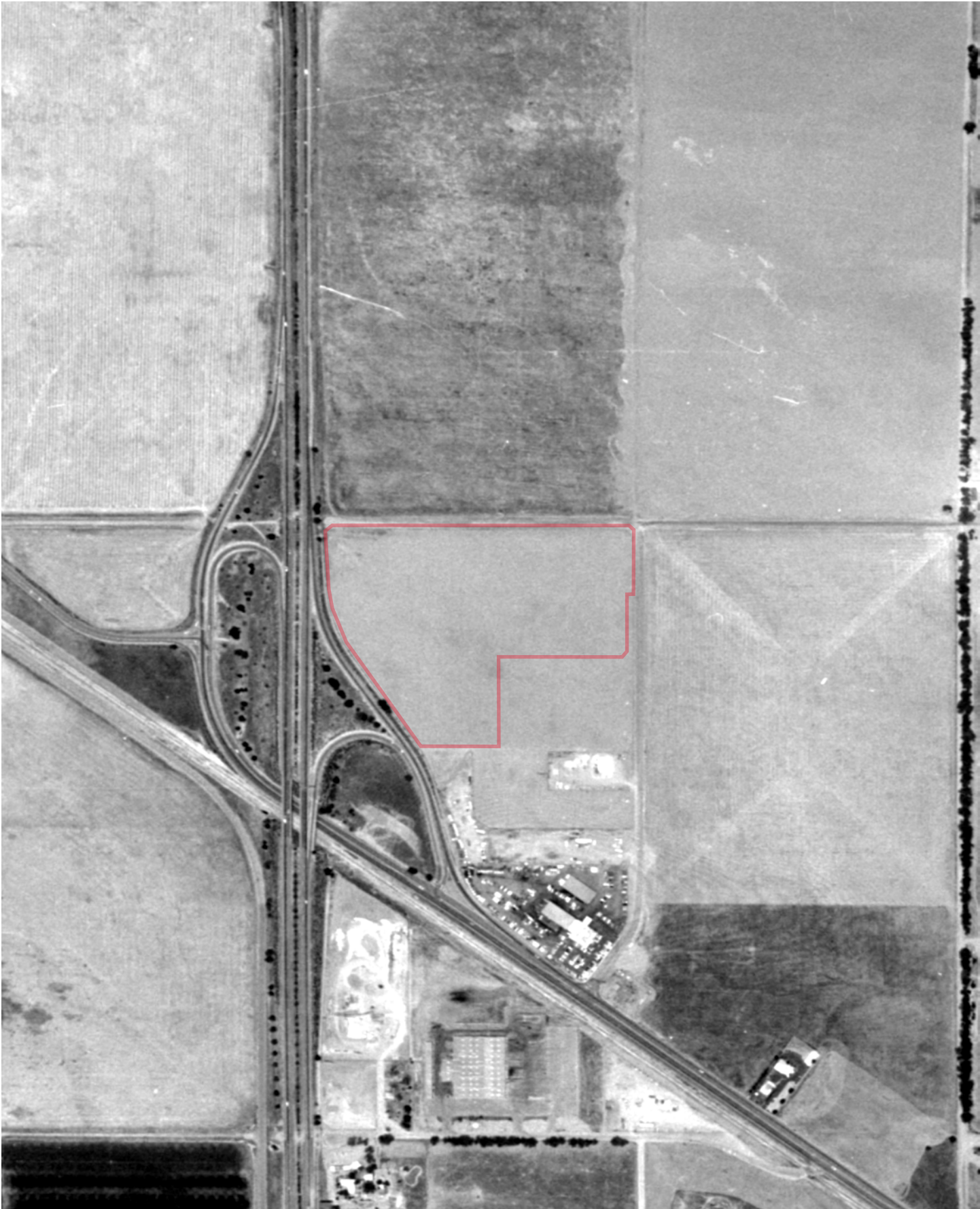

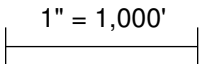


**FLIGHT YEAR:**  
1980

N  
W E S  
**Scale:** 1" = 500'


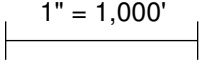


**FLIGHT YEAR:**  
1985

 **Scale:**  1" = 1,000'


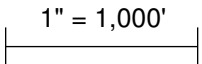


**FLIGHT YEAR:**  
1989

 **Scale:**  1" = 1,000'

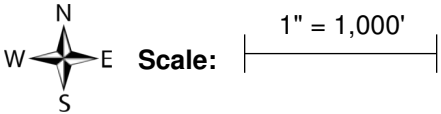


**FLIGHT YEAR:**  
1990

 **Scale:**  1" = 1,000'


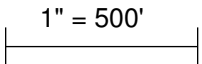


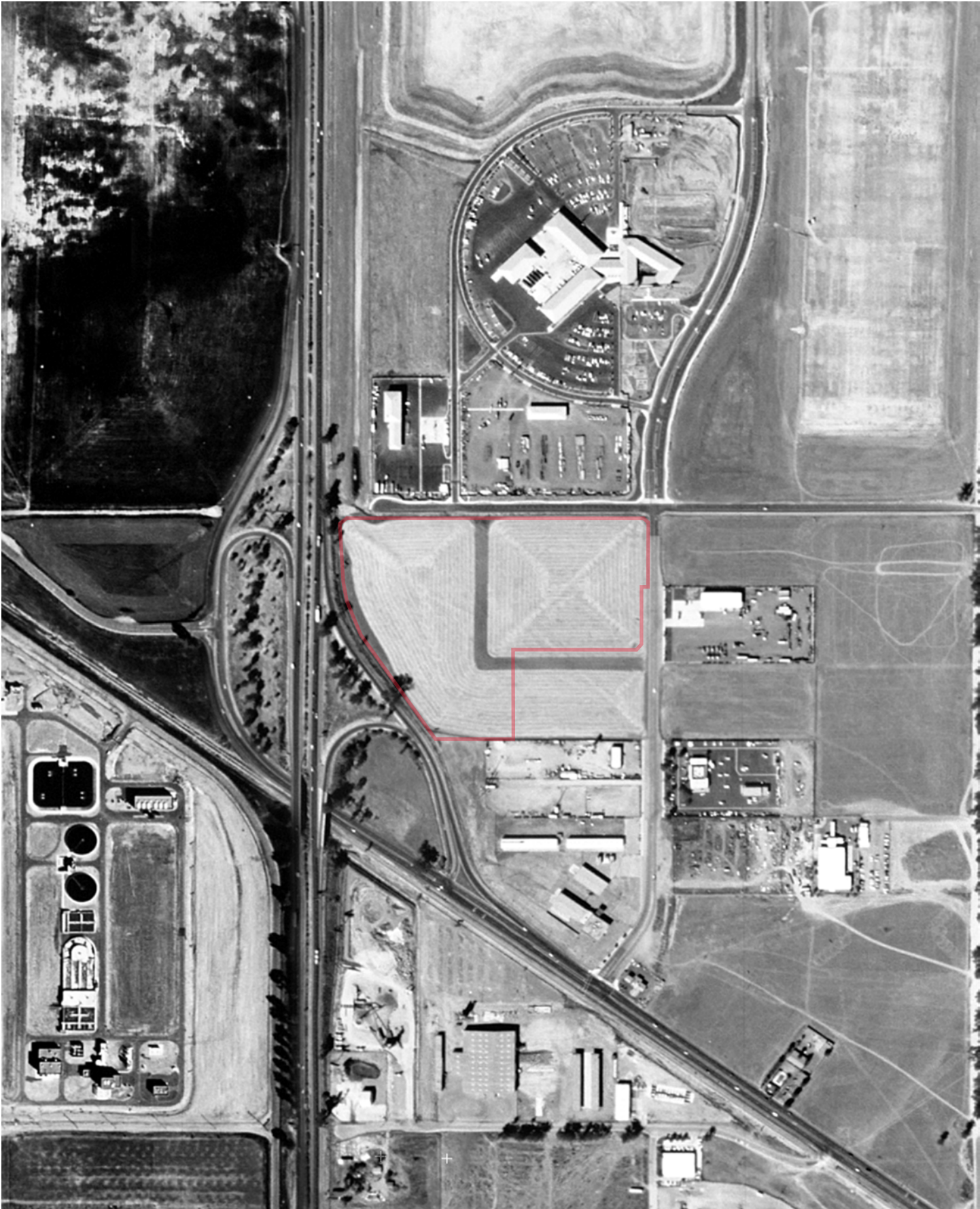
**FLIGHT YEAR:**  
1994

Scale:  1" = 1,000'



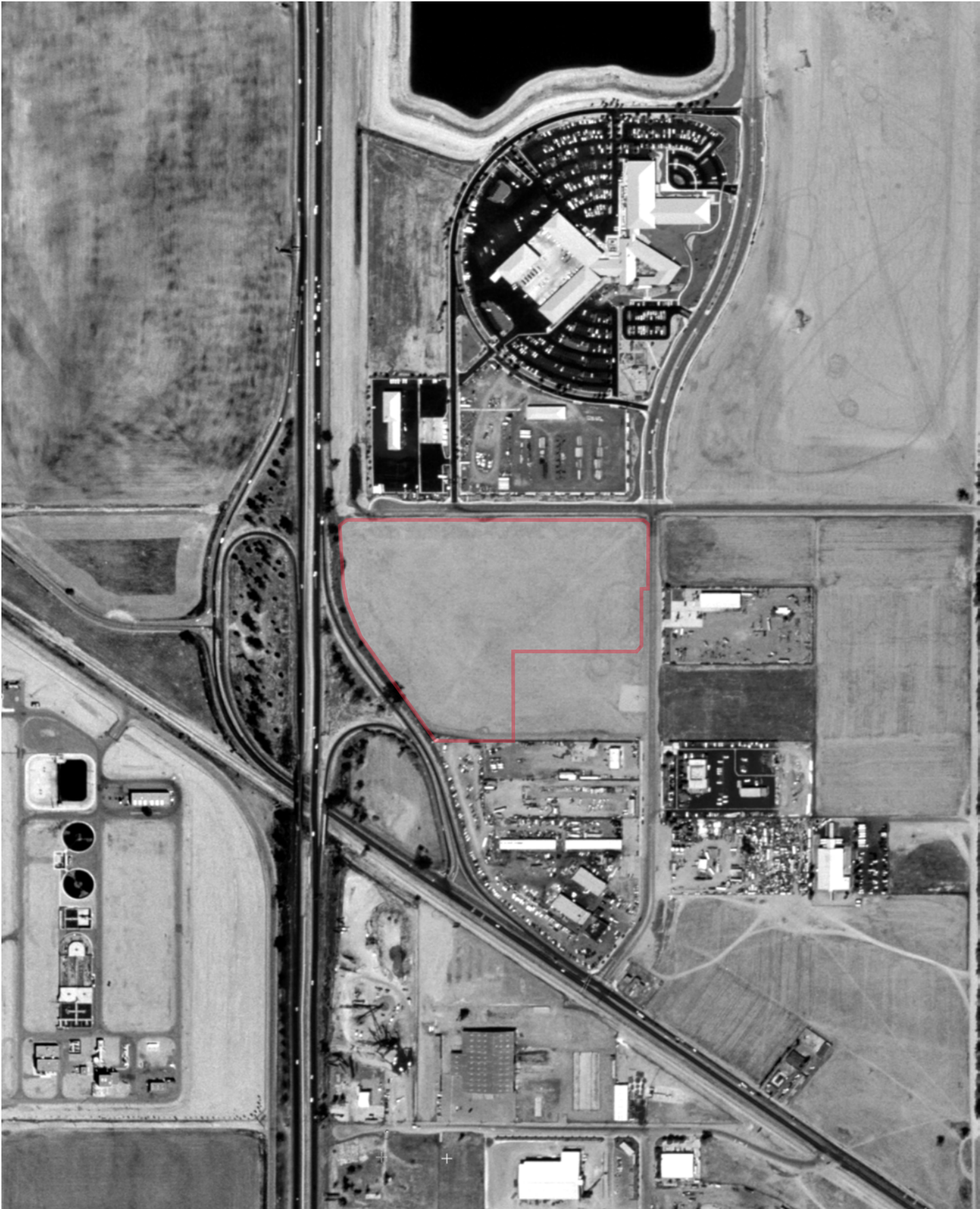
**FLIGHT YEAR:**  
1997

 **Scale:**  1" = 500'



**FLIGHT YEAR:**  
2002

N  
W E Scale: 1" = 500'  
S



**FLIGHT YEAR:**  
2004

**Subject Cannot Be Centered**

N  
W E S  
Scale: 1" = 500'




**FLIGHT YEAR:**  
2005

N  
W E S  
Scale: 1" = 500'



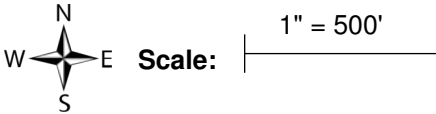
**FLIGHT YEAR:**  
2008

N  
W  E  
S

**Scale:** |-----|  
1" = 500'




**FLIGHT YEAR:**  
2009

Scale:  1" = 500'




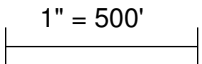
**FLIGHT YEAR:**  
2010

N  
W  E  
S

**Scale:** |-----| 1" = 500'



**FLIGHT YEAR:**  
2012

 **Scale:**  1" = 500'




**FLIGHT YEAR:**  
2014

N  
W E S  
**Scale:** 1" = 500'



**FLIGHT YEAR:**  
2016

N  
W  E  
S

**Scale:** |-----| 1" = 500'




**FLIGHT YEAR:**  
2018

N  
W E S  
Scale: 1" = 500'



**FLIGHT YEAR:**  
2020

N  
W  E  
S

**Scale:** |-----|  
1" = 500'



## **APPENDIX D**

### **SANBORN FIRE INSURANCE MAPS “NO COVERAGE STATEMENT”**

# Fire Insurance Maps No Coverage Statement

**Site Location**

SWC of Trumble Rd & Mapes Rd  
SWC of Trumble Rd  
Perris, CA

**Requested by**

Envirosite Corporation  
2 Corporate Drive, Suite 450  
Shelton, CT

**HIG Project #**

2053504

**Client Project #**

58514

**Date Created**

07/29/2021



Historical  
Information  
Gatherers

---

The HIG Historical Map Collection and the United States Library of Congress Map Collection were searched for fire insurance maps (FIM), real estate atlases and similar maps for the site location and adjoining properties. No FIMs or similar maps were identified for the site location and/or adjacent properties.

**FIM+ Maps**

The HIG Historical Map Collection and the United States Library of Congress Map Collection were searched for fire insurance maps (FIMs), real estate atlases and similar maps for the site location and adjoining properties. No FIMs or similar maps were identified for the site location and/or adjoining properties.

## **APPENDIX E**

### **HISTORICAL CITY DIRECTORIES**

# HIG Research Summary

## Site Location

SWC of Trumble Rd & Mapes Rd  
SWC of Trumble Rd  
Perris, CA

## Requested by

Envirosite Corporation  
2 Corporate Drive, Suite 450  
Shelton, CT

## HIG Project #

2053504

## Client Project #

58514

## Date Created

07/29/2021



Historical  
Information  
Gatherers

This Research Summary identifies the products and services provided by Historical Information Gatherers, Inc. (HIG) for the above referenced site location. All products are provided as PDFs unless otherwise noted.

## City Directory Pages/Abstracts

**Research Methodology:** A search was conducted for city directories that include coverage of the site area using HIG's City Directory Collection and other sources, if needed. Directories for the following years were identified for the site area. A comma between date ranges indicates a gap of 10 years or more in available city directories:

*Riverside: (1923-1951, 1963-1966, 1986-2018)*

*Riverside San Bernardino: (1971-1981)*

The above listed directories were reviewed at approximate 5 year intervals to determine if the street(s) specified in the order were included in the directories and had listings for the site area. HIG attempted to identify former street names and aliases and if identified, these were also included in the review.

**Research Results:** No coverage was identified for the site area as detailed below:

*SWC Trumble Road: (No listings in range)*

*Mapes Road: (No listings in range)*

## FIM+ Maps

The HIG Historical Map Collection and the United States Library of Congress Map Collection were searched for fire insurance maps (FIMs), real estate atlases and similar maps for the site location and adjoining properties. No FIMs or similar maps were identified for the site location and/or adjoining properties.

## Disclaimer & Limitation of Liability

This Research Summary and the related documents and images provided by Historical Information Gatherers (hereafter referred to as the "Site Specific HIG Data") contain information obtained from a variety of public and private sources. Additional information for the site and surrounding properties may exist. Accordingly, there can be no guaranty or warranty that the information provided is complete for its particular intended purpose. No warranty expressed or implied, is made whatsoever in connection with the Site Specific HIG Data. Historical Information Gatherers specifically disclaims the making of any such warranties, including without limitation, merchantability or fitness for a particular purpose. Historical Information Gatherers, its officers, employees and independent contractors cannot be held liable to anyone for any loss or damage, whether arising out of errors or omissions, negligence, accident or any other cause, resulting directly or indirectly from any information provided or any information not provided in the Site Specific HIG Data. Any liability on the part of Historical Information Gatherers is strictly limited to a refund equal to the amount paid for the Site Specific HIG Data.

## HIG Copyright Notice

This Research Summary and the selection, arrangement and compilation of Site Specific HIG Data are the property of Historical Information Gatherers. © Copyright 2021 by Historical Information Gatherers, Inc. All rights reserved. The person or entity that ordered and paid for the Site Specific HIG Data is granted a personal, non-assignable, limited license to reproduce the Site Specific HIG Data solely for purposes of providing supporting documentation for reports produced for the site location which is noted on page one of this Research Summary. Any other reproduction or other use of the Site Specific HIG Data in any media or format, in whole or in part, is expressly prohibited without prior written permission from Historical Information Gatherers, and the person or entity that ordered and paid for the Site Specific HIG Data assumes all liability for the making of any such reproductions.

## Licensing Agreement

The licensing agreement between Historical Information Gatherers and infoGroup provides that Historical Information Gatherers may create photocopies or reproductions of portions of Polk City Directories, Hill-Donnelley Criss-Cross Directories and other directories under infoGroup copyright. The licensing agreement also permits the person or entity that ordered and paid for the Site Specific HIG Data to include photocopies or reproductions of portions of Polk City Directories, Hill-Donnelley Criss-Cross Directories and other directories under infoGroup copyright as supporting documents for reports produced for the site which is the subject of the Site Specific HIG Data.



## **APPENDIX F**

### **HISTORICAL TOPOGRAPHIC MAPS**



# Historical Topographic Map Report | 2021

Order Number: 58514

Report Generated: 07/28/2021

Project Name:

Project Number:

SWC of Trumble Rd & Mapes Rd  
SWC of Trumble Rd & Mapes Rd  
Perris, CA 92570

---

2 Corporate Drive  
Suite 450  
Shelton, CT 06484  
Toll Free: 866-211-2028  
[www.envirositecorp.com](http://www.envirositecorp.com)

Envirosite's Historical Topographic Map Report is designed to assist in evaluating a subject property resulting from past activities. EnviroSite's Historical Topographic Map Report includes a search of USGS historical topographic maps, dating back to the early 1900s.

## TOPOGRAPHIC MAPS FOUND:

	<u>Map Name:</u>	<u>Year:</u>	<u>Revision Year:</u>	<u>Scale:</u>
1.	<u>Perris</u>	1942	N/R	1 : 62500
2.	<u>Perris</u>	1943	N/R	1 : 62500
3.	<u>Perris</u>	1953	N/R	1 : 24000
4.	<u>Perris</u>	1967	1979	1 : 24000
5.	<u>Perris</u>	1967	N/R	1 : 24000
6.	<u>Perris</u>	1967	1973	1 : 24000
7.	<u>Perris</u>	2012	N/R	1 : 24000
8.	<u>Perris</u>	2015	N/R	1 : 24000
9.	<u>Perris</u>	2018	N/R	1 : 24000

The USGS 7.5 minute series includes scales 1:24,000 / 1:25,000 / 1:31,680. The USGS 15 minute series includes scales 1:48,000 / 1:62,500 / 1:63,360. The USGS 30x60 minute series scale is 1:100,000.

### **Disclaimer - Copyright and Trademark Notice**

*All information contained in this report are based on data available from various public, government and other sources and are based upon the best data available from those sources. The information available in this report may be available from other sources and is not exclusive or the exclusive property of EnviroSite Corporation.*

*NO WARRANTY EXPRESSED OR IMPLIED, IS MADE IN CONNECTION WITH THIS REPORT, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ALL RISK IS ASSUMED BY USER AND EnviroSite assumes no liability for faulty or inaccurate information. The Reports may utilize a variety of public and other sources reasonably available to EnviroSite. EnviroSite cannot, and does not assure, warrant, guarantee or assume any liability for the correctness, comprehensiveness, timeliness or completeness of any of such information, nor is the information in any Report to be construed as legal advice with respect to environmental risks associated with any property. EnviroSite shall not be liable to anyone for any claims, causes of action, suits, damages, losses, costs and expenses (including, without limitation, attorneys' fees and costs) arising out of or caused by this report regardless of the acts, errors or omissions, or negligence of EnviroSite. Any damages shall be limited to the purchase price of the report.*

*Purchaser of the report accepts the report "As Is". The report is intended only to provide information only and should not be considered as providing any legal advice, prediction, forecast, or fact as to the environmental risk for any specific property. Reports are proprietary to EnviroSite, and contain copyrighted material and trademarks of EnviroSite. All other trademarks used herein are the property of their respective owners. All rights of EnviroSite as to the Reports are reserved.*

SUBJECT NAME: SWC of Trumble Rd & Mapes Rd  
ADDRESS: SWC of Trumble Rd & Mapes Rd, Perris, CA, 92570  
LAT/LONG: 33.756531 / -117.186929

PREPARED FOR: Environmental Managers & Auditors  
ORDER #: 58514  
REPORT DATE: 07/28/2021

SUBJECT QUAD:

MAP NAME: Perris

MAP YEAR: 1942

REVISION YEAR: N/R

SCALE: 1 : 62500

Part 1



SUBJECT NAME: SWC of Trumble Rd & Mapes Rd  
ADDRESS: SWC of Trumble Rd & Mapes Rd, Perris, CA, 92570  
LAT/LONG: 33.756531 / -117.186929

PREPARED FOR: Environmental Managers & Auditors  
ORDER #: 58514  
REPORT DATE: 07/28/2021

SUBJECT QUAD:

MAP NAME: Perris

MAP YEAR: 1943

REVISION YEAR: N/R

SCALE: 1 : 62500

Part 1

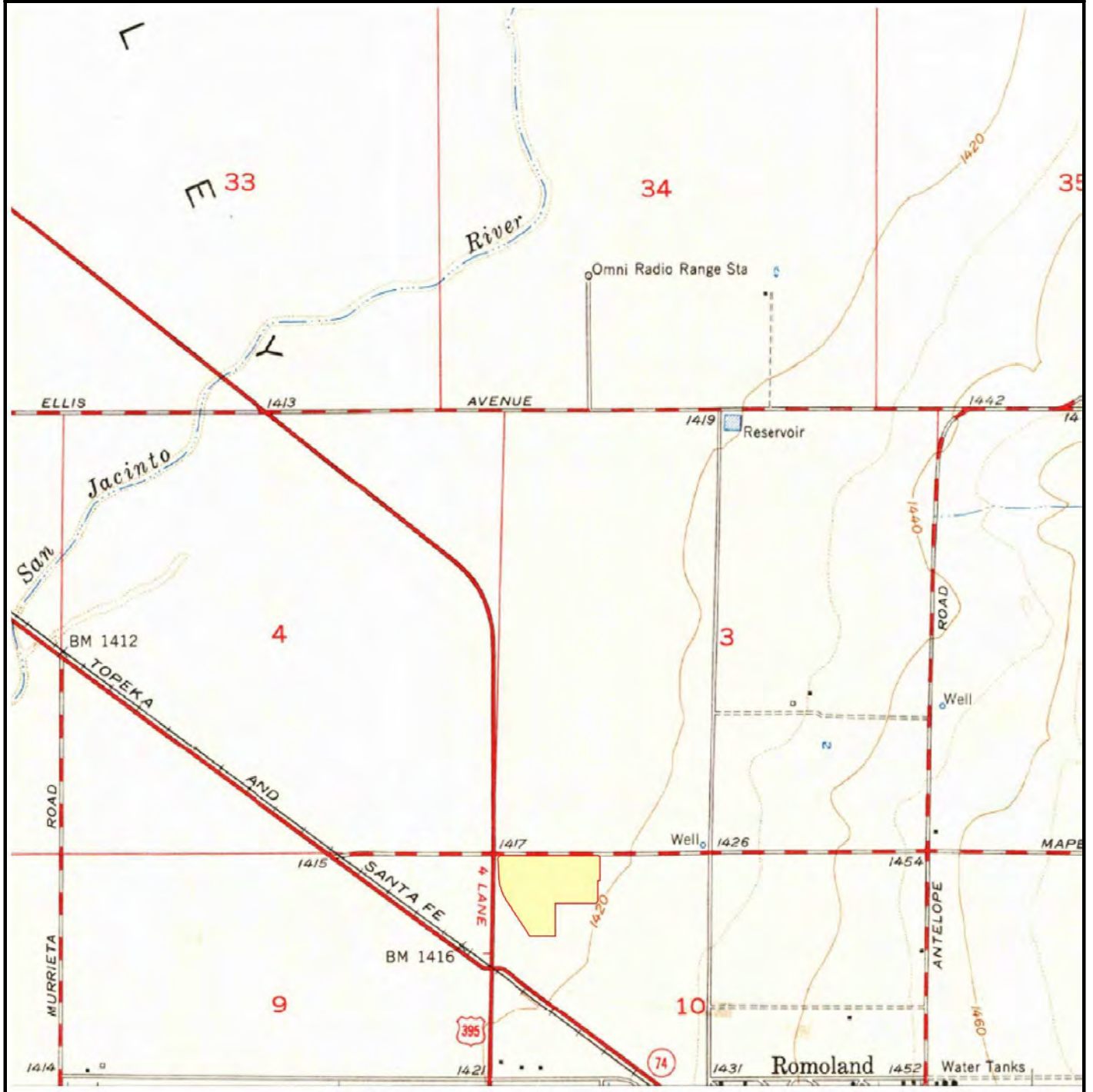


SUBJECT NAME: SWC of Trumble Rd & Mapes Rd  
ADDRESS: SWC of Trumble Rd & Mapes Rd, Perris, CA, 92570  
LAT/LONG: 33.756531 / -117.186929

PREPARED FOR: Environmental Managers & Auditors  
ORDER #: 58514  
REPORT DATE: 07/28/2021

SUBJECT QUAD:

MAP NAME: Perris  
MAP YEAR: 1953  
REVISION YEAR: N/R  
SCALE: 1 : 24000  
Part 1



SUBJECT NAME: SWC of Trumble Rd & Mapes Rd  
ADDRESS: SWC of Trumble Rd & Mapes Rd, Perris, CA, 92570  
LAT/LONG: 33.756531 / -117.186929

PREPARED FOR: Environmental Managers & Auditors  
ORDER #: 58514  
REPORT DATE: 07/28/2021

SUBJECT QUAD:

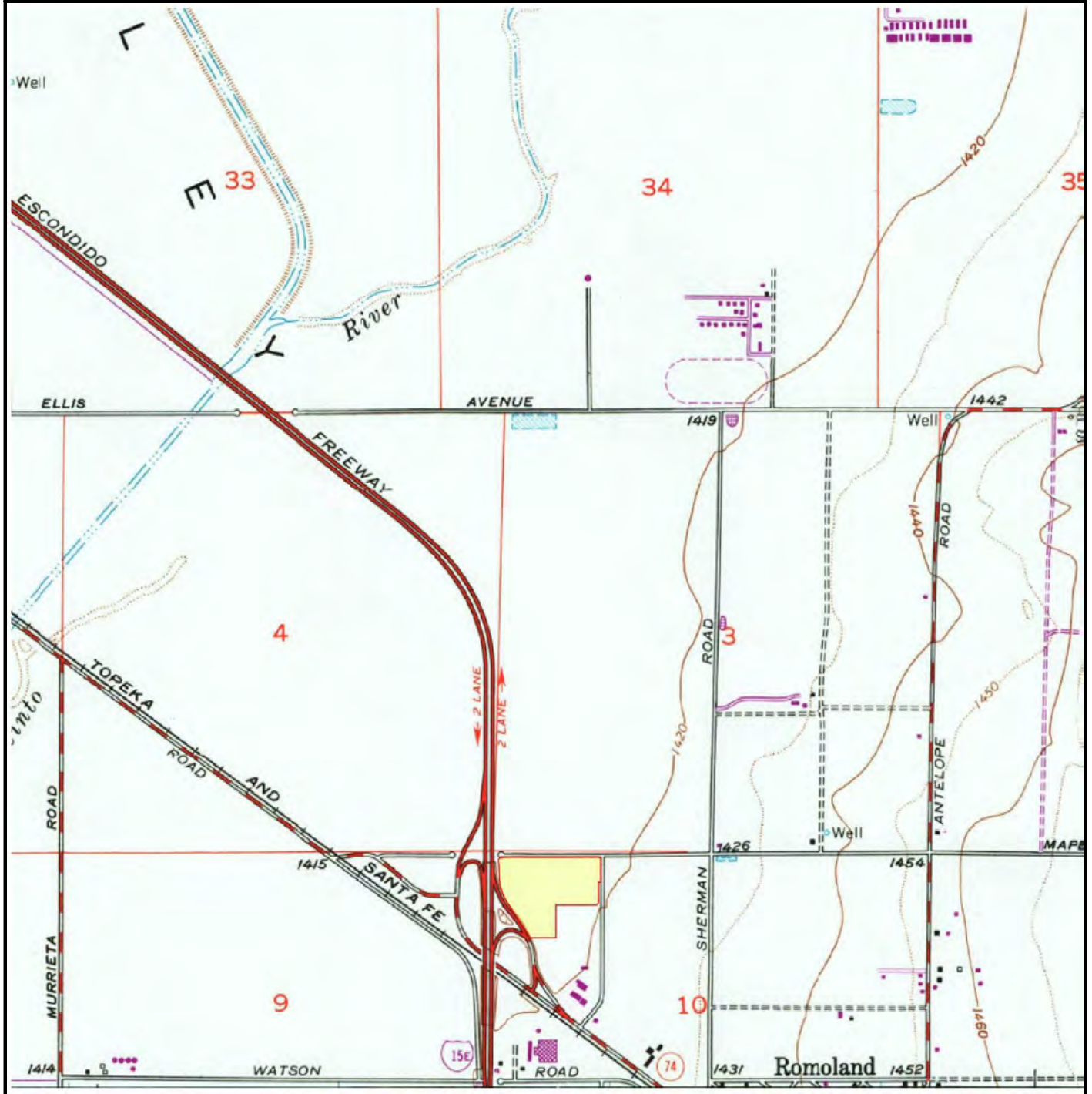
MAP NAME: Perris

MAP YEAR: 1967

REVISION YEAR: 1979

SCALE: 1 : 24000

Part 1



SUBJECT NAME: SWC of Trumble Rd & Mapes Rd  
ADDRESS: SWC of Trumble Rd & Mapes Rd, Perris, CA, 92570  
LAT/LONG: 33.756531 / -117.186929

PREPARED FOR: Environmental Managers & Auditors  
ORDER #: 58514  
REPORT DATE: 07/28/2021

SUBJECT QUAD:

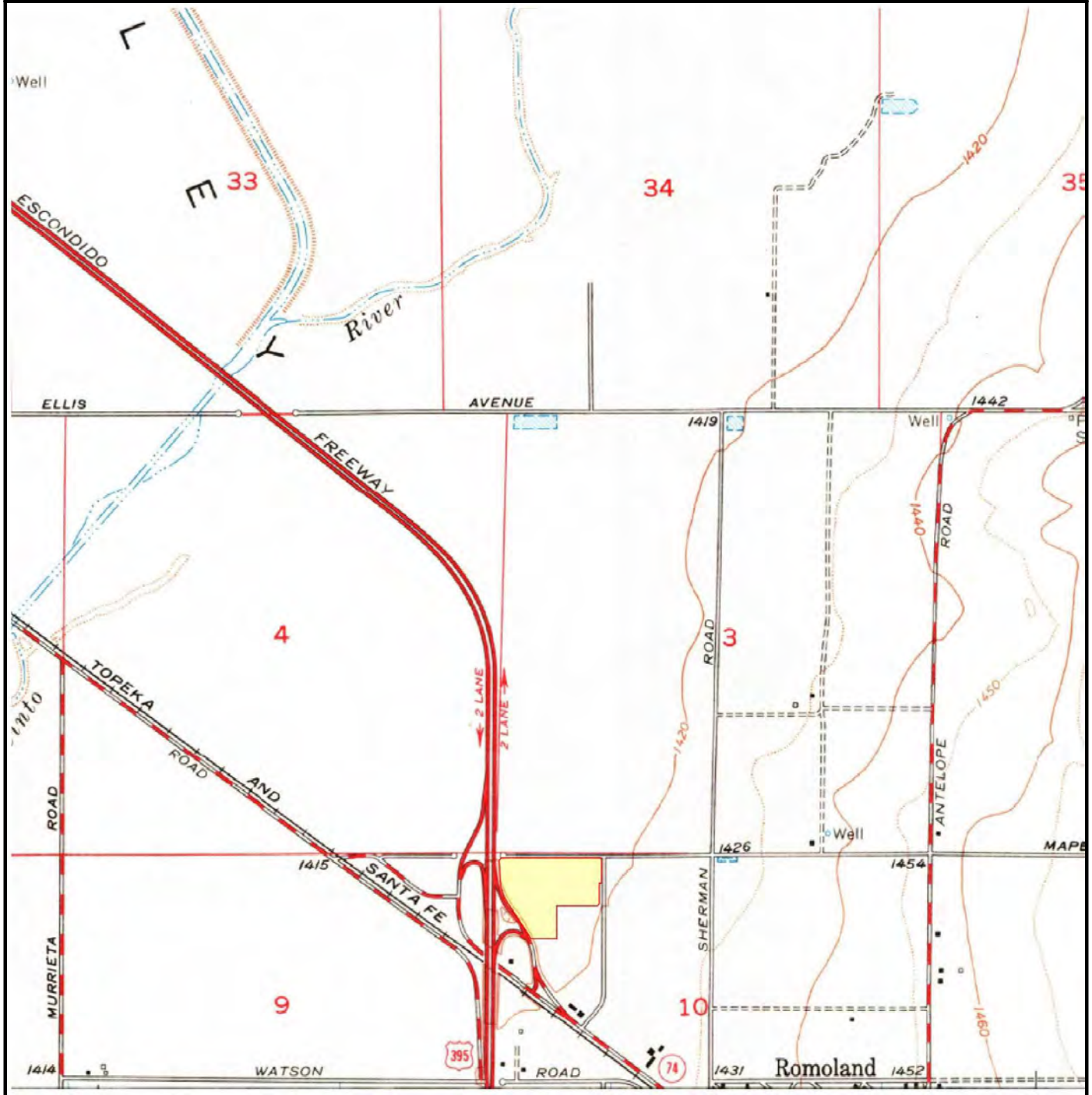
MAP NAME: Perris

MAP YEAR: 1967

REVISION YEAR: N/R

SCALE: 1 : 24000

Part 1



SUBJECT NAME: SWC of Trumble Rd & Mapes Rd  
ADDRESS: SWC of Trumble Rd & Mapes Rd, Perris, CA, 92570  
LAT/LONG: 33.756531 / -117.186929

PREPARED FOR: Environmental Managers & Auditors  
ORDER #: 58514  
REPORT DATE: 07/28/2021

SUBJECT QUAD:

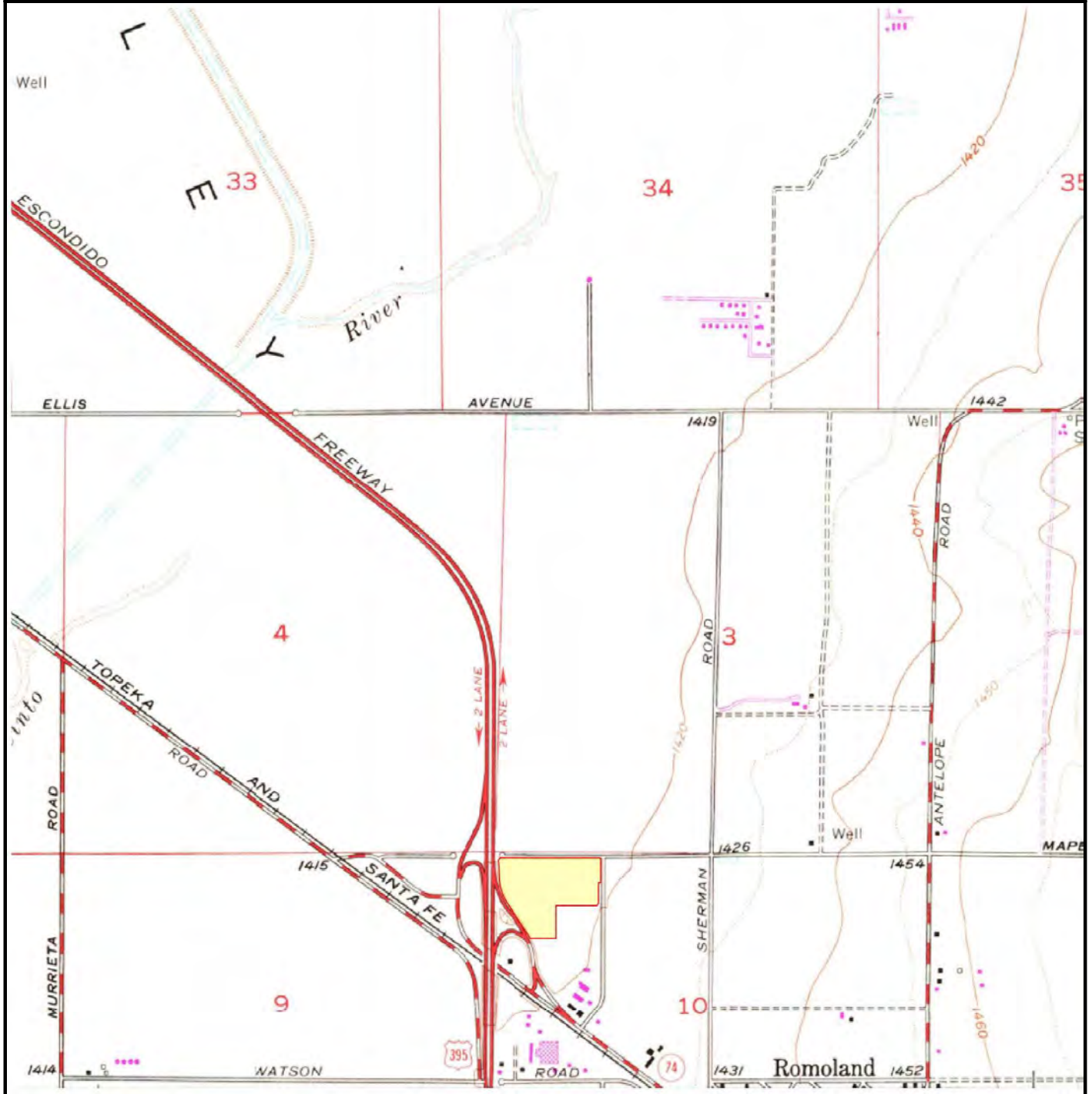
MAP NAME: Perris

MAP YEAR: 1967

REVISION YEAR: 1973

SCALE: 1 : 24000

Part 1

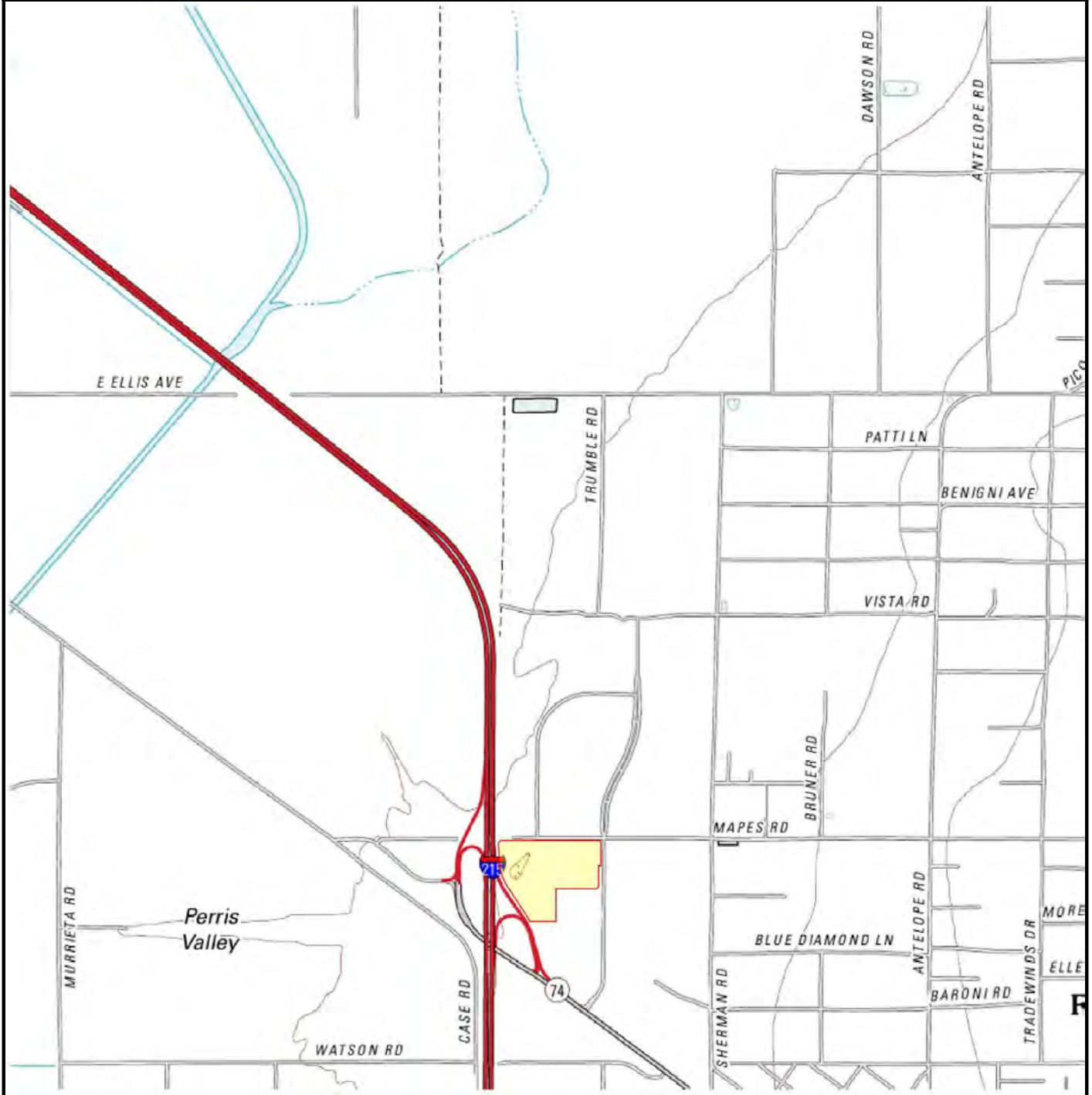


SUBJECT NAME: SWC of Trumble Rd & Mapes Rd  
ADDRESS: SWC of Trumble Rd & Mapes Rd, Perris, CA, 92570  
LAT/LONG: 33.756531 / -117.186929

PREPARED FOR: Environmental Managers & Auditors  
ORDER #: 58514  
REPORT DATE: 07/28/2021

SUBJECT QUAD:

MAP NAME: Perris  
MAP YEAR: 2012  
REVISION YEAR: N/R  
SCALE: 1 : 24000  
Part 1

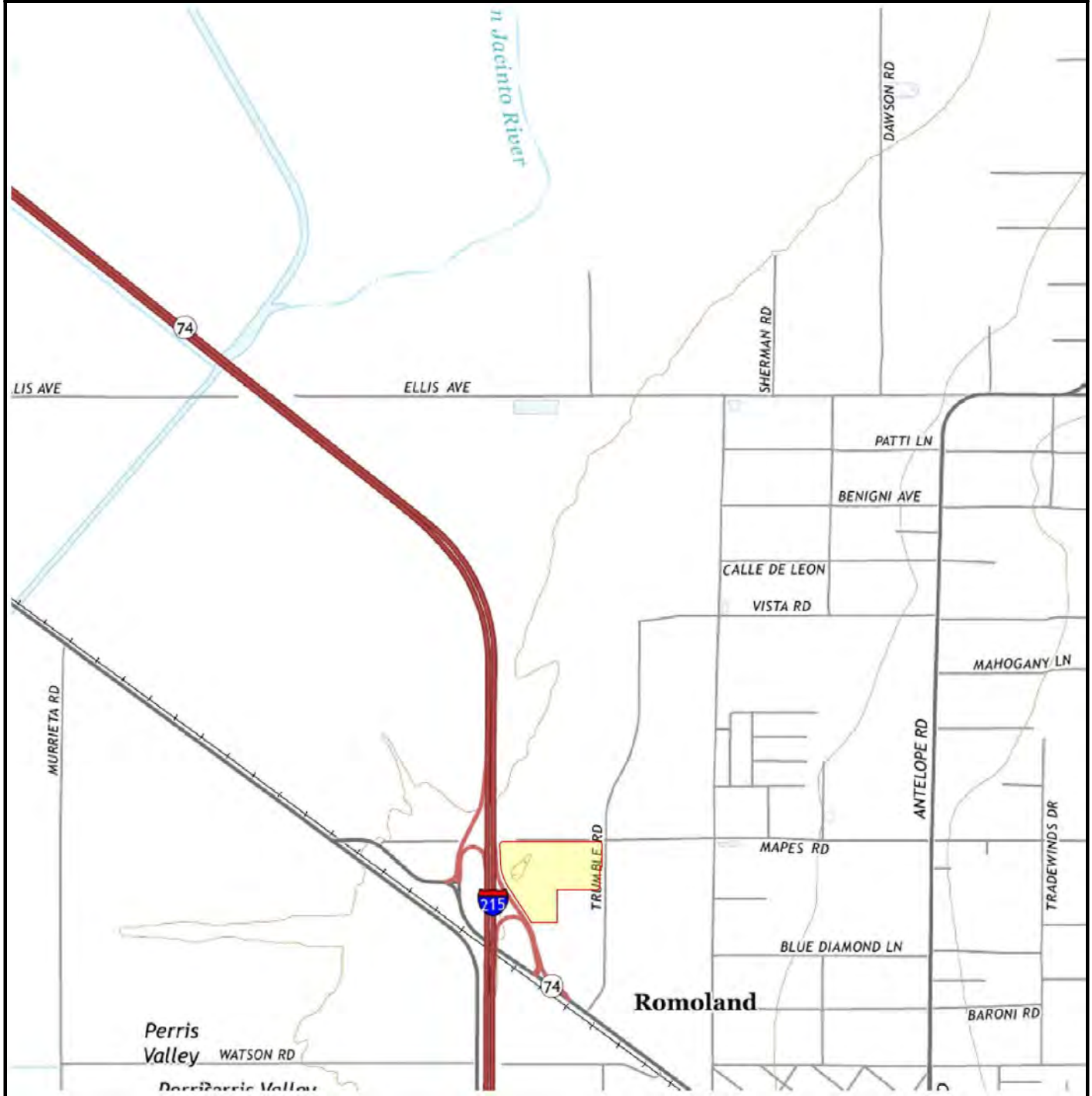


SUBJECT NAME: SWC of Trumble Rd & Mapes Rd  
ADDRESS: SWC of Trumble Rd & Mapes Rd, Perris, CA, 92570  
LAT/LONG: 33.756531 / -117.186929

PREPARED FOR: Environmental Managers & Auditors  
ORDER #: 58514  
REPORT DATE: 07/28/2021

SUBJECT QUAD:

MAP NAME: Perris  
MAP YEAR: 2015  
REVISION YEAR: N/R  
SCALE: 1 : 24000  
Part 1



SUBJECT NAME: SWC of Trumble Rd & Mapes Rd  
ADDRESS: SWC of Trumble Rd & Mapes Rd, Perris, CA, 92570  
LAT/LONG: 33.756531 / -117.186929

PREPARED FOR: Environmental Managers & Auditors  
ORDER #: 58514  
REPORT DATE: 07/28/2021

SUBJECT QUAD:

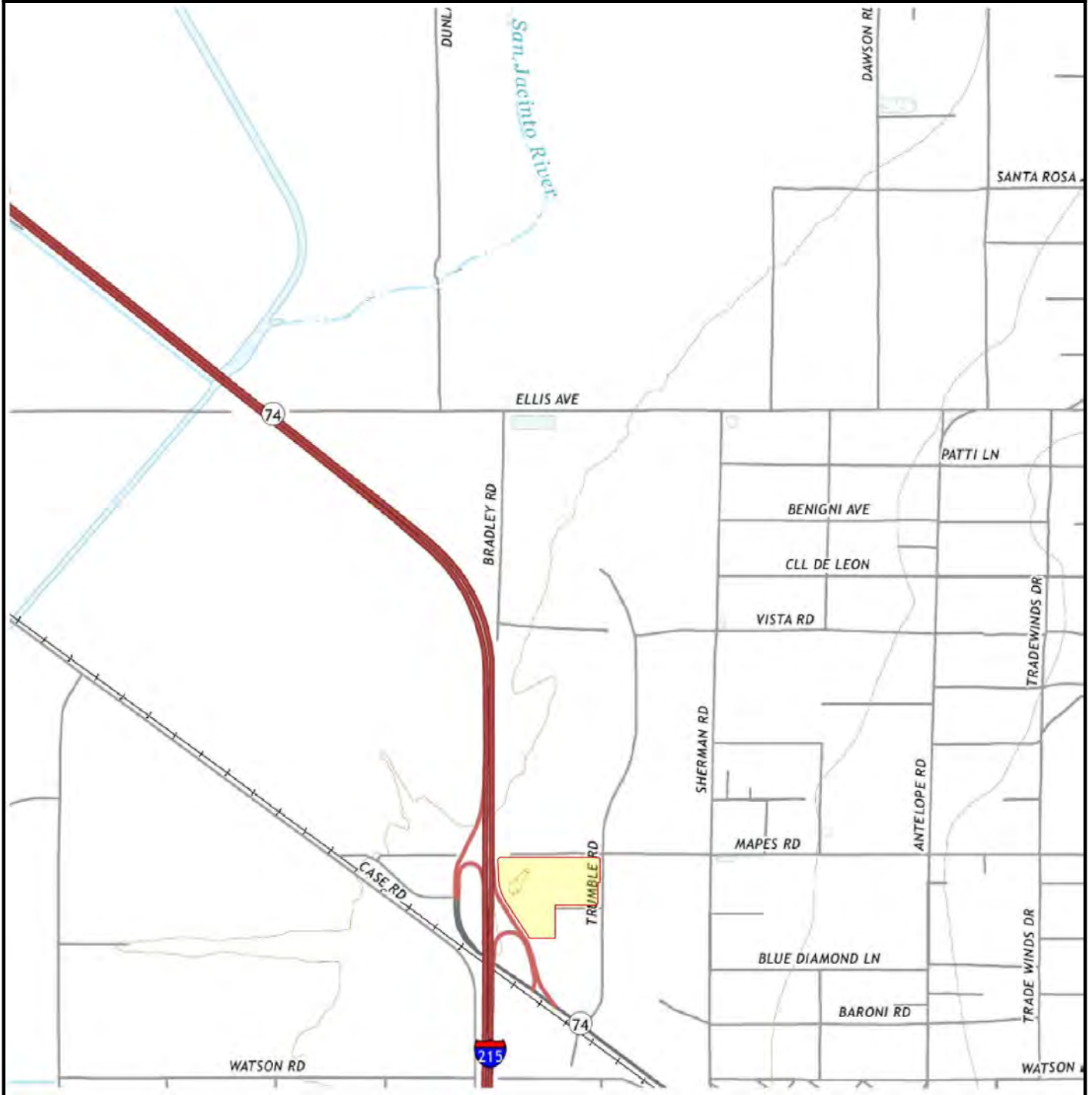
MAP NAME: Perris

MAP YEAR: 2018

REVISION YEAR: N/R

SCALE: 1 : 24000

Part 1



## **APPENDIX G**

### **ENVIRONMENTAL PROFESSIONLA'S RESUME**

## **KHALID MAHMOOD, R.E.A.**

### **CREDENTIALS**

B.S., Chemical Engineering  
University of Maryland (1980)

American Institute of Chemical Engineers

American Chemical Society

National Asbestos Council

Registered Environmental Assessor (R.E.A., No. 1382), State of California

National Society of Professional Engineers

### **EXPERIENCE SUMMARY**

Mr. Mahmood has over twenty years of diversified engineering and management experience in the environmental field. Emphasis has been in hazardous waste site investigations, environmental audits, closure plans, real estate environmental assessments, RCRA Part B application, waste minimization, and remediation. Mr. Mahmood has direct experience in the oversight of remedial investigations, feasibility studies, remedial design, and implementation activities for variety of hazardous waste sites under Federal and State auspices.

Mr. Mahmood has performed over two thousand real estate environmental assessments including office complexes, major shopping centers, commercial, industrial, and manufacturing facilities, and multi family complexes. Some of the environmental assessments included potential environmental liability cost estimates associated with multi-billion-dollar property acquisitions or company asset transfers.

Mr. Mahmood has performed detailed environmental engineering reviews necessary to construct hazardous waste treatment facilities, including bid and construction reviews, and design evaluations. Mr. Mahmood has extensive experience in developing National Pollutant Discharge Elimination System (NPDES) permits for industrial wastewater treatment plants ranging from those for petroleum refining to Publicly Owned Treatment Works (POTW).

Mr. Mahmood has been extensively involved in the evaluation and development of data management system to track compliance of permitted facilities as well as bringing non-compliance facilities into regulatory compliance.

Mr. Mahmood has also been extensively involved in the solid waste area. The experience includes municipal refuse characterization, treatment processes, and environmental impact assessment, assessment studies for on-hand disposal resource recovery experience with treatability studies and evaluation of process for recovery of methane from municipal and industrial wastes.

## KEY PROJECTS

- ! Managed remedial investigation program for the Rocky Mountain Arsenal. Directed services of the Industrial and Hazardous Waste Engineering Group. Assessed the soil and groundwater contamination from chemical warfare and pesticide manufacturing wastes.
- ! Performed detailed feasibility studies to treat Hanford Nuclear Facility groundwater contaminated with radionuclides, organic solvents, metals and inorganics. Recommended remedial alternatives for the mobile treatment systems as well as a fixed central treatment facility.
- ! Managed hazardous waste reduction project at the Hewlett Packard Facility in Palo Alto, California. Project included investigation of processes such as separation, precipitation/fixation, ion exchange, plus other applicable technologies for segregating, reducing, recycling and/or treating arsenic wastes in the calcium fluoride sludge resulting from the manufacture of gallium arsenide chips.
- ! Conducted treatment processes for the volume reduction of wastes containing heavy metals such as arsenic, cadmium, copper, mercury, molybdenum, and zinc at Pacific Gas and Electric (PG&E) geothermal facilities in Northern California.
- ! Established the on-site chemical analysis laboratory for the post-closure treatment for a hazardous waste site for Firestone Tire and Rubber Manufacturing Company in Salinas, California. The project included design and installation of a soil vapor extraction system and a groundwater treatment system to remove organic contaminants from groundwater as well as soil. Assisted with regulatory agency liaison for required permitting. Prepared equipment specifications, drawings and bid documents.
- ! Conducted EPA Superfund investigation and material analysis for hazardous waste assessment of Weldon Springs, Missouri Ammunition Plant. The site is contaminated with radionuclear inorganics, organics and heavy metals. Recommended remedial measures to comply with RCRA regulations.
- ! Performed the treatability testing data, chemical process design, and technical specifications for the leachate treatment plant for Time Oil Company in Washington. Set up bench scale experiments to test the leachability/extraction rate of volatile organics in the soil using water as a flushing solvent.
- ! Conducted soil gas and groundwater investigations for major electronic facilities (i.e., Hewlett Packard, IBM, Monolithic Memories, Electronics Company, etc.), in silicon Valley. Recommended remedial measures for highly contaminated areas.
- ! Prepared an alternative analysis and detailed feasibility study of process alternatives to remove aromatic hydrocarbons (i.e., benzene, toluene, and xylene) from ballast water at Valdez Harbor Oil Terminal in Alaska.
- ! Assisted in preparation of RCRA Part B application for continued operation and closure of operating facilities.
- ! Performed detailed technical, economical, environmental and institutional feasibility studies for recovering energy and materials from solid waste for U.S. Department of Energy and private firms. Set up and tested various conveyors (belt, apron, vibrating), trommels, cyclones, air separation and rotary screen equipment to determine how conveyance of different solid waste fraction may be improved.
- ! Managed SARA Title III, Section 313, Toxic Chemical Release Inventory for a major Oil Refinery in Southern California. The project included detailed review of process operations and performance of material/mass balances to calculate the total emissions of each chemical under Title III into the air, soil, groundwater, surface water etc. Recommended necessary measures to comply with regulations.
- ! Assisted a major valves manufacturing facility in Southern California perform SARA Title III, Toxic

#### Chemical Release Inventory.

- ! Managed U.S. Navy hazardous waste remediation project at North Island, San Diego. The project include hazardous waste characterization of drummed waste accumulated during last 12 years; recommended different alternatives to dispose/thermally destroy hazardous wastes.
- ! Conducted feasibility studies for the remediation alternatives for California Department of Transportation. The project involved detailed evaluation/screening/selection of alternatives to remove contamination from the soils.
- ! Performed a waste minimization study for California utilities. Proposed alternatives to reduce/eliminate/substitute Toxic Chemicals in their operations.
- ! Designed and implemented the In Situ Volatilization (ISV) system for a major valves manufacturing company. The system removed chlorinated solvents and aromatics contamination from the soils. The waste stream treated with activated carbon prior to discharge.
- ! Performed feasibility studies to select/screen remedial alternative to remove radioactive, volatile organic compounds and heavy metals from soils and groundwater at Rocky Flats, Colorado.
- ! Managed and prepared Toxic Hot Spots (AB 2588) Inventory Plans for General Motors, THUMS Long Beach (Consortium of Texaco, Humbel, Union, Mobil, and Shell), chemical Waste Management Kettleman Hill Hazardous Waste Landfill, and SupraCote.
- ! Managed and prepared Air Toxic Inventory Reports (AB 2588) for the University of California and several industrial facilities.

#### **PUBLICATIONS AND MAJOR REPORTS**

Mahmood, K., November 1988. Solvent Waste Reduction in the Electric Utility Industry, Waste Minimization. Electric Power Research Institute.

Mahmood, K., December 1988. Alternative Technologies Assessment for Remediation of Hazardous Waste Streams Generated at Naval Facilities.

# Appendix 5: LID Infeasibility

*LID Technical Infeasibility Analysis*

## CHAPTER 3: PREPARING YOUR PROJECT-SPECIFIC WQMP

TABLE 3-4. LID BMP Applicability

LID BMP Hierarchy	A	B	C	D
	$K_{SAT} > 1.6"/hr.$ , and no restrictions on infiltration	Are Harvest and Use BMPs feasible?	$0.3"/hr. < K_{SAT} < 1.6"/hr.$ , or unpredictable or unknown	$K_{SAT} < 0.3"/hr.$
LID Infiltration BMPs*	✓			
Harvest and Use BMPs		✓		✓
LID Bioretention	✓		✓	✓
LID Biotreatment				✓

Notes for Table 3-5:

**See also** Figure 3-6 for guidance in selecting appropriate BMPs

**Column A:** Selections from this column may be used in locations where the infiltration rate of underlying soils is at least 1.6" per hour and no restrictions on infiltration apply to these locations.

**Column B:** Harvest and Use BMPs may be used where it can be shown that there is sufficient demand for harvested water and where LID Infiltration BMPs are not feasible.

**Column C:** Selections in this column may be used in locations where the measured infiltration rate of underlying soils is between 0.3" and 1.6" per hour or where, in accordance with recommendations of a licensed geotechnical engineer, the post-development saturated hydraulic conductivity is uncertain or unknown or cannot be reliably predicted because of soil disturbance or fill, anisotropic soil characteristics, presence of clay lenses, or other factors.

**Column D:** Selections in this column may be used in locations where the infiltration rate of underlying soils is 0.3" per hour or less. See Chapter 2 for more information.

\* Permeable Pavement, when designed with a maximum of a 2:1 ratio of impervious area to pervious pavement areas, or less, is considered a self-retaining area, and is not considered an LID BMP for the purposes of this table. This table focuses on the 'special case' included in the discussion of 'areas draining to self-retaining areas' above, where a project proponent can choose to design the pervious pavement as a LID BMP in accordance with an approved design, such as the LID BMP Design handbook, and in return drain additional impervious area onto the pervious pavement beyond the 2:1 ratio.

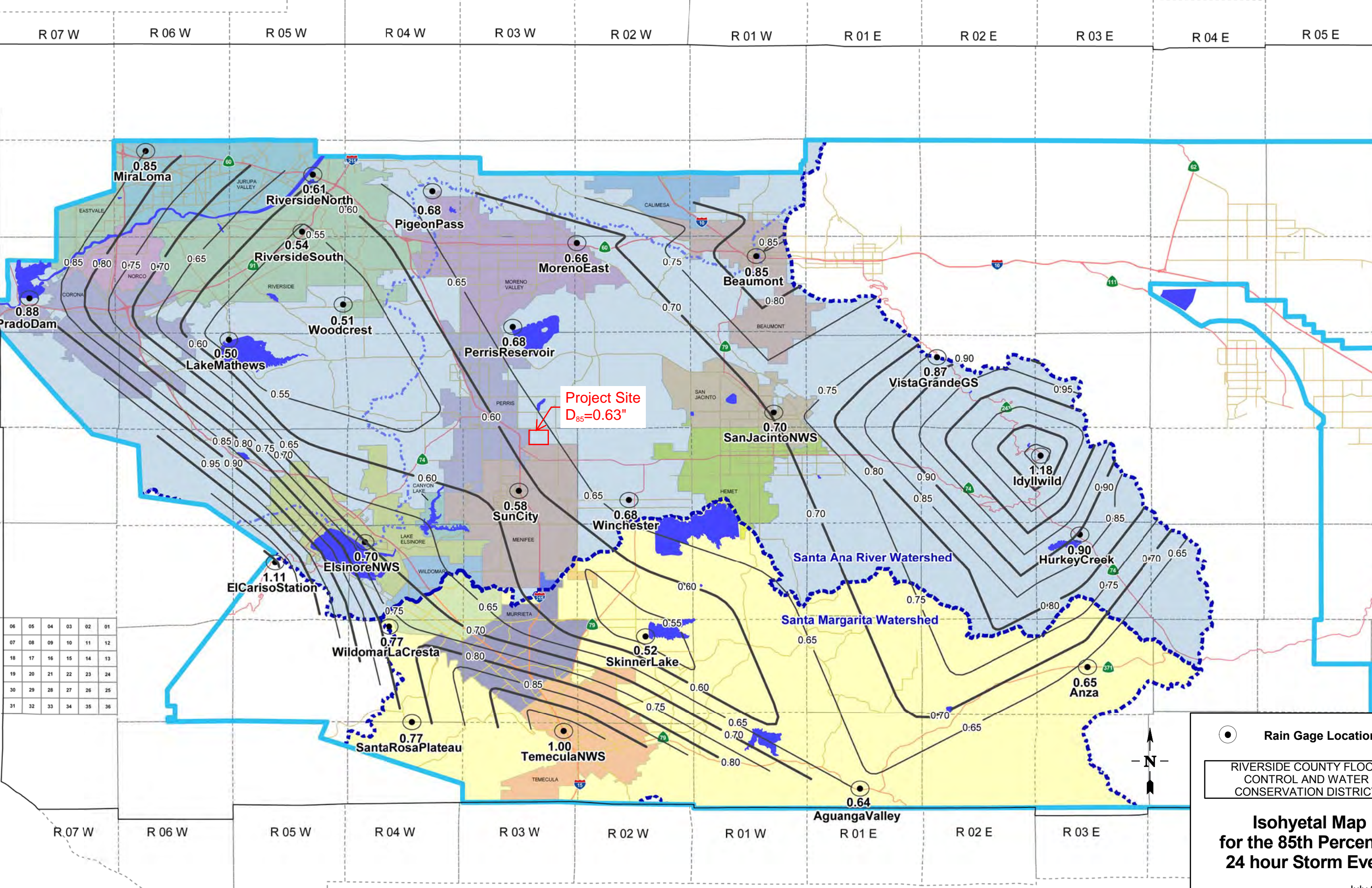
#### 3.4.2.a. Laying out your LID BMPs

Finding the right location for LID BMPs on your site involves a careful and creative integration of several factors:

- ✓ To make the most efficient use of the site and to maximize aesthetic value, **integrate BMPs with site landscaping**. Many local zoning codes may require landscape setbacks or buffers, or may specify that a minimum portion of the site be landscaped. It may be possible to locate some or all of your site's Stormwater BMPs within this same area, or within utility easements or other non-buildable areas.
- ✓ Bioretention BMPs must be **level or nearly level** all the way around. When configured in a linear fashion (similar to swales) bioretention BMPs may be gently sloped end to end, but opposite sides must be at the same

# Appendix 6: BMP Design Details

*BMP Sizing, Design Details and other Supporting Documentation*



Project Site  
 $D_{85} = 0.63"$

06	05	04	03	02	01
07	08	09	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

● Rain Gage Locations

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

**Isohyetal Map for the 85th Percentile 24 hour Storm Event**

July 2011

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

(Rev. 10-2011)

Legend:

Required Entries

Calculated Cells

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

Company Name **Kimley-Horn and Associates**

Date **5/26/2022**

Designed by **Kimley-Horn and Associates**

Case No **CUP 22-05023**

Company Project Number/Name

**Mapes and Trumble Industrial Facility**

**BMP Identification**

BMP NAME / ID **Modular Wetland System #1**

*Must match Name/ID used on BMP Design Calculation Sheet*

**Design Rainfall Depth**

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

$D_{85} =$  **0.63** inches

**Drainage Management Area Tabulation**

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, $I_f$	DMA Runoff Factor	DMA Areas x Runoff Factor	Design Storm Depth (in)	Design Capture Volume, $V_{BMP}$ (cubic feet)	Proposed Volume on Plans (cubic feet)
DA A	787,989	Mixed Surface Types	0.83	0.64	500901.9			
	<b>787989</b>		<b>Total</b>		<b>500901.9</b>	<b>0.63</b>	<b>26297.3</b>	<b>26,993</b>

Notes:

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

(Rev. 10-2011)

Legend:

Required Entries

Calculated Cells

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

Company Name **Kimley-Horn and Associates**

Date **5/26/2022**

Designed by **Kimley-Horn and Associates**

Case No **CUP 22-05023**

Company Project Number/Name

**Mapes and Trumble Industrial Facility**

**BMP Identification**

BMP NAME / ID **Modular Wetland System #2**

*Must match Name/ID used on BMP Design Calculation Sheet*

**Design Rainfall Depth**

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

$D_{85} =$  **0.63** inches

**Drainage Management Area Tabulation**

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, $I_f$	DMA Runoff Factor	DMA Areas x Runoff Factor	Design Storm Depth (in)	Design Capture Volume, $V_{BMP}$ (cubic feet)	Proposed Volume on Plans (cubic feet)
DA B	40,260	Mixed Surface Types	0.73	0.52	21061.4			
	<b>40260</b>		<b>Total</b>		<b>21061.4</b>	<b>0.63</b>	<b>1105.7</b>	<b>1,257</b>

Notes:

## MWS LINEAR 2.0 HGL VOLUME SIZING MATRIX - 48 HOUR DRAINDOWN

MWS MODEL SIZE	WETLAND PERMITTER LENGTH (FEET)	LOADING RATE		DRAIN DOWN (HOURS)	AVAILABLE TREATMENT HGL HEIGHT (FEET)																														
		INCH/HR	GPM/SF		SHALLOW MODELS																							STANDARD HEIGHT MODEL	HIGH CAPACITY MODELS						
					1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6		4.00	4.50	5.00	5.50	6.00	6.50	7.00
MWS-L-4-4	6.70	26	0.26	48	CF	939	1006	1073	1140	1207	1274	1342	1409	1476	1543	1610	1677	1744	1811	1878	1945	2012	2079	2146	2214	2281	2348	2415	2683	3018	3354	3689	4025	4360	4695
					DISCHARGE RATE GPM	2.439	2.613	2.787	2.961	3.136	3.310	3.484	3.658	3.832	4.007	4.181	4.355	4.529	4.703	4.878	5.052	5.226	5.400	5.574	5.749	5.923	6.097	6.271	6.968	7.839	8.710	9.581	10.452	11.323	12.194
MWS-L-4-6	9.30	26	0.26	48	CF	1303	1397	1490	1583	1676	1769	1862	1955	2048	2141	2235	2328	2421	2514	2607	2700	2793	2886	2979	3073	3166	3259	3352	3724	4190	4655	5121	5586	6052	6517
					DISCHARGE RATE GPM	3.385	3.627	3.869	4.111	4.352	4.594	4.836	5.078	5.320	5.561	5.803	6.045	6.287	6.529	6.770	7.012	7.254	7.496	7.738	7.979	8.221	8.463	8.705	9.672	10.881	12.090	13.299	14.508	15.717	16.926
MWS-L-4-8	14.80	26	0.26	48	CF	2074	2223	2371	2519	2667	2815	2963	3112	3260	3408	3556	3704	3852	4001	4149	4297	4445	4593	4741	4890	5038	5186	5334	5927	6668	7408	8149	8890	9631	10372
					DISCHARGE RATE GPM	5.387	5.772	6.157	6.542	6.926	7.311	7.696	8.081	8.466	8.850	9.235	9.620	10.005	10.390	10.774	11.159	11.544	11.929	12.314	12.698	13.083	13.468	13.853	15.392	17.316	19.240	21.164	23.088	25.012	26.936
MWS-L-4-13	18.40	26	0.26	48	CF	2579	2763	2947	3132	3316	3500	3684	3868	4053	4237	4421	4605	4789	4974	5158	5342	5526	5711	5895	6079	6263	6447	6632	7368	8289	9211	10132	11053	11974	12895
					DISCHARGE RATE GPM	6.698	7.176	7.654	8.133	8.611	9.090	9.568	10.046	10.525	11.003	11.482	11.960	12.438	12.917	13.395	13.874	14.352	14.830	15.309	15.787	16.266	16.744	17.222	19.136	21.528	23.920	26.312	28.704	31.096	33.488
MWS-L-4-15	22.40	26	0.26	48	CF	3140	3364	3588	3812	4037	4261	4485	4709	4934	5158	5382	5606	5831	6055	6279	6503	6728	6952	7176	7400	7625	7849	8073	8970	10092	11213	12334	13455	14577	15698
					DISCHARGE RATE GPM	8.154	8.736	9.318	9.901	10.483	11.066	11.648	12.230	12.813	13.395	13.978	14.560	15.142	15.725	16.307	16.890	17.472	18.054	18.637	19.219	19.802	20.384	20.966	23.296	26.208	29.120	32.032	34.944	37.856	40.768
MWS-L-4-17	26.40	26	0.26	48	CF	3700	3965	4229	4493	4757	5022	5286	5550	5815	6079	6343	6608	6872	7136	7400	7665	7929	8193	8458	8722	8986	9251	9515	10572	11894	13215	14537	15858	17180	18501
					DISCHARGE RATE GPM	9.610	10.296	10.982	11.669	12.355	13.042	13.728	14.414	15.101	15.787	16.474	17.160	17.846	18.533	19.219	19.906	20.592	21.278	21.965	22.651	23.338	24.024	24.710	27.456	30.888	34.320	37.752	41.184	44.616	48.048
MWS-L-4-19	30.40	26	0.26	48	CF	4261	4565	4870	5174	5478	5783	6087	6391	6696	7000	7304	7609	7913	8217	8522	8826	9130	9435	9739	10043	10348	10652	10957	12174	13696	15217	16739	18261	19783	21304
					DISCHARGE RATE GPM	11.066	11.856	12.646	13.437	14.227	15.018	15.808	16.598	17.389	18.179	18.970	19.760	20.550	21.341	22.131	22.922	23.712	24.502	25.293	26.083	26.874	27.664	28.454	31.616	35.568	39.520	43.472	47.424	51.376	55.328
MWS-L-4-21	34.40	26	0.26	48	CF	4822	5166	5510	5855	6199	6543	6888	7232	7577	7921	8265	8610	8954	9299	9643	9987	10332	10676	11021	11365	11709	12054	12398	13776	15498	17220	18942	20664	22386	24108
					DISCHARGE RATE GPM	12.522	13.416	14.310	15.205	16.099	16.994	17.888	18.782	19.677	20.571	21.466	22.360	23.254	24.149	25.043	25.938	26.832	27.726	28.621	29.515	30.410	31.304	32.198	35.776	40.248	44.720	49.192	53.664	58.136	62.608
MWS-L-6-8	18.80	26	0.26	48	CF	2635	2823	3011	3200	3388	3576	3764	3953	4141	4329	4517	4705	4894	5082	5270	5458	5646	5835	6023	6211	6399	6588	6776	7529	8470	9411	10352	11293	12234	13175
					DISCHARGE RATE GPM	6.843	7.332	7.821	8.310	8.798	9.287	9.776	10.265	10.754	11.242	11.731	12.220	12.709	13.198	13.686	14.175	14.664	15.153	15.642	16.130	16.619	17.108	17.597	19.552	21.996	24.440	26.884	29.328	31.772	34.216
MWS-L-8-8	29.60	26	0.26	48	CF	4149	4445	4741	5038	5334	5630	5927	6223	6519	6816	7112	7408	7705	8001	8297	8594	8890	9187	9483	9779	10076	10372	10668	11854	13335	14817	16299	17780	19262	20744
					DISCHARGE RATE GPM	10.774	11.544	12.314	13.083	13.853	14.622	15.392	16.162	16.931	17.701	18.470	19.240	20.010	20.779	21.549	22.318	23.088	23.858	24.627	25.397	26.166	26.936	27.706	30.784	34.632	38.480	42.328	46.176	50.024	53.872
MWS-L-8-12	44.40	26	0.26	48	CF	6223	6668	7112	7557	8001	8446	8890	9335	9779	10224	10668	11113	11557	12002	12446	12891	13335	13780	14224	14669	15113	15558	16002	17780	20003	22225	24448	26671	28893	31116
					DISCHARGE RATE GPM	16.162	17.316	18.470	19.625	20.779	21.934	23.088	24.242	25.397	26.551	27.706	28.860	30.014	31.169	32.323	33.478	34.632	35.786	36.941	38.095	39.250	40.404	41.558	46.176	51.948	57.720	63.492	69.264	75.036	80.808
MWS-L-8-16	59.20	26	0.26	48	CF	8297	8890	9483	10076	10668	11261	11854	12446	13039	13632	14224	14817	15410	16002	16595	17188	17780	18373	18966	19558	20151	20744	21336	23707	26671	29634	32597	35561	38524	41487
					DISCHARGE RATE GPM	21.549	23.088	24.627	26.166	27.706	29.245	30.784	32.323	33.862	35.402	36.941	38.480	40.019	41.558	43.098	44.637	46.176	47.715	49.254	50.794	52.333	53.872	55.411	61.568	69.264	76.960	84.656	92.352	100.048	107.744
MWS-L-8-20	74.00	26	0.26	48	CF	10372	11113	11854	12594	13335	14076	14817	15558	16299	17039	17780	18521	19262	20003	20744	21485	22225	22966	23707	24448	25189	25930	26671	29634	33338	37042	40747	44451	48155	51859
					DISCHARGE RATE GPM	26.936	28.860	30.784	32.708	34.632	36.556	38.480	40.404	42.328	44.252	46.176	48.100	50.024	51.948	53.872	55.796	57.720	59.644	61.568	63.492	65.416	67.340	69.264	76.960	86.580	96.200	105.820	115.440	125.060	134.680
MWS-L-8-24 OR MWS-L-10-20	88.80	26	0.26	48	CF	12446	13335	14224	15113	16002	16891	17780	18669	19558	20447	21336	22225	23114	24003	24892	25782	26671	27560	28449	29338	30227	31116	32005	35561	40006	44451	48896	53341	57786	62231
					DISCHARGE RATE GPM	32.323	34.632	36.941	39.250	41.558	43.867	46.176	48.485	50.794	53.102	55.411	57.720	60.029	62.338	64.646	66.955	69.264	71.573	73.882	76.190	78.499	80.808	83.117	92.352	103.896	115.440	126.984	138.528	150.072	161.616



Date: 5/31/2022

Project Name: Underground Detention System #1

# CMP: Underground Detention System

## Storage Volume Estimation

City / County:

State:

Designed By:

Company:

Telephone:

=Adjustable Input Cells

Contech Engineered Solutions, LLC is pleased to offer the following estimate of storage volume for the above named project. The results are submitted as an estimate only, without liability on the part of Contech Engineered Solutions, LLC for accuracy or suitability to any particular application and are subject to verification of the Engineer of Record. **This tool is only applicable for rectangular shaped systems.**

Summary of Inputs					
System Information		Backfill Information		Pipe & Analysis Information	
Out-to-out length (ft):	180.0	Backfill Porosity (%):	0%	System Diameter (in):	144
Out-to-out width (ft):	27.0	Depth Above Pipe (in):	6.0	Pipe Spacing (in):	36
Number of Manifolds (ea):	1.0	Depth Below Pipe (in):	6.0	Incremental Analysis (in):	2
Number of Barrels (ea):	2.0	Width At Ends (ft):	3.0	System Invert (Elevation):	0
		Width At Sides (ft):	3.0		

Storage Volume Estimation									
System		Pipe		Stone		Total System		Miscellaneous	
Depth (ft)	Elevation (ft)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Percent Open Storage (%)	Ave. Surface Area (sf)
0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	0.0
0.17	0.16	0.0	0.0	0.0	0.0	0.0	0.0	#DIV/0!	0.0
0.33	0.33	0.0	0.0	0.0	0.0	0.0	0.0	#DIV/0!	0.0
0.50	0.50	0.0	0.0	0.0	0.0	0.0	0.0	#DIV/0!	0.0
0.67	0.66	113.6	113.6	0.0	0.0	113.6	113.6	100.0%	1,019.6
0.83	0.83	206.4	320.0	0.0	0.0	206.4	320.0	100.0%	1,431.7
1.00	1.00	265.3	585.3	0.0	0.0	265.3	585.3	100.0%	1,740.9
1.17	1.16	312.0	897.3	0.0	0.0	312.0	897.3	100.0%	1,995.6
1.33	1.33	351.3	1,248.5	0.0	0.0	351.3	1,248.5	100.0%	2,214.7
1.50	1.50	385.5	1,634.1	0.0	0.0	385.5	1,634.1	100.0%	2,407.9
1.67	1.66	416.0	2,050.1	0.0	0.0	416.0	2,050.1	100.0%	2,581.0
1.83	1.83	443.4	2,493.5	0.0	0.0	443.4	2,493.5	100.0%	2,737.9
2.00	2.00	468.4	2,961.9	0.0	0.0	468.4	2,961.9	100.0%	2,881.2
2.17	2.16	491.3	3,453.3	0.0	0.0	491.3	3,453.3	100.0%	3,012.9
2.33	2.33	512.4	3,965.7	0.0	0.0	512.4	3,965.7	100.0%	3,134.3
2.50	2.50	531.9	4,497.5	0.0	0.0	531.9	4,497.5	100.0%	3,246.8
2.67	2.66	549.9	5,047.5	0.0	0.0	549.9	5,047.5	100.0%	3,351.1
2.83	2.83	566.7	5,614.2	0.0	0.0	566.7	5,614.2	100.0%	3,448.0
3.00	3.00	582.3	6,196.4	0.0	0.0	582.3	6,196.4	100.0%	3,538.1
3.17	3.16	596.8	6,793.2	0.0	0.0	596.8	6,793.2	100.0%	3,621.9
3.33	3.33	610.2	7,403.4	0.0	0.0	610.2	7,403.4	100.0%	3,699.9
3.50	3.50	622.8	8,026.2	0.0	0.0	622.8	8,026.2	100.0%	3,772.4
3.67	3.66	634.4	8,660.6	0.0	0.0	634.4	8,660.6	100.0%	3,839.7
3.83	3.83	645.2	9,305.8	0.0	0.0	645.2	9,305.8	100.0%	3,902.1
4.00	4.00	655.2	9,961.0	0.0	0.0	655.2	9,961.0	100.0%	3,959.9
4.17	4.16	664.5	10,625.5	0.0	0.0	664.5	10,625.5	100.0%	4,013.1
4.33	4.33	673.0	11,298.5	0.0	0.0	673.0	11,298.5	100.0%	4,062.1
4.50	4.50	680.8	11,979.3	0.0	0.0	680.8	11,979.3	100.0%	4,106.9
4.67	4.66	687.9	12,667.2	0.0	0.0	687.9	12,667.2	100.0%	4,147.7
4.83	4.83	694.4	13,361.6	0.0	0.0	694.4	13,361.6	100.0%	4,184.6
5.00	5.00	700.2	14,061.9	0.0	0.0	700.2	14,061.9	100.0%	4,217.7
5.17	5.16	705.4	14,767.3	0.0	0.0	705.4	14,767.3	100.0%	4,247.1
5.33	5.33	710.0	15,477.4	0.0	0.0	710.0	15,477.4	100.0%	4,272.9
5.50	5.50	714.0	16,191.4	0.0	0.0	714.0	16,191.4	100.0%	4,295.1
5.67	5.66	717.5	16,908.9	0.0	0.0	717.5	16,908.9	100.0%	4,313.8
5.83	5.83	720.3	17,629.2	0.0	0.0	720.3	17,629.2	100.0%	4,329.0
6.00	6.00	722.5	18,351.7	0.0	0.0	722.5	18,351.7	100.0%	4,340.8
6.17	6.16	724.2	19,075.9	0.0	0.0	724.2	19,075.9	100.0%	4,349.3

These results are submitted to you as a guideline only, without liability on the part of CONTECH Engineered Solutions, LLC for accuracy or suitability to any particular application, and are subject to your verification.

6.33	6.33	725.3	19,801.3	0.0	0.0	725.3	19,801.3	100.0%	4,354.3
6.50	6.50	725.9	20,527.2	0.0	0.0	725.9	20,527.2	100.0%	4,356.0
6.67	6.66	725.9	21,253.1	0.0	0.0	725.9	21,253.1	100.0%	4,354.3
6.83	6.83	725.3	21,978.4	0.0	0.0	725.3	21,978.4	100.0%	4,349.3
7.00	7.00	724.2	22,702.6	0.0	0.0	724.2	22,702.6	100.0%	4,340.8
7.17	7.16	722.5	23,425.2	0.0	0.0	722.5	23,425.2	100.0%	4,329.0
7.33	7.33	720.3	24,145.5	0.0	0.0	720.3	24,145.5	100.0%	4,313.8
7.50	7.50	717.5	24,862.9	0.0	0.0	717.5	24,862.9	100.0%	4,295.1
7.67	7.66	714.0	25,577.0	0.0	0.0	714.0	25,577.0	100.0%	4,272.9
7.83	7.83	710.0	26,287.0	0.0	0.0	710.0	26,287.0	100.0%	4,247.1
8.00	8.00	705.4	26,992.5	0.0	0.0	705.4	26,992.5	100.0%	4,217.7
8.17	8.16	700.2	27,692.7	0.0	0.0	700.2	27,692.7	100.0%	4,184.6
8.33	8.33	694.4	28,387.1	0.0	0.0	694.4	28,387.1	100.0%	4,147.7
8.50	8.50	687.9	29,075.0	0.0	0.0	687.9	29,075.0	100.0%	4,106.9
8.67	8.66	680.8	29,755.8	0.0	0.0	680.8	29,755.8	100.0%	4,062.1
8.83	8.83	673.0	30,428.8	0.0	0.0	673.0	30,428.8	100.0%	4,013.1
9.00	9.00	664.5	31,093.3	0.0	0.0	664.5	31,093.3	100.0%	3,959.9
9.17	9.16	655.2	31,748.5	0.0	0.0	655.2	31,748.5	100.0%	3,902.1
9.33	9.33	645.2	32,393.8	0.0	0.0	645.2	32,393.8	100.0%	3,839.7
9.50	9.50	634.4	33,028.2	0.0	0.0	634.4	33,028.2	100.0%	3,772.4
9.67	9.66	622.8	33,650.9	0.0	0.0	622.8	33,650.9	100.0%	3,699.9
9.83	9.83	610.2	34,261.2	0.0	0.0	610.2	34,261.2	100.0%	3,621.9
10.00	10.00	596.8	34,857.9	0.0	0.0	596.8	34,857.9	100.0%	3,538.1
10.17	10.16	582.3	35,440.2	0.0	0.0	582.3	35,440.2	100.0%	3,448.0
10.33	10.33	566.7	36,006.9	0.0	0.0	566.7	36,006.9	100.0%	3,351.1
10.50	10.50	549.9	36,556.8	0.0	0.0	549.9	36,556.8	100.0%	3,246.8
10.67	10.66	531.9	37,088.7	0.0	0.0	531.9	37,088.7	100.0%	3,134.3
10.83	10.83	512.4	37,601.1	0.0	0.0	512.4	37,601.1	100.0%	3,012.9
11.00	11.00	491.3	38,092.4	0.0	0.0	491.3	38,092.4	100.0%	2,881.2
11.17	11.16	468.4	38,560.8	0.0	0.0	468.4	38,560.8	100.0%	2,737.9
11.33	11.33	443.4	39,004.3	0.0	0.0	443.4	39,004.3	100.0%	2,581.0
11.50	11.50	416.0	39,420.3	0.0	0.0	416.0	39,420.3	100.0%	2,407.9
11.67	11.66	385.5	39,805.8	0.0	0.0	385.5	39,805.8	100.0%	2,214.7
11.83	11.83	351.3	40,157.1	0.0	0.0	351.3	40,157.1	100.0%	1,995.6
12.00	12.00	312.0	40,469.0	0.0	0.0	312.0	40,469.0	100.0%	1,740.9
12.17	12.16	265.3	40,734.4	0.0	0.0	265.3	40,734.4	100.0%	1,431.7
12.33	12.33	206.4	40,940.7	0.0	0.0	206.4	40,940.7	100.0%	1,019.6
12.50	12.50	113.6	41,054.3	0.0	0.0	113.6	41,054.3	100.0%	0.0
12.67	12.66	0.0	41,054.3	0.0	0.0	0.0	41,054.3	100.0%	0.0
12.83	12.83	0.0	41,054.3	0.0	0.0	0.0	41,054.3	100.0%	0.0
13.00	13.00	0.0	41,054.3	0.0	0.0	0.0	41,054.3	100.0%	0.0

These results are submitted to you as a guideline only, without liability on the part of CONTECH Engineered Solutions, LLC for accuracy or suitability to any particular application, and are subject to your verification.



