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WALKER ENGINEERING, LLC

TECHNICAL DRAINAGE STUDY
for

RETAIL BUILDING
@ OLD WOMAN SPRINGS ROAD (HWY 247) & CEDARBIRD ROAD
APN: 0629-051-62
Landers, CA

MUP No. P201300087

REGISTERED PROFESSIONAL ENGINEER
DEBRA M. YAMACHIKA
64488
Exp. 6/30/13
CIVIL
STATE OF CALIFORNIA
4/9/13

Prepared for:
DYNAMIC DEVELOPMENT COMPANY, LLC
1725 21st Street
Santa Monica, California 90404
Tel: 310.315.5411
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Date Prepared:
April 9, 2013

Meeting Your Land Development Needs

WALKER ENGINEERING, LLC

April 9, 2013
WE Project No. 1260.00

Mr. Anthony Pham
County of San Bernardino
Public Works Land Development
825 E. Third Street
San Bernardino, CA 92415

RE: Technical Drainage Study for the Retail Building at Old Woman Springs Road (Highway 247) and Cedarbird Road (APN: 0629-051-62)

Dear Mr. Pham:

Attached are two (2) copies of the Technical Drainage Study for the "Retail Building at Old Woman Springs Road & Cedarbird Road" for your review. The site will be developed as a retail project located on the northwest corner of Old Woman Springs Road & Cedarbird Road in Landers, CA.

Please feel free to contact me if you have any questions or need any additional information. Thank you.

Sincerely,
WALKER ENGINEERING, LLC

REGISTERED PROFESSIONAL ENGINEER
DEBRA M. YAMACHIKA
64488
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INTRODUCTION

This report is a Technical Drainage Study for the ***Retail Building at Old Woman Springs Road (Highway 247) & Cedarbird Road,*** a proposed commercial retail project located at the northwest corner (NWC) of Old Woman Springs Road and Cedarbird Road in Landers, California. Site improvements consist of an approximately 9,100 S.F. building, parking area, onsite drainage conveyance systems, and proposed driveways in Old Woman Springs Road and Cedarbird Road. Old Woman Springs Road is a California Department of Transportation (Caltrans) right of way; therefore, an encroachment permit from Caltrans is required.

The purpose of this study is to present the hydrologic and hydraulic findings for the project site based on the drainage criteria set forth by San Bernardino County and Caltrans. Pre- and post-development site conditions will be analyzed to ensure that the proposed development does not adversely impact downstream development and to provide recommendations for flood protection of onsite structures. Per conversation with San Bernardino County Land Development staff, due to the project size and location, **detention/retention for 100 year storm is not required.**

PROJECT DESCRIPTION

The 1.85-acre project site is located on Assessor's Map Book No. 0629, Page 51, and Parcel No. 62 in Landers, California. Old Woman Springs Road borders the project to the east, Cedarbird Road to the south, an existing residential building to the west, and a vacant parcel borders the project to the north.

The Cedarbird Road alignment, adjacent to the site, is undeveloped, consisting of a dirt road. Half street improvements, including new curb, gutter and sidewalk, are proposed in Cedarbird Road along with one driveway. Old Woman Springs Road is partially developed, consisting of a paved access road. Proposed improvements include completing the half street improvements for Old Woman Springs Road, including new curb, gutter, sidewalk, and one driveway.

The *Vicinity Map and Site Description* is included in **Appendix A**. The project site has been previously developed; however, no buildings exist onsite. Existing concrete slabs remain along with vegetation over the majority of the site. The historical drainage pattern is from west to east across the project site according United States Geologic Service (USGS) topography. A copy of the USGS map is included in **Appendix A**.

LAND USE CONDITIONS

The project is currently in the planning process for a Minor Use Permit (No. P201300887).

FLOOD HAZARD DESIGNATION

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) indicates Special Flood Hazard Areas (SFHAs). The project site is located on Community Panel No. **06071C8105H** dated August 28, 2008; however according to FEMA, this map is not printed. Documentation from the FEMA website is included in **Appendix E**; according to FEMA the project is located within **Zone D**, which is not a FEMA designated SFHA.

METHODOLOGY/DESIGN CRITERIA

The hydrologic and hydraulic calculations provided in this report are prepared in accordance with the San Bernardino County Hydrology Manual (SBC Manual), and the Caltrans Highway Design Manual.

Hydrologic Protection Levels

Per the SBC Manual, the 100-year storm event shall be analyzed to determine the required flood protection for all habitable structures and other non-floodproof structures; drainage plans shall demonstrate that this 100-year flood protection criterion is met. Old Woman Springs Road is a designated state road, therefore, per the Caltrans Highway Design Manual, the 25-year storm event shall be analyzed for roadway drainage.

Soil information is obtained from the SBC Manual. According to Figure C-11, Hydrologic Soils Group Map for Southcentral Area, the soil type for the project site is Type B. A Hydrologic Soils Map for the project site is reproduced from Figure C-11 and is included in **Appendix A**. An antecedent moisture condition (AMC) II is assumed. The 25- and 100-year, 1-hour precipitation depths are obtained from NOAA's Atlas 14. Reference information from NOAA Atlas 14 is included in **Appendix E** of this report.

Per conversation with San Bernardino County Land Development staff, the Rational Method shall be used estimate discharges from areas that are less than 640 acres. The Rational Method is defined by the following:

Rational Method Equation:

Q=CIA

Where:
- Q= Peak Discharge, cfs
- C= Coefficient of Runoff, representing the ratio of runoff depth to rainfall depth
- I = Rainfall Intensity, inches/hour, equal to the time of concentration
- A= Drainage Basin Area, acres

The runoff coefficient and rainfall intensity are based on the runoff surface type and time of concentration of a drainage basin. The runoff coefficient can be estimated based on site reconnaissance and aerial photos, identifying runoff surface type. The rainfall intensity is assumed to be uniformly distributed over the drainage area at a uniform rate over the duration of the storm. These assumptions are reasonable for drainage areas less than 640 acres.

Infiltration Basin Criteria

As previously mentioned, due to the project size and location, **detention/retention for 100 year storm is not required.** Runoff storage is, however, provided onsite for the purpose of meeting water quality requirements and ensuring no significant drainage impact to the Caltrans right of way (Old Woman Springs Road).

Advanced Engineering Software (AES) Release 2012 is used for the Rational Method computations and to generate the unit hydrograph calculations.

HYDROLOGY

Offsite Drainage Area

The offsite tributary area to the project site consists of approximately 30 acres, based on USGS topography. Please refer to drainage basins OF-1, OF-2, OF-3, and OF-4, OF-5, OF-6 on Figure 1, *Offsite Drainage Basin Map.*

As previously mentioned, the general drainage pattern of the area is sheet flow from west to east. There are localized high points east of Old Woman Springs Road; these areas drain west to Old Woman Springs Road. Pipes Wash is located approximately 1 mile east of the project site; Pipes Wash conveys upstream runoff to a dry lake bed approximately 11 miles northeast of the project site. It appears sheet flow crosses Old Woman Springs Road at Ruth Lane; therefore, it is assumed that runoff north of this location will not impact the project site. The assumed land covers for the offsite basins are summarized in Table 2. In the existing condition, it appears that much of the drainage tributary is undeveloped with minimal areas of rural residential development. The residential development to the west of the project site does not appear to experience flooding.

Currently, runoff from Basin OF-1 enters the project site from the west and is conveyed toward Cedarbird Road. Basin OF-2 consists of the Cedarbird Road area; this area drains east, then south at Old Woman Springs Road. Runoff from Basin OF-3 enters the project site from the north and is conveyed toward Old Woman Springs Road. Runoff from Basin OF-4 is conveyed to Old Woman Springs Road adjacent to the site. OF-5 consists of the Old Woman Springs Road area, which drains south. A confluence of the runoff from Basins OF-1 through OF-5 d the runoff from the project site occurs at the intersection of Old Woman Springs Road and Cedarbird Road. Runoff from Basin OF-6, located east of Old Woman Springs Road, is conveyed west to Old Woman Springs Road. The AES Rational Method results for the offsite condition are summarized in Table 1 and the calculations are included in **Appendix B**.

TABLE 1
EXISTING OFFSITE CONDITION FLOWS

BASIN ID*	BASIN AREA (acres)	NODE	25-YEAR FLOW (cfs)	100-YEAR FLOW (cfs)
OF-1	16.91	101	29.63	44.86
OF-2	0.25	102	0.95	1.39
OF-3	3.55	201	5.78	8.77
OF-4	1.72	301	3.72	5.56
OF-5	0.40	303	2.00	2.87
OF-6	6.85	401	11.50	17.43

*See **Appendix A** *Offsite Drainage Basin Map* (Figure 1).

TABLE 2
LAND COVER ASSUMPTIONS

BASIN ID*	BASIN AREA (acres)	NODE	EXISTING	NOTES
OF-1	16.91	101	40% 1 DPA/ 60% Desert Brush	Partially rural residential development/undeveloped
OF-2	0.25	102	1 DPA	Consists of dirt road
OF-3	3.55	201	Desert Brush	Undeveloped
OF-4	1.72	301	Desert Brush	Undeveloped
OF-5	0.40	303	Commercial	Consists of paved road
OF-6	6.85	401	Desert Brush	Majority Undeveloped

* See **Appendix A** *Offsite Drainage Basin Map* (Figure 1).

Existing Onsite Drainage Condition

As previously mentioned the project site was previously developed; however the existing concrete pads are insignificant compared to the vegetation and natural ground cover that remains over the site. It is assumed that the project site consists of 100 percent natural land cover.

In the existing condition, the project site consists of two drainage basins, EXON1 and EXON2. Please refer to Figure 2, *Existing Condition Onsite Basin Map*, included in **Appendix A**. These basins are delineated based on site specific 1-foot contour topography. Runoff generated by Basin EXON1 drains to Old Woman Springs Road; runoff generated by Basin EXON2 drains to Cedarbird Road. The AES Rational Method results for the existing onsite drainage condition are summarized in Table 2 and the calculations are included in **Appendix B**.

TABLE 3
EXISTING CONDITION FLOWS

BASIN ID*	BASIN AREA (acres)	NODE	25-YEAR FLOW (cfs)	100-YEAR FLOW (cfs)
EXON1	0.86	101	2.73	4.05
EXON2	0.99	201	3.23	4.78
TOTAL	1.85	N/A	**5.96**	**8.83**

*See **Appendix A** for the *Existing Condition Onsite Drainage Map* (Figure 2).

Proposed Onsite Drainage Condition

In the proposed condition, the existing concrete pads will be removed and a commercial retail building, parking area, and landscaping will be constructed on the project site. The project site maintains existing landscaping (approximately 9,300 square feet of undisturbed land) as well as proposes commercial landscaping in excess of the impervious and pervious percentages associated with typical commercial developments. The actual percent impervious/pervious is 48/52 percent versus the 90/10 for commercial development, as identified in the SBC Manual. In the proposed condition, land use 5-7 Dwellings/Acre, is chosen for the onsite basins solely to represent the actual land cover onsite.

The project site accepts offsite flows from the north and west. These flows are conveyed toward Old Woman Springs Road and Cedarbird Road, respectively, via graded berms/swales along the site's property lines. In the proposed condition, the project site consists of two drainage basins, PRON1 and PRON2. Please refer to Figure 3, *Proposed Condition Onsite Basin Map*, included in **Appendix A**. The project grading plan, included in **Appendix F**, indicates that existing drainage patterns are generally maintained; a portion of the site (PRON1) drains toward Old Woman Springs Road, the remainder (PRON2) drains toward Cedarbird Road. Onsite runoff is conveyed away from the building, to the parking area, and ultimately to the onsite infiltration basin at the southeast corner of the site. The majority of the site will drain to the infiltration basin; a small portion of the site drains to Old Woman Springs Road and Cedarbird Road. The AES Rational Method results for the proposed condition are summarized in Table 4 and the calculations are included in **Appendix B**.

TABLE 4
PROPOSED CONDITION FLOWS

BASIN ID*	BASIN AREA (acres)	NODE	25-YEAR FLOW (cfs)	100-YEAR FLOW (cfs)
PRON1	0.74	102	3.41	4.97
PRON2	1.11	201	3.99	5.86
TOTAL	1.85	N/A	**7.40**	**10.83**

*See **Appendix A** for the *Proposed Condition Onsite Drainage Map* (Figure 3).

Drainage subbasins, PRON1-A, -B, and -C and PRON2-A, -B, and -C, are further delineated to quantify the runoff generated by smaller areas onsite. The peak flow rates for these subbasins are prorated from the values obtained by the AES Rational Method. Table 5 indicates the prorated flow results, the calculations are provided in **Appendix B**.

TABLE 5
PRORATED FLOW RATES

SUBBASIN ID*	BASIN AREA (acres)	25-YEAR FLOW (cfs)	100-YEAR FLOW (cfs)
PRON1-A	0.08	0.37	0.54
PRON1-B	0.19	0.88	1.28
PRON1-C	0.47	2.16	3.15
TOTAL	0.74	3.41	4.97
PRON2-A	0.49	1.76	2.59
PRON2-B	0.10	0.36	0.53
PRON2-C	0.52	1.87	2.74
TOTAL	1.11	3.99	5.86

* See **Appendix A** for the *Proposed Condition Onsite Drainage Map* (Figure 3).

Basin PRON1-A, located along the site's north property line, consists of the graded berm/swale, which is intended to protect the proposed building from offsite flows. Basin PRON1-B, located north of the building, consists of landscaped area; a portion of which is intended to remain undisturbed. A graded swale, located north of the building, conveys runoff away from the building. Basin PRON1-A and PRON1-B drain to Old Woman Springs Road. Basin PRON1-C consists of the parking and landscaped area east of the building and drains to the infiltration basin.

Basin PRON2-A consists of the building area and landscaped area. A graded swale, located west of the building, conveys runoff away from the building, and ultimately to the infiltration basin. Basin PRON2-B, located along the site's west property line, consists of the graded berm/swale, which is also intended to protect the proposed building from offsite flows. Basin PRON2-C consists of the parking and landscaped area south of the building and drains to the infiltration basin.

Drop inlets are proposed at the southern end of the site to convey runoff to the infiltration basin. Although the primary purpose of the infiltration basin is for water quality treatment, the storm drain is designed to convey the 100-year storm flows to the infiltration basin as well. Two inlets are proposed in the parking stalls adjacent to the infiltration basin; one inlet is proposed in the landscape area adjacent to the driveway off Cedarbird Road.

In the proposed condition, the total runoff generated by the project site is approximately 7/11 cfs during the 25/100 year storm events compared to the approximately 6/9 cfs generated in the existing condition. The majority of the proposed condition runoff, 4/6 cfs, is conveyed to the infiltration basin, resulting in approximately 3/5 cfs that actually leaves the project site. This is less than the existing condition runoff; therefore, the proposed development does not adversely impact existing improvements or developments downstream.

INFILTRATION BASIN

An infiltration basin is proposed onsite for the purpose of meeting water quality requirements and ensuring no significant increase of flow into the Caltrans right of way (Old Woman Springs Road). Runoff generated by project site is reduced from the existing to the proposed condition due to the infiltration basin.

The runoff volume generated during the existing condition is 0.35 and 0.58 acre-feet during the 25-year and 100-year storm event, respectively, and 0.24 and 0.43 acre-feet during the proposed condition. Advanced Engineering Software (AES) Release 2012 is used to generate the unit hydrograph calculations; these calculations are provided in **Appendix C**. Although the results indicate that the runoff volume is reduced in the proposed condition, a 0.075 acre-foot infiltration basin is provided for runoff reduction and water quality treatment. The infiltration basin volume calculation is provided in **Appendix C**.

HYDRAULIC CALCULATIONS

Hydraulic calculations are provided for the various drainage conveyance systems both offsite and onsite, which include the Old Woman Springs Road and Cedarbird Road half street improvements, the graded berm/swales along the site's north and west property lines, the graded swales on the north and west sides of the building, and also for the drop inlets proposed at the southeast corner of the site. These calculations validate the onsite design with regard to protection from offsite and onsite storm flows.

The 25-year storm flow depth and velocity is analyzed for conveyance of flows to and within the adjacent streets, however, the 100-year storm flow depth is also checked for flood protection for the proposed building from offsite flows. The 100-year storm flow depth and velocity is analyzed for conveyance of onsite flows for flood protection for the proposed building. The flow rates used were presented in the previous **Hydrology Section** of this report. Storm drain is proposed onsite, but is limited to the inlet pipes to the infiltration basin. The resulting street flow depths and velocities are summarized in Table 6; the calculations are provided in **Appendix D**.

TABLE 6
HYDRAULIC CALCULATIONS

SECTION*	Q25 (cfs)	Flow Depth (ft)	V25 (fps)	V*D	Q100 (cfs)	Flow Depth (ft)	V100 (fps)	V*D
PS-1 (Old Woman Springs Road)	15	0.49	4.70	2.30	22	0.55	5.17	2.84
PS-2 (Cedarbird Road)	32	0.50	6.02	3.01	48	0.56	7.08	3.96
PS-3 Swale (west of building)	N/A	N/A	N/A	N/A	2.59	0.36	1.88	N/A
PS-4 Swale (north of building)	N/A	N/A	N/A	N/A	1.28	0.29	1.98	N/A
PS-5 West PL Swale	30	0.78	7.15	N/A	45	0.96	7.98	N/A
PS-6 North PL Swale	6	0.49	4.37	N/A	9	0.57	4.84	N/A

*See **Appendix A** for *Proposed Drainage Basin Map* (Figure 3).

The 25-year storm depth of flow in Old Woman Springs Road is below the top of curb and the associated runoff (15 cfs) is contained with the west half street right of way. Please note that runoff from the east (Basin OF-6) also drains to Old Woman Springs Road. It is estimated that approximately 12/17 cfs during the 25/100 year storms is conveyed in the east half of Old Woman Springs Road. Runoff in the east half of Old Woman Springs Road will remain in the east half.

The 25-year storm depth of flow in Cedarbird Road is also below the top of curb; flows are contained in the north half street by the proposed 8-inch asphalt dike, located near and along the street crown. Runoff will overtop the crown at the end of the dike near the Cedarbird/Old Woman Springs Road intersection, then will be conveyed south as it does in the existing condition. The project driveways and finished floor elevation are adequately set above the depth flow in Cedarbird Road and Old Woman Springs Road.

Approximately 30/45 cfs during the 25/100 year storm events enters the project site from the west. This flow is conveyed via a graded berm/swale adjacent to the west property line to Cedarbird Road. The swale section is trapezoidal; flows are contained within the project site and discharge to Cedarbird Road via a 10-foot wide u-gutter. The associated flow velocity in this swale is slightly erosive; it is recommended that riprap (d50=12") be installed to prevent erosion. The riprap calculation is provided in **Appendix D**. Approximately 6/7 cfs during the 25/100 year storm events enters the project site from the north. This flow is conveyed via a graded berm/swale along the north property line to Old Woman Springs Road via a 7-foot wide parkway culvert. This swale consists of a v-ditch with 3:1 maximum horizontal to vertical side slopes; flows are also contained within the project site. The velocity in this swale is less than 5 feet per second; therefore, riprap is not proposed at this location. Note that the onsite area consisting of the graded berm/swale is insignificant compared to the upstream tributary area; offsite flowrates alone are used for analyzing these swales. Hydraulic calculations for the u-gutter and parkway culvert are based on the 25-year storm event and are included in **Appendix D**. 100-year storm flows will overtop the outlet facilities and surface drain to the adjacent streets.

The previously mentioned drop inlets convey the majority of the onsite flows to the infiltration basin. Approximately 3 cfs (from PRON1) during the 100-year storm event is conveyed to DI#1 (2'x2' grate). Please refer to Figure 3, *Proposed Condition Onsite Basin Map*, included in **Appendix A**. Approximately 6 cfs during the 100-year storm event is conveyed to DI#2 (3'x3' grate) and approximately 3 cfs to DI#3 (2'x2' grate). The maximum ponding depth over these inlets is 0.5 feet during the 100-year storm event. Please refer to the drop inlet calculations included in **Appendix D**. This depth is significantly lower than the building's finished floor elevation; therefore, the building is adequately protected from these onsite flows. In the event the inlets are clogged, the emergency overflow path provided is over the retaining wall, into the infiltration basin. 12-inch inlets pipes to the infiltration basin are provides for DI#1 and DI#2; an 8-inch pipe is provided for DI#3. Rip rap pads (d50=6 inches) are provided at the pipe inlet locations within the infiltration basin. Hydraulic calculations for the inlet pipes and riprap are provided in **Appendix D**.

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CONCLUSIONS AND RECOMMENDATIONS

1. This project is in compliance with the San Bernardino County Hydrology Manual and the Caltrans Highway Design Manual.

2. This project is within FEMA Zone "**D**", which is not a FEMA designated SFHA.

3. The peak runoff rates leaving the project site in the proposed condition is less than that leaving the project site during the existing condition; therefore, the proposed development does not adversely impact existing improvements or developments downstream.

4. An infiltration basin is proposed onsite for the purpose of meeting water quality requirements and ensuring no adverse impact to downstream improvements or development. The runoff volume generated during the proposed condition is less than that generated during the existing condition.

5. The finished floor elevation for the proposed building, 3453.50 feet is adequately protected from onsite and offsite storm runoff.

6. Runoff is adequately conveyed in the adjacent streets and is consistent with the existing drainage pattern. Erosion protection is provided for the adjacent landscape in Cedarbird Road along with an asphalt dike.

REFERENCES

1. San Bernardino County Hydrology Manual, August 1986.

2. Caltrans Highway Design Manual, Chapter 810, dated August 2011.

3. Caltrans Highway Design Manual, Chapter 830, dated May 2012.

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LIST OF APPENDICES

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APPENDIX D – HYDRAULICS

- Section PS-1 (Old Woman Springs Road) - Q25, Q100
- Section PS-2 (Cedarbird Road) - Q25, Q100
- Section PS-3 (Swale west of building) - Q25, Q100
- Section PS-4 (Swale north of building) – Q25, Q100
- Section PS-5 (Swale at west property line) – Q25, Q100
- Section PS-6 (Swale at north property line) – Q25, Q100
- U-gutter Calculation (at south property line) – Q25
- 8-inch Infiltration Inlet Pipe from DI#3 – Q100
- Drop Inlet Calculations – Q100
- Parkway Culvert Calculation (at east property line) – Q25
- Pipe Culvert Calculation (at DI #1 and DI#2) – Q100
- Rip Rap Calculations (west swale and pipe inlets to infiltration basin) – Q100

APPENDIX E – REFERENCE MATERIALS

- FIRM Map
- NOAA Atlas 14 Point Precipitation values
- Excerpts from the Caltrans Highway Design Manual
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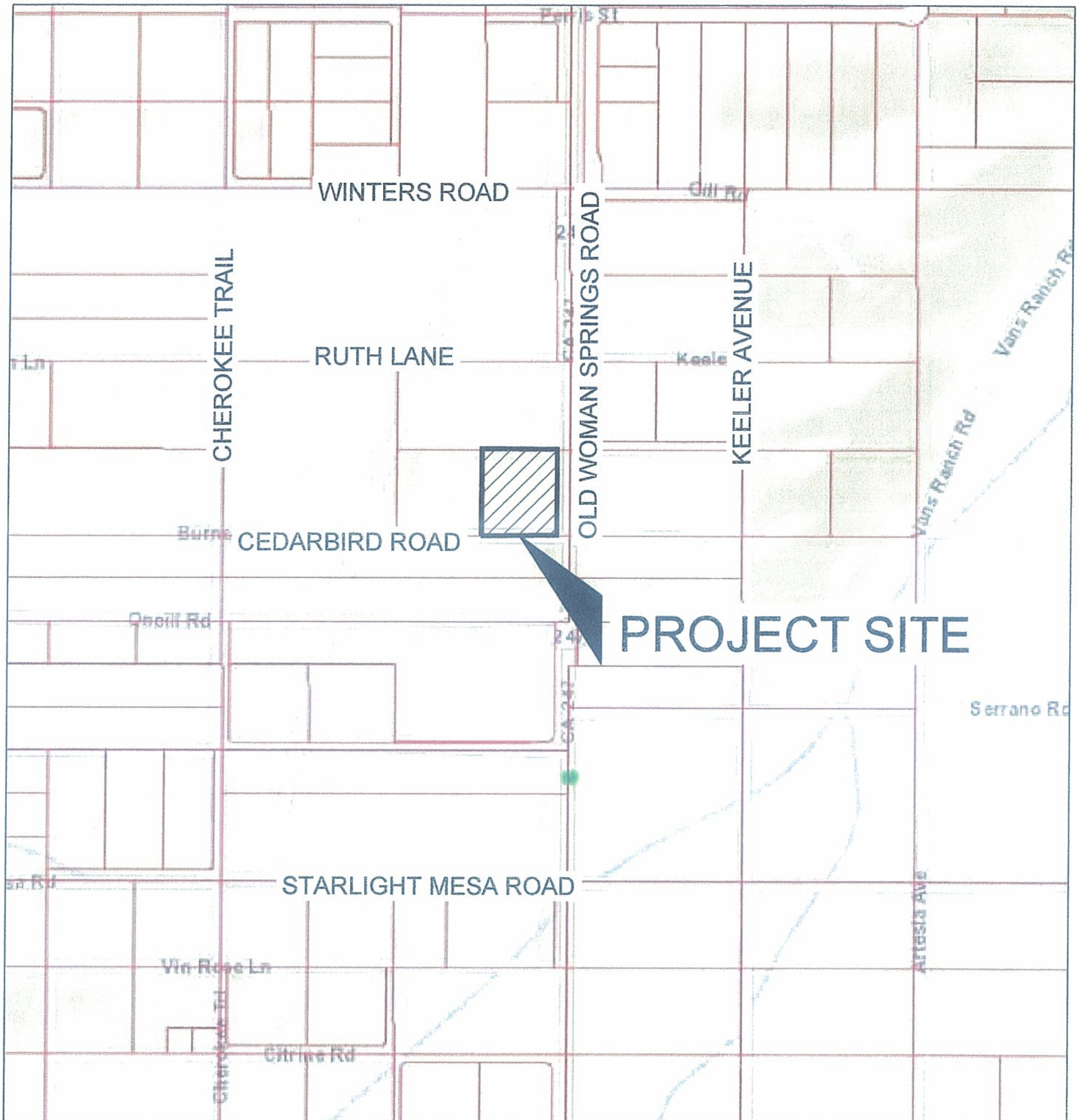
APPENDIX F – IMPROVEMENT PLANS

- Detail Sheet
- Grading Plan

APPENDIX A

APPENDIX A – FIGURES

- VICINITY MAP
- SITE DESCRIPTION
- USGS MAP
- HYDROLOGIC SOILS MAP
- FIGURE 1 – OFFSITE DRAINAGE BASIN MAP
- FIGURE 2 – EXISTING CONDITION ONSITE DRAINAGE MAP
- FIGURE 3 – PROPOSED CONDITION ONSITE DRAINAGE MAP



NORTH
NTS

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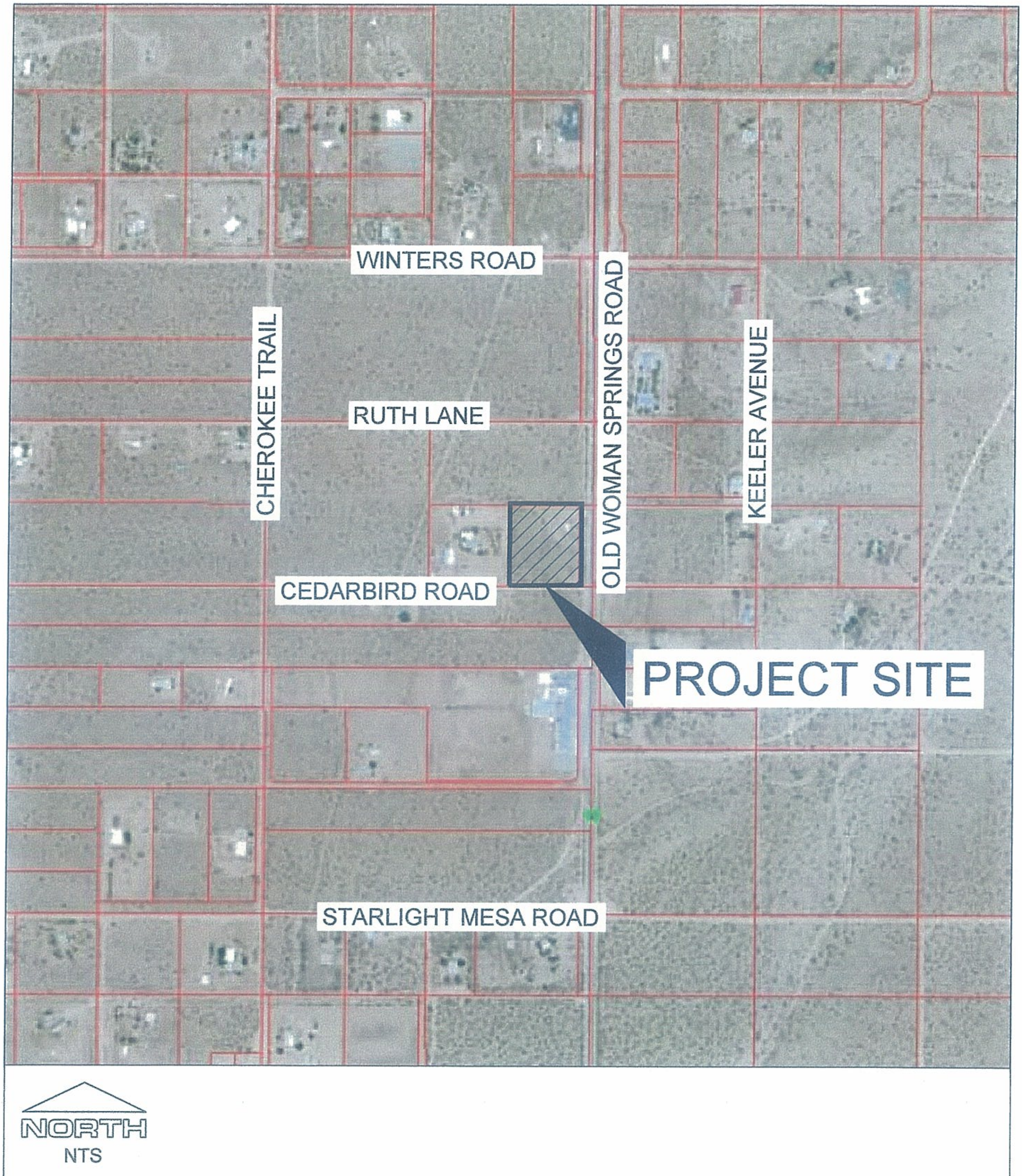
VICINITY MAP

APRIL 9, 2013



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SITE DESCRIPTION

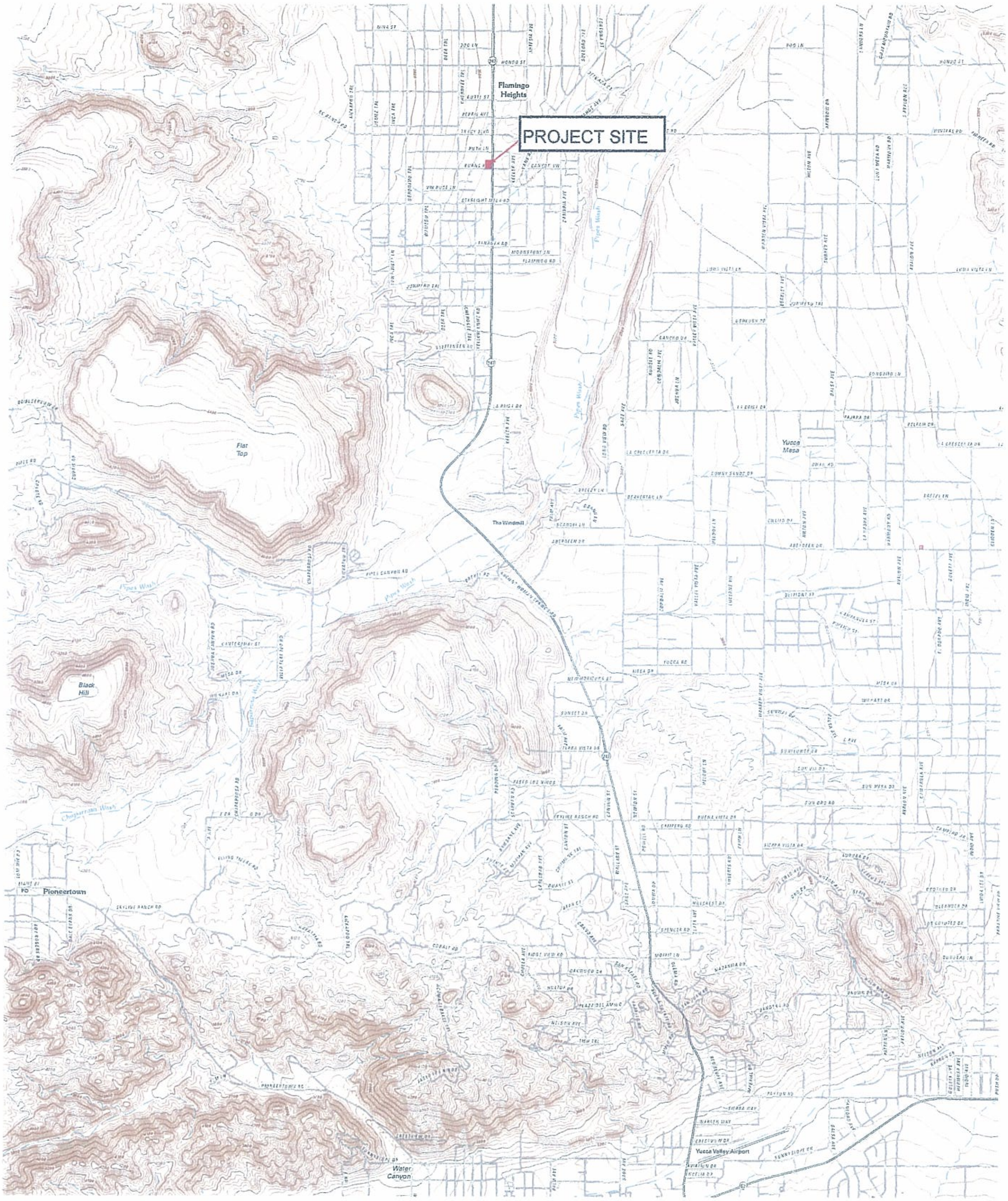
APRIL 9, 2013

USGS
science for a changing world

U.S. DEPARTMENT OF THE INTERIOR
U. S. GEOLOGICAL SURVEY

The National Map
US Topo

YUCCA VALLEY NORTH QUADRANGLE
CALIFORNIA-SAN BERNARDINO CO.
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid: Universal Transverse Mercator, Zone 11S
10 000-foot ticks: California Coordinate System of 1983
(zone 5)

Imagery........NAIP, April 2010 - May 2010
Roads........©2006-2011 TomTom
Names........GNIS, 2011
Hydrography........National Hydrography Dataset, 2010
Contours........National Elevation Dataset, 2006
Boundaries........Census, IBWC, IBC, USGS, 1972 - 2010

UTM GRID AND 2012 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

U.S. National Grid

SCALE 1:24 000

KILOMETERS
METERS
MILES
FEET

CONTOUR INTERVAL 20 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the
National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.1

