ . . . .
0.250	0.0396	3.84	V Q . . . .
0.333	0.0876	6.98	.V Q . . . .
0.417	0.1557	9.89	. V Q . . . .
0.500	0.2403	12.28	. V Q . . . .
0.583	0.3414	14.69	. V Q. . . . .
0.667	0.4615	17.43	. V .Q . . . .
0.750	0.6074	21.18	. V . Q . . . .
0.833	0.8045	28.62	. V Q. . . .
0.917	1.0758	39.41	. . V . Q . . .
1.000	1.4161	49.40	. . V . . Q . .
1.083	1.7761	52.27	. . . V . Q .
1.167	2.0705	42.75	. . . . V Q . .
1.250	2.2746	29.63	. . Q. V. . .
1.333	2.4170	20.68	. . Q . .V . .
1.417	2.5211	15.11	. Q . . V . .
1.500	2.6029	11.88	. Q . . . V .
1.583	2.6695	9.66	. Q . . . V .
1.667	2.7255	8.13	. Q . . . V .
1.750	2.7727	6.86	. Q . . . V .
1.833	2.8132	5.88	. Q . . . V .
1.917	2.8491	5.21	. Q . . . V .
2.000	2.8804	4.54	. Q . . . V .
2.083	2.9078	3.98	. Q . . . V .
2.167	2.9323	3.55	. Q . . . V .
2.250	2.9537	3.12	. Q . . . V .
2.333	2.9729	2.78	.Q . . . V .
2.417	2.9900	2.49	.Q . . . V .
2.500	3.0042	2.06	.Q . . . V .
2.583	3.0168	1.84	.Q . . . V.
2.667	3.0283	1.67	.Q . . . V.
2.750	3.0382	1.43	Q . . . V.
2.833	3.0452	1.03	Q . . . V.
2.917	3.0514	0.89	Q . . . V.
3.000	3.0569	0.81	Q . . . V.
3.083	3.0622	0.77	Q . . . V.
3.167	3.0673	0.74	Q . . . V.
3.250	3.0721	0.70	Q . . . V.
3.333	3.0766	0.65	Q . . . V.
3.417	3.0807	0.60	Q . . . V.
3.500	3.0844	0.54	Q . . . V.
3.583	3.0875	0.45	Q . . . V.
3.667	3.0895	0.28	Q . . . V.
3.750	3.0899	0.07	Q . . . V.
3.833	3.0901	0.02	Q . . . V

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	230.0
10%	95.0
20%	65.0
30%	45.0
40%	35.0
50%	30.0
60%	20.0
70%	20.0
80%	15.0
90%	10.0

END OF FLOODSCx ROUTING ANALYSIS

Appendix D - Detention Basin Calculation Results

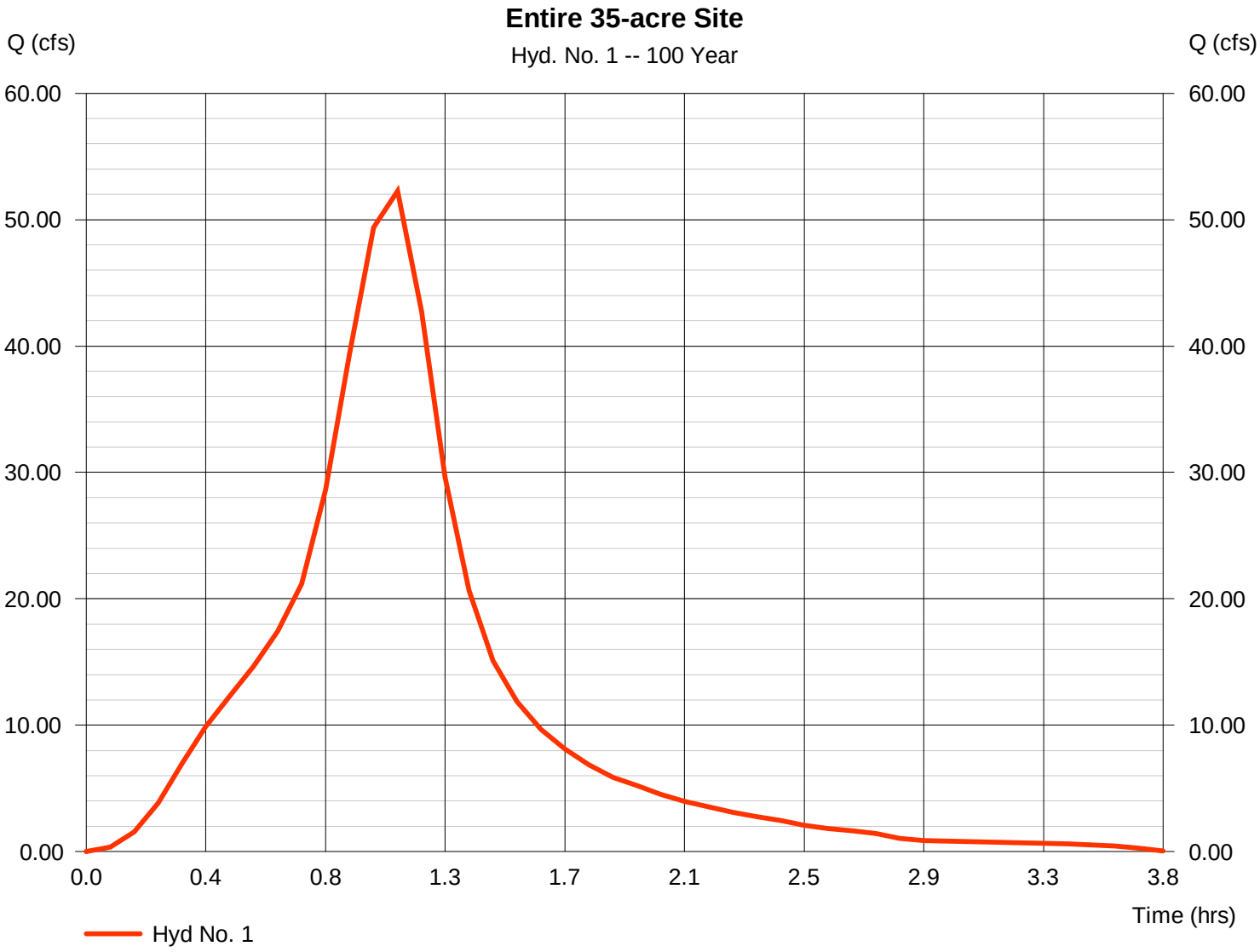
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Friday, Aug 3, 2012

Hyd. No. 1

Entire 35-acre Site

Hydrograph type	= Manual	Peak discharge	= 52.27 cfs
Storm frequency	= 100 yrs	Time to peak	= 1.08 hrs
Time interval	= 5 min	Hyd. volume	= 134,607 cuft



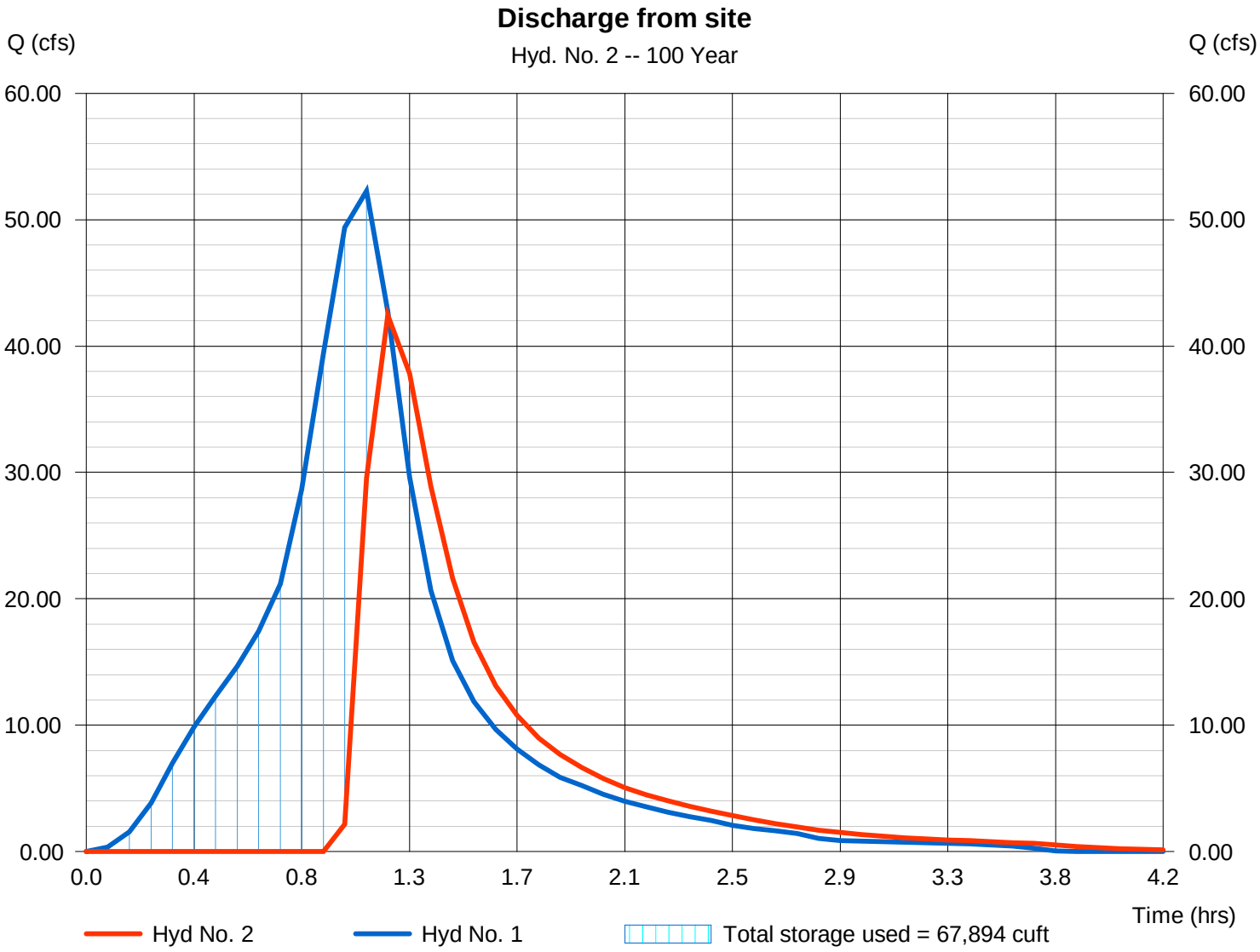
Hydrograph Report

Hyd. No. 2

Discharge from site

Hydrograph type	= Reservoir	Peak discharge	= 42.43 cfs
Storm frequency	= 100 yrs	Time to peak	= 1.17 hrs
Time interval	= 5 min	Hyd. volume	= 82,833 cuft
Inflow hyd. No.	= 1 - Entire 35-acre Site	Max. Elevation	= 104.86 ft
Reservoir name	= Detention Basin	Max. Storage	= 67,894 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Detention Basin

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 100.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	8,859	0	0
4.00	104.00	17,517	51,772	51,772
5.00	105.00	20,075	18,780	70,552

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	0.00	0.00	0.00
Crest El. (ft)	= 104.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	100.00	---	---	---	---	0.00	---	---	---	---	---	0.000
4.00	51,772	104.00	---	---	---	---	0.00	---	---	---	---	---	0.000
5.00	70,552	105.00	---	---	---	---	53.28	---	---	---	---	---	53.28

Appendix E – Riverside County Flood Control Calculations for the Master Drainage Plan

```
**************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
        RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                        (RCFC&WCD)  1978 HYDROLOGY MANUAL
          (c) Copyright 1982-2000 Advanced Engineering Software (aes)
              Ver. 1.5A Release Date: 01/01/2000  License ID 1500

                              Analysis prepared by:

                                  Tetra Tech, Inc
                              17770 Cartwright Road, Suite 500
                                  Irvine, CA 92614
                                  (949)250-6788

--------------------------------------------------------------------------
 FILE NAME: LINEA100.DAT
 TIME/DATE OF STUDY: 08:13 08/16/2001
--------------------------------------------------------------------------
 USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
 USER SPECIFIED STORM EVENT(YEAR) =  100.00
 SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
 SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
 10-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  1.960
 10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.760
 100-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  3.100
 100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.200
 SLOPE OF 10-YEAR INTENSITY-DURATION CURVE =  0.5287434
 SLOPE OF 100-YEAR INTENSITY-DURATION CURVE =  0.5296918
 COMPUTED RAINFALL INTENSITY DATA:
 STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) =   1.200
 SLOPE OF INTENSITY DURATION CURVE = 0.5297
 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  30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150
  2  20.0     12.0    0.018/0.018/0.020   0.50    1.50 0.0313 0.125 0.0150

 GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
   1. Relative Flow-Depth =  1.00 FEET
      as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
   2. (Depth)*(Velocity) Constraint = 10.0 (FT*FT/S)
 *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
  OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**************************************************************************
 FLOW PROCESS FROM NODE       1.00 TO NODE       2.00 IS CODE =  21
--------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS SINGLE FAMILY (1/4 ACRE)
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH =   800.00
 UPSTREAM ELEVATION =    668.00
 DOWNSTREAM ELEVATION =    663.00
 ELEVATION DIFFERENCE =      5.00
 TC = 0.393*[(  800.00**3)/(     5.00)]**.2 =   15.704
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.441
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7649
 SOIL CLASSIFICATION IS "B"
 SUBAREA RUNOFF(CFS) =     13.07
 TOTAL AREA(ACRES) =      7.00   TOTAL RUNOFF(CFS) =     13.07

**************************************************************************
 FLOW PROCESS FROM NODE       2.00 TO NODE       3.00 IS CODE =  61
--------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STANDARD CURB SECTION USED)<<<<<
==========================================================================
 UPSTREAM ELEVATION(FEET) =  663.00  DOWNSTREAM ELEVATION(FEET) =  653.70
 STREET LENGTH(FEET) =  1550.00   CURB HEIGHT(INCHES) =  8.0
```

```
 STREET HALFWIDTH(FEET) = 30.00

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

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

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      37.01
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.65
   HALFSTREET FLOOD WIDTH(FEET) =   24.41
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.01
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.95
 STREET FLOW TRAVEL TIME(MIN.) =   8.59   Tc(MIN.) =  24.29
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.937
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7421
 SOIL CLASSIFICATION IS "B"
 SUBAREA AREA(ACRES) =   33.00      SUBAREA RUNOFF(CFS) =   47.44
 TOTAL AREA(ACRES) =   40.00      PEAK FLOW RATE(CFS) =      60.51

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.75   HALFSTREET FLOOD WIDTH(FEET) =  33.56
 FLOW VELOCITY(FEET/SEC.) =  3.34   DEPTH*VELOCITY(FT*FT/SEC.) =   2.50
 *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
        AND L = 1550.0 FT WITH ELEVATION-DROP =   9.3 FT, IS   52.3 CFS,
        WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE      3.00
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      3.00 =  2350.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      3.00 TO NODE      4.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   651.40  DOWNSTREAM(FEET) =   648.00
 FLOW LENGTH(FEET) =   650.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  30.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.09
 ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     60.51
 PIPE TRAVEL TIME(MIN.) =   1.34    Tc(MIN.) =  25.63
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      4.00 =  3000.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      3.00 TO NODE      4.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.883
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7391
 SOIL CLASSIFICATION IS "B"
 SUBAREA AREA(ACRES) =   21.20   SUBAREA RUNOFF(CFS) =   29.51
 TOTAL AREA(ACRES) =    61.20   TOTAL RUNOFF(CFS) =   90.02
 TC(MIN) =  25.63

****************************************************************************
 FLOW PROCESS FROM NODE      4.00 TO NODE      5.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   648.00  DOWNSTREAM(FEET) =   642.00
 FLOW LENGTH(FEET) =  1320.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  48.0 INCH PIPE IS  38.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.33
 ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     90.02
 PIPE TRAVEL TIME(MIN.) =   2.64    Tc(MIN.) =  28.27
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      5.00 =  4320.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      4.00 TO NODE      5.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
```

```
================================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.788
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .6241
 SOIL CLASSIFICATION IS "A"
 SUBAREA AREA(ACRES) =   20.00   SUBAREA RUNOFF(CFS) =   22.31
 TOTAL AREA(ACRES) =    81.20   TOTAL RUNOFF(CFS) =  112.33
 TC(MIN) =  28.27

****************************************************************************
 FLOW PROCESS FROM NODE       4.00 TO NODE       5.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.788
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7871
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =   20.00   SUBAREA RUNOFF(CFS) =   28.14
 TOTAL AREA(ACRES) =   101.20   TOTAL RUNOFF(CFS) =  140.47
 TC(MIN) =  28.27

****************************************************************************
 FLOW PROCESS FROM NODE       5.00 TO NODE       6.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   642.00  DOWNSTREAM(FEET) =   632.00
 FLOW LENGTH(FEET) =  1320.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  54.0 INCH PIPE IS  38.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  11.49
 ESTIMATED PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    140.47
 PIPE TRAVEL TIME(MIN.) =   1.91    Tc(MIN.) =  30.18
 LONGEST FLOWPATH FROM NODE       1.00 TO NODE       6.00 =  5640.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE       5.00 TO NODE       6.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.727
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .6204
 SOIL CLASSIFICATION IS "A"
 SUBAREA AREA(ACRES) =   20.00   SUBAREA RUNOFF(CFS) =   21.43
 TOTAL AREA(ACRES) =   121.20   TOTAL RUNOFF(CFS) =  161.90
 TC(MIN) =  30.18

****************************************************************************
 FLOW PROCESS FROM NODE       5.00 TO NODE       6.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.727
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7841
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =   20.00   SUBAREA RUNOFF(CFS) =   27.08
 TOTAL AREA(ACRES) =   141.20   TOTAL RUNOFF(CFS) =  188.98
 TC(MIN) =  30.18

****************************************************************************
 FLOW PROCESS FROM NODE       6.00 TO NODE       7.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   632.00  DOWNSTREAM(FEET) =   627.40
 FLOW LENGTH(FEET) =  1500.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  69.0 INCH PIPE IS  53.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.71
 ESTIMATED PIPE DIAMETER(INCH) =  69.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    188.98
 PIPE TRAVEL TIME(MIN.) =   2.87    Tc(MIN.) =  33.06
 LONGEST FLOWPATH FROM NODE       1.00 TO NODE       7.00 =  7140.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE       1.00 TO NODE       7.00 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.) =  33.06
  RAINFALL INTENSITY(INCH/HR) =  1.65
  TOTAL STREAM AREA(ACRES) =  141.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    188.98

****************************************************************************
  FLOW PROCESS FROM NODE      21.00 TO NODE      22.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS SINGLE FAMILY (1/4 ACRE)
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH =   550.00
  UPSTREAM ELEVATION =    641.00
  DOWNSTREAM ELEVATION =    638.00
  ELEVATION DIFFERENCE =      3.00
  TC = 0.393*[(  550.00**3)/(     3.00)]**.2 =   13.891
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.605
  *USER SPECIFIED(SUBAREA):
  SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7500
  SUBAREA RUNOFF(CFS) =     13.67
  TOTAL AREA(ACRES) =      7.00   TOTAL RUNOFF(CFS) =     13.67

****************************************************************************
  FLOW PROCESS FROM NODE      22.00 TO NODE      23.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  638.00  DOWNSTREAM ELEVATION(FEET) =  634.00
  STREET LENGTH(FEET) =   800.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 30.00

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

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      24.32
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.59
    HALFSTREET FLOOD WIDTH(FEET) =   21.45
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.54
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.49
  STREET FLOW TRAVEL TIME(MIN.) =   5.25   Tc(MIN.) =  19.14
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.198
  *USER SPECIFIED(SUBAREA):
  SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7320
  SUBAREA AREA(ACRES) =   13.20      SUBAREA RUNOFF(CFS) =   21.24
  TOTAL AREA(ACRES) =   20.20       PEAK FLOW RATE(CFS) =      34.91

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.65   HALFSTREET FLOOD WIDTH(FEET) =  24.73
  FLOW VELOCITY(FEET/SEC.) =  2.77   DEPTH*VELOCITY(FT*FT/SEC.) =   1.81
  LONGEST FLOWPATH FROM NODE     21.00 TO NODE     23.00 =  1350.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      22.00 TO NODE      23.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.198
  *USER SPECIFIED(SUBAREA):
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6100
  SUBAREA AREA(ACRES) =    8.00   SUBAREA RUNOFF(CFS) =   10.73
  TOTAL AREA(ACRES) =    28.20   TOTAL RUNOFF(CFS) =   45.64
  TC(MIN) =  19.14

****************************************************************************
  FLOW PROCESS FROM NODE      23.00 TO NODE       7.00 IS CODE =  31
```

```
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
 ELEVATION DATA: UPSTREAM(FEET) =   634.00  DOWNSTREAM(FEET) =   627.40
 FLOW LENGTH(FEET) =  1700.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  39.0 INCH PIPE IS  29.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.69
 ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     45.64
 PIPE TRAVEL TIME(MIN.) =   4.24    Tc(MIN.) =  23.38
 LONGEST FLOWPATH FROM NODE     21.00 TO NODE      7.00 =  3050.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     23.00 TO NODE      7.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.977
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .6349
 SOIL CLASSIFICATION IS "A"
 SUBAREA AREA(ACRES) =   29.70   SUBAREA RUNOFF(CFS) =   37.28
 TOTAL AREA(ACRES) =    57.90   TOTAL RUNOFF(CFS) =   82.92
 TC(MIN) =  23.38

****************************************************************************
 FLOW PROCESS FROM NODE     23.00 TO NODE      7.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.977
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7954
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =   29.70   SUBAREA RUNOFF(CFS) =   46.70
 TOTAL AREA(ACRES) =    87.60   TOTAL RUNOFF(CFS) =  129.62
 TC(MIN) =  23.38

****************************************************************************
 FLOW PROCESS FROM NODE     21.00 TO NODE      7.00 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.) =  23.38
 RAINFALL INTENSITY(INCH/HR) =   1.98
 TOTAL STREAM AREA(ACRES) =   87.60
 PEAK FLOW RATE(CFS) AT CONFLUENCE =    129.62

 ** CONFLUENCE DATA **
 STREAM      RUNOFF      Tc       INTENSITY      AREA
 NUMBER       (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       188.98    33.06        1.646        141.20
     2       129.62    23.38        1.977         87.60

 ***********************************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       263.27    23.38        1.977
     2       296.87    33.06        1.646

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =    296.87   Tc(MIN.) =   33.06
 TOTAL AREA(ACRES) =    228.80
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      7.00 =  7140.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      7.00 TO NODE      8.00 IS CODE =  31
```

```
-------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
===============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   627.40  DOWNSTREAM(FEET) =   625.30
  FLOW LENGTH(FEET) =   700.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  81.0 INCH PIPE IS  65.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.60
  ESTIMATED PIPE DIAMETER(INCH) =  81.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    296.87
  PIPE TRAVEL TIME(MIN.) =   1.22    Tc(MIN.) =  34.27
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      8.00 =  7840.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      7.00 TO NODE      8.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.614
  SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .6133
  SOIL CLASSIFICATION IS "A"
  SUBAREA AREA(ACRES) =   22.70   SUBAREA RUNOFF(CFS) =   22.48
  TOTAL AREA(ACRES) =   251.50   TOTAL RUNOFF(CFS) =  319.34
  TC(MIN) =  34.27

****************************************************************************
  FLOW PROCESS FROM NODE      7.00 TO NODE      8.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.614
  SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7782
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =   22.70   SUBAREA RUNOFF(CFS) =   28.52
  TOTAL AREA(ACRES) =   274.20   TOTAL RUNOFF(CFS) =  347.86
  TC(MIN) =  34.27

****************************************************************************
  FLOW PROCESS FROM NODE      8.00 TO NODE      9.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   625.30  DOWNSTREAM(FEET) =   624.00
  FLOW LENGTH(FEET) =   400.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  87.0 INCH PIPE IS  65.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.42
  ESTIMATED PIPE DIAMETER(INCH) =  87.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    347.86
  PIPE TRAVEL TIME(MIN.) =   0.64    Tc(MIN.) =  34.91
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      9.00 =  8240.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      9.00 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.) =  34.91
  RAINFALL INTENSITY(INCH/HR) =   1.60
  TOTAL STREAM AREA(ACRES) =  274.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    347.86

****************************************************************************
  FLOW PROCESS FROM NODE     25.00 TO NODE     26.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS SINGLE FAMILY (1/4 ACRE)
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH =   970.00
  UPSTREAM ELEVATION =    660.00
  DOWNSTREAM ELEVATION =    655.00
  ELEVATION DIFFERENCE =      5.00
  TC = 0.393*[(  970.00**3)/(    5.00)]**.2 =   17.629
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.296
```

```
 *USER SPECIFIED(SUBAREA):
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7370
 SUBAREA RUNOFF(CFS) =     16.58
 TOTAL AREA(ACRES) =      9.80   TOTAL RUNOFF(CFS) =     16.58

****************************************************************************
 FLOW PROCESS FROM NODE     26.00 TO NODE     27.00 IS CODE =  61
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  655.00  DOWNSTREAM ELEVATION(FEET) =  646.00
 STREET LENGTH(FEET) =  1300.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 30.00

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

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      40.49
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.65
  HALFSTREET FLOOD WIDTH(FEET) =   24.61
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.24
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.11
 STREET FLOW TRAVEL TIME(MIN.) =   6.69   Tc(MIN.) =  24.32
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.936
 *USER SPECIFIED(SUBAREA):
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7190
 SUBAREA AREA(ACRES) =   34.20      SUBAREA RUNOFF(CFS) =   47.61
 TOTAL AREA(ACRES) =   44.00       PEAK FLOW RATE(CFS) =      64.19

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.75   HALFSTREET FLOOD WIDTH(FEET) =  29.37
 FLOW VELOCITY(FEET/SEC.) =  3.64   DEPTH*VELOCITY(FT*FT/SEC.) =   2.71
 *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
        AND L = 1300.0 FT WITH ELEVATION-DROP =   9.0 FT, IS   54.7 CFS,
        WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE     27.00
 LONGEST FLOWPATH FROM NODE     25.00 TO NODE     27.00 =  2270.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     27.00 TO NODE     28.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   646.00  DOWNSTREAM(FEET) =   641.00
 FLOW LENGTH(FEET) =  1300.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  45.0 INCH PIPE IS  33.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.29
 ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     64.19
 PIPE TRAVEL TIME(MIN.) =   2.97    Tc(MIN.) =  27.29
 LONGEST FLOWPATH FROM NODE     25.00 TO NODE     28.00 =  3570.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     27.00 TO NODE     28.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.822
 *USER SPECIFIED(SUBAREA):
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7130
 SUBAREA AREA(ACRES) =   30.50   SUBAREA RUNOFF(CFS) =   39.61
 TOTAL AREA(ACRES) =    74.50   TOTAL RUNOFF(CFS) =  103.81
 TC(MIN) =  27.29

****************************************************************************
 FLOW PROCESS FROM NODE     28.00 TO NODE     29.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   641.00  DOWNSTREAM(FEET) =   635.00
 FLOW LENGTH(FEET) =  1300.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  51.0 INCH PIPE IS  39.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.73
  ESTIMATED PIPE DIAMETER(INCH) =  51.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    103.81
  PIPE TRAVEL TIME(MIN.) =   2.48    Tc(MIN.) =  29.77
  LONGEST FLOWPATH FROM NODE     25.00 TO NODE     29.00 =  4870.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     28.00 TO NODE     29.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.739
  *USER SPECIFIED(SUBAREA):
  SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7070
  SUBAREA AREA(ACRES) =   35.00   SUBAREA RUNOFF(CFS) =   43.04
  TOTAL AREA(ACRES) =   109.50   TOTAL RUNOFF(CFS) =  146.85
  TC(MIN) =  29.77

****************************************************************************
  FLOW PROCESS FROM NODE     29.00 TO NODE      9.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   635.00  DOWNSTREAM(FEET) =   626.00
  FLOW LENGTH(FEET) =  1350.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  54.0 INCH PIPE IS  42.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.91
  ESTIMATED PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    146.85
  PIPE TRAVEL TIME(MIN.) =   2.06    Tc(MIN.) =  31.83
  LONGEST FLOWPATH FROM NODE     25.00 TO NODE      9.00 =  6220.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     25.00 TO NODE      9.00 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.) =  31.83
  RAINFALL INTENSITY(INCH/HR) =   1.68
  TOTAL STREAM AREA(ACRES) =  109.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    146.85

  ** CONFLUENCE DATA **
  STREAM      RUNOFF       Tc       INTENSITY       AREA
  NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
      1       347.86    34.91         1.599         274.20
      2       146.85    31.83         1.679         109.50

 ***********************************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       464.02    31.83         1.679
      2       487.70    34.91         1.599

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =    487.70   Tc(MIN.) =   34.91
  TOTAL AREA(ACRES) =    383.70
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      9.00 =  8240.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      9.00 TO NODE     10.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
```

Q used as outflow of detention basin

```
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   624.00  DOWNSTREAM(FEET) =   621.00
  FLOW LENGTH(FEET) =  1350.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN 108.0 INCH PIPE IS  78.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.89
  ESTIMATED PIPE DIAMETER(INCH) = 108.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    487.70
  PIPE TRAVEL TIME(MIN.) =   2.27    Tc(MIN.) =  37.19
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE     10.00 =  9590.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      9.00 TO NODE     10.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.546
  *USER SPECIFIED(SUBAREA):
  SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7110
  SUBAREA AREA(ACRES) =   76.50   SUBAREA RUNOFF(CFS) =   84.10
  TOTAL AREA(ACRES) =   460.20   TOTAL RUNOFF(CFS) =  571.80
  TC(MIN) =  37.19

****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     11.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   621.00  DOWNSTREAM(FEET) =   617.00
  FLOW LENGTH(FEET) =  1250.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN 102.0 INCH PIPE IS  83.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.56
  ESTIMATED PIPE DIAMETER(INCH) = 102.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    571.80
  PIPE TRAVEL TIME(MIN.) =   1.80    Tc(MIN.) =  38.99
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE     11.00 = 10840.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =    460.20  TC(MIN.) =     38.99
  PEAK FLOW RATE(CFS)    =    571.80
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

1
```

H.2 - Preliminary Hydraulic Analysis

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Kimley-Horn
and Associates, Inc.

PRELIMINARY HYDRAULIC ANALYSIS

Proposed Walmart Store No. 3129-00
Southeast corner of Archibald Ave. and Limonite Ave.
Eastvale, California

February 19, 2013

PREPARED FOR:

Wal-Mart Stores, Inc.
2001 SE 10th Street
Bentonville, AR 72716

PREPARED BY:

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

TABLE OF CONTENTS

Project Description and Report Purpose

The proposed project is located on an approximately 37.44 acre site located on the southeast corner of Archibald Avenue and Limonite Avenue in the City of Eastvale, Riverside County, California. For reference, see ***Exhibit 1****, Location Map*.

This project is a commercial development for a proposed Walmart. This proposed development will include the construction of an approximately 180,000 square foot building, parking facilities, driveway entrances connecting to existing roads, three outlots containing three retail shops and a gas station. Improvements within the site will provide an internal drainage and storm water detention system to convey flows within the site. The retail site will be contained within approximately 22 acre of the site; the remaining acreage, located largely within Southern California Edison electrical transmission line easements is currently planned to become a park with trails.

Riverside County's Master Drainage Plan (MDP) includes the site area. Single family residential land use (1/4-acre) lots was assumed for the hydrology calculations in the Master Plan. The purpose of this report is to determine whether the land use change from single family residential on ¼-acre lots to a blend of retail and park development will significantly impact the capacity of the planned storm drain system, a portion of which has been constructed

Master Plan Hydrology and Infrastructure

Within the County Master Plan is a hydrology map for the Eastvale area. The Site is tributary to Lateral A-2 and eventually Line A in the Plan. Lateral A-2 begins approximately 1300 feet east of Archibald Ave on Cloverdale Rd., runs west on Cloverdale Rd. before turning south on Archibald Ave. and travels 2640 feet to confluence with Line A. Lateral A-2, at the point where site runoff enters the underground pipe, has a diameter of 54 in. until it reaches Line A. Line A begins 650 feet north of Cloverdale Rd. on Harrison Ave., runs south on Harrison Ave. for 2600 feet, then west for 5200 feet in Cherry St. before discharging into Cucamonga Creek. Line A is sized with a diameter of 108 in.

In the hydrology calculations for Line A, the peak downstream flow rate is estimated to be 571.8 cfs at the connection to Cucamonga Creek. Plans for Line A, prepared by Tetra Tech, indicate that the storm drain line is designed to accommodate 622.9 cfs in the ultimate build-out condition. Discrepancy between the hydrology calculations and the design flow listed on the storm drain plans occurs at all locations. Plans for Lateral A-2 were prepared by Tetra Tech in the Line A plan set up to the south edge of the project site. Plans for Lateral A-2 upstream of the end of the Tetra Tech plans were prepared by Berryman and Henigar. The design flow rates for Lateral A-2 are not consistent between the two sets of plans. Table A below depicts the discrepancies:

Table A: Peak Flow Rate Comparison at Hydrologic Nodes

Hydrologic Reach (Nodes)	Hydrology Study Q (cfs)	Tetra Tech Q (cfs)	Berryman and Henigar Q (cfs)
10-11	571.8	622.9	N/A
9-10	487.7	534.3	N/A
8-9	347.9	380.9	N/A
29-9	146.9	148.0	N/A
28-29	103.8	148.0	115.5

The upstream Q listed on the Tetra Tech plans is 148.0 cfs. The same point on the Berryman and Henigar plans lists a Q of 115.5 cfs. The discrepancy could possibly be in the interpretation of where flows enter Lateral A-2 from the Project site. Node 29 in the hydrology calculations is where Subarea A-14 in the Master Plan enters Lateral A-2. This is also the approximately the location where the scope of design work on Lateral A-2 change from the Tetra Tech plans to he Berryman and Henigar plans. It appears that Tetra Tech assumed that the flows from Subarea A-15 enter the storm drain system upstream of the large junction structure with Lateral A-3 at station 22+19.91in the ultimate condition. It is possible that Berryman and Henigar assumed that the flows from Subarea A-14 indeed enter Lateral A-2 at that particular junction structure in the plans they subsequently prepared. No hydraulic calculations for either set of plans were made available by the District. Subarea A-14 is the subarea that contains the Project site in its entirety with no additional area included.

Hydrology and Hydraulic Methodology

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

Runoff calculations were performed using the rational method computer program Advanced Engineering Software (AES), 2011 version. This method calculates time of concentration and runoff rates using criteria as specified in the Hydrology Manual. Peak flow rate for the Site were based on a time of concentration of 29.77 minutes. This time of concentration was chosen because it is the time of concentration of the Lateral A-2 at the Project site connection (node 29). In the Master Plan hydrology calculations, subarea times of concentration were not individually determined; instead, subareas were added at the time of concentration of the main line. Therefore, for the purposes of comparison, assuming a time of concentration of 29.77 for the proposed Project will indicate what the impact of the land use change will be upon the master plan drainage system. In addition, while the Project site area is approximately 37.44 acres per surveys prepared for the Project, a site area of 35 cares was used to estimate the impacts since the master plan subarea acreage is 35 acres. Of the 35 acres, 22 are assumed to be retail with the

remaining 13 acres assumed to be park. Results from these calculations are included with this report as ***Appendix B**, Rational Method Calculation Results*.

Hydraulic calculations were performed using the Water Surface Profile Gradient (wspg) computer program. Since the design hydraulic calculations for Line A and Lateral A-2 were unavailable, hydraulic calculations were provided for both the baseline condition without the land use change and the conditions with the land use change. All information for the hydraulic calculations was taken from the record drawings, including flow rates, pipe sizes; invert elevations, curve data, manhole data, and the downstream hydraulic grade line at the channel connection.

Results and Discussion

Based on the rational method hydrology calculations, the 100-year peak runoff from the site at a 29.77-minute time of concentration, the peak time of concentration for Lateral A-2, is 49.46 cfs. In the master plan, based on the single family residential land use, the 100-year peak runoff rate from the site was 43.04cfs. This is an increase of approximately 6.42 cfs.

An increase in flow rates has an impact on the master planned storm drain system. Since the Project will likely connect to Lateral A-2 at approximately station 12+65 on the Berryman and Henigar plans, the analysis for the existing master plan and proposed land use changes end at station 12+65. Table B below depicts the hydraulic grades at several key points in Line A and Lateral A-2.

Table A: Peak Flow Rate Comparison at Hydrologic Nodes

Plan Set/Line	Station	Existing MP HGL	Proposed HGL	Difference
TT/Line A	9+54.25	619.22	619.22	0.0'
TT/Line A	35+06.22	623.25	623.34	0.09'
TT/Line A	35+20.22	623.54	623.64	0.10'
TT/Lateral A-2	10+13.50	623.54	623.64	0.10'
TT/Lateral A-2	22+80.00	624.09	624.16	0.07'
B&H/Lateral A-2	10+00.00	624.09	624.16	0.07'
B&H/Lateral A-2	12+65.00	672.42	627.75	0.33'

There are two main points of interest. Lateral A-2 joins line A at Station 35+20.22 on Line A. No other hydraulic affect will occur to Line A upstream of Station 35+20.22. Since the Line A HGL is affected by only 0.10', KHA concludes that the hydraulic impact to Line A caused by the land use change is insignificant. The second point of interest is at the upstream end of the Lateral A-2 analysis. At Station 12+65.00 on the Berryman

and Henigar Lateral A-2 plan, the HGL is raised by 0.33'. While this is a larger impact to the HGL than the impact to Line A, the HGL will remain several feet below ground surface at Station 12+65.00 and points upstream of Station 12+65.00. Similarly, KHA concludes that the hydraulic impact to Lateral A-2 is insignificant and that the land use change proposed will not significantly affect public drainage infrastructure.

REFERENCES

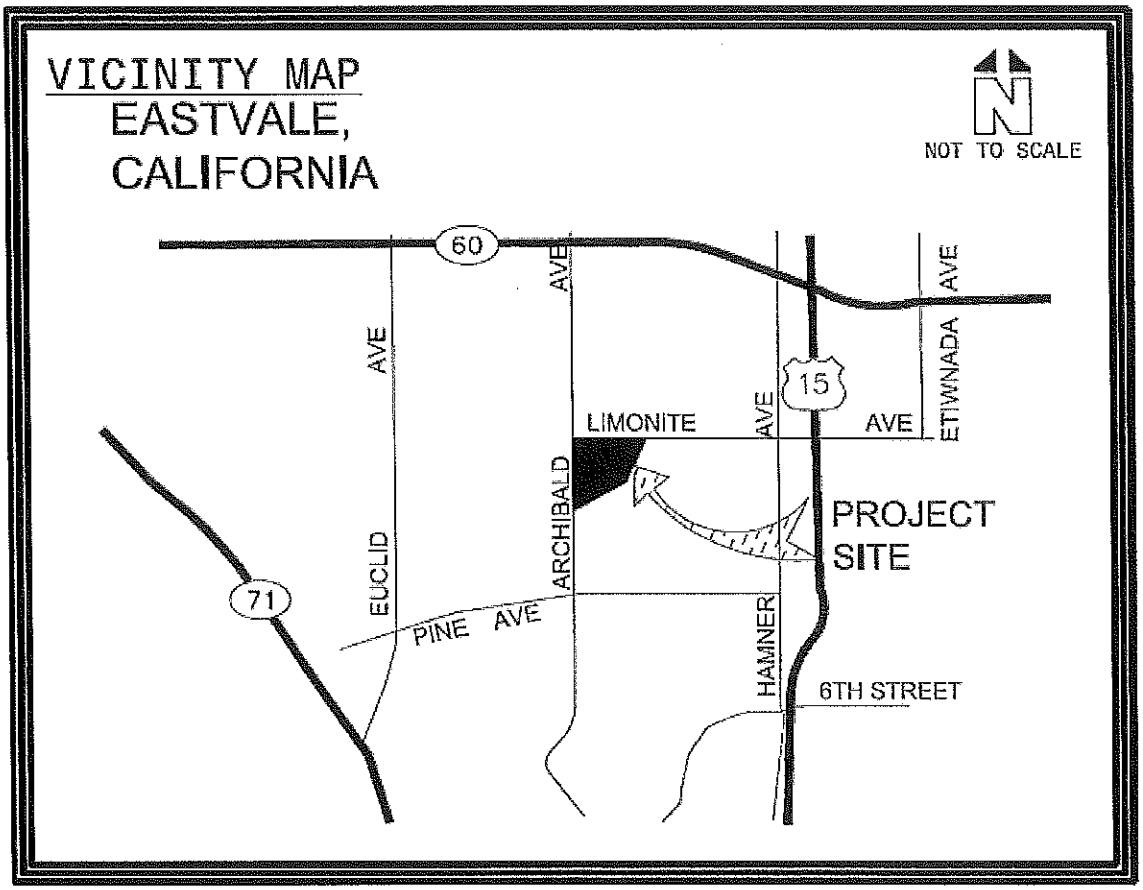
1) Riverside County Hydrology Manual, April 1978.