Date: 5/31/2022

Project Name: Underground Detention System #2

## CMP: Underground Detention System Storage Volume Estimation

City / County:

State:

Designed By:

Company:

Telephone:

=Adjustable Input Cells

Contech Engineered Solutions, LLC is pleased to offer the following estimate of storage volume for the above named project. The results are submitted as an estimate only, without liability on the part of Contech Engineered Solutions, LLC for accuracy or suitability to any particular application and are subject to verification of the Engineer of Record. **This tool is only applicable for rectangular shaped systems.**

Summary of Inputs					
System Information		Backfill Information		Pipe & Analysis Information	
Out-to-out length (ft):	50.0	Backfill Porosity (%):	0%	System Diameter (in):	96
Out-to-out width (ft):	8.0	Depth Above Pipe (in):	6.0	Pipe Spacing (in):	36
Number of Manifolds (ea):	1.0	Depth Below Pipe (in):	6.0	Incremental Analysis (in):	2
Number of Barrels (ea):	1.0	Width At Ends (ft):	3.0	System Invert (Elevation):	0
		Width At Sides (ft):	3.0		

Storage Volume Estimation									
System		Pipe		Stone		Total System		Miscellaneous	
Depth (ft)	Elevation (ft)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Percent Open Storage (%)	Ave. Surface Area (sf)
0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	0.0
0.17	0.16	0.0	0.0	0.0	0.0	0.0	0.0	#DIV/0!	0.0
0.33	0.33	0.0	0.0	0.0	0.0	0.0	0.0	#DIV/0!	0.0
0.50	0.50	0.0	0.0	0.0	0.0	0.0	0.0	#DIV/0!	0.0
0.67	0.66	12.7	12.7	0.0	0.0	12.7	12.7	100.0%	114.3
0.83	0.83	23.1	35.8	0.0	0.0	23.1	35.8	100.0%	159.9
1.00	1.00	29.6	65.4	0.0	0.0	29.6	65.4	100.0%	193.6
1.17	1.16	34.6	100.0	0.0	0.0	34.6	100.0	100.0%	221.1
1.33	1.33	38.8	138.9	0.0	0.0	38.8	138.9	100.0%	244.4
1.50	1.50	42.5	181.3	0.0	0.0	42.5	181.3	100.0%	264.6
1.67	1.66	45.6	226.9	0.0	0.0	45.6	226.9	100.0%	282.4
1.83	1.83	48.4	275.3	0.0	0.0	48.4	275.3	100.0%	298.1
2.00	2.00	50.9	326.2	0.0	0.0	50.9	326.2	100.0%	312.2
2.17	2.16	53.1	379.3	0.0	0.0	53.1	379.3	100.0%	324.9
2.33	2.33	55.1	434.4	0.0	0.0	55.1	434.4	100.0%	336.2
2.50	2.50	56.9	491.3	0.0	0.0	56.9	491.3	100.0%	346.4
2.67	2.66	58.5	549.9	0.0	0.0	58.5	549.9	100.0%	355.5
2.83	2.83	59.9	609.8	0.0	0.0	59.9	609.8	100.0%	363.6
3.00	3.00	61.2	671.0	0.0	0.0	61.2	671.0	100.0%	370.8
3.17	3.16	62.3	733.4	0.0	0.0	62.3	733.4	100.0%	377.1
3.33	3.33	63.3	796.7	0.0	0.0	63.3	796.7	100.0%	382.6
3.50	3.50	64.2	860.8	0.0	0.0	64.2	860.8	100.0%	387.3
3.67	3.66	64.9	925.7	0.0	0.0	64.9	925.7	100.0%	391.2
3.83	3.83	65.5	991.2	0.0	0.0	65.5	991.2	100.0%	394.4
4.00	4.00	65.9	1,057.2	0.0	0.0	65.9	1,057.2	100.0%	396.9
4.17	4.16	66.3	1,123.5	0.0	0.0	66.3	1,123.5	100.0%	398.6
4.33	4.33	66.5	1,190.0	0.0	0.0	66.5	1,190.0	100.0%	399.7
4.50	4.50	66.6	1,256.6	0.0	0.0	66.6	1,256.6	100.0%	400.0
4.67	4.66	66.6	1,323.3	0.0	0.0	66.6	1,323.3	100.0%	399.7
4.83	4.83	66.5	1,389.8	0.0	0.0	66.5	1,389.8	100.0%	398.6
5.00	5.00	66.3	1,456.1	0.0	0.0	66.3	1,456.1	100.0%	396.9
5.17	5.16	65.9	1,522.1	0.0	0.0	65.9	1,522.1	100.0%	394.4
5.33	5.33	65.5	1,587.5	0.0	0.0	65.5	1,587.5	100.0%	391.2
5.50	5.50	64.9	1,652.4	0.0	0.0	64.9	1,652.4	100.0%	387.3
5.67	5.66	64.2	1,716.6	0.0	0.0	64.2	1,716.6	100.0%	382.6
5.83	5.83	63.3	1,779.9	0.0	0.0	63.3	1,779.9	100.0%	377.1
6.00	6.00	62.3	1,842.3	0.0	0.0	62.3	1,842.3	100.0%	370.8
6.17	6.16	61.2	1,903.5	0.0	0.0	61.2	1,903.5	100.0%	363.6

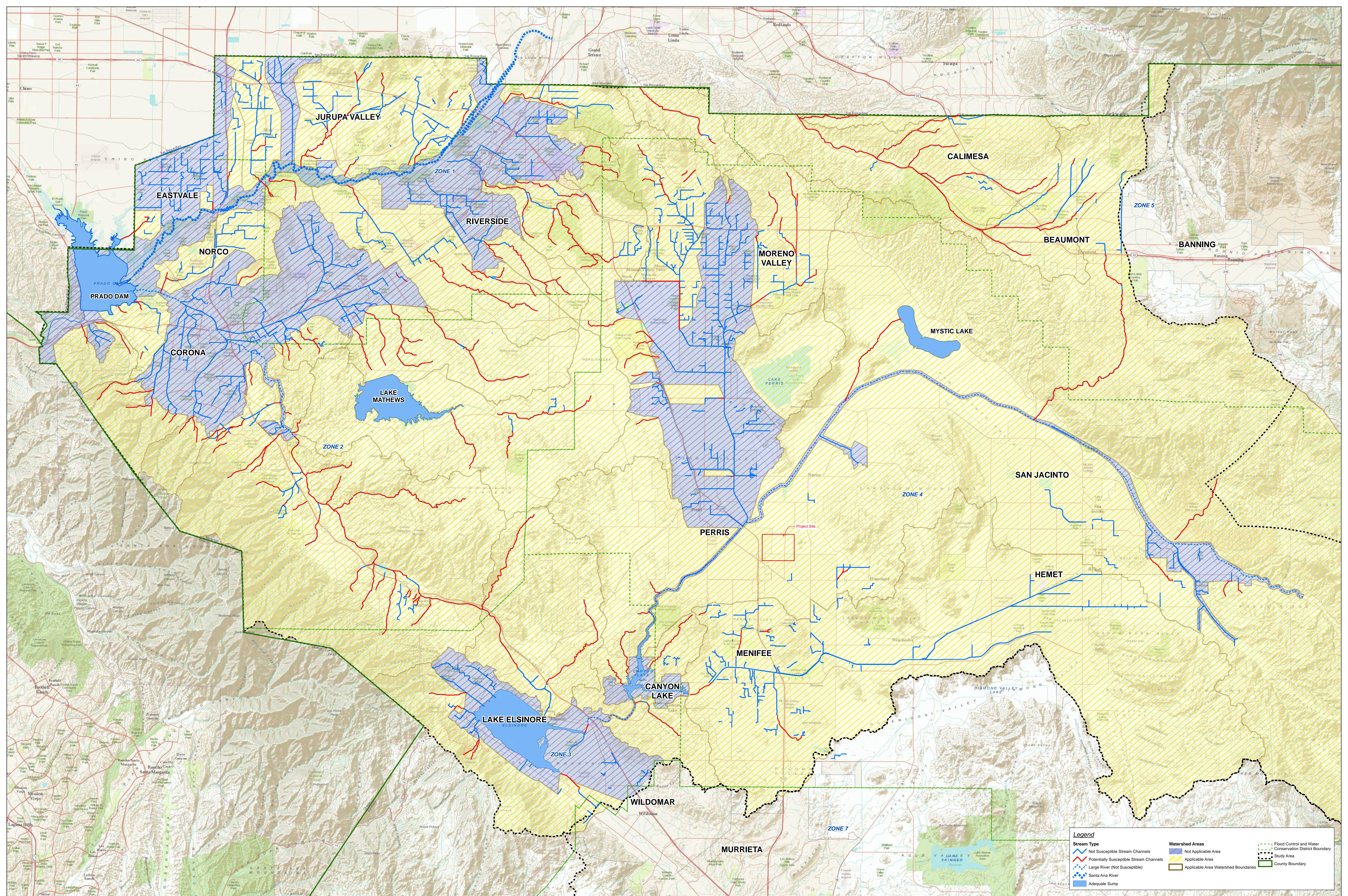
These results are submitted to you as a guideline only, without liability on the part of CONTECH Engineered Solutions, LLC for accuracy or suitability to any particular application, and are subject to your verification.

6.33	6.33	59.9	1,963.4	0.0	0.0	59.9	1,963.4	100.0%	355.5
6.50	6.50	58.5	2,021.9	0.0	0.0	58.5	2,021.9	100.0%	346.4
6.67	6.66	56.9	2,078.8	0.0	0.0	56.9	2,078.8	100.0%	336.2
6.83	6.83	55.1	2,133.9	0.0	0.0	55.1	2,133.9	100.0%	324.9
7.00	7.00	53.1	2,187.1	0.0	0.0	53.1	2,187.1	100.0%	312.2
7.17	7.16	50.9	2,237.9	0.0	0.0	50.9	2,237.9	100.0%	298.1
7.33	7.33	48.4	2,286.3	0.0	0.0	48.4	2,286.3	100.0%	282.4
7.50	7.50	45.6	2,331.9	0.0	0.0	45.6	2,331.9	100.0%	264.6
7.67	7.66	42.5	2,374.4	0.0	0.0	42.5	2,374.4	100.0%	244.4
7.83	7.83	38.8	2,413.2	0.0	0.0	38.8	2,413.2	100.0%	221.1
8.00	8.00	34.6	2,447.9	0.0	0.0	34.6	2,447.9	100.0%	193.6
8.17	8.16	29.6	2,477.4	0.0	0.0	29.6	2,477.4	100.0%	159.9
8.33	8.33	23.1	2,500.5	0.0	0.0	23.1	2,500.5	100.0%	114.3
8.50	8.50	12.7	2,513.3	0.0	0.0	12.7	2,513.3	100.0%	0.0
8.67	8.66	0.0	2,513.3	0.0	0.0	0.0	2,513.3	100.0%	0.0
8.83	8.83	0.0	2,513.3	0.0	0.0	0.0	2,513.3	100.0%	0.0
9.00	9.00	0.0	2,513.3	0.0	0.0	0.0	2,513.3	100.0%	0.0

These results are submitted to you as a guideline only, without liability on the part of CONTECH Engineered Solutions, LLC for accuracy or suitability to any particular application, and are subject to your verification.

# Appendix 7: Hydromodification

*Supporting Detail Relating to Hydrologic Conditions of Concern*



**Legend**

Stream Type	Not Applicable Area	Flood Control and Water Conservation District Boundary
Potentially Susceptible Stream Channels	Applicable Area	Study Area
Large River (Not Susceptible)	Applicable Area Watershed Boundaries	County Boundary
Santa Ana River		
Adequate Sump		

<b>Pre-Development Summary Table</b>			
DMA	Tc (Min)	Q <sub>2</sub> (CFS)	V <sub>2</sub> (CF)
A	27.23	8.30	14,323

<b>Post-Development Summary Table (W/O BMPS)</b>			
DMA	Tc (Min)	Q <sub>2</sub> (CFS)	V <sub>2</sub> (CF)
A	8.11	19.96	103,019
B	10.81	1.00	4,726
Total	10.81	20.96	107,746

<b>HCOC Calculation Summary Table</b>		
	Q <sub>2</sub> (CFS)	V <sub>2</sub> (CF)
<b>Pre-Development Condition</b>	8.30	14,323
<b>Post-Development Condition</b>	20.96	107,746
<b>HCOC Requirement</b> <i>1.10*(Pre-Development Q)</i>	9.13	-
<b>DCV</b> <i>See Appendix 6</i>	-	27,403
<b>Notes</b>	Since it is deemed infeasible to retain runoff onsite, the site will be allowed to release runoff at a flow rate of no greater than 110% of the pre-development peak flow for a 2-year storm.	

<b>Post-Development Summary Table (W/ BMPS)</b>		
DMA	Allowable Q <sub>2</sub> (CFS)	Q <sub>2</sub> (CFS)
A	-	3.55
B	-	0.18
Total	9.13	3.73

# Appendix 7.1: Pre-Development Calculations

*Rational Method – 2-Year*

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2018 Version 9.0

Rational Hydrology Study

Date: 05/26/22

File:MapesPre2Rat.out

-----  
MAPES AND TRUMBLE INDUSTRIAL FACILITY  
RATIONAL METHOD  
PRE-DEVELOPMENT CONDITIONS  
2-YEAR STORM, DA A  
-----

\*\*\*\*\* Hydrology Study Control Information \*\*\*\*\*

English (in-lb) Units used in input data file  
-----

Program License Serial Number 6443  
-----

Rational Method Hydrology Program based on  
Riverside County Flood Control & Water Conservation District  
1978 hydrology manual

Storm event (year) = 2.00 Antecedent Moisture Condition = 1

2 year, 1 hour precipitation = 0.487(In.)

100 year, 1 hour precipitation = 1.520(In.)

Storm event year = 2.0

Calculated rainfall intensity data:

1 hour intensity = 0.487(In/Hr)

Slope of intensity duration curve = 0.4900

++++  
Process from Point/Station 1.100 to Point/Station 3.000  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

-----  
Initial area flow distance = 893.980(Ft.)

Top (of initial area) elevation = 1423.670(Ft.)

Bottom (of initial area) elevation = 1417.830(Ft.)

Difference in elevation = 5.840(Ft.)

Slope = 0.00653 s(percent)= 0.65

TC = k(0.530)\*[(length^3)/(elevation change)]^0.2

Initial area time of concentration = 21.968 min.  
Rainfall intensity = 0.797(In/Hr) for a 2.0 year storm  
UNDEVELOPED (poor cover) subarea  
Runoff Coefficient = 0.593  
Decimal fraction soil group A = 0.000  
Decimal fraction soil group B = 0.000  
Decimal fraction soil group C = 0.000  
Decimal fraction soil group D = 1.000  
RI index for soil(AMC 1) = 76.40  
Pervious area fraction = 1.000; Impervious fraction = 0.000  
Initial subarea runoff = 2.066(CFS)  
Total initial stream area = 4.370(Ac.)  
Pervious area fraction = 1.000

++++  
Process from Point/Station 3.000 to Point/Station 3.000  
\*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 1 in normal stream number 1  
Stream flow area = 4.370(Ac.)  
Runoff from this stream = 2.066(CFS)  
Time of concentration = 21.97 min.  
Rainfall intensity = 0.797(In/Hr)

++++  
Process from Point/Station 2.100 to Point/Station 3.000  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

---

Initial area flow distance = 693.750(Ft.)  
Top (of initial area) elevation = 1422.920(Ft.)  
Bottom (of initial area) elevation = 1417.830(Ft.)  
Difference in elevation = 5.090(Ft.)  
Slope = 0.00734 s(percent)= 0.73  
TC =  $k(0.530)*[(\text{length}^3)/(\text{elevation change})]^{0.2}$   
Initial area time of concentration = 19.393 min.  
Rainfall intensity = 0.847(In/Hr) for a 2.0 year storm  
UNDEVELOPED (poor cover) subarea  
Runoff Coefficient = 0.606  
Decimal fraction soil group A = 0.000  
Decimal fraction soil group B = 0.000  
Decimal fraction soil group C = 0.000  
Decimal fraction soil group D = 1.000  
RI index for soil(AMC 1) = 76.40  
Pervious area fraction = 1.000; Impervious fraction = 0.000  
Initial subarea runoff = 1.621(CFS)  
Total initial stream area = 3.160(Ac.)  
Pervious area fraction = 1.000

+++++  
 Process from Point/Station 3.000 to Point/Station 3.000  
 \*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 1 in normal stream number 2  
 Stream flow area = 3.160(Ac.)  
 Runoff from this stream = 1.621(CFS)  
 Time of concentration = 19.39 min.  
 Rainfall intensity = 0.847(In/Hr)  
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
------------	-----------------	----------	----------------------------

1	2.066	21.97	0.797
2	1.621	19.39	0.847

Largest stream flow has longer time of concentration  
 $Q_p = 2.066 + \text{sum of } Q_b \cdot I_a/I_b$   
 $1.621 * 0.941 = 1.525$   
 $Q_p = 3.591$

Total of 2 streams to confluence:  
 Flow rates before confluence point:  
 2.066 1.621  
 Area of streams before confluence:  
 4.370 3.160  
 Results of confluence:  
 Total flow rate = 3.591(CFS)  
 Time of concentration = 21.968 min.  
 Effective stream area after confluence = 7.530(Ac.)

+++++  
 Process from Point/Station 3.000 to Point/Station 3.100  
 \*\*\*\* IRREGULAR CHANNEL FLOW TRAVEL TIME \*\*\*\*

---

Estimated mean flow rate at midpoint of channel = 5.993(CFS)  
 Depth of flow = 0.614(Ft.), Average velocity = 1.148(Ft/s)  
 \*\*\*\*\* Irregular Channel Data \*\*\*\*\*

-----  
 Information entered for subchannel number 1 :  

Point number	'X' coordinate	'Y' coordinate
1	0.00	0.77
2	4.23	0.00
3	9.79	0.02
4	14.96	1.12

 Manning's 'N' friction factor = 0.030

-----  
Sub-Channel flow = 5.993(CFS)  
' ' flow top width = 11.724(Ft.)  
' ' velocity= 1.148(Ft/s)  
' ' area = 5.222(Sq.Ft)  
' ' Froude number = 0.303

Upstream point elevation = 1417.830(Ft.)  
Downstream point elevation = 1417.250(Ft.)  
Flow length = 362.580(Ft.)  
Travel time = 5.27 min.  
Time of concentration = 27.23 min.  
Depth of flow = 0.614(Ft.)  
Average velocity = 1.148(Ft/s)  
Total irregular channel flow = 5.993(CFS)  
Irregular channel normal depth above invert elev. = 0.614(Ft.)  
Average velocity of channel(s) = 1.148(Ft/s)  
Adding area flow to channel  
UNDEVELOPED (poor cover) subarea  
Runoff Coefficient = 0.572  
Decimal fraction soil group A = 0.000  
Decimal fraction soil group B = 0.000  
Decimal fraction soil group C = 0.000  
Decimal fraction soil group D = 1.000  
RI index for soil(AMC 1) = 76.40  
Pervious area fraction = 1.000; Impervious fraction = 0.000  
Rainfall intensity = 0.717(In/Hr) for a 2.0 year storm  
Subarea runoff = 4.707(CFS) for 11.480(Ac.)  
Total runoff = 8.297(CFS) Total area = 19.010(Ac.)  
Depth of flow = 0.725(Ft.), Average velocity = 1.259(Ft/s)  
End of computations, total study area = 19.01 (Ac.)  
The following figures may  
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction( $A_p$ ) = 1.000  
Area averaged RI index number = 89.0

# Appendix 7.2: Post-Development Calculations

*Rational Method – 2-Year*

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2018 Version 9.0

Rational Hydrology Study

Date: 05/27/22

File:MapesPost2ARat.out

-----  
MAPES AND TRUMBLE INDUSTRIAL FACILITY  
RATIONAL METHOD  
POST-DEVELOPMENT CONDITIONS  
2-YEAR STORM, DA A  
-----

\*\*\*\*\* Hydrology Study Control Information \*\*\*\*\*

English (in-lb) Units used in input data file  
-----

Program License Serial Number 6443  
-----

Rational Method Hydrology Program based on  
Riverside County Flood Control & Water Conservation District  
1978 hydrology manual

Storm event (year) = 2.00 Antecedent Moisture Condition = 1

2 year, 1 hour precipitation = 0.487(In.)

100 year, 1 hour precipitation = 1.520(In.)

Storm event year = 2.0

Calculated rainfall intensity data:

1 hour intensity = 0.487(In/Hr)

Slope of intensity duration curve = 0.4900

++++  
Process from Point/Station 1.100 to Point/Station 1.200  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

-----  
Initial area flow distance = 214.760(Ft.)

Top (of initial area) elevation = 1422.920(Ft.)

Bottom (of initial area) elevation = 1419.450(Ft.)

Difference in elevation = 3.470(Ft.)

Slope = 0.01616 s(percent)= 1.62

TC = k(0.300)\*[(length^3)/(elevation change)]^0.2

Initial area time of concentration = 5.864 min.  
Rainfall intensity = 1.522(In/Hr) for a 2.0 year storm  
COMMERCIAL subarea type  
Runoff Coefficient = 0.864  
Decimal fraction soil group A = 0.000  
Decimal fraction soil group B = 0.000  
Decimal fraction soil group C = 0.000  
Decimal fraction soil group D = 1.000  
RI index for soil(AMC 1) = 57.00  
Pervious area fraction = 0.100; Impervious fraction = 0.900  
Initial subarea runoff = 1.355(CFS)  
Total initial stream area = 1.030(Ac.)  
Pervious area fraction = 0.100

++++  
Process from Point/Station 1.200 to Point/Station 2.300  
\*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 1415.450(Ft.)  
Downstream point/station elevation = 1414.490(Ft.)  
Pipe length = 175.42(Ft.) Manning's N = 0.013  
No. of pipes = 1 Required pipe flow = 1.355(CFS)  
Nearest computed pipe diameter = 12.00(In.)  
Calculated individual pipe flow = 1.355(CFS)  
Normal flow depth in pipe = 6.10(In.)  
Flow top width inside pipe = 12.00(In.)  
Critical Depth = 5.91(In.)  
Pipe flow velocity = 3.38(Ft/s)  
Travel time through pipe = 0.87 min.  
Time of concentration (TC) = 6.73 min.

++++  
Process from Point/Station 2.300 to Point/Station 2.300  
\*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 1 in normal stream number 1  
Stream flow area = 1.030(Ac.)  
Runoff from this stream = 1.355(CFS)  
Time of concentration = 6.73 min.  
Rainfall intensity = 1.423(In/Hr)

++++  
Process from Point/Station 2.100 to Point/Station 2.200  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

---

Initial area flow distance = 130.430(Ft.)  
Top (of initial area) elevation = 1421.180(Ft.)

Bottom (of initial area) elevation = 1418.600(Ft.)  
Difference in elevation = 2.580(Ft.)  
Slope = 0.01978 s(percent)= 1.98  
TC =  $k(0.300)*[(\text{length}^3)/(\text{elevation change})]^{0.2}$   
Warning: TC computed to be less than 5 min.; program is assuming the  
time of concentration is 5 minutes.  
Initial area time of concentration = 5.000 min.  
Rainfall intensity = 1.646(In/Hr) for a 2.0 year storm  
COMMERCIAL subarea type  
Runoff Coefficient = 0.866  
Decimal fraction soil group A = 0.000  
Decimal fraction soil group B = 0.000  
Decimal fraction soil group C = 0.000  
Decimal fraction soil group D = 1.000  
RI index for soil(AMC 1) = 57.00  
Pervious area fraction = 0.100; Impervious fraction = 0.900  
Initial subarea runoff = 2.679(CFS)  
Total initial stream area = 1.880(Ac.)  
Pervious area fraction = 0.100

++++  
Process from Point/Station 2.200 to Point/Station 2.300  
\*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 1414.600(Ft.)  
Downstream point/station elevation = 1414.490(Ft.)  
Pipe length = 21.80(Ft.) Manning's N = 0.013  
No. of pipes = 1 Required pipe flow = 2.679(CFS)  
Nearest computed pipe diameter = 15.00(In.)  
Calculated individual pipe flow = 2.679(CFS)  
Normal flow depth in pipe = 8.23(In.)  
Flow top width inside pipe = 14.93(In.)  
Critical Depth = 7.88(In.)  
Pipe flow velocity = 3.88(Ft/s)  
Travel time through pipe = 0.09 min.  
Time of concentration (TC) = 5.09 min.

++++  
Process from Point/Station 2.300 to Point/Station 2.300  
\*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 1 in normal stream number 2  
Stream flow area = 1.880(Ac.)  
Runoff from this stream = 2.679(CFS)  
Time of concentration = 5.09 min.  
Rainfall intensity = 1.631(In/Hr)  
Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
------------	-----------------	----------	----------------------------

1	1.355	6.73	1.423
2	2.679	5.09	1.631

Largest stream flow has longer or shorter time of concentration

Qp = 2.679 + sum of  
 Qa Tb/Ta  
 1.355 \* 0.757 = 1.025  
 Qp = 3.704

Total of 2 streams to confluence:  
 Flow rates before confluence point:  
 1.355 2.679

Area of streams before confluence:  
 1.030 1.880

Results of confluence:  
 Total flow rate = 3.704(CFS)  
 Time of concentration = 5.094 min.  
 Effective stream area after confluence = 2.910(Ac.)

\*\*\*\*\*  
 Process from Point/Station 2.300 to Point/Station 3.300  
 \*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 1414.490(Ft.)  
 Downstream point/station elevation = 1413.530(Ft.)  
 Pipe length = 191.80(Ft.) Manning's N = 0.013  
 No. of pipes = 1 Required pipe flow = 3.704(CFS)  
 Nearest computed pipe diameter = 15.00(In.)  
 Calculated individual pipe flow = 3.704(CFS)  
 Normal flow depth in pipe = 10.24(In.)  
 Flow top width inside pipe = 13.96(In.)  
 Critical Depth = 9.33(In.)  
 Pipe flow velocity = 4.15(Ft/s)  
 Travel time through pipe = 0.77 min.  
 Time of concentration (TC) = 5.86 min.

\*\*\*\*\*  
 Process from Point/Station 3.300 to Point/Station 3.300  
 \*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 1 in normal stream number 1  
 Stream flow area = 2.910(Ac.)  
 Runoff from this stream = 3.704(CFS)  
 Time of concentration = 5.86 min.  
 Rainfall intensity = 1.522(In/Hr)

++++  
Process from Point/Station            3.100 to Point/Station            3.200  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

---

Initial area flow distance = 120.880(Ft.)  
Top (of initial area) elevation = 1419.390(Ft.)  
Bottom (of initial area) elevation = 1418.600(Ft.)  
Difference in elevation = 0.790(Ft.)  
Slope = 0.00654 s(percent)= 0.65  
TC =  $k(0.300)*[(\text{length}^3)/(\text{elevation change})]^{0.2}$   
Initial area time of concentration = 5.585 min.  
Rainfall intensity = 1.559(In/Hr) for a 2.0 year storm  
COMMERCIAL subarea type  
Runoff Coefficient = 0.865  
Decimal fraction soil group A = 0.000  
Decimal fraction soil group B = 0.000  
Decimal fraction soil group C = 0.000  
Decimal fraction soil group D = 1.000  
RI index for soil(AMC 1) = 57.00  
Pervious area fraction = 0.100; Impervious fraction = 0.900  
Initial subarea runoff = 1.927(CFS)  
Total initial stream area = 1.430(Ac.)  
Pervious area fraction = 0.100

++++  
Process from Point/Station            3.200 to Point/Station            3.300  
\*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 1414.600(Ft.)  
Downstream point/station elevation = 1413.530(Ft.)  
Pipe length = 22.97(Ft.) Manning's N = 0.013  
No. of pipes = 1 Required pipe flow = 1.927(CFS)  
Nearest computed pipe diameter = 9.00(In.)  
Calculated individual pipe flow = 1.927(CFS)  
Normal flow depth in pipe = 4.71(In.)  
Flow top width inside pipe = 8.99(In.)  
Critical Depth = 7.59(In.)  
Pipe flow velocity = 8.24(Ft/s)  
Travel time through pipe = 0.05 min.  
Time of concentration (TC) = 5.63 min.

++++  
Process from Point/Station            3.300 to Point/Station            3.300  
\*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 1 in normal stream number 2

Stream flow area = 1.430(Ac.)  
 Runoff from this stream = 1.927(CFS)  
 Time of concentration = 5.63 min.  
 Rainfall intensity = 1.552(In/Hr)  
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
------------	-----------------	----------	----------------------------

1	3.704	5.86	1.522
2	1.927	5.63	1.552

Largest stream flow has longer time of concentration

Qp = 3.704 + sum of  
 Qb Ia/Ib  
 1.927 \* 0.980 = 1.890  
 Qp = 5.594

Total of 2 streams to confluence:  
 Flow rates before confluence point:

3.704 1.927

Area of streams before confluence:

2.910 1.430

Results of confluence:

Total flow rate = 5.594(CFS)  
 Time of concentration = 5.864 min.  
 Effective stream area after confluence = 4.340(Ac.)

++++  
 Process from Point/Station 3.300 to Point/Station 4.300  
 \*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 1413.530(Ft.)  
 Downstream point/station elevation = 1413.360(Ft.)  
 Pipe length = 34.32(Ft.) Manning's N = 0.013  
 No. of pipes = 1 Required pipe flow = 5.594(CFS)  
 Nearest computed pipe diameter = 18.00(In.)  
 Calculated individual pipe flow = 5.594(CFS)  
 Normal flow depth in pipe = 11.70(In.)  
 Flow top width inside pipe = 17.17(In.)  
 Critical Depth = 10.95(In.)  
 Pipe flow velocity = 4.60(Ft/s)  
 Travel time through pipe = 0.12 min.  
 Time of concentration (TC) = 5.99 min.

++++  
 Process from Point/Station 4.300 to Point/Station 4.300  
 \*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 1 in normal stream number 1  
Stream flow area = 4.340(Ac.)  
Runoff from this stream = 5.594(CFS)  
Time of concentration = 5.99 min.  
Rainfall intensity = 1.506(In/Hr)

++++  
Process from Point/Station 4.100 to Point/Station 4.200  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

---

Initial area flow distance = 256.970(Ft.)  
Top (of initial area) elevation = 1422.990(Ft.)  
Bottom (of initial area) elevation = 1419.100(Ft.)  
Difference in elevation = 3.890(Ft.)  
Slope = 0.01514 s(percent)= 1.51  
TC =  $k(0.300)*[(\text{length}^3)/(\text{elevation change})]^{0.2}$   
Initial area time of concentration = 6.384 min.  
Rainfall intensity = 1.460(In/Hr) for a 2.0 year storm  
COMMERCIAL subarea type  
Runoff Coefficient = 0.863  
Decimal fraction soil group A = 0.000  
Decimal fraction soil group B = 0.000  
Decimal fraction soil group C = 0.000  
Decimal fraction soil group D = 1.000  
RI index for soil(AMC 1) = 57.00  
Pervious area fraction = 0.100; Impervious fraction = 0.900  
Initial subarea runoff = 1.286(CFS)  
Total initial stream area = 1.020(Ac.)  
Pervious area fraction = 0.100

++++  
Process from Point/Station 4.200 to Point/Station 4.300  
\*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 1415.100(Ft.)  
Downstream point/station elevation = 1413.360(Ft.)  
Pipe length = 136.57(Ft.) Manning's N = 0.013  
No. of pipes = 1 Required pipe flow = 1.286(CFS)  
Nearest computed pipe diameter = 9.00(In.)  
Calculated individual pipe flow = 1.286(CFS)  
Normal flow depth in pipe = 5.48(In.)  
Flow top width inside pipe = 8.78(In.)  
Critical Depth = 6.26(In.)  
Pipe flow velocity = 4.56(Ft/s)  
Travel time through pipe = 0.50 min.  
Time of concentration (TC) = 6.88 min.

+++++  
 Process from Point/Station 4.300 to Point/Station 4.300  
 \*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 1 in normal stream number 2  
 Stream flow area = 1.020(Ac.)  
 Runoff from this stream = 1.286(CFS)  
 Time of concentration = 6.88 min.  
 Rainfall intensity = 1.407(In/Hr)  
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
------------	-----------------	----------	----------------------------

1	5.594	5.99	1.506
2	1.286	6.88	1.407

Largest stream flow has longer or shorter time of concentration  
 $Q_p = 5.594 + \text{sum of } Q_a \cdot T_b/T_a$   
 $Q_p = 1.286 * 0.870 = 1.119$   
 $Q_p = 6.712$

Total of 2 streams to confluence:  
 Flow rates before confluence point:  
 5.594 1.286  
 Area of streams before confluence:  
 4.340 1.020

Results of confluence:  
 Total flow rate = 6.712(CFS)  
 Time of concentration = 5.989 min.  
 Effective stream area after confluence = 5.360(Ac.)

+++++  
 Process from Point/Station 4.300 to Point/Station 5.300  
 \*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 1413.360(Ft.)  
 Downstream point/station elevation = 1412.940(Ft.)  
 Pipe length = 83.92(Ft.) Manning's N = 0.013  
 No. of pipes = 1 Required pipe flow = 6.712(CFS)  
 Nearest computed pipe diameter = 18.00(In.)  
 Calculated individual pipe flow = 6.712(CFS)  
 Normal flow depth in pipe = 13.38(In.)  
 Flow top width inside pipe = 15.72(In.)  
 Critical Depth = 12.02(In.)  
 Pipe flow velocity = 4.76(Ft/s)  
 Travel time through pipe = 0.29 min.

Time of concentration (TC) = 6.28 min.

++++  
Process from Point/Station 5.300 to Point/Station 5.300  
\*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 1 in normal stream number 1  
Stream flow area = 5.360(Ac.)  
Runoff from this stream = 6.712(CFS)  
Time of concentration = 6.28 min.  
Rainfall intensity = 1.471(In/Hr)

++++  
Process from Point/Station 5.100 to Point/Station 5.200  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

---

Initial area flow distance = 148.520(Ft.)  
Top (of initial area) elevation = 1422.490(Ft.)  
Bottom (of initial area) elevation = 1419.100(Ft.)  
Difference in elevation = 3.390(Ft.)  
Slope = 0.02283 s(percent)= 2.28  
TC =  $k(0.300)*[(\text{length}^3)/(\text{elevation change})]^{0.2}$   
Warning: TC computed to be less than 5 min.; program is assuming the  
time of concentration is 5 minutes.  
Initial area time of concentration = 5.000 min.  
Rainfall intensity = 1.646(In/Hr) for a 2.0 year storm  
COMMERCIAL subarea type  
Runoff Coefficient = 0.866  
Decimal fraction soil group A = 0.000  
Decimal fraction soil group B = 0.000  
Decimal fraction soil group C = 0.000  
Decimal fraction soil group D = 1.000  
RI index for soil(AMC 1) = 57.00  
Pervious area fraction = 0.100; Impervious fraction = 0.900  
Initial subarea runoff = 0.655(CFS)  
Total initial stream area = 0.460(Ac.)  
Pervious area fraction = 0.100

++++  
Process from Point/Station 5.200 to Point/Station 5.300  
\*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 1415.100(Ft.)  
Downstream point/station elevation = 1412.940(Ft.)  
Pipe length = 40.62(Ft.) Manning's N = 0.013  
No. of pipes = 1 Required pipe flow = 0.655(CFS)  
Nearest computed pipe diameter = 6.00(In.)

Calculated individual pipe flow = 0.655(CFS)  
 Normal flow depth in pipe = 3.02(In.)  
 Flow top width inside pipe = 6.00(In.)  
 Critical Depth = 4.92(In.)  
 Pipe flow velocity = 6.61(Ft/s)  
 Travel time through pipe = 0.10 min.  
 Time of concentration (TC) = 5.10 min.

++++++  
 Process from Point/Station 5.300 to Point/Station 5.300  
 \*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 1 in normal stream number 2  
 Stream flow area = 0.460(Ac.)  
 Runoff from this stream = 0.655(CFS)  
 Time of concentration = 5.10 min.  
 Rainfall intensity = 1.629(In/Hr)  
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	6.712	6.28	1.471
2	0.655	5.10	1.629

Largest stream flow has longer time of concentration  
 $Q_p = 6.712 + \text{sum of } Q_b \cdot I_a/I_b$   
 $Q_p = 0.655 * 0.903 = 0.592$   
 $Q_p = 7.304$

Total of 2 streams to confluence:  
 Flow rates before confluence point:  
 6.712      0.655  
 Area of streams before confluence:  
 5.360      0.460  
 Results of confluence:  
 Total flow rate = 7.304(CFS)  
 Time of concentration = 6.283 min.  
 Effective stream area after confluence = 5.820(Ac.)

++++++  
 Process from Point/Station 5.300 to Point/Station 6.300  
 \*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 1412.940(Ft.)  
 Downstream point/station elevation = 1412.570(Ft.)  
 Pipe length = 73.56(Ft.)      Manning's N = 0.013

No. of pipes = 1 Required pipe flow = 7.304(CFS)  
Nearest computed pipe diameter = 18.00(In.)  
Calculated individual pipe flow = 7.304(CFS)  
Normal flow depth in pipe = 14.44(In.)  
Flow top width inside pipe = 14.34(In.)  
Critical Depth = 12.56(In.)  
Pipe flow velocity = 4.81(Ft/s)  
Travel time through pipe = 0.26 min.  
Time of concentration (TC) = 6.54 min.

++++  
Process from Point/Station 6.300 to Point/Station 6.300  
\*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 1 in normal stream number 1  
Stream flow area = 5.820(Ac.)  
Runoff from this stream = 7.304(CFS)  
Time of concentration = 6.54 min.  
Rainfall intensity = 1.443(In/Hr)

++++  
Process from Point/Station 6.100 to Point/Station 6.200  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

---

Initial area flow distance = 206.100(Ft.)  
Top (of initial area) elevation = 1419.690(Ft.)  
Bottom (of initial area) elevation = 1418.600(Ft.)  
Difference in elevation = 1.090(Ft.)  
Slope = 0.00529 s(percent)= 0.53  
TC =  $k(0.300)*[(\text{length}^3)/(\text{elevation change})]^{0.2}$   
Initial area time of concentration = 7.212 min.  
Rainfall intensity = 1.375(In/Hr) for a 2.0 year storm  
COMMERCIAL subarea type  
Runoff Coefficient = 0.862  
Decimal fraction soil group A = 0.000  
Decimal fraction soil group B = 0.000  
Decimal fraction soil group C = 0.000  
Decimal fraction soil group D = 1.000  
RI index for soil(AMC 1) = 57.00  
Pervious area fraction = 0.100; Impervious fraction = 0.900  
Initial subarea runoff = 2.394(CFS)  
Total initial stream area = 2.020(Ac.)  
Pervious area fraction = 0.100

++++  
Process from Point/Station 6.200 to Point/Station 6.300  
\*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 1414.600(Ft.)  
 Downstream point/station elevation = 1412.570(Ft.)  
 Pipe length = 24.15(Ft.) Manning's N = 0.013  
 No. of pipes = 1 Required pipe flow = 2.394(CFS)  
 Nearest computed pipe diameter = 9.00(In.)  
 Calculated individual pipe flow = 2.394(CFS)  
 Normal flow depth in pipe = 4.49(In.)  
 Flow top width inside pipe = 9.00(In.)  
 Critical Depth = 8.21(In.)  
 Pipe flow velocity = 10.85(Ft/s)  
 Travel time through pipe = 0.04 min.  
 Time of concentration (TC) = 7.25 min.

++++++  
 Process from Point/Station 6.300 to Point/Station 6.300  
 \*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 1 in normal stream number 2  
 Stream flow area = 2.020(Ac.)  
 Runoff from this stream = 2.394(CFS)  
 Time of concentration = 7.25 min.  
 Rainfall intensity = 1.372(In/Hr)  
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	7.304	6.54	1.443
2	2.394	7.25	1.372

Largest stream flow has longer or shorter time of concentration  
 $Q_p = 7.304 + \text{sum of } Q_a \cdot \frac{T_b}{T_a}$   
 $2.394 * 0.902 = 2.159$   
 $Q_p = 9.463$

Total of 2 streams to confluence:  
 Flow rates before confluence point:  
 7.304      2.394  
 Area of streams before confluence:  
 5.820      2.020  
 Results of confluence:  
 Total flow rate = 9.463(CFS)  
 Time of concentration = 6.538 min.  
 Effective stream area after confluence = 7.840(Ac.)

+++++

Process from Point/Station 6.300 to Point/Station 7.300  
\*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 1412.570(Ft.)  
Downstream point/station elevation = 1411.710(Ft.)  
Pipe length = 172.10(Ft.) Manning's N = 0.013  
No. of pipes = 1 Required pipe flow = 9.463(CFS)  
Nearest computed pipe diameter = 21.00(In.)  
Calculated individual pipe flow = 9.463(CFS)  
Normal flow depth in pipe = 14.81(In.)  
Flow top width inside pipe = 19.15(In.)  
Critical Depth = 13.73(In.)  
Pipe flow velocity = 5.22(Ft/s)  
Travel time through pipe = 0.55 min.  
Time of concentration (TC) = 7.09 min.

+++++  
Process from Point/Station 7.300 to Point/Station 7.300  
\*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 1 in normal stream number 1  
Stream flow area = 7.840(Ac.)  
Runoff from this stream = 9.463(CFS)  
Time of concentration = 7.09 min.  
Rainfall intensity = 1.387(In/Hr)

+++++  
Process from Point/Station 7.100 to Point/Station 7.200  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

---

Initial area flow distance = 588.890(Ft.)  
Top (of initial area) elevation = 1422.840(Ft.)  
Bottom (of initial area) elevation = 1418.940(Ft.)  
Difference in elevation = 3.900(Ft.)  
Slope = 0.00662 s(percent)= 0.66  
TC =  $k(0.300)*[(\text{length}^3)/(\text{elevation change})]^{0.2}$   
Initial area time of concentration = 10.494 min.  
Rainfall intensity = 1.144(In/Hr) for a 2.0 year storm  
COMMERCIAL subarea type  
Runoff Coefficient = 0.858  
Decimal fraction soil group A = 0.000  
Decimal fraction soil group B = 0.000  
Decimal fraction soil group C = 0.000  
Decimal fraction soil group D = 1.000  
RI index for soil(AMC 1) = 57.00  
Pervious area fraction = 0.100; Impervious fraction = 0.900  
Initial subarea runoff = 2.287(CFS)  
Total initial stream area = 2.330(Ac.)

Pervious area fraction = 0.100

++++  
Process from Point/Station 7.200 to Point/Station 7.300  
\*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 1414.940(Ft.)  
Downstream point/station elevation = 1411.710(Ft.)  
Pipe length = 27.78(Ft.) Manning's N = 0.013  
No. of pipes = 1 Required pipe flow = 2.287(CFS)  
Nearest computed pipe diameter = 9.00(In.)  
Calculated individual pipe flow = 2.287(CFS)  
Normal flow depth in pipe = 3.99(In.)  
Flow top width inside pipe = 8.94(In.)  
Critical Depth = 8.09(In.)  
Pipe flow velocity = 12.10(Ft/s)  
Travel time through pipe = 0.04 min.  
Time of concentration (TC) = 10.53 min.

++++  
Process from Point/Station 7.300 to Point/Station 7.300  
\*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 1 in normal stream number 2  
Stream flow area = 2.330(Ac.)  
Runoff from this stream = 2.287(CFS)  
Time of concentration = 10.53 min.  
Rainfall intensity = 1.142(In/Hr)  
Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
------------	-----------------	----------	----------------------------

1	9.463	7.09	1.387
2	2.287	10.53	1.142

Largest stream flow has longer or shorter time of concentration

Qp = 9.463 + sum of  
Qa Tb/Ta  
2.287 \* 0.673 = 1.539  
Qp = 11.003

Total of 2 streams to confluence:  
Flow rates before confluence point:  
9.463 2.287  
Area of streams before confluence:  
7.840 2.330  
Results of confluence:

Total flow rate = 11.003(CFS)  
Time of concentration = 7.087 min.  
Effective stream area after confluence = 10.170(Ac.)

++++  
Process from Point/Station 7.300 to Point/Station 8.300  
\*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 1411.710(Ft.)  
Downstream point/station elevation = 1411.620(Ft.)  
Pipe length = 18.21(Ft.) Manning's N = 0.013  
No. of pipes = 1 Required pipe flow = 11.003(CFS)  
Nearest computed pipe diameter = 21.00(In.)  
Calculated individual pipe flow = 11.003(CFS)  
Normal flow depth in pipe = 16.97(In.)  
Flow top width inside pipe = 16.54(In.)  
Critical Depth = 14.83(In.)  
Pipe flow velocity = 5.28(Ft/s)  
Travel time through pipe = 0.06 min.  
Time of concentration (TC) = 7.14 min.