CALIFORNIA

QUADRANGLE LOCATION

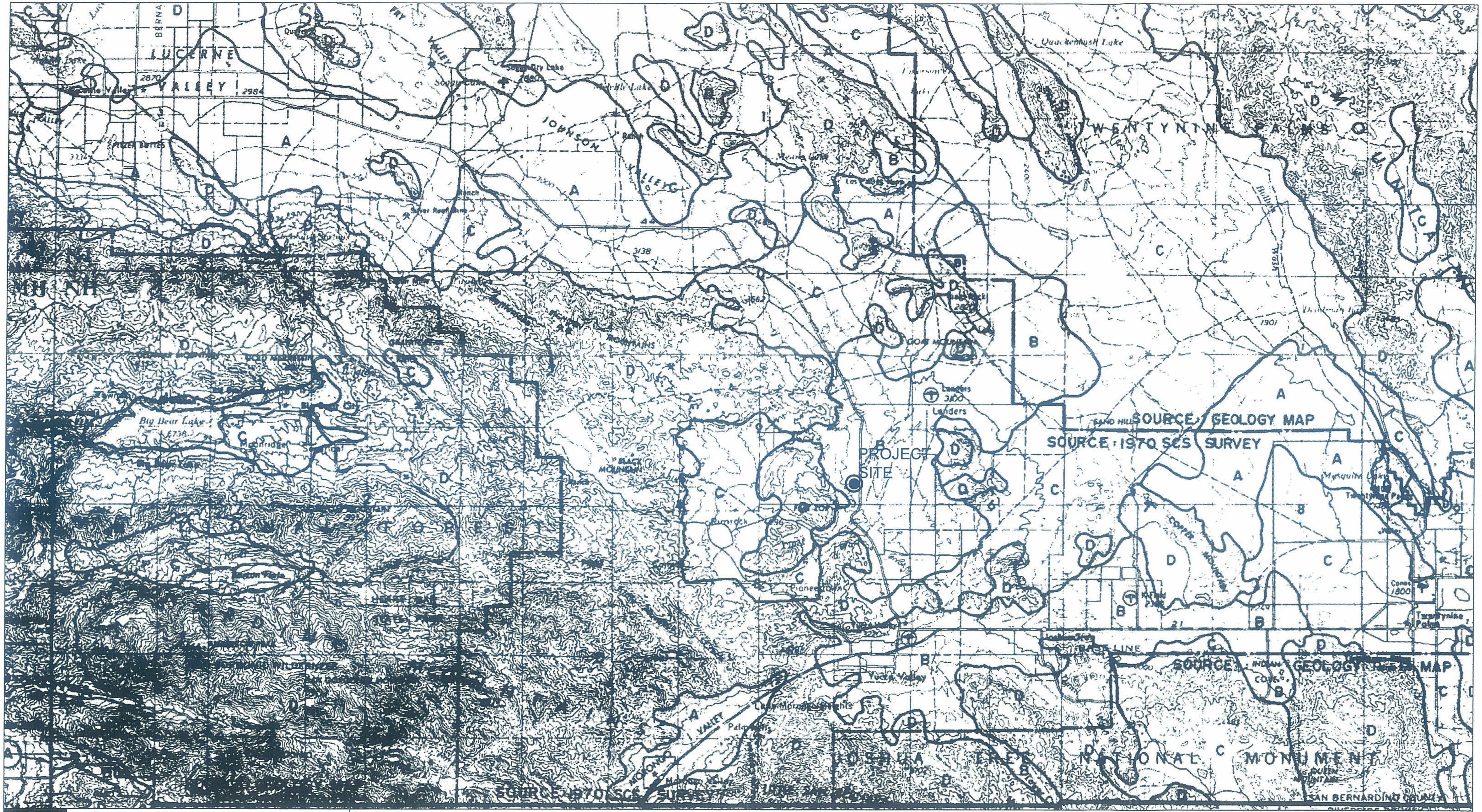
Bighorn Canyon	Landers	Goat Mountain
Rimrock	Yucca Valley North	Joshua Tree North
Morongo Valley	Yucca Valley South	Joshua Tree South

ADJOINING 7.5' QUADRANGLES

ROAD CLASSIFICATION

Interstate Route
US Route
Ramp
State Route
Local Road
4WD

YUCCA VALLEY NORTH, CA
2012



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HYDROLOGIC SOILS MAP

FIGURE C-11 HYDROLOGIC SOILS GROUP MAP FOR SOUTHCENTRAL AREA OF THE SAN BERNARDINO COUNTY HYDROLOGY MANUAL

APPENDIX B

APPENDIX B – HYDROLOGIC CALCULATIONS (RATIONAL METHOD)

- OFFSITE CONDITION ANALYSIS – 25 AND 100- YEAR STORMS
  - OF25YR
  - OF100YR

- EXISTING CONDITION ANALYSIS – 25 AND 100- YEAR STORMS
  - EX25YR
  - EX100YR

- PROPOSED CONDITION ANALYSIS – 25 AND 100- YEAR STORMS
  - PR25YR
  - PR100YR

- PRORATED FLOWS FOR PRON1 AND PRON2

```
****************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
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          Ver. 19.0  Release Date: 06/01/2012  License ID 1645

                      Analysis prepared by:

                     Walker Engineering, LLC
                   5765 S. Rainbow Blvd. Ste. 101
                      Las Vegas, NV  89118
                   Meeting Your Development Needs

 ************************* DESCRIPTION OF STUDY *************************
 * RETAIL BUILDING AT OLD WOMAN SPRINGS ROAD & CEDARBIRD ROAD            *
 * LANDERS, CA   WE No. 1260.00                                          *
 * EXISTING OFFSITE ANALYSIS - 25 YR                                     *
 **************************************************************************

  FILE NAME: OF25YR.DAT
  TIME/DATE OF STUDY: 14:02 04/04/2013
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                   --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.00
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.1900

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *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 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  3542.00
  ELEVATION DATA: UPSTREAM(FEET) =   3620.00  DOWNSTREAM(FEET) =   3460.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   22.903
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.335
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL  AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL(ARID)
  "1 DWELLING/ACRE"          B       3.40      0.52      0.800  56/76  22.90
  NATURAL DESERT COVER
  "DESERT BRUSH"   (50.0%)   B      13.51      0.38      1.000    80   34.48
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.960
  SUBAREA RUNOFF(CFS) =      29.63
```

```
 TOTAL AREA(ACRES) =     16.91   PEAK FLOW RATE(CFS) =      29.63

****************************************************************************
 FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   276.00
 ELEVATION DATA: UPSTREAM(FEET) =   3460.00  DOWNSTREAM(FEET) =   3450.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.624
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.626
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN   (MIN.)
 RESIDENTIAL(ARID)
 "1 DWELLING/ACRE"           B        0.25       0.52     0.800  56/76   8.62
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.52
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.800
 SUBAREA RUNOFF(CFS) =      0.95
 TOTAL AREA(ACRES) =      0.25   PEAK FLOW RATE(CFS) =       0.95

****************************************************************************
 FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =  1509.00
 ELEVATION DATA: UPSTREAM(FEET) =   3520.00  DOWNSTREAM(FEET) =   3460.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   25.141
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.188
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN   (MIN.)
 NATURAL DESERT COVER
 "DESERT BRUSH"    (50.0%)   B        3.55       0.38     1.000    80   25.14
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.38
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
 SUBAREA RUNOFF(CFS) =      5.78
 TOTAL AREA(ACRES) =      3.55   PEAK FLOW RATE(CFS) =       5.78

****************************************************************************
 FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   591.00
 ELEVATION DATA: UPSTREAM(FEET) =   3480.00  DOWNSTREAM(FEET) =   3460.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   17.846
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.781
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN   (MIN.)
 NATURAL DESERT COVER
 "DESERT BRUSH"    (50.0%)   B        1.72       0.38     1.000    80   17.85
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.38
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
 SUBAREA RUNOFF(CFS) =      3.72
 TOTAL AREA(ACRES) =      1.72   PEAK FLOW RATE(CFS) =       3.72

****************************************************************************
 FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
```

```
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    356.00
 ELEVATION DATA: UPSTREAM(FEET) =   3460.00  DOWNSTREAM(FEET) =   3450.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.512
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  5.632
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                 B       0.40      0.75      0.100     56    6.51
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA RUNOFF(CFS) =      2.00
 TOTAL AREA(ACRES) =      0.40   PEAK FLOW RATE(CFS) =      2.00

****************************************************************************
 FLOW PROCESS FROM NODE    400.00 TO NODE    401.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    620.00
 ELEVATION DATA: UPSTREAM(FEET) =   3460.00  DOWNSTREAM(FEET) =   3455.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   24.235
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.245
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 NATURAL DESERT COVER
 "DESERT BRUSH"   (50.0%)   B       6.85      0.38      1.000     80   24.24
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.38
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
 SUBAREA RUNOFF(CFS) =     11.50
 TOTAL AREA(ACRES) =      6.85   PEAK FLOW RATE(CFS) =     11.50
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =        6.8  TC(MIN.) =     24.24
 EFFECTIVE AREA(ACRES) =       6.85  AREA-AVERAGED Fm(INCH/HR)=  0.38
 AREA-AVERAGED Fp(INCH/HR) =  0.38  AREA-AVERAGED Ap = 1.000
 PEAK FLOW RATE(CFS)   =      11.50
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS

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****************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
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                        Analysis prepared by:

                      Walker Engineering, LLC
                   5765 S. Rainbow Blvd. Ste. 101
                        Las Vegas, NV  89118
                   Meeting Your Development Needs

 RETAIL BLDG ********** DESCRIPTION OF STUDY **************************
 *              AT OLD WOMAN SPRINGS ROAD & CEDARBIRD ROAD                *
 * LANDERS, CA                                                            *
 * EXISTING OFFSITE ANALYSIS - 100 YR                                     *
 **************************************************************************

  FILE NAME: OF100YR.DAT
  TIME/DATE OF STUDY: 14:08 04/04/2013
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                  --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.00
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.7000

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *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 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  3542.00
  ELEVATION DATA: UPSTREAM(FEET) =   3620.00  DOWNSTREAM(FEET) =   3460.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   22.903
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.336
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA       Fp          Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL(ARID)
  "1 DWELLING/ACRE"          B        3.40      0.52      0.800  56/76  22.90
  NATURAL DESERT COVER
  "DESERT BRUSH"    (50.0%)  B       13.51      0.38      1.000    80   34.48
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.960
  SUBAREA RUNOFF(CFS) =     44.86
```

```
TOTAL AREA(ACRES) =     16.91   PEAK FLOW RATE(CFS) =      44.86

****************************************************************************
 FLOW PROCESS FROM NODE     101.00 TO NODE    102.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   276.00
 ELEVATION DATA: UPSTREAM(FEET) =   3460.00  DOWNSTREAM(FEET) =   3450.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =     8.624
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  6.609
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL(ARID)
 "1 DWELLING/ACRE"           B        0.25      0.52      0.800  56/76   8.62
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.52
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.800
 SUBAREA RUNOFF(CFS) =       1.39
 TOTAL AREA(ACRES) =       0.25   PEAK FLOW RATE(CFS) =       1.39

****************************************************************************
 FLOW PROCESS FROM NODE     200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =  1509.00
 ELEVATION DATA: UPSTREAM(FEET) =   3520.00  DOWNSTREAM(FEET) =   3460.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    25.141
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.125
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 NATURAL DESERT COVER
 "DESERT BRUSH"    (50.0%)   B        3.55      0.38      1.000     80   25.14
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.38
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
 SUBAREA RUNOFF(CFS) =       8.77
 TOTAL AREA(ACRES) =       3.55   PEAK FLOW RATE(CFS) =       8.77

****************************************************************************
 FLOW PROCESS FROM NODE     300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   591.00
 ELEVATION DATA: UPSTREAM(FEET) =   3480.00  DOWNSTREAM(FEET) =   3460.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    17.846
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.973
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 NATURAL DESERT COVER
 "DESERT BRUSH"    (50.0%)   B        1.72      0.38      1.000     80   17.85
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.38
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
 SUBAREA RUNOFF(CFS) =       5.56
 TOTAL AREA(ACRES) =       1.72   PEAK FLOW RATE(CFS) =       5.56

****************************************************************************
 FLOW PROCESS FROM NODE     301.00 TO NODE    302.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
```

```
INITIAL SUBAREA FLOW-LENGTH(FEET) =    356.00
ELEVATION DATA: UPSTREAM(FEET) =    3460.00  DOWNSTREAM(FEET) =    3450.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.512
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  8.045
SUBAREA Tc AND LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp        Ap      SCS   Tc
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
COMMERCIAL                 B        0.40      0.75     0.100     56    6.51
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA RUNOFF(CFS) =      2.87
TOTAL AREA(ACRES) =      0.40   PEAK FLOW RATE(CFS) =      2.87

****************************************************************************
FLOW PROCESS FROM NODE    400.00 TO NODE    401.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
INITIAL SUBAREA FLOW-LENGTH(FEET) =    620.00
ELEVATION DATA: UPSTREAM(FEET) =    3460.00  DOWNSTREAM(FEET) =    3455.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   24.235
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.207
SUBAREA Tc AND LOSS RATE DATA(AMC  II):
 DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp        Ap      SCS   Tc
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
NATURAL DESERT COVER
"DESERT BRUSH"   (50.0%)   B        6.85      0.38     1.000     80   24.24
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.38
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
SUBAREA RUNOFF(CFS) =     17.43
TOTAL AREA(ACRES) =      6.85   PEAK FLOW RATE(CFS) =     17.43
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =        6.8  TC(MIN.) =     24.24
EFFECTIVE AREA(ACRES) =      6.85  AREA-AVERAGED Fm(INCH/HR)=  0.38
AREA-AVERAGED Fp(INCH/HR) =  0.38  AREA-AVERAGED Ap = 1.000
PEAK FLOW RATE(CFS)    =     17.43
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS
```

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****************************************************************************
        RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
      (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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        Ver. 19.0  Release Date: 06/01/2012  License ID 1645

                      Analysis prepared by:

                     Walker Engineering, LLC
                  5765 S. Rainbow Blvd. Ste. 101
                     Las Vegas, NV  89118
                  Meeting Your Development Needs

 ************************** DESCRIPTION OF STUDY **************************
 *    RETAIL BUILDING AT OLD WOMAN SPRINGS ROAD & CEDARBIRD ROAD          *
 * LANDERS, CA  WE No. 1260.00                                            *
 * EXISTING UNDEVELOPED 25 YEAR ANALYSIS                                  *
 **************************************************************************

  FILE NAME: EX25YR.DAT
  TIME/DATE OF STUDY: 10:45 04/08/2013
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
                --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.00
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.1900

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *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 0.0312 0.167 0.0150

 GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
   1. Relative Flow-Depth =  0.00 FEET
      as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
   2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
 *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
  OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
 *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
 FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   412.00
 ELEVATION DATA: UPSTREAM(FEET) =   3465.00  DOWNSTREAM(FEET) =   3445.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.688
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.981
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp        Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 NATURAL POOR COVER
 "OPEN BRUSH"               B        0.86      0.45     1.000    76   10.69
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
 SUBAREA RUNOFF(CFS) =      2.73
 TOTAL AREA(ACRES) =      0.86   PEAK FLOW RATE(CFS) =      2.73
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     200.00 TO NODE     201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   390.00
  ELEVATION DATA: UPSTREAM(FEET) =   3465.00  DOWNSTREAM(FEET) =   3445.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.342
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.074
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp         Ap     SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "OPEN BRUSH"                B        0.99      0.45      1.000    76   10.34
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =       3.23
  TOTAL AREA(ACRES) =       0.99   PEAK FLOW RATE(CFS) =       3.23
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =        1.0  TC(MIN.) =      10.34
  EFFECTIVE AREA(ACRES) =      0.99  AREA-AVERAGED Fm(INCH/HR)=  0.45
  AREA-AVERAGED Fp(INCH/HR) =  0.45  AREA-AVERAGED Ap = 1.000
  PEAK FLOW RATE(CFS)    =        3.23
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
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                       Analysis prepared by:

                      Walker Engineering, LLC
                   5765 S. Rainbow Blvd. Ste. 101
                       Las Vegas, NV  89118
                   Meeting Your Development Needs

 ************************** DESCRIPTION OF STUDY **************************
 *     RETAIL BUILDING AT OLD WOMAN SPRINGS ROAD & CEDARBIRD ROAD          *
 * LANDERS, CA  WE No. 1260.00                                             *
 * EXISTING UNDEVELOPED 100 YEAR ANALYSIS                                  *
 **************************************************************************

  FILE NAME: EX100YR.DAT
  TIME/DATE OF STUDY: 10:48 04/08/2013
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                  --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.00
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.7000

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *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 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   412.00
  ELEVATION DATA: UPSTREAM(FEET) =   3465.00  DOWNSTREAM(FEET) =   3445.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.688
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.688
  SUBAREA Tc AND LOSS RATE DATA(AMC II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "OPEN BRUSH"               B        0.86      0.45     1.000     76   10.69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =     4.05
  TOTAL AREA(ACRES) =      0.86  PEAK FLOW RATE(CFS) =      4.05
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   390.00
  ELEVATION DATA: UPSTREAM(FEET) =   3465.00  DOWNSTREAM(FEET) =   3445.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.342
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.820
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "OPEN BRUSH"                B        0.99      0.45      1.000    76   10.34
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      4.78
  TOTAL AREA(ACRES) =       0.99   PEAK FLOW RATE(CFS) =       4.78
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =        1.0  TC(MIN.) =      10.34
  EFFECTIVE AREA(ACRES) =       0.99  AREA-AVERAGED Fm(INCH/HR)=  0.45
  AREA-AVERAGED Fp(INCH/HR) =  0.45  AREA-AVERAGED Ap = 1.000
  PEAK FLOW RATE(CFS)    =       4.78
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
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                      Analysis prepared by:



 ************************** DESCRIPTION OF STUDY **************************
 *     RETAIL BUILDING AT OLD WOMAN SPRINGS ROAD & CEDARBIRD ROAD          *
 * LANDERS, CA          WE No. 1260.00                                     *
 * PROPOSED DEVELOPED CONDITION 25 YEAR                                    *
 **************************************************************************

  FILE NAME: P25YR.DAT
  TIME/DATE OF STUDY: 17:12 04/03/2013
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
                 --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.00
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.1900

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *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 0.0312 0.167 0.0150

 GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
   1. Relative Flow-Depth =  0.00 FEET
      as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
   2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
 *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
  OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
 *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   316.05
  ELEVATION DATA: UPSTREAM(FEET) =   3465.00  DOWNSTREAM(FEET) =   3445.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =     6.755
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  5.490
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL  AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       B        0.74      0.75      0.500    56    6.75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA RUNOFF(CFS) =      3.41
  TOTAL AREA(ACRES) =      0.74   PEAK FLOW RATE(CFS) =      3.41
```

```
****************************************************************************
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                    Analysis prepared by:



 ************************** DESCRIPTION OF STUDY **************************
 *     RETAIL BUILDING AT OLD WOMAN SPRINGS ROAD & CEDARBIRD ROAD          *
 * LANDERS, CA        WE No. 1260.00                                       *
 * PROPOSED DEVELOPED 100 YEAR ANALYSIS                                    *
 **************************************************************************

  FILE NAME: PRO100YR.DAT
  TIME/DATE OF STUDY: 15:03 04/03/2013
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.00
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.7000

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *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 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   316.05
  ELEVATION DATA: UPSTREAM(FEET) =   3465.00  DOWNSTREAM(FEET) =   3445.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.755
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  7.842
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap     SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"        B        0.74      0.75      0.500    56    6.75
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA RUNOFF(CFS) =      4.97
  TOTAL AREA(ACRES) =      0.74   PEAK FLOW RATE(CFS) =       4.97
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   544.98
  ELEVATION DATA: UPSTREAM(FEET) =   3465.00  DOWNSTREAM(FEET) =   3445.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.366
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  6.238
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"        B        1.11      0.75      0.500    56    9.37
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA RUNOFF(CFS) =      5.86
  TOTAL AREA(ACRES) =      1.11   PEAK FLOW RATE(CFS) =       5.86
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =         1.1  TC(MIN.) =       9.37
  EFFECTIVE AREA(ACRES) =       1.11  AREA-AVERAGED Fm(INCH/HR)=  0.37
  AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap = 0.500
  PEAK FLOW RATE(CFS)    =       5.86
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

PRORATED FLOW CALCULATIONS

25 YEAR STORM

BASIN ID*	ACRES	Q25	CFS/AC	NOTES
PRON1	0.74	3.41	4.61	
PRON1-A	0.08	0.37		Drains to swale along north PL
PRON1-B	0.19	0.88		Drains to swale north of building
PRON1-C	0.47	2.16		Drains to infiltration basin
TOTAL	**0.74**	**3.41**		
PRON2	1.11	3.99	3.59	
PRON2-A	0.49	1.76		Drains to swale west of building
PRON2-B	0.10	0.36		Drains to Cedarbird Road
PRON2-C	0.52	1.87		Drains to infiltration basin
TOTAL	**1.11**	**3.99**		

100YEAR STORM

BASIN ID*	ACRES	Q100	CFS/AC	NOTES
PRON1	0.74	4.97	6.72	
PRON1-A	0.08	0.54		Drains to swale along north PL
PRON1-B	0.19	1.28		Drains to swale north of building
PRON1-C	0.47	3.15		Drains to infiltration basin
TOTAL	**0.74**	**4.97**		
PRON2	1.11	5.86	5.28	
PRON2-A	0.49	2.59		Drains to swale west of building
PRON2-B	0.10	0.53		Drains to Cedarbird Road
PRON2-C	0.52	2.74		Drains to infiltration basin
TOTAL	**1.11**	**5.86**		

*SEE PROPOSED CONDITION DRAINAGE MAP (FIGURE 3)

APPENDIX C

APPENDIX C- SMALL AREA HYDROGRAPH CALCULATIONS

- EXISTING CONDITIONS ANALYSIS (BASINS EXON1 AND EXON2)
    - E25YR_EXON1
    - E25YR_EXON2
    - E100YR_EXON1
    - E100YR_EXON2

- PROPOSED CONDITION ANALYSIS (BASINS PRON1 AND PRON2)
    - P25YR_PRON1
    - P25YR_PRON2
    - P100YR_PRON1
    - P100YR_PRON2

- LOSS CALCULATIONS

- INFILTRATION BASIN VOLUME CALCULATION

```
****************************************************************************
                      SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                          Analysis prepared by:
```

Walker Engineering, LLC
5765 S. Rainbow Blvd. Ste. 101
Las Vegas, NV 89118
Meeting Your Development Needs

```
****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
      RETAIL BUILDING AT OLD WOMAN SPRINGS ROAD & CEDARBIRD ROAD
  25 YEAR ANALYSIS - EXON1
  1260.00
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 1.36
    TOTAL CATCHMENT AREA(ACRES) =     0.86
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.450
    LOW LOSS FRACTION = 0.610
    TIME OF CONCENTRATION(MIN.) = 10.69
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =  25
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.33
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.87
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.19
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  1.70
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  2.16
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  3.50

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

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =      0.16
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =      0.09

****************************************************************************
  TIME      VOLUME        Q    0.          2.5        5.0        7.5       10.0
 (HOURS)     (AF)       (CFS)
----------------------------------------------------------------------------
   0.14     0.0001      0.02  Q          .          .          .          .
   0.32     0.0005      0.02  Q          .          .          .          .
   0.50     0.0008      0.02  Q          .          .          .          .
   0.68     0.0012      0.02  Q          .          .          .          .
   0.86     0.0015      0.02  Q          .          .          .          .
   1.03     0.0019      0.02  Q          .          .          .          .
   1.21     0.0022      0.02  Q          .          .          .          .
   1.39     0.0026      0.02  Q          .          .          .          .
   1.57     0.0029      0.02  Q          .          .          .          .
   1.75     0.0033      0.02  Q          .          .          .          .
   1.92     0.0037      0.02  Q          .          .          .          .
   2.10     0.0040      0.03  Q          .          .          .          .
   2.28     0.0044      0.03  Q          .          .          .          .
   2.46     0.0048      0.03  Q          .          .          .          .
   2.64     0.0052      0.03  Q          .          .          .          .
```

```
****************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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                        Analysis prepared by:
```

Walker Engineering, LLC
5765 S. Rainbow Blvd. Ste. 101
Las Vegas, NV 89118
Meeting Your Development Needs

```
****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
RETAIL BLDG    AT OLD WOMAN SPRINGS ROAD & CEDARBIRD ROAD
  100 YEAR ANALYSIS - EXON1
  1260.00
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 1.34
    TOTAL CATCHMENT AREA(ACRES) =    0.86
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.450
    LOW LOSS FRACTION = 0.500
    TIME OF CONCENTRATION(MIN.) = 10.69
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.47
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.24
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.70
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.38
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  2.98
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  4.83

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

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.27
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.08

****************************************************************************
  TIME     VOLUME      Q    0.        2.5       5.0       7.5      10.0
 (HOURS)    (AF)     (CFS)
----------------------------------------------------------------------------
  0.14    0.0002     0.04  Q         .         .         .         .
  0.32    0.0008     0.04  Q         .         .         .         .
  0.50    0.0014     0.04  Q         .         .         .         .
  0.68    0.0020     0.04  Q         .         .         .         .
  0.86    0.0026     0.04  Q         .         .         .         .
  1.03    0.0033     0.04  Q         .         .         .         .
  1.21    0.0039     0.04  Q         .         .         .         .
  1.39    0.0045     0.04  Q         .         .         .         .
  1.57    0.0051     0.04  Q         .         .         .         .
  1.75    0.0058     0.04  Q         .         .         .         .
  1.92    0.0064     0.04  Q         .         .         .         .
  2.10    0.0070     0.04  Q         .         .         .         .
  2.28    0.0077     0.04  Q         .         .         .         .
  2.46    0.0083     0.04  Q         .         .         .         .
  2.64    0.0090     0.04  Q         .         .         .         .
```

2.82	0.0055	0.03	Q		.	.	.	.
2.99	0.0059	0.03	Q		.	.	.	.
3.17	0.0063	0.03	Q		.	.	.	.
3.35	0.0067	0.03	Q		.	.	.	.
3.53	0.0071	0.03	Q		.	.	.	.
3.71	0.0075	0.03	Q		.	.	.	.
3.88	0.0079	0.03	Q		.	.	.	.
4.06	0.0083	0.03	Q		.	.	.	.
4.24	0.0087	0.03	Q		.	.	.	.
4.42	0.0091	0.03	Q		.	.	.	.
4.60	0.0095	0.03	Q		.	.	.	.
4.78	0.0100	0.03	Q		.	.	.	.
4.95	0.0104	0.03	Q		.	.	.	.
5.13	0.0108	0.03	Q		.	.	.	.
5.31	0.0113	0.03	Q		.	.	.	.
5.49	0.0117	0.03	Q		.	.	.	.
5.67	0.0121	0.03	Q		.	.	.	.
5.84	0.0126	0.03	Q		.	.	.	.
6.02	0.0131	0.03	Q		.	.	.	.
6.20	0.0135	0.03	Q		.	.	.	.
6.38	0.0140	0.03	Q		.	.	.	.
6.56	0.0144	0.03	Q		.	.	.	.
6.74	0.0149	0.03	Q		.	.	.	.
6.91	0.0154	0.03	Q		.	.	.	.
7.09	0.0159	0.03	Q		.	.	.	.
7.27	0.0164	0.03	Q		.	.	.	.
7.45	0.0169	0.03	Q		.	.	.	.
7.63	0.0174	0.03	Q		.	.	.	.
7.80	0.0179	0.04	Q		.	.	.	.
7.98	0.0184	0.04	Q		.	.	.	.
8.16	0.0190	0.04	Q		.	.	.	.
8.34	0.0195	0.04	Q		.	.	.	.
8.52	0.0201	0.04	Q		.	.	.	.
8.70	0.0206	0.04	Q		.	.	.	.
8.87	0.0212	0.04	Q		.	.	.	.
9.05	0.0218	0.04	Q		.	.	.	.
9.23	0.0223	0.04	Q		.	.	.	.
9.41	0.0229	0.04	Q		.	.	.	.
9.59	0.0235	0.04	Q		.	.	.	.
9.76	0.0241	0.04	Q		.	.	.	.
9.94	0.0248	0.04	Q		.	.	.	.
10.12	0.0254	0.04	Q		.	.	.	.
10.30	0.0260	0.04	Q		.	.	.	.
10.48	0.0267	0.05	Q		.	.	.	.
10.65	0.0274	0.05	Q		.	.	.	.
10.83	0.0281	0.05	Q		.	.	.	.
11.01	0.0288	0.05	Q		.	.	.	.
11.19	0.0295	0.05	Q		.	.	.	.
11.37	0.0302	0.05	Q		.	.	.	.
11.55	0.0310	0.05	Q		.	.	.	.
11.72	0.0318	0.05	Q		.	.	.	.
11.90	0.0326	0.06	Q		.	.	.	.
12.08	0.0334	0.06	Q		.	.	.	.
12.26	0.0342	0.06	Q		.	.	.	.
12.44	0.0351	0.06	Q		.	.	.	.
12.61	0.0360	0.06	Q		.	.	.	.
12.79	0.0369	0.06	Q		.	.	.	.
12.97	0.0378	0.07	Q		.	.	.	.
13.15	0.0388	0.07	Q		.	.	.	.
13.33	0.0399	0.07	Q		.	.	.	.
13.51	0.0409	0.07	Q		.	.	.	.
13.68	0.0420	0.08	Q		.	.	.	.
13.86	0.0432	0.08	Q		.	.	.	.

```
 14.04      0.0444      0.09  Q          .          .          .          .
 14.22      0.0457      0.09  Q          .          .          .          .
 14.40      0.0470      0.09  Q          .          .          .          .
 14.57      0.0484      0.10  Q          .          .          .          .
 14.75      0.0499      0.11  Q          .          .          .          .
 14.93      0.0516      0.12  Q          .          .          .          .
 15.11      0.0534      0.13  Q          .          .          .          .
 15.29      0.0554      0.14  Q          .          .          .          .
 15.47      0.0581      0.22  Q          .          .          .          .
 15.64      0.0618      0.28  .Q         .          .          .          .
 15.82      0.0683      0.60  . Q        .          .          .          .
 16.00      0.0797      0.96  .  Q       .          .          .          .
 16.18      0.1069      2.73  .          Q          .          .          .
 16.36      0.1294      0.32  .Q         .          .          .          .
 16.53      0.1329      0.16  Q          .          .          .          .
 16.71      0.1349      0.12  Q          .          .          .          .
 16.89      0.1366      0.10  Q          .          .          .          .
 17.07      0.1380      0.09  Q          .          .          .          .
 17.25      0.1393      0.08  Q          .          .          .          .
 17.43      0.1404      0.08  Q          .          .          .          .
 17.60      0.1415      0.07  Q          .          .          .          .
 17.78      0.1425      0.06  Q          .          .          .          .
 17.96      0.1434      0.06  Q          .          .          .          .
 18.14      0.1443      0.06  Q          .          .          .          .
 18.32      0.1451      0.05  Q          .          .          .          .
 18.49      0.1459      0.05  Q          .          .          .          .
 18.67      0.1466      0.05  Q          .          .          .          .
 18.85      0.1473      0.05  Q          .          .          .          .
 19.03      0.1480      0.04  Q          .          .          .          .
 19.21      0.1486      0.04  Q          .          .          .          .
 19.39      0.1493      0.04  Q          .          .          .          .
 19.56      0.1499      0.04  Q          .          .          .          .
 19.74      0.1505      0.04  Q          .          .          .          .
 19.92      0.1510      0.04  Q          .          .          .          .
 20.10      0.1516      0.04  Q          .          .          .          .
 20.28      0.1521      0.04  Q          .          .          .          .
 20.45      0.1526      0.03  Q          .          .          .          .
 20.63      0.1531      0.03  Q          .          .          .          .
 20.81      0.1536      0.03  Q          .          .          .          .
 20.99      0.1541      0.03  Q          .          .          .          .
 21.17      0.1545      0.03  Q          .          .          .          .
 21.34      0.1550      0.03  Q          .          .          .          .
 21.52      0.1554      0.03  Q          .          .          .          .
 21.70      0.1559      0.03  Q          .          .          .          .
 21.88      0.1563      0.03  Q          .          .          .          .
 22.06      0.1567      0.03  Q          .          .          .          .
 22.24      0.1571      0.03  Q          .          .          .          .
 22.41      0.1575      0.03  Q          .          .          .          .
 22.59      0.1579      0.03  Q          .          .          .          .
 22.77      0.1583      0.03  Q          .          .          .          .
 22.95      0.1587      0.03  Q          .          .          .          .
 23.13      0.1591      0.03  Q          .          .          .          .
 23.30      0.1594      0.02  Q          .          .          .          .
 23.48      0.1598      0.02  Q          .          .          .          .
 23.66      0.1602      0.02  Q          .          .          .          .
 23.84      0.1605      0.02  Q          .          .          .          .
 24.02      0.1609      0.02  Q          .          .          .          .
 24.20      0.1610      0.00  Q          .          .          .          .
----------------------------------------------------------------------------
------------------------------------------------------------------------------
    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%	1443.1
10%	53.4
20%	32.1
30%	21.4
40%	10.7
50%	10.7
60%	10.7
70%	10.7
80%	10.7
90%	10.7

2.82	0.0097	0.05	Q	.	.	.	.
2.99	0.0103	0.05	Q	.	.	.	.
3.17	0.0110	0.05	Q	.	.	.	.
3.35	0.0117	0.05	Q	.	.	.	.
3.53	0.0124	0.05	Q	.	.	.	.
3.71	0.0131	0.05	Q	.	.	.	.
3.88	0.0138	0.05	Q	.	.	.	.
4.06	0.0145	0.05	Q	.	.	.	.
4.24	0.0152	0.05	Q	.	.	.	.
4.42	0.0159	0.05	Q	.	.	.	.
4.60	0.0166	0.05	Q	.	.	.	.
4.78	0.0174	0.05	Q	.	.	.	.
4.95	0.0181	0.05	Q	.	.	.	.
5.13	0.0189	0.05	Q	.	.	.	.
5.31	0.0196	0.05	Q	.	.	.	.
5.49	0.0204	0.05	Q	.	.	.	.
5.67	0.0212	0.05	Q	.	.	.	.
5.84	0.0220	0.05	Q	.	.	.	.
6.02	0.0228	0.05	Q	.	.	.	.
6.20	0.0236	0.05	Q	.	.	.	.
6.38	0.0244	0.06	Q	.	.	.	.
6.56	0.0252	0.06	Q	.	.	.	.
6.74	0.0260	0.06	Q	.	.	.	.
6.91	0.0269	0.06	Q	.	.	.	.
7.09	0.0277	0.06	Q	.	.	.	.
7.27	0.0286	0.06	Q	.	.	.	.
7.45	0.0295	0.06	Q	.	.	.	.
7.63	0.0304	0.06	Q	.	.	.	.
7.80	0.0313	0.06	Q	.	.	.	.
7.98	0.0322	0.06	Q	.	.	.	.
8.16	0.0331	0.06	Q	.	.	.	.
8.34	0.0340	0.06	Q	.	.	.	.
8.52	0.0350	0.07	Q	.	.	.	.
8.70	0.0360	0.07	Q	.	.	.	.
8.87	0.0369	0.07	Q	.	.	.	.
9.05	0.0379	0.07	Q	.	.	.	.
9.23	0.0389	0.07	Q	.	.	.	.
9.41	0.0400	0.07	Q	.	.	.	.
9.59	0.0410	0.07	Q	.	.	.	.
9.76	0.0421	0.07	Q	.	.	.	.
9.94	0.0432	0.07	Q	.	.	.	.
10.12	0.0443	0.08	Q	.	.	.	.
10.30	0.0454	0.08	Q	.	.	.	.
10.48	0.0466	0.08	Q	.	.	.	.
10.65	0.0478	0.08	Q	.	.	.	.
10.83	0.0490	0.08	Q	.	.	.	.
11.01	0.0502	0.08	Q	.	.	.	.
11.19	0.0514	0.09	Q	.	.	.	.
11.37	0.0527	0.09	Q	.	.	.	.
11.55	0.0540	0.09	Q	.	.	.	.
11.72	0.0554	0.09	Q	.	.	.	.
11.90	0.0568	0.10	Q	.	.	.	.
12.08	0.0582	0.10	Q	.	.	.	.
12.26	0.0596	0.09	Q	.	.	.	.
12.44	0.0610	0.10	Q	.	.	.	.
12.61	0.0625	0.10	Q	.	.	.	.
12.79	0.0640	0.10	Q	.	.	.	.
12.97	0.0656	0.11	Q	.	.	.	.
13.15	0.0672	0.11	Q	.	.	.	.
13.33	0.0689	0.12	Q	.	.	.	.
13.51	0.0706	0.12	Q	.	.	.	.
13.68	0.0725	0.13	Q	.	.	.	.
13.86	0.0744	0.13	Q	.	.	.	.