2) Eastvale Drainage Master Plan Hydrology Calculations

3) Eastvale Drainage Master Plan Line A and Lateral A-2 Record Drawings

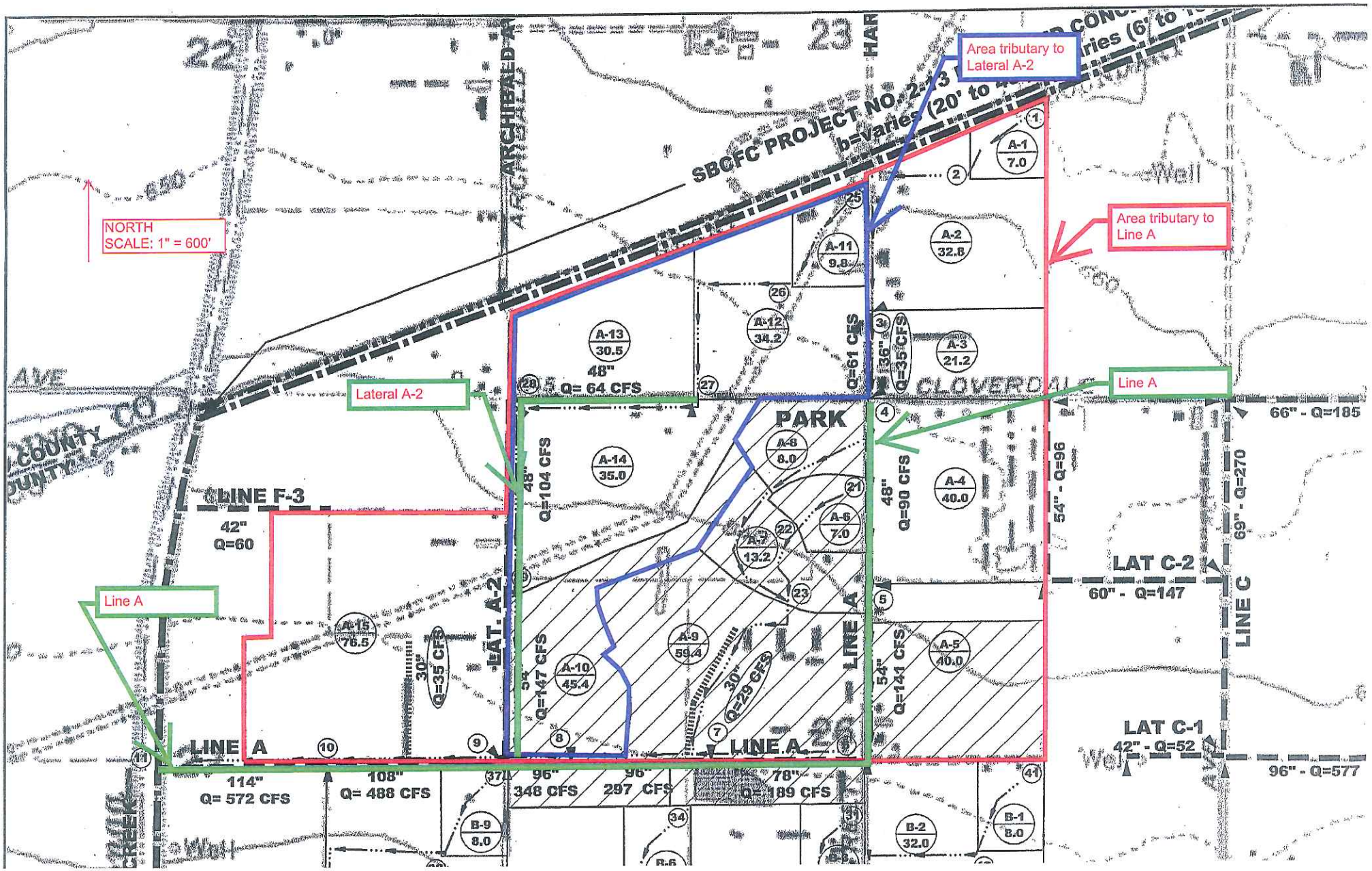
EXHIBITS

Exhibit 1: Location Map



Appendix

Appendix A - Master Plan Information


NORTH
SCALE: 1" = 600'
Area tributary to Lateral A-2
Area tributary to Line A
Lateral A-2
Line A
SBCFC PROJECT NO. 2-3
b=varies (20' to
ARCHIBALD AVE
CLOVERDALE
PARK
A-1 7.0
A-2 32.8
A-3 21.2
A-4 40.0
A-5 40.0
A-6 7.0
A-7 13.2
A-8 8.0
A-9 59.4
A-10 45.4
A-11 9.8
A-12 34.2
A-13 30.5
A-14 35.0
A-15 76.5
B-1 8.0
B-2 32.0
B-9 8.0
48" Q= 64 CFS
48" Q=104 CFS
Q=61 CFS
36" Q=35 CFS
48" Q=90 CFS
54" Q=141 CFS
54" Q=147 CFS
30" Q=29 CFS
30" Q=35 CFS
LINE F-3
42" Q=60
LAT. A-2
LINE A
LINE A
LINE A
LINE A
114" Q= 572 CFS
108" Q= 488 CFS
96" 348 CFS
96" 297 CFS
78" Q= 189 CFS
LAT C-2
60" - Q=147
LAT C-1
42" - Q=52
LINE C
54" - Q=96
69" - Q=270
66" - Q=185
96" - Q=577

```
**************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
        RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                    (RCFC&WCD)  1978 HYDROLOGY MANUAL
          (c) Copyright 1982-2000 Advanced Engineering Software (aes)
              Ver. 1.5A Release Date: 01/01/2000  License ID 1500

                          Analysis prepared by:

                                Tetra Tech, Inc
                          17770 Cartwright Road, Suite 500
                                Irvine, CA 92614
                                (949)250-6788

--------------------------------------------------------------------------
  FILE NAME: LINEA100.DAT
  TIME/DATE OF STUDY: 08:13 08/16/2001
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  10-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  1.960
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.760
  100-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  3.100
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.200
  SLOPE OF 10-YEAR INTENSITY-DURATION CURVE =  0.5287434
  SLOPE OF 100-YEAR INTENSITY-DURATION CURVE =  0.5296918
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) =   1.200
  SLOPE OF INTENSITY DURATION CURVE = 0.5297
  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   30.0     20.0    0.018/0.018/0.020    0.67    2.00 0.0313 0.167 0.0150
  2   20.0     12.0    0.018/0.018/0.020    0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  1.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint = 10.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**************************************************************************
  FLOW PROCESS FROM NODE       1.00 TO NODE       2.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS SINGLE FAMILY (1/4 ACRE)
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH =   800.00
  UPSTREAM ELEVATION =    668.00
  DOWNSTREAM ELEVATION =    663.00
  ELEVATION DIFFERENCE =      5.00
  TC = 0.393*[(  800.00**3)/(     5.00)]**.2 =   15.704
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.441
  SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7649
  SOIL CLASSIFICATION IS "B"
  SUBAREA RUNOFF(CFS) =     13.07
  TOTAL AREA(ACRES) =      7.00   TOTAL RUNOFF(CFS) =     13.07

**************************************************************************
  FLOW PROCESS FROM NODE       2.00 TO NODE       3.00 IS CODE =  61
--------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==========================================================================
  UPSTREAM ELEVATION(FEET) =  663.00  DOWNSTREAM ELEVATION(FEET) =  653.70
  STREET LENGTH(FEET) =  1550.00   CURB HEIGHT(INCHES) =  8.0
```

```
 STREET HALFWIDTH(FEET) = 30.00

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

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

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      37.01
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.65
   HALFSTREET FLOOD WIDTH(FEET) =   24.41
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.01
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.95
 STREET FLOW TRAVEL TIME(MIN.) =   8.59   Tc(MIN.) =  24.29
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.937
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7421
 SOIL CLASSIFICATION IS "B"
 SUBAREA AREA(ACRES) =   33.00      SUBAREA RUNOFF(CFS) =   47.44
 TOTAL AREA(ACRES) =   40.00      PEAK FLOW RATE(CFS) =      60.51

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.75   HALFSTREET FLOOD WIDTH(FEET) =  33.56
 FLOW VELOCITY(FEET/SEC.) =  3.34   DEPTH*VELOCITY(FT*FT/SEC.) =   2.50
 *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
        AND L = 1550.0 FT WITH ELEVATION-DROP =   9.3 FT, IS   52.3 CFS,
        WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE      3.00
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      3.00 =  2350.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      3.00 TO NODE      4.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   651.40  DOWNSTREAM(FEET) =   648.00
 FLOW LENGTH(FEET) =   650.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  30.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.09
 ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     60.51
 PIPE TRAVEL TIME(MIN.) =   1.34    Tc(MIN.) =  25.63
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      4.00 =  3000.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      3.00 TO NODE      4.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.883
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7391
 SOIL CLASSIFICATION IS "B"
 SUBAREA AREA(ACRES) =   21.20   SUBAREA RUNOFF(CFS) =   29.51
 TOTAL AREA(ACRES) =    61.20   TOTAL RUNOFF(CFS) =   90.02
 TC(MIN) =  25.63

****************************************************************************
 FLOW PROCESS FROM NODE      4.00 TO NODE      5.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   648.00  DOWNSTREAM(FEET) =   642.00
 FLOW LENGTH(FEET) =  1320.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  48.0 INCH PIPE IS  38.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.33
 ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     90.02
 PIPE TRAVEL TIME(MIN.) =   2.64    Tc(MIN.) =  28.27
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      5.00 =  4320.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      4.00 TO NODE      5.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
```

```
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.788
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .6241
 SOIL CLASSIFICATION IS "A"
 SUBAREA AREA(ACRES) =   20.00   SUBAREA RUNOFF(CFS) =   22.31
 TOTAL AREA(ACRES) =    81.20   TOTAL RUNOFF(CFS) =  112.33
 TC(MIN) =  28.27

****************************************************************************
 FLOW PROCESS FROM NODE      4.00 TO NODE      5.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.788
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7871
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =   20.00   SUBAREA RUNOFF(CFS) =   28.14
 TOTAL AREA(ACRES) =   101.20   TOTAL RUNOFF(CFS) =  140.47
 TC(MIN) =  28.27

****************************************************************************
 FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   642.00  DOWNSTREAM(FEET) =   632.00
 FLOW LENGTH(FEET) =  1320.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  54.0 INCH PIPE IS  38.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  11.49
 ESTIMATED PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    140.47
 PIPE TRAVEL TIME(MIN.) =   1.91    Tc(MIN.) =  30.18
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      6.00 =  5640.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.727
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .6204
 SOIL CLASSIFICATION IS "A"
 SUBAREA AREA(ACRES) =   20.00   SUBAREA RUNOFF(CFS) =   21.43
 TOTAL AREA(ACRES) =   121.20   TOTAL RUNOFF(CFS) =  161.90
 TC(MIN) =  30.18

****************************************************************************
 FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.727
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7841
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =   20.00   SUBAREA RUNOFF(CFS) =   27.08
 TOTAL AREA(ACRES) =   141.20   TOTAL RUNOFF(CFS) =  188.98
 TC(MIN) =  30.18

****************************************************************************
 FLOW PROCESS FROM NODE      6.00 TO NODE      7.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   632.00  DOWNSTREAM(FEET) =   627.40
 FLOW LENGTH(FEET) =  1500.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  69.0 INCH PIPE IS  53.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.71
 ESTIMATED PIPE DIAMETER(INCH) =  69.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    188.98
 PIPE TRAVEL TIME(MIN.) =   2.87    Tc(MIN.) =  33.06
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      7.00 =  7140.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      1.00 TO NODE      7.00 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.) =  33.06
  RAINFALL INTENSITY(INCH/HR) =   1.65
  TOTAL STREAM AREA(ACRES) =  141.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    188.98

 ********************************************************************************
  FLOW PROCESS FROM NODE     21.00 TO NODE     22.00 IS CODE =  21
 --------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 ================================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS SINGLE FAMILY (1/4 ACRE)
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH =   550.00
  UPSTREAM ELEVATION =    641.00
  DOWNSTREAM ELEVATION =    638.00
  ELEVATION DIFFERENCE =      3.00
  TC = 0.393*[(  550.00**3)/(     3.00)]**.2 =   13.891
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.605
  *USER SPECIFIED(SUBAREA):
  SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7500
  SUBAREA RUNOFF(CFS) =     13.67
  TOTAL AREA(ACRES) =      7.00   TOTAL RUNOFF(CFS) =     13.67

 ********************************************************************************
  FLOW PROCESS FROM NODE     22.00 TO NODE     23.00 IS CODE =  61
 --------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
 ================================================================================
  UPSTREAM ELEVATION(FEET) =  638.00  DOWNSTREAM ELEVATION(FEET) =  634.00
  STREET LENGTH(FEET) =   800.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 30.00

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

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

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      24.32
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.59
    HALFSTREET FLOOD WIDTH(FEET) =   21.45
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.54
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.49
  STREET FLOW TRAVEL TIME(MIN.) =   5.25   Tc(MIN.) =  19.14
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.198
  *USER SPECIFIED(SUBAREA):
  SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7320
  SUBAREA AREA(ACRES) =   13.20      SUBAREA RUNOFF(CFS) =   21.24
  TOTAL AREA(ACRES) =   20.20      PEAK FLOW RATE(CFS) =      34.91

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.65   HALFSTREET FLOOD WIDTH(FEET) =  24.73
  FLOW VELOCITY(FEET/SEC.) =  2.77   DEPTH*VELOCITY(FT*FT/SEC.) =   1.81
  LONGEST FLOWPATH FROM NODE     21.00 TO NODE     23.00 =  1350.00 FEET.

 ********************************************************************************
  FLOW PROCESS FROM NODE     22.00 TO NODE     23.00 IS CODE =  81
 --------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
 ================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.198
  *USER SPECIFIED(SUBAREA):
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6100
  SUBAREA AREA(ACRES) =    8.00   SUBAREA RUNOFF(CFS) =   10.73
  TOTAL AREA(ACRES) =    28.20   TOTAL RUNOFF(CFS) =   45.64
  TC(MIN) =  19.14

 ********************************************************************************
  FLOW PROCESS FROM NODE     23.00 TO NODE      7.00 IS CODE =  31
```

```
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
 ELEVATION DATA: UPSTREAM(FEET) =   634.00  DOWNSTREAM(FEET) =   627.40
 FLOW LENGTH(FEET) =  1700.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  39.0 INCH PIPE IS  29.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.69
 ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     45.64
 PIPE TRAVEL TIME(MIN.) =   4.24    Tc(MIN.) =  23.38
 LONGEST FLOWPATH FROM NODE     21.00 TO NODE      7.00 =  3050.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     23.00 TO NODE      7.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.977
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .6349
 SOIL CLASSIFICATION IS "A"
 SUBAREA AREA(ACRES) =   29.70   SUBAREA RUNOFF(CFS) =   37.28
 TOTAL AREA(ACRES) =    57.90   TOTAL RUNOFF(CFS) =   82.92
 TC(MIN) =  23.38

****************************************************************************
 FLOW PROCESS FROM NODE     23.00 TO NODE      7.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.977
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7954
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =   29.70   SUBAREA RUNOFF(CFS) =   46.70
 TOTAL AREA(ACRES) =    87.60   TOTAL RUNOFF(CFS) =  129.62
 TC(MIN) =  23.38

****************************************************************************
 FLOW PROCESS FROM NODE     21.00 TO NODE      7.00 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.) =  23.38
 RAINFALL INTENSITY(INCH/HR) =   1.98
 TOTAL STREAM AREA(ACRES) =   87.60
 PEAK FLOW RATE(CFS) AT CONFLUENCE =    129.62

 ** CONFLUENCE DATA **
 STREAM      RUNOFF       Tc       INTENSITY       AREA
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
     1       188.98    33.06         1.646         141.20
     2       129.62    23.38         1.977          87.60

**********************************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       263.27    23.38         1.977
     2       296.87    33.06         1.646

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =    296.87   Tc(MIN.) =   33.06
 TOTAL AREA(ACRES) =    228.80
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      7.00 =  7140.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      7.00 TO NODE      8.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   627.40  DOWNSTREAM(FEET) =   625.30
 FLOW LENGTH(FEET) =   700.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  81.0 INCH PIPE IS  65.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.60
 ESTIMATED PIPE DIAMETER(INCH) =  81.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    296.87
 PIPE TRAVEL TIME(MIN.) =   1.22    Tc(MIN.) =  34.27
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      8.00 =  7840.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      7.00 TO NODE      8.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.614
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .6133
 SOIL CLASSIFICATION IS "A"
 SUBAREA AREA(ACRES) =   22.70   SUBAREA RUNOFF(CFS) =   22.48
 TOTAL AREA(ACRES) =   251.50   TOTAL RUNOFF(CFS) =  319.34
 TC(MIN) =  34.27

****************************************************************************
 FLOW PROCESS FROM NODE      7.00 TO NODE      8.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.614
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7782
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =   22.70   SUBAREA RUNOFF(CFS) =   28.52
 TOTAL AREA(ACRES) =   274.20   TOTAL RUNOFF(CFS) =  347.86
 TC(MIN) =  34.27

****************************************************************************
 FLOW PROCESS FROM NODE      8.00 TO NODE      9.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   625.30  DOWNSTREAM(FEET) =   624.00
 FLOW LENGTH(FEET) =   400.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  87.0 INCH PIPE IS  65.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  10.42
 ESTIMATED PIPE DIAMETER(INCH) =  87.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    347.86
 PIPE TRAVEL TIME(MIN.) =   0.64    Tc(MIN.) =  34.91
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      9.00 =  8240.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      1.00 TO NODE      9.00 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.) =  34.91
 RAINFALL INTENSITY(INCH/HR) =   1.60
 TOTAL STREAM AREA(ACRES) =  274.20
 PEAK FLOW RATE(CFS) AT CONFLUENCE =    347.86

****************************************************************************
 FLOW PROCESS FROM NODE     25.00 TO NODE     26.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS SINGLE FAMILY (1/4 ACRE)
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH =   970.00
 UPSTREAM ELEVATION =    660.00
 DOWNSTREAM ELEVATION =    655.00
 ELEVATION DIFFERENCE =      5.00
 TC = 0.393*[(  970.00**3)/(     5.00)]**.2 =   17.629
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.296
```

```
 *USER SPECIFIED(SUBAREA):
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7370
 SUBAREA RUNOFF(CFS) =     16.58
 TOTAL AREA(ACRES) =      9.80   TOTAL RUNOFF(CFS) =     16.58

****************************************************************************
 FLOW PROCESS FROM NODE     26.00 TO NODE     27.00 IS CODE =  61
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  655.00  DOWNSTREAM ELEVATION(FEET) =  646.00
 STREET LENGTH(FEET) =  1300.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 30.00

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

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      40.49
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.65
   HALFSTREET FLOOD WIDTH(FEET) =   24.61
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.24
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.11
 STREET FLOW TRAVEL TIME(MIN.) =   6.69   Tc(MIN.) =  24.32
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.936
 *USER SPECIFIED(SUBAREA):
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7190
 SUBAREA AREA(ACRES) =   34.20      SUBAREA RUNOFF(CFS) =   47.61
 TOTAL AREA(ACRES) =   44.00      PEAK FLOW RATE(CFS) =      64.19

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.75   HALFSTREET FLOOD WIDTH(FEET) =  29.37
 FLOW VELOCITY(FEET/SEC.) =  3.64   DEPTH*VELOCITY(FT*FT/SEC.) =   2.71
 *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
        AND L = 1300.0 FT WITH ELEVATION-DROP =   9.0 FT, IS   54.7 CFS,
        WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE     27.00
 LONGEST FLOWPATH FROM NODE     25.00 TO NODE     27.00 =  2270.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     27.00 TO NODE     28.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   646.00  DOWNSTREAM(FEET) =   641.00
 FLOW LENGTH(FEET) =  1300.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  45.0 INCH PIPE IS  33.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.29
 ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     64.19
 PIPE TRAVEL TIME(MIN.) =   2.97    Tc(MIN.) =  27.29
 LONGEST FLOWPATH FROM NODE     25.00 TO NODE     28.00 =  3570.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     27.00 TO NODE     28.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.822
 *USER SPECIFIED(SUBAREA):
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7130
 SUBAREA AREA(ACRES) =   30.50   SUBAREA RUNOFF(CFS) =   39.61
 TOTAL AREA(ACRES) =    74.50   TOTAL RUNOFF(CFS) =  103.81
 TC(MIN) =  27.29

****************************************************************************
 FLOW PROCESS FROM NODE     28.00 TO NODE     29.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   641.00  DOWNSTREAM(FEET) =   635.00
 FLOW LENGTH(FEET) =  1300.00   MANNING'S N =  0.013
```

```
 DEPTH OF FLOW IN  51.0 INCH PIPE IS  39.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.73
 ESTIMATED PIPE DIAMETER(INCH) =  51.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    103.81
 PIPE TRAVEL TIME(MIN.) =   2.48    Tc(MIN.) =  29.77
 LONGEST FLOWPATH FROM NODE     25.00 TO NODE     29.00 =  4870.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     28.00 TO NODE     29.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.739
 *USER SPECIFIED(SUBAREA):
 SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7070
 SUBAREA AREA(ACRES) =   35.00   SUBAREA RUNOFF(CFS) =   43.04
 TOTAL AREA(ACRES) =   109.50   TOTAL RUNOFF(CFS) =  146.85
 TC(MIN) =  29.77

****************************************************************************
 FLOW PROCESS FROM NODE     29.00 TO NODE      9.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   635.00  DOWNSTREAM(FEET) =   626.00
 FLOW LENGTH(FEET) =  1350.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  54.0 INCH PIPE IS  42.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  10.91
 ESTIMATED PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    146.85
 PIPE TRAVEL TIME(MIN.) =   2.06    Tc(MIN.) =  31.83
 LONGEST FLOWPATH FROM NODE     25.00 TO NODE      9.00 =  6220.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     25.00 TO NODE      9.00 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.) =  31.83
 RAINFALL INTENSITY(INCH/HR) =   1.68
 TOTAL STREAM AREA(ACRES) =  109.50
 PEAK FLOW RATE(CFS) AT CONFLUENCE =    146.85

 ** CONFLUENCE DATA **
 STREAM      RUNOFF      Tc      INTENSITY      AREA
 NUMBER       (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
     1       347.86    34.91        1.599       274.20
     2       146.85    31.83        1.679       109.50

 ********************************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       464.02    31.83        1.679
     2       487.70    34.91        1.599

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =    487.70   Tc(MIN.) =   34.91
 TOTAL AREA(ACRES) =    383.70
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      9.00 =  8240.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      9.00 TO NODE     10.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
```

```
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   624.00  DOWNSTREAM(FEET) =   621.00
  FLOW LENGTH(FEET) =  1350.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN 108.0 INCH PIPE IS  78.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.89
  ESTIMATED PIPE DIAMETER(INCH) = 108.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    487.70
  PIPE TRAVEL TIME(MIN.) =   2.27    Tc(MIN.) =  37.19
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE     10.00 =  9590.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      9.00 TO NODE     10.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.546
  *USER SPECIFIED(SUBAREA):
  SINGLE-FAMILY(1/4 ACRE LOT) RUNOFF COEFFICIENT = .7110
  SUBAREA AREA(ACRES) =   76.50   SUBAREA RUNOFF(CFS) =   84.10
  TOTAL AREA(ACRES) =   460.20   TOTAL RUNOFF(CFS) =  571.80
  TC(MIN) =  37.19

****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     11.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   621.00  DOWNSTREAM(FEET) =   617.00
  FLOW LENGTH(FEET) =  1250.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN 102.0 INCH PIPE IS  83.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.56
  ESTIMATED PIPE DIAMETER(INCH) = 102.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    571.80
  PIPE TRAVEL TIME(MIN.) =   1.80    Tc(MIN.) =  38.99
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE     11.00 = 10840.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =    460.20  TC(MIN.) =     38.99
  PEAK FLOW RATE(CFS)    =    571.80
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

1

Appendix B - Rational Method Calculations

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

                              Analysis prepared by:
```

```
 ************************** DESCRIPTION OF STUDY **************************
* EASTVALE WALMART 100-YEAR STORM PEAK FLOW ANALYSIS                      *
* FOR COMPARISON WITH LINE A-2 HYDROLOGY CALCULATIONS                     *
* 22 ACRES FRO SHOPPING CENTER AND 13 ACRES FOR PARK ASSUMING 29.77 MIN TC *
 **************************************************************************

  FILE NAME: EVP100TC.INP
  TIME/DATE OF STUDY: 09:03 02/19/2013
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  2-YEAR, 1-HOUR PRECIPITATION(INCH) =  0.500
  100-YEAR, 1-HOUR PRECIPITATION(INCH) =  1.200
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) =   1.200
  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   30.0     20.0     0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *PIPE MAY BE SIZED TO HAVE A FLOW CAPACITY LESS THAN
   UPSTREAM TRIBUTARY PIPE.*

+------------------------------------------------------------------------+
| EASTVALE SHOPPING CENTER 100-YEAR RUNOFF                               |
| USING 29.77 MINUTE TC FROM LINE A-2 HYDROLOGY CALCULATIONS             |
|                                                                        |
+------------------------------------------------------------------------+

**************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =  22
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  USER SPECIFIED Tc(MIN.) =   29.770
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.764
  USER-SPECIFIED RUNOFF COEFFICIENT = .8772
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =     34.05
  TOTAL AREA(ACRES) =     22.00   TOTAL RUNOFF(CFS) =     34.05

+------------------------------------------------------------------------+
```

```
| ADJACENT FUTURE PARK AREA 100-YEAR PEAK FLOW                                |
| UTILIZING 29.77 MINUTE TC FROM LINE A-2 HYDROLOGY                           |
|                                                                             |
+-----------------------------------------------------------------------------+

*****************************************************************************
  FLOW PROCESS FROM NODE       2.00 TO NODE       2.00 IS CODE =  22
-----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
=============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS: UNDEVELOPED WITH FAIR COVER
  USER SPECIFIED Tc(MIN.) =   29.770
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.764
  USER-SPECIFIED RUNOFF COEFFICIENT = .6719
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =      15.41
  TOTAL AREA(ACRES) =      13.00   TOTAL RUNOFF(CFS) =      15.41
=============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =        13.0  TC(MIN.) =      29.77
  PEAK FLOW RATE(CFS)    =       15.41
=============================================================================
=============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Appendix C - Hydraulic Calculations

CARD CODE	SECT NO	CHN TYPE	NO OF PIER/PIP	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	4	1		10.000														
CD	2	4	1		10.000														
CD	3	4	1		6.500														
CD	4	4	1		8.500														
CD	5	4	1		5.000														

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

WALMART EASTVALE OFF-SITE STORM DRAIN ANALYSIS

HEADING LINE NO 2 IS -

EASTVALE M.D.P. LINE A HGL FOR ULTIMATE CONDITION

HEADING LINE NO 3 IS -

ADDITIONAL RUNOFF FROM WALMART SITE *NOT* INCLUDED

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 1 IS A SYSTEM OUTLET

U/S DATA	STATION	INVERT	SECT	W S ELEV
	954.250	606.430	1	619.220

ELEMENT NO 2 IS A WALL EXIT

U/S DATA	STATION	INVERT	SECT
	954.250	606.430	2

ELEMENT NO 3 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	972.280	606.480	2	.013	.000	.000	.000	0

ELEMENT NO 4 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1019.560	606.600	2	.013	45.000	60.199	.000	0

ELEMENT NO 5 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1680.000	608.240	2	.013	.000	.000	.000	1

ELEMENT NO 6 IS A JUNCTION

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	1684.670	608.250	2	5	0	.013	48.000	.000	609.000	.000	-30.000	.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 7 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	2201.930	609.530	2	.013	.000	.000	.000	1

ELEMENT NO 8 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	2287.100	609.740	2	.013	217.000	22.488	.000	0

ELEMENT NO 9 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	2372.270	609.960	2	.013	216.999	-22.488	.000	0

ELEMENT NO 10 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H

		2410.000	610.050	2			.013				.000	.000	.000	1
ELEMENT NO	11 IS A JUNCTION		*	*	*	*			*		*		*	
	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4	
		2414.670	610.060	2	5	0	.013	40.600	.000	611.000	.000	-30.000	.000	
										RADIUS	ANGLE			
										.000	.000			

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO	12 IS A REACH		*	*	*									
	U/S DATA	STATION	INVERT	SECT			N				RADIUS	ANGLE	ANG PT	MAN H
		3506.220	612.820	2			.013				.000	.000	.000	2
ELEMENT NO	13 IS A JUNCTION		*	*	*	*			*		*		*	
	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4	
		3520.220	612.855	4	3	0	.013	153.400	.000	613.200	.000	-45.000	.000	
										RADIUS	ANGLE			
										.000	.000			
ELEMENT NO	14 IS A REACH		*	*	*									
	U/S DATA	STATION	INVERT	SECT			N				RADIUS	ANGLE	ANG PT	MAN H
		3620.220	613.105	4			.013				.000	.000	.000	0
ELEMENT NO	15 IS A SYSTEM HEADWORKS				*			*						
	U/S DATA	STATION	INVERT	SECT						W S ELEV				
		3620.220	613.105	4						613.105				

Program Package Serial Number: 1864

WATER SURFACE PROFILE LISTING

Date: 2-19-2013 Time: 9:22:31

WALMART EASTVALE OFF-SITE STORM DRAIN ANALYSIS
EASTVALE M.D.P. LINE A HGL FOR ULTIMATE CONDITION
ADDITIONAL RUNOFF FROM WALMART SITE *NOT* INCLUDED

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
954.250	606.430	12.790	619.220	622.90	7.93	.98	620.20	.00	5.99	.00	10.000	.000	.00	0 .0
WALL EXIT														
954.250	606.430	12.790	619.220	622.90	7.93	.98	620.20	.00	5.99	.00	10.000	.000	.00	1 .0
18.030	.0028					.0014	.03	12.79	.00	6.26	.013	.00	.00	PIPE
972.280	606.480	12.766	619.246	622.90	7.93	.98	620.22	.00	5.99	.00	10.000	.000	.00	1 .0
47.280	.0025					.0014	.07	.00	.00	6.45	.013	.00	.00	PIPE
1019.560	606.600	12.872	619.472	622.90	7.93	.98	620.45	.00	5.99	.00	10.000	.000	.00	1 .0
660.440	.0025					.0014	.94	12.87	.00	6.50	.013	.00	.00	PIPE