++++  
Process from Point/Station 8.300 to Point/Station 8.300  
\*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 1 in normal stream number 1  
Stream flow area = 10.170(Ac.)  
Runoff from this stream = 11.003(CFS)  
Time of concentration = 7.14 min.  
Rainfall intensity = 1.382(In/Hr)

++++  
Process from Point/Station 8.100 to Point/Station 8.200  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

---

Initial area flow distance = 106.130(Ft.)  
Top (of initial area) elevation = 1420.890(Ft.)  
Bottom (of initial area) elevation = 1419.280(Ft.)  
Difference in elevation = 1.610(Ft.)  
Slope = 0.01517 s(percent)= 1.52  
TC =  $k(0.300)*[(\text{length}^3)/(\text{elevation change})]^{0.2}$   
Warning: TC computed to be less than 5 min.; program is assuming the  
time of concentration is 5 minutes.  
Initial area time of concentration = 5.000 min.  
Rainfall intensity = 1.646(In/Hr) for a 2.0 year storm  
COMMERCIAL subarea type  
Runoff Coefficient = 0.866

Decimal fraction soil group A = 0.000  
 Decimal fraction soil group B = 0.000  
 Decimal fraction soil group C = 0.000  
 Decimal fraction soil group D = 1.000  
 RI index for soil(AMC 1) = 57.00  
 Pervious area fraction = 0.100; Impervious fraction = 0.900  
 Initial subarea runoff = 1.396(CFS)  
 Total initial stream area = 0.980(Ac.)  
 Pervious area fraction = 0.100

++++++  
 Process from Point/Station 8.200 to Point/Station 8.300  
 \*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 1415.280(Ft.)  
 Downstream point/station elevation = 1411.620(Ft.)  
 Pipe length = 25.32(Ft.) Manning's N = 0.013  
 No. of pipes = 1 Required pipe flow = 1.396(CFS)  
 Nearest computed pipe diameter = 6.00(In.)  
 Calculated individual pipe flow = 1.396(CFS)  
 Normal flow depth in pipe = 3.54(In.)  
 Flow top width inside pipe = 5.90(In.)  
 Critical depth could not be calculated.  
 Pipe flow velocity = 11.58(Ft/s)  
 Travel time through pipe = 0.04 min.  
 Time of concentration (TC) = 5.04 min.

++++++  
 Process from Point/Station 8.300 to Point/Station 8.300  
 \*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 1 in normal stream number 2  
 Stream flow area = 0.980(Ac.)  
 Runoff from this stream = 1.396(CFS)  
 Time of concentration = 5.04 min.  
 Rainfall intensity = 1.640(In/Hr)  
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	11.003	7.14	1.382
2	1.396	5.04	1.640

Largest stream flow has longer time of concentration

$$Q_p = 11.003 + \text{sum of } \frac{Q_b \cdot I_a/I_b}{1.396 * 0.843} = 1.177$$

Qp = 12.179

Total of 2 streams to confluence:  
Flow rates before confluence point:

11.003 1.396

Area of streams before confluence:

10.170 0.980

Results of confluence:

Total flow rate = 12.179(CFS)

Time of concentration = 7.144 min.

Effective stream area after confluence = 11.150(Ac.)

++++  
Process from Point/Station 8.300 to Point/Station 9.300  
\*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 1411.620(Ft.)  
Downstream point/station elevation = 1410.040(Ft.)  
Pipe length = 317.20(Ft.) Manning's N = 0.013  
No. of pipes = 1 Required pipe flow = 12.179(CFS)  
Nearest computed pipe diameter = 24.00(In.)  
Calculated individual pipe flow = 12.179(CFS)  
Normal flow depth in pipe = 15.70(In.)  
Flow top width inside pipe = 22.83(In.)  
Critical Depth = 15.06(In.)  
Pipe flow velocity = 5.60(Ft/s)  
Travel time through pipe = 0.94 min.  
Time of concentration (TC) = 8.09 min.

++++  
Process from Point/Station 9.300 to Point/Station 9.300  
\*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 1 in normal stream number 1  
Stream flow area = 11.150(Ac.)  
Runoff from this stream = 12.179(CFS)  
Time of concentration = 8.09 min.  
Rainfall intensity = 1.300(In/Hr)

++++  
Process from Point/Station 9.100 to Point/Station 9.300  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

---

Initial area flow distance = 252.240(Ft.)  
Top (of initial area) elevation = 1421.240(Ft.)  
Bottom (of initial area) elevation = 1420.100(Ft.)  
Difference in elevation = 1.140(Ft.)

Slope = 0.00452 s(percent)= 0.45  
 TC =  $k(0.300)*[(\text{length}^3)/(\text{elevation change})]^{0.2}$   
 Initial area time of concentration = 8.069 min.  
 Rainfall intensity = 1.302(In/Hr) for a 2.0 year storm  
 COMMERCIAL subarea type  
 Runoff Coefficient = 0.861  
 Decimal fraction soil group A = 0.000  
 Decimal fraction soil group B = 0.000  
 Decimal fraction soil group C = 0.000  
 Decimal fraction soil group D = 1.000  
 RI index for soil(AMC 1) = 57.00  
 Pervious area fraction = 0.100; Impervious fraction = 0.900  
 Initial subarea runoff = 7.787(CFS)  
 Total initial stream area = 6.950(Ac.)  
 Pervious area fraction = 0.100

++++++  
 Process from Point/Station 9.300 to Point/Station 9.300  
 \*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

Along Main Stream number: 1 in normal stream number 2  
 Stream flow area = 6.950(Ac.)  
 Runoff from this stream = 7.787(CFS)  
 Time of concentration = 8.07 min.  
 Rainfall intensity = 1.302(In/Hr)  
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	12.179	8.09	1.300
2	7.787	8.07	1.302

Largest stream flow has longer time of concentration

$Q_p = 12.179 + \text{sum of}$   
 $\quad Q_b \quad I_a/I_b$   
 $\quad 7.787 * 0.999 = 7.777$   
 $Q_p = 19.956$

Total of 2 streams to confluence:  
 Flow rates before confluence point:  
 12.179 7.787  
 Area of streams before confluence:  
 11.150 6.950

Results of confluence:  
 Total flow rate = 19.956(CFS)  
 Time of concentration = 8.089 min.  
 Effective stream area after confluence = 18.100(Ac.)

+++++  
Process from Point/Station 9.300 to Point/Station 9.400  
\*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 1410.040(Ft.)  
Downstream point/station elevation = 1409.990(Ft.)  
Pipe length = 9.57(Ft.) Manning's N = 0.013  
No. of pipes = 1 Required pipe flow = 19.956(CFS)  
Nearest computed pipe diameter = 27.00(In.)  
Calculated individual pipe flow = 19.956(CFS)  
Normal flow depth in pipe = 19.88(In.)  
Flow top width inside pipe = 23.80(In.)  
Critical Depth = 18.75(In.)  
Pipe flow velocity = 6.36(Ft/s)  
Travel time through pipe = 0.03 min.  
Time of concentration (TC) = 8.11 min.  
End of computations, total study area = 18.10 (Ac.)  
The following figures may  
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100  
Area averaged RI index number = 75.0

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2018 Version 9.0

Rational Hydrology Study

Date: 05/27/22

File:MapesPost2BRat.out

-----  
MAPES AND TRUMBLE INDUSTRIAL FACILITY  
RATIONAL METHOD  
POST-DEVELOPMENT CONDITIONS  
2-YEAR STORM, DA B  
-----

\*\*\*\*\* Hydrology Study Control Information \*\*\*\*\*

English (in-lb) Units used in input data file  
-----

Program License Serial Number 6443  
-----

Rational Method Hydrology Program based on  
Riverside County Flood Control & Water Conservation District  
1978 hydrology manual

Storm event (year) = 2.00 Antecedent Moisture Condition = 1

2 year, 1 hour precipitation = 0.487(In.)

100 year, 1 hour precipitation = 1.520(In.)

Storm event year = 2.0

Calculated rainfall intensity data:

1 hour intensity = 0.487(In/Hr)

Slope of intensity duration curve = 0.4900

++++  
Process from Point/Station 10.100 to Point/Station 10.200  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

Initial area flow distance = 333.910(Ft.)

Top (of initial area) elevation = 1423.670(Ft.)

Bottom (of initial area) elevation = 1420.530(Ft.)

Difference in elevation = 3.140(Ft.)

Slope = 0.00940 s(percent)= 0.94

TC = k(0.300)\*[(length^3)/(elevation change)]^0.2

Initial area time of concentration = 7.797 min.  
Rainfall intensity = 1.324(In/Hr) for a 2.0 year storm  
COMMERCIAL subarea type  
Runoff Coefficient = 0.861  
Decimal fraction soil group A = 0.000  
Decimal fraction soil group B = 0.000  
Decimal fraction soil group C = 0.000  
Decimal fraction soil group D = 1.000  
RI index for soil(AMC 1) = 57.00  
Pervious area fraction = 0.100; Impervious fraction = 0.900  
Initial subarea runoff = 0.627(CFS)  
Total initial stream area = 0.550(Ac.)  
Pervious area fraction = 0.100

++++  
Process from Point/Station 10.200 to Point/Station 11.300  
\*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 1416.530(Ft.)  
Downstream point/station elevation = 1414.760(Ft.)  
Pipe length = 354.30(Ft.) Manning's N = 0.013  
No. of pipes = 1 Required pipe flow = 0.627(CFS)  
Nearest computed pipe diameter = 9.00(In.)  
Calculated individual pipe flow = 0.627(CFS)  
Normal flow depth in pipe = 4.69(In.)  
Flow top width inside pipe = 8.99(In.)  
Critical Depth = 4.31(In.)  
Pipe flow velocity = 2.69(Ft/s)  
Travel time through pipe = 2.19 min.  
Time of concentration (TC) = 9.99 min.

++++  
Process from Point/Station 11.300 to Point/Station 11.300  
\*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 1 in normal stream number 1  
Stream flow area = 0.550(Ac.)  
Runoff from this stream = 0.627(CFS)  
Time of concentration = 9.99 min.  
Rainfall intensity = 1.172(In/Hr)

++++  
Process from Point/Station 11.100 to Point/Station 11.200  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

---

Initial area flow distance = 169.180(Ft.)  
Top (of initial area) elevation = 1423.740(Ft.)

Bottom (of initial area) elevation = 1421.670(Ft.)  
 Difference in elevation = 2.070(Ft.)  
 Slope = 0.01224 s(percent)= 1.22  
 $TC = k(0.300)*[(length^3)/(elevation\ change)]^{0.2}$   
 Initial area time of concentration = 5.636 min.  
 Rainfall intensity = 1.552(In/Hr) for a 2.0 year storm  
 COMMERCIAL subarea type  
 Runoff Coefficient = 0.865  
 Decimal fraction soil group A = 0.000  
 Decimal fraction soil group B = 0.000  
 Decimal fraction soil group C = 0.000  
 Decimal fraction soil group D = 1.000  
 RI index for soil(AMC 1) = 57.00  
 Pervious area fraction = 0.100; Impervious fraction = 0.900  
 Initial subarea runoff = 0.496(CFS)  
 Total initial stream area = 0.370(Ac.)  
 Pervious area fraction = 0.100

++++++  
 Process from Point/Station 11.200 to Point/Station 11.300  
 \*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 1417.670(Ft.)  
 Downstream point/station elevation = 1414.760(Ft.)  
 Pipe length = 5.72(Ft.) Manning's N = 0.013  
 No. of pipes = 1 Required pipe flow = 0.496(CFS)  
 Nearest computed pipe diameter = 3.00(In.)  
 Calculated individual pipe flow = 0.496(CFS)  
 Normal flow depth in pipe = 2.01(In.)  
 Flow top width inside pipe = 2.82(In.)  
 Critical depth could not be calculated.  
 Pipe flow velocity = 14.23(Ft/s)  
 Travel time through pipe = 0.01 min.  
 Time of concentration (TC) = 5.64 min.

++++++  
 Process from Point/Station 11.300 to Point/Station 11.300  
 \*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 1 in normal stream number 2  
 Stream flow area = 0.370(Ac.)  
 Runoff from this stream = 0.496(CFS)  
 Time of concentration = 5.64 min.  
 Rainfall intensity = 1.551(In/Hr)  
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
------------	-----------------	----------	----------------------------

1            0.627            9.99                            1.172  
 2            0.496            5.64                            1.551  
 Largest stream flow has longer time of concentration  
 Qp =        0.627 + sum of  
               Qb            Ia/Ib  
               0.496 \*        0.756 =            0.375  
 Qp =        1.002

Total of 2 streams to confluence:  
 Flow rates before confluence point:  
               0.627            0.496  
 Area of streams before confluence:  
               0.550            0.370  
 Results of confluence:  
 Total flow rate =        1.002(CFS)  
 Time of concentration =        9.990 min.  
 Effective stream area after confluence =        0.920(Ac.)

++++++  
 Process from Point/Station            11.300 to Point/Station            11.400  
 \*\*\*\* PIPEFLOW TRAVEL TIME (Program estimated size) \*\*\*\*

---

Upstream point/station elevation = 1414.760(Ft.)  
 Downstream point/station elevation = 1414.030(Ft.)  
 Pipe length = 146.40(Ft.)    Manning's N = 0.013  
 No. of pipes = 1    Required pipe flow =        1.002(CFS)  
 Nearest computed pipe diameter =        9.00(In.)  
 Calculated individual pipe flow =        1.002(CFS)  
 Normal flow depth in pipe =        6.42(In.)  
 Flow top width inside pipe =        8.14(In.)  
 Critical Depth =        5.51(In.)  
 Pipe flow velocity =        2.97(Ft/s)  
 Travel time through pipe =        0.82 min.  
 Time of concentration (TC) =        10.81 min.  
 End of computations, total study area =                            0.92 (Ac.)  
 The following figures may  
 be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100  
 Area averaged RI index number = 75.0

# Appendix 7.3: Pre-Development Calculations

*Unit Hydrograph – 2-Year, 24hr*

Unit Hydrograph Analysis

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2018, Version 9.0  
Study date 05/26/22 File: MapesPre2UH242.out

+++++

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

Program License Serial Number 6443

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

-----  
MAPES AND TRUMBLE INDUSTRIAL FACILITY  
UNIT HYDROGRAPH  
PRE-DEVELOPMENT CONDITIONS  
2-YEAR, 24HR STORM, DA A

-----  
Drainage Area = 19.01(Ac.) = 0.030 Sq. Mi.  
Drainage Area for Depth-Area Areal Adjustment = 19.01(Ac.) =  
0.030 Sq. Mi.  
Length along longest watercourse = 1256.56(Ft.)  
Length along longest watercourse measured to centroid = 586.75(Ft.)  
Length along longest watercourse = 0.238 Mi.  
Length along longest watercourse measured to centroid = 0.111 Mi.  
Difference in elevation = 6.42(Ft.)  
Slope along watercourse = 26.9765 Ft./Mi.  
Average Manning's 'N' = 0.030  
Lag time = 0.097 Hr.  
Lag time = 5.81 Min.  
25% of lag time = 1.45 Min.  
40% of lag time = 2.32 Min.  
Unit time = 5.00 Min.  
Duration of storm = 24 Hour(s)  
User Entered Base Flow = 0.00(CFS)

2 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
19.01	2.06	39.16

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
19.01	5.31	100.94

STORM EVENT (YEAR) = 2.00  
 Area Averaged 2-Year Rainfall = 2.060(In)  
 Area Averaged 100-Year Rainfall = 5.310(In)

Point rain (area averaged) = 2.060(In)  
 Areal adjustment factor = 100.00 %  
 Adjusted average point rain = 2.060(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
19.010	89.00	0.000
Total Area Entered = 19.01(Ac.)		

RI	RI	Infil. Rate	Impervious	Adj. Infil. Rate	Area%	F
AMC2	AMC-1	(In/Hr)	(Dec.%)	(In/Hr)	(Dec.)	(In/Hr)
89.0	76.4	0.286	0.000	0.286	1.000	0.286
Sum (F) =						0.286

Area averaged mean soil loss (F) (In/Hr) = 0.286  
 Minimum soil loss rate ((In/Hr)) = 0.143  
 (for 24 hour storm duration)  
 Soil low loss rate (decimal) = 0.900

-----  
 U n i t H y d r o g r a p h  
 VALLEY S-Curve  
 -----

Unit Hydrograph Data  
 -----

Unit time period (hrs)	Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)
1	0.083	86.074	15.028
2	0.167	172.149	46.219
3	0.250	258.223	18.315
4	0.333	344.297	7.866
5	0.417	430.372	4.648
6	0.500	516.446	2.910
7	0.583	602.520	2.059
8	0.667	688.594	1.359

9	0.750	774.669	0.913	0.175
10	0.833	860.743	0.684	0.131
			Sum = 100.000	Sum= 19.159

-----

The following loss rate calculations reflect use of the minimum calculated loss rate subtracted from the Storm Rain to produce the maximum Effective Rain value

Unit	Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr)		Effective (In/Hr)
				Max	Low	
1	0.08	0.07	0.016	( 0.508)	0.015	0.002
2	0.17	0.07	0.016	( 0.506)	0.015	0.002
3	0.25	0.07	0.016	( 0.504)	0.015	0.002
4	0.33	0.10	0.025	( 0.502)	0.022	0.002
5	0.42	0.10	0.025	( 0.500)	0.022	0.002
6	0.50	0.10	0.025	( 0.498)	0.022	0.002
7	0.58	0.10	0.025	( 0.496)	0.022	0.002
8	0.67	0.10	0.025	( 0.494)	0.022	0.002
9	0.75	0.10	0.025	( 0.492)	0.022	0.002
10	0.83	0.13	0.033	( 0.490)	0.030	0.003
11	0.92	0.13	0.033	( 0.488)	0.030	0.003
12	1.00	0.13	0.033	( 0.486)	0.030	0.003
13	1.08	0.10	0.025	( 0.485)	0.022	0.002
14	1.17	0.10	0.025	( 0.483)	0.022	0.002
15	1.25	0.10	0.025	( 0.481)	0.022	0.002
16	1.33	0.10	0.025	( 0.479)	0.022	0.002
17	1.42	0.10	0.025	( 0.477)	0.022	0.002
18	1.50	0.10	0.025	( 0.475)	0.022	0.002
19	1.58	0.10	0.025	( 0.473)	0.022	0.002
20	1.67	0.10	0.025	( 0.471)	0.022	0.002
21	1.75	0.10	0.025	( 0.469)	0.022	0.002
22	1.83	0.13	0.033	( 0.467)	0.030	0.003
23	1.92	0.13	0.033	( 0.466)	0.030	0.003
24	2.00	0.13	0.033	( 0.464)	0.030	0.003
25	2.08	0.13	0.033	( 0.462)	0.030	0.003
26	2.17	0.13	0.033	( 0.460)	0.030	0.003
27	2.25	0.13	0.033	( 0.458)	0.030	0.003
28	2.33	0.13	0.033	( 0.456)	0.030	0.003
29	2.42	0.13	0.033	( 0.454)	0.030	0.003
30	2.50	0.13	0.033	( 0.452)	0.030	0.003
31	2.58	0.17	0.041	( 0.451)	0.037	0.004
32	2.67	0.17	0.041	( 0.449)	0.037	0.004
33	2.75	0.17	0.041	( 0.447)	0.037	0.004
34	2.83	0.17	0.041	( 0.445)	0.037	0.004
35	2.92	0.17	0.041	( 0.443)	0.037	0.004
36	3.00	0.17	0.041	( 0.441)	0.037	0.004
37	3.08	0.17	0.041	( 0.440)	0.037	0.004
38	3.17	0.17	0.041	( 0.438)	0.037	0.004
39	3.25	0.17	0.041	( 0.436)	0.037	0.004

40	3.33	0.17	0.041	( 0.434)	0.037	0.004
41	3.42	0.17	0.041	( 0.432)	0.037	0.004
42	3.50	0.17	0.041	( 0.430)	0.037	0.004
43	3.58	0.17	0.041	( 0.429)	0.037	0.004
44	3.67	0.17	0.041	( 0.427)	0.037	0.004
45	3.75	0.17	0.041	( 0.425)	0.037	0.004
46	3.83	0.20	0.049	( 0.423)	0.044	0.005
47	3.92	0.20	0.049	( 0.422)	0.044	0.005
48	4.00	0.20	0.049	( 0.420)	0.044	0.005
49	4.08	0.20	0.049	( 0.418)	0.044	0.005
50	4.17	0.20	0.049	( 0.416)	0.044	0.005
51	4.25	0.20	0.049	( 0.414)	0.044	0.005
52	4.33	0.23	0.058	( 0.413)	0.052	0.006
53	4.42	0.23	0.058	( 0.411)	0.052	0.006
54	4.50	0.23	0.058	( 0.409)	0.052	0.006
55	4.58	0.23	0.058	( 0.407)	0.052	0.006
56	4.67	0.23	0.058	( 0.406)	0.052	0.006
57	4.75	0.23	0.058	( 0.404)	0.052	0.006
58	4.83	0.27	0.066	( 0.402)	0.059	0.007
59	4.92	0.27	0.066	( 0.400)	0.059	0.007
60	5.00	0.27	0.066	( 0.399)	0.059	0.007
61	5.08	0.20	0.049	( 0.397)	0.044	0.005
62	5.17	0.20	0.049	( 0.395)	0.044	0.005
63	5.25	0.20	0.049	( 0.393)	0.044	0.005
64	5.33	0.23	0.058	( 0.392)	0.052	0.006
65	5.42	0.23	0.058	( 0.390)	0.052	0.006
66	5.50	0.23	0.058	( 0.388)	0.052	0.006
67	5.58	0.27	0.066	( 0.387)	0.059	0.007
68	5.67	0.27	0.066	( 0.385)	0.059	0.007
69	5.75	0.27	0.066	( 0.383)	0.059	0.007
70	5.83	0.27	0.066	( 0.382)	0.059	0.007
71	5.92	0.27	0.066	( 0.380)	0.059	0.007
72	6.00	0.27	0.066	( 0.378)	0.059	0.007
73	6.08	0.30	0.074	( 0.376)	0.067	0.007
74	6.17	0.30	0.074	( 0.375)	0.067	0.007
75	6.25	0.30	0.074	( 0.373)	0.067	0.007
76	6.33	0.30	0.074	( 0.371)	0.067	0.007
77	6.42	0.30	0.074	( 0.370)	0.067	0.007
78	6.50	0.30	0.074	( 0.368)	0.067	0.007
79	6.58	0.33	0.082	( 0.366)	0.074	0.008
80	6.67	0.33	0.082	( 0.365)	0.074	0.008
81	6.75	0.33	0.082	( 0.363)	0.074	0.008
82	6.83	0.33	0.082	( 0.362)	0.074	0.008
83	6.92	0.33	0.082	( 0.360)	0.074	0.008
84	7.00	0.33	0.082	( 0.358)	0.074	0.008
85	7.08	0.33	0.082	( 0.357)	0.074	0.008
86	7.17	0.33	0.082	( 0.355)	0.074	0.008
87	7.25	0.33	0.082	( 0.353)	0.074	0.008
88	7.33	0.37	0.091	( 0.352)	0.082	0.009
89	7.42	0.37	0.091	( 0.350)	0.082	0.009

90	7.50	0.37	0.091	( 0.349)	0.082	0.009
91	7.58	0.40	0.099	( 0.347)	0.089	0.010
92	7.67	0.40	0.099	( 0.345)	0.089	0.010
93	7.75	0.40	0.099	( 0.344)	0.089	0.010
94	7.83	0.43	0.107	( 0.342)	0.096	0.011
95	7.92	0.43	0.107	( 0.341)	0.096	0.011
96	8.00	0.43	0.107	( 0.339)	0.096	0.011
97	8.08	0.50	0.124	( 0.337)	0.111	0.012
98	8.17	0.50	0.124	( 0.336)	0.111	0.012
99	8.25	0.50	0.124	( 0.334)	0.111	0.012
100	8.33	0.50	0.124	( 0.333)	0.111	0.012
101	8.42	0.50	0.124	( 0.331)	0.111	0.012
102	8.50	0.50	0.124	( 0.330)	0.111	0.012
103	8.58	0.53	0.132	( 0.328)	0.119	0.013
104	8.67	0.53	0.132	( 0.327)	0.119	0.013
105	8.75	0.53	0.132	( 0.325)	0.119	0.013
106	8.83	0.57	0.140	( 0.323)	0.126	0.014
107	8.92	0.57	0.140	( 0.322)	0.126	0.014
108	9.00	0.57	0.140	( 0.320)	0.126	0.014
109	9.08	0.63	0.157	( 0.319)	0.141	0.016
110	9.17	0.63	0.157	( 0.317)	0.141	0.016
111	9.25	0.63	0.157	( 0.316)	0.141	0.016
112	9.33	0.67	0.165	( 0.314)	0.148	0.016
113	9.42	0.67	0.165	( 0.313)	0.148	0.016
114	9.50	0.67	0.165	( 0.311)	0.148	0.016
115	9.58	0.70	0.173	( 0.310)	0.156	0.017
116	9.67	0.70	0.173	( 0.308)	0.156	0.017
117	9.75	0.70	0.173	( 0.307)	0.156	0.017
118	9.83	0.73	0.181	( 0.305)	0.163	0.018
119	9.92	0.73	0.181	( 0.304)	0.163	0.018
120	10.00	0.73	0.181	( 0.303)	0.163	0.018
121	10.08	0.50	0.124	( 0.301)	0.111	0.012
122	10.17	0.50	0.124	( 0.300)	0.111	0.012
123	10.25	0.50	0.124	( 0.298)	0.111	0.012
124	10.33	0.50	0.124	( 0.297)	0.111	0.012
125	10.42	0.50	0.124	( 0.295)	0.111	0.012
126	10.50	0.50	0.124	( 0.294)	0.111	0.012
127	10.58	0.67	0.165	( 0.292)	0.148	0.016
128	10.67	0.67	0.165	( 0.291)	0.148	0.016
129	10.75	0.67	0.165	( 0.290)	0.148	0.016
130	10.83	0.67	0.165	( 0.288)	0.148	0.016
131	10.92	0.67	0.165	( 0.287)	0.148	0.016
132	11.00	0.67	0.165	( 0.285)	0.148	0.016
133	11.08	0.63	0.157	( 0.284)	0.141	0.016
134	11.17	0.63	0.157	( 0.282)	0.141	0.016
135	11.25	0.63	0.157	( 0.281)	0.141	0.016
136	11.33	0.63	0.157	( 0.280)	0.141	0.016
137	11.42	0.63	0.157	( 0.278)	0.141	0.016
138	11.50	0.63	0.157	( 0.277)	0.141	0.016
139	11.58	0.57	0.140	( 0.276)	0.126	0.014

140	11.67	0.57	0.140	( 0.274)	0.126	0.014
141	11.75	0.57	0.140	( 0.273)	0.126	0.014
142	11.83	0.60	0.148	( 0.271)	0.133	0.015
143	11.92	0.60	0.148	( 0.270)	0.133	0.015
144	12.00	0.60	0.148	( 0.269)	0.133	0.015
145	12.08	0.83	0.206	( 0.267)	0.185	0.021
146	12.17	0.83	0.206	( 0.266)	0.185	0.021
147	12.25	0.83	0.206	( 0.265)	0.185	0.021
148	12.33	0.87	0.214	( 0.263)	0.193	0.021
149	12.42	0.87	0.214	( 0.262)	0.193	0.021
150	12.50	0.87	0.214	( 0.261)	0.193	0.021
151	12.58	0.93	0.231	( 0.259)	0.208	0.023
152	12.67	0.93	0.231	( 0.258)	0.208	0.023
153	12.75	0.93	0.231	( 0.257)	0.208	0.023
154	12.83	0.97	0.239	( 0.256)	0.215	0.024
155	12.92	0.97	0.239	( 0.254)	0.215	0.024
156	13.00	0.97	0.239	( 0.253)	0.215	0.024
157	13.08	1.13	0.280	0.252 ( 0.252)		0.028
158	13.17	1.13	0.280	0.250 ( 0.252)		0.030
159	13.25	1.13	0.280	0.249 ( 0.252)		0.031
160	13.33	1.13	0.280	0.248 ( 0.252)		0.032
161	13.42	1.13	0.280	0.247 ( 0.252)		0.034
162	13.50	1.13	0.280	0.245 ( 0.252)		0.035
163	13.58	0.77	0.190	( 0.244)	0.171	0.019
164	13.67	0.77	0.190	( 0.243)	0.171	0.019
165	13.75	0.77	0.190	( 0.242)	0.171	0.019
166	13.83	0.77	0.190	( 0.240)	0.171	0.019
167	13.92	0.77	0.190	( 0.239)	0.171	0.019
168	14.00	0.77	0.190	( 0.238)	0.171	0.019
169	14.08	0.90	0.222	( 0.237)	0.200	0.022
170	14.17	0.90	0.222	( 0.236)	0.200	0.022
171	14.25	0.90	0.222	( 0.234)	0.200	0.022
172	14.33	0.87	0.214	( 0.233)	0.193	0.021
173	14.42	0.87	0.214	( 0.232)	0.193	0.021
174	14.50	0.87	0.214	( 0.231)	0.193	0.021
175	14.58	0.87	0.214	( 0.230)	0.193	0.021
176	14.67	0.87	0.214	( 0.228)	0.193	0.021
177	14.75	0.87	0.214	( 0.227)	0.193	0.021
178	14.83	0.83	0.206	( 0.226)	0.185	0.021
179	14.92	0.83	0.206	( 0.225)	0.185	0.021
180	15.00	0.83	0.206	( 0.224)	0.185	0.021
181	15.08	0.80	0.198	( 0.223)	0.178	0.020
182	15.17	0.80	0.198	( 0.221)	0.178	0.020
183	15.25	0.80	0.198	( 0.220)	0.178	0.020
184	15.33	0.77	0.190	( 0.219)	0.171	0.019
185	15.42	0.77	0.190	( 0.218)	0.171	0.019
186	15.50	0.77	0.190	( 0.217)	0.171	0.019
187	15.58	0.63	0.157	( 0.216)	0.141	0.016
188	15.67	0.63	0.157	( 0.215)	0.141	0.016
189	15.75	0.63	0.157	( 0.214)	0.141	0.016

190	15.83	0.63	0.157	( 0.213)	0.141	0.016
191	15.92	0.63	0.157	( 0.211)	0.141	0.016
192	16.00	0.63	0.157	( 0.210)	0.141	0.016
193	16.08	0.13	0.033	( 0.209)	0.030	0.003
194	16.17	0.13	0.033	( 0.208)	0.030	0.003
195	16.25	0.13	0.033	( 0.207)	0.030	0.003
196	16.33	0.13	0.033	( 0.206)	0.030	0.003
197	16.42	0.13	0.033	( 0.205)	0.030	0.003
198	16.50	0.13	0.033	( 0.204)	0.030	0.003
199	16.58	0.10	0.025	( 0.203)	0.022	0.002
200	16.67	0.10	0.025	( 0.202)	0.022	0.002
201	16.75	0.10	0.025	( 0.201)	0.022	0.002
202	16.83	0.10	0.025	( 0.200)	0.022	0.002
203	16.92	0.10	0.025	( 0.199)	0.022	0.002
204	17.00	0.10	0.025	( 0.198)	0.022	0.002
205	17.08	0.17	0.041	( 0.197)	0.037	0.004
206	17.17	0.17	0.041	( 0.196)	0.037	0.004
207	17.25	0.17	0.041	( 0.195)	0.037	0.004
208	17.33	0.17	0.041	( 0.194)	0.037	0.004
209	17.42	0.17	0.041	( 0.193)	0.037	0.004
210	17.50	0.17	0.041	( 0.192)	0.037	0.004
211	17.58	0.17	0.041	( 0.191)	0.037	0.004
212	17.67	0.17	0.041	( 0.190)	0.037	0.004
213	17.75	0.17	0.041	( 0.189)	0.037	0.004
214	17.83	0.13	0.033	( 0.188)	0.030	0.003
215	17.92	0.13	0.033	( 0.187)	0.030	0.003
216	18.00	0.13	0.033	( 0.186)	0.030	0.003
217	18.08	0.13	0.033	( 0.185)	0.030	0.003
218	18.17	0.13	0.033	( 0.185)	0.030	0.003
219	18.25	0.13	0.033	( 0.184)	0.030	0.003
220	18.33	0.13	0.033	( 0.183)	0.030	0.003
221	18.42	0.13	0.033	( 0.182)	0.030	0.003
222	18.50	0.13	0.033	( 0.181)	0.030	0.003
223	18.58	0.10	0.025	( 0.180)	0.022	0.002
224	18.67	0.10	0.025	( 0.179)	0.022	0.002
225	18.75	0.10	0.025	( 0.178)	0.022	0.002
226	18.83	0.07	0.016	( 0.177)	0.015	0.002
227	18.92	0.07	0.016	( 0.177)	0.015	0.002
228	19.00	0.07	0.016	( 0.176)	0.015	0.002
229	19.08	0.10	0.025	( 0.175)	0.022	0.002
230	19.17	0.10	0.025	( 0.174)	0.022	0.002
231	19.25	0.10	0.025	( 0.173)	0.022	0.002
232	19.33	0.13	0.033	( 0.173)	0.030	0.003
233	19.42	0.13	0.033	( 0.172)	0.030	0.003
234	19.50	0.13	0.033	( 0.171)	0.030	0.003
235	19.58	0.10	0.025	( 0.170)	0.022	0.002
236	19.67	0.10	0.025	( 0.169)	0.022	0.002
237	19.75	0.10	0.025	( 0.169)	0.022	0.002
238	19.83	0.07	0.016	( 0.168)	0.015	0.002
239	19.92	0.07	0.016	( 0.167)	0.015	0.002

240	20.00	0.07	0.016	( 0.166)	0.015	0.002
241	20.08	0.10	0.025	( 0.166)	0.022	0.002
242	20.17	0.10	0.025	( 0.165)	0.022	0.002
243	20.25	0.10	0.025	( 0.164)	0.022	0.002
244	20.33	0.10	0.025	( 0.163)	0.022	0.002
245	20.42	0.10	0.025	( 0.163)	0.022	0.002
246	20.50	0.10	0.025	( 0.162)	0.022	0.002
247	20.58	0.10	0.025	( 0.161)	0.022	0.002
248	20.67	0.10	0.025	( 0.161)	0.022	0.002
249	20.75	0.10	0.025	( 0.160)	0.022	0.002
250	20.83	0.07	0.016	( 0.159)	0.015	0.002
251	20.92	0.07	0.016	( 0.159)	0.015	0.002
252	21.00	0.07	0.016	( 0.158)	0.015	0.002
253	21.08	0.10	0.025	( 0.157)	0.022	0.002
254	21.17	0.10	0.025	( 0.157)	0.022	0.002
255	21.25	0.10	0.025	( 0.156)	0.022	0.002
256	21.33	0.07	0.016	( 0.156)	0.015	0.002
257	21.42	0.07	0.016	( 0.155)	0.015	0.002
258	21.50	0.07	0.016	( 0.155)	0.015	0.002
259	21.58	0.10	0.025	( 0.154)	0.022	0.002
260	21.67	0.10	0.025	( 0.153)	0.022	0.002
261	21.75	0.10	0.025	( 0.153)	0.022	0.002
262	21.83	0.07	0.016	( 0.152)	0.015	0.002
263	21.92	0.07	0.016	( 0.152)	0.015	0.002
264	22.00	0.07	0.016	( 0.151)	0.015	0.002
265	22.08	0.10	0.025	( 0.151)	0.022	0.002
266	22.17	0.10	0.025	( 0.150)	0.022	0.002
267	22.25	0.10	0.025	( 0.150)	0.022	0.002
268	22.33	0.07	0.016	( 0.149)	0.015	0.002
269	22.42	0.07	0.016	( 0.149)	0.015	0.002
270	22.50	0.07	0.016	( 0.148)	0.015	0.002
271	22.58	0.07	0.016	( 0.148)	0.015	0.002
272	22.67	0.07	0.016	( 0.148)	0.015	0.002
273	22.75	0.07	0.016	( 0.147)	0.015	0.002
274	22.83	0.07	0.016	( 0.147)	0.015	0.002
275	22.92	0.07	0.016	( 0.146)	0.015	0.002
276	23.00	0.07	0.016	( 0.146)	0.015	0.002
277	23.08	0.07	0.016	( 0.146)	0.015	0.002
278	23.17	0.07	0.016	( 0.145)	0.015	0.002
279	23.25	0.07	0.016	( 0.145)	0.015	0.002
280	23.33	0.07	0.016	( 0.145)	0.015	0.002
281	23.42	0.07	0.016	( 0.145)	0.015	0.002
282	23.50	0.07	0.016	( 0.144)	0.015	0.002
283	23.58	0.07	0.016	( 0.144)	0.015	0.002
284	23.67	0.07	0.016	( 0.144)	0.015	0.002
285	23.75	0.07	0.016	( 0.144)	0.015	0.002
286	23.83	0.07	0.016	( 0.143)	0.015	0.002
287	23.92	0.07	0.016	( 0.143)	0.015	0.002
288	24.00	0.07	0.016	( 0.143)	0.015	0.002

(Loss Rate Not Used)



2+35	0.0105	0.07	QV
2+40	0.0110	0.07	QV
2+45	0.0115	0.08	QV
2+50	0.0120	0.08	QV
2+55	0.0125	0.08	QV
3+ 0	0.0131	0.08	QV
3+ 5	0.0136	0.08	QV
3+10	0.0142	0.08	QV
3+15	0.0147	0.08	QV
3+20	0.0153	0.08	QV
3+25	0.0158	0.08	QV
3+30	0.0163	0.08	QV
3+35	0.0169	0.08	Q V
3+40	0.0174	0.08	Q V
3+45	0.0180	0.08	Q V
3+50	0.0185	0.08	Q V
3+55	0.0191	0.09	Q V
4+ 0	0.0198	0.09	Q V
4+ 5	0.0204	0.09	Q V
4+10	0.0211	0.09	Q V
4+15	0.0217	0.09	Q V
4+20	0.0224	0.10	Q V
4+25	0.0231	0.10	Q V
4+30	0.0238	0.11	Q V
4+35	0.0246	0.11	Q V
4+40	0.0253	0.11	Q V
4+45	0.0261	0.11	Q V
4+50	0.0269	0.11	Q V
4+55	0.0277	0.12	Q V
5+ 0	0.0285	0.12	Q V
5+ 5	0.0294	0.12	Q V
5+10	0.0301	0.11	Q V
5+15	0.0308	0.10	Q V
5+20	0.0315	0.10	Q V
5+25	0.0322	0.11	Q V
5+30	0.0330	0.11	Q V
5+35	0.0337	0.11	Q V
5+40	0.0345	0.12	Q V
5+45	0.0354	0.12	Q V
5+50	0.0362	0.12	Q V
5+55	0.0371	0.12	Q V
6+ 0	0.0380	0.13	Q V
6+ 5	0.0389	0.13	Q V
6+10	0.0398	0.14	Q V
6+15	0.0407	0.14	Q V
6+20	0.0417	0.14	Q V
6+25	0.0427	0.14	Q V
6+30	0.0437	0.14	Q V
6+35	0.0446	0.14	Q V
6+40	0.0457	0.15	Q V

6+45	0.0468	0.15	Q	V				
6+50	0.0478	0.16	Q	V				
6+55	0.0489	0.16	Q	V				
7+ 0	0.0500	0.16	Q	V				
7+ 5	0.0511	0.16	Q	V				
7+10	0.0522	0.16	Q	V				
7+15	0.0532	0.16	Q	V				
7+20	0.0544	0.16	Q	V				
7+25	0.0555	0.17	Q	V				
7+30	0.0567	0.17	Q	V				
7+35	0.0579	0.17	Q	V				
7+40	0.0591	0.18	Q	V				
7+45	0.0604	0.19	Q	V				
7+50	0.0617	0.19	Q	V				
7+55	0.0631	0.20	Q	V				
8+ 0	0.0645	0.20	Q	V				
8+ 5	0.0659	0.21	Q	V				
8+10	0.0674	0.22	Q	V				
8+15	0.0690	0.23	Q	V				
8+20	0.0706	0.23	Q	V				
8+25	0.0722	0.23	Q	V				
8+30	0.0738	0.24	Q	V				
8+35	0.0755	0.24	Q	V				
8+40	0.0772	0.25	Q	V				
8+45	0.0789	0.25	Q	V				
8+50	0.0806	0.25	Q	V				
8+55	0.0824	0.26	Q	V				
9+ 0	0.0843	0.26	Q	V				
9+ 5	0.0861	0.27	Q	V				
9+10	0.0881	0.29	Q	V				
9+15	0.0901	0.29	Q	V				
9+20	0.0922	0.30	Q	V				
9+25	0.0943	0.31	Q	V				
9+30	0.0964	0.31	Q	V				
9+35	0.0986	0.32	Q	V				
9+40	0.1008	0.32	Q	V				
9+45	0.1031	0.33	Q	V				
9+50	0.1054	0.33	Q	V				
9+55	0.1077	0.34	Q	V				
10+ 0	0.1101	0.34	Q	V				
10+ 5	0.1123	0.33	Q	V				
10+10	0.1142	0.28	Q	V				
10+15	0.1160	0.26	Q	V				
10+20	0.1178	0.25	Q	V				
10+25	0.1194	0.25	Q	V				
10+30	0.1211	0.24	Q	V				
10+35	0.1228	0.25	Q	V				
10+40	0.1248	0.29	Q	V				
10+45	0.1269	0.30	Q	V				
10+50	0.1290	0.31	Q	V				

10+55	0.1311	0.31	Q	V			
11+ 0	0.1333	0.31	Q	V			
11+ 5	0.1354	0.31	Q	V			
11+10	0.1375	0.30	Q	V			
11+15	0.1396	0.30	Q	V			
11+20	0.1417	0.30	Q	V			
11+25	0.1438	0.30	Q	V			
11+30	0.1458	0.30	Q	V			
11+35	0.1479	0.30	Q	V			
11+40	0.1498	0.28	Q	V			
11+45	0.1517	0.28	Q	V			
11+50	0.1536	0.27	Q	V			
11+55	0.1555	0.28	Q	V			
12+ 0	0.1575	0.28	Q	V			
12+ 5	0.1595	0.30	Q	V			
12+10	0.1620	0.35	Q	V			
12+15	0.1645	0.37	Q	V			
12+20	0.1672	0.38	Q	V			
12+25	0.1699	0.40	Q	V			
12+30	0.1726	0.40	Q	V			
12+35	0.1755	0.41	Q	V			
12+40	0.1784	0.43	Q	V			
12+45	0.1814	0.43	Q	V			
12+50	0.1844	0.44	Q	V			
12+55	0.1875	0.45	Q	V			
13+ 0	0.1906	0.45	Q	V			
13+ 5	0.1939	0.47	Q	V			
13+10	0.1974	0.51	Q	V			
13+15	0.2012	0.55	Q	V			
13+20	0.2051	0.57	Q	V			
13+25	0.2092	0.60	Q	V			
13+30	0.2135	0.62	Q	V			
13+35	0.2176	0.60	Q	V			
13+40	0.2208	0.47	Q	V			
13+45	0.2237	0.42	Q	V			
13+50	0.2264	0.40	Q	V			
13+55	0.2291	0.38	Q	V			
14+ 0	0.2317	0.38	Q	V			
14+ 5	0.2343	0.38	Q	V			
14+10	0.2371	0.41	Q	V			
14+15	0.2400	0.42	Q	V			
14+20	0.2429	0.42	Q	V			
14+25	0.2457	0.41	Q	V			
14+30	0.2485	0.41	Q	V			
14+35	0.2513	0.41	Q	V			
14+40	0.2542	0.41	Q	V			
14+45	0.2570	0.41	Q	V			
14+50	0.2598	0.41	Q	V			
14+55	0.2626	0.40	Q	V			
15+ 0	0.2653	0.40	Q	V			