```
14.04      0.0765      0.14  Q         .         .         .         .
14.22      0.0786      0.14  Q         .         .         .         .
14.40      0.0808      0.15  Q         .         .         .         .
14.57      0.0831      0.16  Q         .         .         .         .
14.75      0.0856      0.18  Q         .         .         .         .
14.93      0.0884      0.19  Q         .         .         .         .
15.11      0.0915      0.22  Q         .         .         .         .
15.29      0.0949      0.24  Q         .         .         .         .
15.47      0.0996      0.39  .Q        .         .         .         .
15.64      0.1062      0.50  . Q       .         .         .         .
15.82      0.1178      1.07  .   Q     .         .         .         .
16.00      0.1372      1.56  .     Q   .         .         .         .
16.18      0.1786      4.05  .         .     Q   .         .         .
16.36      0.2131      0.64  . Q       .         .         .         .
16.53      0.2197      0.27  .Q        .         .         .         .
16.71      0.2233      0.21  Q         .         .         .         .
16.89      0.2261      0.17  Q         .         .         .         .
17.07      0.2284      0.15  Q         .         .         .         .
17.25      0.2305      0.14  Q         .         .         .         .
17.43      0.2325      0.13  Q         .         .         .         .
17.60      0.2342      0.11  Q         .         .         .         .
17.78      0.2358      0.11  Q         .         .         .         .
17.96      0.2374      0.10  Q         .         .         .         .
18.14      0.2388      0.10  Q         .         .         .         .
18.32      0.2402      0.09  Q         .         .         .         .
18.49      0.2415      0.09  Q         .         .         .         .
18.67      0.2428      0.09  Q         .         .         .         .
18.85      0.2440      0.08  Q         .         .         .         .
19.03      0.2452      0.08  Q         .         .         .         .
19.21      0.2464      0.08  Q         .         .         .         .
19.39      0.2474      0.07  Q         .         .         .         .
19.56      0.2485      0.07  Q         .         .         .         .
19.74      0.2495      0.07  Q         .         .         .         .
19.92      0.2505      0.07  Q         .         .         .         .
20.10      0.2514      0.06  Q         .         .         .         .
20.28      0.2524      0.06  Q         .         .         .         .
20.45      0.2533      0.06  Q         .         .         .         .
20.63      0.2541      0.06  Q         .         .         .         .
20.81      0.2550      0.06  Q         .         .         .         .
20.99      0.2558      0.06  Q         .         .         .         .
21.17      0.2566      0.05  Q         .         .         .         .
21.34      0.2574      0.05  Q         .         .         .         .
21.52      0.2582      0.05  Q         .         .         .         .
21.70      0.2590      0.05  Q         .         .         .         .
21.88      0.2597      0.05  Q         .         .         .         .
22.06      0.2604      0.05  Q         .         .         .         .
22.24      0.2612      0.05  Q         .         .         .         .
22.41      0.2619      0.05  Q         .         .         .         .
22.59      0.2626      0.05  Q         .         .         .         .
22.77      0.2632      0.05  Q         .         .         .         .
22.95      0.2639      0.04  Q         .         .         .         .
23.13      0.2645      0.04  Q         .         .         .         .
23.30      0.2652      0.04  Q         .         .         .         .
23.48      0.2658      0.04  Q         .         .         .         .
23.66      0.2664      0.04  Q         .         .         .         .
23.84      0.2671      0.04  Q         .         .         .         .
24.02      0.2677      0.04  Q         .         .         .         .
24.20      0.2680      0.00  Q         .         .         .         .
----------------------------------------------------------------------------
--------------------------------------------------------------------------------
    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%	1443.1
10%	53.4
20%	32.1
30%	21.4
40%	10.7
50%	10.7
60%	10.7
70%	10.7
80%	10.7
90%	10.7

```
****************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
      (C) Copyright 1989-2012 Advanced Engineering Software (aes)
      Ver. 19.3  Release Date: 12/28/2012  License ID 1645

                        Analysis prepared by:

                        Walker Engineering, LLC
                      5765 S. Rainbow Blvd. Ste. 101
                          Las Vegas, NV 89118
                    Meeting Your Development Needs
****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
      RETAIL BUILDING AT OLD WOMAN SPRINGS ROAD & CEDARBIRD ROAD
  25 YEAR ANALYSIS - EXON2
  1260.00
----------------------------------------------------------------------------

    RATIONAL METHOD CALIBRATION COEFFICIENT = 1.37
    TOTAL CATCHMENT AREA(ACRES) =    0.99
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.450
    LOW LOSS FRACTION = 0.610
    TIME OF CONCENTRATION(MIN.) = 10.34
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =  25
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.33
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.87
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.19
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  1.70
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  2.16
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  3.50

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

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =      0.19
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =      0.10

****************************************************************************
  TIME     VOLUME       Q    0.        2.5        5.0        7.5       10.0
 (HOURS)    (AF)      (CFS)
----------------------------------------------------------------------------
   0.15    0.0002      0.03  Q          .          .          .          .
   0.32    0.0006      0.03  Q          .          .          .          .
   0.49    0.0010      0.03  Q          .          .          .          .
   0.66    0.0013      0.03  Q          .          .          .          .
   0.83    0.0017      0.03  Q          .          .          .          .
   1.01    0.0021      0.03  Q          .          .          .          .
   1.18    0.0025      0.03  Q          .          .          .          .
   1.35    0.0029      0.03  Q          .          .          .          .
   1.52    0.0033      0.03  Q          .          .          .          .
   1.70    0.0037      0.03  Q          .          .          .          .
   1.87    0.0041      0.03  Q          .          .          .          .
   2.04    0.0046      0.03  Q          .          .          .          .
   2.21    0.0050      0.03  Q          .          .          .          .
   2.39    0.0054      0.03  Q          .          .          .          .
   2.56    0.0058      0.03  Q          .          .          .          .
```

2.73	0.0062	0.03	Q	.	.	.	.
2.90	0.0067	0.03	Q	.	.	.	.
3.07	0.0071	0.03	Q	.	.	.	.
3.25	0.0075	0.03	Q	.	.	.	.
3.42	0.0080	0.03	Q	.	.	.	.
3.59	0.0084	0.03	Q	.	.	.	.
3.76	0.0089	0.03	Q	.	.	.	.
3.94	0.0093	0.03	Q	.	.	.	.
4.11	0.0098	0.03	Q	.	.	.	.
4.28	0.0102	0.03	Q	.	.	.	.
4.45	0.0107	0.03	Q	.	.	.	.
4.63	0.0112	0.03	Q	.	.	.	.
4.80	0.0117	0.03	Q	.	.	.	.
4.97	0.0121	0.03	Q	.	.	.	.
5.14	0.0126	0.03	Q	.	.	.	.
5.32	0.0131	0.03	Q	.	.	.	.
5.49	0.0136	0.03	Q	.	.	.	.
5.66	0.0141	0.04	Q	.	.	.	.
5.83	0.0146	0.04	Q	.	.	.	.
6.00	0.0151	0.04	Q	.	.	.	.
6.18	0.0156	0.04	Q	.	.	.	.
6.35	0.0162	0.04	Q	.	.	.	.
6.52	0.0167	0.04	Q	.	.	.	.
6.69	0.0172	0.04	Q	.	.	.	.
6.87	0.0178	0.04	Q	.	.	.	.
7.04	0.0183	0.04	Q	.	.	.	.
7.21	0.0189	0.04	Q	.	.	.	.
7.38	0.0194	0.04	Q	.	.	.	.
7.56	0.0200	0.04	Q	.	.	.	.
7.73	0.0206	0.04	Q	.	.	.	.
7.90	0.0211	0.04	Q	.	.	.	.
8.07	0.0217	0.04	Q	.	.	.	.
8.24	0.0223	0.04	Q	.	.	.	.
8.42	0.0229	0.04	Q	.	.	.	.
8.59	0.0236	0.04	Q	.	.	.	.
8.76	0.0242	0.04	Q	.	.	.	.
8.93	0.0248	0.05	Q	.	.	.	.
9.11	0.0255	0.05	Q	.	.	.	.
9.28	0.0261	0.05	Q	.	.	.	.
9.45	0.0268	0.05	Q	.	.	.	.
9.62	0.0275	0.05	Q	.	.	.	.
9.80	0.0282	0.05	Q	.	.	.	.
9.97	0.0289	0.05	Q	.	.	.	.
10.14	0.0296	0.05	Q	.	.	.	.
10.31	0.0303	0.05	Q	.	.	.	.
10.49	0.0310	0.05	Q	.	.	.	.
10.66	0.0318	0.05	Q	.	.	.	.
10.83	0.0326	0.05	Q	.	.	.	.
11.00	0.0334	0.06	Q	.	.	.	.
11.17	0.0342	0.06	Q	.	.	.	.
11.35	0.0350	0.06	Q	.	.	.	.
11.52	0.0359	0.06	Q	.	.	.	.
11.69	0.0367	0.06	Q	.	.	.	.
11.86	0.0376	0.06	Q	.	.	.	.
12.04	0.0385	0.07	Q	.	.	.	.
12.21	0.0395	0.07	Q	.	.	.	.
12.38	0.0404	0.07	Q	.	.	.	.
12.55	0.0414	0.07	Q	.	.	.	.
12.73	0.0424	0.07	Q	.	.	.	.
12.90	0.0435	0.07	Q	.	.	.	.
13.07	0.0446	0.08	Q	.	.	.	.
13.24	0.0457	0.08	Q	.	.	.	.
13.41	0.0469	0.08	Q	.	.	.	.

```
    13.59         0.0481        0.09  Q            .          .          .          .
    13.76         0.0494        0.09  Q            .          .          .          .
    13.93         0.0507        0.10  Q            .          .          .          .
    14.10         0.0521        0.10  Q            .          .          .          .
    14.28         0.0535        0.10  Q            .          .          .          .
    14.45         0.0550        0.11  Q            .          .          .          .
    14.62         0.0566        0.12  Q            .          .          .          .
    14.79         0.0584        0.13  Q            .          .          .          .
    14.97         0.0603        0.14  Q            .          .          .          .
    15.14         0.0624        0.16  Q            .          .          .          .
    15.31         0.0647        0.17  Q            .          .          .          .
    15.48         0.0679        0.28  .Q           .          .          .          .
    15.66         0.0722        0.33  .Q           .          .          .          .
    15.83         0.0798        0.74  . Q          .          .          .          .
    16.00         0.0931        1.14  .   Q        .          .          .          .
    16.17         0.1242        3.23  .            . Q        .          .          .
    16.34         0.1498        0.37  .Q           .          .          .          .
    16.52         0.1538        0.19  Q            .          .          .          .
    16.69         0.1562        0.15  Q            .          .          .          .
    16.86         0.1581        0.12  Q            .          .          .          .
    17.03         0.1597        0.10  Q            .          .          .          .
    17.21         0.1612        0.10  Q            .          .          .          .
    17.38         0.1625        0.09  Q            .          .          .          .
    17.55         0.1638        0.08  Q            .          .          .          .
    17.72         0.1649        0.08  Q            .          .          .          .
    17.90         0.1660        0.07  Q            .          .          .          .
    18.07         0.1669        0.07  Q            .          .          .          .
    18.24         0.1679        0.06  Q            .          .          .          .
    18.41         0.1688        0.06  Q            .          .          .          .
    18.58         0.1696        0.06  Q            .          .          .          .
    18.76         0.1704        0.06  Q            .          .          .          .
    18.93         0.1712        0.05  Q            .          .          .          .
    19.10         0.1719        0.05  Q            .          .          .          .
    19.27         0.1727        0.05  Q            .          .          .          .
    19.45         0.1733        0.05  Q            .          .          .          .
    19.62         0.1740        0.05  Q            .          .          .          .
    19.79         0.1747        0.04  Q            .          .          .          .
    19.96         0.1753        0.04  Q            .          .          .          .
    20.14         0.1759        0.04  Q            .          .          .          .
    20.31         0.1765        0.04  Q            .          .          .          .
    20.48         0.1771        0.04  Q            .          .          .          .
    20.65         0.1776        0.04  Q            .          .          .          .
    20.83         0.1782        0.04  Q            .          .          .          .
    21.00         0.1787        0.04  Q            .          .          .          .
    21.17         0.1792        0.04  Q            .          .          .          .
    21.34         0.1797        0.04  Q            .          .          .          .
    21.51         0.1802        0.03  Q            .          .          .          .
    21.69         0.1807        0.03  Q            .          .          .          .
    21.86         0.1812        0.03  Q            .          .          .          .
    22.03         0.1817        0.03  Q            .          .          .          .
    22.20         0.1821        0.03  Q            .          .          .          .
    22.38         0.1826        0.03  Q            .          .          .          .
    22.55         0.1830        0.03  Q            .          .          .          .
    22.72         0.1835        0.03  Q            .          .          .          .
    22.89         0.1839        0.03  Q            .          .          .          .
    23.07         0.1843        0.03  Q            .          .          .          .
    23.24         0.1847        0.03  Q            .          .          .          .
    23.41         0.1851        0.03  Q            .          .          .          .
    23.58         0.1856        0.03  Q            .          .          .          .
    23.76         0.1859        0.03  Q            .          .          .          .
    23.93         0.1863        0.03  Q            .          .          .          .
    24.10         0.1867        0.03  Q            .          .          .          .
    24.27         0.1869        0.00  Q            .          .          .          .
```

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%	1447.6
10%	51.7
20%	31.0
30%	20.7
40%	10.3
50%	10.3
60%	10.3
70%	10.3
80%	10.3
90%	10.3

```
****************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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            Ver. 19.3  Release Date: 12/28/2012  License ID 1645

                          Analysis prepared by:
```


Walker Engineering, LLC
5765 S. Rainbow Blvd. Ste. 101
Las Vegas, NV 89118
Meeting Your Development Needs


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

 Problem Descriptions:
      RETAIL BUILDING AT OLD WOMAN SPRINGS ROAD & CEDARBIRD ROAD
  100 YEAR ANALYSIS - EXON2
  1260.00
----------------------------------------------------------------------------


   RATIONAL METHOD CALIBRATION COEFFICIENT = 1.35
   TOTAL CATCHMENT AREA(ACRES) =     0.99
   SOIL-LOSS RATE, Fm,(INCH/HR) =  0.450
   LOW LOSS FRACTION = 0.500
   TIME OF CONCENTRATION(MIN.) = 10.34
   SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
   USER SPECIFIED RAINFALL VALUES ARE USED
   RETURN FREQUENCY(YEARS) = 100
      5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.47
     30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.24
      1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.70
      3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.38
      6-HOUR   POINT RAINFALL VALUE(INCHES) =  2.98
     24-HOUR   POINT RAINFALL VALUE(INCHES) =  4.83

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

   TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =      0.31
   TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =      0.09

****************************************************************************
  TIME     VOLUME       Q    0.         2.5        5.0        7.5       10.0
 (HOURS)    (AF)      (CFS)
----------------------------------------------------------------------------
  0.15     0.0003      0.05  Q          .          .          .          .
  0.32     0.0010      0.05  Q          .          .          .          .
  0.49     0.0017      0.05  Q          .          .          .          .
  0.66     0.0023      0.05  Q          .          .          .          .
  0.83     0.0030      0.05  Q          .          .          .          .
  1.01     0.0037      0.05  Q          .          .          .          .
  1.18     0.0044      0.05  Q          .          .          .          .
  1.35     0.0051      0.05  Q          .          .          .          .
  1.52     0.0058      0.05  Q          .          .          .          .
  1.70     0.0065      0.05  Q          .          .          .          .
  1.87     0.0072      0.05  Q          .          .          .          .
  2.04     0.0079      0.05  Q          .          .          .          .
  2.21     0.0087      0.05  Q          .          .          .          .
  2.39     0.0094      0.05  Q          .          .          .          .
  2.56     0.0101      0.05  Q          .          .          .          .
```

2.73	0.0109	0.05	Q	.	.	.	.
2.90	0.0116	0.05	Q	.	.	.	.
3.07	0.0124	0.05	Q	.	.	.	.
3.25	0.0131	0.05	Q	.	.	.	.
3.42	0.0139	0.05	Q	.	.	.	.
3.59	0.0147	0.05	Q	.	.	.	.
3.76	0.0155	0.06	Q	.	.	.	.
3.94	0.0163	0.06	Q	.	.	.	.
4.11	0.0171	0.06	Q	.	.	.	.
4.28	0.0179	0.06	Q	.	.	.	.
4.45	0.0187	0.06	Q	.	.	.	.
4.63	0.0195	0.06	Q	.	.	.	.
4.80	0.0203	0.06	Q	.	.	.	.
4.97	0.0212	0.06	Q	.	.	.	.
5.14	0.0220	0.06	Q	.	.	.	.
5.32	0.0229	0.06	Q	.	.	.	.
5.49	0.0237	0.06	Q	.	.	.	.
5.66	0.0246	0.06	Q	.	.	.	.
5.83	0.0255	0.06	Q	.	.	.	.
6.00	0.0264	0.06	Q	.	.	.	.
6.18	0.0273	0.06	Q	.	.	.	.
6.35	0.0282	0.06	Q	.	.	.	.
6.52	0.0291	0.07	Q	.	.	.	.
6.69	0.0300	0.07	Q	.	.	.	.
6.87	0.0310	0.07	Q	.	.	.	.
7.04	0.0319	0.07	Q	.	.	.	.
7.21	0.0329	0.07	Q	.	.	.	.
7.38	0.0339	0.07	Q	.	.	.	.
7.56	0.0349	0.07	Q	.	.	.	.
7.73	0.0359	0.07	Q	.	.	.	.
7.90	0.0369	0.07	Q	.	.	.	.
8.07	0.0379	0.07	Q	.	.	.	.
8.24	0.0390	0.07	Q	.	.	.	.
8.42	0.0400	0.07	Q	.	.	.	.
8.59	0.0411	0.08	Q	.	.	.	.
8.76	0.0422	0.08	Q	.	.	.	.
8.93	0.0433	0.08	Q	.	.	.	.
9.11	0.0444	0.08	Q	.	.	.	.
9.28	0.0456	0.08	Q	.	.	.	.
9.45	0.0467	0.08	Q	.	.	.	.
9.62	0.0479	0.08	Q	.	.	.	.
9.80	0.0491	0.09	Q	.	.	.	.
9.97	0.0503	0.09	Q	.	.	.	.
10.14	0.0516	0.09	Q	.	.	.	.
10.31	0.0529	0.09	Q	.	.	.	.
10.49	0.0542	0.09	Q	.	.	.	.
10.66	0.0555	0.09	Q	.	.	.	.
10.83	0.0568	0.10	Q	.	.	.	.
11.00	0.0582	0.10	Q	.	.	.	.
11.17	0.0596	0.10	Q	.	.	.	.
11.35	0.0611	0.10	Q	.	.	.	.
11.52	0.0625	0.10	Q	.	.	.	.
11.69	0.0640	0.11	Q	.	.	.	.
11.86	0.0656	0.11	Q	.	.	.	.
12.04	0.0672	0.11	Q	.	.	.	.
12.21	0.0688	0.11	Q	.	.	.	.
12.38	0.0703	0.11	Q	.	.	.	.
12.55	0.0720	0.11	Q	.	.	.	.
12.73	0.0736	0.12	Q	.	.	.	.
12.90	0.0754	0.12	Q	.	.	.	.
13.07	0.0772	0.13	Q	.	.	.	.
13.24	0.0790	0.13	Q	.	.	.	.
13.41	0.0810	0.14	Q	.	.	.	.

```
13.59      0.0830      0.14  Q         .         .         .         .
13.76      0.0851      0.15  Q         .         .         .         .
13.93      0.0873      0.16  Q         .         .         .         .
14.10      0.0896      0.17  Q         .         .         .         .
14.28      0.0920      0.17  Q         .         .         .         .
14.45      0.0945      0.18  Q         .         .         .         .
14.62      0.0972      0.19  Q         .         .         .         .
14.79      0.1001      0.22  Q         .         .         .         .
14.97      0.1033      0.23  Q         .         .         .         .
15.14      0.1068      0.27  .Q        .         .         .         .
15.31      0.1108      0.29  .Q        .         .         .         .
15.48      0.1164      0.50  .Q        .         .         .         .
15.66      0.1242      0.59  . Q       .         .         .         .
15.83      0.1376      1.30  .    Q    .         .         .         .
16.00      0.1600      1.85  .      Q  .         .         .         .
16.17      0.2073      4.78  .         .        Q.         .         .
16.34      0.2468      0.76  .  Q      .         .         .         .
16.52      0.2545      0.32  .Q        .         .         .         .
16.69      0.2585      0.25  Q         .         .         .         .
16.86      0.2617      0.20  Q         .         .         .         .
17.03      0.2644      0.18  Q         .         .         .         .
17.21      0.2668      0.16  Q         .         .         .         .
17.38      0.2691      0.15  Q         .         .         .         .
17.55      0.2711      0.14  Q         .         .         .         .
17.72      0.2730      0.13  Q         .         .         .         .
17.90      0.2747      0.12  Q         .         .         .         .
18.07      0.2763      0.11  Q         .         .         .         .
18.24      0.2779      0.11  Q         .         .         .         .
18.41      0.2794      0.11  Q         .         .         .         .
18.58      0.2809      0.10  Q         .         .         .         .
18.76      0.2823      0.10  Q         .         .         .         .
18.93      0.2837      0.09  Q         .         .         .         .
19.10      0.2850      0.09  Q         .         .         .         .
19.27      0.2862      0.09  Q         .         .         .         .
19.45      0.2874      0.08  Q         .         .         .         .
19.62      0.2886      0.08  Q         .         .         .         .
19.79      0.2897      0.08  Q         .         .         .         .
19.96      0.2908      0.08  Q         .         .         .         .
20.14      0.2919      0.07  Q         .         .         .         .
20.31      0.2929      0.07  Q         .         .         .         .
20.48      0.2939      0.07  Q         .         .         .         .
20.65      0.2949      0.07  Q         .         .         .         .
20.83      0.2958      0.07  Q         .         .         .         .
21.00      0.2968      0.06  Q         .         .         .         .
21.17      0.2977      0.06  Q         .         .         .         .
21.34      0.2986      0.06  Q         .         .         .         .
21.51      0.2994      0.06  Q         .         .         .         .
21.69      0.3003      0.06  Q         .         .         .         .
21.86      0.3011      0.06  Q         .         .         .         .
22.03      0.3019      0.06  Q         .         .         .         .
22.20      0.3027      0.06  Q         .         .         .         .
22.38      0.3035      0.05  Q         .         .         .         .
22.55      0.3043      0.05  Q         .         .         .         .
22.72      0.3051      0.05  Q         .         .         .         .
22.89      0.3058      0.05  Q         .         .         .         .
23.07      0.3066      0.05  Q         .         .         .         .
23.24      0.3073      0.05  Q         .         .         .         .
23.41      0.3080      0.05  Q         .         .         .         .
23.58      0.3087      0.05  Q         .         .         .         .
23.76      0.3094      0.05  Q         .         .         .         .
23.93      0.3101      0.05  Q         .         .         .         .
24.10      0.3107      0.05  Q         .         .         .         .
24.27      0.3111      0.00  Q         .         .         .         .
```

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%	1447.6
10%	62.0
20%	31.0
30%	20.7
40%	10.3
50%	10.3
60%	10.3
70%	10.3
80%	10.3
90%	10.3

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****************************************************************************
                      SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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              Ver. 19.3  Release Date: 12/28/2012  License ID 1645

                          Analysis prepared by:

                         Walker Engineering, LLC
                       5765 S. Rainbow Blvd. Ste. 101
                           Las Vegas, NV 89118
                       Meeting Your Development Needs
****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
      RETAIL BUILDING AT OLD WOMAN SPRINGS ROAD & CEDARBIRD ROAD
  25 YEAR ANALYSIS - PRON1
  1260.00
----------------------------------------------------------------------------


   RATIONAL METHOD CALIBRATION COEFFICIENT = 1.50
   TOTAL CATCHMENT AREA(ACRES) =    0.74
   SOIL-LOSS RATE, Fm,(INCH/HR) =  0.380
   LOW LOSS FRACTION = 0.890
   TIME OF CONCENTRATION(MIN.) =  6.75
   SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
   USER SPECIFIED RAINFALL VALUES ARE USED
   RETURN FREQUENCY(YEARS) =  25
      5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.33
     30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.87
      1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.19
      3-HOUR   POINT RAINFALL VALUE(INCHES) =  1.70
      6-HOUR   POINT RAINFALL VALUE(INCHES) =  2.16
     24-HOUR   POINT RAINFALL VALUE(INCHES) =  3.50

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

   TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.10
   TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.12

****************************************************************************
  TIME     VOLUME       Q    0.         2.5        5.0        7.5       10.0
 (HOURS)    (AF)      (CFS)
----------------------------------------------------------------------------
  0.03     0.0000      0.00  Q          .          .          .          .
  0.14     0.0000      0.01  Q          .          .          .          .
  0.25     0.0001      0.01  Q          .          .          .          .
  0.36     0.0001      0.01  Q          .          .          .          .
  0.47     0.0002      0.01  Q          .          .          .          .
  0.59     0.0003      0.01  Q          .          .          .          .
  0.70     0.0003      0.01  Q          .          .          .          .
  0.81     0.0004      0.01  Q          .          .          .          .
  0.93     0.0004      0.01  Q          .          .          .          .
  1.04     0.0005      0.01  Q          .          .          .          .
  1.15     0.0006      0.01  Q          .          .          .          .
  1.26     0.0006      0.01  Q          .          .          .          .
  1.38     0.0007      0.01  Q          .          .          .          .
  1.49     0.0007      0.01  Q          .          .          .          .
  1.60     0.0008      0.01  Q          .          .          .          .
```

1.71	0.0009	0.01	Q	.	.	.	.
1.83	0.0009	0.01	Q	.	.	.	.
1.94	0.0010	0.01	Q	.	.	.	.
2.05	0.0011	0.01	Q	.	.	.	.
2.16	0.0011	0.01	Q	.	.	.	.
2.28	0.0012	0.01	Q	.	.	.	.
2.39	0.0012	0.01	Q	.	.	.	.
2.50	0.0013	0.01	Q	.	.	.	.
2.61	0.0014	0.01	Q	.	.	.	.
2.72	0.0014	0.01	Q	.	.	.	.
2.84	0.0015	0.01	Q	.	.	.	.
2.95	0.0016	0.01	Q	.	.	.	.
3.06	0.0016	0.01	Q	.	.	.	.
3.17	0.0017	0.01	Q	.	.	.	.
3.29	0.0018	0.01	Q	.	.	.	.
3.40	0.0018	0.01	Q	.	.	.	.
3.51	0.0019	0.01	Q	.	.	.	.
3.62	0.0020	0.01	Q	.	.	.	.
3.74	0.0020	0.01	Q	.	.	.	.
3.85	0.0021	0.01	Q	.	.	.	.
3.96	0.0022	0.01	Q	.	.	.	.
4.07	0.0022	0.01	Q	.	.	.	.
4.19	0.0023	0.01	Q	.	.	.	.
4.30	0.0024	0.01	Q	.	.	.	.
4.41	0.0024	0.01	Q	.	.	.	.
4.53	0.0025	0.01	Q	.	.	.	.
4.64	0.0026	0.01	Q	.	.	.	.
4.75	0.0027	0.01	Q	.	.	.	.
4.86	0.0027	0.01	Q	.	.	.	.
4.97	0.0028	0.01	Q	.	.	.	.
5.09	0.0029	0.01	Q	.	.	.	.
5.20	0.0030	0.01	Q	.	.	.	.
5.31	0.0030	0.01	Q	.	.	.	.
5.43	0.0031	0.01	Q	.	.	.	.
5.54	0.0032	0.01	Q	.	.	.	.
5.65	0.0033	0.01	Q	.	.	.	.
5.76	0.0033	0.01	Q	.	.	.	.
5.88	0.0034	0.01	Q	.	.	.	.
5.99	0.0035	0.01	Q	.	.	.	.
6.10	0.0036	0.01	Q	.	.	.	.
6.21	0.0036	0.01	Q	.	.	.	.
6.32	0.0037	0.01	Q	.	.	.	.
6.44	0.0038	0.01	Q	.	.	.	.
6.55	0.0039	0.01	Q	.	.	.	.
6.66	0.0040	0.01	Q	.	.	.	.
6.78	0.0040	0.01	Q	.	.	.	.
6.89	0.0041	0.01	Q	.	.	.	.
7.00	0.0042	0.01	Q	.	.	.	.
7.11	0.0043	0.01	Q	.	.	.	.
7.22	0.0044	0.01	Q	.	.	.	.
7.34	0.0045	0.01	Q	.	.	.	.
7.45	0.0045	0.01	Q	.	.	.	.
7.56	0.0046	0.01	Q	.	.	.	.
7.68	0.0047	0.01	Q	.	.	.	.
7.79	0.0048	0.01	Q	.	.	.	.
7.90	0.0049	0.01	Q	.	.	.	.
8.01	0.0050	0.01	Q	.	.	.	.
8.12	0.0051	0.01	Q	.	.	.	.
8.24	0.0052	0.01	Q	.	.	.	.
8.35	0.0053	0.01	Q	.	.	.	.
8.46	0.0054	0.01	Q	.	.	.	.
8.57	0.0055	0.01	Q	.	.	.	.
8.69	0.0055	0.01	Q	.	.	.	.

8.80	0.0056	0.01	Q	.	.	.	.
8.91	0.0057	0.01	Q	.	.	.	.
9.02	0.0058	0.01	Q	.	.	.	.
9.14	0.0059	0.01	Q	.	.	.	.
9.25	0.0060	0.01	Q	.	.	.	.
9.36	0.0061	0.01	Q	.	.	.	.
9.48	0.0062	0.01	Q	.	.	.	.
9.59	0.0063	0.01	Q	.	.	.	.
9.70	0.0064	0.01	Q	.	.	.	.
9.81	0.0065	0.01	Q	.	.	.	.
9.93	0.0067	0.01	Q	.	.	.	.
10.04	0.0068	0.01	Q	.	.	.	.
10.15	0.0069	0.01	Q	.	.	.	.
10.26	0.0070	0.01	Q	.	.	.	.
10.38	0.0071	0.01	Q	.	.	.	.
10.49	0.0072	0.01	Q	.	.	.	.
10.60	0.0073	0.01	Q	.	.	.	.
10.71	0.0074	0.01	Q	.	.	.	.
10.82	0.0076	0.01	Q	.	.	.	.
10.94	0.0077	0.01	Q	.	.	.	.
11.05	0.0078	0.01	Q	.	.	.	.
11.16	0.0079	0.01	Q	.	.	.	.
11.27	0.0080	0.01	Q	.	.	.	.
11.39	0.0082	0.01	Q	.	.	.	.
11.50	0.0083	0.01	Q	.	.	.	.
11.61	0.0084	0.01	Q	.	.	.	.
11.73	0.0086	0.01	Q	.	.	.	.
11.84	0.0087	0.01	Q	.	.	.	.
11.95	0.0088	0.01	Q	.	.	.	.
12.06	0.0090	0.02	Q	.	.	.	.
12.18	0.0091	0.02	Q	.	.	.	.
12.29	0.0093	0.02	Q	.	.	.	.
12.40	0.0094	0.02	Q	.	.	.	.
12.51	0.0096	0.02	Q	.	.	.	.
12.62	0.0097	0.02	Q	.	.	.	.
12.74	0.0099	0.02	Q	.	.	.	.
12.85	0.0100	0.02	Q	.	.	.	.
12.96	0.0102	0.02	Q	.	.	.	.
13.07	0.0104	0.02	Q	.	.	.	.
13.19	0.0105	0.02	Q	.	.	.	.
13.30	0.0107	0.02	Q	.	.	.	.
13.41	0.0109	0.02	Q	.	.	.	.
13.52	0.0111	0.02	Q	.	.	.	.
13.64	0.0113	0.02	Q	.	.	.	.
13.75	0.0115	0.02	Q	.	.	.	.
13.86	0.0117	0.02	Q	.	.	.	.
13.98	0.0119	0.02	Q	.	.	.	.
14.09	0.0121	0.02	Q	.	.	.	.
14.20	0.0123	0.02	Q	.	.	.	.
14.31	0.0125	0.02	Q	.	.	.	.
14.43	0.0128	0.03	Q	.	.	.	.
14.54	0.0130	0.03	Q	.	.	.	.
14.65	0.0133	0.03	Q	.	.	.	.
14.76	0.0135	0.03	Q	.	.	.	.
14.88	0.0138	0.03	Q	.	.	.	.
14.99	0.0141	0.03	Q	.	.	.	.
15.10	0.0144	0.04	Q	.	.	.	.
15.21	0.0148	0.04	Q	.	.	.	.
15.32	0.0152	0.04	Q	.	.	.	.
15.44	0.0162	0.17	Q	.	.	.	.
15.55	0.0180	0.23	Q	.	.	.	.
15.66	0.0208	0.36	.Q	.	.	.	.
15.77	0.0249	0.52	. Q	.	.	.	.

```
 15.89      0.0317      0.95  .  Q       .         .         .         .
 16.00      0.0422      1.32  .    Q     .         .         .         .
 16.11      0.0642      3.41  .          .  Q      .         .         .
 16.23      0.0835      0.75  . Q        .         .         .         .
 16.34      0.0883      0.29  .Q         .         .         .         .
 16.45      0.0899      0.05  Q          .         .         .         .
 16.56      0.0903      0.04  Q          .         .         .         .
 16.67      0.0906      0.03  Q          .         .         .         .
 16.79      0.0909      0.03  Q          .         .         .         .
 16.90      0.0911      0.03  Q          .         .         .         .
 17.01      0.0914      0.02  Q          .         .         .         .
 17.12      0.0916      0.02  Q          .         .         .         .
 17.24      0.0918      0.02  Q          .         .         .         .
 17.35      0.0920      0.02  Q          .         .         .         .
 17.46      0.0922      0.02  Q          .         .         .         .
 17.58      0.0924      0.02  Q          .         .         .         .
 17.69      0.0925      0.02  Q          .         .         .         .
 17.80      0.0927      0.02  Q          .         .         .         .
 17.91      0.0928      0.02  Q          .         .         .         .
 18.02      0.0930      0.02  Q          .         .         .         .
 18.14      0.0931      0.02  Q          .         .         .         .
 18.25      0.0933      0.01  Q          .         .         .         .
 18.36      0.0934      0.01  Q          .         .         .         .
 18.48      0.0935      0.01  Q          .         .         .         .
 18.59      0.0937      0.01  Q          .         .         .         .
 18.70      0.0938      0.01  Q          .         .         .         .
 18.81      0.0939      0.01  Q          .         .         .         .
 18.92      0.0940      0.01  Q          .         .         .         .
 19.04      0.0941      0.01  Q          .         .         .         .
 19.15      0.0942      0.01  Q          .         .         .         .
 19.26      0.0943      0.01  Q          .         .         .         .
 19.38      0.0944      0.01  Q          .         .         .         .
 19.49      0.0945      0.01  Q          .         .         .         .
 19.60      0.0946      0.01  Q          .         .         .         .
 19.71      0.0947      0.01  Q          .         .         .         .
 19.83      0.0948      0.01  Q          .         .         .         .
 19.94      0.0949      0.01  Q          .         .         .         .
 20.05      0.0950      0.01  Q          .         .         .         .
 20.16      0.0951      0.01  Q          .         .         .         .
 20.27      0.0952      0.01  Q          .         .         .         .
 20.39      0.0953      0.01  Q          .         .         .         .
 20.50      0.0954      0.01  Q          .         .         .         .
 20.61      0.0955      0.01  Q          .         .         .         .
 20.73      0.0955      0.01  Q          .         .         .         .
 20.84      0.0956      0.01  Q          .         .         .         .
 20.95      0.0957      0.01  Q          .         .         .         .
 21.06      0.0958      0.01  Q          .         .         .         .
 21.17      0.0959      0.01  Q          .         .         .         .
 21.29      0.0959      0.01  Q          .         .         .         .
 21.40      0.0960      0.01  Q          .         .         .         .
 21.51      0.0961      0.01  Q          .         .         .         .
 21.62      0.0962      0.01  Q          .         .         .         .
 21.74      0.0962      0.01  Q          .         .         .         .
 21.85      0.0963      0.01  Q          .         .         .         .
 21.96      0.0964      0.01  Q          .         .         .         .
 22.08      0.0964      0.01  Q          .         .         .         .
 22.19      0.0965      0.01  Q          .         .         .         .
 22.30      0.0966      0.01  Q          .         .         .         .
 22.41      0.0967      0.01  Q          .         .         .         .
 22.52      0.0967      0.01  Q          .         .         .         .
 22.64      0.0968      0.01  Q          .         .         .         .
 22.75      0.0968      0.01  Q          .         .         .         .
 22.86      0.0969      0.01  Q          .         .         .         .
```

```
 22.98        0.0970       0.01  Q          .         .         .         .
 23.09        0.0970       0.01  Q          .         .         .         .
 23.20        0.0971       0.01  Q          .         .         .         .
 23.31        0.0972       0.01  Q          .         .         .         .
 23.42        0.0972       0.01  Q          .         .         .         .
 23.54        0.0973       0.01  Q          .         .         .         .
 23.65        0.0973       0.01  Q          .         .         .         .
 23.76        0.0974       0.01  Q          .         .         .         .
 23.88        0.0975       0.01  Q          .         .         .         .
 23.99        0.0975       0.01  Q          .         .         .         .
 24.10        0.0976       0.01  Q          .         .         .         .
 24.21        0.0976       0.00  Q          .         .         .         .
----------------------------------------------------------------------------
```