1680.000	608.240	12.218	620.458	622.90	7.93	.98	621.44	.00	5.99	.00	10.000	.000	.00	1 .0
JUNCT STR	.0021					.0013	.01	12.22	.00		.013	.00	.00	PIPE
1684.670	608.250	12.464	620.714	574.90	7.32	.83	621.55	.00	5.74	.00	10.000	.000	.00	1 .0
517.260	.0025					.0012	.63	12.46	.00	6.16	.013	.00	.00	PIPE
2201.930	609.530	11.850	621.380	574.90	7.32	.83	622.21	.00	5.74	.00	10.000	.000	.00	1 .0
85.170	.0025					.0012	.10	.00	.00	6.17	.013	.00	.00	PIPE
2287.100	609.740	11.827	621.567	574.90	7.32	.83	622.40	.00	5.74	.00	10.000	.000	.00	1 .0
85.170	.0026					.0012	.10	.00	.00	6.07	.013	.00	.00	PIPE
2372.270	609.960	11.793	621.753	574.90	7.32	.83	622.58	.00	5.74	.00	10.000	.000	.00	1 .0
37.730	.0024					.0012	.05	11.79	.00	6.24	.013	.00	.00	PIPE

WALMART EASTVALE OFF-SITE STORM DRAIN ANALYSIS
EASTVALE M.D.P. LINE A HGL FOR ULTIMATE CONDITION
ADDITIONAL RUNOFF FROM WALMART SITE *NOT* INCLUDED

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
2410.000	610.050	11.790	621.840	574.90	7.32	.83	622.67	.00	5.74	.00	10.000	.000	.00	1 .0
JUNCT STR	.0021					.0011	.01	11.79	.00		.013	.00	.00	PIPE
2414.670	610.060	11.983	622.043	534.30	6.80	.72	622.76	.00	5.52	.00	10.000	.000	.00	1 .0
1091.550	.0025					.0010	1.14	11.98	.00	5.83	.013	.00	.00	PIPE
3506.220	612.820	10.434	623.254	534.30	6.80	.72	623.97	.00	5.52	.00	10.000	.000	.00	1 .0
JUNCT STR	.0025					.0012	.02	10.43	.00		.013	.00	.00	PIPE
3520.220	612.855	10.680	623.535	380.90	6.71	.70	624.23	.00	4.87	.00	8.500	.000	.00	1 .0
100.000	.0025					.0013	.13	10.68	.00	5.29	.013	.00	.00	PIPE
3620.220	613.105	10.557	623.661	380.90	6.71	.70	624.36	.00	4.87	.00	8.500	.000	.00	1 .0

CARD CODE	SECT NO	CHN TYPE	NO OF PIER/PIP	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	4	1		10.000														
CD	2	4	1		10.000														
CD	3	4	1		6.500														
CD	4	4	1		8.500														
CD	5	4	1		5.000														

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

WALMART EASTVALE OFF-SITE STORM DRAIN ANALYSIS

HEADING LINE NO 2 IS -

EASTVALE M.D.P. LINE A HGL FOR ULTIMATE CONDITION

HEADING LINE NO 3 IS -

6.42 CFS ADDITIONAL RUNOFF FROM WALMART SITE INCLUDED

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 1 IS A SYSTEM OUTLET

U/S DATA	STATION	INVERT	SECT	W S ELEV
	954.250	606.430	1	619.220

ELEMENT NO 2 IS A WALL EXIT

U/S DATA	STATION	INVERT	SECT
	954.250	606.430	2

ELEMENT NO 3 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	972.280	606.480	2	.013	.000	.000	.000	0

ELEMENT NO 4 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1019.560	606.600	2	.013	45.000	60.199	.000	0

ELEMENT NO 5 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1680.000	608.240	2	.013	.000	.000	.000	1

ELEMENT NO 6 IS A JUNCTION

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	1684.670	608.250	2	5	0	.013	48.000	.000	609.000	.000	-30.000	.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 7 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	2201.930	609.530	2	.013	.000	.000	.000	1

ELEMENT NO 8 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	2287.100	609.740	2	.013	217.000	22.488	.000	0

ELEMENT NO 9 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	2372.270	609.960	2	.013	216.999	-22.488	.000	0

ELEMENT NO 10 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H

		2410.000	610.050	2			.013			.000	.000	.000	1
ELEMENT NO	11 IS A JUNCTION	*	*	*	*			*		*		*	
	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
		2414.670	610.060	2	5	0	.013	40.600	.000	611.000	.000	-30.000	.000
										RADIUS	ANGLE		
										.000	.000		

ELEMENT NO	12 IS A REACH	*	*	*									
	U/S DATA	STATION	INVERT	SECT			N			RADIUS	ANGLE	ANG PT	MAN H
		3506.220	612.820	2			.013			.000	.000	.000	2
ELEMENT NO	13 IS A JUNCTION	*	*	*	*			*		*		*	
	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
		3520.220	612.855	4	3	0	.013	159.820	.000	613.200	.000	-45.000	.000
										RADIUS	ANGLE		
										.000	.000		
ELEMENT NO	14 IS A REACH	*	*	*									
	U/S DATA	STATION	INVERT	SECT			N			RADIUS	ANGLE	ANG PT	MAN H
		3620.220	613.105	4			.013			.000	.000	.000	0
ELEMENT NO	15 IS A SYSTEM HEADWORKS			*				*					
	U/S DATA	STATION	INVERT	SECT						W S ELEV			
		3620.220	613.105	4						613.105			

W S P G W - CIVILDESIGN Version 14.06

Program Package Serial Number: 1864

WATER SURFACE PROFILE LISTING

Date: 2-19-2013 Time: 9:18:29

WALMART EASTVALE OFF-SITE STORM DRAIN ANALYSIS

EASTVALE M.D.P. LINE A HGL FOR ULTIMATE CONDITION

6.42 CFS ADDITIONAL RUNOFF FROM WALMART SITE INCLUDED

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
954.250	606.430	12.790	619.220	629.32	8.01	1.00	620.22	.00	6.02	.00	10.000	.000	.00	0 .0
WALL EXIT														
954.250	606.430	12.791	619.221	629.32	8.01	1.00	620.22	.00	6.02	.00	10.000	.000	.00	1 .0
18.030	.0028					.0014	.03	12.79	.00	6.30	.013	.00	.00	PIPE
972.280	606.480	12.767	619.247	629.32	8.01	1.00	620.24	.00	6.02	.00	10.000	.000	.00	1 .0
47.280	.0025					.0014	.07	.00	.00	6.49	.013	.00	.00	PIPE
1019.560	606.600	12.879	619.479	629.32	8.01	1.00	620.48	.00	6.02	.00	10.000	.000	.00	1 .0
660.440	.0025					.0014	.96	12.88	.00	6.54	.013	.00	.00	PIPE
1680.000	608.240	12.245	620.485	629.32	8.01	1.00	621.48	.00	6.02	.00	10.000	.000	.00	1 .0
JUNCT STR	.0021					.0013	.01	12.24	.00		.013	.00	.00	PIPE
1684.670	608.250	12.494	620.744	581.32	7.40	.85	621.59	.00	5.77	.00	10.000	.000	.00	1 .0
517.260	.0025					.0012	.64	12.49	.00	6.20	.013	.00	.00	PIPE
2201.930	609.530	11.895	621.425	581.32	7.40	.85	622.28	.00	5.77	.00	10.000	.000	.00	1 .0
85.170	.0025					.0012	.11	.00	.00	6.21	.013	.00	.00	PIPE
2287.100	609.740	11.876	621.616	581.32	7.40	.85	622.47	.00	5.77	.00	10.000	.000	.00	1 .0
85.170	.0026					.0012	.11	.00	.00	6.12	.013	.00	.00	PIPE
2372.270	609.960	11.846	621.806	581.32	7.40	.85	622.66	.00	5.77	.00	10.000	.000	.00	1 .0
37.730	.0024					.0012	.05	11.85	.00	6.28	.013	.00	.00	PIPE

Program Package Serial Number: 1864

WATER SURFACE PROFILE LISTING

Date: 2-19-2013 Time: 9:18:29

WALMART EASTVALE OFF-SITE STORM DRAIN ANALYSIS

EASTVALE M.D.P. LINE A HGL FOR ULTIMATE CONDITION

6.42 CFS ADDITIONAL RUNOFF FROM WALMART SITE INCLUDED

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
2410.000	610.050	11.845	621.895	581.32	7.40	.85	622.75	.00	5.77	.00	10.000	.000	.00	1 .0
JUNCT STR	.0021					.0012	.01	11.85	.00		.013	.00	.00	PIPE
2414.670	610.060	12.041	622.101	540.72	6.88	.74	622.84	.00	5.56	.00	10.000	.000	.00	1 .0
1091.550	.0025					.0011	1.17	12.04	.00	5.87	.013	.00	.00	PIPE
3506.220	612.820	10.522	623.342	540.72	6.88	.74	624.08	.00	5.56	.00	10.000	.000	.00	1 .0
JUNCT STR	.0025					.0012	.02	10.52	.00		.013	.00	.00	PIPE
3520.220	612.855	10.788	623.643	380.90	6.71	.70	624.34	.00	4.87	.00	8.500	.000	.00	1 .0
100.000	.0025					.0013	.13	10.79	.00	5.29	.013	.00	.00	PIPE
3620.220	613.105	10.665	623.770	380.90	6.71	.70	624.47	.00	4.87	.00	8.500	.000	.00	1 .0

CARD CODE	SECT NO	CHN TYPE	NO OF PIER/PIP	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	4	1		6.500														
CD	2	4	1		3.000														
CD	3	4	1		6.500														
CD	4	4	1		4.500														
CD	5	4	1		4.000														

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -
WALMART EASTVALE OFF-SITE STORM DRAIN ANALYSIS

HEADING LINE NO 2 IS -
EASTVALE M.D.P. LATERAL A-1 AND A-2 HGL FOR ULTIMATE CONDITION

HEADING LINE NO 3 IS -
ADDITIONAL RUNOFF FROM WALMART SITE NOT INCLUDED

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 1 IS A SYSTEM OUTLET * * *

U/S DATA	STATION	INVERT	SECT	W S ELEV
	1013.500	613.200	1	623.540

ELEMENT NO 2 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1071.490	613.490	1	.013	.000	.000	.000	0

ELEMENT NO 3 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1106.830	613.670	1	.013	45.000	-44.996	.000	0

ELEMENT NO 4 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1820.000	617.230	1	.013	.000	.000	.000	1

ELEMENT NO 5 IS A JUNCTION * * * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	1824.670	617.260	1	2	0	.013	9.500	.000	618.000	.000	30.000	.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 6 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	2215.910	619.130	1	.013	.000	.000	.000	0

ELEMENT NO 7 IS A JUNCTION * * * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	2234.410	621.380	4	3	0	.013	32.500	.000	619.180	.000	30.000	.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 8 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	2280.000	621.770	4	.013	.000	.000	.000	0

ELEMENT NO 9 IS A STATION CHANGE FROM STA = 2280.000 TO NEW STATION =

U/S DATA	STATION
	1000.000

ELEMENT NO 10 IS A TRANSITION * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE
	1003.000	622.290	5	.013	.000	.000

W S P G W

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 11 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1013.000	622.340	5	.013	.000	.000	.000	0

ELEMENT NO 12 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1032.630	622.440	5	.013	75.001	-14.996	.000	0

ELEMENT NO 13 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1084.360	622.690	5	.013	.000	.000	.000	0

ELEMENT NO 14 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1103.990	622.785	5	.013	75.001	14.996	.000	0

ELEMENT NO 15 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1265.000	623.590	5	.013	.000	.000	.000	0

ELEMENT NO 16 IS A SYSTEM HEADWORKS *

U/S DATA	STATION	INVERT	SECT	W S ELEV
	1265.000	623.590	5	623.590

Program Package Serial Number: 1864

WATER SURFACE PROFILE LISTING

Date: 2-19-2013 Time: 9:30:31

WALMART EASTVALE OFF-SITE STORM DRAIN ANALYSIS

EASTVALE M.D.P. LATERAL A-1 AND A-2 HGL FOR ULTIMATE CONDITION

ADDITIONAL RUNOFF FROM WALMART SITE NOT INCLUDED

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1013.500	613.200	10.340	623.540	157.50	4.75	.35	623.89	.00	3.33	.00	6.500	.000	.00	1 .0
57.990	.0050					.0009	.05	10.34	.00	2.96	.013	.00	.00	PIPE
1071.490	613.490	10.102	623.592	157.50	4.75	.35	623.94	.00	3.33	.00	6.500	.000	.00	1 .0
35.340	.0051					.0009	.03	.00	.00	2.94	.013	.00	.00	PIPE
1106.830	613.670	10.004	623.674	157.50	4.75	.35	624.02	.00	3.33	.00	6.500	.000	.00	1 .0
713.170	.0050					.0009	.64	10.00	.00	2.96	.013	.00	.00	PIPE
1820.000	617.230	7.105	624.335	157.50	4.75	.35	624.68	.00	3.33	.00	6.500	.000	.00	1 .0
JUNCT STR	.0064					.0008	.00	7.10	.00		.013	.00	.00	PIPE
1824.670	617.260	7.150	624.410	148.00	4.46	.31	624.72	.00	3.22	.00	6.500	.000	.00	1 .0
163.259	.0048					.0008	.13	7.15	.00	2.89	.013	.00	.00	PIPE
1987.929	618.040	6.500	624.540	148.00	4.46	.31	624.85	.00	3.22	.00	6.500	.000	.00	1 .0
141.326	.0048					.0007	.10	6.50	.00	2.89	.013	.00	.00	PIPE
2129.255	618.716	5.898	624.613	148.00	4.68	.34	624.95	.00	3.22	3.77	6.500	.000	.00	1 .0
77.875	.0048					.0007	.06	5.90	.28	2.89	.013	.00	.00	PIPE
2207.131	619.088	5.548	624.636	148.00	4.91	.37	625.01	.00	3.22	4.60	6.500	.000	.00	1 .0
8.779	.0048					.0008	.01	5.55	.34	2.89	.013	.00	.00	PIPE
2215.910	619.130	5.508	624.638	148.00	4.94	.38	625.02	.00	3.22	4.68	6.500	.000	.00	1 .0
JUNCT STR	.1216							5.51	.34		.013	.00	.00	PIPE

WALMART EASTVALE OFF-SITE STORM DRAIN ANALYSIS

EASTVALE M.D.P. LATERAL A-1 AND A-2 HGL FOR ULTIMATE CONDITION

ADDITIONAL RUNOFF FROM WALMART SITE NOT INCLUDED

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
2234.410	621.380	2.394	623.774	115.50	13.43	2.80	626.58	.00	3.16	4.49	4.500	.000	.00	1 .0
45.590	.0086					.0118	.54	2.39	1.71	2.60	.013	.00	.00	PIPE
2280.000	621.770	2.323	624.093	115.50	13.95	3.02	627.11	.00	3.16	4.50	4.500	.000	.00	1 .0
-1280.000	.0086					.0124	-15.85	2.32	1.81	2.60	.013	.00	.00	PIPE
****CHANGE IN STATIONING STATION = 2280.000 = NEW STATION 1000.000****														
1000.000	621.770	2.323	624.093	115.50	13.95	3.02	627.11	.00	3.16	4.50	4.500	.000	.00	1 .0
TRANS STR	.1733					.0095	.03	2.32	1.81		.013	.00	.00	PIPE
1003.000	622.290	3.242	625.532	115.50	10.59	1.74	627.27	.00	3.24	3.14	4.000	.000	.00	1 .0
10.000	.0050					.0064	.06	3.24	1.00	4.00	.013	.00	.00	PIPE
1013.000	622.340	3.387	625.727	115.50	10.18	1.61	627.34	.06	3.24	2.88	4.000	.000	.00	1 .0
19.630	.0051					.0060	.12	3.45	.90	4.00	.013	.00	.00	PIPE
1032.630	622.440	3.468	625.908	115.50	9.98	1.55	627.45	.00	3.24	2.72	4.000	.000	.00	1 .0
51.730	.0048					.0058	.30	3.47	.85	4.00	.013	.00	.00	PIPE
1084.360	622.690	3.611	626.301	115.50	9.67	1.45	627.75	.05	3.24	2.37	4.000	.000	.00	1 .0
19.630	.0048					.0057	.11	3.66	.76	4.00	.013	.00	.00	PIPE
1103.990	622.785	3.648	626.433	115.50	9.61	1.43	627.87	.00	3.24	2.27	4.000	.000	.00	1 .0
161.010	.0050					.0056	.91	3.65	.73	4.00	.013	.00	.00	PIPE
1265.000	623.590	3.832	627.422	115.50	9.33	1.35	628.77	.00	3.24	1.61	4.000	.000	.00	1 .0

CARD CODE	SECT NO	CHN TYPE	NO OF PIER/PIP	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	4	1		6.500														
CD	2	4	1		3.000														
CD	3	4	1		6.500														
CD	4	4	1		4.500														
CD	5	4	1		4.000														

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

WALMART EASTVALE OFF-SITE STORM DRAIN ANALYSIS

HEADING LINE NO 2 IS -

EASTVALE M.D.P. LATERAL A-1 AND A-2 HGL FOR ULTIMATE CONDITION

HEADING LINE NO 3 IS -

6.42 CFS ADDITIONAL RUNOFF FROM WALMART SITE INCLUDED, DS HGL ADJUSTED 0.1

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 1 IS A SYSTEM OUTLET * * *

U/S DATA	STATION	INVERT	SECT	W S ELEV
	1013.500	613.200	1	623.640

ELEMENT NO 2 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1071.490	613.490	1	.013	.000	.000	.000	0

ELEMENT NO 3 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1106.830	613.670	1	.013	45.000	-44.996	.000	0

ELEMENT NO 4 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1820.000	617.230	1	.013	.000	.000	.000	1

ELEMENT NO 5 IS A JUNCTION * * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	1824.670	617.260	1	2	0	.013	9.500	.000	618.000	.000	30.000	.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 6 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	2215.910	619.130	1	.013	.000	.000	.000	0

ELEMENT NO 7 IS A JUNCTION * * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	2234.410	621.380	4	3	0	.013	.001	.000	619.180	.000	30.000	.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 8 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	2280.000	621.770	4	.013	.000	.000	.000	0

ELEMENT NO 9 IS A STATION CHANGE FROM STA = 2280.000 TO NEW STATION =

U/S DATA	STATION
	1000.000

ELEMENT NO 10 IS A TRANSITION * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE
	1003.000	622.290	5	.013	.000	.000

W S P G W

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 11 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1013.000	622.340	5	.013	.000	.000	.000	0

ELEMENT NO 12 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1032.630	622.440	5	.013	75.001	-14.996	.000	0

ELEMENT NO 13 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1084.360	622.690	5	.013	.000	.000	.000	0

ELEMENT NO 14 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1103.990	622.785	5	.013	75.001	14.996	.000	0

ELEMENT NO 15 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1265.000	623.590	5	.013	.000	.000	.000	0

ELEMENT NO 16 IS A SYSTEM HEADWORKS * *

U/S DATA	STATION	INVERT	SECT	W S ELEV
	1265.000	623.590	5	623.590

W S P G W - CIVILDESIGN Version 14.06

Program Package Serial Number: 1864

WATER SURFACE PROFILE LISTING

Date: 2-19-2013 Time: 9:30:41

WALMART EASTVALE OFF-SITE STORM DRAIN ANALYSIS
EASTVALE M.D.P. LATERAL A-1 AND A-2 HGL FOR ULTIMATE CONDITION
6.42 CFS ADDITIONAL RUNOFF FROM WALMART SITE INCLUDED, DS HGL ADJUSTED

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1013.500	613.200	10.440	623.640	131.42	3.96	.24	623.88	.00	3.03	.00	6.500	.000	.00	1 .0
57.990	.0050					.0006	.04	10.44	.00	2.67	.013	.00	.00	PIPE
1071.490	613.490	10.186	623.676	131.42	3.96	.24	623.92	.00	3.03	.00	6.500	.000	.00	1 .0
35.340	.0051					.0006	.02	.00	.00	2.66	.013	.00	.00	PIPE
1106.830	613.670	10.063	623.733	131.42	3.96	.24	623.98	.00	3.03	.00	6.500	.000	.00	1 .0
713.170	.0050					.0006	.45	10.06	.00	2.67	.013	.00	.00	PIPE
1820.000	617.230	6.963	624.193	131.42	3.96	.24	624.44	.00	3.03	.00	6.500	.000	.00	1 .0
JUNCT STR	.0064					.0006	.00	6.96	.00		.013	.00	.00	PIPE
1824.670	617.260	6.994	624.254	121.92	3.67	.21	624.46	.00	2.91	.00	6.500	.000	.00	1 .0
116.458	.0048					.0005	.06	6.99	.00	2.60	.013	.00	.00	PIPE
1941.128	617.817	6.500	624.317	121.92	3.67	.21	624.53	.00	2.91	.00	6.500	.000	.00	1 .0
135.756	.0048					.0005	.07	6.50	.00	2.60	.013	.00	.00	PIPE
2076.884	618.466	5.898	624.363	121.92	3.85	.23	624.59	.00	2.91	3.77	6.500	.000	.00	1 .0
76.211	.0048					.0005	.04	5.90	.23	2.60	.013	.00	.00	PIPE
2153.095	618.830	5.548	624.377	121.92	4.04	.25	624.63	.00	2.91	4.60	6.500	.000	.00	1 .0
61.968	.0048					.0005	.03	5.55	.28	2.60	.013	.00	.00	PIPE
2215.062	619.126	5.259	624.385	121.92	4.24	.28	624.66	.00	2.91	5.11	6.500	.000	.00	1 .0
.847	.0048					.0006	.00	5.26	.31	2.60	.013	.00	.00	PIPE

Program Package Serial Number: 1864

WATER SURFACE PROFILE LISTING

Date: 2-19-2013 Time: 9:30:41

WALMART EASTVALE OFF-SITE STORM DRAIN ANALYSIS

EASTVALE M.D.P. LATERAL A-1 AND A-2 HGL FOR ULTIMATE CONDITION

6.42 CFS ADDITIONAL RUNOFF FROM WALMART SITE INCLUDED, DS HGL ADJUSTED

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
2215.910	619.130	5.255	624.385	121.92	4.24	.28	624.66	.00	2.91	5.12	6.500	.000	.00	1 .0
JUNCT STR	.1216							5.26	.32		.013	.00	.00	PIPE
2234.410	621.380	2.460	623.840	121.92	13.71	2.92	626.76	.00	3.25	4.48	4.500	.000	.00	1 .0
45.590	.0086					.0120	.55	2.46	1.71	2.70	.013	.00	.00	PIPE
2280.000	621.770	2.385	624.155	121.92	14.25	3.15	627.31	.00	3.25	4.49	4.500	.000	.00	1 .0
-1280.000	.0086					.0127	-16.20	2.38	1.82	2.70	.013	.00	.00	PIPE
****CHANGE IN STATIONING STATION = 2280.000 = NEW STATION 1000.000****														
1000.000	621.770	2.385	624.155	121.92	14.25	3.15	627.31	.00	3.25	4.49	4.500	.000	.00	1 .0
TRANS STR	.1733					.0099	.03	2.38	1.82		.013	.00	.00	PIPE
1003.000	622.290	3.320	625.610	121.92	10.93	1.86	627.47	.00	3.32	3.00	4.000	.000	.00	1 .0
10.000	.0050					.0068	.07	3.32	1.00	4.00	.013	.00	.00	PIPE
1013.000	622.340	3.486	625.826	121.92	10.49	1.71	627.53	.06	3.32	2.68	4.000	.000	.00	1 .0
19.630	.0051					.0065	.13	3.55	.89	4.00	.013	.00	.00	PIPE
1032.630	622.440	3.585	626.025	121.92	10.27	1.64	627.66	.00	3.32	2.44	4.000	.000	.00	1 .0
51.730	.0048					.0063	.33	3.59	.82	4.00	.013	.00	.00	PIPE
1084.360	622.690	3.763	626.453	121.92	9.94	1.53	627.99	.04	3.32	1.89	4.000	.000	.00	1 .0
19.630	.0048					.0062	.12	3.80	.69	4.00	.013	.00	.00	PIPE
1103.990	622.785	3.812	626.597	121.92	9.87	1.51	628.11	.00	3.32	1.69	4.000	.000	.00	1 .0
86.812	.0050					.0066	.57	3.81	.64	4.00	.013	.00	.00	PIPE

WALMART EASTVALE OFF-SITE STORM DRAIN ANALYSIS

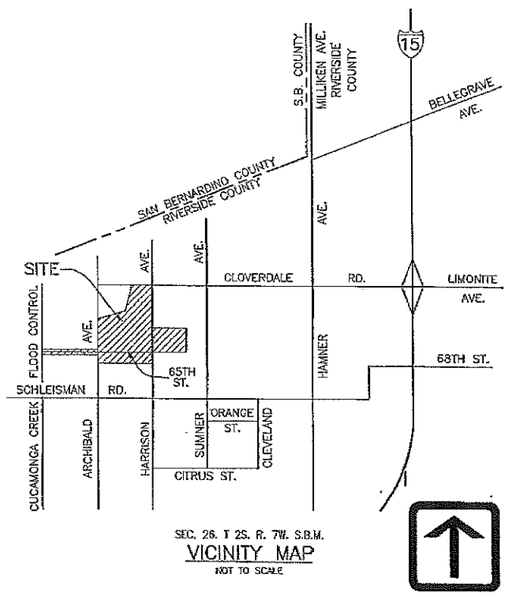
EASTVALE M.D.P. LATERAL A-1 AND A-2 HGL FOR ULTIMATE CONDITION

6.42 CFS ADDITIONAL RUNOFF FROM WALMART SITE INCLUDED, DS HGL ADJUSTED

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1190.802	623.219	4.000	627.219	121.92	9.70	1.46	628.68	.00	3.32	.00	4.000	.000	.00	1 .0
74.198	.0050					.0071	.52	4.00	.00	4.00	.013	.00	.00	PIPE
1265.000	623.590	4.164	627.754	121.92	9.70	1.46	629.22	.00	3.32	.00	4.000	.000	.00	1 .0

Appendix D - Line A and Lateral A-2 Record Drawing

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT



SEC. 26, T 2S, R. 7W. S.B.M.

VICINITY MAP

NOT TO SCALE

NOTIFICATIONS

THE CONTRACTOR SHALL NOTIFY THE FOLLOWING UTILITIES OR AGENCIES 48 HOURS PRIOR TO STARTING CONSTRUCTION OR EXCAVATION..

RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT	(909) 955-1300
RIVERSIDE COUNTY TRANSPORTATION DEPARTMENT	(909) 955-6885
PACIFIC BELL	(714) 237-7126
JURUPA COMMUNITY SERVICE DISTRICT	(909) 685-7434
SOUTHERN CALIFORNIA GAS COMPANY	(909) 335-7744
SOUTHERN CALIFORNIA EDISON COMPANY	(909) 820-5588
SANTA ANA WATERSHED PROJECT AUTHORITY	(909) 685-7434
SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT	(909) 387-8104

CAST-IN-PLACE CONCRETE PIPE REQUIREMENTS

1. THE CONTRACTOR SHALL CONTROL CONCRETE BY MEANS OF 8" X 12" TEST CYLINDERS A MINIMUM OF 1 SET OF FOUR (4) CYLINDERS/100 C.Y. AND NOT LESS THAN TWO (2) SETS OF CYLINDERS PER EACH DAYS POUR.
2. THE SUPPLYING BATCH PLANT SHALL BE INSPECTED BY THE CONTRACTOR'S ENGINEER OR INSPECTOR, AT THE START OF CONSTRUCTION AND NOT LESS THAN ONCE A WEEK THEREAFTER TO OBSERVE PLANT OPERATIONS, BATCH WEIGHTS, AND OTHER CONCRETE CONTROL MEASURES.
3. CONCRETE MIXES SHALL NOT HAVE LESS THAN SIX (6) SACKS OF PORTLAND CEMENT/CU. YD.
4. CONCRETE MIX DESIGNS SHALL BE SUBMITTED BY THE CONTRACTOR FOR APPROVAL PRIOR TO START OF CONSTRUCTION.
5. IF AND WHEN FLOW VELOCITY EXCEEDS 10 F.P.S., A 140' SEGMENT OF THE C.I.P.P. INVERT SHALL BE THICKENED 2 INCHES IN WALL THICKNESS AS "SACRIFICIAL CONCRETE" TO RESIST ABRASION; COMPRESSIVE STRENGTH OF CONCRETE AT 28 DAYS SHALL BE AT LEAST F'c = 4000 PSI. FOR DESIGN VELOCITIES GREATER THAN 20 FPS, CIPP SHALL NOT BE USED.
6. MAXIMUM PERMISSIBLE CONCRETE SLUMP SHALL BE 2-1/2".
7. THE CONTRACTOR SHALL ALLOW THE DISTRICT INSPECTOR INTO PIPE WHILE UNDER CONSTRUCTION & ROD FOR ALL WALL THICKNESS AT A MIN. OF 25 C.Y. OF THE POUR.
8. AT THE END OF ALL POURS, AND AT THE END OF EACH WORKING DAY, THE CONTRACTOR SHALL INSTALL #4 DOWELS 24" LONG, 12" INTO THE LAST POUR AT 12" CENTERS AROUND THE CIRCUMFERENCE OF CAST-IN-PLACE PIPE.
9. JUNCTION STRUCTURES SHOWN ON THE PLANS ARE FOR REINFORCED CONCRETE PIPE. THE FOLLOWING SUBSTITUTION SHALL BE MADE FOR JUNCTION STRUCTURES FOR USE WITH CIPP:
   a. A JUNCTION STRUCTURE No. 4 (JS229) SHALL BE REPLACED WITH EITHER A JUNCTION STRUCTURE No. 2 (JS227) OR A TRANSITION STRUCTURE No. 3 (TS 303).
   b. A JUNCTION STRUCTURE No. 2 (JS227) SHALL BE REPLACED WITH A TRANSITION STRUCTURE No. 3 (TS 303).
10. STANDARD DRAWING No. JS 227: JUNCTION STRUCTURES No. 2 WHEN USED WITH CIPP SHALL BE MODIFIED TO INCLUDE CONCRETE BACK FILL 1 FOOT OVER THE CIPP.

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 MEMORANDUM OF UNDERSTANDING STANDARD SPECIFICATIONS DATED SEPTEMBER 1994 AND DESIGN MANUAL. STANDARD DRAWINGS DATED MAY 1971.
2. IF AN ENCROACHMENT PERMIT IS REQUIRED FROM RIVERSIDE COUNTY FLOOD CONTROL, THEN 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 NOTIFIED TWO WEEKS PRIOR TO CONSTRUCTION.
4. ALL STATIONING REFERS TO CENTER LINE OF CONSTRUCTION UNLESS OTHERWISE NOTED.
5. STATIONING FOR LATERALS AND CONNECTOR PIPE REFERS TO THE CENTERLINE INTERSECTION STATION.
6. 48 HOURS BEFORE EXCAVATION, CALL UNDERGROUND SERVICE ALERT AT 1-800-227-2600.
7. THE VERTICAL DATUM IS DERIVED FROM NGVD 29. THE HORIZONTAL DATUM IS DERIVED FROM NAD 83.
8. ALL CROSS SECTIONS ARE TAKEN LOOKING DOWNSTREAM.
9. ELEVATIONS OF UTILITIES ARE APPROXIMATE UNLESS OTHERWISE NOTED.
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 FOR PIPE WITH LESS THAN TWO FEET OF COVER SHALL CONFORM TO LOS ANGELES COUNTY FLOOD CONTROL DISTRICT STANDARD DRAWINGS 2-0213.3 AND 2-0177 FOR CONCRETE BACKFILL IN TRENCHES. ALL OTHER PIPES SHALL CONFORM TO THE RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT STANDARD DRAWING MB15.
13. B-1 INDICATES SOIL BORING APPROXIMATE LOCATIONS BASED ON THE SOIL REPORT BY PETRA GEOTECHNICAL INC., DATED JULY 18, 2001. THE CIPP OPTION SHOWN ON THE PLANS IS BASED ON MINIMUM SLOPE REQUIREMENT OF 0.5%. THE CIPP OPTION SHALL FOLLOW THE RECOMMENDATIONS OF THE SOILS REPORT, THE SOILS ENGINEER, AND WILL REQUIRE DESIGN REVISIONS TO MEET R.C.F.C. & W.C.D. REQUIREMENTS.
14. 'V' IS THE DEPTH OF CATCH BASINS MEASURED FROM THE TOP OF CURB TO THE INVERT OF THE CONNECTOR PIPE.
15. CATCH BASINS SHALL BE LOCATED SO THAT LOCAL DEPRESSION BEGINS AT 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 AS THE EXISTING IMPROVEMENTS UNLESS OTHERWISE NOTED.
17. ALL CONCRETE IN FLOOD CONTROL DISTRICT RIGHT-OF-WAY (CUCAMONGA CHANNEL) SHALL CONFORM TO SECTION 201-1 OF STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, EXCEPT AS FOLLOWS: ALL STRUCTURAL CONCRETE SHALL BE 4,000 PSI WITH "A" GRADATION IN ALL INVERTS AND 4,000 PSI WITH "B" GRADATION FOR ALL WALLS.

INDEX

APWA STANDARD DRAWINGS

360 SLOPED PROTECTION BARRIER
635 STEEL STEPS

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

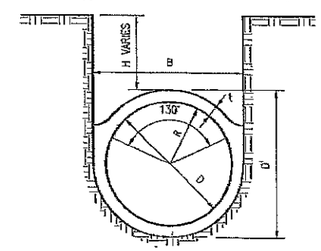
SB 101 OUTLET PROTECTION BARRIER

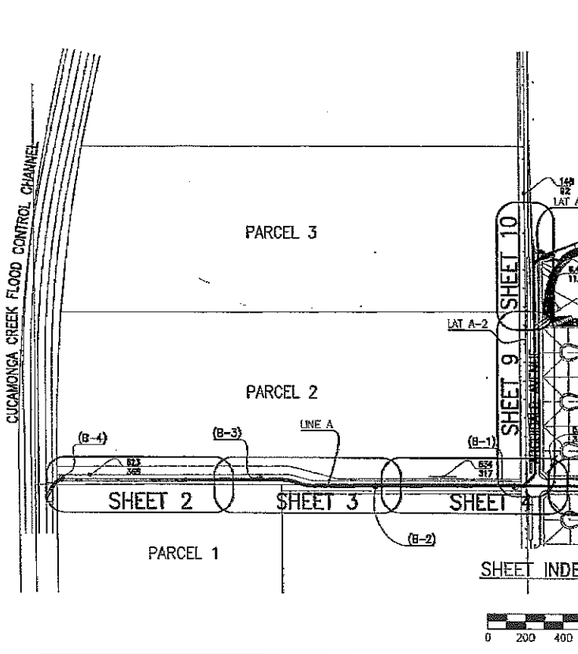
CALTRANS STANDARD DRAWINGS

B11-47 CABLE RAILING

DIMENSIONS OF CIP CONCRETE PIPE

NORMAL DIAMETER (Interior)	OUTER DIAMETER (Depth)	WIDTH OF PIPE TRENCH (Nominal)	NORMAL THICKNESS (Minimum)	SIDEWALL THICKNESS (Minimum)
D	D'	B	t	t'
78"	93"	94"	7.5"	7.5"
72"	86"	87"	7"	7"
66"	79"	80"	6.5"	6.5"
60"	72"	73"	6"	6"
54"	65"	66"	5.5"	5.5"
48"	58"	59"	5"	5"
42"	50"	51"	4"	4"





LEGENDS:

210/122 100-YEAR Q, 10-YEAR Q, DIRECTION OF FLOW

B-1 APPROXIMATE BORING LOCATION (PER GEOTECHNICAL INVESTIGATION PREPARED BY PETRA, DATED 9-27-00)

(B-1) APPROXIMATE BORING LOCATION (PER GEOTECHNICAL EVALUTATION OF SUBSURFACE CONDITIONS ALONG THE EXT. OF 65TH STREET, PREPARED BY PETRA, DATED 9-19-02)

SHEET INDEX MAP & LOCATION MAP

SCALE 1" = 400'

0 200 400 800 1200 1600

NOTICE TO CONTRACTOR

CONTRACTOR AGREES THAT HE/SHE SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY, THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND THAT THE CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD THE OWNER AND THE ENGINEER HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE OWNER OR THE ENGINEER.

UNDERGROUND STRUCTURE

ALL UNDERGROUND UTILITIES OR STRUCTURES REPORTED BY THE OWNER OR OTHERS AND THOSE SHOWN ON THE RECORDS EXAMINED ARE INDICATED WITH THEIR APPROXIMATE LOCATION AND EXTENT. THE OWNER, BY ACCEPTING THESE PLANS OR PROCEEDING WITH IMPROVEMENTS PURSUANT THERETO, AGREES TO ASSUME LIABILITY AND TO HOLD THE UNDERSIGNED HARMLESS FOR ANY DAMAGES RESULTING FROM THE EXISTENCE OF UNDERGROUND UTILITIES OR STRUCTURES NOT REPORTED TO THE UNDERSIGNED; OR NOT INDICATED ON THE PUBLIC RECORDS EXAMINED OR SHOWN ON RECORDS EXAMINED. THE CONTRACTOR IS REQUIRED TO TAKE DUE PRECAUTIONARY MEASURES TO PROTECT THE UTILITIES OR STRUCTURES SHOWN AND ANY OTHER UTILITIES OR STRUCTURES FOUND AT THE SITE. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY THE OWNERS OF THE UTILITIES OR STRUCTURES CONCERNED BEFORE STARTING WORK.

THE FOLLOWING ITEMS ARE TO BE MAINTAINED BY R.C.F.C. & W.C.D.:

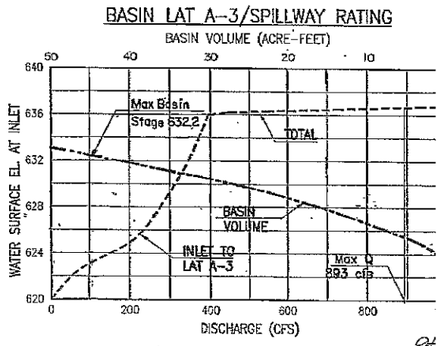
LINE A	120" RCP FROM STA	9+52 TO 35+06, AS SHOWN ON SHEETS		2 TO 4
	102" RCP	35+20	48+32	4 TO 6
	78" RCP	48+42	61+40	6 TO 7
	54" RCP	61+48	71+33	7 TO 8
LAT. A-2	78" RCP	10+13	21+84	9 TO 10
	54" RCP	22+02	22+41	10
LAT. A-3	78" RCP	10+14	11+27	10
LINE A-6	72" RCP	10+11	11+71	11
	60" RCP	11+79	14+57	11
	42" RCP	14+62	24+68	11 TO 12
LINE A-7	48" RCP	11+80	12+80	11
LINE B	42" RCP	10+10	10+40	7

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

MH252	MANHOLE NO. 2
MH254	MANHOLE NO. 4
TS301	TRANSITION STRUCTURE No.1
TS303	TRANSITION STRUCTURE No.3
M814	LEGEND & ABBREVIATIONS
M816	CONCRETE BULKHEAD
MH259	STANDARD DROP STEPS
BX401	TRANSVERSE EXPANSION JOINT
M805	PIPE SUPPORT ACCROSS TRENCHES
M816	CONCRETE BULK HEAD

REGISTERED PROFESSIONAL ENGINEER — HAROLD A. OTAWKA — No. CE 33950 Exp. 6-30-06 — CIVIL — STATE OF CALIFORNIA

BASIN LAT A-3/SPILLWAY RATING



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

REGISTERED PROFESSIONAL ENGINEER — PAUL A. PECK — No. 58602 EXP. 12-31-05 — CIVIL — STATE OF CALIFORNIA

TETRA TECH, INC.
INFRASTRUCTURE SERVICES GROUP
4120 E. JURUPA AVE., SUITE 205, ONTARIO, CA 91761
(909) 390-8500 FAX (909) 390-8020

PREPARED BY: PAUL A. PECK — R.C.E. NO. 58602
DATE: 4/9/03 — EXP. DATE: 12/31/05

BENCHMARK:
BM NO.-33 RESET 64
AT THE INTERSECTION OF ARCHIBALD AVE & CLOVERDALE RD 47.0' SO. OF CLOVERDALE RD, 25.0' W. OF ARCHIBALD AVE. A BRASS DISK SET IN THE TOP OF THE S.E. CORNER OF A 3.0' BY 3.0' CONCRETE GAS CO. VAULT & MARKED NO. 33 RESET JULY 1994. ELEV. 645.183 (5-71 ADJUSTMENT)

SCALE: AS SHOWN
DATE: 9/19/02

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

RECOMMENDED FOR APPROVAL BY: PLANNING ENGINEER — DATE: 24 Apr 03

APPROVED BY: CHIEF ENGINEER — DATE: 4/24/03

County of Riverside

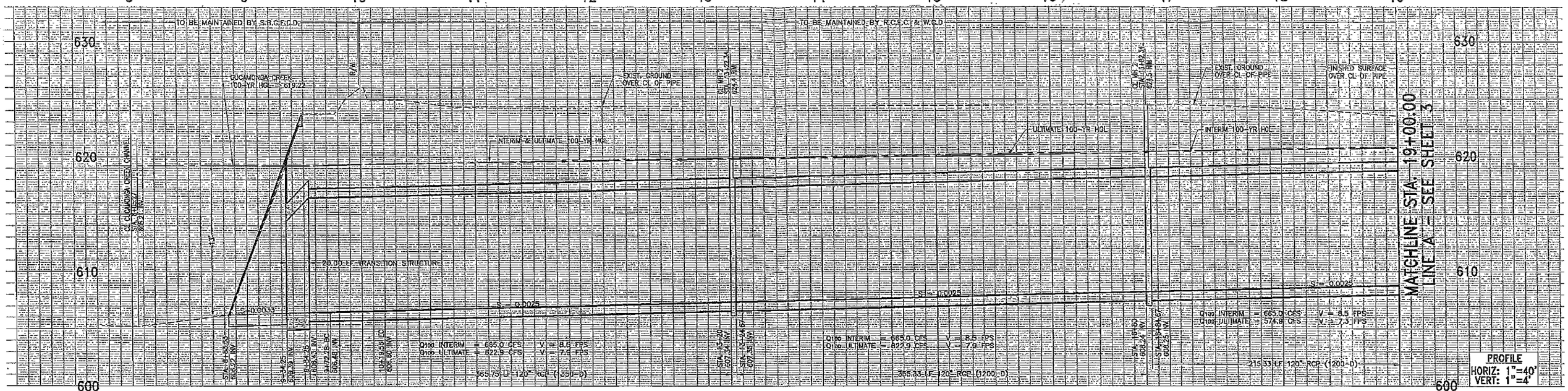
APPROVED BY: TRANSPORTATION DEPARTMENT, RIVERSIDE COUNTY, CALIF. — DATE: 4/17/03

MS#3838 - IP#010099

EASTVALE M.D.P. LINE A & LATERALS TITLE SHEET

STORM DRAIN PLANS

Project No. 2-0-0313 & 0
Drawing No. 2-313
Sheet 1 of



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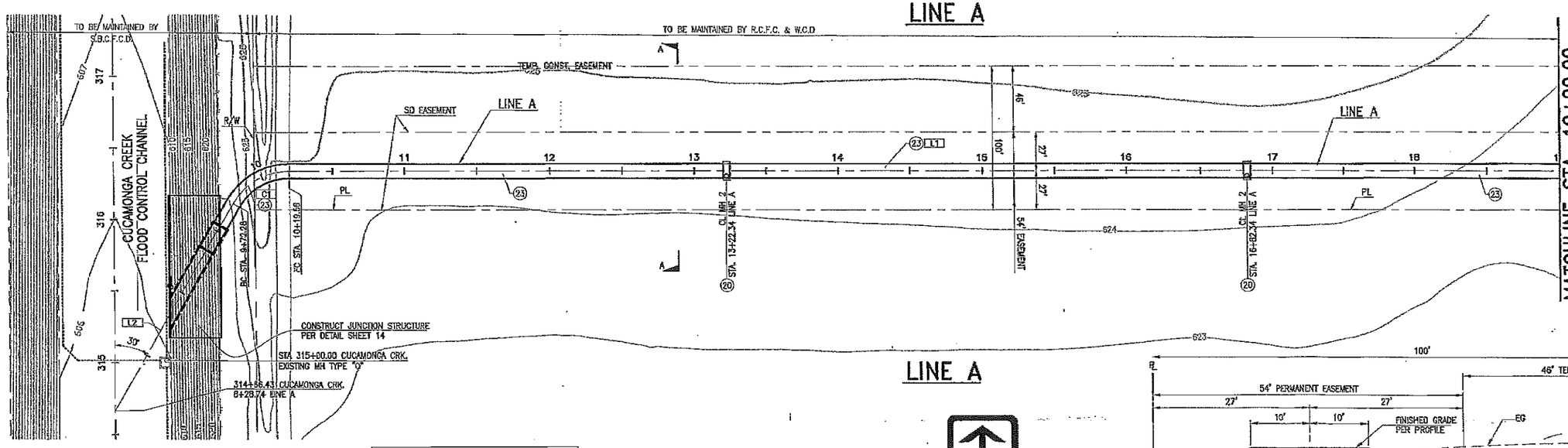

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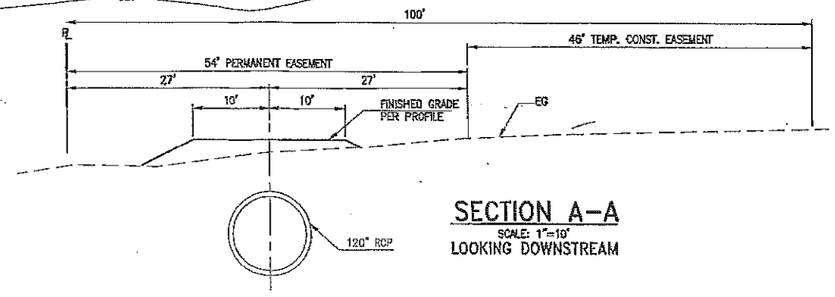


SECTION A-A

SCALE: 1"=10'
LOOKING DOWNSTREAM

CONSTRUCTION NOTES

(20) CONSTRUCT MANHOLE NO. 2 PER RCFC & WCD STD. DWG. MH252

(23) CONSTRUCT 120" RCP (D-LOAD AS SHOWN)

CURVE TABLE				
CURVE	RADIUS	LENGTH	DELTA	TANGENT
C1	45.00'	47.63'	60°12'00"	26.09'

LINE TABLE		
LINE	LENGTH	BEARING
L1	1182.37'	N89°45'30"E
L2	167.01'	N29°33'29"E

NOTES:
SEE SHEET 1 FOR GENERAL NOTES
FOR ABBREVIATIONS & LEGEND SEE RCFC & WCD M814

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

REGISTERED PROFESSIONAL ENGINEER
PAUL A. PECK
No. 58602
EXP. 12-31-05
CIVIL
STATE OF CALIFORNIA

TETRA TECH, INC.
INFRASTRUCTURE SERVICES GROUP
4120 E. JURUPA AVE., SUITE 206, ONTARIO, CA 91761
(909) 390-8088 FAX (909) 390-8020

PREPARED BY: PAUL A. PECK
DATE: 4/9/03
R.C.E. NO. 58602
EXP. DATE: 12/31/05

BENCHMARK:
ENGINEERING MONUMENT ML-33 RESET 64
AT THE INTERSECTION OF ARCHIBALD AVE. & CLOVERDALE RD 47.0' SO. OF CLOVERDALE RD, 23.0' W. OF ARCHIBALD AVE. A BRASS DISK SET IN THE TOP OF THE S.E. CORNER OF A 5.0' BY 5.0' CONCRETE GAS CO. VAULT & MARKED M.L. 33 RESET JULY 1964. ELEV. 545.163 (5-71 ADJUSTMENT)

SCALE: AS SHOWN
DATE: 9/19/02

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

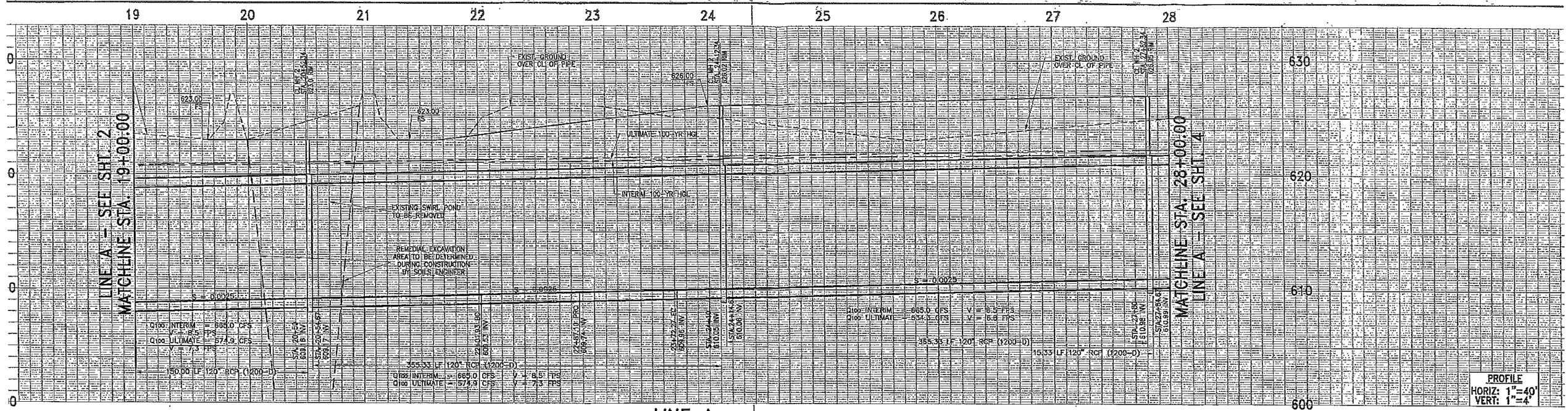
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY:
PLANNING ENGINEER
DATE: 29 Apr 03

APPROVED BY:
CHIEF ENGINEER
DATE: 4/24/03

County of Riverside
APPROVED BY:
FOR TRANSPORTATION DEPARTMENT
RIVERSIDE COUNTY, CALIF.
DATE: 4/17/03

MS#5838 - IP#010099
EASTVALE M.D.P.
LINE "A"
STA: 9+52.37 TO STA: 19+00.00
STORM DRAIN PLANS

Project No. 2-0-0313
Drawing No. 2-313
Sheet 2 of



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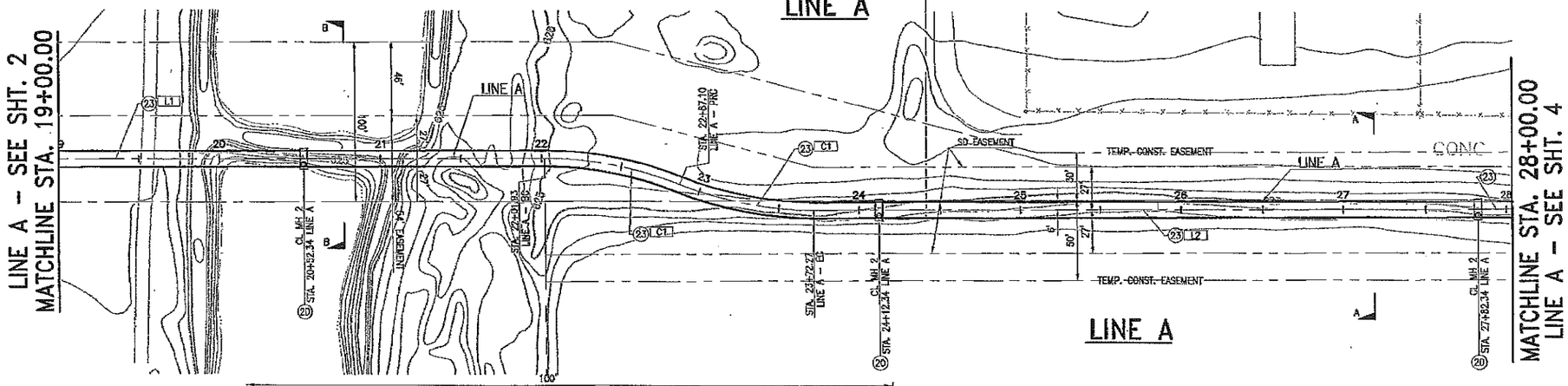

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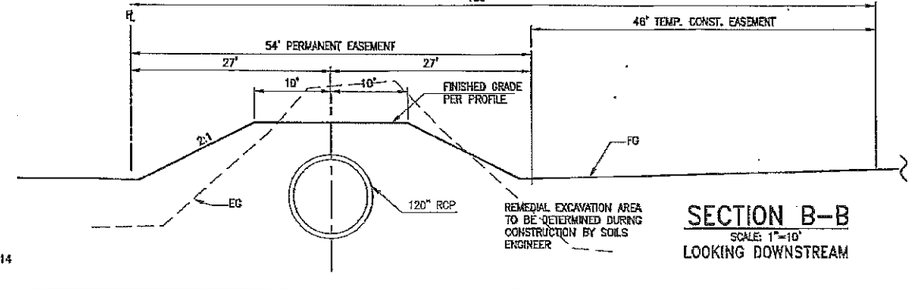
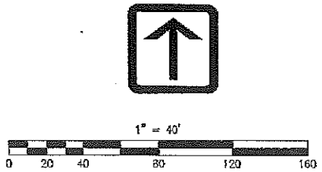