15+ 5	0.2680	0.39	Q			V	
15+10	0.2707	0.39	Q			V	
15+15	0.2733	0.38	Q			V	
15+20	0.2760	0.38	Q			V	
15+25	0.2785	0.37	Q			V	
15+30	0.2810	0.37	Q			V	
15+35	0.2835	0.36	Q			V	
15+40	0.2857	0.33	Q			V	
15+45	0.2879	0.31	Q			V	
15+50	0.2900	0.31	Q			V	
15+55	0.2921	0.31	Q			V	
16+ 0	0.2942	0.30	Q			V	
16+ 5	0.2961	0.27	Q			V	
16+10	0.2971	0.16	Q			V	
16+15	0.2979	0.11	Q			V	
16+20	0.2985	0.09	Q			V	
16+25	0.2991	0.08	Q			V	
16+30	0.2996	0.08	Q			V	
16+35	0.3001	0.07	Q			V	
16+40	0.3005	0.06	Q			V	
16+45	0.3008	0.05	Q			V	
16+50	0.3012	0.05	Q			V	
16+55	0.3015	0.05	Q			V	
17+ 0	0.3018	0.05	Q			V	
17+ 5	0.3022	0.05	Q			V	
17+10	0.3027	0.07	Q			V	
17+15	0.3032	0.07	Q			V	
17+20	0.3037	0.07	Q			V	
17+25	0.3042	0.08	Q			V	
17+30	0.3047	0.08	Q			V	
17+35	0.3053	0.08	Q			V	
17+40	0.3058	0.08	Q			V	
17+45	0.3064	0.08	Q			V	
17+50	0.3069	0.08	Q			V	
17+55	0.3074	0.07	Q			V	
18+ 0	0.3078	0.07	Q			V	
18+ 5	0.3083	0.07	Q			V	
18+10	0.3087	0.06	Q			V	
18+15	0.3092	0.06	Q			V	
18+20	0.3096	0.06	Q			V	
18+25	0.3100	0.06	Q			V	
18+30	0.3105	0.06	Q			V	
18+35	0.3109	0.06	Q			V	
18+40	0.3113	0.05	Q			V	
18+45	0.3116	0.05	Q			V	
18+50	0.3119	0.05	Q			V	
18+55	0.3122	0.04	Q			V	
19+ 0	0.3124	0.04	Q			V	
19+ 5	0.3127	0.04	Q			V	
19+10	0.3130	0.04	Q			V	

19+15	0.3133	0.05	Q				V
19+20	0.3136	0.05	Q				V
19+25	0.3140	0.06	Q				V
19+30	0.3144	0.06	Q				V
19+35	0.3148	0.06	Q				V
19+40	0.3152	0.05	Q				V
19+45	0.3155	0.05	Q				V
19+50	0.3159	0.05	Q				V
19+55	0.3161	0.04	Q				V
20+ 0	0.3164	0.04	Q				V
20+ 5	0.3166	0.04	Q				V
20+10	0.3169	0.04	Q				V
20+15	0.3172	0.05	Q				V
20+20	0.3175	0.05	Q				V
20+25	0.3179	0.05	Q				V
20+30	0.3182	0.05	Q				V
20+35	0.3185	0.05	Q				V
20+40	0.3188	0.05	Q				V
20+45	0.3191	0.05	Q				V
20+50	0.3195	0.05	Q				V
20+55	0.3197	0.04	Q				V
21+ 0	0.3200	0.03	Q				V
21+ 5	0.3202	0.04	Q				V
21+10	0.3205	0.04	Q				V
21+15	0.3208	0.04	Q				V
21+20	0.3211	0.04	Q				V
21+25	0.3214	0.04	Q				V
21+30	0.3216	0.03	Q				V
21+35	0.3218	0.04	Q				V
21+40	0.3221	0.04	Q				V
21+45	0.3224	0.04	Q				V
21+50	0.3227	0.04	Q				V
21+55	0.3230	0.04	Q				V
22+ 0	0.3232	0.03	Q				V
22+ 5	0.3235	0.04	Q				V
22+10	0.3238	0.04	Q				V
22+15	0.3241	0.04	Q				V
22+20	0.3244	0.04	Q				V
22+25	0.3246	0.04	Q				V
22+30	0.3249	0.03	Q				V
22+35	0.3251	0.03	Q				V
22+40	0.3253	0.03	Q				V
22+45	0.3255	0.03	Q				V
22+50	0.3258	0.03	Q				V
22+55	0.3260	0.03	Q				V
23+ 0	0.3262	0.03	Q				V
23+ 5	0.3264	0.03	Q				V
23+10	0.3266	0.03	Q				V
23+15	0.3268	0.03	Q				V
23+20	0.3271	0.03	Q				V

23+25	0.3273	0.03	Q				V
23+30	0.3275	0.03	Q				V
23+35	0.3277	0.03	Q				V
23+40	0.3279	0.03	Q				V
23+45	0.3281	0.03	Q				V
23+50	0.3284	0.03	Q				V
23+55	0.3286	0.03	Q				V
24+ 0	0.3288	0.03	Q				V
24+ 5	0.3290	0.03	Q				V
24+10	0.3291	0.01	Q				V
24+15	0.3291	0.01	Q				V
24+20	0.3291	0.00	Q				V
24+25	0.3292	0.00	Q				V
24+30	0.3292	0.00	Q				V
24+35	0.3292	0.00	Q				V
24+40	0.3292	0.00	Q				V
24+45	0.3292	0.00	Q				V

---

# Appendix 7.4: Post-Development Calculations

*Unit Hydrograph – 2-Year, 24hr*

Unit Hydrograph Analysis

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2018, Version 9.0  
Study date 05/27/22 File: MapesPost2AUH242.out

+++++

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

Program License Serial Number 6443

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

-----  
MAPES AND TRUMBLE INDUSTRIAL FACILITY  
UNIT HYDROGRAPH  
POST-DEVELOPMENT CONDITIONS  
2-YEAR, 24HR STORM, DA A

-----  
Drainage Area = 18.09(Ac.) = 0.028 Sq. Mi.  
Drainage Area for Depth-Area Areal Adjustment = 18.09(Ac.) =  
0.028 Sq. Mi.  
Length along longest watercourse = 1290.86(Ft.)  
Length along longest watercourse measured to centroid = 632.74(Ft.)  
Length along longest watercourse = 0.244 Mi.  
Length along longest watercourse measured to centroid = 0.120 Mi.  
Difference in elevation = 12.93(Ft.)  
Slope along watercourse = 52.8875 Ft./Mi.  
Average Manning's 'N' = 0.015  
Lag time = 0.044 Hr.  
Lag time = 2.66 Min.  
25% of lag time = 0.66 Min.  
40% of lag time = 1.06 Min.  
Unit time = 5.00 Min.  
Duration of storm = 24 Hour(s)  
User Entered Base Flow = 0.00(CFS)

2 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
18.09	2.06	37.27

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
18.09	5.31	96.06

STORM EVENT (YEAR) = 2.00  
 Area Averaged 2-Year Rainfall = 2.060(In)  
 Area Averaged 100-Year Rainfall = 5.310(In)

Point rain (area averaged) = 2.060(In)  
 Areal adjustment factor = 100.00 %  
 Adjusted average point rain = 2.060(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
18.090	75.00	0.830
Total Area Entered = 18.09(Ac.)		

RI	RI	Infil. Rate	Impervious	Adj. Infil. Rate	Area%	F
AMC2	AMC-1	(In/Hr)	(Dec.%)	(In/Hr)	(Dec.)	(In/Hr)
75.0	57.0	0.501	0.830	0.127	1.000	0.127
Sum (F) =						0.127

Area averaged mean soil loss (F) (In/Hr) = 0.127  
 Minimum soil loss rate ((In/Hr)) = 0.063  
 (for 24 hour storm duration)  
 Soil low loss rate (decimal) = 0.238

-----  
 U n i t H y d r o g r a p h  
 VALLEY S-Curve  
 -----

Unit Hydrograph Data  
 -----

Unit time period (hrs)	Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)	
1	0.083	188.172	41.282	7.526
2	0.167	376.344	44.201	8.058
3	0.250	564.517	9.293	1.694
4	0.333	752.689	3.719	0.678
5	0.417	940.861	1.505	0.274
		Sum = 100.000	Sum=	18.231

-----

The following loss rate calculations reflect use of the minimum calculated loss rate subtracted from the Storm Rain to produce the maximum Effective Rain value

Unit	Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr)		Effective (In/Hr)
				Max	Low	
1	0.08	0.07	0.016	( 0.225)	0.004	0.013
2	0.17	0.07	0.016	( 0.224)	0.004	0.013
3	0.25	0.07	0.016	( 0.223)	0.004	0.013
4	0.33	0.10	0.025	( 0.222)	0.006	0.019
5	0.42	0.10	0.025	( 0.221)	0.006	0.019
6	0.50	0.10	0.025	( 0.220)	0.006	0.019
7	0.58	0.10	0.025	( 0.219)	0.006	0.019
8	0.67	0.10	0.025	( 0.218)	0.006	0.019
9	0.75	0.10	0.025	( 0.218)	0.006	0.019
10	0.83	0.13	0.033	( 0.217)	0.008	0.025
11	0.92	0.13	0.033	( 0.216)	0.008	0.025
12	1.00	0.13	0.033	( 0.215)	0.008	0.025
13	1.08	0.10	0.025	( 0.214)	0.006	0.019
14	1.17	0.10	0.025	( 0.213)	0.006	0.019
15	1.25	0.10	0.025	( 0.213)	0.006	0.019
16	1.33	0.10	0.025	( 0.212)	0.006	0.019
17	1.42	0.10	0.025	( 0.211)	0.006	0.019
18	1.50	0.10	0.025	( 0.210)	0.006	0.019
19	1.58	0.10	0.025	( 0.209)	0.006	0.019
20	1.67	0.10	0.025	( 0.208)	0.006	0.019
21	1.75	0.10	0.025	( 0.207)	0.006	0.019
22	1.83	0.13	0.033	( 0.207)	0.008	0.025
23	1.92	0.13	0.033	( 0.206)	0.008	0.025
24	2.00	0.13	0.033	( 0.205)	0.008	0.025
25	2.08	0.13	0.033	( 0.204)	0.008	0.025
26	2.17	0.13	0.033	( 0.203)	0.008	0.025
27	2.25	0.13	0.033	( 0.202)	0.008	0.025
28	2.33	0.13	0.033	( 0.202)	0.008	0.025
29	2.42	0.13	0.033	( 0.201)	0.008	0.025
30	2.50	0.13	0.033	( 0.200)	0.008	0.025
31	2.58	0.17	0.041	( 0.199)	0.010	0.031
32	2.67	0.17	0.041	( 0.198)	0.010	0.031
33	2.75	0.17	0.041	( 0.198)	0.010	0.031
34	2.83	0.17	0.041	( 0.197)	0.010	0.031
35	2.92	0.17	0.041	( 0.196)	0.010	0.031
36	3.00	0.17	0.041	( 0.195)	0.010	0.031
37	3.08	0.17	0.041	( 0.194)	0.010	0.031
38	3.17	0.17	0.041	( 0.194)	0.010	0.031
39	3.25	0.17	0.041	( 0.193)	0.010	0.031
40	3.33	0.17	0.041	( 0.192)	0.010	0.031
41	3.42	0.17	0.041	( 0.191)	0.010	0.031
42	3.50	0.17	0.041	( 0.190)	0.010	0.031
43	3.58	0.17	0.041	( 0.190)	0.010	0.031
44	3.67	0.17	0.041	( 0.189)	0.010	0.031

45	3.75	0.17	0.041	( 0.188)	0.010	0.031
46	3.83	0.20	0.049	( 0.187)	0.012	0.038
47	3.92	0.20	0.049	( 0.186)	0.012	0.038
48	4.00	0.20	0.049	( 0.186)	0.012	0.038
49	4.08	0.20	0.049	( 0.185)	0.012	0.038
50	4.17	0.20	0.049	( 0.184)	0.012	0.038
51	4.25	0.20	0.049	( 0.183)	0.012	0.038
52	4.33	0.23	0.058	( 0.182)	0.014	0.044
53	4.42	0.23	0.058	( 0.182)	0.014	0.044
54	4.50	0.23	0.058	( 0.181)	0.014	0.044
55	4.58	0.23	0.058	( 0.180)	0.014	0.044
56	4.67	0.23	0.058	( 0.179)	0.014	0.044
57	4.75	0.23	0.058	( 0.179)	0.014	0.044
58	4.83	0.27	0.066	( 0.178)	0.016	0.050
59	4.92	0.27	0.066	( 0.177)	0.016	0.050
60	5.00	0.27	0.066	( 0.176)	0.016	0.050
61	5.08	0.20	0.049	( 0.175)	0.012	0.038
62	5.17	0.20	0.049	( 0.175)	0.012	0.038
63	5.25	0.20	0.049	( 0.174)	0.012	0.038
64	5.33	0.23	0.058	( 0.173)	0.014	0.044
65	5.42	0.23	0.058	( 0.172)	0.014	0.044
66	5.50	0.23	0.058	( 0.172)	0.014	0.044
67	5.58	0.27	0.066	( 0.171)	0.016	0.050
68	5.67	0.27	0.066	( 0.170)	0.016	0.050
69	5.75	0.27	0.066	( 0.169)	0.016	0.050
70	5.83	0.27	0.066	( 0.169)	0.016	0.050
71	5.92	0.27	0.066	( 0.168)	0.016	0.050
72	6.00	0.27	0.066	( 0.167)	0.016	0.050
73	6.08	0.30	0.074	( 0.166)	0.018	0.057
74	6.17	0.30	0.074	( 0.166)	0.018	0.057
75	6.25	0.30	0.074	( 0.165)	0.018	0.057
76	6.33	0.30	0.074	( 0.164)	0.018	0.057
77	6.42	0.30	0.074	( 0.163)	0.018	0.057
78	6.50	0.30	0.074	( 0.163)	0.018	0.057
79	6.58	0.33	0.082	( 0.162)	0.020	0.063
80	6.67	0.33	0.082	( 0.161)	0.020	0.063
81	6.75	0.33	0.082	( 0.161)	0.020	0.063
82	6.83	0.33	0.082	( 0.160)	0.020	0.063
83	6.92	0.33	0.082	( 0.159)	0.020	0.063
84	7.00	0.33	0.082	( 0.158)	0.020	0.063
85	7.08	0.33	0.082	( 0.158)	0.020	0.063
86	7.17	0.33	0.082	( 0.157)	0.020	0.063
87	7.25	0.33	0.082	( 0.156)	0.020	0.063
88	7.33	0.37	0.091	( 0.156)	0.022	0.069
89	7.42	0.37	0.091	( 0.155)	0.022	0.069
90	7.50	0.37	0.091	( 0.154)	0.022	0.069
91	7.58	0.40	0.099	( 0.153)	0.024	0.075
92	7.67	0.40	0.099	( 0.153)	0.024	0.075
93	7.75	0.40	0.099	( 0.152)	0.024	0.075
94	7.83	0.43	0.107	( 0.151)	0.025	0.082

95	7.92	0.43	0.107	( 0.151)	0.025	0.082
96	8.00	0.43	0.107	( 0.150)	0.025	0.082
97	8.08	0.50	0.124	( 0.149)	0.029	0.094
98	8.17	0.50	0.124	( 0.148)	0.029	0.094
99	8.25	0.50	0.124	( 0.148)	0.029	0.094
100	8.33	0.50	0.124	( 0.147)	0.029	0.094
101	8.42	0.50	0.124	( 0.146)	0.029	0.094
102	8.50	0.50	0.124	( 0.146)	0.029	0.094
103	8.58	0.53	0.132	( 0.145)	0.031	0.100
104	8.67	0.53	0.132	( 0.144)	0.031	0.100
105	8.75	0.53	0.132	( 0.144)	0.031	0.100
106	8.83	0.57	0.140	( 0.143)	0.033	0.107
107	8.92	0.57	0.140	( 0.142)	0.033	0.107
108	9.00	0.57	0.140	( 0.142)	0.033	0.107
109	9.08	0.63	0.157	( 0.141)	0.037	0.119
110	9.17	0.63	0.157	( 0.140)	0.037	0.119
111	9.25	0.63	0.157	( 0.140)	0.037	0.119
112	9.33	0.67	0.165	( 0.139)	0.039	0.126
113	9.42	0.67	0.165	( 0.138)	0.039	0.126
114	9.50	0.67	0.165	( 0.138)	0.039	0.126
115	9.58	0.70	0.173	( 0.137)	0.041	0.132
116	9.67	0.70	0.173	( 0.136)	0.041	0.132
117	9.75	0.70	0.173	( 0.136)	0.041	0.132
118	9.83	0.73	0.181	( 0.135)	0.043	0.138
119	9.92	0.73	0.181	( 0.134)	0.043	0.138
120	10.00	0.73	0.181	( 0.134)	0.043	0.138
121	10.08	0.50	0.124	( 0.133)	0.029	0.094
122	10.17	0.50	0.124	( 0.132)	0.029	0.094
123	10.25	0.50	0.124	( 0.132)	0.029	0.094
124	10.33	0.50	0.124	( 0.131)	0.029	0.094
125	10.42	0.50	0.124	( 0.131)	0.029	0.094
126	10.50	0.50	0.124	( 0.130)	0.029	0.094
127	10.58	0.67	0.165	( 0.129)	0.039	0.126
128	10.67	0.67	0.165	( 0.129)	0.039	0.126
129	10.75	0.67	0.165	( 0.128)	0.039	0.126
130	10.83	0.67	0.165	( 0.127)	0.039	0.126
131	10.92	0.67	0.165	( 0.127)	0.039	0.126
132	11.00	0.67	0.165	( 0.126)	0.039	0.126
133	11.08	0.63	0.157	( 0.126)	0.037	0.119
134	11.17	0.63	0.157	( 0.125)	0.037	0.119
135	11.25	0.63	0.157	( 0.124)	0.037	0.119
136	11.33	0.63	0.157	( 0.124)	0.037	0.119
137	11.42	0.63	0.157	( 0.123)	0.037	0.119
138	11.50	0.63	0.157	( 0.122)	0.037	0.119
139	11.58	0.57	0.140	( 0.122)	0.033	0.107
140	11.67	0.57	0.140	( 0.121)	0.033	0.107
141	11.75	0.57	0.140	( 0.121)	0.033	0.107
142	11.83	0.60	0.148	( 0.120)	0.035	0.113
143	11.92	0.60	0.148	( 0.119)	0.035	0.113
144	12.00	0.60	0.148	( 0.119)	0.035	0.113

145	12.08	0.83	0.206	( 0.118)	0.049	0.157
146	12.17	0.83	0.206	( 0.118)	0.049	0.157
147	12.25	0.83	0.206	( 0.117)	0.049	0.157
148	12.33	0.87	0.214	( 0.116)	0.051	0.163
149	12.42	0.87	0.214	( 0.116)	0.051	0.163
150	12.50	0.87	0.214	( 0.115)	0.051	0.163
151	12.58	0.93	0.231	( 0.115)	0.055	0.176
152	12.67	0.93	0.231	( 0.114)	0.055	0.176
153	12.75	0.93	0.231	( 0.114)	0.055	0.176
154	12.83	0.97	0.239	( 0.113)	0.057	0.182
155	12.92	0.97	0.239	( 0.112)	0.057	0.182
156	13.00	0.97	0.239	( 0.112)	0.057	0.182
157	13.08	1.13	0.280	( 0.111)	0.067	0.213
158	13.17	1.13	0.280	( 0.111)	0.067	0.213
159	13.25	1.13	0.280	( 0.110)	0.067	0.213
160	13.33	1.13	0.280	( 0.110)	0.067	0.213
161	13.42	1.13	0.280	( 0.109)	0.067	0.213
162	13.50	1.13	0.280	( 0.108)	0.067	0.213
163	13.58	0.77	0.190	( 0.108)	0.045	0.144
164	13.67	0.77	0.190	( 0.107)	0.045	0.144
165	13.75	0.77	0.190	( 0.107)	0.045	0.144
166	13.83	0.77	0.190	( 0.106)	0.045	0.144
167	13.92	0.77	0.190	( 0.106)	0.045	0.144
168	14.00	0.77	0.190	( 0.105)	0.045	0.144
169	14.08	0.90	0.222	( 0.105)	0.053	0.170
170	14.17	0.90	0.222	( 0.104)	0.053	0.170
171	14.25	0.90	0.222	( 0.104)	0.053	0.170
172	14.33	0.87	0.214	( 0.103)	0.051	0.163
173	14.42	0.87	0.214	( 0.103)	0.051	0.163
174	14.50	0.87	0.214	( 0.102)	0.051	0.163
175	14.58	0.87	0.214	( 0.101)	0.051	0.163
176	14.67	0.87	0.214	( 0.101)	0.051	0.163
177	14.75	0.87	0.214	( 0.100)	0.051	0.163
178	14.83	0.83	0.206	( 0.100)	0.049	0.157
179	14.92	0.83	0.206	( 0.099)	0.049	0.157
180	15.00	0.83	0.206	( 0.099)	0.049	0.157
181	15.08	0.80	0.198	( 0.098)	0.047	0.151
182	15.17	0.80	0.198	( 0.098)	0.047	0.151
183	15.25	0.80	0.198	( 0.097)	0.047	0.151
184	15.33	0.77	0.190	( 0.097)	0.045	0.144
185	15.42	0.77	0.190	( 0.096)	0.045	0.144
186	15.50	0.77	0.190	( 0.096)	0.045	0.144
187	15.58	0.63	0.157	( 0.095)	0.037	0.119
188	15.67	0.63	0.157	( 0.095)	0.037	0.119
189	15.75	0.63	0.157	( 0.094)	0.037	0.119
190	15.83	0.63	0.157	( 0.094)	0.037	0.119
191	15.92	0.63	0.157	( 0.093)	0.037	0.119
192	16.00	0.63	0.157	( 0.093)	0.037	0.119
193	16.08	0.13	0.033	( 0.093)	0.008	0.025
194	16.17	0.13	0.033	( 0.092)	0.008	0.025

195	16.25	0.13	0.033	( 0.092)	0.008	0.025
196	16.33	0.13	0.033	( 0.091)	0.008	0.025
197	16.42	0.13	0.033	( 0.091)	0.008	0.025
198	16.50	0.13	0.033	( 0.090)	0.008	0.025
199	16.58	0.10	0.025	( 0.090)	0.006	0.019
200	16.67	0.10	0.025	( 0.089)	0.006	0.019
201	16.75	0.10	0.025	( 0.089)	0.006	0.019
202	16.83	0.10	0.025	( 0.088)	0.006	0.019
203	16.92	0.10	0.025	( 0.088)	0.006	0.019
204	17.00	0.10	0.025	( 0.087)	0.006	0.019
205	17.08	0.17	0.041	( 0.087)	0.010	0.031
206	17.17	0.17	0.041	( 0.087)	0.010	0.031
207	17.25	0.17	0.041	( 0.086)	0.010	0.031
208	17.33	0.17	0.041	( 0.086)	0.010	0.031
209	17.42	0.17	0.041	( 0.085)	0.010	0.031
210	17.50	0.17	0.041	( 0.085)	0.010	0.031
211	17.58	0.17	0.041	( 0.084)	0.010	0.031
212	17.67	0.17	0.041	( 0.084)	0.010	0.031
213	17.75	0.17	0.041	( 0.084)	0.010	0.031
214	17.83	0.13	0.033	( 0.083)	0.008	0.025
215	17.92	0.13	0.033	( 0.083)	0.008	0.025
216	18.00	0.13	0.033	( 0.082)	0.008	0.025
217	18.08	0.13	0.033	( 0.082)	0.008	0.025
218	18.17	0.13	0.033	( 0.082)	0.008	0.025
219	18.25	0.13	0.033	( 0.081)	0.008	0.025
220	18.33	0.13	0.033	( 0.081)	0.008	0.025
221	18.42	0.13	0.033	( 0.080)	0.008	0.025
222	18.50	0.13	0.033	( 0.080)	0.008	0.025
223	18.58	0.10	0.025	( 0.080)	0.006	0.019
224	18.67	0.10	0.025	( 0.079)	0.006	0.019
225	18.75	0.10	0.025	( 0.079)	0.006	0.019
226	18.83	0.07	0.016	( 0.078)	0.004	0.013
227	18.92	0.07	0.016	( 0.078)	0.004	0.013
228	19.00	0.07	0.016	( 0.078)	0.004	0.013
229	19.08	0.10	0.025	( 0.077)	0.006	0.019
230	19.17	0.10	0.025	( 0.077)	0.006	0.019
231	19.25	0.10	0.025	( 0.077)	0.006	0.019
232	19.33	0.13	0.033	( 0.076)	0.008	0.025
233	19.42	0.13	0.033	( 0.076)	0.008	0.025
234	19.50	0.13	0.033	( 0.076)	0.008	0.025
235	19.58	0.10	0.025	( 0.075)	0.006	0.019
236	19.67	0.10	0.025	( 0.075)	0.006	0.019
237	19.75	0.10	0.025	( 0.075)	0.006	0.019
238	19.83	0.07	0.016	( 0.074)	0.004	0.013
239	19.92	0.07	0.016	( 0.074)	0.004	0.013
240	20.00	0.07	0.016	( 0.074)	0.004	0.013
241	20.08	0.10	0.025	( 0.073)	0.006	0.019
242	20.17	0.10	0.025	( 0.073)	0.006	0.019
243	20.25	0.10	0.025	( 0.073)	0.006	0.019
244	20.33	0.10	0.025	( 0.072)	0.006	0.019



Total rainfall = 2.06(In)  
 Flood volume = 103074.7 Cubic Feet  
 Total soil loss = 32193.9 Cubic Feet

-----  
 Peak flow rate of this hydrograph = 3.894(CFS)  
 -----

+++++

24 - H O U R S T O R M  
 R u n o f f H y d r o g r a p h

-----  
 Hydrograph in 5 Minute intervals ((CFS))  
 -----

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0007	0.09	Q				
0+10	0.0020	0.20	Q				
0+15	0.0035	0.22	Q				
0+20	0.0054	0.27	VQ				
0+25	0.0076	0.33	VQ				
0+30	0.0100	0.34	VQ				
0+35	0.0123	0.34	VQ				
0+40	0.0147	0.34	VQ				
0+45	0.0170	0.34	VQ				
0+50	0.0197	0.39	VQ				
0+55	0.0228	0.44	VQ				
1+ 0	0.0259	0.45	VQ				
1+ 5	0.0287	0.41	VQ				
1+10	0.0312	0.36	VQ				
1+15	0.0336	0.35	VQ				
1+20	0.0360	0.35	VQ				
1+25	0.0383	0.34	VQ				
1+30	0.0407	0.34	VQ				
1+35	0.0431	0.34	VQ				
1+40	0.0454	0.34	VQ				
1+45	0.0478	0.34	VQ				
1+50	0.0505	0.39	VQ				
1+55	0.0535	0.44	VQ				
2+ 0	0.0566	0.45	VQ				
2+ 5	0.0598	0.46	Q				
2+10	0.0629	0.46	Q				
2+15	0.0661	0.46	Q				
2+20	0.0693	0.46	Q				
2+25	0.0724	0.46	Q				
2+30	0.0756	0.46	Q				
2+35	0.0790	0.51	VQ				
2+40	0.0829	0.56	VQ				
2+45	0.0868	0.57	VQ				
2+50	0.0907	0.57	VQ				
2+55	0.0947	0.57	VQ				

3+ 0	0.0986	0.57	VQ
3+ 5	0.1025	0.57	VQ
3+10	0.1065	0.57	VQ
3+15	0.1104	0.57	VQ
3+20	0.1144	0.57	VQ
3+25	0.1183	0.57	Q
3+30	0.1223	0.57	Q
3+35	0.1262	0.57	Q
3+40	0.1301	0.57	Q
3+45	0.1341	0.57	Q
3+50	0.1384	0.62	Q
3+55	0.1430	0.67	Q
4+ 0	0.1477	0.68	Q
4+ 5	0.1524	0.69	Q
4+10	0.1571	0.69	Q
4+15	0.1619	0.69	Q
4+20	0.1669	0.73	Q
4+25	0.1723	0.79	VQ
4+30	0.1778	0.80	Q
4+35	0.1833	0.80	Q
4+40	0.1888	0.80	Q
4+45	0.1944	0.80	Q
4+50	0.2002	0.85	Q
4+55	0.2064	0.90	Q
5+ 0	0.2127	0.91	Q
5+ 5	0.2183	0.82	Q
5+10	0.2233	0.72	QV
5+15	0.2281	0.70	QV
5+20	0.2332	0.74	QV
5+25	0.2386	0.79	QV
5+30	0.2441	0.80	QV
5+35	0.2499	0.85	QV
5+40	0.2561	0.90	QV
5+45	0.2624	0.91	QV
5+50	0.2687	0.91	QV
5+55	0.2750	0.92	QV
6+ 0	0.2813	0.92	QV
6+ 5	0.2879	0.96	QV
6+10	0.2949	1.01	Q
6+15	0.3020	1.02	QV
6+20	0.3090	1.03	QV
6+25	0.3161	1.03	QV
6+30	0.3232	1.03	QV
6+35	0.3307	1.08	QV
6+40	0.3384	1.13	QV
6+45	0.3463	1.14	QV
6+50	0.3542	1.14	QV
6+55	0.3620	1.15	Q V
7+ 0	0.3699	1.15	Q V
7+ 5	0.3778	1.15	Q V

7+10	0.3857	1.15	Q V			
7+15	0.3936	1.15	Q V			
7+20	0.4018	1.19	Q V			
7+25	0.4104	1.24	Q V			
7+30	0.4190	1.25	Q V			
7+35	0.4280	1.31	Q V			
7+40	0.4373	1.36	Q V			
7+45	0.4468	1.37	Q V			
7+50	0.4565	1.42	Q V			
7+55	0.4667	1.47	Q V			
8+ 0	0.4769	1.48	Q V			
8+ 5	0.4878	1.58	Q V			
8+10	0.4994	1.68	Q V			
8+15	0.5111	1.71	Q V			
8+20	0.5229	1.71	Q V			
8+25	0.5348	1.72	Q V			
8+30	0.5466	1.72	Q V			
8+35	0.5588	1.77	Q V			
8+40	0.5713	1.82	Q V			
8+45	0.5839	1.83	Q V			
8+50	0.5968	1.88	Q V			
8+55	0.6101	1.93	Q V			
9+ 0	0.6234	1.94	Q V			
9+ 5	0.6375	2.04	Q V			
9+10	0.6523	2.14	Q V			
9+15	0.6672	2.16	Q V			
9+20	0.6824	2.22	Q V			
9+25	0.6981	2.27	Q V			
9+30	0.7138	2.28	Q V			
9+35	0.7299	2.34	Q V			
9+40	0.7464	2.39	Q V			
9+45	0.7629	2.40	Q V			
9+50	0.7798	2.45	Q V			
9+55	0.7970	2.50	Q V			
10+ 0	0.8143	2.51	Q V			
10+ 5	0.8294	2.19	Q V			
10+10	0.8420	1.83	Q V			
10+15	0.8541	1.76	Q V			
10+20	0.8661	1.73	Q V			
10+25	0.8779	1.72	Q V			
10+30	0.8897	1.72	Q V			
10+35	0.9032	1.95	Q V			
10+40	0.9184	2.21	Q V			
10+45	0.9340	2.26	Q V			
10+50	0.9497	2.28	Q V			
10+55	0.9654	2.29	Q V			
11+ 0	0.9812	2.29	Q V			
11+ 5	0.9967	2.24	Q V			
11+10	1.0118	2.19	Q V			
11+15	1.0268	2.18	Q V			

11+20	1.0418	2.18	Q	V		
11+25	1.0568	2.18	Q	V		
11+30	1.0718	2.18	Q	V		
11+35	1.0861	2.08	Q	V		
11+40	1.0997	1.98	Q	V		
11+45	1.1132	1.96	Q	V		
11+50	1.1270	2.00	Q	V		
11+55	1.1411	2.04	Q	V		
12+ 0	1.1552	2.06	Q	V		
12+ 5	1.1717	2.39	Q	V		
12+10	1.1906	2.75	Q	V		
12+15	1.2100	2.82	Q	V		
12+20	1.2300	2.90	Q	V		
12+25	1.2504	2.96	Q	V		
12+30	1.2709	2.97	Q	V		
12+35	1.2920	3.07	Q	V		
12+40	1.3139	3.17	Q	V		
12+45	1.3359	3.19	Q	V		
12+50	1.3583	3.25	Q	V		
12+55	1.3810	3.30	Q	V		
13+ 0	1.4038	3.32	Q	V		
13+ 5	1.4283	3.56	Q	V		
13+10	1.4546	3.81	Q	V		
13+15	1.4812	3.86	Q	V		
13+20	1.5080	3.89	Q	V		
13+25	1.5348	3.89	Q	V		
13+30	1.5616	3.89	Q	V		
13+35	1.5848	3.37	Q	V		
13+40	1.6042	2.82	Q	V		
13+45	1.6228	2.70	Q	V		
13+50	1.6411	2.65	Q	V		
13+55	1.6592	2.63	Q	V		
14+ 0	1.6774	2.63	Q	V		
14+ 5	1.6968	2.82	Q	V		
14+10	1.7177	3.03	Q	V		
14+15	1.7388	3.07	Q	V		
14+20	1.7597	3.04	Q	V		
14+25	1.7803	2.99	Q	V		
14+30	1.8009	2.98	Q	V		
14+35	1.8214	2.98	Q	V		
14+40	1.8419	2.98	Q	V		
14+45	1.8624	2.98	Q	V		
14+50	1.8826	2.93	Q	V		
14+55	1.9024	2.88	Q	V		
15+ 0	1.9222	2.87	Q	V		
15+ 5	1.9416	2.82	Q	V		
15+10	1.9606	2.77	Q	V		
15+15	1.9796	2.75	Q	V		
15+20	1.9982	2.70	Q	V		
15+25	2.0165	2.65	Q	V		



19+40	2.2673	0.36	Q				V
19+45	2.2697	0.35	Q				V
19+50	2.2718	0.30	Q				V
19+55	2.2735	0.25	Q				V
20+ 0	2.2751	0.24	Q				V
20+ 5	2.2770	0.28	Q				V
20+10	2.2792	0.33	Q				V
20+15	2.2816	0.34	Q				V
20+20	2.2839	0.34	Q				V
20+25	2.2863	0.34	Q				V
20+30	2.2887	0.34	Q				V
20+35	2.2910	0.34	Q				V
20+40	2.2934	0.34	Q				V
20+45	2.2958	0.34	Q				V
20+50	2.2978	0.30	Q				V
20+55	2.2995	0.25	Q				V
21+ 0	2.3011	0.24	Q				V
21+ 5	2.3030	0.28	Q				V
21+10	2.3053	0.33	Q				V
21+15	2.3076	0.34	Q				V
21+20	2.3096	0.29	Q				V
21+25	2.3113	0.25	Q				V
21+30	2.3129	0.24	Q				V
21+35	2.3149	0.28	Q				V
21+40	2.3171	0.33	Q				V
21+45	2.3194	0.34	Q				V
21+50	2.3215	0.29	Q				V
21+55	2.3232	0.25	Q				V
22+ 0	2.3248	0.24	Q				V
22+ 5	2.3267	0.28	Q				V
22+10	2.3289	0.33	Q				V
22+15	2.3313	0.34	Q				V
22+20	2.3333	0.29	Q				V
22+25	2.3350	0.25	Q				V
22+30	2.3366	0.24	Q				V
22+35	2.3382	0.23	Q				V
22+40	2.3398	0.23	Q				V
22+45	2.3413	0.23	Q				V
22+50	2.3429	0.23	Q				V
22+55	2.3445	0.23	Q				V
23+ 0	2.3461	0.23	Q				V
23+ 5	2.3477	0.23	Q				V
23+10	2.3492	0.23	Q				V
23+15	2.3508	0.23	Q				V
23+20	2.3524	0.23	Q				V
23+25	2.3540	0.23	Q				V
23+30	2.3555	0.23	Q				V
23+35	2.3571	0.23	Q				V
23+40	2.3587	0.23	Q				V
23+45	2.3603	0.23	Q				V

23+50	2.3619	0.23	Q				V
23+55	2.3634	0.23	Q				V
24+ 0	2.3650	0.23	Q				V
24+ 5	2.3659	0.13	Q				V
24+10	2.3662	0.03	Q				V
24+15	2.3662	0.01	Q				V
24+20	2.3663	0.00	Q				V

---

Unit Hydrograph Analysis

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2018, Version 9.0  
Study date 05/27/22 File: MapesPost2BUH242.out

+++++

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

Program License Serial Number 6443

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

-----  
MAPES AND TRUMBLE INDUSTRIAL FACILITY  
UNIT HYDROGRAPH  
POST-DEVELOPMENT CONDITIONS  
2-YEAR, 6HR STORM, DA B

-----  
Drainage Area = 0.92(Ac.) = 0.001 Sq. Mi.  
Drainage Area for Depth-Area Areal Adjustment = 0.92(Ac.) =  
0.001 Sq. Mi.  
Length along longest watercourse = 834.61(Ft.)  
Length along longest watercourse measured to centroid = 558.41(Ft.)  
Length along longest watercourse = 0.158 Mi.  
Length along longest watercourse measured to centroid = 0.106 Mi.  
Difference in elevation = 9.65(Ft.)  
Slope along watercourse = 61.0489 Ft./Mi.  
Average Manning's 'N' = 0.015  
Lag time = 0.035 Hr.  
Lag time = 2.09 Min.  
25% of lag time = 0.52 Min.  
40% of lag time = 0.84 Min.  
Unit time = 5.00 Min.  
Duration of storm = 24 Hour(s)  
User Entered Base Flow = 0.00(CFS)

2 YEAR Area rainfall data:

Area(Ac.)[1]                  Rainfall(In)[2]                  Weighting[1\*2]  
                   0.92                                  2.06                                  1.90

100 YEAR Area rainfall data:

Area(Ac.)[1]                  Rainfall(In)[2]                  Weighting[1\*2]  
                   0.92                                  5.31                                  4.89

STORM EVENT (YEAR) =    2.00  
 Area Averaged 2-Year Rainfall =    2.060(In)  
 Area Averaged 100-Year Rainfall =    5.310(In)

Point rain (area averaged) =    2.060(In)  
 Areal adjustment factor = 100.00 %  
 Adjusted average point rain =    2.060(In)

Sub-Area Data:

Area(Ac.)                  Runoff Index                  Impervious %  
                   0.920                                  75.00                                  0.730  
 Total Area Entered =                  0.92(Ac.)