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%	1444.5
10%	40.5
20%	27.0
30%	13.5
40%	6.8
50%	6.8
60%	6.8
70%	6.8
80%	6.8
90%	6.8

```
****************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
        (C) Copyright 1989-2012 Advanced Engineering Software (aes)
            Ver. 19.3  Release Date: 12/28/2012  License ID 1645

                        Analysis prepared by:

                      Walker Engineering, LLC
                   5765 S. Rainbow Blvd. Ste. 101
                       Las Vegas, NV 89118
                  Meeting Your Development Needs
****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
 RETAIL BLDG  AT OLD WOMAN SPRINGS ROAD & CEDARBIRD ROAD
 100 YEAR ANALYSIS - PRON1
 1260.00
----------------------------------------------------------------------------


   RATIONAL METHOD CALIBRATION COEFFICIENT = 1.48
   TOTAL CATCHMENT AREA(ACRES) =    0.74
   SOIL-LOSS RATE, Fm,(INCH/HR) =  0.380
   LOW LOSS FRACTION = 0.800
   TIME OF CONCENTRATION(MIN.) =  6.75
   SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
   USER SPECIFIED RAINFALL VALUES ARE USED
   RETURN FREQUENCY(YEARS) = 100
      5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.47
     30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.24
      1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.70
      3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.38
      6-HOUR   POINT RAINFALL VALUE(INCHES) =  2.98
     24-HOUR   POINT RAINFALL VALUE(INCHES) =  4.83

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

   TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.18
   TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.12

****************************************************************************
  TIME     VOLUME       Q    0.        2.5       5.0       7.5      10.0
 (HOURS)    (AF)      (CFS)
----------------------------------------------------------------------------
  0.03     0.0000     0.00  Q          .         .         .         .
  0.14     0.0001     0.02  Q          .         .         .         .
  0.25     0.0002     0.02  Q          .         .         .         .
  0.36     0.0004     0.02  Q          .         .         .         .
  0.47     0.0005     0.02  Q          .         .         .         .
  0.59     0.0006     0.02  Q          .         .         .         .
  0.70     0.0008     0.02  Q          .         .         .         .
  0.81     0.0009     0.02  Q          .         .         .         .
  0.93     0.0011     0.02  Q          .         .         .         .
  1.04     0.0012     0.02  Q          .         .         .         .
  1.15     0.0014     0.02  Q          .         .         .         .
  1.26     0.0015     0.02  Q          .         .         .         .
  1.38     0.0017     0.02  Q          .         .         .         .
  1.49     0.0018     0.02  Q          .         .         .         .
  1.60     0.0020     0.02  Q          .         .         .         .
```

1.71	0.0021	0.02	Q		.	.	.	.
1.83	0.0023	0.02	Q		.	.	.	.
1.94	0.0024	0.02	Q		.	.	.	.
2.05	0.0026	0.02	Q		.	.	.	.
2.16	0.0028	0.02	Q		.	.	.	.
2.28	0.0029	0.02	Q		.	.	.	.
2.39	0.0031	0.02	Q		.	.	.	.
2.50	0.0032	0.02	Q		.	.	.	.
2.61	0.0034	0.02	Q		.	.	.	.
2.72	0.0036	0.02	Q		.	.	.	.
2.84	0.0037	0.02	Q		.	.	.	.
2.95	0.0039	0.02	Q		.	.	.	.
3.06	0.0040	0.02	Q		.	.	.	.
3.17	0.0042	0.02	Q		.	.	.	.
3.29	0.0044	0.02	Q		.	.	.	.
3.40	0.0045	0.02	Q		.	.	.	.
3.51	0.0047	0.02	Q		.	.	.	.
3.62	0.0049	0.02	Q		.	.	.	.
3.74	0.0050	0.02	Q		.	.	.	.
3.85	0.0052	0.02	Q		.	.	.	.
3.96	0.0054	0.02	Q		.	.	.	.
4.07	0.0055	0.02	Q		.	.	.	.
4.19	0.0057	0.02	Q		.	.	.	.
4.30	0.0059	0.02	Q		.	.	.	.
4.41	0.0061	0.02	Q		.	.	.	.
4.53	0.0062	0.02	Q		.	.	.	.
4.64	0.0064	0.02	Q		.	.	.	.
4.75	0.0066	0.02	Q		.	.	.	.
4.86	0.0068	0.02	Q		.	.	.	.
4.97	0.0070	0.02	Q		.	.	.	.
5.09	0.0071	0.02	Q		.	.	.	.
5.20	0.0073	0.02	Q		.	.	.	.
5.31	0.0075	0.02	Q		.	.	.	.
5.43	0.0077	0.02	Q		.	.	.	.
5.54	0.0079	0.02	Q		.	.	.	.
5.65	0.0081	0.02	Q		.	.	.	.
5.76	0.0083	0.02	Q		.	.	.	.
5.88	0.0084	0.02	Q		.	.	.	.
5.99	0.0086	0.02	Q		.	.	.	.
6.10	0.0088	0.02	Q		.	.	.	.
6.21	0.0090	0.02	Q		.	.	.	.
6.32	0.0092	0.02	Q		.	.	.	.
6.44	0.0094	0.02	Q		.	.	.	.
6.55	0.0096	0.02	Q		.	.	.	.
6.66	0.0098	0.02	Q		.	.	.	.
6.78	0.0100	0.02	Q		.	.	.	.
6.89	0.0102	0.02	Q		.	.	.	.
7.00	0.0104	0.02	Q		.	.	.	.
7.11	0.0106	0.02	Q		.	.	.	.
7.22	0.0108	0.02	Q		.	.	.	.
7.34	0.0111	0.02	Q		.	.	.	.
7.45	0.0113	0.02	Q		.	.	.	.
7.56	0.0115	0.02	Q		.	.	.	.
7.68	0.0117	0.02	Q		.	.	.	.
7.79	0.0119	0.02	Q		.	.	.	.
7.90	0.0121	0.02	Q		.	.	.	.
8.01	0.0124	0.02	Q		.	.	.	.
8.12	0.0126	0.02	Q		.	.	.	.
8.24	0.0128	0.02	Q		.	.	.	.
8.35	0.0130	0.02	Q		.	.	.	.
8.46	0.0133	0.02	Q		.	.	.	.
8.57	0.0135	0.03	Q		.	.	.	.
8.69	0.0137	0.03	Q		.	.	.	.

8.80	0.0140	0.03	Q . . . .
8.91	0.0142	0.03	Q . . . .
9.02	0.0145	0.03	Q . . . .
9.14	0.0147	0.03	Q . . . .
9.25	0.0149	0.03	Q . . . .
9.36	0.0152	0.03	Q . . . .
9.48	0.0154	0.03	Q . . . .
9.59	0.0157	0.03	Q . . . .
9.70	0.0160	0.03	Q . . . .
9.81	0.0162	0.03	Q . . . .
9.93	0.0165	0.03	Q . . . .
10.04	0.0168	0.03	Q . . . .
10.15	0.0170	0.03	Q . . . .
10.26	0.0173	0.03	Q . . . .
10.38	0.0176	0.03	Q . . . .
10.49	0.0179	0.03	Q . . . .
10.60	0.0181	0.03	Q . . . .
10.71	0.0184	0.03	Q . . . .
10.82	0.0187	0.03	Q . . . .
10.94	0.0190	0.03	Q . . . .
11.05	0.0193	0.03	Q . . . .
11.16	0.0196	0.03	Q . . . .
11.27	0.0199	0.03	Q . . . .
11.39	0.0202	0.03	Q . . . .
11.50	0.0206	0.03	Q . . . .
11.61	0.0209	0.04	Q . . . .
11.73	0.0212	0.04	Q . . . .
11.84	0.0216	0.04	Q . . . .
11.95	0.0219	0.04	Q . . . .
12.06	0.0222	0.04	Q . . . .
12.18	0.0226	0.04	Q . . . .
12.29	0.0229	0.04	Q . . . .
12.40	0.0233	0.04	Q . . . .
12.51	0.0236	0.04	Q . . . .
12.62	0.0240	0.04	Q . . . .
12.74	0.0243	0.04	Q . . . .
12.85	0.0247	0.04	Q . . . .
12.96	0.0251	0.04	Q . . . .
13.07	0.0255	0.04	Q . . . .
13.19	0.0259	0.04	Q . . . .
13.30	0.0263	0.04	Q . . . .
13.41	0.0267	0.05	Q . . . .
13.52	0.0272	0.05	Q . . . .
13.64	0.0276	0.05	Q . . . .
13.75	0.0281	0.05	Q . . . .
13.86	0.0285	0.05	Q . . . .
13.98	0.0290	0.05	Q . . . .
14.09	0.0295	0.05	Q . . . .
14.20	0.0301	0.05	Q . . . .
14.31	0.0306	0.06	Q . . . .
14.43	0.0311	0.06	Q . . . .
14.54	0.0317	0.06	Q . . . .
14.65	0.0323	0.07	Q . . . .
14.76	0.0329	0.07	Q . . . .
14.88	0.0336	0.07	Q . . . .
14.99	0.0343	0.08	Q . . . .
15.10	0.0351	0.09	Q . . . .
15.21	0.0360	0.10	Q . . . .
15.32	0.0369	0.10	Q . . . .
15.44	0.0393	0.42	.Q . . . .
15.55	0.0437	0.51	. Q . . . .
15.66	0.0492	0.69	. Q . . . .
15.77	0.0567	0.92	. Q . . . .

```
15.89      0.0680       1.51  .     Q   .         .         .         .
16.00      0.0844       2.04  .       Q .         .         .         .
16.11      0.1170       4.97  .         .        Q.         .         .
16.23      0.1458       1.23  .   Q     .         .         .         .
16.34      0.1542       0.59  . Q       .         .         .         .
16.45      0.1576       0.13  Q         .         .         .         .
16.56      0.1586       0.09  Q         .         .         .         .
16.67      0.1594       0.08  Q         .         .         .         .
16.79      0.1601       0.07  Q         .         .         .         .
16.90      0.1607       0.06  Q         .         .         .         .
17.01      0.1612       0.06  Q         .         .         .         .
17.12      0.1617       0.06  Q         .         .         .         .
17.24      0.1622       0.05  Q         .         .         .         .
17.35      0.1627       0.05  Q         .         .         .         .
17.46      0.1631       0.05  Q         .         .         .         .
17.58      0.1635       0.04  Q         .         .         .         .
17.69      0.1639       0.04  Q         .         .         .         .
17.80      0.1643       0.04  Q         .         .         .         .
17.91      0.1647       0.04  Q         .         .         .         .
18.02      0.1650       0.04  Q         .         .         .         .
18.14      0.1653       0.04  Q         .         .         .         .
18.25      0.1657       0.04  Q         .         .         .         .
18.36      0.1660       0.03  Q         .         .         .         .
18.48      0.1663       0.03  Q         .         .         .         .
18.59      0.1666       0.03  Q         .         .         .         .
18.70      0.1669       0.03  Q         .         .         .         .
18.81      0.1672       0.03  Q         .         .         .         .
18.92      0.1675       0.03  Q         .         .         .         .
19.04      0.1678       0.03  Q         .         .         .         .
19.15      0.1681       0.03  Q         .         .         .         .
19.26      0.1683       0.03  Q         .         .         .         .
19.38      0.1686       0.03  Q         .         .         .         .
19.49      0.1688       0.03  Q         .         .         .         .
19.60      0.1691       0.03  Q         .         .         .         .
19.71      0.1693       0.03  Q         .         .         .         .
19.83      0.1696       0.03  Q         .         .         .         .
19.94      0.1698       0.02  Q         .         .         .         .
20.05      0.1700       0.02  Q         .         .         .         .
20.16      0.1703       0.02  Q         .         .         .         .
20.27      0.1705       0.02  Q         .         .         .         .
20.39      0.1707       0.02  Q         .         .         .         .
20.50      0.1709       0.02  Q         .         .         .         .
20.61      0.1711       0.02  Q         .         .         .         .
20.73      0.1713       0.02  Q         .         .         .         .
20.84      0.1715       0.02  Q         .         .         .         .
20.95      0.1717       0.02  Q         .         .         .         .
21.06      0.1719       0.02  Q         .         .         .         .
21.17      0.1721       0.02  Q         .         .         .         .
21.29      0.1723       0.02  Q         .         .         .         .
21.40      0.1725       0.02  Q         .         .         .         .
21.51      0.1727       0.02  Q         .         .         .         .
21.62      0.1729       0.02  Q         .         .         .         .
21.74      0.1730       0.02  Q         .         .         .         .
21.85      0.1732       0.02  Q         .         .         .         .
21.96      0.1734       0.02  Q         .         .         .         .
22.08      0.1736       0.02  Q         .         .         .         .
22.19      0.1737       0.02  Q         .         .         .         .
22.30      0.1739       0.02  Q         .         .         .         .
22.41      0.1741       0.02  Q         .         .         .         .
22.52      0.1742       0.02  Q         .         .         .         .
22.64      0.1744       0.02  Q         .         .         .         .
22.75      0.1746       0.02  Q         .         .         .         .
22.86      0.1747       0.02  Q         .         .         .         .
```

```
22.98        0.1749       0.02  Q           .         .         .         .
23.09        0.1750       0.02  Q           .         .         .         .
23.20        0.1752       0.02  Q           .         .         .         .
23.31        0.1754       0.02  Q           .         .         .         .
23.42        0.1755       0.02  Q           .         .         .         .
23.54        0.1757       0.02  Q           .         .         .         .
23.65        0.1758       0.02  Q           .         .         .         .
23.76        0.1759       0.02  Q           .         .         .         .
23.88        0.1761       0.02  Q           .         .         .         .
23.99        0.1762       0.02  Q           .         .         .         .
24.10        0.1764       0.02  Q           .         .         .         .
24.21        0.1765       0.00  Q           .         .         .         .
-----------------------------------------------------------------------------
--------------------------------------------------------------------------------
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                  Duration
        Peak Flow Rate                       (minutes)
    =======================                  =========
                0%                            1444.5
               10%                              54.0
               20%                              27.0
               30%                              20.2
               40%                              13.5
               50%                               6.8
               60%                               6.8
               70%                               6.8
               80%                               6.8
               90%                               6.8
```

****

SMALL AREA UNIT HYDROGRAPH MODEL

==

Analysis prepared by:

Walker Engineering, LLC
5765 S. Rainbow Blvd. Ste. 101
Las Vegas, NV 89118
Meeting Your Development Needs

****

Problem Descriptions:
RETAIL BUILDING AT OLD WOMAN SPRINGS ROAD & CEDARBIRD ROAD
25 YEAR ANALYSIS - PRON2
1260.00

```
RATIONAL METHOD CALIBRATION COEFFICIENT = 1.39
TOTAL CATCHMENT AREA(ACRES) =    1.11
SOIL-LOSS RATE, Fm,(INCH/HR) =  0.380
LOW LOSS FRACTION = 0.890
TIME OF CONCENTRATION(MIN.) =  9.37
SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
USER SPECIFIED RAINFALL VALUES ARE USED
RETURN FREQUENCY(YEARS) =  25
   5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.33
  30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.87
   1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.19
   3-HOUR   POINT RAINFALL VALUE(INCHES) =  1.70
   6-HOUR   POINT RAINFALL VALUE(INCHES) =  2.16
  24-HOUR   POINT RAINFALL VALUE(INCHES) =  3.50
```

```
TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.14
TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.19
```

****

TIME (HOURS)	VOLUME (AF)	Q (CFS)	0.	2.5	5.0	7.5	10.0
0.07	0.0000	0.00	Q	.	.	.	.
0.23	0.0001	0.01	Q	.	.	.	.
0.38	0.0002	0.01	Q	.	.	.	.
0.54	0.0003	0.01	Q	.	.	.	.
0.70	0.0004	0.01	Q	.	.	.	.
0.85	0.0005	0.01	Q	.	.	.	.
1.01	0.0006	0.01	Q	.	.	.	.
1.16	0.0007	0.01	Q	.	.	.	.
1.32	0.0009	0.01	Q	.	.	.	.
1.48	0.0010	0.01	Q	.	.	.	.
1.63	0.0011	0.01	Q	.	.	.	.
1.79	0.0012	0.01	Q	.	.	.	.
1.95	0.0013	0.01	Q	.	.	.	.
2.10	0.0015	0.01	Q	.	.	.	.
2.26	0.0016	0.01	Q	.	.	.	.

2.41	0.0017	0.01	Q	.	.	.	.
2.57	0.0018	0.01	Q	.	.	.	.
2.73	0.0019	0.01	Q	.	.	.	.
2.88	0.0021	0.01	Q	.	.	.	.
3.04	0.0022	0.01	Q	.	.	.	.
3.19	0.0023	0.01	Q	.	.	.	.
3.35	0.0024	0.01	Q	.	.	.	.
3.51	0.0026	0.01	Q	.	.	.	.
3.66	0.0027	0.01	Q	.	.	.	.
3.82	0.0028	0.01	Q	.	.	.	.
3.98	0.0030	0.01	Q	.	.	.	.
4.13	0.0031	0.01	Q	.	.	.	.
4.29	0.0032	0.01	Q	.	.	.	.
4.44	0.0034	0.01	Q	.	.	.	.
4.60	0.0035	0.01	Q	.	.	.	.
4.76	0.0037	0.01	Q	.	.	.	.
4.91	0.0038	0.01	Q	.	.	.	.
5.07	0.0039	0.01	Q	.	.	.	.
5.22	0.0041	0.01	Q	.	.	.	.
5.38	0.0042	0.01	Q	.	.	.	.
5.54	0.0044	0.01	Q	.	.	.	.
5.69	0.0045	0.01	Q	.	.	.	.
5.85	0.0047	0.01	Q	.	.	.	.
6.01	0.0048	0.01	Q	.	.	.	.
6.16	0.0050	0.01	Q	.	.	.	.
6.32	0.0051	0.01	Q	.	.	.	.
6.47	0.0053	0.01	Q	.	.	.	.
6.63	0.0054	0.01	Q	.	.	.	.
6.79	0.0056	0.01	Q	.	.	.	.
6.94	0.0057	0.01	Q	.	.	.	.
7.10	0.0059	0.01	Q	.	.	.	.
7.25	0.0061	0.01	Q	.	.	.	.
7.41	0.0062	0.01	Q	.	.	.	.
7.57	0.0064	0.01	Q	.	.	.	.
7.72	0.0066	0.01	Q	.	.	.	.
7.88	0.0067	0.01	Q	.	.	.	.
8.04	0.0069	0.01	Q	.	.	.	.
8.19	0.0071	0.01	Q	.	.	.	.
8.35	0.0073	0.01	Q	.	.	.	.
8.50	0.0074	0.01	Q	.	.	.	.
8.66	0.0076	0.01	Q	.	.	.	.
8.82	0.0078	0.01	Q	.	.	.	.
8.97	0.0080	0.01	Q	.	.	.	.
9.13	0.0082	0.01	Q	.	.	.	.
9.28	0.0084	0.02	Q	.	.	.	.
9.44	0.0086	0.02	Q	.	.	.	.
9.60	0.0088	0.02	Q	.	.	.	.
9.75	0.0090	0.02	Q	.	.	.	.
9.91	0.0092	0.02	Q	.	.	.	.
10.07	0.0094	0.02	Q	.	.	.	.
10.22	0.0096	0.02	Q	.	.	.	.
10.38	0.0098	0.02	Q	.	.	.	.
10.53	0.0100	0.02	Q	.	.	.	.
10.69	0.0102	0.02	Q	.	.	.	.
10.85	0.0105	0.02	Q	.	.	.	.
11.00	0.0107	0.02	Q	.	.	.	.
11.16	0.0109	0.02	Q	.	.	.	.
11.32	0.0112	0.02	Q	.	.	.	.
11.47	0.0114	0.02	Q	.	.	.	.
11.63	0.0117	0.02	Q	.	.	.	.
11.78	0.0119	0.02	Q	.	.	.	.
11.94	0.0122	0.02	Q	.	.	.	.
12.10	0.0125	0.02	Q	.	.	.	.

12.25	0.0127	0.02	Q . . . .
12.41	0.0130	0.02	Q . . . .
12.56	0.0133	0.02	Q . . . .
12.72	0.0136	0.02	Q . . . .
12.88	0.0139	0.02	Q . . . .
13.03	0.0142	0.03	Q . . . .
13.19	0.0146	0.03	Q . . . .
13.35	0.0149	0.03	Q . . . .
13.50	0.0152	0.03	Q . . . .
13.66	0.0156	0.03	Q . . . .
13.81	0.0160	0.03	Q . . . .
13.97	0.0164	0.03	Q . . . .
14.13	0.0168	0.03	Q . . . .
14.28	0.0172	0.03	Q . . . .
14.44	0.0177	0.03	Q . . . .
14.59	0.0181	0.04	Q . . . .
14.75	0.0186	0.04	Q . . . .
14.91	0.0192	0.04	Q . . . .
15.06	0.0198	0.05	Q . . . .
15.22	0.0204	0.05	Q . . . .
15.38	0.0211	0.06	Q . . . .
15.53	0.0236	0.32	.Q . . . .
15.69	0.0283	0.42	.Q . . . .
15.84	0.0378	1.05	. Q . . . .
16.00	0.0543	1.50	. Q . . . .
16.16	0.0897	3.99	. . Q . . .
16.31	0.1195	0.62	. Q . . . .
16.47	0.1241	0.10	Q . . . .
16.62	0.1251	0.05	Q . . . .
16.78	0.1257	0.04	Q . . . .
16.94	0.1262	0.04	Q . . . .
17.09	0.1266	0.03	Q . . . .
17.25	0.1270	0.03	Q . . . .
17.41	0.1274	0.03	Q . . . .
17.56	0.1278	0.03	Q . . . .
17.72	0.1281	0.02	Q . . . .
17.87	0.1284	0.02	Q . . . .
18.03	0.1287	0.02	Q . . . .
18.19	0.1290	0.02	Q . . . .
18.34	0.1292	0.02	Q . . . .
18.50	0.1295	0.02	Q . . . .
18.65	0.1297	0.02	Q . . . .
18.81	0.1299	0.02	Q . . . .
18.97	0.1302	0.02	Q . . . .
19.12	0.1304	0.02	Q . . . .
19.28	0.1306	0.02	Q . . . .
19.44	0.1308	0.02	Q . . . .
19.59	0.1310	0.01	Q . . . .
19.75	0.1312	0.01	Q . . . .
19.90	0.1314	0.01	Q . . . .
20.06	0.1315	0.01	Q . . . .
20.22	0.1317	0.01	Q . . . .
20.37	0.1319	0.01	Q . . . .
20.53	0.1320	0.01	Q . . . .
20.68	0.1322	0.01	Q . . . .
20.84	0.1324	0.01	Q . . . .
21.00	0.1325	0.01	Q . . . .
21.15	0.1327	0.01	Q . . . .
21.31	0.1328	0.01	Q . . . .
21.47	0.1330	0.01	Q . . . .
21.62	0.1331	0.01	Q . . . .
21.78	0.1333	0.01	Q . . . .
21.93	0.1334	0.01	Q . . . .

```
 22.09       0.1335      0.01  Q         .         .         .         .
 22.25       0.1337      0.01  Q         .         .         .         .
 22.40       0.1338      0.01  Q         .         .         .         .
 22.56       0.1339      0.01  Q         .         .         .         .
 22.72       0.1340      0.01  Q         .         .         .         .
 22.87       0.1342      0.01  Q         .         .         .         .
 23.03       0.1343      0.01  Q         .         .         .         .
 23.18       0.1344      0.01  Q         .         .         .         .
 23.34       0.1345      0.01  Q         .         .         .         .
 23.50       0.1347      0.01  Q         .         .         .         .
 23.65       0.1348      0.01  Q         .         .         .         .
 23.81       0.1349      0.01  Q         .         .         .         .
 23.96       0.1350      0.01  Q         .         .         .         .
 24.12       0.1351      0.01  Q         .         .         .         .
 24.28       0.1352      0.00  Q         .         .         .         .
-----------------------------------------------------------------------------
--------------------------------------------------------------------------------
```

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%	1443.0
10%	46.8
20%	28.1
30%	18.7
40%	9.4
50%	9.4
60%	9.4
70%	9.4
80%	9.4
90%	9.4

```
****************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
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           Ver. 19.3  Release Date: 12/28/2012  License ID 1645

                       Analysis prepared by:
```

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Meeting Your Development Needs

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****************************************************************************
----------------------------------------------------------------------------

Problem Descriptions:
        RETAIL BUILDING AT OLD WOMAN SPRINGS ROAD & CEDARBIRD ROAD
 100 YEAR ANALYSIS - PRON2
 1260.00
----------------------------------------------------------------------------


   RATIONAL METHOD CALIBRATION COEFFICIENT = 1.37
   TOTAL CATCHMENT AREA(ACRES) =     1.11
   SOIL-LOSS RATE, Fm,(INCH/HR) =  0.380
   LOW LOSS FRACTION = 0.800
   TIME OF CONCENTRATION(MIN.) =  9.37
   SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
   USER SPECIFIED RAINFALL VALUES ARE USED
   RETURN FREQUENCY(YEARS) = 100
      5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.47
     30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.24
      1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.70
      3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.38
      6-HOUR   POINT RAINFALL VALUE(INCHES) =  2.98
     24-HOUR   POINT RAINFALL VALUE(INCHES) =  4.83

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

   TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =      0.25
   TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =      0.20

****************************************************************************
  TIME     VOLUME       Q    0.          2.5        5.0        7.5       10.0
 (HOURS)    (AF)      (CFS)
----------------------------------------------------------------------------
  0.07     0.0000      0.00  Q           .          .          .          .
  0.23     0.0001      0.02  Q           .          .          .          .
  0.38     0.0004      0.02  Q           .          .          .          .
  0.54     0.0007      0.02  Q           .          .          .          .
  0.70     0.0010      0.02  Q           .          .          .          .
  0.85     0.0013      0.02  Q           .          .          .          .
  1.01     0.0015      0.02  Q           .          .          .          .
  1.16     0.0018      0.02  Q           .          .          .          .
  1.32     0.0021      0.02  Q           .          .          .          .
  1.48     0.0024      0.02  Q           .          .          .          .
  1.63     0.0027      0.02  Q           .          .          .          .
  1.79     0.0030      0.02  Q           .          .          .          .
  1.95     0.0033      0.02  Q           .          .          .          .
  2.10     0.0036      0.02  Q           .          .          .          .
  2.26     0.0039      0.02  Q           .          .          .          .
```

2.41	0.0042	0.02	Q		.	.	.	.
2.57	0.0045	0.02	Q		.	.	.	.
2.73	0.0048	0.02	Q		.	.	.	.
2.88	0.0051	0.02	Q		.	.	.	.
3.04	0.0054	0.02	Q		.	.	.	.
3.19	0.0058	0.02	Q		.	.	.	.
3.35	0.0061	0.02	Q		.	.	.	.
3.51	0.0064	0.02	Q		.	.	.	.
3.66	0.0067	0.03	Q		.	.	.	.
3.82	0.0070	0.03	Q		.	.	.	.
3.98	0.0074	0.03	Q		.	.	.	.
4.13	0.0077	0.03	Q		.	.	.	.
4.29	0.0080	0.03	Q		.	.	.	.
4.44	0.0084	0.03	Q		.	.	.	.
4.60	0.0087	0.03	Q		.	.	.	.
4.76	0.0091	0.03	Q		.	.	.	.
4.91	0.0094	0.03	Q		.	.	.	.
5.07	0.0097	0.03	Q		.	.	.	.
5.22	0.0101	0.03	Q		.	.	.	.
5.38	0.0105	0.03	Q		.	.	.	.
5.54	0.0108	0.03	Q		.	.	.	.
5.69	0.0112	0.03	Q		.	.	.	.
5.85	0.0115	0.03	Q		.	.	.	.
6.01	0.0119	0.03	Q		.	.	.	.
6.16	0.0123	0.03	Q		.	.	.	.
6.32	0.0127	0.03	Q		.	.	.	.
6.47	0.0130	0.03	Q		.	.	.	.
6.63	0.0134	0.03	Q		.	.	.	.
6.79	0.0138	0.03	Q		.	.	.	.
6.94	0.0142	0.03	Q		.	.	.	.
7.10	0.0146	0.03	Q		.	.	.	.
7.25	0.0150	0.03	Q		.	.	.	.
7.41	0.0154	0.03	Q		.	.	.	.
7.57	0.0158	0.03	Q		.	.	.	.
7.72	0.0163	0.03	Q		.	.	.	.
7.88	0.0167	0.03	Q		.	.	.	.
8.04	0.0171	0.03	Q		.	.	.	.
8.19	0.0175	0.03	Q		.	.	.	.
8.35	0.0180	0.03	Q		.	.	.	.
8.50	0.0184	0.03	Q		.	.	.	.
8.66	0.0189	0.04	Q		.	.	.	.
8.82	0.0193	0.04	Q		.	.	.	.
8.97	0.0198	0.04	Q		.	.	.	.
9.13	0.0203	0.04	Q		.	.	.	.
9.28	0.0207	0.04	Q		.	.	.	.
9.44	0.0212	0.04	Q		.	.	.	.
9.60	0.0217	0.04	Q		.	.	.	.
9.75	0.0222	0.04	Q		.	.	.	.
9.91	0.0227	0.04	Q		.	.	.	.
10.07	0.0232	0.04	Q		.	.	.	.
10.22	0.0237	0.04	Q		.	.	.	.
10.38	0.0243	0.04	Q		.	.	.	.
10.53	0.0248	0.04	Q		.	.	.	.
10.69	0.0254	0.04	Q		.	.	.	.
10.85	0.0259	0.04	Q		.	.	.	.
11.00	0.0265	0.04	Q		.	.	.	.
11.16	0.0271	0.05	Q		.	.	.	.
11.32	0.0277	0.05	Q		.	.	.	.
11.47	0.0283	0.05	Q		.	.	.	.
11.63	0.0289	0.05	Q		.	.	.	.
11.78	0.0296	0.05	Q		.	.	.	.
11.94	0.0302	0.05	Q		.	.	.	.
12.10	0.0309	0.05	Q		.	.	.	.

12.25	0.0315	0.05	Q . . . .
12.41	0.0322	0.05	Q . . . .
12.56	0.0328	0.05	Q . . . .
12.72	0.0335	0.05	Q . . . .
12.88	0.0343	0.06	Q . . . .
13.03	0.0350	0.06	Q . . . .
13.19	0.0358	0.06	Q . . . .
13.35	0.0366	0.06	Q . . . .
13.50	0.0374	0.06	Q . . . .
13.66	0.0382	0.07	Q . . . .
13.81	0.0391	0.07	Q . . . .
13.97	0.0401	0.08	Q . . . .
14.13	0.0411	0.08	Q . . . .
14.28	0.0421	0.08	Q . . . .
14.44	0.0431	0.08	Q . . . .
14.59	0.0442	0.09	Q . . . .
14.75	0.0454	0.09	Q . . . .
14.91	0.0467	0.11	Q . . . .
15.06	0.0481	0.11	Q . . . .
15.22	0.0497	0.13	Q . . . .
15.38	0.0514	0.14	Q . . . .
15.53	0.0569	0.70	. Q . . . .
15.69	0.0669	0.85	. Q . . . .
15.84	0.0836	1.72	. Q . . . .
16.00	0.1099	2.36	. Q. . . .
16.16	0.1629	5.86	. . . Q . .
16.31	0.2080	1.13	. Q . . . .
16.47	0.2177	0.36	.Q . . . .
16.62	0.2208	0.12	Q . . . .
16.78	0.2222	0.10	Q . . . .
16.94	0.2234	0.09	Q . . . .
17.09	0.2245	0.08	Q . . . .
17.25	0.2254	0.07	Q . . . .
17.41	0.2263	0.07	Q . . . .
17.56	0.2271	0.06	Q . . . .
17.72	0.2279	0.06	Q . . . .
17.87	0.2286	0.05	Q . . . .
18.03	0.2293	0.05	Q . . . .
18.19	0.2300	0.05	Q . . . .
18.34	0.2306	0.05	Q . . . .
18.50	0.2312	0.05	Q . . . .
18.65	0.2318	0.05	Q . . . .
18.81	0.2324	0.04	Q . . . .
18.97	0.2330	0.04	Q . . . .
19.12	0.2335	0.04	Q . . . .
19.28	0.2340	0.04	Q . . . .
19.44	0.2345	0.04	Q . . . .
19.59	0.2350	0.04	Q . . . .
19.75	0.2355	0.04	Q . . . .
19.90	0.2359	0.03	Q . . . .
20.06	0.2364	0.03	Q . . . .
20.22	0.2368	0.03	Q . . . .
20.37	0.2372	0.03	Q . . . .
20.53	0.2376	0.03	Q . . . .
20.68	0.2380	0.03	Q . . . .
20.84	0.2384	0.03	Q . . . .
21.00	0.2388	0.03	Q . . . .
21.15	0.2392	0.03	Q . . . .
21.31	0.2396	0.03	Q . . . .
21.47	0.2399	0.03	Q . . . .
21.62	0.2403	0.03	Q . . . .
21.78	0.2406	0.03	Q . . . .
21.93	0.2410	0.03	Q . . . .