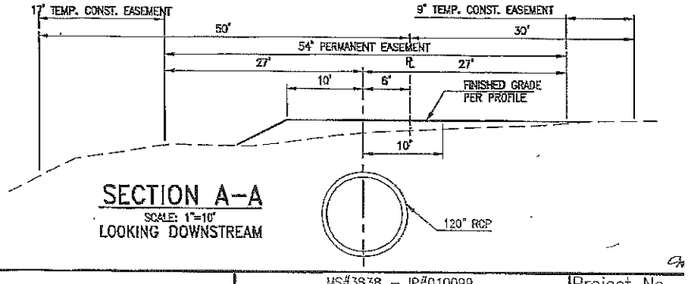


SECTION B–B

SCALE: 1"=10'
LOOKING DOWNSTREAM





SECTION A–A

SCALE: 1"=10'
LOOKING DOWNSTREAM

CONSTRUCTION NOTES

(20) CONSTRUCT MANHOLE NO. 2 PER RCFC & WCD STD. DWG. MH252
(23) CONSTRUCT 120" RCP (B-LOAD AS SHOWN)

CURVE TABLE				
CURVE	RADIUS	LENGTH	DELTA	TANGENT
C1	217.00'	85.17'	22°29'15"	43.14'

LINE TABLE		
LINE	LENGTH	BEARING
L1	1182.37'	N89°45'30"E
L2	1153.68'	N89°45'30"E

NOTES:
SEE SHEET 1 FOR GENERAL NOTES
FOR ABBREVIATIONS & LEGEND SEE RCFC & WCD M814

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

REGISTERED PROFESSIONAL ENGINEER PAUL A. PECK NO. 58502 EXP. 12-31-06 CIVIL STATE OF CALIFORNIA

TETRA TECH, INC.
INFRASTRUCTURE SERVICES GROUP
4120 E. JURUPA AVE., SUITE 206, ONTARIO, CA 91761
(909) 390-8000 FAX (909) 390-8020

PREPARED BY: PAUL A. PECK R.C.E. NO. 58502
DATE: 4/17/03 EXP. DATE: 12/31/06

BENCHMARK:
BM ML-33 RESET 64
AT THE INTERSECTION OF ARCHIBALD AVE. & CLOVERDALE RD 47.0' SO. OF CLOVERDALE RD, 25.0' W. OF ARCHIBALD AVE. A BRASS DISK SET IN THE TOP OF THE S.E. CORNER OF A 5.0' BY 5.0' CONCRETE GAS CO. VAULT & MARKED ML 33 RESET JULY 1964. ELEV. 645.193 (S-71 ADJUSTMENT)

SCALE: AS SHOWN
DATE: 9/19/02

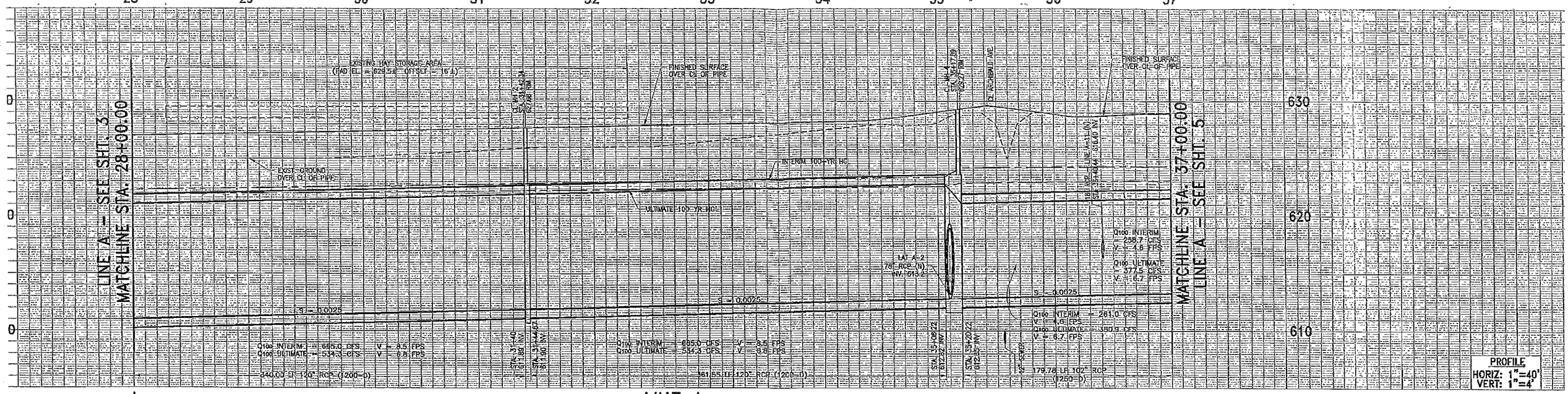
REVISIONS			
REF.	DESCRIPTION	APPR	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: PLANNING ENGINEER DATE: 29 Apr 03
APPROVED BY: CHIEF ENGINEER DATE: 4/29/03

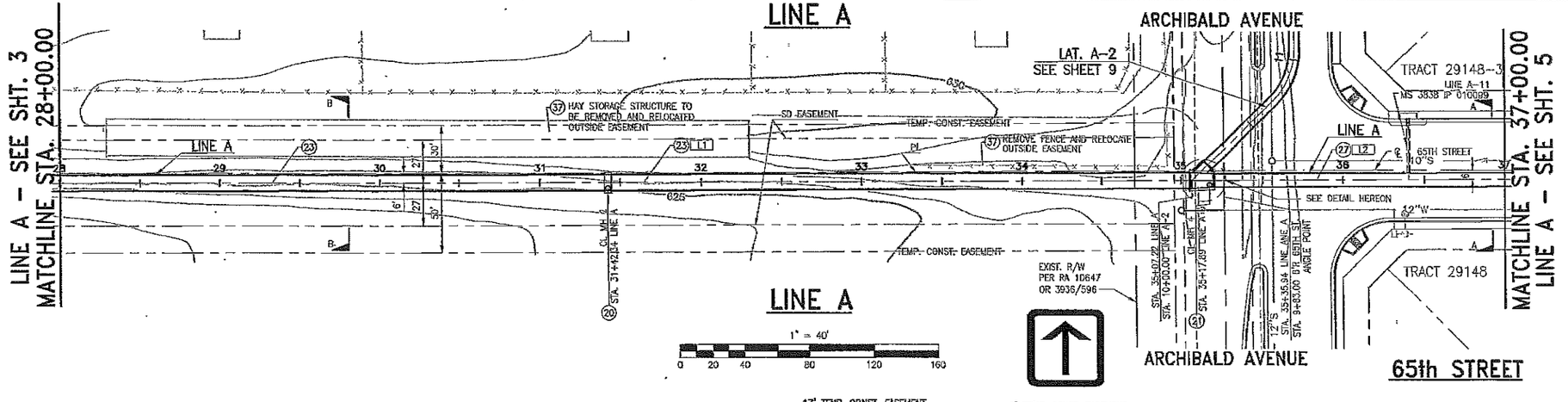
County of Riverside
APPROVED BY: FOR TRANSPORTATION DEPARTMENT RIVERSIDE COUNTY, CALIF. DATE: 4/17/03

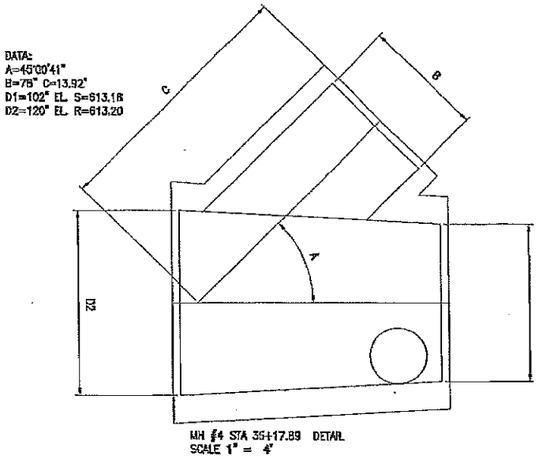
MS#3838 – IP#010099
EASTVALE M.D.P.
LINE "A"
STA: 19+00.00 TO STA: 28+00.00
STORM DRAIN PLANS

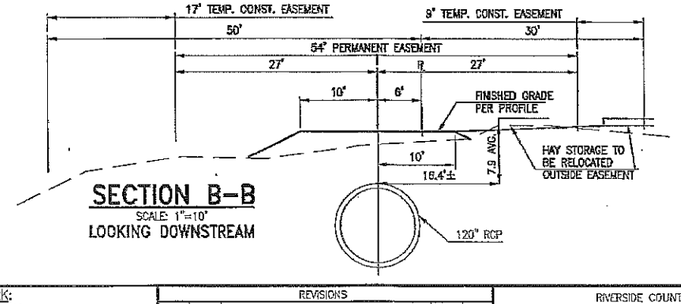
Project No. 2-0-0313
Drawing No. 2-313
Sheet 3 of



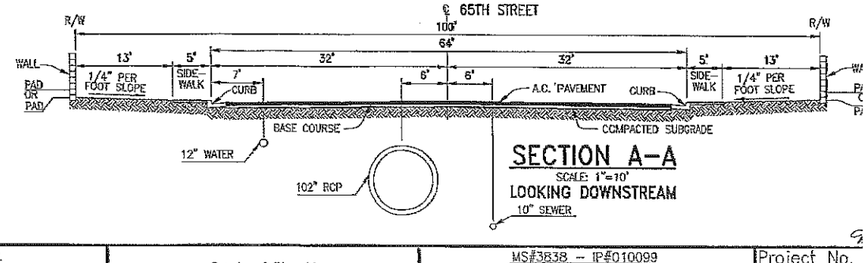
PROFILE
HORIZ: 1"=40'
VERT: 1"=4'







SECTION B–B
SCALE: 1"=10'
LOOKING DOWNSTREAM



SECTION A–A
SCALE: 1"=10'
LOOKING DOWNSTREAM

CONSTRUCTION NOTES

(20) CONSTRUCT MANHOLE NO. 2 PER RCFC & WCD STD. DWG. MH252
(21) CONSTRUCT MANHOLE NO. 4 PER RCFC & WCD STD. DWG. MH254
(23) CONSTRUCT 120" RCP (D-LOAD AS SHOWN)
(27) CONSTRUCT 102" RCP (D-LOAD AS SHOWN)
(37) REMOVE AND REPLACE IN KIND ITEM AS NOTED

LINE TABLE		
LINE	LENGTH	BEARING
L1	2520.94'	N89°45'30"E
L2	2575.15'	N89°44'49"E

NOTES:
SEE SHEET 1 FOR GENERAL NOTES
FOR ABBREVIATIONS & LEGEND SEE RCFC & WCD M814

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

REGISTERED PROFESSIONAL ENGINEER PAUL A. PECK NO. 58502 EXP. 12-31-06 CIVIL STATE OF CALIFORNIA

TETRA TECH, INC.
INFRASTRUCTURE SERVICES GROUP
4120 E. JURUPA AVE., SUITE 205, ONTARIO, CA 91761
(909) 390-8[illegible] FAX (909) 390-8020
PREPARED BY: PAUL A. PECK R.C.E. NO. C58602
DATE: 4/19/03 EXP. DATE: 12/31/06

BENCHMARK:
BM ML-33 RESET 64
AT THE INTERSECTION OF ARCHIBALD AVE & CLOVERDALE RD 47.0' SO. OF CLOVERDALE RD, 25.0' W. OF ARCHIBALD AVE. A BRASS DISK SET IN THE TOP OF THE S.E. CORNER OF A 5.0' BY 5.0' CONCRETE GAS CO. VAULT & MARKED M.L. 33 RESET JULY 1964. ELEV. 645.133 (6-71 ADJUSTMENT)
SCALE: AS SHOWN
DATE: 9/19/02

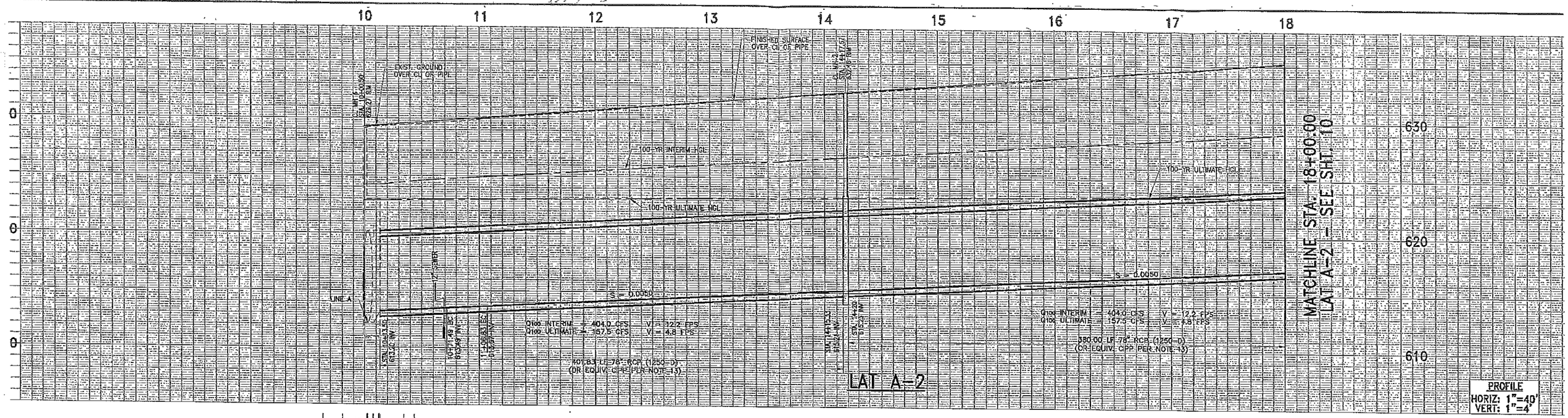
REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

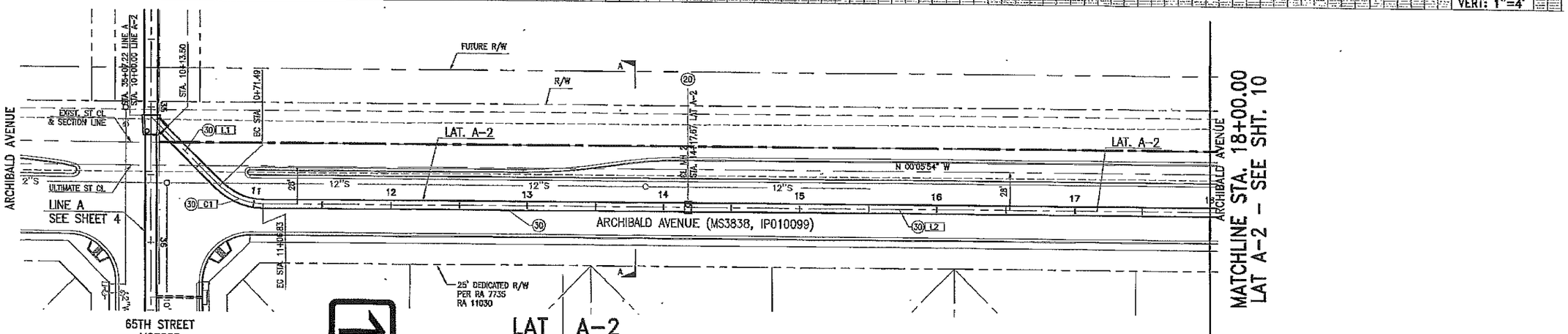
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: PLANNING ENGINEER DATE: 24 Apr 03
APPROVED BY: CHIEF ENGINEER DATE: 4/24/03

County of Riverside
APPROVED BY: FOR TRANSPORTATION DEPARTMENT RIVERSIDE COUNTY, CALIF. DATE: 4/17/03

MS#3838 – IP#010099
EASTVALE M.D.P.
LINE "A"
STA: 28+00.00 TO STA: 37+00.00
STORM DRAIN PLANS

Project No. 2-0-0313
Drawing No. 2-313
Sheet 4 of





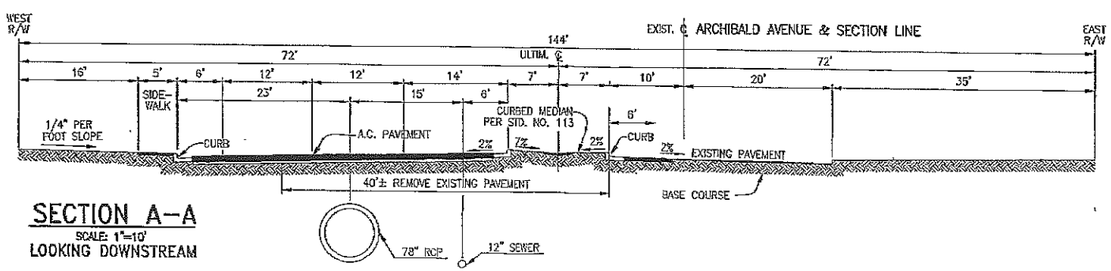
CONSTRUCTION NOTES

(20) CONSTRUCT MANHOLE NO. 2 PER RCFC & WCD STD. DWG. MH252

(30) CONSTRUCT 78" RCP (D-LOAD AS SHOWN)

CURVE TABLE				
CURVE	RADIUS	LENGTH	DELTA	TANGENT
C1	45.00'	35.34'	44°59'49"	18.64'

LINE TABLE		
LINE	LENGTH	BEARING
L1	71.49'	N44°44'49"E
L2	1113.09'	N00°15'00"W



SECTION A-A
SCALE: 1"=10'
LOOKING DOWNSTREAM

NOTES:
SEE SHEET 1 FOR GENERAL NOTES
FOR ABBREVIATIONS & LEGEND SEE RCFC & WCD M814

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

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

REGISTERED PROFESSIONAL ENGINEER PAUL A. PECK NO. 58602 EXP. 12-31-06 CIVIL STATE OF CALIFORNIA

TETRA TECH, INC.
INFRASTRUCTURE SERVICES GROUP
4120 E. JURUPA AVE., SUITE 206, ONTARIO, CA 91761
(909) 390-8020 • FAX (909) 390-8020

PREPARED BY: PAUL A. PECK R.C.E. NO. 58602
DATE: 4/9/03 EXP. DATE: 12/31/06

BENCHMARK:
BM ML-33 RESET 64
AT THE INTERSECTION OF ARCHIBALD AVE & CLOVERDALE RD 47.0' SO. OF CLOVERDALE RD, 23.0' W. OF ARCHIBALD AVE. A BRASS DISK SET IN THE TOP OF THE S.E. CORNER OF A 5.0' BY 5.0' CONCRETE GAS CO. VAULT & MARKED M.L. 33 RESET JULY 1964. ELEV. 645.183 (3-71 ADJUSTMENT)

SCALE: AS SHOWN
DATE: 3/19/02

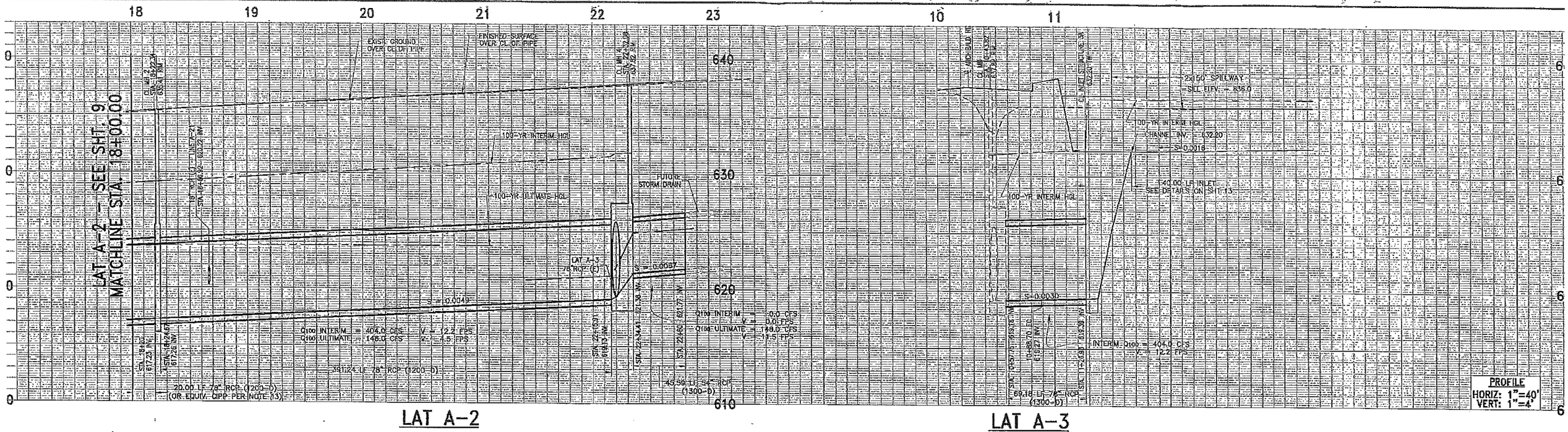
REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

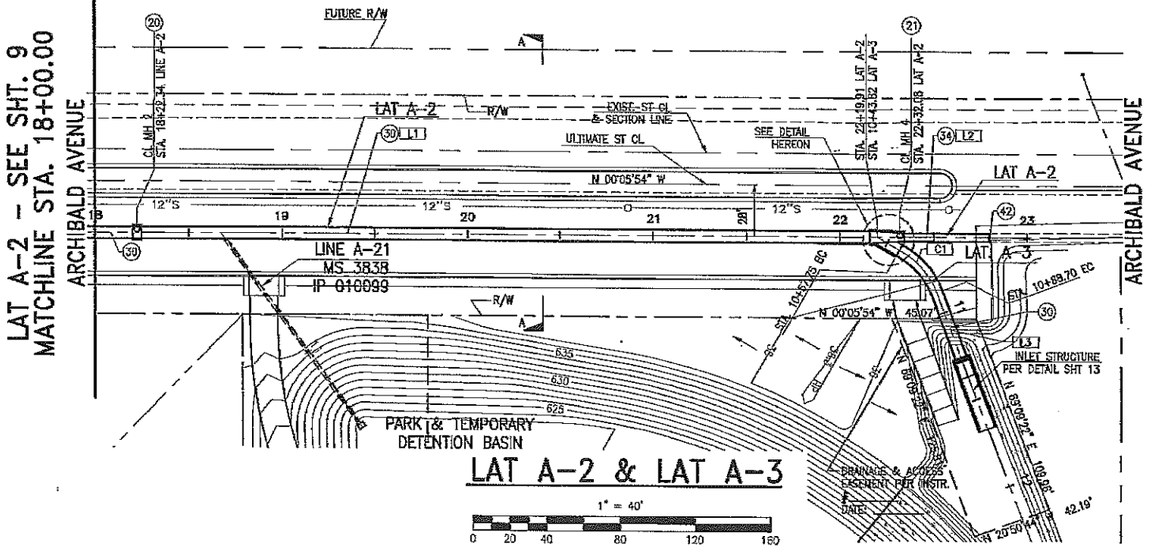
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: PLANNING ENGINEER DATE: 2 APR 07
APPROVED BY: CHIEF ENGINEER DATE: 4/24/07

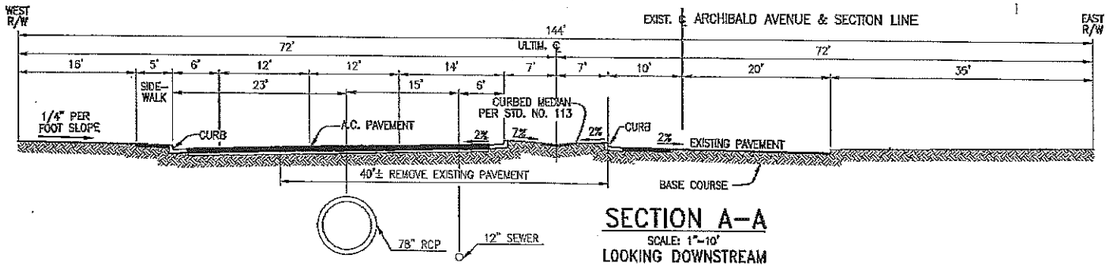
County of Riverside
APPROVED BY: FOR TRANSPORTATION DEPARTMENT RIVERSIDE COUNTY, CALIF. DATE: 4/17/07

MS#3838 - IP#010099
EASTVALE M.D.P.
LAT. "A-2"
STA: 10+00.00 TO STA: 18+00.00
STORM DRAIN PLANS

Project No. 2-0-0314
Drawing No. 2-313
Sheet 9 of





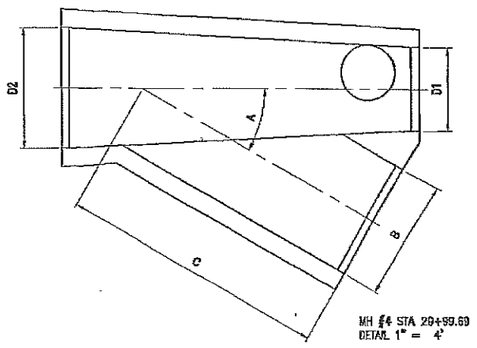


SECTION A-A
SCALE: 1"=10'
LOOKING DOWNSTREAM

LINE TABLE		
LINE	LENGTH	BEARING
L1	1113.09'	N00°15'00"W
L2	60.09'	N00°15'00"W
L3	38.23'	N69°09'04"E

CURVE TABLE				
LINE	RADIUS	LENGTH	DELTA	TANGENT
C1	45°00'00"	39.95'	39°24'15"	16.11'

CONSTRUCTION NOTES
(20) CONSTRUCT MANHOLE NO. 2 PER RCFC & WCD STD. DWG. MH252
(21) CONSTRUCT MANHOLE NO. 4 PER RCFC & WCD STD. DWG. MH254 (SEE DETAIL, THIS SHEET)
(30) CONSTRUCT 78" RCP (D-LOAD AS SHOWN)
(34) CONSTRUCT 54" RCP (D-LOAD AS SHOWN)
(42) CONSTRUCT CONC. BULKHEAD PER RCFC & WCD STD MB16



DATA:
A=30°00'00"
B=78"
C=10.42'
D1=54"
EL. S=618.02
EL. R=619.05
D2=78"

MH #4 STA 294+99.69
DETAIL 1" = 4'

NOTES:
SEE SHEET 1 FOR GENERAL NOTES
FOR ABBREVIATIONS & LEGEND SEE RCFC & WCD MB14

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

REGISTERED PROFESSIONAL ENGINEER PAUL A. PECK NO. 58602 EXP. 12-31-06 CIVIL STATE OF CALIFORNIA

TETRA TECH, INC.
INFRASTRUCTURE SERVICES GROUP
4120 E. JURUPA AVE., SUITE 206, ONTARIO, CA 91761
(909) 390-8000 FAX (909) 390-8020

PREPARED BY: PAUL A. PECK R.C.E. NO. 58602
DATE: 4/14/03 EXP. DATE: 12/31/06

BENCHMARK:
BM ML-33 RESET 84
AT THE INTERSECTION OF ARCHIBALD AVE. & CLOVERDALE RD 47.0' SO. OF CLOVERDALE RD, 25.0' W. OF ARCHIBALD AVE. A BRASS DISK SET IN THE TOP OF THE S.E. CORNER OF A 5.5' BY 5.0' CONCRETE GAS CO. VAULT & MARKED ML-33 RESET JULY 1984. ELEV. 845.183 (5-71 ADJUSTMENT)

SCALE: AS SHOWN
DATE: 9/19/02

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: PLANNING ENGINEER
DATE: 24 Apr 03

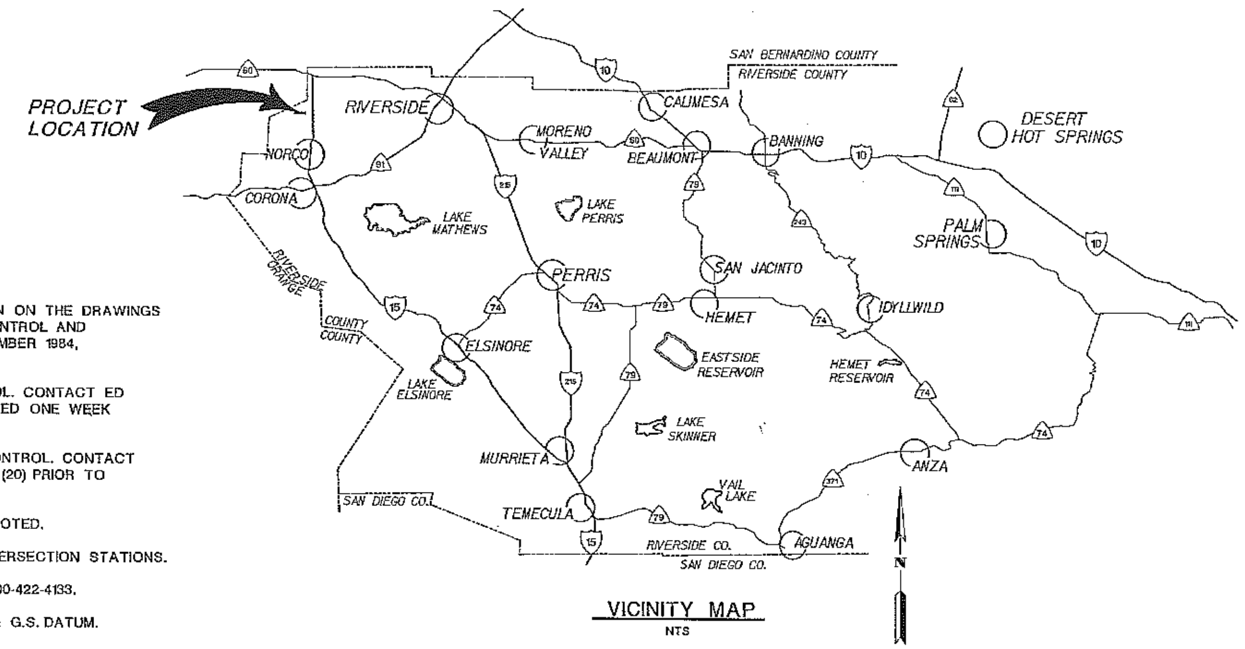
APPROVED BY: CHIEF ENGINEER
DATE: 4/24/03

County of Riverside
APPROVED BY: FOR TRANSPORTATION DEPARTMENT RIVERSIDE COUNTY, CALIF.
DATE: 4/17/03

MS#3838 - IP#010099
EASTVALE M.D.P.
LAT "A-2" & LAT "A-3"
STA: 18+00.00 TO STA: 22+41.30
STORM DRAIN PLANS

Project No. 2-0-0314
Drawing No. 2-313
Sheet 10 of

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT



VICINITY MAP
NTS

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	SHEET NO.
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R.C.F.C. & W.C.D. STANDARD DRAWINGS

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MH 254	MANHOLE No. 4	4, 5, 9
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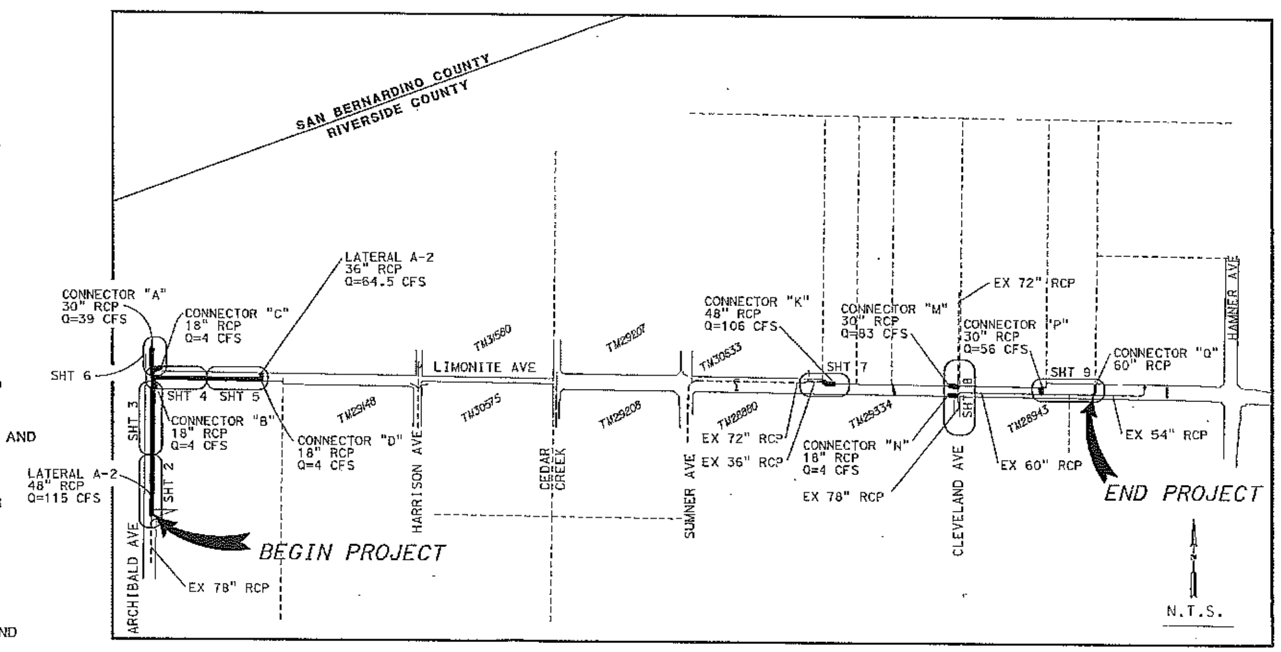
M 815	BEDDING AND PAY LINES	2-9
M 816	CONCRETE BULKHEAD	9

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 SEPTEMBER 1984, AND DESIGN MANUAL STANDARD DRAWINGS DATED APRIL 1984.
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 NOTIFIED TWENTY DAYS (20) PRIOR TO CONSTRUCTION.
4. ALL STATIONING REFERS TO CENTERLINE OF CONSTRUCTION UNLESS OTHERWISE NOTED.
5. STATIONING FOR LATERALS AND CONNECTOR PIPE REFER TO THE CENTERLINE INTERSECTION STATIONS.
6. FORTY-EIGHT HOURS BEFORE EXCAVATION, CALL UNDERGROUND SERVICE ALERT 1-800-422-4133.
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.
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 (JS 229) UNLESS OTHERWISE NOTED.
12. PIPE BEDDING SHALL CONFORM TO RCFC & WCD STD. DWG. NO. M815 EXCEPT FOR COVER <2 FEET. FOR COVER <2 FEET, CONCRETE SLURRY (2000 PSI- 2 SACK) SHALL BE USED. THE ENTIRE TRENCH SHALL BE SLURRY EXTENDING 4 INCHES MINIMUM AND 12 INCHES MAXIMUM ABOVE THE TOP OF THE PIPE.
13. "V" IS THE DEPTH OF CONCRETE DROP INLET MEASURED FROM THE TOP OF INLET TO INVERT OF CONNECTOR PIPE.
14. CATCH BASINS SHALL BE LOCATED SO THAT LOCAL DEPRESSION SHALL BEGIN AT EXISTING CURB RETURN JOINT, UNLESS OTHERWISE SPECIFIED.
15. ALL CURBS, GUTTER, 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.
16. STANDARD DRAWINGS CALLED FOR ON THE PLAN AND PROFILE SHALL CONFORM TO RCFC & WCD STANDARD DRAWINGS OR RCTD STANDARD PLANS UNLESS NOTED OTHERWISE.
17. THE CONTRACTOR IS REQUIRED TO CALL ALL UTILITY AGENCIES REGARDING TEMPORARY SHORING AND SUPPORT REQUIREMENTS FOR THE VARIOUS UTILITY LINES SHOWN ON THESE PLANS.
18. DURING ROUGH GRADING OPERATIONS AND PRIOR TO CONSTRUCTION OF PERMANENT DRAINAGE STRUCTURES, TEMPORARY DRAINAGE CONTROL SHOULD BE PROVIDED TO PREVENT PONDING WATER AND DAMAGE TO ADJACENT PROPERTIES.
19. APPROVAL OF THESE PLANS BY THE RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT DOES NOT RELIEVE THE DEVELOPER'S ENGINEER OF RESPONSIBILITY FOR THE ENGINEERING DESIGN. IF FIELD CHANGES ARE REQUIRED, IT WILL BE THE RESPONSIBILTY OF THE DESIGN ENGINEER TO MAKE THE NECESSARY CORRECTIONS.
20. THE CONTRACTOR OR DEVELOPER SHALL SECURE ALL REQUIRED ENCROACHMENT AND/OR STATE AND FEDERAL REGULATORY PERMITS PRIOR TO THE COMMENCEMENT OF ANY WORK.
21. THE BASIS OF BEARINGS USED FOR THIS PROJECT IS THE CALIFORNIA STATE PLANE COORDINATE SYSTEM, CCS83, ZONE 6, BASED TOTALLY ON THE GPS CONTROL STATION "METZ" AND "ROSA", EPOCH 1992.9.



INDEX MAP
T2S,R7W. PORTIONS OF SECTIONS 23, 24, 25, & 26
NTS

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361	TRASH RACK	6

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D-40	RIP RAP ENERGY DISSAPATOR	6

COUNTY OF RIVERSIDE
TRANSPORTATION DEPARTMENT
APPROVED BY:
DEPUTY DIRECTOR OF TRANSPORTATION
DATE: 6/29/05

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

REGISTERED PROFESSIONAL ENGINEER
HOANG NGUYEN
No. C64747
Exp. 06/30/07
5-12-05
CIVIL
STATE OF CALIFORNIA

Berryman Henigar
11590 W. Bernardo Ct. Suite 100
San Diego, CA 92127
TEL: (858)451-6100 FAX: (858)451-2846

THE BENCHMARK USED FOR THIS SURVEY IS A FOUND AERIAL CONTROL POINT DESIGNATED HVP-3. THE VERTICAL VALUE FOR THIS AERIAL CONTROL POINT WAS PROVIDED BY RCTD AND LAND MANAGEMENT AGENCY IN A SURVEY CONTROL REPORT FOR LIMONITE AVE DATED 1-14-2002, W.O. NO. A3-0320, B10670, F.B. 2207, SURVEY NO. 6269.
ELEV: 654.044

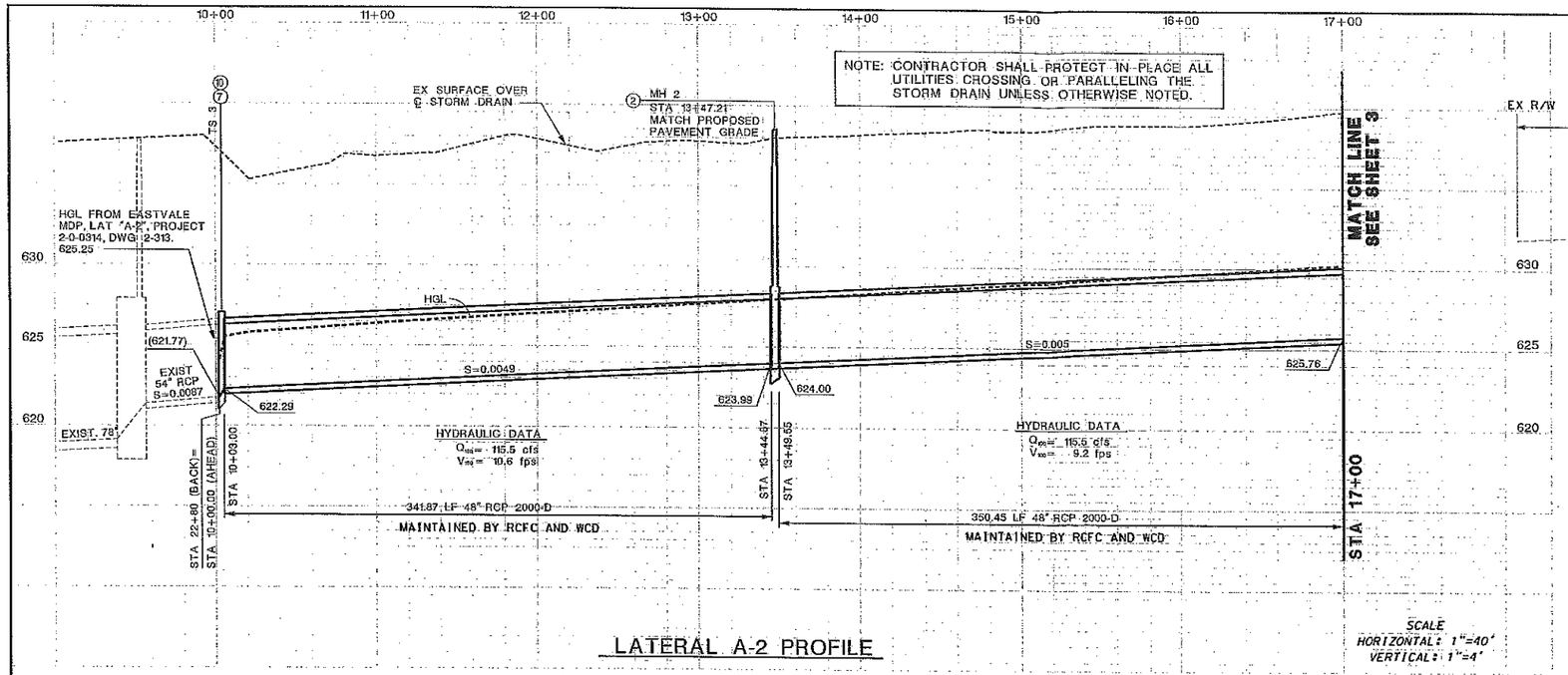
REF.	REVISIONS / DESCRIPTION	APPR.	DATE
△	REPLACE SHEETS 2,3,4 & 6	HN	11-7-05
	REMOVE LINE 'N' ON SHEET 8		11/8/05

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: PLANNING ENGINEER DATE: 6-29-2005
APPROVED BY: CHIEF ENGINEER DATE: 6-30-05

EASTVALE MASTER DRAINAGE PLAN
LIMONITE AVE
TITLE SHEET

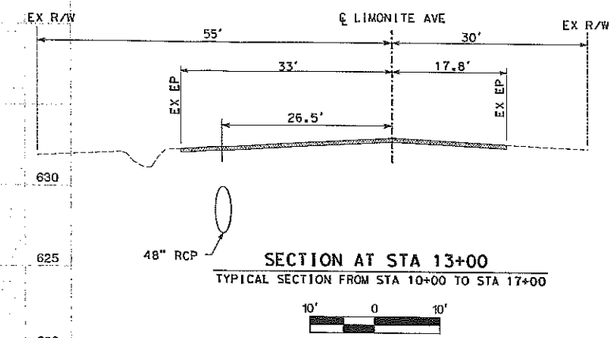
PROJECT NO. 2-0-0314
DRAWING NO. 2-339
SHEET NO. 1 OF 10

#SDO1PLAN&PROFILE



LATERAL A-2 PROFILE

SCALE
HORIZONTAL: 1"=40'
VERTICAL: 1"=4'



SECTION AT STA 13+00
TYPICAL SECTION FROM STA 10+00 TO STA 17+00

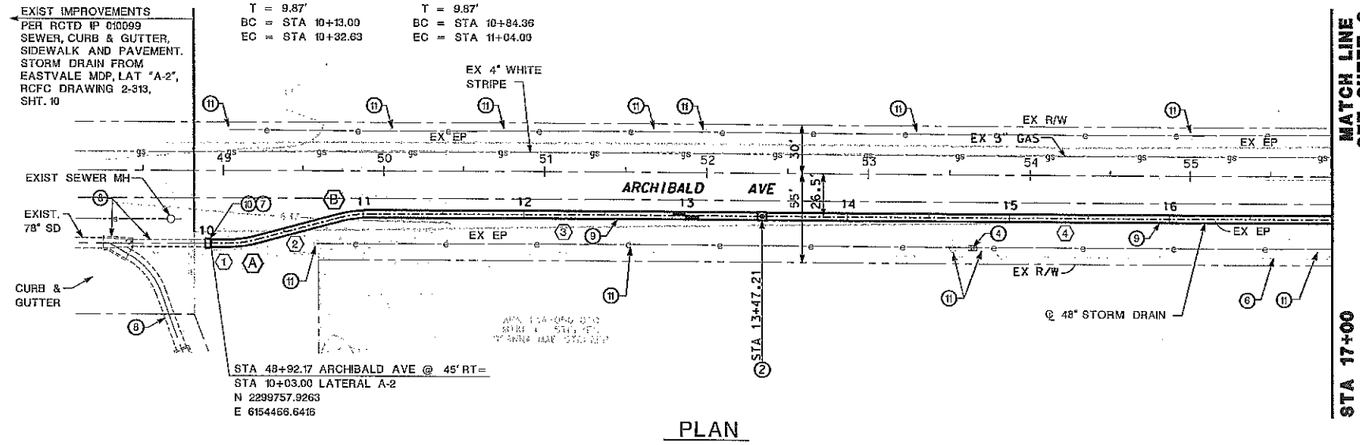
10' 0 10'

INFORMATIONAL NOTE

ALL X-SECTIONS TAKEN LOOKING DOWNSTREAM

Ⓐ ℄ CURVE DATA
Δ = 15°00'00"
R = 75.00'
L = 19.63'
T = 9.87'
BC = STA 10+13.00
EC = STA 10+32.63

Ⓑ ℄ CURVE DATA
Δ = 15°00'00"
R = 75.00'
L = 19.63'
T = 9.87'
BC = STA 10+84.36
EC = STA 11+04.09



PLAN

40' 0 40'

⬡ STORM DRAIN DATA TABLE					
NO.	DELTA / BEARING	RADIUS	LENGTH	TANGENT	REMARKS
1	N 00°38'45"E	--	10.00'	--	48" RCP
2	N 14°21'15"W	--	51.73'	--	48" RCP
3	N 00°38'45"E	--	240.87'	--	48" RCP
4	N 00°38'45"E	--	350.45'	--	48" RCP

NOTES

1. EXISTING POWER POLE/GUY WIRE TO BE RELOCATED BE S.C.E.
2. CONSTRUCT MH 2 PER RCFC STD DRAWING MH252.
4. EXISTING TELEPHONE RISER, PROTECT IN PLACE.
6. EXISTING FENCE, PROTECT IN PLACE.
7. REMOVE EX CONC BULKHEAD.
8. PROPOSED STORM DRAIN LATERAL A-2 PER RCFC DRAWING 2-313.
9. CONSTRUCT 48" RCP (D-LOAD SHOWN IN PROFILE).
10. CONSTRUCT TS 3 PER RCFC STD DRAWING TS303 D1=48", D2=54".
11. EXISTING POWER POLE, PROTECT IN PLACE.

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

REGISTERED PROFESSIONAL ENGINEER Hung Hoang Nguyen No. C64747 Exp. 06/30/07 4-3-05 CIVIL STATE OF CALIFORNIA

Berryman & Henigar
11590 W. Bernardo Ct. Suite 100 San Diego, CA 92127
TEL: (858)451-8100 FAX: (858)451-2649

THE BENCHMARK USED FOR THIS SURVEY IS A FOUND AERIAL CONTROL POINT DESIGNATED HVP3. THE VERTICAL VALUE FOR THIS AERIAL CONTROL POINT WAS PROVIDED BY RCTD AND LAND MANAGEMENT AGENCY IN A SURVEY CONTROL REPORT FOR LIMONITE AVE DATED 1-14-2002, W.O. NO. A3-0320, B10670, F.B. 2207, SURVEY NO. 6269.

ELEV: 654.044

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

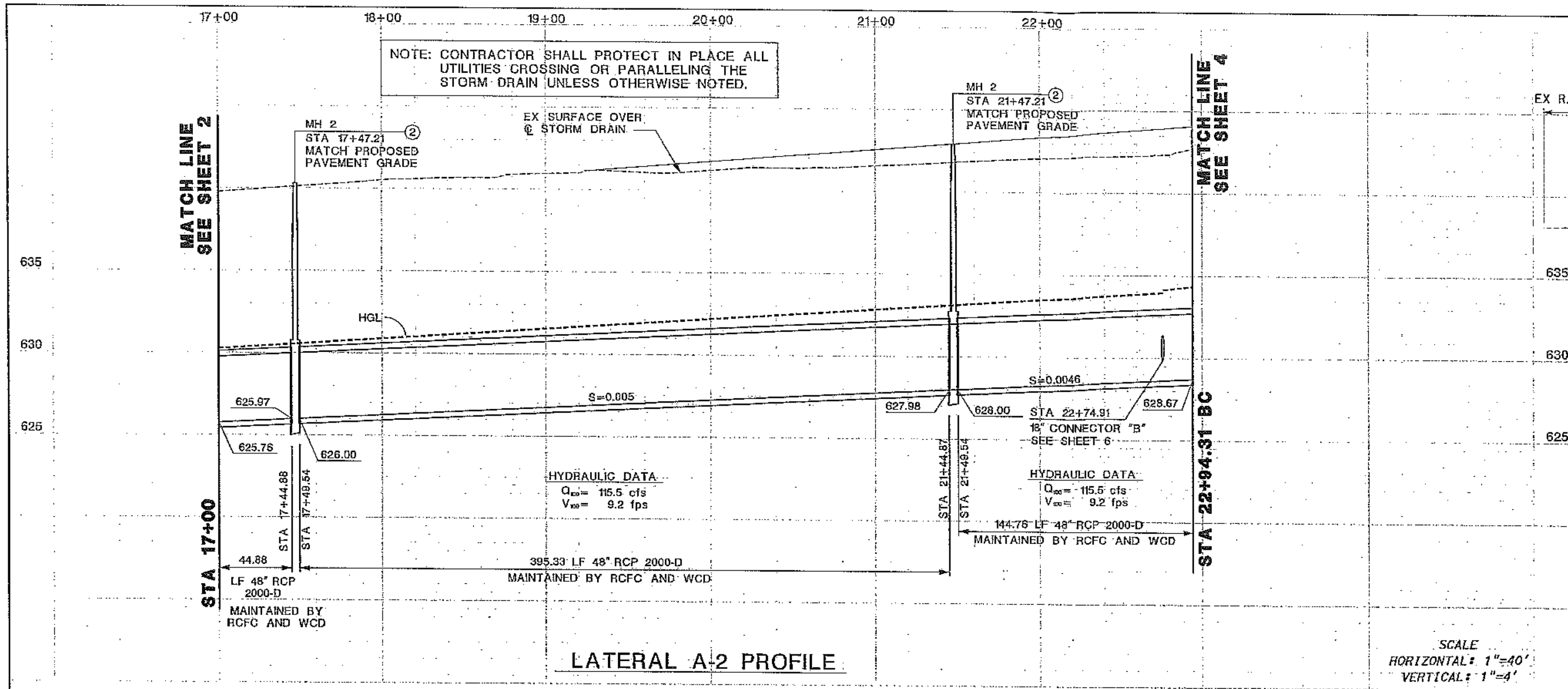
RECOMMENDED FOR APPROVAL BY: [signature] DATE: 11/8/05

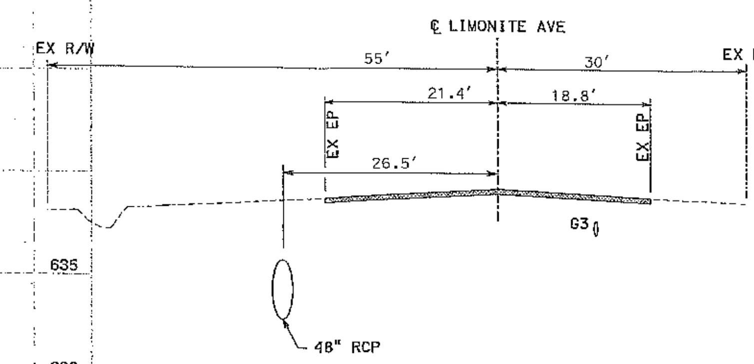
APPROVED BY: [signature] DATE: 11-14-2005

EASTVALE MASTER DRAINAGE PLAN
LATERAL A-2
STA 10+00 TO STA 17+00

PROJECT NO. 2-0-0314
DRAWING NO. 2-339
SHEET NO. 2 OF 10

#SD02Plan&Profile



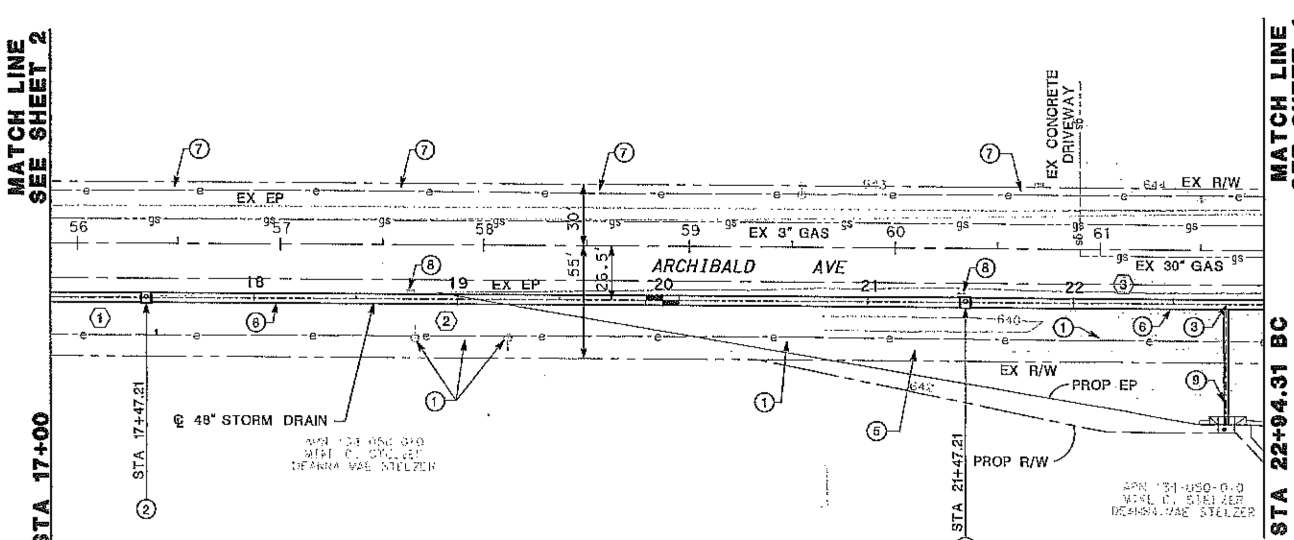


SECTION AT STA 20+00

TYPICAL STA FROM 17+00 TO STA 22+94.31

INFORMATIONAL NOTE

ALL X-SECTIONS TAKEN LOOKING DOWNSTREAM



PLAN

⬡ STORM DRAIN DATA TABLE

NO.	DELTA / BEARING	RADIUS	LENGTH	TANGENT	REMARKS
1	N 00°38'45"E	--	44.88'	--	48" RCP
2	N 00°38'45"E	--	395.33'	--	48" RCP
3	N 9°21'15"W	--	144.76'	--	48" RCP

NOTES

1. EXISTING POWER POLE/GUY WIRE TO BE RELOCATED BY S.C.E.
2. CONSTRUCT MH 2 PER RCFC STD DRAWING MH252.
3. CONSTRUCT JS NO. 4 PER RCFC & WCD STD. JS 229, CASE 1.
5. REMOVE EXISTING FENCE AS NECESSARY.
6. CONSTRUCT 48" RCP (D-LOAD SHOWN IN PROFILE).
7. EXISTING POWER POLE, PROTECT IN PLACE.
8. EX TRAFFIC SIGNAL PULL BOX TO BE SALVAGED/REMOVED. SEE SIGNAL RCTD IP 010033.
9. STORM DRAIN CONNECTOR "B". SEE SHEET 6 FOR PLAN AND PROFILE.

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

REGISTERED PROFESSIONAL ENGINEER HOANG NGUYEN No. C64747 Exp. 06/30/07 CIVIL STATE OF CALIFORNIA

Berryman & Henigar
11590 W. Bernardo Ct. Suite 100 San Diego, CA 92127

THE BENCHMARK USED FOR THIS SURVEY IS A FOUND AERIAL CONTROL POINT DESIGNATED HVP-3. THE VERTICAL VALUE FOR THIS AERIAL CONTROL POINT WAS PROVIDED BY RCTD AND LAND MANAGEMENT AGENCY IN A SURVEY CONTROL REPORT FOR LIMONITE AVE DATED 5-14-2002, W.O. NO. A3-0320, B10670, F.B. 2207, SURVEY NO. 6269.
ELEV: 654.044

REF.	REVISIONS DESCRIPTION	APPR.	DATE

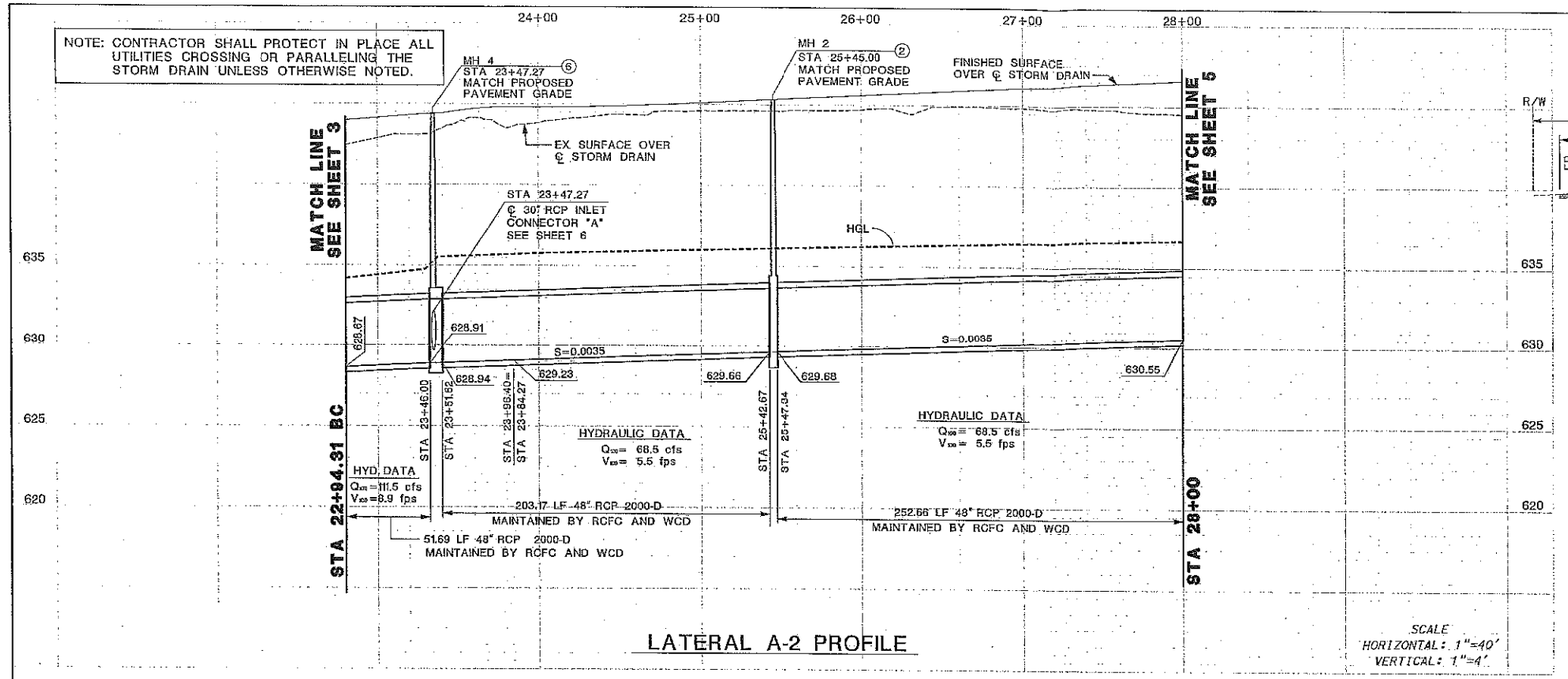
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: DATE: 11/8/05
APPROVED BY: Stuart E. McKibbin DATE: 11-14-2005

EASTVALE MASTER DRAINAGE PLAN
LATERAL A-2
STA 17+00 TO STA 22+94.31

PROJECT NO. 2-0-0314
DRAWING NO. 2-339
SHEET NO. 3 OF 10

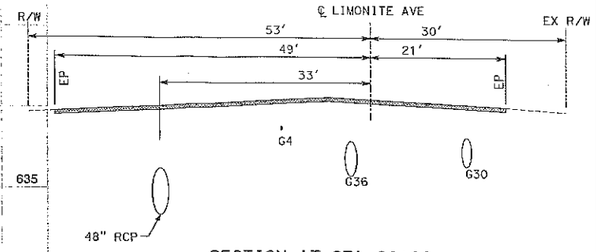
SD03Plan&Profile

NOTE: CONTRACTOR SHALL PROTECT IN PLACE ALL UTILITIES CROSSING OR PARALLELING THE STORM DRAIN UNLESS OTHERWISE NOTED.



LATERAL A-2 PROFILE

SCALE
HORIZONTAL: 1"=40'
VERTICAL: 1"=4'

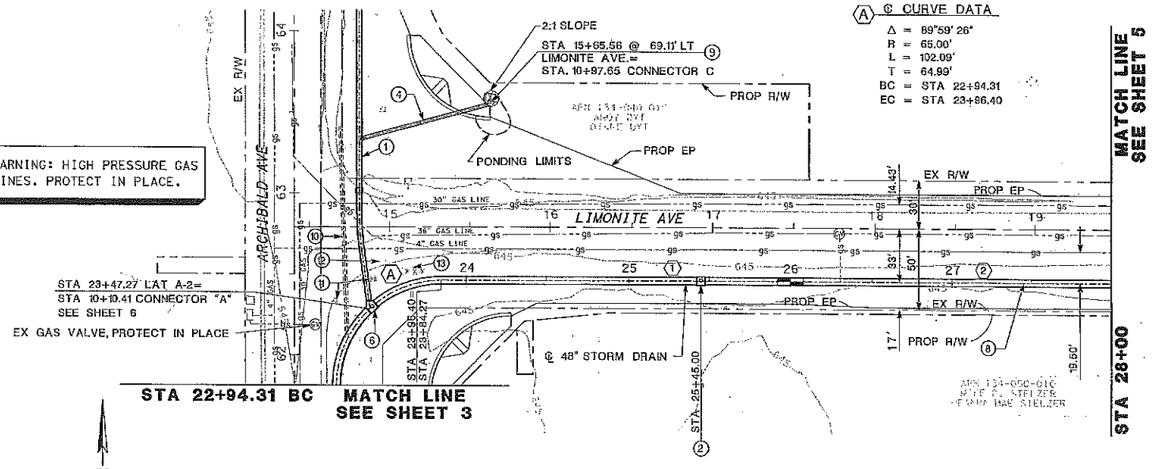


SECTION AT STA 26+00
TYPICAL STA FROM STA 24+00 TO STA 28+00

10' 0 10'

INFORMATIONAL NOTE

ALL X-SECTIONS TAKEN LOOKING DOWNSTREAM



PLAN

(A) ℄ CURVE DATA
Δ = 89°59' 26"
R = 65.00'
L = 102.09'
T = 64.99'
BC = STA 22+94.31
EC = STA 23+86.40

⬡ STORM DRAIN DATA TABLE

NO.	DELTA / BEARING	RADIUS	LENGTH	TANGENT	REMARKS
1	S 89°21'49"E	---	158.40'	---	48" RCP
2	S 89°21'49"E	---	252.66'	---	48" RCP

NOTES

1. STORM DRAIN CONNECTOR "A". SEE SHEET 6 FOR PLAN & PROFILE.
2. CONSTRUCT MH 2 PER RCFC STD DRAWING MH252.
4. STORM DRAIN CONNECTOR "C". SEE SHEET 6 FOR PLAN & PROFILE.
6. CONSTRUCT MH NO. 4 PER RCFC STD DRAWING MH 254. A=30", B=30" C=8.3', D1/D2=48", R=629.29, S=529.27.
8. CONSTRUCT 48" RCP (D-LOAD SHOWN IN PROFILE).
9. CONSTRUCT CONCRETE DROP INLET, SEE SHEET 6.
10. EXISTING CMP TO BE REMOVED.
11. EXISTING TRAFFIC PULL BOX TO BE RELOCATED PER RCTD IP 010099.
12. EXISTING STREET LIGHT TO BE REMOVED BY SCE.
13. EXISTING TRAFFIC CONTROL CABINETS (3) TO BE RELOCATED PER RCTD IP 010099.

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

REGISTERED PROFESSIONAL ENGINEER — HOANG NGUYEN — No. C64747 — Exp. 06/30/07 — CIVIL — STATE OF CALIFORNIA

Berrymann Henigar
31590 W. Bernardo Ct. Suite 100 San Diego, CA 92127
TEL: (858)451-6100 FAX: (858)451-2346

THE BENCHMARK USED FOR THIS SURVEY IS A FOUND AERIAL CONTROL POINT DESIGNATED HVP-3. THE VERTICAL VALUE FOR THIS AERIAL CONTROL POINT WAS PROVIDED BY RCTD AND LAND MANAGEMENT AGENCY IN A SURVEY CONTROL REPORT FOR LIMONITE AVE DATED 1-14-2002, W.O. NO. A3-0320, EI9670, F.B. 2207, SURVEY NO. 6269.
ELEV: 654.044

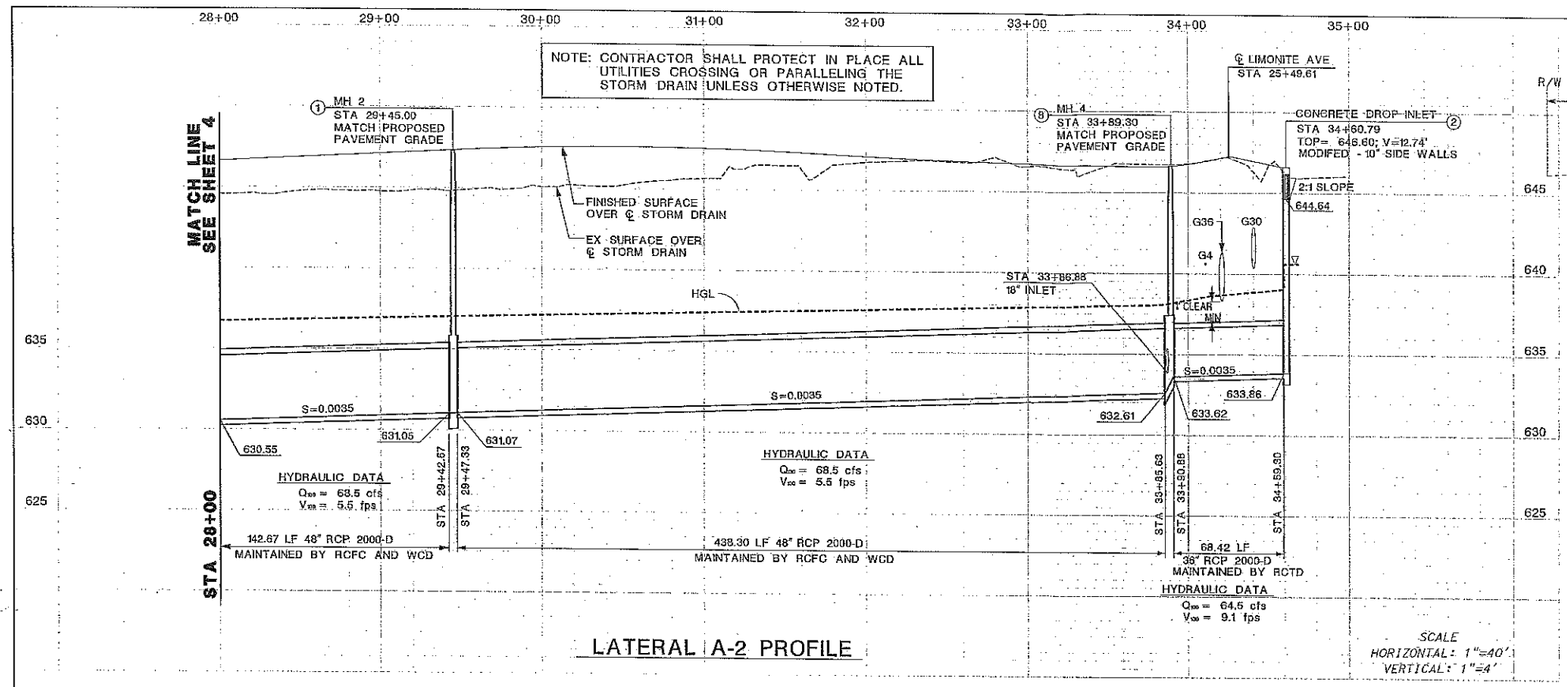
REF.	REVISIONS DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: [signature] DATE: 11/8/05
APPROVED BY: [signature] DATE: 11-14-2005

EASTVALE MASTER DRAINAGE PLAN
LATERAL A-2
STA 22+94.31 TO STA 28+00

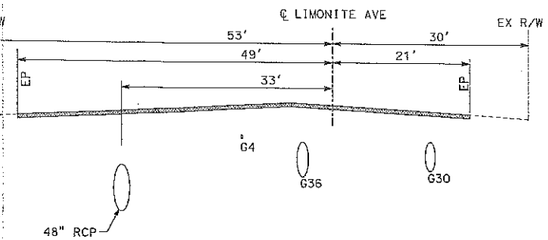
PROJECT NO. 2-0-0314
DRAWING NO. 2-339
SHEET NO. 4 OF 10

#SD04PLAN&PROFILE



LATERAL A-2 PROFILE

SCALE
HORIZONTAL: 1"=40'
VERTICAL: 1"=4'



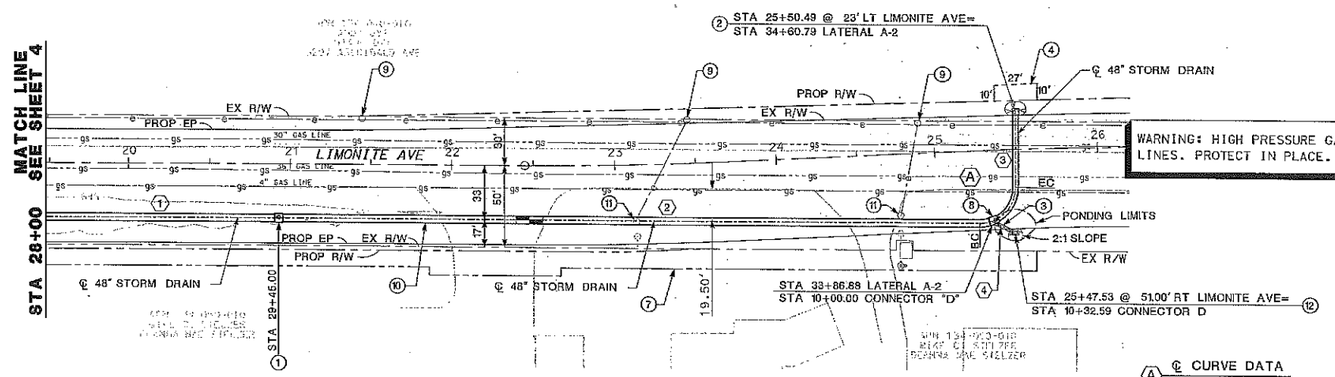
SECTION AT STA 31+00

TYPICAL STA FROM 28+00 TO STA 33+80

10' 0 10'

INFORMATIONAL NOTE

ALL X-SECTIONS TAKEN LOOKING DOWNSTREAM



PLAN

℄ CURVE DATA (A)

Δ = 90°00'01"
R = 22.50'
L = 35.34'
T = 31.82'
BC = STA 33+79.03
EC = STA 34+14.37

STORM DRAIN DATA TABLE

NO.	DELTA / BEARING	RADIUS	LENGTH	TANGENT	REMARKS
1	S 89°21'49"E	--	142.67'	--	48" RCP
2	S 89°21'49"E	--	438.30'	--	48" RCP
3	N 00°38'10"E	--	44.93'	--	36" RCP
4	S 44°21'49"E	--	28.73'	--	18" RCP

NOTES

1. CONSTRUCT MH 2 PER RCFC STD DRAWING MH252.
2. CONSTRUCT CONCRETE DROP INLET PER RCFC STD DRAWING CB110, V=12.74' THIS INLET SHALL BE MODIFIED - CONSTRUCT WITH 10" WALLS.
3. CONSTRUCT 18" RCP CONNECTOR "D", SEE PROFILE ON SHEET 10.
4. DRAINAGE EASEMENT DEDICATED TO RIVERSIDE COUNTY.
7. TEMPORARY CONSTRUCTION EASEMENT DEDICATED TO RIVERSIDE COUNTY.
8. CONSTRUCT MH 4 PER RCFC STD DRAWING MH254. A=45°, B=18", C=4.6', D1=36", D2=48", R=635.62, S=634.98.
9. EXISTING POWER POLE, DO NOT DISTURB.
10. CONSTRUCT 48" RCP (D-LOAD SHOWN IN PROFILE).
11. EXISTING POWER POLE TO BE RELOCATED BY SOUTHERN CALIFORNIA EDISON.
12. CONSTRUCT CONCRETE DROP INLET PER RCFC STD DRAWING CB110, V=6.88'

COUNTY OF RIVERSIDE
TRANSPORTATION DEPARTMENT
APPROVED BY:
DEPUTY DIRECTOR OF TRANSPORTATION
DATE: 7/6/05

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

REGISTERED PROFESSIONAL ENGINEER — HOANG NGUYEN — No. C54747 — Exp. 06/30/07 — CIVIL — STATE OF CALIFORNIA

Berryman Henigar
31590 W. Bernardo Ct. Suite 100
San Diego, CA 92127
TEL: (858)451-6100 FAX: (858)451-2648

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ELEV: 654.044

REF.	REVISIONS	APPR.	DATE
	DESCRIPTION		

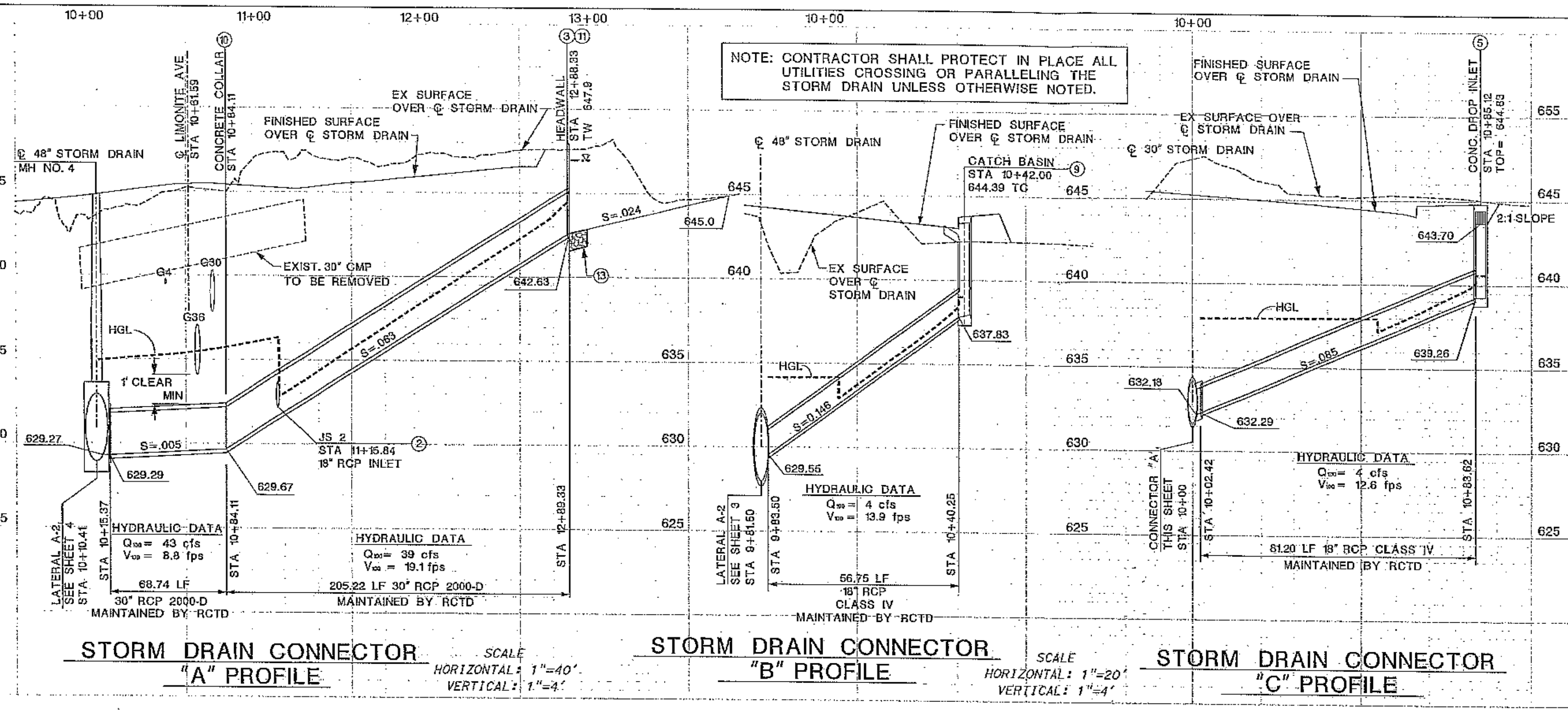
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY:
DATE: 6/29/05
APPROVED BY: Stuart E. McKelvy
DATE: 7-5-2005

EASTVALE MASTER DRAINAGE PLAN
LATERAL A-2
STA 28+00 TO STA 34+68.37

PROJECT NO. 2-0-0314
DRAWING NO. 2-339
SHEET NO. 5 OF 10

S:\SDDSPLANS&PROFILE

NOTE: CONTRACTOR SHALL PROTECT IN PLACE ALL UTILITIES CROSSING OR PARALLELING THE STORM DRAIN UNLESS OTHERWISE NOTED.



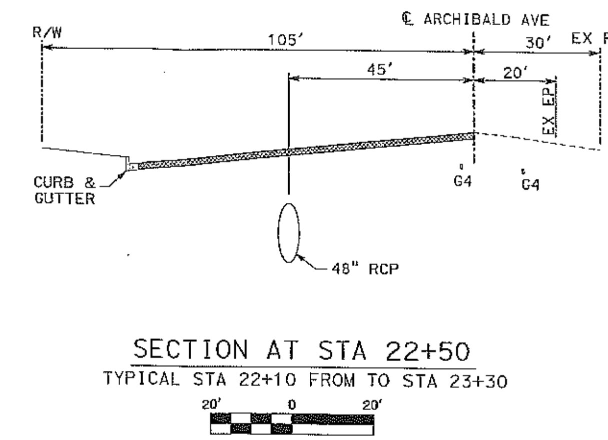
STORM DRAIN CONNECTOR "A" PROFILE

STORM DRAIN CONNECTOR "B" PROFILE

STORM DRAIN CONNECTOR "C" PROFILE

SCALE HORIZONTAL: 1"=40' VERTICAL: 1"=4'

SCALE HORIZONTAL: 1"=20' VERTICAL: 1"=4'



SECTION AT STA 22+50

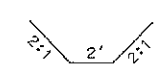
TYPICAL STA 22+10 FROM TO STA 23+30

INFORMATIONAL NOTE

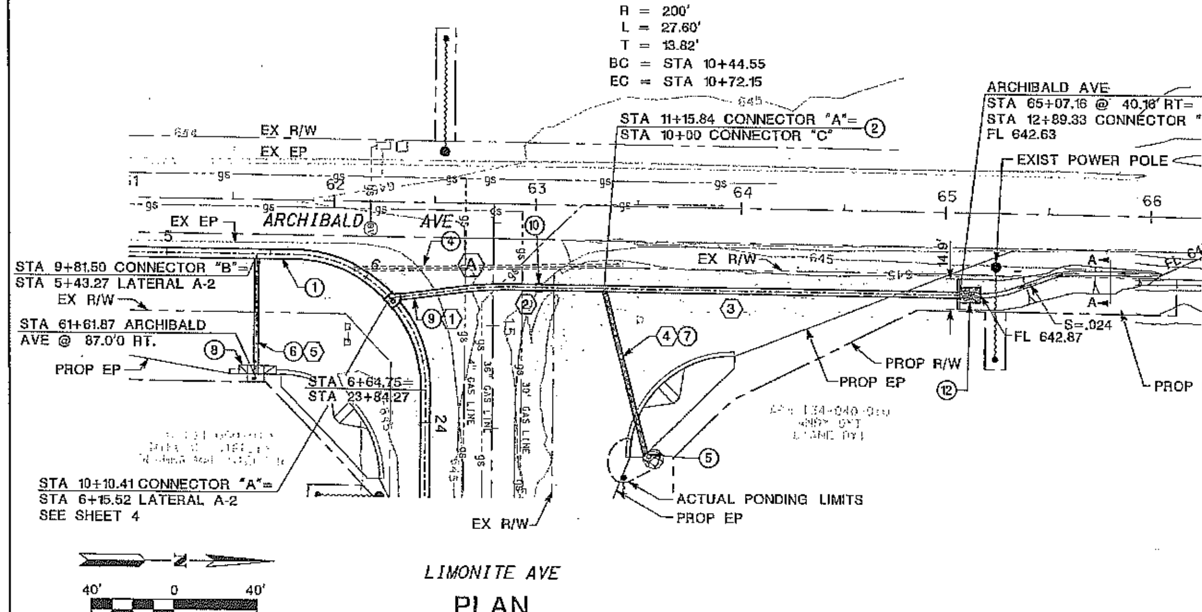
ALL X-SECTIONS TAKEN LOOKING DOWNSTREAM

(A) ℄ CURVE DATA

Δ = 7°54' 20"
R = 200'
L = 27.60'
T = 13.82'
BC = STA 10+44.55
EC = STA 10+72.15



SECTION A-A
DITCH CROSS SECTION



LIMONITE AVE

PLAN

STORM DRAIN DATA TABLE					
NO.	DELTA / BEARING	RADIUS	LENGTH	TANGENT	REMARKS
1	N 07°11'11"W	--	29.18'	--	30" RCP
2	N 0°43'9"E	--	11.96'	--	30" RCP
3	N 0°43'9"E	--	205.22'	--	30" RCP
4	N 75°43'9"E	--	81.20'	--	18" RCP
5	N 89°21'15"W	--	56.75'	--	18" RCP

NOTES

(1) STORM DRAIN LATERAL A-2. SEE SHEET 3 FOR PLAN & PROFILE.

(2) CONSTRUCT JS 2 PER RCFC STD DRAWING JS227. A=75° B=18",C=2.84', D=30", E=1.56', F=0.86', G=0.78', L=2.33', R=632.18, S=632.29.

(3) CONSTRUCT HEADWALL/WINGWALL PER CALTRANS STD PLAN D890A H= 4.88'.

(4) REMOVE EXISTING CMP.

(5) CONSTRUCT CONCRETE DROP INLET PER RCFC STD DRAWING CB110, V=5.57'.

(6) CONSTRUCT 18" RCP CONNECTOR "B". SEE PROFILE, THIS SHEET.

(7) CONSTRUCT 18" RCP CONNECTOR "C". SEE PROFILE, THIS SHEET.

(8) CONSTRUCT CATCH BASIN PER RCTD STD DRAWING NO. 300. W=7', V=6.56'

(9) CONSTRUCT 30" RCP (D-LOAD SHOWN IN PROFILE).

(10) CONSTRUCT CONCRETE COLLAR PER RCFD & WCD STD DWG M803.

(11) CONSTRUCT TRASH RACK PER APWA STD DWG 361-0.

(12) CONSTRUCT 7.5'x10' GROUTED RIP RAP ENERGY DISSIPATOR (T=1.0', NO. 2 BACKING) OVER FILTER FABRIC PER SAN DIEGO REGIONAL STD DWG D-40.

COUNTY OF RIVERSIDE
TRANSPORTATION DEPARTMENT
APPROVED BY:
DEPUTY DIRECTOR OF TRANSPORTATION
DATE:

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REGISTERED PROFESSIONAL ENGINEER HOANG NGUYEN No. C64747 Exp. 06/30/07 CIVIL STATE OF CALIFORNIA 4-7-05

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ELEV: 654.044

REF.	REVISIONS DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: APPROVED BY:
DATE: DATE:

EASTVALE MASTER DRAINAGE PLAN

CONNECTORS "A", "B" AND "C"

PROJECT NO. 2-0-0314
DRAWING NO. 2-339
SHEET NO. 6 OF 10

SSD06PLAN&PROFILE

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H.3 - Preliminary Water Quality Management Plan

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Project Specific
Preliminary Water Quality Management Plan

For: **Plot Plan/CUP 12-0051**

SEC Archibald and Limonite

DEVELOPMENT NO. **Plot Plan/CUP 12-0051**
DESIGN REVIEW NO. **PLOT PLAN REVIEW**

Prepared for:

Wal-Mart Stores, Inc.
2001 SE 10th Street
Bentonville, AR 72716

Prepared by:
Kevin M. Roberson, P.E., CPESC, LEED AP ®
Kimley-Horn and Associates
765 The City Drive, Suite 200
Orange, CA 92868
Telephone: (714) 939-1030

WQMP Preparation/Revision Date: September 5, 2012

Kimley-Horn
and Associates, Inc.

OWNER'S CERTIFICATION

This project-specific Water Quality Management Plan (WQMP) has been prepared for:

Wal-Mart Stores, Inc.

by Kimley-Horn and Associates for the project known as Walmart Store 3129-00, Eastvale, CA.

This WQMP is intended to comply with the requirements of Riverside County, 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 of this WQMP and will ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site. This WQMP will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party (or parties) having responsibility for implementing portions of this WQMP. At least one copy of this WQMP will be maintained at the project site or project office in perpetuity.

The undersigned is authorized to certify and to approve implementation of this WQMP. The undersigned is aware that implementation of this WQMP is enforceable under Riverside County Water Quality Ordinance (Municipal Code Section R8-2010-0033).

If the undersigned transfers its interest in the subject property/project, its successor in interest the undersigned shall notify the successor in interest of its responsibility to implement this WQMP.

"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

Wal-Mart Stores, Inc.
2001 SE 10th Street
Bentonville, AR 72716

TABLE OF CONTENTS

APPENDICES

I. Project Description

Instructions:

The project description shall be completely and accurately described in narrative form. In the field provided on page A-3, describe and with supporting figures (maps or exhibits), where facilities will be located, what activities will be conducted and where, what kinds of materials will be used and/or stored, how and where materials will be delivered, and the types of wastes that will be generated. The following information shall be described and/or addressed in the "Project Description" section of the project-specific WQMP:

- Project owner and WQMP preparer;
- Project location;
- Project size;
- Standard Industrial Classification (SIC), if applicable;
- Location of facilities;
- Activities and location of activities;
- Materials Storage and Delivery Areas;
- Wastes generated by project activities.

Project Owner: Wal-Mart Stores, Inc.
2001 SE 10th Street
Bentonville, AR 72716-5570

WQMP Preparer: **Error! Reference source not found.**, CPESC, LEED AP ®
765 The City Drive, Suite 200
Orange, CA 92868
Telephone: **Error! Reference source not found.**

Project Site Address: SEC Archibald Avenue and Limonite Avenue
City of Eastvale
County of Riverside

Planning Area/
Community Name/
Development Name: Eastvale

APN Number(s): 144-030-012, -014, -028

Thomas Bros. Map: Reference # 683-A6

Project Watershed: Santa Ana

Sub-watershed: Middle Santa Ana Watershed

Project Site Size: 37.44 acres

Standard Industrial Classification (SIC) Code: 5411 Grocery Stores, 5311 Department Stores

Formation of Home Owners' Association (HOA) or Property Owners Association (POA):

Y ☐ N ☒

Additional Permits/Approvals required for the Project

AGENCY	Permit required
State Department of Fish and Game, 1601 Streambed Alteration Agreement	Y ☐ N☒
State Water Resources Control Board, Clean Water Act (CWA) section 401 Water Quality Certification	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☒
Other *(please list in the space below as required)* State Construction General Permit Order No. 2009-0009-SWQ, as modified by 2010-0014-DWQ	Y ☒ N☐
State General Industrial Activity Permit Order No. 97-03-DWQ	Y ☐ N☒

This Water Quality Management Plan was prepared for the development of a Walmart Supercenter within the Parcel Map 35061, PP/CUP/COZ/GPA 12-0051 in Eastvale, CA. The proposed project consists of the construction of an approximately 180,000 square foot Walmart store, along with three outparcels, on 37.44 acres (the "Project"); located on the site of the previously approved Stelzer Center mixed use development in the City of Eastvale. The Project site is located south of Limonite Avenue, on the east side of Archibald Avenue. Southern California Edison has an easement over the southern portion of the site and the James C. Huber Park abuts the easement area to the south and separates the Project from an existing single-family residential development. The main access points will be signalized intersections at Archibald Avenue and the western boundary of the site, as well as a signalized intersection at Limonite Avenue and the northern boundary of the site. There will also be two right-in/right-out driveways: one located along Archibald Avenue, and one located along Limonite Avenue. See **Appendix B** for the project Vicinity Map.

The outparcel uses will include a gas station including an approximately 3,550 square foot convenience store, sixteen (16) fueling positions, and a self-service drive-thru carwash, at the northeast corner of the site along Limonite Avenue. Along Archibald Avenue, there will be an approximately 3,500 square foot fast food restaurant with a drive-thru, a 6,200 square foot retail shop building, and a 6,000 square foot retail shop building, both with a drive-thru.

The Conditional Use Permits for the Walmart store, including alcohol sales, tobacco sales and drive-thru pharmacy will be processed concurrently. The necessary Conditional Use Permits for the outparcel uses will be processed concurrently with the Project, but will be separate approvals from the Walmart Conditional Use Permit.

Appendix A of this project-specific WQMP will include a complete copy of the final Conditions of Approval.

Appendix B of this project-specific WQMP shall include:

A Vicinity Map identifying the project site and surrounding planning areas in sufficient detail to allow the project site to be plotted on Co-Permittee base mapping; and a Site Plan for the project. The Site Plan included as part of Appendix B depicts the following project features:

- Location and identification of all structural BMPs, including Treatment Control BMPs.
- Landscaped areas.
- Paved areas and intended uses (i.e., parking, outdoor work area, outdoor material storage area, sidewalks, patios, tennis courts, etc.).
- Number and type of structures and intended uses (i.e., buildings, tenant spaces, dwelling units, community facilities such as pools, recreation facilities, tot lots, etc.).
- Infrastructure (i.e., streets, storm drains, etc.) that will revert to public agency ownership and operation.
- Location of existing and proposed public and private storm drainage facilities (i.e., storm drains, channels, basins, etc.), including catch basins and other inlets/outlet structures. Existing and proposed drainage facilities should be clearly differentiated.
- Location(s) of Receiving Waters to which the project directly or indirectly discharges.
- Location of points where onsite (or tributary offsite) flows exit the property/project site.

- Proposed drainage areas boundaries, including tributary offsite areas, for each location where flows exits the property/project site. Each tributary area should be clearly denoted.
- Pre- and post-project topography.

Appendix G of this project-specific WQMP shall include copies of CC&Rs, Covenant and Agreements, and/or other mechanisms used to ensure the ongoing operation, maintenance, funding, transfer and implementation of the project-specific WQMP requirements.

II. Site Characterization

Land Use Designation or Zoning:	Commercial C-1
Current Property Use:	Currently Undeveloped
Proposed Property Use:	Commercial/Retail
Availability of Soils Report:	Y ☒ N ☐ *Note: A soils report is required if infiltration BMPs are utilized. Attach report in Appendix E.*