RI	RI	Infil. Rate	Impervious	Adj. Infil. Rate	Area%	F
AMC2	AMC-1	(In/Hr)	(Dec.%)	(In/Hr)	(Dec.)	(In/Hr)
75.0	57.0	0.501	0.730	0.172	1.000	0.172
Sum (F) =						0.172

Area averaged mean soil loss (F) (In/Hr) = 0.172  
 Minimum soil loss rate ((In/Hr)) = 0.086  
 (for 24 hour storm duration)  
 Soil low loss rate (decimal) = 0.313

-----  
 U n i t   H y d r o g r a p h  
 VALLEY S-Curve  
 -----

Unit Hydrograph Data  
 -----

Unit time period	Time % of lag	Distribution	Unit Hydrograph
(hrs)		Graph %	(CFS)
1	0.083	239.327	49.466
2	0.167	478.653	40.724
3	0.250	717.980	7.375
4	0.333	957.306	2.435
		Sum = 100.000	Sum= 0.927

-----

The following loss rate calculations reflect use of the minimum calculated loss rate subtracted from the Storm Rain to produce the maximum Effective Rain value

Unit	Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr)		Effective (In/Hr)
				Max	Low	
1	0.08	0.07	0.016	( 0.304)	0.005	0.011
2	0.17	0.07	0.016	( 0.303)	0.005	0.011
3	0.25	0.07	0.016	( 0.302)	0.005	0.011
4	0.33	0.10	0.025	( 0.301)	0.008	0.017
5	0.42	0.10	0.025	( 0.300)	0.008	0.017
6	0.50	0.10	0.025	( 0.299)	0.008	0.017
7	0.58	0.10	0.025	( 0.297)	0.008	0.017
8	0.67	0.10	0.025	( 0.296)	0.008	0.017
9	0.75	0.10	0.025	( 0.295)	0.008	0.017
10	0.83	0.13	0.033	( 0.294)	0.010	0.023
11	0.92	0.13	0.033	( 0.293)	0.010	0.023
12	1.00	0.13	0.033	( 0.292)	0.010	0.023
13	1.08	0.10	0.025	( 0.290)	0.008	0.017
14	1.17	0.10	0.025	( 0.289)	0.008	0.017
15	1.25	0.10	0.025	( 0.288)	0.008	0.017
16	1.33	0.10	0.025	( 0.287)	0.008	0.017
17	1.42	0.10	0.025	( 0.286)	0.008	0.017
18	1.50	0.10	0.025	( 0.285)	0.008	0.017
19	1.58	0.10	0.025	( 0.284)	0.008	0.017
20	1.67	0.10	0.025	( 0.282)	0.008	0.017
21	1.75	0.10	0.025	( 0.281)	0.008	0.017
22	1.83	0.13	0.033	( 0.280)	0.010	0.023
23	1.92	0.13	0.033	( 0.279)	0.010	0.023
24	2.00	0.13	0.033	( 0.278)	0.010	0.023
25	2.08	0.13	0.033	( 0.277)	0.010	0.023
26	2.17	0.13	0.033	( 0.276)	0.010	0.023
27	2.25	0.13	0.033	( 0.275)	0.010	0.023
28	2.33	0.13	0.033	( 0.273)	0.010	0.023
29	2.42	0.13	0.033	( 0.272)	0.010	0.023
30	2.50	0.13	0.033	( 0.271)	0.010	0.023
31	2.58	0.17	0.041	( 0.270)	0.013	0.028
32	2.67	0.17	0.041	( 0.269)	0.013	0.028
33	2.75	0.17	0.041	( 0.268)	0.013	0.028
34	2.83	0.17	0.041	( 0.267)	0.013	0.028
35	2.92	0.17	0.041	( 0.266)	0.013	0.028
36	3.00	0.17	0.041	( 0.265)	0.013	0.028
37	3.08	0.17	0.041	( 0.263)	0.013	0.028
38	3.17	0.17	0.041	( 0.262)	0.013	0.028
39	3.25	0.17	0.041	( 0.261)	0.013	0.028
40	3.33	0.17	0.041	( 0.260)	0.013	0.028
41	3.42	0.17	0.041	( 0.259)	0.013	0.028
42	3.50	0.17	0.041	( 0.258)	0.013	0.028
43	3.58	0.17	0.041	( 0.257)	0.013	0.028
44	3.67	0.17	0.041	( 0.256)	0.013	0.028
45	3.75	0.17	0.041	( 0.255)	0.013	0.028

46	3.83	0.20	0.049	( 0.254)	0.015	0.034
47	3.92	0.20	0.049	( 0.253)	0.015	0.034
48	4.00	0.20	0.049	( 0.252)	0.015	0.034
49	4.08	0.20	0.049	( 0.250)	0.015	0.034
50	4.17	0.20	0.049	( 0.249)	0.015	0.034
51	4.25	0.20	0.049	( 0.248)	0.015	0.034
52	4.33	0.23	0.058	( 0.247)	0.018	0.040
53	4.42	0.23	0.058	( 0.246)	0.018	0.040
54	4.50	0.23	0.058	( 0.245)	0.018	0.040
55	4.58	0.23	0.058	( 0.244)	0.018	0.040
56	4.67	0.23	0.058	( 0.243)	0.018	0.040
57	4.75	0.23	0.058	( 0.242)	0.018	0.040
58	4.83	0.27	0.066	( 0.241)	0.021	0.045
59	4.92	0.27	0.066	( 0.240)	0.021	0.045
60	5.00	0.27	0.066	( 0.239)	0.021	0.045
61	5.08	0.20	0.049	( 0.238)	0.015	0.034
62	5.17	0.20	0.049	( 0.237)	0.015	0.034
63	5.25	0.20	0.049	( 0.236)	0.015	0.034
64	5.33	0.23	0.058	( 0.235)	0.018	0.040
65	5.42	0.23	0.058	( 0.234)	0.018	0.040
66	5.50	0.23	0.058	( 0.233)	0.018	0.040
67	5.58	0.27	0.066	( 0.232)	0.021	0.045
68	5.67	0.27	0.066	( 0.231)	0.021	0.045
69	5.75	0.27	0.066	( 0.230)	0.021	0.045
70	5.83	0.27	0.066	( 0.229)	0.021	0.045
71	5.92	0.27	0.066	( 0.228)	0.021	0.045
72	6.00	0.27	0.066	( 0.227)	0.021	0.045
73	6.08	0.30	0.074	( 0.226)	0.023	0.051
74	6.17	0.30	0.074	( 0.225)	0.023	0.051
75	6.25	0.30	0.074	( 0.224)	0.023	0.051
76	6.33	0.30	0.074	( 0.223)	0.023	0.051
77	6.42	0.30	0.074	( 0.222)	0.023	0.051
78	6.50	0.30	0.074	( 0.221)	0.023	0.051
79	6.58	0.33	0.082	( 0.220)	0.026	0.057
80	6.67	0.33	0.082	( 0.219)	0.026	0.057
81	6.75	0.33	0.082	( 0.218)	0.026	0.057
82	6.83	0.33	0.082	( 0.217)	0.026	0.057
83	6.92	0.33	0.082	( 0.216)	0.026	0.057
84	7.00	0.33	0.082	( 0.215)	0.026	0.057
85	7.08	0.33	0.082	( 0.214)	0.026	0.057
86	7.17	0.33	0.082	( 0.213)	0.026	0.057
87	7.25	0.33	0.082	( 0.212)	0.026	0.057
88	7.33	0.37	0.091	( 0.211)	0.028	0.062
89	7.42	0.37	0.091	( 0.210)	0.028	0.062
90	7.50	0.37	0.091	( 0.209)	0.028	0.062
91	7.58	0.40	0.099	( 0.208)	0.031	0.068
92	7.67	0.40	0.099	( 0.207)	0.031	0.068
93	7.75	0.40	0.099	( 0.206)	0.031	0.068
94	7.83	0.43	0.107	( 0.205)	0.034	0.074
95	7.92	0.43	0.107	( 0.204)	0.034	0.074

96	8.00	0.43	0.107	( 0.203)	0.034	0.074
97	8.08	0.50	0.124	( 0.202)	0.039	0.085
98	8.17	0.50	0.124	( 0.201)	0.039	0.085
99	8.25	0.50	0.124	( 0.200)	0.039	0.085
100	8.33	0.50	0.124	( 0.199)	0.039	0.085
101	8.42	0.50	0.124	( 0.199)	0.039	0.085
102	8.50	0.50	0.124	( 0.198)	0.039	0.085
103	8.58	0.53	0.132	( 0.197)	0.041	0.091
104	8.67	0.53	0.132	( 0.196)	0.041	0.091
105	8.75	0.53	0.132	( 0.195)	0.041	0.091
106	8.83	0.57	0.140	( 0.194)	0.044	0.096
107	8.92	0.57	0.140	( 0.193)	0.044	0.096
108	9.00	0.57	0.140	( 0.192)	0.044	0.096
109	9.08	0.63	0.157	( 0.191)	0.049	0.108
110	9.17	0.63	0.157	( 0.190)	0.049	0.108
111	9.25	0.63	0.157	( 0.189)	0.049	0.108
112	9.33	0.67	0.165	( 0.188)	0.052	0.113
113	9.42	0.67	0.165	( 0.188)	0.052	0.113
114	9.50	0.67	0.165	( 0.187)	0.052	0.113
115	9.58	0.70	0.173	( 0.186)	0.054	0.119
116	9.67	0.70	0.173	( 0.185)	0.054	0.119
117	9.75	0.70	0.173	( 0.184)	0.054	0.119
118	9.83	0.73	0.181	( 0.183)	0.057	0.125
119	9.92	0.73	0.181	( 0.182)	0.057	0.125
120	10.00	0.73	0.181	( 0.181)	0.057	0.125
121	10.08	0.50	0.124	( 0.180)	0.039	0.085
122	10.17	0.50	0.124	( 0.180)	0.039	0.085
123	10.25	0.50	0.124	( 0.179)	0.039	0.085
124	10.33	0.50	0.124	( 0.178)	0.039	0.085
125	10.42	0.50	0.124	( 0.177)	0.039	0.085
126	10.50	0.50	0.124	( 0.176)	0.039	0.085
127	10.58	0.67	0.165	( 0.175)	0.052	0.113
128	10.67	0.67	0.165	( 0.174)	0.052	0.113
129	10.75	0.67	0.165	( 0.174)	0.052	0.113
130	10.83	0.67	0.165	( 0.173)	0.052	0.113
131	10.92	0.67	0.165	( 0.172)	0.052	0.113
132	11.00	0.67	0.165	( 0.171)	0.052	0.113
133	11.08	0.63	0.157	( 0.170)	0.049	0.108
134	11.17	0.63	0.157	( 0.169)	0.049	0.108
135	11.25	0.63	0.157	( 0.168)	0.049	0.108
136	11.33	0.63	0.157	( 0.168)	0.049	0.108
137	11.42	0.63	0.157	( 0.167)	0.049	0.108
138	11.50	0.63	0.157	( 0.166)	0.049	0.108
139	11.58	0.57	0.140	( 0.165)	0.044	0.096
140	11.67	0.57	0.140	( 0.164)	0.044	0.096
141	11.75	0.57	0.140	( 0.164)	0.044	0.096
142	11.83	0.60	0.148	( 0.163)	0.046	0.102
143	11.92	0.60	0.148	( 0.162)	0.046	0.102
144	12.00	0.60	0.148	( 0.161)	0.046	0.102
145	12.08	0.83	0.206	( 0.160)	0.064	0.142

146	12.17	0.83	0.206	( 0.159)	0.064	0.142
147	12.25	0.83	0.206	( 0.159)	0.064	0.142
148	12.33	0.87	0.214	( 0.158)	0.067	0.147
149	12.42	0.87	0.214	( 0.157)	0.067	0.147
150	12.50	0.87	0.214	( 0.156)	0.067	0.147
151	12.58	0.93	0.231	( 0.156)	0.072	0.159
152	12.67	0.93	0.231	( 0.155)	0.072	0.159
153	12.75	0.93	0.231	( 0.154)	0.072	0.159
154	12.83	0.97	0.239	( 0.153)	0.075	0.164
155	12.92	0.97	0.239	( 0.152)	0.075	0.164
156	13.00	0.97	0.239	( 0.152)	0.075	0.164
157	13.08	1.13	0.280	( 0.151)	0.088	0.192
158	13.17	1.13	0.280	( 0.150)	0.088	0.192
159	13.25	1.13	0.280	( 0.149)	0.088	0.192
160	13.33	1.13	0.280	( 0.149)	0.088	0.192
161	13.42	1.13	0.280	( 0.148)	0.088	0.192
162	13.50	1.13	0.280	( 0.147)	0.088	0.192
163	13.58	0.77	0.190	( 0.146)	0.059	0.130
164	13.67	0.77	0.190	( 0.146)	0.059	0.130
165	13.75	0.77	0.190	( 0.145)	0.059	0.130
166	13.83	0.77	0.190	( 0.144)	0.059	0.130
167	13.92	0.77	0.190	( 0.143)	0.059	0.130
168	14.00	0.77	0.190	( 0.143)	0.059	0.130
169	14.08	0.90	0.222	( 0.142)	0.070	0.153
170	14.17	0.90	0.222	( 0.141)	0.070	0.153
171	14.25	0.90	0.222	( 0.140)	0.070	0.153
172	14.33	0.87	0.214	( 0.140)	0.067	0.147
173	14.42	0.87	0.214	( 0.139)	0.067	0.147
174	14.50	0.87	0.214	( 0.138)	0.067	0.147
175	14.58	0.87	0.214	( 0.138)	0.067	0.147
176	14.67	0.87	0.214	( 0.137)	0.067	0.147
177	14.75	0.87	0.214	( 0.136)	0.067	0.147
178	14.83	0.83	0.206	( 0.135)	0.064	0.142
179	14.92	0.83	0.206	( 0.135)	0.064	0.142
180	15.00	0.83	0.206	( 0.134)	0.064	0.142
181	15.08	0.80	0.198	( 0.133)	0.062	0.136
182	15.17	0.80	0.198	( 0.133)	0.062	0.136
183	15.25	0.80	0.198	( 0.132)	0.062	0.136
184	15.33	0.77	0.190	( 0.131)	0.059	0.130
185	15.42	0.77	0.190	( 0.131)	0.059	0.130
186	15.50	0.77	0.190	( 0.130)	0.059	0.130
187	15.58	0.63	0.157	( 0.129)	0.049	0.108
188	15.67	0.63	0.157	( 0.129)	0.049	0.108
189	15.75	0.63	0.157	( 0.128)	0.049	0.108
190	15.83	0.63	0.157	( 0.127)	0.049	0.108
191	15.92	0.63	0.157	( 0.127)	0.049	0.108
192	16.00	0.63	0.157	( 0.126)	0.049	0.108
193	16.08	0.13	0.033	( 0.125)	0.010	0.023
194	16.17	0.13	0.033	( 0.125)	0.010	0.023
195	16.25	0.13	0.033	( 0.124)	0.010	0.023

196	16.33	0.13	0.033	( 0.124)	0.010	0.023
197	16.42	0.13	0.033	( 0.123)	0.010	0.023
198	16.50	0.13	0.033	( 0.122)	0.010	0.023
199	16.58	0.10	0.025	( 0.122)	0.008	0.017
200	16.67	0.10	0.025	( 0.121)	0.008	0.017
201	16.75	0.10	0.025	( 0.120)	0.008	0.017
202	16.83	0.10	0.025	( 0.120)	0.008	0.017
203	16.92	0.10	0.025	( 0.119)	0.008	0.017
204	17.00	0.10	0.025	( 0.119)	0.008	0.017
205	17.08	0.17	0.041	( 0.118)	0.013	0.028
206	17.17	0.17	0.041	( 0.117)	0.013	0.028
207	17.25	0.17	0.041	( 0.117)	0.013	0.028
208	17.33	0.17	0.041	( 0.116)	0.013	0.028
209	17.42	0.17	0.041	( 0.116)	0.013	0.028
210	17.50	0.17	0.041	( 0.115)	0.013	0.028
211	17.58	0.17	0.041	( 0.114)	0.013	0.028
212	17.67	0.17	0.041	( 0.114)	0.013	0.028
213	17.75	0.17	0.041	( 0.113)	0.013	0.028
214	17.83	0.13	0.033	( 0.113)	0.010	0.023
215	17.92	0.13	0.033	( 0.112)	0.010	0.023
216	18.00	0.13	0.033	( 0.112)	0.010	0.023
217	18.08	0.13	0.033	( 0.111)	0.010	0.023
218	18.17	0.13	0.033	( 0.111)	0.010	0.023
219	18.25	0.13	0.033	( 0.110)	0.010	0.023
220	18.33	0.13	0.033	( 0.110)	0.010	0.023
221	18.42	0.13	0.033	( 0.109)	0.010	0.023
222	18.50	0.13	0.033	( 0.108)	0.010	0.023
223	18.58	0.10	0.025	( 0.108)	0.008	0.017
224	18.67	0.10	0.025	( 0.107)	0.008	0.017
225	18.75	0.10	0.025	( 0.107)	0.008	0.017
226	18.83	0.07	0.016	( 0.106)	0.005	0.011
227	18.92	0.07	0.016	( 0.106)	0.005	0.011
228	19.00	0.07	0.016	( 0.105)	0.005	0.011
229	19.08	0.10	0.025	( 0.105)	0.008	0.017
230	19.17	0.10	0.025	( 0.104)	0.008	0.017
231	19.25	0.10	0.025	( 0.104)	0.008	0.017
232	19.33	0.13	0.033	( 0.103)	0.010	0.023
233	19.42	0.13	0.033	( 0.103)	0.010	0.023
234	19.50	0.13	0.033	( 0.102)	0.010	0.023
235	19.58	0.10	0.025	( 0.102)	0.008	0.017
236	19.67	0.10	0.025	( 0.102)	0.008	0.017
237	19.75	0.10	0.025	( 0.101)	0.008	0.017
238	19.83	0.07	0.016	( 0.101)	0.005	0.011
239	19.92	0.07	0.016	( 0.100)	0.005	0.011
240	20.00	0.07	0.016	( 0.100)	0.005	0.011
241	20.08	0.10	0.025	( 0.099)	0.008	0.017
242	20.17	0.10	0.025	( 0.099)	0.008	0.017
243	20.25	0.10	0.025	( 0.098)	0.008	0.017
244	20.33	0.10	0.025	( 0.098)	0.008	0.017
245	20.42	0.10	0.025	( 0.098)	0.008	0.017

246	20.50	0.10	0.025	( 0.097)	0.008	0.017
247	20.58	0.10	0.025	( 0.097)	0.008	0.017
248	20.67	0.10	0.025	( 0.096)	0.008	0.017
249	20.75	0.10	0.025	( 0.096)	0.008	0.017
250	20.83	0.07	0.016	( 0.096)	0.005	0.011
251	20.92	0.07	0.016	( 0.095)	0.005	0.011
252	21.00	0.07	0.016	( 0.095)	0.005	0.011
253	21.08	0.10	0.025	( 0.094)	0.008	0.017
254	21.17	0.10	0.025	( 0.094)	0.008	0.017
255	21.25	0.10	0.025	( 0.094)	0.008	0.017
256	21.33	0.07	0.016	( 0.093)	0.005	0.011
257	21.42	0.07	0.016	( 0.093)	0.005	0.011
258	21.50	0.07	0.016	( 0.093)	0.005	0.011
259	21.58	0.10	0.025	( 0.092)	0.008	0.017
260	21.67	0.10	0.025	( 0.092)	0.008	0.017
261	21.75	0.10	0.025	( 0.092)	0.008	0.017
262	21.83	0.07	0.016	( 0.091)	0.005	0.011
263	21.92	0.07	0.016	( 0.091)	0.005	0.011
264	22.00	0.07	0.016	( 0.091)	0.005	0.011
265	22.08	0.10	0.025	( 0.090)	0.008	0.017
266	22.17	0.10	0.025	( 0.090)	0.008	0.017
267	22.25	0.10	0.025	( 0.090)	0.008	0.017
268	22.33	0.07	0.016	( 0.089)	0.005	0.011
269	22.42	0.07	0.016	( 0.089)	0.005	0.011
270	22.50	0.07	0.016	( 0.089)	0.005	0.011
271	22.58	0.07	0.016	( 0.089)	0.005	0.011
272	22.67	0.07	0.016	( 0.088)	0.005	0.011
273	22.75	0.07	0.016	( 0.088)	0.005	0.011
274	22.83	0.07	0.016	( 0.088)	0.005	0.011
275	22.92	0.07	0.016	( 0.088)	0.005	0.011
276	23.00	0.07	0.016	( 0.088)	0.005	0.011
277	23.08	0.07	0.016	( 0.087)	0.005	0.011
278	23.17	0.07	0.016	( 0.087)	0.005	0.011
279	23.25	0.07	0.016	( 0.087)	0.005	0.011
280	23.33	0.07	0.016	( 0.087)	0.005	0.011
281	23.42	0.07	0.016	( 0.087)	0.005	0.011
282	23.50	0.07	0.016	( 0.086)	0.005	0.011
283	23.58	0.07	0.016	( 0.086)	0.005	0.011
284	23.67	0.07	0.016	( 0.086)	0.005	0.011
285	23.75	0.07	0.016	( 0.086)	0.005	0.011
286	23.83	0.07	0.016	( 0.086)	0.005	0.011
287	23.92	0.07	0.016	( 0.086)	0.005	0.011
288	24.00	0.07	0.016	( 0.086)	0.005	0.011

(Loss Rate Not Used)

Sum = 100.0

Sum = 17.0

Flood volume = Effective rainfall 1.42(In)

times area 0.9(Ac.)/[ (In)/(Ft.) ] = 0.1(Ac.Ft)

Total soil loss = 0.64(In)

Total soil loss = 0.049(Ac.Ft)

Total rainfall = 2.06(In)

Flood volume = 4726.3 Cubic Feet  
 Total soil loss = 2153.3 Cubic Feet

-----  
 Peak flow rate of this hydrograph = 0.179(CFS)  
 -----

+++++

24 - H O U R S T O R M  
 R u n o f f H y d r o g r a p h

-----  
 Hydrograph in 5 Minute intervals ((CFS))  
 -----

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0000	0.01	Q				
0+10	0.0001	0.01	Q				
0+15	0.0002	0.01	Q				
0+20	0.0003	0.01	Q				
0+25	0.0004	0.02	Q				
0+30	0.0005	0.02	Q				
0+35	0.0006	0.02	Q				
0+40	0.0007	0.02	Q				
0+45	0.0008	0.02	Q				
0+50	0.0009	0.02	Q				
0+55	0.0011	0.02	Q				
1+ 0	0.0012	0.02	Q				
1+ 5	0.0013	0.02	Q				
1+10	0.0015	0.02	Q				
1+15	0.0016	0.02	Q				
1+20	0.0017	0.02	Q				
1+25	0.0018	0.02	Q				
1+30	0.0019	0.02	Q				
1+35	0.0020	0.02	Q				
1+40	0.0021	0.02	Q				
1+45	0.0022	0.02	Q				
1+50	0.0023	0.02	Q				
1+55	0.0025	0.02	Q				
2+ 0	0.0026	0.02	Q				
2+ 5	0.0028	0.02	QV				
2+10	0.0029	0.02	QV				
2+15	0.0031	0.02	QV				
2+20	0.0032	0.02	QV				
2+25	0.0033	0.02	QV				
2+30	0.0035	0.02	QV				
2+35	0.0037	0.02	QV				
2+40	0.0038	0.03	QV				
2+45	0.0040	0.03	QV				
2+50	0.0042	0.03	QV				
2+55	0.0044	0.03	QV				
3+ 0	0.0046	0.03	QV				

3+ 5	0.0047	0.03	QV
3+10	0.0049	0.03	QV
3+15	0.0051	0.03	QV
3+20	0.0053	0.03	QV
3+25	0.0055	0.03	Q V
3+30	0.0056	0.03	Q V
3+35	0.0058	0.03	Q V
3+40	0.0060	0.03	Q V
3+45	0.0062	0.03	Q V
3+50	0.0064	0.03	Q V
3+55	0.0066	0.03	Q V
4+ 0	0.0068	0.03	Q V
4+ 5	0.0070	0.03	Q V
4+10	0.0072	0.03	Q V
4+15	0.0075	0.03	Q V
4+20	0.0077	0.03	Q V
4+25	0.0079	0.04	Q V
4+30	0.0082	0.04	Q V
4+35	0.0084	0.04	Q V
4+40	0.0087	0.04	Q V
4+45	0.0090	0.04	Q V
4+50	0.0092	0.04	Q V
4+55	0.0095	0.04	Q V
5+ 0	0.0098	0.04	Q V
5+ 5	0.0101	0.04	Q V
5+10	0.0103	0.03	Q V
5+15	0.0105	0.03	Q V
5+20	0.0107	0.03	Q V
5+25	0.0110	0.04	Q V
5+30	0.0112	0.04	Q V
5+35	0.0115	0.04	Q V
5+40	0.0118	0.04	Q V
5+45	0.0121	0.04	Q V
5+50	0.0124	0.04	Q V
5+55	0.0127	0.04	Q V
6+ 0	0.0129	0.04	Q V
6+ 5	0.0133	0.04	Q V
6+10	0.0136	0.05	Q V
6+15	0.0139	0.05	Q V
6+20	0.0142	0.05	Q V
6+25	0.0146	0.05	Q V
6+30	0.0149	0.05	Q V
6+35	0.0152	0.05	Q V
6+40	0.0156	0.05	Q V
6+45	0.0159	0.05	Q V
6+50	0.0163	0.05	Q V
6+55	0.0167	0.05	Q V
7+ 0	0.0170	0.05	Q V
7+ 5	0.0174	0.05	Q V
7+10	0.0177	0.05	Q V

7+15	0.0181	0.05	Q	V				
7+20	0.0185	0.06	Q	V				
7+25	0.0189	0.06	Q	V				
7+30	0.0193	0.06	Q	V				
7+35	0.0197	0.06	Q	V				
7+40	0.0201	0.06	Q	V				
7+45	0.0206	0.06	Q	V				
7+50	0.0210	0.07	Q	V				
7+55	0.0215	0.07	Q	V				
8+ 0	0.0219	0.07	Q	V				
8+ 5	0.0225	0.07	Q	V				
8+10	0.0230	0.08	Q	V				
8+15	0.0235	0.08	Q	V				
8+20	0.0241	0.08	Q	V				
8+25	0.0246	0.08	Q	V				
8+30	0.0252	0.08	Q	V				
8+35	0.0257	0.08	Q	V				
8+40	0.0263	0.08	Q	V				
8+45	0.0269	0.08	Q	V				
8+50	0.0275	0.09	Q	V				
8+55	0.0281	0.09	Q	V				
9+ 0	0.0287	0.09	Q	V				
9+ 5	0.0293	0.09	Q	V				
9+10	0.0300	0.10	Q	V				
9+15	0.0307	0.10	Q	V				
9+20	0.0314	0.10	Q	V				
9+25	0.0321	0.10	Q	V				
9+30	0.0329	0.10	Q	V				
9+35	0.0336	0.11	Q	V				
9+40	0.0344	0.11	Q	V				
9+45	0.0351	0.11	Q	V				
9+50	0.0359	0.11	Q	V				
9+55	0.0367	0.12	Q	V				
10+ 0	0.0375	0.12	Q	V				
10+ 5	0.0381	0.10	Q	V				
10+10	0.0387	0.08	Q	V				
10+15	0.0393	0.08	Q	V				
10+20	0.0398	0.08	Q	V				
10+25	0.0403	0.08	Q	V				
10+30	0.0409	0.08	Q	V				
10+35	0.0415	0.09	Q	V				
10+40	0.0422	0.10	Q	V				
10+45	0.0429	0.10	Q	V				
10+50	0.0437	0.11	Q	V				
10+55	0.0444	0.11	Q	V				
11+ 0	0.0451	0.11	Q	V				
11+ 5	0.0458	0.10	Q	V				
11+10	0.0465	0.10	Q	V				
11+15	0.0472	0.10	Q	V				
11+20	0.0479	0.10	Q	V				



15+35	0.0942	0.11	Q				V
15+40	0.0949	0.10	Q				V
15+45	0.0956	0.10	Q				V
15+50	0.0963	0.10	Q				V
15+55	0.0970	0.10	Q				V
16+ 0	0.0977	0.10	Q				V
16+ 5	0.0981	0.06	Q				V
16+10	0.0983	0.03	Q				V
16+15	0.0984	0.02	Q				V
16+20	0.0986	0.02	Q				V
16+25	0.0987	0.02	Q				V
16+30	0.0989	0.02	Q				V
16+35	0.0990	0.02	Q				V
16+40	0.0991	0.02	Q				V
16+45	0.0992	0.02	Q				V
16+50	0.0993	0.02	Q				V
16+55	0.0994	0.02	Q				V
17+ 0	0.0995	0.02	Q				V
17+ 5	0.0997	0.02	Q				V
17+10	0.0999	0.03	Q				V
17+15	0.1000	0.03	Q				V
17+20	0.1002	0.03	Q				V
17+25	0.1004	0.03	Q				V
17+30	0.1006	0.03	Q				V
17+35	0.1008	0.03	Q				V
17+40	0.1009	0.03	Q				V
17+45	0.1011	0.03	Q				V
17+50	0.1013	0.02	Q				V
17+55	0.1014	0.02	Q				V
18+ 0	0.1016	0.02	Q				V
18+ 5	0.1017	0.02	Q				V
18+10	0.1019	0.02	Q				V
18+15	0.1020	0.02	Q				V
18+20	0.1022	0.02	Q				V
18+25	0.1023	0.02	Q				V
18+30	0.1024	0.02	Q				V
18+35	0.1026	0.02	Q				V
18+40	0.1027	0.02	Q				V
18+45	0.1028	0.02	Q				V
18+50	0.1029	0.01	Q				V
18+55	0.1030	0.01	Q				V
19+ 0	0.1030	0.01	Q				V
19+ 5	0.1031	0.01	Q				V
19+10	0.1032	0.02	Q				V
19+15	0.1033	0.02	Q				V
19+20	0.1035	0.02	Q				V
19+25	0.1036	0.02	Q				V
19+30	0.1037	0.02	Q				V
19+35	0.1039	0.02	Q				V
19+40	0.1040	0.02	Q				V

19+45	0.1041	0.02	Q				V
19+50	0.1042	0.01	Q				V
19+55	0.1043	0.01	Q				V
20+ 0	0.1043	0.01	Q				V
20+ 5	0.1044	0.01	Q				V
20+10	0.1045	0.02	Q				V
20+15	0.1046	0.02	Q				V
20+20	0.1047	0.02	Q				V
20+25	0.1049	0.02	Q				V
20+30	0.1050	0.02	Q				V
20+35	0.1051	0.02	Q				V
20+40	0.1052	0.02	Q				V
20+45	0.1053	0.02	Q				V
20+50	0.1054	0.01	Q				V
20+55	0.1055	0.01	Q				V
21+ 0	0.1055	0.01	Q				V
21+ 5	0.1056	0.01	Q				V
21+10	0.1057	0.02	Q				V
21+15	0.1058	0.02	Q				V
21+20	0.1059	0.01	Q				V
21+25	0.1060	0.01	Q				V
21+30	0.1061	0.01	Q				V
21+35	0.1062	0.01	Q				V
21+40	0.1063	0.02	Q				V
21+45	0.1064	0.02	Q				V
21+50	0.1065	0.01	Q				V
21+55	0.1065	0.01	Q				V
22+ 0	0.1066	0.01	Q				V
22+ 5	0.1067	0.01	Q				V
22+10	0.1068	0.02	Q				V
22+15	0.1069	0.02	Q				V
22+20	0.1070	0.01	Q				V
22+25	0.1071	0.01	Q				V
22+30	0.1072	0.01	Q				V
22+35	0.1072	0.01	Q				V
22+40	0.1073	0.01	Q				V
22+45	0.1074	0.01	Q				V
22+50	0.1074	0.01	Q				V
22+55	0.1075	0.01	Q				V
23+ 0	0.1076	0.01	Q				V
23+ 5	0.1077	0.01	Q				V
23+10	0.1077	0.01	Q				V
23+15	0.1078	0.01	Q				V
23+20	0.1079	0.01	Q				V
23+25	0.1079	0.01	Q				V
23+30	0.1080	0.01	Q				V
23+35	0.1081	0.01	Q				V
23+40	0.1082	0.01	Q				V
23+45	0.1082	0.01	Q				V
23+50	0.1083	0.01	Q				V

23+55	0.1084	0.01	Q				V
24+ 0	0.1085	0.01	Q				V
24+ 5	0.1085	0.01	Q				V
24+10	0.1085	0.00	Q				V
24+15	0.1085	0.00	Q				V

---

# Appendix 7.5: Post-Development Calculations

*Basin Analysis – 2-Year, 24hr*

# Pond Report

## Pond No. 1 - Mapes Industrial - DA A

### Pond Data

Pond storage is based on user-defined values.

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	n/a	0	0
8.00	108.00	n/a	26,993	26,993
8.50	108.50	n/a	2,083	29,075
9.00	109.00	n/a	2,018	31,093
9.50	109.50	n/a	1,935	33,028
10.00	110.00	n/a	1,830	34,858
10.50	110.50	n/a	1,699	36,557
11.00	111.00	n/a	1,536	38,092
11.50	111.50	n/a	1,328	39,420
12.00	112.00	n/a	1,049	40,469
12.50	112.50	n/a	585	41,054

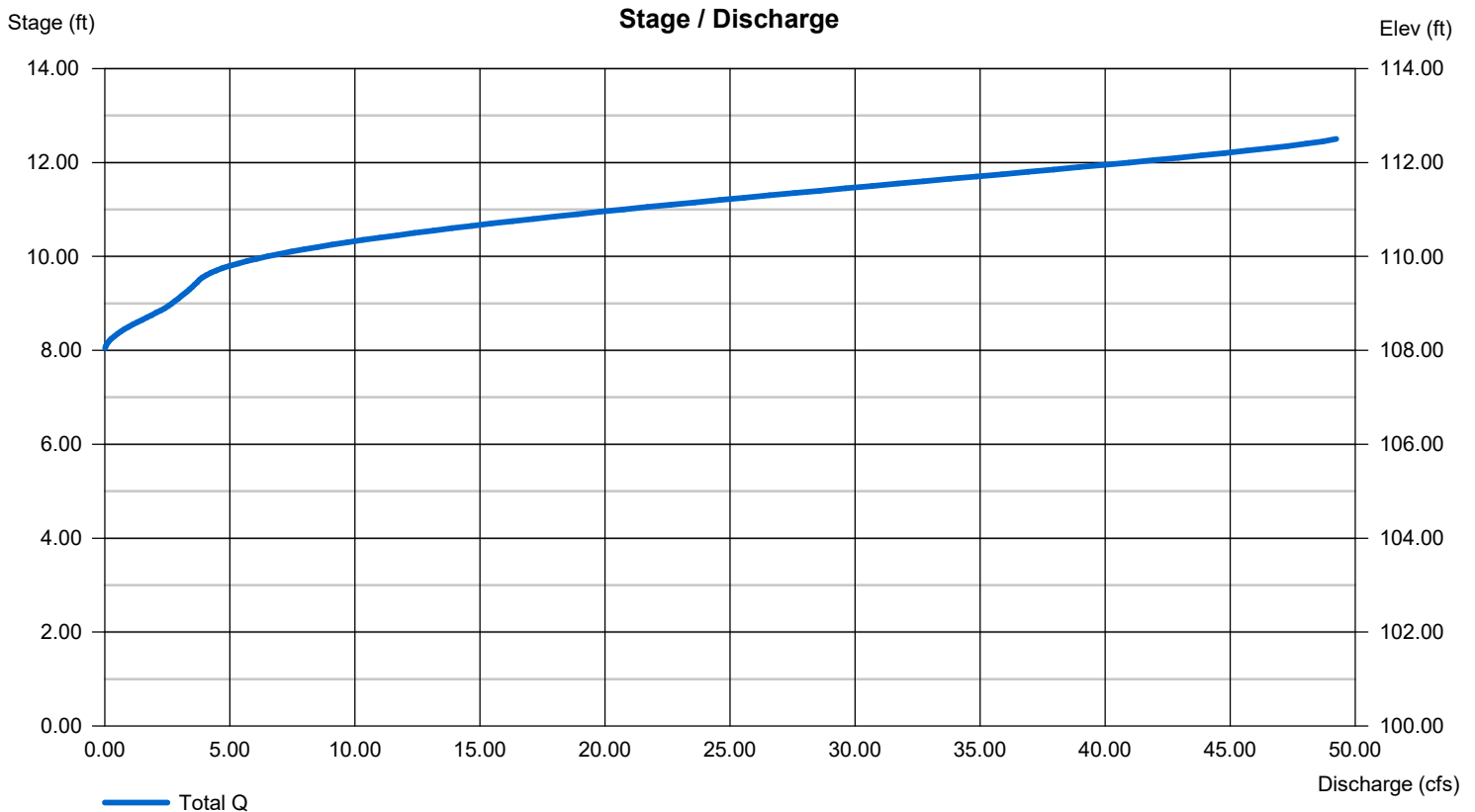
### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	36.00	0.00	0.00
Span (in)	= 12.00	36.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 108.00	109.50	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

### Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.000	(by Wet area)		
TW Elev. (ft)	= 0.00			

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





FLOOD HYDROGRAPH ROUTING PROGRAM  
Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2018  
Study date: 05/30/22

-----  
MAPES AND TRUMBLE INDUSTRIAL FACILITY  
BASIN ROUTING  
POST-DEVELOPMENT CONDITIONS  
2-YEAR STORM, DA A  
-----

Program License Serial Number 6443

-----  
\*\*\*\*\* HYDROGRAPH INFORMATION \*\*\*\*\*

From study/file name: MapesPost2AUH24.rte  
\*\*\*\*\*HYDROGRAPH DATA\*\*\*\*\*  
Number of intervals = 292  
Time interval = 5.0 (Min.)  
Maximum/Peak flow rate = 3.894 (CFS)  
Total volume = 2.366 (Ac.Ft)  
Status of hydrographs being held in storage  
Stream 1 Stream 2 Stream 3 Stream 4 Stream 5  
Peak (CFS) 0.000 0.000 0.000 0.000 0.000  
Vol (Ac.Ft) 0.000 0.000 0.000 0.000 0.000  
\*\*\*\*\*

++++  
Process from Point/Station 0.000 to Point/Station 0.000  
\*\*\*\* RETARDING BASIN ROUTING \*\*\*\*

-----  
User entry of depth-outflow-storage data  
-----

Total number of inflow hydrograph intervals = 292  
Hydrograph time unit = 5.000 (Min.)  
Initial depth in storage basin = 0.00(Ft.)  
-----

-----  
Initial basin depth = 0.00 (Ft.)  
Initial basin storage = 0.00 (Ac.Ft)  
Initial basin outflow = 0.00 (CFS)

-----

-----

Depth vs. Storage and Depth vs. Discharge data:

Basin Depth (Ft.)	Storage (Ac.Ft)	Outflow (CFS)	(S-0*dt/2) (Ac.Ft)	(S+0*dt/2) (Ac.Ft)
0.000	0.000	0.000	0.000	0.000
8.000	0.620	0.001	0.620	0.620
8.500	0.667	0.950	0.664	0.670
9.000	0.714	2.670	0.705	0.723
9.500	0.758	3.780	0.745	0.771
10.000	0.800	6.500	0.778	0.822
10.500	0.839	12.380	0.796	0.882
11.000	0.874	20.750	0.803	0.945
11.500	0.905	30.670	0.799	1.011
12.000	0.929	40.970	0.788	1.070
12.500	0.942	49.240	0.772	1.112

-----

-----

Hydrograph Detention Basin Routing

-----

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

-----

Time (Hours)	Inflow (CFS)	Outflow (CFS)	Storage (Ac.Ft)	.0	1.0	1.95	2.92	3.89	Depth (Ft.)
0.083	0.09	0.00	0.000	O					0.00
0.167	0.20	0.00	0.001	O I					0.02
0.250	0.22	0.00	0.003	O I					0.04
0.333	0.27	0.00	0.004	O I					0.06
0.417	0.33	0.00	0.006	O I					0.08
0.500	0.34	0.00	0.009	O I					0.11
0.583	0.34	0.00	0.011	O I					0.14
0.667	0.34	0.00	0.013	O I					0.17
0.750	0.34	0.00	0.016	O I					0.20
0.833	0.39	0.00	0.018	O I					0.24
0.917	0.44	0.00	0.021	O I					0.27
1.000	0.45	0.00	0.024	O I					0.31
1.083	0.41	0.00	0.027	O I					0.35
1.167	0.36	0.00	0.030	O I					0.39
1.250	0.35	0.00	0.032	O I					0.42
1.333	0.35	0.00	0.035	O I					0.45
1.417	0.34	0.00	0.037	O I					0.48
1.500	0.34	0.00	0.040	O I					0.51
1.583	0.34	0.00	0.042	O I					0.54
1.667	0.34	0.00	0.044	O I					0.57
1.750	0.34	0.00	0.047	O I					0.60
1.833	0.39	0.00	0.049	O I					0.63
1.917	0.44	0.00	0.052	O I					0.67
2.000	0.45	0.00	0.055	O I					0.71
2.083	0.46	0.00	0.058	O I					0.75

2.167	0.46	0.00	0.061	0	I					0.79
2.250	0.46	0.00	0.065	0	I					0.83
2.333	0.46	0.00	0.068	0	I					0.87
2.417	0.46	0.00	0.071	0	I					0.91
2.500	0.46	0.00	0.074	0	I					0.95
2.583	0.51	0.00	0.077	0	I					1.00
2.667	0.56	0.00	0.081	0	I					1.04
2.750	0.57	0.00	0.085	0	I					1.09
2.833	0.57	0.00	0.089	0	I					1.14
2.917	0.57	0.00	0.093	0	I					1.20
3.000	0.57	0.00	0.097	0	I					1.25
3.083	0.57	0.00	0.101	0	I					1.30
3.167	0.57	0.00	0.104	0	I					1.35
3.250	0.57	0.00	0.108	0	I					1.40
3.333	0.57	0.00	0.112	0	I					1.45
3.417	0.57	0.00	0.116	0	I					1.50
3.500	0.57	0.00	0.120	0	I					1.55
3.583	0.57	0.00	0.124	0	I					1.60
3.667	0.57	0.00	0.128	0	I					1.65
3.750	0.57	0.00	0.132	0	I					1.70
3.833	0.62	0.00	0.136	0	I					1.76
3.917	0.67	0.00	0.141	0	I					1.81
4.000	0.68	0.00	0.145	0	I					1.87
4.083	0.69	0.00	0.150	0	I					1.94
4.167	0.69	0.00	0.155	0	I					2.00
4.250	0.69	0.00	0.159	0	I					2.06
4.333	0.73	0.00	0.164	0	I					2.12
4.417	0.79	0.00	0.170	0	I					2.19
4.500	0.80	0.00	0.175	0	I					2.26
4.583	0.80	0.00	0.181	0	I					2.33
4.667	0.80	0.00	0.186	0	I					2.40
4.750	0.80	0.00	0.192	0	I					2.47
4.833	0.85	0.00	0.197	0	I					2.54
4.917	0.90	0.00	0.203	0	I					2.62
5.000	0.91	0.00	0.209	0	I					2.70
5.083	0.82	0.00	0.215	0	I					2.78
5.167	0.72	0.00	0.221	0	I					2.85
5.250	0.70	0.00	0.226	0	I					2.91
5.333	0.74	0.00	0.231	0	I					2.97
5.417	0.79	0.00	0.236	0	I					3.04
5.500	0.80	0.00	0.241	0	I					3.11
5.583	0.85	0.00	0.247	0	I					3.19
5.667	0.90	0.00	0.253	0	I					3.26
5.750	0.91	0.00	0.259	0	I					3.34
5.833	0.91	0.00	0.265	0	I					3.42
5.917	0.92	0.00	0.272	0	I					3.51
6.000	0.92	0.00	0.278	0	I					3.59
6.083	0.96	0.00	0.284	0	I					3.67
6.167	1.01	0.00	0.291	0	I					3.76
6.250	1.02	0.00	0.298	0	I					3.85

6.333	1.03	0.00	0.305	0	I				3.94
6.417	1.03	0.00	0.312	0	I				4.03
6.500	1.03	0.00	0.320	0	I				4.12
6.583	1.08	0.00	0.327	0	I				4.22
6.667	1.13	0.00	0.334	0	I				4.32
6.750	1.14	0.00	0.342	0	I				4.42
6.833	1.14	0.00	0.350	0	I				4.52
6.917	1.15	0.00	0.358	0	I				4.62
7.000	1.15	0.00	0.366	0	I				4.72
7.083	1.15	0.00	0.374	0	I				4.82
7.167	1.15	0.00	0.382	0	I				4.92
7.250	1.15	0.00	0.390	0	I				5.03
7.333	1.19	0.00	0.398	0	I				5.13
7.417	1.24	0.00	0.406	0	I				5.24
7.500	1.25	0.00	0.415	0	I				5.35
7.583	1.31	0.00	0.423	0	I				5.46
7.667	1.36	0.00	0.433	0	I				5.58
7.750	1.37	0.00	0.442	0	I				5.70
7.833	1.42	0.00	0.451	0	I				5.83
7.917	1.47	0.00	0.461	0	I				5.95
8.000	1.48	0.00	0.472	0	I				6.09
8.083	1.58	0.00	0.482	0	I				6.22
8.167	1.68	0.00	0.493	0	I				6.37
8.250	1.71	0.00	0.505	0	I				6.52
8.333	1.71	0.00	0.517	0	I				6.67
8.417	1.72	0.00	0.529	0	I				6.82
8.500	1.72	0.00	0.540	0	I				6.97
8.583	1.77	0.00	0.552	0	I				7.13
8.667	1.82	0.00	0.565	0	I				7.29
8.750	1.83	0.00	0.577	0	I				7.45
8.833	1.88	0.00	0.590	0	I				7.61
8.917	1.93	0.00	0.603	0	I				7.78
9.000	1.94	0.00	0.617	0	I				7.95
9.083	2.04	0.19	0.630	0	I				8.10
9.167	2.14	0.44	0.642	0	I				8.23
9.250	2.16	0.66	0.653	0	I				8.35
9.333	2.22	0.86	0.663	0	I				8.45
9.417	2.27	1.11	0.671	0	I				8.55
9.500	2.28	1.37	0.678	0	I				8.62
9.583	2.34	1.58	0.684	0	I				8.68
9.667	2.39	1.76	0.689	0	I				8.73
9.750	2.40	1.90	0.693	0	I				8.78
9.833	2.45	2.02	0.696	0	I				8.81
9.917	2.50	2.12	0.699	0	I				8.84
10.000	2.51	2.21	0.701	0	I				8.87
10.083	2.19	2.24	0.702	0	I				8.87
10.167	1.83	2.19	0.701	0	I				8.86
10.250	1.76	2.10	0.698	0	I				8.83
10.333	1.73	2.02	0.696	0	I				8.81
10.417	1.72	1.95	0.694	0	I				8.79

10.500	1.72	1.90	0.693			IO			8.78	
10.583	1.95	1.89	0.693			OI			8.77	
10.667	2.21	1.93	0.694			O	I		8.78	
10.750	2.26	2.00	0.696			O	I		8.80	
10.833	2.28	2.06	0.697			O	I		8.82	
10.917	2.29	2.11	0.699				OI		8.84	
11.000	2.29	2.15	0.700				OI		8.85	
11.083	2.24	2.18	0.701				OI		8.86	
11.167	2.19	2.19	0.701				OI		8.86	
11.250	2.18	2.19	0.701				O		8.86	
11.333	2.18	2.18	0.701				O		8.86	
11.417	2.18	2.18	0.701				O		8.86	
11.500	2.18	2.18	0.701				O		8.86	
11.583	2.08	2.17	0.700				O		8.85	
11.667	1.98	2.14	0.699			IO			8.85	
11.750	1.96	2.10	0.698			IO			8.83	
11.833	2.00	2.07	0.698			IO			8.83	
11.917	2.04	2.06	0.697			O			8.82	
12.000	2.06	2.06	0.697			O			8.82	
12.083	2.39	2.10	0.698				O	I	8.83	
12.167	2.75	2.20	0.701					O	I	8.86
12.250	2.82	2.33	0.705					O	I	8.90
12.333	2.90	2.45	0.708					O	I	8.94
12.417	2.96	2.56	0.711					O	I	8.97
12.500	2.97	2.65	0.713					O	I	8.99
12.583	3.07	2.71	0.716					O	I	9.02
12.667	3.17	2.78	0.718					O	I	9.05
12.750	3.19	2.84	0.721					O	I	9.08
12.833	3.25	2.90	0.723					O	I	9.11
12.917	3.30	2.96	0.726					O	I	9.13
13.000	3.32	3.02	0.728					O	I	9.16
13.083	3.56	3.09	0.730					O	I	9.19
13.167	3.81	3.18	0.734					O	I	9.23
13.250	3.86	3.29	0.738					O	I	9.28
13.333	3.89	3.38	0.742					O	I	9.32
13.417	3.89	3.46	0.745					O	I	9.36
13.500	3.89	3.53	0.748					O	I	9.39
13.583	3.37	3.55	0.749					I	O	9.40
13.667	2.82	3.48	0.746					I	O	9.36
13.750	2.70	3.36	0.741					I	O	9.31
13.833	2.65	3.25	0.737					I	O	9.26
13.917	2.63	3.15	0.733					I	O	9.22
14.000	2.63	3.07	0.730					I	O	9.18
14.083	2.82	3.02	0.728					IO		9.16
14.167	3.03	3.00	0.727					O		9.15
14.250	3.07	3.01	0.727					OI		9.15
14.333	3.04	3.02	0.728					O		9.16
14.417	2.99	3.02	0.728					O		9.16
14.500	2.98	3.01	0.728					O		9.15
14.583	2.98	3.01	0.727					O		9.15