```
 22.09       0.2413       0.03  Q         .         .         .         .
 22.25       0.2416       0.03  Q         .         .         .         .
 22.40       0.2420       0.03  Q         .         .         .         .
 22.56       0.2423       0.02  Q         .         .         .         .
 22.72       0.2426       0.02  Q         .         .         .         .
 22.87       0.2429       0.02  Q         .         .         .         .
 23.03       0.2432       0.02  Q         .         .         .         .
 23.18       0.2435       0.02  Q         .         .         .         .
 23.34       0.2438       0.02  Q         .         .         .         .
 23.50       0.2441       0.02  Q         .         .         .         .
 23.65       0.2444       0.02  Q         .         .         .         .
 23.81       0.2447       0.02  Q         .         .         .         .
 23.96       0.2450       0.02  Q         .         .         .         .
 24.12       0.2452       0.02  Q         .         .         .         .
 24.28       0.2454       0.00  Q         .         .         .         .
----------------------------------------------------------------------------
--------------------------------------------------------------------------------
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                 Duration
        Peak Flow Rate                      (minutes)
    =======================                 =========
               0%                            1443.0
              10%                              56.2
              20%                              28.1
              30%                              18.7
              40%                              18.7
              50%                               9.4
              60%                               9.4
              70%                               9.4
              80%                               9.4
              90%                               9.4
```

25 year storm

Basin ID	CN	P24	S	Ia	Y	Ybar	ap	Fp	Fm
EXON1	76	3.5	3.16	0.63	0.39	0.61	1.00	0.45	0.45
EXON2	76	3.5	3.16	0.63	0.39	0.61	1.00	0.45	0.45
PRON1	56	3.5	7.86	1.57	0.11	0.89	0.50	0.75	0.38
PRON2	56	3.5	7.86	1.57	0.11	0.89	0.50	0.75	0.38

100 year storm

Basin ID	CN	P24	S	Ia	Y	Ybar	ap	Fp	Fm
EXON1	76	4.83	3.16	0.63	0.50	0.50	1.00	0.45	0.45
EXON2	76	4.83	3.16	0.63	0.50	0.50	1.00	0.45	0.45
PRON1	56	4.83	7.86	1.57	0.20	0.80	0.50	0.75	0.38
PRON2	56	4.83	7.86	1.57	0.20	0.80	0.50	0.75	0.38

WHERE:

CN = Rational Method AES
P24 = Point precip value from NOAA 14
S = calculated from equation (1000/CN)-10
Ia = calcuated from equation 0.2(S)
Y = calculated from equation (P24-Ia)^2/[(P24-Ia+S)P24]
Ybar = calculated from equation 1-Y
ap = Rational Method AES
Fp = Rational Method AES
Fm = calculated from equation ap*Fp

Infiltration Basin
Volume Calculation

Elevation (ft)	Depth (ft)	Surface Area (Ft^2)	Surface Area (Ac)	Volume (Ac-Ft)	Total Volume (Ac-Ft)
44.0	0.00	1532.640	0.035	0.000	0.000
44.5	0.50	2292.900	0.053	0.031	0.031
45.0	1.0	3085.160	0.071	0.044	0.075

Volume provided by detention basin = .075 ac-ft = 3,267 ft^3

APPENDIX D

APPENDIX D - HYRRAULICS

- SECTION PS-1 (OLD WOMAN SPRINGS ROAD) – Q25, Q100
- SECTION PS-2 (CEDARBIRD ROAD) – Q25, Q100
- SECTION PS-3 (SWALE WEST OF BUILDING) – Q25, Q100
- SECTION PS-4 (SWALE NORTH OF BUILDING) – Q25, Q100
- SECTION PS-5 (SWALE AT WEST PROPERTY LINE) – Q25, Q100
- SECTION PS-6 (SWALE AT NORTH PROPERTY LINE) – Q25, Q100
- U-GUTTER CALCULATION (AT SOUTH PROPERTY LINE) – Q25
- 8-INCH INFILTRATION INLET PIPE FROM DI#3 – Q100
- DROP INLET CALCULATIONS – Q100
- PARKWAY CULVERT CALCULATION (AT EAST PROPERTY LINE)– Q25
- PIPE CULVERT CALCULATION (AT DI#1 AND DI#2))– Q100
- RIP RAP CALCULATIONS (WEST SWALE AND PIPE INLETS TO INFILTRATION BASIN) – Q100

Cross Section for PS-1 OLD WOMAN SPRINGS Q25

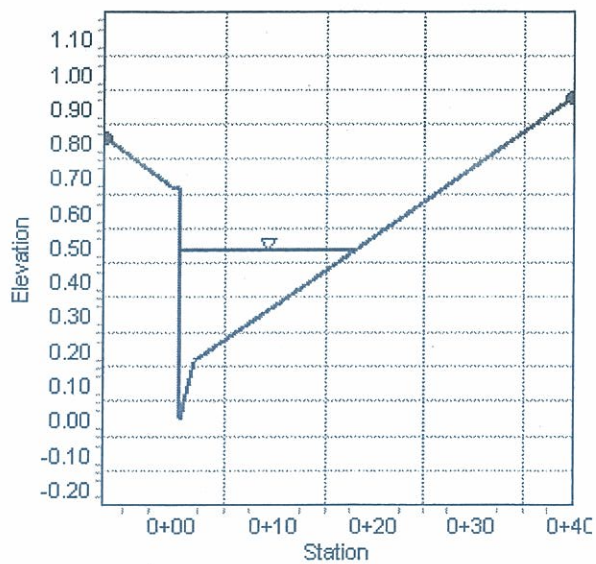
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02580	ft/ft
Normal Depth	0.49	ft
Discharge	15.00	ft³/s

Cross Section Image



Worksheet for PS-1 OLD WOMAN SPRINGS Q25

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02580	ft/ft
Discharge	15.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
-0+07.00	0.81
0+00.00	0.67
0+00.50	0.67
0+00.50	0.00
0+02.00	0.17
0+39.83	0.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+07.00, 0.81)	(0+39.83, 0.93)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.49	ft
Elevation Range	0.00 to 0.93 ft	
Flow Area	3.19	ft²
Wetted Perimeter	18.03	ft
Hydraulic Radius	0.18	ft
Top Width	17.53	ft
Normal Depth	0.49	ft

Worksheet for PS-1 OLD WOMAN SPRINGS Q25

Results

Critical Depth	0.60	ft
Critical Slope	0.00625	ft/ft
Velocity	4.70	ft/s
Velocity Head	0.34	ft
Specific Energy	0.84	ft
Froude Number	1.94	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.49	ft
Critical Depth	0.60	ft
Channel Slope	0.02580	ft/ft
Critical Slope	0.00625	ft/ft

Cross Section for PS-1 OLD WOMAN SPRINGS Q100

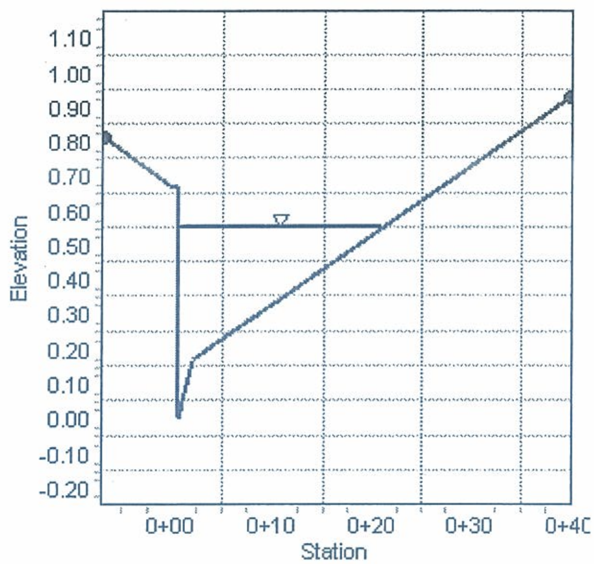
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02580	ft/ft
Normal Depth	0.55	ft
Discharge	22.00	ft^3/s

Cross Section Image



Worksheet for PS-1 OLD WOMAN SPRINGS Q100

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02580	ft/ft
Discharge	22.00	ft³/s
Section Definitions		

Station (ft)	Elevation (ft)
-0+07.00	0.81
0+00.00	0.67
0+00.50	0.67
0+00.50	0.00
0+02.00	0.17
0+39.83	0.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+07.00, 0.81)	(0+39.83, 0.93)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.55	ft
Elevation Range	0.00 to 0.93 ft	
Flow Area	4.26	ft²
Wetted Perimeter	20.90	ft
Hydraulic Radius	0.20	ft
Top Width	20.34	ft
Normal Depth	0.55	ft

Worksheet for PS-1 OLD WOMAN SPRINGS Q100

Results

Critical Depth		0.69	ft
Critical Slope		0.00599	ft/ft
Velocity		5.17	ft/s
Velocity Head		0.41	ft
Specific Energy		0.96	ft
Froude Number		1.99	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.55	ft
Critical Depth	0.69	ft
Channel Slope	0.02580	ft/ft
Critical Slope	0.00599	ft/ft

Cross Section for PS-2 CEDARBIRD Q25

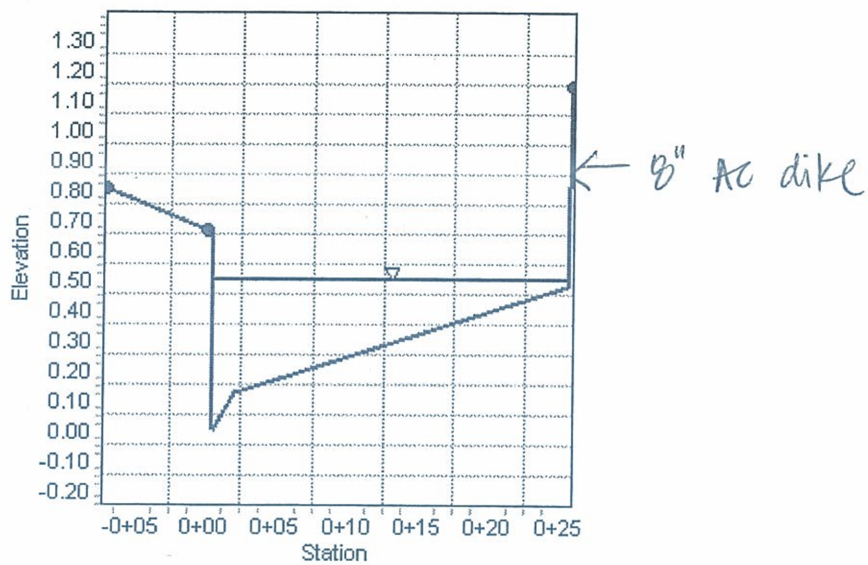
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03400	ft/ft
Normal Depth	0.50	ft
Discharge	32.00	ft³/s

Cross Section Image



Worksheet for PS-2 CEDARBIRD Q25

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03400	ft/ft
Discharge	32.00	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
-0+07.00	0.81
0+00.00	0.67
0+00.50	0.67
0+00.50	0.00
0+02.00	0.13
0+25.43	0.48
0+25.72	1.15

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+07.00, 0.81)	(0+00.00, 0.67)	0.025
(0+00.00, 0.67)	(0+25.72, 1.15)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.50	ft
Elevation Range	0.00 to 1.15 ft	
Flow Area	5.32	ft^2
Wetted Perimeter	25.47	ft
Hydraulic Radius	0.21	ft

Worksheet for PS-2 CEDARBIRD Q25

Results

Top Width	24.94	ft
Normal Depth	0.50	ft
Critical Depth	0.66	ft
Critical Slope	0.00541	ft/ft
Velocity	6.02	ft/s
Velocity Head	0.56	ft
Specific Energy	1.07	ft
Froude Number	2.30	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.50	ft
Critical Depth	0.66	ft
Channel Slope	0.03400	ft/ft
Critical Slope	0.00541	ft/ft

Cross Section for PS-2 CEDARBIRD Q100

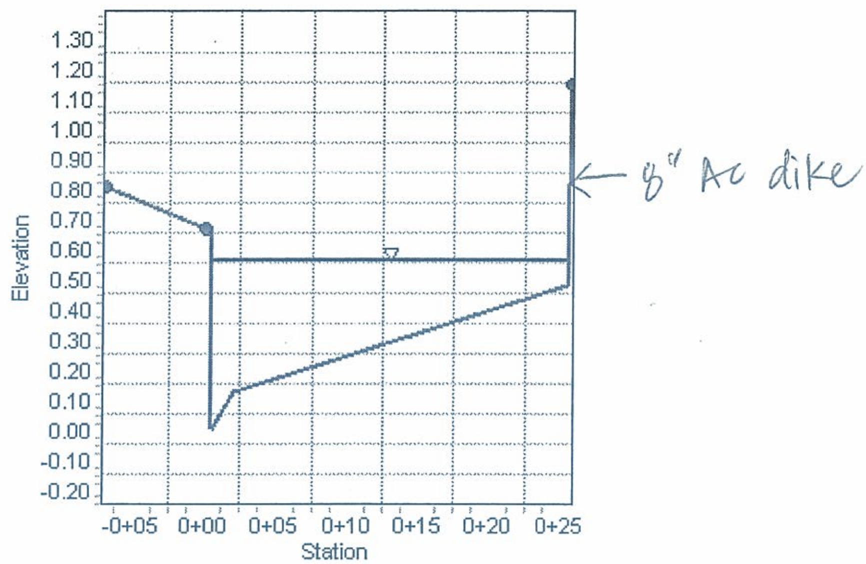
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03400	ft/ft
Normal Depth	0.56	ft
Discharge	48.00	ft^3/s

Cross Section Image



Worksheet for PS-2 CEDARBIRD Q100

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03400	ft/ft
Discharge	48.00	ft³/s
Section Definitions		

Station (ft)	Elevation (ft)
-0+07.00	0.81
0+00.00	0.67
0+00.50	0.67
0+00.50	0.00
0+02.00	0.13
0+25.43	0.48
0+25.72	1.15

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+07.00, 0.81)	(0+00.00, 0.67)	0.025
(0+00.00, 0.67)	(0+25.72, 1.15)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.56	ft
Elevation Range	0.00 to 1.15 ft	
Flow Area	6.78	ft²
Wetted Perimeter	25.59	ft
Hydraulic Radius	0.27	ft

Worksheet for PS-2 CEDARBIRD Q100

Results

Top Width	24.97	ft
Normal Depth	0.56	ft
Critical Depth	0.80	ft
Critical Slope	0.00520	ft/ft
Velocity	7.08	ft/s
Velocity Head	0.78	ft
Specific Energy	1.34	ft
Froude Number	2.39	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.56	ft
Critical Depth	0.80	ft
Channel Slope	0.03400	ft/ft
Critical Slope	0.00520	ft/ft

Cross Section for PS-3 SWALE (WEST OF BLDG) - Q100

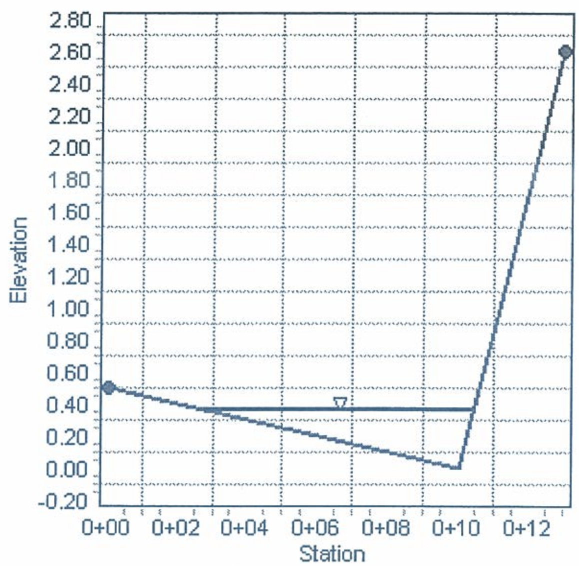
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Normal Depth	0.36	ft
Discharge	2.59	ft³/s

Cross Section Image



Worksheet for PS-3 SWALE (WEST OF BLDG) - Q100

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Discharge	2.59	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.50
0+10.00	0.00
0+13.00	2.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.50)	(0+13.00, 2.60)	0.025

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.36	ft
Elevation Range	0.00 to 2.60 ft	
Flow Area	1.38	ft²
Wetted Perimeter	7.78	ft
Hydraulic Radius	0.18	ft
Top Width	7.64	ft
Normal Depth	0.36	ft
Critical Depth	0.33	ft
Critical Slope	0.01708	ft/ft
Velocity	1.88	ft/s

Worksheet for PS-3 SWALE (WEST OF BLDG) - Q100

Results

Velocity Head		0.05	ft
Specific Energy		0.42	ft
Froude Number		0.78	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.36	ft
Critical Depth	0.33	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.01708	ft/ft

Cross Section for PS-4 SWALE (NORTH OF BLDG) - Q100

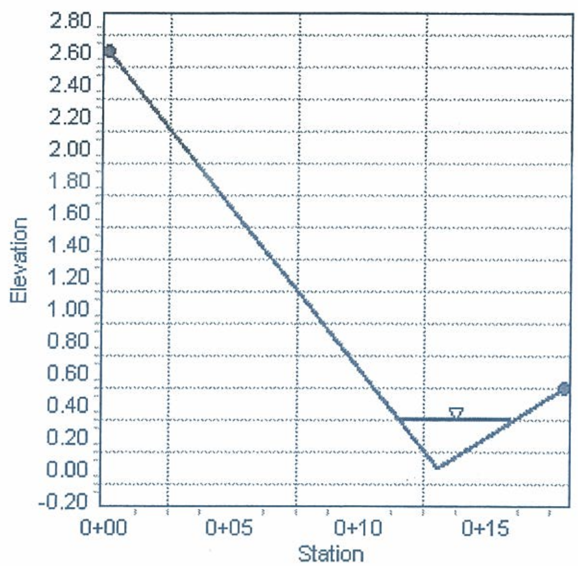
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01450	ft/ft
Normal Depth	0.29	ft
Discharge	1.28	ft³/s

Cross Section Image



Worksheet for PS-4 SWALE (NORTH OF BLDG) - Q100

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01450	ft/ft
Discharge	1.28	ft³/s
Section Definitions		

Station (ft)	Elevation (ft)
0+00.00	2.60
0+13.00	0.00
0+18.00	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2.60)	(0+18.00, 0.50)	0.025

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.29	ft
Elevation Range	0.00 to 2.60 ft	
Flow Area	0.65	ft²
Wetted Perimeter	4.45	ft
Hydraulic Radius	0.15	ft
Top Width	4.41	ft
Normal Depth	0.29	ft
Critical Depth	0.28	ft
Critical Slope	0.01771	ft/ft
Velocity	1.98	ft/s

Worksheet for PS-4 SWALE (NORTH OF BLDG) - Q100

Results

Velocity Head		0.06	ft
Specific Energy		0.35	ft
Froude Number		0.91	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.29	ft
Critical Depth	0.28	ft
Channel Slope	0.01450	ft/ft
Critical Slope	0.01771	ft/ft

Cross Section for PS-5 SWALE TRAP (WEST PL) - Q25

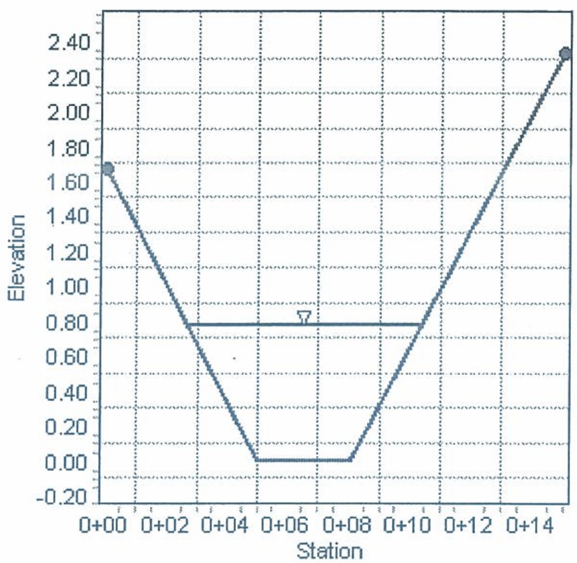
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03400	ft/ft
Normal Depth	0.78	ft
Discharge	30.00	ft³/s

Cross Section Image



Worksheet for PS-5 SWALE TRAP (WEST PL) - Q25

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03400	ft/ft
Discharge	30.00	ft^3/s
Section Definitions		

Station (ft)	Elevation (ft)
0+00.00	1.67
0+05.00	0.00
0+08.00	0.00
0+15.00	2.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 1.67)	(0+15.00, 2.33)	0.025

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.78	ft
Elevation Range	0.00 to 2.33 ft	
Flow Area	4.19	ft^2
Wetted Perimeter	7.96	ft
Hydraulic Radius	0.53	ft
Top Width	7.70	ft
Normal Depth	0.78	ft
Critical Depth	1.04	ft
Critical Slope	0.01082	ft/ft

Worksheet for PS-5 SWALE TRAP (WEST PL) - Q25

Results

Velocity		7.15	ft/s
Velocity Head		0.79	ft
Specific Energy		1.58	ft
Froude Number		1.71	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.78	ft
Critical Depth	1.04	ft
Channel Slope	0.03400	ft/ft
Critical Slope	0.01082	ft/ft

Cross Section for PS-5 SWALE TRAP (WEST PL) - Q100

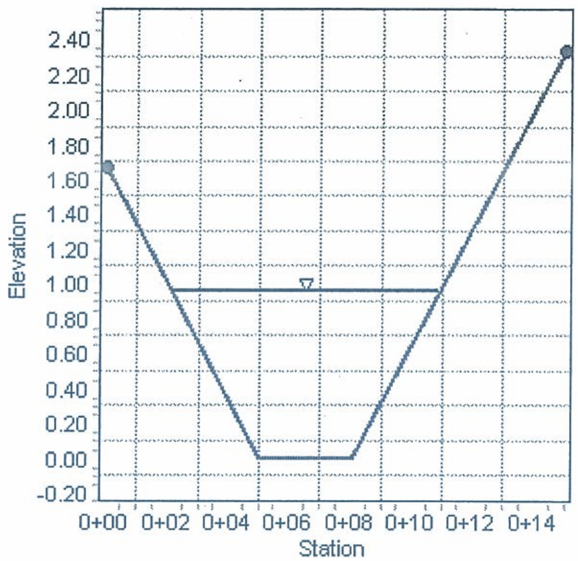
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03400	ft/ft
Normal Depth	0.96	ft
Discharge	45.00	ft³/s

Cross Section Image



Worksheet for PS-5 SWALE TRAP (WEST PL) - Q100

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03400	ft/ft
Discharge	45.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	1.67
0+05.00	0.00
0+08.00	0.00
0+15.00	2.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 1.67)	(0+15.00, 2.33)	0.025

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.96	ft
Elevation Range	0.00 to 2.33 ft	
Flow Area	5.64	ft²
Wetted Perimeter	9.06	ft
Hydraulic Radius	0.62	ft
Top Width	8.75	ft
Normal Depth	0.96	ft
Critical Depth	1.28	ft
Critical Slope	0.01024	ft/ft

Worksheet for PS-5 SWALE TRAP (WEST PL) - Q100

Results

Velocity		7.98	ft/s
Velocity Head		0.99	ft
Specific Energy		1.95	ft
Froude Number		1.75	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.96	ft
Critical Depth	1.28	ft
Channel Slope	0.03400	ft/ft
Critical Slope	0.01024	ft/ft

(PS-6)

Cross Section for SWALE VDITCH (NORTH PL) - Q25

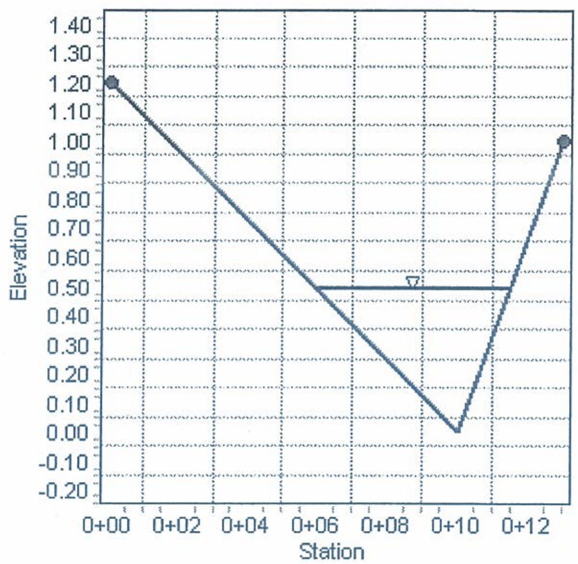
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03600	ft/ft
Normal Depth	0.49	ft
Discharge	6.00	ft³/s

Cross Section Image



(PS-6)

Worksheet for SWALE VDITCH (NORTH PL) - Q25

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03600	ft/ft
Discharge	6.00	ft³/s
Section Definitions		

Station (ft)	Elevation (ft)
0+00.00	1.20
0+10.00	0.00
0+13.00	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 1.20)	(0+13.00, 1.00)	0.025

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.49	ft
Elevation Range	0.00 to 1.20 ft	
Flow Area	1.37	ft²
Wetted Perimeter	5.69	ft
Hydraulic Radius	0.24	ft
Top Width	5.58	ft
Normal Depth	0.49	ft
Critical Depth	0.59	ft
Critical Slope	0.01406	ft/ft
Velocity	4.37	ft/s

(PS-6)

Worksheet for SWALE VDITCH (NORTH PL) - Q25

Results

Velocity Head		0.30	ft
Specific Energy		0.79	ft
Froude Number		1.55	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.49	ft
Critical Depth	0.59	ft
Channel Slope	0.03600	ft/ft
Critical Slope	0.01406	ft/ft

(PS-6)

Cross Section for SWALE VDITCH (NORTH PL) - Q100

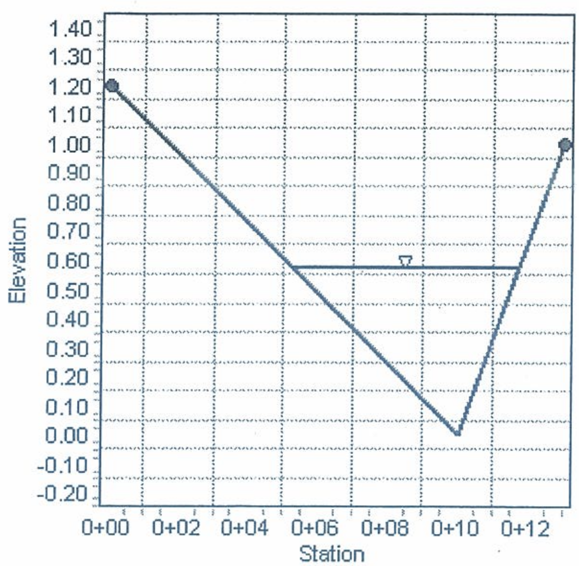
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03600	ft/ft
Normal Depth	0.57	ft
Discharge	9.00	ft^3/s

Cross Section Image



(PS-6)

Worksheet for SWALE VDITCH (NORTH PL) - Q100

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03600	ft/ft
Discharge	9.00	ft³/s
Section Definitions		

Station (ft)	Elevation (ft)
0+00.00	1.20
0+10.00	0.00
0+13.00	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 1.20)	(0+13.00, 1.00)	0.025

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.57	ft
Elevation Range	0.00 to 1.20 ft	
Flow Area	1.86	ft²
Wetted Perimeter	6.62	ft
Hydraulic Radius	0.28	ft
Top Width	6.49	ft
Normal Depth	0.57	ft
Critical Depth	0.69	ft
Critical Slope	0.01332	ft/ft
Velocity	4.84	ft/s

(PS-6)

Worksheet for SWALE VDITCH (NORTH PL) - Q100

Results

Velocity Head		0.36	ft
Specific Energy		0.94	ft
Froude Number		1.59	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.57	ft
Critical Depth	0.69	ft
Channel Slope	0.03600	ft/ft
Critical Slope	0.01332	ft/ft

Cross Section for U-GUTTER (WEST PL) - Q25

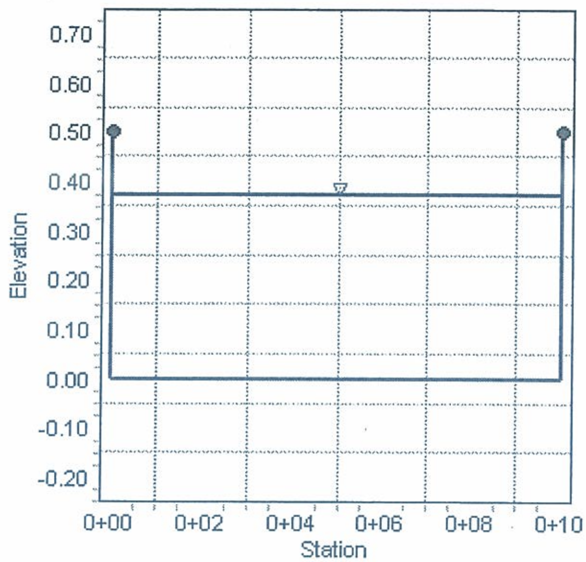
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02000	ft/ft
Normal Depth	0.37	ft
Discharge	30.00	ft^3/s

Cross Section Image



Worksheet for U-GUTTER (WEST PL) - Q25

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02000	ft/ft
Discharge	30.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.50
0+00.00	0.00
0+10.00	0.00
0+10.00	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.50)	(0+10.00, 0.50)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.37	ft
Elevation Range	0.00 to 0.50 ft	
Flow Area	3.75	ft²
Wetted Perimeter	10.75	ft
Hydraulic Radius	0.35	ft
Top Width	10.00	ft
Normal Depth	0.37	ft
Critical Depth	0.65	ft
Critical Slope	0.00334	ft/ft

Worksheet for U-GUTTER (WEST PL) - Q25

Results

Velocity		8.01	ft/s
Velocity Head		1.00	ft
Specific Energy		1.37	ft
Froude Number		2.31	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.37	ft
Critical Depth	0.65	ft
Channel Slope	0.02000	ft/ft
Critical Slope	0.00334	ft/ft

Infiltration Basin
Inlet pipe from DI #3

Cross Section for CATCH BASIN 8" OUTLET PIPE

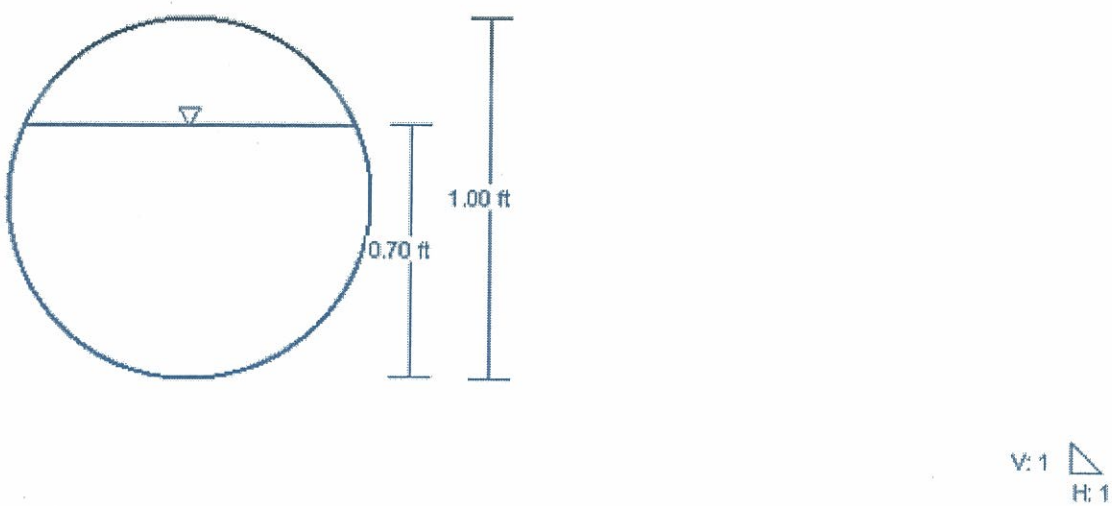
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Normal Depth	0.70	ft
Diameter	1.00	ft
Discharge	3.00	ft³/s

Cross Section Image



Worksheet for CATCH BASIN 8" OUTLET PIPE

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	1.00	ft
Discharge	3.00	ft^3/s

Results

Normal Depth	0.70	ft
Flow Area	0.59	ft^2
Wetted Perimeter	1.99	ft
Hydraulic Radius	0.30	ft
Top Width	0.91	ft
Critical Depth	0.74	ft
Percent Full	70.3	%
Critical Slope	0.00873	ft/ft
Velocity	5.08	ft/s
Velocity Head	0.40	ft
Specific Energy	1.10	ft
Froude Number	1.12	
Maximum Discharge	3.83	ft^3/s
Discharge Full	3.56	ft^3/s
Slope Full	0.00709	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	70.30	%
Downstream Velocity	Infinity	ft/s

Worksheet for CATCH BASIN 8" OUTLET PIPE

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.70	ft
Critical Depth	0.74	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00873	ft/ft

Grate Inlet Headwater Depth Calculation

2'X2' GRATE - DI #1 (PRON1)

Known:

Q =	Flow	3	cfs
W =	Width of Grate	2	ft
L =	Length of Grate	2	ft
D =	Diameter of Circle		in
Cf =	Clogging Factor	50	%

Weir Conditions:

Hw=(Q/(Cw*P))2/3

Cw =	Weir Coefficient	2.70	
P =	Perimeter of Grate	8.00	ft
Pc =	Perimeter (w/clogging)	4.00	ft
Hw =	Headwater Depth	0.43	ft

Orifice Conditions:

Hw=(Q/(Co*Ac))2/2*g

Co =	Orifice Coefficient	0.67	
A =	Grate Area	4.00	ft^2
Gf =	Grate Opening Factor	0.67	
Ac =	Grate Open Area (w/clogging)	1.34	ft^2