Phase 1 Site Assessment:	Y ☒ N ☐ *Note: If prepared, attached remediation summary and use restrictions in Appendix H.*

Receiving Waters for Urban Runoff from Site

Instructions:

On the following page, list in order of upstream to downstream, the receiving waters that the project is tributary to. Continue to fill each row with the receiving water's 303(d) listed impairments, designated beneficial uses, and proximity, if any, to a RARE beneficial use.

Receiving Waters for Urban Runoff from Site

Receiving Waters	303(d) List Impairments (2010 list)	Designated Beneficial Uses	Proximity to RARE Beneficial Use
MS4 system operated by the Riverside County Flood Control & Water Conservation District	Not listed	Not listed	N/A
Cucamonga Creek (Valley Reach)	Cadmium, Coliform Bacteria, Copper, Lead, Zinc and pH	GWR, REC1, REC2, LWARM, WILD	N/A
Mill Creek (Prado Area)	Nutrients, pathogens and total suspended solids (TSS)	REC1, REC2, WARM, WILD, RARE	Approx. 7.0 miles southwest from project outfall
Santa Ana River (Reach 3- Prado Dam to Mission Blvd. in Riverside)	Copper, Lead, Pathogens	AGR, GWR, REC1, REC2, WARM, WILD, RARE	Reach 3 is located approx. 7.0 miles southwest from project outfall
Santa Ana River (Reach 2 – 17th Street in Santa Ana to Prado Dam)	Indicator Bacteria	AGR, GWR, REC1, REC2, WARM, WILD, RARE	The easternmost part of Reach 2 is approx. 7.5 miles southwest from the project outfall.
Santa Ana (Reach 1-Tidal Prism to 17th Street in Santa Ana)	Not listed	REC1, REC2, WARM, WILD	N/A
Pacific Ocean at Newport Beach (tidal prism of Santa Ana River)	Not listed	REC1, REC2, COMM, WILD, RARE, MAR	Pacific Ocean is located approx. 34 miles southwest from project outfall.

III. Pollutants of Concern

Potential pollutants associated with Urban Runoff from the proposed project must be identified. Exhibit B of the WQMP provides brief descriptions of typical pollutants associated with Urban Runoff and a table that associates typical potential pollutants with types of development (land use). It should be noted that at the Co-Permittees discretion, the Co-Permittees may also accept updated studies from the California Association of Stormwater Quality Agencies (CASQA), USEPA, SWRCB and/or other commonly accepted agencies/associations acceptable to the Co-Permittee for determination of Pollutants of Concern associated with given land use. Additionally, in identifying Pollutants of Concern, the presence of legacy pesticides, nutrients, or hazardous substances in the site's soils as a result of past uses and their potential for exposure to Urban Runoff must be addressed in project-specific WQMPs. The Co-Permittee may also require specific pollutants commonly associated with urban runoff to be addressed based on known problems in the watershed. The list of potential Urban Runoff pollutants identified for the project must be compared with the pollutants identified as causing an impairment of Receiving Waters, if any. To identify pollutants impairing proximate Receiving Waters, each project proponent preparing a project-specific WQMP shall, at a minimum, do the following:

1. For each of the proposed project discharge points, identify the proximate Receiving Water for each discharge point, using hydrologic unit basin numbers as identified in the most recent version of the Water Quality Control Plan for the Santa Ana River Basin or the San Diego Region.

    1.1. The project indirectly discharges to Cucamonga Creek, which is concrete lined and was extremely limited aquatic habitat. This improved channel ends near the Prado Basin and the stream changes names to Mill Creek. Downstream of the Prado Dam, the water discharges to the Santa Ana River. According to the Santa Ana River Basin Plan, the river slows as it reaches the City of Anaheim, where Orange County Water District diverts and recharges essentially all the dry weather flows. Most of the time, the Santa Ana River is dry downstream of Anaheim. During wet weather the Santa Ana River discharges to the Pacific Ocean. These waterbodies are respectively 0.5, 7 and 34 miles downstream of the project, approximately. The hydrologic units are: 801.21 for Cucamonga Creek, 801.24 for Mill Creek (Prado Area) and 801.11, 801.21, 801.25, 801.27 for the Santa Ana River and the tidal prism at Newport Beach.

2. Identify each proximate identified above that is listed on the most recent list of Clean Water Act Section 303(d) list of impaired water bodies, which can be found at website www.swrcb.ca.gov/tmdl/303d_lists.html. List all pollutants for which the proximate Receiving Waters are impaired.

    2.1. Cucamonga Creek, Mill Creek (Prado Area), and Reach 3 and Reach 2 of the Santa Ana River are the only impaired water bodies downstream from the site. The pollutant stressors for Cucamonga Creek are Cadmium, Coliform Bacteria, Copper, Lead, Zinc and pH. There is a TMDL in place for Coliform Bacteria. TMDLs for Cadmium, Copper, Lead, Zinc and pH are estimated to be completed by 2021.

    2.2. The pollutant stressors for Mill Creek (Prado Area) are Nutrients, pathogens and TSS. There is a TMDL in place for pathogens. TMDLs for nutrients and TSS are estimated to be completed by 2019.

    2.3. The pollutant stressors for Reach 2 of the Santa Ana Rivers are indicator bacteria. TMDLs for indicator bacteria are estimated to be completed by 2021.

2.4. The pollutant stressors for Reach 3 of the Santa Ana River are Copper, Lead, and Pathogens. The impairment for copper is during the wet season only. There is a TMDL in place for pathogens. TMDLs for copper and lead are estimated to be completed by 2021.

3. Compare the list of pollutants for which the proximate Receiving Waters are impaired with the pollutants expected to be generated by the project.

3.1 Urban Runoff Pollutants: The following is a list of potential pollutants for an Commercial/Industrial Development and Parking Lots categories. The potential stormwater pollutants associated with this project include the following: sediment and turbidity, nutrients, organic compounds, oxygen demanding substances, trash and debris, bacteria and viruses, oil and grease, pesticides and metals.

The following water bodies are impaired:

Cucamonga Creek: nutrients and pathogens, metals, and bacteria and viruses (see Treatment Control BMPs section and plans for landscaping information).

Mill Creek (Prado Area): nutrients, pathogens and TSS

Santa Ana River: metals and bacteria and viruses. There is one approved TMDL for the Santa Ana River for pathogens, likely related to dairy farms. Bacteria and virus related to Industrial/Commercial development are typically a result of animal waste on the property (see Treatment Control BMPs section and Table 3 for removal efficiencies).

IV. Hydrologic Conditions of Concern

Impacts to the hydrologic regime resulting from the Project may include increased runoff volume and velocity; reduced infiltration; increased flow frequency, duration, and peaks; faster time to reach peak flow; and water quality degradation. Under certain circumstances, changes could also result in the reduction in the amount of available sediment for transport; storm flows could fill this sediment-carrying capacity by eroding the downstream channel. These changes have the potential to permanently impact downstream channels and habitat integrity. A change to the hydrologic regime of a Project's site would be considered a hydrologic condition of concern if the change would have a significant impact on downstream erosion compared to the pre-development condition or have significant impacts on stream habitat, alone or as part of a cumulative impact from development in the watershed.

This project-specific WQMP must address the issue of Hydrologic Conditions of Concern unless one of the following conditions are met:

- **Condition A:** Runoff from the Project is discharged directly to a publicly-owned, operated and maintained MS4; the discharge is in full compliance with Co-Permittee requirements for connections and discharges to the MS4 (including both quality and quantity requirements); the discharge would not significantly impact stream habitat in proximate Receiving Waters; and the discharge is authorized by the Co-Permittee.
- **Condition B:** The project disturbs less than 1 acre. The disturbed area calculation should include all disturbances associated with larger plans of development.
- **Condition C:** The project's runoff flow rate, volume, velocity and duration for the post-development condition do not exceed the pre-development condition for the 2-year, 24-hour and 10-year 24-hour rainfall events. This condition can be achieved by minimizing impervious area on a site and incorporating other site-design concepts that mimic pre-development conditions. This condition must be substantiated by hydrologic modeling methods acceptable to the Co-Permittee.

  This Project meets the following condition: This project complies with Condition A, as this project discharges directly into the MS4 system operated by the Riverside County Flood Control & Water Conservation District.

	2 year – 24 hour		10 year – 24 hour	
	Precondition	**Post-condition**	**Precondition**	**Post-condition**
Discharge (cfs)	N/A	N/A	N/A	N/A
Velocity (fps)	N/A	N/A	N/A	N/A
Volume (cubic feet)	N/A	N/A	N/A	N/A
Duration (minutes)	N/A	N/A	N/A	N/A

V. Best Management Practices

V.1 SITE DESIGN BMPS

Project proponents shall implement Site Design concepts that achieve each of the following:

1) Minimize Urban Runoff
2) Minimize Impervious Footprint
3) Conserve Natural Areas
4) Minimize Directly Connected Impervious Areas (DCIAs)

The project proponent should identify the specific BMPs implemented to achieve each Site Design concept and provide a brief explanation for those Site Design concepts considered not applicable.

Instructions:

In field below, provide narrative describing which site design concepts were incorporated into project plans. If the project proponent implements a Co-Permittee approved alternative or equally-effective Site Design BMP not specifically described below, the Site Design BMP checkbox in Table I should be marked and an additional description indicating the nature of the BMP and how it addresses the Site Design concept should be provided. Continue with completion of Table 1.

Note: *The Co-Permittees general plan or other land use regulations/documents may require several measures that are effectively site design BMPs (such as minimization of directly connected impervious areas and/or setbacks from natural stream courses). The Project Proponent should work with Co-Permittee staff to determine if those requirements may be interpreted as site design BMPs for use in this table/narrative. See Section 4.5.1 of the WQMP for additional guidance on Site Design BMPs.*

Following Table 1: if a particular Site Design BMP concept is found to be not applicable, please provide a brief explanation as to why the concept cannot be implemented. Also include descriptions explaining how each ***included*** *BMP will be implemented. In those areas where Site Design BMPs require ongoing maintenance, the inspection and maintenance frequency, the inspection criteria, and the entity or party responsible for implementation, maintenance, and/or inspection shall be described. The location of each Site Design BMP must also be shown on the WQMP Site Plan included in Appendix B.*

The project site will utilize various site and source control techniques in an attempt to minimize the degredation of stormwater quality. The project will incorporate the following treatment train:

- Vegetated Swales
- Continuous Deflection Separation (CDS) Unit
- Contech Corrugated Metal Pipe (CMP) Detention and Infiltration System
- Detention Basin

Table 1. Site Design BMPs

Design Concept	Technique	Specific BMP	Included: Yes	Included: No	Included: N/A
Site Design Concept 1	*Minimize Urban Runoff*	Maximize the permeable area (See Section 4.5.1 of the WQMP).	☐	☒	☐
		Incorporate landscaped buffer areas between sidewalks and streets.	☒	☐	☐
		Maximize canopy interception and water conservation by preserving existing native trees and shrubs, and planting additional native or drought tolerant trees and large shrubs.	☐	☐	☒
		Use natural drainage systems.	☐	☒	☐
		Where soils conditions are suitable, use perforated pipe or gravel filtration pits for low flow infiltration.	☐	☒	☐
		Construct onsite ponding areas or retention facilities to increase opportunities for infiltration consistent with vector control objectives.	☒	☒	☐
		Other comparable and equally effective site design concepts as approved by the Co-Permittee (Note: Additional narrative required to describe BMP and how it addresses Site Design concept).	☐	☒	☐

Table 1. Site Design BMPs (Cont.)

Design Concept	Technique	Specific BMP	Included		
			Yes	No	N/A
Site Design Concept 2	*Minimize Impervious Footprint*	Maximize the permeable area (See Section 4.5.1 of the WQMP).	☐	☒	☐
		Construct walkways, trails, patios, overflow parking lots, alleys, driveways, low-traffic streets and other low -traffic areas with open-jointed paving materials or permeable surfaces, such as pervious concrete, porous asphalt, unit pavers, and granular materials.	☐	☒	☐
		Construct streets, sidewalks and parking lot aisles to the minimum widths necessary, provided that public safety and a walk able environment for pedestrians are not compromised.	☒	☐	☐
		Reduce widths of street where off-street parking is available.	☐	☐	☒
		Minimize the use of impervious surfaces, such as decorative concrete, in the landscape design.	☐	☒	☐
Site Design Concept 3	*Conserve Natural Areas*	Other comparable and equally effective site design concepts as approved by the Co-Permittee (Note: Additional narrative required describing BMP and how it addresses Site Design concept).	☐	☒	☐
		Conserve natural areas (See WQMP Section 4.5.1).	☐	☒	☐
		Maximize canopy interception and water conservation by preserving existing native trees and shrubs, and planting additional native or drought tolerant trees and large shrubs.	☐	☐	☒
		Use natural drainage systems.	☐	☐	☒
		Other comparable and equally effective site design concepts as approved by the Co-Permittee (Note: Additional narrative required describing BMP and how it addresses Site Design concept).	☐	☒	☐

Table 1. Site Design BMPs (Cont.)

Design Concept	Technique	Specific BMP	Included		
			Yes	No	N/A
Site Design Concept 4	*Minimize Directly Connected Impervious Areas (DCIAs)*	Residential and commercial sites must be designed to contain and infiltrate roof runoff, or direct roof runoff to vegetative swales or buffer areas, where feasible.	☐	☒	☐
		Where landscaping is proposed, drain impervious sidewalks, walkways, trails, and patios into adjacent landscaping.	☒	☒	☐
		Increase the use of vegetated drainage swales in lieu of underground piping or imperviously lined swales.	☒	☐	☐
		Rural swale system: street sheet flows to vegetated swale or gravel shoulder, curbs at street corners, culverts under driveways and street crossings.	☐	☐	☒
		Urban curb/swale system: street slopes to curb; periodic swale inlets drain to vegetated swale/biofilter.	☐	☒	☐
		Dual drainage system: First flush captured in street catch basins and discharged to adjacent vegetated swale or gravel shoulder, high flows connect directly to MS4s.	☐	☒	☐
		Design driveways with shared access, flared (single lane at street) or wheel strips (paving only under tires); or, drain into landscaping prior to discharging to the MS4.	☐	☒	☐
		Uncovered temporary or guest parking on private residential lots may be paved with a permeable surface, or designed to drain into landscaping prior to discharging to the MS4.	☐	☐	☒
		Where landscaping is proposed in parking areas, incorporate landscape areas into the drainage design.	☒	☐	☐
		Overflow parking (parking stalls provided in excess of the Co-Permittee's minimum parking requirements) may be constructed with permeable paving.	☐	☐	☒
		Other comparable and equally effective design concepts as approved by the Co-Permittee (Note: Additional narrative required describing BMP and how it addresses Site Design concept).	☐	☒	☐

Non-applicable Site Design BMPs:

Minimize Urban Runoff:
Porous pavement or pervious concrete were not selected for this site because they are difficult and costly to maintain. Additionally, long-term, these BMPs are not as effective at infiltrating versus the CMP Detention and Infiltration System proposed for this site.

Maximizing canopy interception does not apply because lot has been mass graded following previous dairy calving farm use and existing trees and shrubs are not applicable.

The project site has been mass graded following previous dairy calving farm use and natural drainage systems do not apply.

Minimize Impervious Footprint:
The project does not propose public streets where off street parking would be pertinent to the project design.

Conserve Natural Areas:
Conserving Natural Areas would not apply as the project site was graded with the previous dairy calving use.

Canopy Interception would not apply as the project site does not have native trees or plants as a result of the previous dairy calving farm use.

Natural Drainage Systems would not apply to the project as the site has been mass graded following previous dairy calving farm use.

Minimize Directly Connected Impervious Areas:
Designing roof drains into landscaping adjacent to truck docks/bays are infeasible because of the drainage quantity associated with the size of the building. The roof and truck docks drain into the CMP Detention and Infiltration System which discharges into the detention basin in the southwest corner of the site.

Rural Swale System is not applicable as this is a commercial (urban) use.

Uncovered Temporary Parking on private residential lots does not apply to a commercial site.

Overflow parking on this project is not used and not applicable.

Project Site Design BMPs:

1. The project will be designed to incorporate landscaped areas between sidewalks and streets.
2. The project will construct a detention basin in the southwest corner of the site to increase opportunities for infiltration consistent with vector control objectives. In addition, the project will construct a CMP Detention and Infiltration system which stores stormwater runoff in the pipe and surrounding stone during a storm event until it can be released in the surrounding soil. This system will work in conjunction with the detention basin.
3. Where landscaping is proposed, drought resistant and endemic varieties are recommended. Integrated Pest Management practices are suggested as educational resources for the tenant.
4. Streets, sidewalks and parking lots will be designed to the minimum widths necessary to minimize the impervious footprint.
5. The parking lot will drain into vegetated swales located in the medians of the parking field.
6. The parking lot includes landscaped areas. Additionally, the landscaping should use where best suited integrated pest management materials to minimize pesticides and fertilizer on-site.

The operation and maintenance of the above referenced site design measures shall be the responsibility of the owner. The owner shall maintain all permanent storm water BMP's within their property. The owner shall complete and maintain all operation and maintenance forms documenting maintenance activities. Records shall be retained by the owner for at least 5 years.

The site design BMPs not included as part of this plan were not incorporated into the project design either because of the nature of the project, or the site could not physically accommodate them. However, the project will accommodate at least one design concept from each of the four categories above.

V.2 SOURCE CONTROL BMPS

Instructions: *Complete Table 2.*

Table 2. Source Control BMPs

BMP Name	Check One		If not applicable, state brief reason
	Included	Not Applicable	
Non-Structural Source Control BMPs			
Education for Property Owners, Operators, Tenants, Occupants, or Employees	☒	☐	
Activity Restrictions	☒	☐	
Irrigation System and Landscape Maintenance	☒	☐	
Common Area Litter Control	☒	☐	
Street Sweeping Private Streets and Parking Lots	☒	☐	
Drainage Facility Inspection and Maintenance	☒	☐	
Structural Source Control BMPs			
MS4 Stenciling and Signage	☒	☐	
Landscape and Irrigation System Design	☒	☐	
Protect Slopes and Channels	☒	☐	
Provide Community Car Wash Racks	☐	☒	Not proposed for this use
Properly Design:	☐	☐	
Fueling Areas	☐	☒	Not proposed for this use
Air/Water Supply Area Drainage	☐	☒	Not proposed for this use
Trash Storage Areas	☒	☐	
Loading Docks	☒	☐	
Maintenance Bays	☐	☒	Not proposed for this use
Vehicle and Equipment Wash Areas	☐	☒	Not proposed for this use
Outdoor Material Storage Areas	☒	☐	
Outdoor Work Areas or Processing Areas	☐	☒	Not proposed for this use
Provide Wash Water Controls for Food Preparation Areas	☐	☒	Not proposed for this use

Instructions: *Provide narrative below describing how each* ***included*** *BMP will be implemented, the implementation frequency, inspection and maintenance frequency, inspection criteria, and the entity or party responsible for implementation, maintenance, and/or inspection. The location of each structural BMP must also be shown on the WQMP Site Plan included in Appendix B.*

- Education for property owners, operators, tenants, occupants, or employees - **Appendix D** includes copies of the educational materials that will be used distributed to property owners, and tenants.
- Activity Restrictions – Wal-Mart Stores, Inc. (or current property owner) will prepare CC&Rs with restrictions of uses for the site.
- Irrigation system and landscape maintenance – Wal-Mart Stores, Inc. (or current property owner) will be responsible for the irrigation system and landscape maintenance.

- Common Area Litter Control – Wal-Mart Stores, Inc., (or current property owner) will be responsible for on-site litter control.
- Street Sweeping Private Streets and Parking Lots – Wal-Mart Stores, Inc., (or current property owner) will be responsible for sweeping their parking lots.
- Protect Slopes – slopes shall be planted to protect against erosion. See landscape plans that are included with the architectural plans.
- Drainage Facility Inspection and Maintenance – Wal-Mart Stores, Inc., LLC, (or current property owner) will fund the maintenance of on-site BMPs.
- MS4 Stenciling and Signage – The owner will be responsible for implementing initial catch basin stenciling.
- Landscape and Irrigation System Design – Wal-Mart Stores, Inc. (or current property owner) will be responsible for implementing efficient irrigation systems.
- Trash Storage Areas – All trash storage areas will be enclosed to minimize contact with storm water.

The operation and maintenance of the above referenced source control measures shall be the responsibility of Wal-Mart Stores, Inc. (or current property owner). The owner shall maintain all permanent storm water BMPs within their property. The owner shall complete and maintain all operation and maintenance forms documenting maintenance activities. Records shall be retained by the owner for at least 5 years.

Appendix D includes copies of the educational materials that will be used in implementing this project-specific WQMP.

V.3 TREATMENT CONTROL BMPS

Instructions:

1. *Provide narrative below describing each Treatment Control BMP. Include location, identify the sizing criteria [i.e., Urban Runoff quality design flow (QBMP) or the Urban Runoff quality design volume (VBMP), preliminary design calculations, for sizing BMPs, maintenance procedures, and the frequency of maintenance procedures necessary to sustain BMP effectiveness. The location of each Treatment Control BMP must also be shown on the Site Plan included in Appendix B.*
2. *Complete Table 3: Treatment Control BMP Selection Matrix*

   Directions for completing Table 3:

   - *For each pollutant of concern enter "yes" if identified using Exhibit B (Riverside County WQMP - General Categories of Pollutants of Concern per the instructions specified in Section III of this Template), or "no" if not identified for the project.*
   - *Check the boxes of selected BMPs that will be implemented for the project to address each pollutant of concern from the project as identified using Exhibit B. Treatment Control BMPs must be selected and installed with respect to identified pollutant characteristics and concentrations that will be discharged from the site.*
   - *For any identified pollutants of concern not listed in the Treatment Control BMP Selection Matrix, provide an explanation (in space below) of how they will be addressed by Treatment Control BMPs.*
3. *In addition to completing Table 3, provide detailed descriptions on the location, implementation, installation, and long-term O&M of planned Treatment* Control BMPs.

*For identified pollutants of concern that are **causing an impairment in receiving waters**, the project WQMP shall incorporate one or more Treatment Control BMPs of medium or high effectiveness in reducing those pollutants. It is the responsibility of the project proponent to demonstrate, and document in the project WQMP, that all pollutants of concern will be fully addressed. The Agency may require information beyond the minimum requirements of this WQMP to demonstrate that adequate pollutant treatment is being accomplished.*

Supporting engineering calculations for Q_{BMP} and/or V_{BMP}, and Treatment Control BMP design details are included in Appendix F.

***Note**: Projects that will utilize infiltration-based Treatment Control BMPs (e.g., Infiltration Basins, Infiltration Trenches, Porous Pavement) must include a copy of the property/project soils report as Appendix E to the project-specific WQMP. The selection of a Treatment Control BMP (or BMPs) for the project must specifically consider the effectiveness of the Treatment Control BMP for pollutants identified as causing an impairment of Receiving Waters to which the project will discharge Urban Runoff.*

The project will incorporate the following treatment train: vegetated swales to a CDS unit to a Contech CMP Detention and Infiltration system with the overflow discharging to a detention basin.

The project is proposing vegetated swales within the medians of the parking field to reduce the potential of oil and grease, sediment, metals, and organics from leaving the site. Due to the low velocities associated with the design, it is anticipated that these pollutants will be removed by infiltration and plant uptake. Supporting documentation and calculations are found in Appendix F of this report.

The project is proposing a CDS to remove mainly trash and debris, and sediments. According to the manufacturer, the CDS unit captures sands and solids and is capable of removing 80% of annual TSS from storm water. CDS units also remove 100% of all floatables and particles that are equal to or greater than one-half of the size of the screen opening.

The project will also construct a Contech CMP Detention and Infiltration system which stores stormwater runoff in the pipe and surrounding stone during a storm event until it can be released in the surrounding soil.

The project is proposing a detention basin to be located in the southwest corner of the site. The detention basin will detain sediment-laden storm water, allowing sediment to settle and cleaner water to spill over the top of the weir prior to discharge into the MS4 system operated by the Riverside County Flood Control & Water Conservation District. The detention basin will collect and contain sediment, debris, petroleum hydrocarbons (oil and greases), metals, organics, and bacteria. Detention basins can provide substantial capture of sediment and the toxics fraction associated with particulates. Please see WQMP Exhibit in Appendix B for locations.

Table 3: Treatment Control BMP Selection Matrix [1]

Pollutant of Concern	Treatment Control BMP Categories[2]							
	Veg. Swale & Veg. Filter Strips[3]	Detention Basins[4]	Infiltration Basins, Infiltration Trenches, & Porous Pavement[5]	Wet Ponds or Wetlands[6]	Sand Filter or Media Filters	Water Quality Inlets	Hydrodynamic Separator Systems [7]	Manufactured / Proprietary Devices[8]
Sediment/Turbidity	H/M	M	H/M	H/M	H/M	L	H/M (L for turbidity)	U
Y ☒ N ☐	☒	☒	☐	☐	☐	☐	☐	☒
Nutrients	L	M	H/M	H/M	L/M	L	L	U
Y ☒ N ☐	☒	☒	☐	☐	☐	☐	☐	☒
Organic Compounds	U	U	U	U	H/M	L	L	U
Y ☒ N ☐	☒	☒	☐	☐	☐	☐	☐	☒
Trash & Debris	L	M	U	U	H/M	M	H/M	U
Y ☒ N ☐	☒	☒	☐	☐	☐	☐	☐	☒
Oxygen Demanding Substances	L	M	H/M	H/M	H/M	L	L	U
Y ☒ N ☐	☒	☒	☐	☐	☐	☐	☐	☒
Bacteria & Viruses	U	U	H/M	U	H/M	L	L	U
Y ☒ N ☐	☒	☒	☐	☐	☐	☐	☐	☒
Oils & Grease	H/M	M	U	U	H/M	M	L/M	U
Y ☒ N ☐	☒	☒	☐	☐	☐	☐	☐	☒
Pesticides (non-soil bound)	U	U	U	U	U	L	L	U
Y ☒ N ☐	☒	☒	☐	☐	☐	☐	☐	☒
Metals	H/M	M	H	H	H	L	L	U
Y ☒ N ☐	☒	☒	☐	☐	☐	☐	☐	☒

Abbreviations:

L: Low removal efficiency H/M: High or medium removal efficiency U: Unknown removal efficiency

Notes:

(1) Periodic performance assessment and updating of the guidance provided by this table may be necessary.

(2) Project applicants should base BMP designs on the Riverside County Stormwater Quality Best Management Practice Design Handbook. However, project applicants may also wish to reference the California Stormwater BMP Handbook – New Development and Redevelopment (www.cabmphandbooks.com). The Handbook contains additional information on BMP operation and maintenance.

(3) Includes grass swales, grass strips, wetland vegetation swales, and bioretention.

(4) Includes extended/dry detention basins with grass lining and extended/dry detention basins with impervious lining. Effectiveness based upon minimum 36-48-hour drawdown time.

(5) Projects that will utilize infiltration-based Treatment Control BMPs (e.g., Infiltration Basins, Infiltration Trenches, Porous Pavement, etc.) must include a copy of the property/project soils report as Appendix E to the project-specific WQMP. The selection of a Treatment Control BMP (or BMPs) for the project must specifically consider the effectiveness of the Treatment Control BMP for pollutants identified as causing an impairment of Receiving Waters to which the project will discharge Urban Runoff.