14.667	2.98	3.00	0.727				0	9.15
14.750	2.98	3.00	0.727				0	9.15
14.833	2.93	2.99	0.727				0	9.14
14.917	2.88	2.98	0.726				IO	9.14
15.000	2.87	2.96	0.726				IO	9.13
15.083	2.82	2.94	0.725				IO	9.12
15.167	2.77	2.92	0.724				IO	9.11
15.250	2.75	2.89	0.723				IO	9.10
15.333	2.70	2.87	0.722				IO	9.09
15.417	2.65	2.84	0.721				I 0	9.07
15.500	2.64	2.81	0.719				I 0	9.06
15.583	2.45	2.76	0.718				I 0	9.04
15.667	2.24	2.70	0.715				I 0	9.01
15.750	2.20	2.60	0.712				I 0	8.98
15.833	2.18	2.51	0.710				I 0	8.95
15.917	2.18	2.44	0.708				I 0	8.93
16.000	2.18	2.38	0.706				I 0	8.91
16.083	1.47	2.25	0.703			I	0	8.88
16.167	0.71	1.99	0.695	I			0	8.80
16.250	0.55	1.69	0.687	I		0		8.71
16.333	0.48	1.42	0.680	I		0		8.64
16.417	0.46	1.21	0.674	I		0		8.58
16.500	0.46	1.04	0.670	I		0		8.53
16.583	0.41	0.92	0.666	I		0		8.49
16.667	0.36	0.85	0.662	I		0		8.45
16.750	0.35	0.79	0.659	I		0		8.42
16.833	0.35	0.73	0.656	I		0		8.39
16.917	0.34	0.68	0.654	I		0		8.36
17.000	0.34	0.64	0.652	I		0		8.34
17.083	0.44	0.61	0.650	IO				8.32
17.167	0.54	0.59	0.649	0				8.31
17.250	0.56	0.59	0.649	0				8.31
17.333	0.57	0.58	0.649	0				8.31
17.417	0.57	0.58	0.649	0				8.31
17.500	0.57	0.58	0.649	0				8.31
17.583	0.57	0.58	0.649	0				8.30
17.667	0.57	0.58	0.649	0				8.30
17.750	0.57	0.58	0.649	0				8.30
17.833	0.53	0.57	0.648	0				8.30
17.917	0.47	0.56	0.648	IO				8.30
18.000	0.46	0.55	0.647	IO				8.29
18.083	0.46	0.54	0.647	IO				8.28
18.167	0.46	0.53	0.646	IO				8.28
18.250	0.46	0.52	0.646	IO				8.27
18.333	0.46	0.51	0.645	IO				8.27
18.417	0.46	0.51	0.645	IO				8.27
18.500	0.46	0.50	0.645	IO				8.26
18.583	0.41	0.49	0.644	IO				8.26
18.667	0.36	0.48	0.644	IO				8.25
18.750	0.35	0.46	0.643	IO				8.24

18.833	0.30	0.44	0.642	IO					8.23
18.917	0.25	0.42	0.641	IO					8.22
19.000	0.24	0.40	0.640	I 0					8.21
19.083	0.28	0.38	0.639	IO					8.20
19.167	0.33	0.37	0.638	IO					8.19
19.250	0.34	0.36	0.638	0					8.19
19.333	0.39	0.36	0.638	OI					8.19
19.417	0.44	0.37	0.638	0					8.19
19.500	0.45	0.38	0.639	0					8.20
19.583	0.41	0.39	0.639	0					8.20
19.667	0.36	0.39	0.639	IO					8.20
19.750	0.35	0.38	0.639	IO					8.20
19.833	0.30	0.38	0.639	IO					8.20
19.917	0.25	0.36	0.638	0					8.19
20.000	0.24	0.35	0.637	IO					8.18
20.083	0.28	0.33	0.637	0					8.18
20.167	0.33	0.33	0.636	0					8.17
20.250	0.34	0.33	0.636	0					8.17
20.333	0.34	0.33	0.636	0					8.17
20.417	0.34	0.33	0.636	0					8.17
20.500	0.34	0.33	0.637	0					8.18
20.583	0.34	0.34	0.637	0					8.18
20.667	0.34	0.34	0.637	0					8.18
20.750	0.34	0.34	0.637	0					8.18
20.833	0.30	0.34	0.637	0					8.18
20.917	0.25	0.33	0.636	0					8.17
21.000	0.24	0.32	0.636	IO					8.17
21.083	0.28	0.31	0.635	0					8.16
21.167	0.33	0.31	0.635	0					8.16
21.250	0.34	0.31	0.635	0					8.16
21.333	0.29	0.31	0.635	0					8.16
21.417	0.25	0.31	0.635	0					8.16
21.500	0.24	0.30	0.635	IO					8.16
21.583	0.28	0.29	0.634	0					8.15
21.667	0.33	0.29	0.634	0					8.15
21.750	0.34	0.30	0.635	0					8.16
21.833	0.29	0.30	0.635	0					8.16
21.917	0.25	0.30	0.635	0					8.16
22.000	0.24	0.29	0.634	IO					8.15
22.083	0.28	0.29	0.634	0					8.15
22.167	0.33	0.29	0.634	0					8.15
22.250	0.34	0.29	0.634	0					8.15
22.333	0.29	0.30	0.635	0					8.16
22.417	0.25	0.29	0.634	0					8.15
22.500	0.24	0.29	0.634	IO					8.15
22.583	0.23	0.28	0.634	IO					8.15
22.667	0.23	0.27	0.633	IO					8.14
22.750	0.23	0.27	0.633	IO					8.14
22.833	0.23	0.26	0.633	IO					8.14
22.917	0.23	0.26	0.633	IO					8.14

23.000	0.23	0.25	0.633	IO					8.13
23.083	0.23	0.25	0.632	IO					8.13
23.167	0.23	0.25	0.632	IO					8.13
23.250	0.23	0.25	0.632	IO					8.13
23.333	0.23	0.24	0.632	IO					8.13
23.417	0.23	0.24	0.632	0					8.13
23.500	0.23	0.24	0.632	0					8.13
23.583	0.23	0.24	0.632	0					8.13
23.667	0.23	0.24	0.632	0					8.12
23.750	0.23	0.24	0.632	0					8.12
23.833	0.23	0.24	0.632	0					8.12
23.917	0.23	0.23	0.632	0					8.12
24.000	0.23	0.23	0.632	0					8.12
24.083	0.13	0.23	0.631	0					8.12
24.167	0.03	0.21	0.630	IO					8.11
24.250	0.01	0.18	0.629	IO					8.10
24.333	0.00	0.16	0.628	IO					8.08
24.417	0.00	0.14	0.627	IO					8.07
24.500	0.00	0.12	0.626	IO					8.06
24.583	0.00	0.11	0.625	0					8.06
24.667	0.00	0.09	0.625	0					8.05
24.750	0.00	0.08	0.624	0					8.04
24.833	0.00	0.07	0.623	0					8.04
24.917	0.00	0.06	0.623	0					8.03
25.000	0.00	0.05	0.623	0					8.03
25.083	0.00	0.05	0.622	0					8.02
25.167	0.00	0.04	0.622	0					8.02
25.250	0.00	0.03	0.622	0					8.02
25.333	0.00	0.03	0.621	0					8.02
25.417	0.00	0.03	0.621	0					8.01
25.500	0.00	0.02	0.621	0					8.01
25.583	0.00	0.02	0.621	0					8.01
25.667	0.00	0.02	0.621	0					8.01
25.750	0.00	0.02	0.621	0					8.01
25.833	0.00	0.01	0.621	0					8.01
25.917	0.00	0.01	0.621	0					8.01
26.000	0.00	0.01	0.620	0					8.00
26.083	0.00	0.01	0.620	0					8.00
26.167	0.00	0.01	0.620	0					8.00
26.250	0.00	0.01	0.620	0					8.00
26.333	0.00	0.01	0.620	0					8.00
26.417	0.00	0.00	0.620	0					8.00
26.500	0.00	0.00	0.620	0					8.00
26.583	0.00	0.00	0.620	0					8.00
26.667	0.00	0.00	0.620	0					8.00
26.750	0.00	0.00	0.620	0					8.00
26.833	0.00	0.00	0.620	0					8.00
26.917	0.00	0.00	0.620	0					8.00
27.000	0.00	0.00	0.620	0					8.00
27.083	0.00	0.00	0.620	0					8.00

27.167	0.00	0.00	0.620	0					8.00
27.250	0.00	0.00	0.620	0					8.00
27.333	0.00	0.00	0.620	0					8.00
27.417	0.00	0.00	0.620	0					8.00

Remaining water in basin = 0.62 (Ac.Ft)

\*\*\*\*\*HYDROGRAPH DATA\*\*\*\*\*

Number of intervals = 329

Time interval = 5.0 (Min.)

Maximum/Peak flow rate = 3.547 (CFS)

Total volume = 1.746 (Ac.Ft)

Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

\*\*\*\*\*

-----

# Pond Report

## Pond No. 2 - Mapes Industrial - DA B

### Pond Data

Pond storage is based on user-defined values.

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	n/a	0	0
4.50	104.50	n/a	1,257	1,257
5.00	105.00	n/a	200	1,456
5.50	105.50	n/a	196	1,652
6.00	106.00	n/a	190	1,842
6.50	106.50	n/a	180	2,022
7.00	107.00	n/a	165	2,187
7.50	107.50	n/a	145	2,332
8.00	108.00	n/a	116	2,448
8.50	108.50	n/a	65	2,513

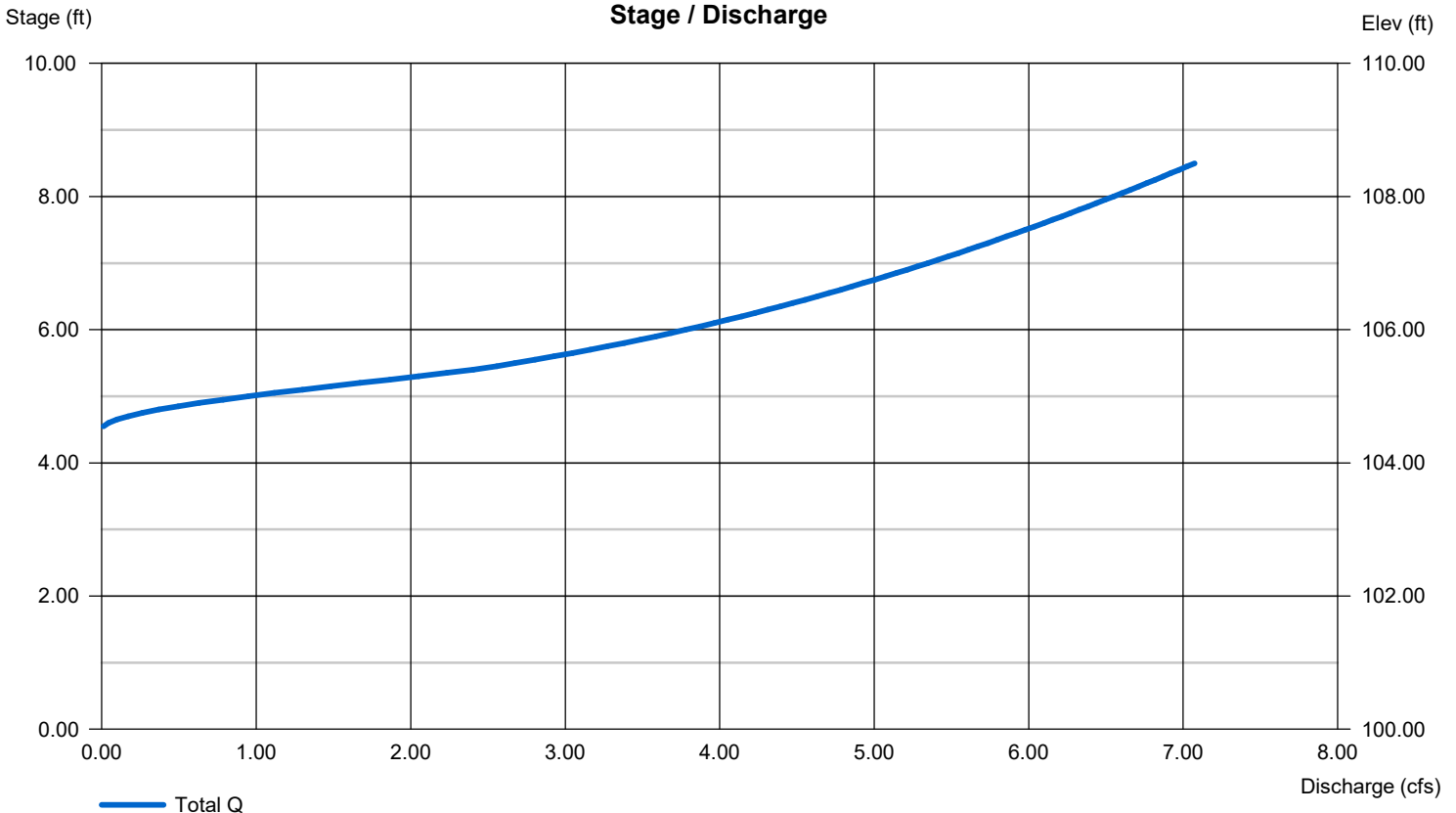
### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 104.50	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

### Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

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





FLOOD HYDROGRAPH ROUTING PROGRAM  
Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2018  
Study date: 05/30/22

-----  
MAPES AND TRUMBLE INDUSTRIAL FACILITY  
BASIN ROUTING  
POST-DEVELOPMENT CONDITIONS  
2-YEAR STORM, DA B  
-----

Program License Serial Number 6443

-----  
\*\*\*\*\* HYDROGRAPH INFORMATION \*\*\*\*\*

From study/file name: MapesPost2BUH24.rte  
\*\*\*\*\*HYDROGRAPH DATA\*\*\*\*\*  
Number of intervals = 291  
Time interval = 5.0 (Min.)  
Maximum/Peak flow rate = 0.179 (CFS)  
Total volume = 0.109 (Ac.Ft)  
Status of hydrographs being held in storage  
Stream 1 Stream 2 Stream 3 Stream 4 Stream 5  
Peak (CFS) 0.000 0.000 0.000 0.000 0.000  
Vol (Ac.Ft) 0.000 0.000 0.000 0.000 0.000  
\*\*\*\*\*

+++++  
Process from Point/Station 0.000 to Point/Station 0.000  
\*\*\*\* RETARDING BASIN ROUTING \*\*\*\*

-----  
User entry of depth-outflow-storage data  
-----

Total number of inflow hydrograph intervals = 291  
Hydrograph time unit = 5.000 (Min.)  
Initial depth in storage basin = 0.00(Ft.)  
-----

-----  
Initial basin depth = 0.00 (Ft.)  
Initial basin storage = 0.00 (Ac.Ft)  
Initial basin outflow = 0.00 (CFS)

-----  
-----

Depth vs. Storage and Depth vs. Discharge data:

Basin Depth (Ft.)	Storage (Ac.Ft)	Outflow (CFS)	(S-0*dt/2) (Ac.Ft)	(S+0*dt/2) (Ac.Ft)
0.000	0.000	0.000	0.000	0.000
4.500	0.029	0.001	0.029	0.029
5.000	0.033	0.950	0.030	0.036
5.500	0.038	2.670	0.029	0.047
6.000	0.042	3.780	0.029	0.055
6.500	0.046	4.630	0.030	0.062
7.000	0.050	5.350	0.032	0.068
7.500	0.054	5.980	0.033	0.075
8.000	0.056	6.550	0.033	0.079
8.500	0.058	7.070	0.034	0.082

-----

-----

Hydrograph Detention Basin Routing

-----

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

-----

Time (Hours)	Inflow (CFS)	Outflow (CFS)	Storage (Ac.Ft)	Depth (Ft.)					
				0	0.0	0.09	0.13	0.18	
0.083	0.01	0.00	0.000	O					0.00
0.167	0.01	0.00	0.000	O I					0.01
0.250	0.01	0.00	0.000	O I					0.02
0.333	0.01	0.00	0.000	O I					0.03
0.417	0.02	0.00	0.000	O I					0.05
0.500	0.02	0.00	0.000	O I					0.07
0.583	0.02	0.00	0.001	O I					0.08
0.667	0.02	0.00	0.001	O I					0.10
0.750	0.02	0.00	0.001	O I					0.12
0.833	0.02	0.00	0.001	O I					0.13
0.917	0.02	0.00	0.001	O I					0.15
1.000	0.02	0.00	0.001	O I					0.18
1.083	0.02	0.00	0.001	O I					0.20
1.167	0.02	0.00	0.001	O I					0.22
1.250	0.02	0.00	0.002	O I					0.23
1.333	0.02	0.00	0.002	O I					0.25
1.417	0.02	0.00	0.002	O I					0.27
1.500	0.02	0.00	0.002	O I					0.28
1.583	0.02	0.00	0.002	O I					0.30
1.667	0.02	0.00	0.002	O I					0.32
1.750	0.02	0.00	0.002	O I					0.33
1.833	0.02	0.00	0.002	O I					0.35
1.917	0.02	0.00	0.002	O I					0.37
2.000	0.02	0.00	0.003	O I					0.39
2.083	0.02	0.00	0.003	O I					0.42
2.167	0.02	0.00	0.003	O I					0.44

2.250	0.02	0.00	0.003	0	I					0.46
2.333	0.02	0.00	0.003	0	I					0.48
2.417	0.02	0.00	0.003	0	I					0.51
2.500	0.02	0.00	0.003	0	I					0.53
2.583	0.02	0.00	0.004	0	I					0.55
2.667	0.03	0.00	0.004	0	I					0.58
2.750	0.03	0.00	0.004	0	I					0.61
2.833	0.03	0.00	0.004	0	I					0.63
2.917	0.03	0.00	0.004	0	I					0.66
3.000	0.03	0.00	0.004	0	I					0.69
3.083	0.03	0.00	0.005	0	I					0.72
3.167	0.03	0.00	0.005	0	I					0.75
3.250	0.03	0.00	0.005	0	I					0.77
3.333	0.03	0.00	0.005	0	I					0.80
3.417	0.03	0.00	0.005	0	I					0.83
3.500	0.03	0.00	0.006	0	I					0.86
3.583	0.03	0.00	0.006	0	I					0.88
3.667	0.03	0.00	0.006	0	I					0.91
3.750	0.03	0.00	0.006	0	I					0.94
3.833	0.03	0.00	0.006	0	I					0.97
3.917	0.03	0.00	0.006	0	I					1.00
4.000	0.03	0.00	0.007	0	I					1.03
4.083	0.03	0.00	0.007	0	I					1.07
4.167	0.03	0.00	0.007	0	I					1.10
4.250	0.03	0.00	0.007	0	I					1.13
4.333	0.03	0.00	0.008	0	I					1.17
4.417	0.04	0.00	0.008	0	I					1.21
4.500	0.04	0.00	0.008	0	I					1.25
4.583	0.04	0.00	0.008	0	I					1.28
4.667	0.04	0.00	0.009	0	I					1.32
4.750	0.04	0.00	0.009	0	I					1.36
4.833	0.04	0.00	0.009	0	I					1.40
4.917	0.04	0.00	0.009	0	I					1.45
5.000	0.04	0.00	0.010	0	I					1.49
5.083	0.04	0.00	0.010	0	I					1.53
5.167	0.03	0.00	0.010	0	I					1.57
5.250	0.03	0.00	0.010	0	I					1.60
5.333	0.03	0.00	0.011	0	I					1.64
5.417	0.04	0.00	0.011	0	I					1.67
5.500	0.04	0.00	0.011	0	I					1.71
5.583	0.04	0.00	0.011	0	I					1.75
5.667	0.04	0.00	0.012	0	I					1.80
5.750	0.04	0.00	0.012	0	I					1.84
5.833	0.04	0.00	0.012	0	I					1.88
5.917	0.04	0.00	0.012	0	I					1.93
6.000	0.04	0.00	0.013	0	I					1.97
6.083	0.04	0.00	0.013	0	I					2.02
6.167	0.05	0.00	0.013	0	I					2.07
6.250	0.05	0.00	0.014	0	I					2.12
6.333	0.05	0.00	0.014	0	I					2.17

6.417	0.05	0.00	0.014	0	I				2.22
6.500	0.05	0.00	0.015	0	I				2.27
6.583	0.05	0.00	0.015	0	I				2.32
6.667	0.05	0.00	0.015	0	I				2.37
6.750	0.05	0.00	0.016	0	I				2.43
6.833	0.05	0.00	0.016	0	I				2.48
6.917	0.05	0.00	0.016	0	I				2.54
7.000	0.05	0.00	0.017	0	I				2.59
7.083	0.05	0.00	0.017	0	I				2.65
7.167	0.05	0.00	0.017	0	I				2.70
7.250	0.05	0.00	0.018	0	I				2.76
7.333	0.06	0.00	0.018	0	I				2.82
7.417	0.06	0.00	0.019	0	I				2.88
7.500	0.06	0.00	0.019	0	I				2.94
7.583	0.06	0.00	0.019	0	I				3.00
7.667	0.06	0.00	0.020	0	I				3.06
7.750	0.06	0.00	0.020	0	I				3.13
7.833	0.07	0.00	0.021	0	I				3.20
7.917	0.07	0.00	0.021	0	I				3.27
8.000	0.07	0.00	0.022	0	I				3.34
8.083	0.07	0.00	0.022	0	I				3.42
8.167	0.08	0.00	0.023	0	I				3.50
8.250	0.08	0.00	0.023	0	I				3.58
8.333	0.08	0.00	0.024	0	I				3.66
8.417	0.08	0.00	0.024	0	I				3.74
8.500	0.08	0.00	0.025	0	I				3.83
8.583	0.08	0.00	0.025	0	I				3.91
8.667	0.08	0.00	0.026	0	I				4.00
8.750	0.08	0.00	0.026	0	I				4.09
8.833	0.09	0.00	0.027	0	I				4.18
8.917	0.09	0.00	0.028	0	I				4.27
9.000	0.09	0.00	0.028	0	I				4.37
9.083	0.09	0.00	0.029	0	I				4.46
9.167	0.10	0.06	0.029		0	I			4.53
9.250	0.10	0.09	0.029			OI			4.55
9.333	0.10	0.10	0.029			OI			4.55
9.417	0.10	0.10	0.029			0			4.55
9.500	0.10	0.10	0.029			0			4.55
9.583	0.11	0.11	0.029			0			4.56
9.667	0.11	0.11	0.029			0			4.56
9.750	0.11	0.11	0.029			0			4.56
9.833	0.11	0.11	0.029			OI			4.56
9.917	0.12	0.11	0.029			0			4.56
10.000	0.12	0.12	0.029			0			4.56
10.083	0.10	0.11	0.029			I 0			4.56
10.167	0.08	0.09	0.029			I 0			4.55
10.250	0.08	0.08	0.029			0			4.54
10.333	0.08	0.08	0.029			0			4.54
10.417	0.08	0.08	0.029			0			4.54
10.500	0.08	0.08	0.029			0			4.54

10.583	0.09	0.08	0.029		OI		4.54
10.667	0.10	0.10	0.029		OI		4.55
10.750	0.10	0.10	0.029		0		4.55
10.833	0.11	0.10	0.029		0		4.55
10.917	0.11	0.10	0.029		0		4.55
11.000	0.11	0.11	0.029		0		4.55
11.083	0.10	0.10	0.029		0		4.55
11.167	0.10	0.10	0.029		IO		4.55
11.250	0.10	0.10	0.029		0		4.55
11.333	0.10	0.10	0.029		0		4.55
11.417	0.10	0.10	0.029		0		4.55
11.500	0.10	0.10	0.029		0		4.55
11.583	0.09	0.10	0.029		IO		4.55
11.667	0.09	0.09	0.029		0		4.55
11.750	0.09	0.09	0.029		0		4.55
11.833	0.09	0.09	0.029		0		4.55
11.917	0.09	0.09	0.029		0		4.55
12.000	0.09	0.09	0.029		0		4.55
12.083	0.11	0.10	0.029		0 I		4.55
12.167	0.13	0.12	0.029		OI		4.56
12.250	0.13	0.13	0.030		OI		4.57
12.333	0.13	0.13	0.030		0		4.57
12.417	0.14	0.13	0.030		0		4.57
12.500	0.14	0.14	0.030		0		4.57
12.583	0.14	0.14	0.030		OI		4.57
12.667	0.15	0.14	0.030		OI		4.58
12.750	0.15	0.15	0.030		0		4.58
12.833	0.15	0.15	0.030		0		4.58
12.917	0.15	0.15	0.030		OI		4.58
13.000	0.15	0.15	0.030		0		4.58
13.083	0.17	0.16	0.030		OI		4.58
13.167	0.18	0.17	0.030		OI		4.59
13.250	0.18	0.18	0.030		0		4.59
13.333	0.18	0.18	0.030		OI		4.59
13.417	0.18	0.18	0.030		OI		4.59
13.500	0.18	0.18	0.030		OI		4.59
13.583	0.15	0.17	0.030		I 0		4.59
13.667	0.13	0.14	0.030		I 0		4.57
13.750	0.12	0.13	0.030		IO		4.57
13.833	0.12	0.12	0.030		0		4.56
13.917	0.12	0.12	0.030		0		4.56
14.000	0.12	0.12	0.030		0		4.56
14.083	0.13	0.13	0.030		OI		4.57
14.167	0.14	0.13	0.030		OI		4.57
14.250	0.14	0.14	0.030		0		4.57
14.333	0.14	0.14	0.030		IO		4.57
14.417	0.14	0.14	0.030		0		4.57
14.500	0.14	0.14	0.030		0		4.57
14.583	0.14	0.14	0.030		0		4.57
14.667	0.14	0.14	0.030		0		4.57

14.750	0.14	0.14	0.030				0	4.57
14.833	0.13	0.14	0.030				0	4.57
14.917	0.13	0.13	0.030				0	4.57
15.000	0.13	0.13	0.030				0	4.57
15.083	0.13	0.13	0.030				0	4.57
15.167	0.13	0.13	0.030				0	4.57
15.250	0.13	0.13	0.030				0	4.57
15.333	0.12	0.12	0.030				0	4.57
15.417	0.12	0.12	0.030				0	4.56
15.500	0.12	0.12	0.030				0	4.56
15.583	0.11	0.12	0.029				IO	4.56
15.667	0.10	0.11	0.029				IO	4.56
15.750	0.10	0.10	0.029				IO	4.55
15.833	0.10	0.10	0.029				0	4.55
15.917	0.10	0.10	0.029				0	4.55
16.000	0.10	0.10	0.029				0	4.55
16.083	0.06	0.08	0.029		I	0		4.54
16.167	0.03	0.05	0.029		I	0		4.53
16.250	0.02	0.03	0.029		IO			4.51
16.333	0.02	0.02	0.029		IO			4.51
16.417	0.02	0.02	0.029		0			4.51
16.500	0.02	0.02	0.029		0			4.51
16.583	0.02	0.02	0.029		0			4.51
16.667	0.02	0.02	0.029		IO			4.51
16.750	0.02	0.02	0.029		0			4.51
16.833	0.02	0.02	0.029		0			4.51
16.917	0.02	0.02	0.029		0			4.51
17.000	0.02	0.02	0.029		0			4.51
17.083	0.02	0.02	0.029		0			4.51
17.167	0.03	0.02	0.029		0			4.51
17.250	0.03	0.03	0.029		0			4.51
17.333	0.03	0.03	0.029		0			4.51
17.417	0.03	0.03	0.029		0			4.51
17.500	0.03	0.03	0.029		0			4.51
17.583	0.03	0.03	0.029		0			4.51
17.667	0.03	0.03	0.029		0			4.51
17.750	0.03	0.03	0.029		0			4.51
17.833	0.02	0.03	0.029		0			4.51
17.917	0.02	0.02	0.029		IO			4.51
18.000	0.02	0.02	0.029		0			4.51
18.083	0.02	0.02	0.029		0			4.51
18.167	0.02	0.02	0.029		0			4.51
18.250	0.02	0.02	0.029		0			4.51
18.333	0.02	0.02	0.029		0			4.51
18.417	0.02	0.02	0.029		0			4.51
18.500	0.02	0.02	0.029		0			4.51
18.583	0.02	0.02	0.029		0			4.51
18.667	0.02	0.02	0.029		IO			4.51
18.750	0.02	0.02	0.029		0			4.51
18.833	0.01	0.01	0.029		0			4.51

18.917	0.01	0.01	0.029	IO					4.51
19.000	0.01	0.01	0.029	0					4.51
19.083	0.01	0.01	0.029	0					4.51
19.167	0.02	0.01	0.029	0					4.51
19.250	0.02	0.02	0.029	0					4.51
19.333	0.02	0.02	0.029	0					4.51
19.417	0.02	0.02	0.029	0					4.51
19.500	0.02	0.02	0.029	0					4.51
19.583	0.02	0.02	0.029	0					4.51
19.667	0.02	0.02	0.029	IO					4.51
19.750	0.02	0.02	0.029	0					4.51
19.833	0.01	0.01	0.029	0					4.51
19.917	0.01	0.01	0.029	IO					4.51
20.000	0.01	0.01	0.029	0					4.51
20.083	0.01	0.01	0.029	0					4.51
20.167	0.02	0.01	0.029	0					4.51
20.250	0.02	0.02	0.029	0					4.51
20.333	0.02	0.02	0.029	0					4.51
20.417	0.02	0.02	0.029	0					4.51
20.500	0.02	0.02	0.029	0					4.51
20.583	0.02	0.02	0.029	0					4.51
20.667	0.02	0.02	0.029	0					4.51
20.750	0.02	0.02	0.029	0					4.51
20.833	0.01	0.01	0.029	0					4.51
20.917	0.01	0.01	0.029	IO					4.51
21.000	0.01	0.01	0.029	0					4.51
21.083	0.01	0.01	0.029	0					4.51
21.167	0.02	0.01	0.029	0					4.51
21.250	0.02	0.02	0.029	0					4.51
21.333	0.01	0.01	0.029	0					4.51
21.417	0.01	0.01	0.029	IO					4.51
21.500	0.01	0.01	0.029	0					4.51
21.583	0.01	0.01	0.029	0					4.51
21.667	0.02	0.01	0.029	0					4.51
21.750	0.02	0.02	0.029	0					4.51
21.833	0.01	0.01	0.029	0					4.51
21.917	0.01	0.01	0.029	IO					4.51
22.000	0.01	0.01	0.029	0					4.51
22.083	0.01	0.01	0.029	0					4.51
22.167	0.02	0.01	0.029	0					4.51
22.250	0.02	0.02	0.029	0					4.51
22.333	0.01	0.01	0.029	0					4.51
22.417	0.01	0.01	0.029	IO					4.51
22.500	0.01	0.01	0.029	0					4.51
22.583	0.01	0.01	0.029	0					4.51
22.667	0.01	0.01	0.029	0					4.51
22.750	0.01	0.01	0.029	0					4.51
22.833	0.01	0.01	0.029	0					4.51
22.917	0.01	0.01	0.029	0					4.51
23.000	0.01	0.01	0.029	0					4.51

23.083	0.01	0.01	0.029	0					4.51
23.167	0.01	0.01	0.029	0					4.51
23.250	0.01	0.01	0.029	0					4.51
23.333	0.01	0.01	0.029	0					4.51
23.417	0.01	0.01	0.029	0					4.51
23.500	0.01	0.01	0.029	0					4.51
23.583	0.01	0.01	0.029	0					4.51
23.667	0.01	0.01	0.029	0					4.51
23.750	0.01	0.01	0.029	0					4.51
23.833	0.01	0.01	0.029	0					4.51
23.917	0.01	0.01	0.029	0					4.51
24.000	0.01	0.01	0.029	0					4.51
24.083	0.01	0.01	0.029	IO					4.50
24.167	0.00	0.00	0.029	0					4.50
24.250	0.00	0.00	0.029	0					4.50
24.333	0.00	0.00	0.029	0					4.50

Remaining water in basin = 0.03 (Ac.Ft)

```

*****HYDROGRAPH DATA*****
      Number of intervals = 292
      Time interval = 5.0 (Min.)
      Maximum/Peak flow rate = 0.179 (CFS)
      Total volume = 0.080 (Ac.Ft)
      Status of hydrographs being held in storage
          Stream 1 Stream 2 Stream 3 Stream 4 Stream 5
      Peak (CFS) 0.000 0.000 0.000 0.000 0.000
      Vol (Ac.Ft) 0.000 0.000 0.000 0.000 0.000
*****

```

-----

# Appendix 8: Source Control

*Pollutant Sources/Source Control Checklist*

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

How to use this worksheet (also see instructions in Section G of the WQMP Template):

1. Review Column 1 and identify which of these potential sources of stormwater pollutants apply to your site. Check each box that applies.
2. Review Column 2 and incorporate all of the corresponding applicable BMPs in your WQMP Exhibit.
3. Review Columns 3 and 4 and incorporate all of the corresponding applicable permanent controls and operational BMPs in your WQMP. Use the format shown in Table G.1 on page 23 of this WQMP Template. Describe your specific BMPs in an accompanying narrative, and explain any special conditions or situations that required omitting BMPs or substituting alternative BMPs for those shown here.

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
<input checked="" type="checkbox"/> A. On-site storm drain inlets	<input checked="" type="checkbox"/> Locations of inlets.	<input checked="" type="checkbox"/> Mark all inlets with the words “Only Rain Down the Storm Drain” or similar. Catch Basin Markers may be available from the Riverside County Flood Control and Water Conservation District, call 951.955.1200 to verify.	<input checked="" type="checkbox"/> Maintain and periodically repaint or replace inlet markings. <input checked="" type="checkbox"/> Provide stormwater pollution prevention information to new site owners, lessees, or operators. <input checked="" type="checkbox"/> See applicable operational BMPs in Fact Sheet SC-44, “Drainage System Maintenance,” in the CASQA Stormwater Quality Handbooks at <a href="http://www.cabmphandbooks.com">www.cabmphandbooks.com</a> <input checked="" type="checkbox"/> Include the following in lease agreements: “Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains.”
<input type="checkbox"/> B. Interior floor drains and elevator shaft sump pumps		<input type="checkbox"/> State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.	<input type="checkbox"/> Inspect and maintain drains to prevent blockages and overflow.
<input type="checkbox"/> C. Interior parking garages		<input type="checkbox"/> State that parking garage floor drains will be plumbed to the sanitary sewer.	<input type="checkbox"/> Inspect and maintain drains to prevent blockages and overflow.

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
<input type="checkbox"/> D1. Need for future indoor & structural pest control		<input type="checkbox"/> Note building design features that discourage entry of pests.	<input type="checkbox"/> Provide Integrated Pest Management information to owners, lessees, and operators.
<input checked="" type="checkbox"/> D2. Landscape/ Outdoor Pesticide Use	<input checked="" type="checkbox"/> Show locations of native trees or areas of shrubs and ground cover to be undisturbed and retained. <input checked="" type="checkbox"/> Show self-retaining landscape areas, if any. <input checked="" type="checkbox"/> Show stormwater treatment and hydrograph modification management BMPs. (See instructions in Chapter 3, Step 5 and guidance in Chapter 5.)	<p>State that final landscape plans will accomplish all of the following.</p> <input checked="" type="checkbox"/> Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. <input checked="" type="checkbox"/> Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution. <input checked="" type="checkbox"/> Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions. <input checked="" type="checkbox"/> Consider using pest-resistant plants, especially adjacent to hardscape. <p>To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.</p>	<input checked="" type="checkbox"/> Maintain landscaping using minimum or no pesticides. <input checked="" type="checkbox"/> See applicable operational BMPs in “What you should know for.....Landscape and Gardening” at <a href="http://rcflood.org/stormwater/Error!">http://rcflood.org/stormwater/Error!</a> <small>Hyperlink reference not valid.</small> <input checked="" type="checkbox"/> Provide IPM information to new owners, lessees and operators.

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
<input type="checkbox"/> E. Pools, spas, ponds, decorative fountains, and other water features.	<input type="checkbox"/> Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet. (Exception: Public pools must be plumbed according to County Department of Environmental Health Guidelines.)	If the Co-Permittee requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.	<input type="checkbox"/> See applicable operational BMPs in “Guidelines for Maintaining Your Swimming Pool, Jacuzzi and Garden Fountain” at <a href="http://rcflood.org/stormwater/">http://rcflood.org/stormwater/</a>
<input type="checkbox"/> F. Food service	<input type="checkbox"/> For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment.  <input type="checkbox"/> On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.	<input type="checkbox"/> Describe the location and features of the designated cleaning area.  <input type="checkbox"/> Describe the items to be cleaned in this facility and how it has been sized to insure that the largest items can be accommodated.	<input type="checkbox"/> See the brochure, “The Food Service Industry Best Management Practices for: Restaurants, Grocery Stores, Delicatessens and Bakeries” at <a href="http://rcflood.org/stormwater/">http://rcflood.org/stormwater/</a>  <b>Provide this brochure to new site owners, lessees, and operators.</b>
<input checked="" type="checkbox"/> G. Refuse areas	<input checked="" type="checkbox"/> Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas.  <input checked="" type="checkbox"/> If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run-on and show locations of berms to prevent runoff from the area.  <input checked="" type="checkbox"/> Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.	<input checked="" type="checkbox"/> State how site refuse will be handled and provide supporting detail to what is shown on plans.  <input checked="" type="checkbox"/> State that signs will be posted on or near dumpsters with the words “Do not dump hazardous materials here” or similar.	<input checked="" type="checkbox"/> State how the following will be implemented:  <b>Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post “no hazardous materials” signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. See Fact Sheet SC-34, “Waste Handling and Disposal” in the CASQA Stormwater Quality Handbooks at <a href="http://www.cabmphandbooks.com">www.cabmphandbooks.com</a></b>

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
<input type="checkbox"/> H. Industrial processes.	<input type="checkbox"/> Show process area.	<input type="checkbox"/> If industrial processes are to be located on site, state: “All process activities to be performed indoors. No processes to drain to exterior or to storm drain system.”	<input type="checkbox"/> See Fact Sheet SC-10, “Non-Stormwater Discharges” in the CASQA Stormwater Quality Handbooks at <a href="http://www.cabmphandbooks.com">www.cabmphandbooks.com</a>  See the brochure “Industrial & Commercial Facilities Best Management Practices for: Industrial, Commercial Facilities” at <a href="http://rcflood.org/stormwater/">http://rcflood.org/stormwater/</a>

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
<p><input type="checkbox"/> I. Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.)</p>	<p><input type="checkbox"/> Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or run-off from area.</p> <p><input type="checkbox"/> Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults.</p> <p><input type="checkbox"/> Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.</p>	<p>Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains.</p> <p>Where appropriate, reference documentation of compliance with the requirements of Hazardous Materials Programs for:</p> <ul style="list-style-type: none"> <li>▪ Hazardous Waste Generation</li> <li>▪ Hazardous Materials Release Response and Inventory</li> <li>▪ California Accidental Release (CalARP)</li> <li>▪ Aboveground Storage Tank</li> <li>▪ Uniform Fire Code Article 80 Section 103(b) &amp; (c) 1991</li> <li>▪ Underground Storage Tank</li> </ul> <p><a href="http://www.cchealth.org/groups/hazmat/">www.cchealth.org/groups/hazmat/</a></p>	<p><input type="checkbox"/> See the Fact Sheets SC-31, “Outdoor Liquid Container Storage” and SC-33, “Outdoor Storage of Raw Materials ” in the CASQA Stormwater Quality Handbooks at <a href="http://www.cabmphandbooks.com">www.cabmphandbooks.com</a></p>

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
<input type="checkbox"/> <b>J. Vehicle and Equipment Cleaning</b>	<input type="checkbox"/> <b>Show on drawings as appropriate:</b> (1) Commercial/industrial facilities having vehicle/equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses. (2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited on-site and hoses are provided with an automatic shut-off to discourage such use). (3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer. (4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.	<input type="checkbox"/> <b>If a car wash area is not provided, describe any measures taken to discourage on-site car washing and explain how these will be enforced.</b>	<b>Describe operational measures to implement the following (if applicable):</b> <input type="checkbox"/> <b>Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system.</b> Refer to “Outdoor Cleaning Activities and Professional Mobile Service Providers” for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at <a href="http://rcflood.org/stormwater/">http://rcflood.org/stormwater/</a> <input type="checkbox"/> <b>Car dealerships and similar may rinse cars with water only.</b>

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
<p><input type="checkbox"/> <b>K. Vehicle/Equipment Repair and Maintenance</b></p>	<p><input type="checkbox"/> Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to prevent run-on and runoff of stormwater.</p> <p><input type="checkbox"/> Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas.</p> <p><input type="checkbox"/> Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.</p>	<p><input type="checkbox"/> State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area.</p> <p><input type="checkbox"/> State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency’s requirements.</p> <p><input type="checkbox"/> State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency’s requirements.</p>	<p>In the Stormwater Control Plan, note that all of the following restrictions apply to use the site:</p> <p><input type="checkbox"/> No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinsewater from parts cleaning into storm drains.</p> <p><input type="checkbox"/> No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately.</p> <p><input type="checkbox"/> No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment.</p> <p>Refer to “Automotive Maintenance &amp; Car Care Best Management Practices for Auto Body Shops, Auto Repair Shops, Car Dealerships, Gas Stations and Fleet Service Operations”. Brochure can be found at <a href="http://rcflood.org/stormwater/">http://rcflood.org/stormwater/</a></p> <p>Refer to Outdoor Cleaning Activities and Professional Mobile Service Providers for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at <a href="http://rcflood.org/stormwater/">http://rcflood.org/stormwater/</a></p>

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
<input type="checkbox"/> L. Fuel Dispensing Areas	<input type="checkbox"/> Fueling areas <sup>6</sup> shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of stormwater to the maximum extent practicable.  <input type="checkbox"/> Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area <sup>1</sup> .] The canopy [or cover] shall not drain onto the fueling area.		<input type="checkbox"/> The property owner shall dry sweep the fueling area routinely. <input type="checkbox"/> See the Fact Sheet SD-30 , “Fueling Areas” in the CASQA Stormwater Quality Handbooks at <a href="http://www.cabmphandbooks.com">www.cabmphandbooks.com</a>

---

<sup>6</sup> The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
<p><input checked="" type="checkbox"/> M. Loading Docks</p>	<p><input checked="" type="checkbox"/> Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct stormwater away from the loading area. Water from loading dock areas shall be drained to the sanitary sewer, or diverted and collected for ultimate discharge to the sanitary sewer.</p> <p><input checked="" type="checkbox"/> Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation.</p> <p><input checked="" type="checkbox"/> Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.</p>		<p><input checked="" type="checkbox"/> Move loaded and unloaded items indoors as soon as possible.</p> <p><input checked="" type="checkbox"/> See Fact Sheet SC-30, “Outdoor Loading and Unloading,” in the CASQA Stormwater Quality Handbooks at <a href="http://www.cabmphandbooks.com">www.cabmphandbooks.com</a></p>

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
<input checked="" type="checkbox"/> N. Fire Sprinkler Test Water		<input checked="" type="checkbox"/> Provide a means to drain fire sprinkler test water to the sanitary sewer.	<input checked="" type="checkbox"/> See the note in Fact Sheet SC-41, “Building and Grounds Maintenance,” in the CASQA Stormwater Quality Handbooks at <a href="http://www.cabmphandbooks.com">www.cabmphandbooks.com</a>
<p>O. Miscellaneous Drain or Wash Water or Other Sources</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Boiler drain lines</li> <li><input type="checkbox"/> Condensate drain lines</li> <li><input type="checkbox"/> Rooftop equipment</li> <li><input type="checkbox"/> Drainage sumps</li> <li><input type="checkbox"/> Roofing, gutters, and trim.</li> <li><input type="checkbox"/> Other sources</li> </ul>		<ul style="list-style-type: none"> <li><input type="checkbox"/> Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system.</li> <li><input type="checkbox"/> Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system.</li> <li><input type="checkbox"/> Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment.</li> <li><input type="checkbox"/> Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water.</li> <li><input type="checkbox"/> Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.</li> </ul> <p>Include controls for other sources as specified by local reviewer.</p>	

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
<input checked="" type="checkbox"/> P. Plazas, sidewalks, and parking lots.			<input checked="" type="checkbox"/> Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.