Hw =	Headwater Depth	0.17	ft

Worst Case Scenario Occurs Under Weir Conditions

Headwater Depth = **0.43 ft** with Rectangular Grate

Grate Inlet Headwater Depth Calculation

2'X2' GRATE - DI #3 (PRON2)

Known:

Q =	Flow	3	cfs
W =	Width of Grate	2	ft
L =	Length of Grate	2	ft
D =	Diameter of Circle		in
Cf =	Clogging Factor	50	%

Weir Conditions:

Hw=(Q/(Cw*P))2/3

Cw =	Weir Coefficient	2.70	
P =	Perimeter of Grate	8.00	ft
Pc =	Perimeter (w/clogging)	4.00	ft
Hw =	Headwater Depth	0.43	ft

Orifice Conditions:

Hw=(Q/(Co*Ac))2/2*g

Co =	Orifice Coefficient	0.67	
A =	Grate Area	4.00	ft^2
Gf =	Grate Opening Factor	0.67	
Ac =	Grate Open Area (w/clogging)	1.34	ft^2
Hw =	Headwater Depth	0.17	ft

Worst Case Scenario Occurs Under Weir Conditions

Headwater Depth = **0.43 ft** with Rectangular Grate

Grate Inlet Headwater Depth Calculation

3'X3' GRATE - DI #2 (PRON2)

Known:

Q =	Flow	5	cfs
W =	Width of Grate	3	ft
L =	Length of Grate	3	ft
D =	Diameter of Circle		in
Cf =	Clogging Factor	50	%

Weir Conditions:

Hw=(Q/(Cw*P))2/3

Cw =	Weir Coefficient	2.70	
P =	Perimeter of Grate	12.00	ft
Pc =	Perimeter (w/clogging)	6.00	ft
Hw =	Headwater Depth	0.46	ft

Orifice Conditions:

Hw=(Q/(Co*Ac))2/2*g

Co =	Orifice Coefficient	0.67	
A =	Grate Area	9.00	ft^2
Gf =	Grate Opening Factor	0.67	
Ac =	Grate Open Area (w/clogging)	3.02	ft^2
Hw =	Headwater Depth	0.10	ft

Worst Case Scenario Occurs Under Weir Conditions

Headwater Depth = **0.46 ft** with Rectangular Grate

BOX CULVERT

Inlet control and outlet control.

Parkway Culvert

INPUT VARIABLES:		OUTPUT VARIABLES:	
Box Height	0.50 ft	INLET CONTROL HWo:	
Box Width	7.00 ft	Tapered throat	0.42 ft
Slope	2.00 %	45 degree bevels	0.44 ft
Manning's 'n'	0.013	Sq. edge headwall	0.48 ft
Number of boxes	1		
Culvert length	12 ft		
Discharge	6 cfs (Q25)	OUTLET CONTROL HWo:	
		HWo depth	0.23 ft
		Velocity	1.71 fps
Ent. Coef. (Ke)	0.35	Critical depth	0.28 ft

Note: 1. Outlet control assumes full flow.
2. Critical depth can not exceed the box height

PIPE CULVERT

Inlet control and outlet control.

Infiltration Basin
Inlet Pipes from ~~DI #1 and DI #2~~

INPUT VARIABLES:	
Pipe diameter	12.00 in
Slope	0.50 %
Number of pipes	1
Manning's 'n'	0.013
Culvert length	8.50 ft
Discharge	6.00 cfs
Ent. Coef. (Ke)	0.35

OUTPUT VARIABLES:	
INLET CONTROL HWo:	
Tapered throat	2.14 ft
45 degree bevels	2.71 ft
Sq. edge headwall	3.05 ft
Thin edge projecting	3.91 ft
OUTLET CONTROL HWo:	
HWo depth	2.42 ft
Velocity	7.64 fps
Critical depth	1.00 ft

Note: 1. Outlet control assumes full pipe flow.
2. Critical depth can not exceed the pipe diameter.

Date 04/04/13 Project Retail Bldg @ Landers

Calced by DY

Riprap Lining Calculation
West PL swale

Velocity = 7.98

S = 0.034

$d_{50} = (3v * (S^{0.17}/S_s-1))^2$

S_S = 2.5

d_{50} = 0.976

Date 04/05/13 Project Retail Bldg @ Landers

Calced by DY

Riprap Lining Calculation
at 12" outlet pipe in Infiltration Basin

Velocity = 7.664

S = 0.005

S_S = 2.5

d_{50} = 0.469

d_{50} = (3v * (S^0.17/S_s-1))^2

APPENDIX E

APPENDIX E – REFERENCE MATERIALS

- FIRM MAP
- NOAA ATLAS 14 POINT PRECIPITATION VALUES
- EXCERPTS FORM CALTRANS HIGHWAY DESIGN MANUAL
- EXCERPTS FROM SBC MANUAL

Mapping Information Platform

This Map Is For Advisory Purposes Only

N W E S

Wednesday, 23 January 2013 22:38

Legend

Cities
- Other Places
- Small Towns
- Small Cities
- State Largest Cities
- Major Cities
- Completed LOMAs
- LOMR's
- DFIRM Panels
- Bench Marks

General Structures
- Culverts
- Foot Bridges
- Dams
- Levees
- Wing Walls

Base Flood Elevation (cont)
- BFE with NGVD29 datum
- BFE with NAVD88 datum
- BFE with other datum

Cross Section Lines
- Cross Section with NGVD29 datum
- Cross Section with NAVD88 datum
- Cross Section with other datum

Streams

Streets
- Streets
- Major Roads
- Highways
- Major Highways

States

Lakes, Major Rivers

Land Areas
- US (cont)
- Other Countries

U.S. DEPARTMENT OF HOMELAND SECURITY

FEMA

National Flood Hazard Layer Point Location Report

FEMA

Point Location

Latitude: 34.23356	Longitude: -116.44008	(North American Datum of 1983)

Community

Community Name:	San Bernardino County Unincorporated Areas
NFIP Community Identification Number:	060270
County:	
State:	

Flood Hazard Zone

For more information about flood hazard zones see http://www.fema.gov/plan/prevent/fhm/fq_gen13.shtm	
Zone:	D
Is this Zone a Special Flood Hazard Area (SFHA)?	No
Is this location a floodway?	No

Coastal Barrier Resources System (CBRS) or Otherwise Protected Area (OPA) Unit

No CBRS or OPA unit at this location.

For more information about CBRS and OPA units see http://www.fema.gov/plan/prevent/floodplain/nfipkeywords/cbrs.shtm

National Flood Insurance Program (NFIP) Map

Map Panel Number:	06071C8105H
Effective or Revised Date:	August 28, 2008
Panel Type:	COUNTYWIDE, NOT PRINTED
Reason Panel Not Printed:	AREA ALL IN ZONE D
Initial FIRM Date:	September 29, 1978
Date of FIRM Index Map:	August 28, 2008

To view the flood hazard map or order the map or flood hazard data please visit FEMA's Map Service Center at http://msc.fema.gov.

Letter(s) of Map Revision (LOMRs)

No LOMRs at this location.

Remarks

This report provides information found in the National Flood Hazard Layer for the point location on which you clicked.

If you clicked on a boundary, the system decides the side of the boundary on which to report. If the location in which you are interested is very close to a boundary, use extra care to click on the exact location.

The elevation of your property relative to the Base Flood Elevation (BFE) is the main factor in determining a flood hazard. To validate that a location is outside of a base flood, determine if the elevation of the location is higher than those of nearby Base Flood Elevations.

Flood hazards change gradually with the distance from potential sources of flooding, elevation, and other factors. You always should be aware of nearby areas that have a flood hazard and do not rely solely on flood hazard information for a single location.

For detailed information about Base Flood Elevations and other data, supplement the information on this report by reviewing the National Flood Hazard Layer data or National Flood Insurance Program map, the Flood Insurance Study (FIS) report, and nearby Letters of Map Change (LOMCs) that provide changes to the map and report. These items are available through FEMA's Map Service Center at http://msc.fema.gov.

For more information about the National Flood Insurance Program please visit the web site http://www.fema.gov/business/nfip/.

Report generated: January 23, 2013. Report version: 1.0

NOAA Atlas 14, Volume 6, Version 2
Location name: Yucca Valley, California, US*
Coordinates: 34.2336, -116.4400
Elevation: 3455 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.097** (0.080-0.119)	**0.140** (0.115-0.171)	**0.200** (0.165-0.246)	**0.253** (0.207-0.314)	**0.333** (0.263-0.426)	**0.400** (0.310-0.522)	**0.474** (0.358-0.634)	**0.557** (0.410-0.765)	**0.681** (0.481-0.975)	**0.790** (0.539-1.17)
10-min	**0.139** (0.115-0.170)	**0.200** (0.165-0.245)	**0.287** (0.236-0.352)	**0.363** (0.297-0.449)	**0.477** (0.377-0.610)	**0.574** (0.444-0.748)	**0.680** (0.514-0.909)	**0.799** (0.587-1.10)	**0.976** (0.689-1.40)	**1.13** (0.772-1.68)
15-min	**0.169** (0.139-0.206)	**0.242** (0.200-0.296)	**0.347** (0.286-0.426)	**0.439** (0.359-0.543)	**0.577** (0.456-0.738)	**0.694** (0.537-0.905)	**0.822** (0.621-1.10)	**0.966** (0.710-1.33)	**1.18** (0.833-1.69)	**1.37** (0.934-2.03)
30-min	**0.254** (0.210-0.310)	**0.364** (0.301-0.446)	**0.522** (0.430-0.640)	**0.661** (0.540-0.818)	**0.869** (0.687-1.11)	**1.04** (0.808-1.36)	**1.24** (0.935-1.65)	**1.45** (1.07-2.00)	**1.78** (1.25-2.54)	**2.06** (1.41-3.05)
60-min	**0.349** (0.288-0.426)	**0.500** (0.413-0.612)	**0.717** (0.590-0.879)	**0.908** (0.741-1.12)	**1.19** (0.943-1.52)	**1.43** (1.11-1.87)	**1.70** (1.28-2.27)	**2.00** (1.47-2.74)	**2.44** (1.72-3.49)	**2.83** (1.93-4.19)
2-hr	**0.463** (0.382-0.565)	**0.648** (0.535-0.792)	**0.911** (0.750-1.12)	**1.14** (0.933-1.41)	**1.48** (1.17-1.90)	**1.77** (1.37-2.31)	**2.08** (1.57-2.78)	**2.42** (1.78-3.33)	**2.92** (2.06-4.18)	**3.35** (2.28-4.96)
3-hr	**0.542** (0.448-0.663)	**0.754** (0.622-0.922)	**1.05** (0.867-1.29)	**1.32** (1.07-1.63)	**1.70** (1.35-2.18)	**2.03** (1.57-2.64)	**2.38** (1.80-3.18)	**2.76** (2.03-3.79)	**3.32** (2.35-4.76)	**3.79** (2.59-5.62)
6-hr	**0.700** (0.579-0.856)	**0.969** (0.800-1.19)	**1.35** (1.11-1.65)	**1.68** (1.37-2.07)	**2.16** (1.71-2.76)	**2.56** (1.98-3.33)	**2.98** (2.26-3.99)	**3.45** (2.54-4.74)	**4.13** (2.92-5.92)	**4.70** (3.20-6.96)
12-hr	**0.865** (0.715-1.06)	**1.21** (0.997-1.48)	**1.69** (1.39-2.07)	**2.10** (1.72-2.60)	**2.70** (2.13-3.45)	**3.19** (2.47-4.16)	**3.72** (2.81-4.97)	**4.29** (3.15-5.89)	**5.10** (3.60-7.31)	**5.78** (3.94-8.56)
24-hr	**1.08** (0.954-1.24)	**1.53** (1.35-1.76)	**2.16** (1.91-2.50)	**2.71** (2.37-3.16)	**3.50** (2.96-4.21)	**4.14** (3.44-5.09)	**4.83** (3.92-6.08)	**5.58** (4.40-7.22)	**6.67** (5.05-8.98)	**7.56** (5.54-10.5)
2-day	**1.22** (1.08-1.40)	**1.76** (1.56-2.04)	**2.54** (2.25-2.94)	**3.22** (2.82-3.75)	**4.21** (3.57-5.07)	**5.03** (4.18-6.18)	**5.92** (4.80-7.45)	**6.89** (5.44-8.92)	**8.31** (6.30-11.2)	**9.50** (6.96-13.2)
3-day	**1.31** (1.16-1.51)	**1.93** (1.71-2.22)	**2.81** (2.48-3.25)	**3.60** (3.15-4.19)	**4.75** (4.02-5.71)	**5.71** (4.74-7.02)	**6.76** (5.48-8.51)	**7.93** (6.26-10.3)	**9.65** (7.31-13.0)	**11.1** (8.14-15.5)
4-day	**1.36** (1.20-1.56)	**2.02** (1.79-2.33)	**2.97** (2.63-3.44)	**3.82** (3.34-4.45)	**5.07** (4.29-6.10)	**6.12** (5.08-7.51)	**7.27** (5.89-9.15)	**8.55** (6.75-11.1)	**10.5** (7.92-14.1)	**12.1** (8.84-16.8)
7-day	**1.49** (1.32-1.71)	**2.24** (1.98-2.58)	**3.34** (2.95-3.86)	**4.31** (3.78-5.03)	**5.77** (4.89-6.94)	**6.99** (5.80-8.59)	**8.33** (6.75-10.5)	**9.82** (7.75-12.7)	**12.0** (9.12-16.2)	**13.9** (10.2-19.4)
10-day	**1.57** (1.39-1.81)	**2.39** (2.11-2.75)	**3.58** (3.16-4.14)	**4.64** (4.07-5.41)	**6.23** (5.28-7.50)	**7.57** (6.28-9.30)	**9.03** (7.32-11.4)	**10.7** (8.41-13.8)	**13.1** (9.91-17.6)	**15.1** (11.1-21.1)
20-day	**1.69** (1.50-1.94)	**2.63** (2.32-3.03)	**4.00** (3.53-4.62)	**5.22** (4.57-6.08)	**7.05** (5.98-8.49)	**8.59** (7.13-10.6)	**10.3** (8.33-12.9)	**12.1** (9.58-15.7)	**14.9** (11.3-20.1)	**17.2** (12.6-24.0)
30-day	**1.86** (1.65-2.14)	**2.91** (2.58-3.35)	**4.46** (3.94-5.16)	**5.84** (5.12-6.81)	**7.92** (6.72-9.54)	**9.66** (8.03-11.9)	**11.6** (9.37-14.5)	**13.6** (10.8-17.7)	**16.7** (12.7-22.5)	**19.3** (14.1-26.8)
45-day	**2.10** (1.86-2.42)	**3.30** (2.92-3.81)	**5.07** (4.48-5.86)	**6.65** (5.83-7.75)	**9.03** (7.65-10.9)	**11.0** (9.16-13.5)	**13.2** (10.7-16.6)	**15.6** (12.3-20.1)	**19.0** (14.4-25.6)	**21.8** (16.0-30.4)
60-day	**2.33** (2.07-2.69)	**3.67** (3.25-4.23)	**5.64** (4.97-6.52)	**7.39** (6.47-8.62)	**10.0** (8.50-12.1)	**12.2** (10.2-15.0)	**14.6** (11.9-18.4)	**17.2** (13.6-22.3)	**21.0** (15.9-28.3)	**24.1** (17.6-33.5)

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

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

Please refer to NOAA Atlas 14 document for more information.

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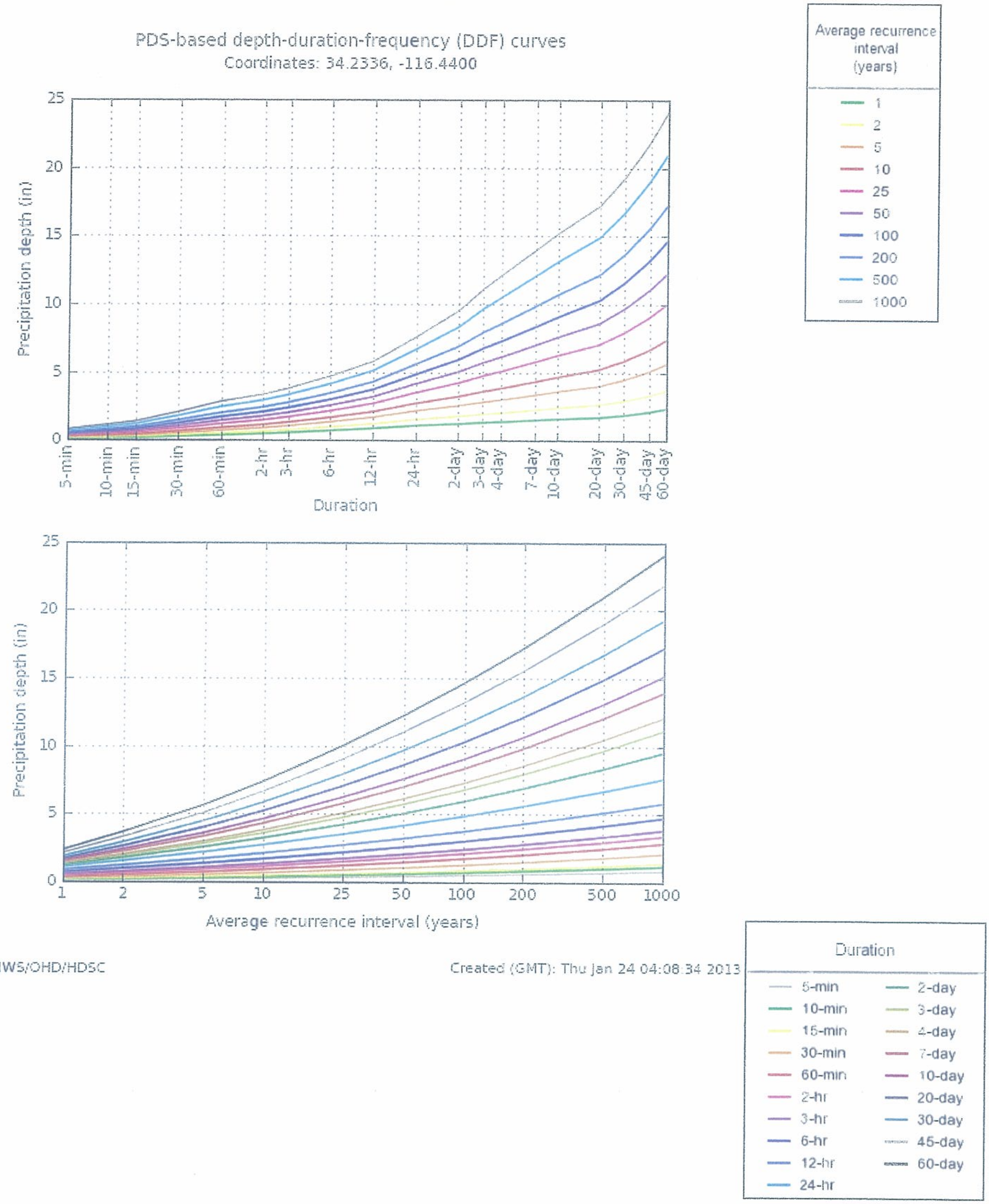
PF graphical



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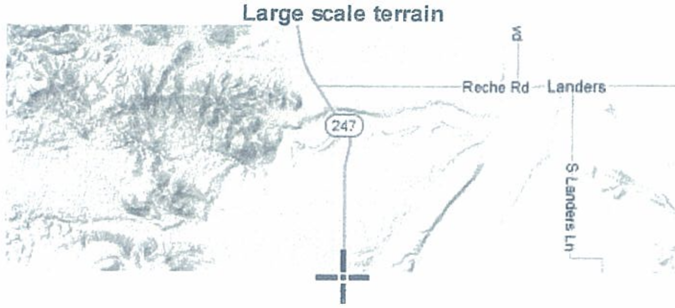
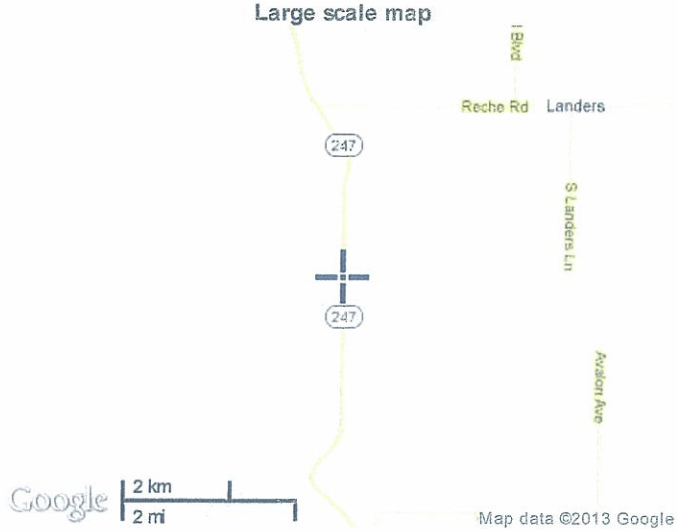
Maps & aerials

Small scale terrain

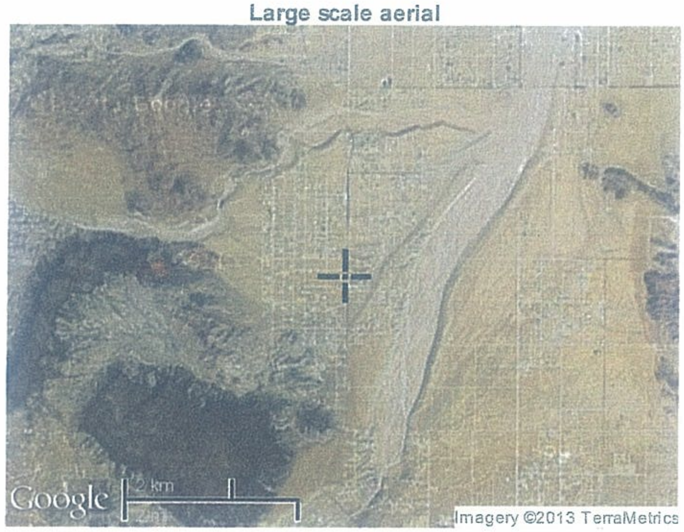
Large scale terrain



Large scale map



Large scale aerial



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National Weather Service
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highway, over the watershed divide, or through structure(s) provided for emergency relief". The "overtopping flood" is of particular interest to highway drainage engineers because it may be the threshold where the relatively low profile of the highway acts as a flood relief mechanism for the purpose of minimizing upstream backwater damages.

(3) *Design Flood.* "The peak discharge (when appropriate, the volume, stage, or wave crest elevation) of the flood associated with the probability of exceedance selected for the design of a highway encroachment". Except for the rare situation where the risks associated with a low water crossing are acceptable, the highway will not be inundated by the "design flood".

(4) *Maximum Historical Flood.* "The maximum flood that has been recorded or experienced at any particular highway location". This information is very desirable and where available is an indication that the flood of this magnitude may be repeated at the project site. Hydrologic analysis may suggest that the probability for recurrence of the "maximum historical flood" is very small, less than 1 percent. Nevertheless consideration should be given to sizing drainage structures to convey the "maximum historical flood".

(5) *Probable Maximum Flood.* "The flood discharge that may be expected from the most severe combination of critical meteorological and hydrological conditions that are reasonably possible in the region". The "probable maximum flood" is generally not applicable to highway projects. The possibility of a flood of such rare magnitude, as used by the Corps of Engineers, is applicable to projects such as major dams, when consideration is to be given to virtually complete security from potential floods.

818.2 Establishing Design Flood Frequency

There are two recognized alternatives to establishing an appropriate highway drainage design frequency. That is, by policy or by economic analysis. Both alternatives have merit and may be applied exclusively or jointly depending upon general conditions or specific constraints.

Application of traditional predetermined design flood frequencies implies that an acceptable level of risk was considered in establishing the design standard. Modern design concepts, on the other hand, recommend that a range of peak flows be considered and that the design flood be established which best satisfies the specific site conditions and associated risks. A preliminary evaluation of the inherent flood-related risks to upstream and downstream properties, the highway facility, and to the traveling public should be made. This evaluation will indicate whether a predetermined design flood frequency is applicable or additional study is warranted.

Highway classification is one of the most important factors, but not the sole factor, in establishing an appropriate design flood frequency. Due consideration should be given to all the other factors listed under Index 801.5. If the analysis is correct, the highway drainage system will occasionally be overtaxed. The alternative of accommodating the worst possible event that could happen is usually so costly that it may not be justified.

Highway engineers should understand that the option to select a predetermined design flood frequency is generally only applicable to new highway locations. Because of existing constraints, the freedom to select a prescribed design flood frequency may not exist for projects involving replacement of existing facilities. Caltrans policy relative to up-grading of existing drainage facilities may be found in Index 803.3.

Although the procedures and methodology presented in HEC 17, Design of Encroachments on Flood Plains Using Risk Analysis, are not fully endorsed by Caltrans, the circular is an available source of information on the theory of "least total expected cost (LTEC) design". Highway engineers are cautioned about applying LTEC methodology and procedures to ordinary drainage design problems. The Headquarters Hydraulics Engineer in the Division of Design should be consulted before committing to design by the LTEC method since its use can only be justified and recommended under extra-ordinary circumstances.

generated output without questioning the reasonableness of the results obtained from a hydrologic viewpoint. Most computer simulation models require a significant amount of input data that must be carefully examined by a competent and experienced user to assure reliable results.

Some hydrologic computer models merely solve empirical hand methods more quickly. Other models are theoretical and solve the entire runoff cycle using mathematical equations to represent each phase of the runoff cycle.

In most simulation models, the drainage area is divided into subareas with similar hydrologic characteristics. A design rainfall is synthesized for each subarea, abstractions removed, and an overland flow routine simulates the movement of surface water into channels. The channels of the watershed are linked together and the channel flow is routed through them to complete the basin's response to the design rainstorm. Simulation models require calibration of modeling parameters using measured historical events to increase their validity.

A summary of personal computer programs is listed in Table 808.1.

Watershed Modeling System (WMS) is a comprehensive environment for hydrologic analysis. It was developed by the Engineering Computer Graphics Laboratory of Brigham Young University in cooperation with the U.S. Army Corps of Engineers Waterways Experiment Station (WES).