(6) Includes permanent pool wet ponds and constructed wetlands.

(7) Also known as hydrodynamic devices, baffle boxes, swirl concentrators, or cyclone separators.

(8) Includes proprietary stormwater treatment devices as listed in the CASQA Stormwater Best Management Practices Handbooks, other stormwater treatment BMPs not specifically listed in this WQMP, or newly developed/emerging stormwater treatment technologies.

V.4 EQUIVALENT TREATMENT CONTROL ALTERNATIVES

Not Applicable

V.5 REGIONALLY-BASED TREATMENT CONTROL BMPS

Not Applicable

VI. Operation and Maintenance Responsibility for Treatment Control BMPs

Operation and maintenance (O&M) requirements for all structural Source Control and Treatment Control BMPs shall be identified in the project-specific WQMP. The project-specific WQMP shall address the following:

- Identification of each BMP that requires O&M.
- Thorough description of O&M activities, the O&M process, and the handling and placement of any wastes.
- BMP start-up dates.
- Schedule of the frequency of O&M for each BMP.
- Identification of the parties (name, address, and telephone number) responsible for O&M, including a written agreement with the entities responsible for O&M. This agreement can take the form of a Covenant and Agreement recorded by the Project Proponent with the County Recorder, HOA or POA CC&Rs, formation of a maintenance district or assessment district or other instrument sufficient to guarantee perpetual O&M. The preparer of this project-specific WQMP should carefully review Section 4.6 of the WQMP prior to completing this section of the project-specific WQMP.
- Self-inspections and record-keeping requirements for BMPs (review local specific requirements regarding self-inspections and/or annual reporting), including identification of responsible parties for inspection and record- keeping.
- Thorough descriptions of water quality monitoring, if required by the Co-Permittee.

Instructions: *Identify below all operations and maintenance requirements, as described above, for each structural BMP. Where a public agency is identified as the funding source and responsible party for a Treatment Control BMP, a copy of the written agreement stating the public agency's acceptance of these responsibilities must be provided in Appendix G.*

Vegetated Swale

1. Include periodic weed control, trash inspection after large storm events, and areas of accumulated sediment inspection.
2. Include periodic trimming of vegetation.
3. Regularly inspect for pools of standing water.

CDS Unit

The CDS Unit detailed in this report shall be maintained in good and effective condition as specified by the manufacturer's recommendations which are summarized as follows:

1. On an annual basis, maintenance shall include a minimum of two (2) inspections per year, which includes checking that the components are in working order and there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash and sediment in the system. Keep a record of each inspection.
2. The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an equivalent level of hydrocarbons and trash has accumulated. Cleaning of a CDS unit should be done during dry weather conditions. The material should be removed via a vacuum truck.

Contech CMP Detention and Infiltration system

The Contech CMP Detention and Infiltration system detailed in this report shall be maintained in good and effective condition as specified by the manufacturer's recommendations which are summarized as follows:

1. Maintenance shall include quarterly inspection of the accumulated sediment. Keep a record of each inspection.
2. The system should be cleaned when the accumulated sediment or trash is clogging the discharge orifice. Cleaning of the system should be done during dry weather conditions. The material should be removed via a vacuum truck.

Detention Basin

An effective maintenance program should include the following key components:

1. Weather-triggered inspections – Inspect after several storm events for bank stability, vegetation growth and to determine if the desired residence time has been achieved.
2. Regular inspections – Inspect semi-annually and after significant storm events. Inspect for the issues as described in BMP detail TC-22 in Appendix F.
3. Sediment Removal – Remove accumulated sediment when accumulated sediment volume exceeds 10-20% of the basin volume or when accumulation reaches 6 inches or if re-suspension is observed.
4. Water Removal – Basin will be designed with a "low-flow" outlet, however if water remains; remove standing water from basin within 72 hours after accumulation.
5. General Maintenance Activities – see BMP detail TC-22 in Appendix F for maintenance activities and suggested frequency.

It is the responsibility of Wal-Mart Stores, Inc. (or current property owner) to operate and maintain all of the above referenced Treatment Control measures. The owner shall complete and maintain all operation and maintenance forms documenting maintenance activities. Records shall be retained by the owner for at least 5 years.

VII. Funding

A funding source or sources for the O&M of each Treatment Control BMP identified in the project-specific WQMP must be identified. By certifying the project-specific WQMP, the Project applicant is certifying that the funding responsibilities have been addressed and will be transferred to future owners. One example of how to adhere to the requirement to transfer O&M responsibilities is to record the project-specific WQMP against the title to the property.

It is the responsibility of Wal-Mart Stores, Inc. (or current property owner) to operate and maintain all of the above referenced Site, Source, and Treatment Control BMPs. The owner shall maintain all permanent storm water BMPs within their property. The owner shall complete and maintain all operation and maintenance forms documenting maintenance activities. Records shall be retained by the owner for at least 5 years.

Appendix A

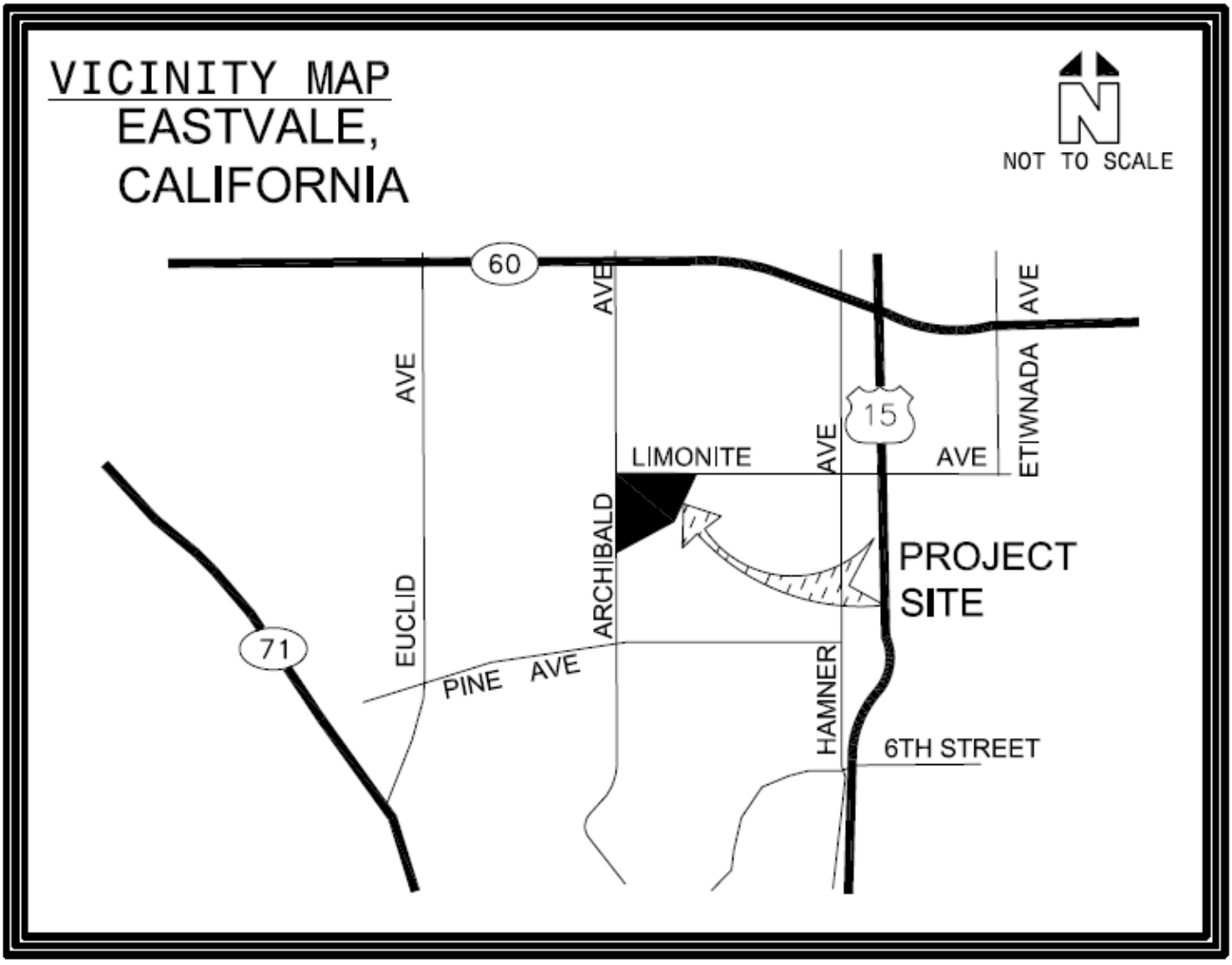
CONDITIONS OF APPROVAL

Planning Commission Resolution TBD through Plot Plan Process

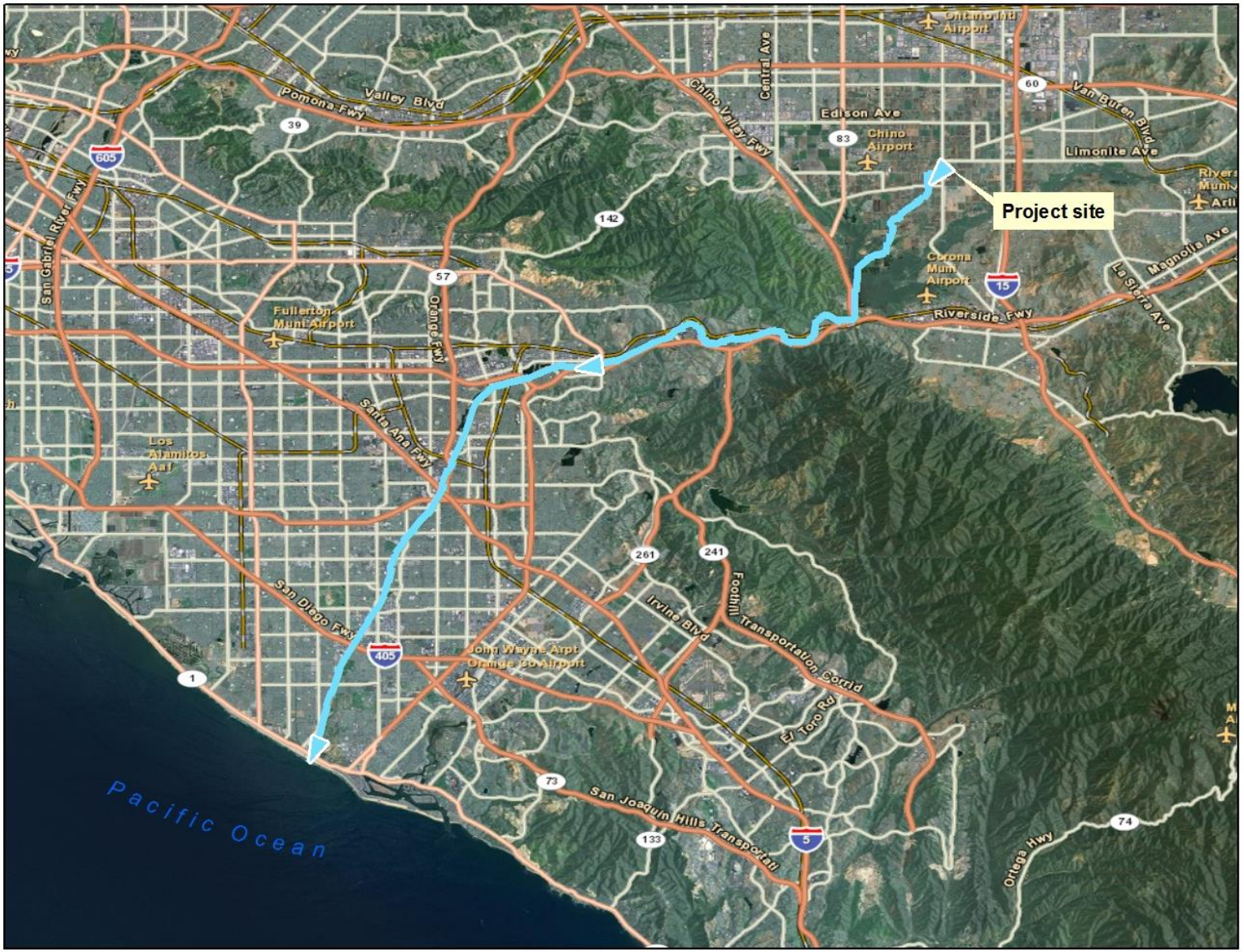
Dated TBD

Appendix B

VICINITY MAP, WQMP SITE PLAN, PRE AND POST DEVELOPMENT DRAINAGE CONDITIONS, AND RECEIVING WATERS MAP



Receiving Waters Map



Appendix C

SUPPORTING DETAIL RELATED TO HYDRAULIC CONDITIONS OF CONCERN

N/A

Appendix D

EDUCATIONAL MATERIALS

Non-Stormwater Discharges SC-10

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Description

Non-stormwater discharges are those flows that do not consist entirely of stormwater. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include car washing, air conditioner condensate, etc. However there are certain non-stormwater discharges that pose environmental concern. These discharges may originate from illegal dumping or from internal floor drains, appliances, industrial processes, sinks, and toilets that are connected to the nearby storm drainage system. These discharges (which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants into storm drains. They can generally be detected through a combination of detection and elimination. The ultimate goal is to effectively eliminate non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges of pollutants on streets and into the storm drain system and creeks.

Targeted Constituents

Sediment	
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Approach

Initially the industry must make an assessment of non-stormwater discharges to determine which types must be eliminated or addressed through BMPs. The focus of the following approach is in the elimination of non-stormwater discharges.

CASQA California Stormwater Quality Association

SC-10 Non-Stormwater Discharges

Pollution Prevention

- Ensure that used oil, used antifreeze, and hazardous chemical recycling programs are being implemented. Encourage litter control.

Suggested Protocols

Recommended Complaint Investigation Equipment

- Field Screening Analysis
  - pH paper or meter
  - Commercial stormwater pollutant screening kit that can detect for reactive phosphorus, nitrate nitrogen, ammonium nitrogen, specific conductance, and turbidity
  - Sample jars
  - Sample collection pole
  - A tool to remove access hole covers
- Laboratory Analysis
  - Sample cooler
  - Ice
  - Sample jars and labels
  - Chain of custody forms
- Documentation
  - Camera
  - Notebook
  - Pens
  - Notice of Violation forms
  - Educational materials

General

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially those that are not classified as hazardous. These are often not responded to as effectively as they need to be.
- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” stenciled or demarcated next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.

Non-Stormwater Discharges SC-10

- See SC44 Stormwater Drainage System Maintenance for additional information.

Illicit Connections

- Locate discharges from the industrial storm drainage system to the municipal storm drain system through review of "as-built" piping schematics.
- Isolate problem areas and plug illicit discharge points.
- Locate and evaluate all discharges to the industrial storm drain system.

Visual Inspection and Inventory

- Inventory and inspect each discharge point during dry weather.
- Keep in mind that drainage from a storm event can continue for a day or two following the end of a storm and groundwater may infiltrate the underground stormwater collection system. Also, non-stormwater discharges are often intermittent and may require periodic inspections.

Review Infield Piping

- A review of the "as-built" piping schematic is a way to determine if there are any connections to the stormwater collection system.
- Inspect the path of floor drains in older buildings.

Smoke Testing

- Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two systems.
- During dry weather the stormwater collection system is filled with smoke and then traced to sources. The appearance of smoke at the base of a toilet indicates that there may be a connection between the sanitary and the stormwater system.

Dye Testing

- A dye test can be performed by simply releasing a dye into either your sanitary or process wastewater system and examining the discharge points from the stormwater collection system for discoloration.

TV Inspection of Drainage System

- TV Cameras can be employed to visually identify illicit connections to the industrial storm drainage system.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.

SC-10 Non-Stormwater Discharges

- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Once a site has been cleaned:

- Post "No Dumping" signs with a phone number for reporting dumping and disposal.
- Landscaping and beautification efforts of hot spots may also discourage future dumping, as well as provide open space and increase property values.
- Lighting or barriers may also be needed to discourage future dumping.
- See fact sheet SC11 Spill Prevention, Control, and Cleanup.

Inspection

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Conduct field investigations of the industrial storm drain system for potential sources of non-stormwater discharges.
- Pro-actively conduct investigations of high priority areas. Based on historical data, prioritize specific geographic areas and/or incident type for pro-active investigations.

Reporting

- A database is useful for defining and tracking the magnitude and location of the problem.
- Report prohibited non-stormwater discharges observed during the course of normal daily activities so they can be investigated, contained, and cleaned up or eliminated.
- Document that non-stormwater discharges have been eliminated by recording tests performed, methods used, dates of testing, and any on-site drainage points observed.
- Document and report annually the results of the program.
- Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.

Training

- Training of technical staff in identifying and documenting illegal dumping incidents is required.
- Consider posting the quick reference table near storm drains to reinforce training.
- Train employees to identify non-stormwater discharges and report discharges to the appropriate departments.

Non-Stormwater Discharges SC-10

- Educate employees about spill prevention and cleanup.
- Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Determine and implement appropriate outreach efforts to reduce non-permissible non-stormwater discharges.
- Conduct spill response drills annually (if no events occurred to evaluate your plan) in cooperation with other industries.
- When a responsible party is identified, educate the party on the impacts of his or her actions.

Spill Response and Prevention

- See SC11 Spill Prevention Control and Cleanup.

Other Considerations

- Many facilities do not have accurate, up-to-date schematic drawings.

Requirements

Costs (including capital and operation & maintenance)

- The primary cost is for staff time and depends on how aggressively a program is implemented.
- Cost for containment and disposal is borne by the discharger.
- Illicit connections can be difficult to locate especially if there is groundwater infiltration.
- Indoor floor drains may require re-plumbing if cross-connections to storm drains are detected.

Maintenance (including administrative and staffing)

- Illegal dumping and illicit connection violations requires technical staff to detect and investigate them.

Supplemental Information

Further Detail of the BMP

Illegal Dumping

- Substances illegally dumped on streets and into the storm drain systems and creeks include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes. All of these wastes cause stormwater and receiving water quality problems as well as clog the storm drain system itself.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots

SC-10 Non-Stormwater Discharges

- Types and quantities (in some cases) of wastes
- Patterns in time of occurrence (time of day/night, month, or year)
- Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
- Responsible parties

One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people at the facility who are aware of the problem and who have the tools to at least identify the incident, if not correct it. Therefore, train field staff to recognize and report the incidents.

What constitutes a "non-stormwater" discharge?

- Non-stormwater discharges to the stormwater collection system may include any water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

Permit Requirements

- Facilities subject to stormwater permit requirements must include a certification that the stormwater collection system has been tested or evaluated for the presence of non-stormwater discharges. The State's General Industrial Stormwater Permit requires that non-stormwater discharges be eliminated prior to implementation of the facility's SWPPP.

Performance Evaluation

- Review annually internal investigation results; assess whether goals were met and what changes or improvements are necessary.
- Obtain feedback from personnel assigned to respond to, or inspect for, illicit connections and illegal dumping incidents.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Spill Prevention, Control & Cleanup SC-11

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Description

Many activities that occur at an industrial or commercial site have the potential to cause accidental or illegal spills. Preparation for accidental or illegal spills, with proper training and reporting systems implemented, can minimize the discharge of pollutants to the environment.

Spills and leaks are one of the largest contributors of stormwater pollutants. Spill prevention and control plans are applicable to any site at which hazardous materials are stored or used. An effective plan should have spill prevention and response procedures that identify potential spill areas, specify material handling procedures, describe spill response procedures, and provide spill clean-up equipment. The plan should take steps to identify and characterize potential spills, eliminate and reduce spill potential, respond to spills when they occur in an effort to prevent pollutants from entering the stormwater drainage system, and train personnel to prevent and control future spills.

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Approach

Pollution Prevention

- Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

- Develop a Spill Prevention Control and Countermeasure (SPCC) Plan. The plan should include:

SC-11 Spill Prevention, Control & Cleanup

- Description of the facility, owner and address, activities and chemicals present
- Facility map
- Notification and evacuation procedures
- Cleanup instructions
- Identification of responsible departments
- Identify key spill response personnel

- Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of process materials that are brought into the facility.

Suggested Protocols (including equipment needs)

Spill Prevention

- Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- If consistent illegal dumping is observed at the facility:
  - Post "No Dumping" signs with a phone number for reporting illegal dumping and disposal. Signs should also indicate fines and penalties applicable for illegal dumping.
  - Landscaping and beautification efforts may also discourage illegal dumping.
  - Bright lighting and/or entrance barriers may also be needed to discourage illegal dumping.
- Store and contain liquid materials in such a manner that if the tank is ruptured, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters, or groundwater.
- If the liquid is oil, gas, or other material that separates from and floats on water, install a spill control device (such as a tee section) in the catch basins that collects runoff from the storage tank area.
- Routine maintenance:
  - Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Any collected liquids or soiled absorbent materials must be reused/recycled or properly disposed.
  - Store and maintain appropriate spill cleanup materials in a location known to all near the tank storage area; and ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
  - Sweep and clean the storage area monthly if it is paved, *do not hose down the area to a storm drain.*

Spill Prevention, Control & Cleanup SC-11

  - Check tanks (and any containment sumps) daily for leaks and spills. Replace tanks that are leaking, corroded, or otherwise deteriorating with tanks in good condition. Collect all spilled liquids and properly dispose of them.

- Label all containers according to their contents (e.g., solvent, gasoline).
- Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).
- Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).
- Identify key spill response personnel.

Spill Control and Cleanup Activities

- Follow the Spill Prevention Control and Countermeasure Plan.
- Clean up leaks and spills immediately.
- Place a stockpile of spill cleanup materials where it will be readily accessible (e.g., near storage and maintenance areas).
- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste. Physical methods for the cleanup of dry chemicals include the use of brooms, shovels, sweepers, or plows.
- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Chemical cleanups of material can be achieved with the use of adsorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Reporting

- Report spills that pose an immediate threat to human health or the environment to the Regional Water Quality Control Board.
- Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour).
- Report spills to local agencies, such as the fire department; they can assist in cleanup.
- Establish a system for tracking incidents. The system should be designed to identify the following:

  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)

SC-11 Spill Prevention, Control & Cleanup

- Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
- Responsible parties

Training

- Educate employees about spill prevention and cleanup.
- Well-trained employees can reduce human errors that lead to accidental releases or spills:
  - The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur.
  - Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Employees should be educated about aboveground storage tank requirements. Employees responsible for aboveground storage tanks and liquid transfers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.
- Train employees to recognize and report illegal dumping incidents.

Other Considerations (Limitations and Regulations)

- State regulations exist for facilities with a storage capacity of 10,000 gallons or more of petroleum to prepare a Spill Prevention Control and Countermeasure (SPCC) Plan (Health & Safety Code Chapter 6.67).
- State regulations also exist for storage of hazardous materials (Health & Safety Code Chapter 6.95), including the preparation of area and business plans for emergency response to the releases or threatened releases.
- Consider requiring smaller secondary containment areas (less than 200 sq. ft.) to be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

Requirements

Costs (including capital and operation & maintenance)

- Will vary depending on the size of the facility and the necessary controls.
- Prevention of leaks and spills is inexpensive. Treatment and/or disposal of contaminated soil or water can be quite expensive.

Maintenance (including administrative and staffing)

- This BMP has no major administrative or staffing requirements. However, extra time is needed to properly handle and dispose of spills, which results in increased labor costs.

Spill Prevention, Control & Cleanup SC-11

Supplemental Information

Further Detail of the BMP

Reporting

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the facility and the effectiveness of BMPs. A good record keeping system helps the facility minimize incident recurrence, correctly respond with appropriate cleanup activities, and comply with legal requirements. A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm sewer. These records should contain the following information:

- Date and time of the incident
- Weather conditions
- Duration of the spill/leak/discharge
- Cause of the spill/leak/discharge
- Response procedures implemented
- Persons notified
- Environmental problems associated with the spill/leak/discharge

Separate record keeping systems should be established to document housekeeping and preventive maintenance inspections, and training activities. All housekeeping and preventive maintenance inspections should be documented. Inspection documentation should contain the following information:

- The date and time the inspection was performed
- Name of the inspector
- Items inspected
- Problems noted
- Corrective action required
- Date corrective action was taken

Other means to document and record inspection results are field notes, timed and dated photographs, videotapes, and drawings and maps.

Aboveground Tank Leak and Spill Control

Accidental releases of materials from aboveground liquid storage tanks present the potential for contaminating stormwater with many different pollutants. Materials spilled, leaked, or lost from

SC-11 Spill Prevention, Control & Cleanup

tanks may accumulate in soils or on impervious surfaces and be carried away by stormwater runoff.

The most common causes of unintentional releases are:

- Installation problems
- Failure of piping systems (pipes, pumps, flanges, couplings, hoses, and valves)
- External corrosion and structural failure
- Spills and overfills due to operator error
- Leaks during pumping of liquids or gases from truck or rail car to a storage tank or vice versa

Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code. Practices listed below should be employed to enhance the code requirements:

- Tanks should be placed in a designated area.
- Tanks located in areas where firearms are discharged should be encapsulated in concrete or the equivalent.
- Designated areas should be impervious and paved with Portland cement concrete, free of cracks and gaps, in order to contain leaks and spills.
- Liquid materials should be stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10 percent of the volume of all of the containers or 110 percent of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain.
- For used oil or dangerous waste, a dead-end sump should be installed in the drain.
- All other liquids should be drained to the sanitary sewer if available. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.
- Accumulated stormwater in petroleum storage areas should be passed through an oil/water separator.

Maintenance is critical to preventing leaks and spills. Conduct routine inspections and:

- Check for external corrosion and structural failure.
- Check for spills and overfills due to operator error.
- Check for failure of piping system (pipes, pumps, flanger, coupling, hoses, and valves).
- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.

Spill Prevention, Control & Cleanup SC-11

- Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.
- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- Frequently relocate accumulated stormwater during the wet season.
- Periodically conduct integrity testing by a qualified professional.

Vehicle Leak and Spill Control

Major spills on roadways and other public areas are generally handled by highly trained Hazmat teams from local fire departments or environmental health departments. The measures listed below pertain to leaks and smaller spills at vehicle maintenance shops.

In addition to implementing the spill prevention, control, and clean up practices above, use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- Perform all vehicle fluid removal or changing inside or under cover to prevent the run-on of stormwater and the runoff of spills.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Immediately drain all fluids from wrecked vehicles.
- Store wrecked vehicles or damaged equipment under cover.
- Place drip pans or absorbent materials under heavy equipment when not in use.
- Use adsorbent materials on small spills rather than hosing down the spill.
- Remove the adsorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- Oil filters disposed of in trashcans or dumpsters can leak oil and contaminate stormwater. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.

SC-11 Spill Prevention, Control & Cleanup

- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- Design the fueling area to prevent the run-on of stormwater and the runoff of spills:
  - Cover fueling area if possible.
  - Use a perimeter drain or slope pavement inward with drainage to a sump.
  - Pave fueling area with concrete rather than asphalt.
- If dead-end sump is not used to collect spills, install an oil/water separator.
- Install vapor recovery nozzles to help control drips as well as air pollution.
- Discourage "topping-off' of fuel tanks.
- Use secondary containment when transferring fuel from the tank truck to the fuel tank.
- Use adsorbent materials on small spills and general cleaning rather than hosing down the area. Remove the adsorbent materials promptly.
- Carry out all Federal and State requirements regarding underground storage tanks, or install above ground tanks.
- Do not use mobile fueling of mobile industrial equipment around the facility; rather, transport the equipment to designated fueling areas.
- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Train employees in proper fueling and cleanup procedures.

Industrial Spill Prevention Response

For the purposes of developing a spill prevention and response program to meet the stormwater regulations, facility managers should use information provided in this fact sheet and the spill prevention/response portions of the fact sheets in this handbook, for specific activities. The program should:

- Integrate with existing emergency response/hazardous materials programs (e.g., Fire Department)
- Develop procedures to prevent/mitigate spills to storm drain systems
- Identify responsible departments
- Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures
- Address spills at municipal facilities, as well as public areas

Spill Prevention, Control & Cleanup SC-11

- Provide training concerning spill prevention, response and cleanup to all appropriate personnel

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Stormwater Managers Resource Center http://www.stormwatercenter.net/

Contaminated or Erodible Areas SC-40

Description

Areas within an industrial site that are bare of vegetation or are subject to activities that promote the suppression of vegetation are often subject to erosion. In addition, they may or may not be contaminated from past or current activities. If the area is temporarily bare because of construction, see SC-42, Building Repair, Remodeling, and Construction. Sites with excessive erosion or the potential for excessive erosion should consider employing the soil erosion BMPs identified in the Construction BMP Handbook. Note that this fact sheet addresses soils that are not so contaminated as to exceed hazardous waste criteria (see Title 22 California Code of Regulations for Hazardous Waste Criteria).

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Pollution Prevention

Preserve natural vegetation whenever possible. See also EC-2, Preservation of Existing Vegetation, in the Construction BMP Handbook.

Suggested Protocols

- Preserve natural vegetation.
- Analyze soil conditions.
- Re-vegetate when necessary.
- Remove contaminated soil.
- Utilize chemical stabilization when needed. See also EC-5, Soil Binders, and EC-13, Polyacrylamide, in the Construction BMP Handbook.
- Use geosynthetic membranes to control erosion if feasible. See also EC-7, Geotextiles and Mats, in the Construction BMP Handbook.

Training

Training is not a significant element of this best management practice.

SC-40 Contaminated or Erodible Areas

Other Considerations

- Disadvantages of preserving natural vegetation or revegetation include:
  - Requires substantial planning to preserve and maintain the existing vegetation
  - May not be cost-effective with high land costs
  - Lack of rainfall, inadequate irrigation and/or poor soils may limit the success of re-vegetated areas
- Disadvantages of chemical stabilization include:
  - Creation of impervious surfaces
  - May cause harmful effects on water quality
  - Is usually more expensive than vegetative cover

Requirements

Costs

Except for preservation of natural vegetation, each of the above solutions can be quite expensive depending upon the size of the area.

Maintenance

Maintenance should be minimal, except possibly if irrigation of vegetation is necessary.

Supplemental Information

Preserving Vegetation to Minimize Erosion

Preserving stabilized areas minimizes erosion potential, protects water quality, and provides aesthetic benefits. The most effective way to control erosion is to preserve existing vegetation. Preservation of natural vegetation provides a natural buffer zone and an opportunity for infiltration of stormwater and capture of pollutants in the soil matrix. This practice can be used as a permanent source control measure.

Vegetation preservation should be incorporated into the site. Preservation requires good site management to minimize the impact of construction when construction is underway and exposure of soils after construction. Proper maintenance is important to ensure healthy vegetation that can control erosion. Different species, soil types, and climatic conditions will require different maintenance activities such as mulching, fertilizing, liming, irrigation, pruning and weed and pest control. Maintenance should be performed regularly especially during construction phases.

The preferred approach is to leave as much native vegetation on-site as possible, thereby reducing or eliminating any erosion problem. However, assuming the site already has contaminated or erodible surface areas, there are four possible courses of action which can be taken:

- The area can be revegetated if it is not in use and therefore not subject to damage from site activities. In as much as the area is already devoid of vegetation, special measures are likely

Contaminated or Erodible Areas SC-40

necessary. Lack of vegetation may be due to the lack of water and/or poor soils. The latter can perhaps be solved with fertilization, or the ground may simply be too compacted from prior use. Improving soil conditions may be sufficient to support the recovery of vegetation. Use process wastewater for irrigation if possible. Finally, see the Construction BMP Handbook for further procedures on establishing vegetation.

- Chemical stabilization can be used as an alternate method in areas where temporary seeding practices cannot be used because of season or climate. It can provide immediate, effective, and inexpensive erosion control. Application rates and procedures recommended by the manufacturer should be followed as closely as possible to prevent the products from forming ponds and creating large areas where moisture cannot penetrate the soil. See also EC-5, Soil Binders, and EC-13, Polyacrylamide, in the Construction BMP Handbook for more information. Advantages of chemical stabilization include:
  - Applied easily to the surface
  - Stabilizes areas effectively
  - Provides immediate protection to soils that are in danger of erosion
- Contaminated soils can be removed, however this is a last resort and quite expensive. The level and extent of the contamination must be determined. This determination and removal must comply with State and Federal regulations, permits must be acquired and fees paid.
- Geosynthetics may be used. Geosynthetics include those materials that are designed as an impermeable barrier to contain or control large amounts of liquid or solid matter. Geosynthetics have been developed primarily for use in landfills and surface impoundments, and the technology is well established. There are two general types of geosynthetics: geomembranes (impermeable) and geotextiles (permeable). Geomembranes are composed of one of three types of impermeable materials: elastomers (rubbers), thermoplasics (plastics), or a combination of these two types of materials. See also EC-7, Geotextiles and Mats, in the Construction BMP Handbook for more information. The advantages of these materials include:
  - A variety of compounds are available
  - Sheeting is produced in a factory environment
  - Polymeric membranes are flexible
  - Installation is simple

  Disadvantages include:
  - Chemical resistance must be determined for each application
  - Seaming systems may be a weak link in the system
  - Many materials are subject to attack from biotic, mechanical, or environmental sources

SC-40 Contaminated or Erodible Areas

Geotextiles are uncoated synthetic textile products that are not watertight. They are composed of a variety of materials, most commonly polypropylene and polyester. Geotextiles serve five basic functions:

- Filtration
- Drainage
- Separation
- Reinforcement
- Armoring

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

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Building & Grounds Maintenance SC-41

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	
Organics	

Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Encourage proper lawn management and landscaping, including use of native vegetation.

CASQA California Stormwater Quality Association

SC-41 Building & Grounds Maintenance

- Encourage use of Integrated Pest Management techniques for pest control.
- Encourage proper onsite recycling of yard trimmings.
- Recycle residual paints, solvents, lumber, and other material as much as possible.

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.
- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.
- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

Building & Grounds Maintenance SC-41

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.
- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures when soils are exposed.
- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.
- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.
- Do not use pesticides if rain is expected.
- Do not mix or prepare pesticides for application near storm drains.
- Use the minimum amount needed for the job.
- Calibrate fertilizer distributors to avoid excessive application.
- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.
- Apply pesticides only when wind speeds are low.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Dispose of empty pesticide containers according to the instructions on the container label.

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- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering and repair leaks in the irrigation system as soon as they are observed.

Training

- Educate and train employees on pesticide use and in pesticide application techniques to prevent pollution.
- Train employees and contractors in proper techniques for spill containment and cleanup.
- Be sure the frequency of training takes into account the complexity of the operations and the nature of the staff.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.
- Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.
- Familiarize employees with the Spill Prevention Control and Countermeasure Plan.
- Clean up spills immediately.

Other Considerations

Alternative pest/weed controls may not be available, suitable, or effective in many cases.

Requirements

Costs

- Cost will vary depending on the type and size of facility.
- Overall costs should be low in comparison to other BMPs.

Maintenance

Sweep paved areas regularly to collect loose particles. Wipe up spills with rags and other absorbent material immediately, do not hose down the area to a storm drain.

Building & Grounds Maintenance SC-41

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

Building fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping, but it is subject to rusting and results in lower quality water. Initially, the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and between flushes may accumulate iron, manganese, lead, copper, nickel, and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Mobile Cleaners Pilot Program: Final Report. 1997. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Building Repair and Construction SC-42

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Recycle

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Description

Modifications are common particularly at large industrial sites. The activity may vary from minor and normal building repair to major remodeling, or the construction of new facilities. These activities can generate pollutants including solvents, paints, paint and varnish removers, finishing residues, spent thinners, soap cleaners, kerosene, asphalt and concrete materials, adhesive residues, and old asbestos installation. Protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants to stormwater from building repair, remodeling, and construction by using soil erosion controls, enclosing or covering building material storage areas, using good housekeeping practices, using safer alternative products, and training employees.

Approach

Pollution Prevention

- Recycle residual paints, solvents, lumber, and other materials to the maximum extent practical.
- Buy recycled products to the maximum extent practical.
- Inform on-site contractors of company policy on these matters and include appropriate provisions in their contract to ensure certain proper housekeeping and disposal practices are implemented.

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SC-42 Building Repair and Construction

- Make sure that nearby storm drains are well marked to minimize the chance of inadvertent disposal of residual paints and other liquids.

Suggested Protocols

Repair & Remodeling

- Follow BMPs identified in Construction BMP Handbook.
- Maintain good housekeeping practices while work is underway.
- Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep the area.
- Cover materials of particular concern that must be left outside, particularly during the rainy season.
- Do not dump waste liquids down the storm drain.
- Dispose of wash water, sweepings, and sediments properly.
- Store materials properly that are normally used in repair and remodeling such as paints and solvents.
- Sweep out the gutter or wash the gutter and trap the particles at the outlet of the downspout if when repairing roofs, small particles have accumulated in the gutter. A sock or geofabric placed over the outlet may effectively trap the materials. If the downspout is tight lined, place a temporary plug at the first convenient point in the storm drain and pump out the water with a vactor truck, and clean the catch basin sump where you placed the plug.
- Properly store and dispose waste materials generated from construction activities. See Construction BMP Handbook.
- Clean the storm drain system in the immediate vicinity of the construction activity after it is completed.

Painting

- Enclose painting operations consistent with local air quality regulations and OSHA.
- Local air pollution regulations may, in many areas of the state, specify painting procedures which if properly carried out are usually sufficient to protect water quality.
- Develop paint handling procedures for proper use, storage, and disposal of paints.
- Transport paint and materials to and from job sites in containers with secure lids and tied down to the transport vehicle.
- Test and inspect spray equipment prior to starting to paint. Tighten all hoses and connections and do not overfill paint containers.
- Mix paint indoors before using so that any spill will not be exposed to rain. Do so even during dry weather because cleanup of a spill will never be 100% effective.
- Transfer and load paint and hot thermoplastic away from storm drain inlets.

Building Repair and Construction SC-42

- Do not transfer or load paint near storm drain inlets.
- Plug nearby storm drain inlets prior to starting painting and remove plugs when job is complete when there is significant risk of a spill reaching storm drains.
- Cover nearby storm drain inlets prior to starting work if sand blasting is used to remove paint.
- Use a ground cloth to collect the chips if painting requires scraping or sand blasting of the existing surface. Dispose the residue properly.
- Cover or enclose painting operations properly to avoid drift.
- Clean the application equipment in a sink that is connected to the sanitary sewer if using water based paints.
- Capture all cleanup-water and dispose of properly.
- Dispose of paints containing lead or tributyl tin and considered a hazardous waste properly.
- Store leftover paints if they are to be kept for the next job properly, or dispose properly.
- Recycle paint when possible. Dispose of paint at an appropriate household hazardous waste facility.

Training

Proper education of off-site contractors is often overlooked. The conscientious efforts of well trained employees can be lost by unknowing off-site contractors, so make sure they are well informed about what they are expected to do.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Clean up spills immediately.
- Excavate and remove the contaminated (stained) soil if a spill occurs on dirt.

Limitations

- This BMP is for minor construction only. The State's General Construction Activity Stormwater Permit has more requirements for larger projects. The companion "Construction Best Management Practice Handbook" contains specific guidance and best management practices for larger-scale projects.
- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
- Be certain that actions to help stormwater quality are consistent with Cal- and Fed-OSHA and air quality regulations.

SC-42 Building Repair and Construction

Requirements

Costs

These BMPs are generally low to modest in cost.

Maintenance

N/A

Supplemental Information

Further Detail of the BMP

Soil/Erosion Control

If the work involves exposing large areas of soil, employ the appropriate soil erosion and control techniques. See the Construction Best Management Practice Handbook. If old buildings are being torn down and not replaced in the near future, stabilize the site using measures described in SC-40 Contaminated or Erodible Areas.

If a building is to be placed over an open area with a storm drainage system, make sure the storm inlets within the building are covered or removed, or the storm line is connected to the sanitary sewer. If because of the remodeling a new drainage system is to be installed or the existing system is to be modified, consider installing catch basins as they serve as effective "in-line" treatment devices. See Treatment Control Fact Sheet TC-20 Wet Pond/Basin in Section 5 of the New Development and Redevelopment Handbook regarding design criteria. Include in the catch basin a "turn-down" elbow or similar device to trap floatables.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Parking/Storage Area Maintenance SC-43

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Description

Parking lots and storage areas can contribute a number of substances, such as trash, suspended solids, hydrocarbons, oil and grease, and heavy metals that can enter receiving waters through stormwater runoff or non-stormwater discharges. The protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants from parking/storage areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking areas and storage areas to reduce potential for pollutant discharge to receiving waters. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Encourage alternative designs and maintenance strategies for impervious parking lots. (See New Development and Redevelopment BMP Handbook)
- Keep accurate maintenance logs to evaluate BMP implementation.

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SC-43 Parking/Storage Area Maintenance

Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide an adequate number of litter receptacles.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Provide trash receptacles in parking lots to discourage litter.
- Routinely sweep, shovel, and dispose of litter in the trash.

Surface Cleaning

- Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system if possible.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- Follow the procedures below if water is used to clean surfaces:
  - Block the storm drain or contain runoff.
  - Collect and pump wash water to the sanitary sewer or discharge to a pervious surface. Do not allow wash water to enter storm drains.
  - Dispose of parking lot sweeping debris and dirt at a landfill.
- Follow the procedures below when cleaning heavy oily deposits:
  - Clean oily spots with absorbent materials.
  - Use a screen or filter fabric over inlet, then wash surfaces.

Parking/Storage Area Maintenance SC-43

- Do not allow discharges to the storm drain.
- Vacuum/pump discharges to a tank or discharge to sanitary sewer.
- Appropriately dispose of spilled materials and absorbents.

Surface Repair

- Preheat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.
- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Inspection

- Have designated personnel conduct inspections of parking facilities and stormwater conveyance systems associated with parking facilities on a regular basis.
- Inspect cleaning equipment/sweepers for leaks on a regular basis.

Training

- Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.
- Train employees and contractors in proper techniques for spill containment and cleanup.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- Clean up fluid spills immediately with absorbent rags or material.
- Dispose of spilled material and absorbents properly.

Other Considerations

Limitations related to sweeping activities at large parking facilities may include high equipment costs, the need for sweeper operator training, and the inability of current sweeper technology to remove oil and grease.

SC-43 Parking/Storage Area Maintenance

Requirements

Costs

Cleaning/sweeping costs can be quite large. Construction and maintenance of stormwater structural controls can be quite expensive as well.

Maintenance

- Sweep parking lot regularly to minimize cleaning with water.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Clean parking facilities regularly to prevent accumulated wastes and pollutants from being discharged into conveyance systems during rainy conditions.

Supplemental Information

Further Detail of the BMP

Surface Repair

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal. Only use only as much water as is necessary for dust control to avoid runoff.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Drainage System Maintenance SC-44

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and stormwater that may contain certain pollutants. The protocols in this fact sheet are intended to reduce pollutants reaching receiving waters through proper conveyance system operation and maintenance.

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	
Bacteria	✓
Oil and Grease	
Organics	

Approach

Pollution Prevention

Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Suggested Protocols

Catch Basins/Inlet Structures

- Staff should regularly inspect facilities to ensure compliance with the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC34 Waste Handling and Disposal).

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SC-44 Drainage System Maintenance

- Clean catch basins, storm drain inlets, and other conveyance structures before the wet season to remove sediments and debris accumulated during the summer.
- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed. Do not dewater near a storm drain or stream.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect and pump flushed effluent to the sanitary sewer for treatment whenever possible.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge to reach the storm drain system when cleaning a storm drain pump station or other facility.
- Conduct routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

Open Channel

- Modify storm channel characteristics to improve channel hydraulics, increase pollutant removals, and enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a Steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies (SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS.

Illicit Connections and Discharges

- Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:
  - Is there evidence of spills such as paints, discoloring, etc?

Drainage System Maintenance SC-44

- Are there any odors associated with the drainage system?
- Record locations of apparent illegal discharges/illicit connections?
- Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
- Eliminate the discharge once the origin of flow is established.

- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

- Inspect and clean up hot spots and other storm drainage areas regularly where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties
- Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Allow only properly trained individuals to handle hazardous materials/wastes.
- Have staff involved in detection and removal of illicit connections trained in the following:
  - OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).

SC-44 Drainage System Maintenance

- OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).
- Procedural training (field screening, sampling, smoke/dye testing, TV inspection).

Spill Response and Prevention

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- Clean up all spills and leaks using "dry" methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.
- Refer to fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Other Considerations (Limitations and Regulations)

- Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.
- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and prohibition against disposal of flushed effluent to sanitary sewer in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget.
- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The primary cost is for staff time. Cost depends on how aggressively a program is implemented. Other cost considerations for an illegal dumping program include:
  - Purchase and installation of signs.
  - Rental of vehicle(s) to haul illegally-disposed items and material to landfills.
  - Rental of heavy equipment to remove larger items (e.g., car bodies) from channels.
  - Purchase of landfill space to dispose of illegally-dumped items and material.

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- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.

Supplemental Information

Further Detail of the BMP

Storm Drain Flushing

Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in storm drainage systems. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as an open channel, another point where flushing will be initiated, or the sanitary sewer and the treatment facilities, thus preventing resuspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. Deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, thereby releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce impacts of stormwater pollution, a second inflatable device placed well downstream may be used to recollect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to recollect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75% for organics and 55-65% for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm sewer flushing.

SC-44 Drainage System Maintenance

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

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King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

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Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

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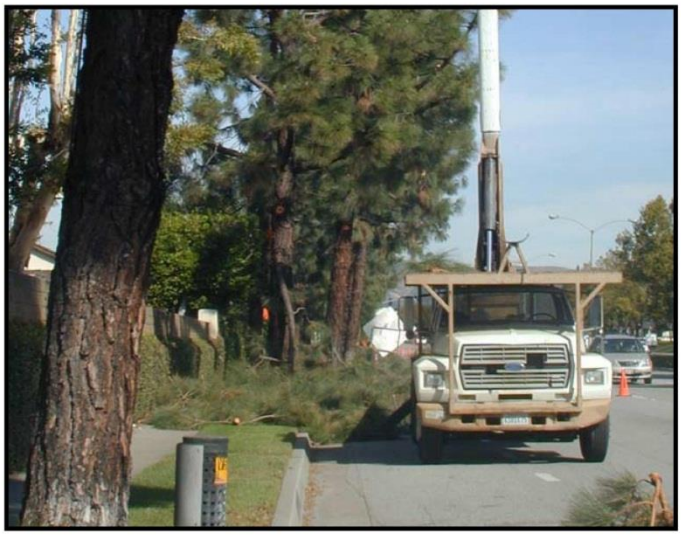
Landscape Maintenance SC-73



Objectives

- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	
Oxygen Demanding	☑

Description

Landscape maintenance activities include vegetation removal; herbicide and insecticide application; fertilizer application; watering; and other gardening and lawn care practices. Vegetation control typically involves a combination of chemical (herbicide) application and mechanical methods. All of these maintenance practices have the potential to contribute pollutants to the storm drain system. The major objectives of this BMP are to minimize the discharge of pesticides, herbicides and fertilizers to the storm drain system and receiving waters; prevent the disposal of landscape waste into the storm drain system by collecting and properly disposing of clippings and cuttings, and educating employees and the public.

Approach

Pollution Prevention

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools.
- Choose low water using flowers, trees, shrubs, and groundcover.
- Consider alternative landscaping techniques such as naturescaping and xeriscaping.
- Conduct appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) to help preserve the landscapes water efficiency.

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SC-73 Landscape Maintenance

- Consider grass cycling (grass cycling is the natural recycling of grass by leaving the clippings on the lawn when mowing. Grass clippings decompose quickly and release valuable nutrients back into the lawn).

Suggested Protocols

Mowing, Trimming, and Weeding

- Whenever possible use mechanical methods of vegetation removal (e.g mowing with tractor-type or push mowers, hand cutting with gas or electric powered weed trimmers) rather than applying herbicides. Use hand weeding where practical.
- Avoid loosening the soil when conducting mechanical or manual weed control, this could lead to erosion. Use mulch or other erosion control measures when soils are exposed.
- Performing mowing at optimal times. Mowing should not be performed if significant rain events are predicted.
- Mulching mowers may be recommended for certain flat areas. Other techniques may be employed to minimize mowing such as selective vegetative planting using low maintenance grasses and shrubs.
- Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this fact sheet).
- Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

- Determine existing native vegetation features (location, species, size, function, importance) and consider the feasibility of protecting them. Consider elements such as their effect on drainage and erosion, hardiness, maintenance requirements, and possible conflicts between preserving vegetation and the resulting maintenance needs.
- Retain and/or plant selected native vegetation whose features are determined to be beneficial, where feasible. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting new vegetation.
- Consider using low water use groundcovers when planting or replanting.

Waste Management

- Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.

Landscape Maintenance SC-73

- Avoid landscape wastes in and around storm drain inlets by either using bagging equipment or by manually picking up the material.

Irrigation

- Where practical, use automatic timers to minimize runoff.
- Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.
- Ensure that there is no runoff from the landscaped area(s) if re-claimed water is used for irrigation.
- If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.
- Irrigate slowly or pulse irrigate to prevent runoff and then only irrigate as much as is needed.
- Apply water at rates that do not exceed the infiltration rate of the soil.

Fertilizer and Pesticide Management

- Utilize a comprehensive management system that incorporates integrated pest management (IPM) techniques. There are many methods and types of IPM, including the following:
  - Mulching can be used to prevent weeds where turf is absent, fencing installed to keep rodents out, and netting used to keep birds and insects away from leaves and fruit.
  - Visible insects can be removed by hand (with gloves or tweezers) and placed in soapy water or vegetable oil. Alternatively, insects can be sprayed off the plant with water or in some cases vacuumed off of larger plants.
  - Store-bought traps, such as species-specific, pheromone-based traps or colored sticky cards, can be used.
  - Slugs can be trapped in small cups filled with beer that are set in the ground so the slugs can get in easily.
  - In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of (pruning equipment should be disinfected with bleach to prevent spreading the disease organism).
  - Small mammals and birds can be excluded using fences, netting, tree trunk guards.
  - Beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seed head weevils, and spiders that prey on detrimental pest species can be promoted.
- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

SC-73 Landscape Maintenance

- Use pesticides only if there is an actual pest problem (not on a regular preventative schedule).
- Do not use pesticides if rain is expected. Apply pesticides only when wind speeds are low (less than 5 mph).
- Do not mix or prepare pesticides for application near storm drains.
- Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.
- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- Periodically test soils for determining proper fertilizer use.
- Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Dispose of empty pesticide containers according to the instructions on the container label.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed.
- Inspect pesticide/fertilizer equipment and transportation vehicles daily.

Training

- Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution. Pesticide application must be under the supervision of a California qualified pesticide applicator.
- Train/encourage municipal maintenance crews to use IPM techniques for managing public green areas.
- Annually train employees within departments responsible for pesticide application on the appropriate portions of the agency's IPM Policy, SOPs, and BMPs, and the latest IPM techniques.