WMS merges information obtained from terrain models and GIS with industry standard hydrologic analysis models such as HEC-1 and TR-55. HY-8 has also been incorporated for culvert design.

Terrain models can obtain geometric attributes such as area, slope and runoff distances. Many display options are provided to aid in modeling and understanding the drainage characteristics of terrain surfaces.

The distinguishing difference between WMS and other applications designed for setting up hydrologic models like HEC-1 and TR-55 is its unique ability to take advantage of digital terrain for hydrologic data development.

WMS uses three primary data sources for model development:

1. Geographic Information Systems (GIS) Data
2. Digital Elevation Models (DEMs) published by the U.S. Geological Survey (USGS) at both 1:24,000 and 1:250,000 for the entire U.S. (the 1:24,000 data coverage is not complete)
3. Triangulated Irregular Networks (TINs)

Two other hydrologic computer programs that are commonly used are the Army Corps of Engineers' HEC-HMS and the National Resources Conservation Service's TR-20 Method.

Other programs include the Caltrans Rainfall Intensity-Duration-Frequency Program, IDF2000, which incorporates the California Department of Water Resources (DWR) short duration precipitation data (See Index 815.3(3)) with an updated station-interpolation routine and GIS mapping capability; and the more recent NOAA Atlas 14 web-based IDF product. The NOAA Atlas 14 product is the preferred IDF tool for State highway projects.

819.7 Region-Specific Analysis

(1) *Desert Hydrology* → SEE FOLLOWING TABLE

Figure 819.7A shows the different desert regions in California, each with distinct hydrological characteristics that will be explained in this section.

(a) Storm Type

Summer Convective Storms - In the southern desert regions (Owens Valley/Mono Lake, Mojave Desert, Sonoran Desert and the Colorado Desert), the dominant storm type is the local thunderstorm, specifically summer convective storms. These storms are characterized by their short duration, over a relatively small area (generally less than 20 mi^2), and intense rainfall, which may result in flash floods. These summer convective storms may occur at any time during the year, but are most common and intense during the summer. General summer storms can also occur over these desert regions, but are rare, and usually occur from mid-August to early October. The rainfall intensity can vary from heavy rainfall to heavy thunderstorms.

Table 819.7H

Design Storm Durations

Drainage Area	Desert Region	100-year, 6-hour Convective Storm (AMC I)	100-year, 24-hour General Storm (AMC II)	Regional Regression Equations
> 20 mi^2	Colorado Desert	X		
	Sonoran Desert	X		
	Mojave Desert	X		
	Antelope Valley Desert	X		
< 20 mi^2	Colorado Desert	X*	X*	
	Sonoran Desert	X*	X*	
	Mojave Desert	X*	X* ← CONTROLS	
	Antelope Valley Desert	X*	X*	
	Owens Valley/Mono Lake			X**
	Northern Basin & Range		X	

* For watersheds greater than 20 mi^2 in the southern desert regions, both the 6-hour Convective Storm (AMC I) and the 24-hour General Storm (AMC II) should be analyzed and the larger of the two peak discharges selected.

** The use of regional regression equations is recommended where streamgage data are not available; otherwise, hydrologic modeling could be performed with snowmelt simulation.

CHAPTER 830
TRANSPORTATION FACILITY DRAINAGE

Topic 831 - General

Index 831.1 - Basic Concepts

Roadway drainage involves the collection, conveyance, removal, and disposal of surface water runoff from the traveled way, shoulders, sidewalks, and adjoining areas defined in Index 62.1(7) as comprising the roadway. Roadway drainage is also concerned with the handling of water from the following additional sources:

- Surface water from outside the right of way and not confined to channels that would reach the traveled way if not intercepted.
- Crossroads or streets.
- Irrigation of landscaped areas.

The design of roadway drainage systems often involves consideration of the problems associated with inadequate drainage of the adjacent or surrounding area. Cooperative drainage improvement projects with the responsible local agency may offer the best overall solution. Cooperative agreements are more fully discussed under Index 803.2

Some of the major considerations of good roadway drainage design are:

- Facility user safety.
- Convenience to vehicular, bicycle and pedestrian traffic.
- Aesthetics.
- Flooding of the transportation facility and adjacent property.
- Subgrade infiltration.
- Potential erosion, pollution and other environmental concerns.
- Economy of construction.
- Economy of maintenance.

This section involves the hydraulic design fundamentals necessary for properly sizing and locating standard highway drainage features such as:

- Asphalt dikes and gutters.
- Concrete curbs and gutters.
- Median drains.
- Roadside ditches
- Overside drains.
- Drop inlets.
- Storm drains.

Removal of storm water from highway pavement surfaces and median areas is more fully discussed in FHWA Hydraulic Engineering Circular No. 22, "Urban Drainage Design Manual". HEC 22 includes discussion of the effects of roadway geometry on pavement drainage; the philosophy of design storm frequency and design spread selection; storm runoff estimating methods; pavement and bridge deck inlets; and flow in gutters. Charts and procedures are provided for the hydraulic analysis and design of roadway drainage features.

831.2 Highway Grade Line

In flat terrain, roadway drainage considerations often control the longitudinal grade line of the highway. A grade line that assures the desirable goal of keeping the traveled way free of flooding can usually be established for new freeway projects and rural conventional highways.

For multilane urban highways with nearly continuous dike or curb along the shoulder or parking area, it is seldom practical to design the highway with a gutter section which will contain all of the runoff even from frequent rains. For this reason the gutter and shoulder combination, and often partial or full width of the traveled way, are used to convey the runoff to inlets.

831.3 Design Storm and Water Spread

Before the hydraulic adequacy of roadway drainage facilities can be analyzed, the quantity of water (design Q) that the facility may reasonably be expected to convey must be estimated. The most important, and often the most difficult phase of this task is the selection of an appropriate design storm frequency for the specific project, location or site under consideration. In order for a design frequency to be meaningful criteria for roadway drainage design, it must be tied to an acceptable tolerance of flooding. Design water spread, encroachment upon the roadbed or adjacent property, is the tolerance of flooding directly related to roadway drainage design. Allowing too little spread is uneconomical in design and too much spread may result in unsafe driving conditions.

To optimize economy in roadway drainage, the allowable water spread should vary, depending on the type of project being designed. Because of the effect of splash and spray on motorist visibility and vehicle control, high volume roads with high speed traffic cannot tolerate as much water spread as urban streets. Likewise, the allowable water spread should be minimized on urban streets where a large number of pedestrians use adjacent sidewalks and pedestrian crosswalks. Consideration should be given to the element of motorist surprise when encountering intermittent puddles rather than a continuous encroachment of water on the driving lane. Eccentric forces are exerted on a vehicle when one side encounters water in the lane and the other side does not.

The probability of exceedance of the design storm and the acceptable tolerance to flooding depends on the importance of the highway and risks involved. Selection of the design storm and water spread parameters on rehabilitation and reconstruction are generally controlled by existing constraints.

In addition to the major roadway drainage considerations previously listed, the following more specific factors are to be considered in establishing the project design storm:

- Highway type
- Traffic volume
- Design speed
- Local standards

The following geometric and design features of the highway directly affect establishment of the project design water spread:

- Cross slope
- Longitudinal slope
- Number of lanes
- Width of shoulders
- Height of curb and dike
- Parking lanes
- Bus/Transit pullouts and loading areas

Desirable limits for water spread with respect to design storm probability of exceedance are given in Table 831.3. The parameters shown are considered minimum roadway drainage design standards for new freeway construction and for all State highways with depressed sections which require pumping. Local conditions may justify less stringent criteria than the table parameters for conventional highways. Exceptions should be documented by memo to the project file.

It is often advantageous, to both the State and the local agency, for highway drainage and street drainage to be compatible. This is particularly true in urban areas and rapidly developing suburban areas where a conventional highway is, or will become, part of the street network. Street drainage criteria adopted by a local agency are generally based on the hydrologic events peculiar to a geographical area. Local drainage standards that satisfy the needs of the community, usually provide reasonable traffic safety and flood risk considerations commensurate with those normally expected for conventional highways in urban areas.

831.4 Other Considerations

(1) *Sheet Flow.* Concentrations of sheet flow across roadways are to be avoided. As a general rule, no more than 0.10 cubic feet per second should be allowed to concentrate and flow across a roadway. Particular attention should be given to reversal points of superelevation where shoulder and gutter slopes may direct flows across the roadway and gore areas.

Table 831.3

Desirable Roadway Drainage Guidelines

HIGHWAY Type/Category/Feature	DESIGN STORM		DESIGN WATER SPREAD		
	4% (25 yrs)	10% (10 yrs)	Shldr or Parking Lane	1/2 Outer Lane	Local Standard
FREEWAYS					
Through traffic lanes, branch connections, and other major ramp connections.	X	--	X	--	--
Minor ramps.	--	X	X	--	--
Frontage roads.	--	X	--	--	X
CONVENTIONAL HIGHWAYS					
High volume, multilane Speeds over 45 mph.	X	--	X	--	--
High volume, multilane Speeds 45 mph and under.	--	X	--	X	--
Low volume, rural Speeds over 45 mph.	X	--	X	--	--
Urban Speeds 45 mph and under.	--	X	--	--	X
ALL STATE HIGHWAYS					
Depressed Sections That Require Pumping:					

CONTROLS FOR ROADWAY DRAINAG

Use a 2% (50 yrs) design storm for freeways and conventional State highways. Design water spread at depressed sections should not exceed that of adjacent roadway sections. A 4% (25 yr) design storm may be used on local streets or road undercrossings that require pumping.

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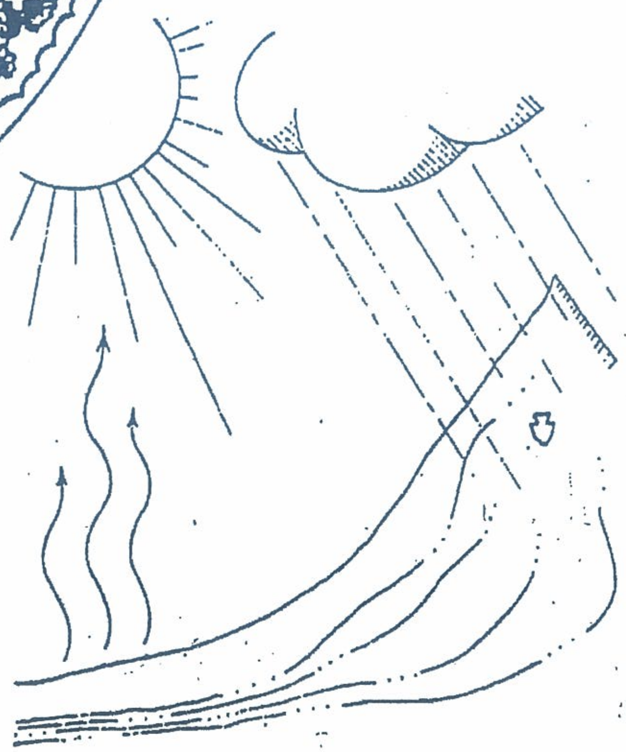
HYDROLOGY MANUAL



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

SOIL TYPE FOR ENTIRE SITE

GROUP C: Soils having slow infiltration rates when thoroughly wetted and consisting chiefly of silty-loam 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.

C.2.1. Soil Maps

Maps have been prepared which designate the locations of the various soil groups within San Bernardino County (see Figure C-1 for index map) and are contained at the back of this section (Figures C-9 through C-16). Section C.8 contains details regarding soil map data and sources of information.

C.3. SOIL COVER AND HYDROLOGIC CONDITIONS

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. Definitions of specific cover types are provided in Figure C-2. Further refinement in the cover type descriptions is provided by the definition of cover quality 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.

USED FOR EXISTING UNDEVELOPED CONDITIONS RATIONAL METHOD ANALYSI.

FAIR: Moderate cover with 50 percent to 75 percent of the ground surface protected by vegetation.

GOOD: Heavy or dense cover with more than 75 percent of the ground surface protected by vegetation.

In most cases, watershed existing conditions cover type and quality can be readily determined by a field review of a watershed. In ultimate planned open spaces, the soil cover condition shall be considered as "good." Figure C-3 provides the CN values for various types and quality of ground cover. Impervious areas shall be assigned a CN of 98. It is noted that for ultimately developed conditions, the CN for urban landscaping (turf) is provided in Figure C-3.

C.4. WATERSHED DEVELOPMENT CONDITIONS

Ultimate development of the watershed should normally be assumed since watershed urbanization is reasonably likely within the expected life of most hydraulic facilities. Long range master plans for the County and incorporated cities should be reviewed to insure that reasonable land use assumptions are made for the ultimate development of the watershed. A field review shall also be made to confirm existing use and drainage patterns. Particular attention shall be paid to existing and proposed landscape practices, as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. Appropriate actual impervious percentages can then be selected from Figure C-4. It should be noted that the recommended values from these figures are for average conditions and, therefore, some adjustment for particular applications may be required.

Curve (1) 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
Chaparral, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, 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	71	78
EXISTING UNDEVELOPED CONDITION → 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	25	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)		77	86	91	94

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

CURVE NUMBERS FOR PERVIOUS AREAS

Figure C-3 (1 of 2)

Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
AGRICULTURAL COVERS (Continued)					
Legumes, Close Seeded (Alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Evergreen (Citrus, avocados, etc.)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
Pasture, Dryland (Annual grasses)	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Pasture, Irrigated (Legumes and perennial grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
Row Crops (Field crops - tomatoes, sugar beets, etc.)	Poor	72	81	88	91
	Good	67	78	85	89
Small grain (Wheat, oats, barley, etc.)	Poor	65	76	84	88
	Good	63	75	83	87

Notes:

1. All curve numbers are for Antecedent Moisture Condition (AMC) II.
2. Quality of cover definitions:

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

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

   Good-Heavy or dense cover with more than 75 percent of the ground surface protected.
3. See Figure C-2 for definition of cover types.

ACTUAL IMPERVIOUS COVER

Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent (2)
Natural or Agriculture	0 - 0	0
Public Park	10 - 25	15
School	30 - 50	40
Single Family Residential: (3)		
2.5 acre lots	5 - 15	10
1 acre lots	10 - 25	20
2 dwellings/acre	20 - 40	30
3-4 dwellings/acre	30 - 50	40
5-7 dwellings/acre	35 - 55	50
8-10 dwellings/acre	50 - 70	60
More than 10 dwellings/acre	65 - 90	80
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
Commercial, Downtown Business or Industrial	80 - 100	90

'ROPOSED DEVELOPED CONDITION
~48% IMPERVIOUS
~52% PERVIOUS

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.

2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area shall always be made, and a review of aerial photos, where available, may assist in estimating the percentage of impervious cover in developed areas.

3. For typical equestrian subdivisions increase impervious area 5 percent over the values recommended in the table above.

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

ACTUAL IMPERVIOUS COVER FOR DEVELOPED AREAS

C.6.1. Estimation of Initial Abstraction (Ia)

The initial abstraction (Ia) for an area is a function of land use, treatment, and condition; interception; infiltration; depression storage; and antecedent soil moisture. An estimate for Ia is given by the SCS as

$$Ia = 0.2S \qquad (C.1)$$

where S is an estimate of total soil capacity given by

$$S = \frac{1000}{CN} - 10 \qquad (C.2)$$

where CN is the area curve number.

C.6.2. Estimation of Storm Runoff Yield

Given the CN for a subarea A_j, the corresponding 24-hour storm runoff yield fraction, Y_j, is estimated by

$$Y_j = \frac{(P_{24} - Ia)^2}{(P_{24} - Ia + S)P_{24}} \qquad (C.3)$$

where

Y_j = 24-hour storm runoff yield fraction for subarea A_j

P_{24} = 24-hour storm rainfall

Ia = initial abstraction from (C.1)

S = see (C.2)

It is noted that should Ia be greater than P_{24} in (C.3), then Y_j is defined to be zero. In this manual, the notation Y and Y_j will represent the runoff yield fraction, rather than the volume of runoff.