Landscape Maintenance SC-73

- Employees who are not authorized and trained to apply pesticides should be periodically (at least annually) informed that they cannot use over-the-counter pesticides in or around the workplace.
- Use a training log or similar method to document training.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a know in location
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- The Federal Pesticide, Fungicide, and Rodenticide Act and California Title 3, Division 6, Pesticides and Pest Control Operations place strict controls over pesticide application and handling and specify training, annual refresher, and testing requirements. The regulations generally cover: a list of approved pesticides and selected uses, updated regularly; general application information; equipment use and maintenance procedures; and record keeping. The California Department of Pesticide Regulations and the County Agricultural Commission coordinate and maintain the licensing and certification programs. All public agency employees who apply pesticides and herbicides in "agricultural use" areas such as parks, golf courses, rights-of-way and recreation areas should be properly certified in accordance with state regulations. Contracts for landscape maintenance should include similar requirements.
- All employees who handle pesticides should be familiar with the most recent material safety data sheet (MSDS) files.
- Municipalities do not have the authority to regulate the use of pesticides by school districts, however the California Healthy Schools Act of 2000 (AB 2260) has imposed requirements on California school districts regarding pesticide use in schools. Posting of notification prior to the application of pesticides is now required, and IPM is stated as the preferred approach to pest management in schools.

Requirements

Costs

Additional training of municipal employees will be required to address IPM techniques and BMPs. IPM methods will likely increase labor cost for pest control which may be offset by lower chemical costs.

Maintenance

Not applicable

SC-73 Landscape Maintenance

Supplemental Information

Further Detail of the BMP

Waste Management

Composting is one of the better disposal alternatives if locally available. Most municipalities either have or are planning yard waste composting facilities as a means of reducing the amount of waste going to the landfill. Lawn clippings from municipal maintenance programs as well as private sources would probably be compatible with most composting facilities

Contractors and Other Pesticide Users

Municipal agencies should develop and implement a process to ensure that any contractor employed to conduct pest control and pesticide application on municipal property engages in pest control methods consistent with the IPM Policy adopted by the agency. Specifically, municipalities should require contractors to follow the agency's IPM policy, SOPs, and BMPs; provide evidence to the agency of having received training on current IPM techniques when feasible; provide documentation of pesticide use on agency property to the agency in a timely manner.

References and Resources

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. 1995. King County Surface Water Management. July. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Los Angeles County Stormwater Quality Model Programs. Public Agency Activities http://ladpw.org/wmd/npdes/model_links.cfm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Orange County Stormwater Program http://www.ocwatersheds.com/StormWater/swp_introduction.asp

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Landscaping and Lawn Care. Office of Water. Office of Wastewater Management. On-line: http://www.epa.gov/npdes/menuofbmps/poll_8.htm

Storm Drain Signage SD-13

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include “NO DUMPING

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SD-13 Storm Drain Signage

– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.
- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Trash Storage Areas SD-32

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

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SD-32 Trash Storage Areas

- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Section 5
Monitoring, Reporting, and Program Evaluation

Conducting a monitoring program, reviewing the monitoring information, evaluating BMPs, and record keeping and reporting are all important elements of the implementation phase of the SWPPP. The success of the SWPPP depends upon the thorough implementation of the monitoring plan and evaluation of the effectiveness of the plan elements once they have been implemented.

Monitoring, Reporting, and Evaluation Elements

- Conduct monitoring program
- Conduct record keeping and reporting
- Conduct annual site evaluation
  - Review monitoring information
  - Evaluate BMPs
  - Review and revise the SWPPP as necessary

5.1 Conduct Monitoring Program

The General Permit requires that a monitoring program be a component of the SWPPP. The program has the following objectives:

- To monitor the quality of the stormwater discharge
- To aid in SWPPP implementation
- To measure the BMP effectiveness

To meet these objectives the monitoring effort has these elements:

- Training
- Visual observations
- Stormwater monitoring
- Authorized non-stormwater discharges

5.1.1 Training

Familiarity with the requirements of the stormwater monitoring plan and competence in the techniques and protocols specified in the plan are essential to ensure that stormwater samples are collected in a manner that meets the goals of the plan, while protecting the health and safety of the monitoring team members. It is recommended that all stormwater monitoring personnel receive training prior to conducting any stormwater monitoring activities. Stormwater monitoring training should include the following basic elements:

- Review of the Monitoring Plan and Health and Safety Plan

- Classroom training session
- Field training and sampling simulation (dry run)
- Annual refresher training

5.1.2 Visual Observations

Visual observations of both stormwater and non-stormwater discharges should be made at all facilities to document the presence of any discolorations, odors, floating and suspended material, oil and grease, etc., and to identify the source of any pollutants and non-stormwater flows. Visual observations should be made under the leadership of the SWPPP Leader, with appropriate members of the Pollution Prevention Team, according to the following schedule:

- All drainage areas within the facility should be checked for the presence of unauthorized non-stormwater discharges on a quarterly basis, during daylight hours, on days with no stormwater discharges.
- All authorized non-stormwater discharges and their sources should be observed quarterly during daylight hours, on days with no stormwater discharges.
- One storm event per month during the wet season (October 1-May 30) should be visually observed during the first hour of discharge at all discharge locations. These observations are only required of stormwater discharges that occur during daylight hours that are preceded by at least three working days without stormwater discharges and that occur during scheduled facility operating hours.

The results of the visual observations should be recorded and include: the date of the observation, locations observed, observations, response taken to eliminate unauthorized non-stormwater discharges, and actions taken to reduce or prevent pollutants from contacting non-stormwater or stormwater discharges. Results are included in the Annual Report.

5.1.3 Stormwater Monitoring

Each facility should either conduct an individual monitoring plan or participate in a group-sampling program. A group-monitoring program may be developed either by an entity representing a group of similar facilities or by a local stormwater agency that holds its own NPDES permit. According to the General Permit, the monitoring plan is to contain the rationale and description of the visual observation methods, location, and frequency; and the analytical methods and corresponding method detection limits used to detect constituents.

Selection of sites for industrial stormwater monitoring will depend on many factors including the following:

Representativeness

It is important to select sites that are representative of typical site operations.

- Runoff from the facility should combine to form a definable runoff stream.

- The runoff stream should represent the full range of activities at the facility.
- Runoff from the facility should not combine with runoff from other sources.
- Adequate flow volume must be available for sample collection.

Personal Safety

Development of a health and safety plan is recommended. Site selection should insure monitoring personnel from the following potential hazards:

- Traffic
- Uneven or slippery footing surface
- Poor night visibility (lighting)

Site Access

Ease of monitoring site access for monitoring personnel and vehicles parking is essential. Also, for sites that require installation of sample collection or flow metering equipment, adequate equipment access for maintenance and monitoring activities must be available.

Equipment Security

Permanently installed monitoring equipment must be located at a site that will minimize potential vandalism and other possible damage.

Adequate Flow Volume

Monitoring sites should be configured such that adequate flow volume is present for sample collection. Hydraulic conditions should be well mixed and free flowing.

Utility Access

If automated monitoring equipment is required, electrical power should be readily available at selected monitoring sites. Additionally, telephone service may be required for off-site station controlling and data transfer.

Stormwater samples should be collected during the first hour of discharge from (1) the first storm event of the wet season, and (2) at least one other storm event in the wet season. If the first event is missed, sampling of two events during the wet season is still required. Furthermore, a justification for failing to sample the first event should be provided in the Annual Report. Sample collection is only required of stormwater discharges that occur during scheduled facility operating hours and that are preceded by at least three working days without stormwater discharge. Sample collection is not required if dangerous weather conditions are present (e.g., flooding, electrical storm, etc.), when stormwater discharges begin after scheduled facility operating hours or when stormwater discharges are not preceded by three working days without discharge. When the required samples are not collected due to these exceptions, an explanation must be provided in the Annual Report. Visual observations and sample collection may be conducted more than one hour after discharge begins if it is determined that the

monitoring objectives will be better satisfied. If this occurs, an explanation should be provided in the Annual Report.

Specific sampling and analysis requirements include the following:

- All sampling and sample preservation should be in accordance with the current edition of "Standard Methods for the Examination of Water and Wastewater".
- All monitoring instruments and equipment should be calibrated and maintained in accordance with manufacturers' specifications to ensure accurate measurements.
- All laboratory analyses should be conducted according to test procedures under 40 CFR Part 136, unless other test procedures have been specified by the RWQCB.
- Analyze samples for total suspended solids (TSS), pH, specific conductance, and total organic carbon (TOC). Oil and grease (O&G) may be substituted for TOC.
- Analyze toxic chemicals and other pollutants that are likely to be present in stormwater discharges. Any of these pollutants that are not detected in significant quantities after two consecutive sampling events may be eliminated from future sampling analysis until the pollutant is likely to be present again. (According to the definitions section of the General Permit, "significant quantities" is defined as the volume, concentration, or mass of a pollutant that can cause or threaten to cause pollution, contamination, or nuisance; adversely impact human health or the environment; and/or cause or contribute to a violation of any applicable water quality standards for the receiving water.)
- Other analytical parameters should be included based on the facility's standard industrial classification (see Table D of the General Permit).

Rules to Follow to Reduce Potential Sample Contamination

1. No smoking.
2. Never sample near a running vehicle. Do not park vehicles in immediate sample collection area (even non-running vehicles)
3. Always wear clean, powder-free nitrile gloves when handling composite bottles, lids, sterile grab sample bottles, tubing, or strainers.
4. Never touch the inside surface of a sample bottle or lid, even with gloved hands.
5. Never touch the exposed end of a sampling tube.
6. Never allow the inner surface of a sample bottle, lid, or sampling tube to be contacted by any material other than the sample water.
7. Never allow any object or material to fall into or contact the collected sample water.
8. Avoid allowing rain water to drip from rain gear or other surfaces into sample bottles.
9. Do not eat or drink during sample collection.
10. Do not breathe, sneeze or cough in the direction of an open sample bottle.

In addition to the requirements above, which are outlined in the General Permit, the following procedures are recommended to maximize the ability of sampling personnel to collect samples reliably and with minimal sample contamination.

- Before stormwater samples are collected, personnel must ensure the safety of such activities at each sampling location.
- Select the appropriate sample bottles and equipment for each parameter to be measured. As general guidelines, all sampling equipment and sample bottles used for trace metals determination should be nonmetallic and free from any material that may contain metals. Only high-density plastic or Teflon containers should be used for metals analytical sample storage bottles. All sampling equipment and sample bottles used for trace organics determination should be glass or Teflon. Nutrients and most "conventional" parameters may be sampled using plastic or glass bottles.
- Employ "clean" sampling techniques to minimize potential sources of sample contamination, particularly from trace pollutants. Experience has shown that when clean sampling techniques are used, detected concentrations of constituents tend to be lower.

5.2 Conduct Record Keeping and Reporting

Records of all stormwater monitoring information, inspections and visual observations, certifications, corrective actions and follow-up activities, and copies of all reports should be retained for a period of at least five years. These records should include:

- The date, place, and time of site inspections, sampling, visual observations, and measurements
- The individual(s) who performed the site inspections, sampling, visual observations, and measurements
- Flow measurements or estimates (as required by Section B.6 of the General Permit)
- The date and approximate time of analyses
- The individual who performed the analyses
- Analytical results, method detection limits, and the analytical techniques or methods used
- Quality assurance and quality control records and results
- Non-stormwater discharge inspections and visual observations and stormwater discharge visual observation records
- Visual observations and sample collection exception records
- All calibration and maintenance records of onsite instruments used

- All sampling and analysis exemption and reduction certifications and supporting documentation
- The records of any corrective actions and follow-up activities that resulted from the visual observations

It is also recommended that information regarding the rain event be collected. A nearby recording gage should be identified and used to document the start and stop times and date of precipitation event. Some industries may want to consider installing a recording gage at the monitoring site.

Photographs can be useful. Also keep a record of maintenance activities or any other BMPs that are of an "action" nature. It is easy to demonstrate that a BMP that involves a physical change, such as berming or covering, has been accomplished. But actions that relate to good housekeeping can only be demonstrated by record keeping. Keeping a record of catch basin cleaning, for example, also provides insight into how soon it takes for the catch basin sump to refill.

An Annual Report including the items listed below should be submitted by July 1 of each year to the Executive Officer of the appropriate RWQCB.

- Summary of visual observations and sampling results
- Evaluation of the visual observations and sampling and analysis results
- Documentation that the BMPs in the SWPPP are being implemented and properly maintained as necessary
- Laboratory reports (including detection limits for each analytical parameter)
- The Annual Comprehensive Site Compliance Evaluation Report (as described below)
- Documentation, including the justification, of any deviations from the General Permit requirements (if not already included in the Evaluation Report)
- Records
- Detection limits for each analytical parameter

5.3 Conduct Annual Site Evaluation

All facilities should conduct an annual comprehensive site compliance evaluation. It may be helpful to involve the Pollution Prevention Team (PPT) in this effort (see Section 2). The SWPPP should be revised within 90 days of the evaluation based on the evaluation and the revisions implemented. Evaluations should include the following:

- A review of the results of visual inspections of potential pollutant sources for evidence of, or the potential for, pollutants entering the drainage system

- A review of visual observation records, inspection records, and sampling and analysis results
- A review and evaluation of each BMP to determine whether it is adequate, properly implemented, and maintained
- A review of site activities to ascertain if change has occurred, and if so, whether new or modified BMPs are needed
- A review of the list of significant materials to ascertain if the list has changed, and if so, whether new or modified BMPs are needed
- A review of spills that have occurred over the past 12 months, with a determination of cause(s) and possible solutions, including modified or new BMPs
- A determination of whether each BMP must be modified, replaced, and whether additional BMPs are needed
- An evaluation report

Appendix E

SOILS REPORT

THIS DOCUMENT IS TO BE PROVIDED DURING FINAL DESIGN AND FINAL WQMP IMPLEMENTATION

DUE TO FILE SIZE, THE GEOTECHNICAL REPORT WAS SUBMITTED UNDER SEPARATE COVER. REPORT WILL BE AVAILABLE UPON REQUEST.

Appendix F

TREATMENT CONTROL BMP SIZING CALCULATIONS AND DESIGN DETAILS

Riverside County Treatment Volume Calculation
Underground Infiltration System

A_{imp}	22.176	acre
A_{tot}	24.64	acre
i	0.90	
c	0.73	
Slope	0.85	in
V_u	0.62	in-acre/acre
V_{bmp}	15.30	in-acre
V_{bmp}	1.27	ft-acre
V_{bmp}	55521	cu ft

Appendix G

AGREEMENTS – CC&RS, COVENANT AND AGREEMENTS AND/OR OTHER MECHANISMS FOR ENSURING ONGOING OPERATION, MAINTENANCE, FUNDING AND TRANSFER OF REQUIREMENTS FOR THIS PROJECT-SPECIFIC WQMP

Typical Requirements for Common Maintenance Mechanisms

1. **Public entity maintenance**: The Co-Permittee may approve a public or acceptable quasipublic entity (e.g., the Riverside County Flood Control District, or annex to an existing assessment district, an existing utility district, a state or federal resource agency, or a conservation conservancy) to assume responsibility for operation, maintenance, repair and replacement of the BMP. Unless otherwise acceptable to individual Co-Permittees, public entity maintenance agreements shall ensure estimated costs are front-funded or reliably guaranteed, (e.g., through a trust fund, assessment district fees, bond, letter of credit or similar means). In addition, the Co-Permittees may seek protection from liability by appropriate releases and indemnities.
   The Co-Permittee shall have the authority to approve Urban Runoff BMPs proposed for transfer to any other public entity within its jurisdiction before installation. The Co-Permittee shall be involved in the negotiation of maintenance requirements with any other public entities accepting maintenance responsibilities within their respective jurisdictions; and in negotiations with the resource agencies responsible for issuing permits for the construction and/or maintenance of the facilities. The Co-Permittee must be identified as a third party beneficiary empowered to enforce any such maintenance agreement within their respective jurisdictions.

2. **Project proponent agreement to maintain Urban Runoff BMPs:** The Co-Permittee may enter into a contract with the project proponent obliging the project proponent to maintain, repair and replace the Urban Runoff BMP as necessary into perpetuity. Security or a funding mechanism with a "no sunset" clause may be required.

3. **Assessment districts:** The Co-Permittee may approve an Assessment District or other funding mechanism created by the project proponent to provide funds for Urban Runoff BMP maintenance, repair and replacement on an ongoing basis. Any agreement with such a District shall be subject to the Public Entity Maintenance Provisions above.

4. **Lease provisions:** In those cases where the Co-Permittee holds title to the land in question, and the land is being leased to another party for private or public use, the Co-Permittee may assure Urban Runoff BMP maintenance, repair and replacement through conditions in the lease.

5. **Conditional use permits:** For discretionary projects only, the Co-Permittee may assure maintenance of Urban Runoff BMPs through the inclusion of maintenance conditions in the conditional use permit. Security may be required.

6. **Alternative mechanisms:** The Co-Permittee may accept alternative maintenance mechanisms if such mechanisms are as protective as those listed above.

Water Quality Management Plan and Stormwater BMP Transfer, Access and Maintenance Agreement (adapted from documents from the Ventura County Stormwater Management Program)

Recorded at the request of:

City of Eastvale, California

After recording, return to:

City of Eastvale, California

City Clerk

Water Quality Management Plan and Stormwater BMP Transfer, Access and Maintenance Agreement

OWNER: Wal-Mart Stores, Inc.

PROPERTY ADDRESS: *(Address pending)*

APN: *35061*

THIS AGREEMENT is made and entered into in

_____, California, this _____ day of

_____, by and between

WAL-MART STORES, INC. herein after referred to as "Owner" and the CITY OF EASTVALE, a municipal corporation, located in the County of Riverside, State of California hereinafter referred to as "CITY";

WHEREAS, the Owner owns real property ("Property") in the City of Eastvale, County of Riverside, State of California, more specifically described in and depicted in Appendix "A," each of which exhibits is attached hereto and incorporated herein by this reference;

WHEREAS, at the time of initial approval of development project known as Walmart Store 3129-00 within the Property described herein, the City required the project to employ Best Management Practices, hereinafter referred to as "BMPs," to minimize pollutants in urban runoff;

WHEREAS, the Owner has chosen to install and/or implement BMPs as described in the Water Quality Management Plan, on file with the City, hereinafter referred to as "WQMP," to minimize pollutants in urban runoff and to minimize other adverse impacts of urban runoff;

WHEREAS, said WQMP has been certified by the Owner and reviewed and approved by the City;

WHEREAS, said BMPs, with installation and/or implementation on private property and draining only private property, are part of a private facility with all maintenance or replacement, therefore, the sole responsibility of the Owner in accordance with the terms of this Agreement;

WHEREAS, the Owner is aware that periodic and continuous maintenance, including, but not necessarily limited to, filter material replacement and sediment removal, is required to assure peak performance of all BMPs in the WQMP and that, furthermore, such maintenance activity will require compliance with all Local, State, or Federal laws and regulations, including those pertaining to confined space and waste disposal methods, in effect at the time such maintenance occurs;

NOW THEREFORE, it is mutually stipulated and agreed as follows:

1. Owner hereby provides the City of City's designee complete access, of any duration, to the BMPs and their immediate vicinity at any time, upon reasonable notice, or in the event of emergency, as determined by City's Director of Public Works no advance notice, for the purpose of inspection, sampling, testing of the Device, and in case of emergency, to undertake all necessary repairs or other preventative measures at owner's expense as provided in paragraph 3 below. City shall make every effort at all times to minimize or avoid interference with Owner's use of the Property.

2. Owner shall use its best efforts diligently to maintain all BMPs in a manner assuring peak performance at all times. All reasonable precautions shall be exercised by Owner and Owner's representative or contractor in the removal and extraction of any material(s) from the BMPs and the ultimate disposal of the material(s) in a manner consistent with all relevant laws and regulations in effect at the time. As may be requested from time to time by the City, the Owner shall provide the City with documentation identifying the material(s) removed, the quantity, and disposal destination.

3. In the event Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this Agreement, within five (5) days of being given written notice by the City, the City is hereby authorized to cause any maintenance necessary to be done and charge the entire cost and expense to the Owner or Owner's successors or assigns, including administrative costs, attorneys fees and interest thereon at the maximum rate authorized by the Civil Code from the date of the notice of expense until paid in full.

4. The City may require the owner to post security in form and for a time period satisfactory to the city to guarantee the performance of the obligations state herein. Should the Owner fail to perform the obligations under the Agreement, the City may, in the case of a cash bond, act for the Owner using the proceeds from it, or in the case of a surety bond, require the sureties to perform the obligations of the Agreement. As an additional remedy, the Director may withdraw any previous stormwater-related approval with respect to the property on which BMPs have been installed and/or implemented until such time as Owner repays to City its reasonable costs incurred in accordance with paragraph 3 above.

5. This agreement shall be recorded in the Office of the Recorder of Riverside County, California, at the expense of the Owner and shall constitute notice to all successors and assigns of the title to said Property of the obligation herein set forth, and also a lien in such amount as will fully reimburse the City, including interest as herein above set forth, subject to foreclosure in event of default in payment.

6. In event of legal action occasioned by any default or action of the Owner, or its successors or assigns, then the Owner and its successors or assigns agree(s) to pay all costs incurred by the City in enforcing the terms

of this Agreement, including reasonable attorney's fees and costs, and that the same shall become a part of the lien against said Property.

7. It is the intent of the parties hereto that burdens and benefits herein undertaken shall constitute covenants that run with said Property and constitute a lien there against.

8. The obligations herein undertaken shall be binding upon the heirs, successors, executors, administrators and assigns of the parties hereto. The term "Owner" shall include not only the present Owner, but also its heirs, successors, executors, administrators, and assigns. Owner shall notify any successor to title of all or part of the Property about the existence of this Agreement. Owner shall provide such notice prior to such successor obtaining an interest in all or part of the Property. Owner shall provide a copy of such notice to the City at the same time such notice is provided to the successor.

9. Time is of the essence in the performance of this Agreement.

10. Any notice to a party required or called for in this Agreement shall be served in person, or by deposit in the U.S. Mail, first class postage prepaid, to the address set forth below. Notice(s) shall be deemed effective upon receipt, or seventy-two (72) hours after deposit in the U.S. Mail, whichever is earlier. A party may change a notice address only by providing written notice thereof to the other party.

IF TO CITY:

_____

_____

_____

_____

IF TO OWNER:

_____

_____

_____

_____

IN WITNESS THEREOF, the parties hereto have affixed their signatures as of the date first written above.

APPROVED AS TO FORM:

_____
City Attorney

_____
CITY OF

_____
Name

_____
Title

ATTEST:

_____
City Clerk Date

OWNER:

_____
Name

_____
Title

OWNER:

_____
Name

_____
Title

NOTARIES ON FOLLOWING PAGE

Appendix H

PHASE 1 ENVIRONMENTAL SITE ASSESSMENT – SUMMARY OF SITE REMEDIATION CONDUCTED AND USE RESTRICTIONS

DUE TO THE FILE SIZE, THE PHASE I ENVIRONMENTAL SITE ASSESSMENT HAS BEEN EXCLUDED FROM THIS WQMP. THE PHASE I ENVIRONMENTAL SITE ASSESSMENT WILL BE AVAILABLE UPON REQUEST.

Phase I Environmental Site Assessment
Store 3129-00, Eastvale, Riverside County, California

Prepared by: Kimley-Horn and Associates
Report Viability Date: 08/06/11