If the area under study contains several (say m) CN designations, then the yield, Y, for the total area must represent the net effect of the several curve numbers. By weighting each of the subarea yield values according to the respective areas,

$$Y = (Y_1A_1 + \cdots + Y_mA_m)/(A_1 + A_2 + \cdots + A_m) \qquad (C.4)$$

where each Y_j follows from (C.3).

C.6.3. Low Loss Rate, F*

In design storm runoff hydrograph studies, the following formula is used to estimate that portion of rainfall to be attributed to watershed losses:

$$\bar{Y} = 1 - Y \qquad (C.5)$$

where

$\bar{Y}$ = catchment low loss fraction

Y = catchment 24-hour storm runoff yield fraction computed from (C.4)

Using the low loss fraction, $\bar{Y}$, the corresponding low loss rate, F*, is given by

$$F^* = \bar{Y} \cdot I \qquad (C.6)$$

where I is the rainfall intensity and F* has units of inches/hour. Use of F* enables the design storm 24-hour storm runoff yield to approximate the yield values obtained from the CN approach (see Figure C-5).

C.6.4. Infiltration Rates

Soil infiltration rates have been estimated for each of the soil groups by laboratory studies and measurements. These measurements show that an initially dry soil will have an associated infiltration rate which essentially decreases with time as the soil becomes wetted. As the soil is subjected to continual heavy rainfall, this infiltration rate approaches a minimum (usually within about 30 minutes) which represents the infiltration capacity of the soil.

When sufficient stream gauge information is available, infiltration rates for unit hydrograph hydrology can be estimated from a study of rainfall-runoff relationships of major storms. Where such data is not available, infiltration rates for pervious areas as a function of CN can be estimated using Figures C-3 and C-6. Loss rates for pervious areas estimated from the Figure C-6 curves are generally consistent with values developed from rainfall-runoff reconstitution studies in San Bernardino County watersheds.

C.6.5. Estimation of Catchment Maximum Loss Rates, F_m

The infiltration rate selected from Figure C-6 applies to the pervious area fraction of the watershed. The infiltration rate assumed for an impervious surface is 0.0 inch/hour. The maximum loss rate, F_m, for a catchment is therefore given by

$$F_m = a_p F_p \tag{C.7}$$

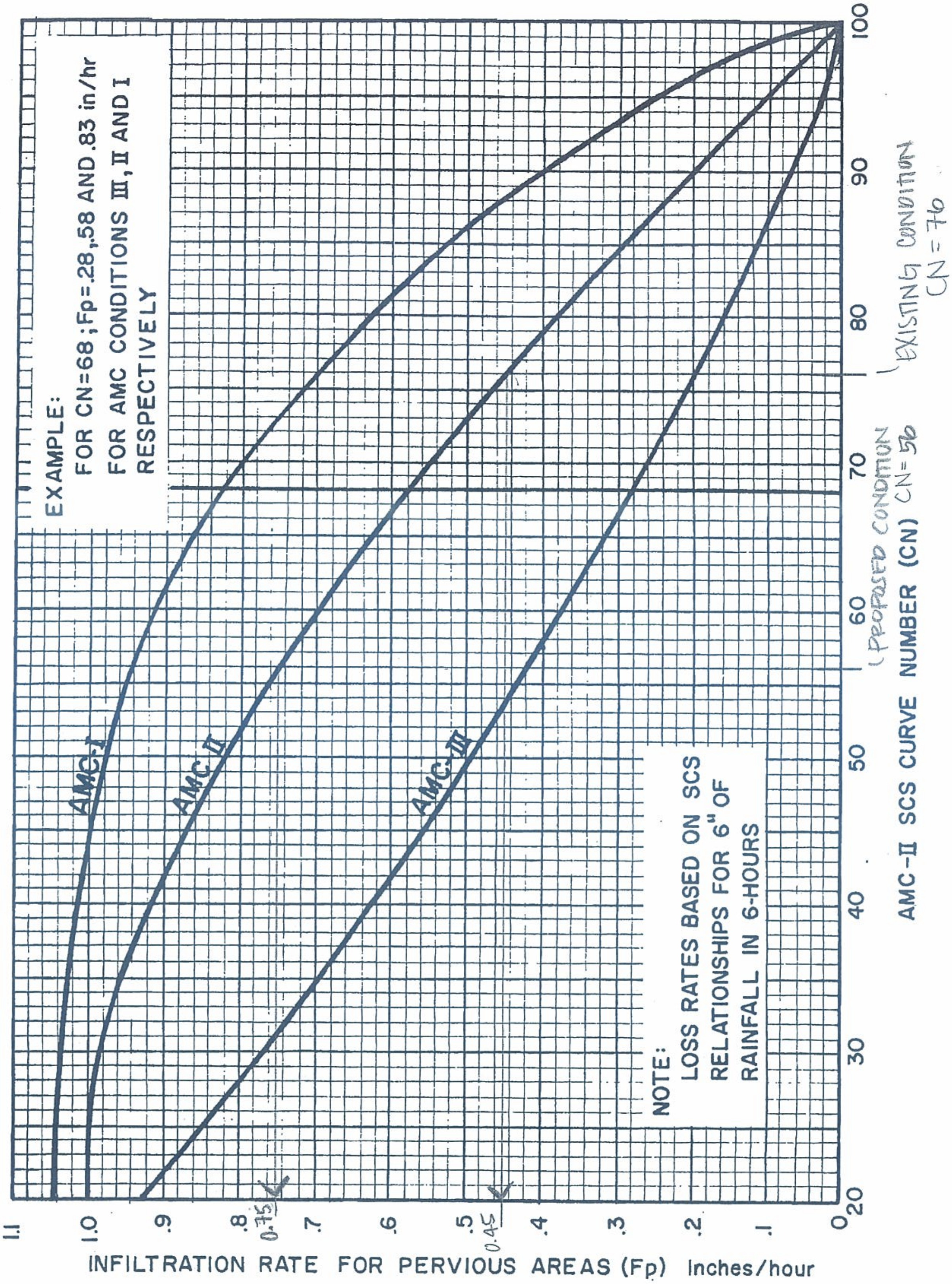
where a_p is the pervious area fraction, and F_p is the infiltration rate for the pervious area.

Should a catchment contain several F_p values, the composite F_m value is determined as a simple area average of the several F_m values. Table C.2 provides Fm values for a wide range of cover types and soil groups.

C.6.6. Design Storm Loss Rates

In design storm runoff hydrograph studies, a 24-hour duration storm pattern is used to develop the time distribution of effective rainfall over the watershed. The effective rainfall quantities are determined by subtracting the watershed losses from the design storm rainfall.

The loss rate used for a particular catchment is a combination of the maximum loss rate F_m and the low loss rate F^*. F^* is used as the loss rate unless F^* exceeds F_m, in which case F_m is used as the loss rate. That is, F_m serves as the maximum loss rate. Typically in 100-year storm studies, F^* serves as the loss rate for the entire storm pattern except for the most



SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

INFILTRATION RATE FOR PERVIOUS AREAS VERSUS SCS CURVE NUMBERS

TABLE C.2. Fm (in/hr) VALUES
FOR TYPICAL COVER TYPES

COVER TYPE	A_p(1)	SOIL GROUP A	B	C	D
NATURAL:					
Barren	1.0	0.41	0.27	0.18	0.14
Row Crops (good)	1.0	0.59	0.41	0.29	0.22
Grass (fair)	1.0	0.82	0.56	0.40	0.31
Orchards (fair)	1.0	0.88	0.62	0.43	0.34
Woodland (fair)	1.0	0.95	0.69	0.50	0.40
URBAN:					
Residential (1 DU/AC)	0.80	0.78	0.60	0.45	0.37
Residential (2 DU/AC)	0.70	0.68	0.53	0.39	0.32
Residential (4 DU/AC)	0.60	0.58	0.45	0.34	0.28
Residential (10 DU/AC)	0.40	0.39	0.30	0.22	0.18
Condominium	0.35	0.34	0.26	0.20	0.16
Mobile Home Park	0.25	0.24	0.19	0.14	0.12
Apartments	0.20	0.19	0.15	0.11	0.09
Commercial/Industrial	0.10	0.10	0.08	0.06	0.05

NOTES:

(1) Recommended a_p values from Figure C-4

(2) AMC II assumed for all Fm values

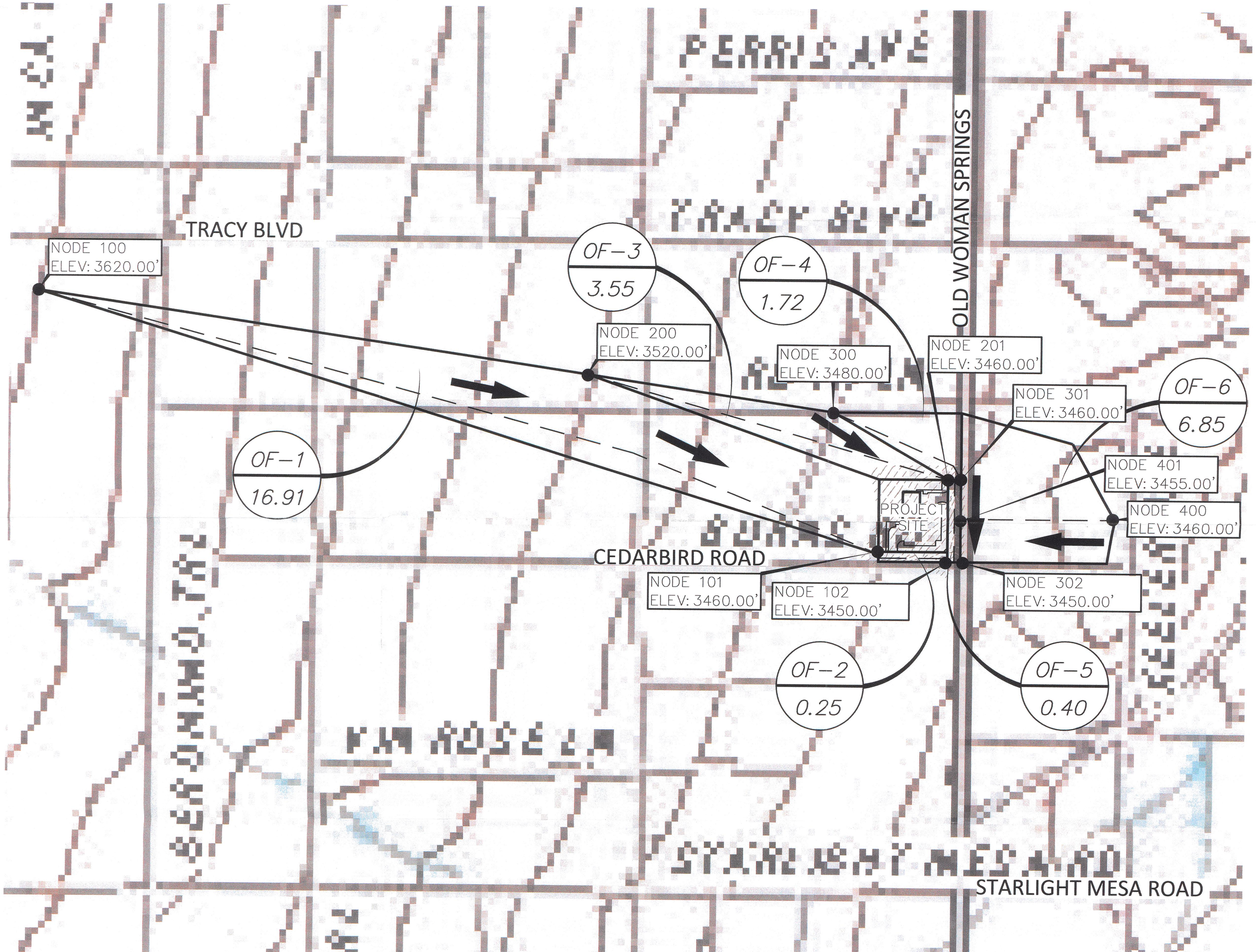
(3) CN values obtained from Figure C-3

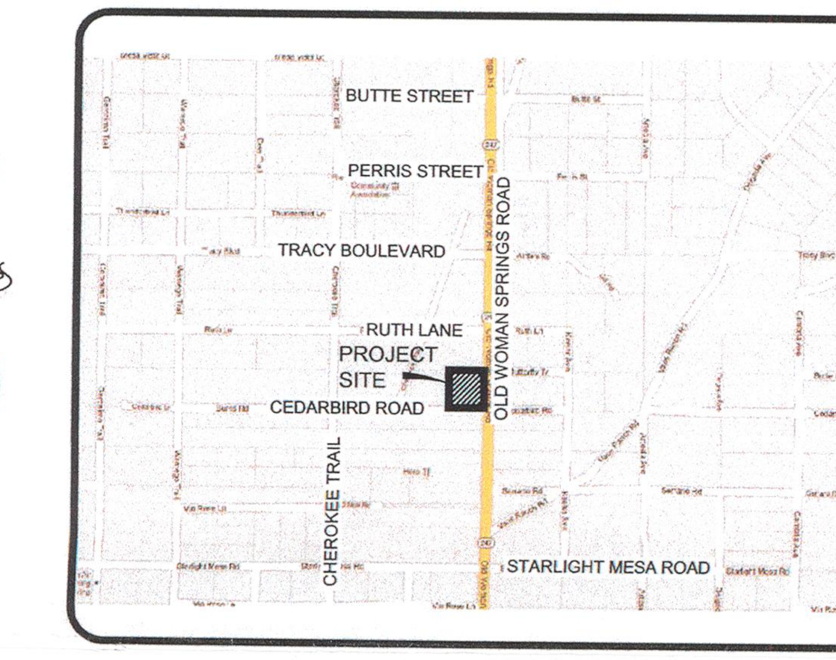
(4) DU/AC=dwelling unit per acre

APPENDIX F

APPENDIX F – IMPROVEMENT PLANS

- DETAIL SHEET
- GRADING PLAN





VICINITY MAP
N.T.S.

GRAPHIC SCALE

300 0 150 300 600 1200

(IN FEET)
1 inch = 300 feet

LEGEND

OF-1 / 0.16 — BASIN ID / BASIN AREA (ACRES)

BASIN BOUNDARY

FLOW PATH

FLOW ARROW

NODE 101 — NODE NUMBER
ELEV: 1028 — NODE ELEVATION

FLOW SUMMARY

BASIN ID*	BASIN AREA (acres)	NODE	25-YEAR FLOW (cfs)	100-YEAR FLOW (cfs)	FLOW LENGTH (ft)
OF-1	16.91	101	29.63	44.86	3542
OF-2	0.25	102	0.95	1.39	276
OF-3	3.55	201	5.78	8.77	1509
OF-4	1.72	301	3.72	5.56	591
OF-5	0.40	303	2.00	2.87	356
OF-6	6.85	401	11.50	17.43	620

GENERAL NOTE

PER INFORMATION OBTAINED FROM THE SAN BERNARDINO HYDROLOGY MANUAL (1986), FIGURE C-11 "HYDROLOGIC SOILS GROUP MAP FOR THE SOUTHCENTRAL AREA," THE SOIL TYPE FOR THE PROJECT SITE IS TYPE B.

WE PROJECT NO. 1260.00 SUBMITTAL NO. 1

FIGURE 1

APN: 0629-051-62

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BENCHMARK

EV3544 DESIGNATION – K 1306
PID – EV3544
STATE/COUNTY– CA/SAN BERNARDINO
USGS QUAD – YUCCA VALLEY NORTH (1994)
NAVD 88 – 1045.240 (meters) 3429.26 (feet) READJUSTED
U.S. NATIONAL GRID SPATIAL ADDRESS: 11SNT515877(NAD 83)
MARKER: DB = BENCH MARK DISK

STAMPING: K 1306 1978
STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO STATION DESCRIPTION

DESCRIBED BY NATIONAL GEODETIC SURVEY 1978
8.0 MI NORTH FROM YUCCA VALLEY.
8.0 MILES NORTH ALONG OLD WOMAN SPRINGS ROAD FROM THE JUNCTION OF STATE HIGHWAY 62 AT YUCCA VALLEY, AT THE SOUTHWEST CORNER OF THE T JUNCTION OF VIA ROSE LANE, 59 FEET WEST OF THE CENTER LINE OF THE ROAD, 31 FEET SOUTH OF THE CENTER LINE OF THE LANE, AND 14.5 FEET SOUTHWEST OF POWER POLE 1742807 E. THE DISK PROJECTS 1 INCH ABOVE THE SURFACE OF THE GROUND, ACCESS TO WHICH IS HAD THROUGH A 4-INCH PLASTIC SCREW PLUG.

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DEBRA M. YAMACHIKA
64488
Exp. 6-30-13
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DEPARTMENT OF PUBLIC WORKS

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ENGINEER, TRAFFIC DIVISION

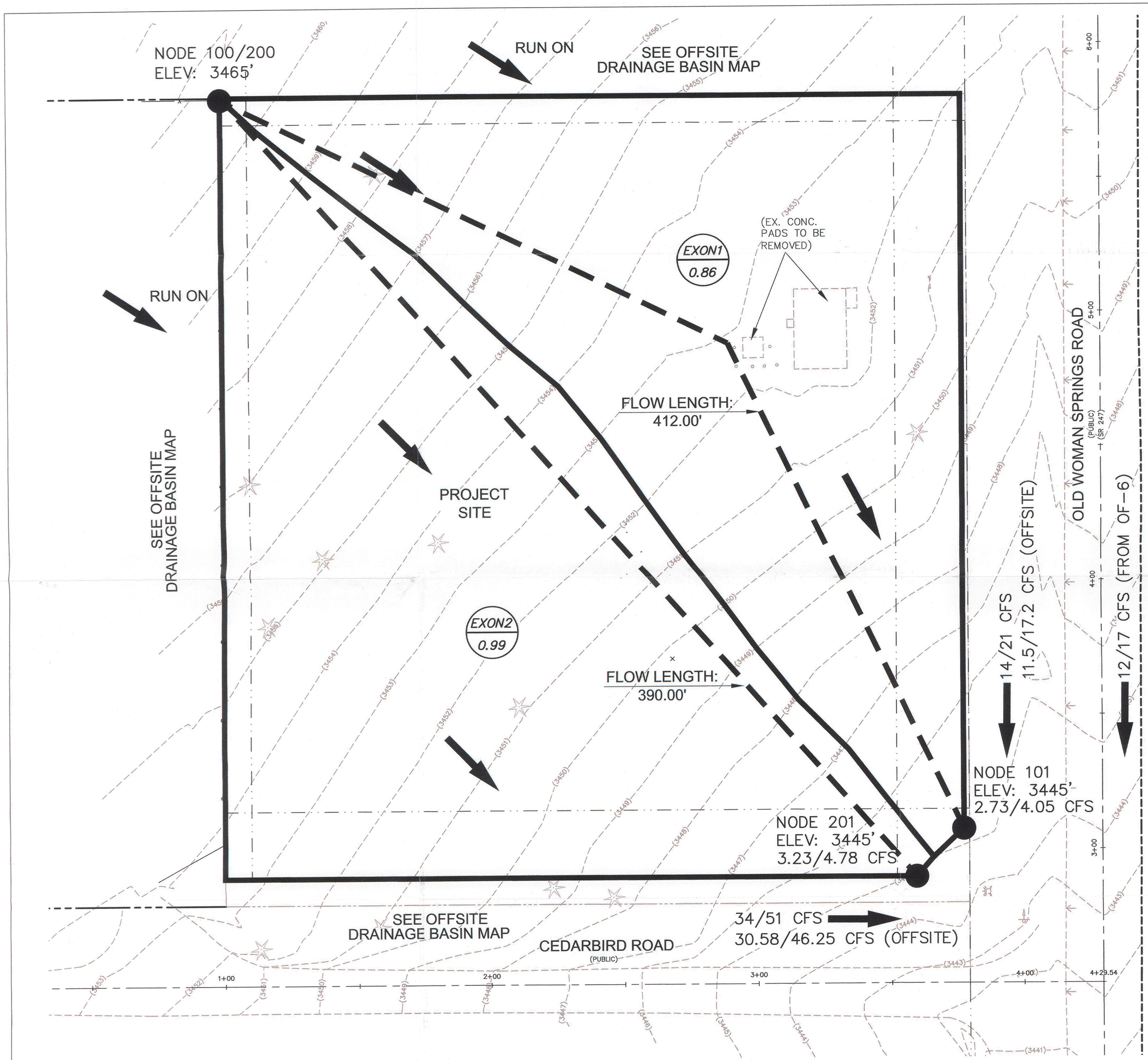
MOHAMMAD QURESHI — DATE
TRAFFIC DIVISION CHIEF

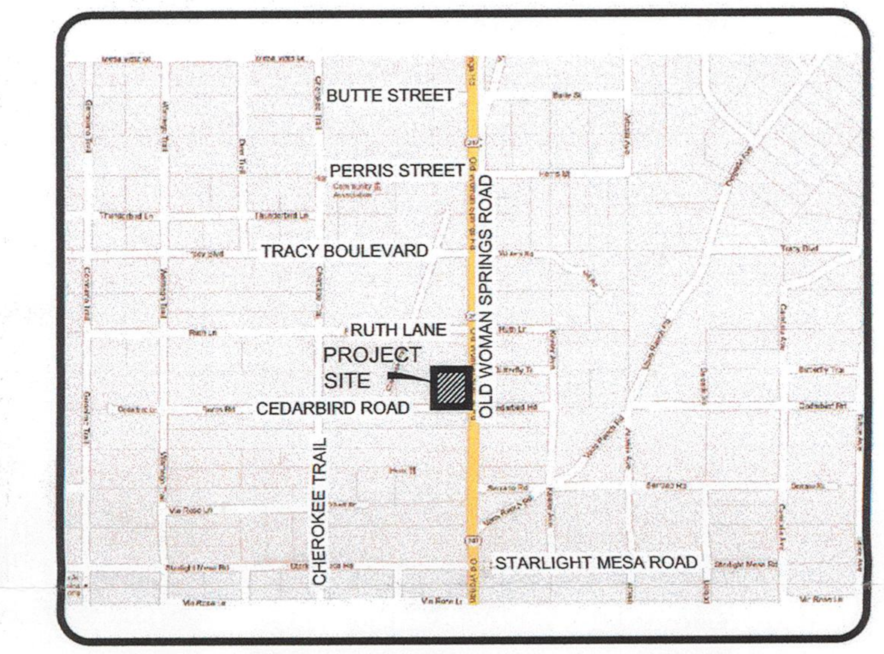
RECOMMENDED BY:

APPROVED BY:
GIA KIM — DATE
CHIEF, LAND DEVELOPMENT DIVISION

OFFSITE BASIN MAP
DRAINAGE
LANDERS

DRAWING NO. 1
ROAD NO. #
FILE NO. TBD
SHEET 1 OF 1





VICINITY MAP
N.T.S.

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

SUBMITTAL NO. 1

WE PROJECT NO. 1260.00

LEGEND

- EXON1 — BASIN ID
- 0.16 — BASIN AREA (ACRES)
- BASIN BOUNDARY
- FLOW PATH
- FLOW ARROW
- NODE 101 — NODE NUMBER
- ELEV: 1028 — NODE ELEVATION
- 34/51 CFS — 25 YR / 100 YR FLOWRATE (CFS)

FLOW SUMMARY

BASIN ID	BASIN AREA (acres)	NODE	25-YEAR FLOW (cfs)	100-YEAR FLOW (cfs)
EXON1	0.86	101	2.73	4.05
EXON2	0.99	201	3.23	4.78
TOTAL	1.85	N/A	**5.96**	**8.83**

GENERAL NOTE

PER INFORMATION OBTAINED FROM THE SAN BERNARDINO HYDROLOGY MANUAL (1986), FIGURE C-11 "HYDROLOGIC SOILS GROUP MAP FOR THE SOUTHCENTRAL AREA, " THE SOIL TYPE FOR THE PROJECT SITE IS TYPE B.

FIGURE 2

APN: 0629-051-62

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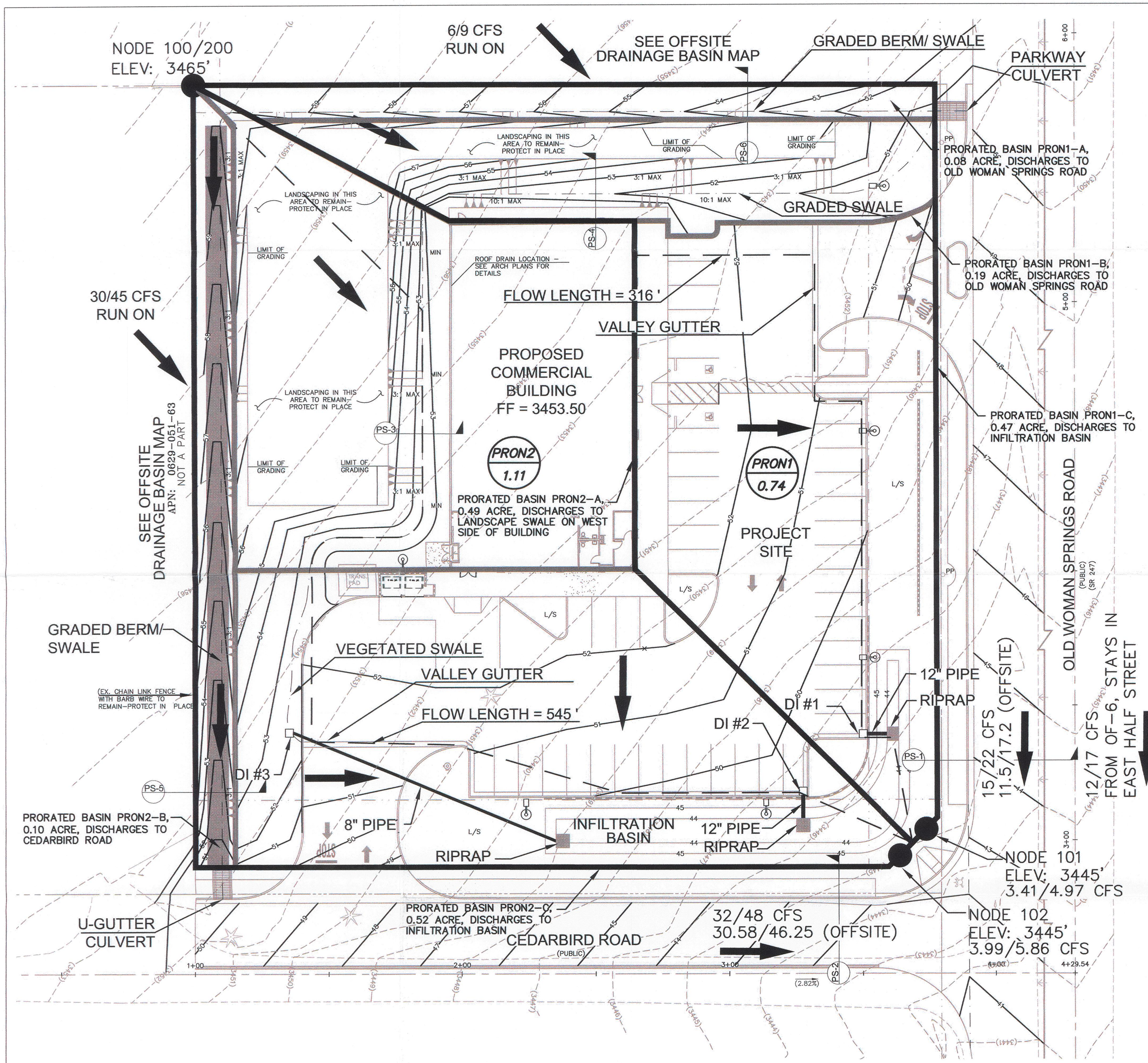
RECOMMENDED BY:
APPROVED BY:
GIA KIM, CHIEF, LAND DEVELOPMENT DIVISION — DATE

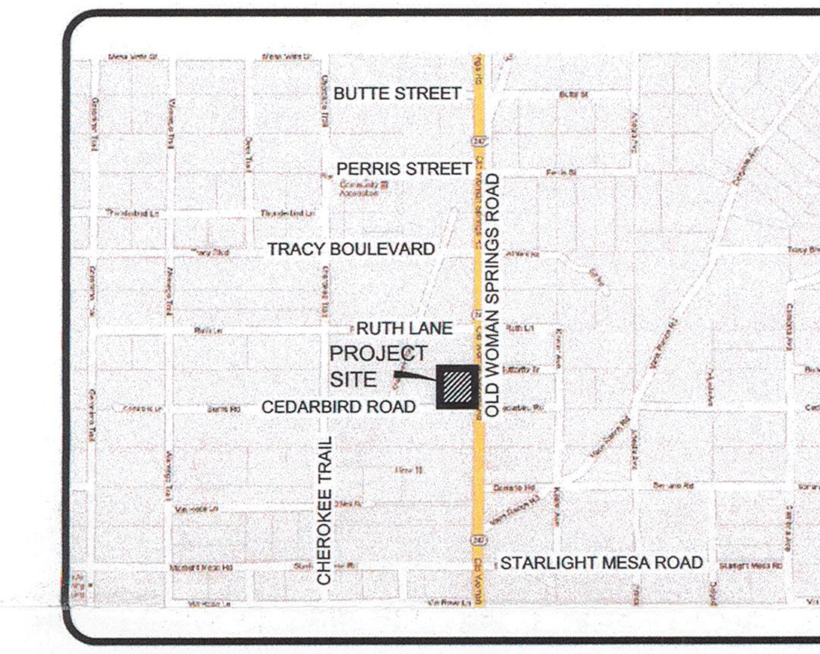
EXISTING CONDITION
BASIN MAP
LANDERS

ROAD NO. #
FILE NO. TBD
SHEET 1 OF 1



LEGEND

PRON1	BASIN ID
0.16	BASIN AREA (ACRES)
(thick line)	BASIN BOUNDARY
(dashed line)	FLOW PATH
(grey line)	PRORATED BASIN BOUNDARY
(arrow)	FLOW ARROW
NODE 101	NODE NUMBER
ELEV: 1028	NODE ELEVATION
47/73	25 YR / 100 YR FLOWRATE (CFS)



VICINITY MAP
N.T.S.

GRAPHIC SCALE
(IN FEET)
1 inch = 20 ft.

FLOW SUMMARY

BASIN ID	BASIN AREA (acres)	NODE	25-YEAR FLOW (cfs)	100-YEAR FLOW (cfs)
PRON1	0.74	102	3.41	4.97
PRON2	1.11	201	3.99	5.86
TOTAL	1.85	N/A	**7.4**	**10.83**

PRORATED FLOW RATES

SUBBASIN ID*	BASIN AREA (acres)	25-YEAR FLOW (cfs)	100-YEAR FLOW (cfs)
PRON1-A	0.08	0.37	0.54
PRON1-B	0.19	0.88	1.28
PRON1-C	0.47	2.16	3.15
TOTAL	0.74	3.41	4.97
PRON2-A	0.49	1.76	2.59
PRON2-B	0.1	0.36	0.53
PRON2-C	0.52	1.87	2.74
TOTAL	1.11	3.99	5.86

HYDRAULIC SUMMARY

SECTION	Q25 (cfs)	Flow Depth (ft)	V25 (fps)	V*D	Q100 (cfs)	Flow Depth (ft)	V100 (fps)	V*D
PS-1 (Old Woman Springs Road)	15	0.49	4.7	2.3	22	0.55	5.17	2.84
PS-2 (Cedarbird Road)	32	0.5	6.02	3.01	48	0.56	7.08	3.96
PS-3 Swale (west of building)	N/A	N/A	N/A	N/A	2.59	0.36	1.88	N/A
PS-4 Swale (north of building)	N/A	N/A	N/A	N/A	1.28	0.29	1.98	N/A
PS-5 West PL Swale	30	0.78	7.15	N/A	45	0.96	7.98	N/A
PS-6 North PL Swale	6	0.49	4.37	N/A	9	0.57	4.84	N/A

FIGURE 3

GENERAL NOTE

PER INFORMATION OBTAINED FROM THE SAN BERNARDINO HYDROLOGY MANUAL (1986), FIGURE C-11 "HYDROLOGIC SOILS GROUP MAP FOR THE SOUTHCENTRAL AREA," THE SOIL TYPE FOR THE PROJECT SITE IS TYPE B.

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MOHAMMAD QURESHI, TRAFFIC DIVISION CHIEF — DATE
GIA KIM, CHIEF, LAND DEVELOPMENT DIVISION — DATE

PROPOSED CONDITION
BASIN MAP
LANDERS

ROAD NO. #
FILE NO. TBD
SHEET 1 OF 1

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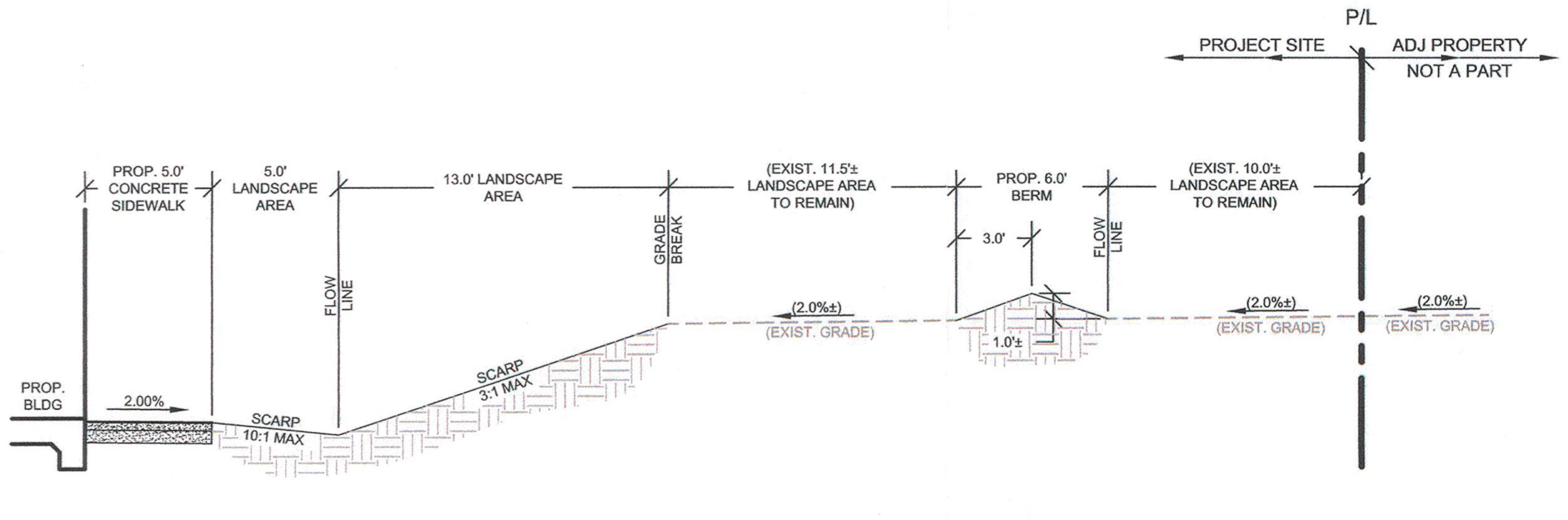
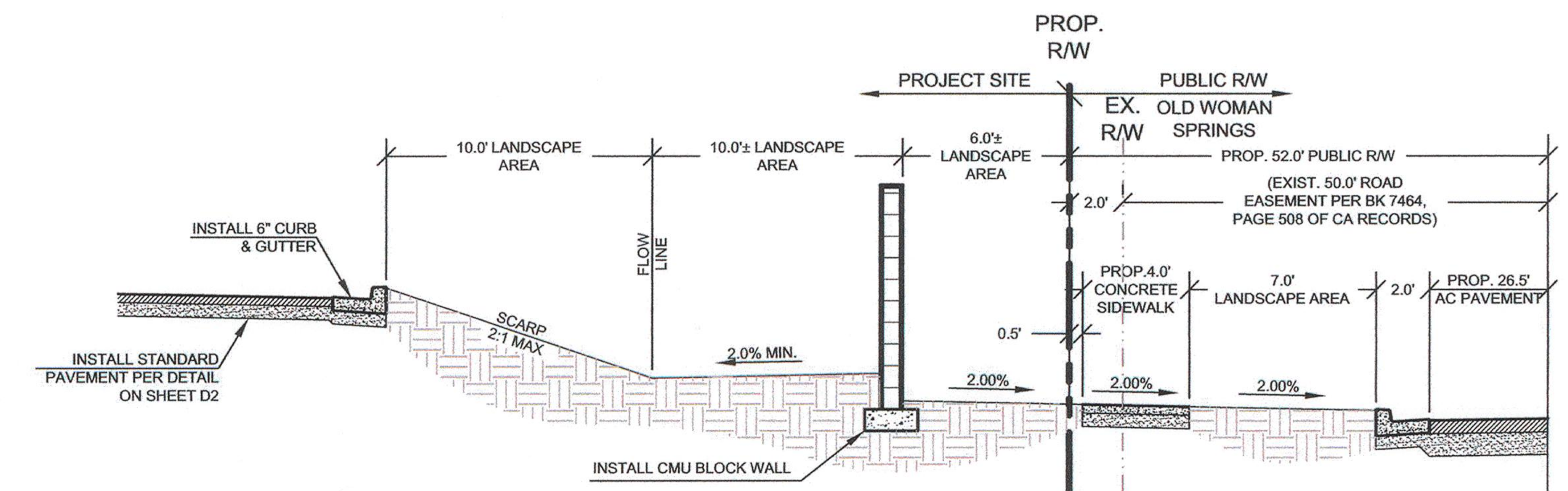
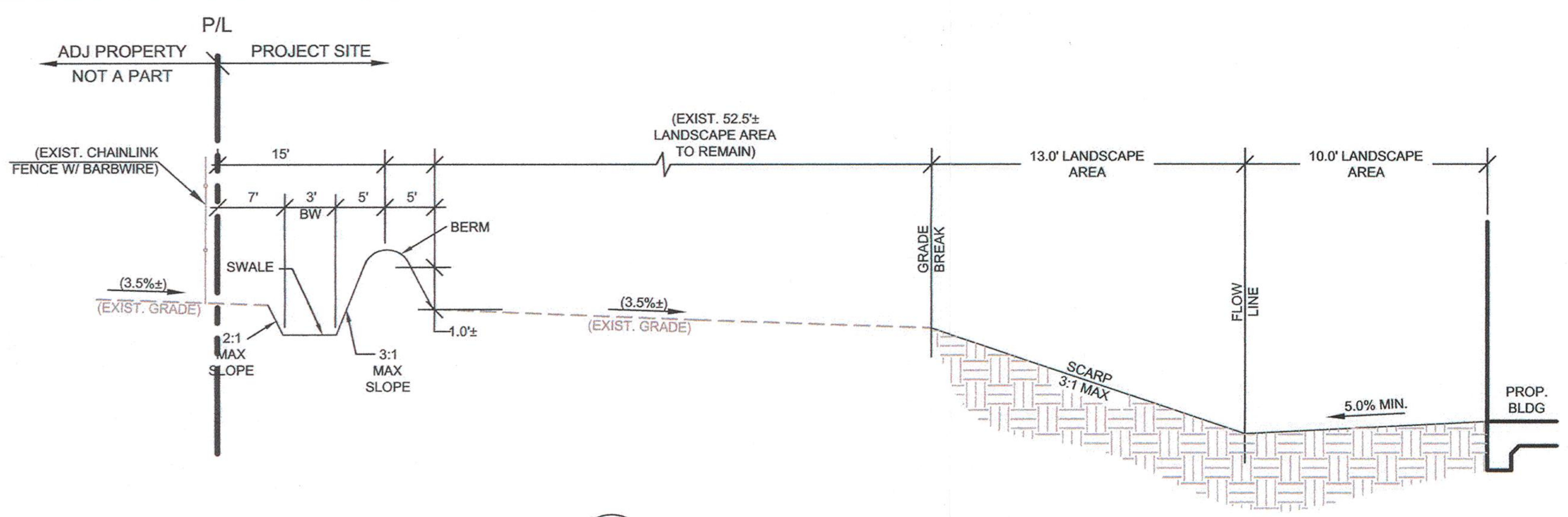


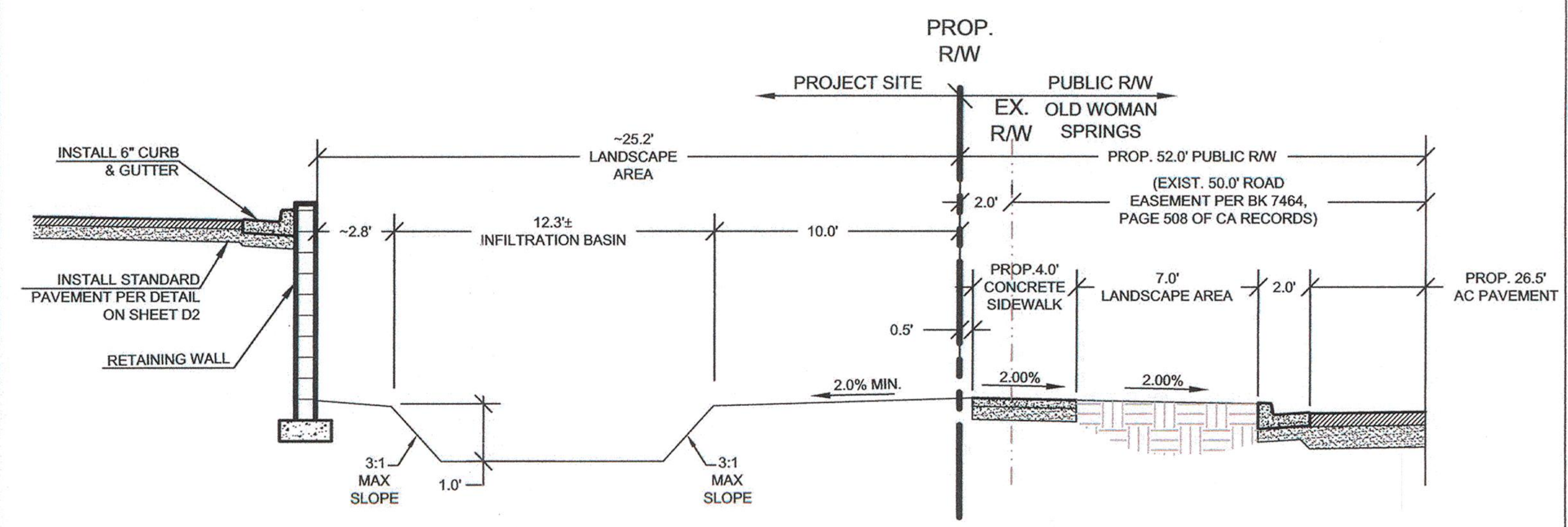
A / D1 NORTH PROPERTY BOUNDARY (NOT TO SCALE)



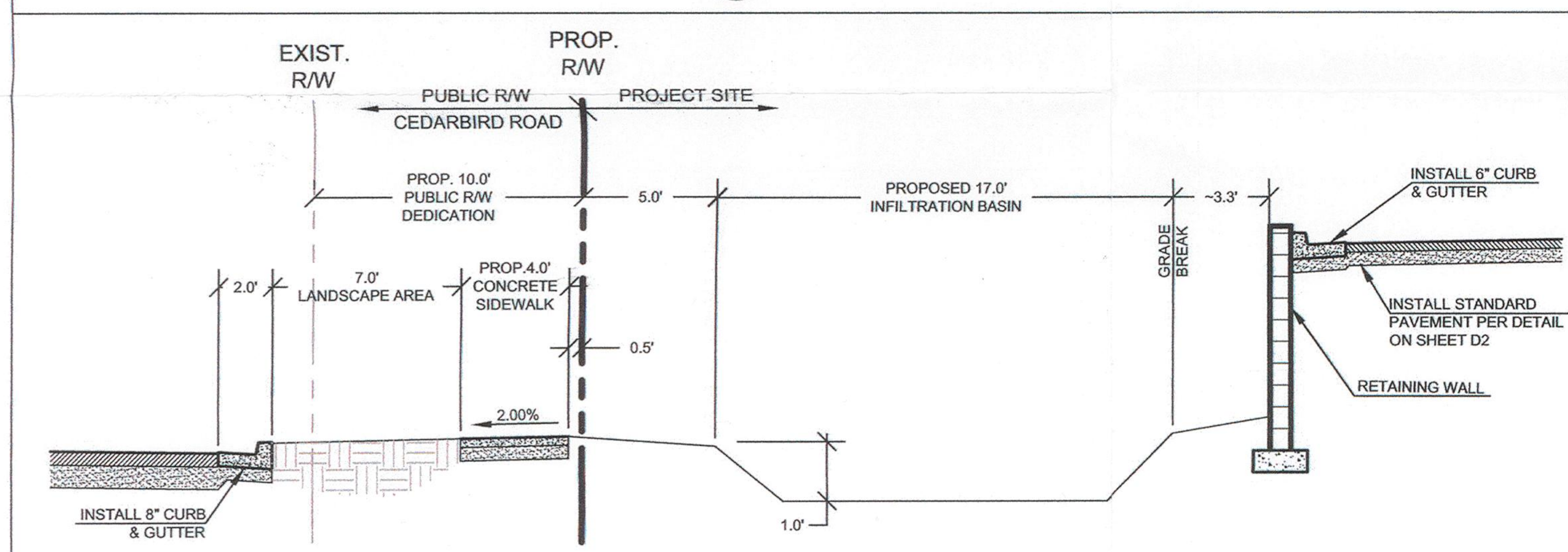
D / D1 EAST PROPERTY BOUNDARY WITH SCREEN WALL (NOT TO SCALE)



B / D1 WEST PROPERTY BOUNDARY (NOT TO SCALE)



E / D1 EAST PROPERTY BOUNDARY WITH RETAINING WALL (NOT TO SCALE)



C / D1 SOUTH PROPERTY BOUNDARY (NOT TO SCALE)

WE PROJECT NO. 1260.00 SUBMITTAL NO. TDS

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APPROVED BY:
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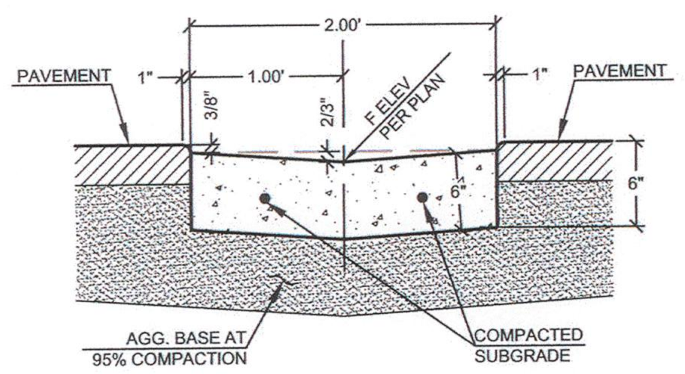
GIA KIM CHIEF, LAND DEVELOPMENT DIVISION — DATE

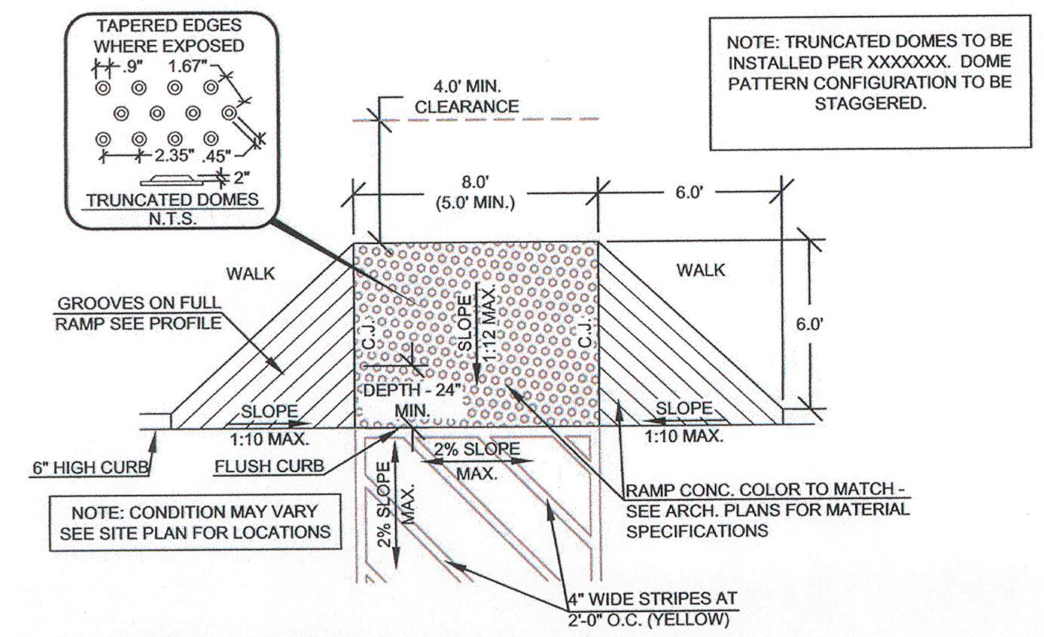
DETAIL SHEET

LANDERS

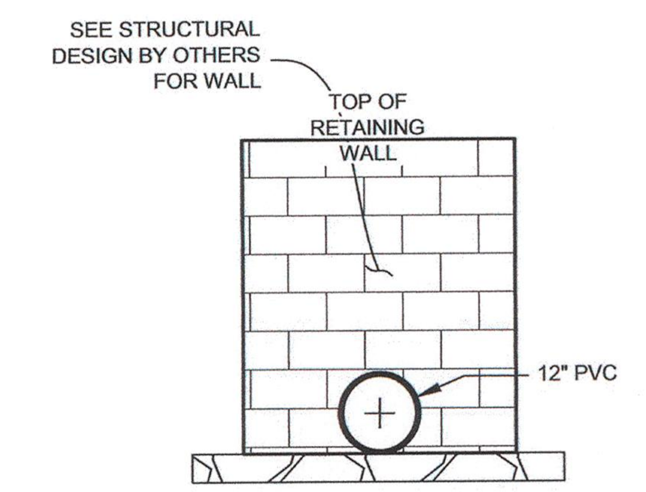
DRAWING NO. D1
ROAD NO. #
FILE NO. TBD
SHEET 3 OF X



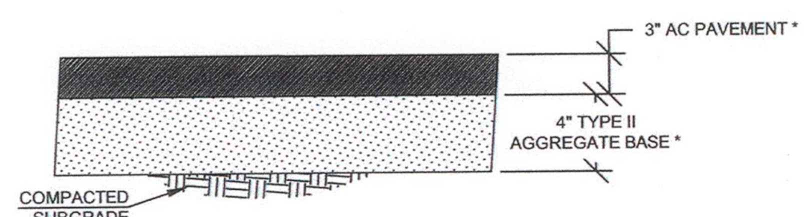
1 D2 2' VALLEY GUTTER (NOT TO SCALE)



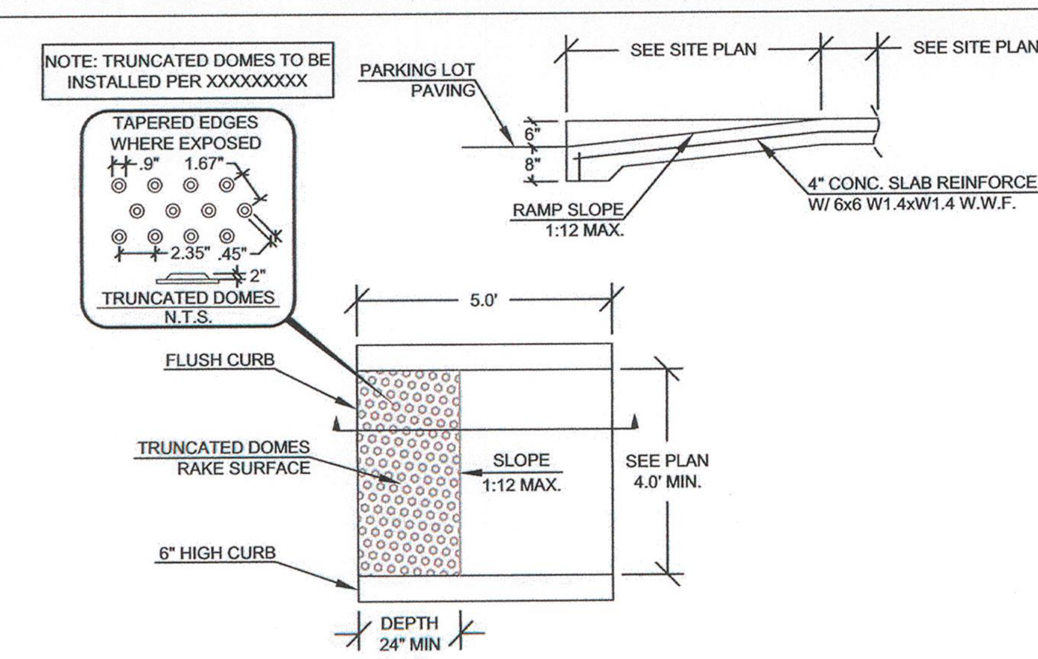
5 D2 ON-SITE RAMP (NOT TO SCALE)



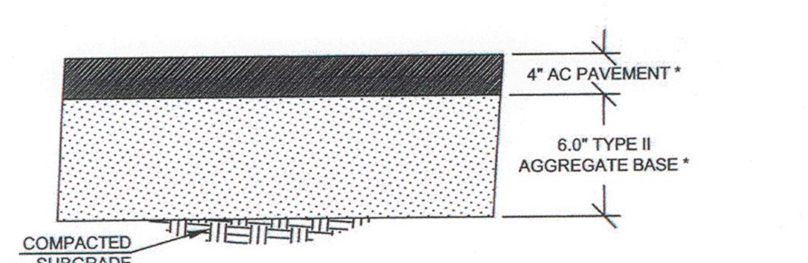
9 D2 PIPE THROUGH WALL DETAIL SOUTH BOUNDARY (NOT TO SCALE)



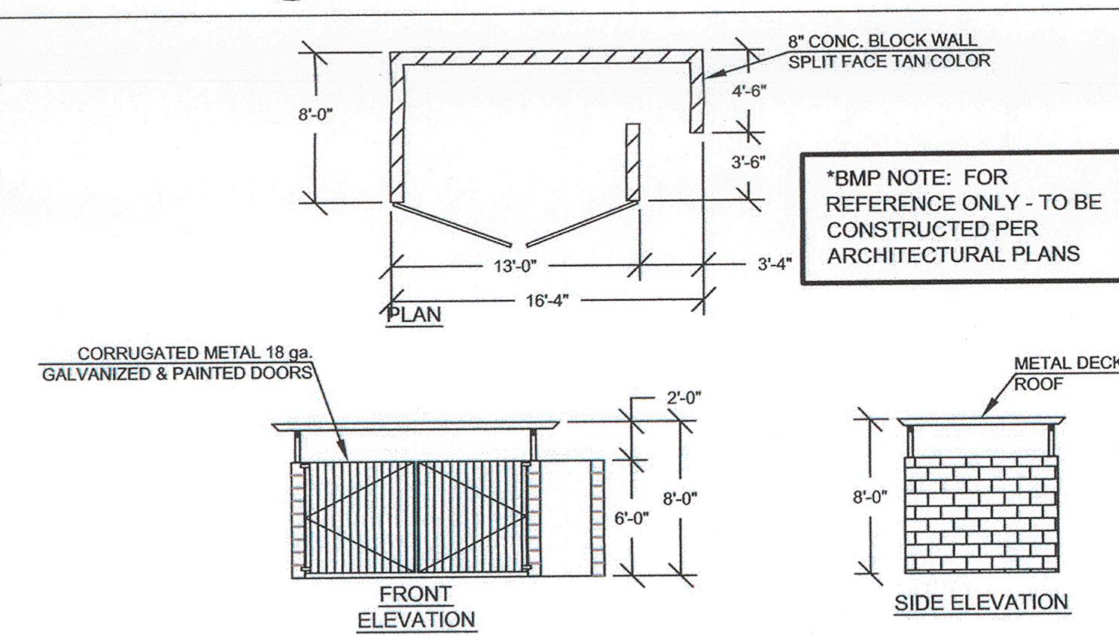
2 D2 STANDARD PAYMENT SECTION (NOT TO SCALE)



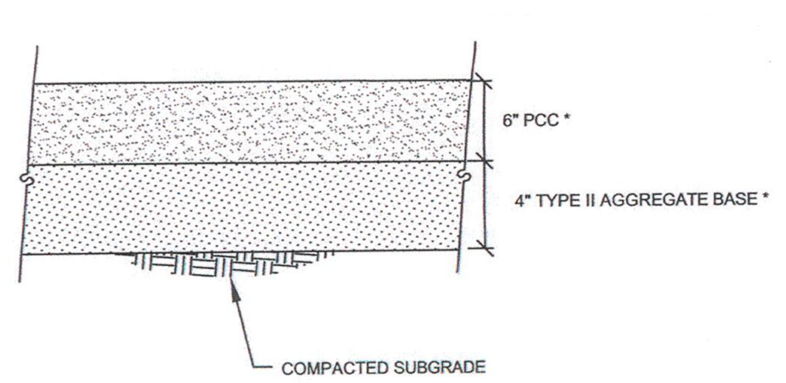
6 D2 ON-SITE RAMP (NOT TO SCALE)



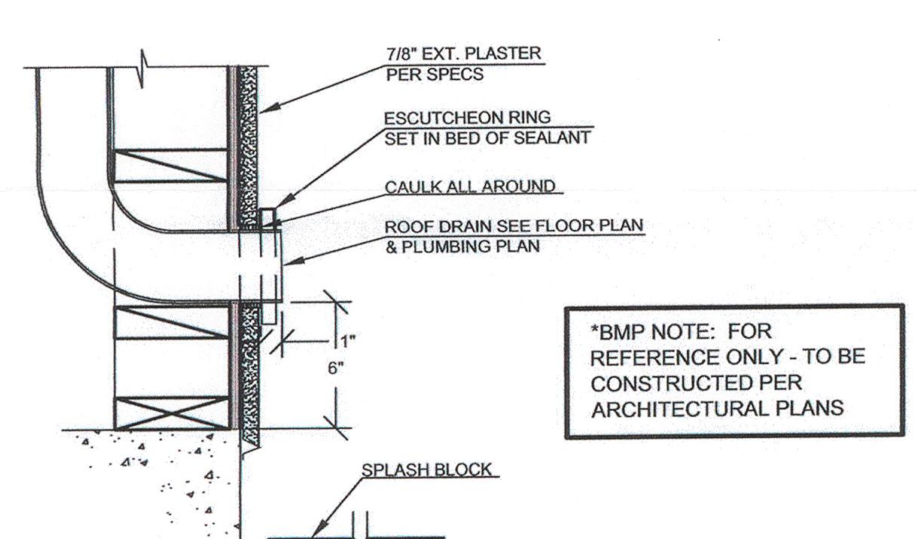
3 D2 HEAVY PAYMENT SECTION (NOT TO SCALE)



7 D2 COVERED TRASH ENCLOSURE PER SEPARATE PERMIT (NOT TO SCALE)



4 D2 PCC SECTION (NOT TO SCALE)



8 D2 ROOF DRAIN OUTLET PER PER SEPARATE PERMIT (NOT TO SCALE)

WE PROJECT NO. 1260.00 SUBMITTAL NO. TDS

APN: 0629-051-62

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

BENCHMARK

DEVELOPER
DYNAMIC DEVELOPMENT CO
1725 21ST STREET
SANTA MONICA, CA 90404
TEL: 310.315.5411
CONTACT: JON TANURY

Dynamic DEVELOP DESIGN BUILD

PREPARED BY:
WALKER ENGINEERING, LLC
5765 S. RAINBOW BLVD, STE. 101
LAS VEGAS, NV 89118
T: 702.873.5197 F: 702.873.5346

W|E meeting your land development needs

REGISTERED PROFESSIONAL ENGINEER DEBRA M. YAMACHIKA 64488 Exp. 6-30-13 CIVIL STATE OF CALIFORNIA 4/9/13

MARK	REVISIONS	APPR	DATE

COUNTY OF SAN BERNARDINO
DEPARTMENT OF PUBLIC WORKS

RECOMMENDED BY:
MOHAMMAD SIDDIQUI ENGINEER, TRAFFIC DIVISION — DATE
APPROVED BY:
MOHAMMAD QURESHI TRAFFIC DIVISION CHIEF — DATE
GIA KIM CHIEF, LAND DEVELOPMENT DIVISION — DATE

DETAIL SHEET

LANDERS

DRAWING NO. D2
ROAD NO. #
FILE NO. TBD
SHEET 4 OF X

E:\1260_DYNAMIC\dwg\1IMPRDWGS\03-1260D1.dwg, 4/9/2013 5:28:55 PM, dyamachika, DJ 1050c.pc3

LEGEND

PROPERTY LINE	FLOW LINE
STREET CENTERLINE	EASEMENT LINE
EXISTING WALL	HANDICAP PARKING
PROPOSED BUILDING	FS — FINISHED SURFACE
(1030) EXISTING CONTOUR	TC — CURB BACK
30 PROPOSED CONTOUR	EP — EDGE OF PAVEMENT
PROPOSED CURB & GUTTER	FG — FINISHED GRADE
PROPOSED CURB	FL — FLOW LINE
EXISTING CURB & GUTTER	FF — FINISHED FLOOR
EXISTING CURB	30.50 TC — PROPOSED GRADE
EXISTING BUILDING	(32.27) AC — EXISTING GRADE
(10) CONSTRUCTION NOTE	0.40% — SLOPE
CUT FILL TRANSITION	NEW PAVEMENT
SAWCUT LIMITS	
3:1 SCARP	

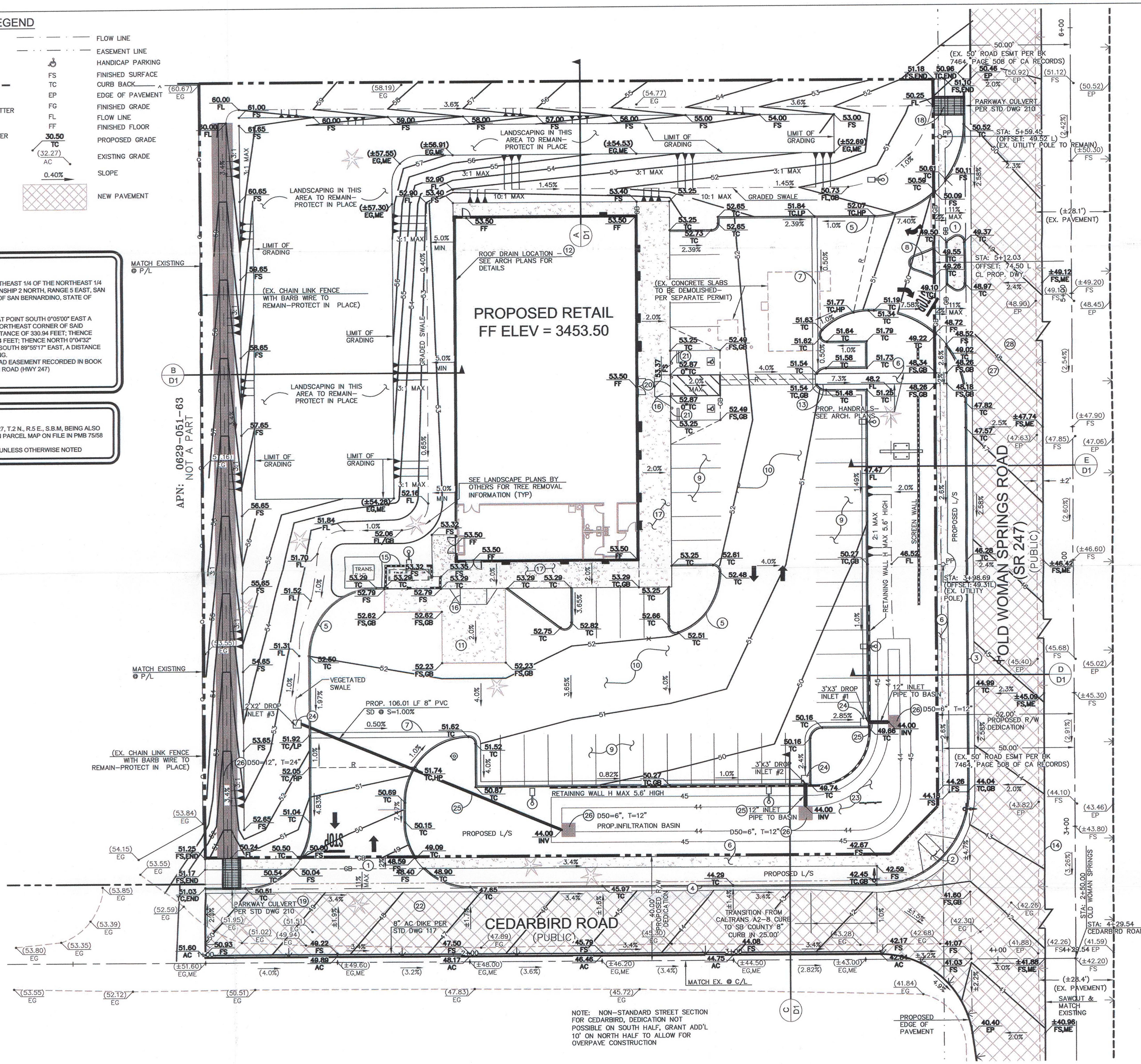
LEGAL DESCRIPTION

THE EAST 1/2 OF THE SOUTH 1/2 OF THE SOUTHEAST 1/4 OF THE NORTHEAST 1/4 OF THE NORTHEAST 1/4 OF SECTION 27, TOWNSHIP 2 NORTH, RANGE 5 EAST, SAN BERNARDINO BASE AND MERIDIAN, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA

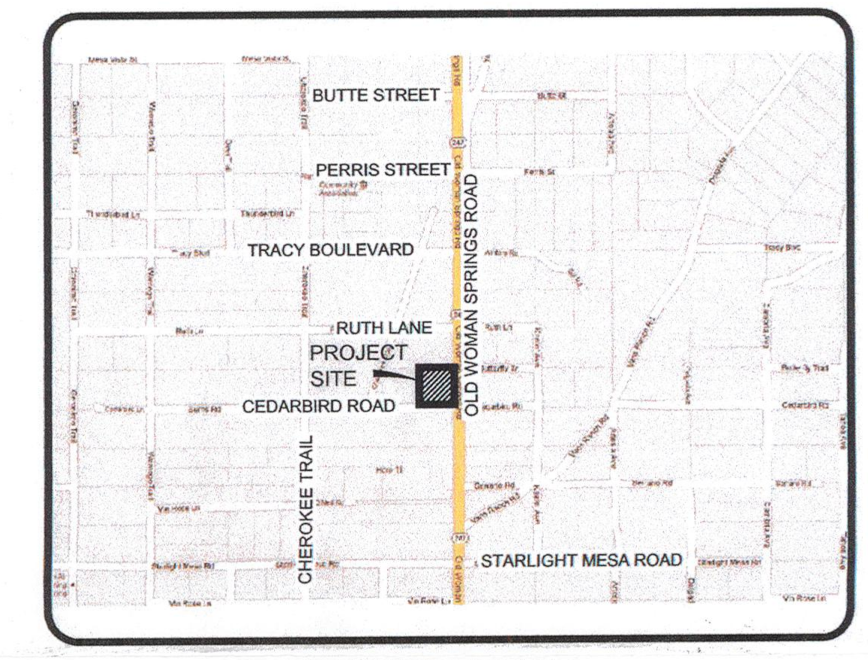
ALSO DESCRIBED AS FOLLOWS: BEGINNING AT POINT SOUTH 0°05'00" EAST A DISTANCE OF 992.82 FEET ALSO BEING THE NORTHEAST CORNER OF SAID PARCEL; THENCE SOUTH 0°05'00" EAST, A DISTANCE OF 330.94 FEET; THENCE NORTH 89°55'05" WEST, A DISTANCE OF 329.44 FEET; THENCE NORTH 0°04'32" WEST, A DISTANCE OF 330.92 FEET; THENCE SOUTH 89°55'17" EAST, A DISTANCE OF 329.39 FEET TO THE TRUE POINT BEGINNING.
SUBJECT TO THE EAST 50.00 FOOT FOR A ROAD EASEMENT RECORDED IN BOOK 7464, PAGE 508 ALSO KNOWN AS OLD WOMAN ROAD (HWY 247)
APN'S: 0629-051-62

BASIS OF BEARINGS

THE EAST LINE OF THE SECTION 27 SECTION 27, T.2 N., R.5 E., S.B.M, BEING ALSO THE CENTERLINE HIGHWAY 247 AS SHOWN ON PARCEL MAP ON FILE IN PMB 75/58 AS SHOWN N 0°05'00" W
(~) INDCATES RECORD DATA FROM PMB 75/58 UNLESS OTHERWISE NOTED



NOTE: NON–STANDARD STREET SECTION FOR CEDARBIRD, DEDICATION NOT POSSIBLE ON SOUTH HALF, GRANT ADD'L 10' ON NORTH HALF TO ALLOW FOR OVERPAVE CONSTRUCTION



VICINITY MAP
N.T.S.

GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)
1 inch = 20 ft.

	CONSTRUCTION NOTES
NO	ITEM
1	CONSTRUCT COMMERCIAL DRIVEWAY PER COUNTY STD No. 129B
2	CONSTRUCT CURB RAMP PER CALTRANS STD PLAN A88A, CASE A
3	CONSTRUCT 8" CURB AND GUTTER PER CALTRANS STD PLAN A87A
4	CONSTRUCT 8" CURB AND GUTTER PER COUNTY STD No. 115
5	CONSTRUCT 6" ONSITE CURB PER ARCHITECTURAL PLANS
6	CONSTRUCT SIDEWALK (TYPE "B") PER COUNTY STD No. 109
7	CONSTRUCT 2' WIDE VALLEY GUTTER PER DETAIL 1 ON SHEET D1
8	CONSTRUCT RAISED PASSAGEWAY (TYPE "B") PER CALTRANS STD PLAN A88B
9	CONSTRUCT 3" MIN AC OVER 4" TYPE II AGG. BASE PER SOILS REPORT BY PSI. SEE DETAIL 2 ON SHEET D1
10	CONSTRUCT 4" MIN AC OVER 6" TYPE II AGG. BASE PER SOILS REPORT BY PSI. SEE DETAIL 3 ON SHEET D1
11	CONSTRUCT 6" MIN PCC OVER 4" TYPE II AGG. BASE PER SOILS REPORT BY PSI. SEE DETAIL 4 ON SHEET D1.
12	INSTALL 8" PVC ROOF DRAIN PER ARCHITECTURAL PLANS
13	INSTALL HANDRAILS PER ARCHITECTURAL PLANS
14	SAWCUT AND JOIN EXISTING A/C PAVEMENT
15	CONSTRUCT TRASH ENCLOSURE PER ARCHITECTURAL PLANS
16	CONSTRUCT ON–SITE RAMP PER ARCHITECTURAL PLANS
17	CONSTRUCT MONOLITHIC POUR OF CURB & SIDEWALK ADJACENT TO BUILDING. SEE ARCH. PLANS FOR DETAILS.
18	CONSTRUCT (2) 3'–6" CURB OUTLET STRUCTURE PER COUNTY STD No. 210
19	CONSTRUCT (2) 5' WIDE PARKWAY CULVERT W/STEEL PLATE COVER PER COUNTY STD No. 211
20	CONSTRUCT 0" CURB
21	TRANSITION FROM 0" CURB TO 6" CURB IN 10' OR AS SHOWN ON PLANS
22	CONSTRUCT HALF WIDTH LOCAL STREET PER COUNTY STD No. 111
23	CONSTRUCT INFILTRATION BASIN PER SECTION DETAILS ON SHEET D1
24	INSTALL DROP INLET (SIZE PER PLAN)
25	INSTALL PVC STORM DRAIN PIPE (SIZE PER PLAN)
26	INSTALL RIPRAP (SIZE PER PLAN)
27	CONSTRUCT 9" A.C. OVER 19" CLASS II AGGREGATE BASE AND HOT MIX ASPHALT OVERLAY
28	COLD PLAN (GRIND) EXISTING PAVEMENT TO ACHIEVE 0.25' MINIMUM OF OVERLAY THICKNESS.

EARTHWORK QUANTITIES

*NOTE: THESE QUANTITIES ARE APPROXIMATE AND ARE RAW VOLUMES ONLY. OVEREXCAVATION SUBSIDENCE,
SHRINKAGE, & BULKING FACTORS ARE NOT TAKEN INTO ACCOUNT.
CUT = TBD CY
FILL = TBD CY

GEOTECHNICAL NOTE

PER THE GEOTECHNICAL ENGINEERING SERVICES REPORT PERFORMED BY PROFESSIONAL SERVICES INDUSTRIES, REPORT NO. XXXXXXXXX, DATED XXXXXXXXXXXXXXX:
1. SITE NOT LOCATED WITHIN A CURRENTLY DESIGNATED EARTHQUAKE FAULT ZONE.
2. THE NEAREST MAPPED FAULT APPEARS TO BE LOCATED LESS THAN XXXXX MILES FROM THE PROJECT SITE.

APN: 0629-051-62

Underground Service Alert
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TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK

EV3544 DESIGNATION – K 1308
PID – EV3544
STATE/COUNTY– CA/SAN BERNARDINO
USGS QUAD – YUCCA VALLEY NORTH (1994)
NAVD 88 – 1045.240 (meters) 3429.26 (feet) READJUSTED
U.S. NATIONAL GRID SPATIAL ADDRESS: 11SNT515877(NAD 83)
MARKER: DB = BENCH MARK DISK

STAMPING: K 1308 1978
STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO STATION DESCRIPTION

DESCRIBED BY NATIONAL GEODETIC SURVEY 1978
8.0 MI NORTH FROM YUCCA VALLEY.
8.0 MILES NORTH ALONG OLD WOMAN SPRINGS ROAD FROM THE JUNCTION OF STATE HIGHWAY 62 AT YUCCA VALLEY, AT THE SOUTHWEST CORNER OF THE T JUNCTION OF VIN ROSE LANE, 59 FEET WEST OF THE CENTER LINE OF THE ROAD, 31 FEET SOUTH OF THE CENTER LINE OF THE LANE, AND 14.5 FEET SOUTHWEST OF POWER POLE 1742807 E. THE DISK PROJECTS 1 INCH ABOVE THE SURFACE OF THE GROUND, ACCESS TO WHICH IS HAD THROUGH A 4–INCH PLASTIC SCREW PLUG.

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DETAIL SHEET

LANDERS

DRAWING NO. G1
ROAD NO. #
FILE NO. TBD
SHEET 5 OF X

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