# Appendix 9: O&M

*Operation and Maintenance Plan and Documentation of Finance, Maintenance and Recording Mechanisms*

To be prepared in Final Engineering

## BMP Inspection and Maintenance

BMP	Responsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Modular Wetland System	Property Owner	Inspect pre-treatment, biofiltration, and discharge chambers to ensure that there is no blockage and excess sediments. See Appendix 10 for more information.	Every 6 months prior to the wet season and 48 hours following a storm event
Underground Detention System	Property Owner	Visual inspection to verify that there is no standing water and excess debris.	Every 6 months prior to the wet season and 48 hours following a storm event
Landscape	Property Owner	Maintain landscape vegetation, slope protection and grades adjacent to hardscape	Bi-Weekly
Refuse Areas	Property Owner	Maintain waste collection areas and vacuum drive aisles and parking areas	Monthly
Loading Docks	Property Owner	Sweep and clear debris from dock areas to remove potential stormwater contaminants.	Monthly
Catch Basins and Inlets	Property Owner	Visual inspection and debris removal	Monthly

# Appendix 10: Educational Materials

*BMP Fact Sheets, Maintenance Guidelines and Other End-User BMP Information*

## BIORETENTION FACILITY BMP FACT SHEET

### Engineered Soil Media Requirements

The engineered soil media shall be comprised of 85 percent mineral component and 15 percent organic component, by volume, drum mixed prior to placement. The mineral component shall be a Class A sandy loam topsoil that meets the range specified in Table 1 below. The organic component shall be nitrogen stabilized compost<sup>1</sup>, such that nitrogen does not leach from the media.

**Table 1: Mineral Component Range Requirements**

Percent Range	Component
70-80	Sand
15-20	Silt
5-10	Clay

The trip ticket, or certificate of compliance, shall be made available to the inspector to prove the engineered mix meets this specification.

### Vegetation Requirements

Vegetative cover is important to minimize erosion and ensure that treatment occurs in the Bioretention Facility. The area should be designed for at least 70 percent mature coverage throughout the Bioretention Facility. To prevent the BMP from being used as walkways, Bioretention Facilities shall be planted with a combination of small trees, densely planted shrubs, and natural grasses. Grasses shall be native or ornamental; preferably ones that do not need to be mowed. The application of fertilizers and pesticides should be minimal. To maintain oxygen levels for the vegetation and promote biodegradation, it is important that vegetation not be completely submerged for any extended period of time. Therefore, a maximum of 6 inches of ponded water shall be used in the design to ensure that plants within the Bioretention Facility remain healthy.

A 2 to 3-inch layer of standard shredded aged hardwood mulch shall be placed as the top layer inside the Bioretention Facility. The 6-inch ponding depth shown in Figure 1 above shall be measured from the top surface of the 2 to 3-inch mulch layer.

### Curb Cuts

To allow water to flow into the Bioretention Facility, 1-foot-wide (minimum) curb cuts should be placed approximately every 10 feet around the perimeter of the Bioretention Facility. Figure 2 shows a curb cut in a Bioretention Facility. Curb cut flow lines must be at or above the  $V_{BMP}$  water surface level.

---

<sup>1</sup> For more information on compost, visit the US Composting Council website at: <http://compostingcouncil.org/>

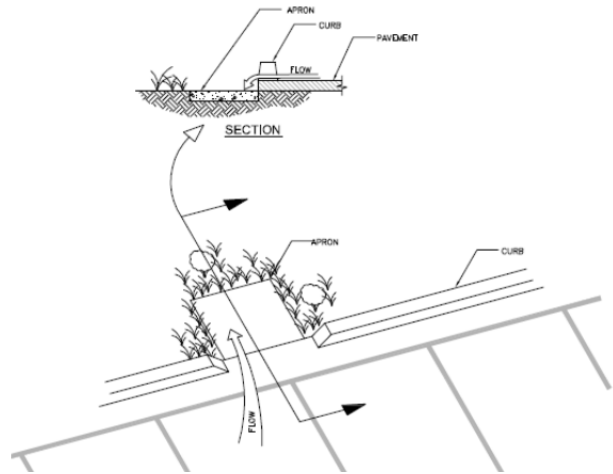
## BIORETENTION FACILITY BMP FACT SHEET



**Figure 2: Curb Cut located in a Bioretention Facility**

To reduce erosion, a gravel pad shall be placed at each inlet point to the Bioretention Facility. The gravel should be 1- to 1.5-inch diameter in size. The gravel should overlap the curb cut opening a minimum of 6 inches. The gravel pad inside the Bioretention Facility should be flush with the finished surface at the curb cut and extend to the bottom of the slope.

In addition, place an apron of stone or concrete, a foot square or larger, inside each inlet to prevent vegetation from growing up and blocking the inlet. See Figure 3.



**Figure 3: Apron located in a Bioretention Facility**

### **Terracing the Landscaped Filter Basin**

It is recommended that Bioretention Facilities be level. In the event the facility site slopes and lacks proper design, water would fill the lowest point of the BMP and then discharge from the basin without being treated. To ensure that the water will be held within the Bioretention Facility on sloped sites, the BMP must be terraced with nonporous check dams to provide the required storage and treatment capacity.

The terraced version of this BMP shall be used on non-flat sites with no more than a 3 percent slope. The surcharge depth cannot exceed 0.5 feet, and side slopes shall not exceed 4:1. Table 2 below shows the spacing of the check dams, and slopes shall be rounded up (i.e., 2.5 percent slope shall use 10' spacing for check dams).

**Table 2: Check Dam Spacing**

6" Check Dam Spacing	
Slope	Spacing
<b>1%</b>	<b>25'</b>
<b>2%</b>	<b>15'</b>
<b>3%</b>	<b>10'</b>

## BIORETENTION FACILITY BMP FACT SHEET

### **Roof Runoff**

Roof downspouts may be directed towards Bioretention Facilities. However, the downspouts must discharge onto a concrete splash block to protect the Bioretention Facility from erosion.

### **Retaining Walls**

It is recommended that Retaining Wall Type 1A, per Caltrans Standard B3-3 or equivalent, be constructed around the entire perimeter of the Bioretention Facility. This practice will protect the sides of the Bioretention Facility from collapsing during construction and maintenance or from high service loads adjacent to the BMP. Where such service loads would not exist adjacent to the BMP, an engineered alternative may be used if signed by a licensed civil engineer.

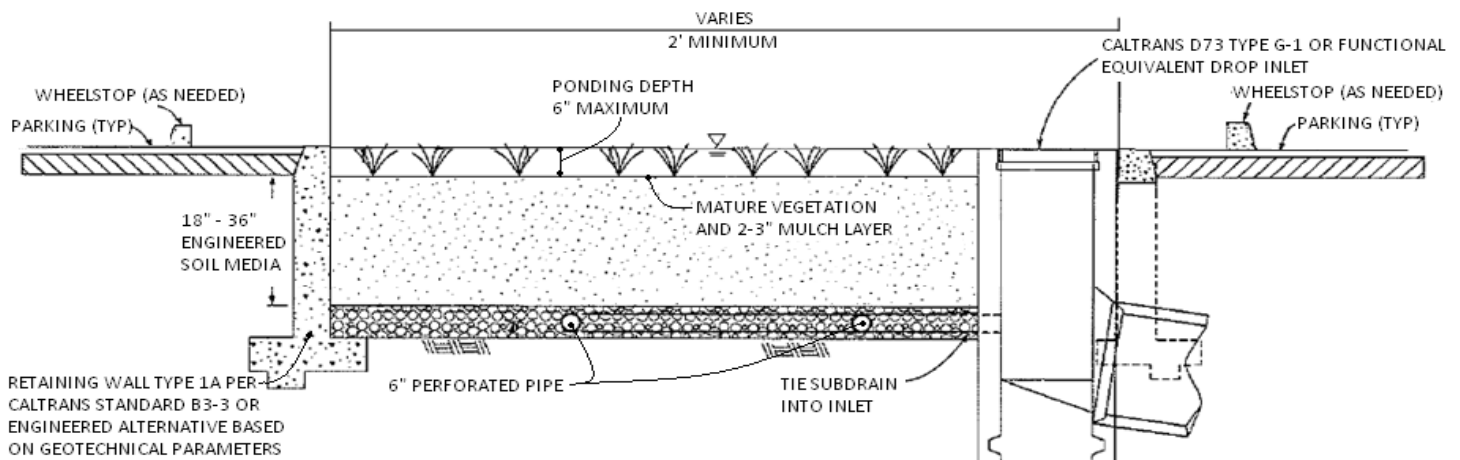
### **Side Slope Requirements**

#### ***Bioretention Facilities Requiring Side Slopes***

The design should assure that the Bioretention Facility does not present a tripping hazard. Bioretention Facilities proposed near pedestrian areas, such as areas parallel to parking spaces or along a walkway, must have a gentle slope to the bottom of the facility. Side slopes inside of a Bioretention Facility shall be 4:1. A typical cross section for the Bioretention Facility is shown in Figure 1.

#### ***Bioretention Facilities Not Requiring Side Slopes***

Where cars park perpendicular to the Bioretention Facility, side slopes are not required. A 6-inch maximum drop may be used, and the Bioretention Facility must be planted with trees and shrubs to prevent pedestrian access. In this case, a curb is not placed around the Bioretention Facility, but wheel stops shall be used to prevent vehicles from entering the Bioretention Facility, as shown in Figure 4.



## BIORETENTION FACILITY BMP FACT SHEET

### **Planter Boxes**

Bioretention Facilities can also be placed above ground as planter boxes. Planter boxes must have a minimum width of 2 feet, a maximum surcharge depth of 6 inches, and no side slopes are necessary. Planter boxes must be constructed so as to ensure that the top surface of the engineered soil media will remain level. This option may be constructed of concrete, brick, stone or other stable materials that will not warp or bend. Chemically treated wood or galvanized steel, which has the ability to contaminate stormwater, should not be used. Planter boxes must be lined with an impermeable liner on all sides, including the bottom. Due to the impermeable liner, the inside bottom of the planter box shall be designed and constructed with a cross fall, directing treated flows within the subdrain layer toward the point where subdrain exits the planter box, and subdrains shall be oriented with drain holes oriented down. These provisions will help avoid excessive stagnant water within the gravel underdrain layer. Similar to the in-ground Bioretention Facility versions, this BMP benefits from healthy plants and biological activity in the root zone. Planter boxes should be planted with appropriately selected vegetation.



**Figure 5: Planter Box**

Source: LA Team Effort

### **Overflow**

An overflow route is needed in the Bioretention Facility design to bypass stored runoff from storm events larger than  $V_{BMP}$  or in the event of facility or subdrain clogging. Overflow systems must connect to an acceptable discharge point, such as a downstream conveyance system as shown in Figure 1 and Figure 4. The inlet to the overflow structure shall be elevated inside the Bioretention Facility to be flush with the ponding surface for the design capture volume ( $V_{BMP}$ ) as shown in Figure 4. This will allow the design capture volume to be fully treated by the Bioretention Facility, and for larger events to safely be conveyed to downstream systems. The overflow inlet shall **not** be located in the entrance of a Bioretention Facility, as shown in Figure 6.

## BIORETENTION FACILITY BMP FACT SHEET

### **Underdrain Gravel and Pipes**

An underdrain gravel layer and pipes shall be provided in accordance with Appendix B – Underdrains.



**Figure 6: Incorrect Placement of an Overflow Inlet.**

### **Inspection and Maintenance Schedule**

The Bioretention Facility area shall be inspected for erosion, dead vegetation, soggy soils, or standing water. The use of fertilizers and pesticides on the plants inside the Bioretention Facility should be minimized.

Schedule	Activity
Ongoing	<ul style="list-style-type: none"><li>• Keep adjacent landscape areas maintained. Remove clippings from landscape maintenance activities.</li><li>• Remove trash and debris</li><li>• Replace damaged grass and/or plants</li><li>• Replace surface mulch layer as needed to maintain a 2-3 inch soil cover.</li></ul>
After storm events	<ul style="list-style-type: none"><li>• Inspect areas for ponding</li></ul>
Annually	<ul style="list-style-type: none"><li>• Inspect/clean inlets and outlets</li></ul>



# Modular Wetlands<sup>®</sup> System Linear

A Stormwater Biofiltration Solution



# OVERVIEW

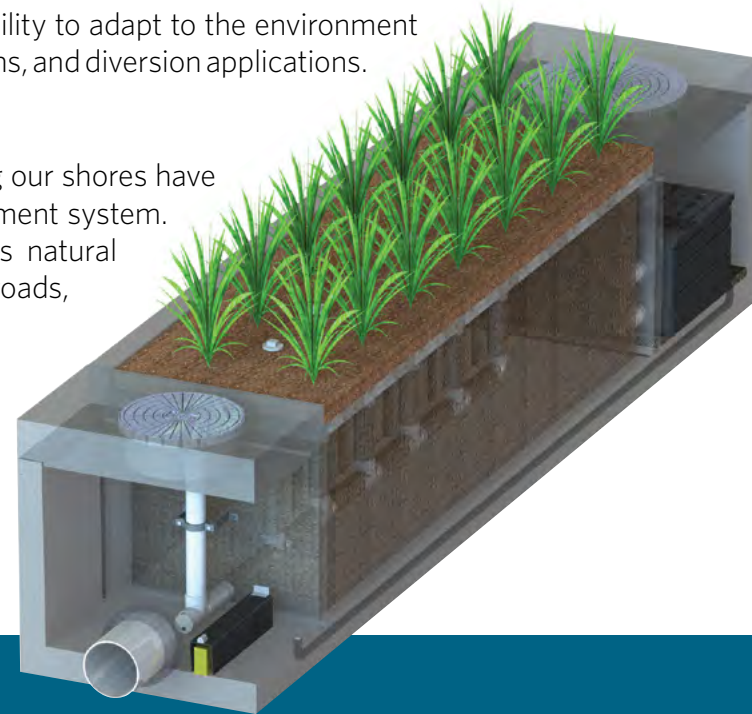
The Bio Clean Modular Wetlands® System Linear (MWS Linear) represents a pioneering breakthrough in stormwater technology as the only biofiltration system to utilize patented horizontal flow, allowing for a smaller footprint, higher treatment capacity, and a wide range of versatility. While most biofilters use little or no pretreatment, the Modular Wetlands System Linear incorporates an advanced pretreatment chamber that includes separation and pre-filter cartridges. In this chamber, sediment and hydrocarbons are removed from runoff before entering the biofiltration chamber, reducing maintenance costs and improving performance.

Horizontal flow also gives the system the unique ability to adapt to the environment through a variety of configurations, bypass orientations, and diversion applications.

## The Urban Impact

For hundreds of years, natural wetlands surrounding our shores have played an integral role as nature's stormwater treatment system. But as cities grow and develop, our environment's natural filtration systems are blanketed with impervious roads, rooftops, and parking lots.

Bio Clean understands this loss and has spent years re-establishing nature's presence in urban areas, and rejuvenating waterways with the MWS Linear.



# PERFORMANCE

The Modular Wetlands® System Linear continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, hydrocarbons, and bacteria. Since 2007 the MWS Linear has been field tested on numerous sites across the country and is proven to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes. In fact, the MWS Linear harnesses some of the same biological processes found in natural wetlands in order to collect, transform, and remove even the most harmful pollutants.

<b>66%</b> REMOVAL OF DISSOLVED ZINC	<b>69%</b> REMOVAL OF TOTAL ZINC	<b>38%</b> REMOVAL OF DISSOLVED COPPER	<b>64%</b> REMOVAL OF TOTAL PHOSPHORUS	
<b>45%</b> REMOVAL OF NITROGEN	<b>50%</b> REMOVAL OF TOTAL COPPER	<b>95%</b> REMOVAL OF MOTOR OIL	<b>67%</b> REMOVAL OF ORTHO PHOSPHORUS	<b>85%</b> REMOVAL OF TSS

# APPROVALS

The Modular Wetlands® System Linear has successfully met years of challenging technical reviews and testing from some of the most prestigious and demanding agencies in the nation and perhaps the world. Here is a list of some of the most high-profile approvals, certifications, and verifications from around the country.



## Washington State Department of Ecology TAFE Approved

The MWS Linear is approved for General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus treatment at 1 gpm/ft<sup>2</sup> loading rate. The highest performing BMP on the market for all main pollutant categories.



## California Water Resources Control Board, Full Capture Certification

The Modular Wetlands® System is the first biofiltration system to receive certification as a full capture trash treatment control device.



## Virginia Department of Environmental Quality, Assignment

The Virginia Department of Environmental Quality assigned the MWS Linear the highest phosphorus removal rating for manufactured treatment devices to meet the new Virginia Stormwater Management Program (VSMP) regulation technical criteria.



## Maryland Department of the Environment, Approved ESD

Granted Environmental Site Design (ESD) status for new construction, redevelopment, and retrofitting when designed in accordance with the design manual.



## MASTEP Evaluation

The University of Massachusetts at Amherst - Water Resources Research Center issued a technical evaluation report noting removal rates up to 84% TSS, 70% total phosphorus, 68.5% total zinc, and more.



## Rhode Island Department of Environmental Management, Approved BMP

Approved as an authorized BMP and noted to achieve the following minimum removal efficiencies: 85% TSS, 60% pathogens, 30% total phosphorus, and 30% total nitrogen.



## Texas Commission on Environmental Quality



## Atlanta Regional Commission

# ADVANTAGES

- HORIZONTAL FLOW BIOFILTRATION
- GREATER FILTER SURFACE AREA
- PRETREATMENT CHAMBER
- PATENTED PERIMETER VOID AREA
- FLOW CONTROL
- NO DEPRESSED PLANTER AREA
- AUTO DRAINDOWN MEANS NO MOSQUITO VECTOR

# OPERATION

The Modular Wetlands® System Linear is the most efficient and versatile biofiltration system on the market, and it is the only system with horizontal flow which:

- Improves performance
- Reduces footprint
- Minimizes maintenance

Figure 1 & Figure 2 illustrate the invaluable benefits of horizontal flow and the multiple treatment stages.

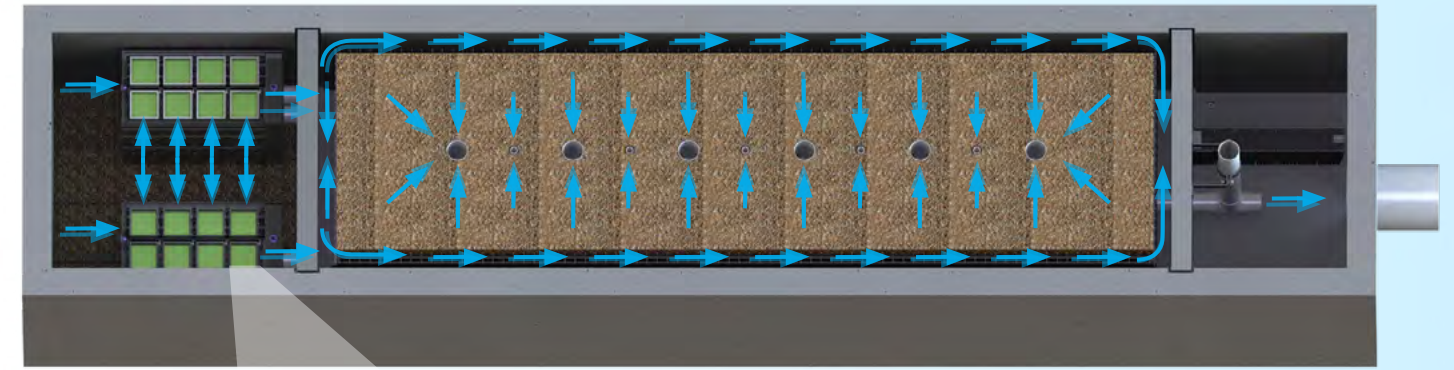


Figure 2,  
Top View

2x to 3x more surface area than traditional downward flow bioretention systems.

## 1 PRETREATMENT

### SEPARATION

- Trash, sediment, and debris are separated before entering the pre-filter boxes
- Designed for easy maintenance access

### PRE-FILTER BOXES

- Over 25 sq. ft. of surface area per box
- Utilizes BioMediaGREEN™ filter material
- Removes over 80% of TSS and 90% of hydrocarbons
- Prevents pollutants that cause clogging from migrating to the biofiltration chamber

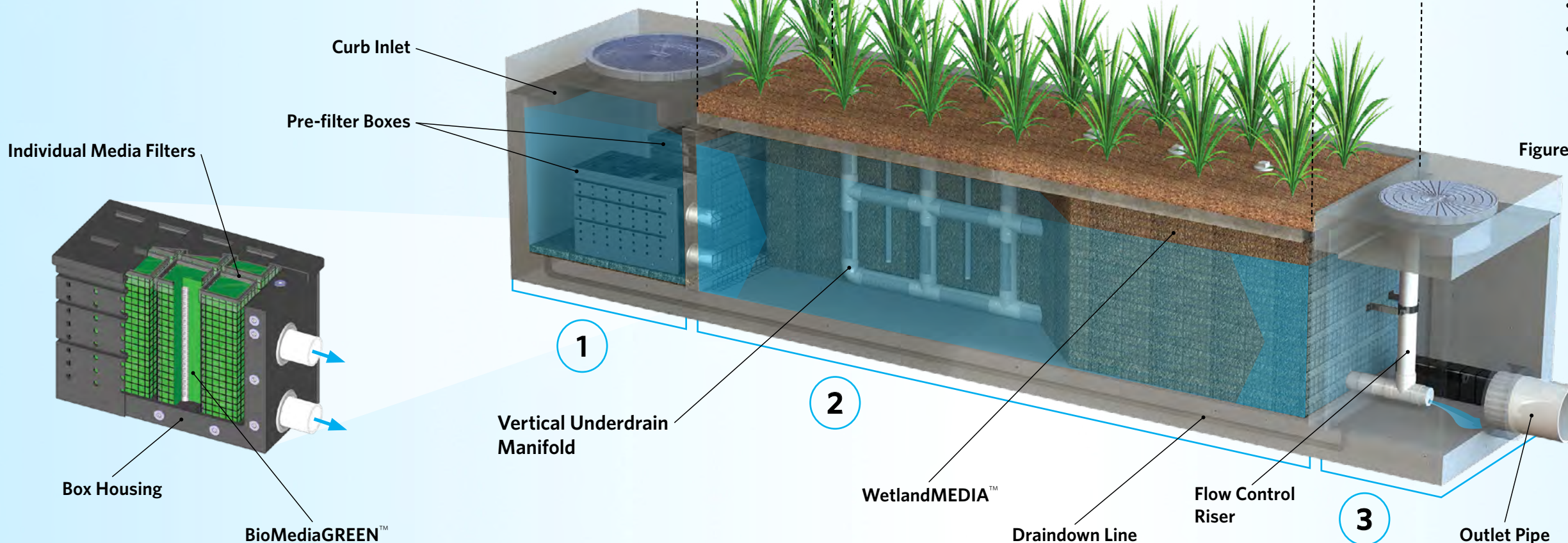


Figure 1

## 2 BIOFILTRATION

### HORIZONTAL FLOW

- Less clogging than downward flow biofilters
- Water flow is subsurface
- Improves biological filtration

### PATENTED PERIMETER VOID AREA

- Vertically extends void area between the walls and the WetlandMEDIA™ on all four sides
- Maximizes surface area of the media for higher treatment capacity

### WETLANDMEDIA

- Contains no organics and removes phosphorus
- Greater surface area and 48% void space
- Maximum evapotranspiration
- High ion exchange capacity and lightweight

## 3 DISCHARGE

### FLOW CONTROL

- Orifice plate controls flow of water through WetlandMEDIA™ to a level lower than the media's capacity
- Extends the life of the media and improves performance

### DRAINDOWN FILTER

- The draindown is an optional feature that completely drains the pretreatment chamber
- Water that drains from the pretreatment chamber between storm events will be treated



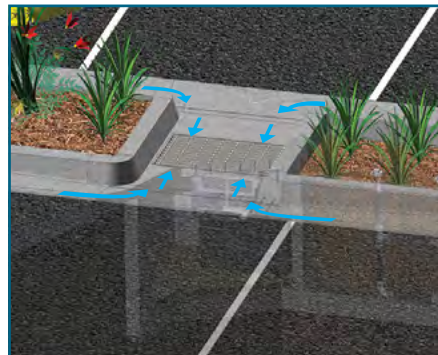
## CONFIGURATIONS

The Modular Wetlands® System Linear is the preferred biofiltration system of civil engineers across the country due to its versatile design. This highly versatile system has available “pipe-in” options on most models, along with built-in curb or grated inlets for simple integration into your storm drain design.



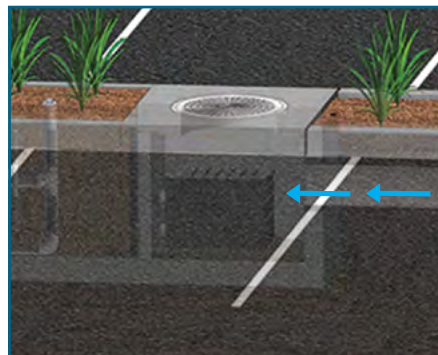
### CURB TYPE

The Curb Type configuration accepts sheet flow through a curb opening and is commonly used along roadways and parking lots. It can be used in sump or flow-by conditions. Length of curb opening varies based on model and size.



### GRATE TYPE

The Grate Type configuration offers the same features and benefits as the Curb Type but with a grated/drop inlet above the systems pretreatment chamber. It has the added benefit of allowing pedestrian access over the inlet. ADA-compliant grates are available to assure easy and safe access. The Grate Type can also be used in scenarios where runoff needs to be intercepted on both sides of landscape islands.



### VAULT TYPE

The system’s patented horizontal flow biofilter is able to accept inflow pipes directly into the pretreatment chamber, meaning the Modular Wetlands® can be used in end-of-the-line installations. This greatly improves feasibility over typical decentralized designs that are required with other biofiltration/bioretenion systems. Another benefit of the “pipe-in” design is the ability to install the system downstream of underground detention systems to meet water quality volume requirements.



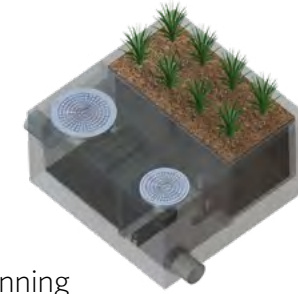
### DOWNSPOUT TYPE

The Downspout Type is a variation of the Vault Type and is designed to accept a vertical downspout pipe from rooftop and podium areas. Some models have the option of utilizing an internal bypass, simplifying the overall design. The system can be installed as a raised planter, and the exterior can be stuccoed or covered with other finishes to match the look of adjacent buildings.

## ORIENTATIONS

### SIDE-BY-SIDE

The Side-By-Side orientation places the pretreatment and discharge chamber adjacent to one another with the biofiltration chamber running parallel on either side. This minimizes the system length, providing a highly compact footprint. It has been proven useful in situations such as streets with directly adjacent sidewalks, as half of the system can be placed under that sidewalk. This orientation also offers internal bypass options as discussed below.



### END-TO-END

The End-To-End orientation places the pretreatment and discharge chambers on opposite ends of the biofiltration chamber, therefore minimizing the width of the system to 5 ft. (outside dimension). This orientation is perfect for linear projects and street retrofits where existing utilities and sidewalks limit the amount of space available for installation. One limitation of this orientation is that bypass must be external.



## BYPASS

### INTERNAL BYPASS WEIR (SIDE-BY-SIDE ONLY)

The Side-By-Side orientation places the pretreatment and discharge chambers adjacent to one another allowing for integration of internal bypass. The wall between these chambers can act as a bypass weir when flows exceed the system’s treatment capacity, thus allowing bypass from the pretreatment chamber directly to the discharge chamber.

### EXTERNAL DIVERSION WEIR STRUCTURE

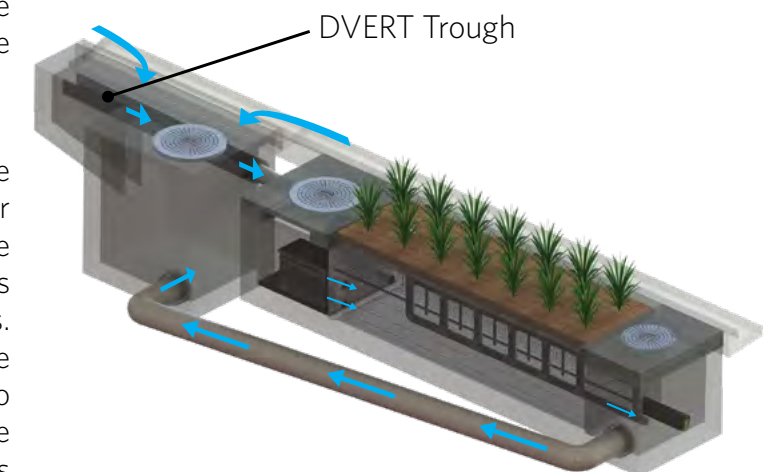
This traditional offline diversion method can be used with the Modular Wetlands® System Linear in scenarios where runoff is being piped to the system. These simple and effective structures are generally configured with two outflow pipes. The first is a smaller pipe on the upstream side of the diversion weir - to divert low flows over to the MWS Linear for treatment. The second is the main pipe that receives water once the system has exceeded treatment capacity and water flows over the weir.

### FLOW-BY-DESIGN

This method is one in which the system is placed just upstream of a standard curb or grate inlet to intercept the first flush. Higher flows simply pass by the MWS Linear and into the standard inlet downstream.

### DVERT LOW FLOW DIVERSION

This simple yet innovative diversion trough can be installed in existing or new curb and grate inlets to divert the first flush to the Modular Wetlands® System Linear via pipe. It works similar to a rain gutter and is installed just below the opening into the inlet. It captures the low flows and channels



them over to a connecting pipe exiting out the wall of the inlet and leading to the MWS Linear. The DVERT is perfect for retrofit and green street applications that allow the system to be installed anywhere space is available.

# SPECIFICATIONS

## FLOW-BASED DESIGNS

The Modular Wetlands® System Linear can be used in stand-alone applications to meet treatment flow requirements, and since it is the only biofiltration system that can accept inflow pipes several feet below the surface, it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

MODEL #	DIMENSIONS	WETLAND MEDIA SURFACE AREA (sq. ft.)	TREATMENT FLOW RATE (cfs)
MWS-L-4-4	4' x 4'	23	0.052
MWS-L-4-6	4' x 6'	32	0.073
MWS-L-4-8	4' x 8'	50	0.115
MWS-L-4-13	4' x 13'	63	0.144
MWS-L-4-15	4' x 15'	76	0.175
MWS-L-4-17	4' x 17'	90	0.206
MWS-L-4-19	4' x 19'	103	0.237
MWS-L-4-21	4' x 21'	117	0.268
MWS-L-6-8	7' x 9'	64	0.147
MWS-L-8-8	8' x 8'	100	0.230
MWS-L-8-12	8' x 12'	151	0.346
MWS-L-8-16	8' x 16'	201	0.462
MWS-L-8-20	9' x 21'	252	0.577
MWS-L-8-24	9' x 25'	302	0.693
MWS-L-10-20	10' x 20'	302	0.693

# VOLUME-BASED DESIGNS

## HORIZONTAL FLOW BIOFILTRATION ADVANTAGE



### MODULAR WETLANDS® SYSTEM LINEAR WITH URBANPOND™ PRESTORAGE

In the example above, the Modular Wetlands® System Linear is installed downstream of the UrbanPond storage system. The MWS Linear is designed for the water quality volume and will treat and discharge the required volume within local draindown time requirements. The MWS Linear's unique horizontal flow design, gives it benefits no other biofilter has - the ability to be placed downstream of detention ponds, extended dry detention basins, underground storage systems and permeable paver reservoirs. The system's horizontal flow configuration and built-in orifice control allows it to be installed with just 6" of fall between inlet and outlet pipe for a simple connection to projects with shallow downstream tie-in points.

UrbanPond  
Single and Double Modules



### DESIGN SUPPORT

Bio Clean engineers are trained to provide you with superior support for all volume sizing configurations throughout the country. Our vast knowledge of state and local regulations allow us to quickly and efficiently size a system to maximize feasibility. Volume control and hydromodification regulations are expanding the need to decrease the cost and size of your biofiltration system. Bio Clean will help you realize these cost savings with the MWS Linear, the only biofilter than can be used downstream of storage BMPs.

## ADVANTAGES

- LOWER COST THAN FLOW-BASED DESIGN
- MEETS LID REQUIREMENTS
- BUILT-IN ORIFICE CONTROL STRUCTURE
- WORKS WITH DEEP INSTALLATIONS

# APPLICATIONS

The Modular Wetlands® System Linear has been successfully used on numerous new construction and retrofit projects. The system's superior versatility makes it beneficial for a wide range of stormwater and waste water applications - treating rooftops, streetscapes, parking lots, and industrial sites.



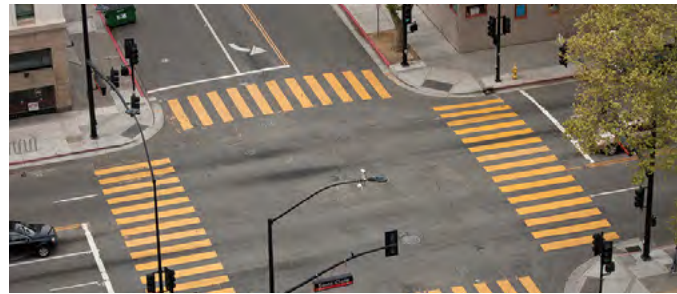
## INDUSTRIAL

Many states enforce strict regulations for discharges from industrial sites. The MWS Linear has helped various sites meet difficult EPA-mandated effluent limits for dissolved metals and other pollutants.



## RESIDENTIAL

Low to high density developments can benefit from the versatile design of the MWS Linear. The system can be used in both decentralized LID design and cost-effective end-of-the-line configurations.



## STREETS

Street applications can be challenging due to limited space. The MWS Linear is very adaptable, and it offers the smallest footprint to work around the constraints of existing utilities on retrofit projects.



## PARKING LOTS

Parking lots are designed to maximize space and the Modular Wetlands® 4 ft. standard planter width allows for easy integration into parking lot islands and other landscape medians.



## COMMERCIAL

Compared to bioretention systems, the MWS Linear can treat far more area in less space, meeting treatment and volume control requirements.



## MIXED USE

The MWS Linear can be installed as a raised planter to treat runoff from rooftops or patios, making it perfect for sustainable "live-work" spaces.

### More applications include:

- Agriculture
- Reuse
- Low Impact Development
- Waste Water

# PLANT SELECTION

Abundant plants, trees, and grasses bring value and an aesthetic benefit to any urban setting, but those in the Modular Wetlands® System Linear do even more - they increase pollutant removal. What's not seen, but very important, is that below grade, the stormwater runoff/flow is being subjected to nature's secret weapon: a dynamic physical, chemical, and biological process working to break down and remove non-point source pollutants. The flow rate is controlled in the MWS Linear, giving the plants more contact time so that pollutants are more successfully decomposed, volatilized, and incorporated into the biomass of the Modular Wetlands® micro/macro flora and fauna.



A wide range of plants are suitable for use in the Modular Wetlands®, but selections vary by location and climate. View suitable plants by visiting [biocleanenvironmental.com/plants](http://biocleanenvironmental.com/plants).

# INSTALLATION



The Modular Wetlands® System Linear is simple, easy to install, and has a space-efficient design that offers lower excavation and installation costs compared to traditional tree-box type systems. The structure of the system resembles precast catch basin or utility vaults and is installed in a similar fashion.

The system is delivered fully assembled for quick installation. Generally, the structure can be unloaded and set in place in 15 minutes. Our experienced team of field technicians is available to supervise installations and provide technical support.

# MAINTENANCE



Reduce your maintenance costs, man hours, and materials with the Modular Wetlands® System Linear. Unlike other biofiltration systems that provide no pretreatment, the MWS Linear is a self-contained treatment train which incorporates simple and effective pretreatment.

Maintenance requirements for the biofilter itself are almost completely eliminated, as the pretreatment chamber removes and isolates trash, sediments, and hydrocarbons. What's left is the simple maintenance of an easily accessible pretreatment chamber that can be cleaned by hand or with a standard vac truck. Only periodic replacement of low-cost media in the pre-filter boxes is required for long-term operation, and there is absolutely no need to replace expensive biofiltration media.



**Bio  Clean**  
A Forterra Company

5796 Armada Drive Suite 250  
Carlsbad, CA 92008  
855.566.3938  
stormwater@forterrabp.com  
biocleanenvironmental.com



# Modular Wetlands<sup>®</sup> Linear

A Stormwater Biofiltration Solution

## OPERATION & MAINTENANCE MANUAL



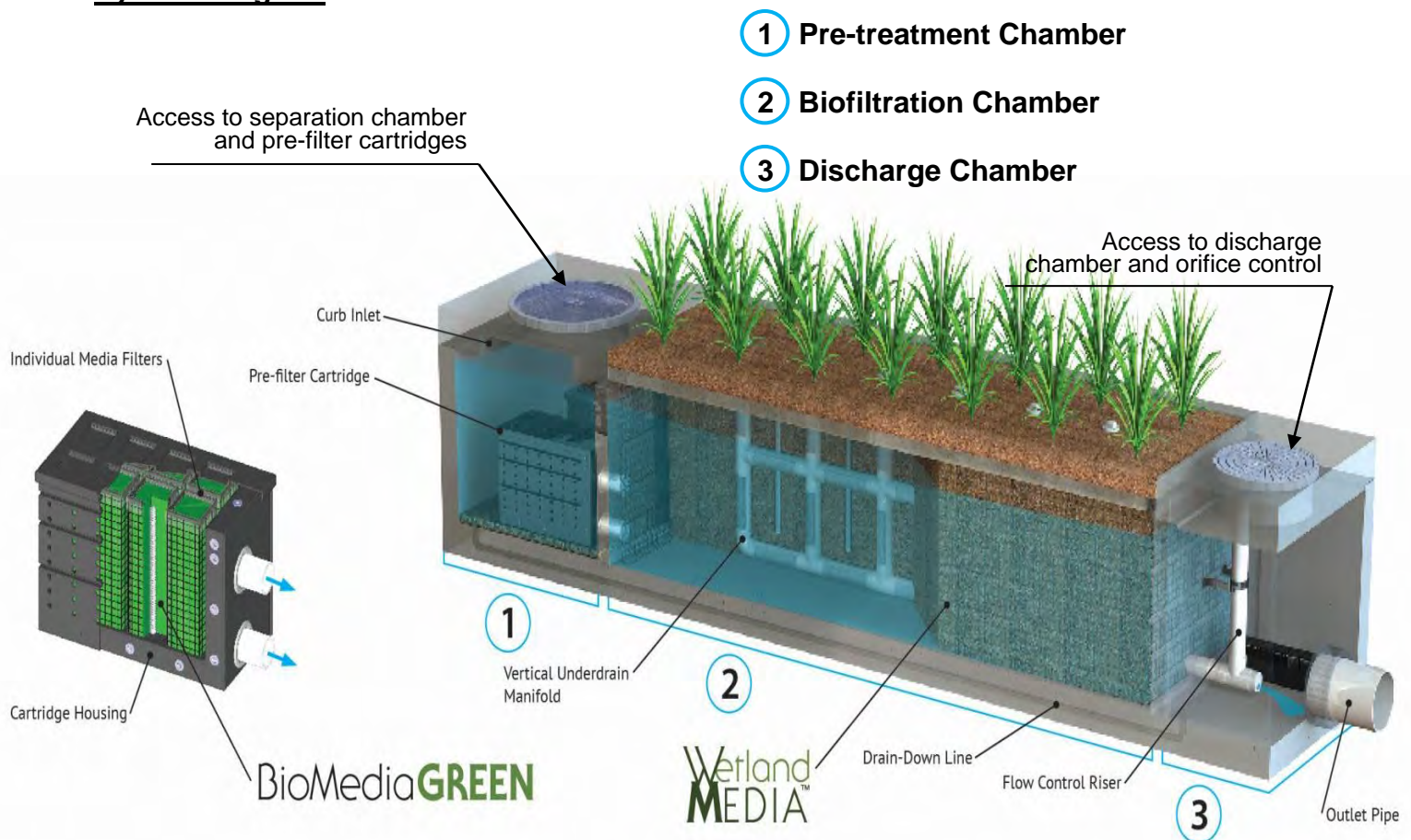


# Inspection Guidelines for Modular Wetland System - Linear

## Inspection Summary

- Inspect Pre-Treatment, Biofiltration and Discharge Chambers – average inspection interval is 6 to 12 months.
  - *(15 minute average inspection time).*
- NOTE: Pollutant loading varies greatly from site to site and no two sites are the same. Therefore, the first year requires inspection monthly during the wet season and every other month during the dry season in order to observe and record the amount of pollutant loading the system is receiving.

## System Diagram



## Inspection Overview

As with all stormwater BMPs inspection and maintenance on the MWS Linear is necessary. Stormwater regulations require that all BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess the site specific loading conditions. This is recommended because pollutant loading and pollutant characteristics can vary greatly from site to site. Variables such as nearby soil erosion or construction sites, winter sanding on roads, amount of daily traffic and land use can increase pollutant loading on the system. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years to ensure appropriate maintenance is provided. Without appropriate maintenance a BMP will exceed its storage capacity which can negatively affect its continued performance in removing and retaining captured pollutants.

### Inspection Equipment

Following is a list of equipment to allow for simple and effective inspection of the MWS Linear:

- Modular Wetland Inspection Form
- Flashlight
- Manhole hook or appropriate tools to remove access hatches and covers
- Appropriate traffic control signage and procedures
- Measuring pole and/or tape measure.
- Protective clothing and eye protection.
- 7/16" open or closed ended wrench.
- Large permanent black marker (initial inspections only – first year)
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections of the system.





## **Inspection Steps**

The core to any successful stormwater BMP maintenance program is routine inspections. The inspection steps required on the MWS Linear are quick and easy. As mentioned above the first year should be seen as the maintenance interval establishment phase. During the first year more frequent inspections should occur in order to gather loading data and maintenance requirements for that specific site. This information can be used to establish a base for long term inspection and maintenance interval requirements.

The MWS Linear can be inspected through visual observation without entry into the system. All necessary pre-inspection steps must be carried out before inspection occurs, especially traffic control and other safety measures to protect the inspector and near-by pedestrians from any dangers associated with an open access hatch or manhole. Once these access covers have been safely opened the inspection process can proceed:

- Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other info (see inspection form).
- Observe the inside of the system through the access hatches. If minimal light is available and vision into the unit is impaired utilize a flashlight to see inside the system and all of its chambers.
- Look for any out of the ordinary obstructions in the inflow pipe, pre-treatment chamber, biofiltration chamber, discharge chamber or outflow pipe. Write down any observations on the inspection form.
- Through observation and/or digital photographs estimate the amount of trash, debris and sediment accumulated in the pre-treatment chamber. Utilizing a tape measure or measuring stick estimate the amount of trash, debris and sediment in this chamber. Record this depth on the inspection form.

- Through visual observation inspect the condition of the pre-filter cartridges. Look for excessive build-up of sediments on the cartridges, any build-up on the top of the cartridges, or clogging of the holes. Record this information on the inspection form. The pre-filter cartridges can further be inspected by removing the cartridge tops and assessing the color of the BioMediaGREEN filter cubes (requires entry into pre-treatment chamber – see notes above regarding confined space entry). Record the color of the material. New material is a light green in color. As the media becomes clogged it will turn darker in color, eventually becoming dark brown or black. Using the below color indicator record the percentage of media exhausted.



The biofiltration chamber is generally maintenance free due to the system's advanced pre-treatment chamber. For units which have open planters with vegetation it is recommended that the vegetation be inspected. Look for any plants that are dead or showing signs of disease or other negative stressors. Record the general health of the plants on the inspection and indicate through visual observation or digital photographs if trimming of the vegetation is needed. The discharge chamber houses the orifice control structure, drain down filter and is connected to the outflow pipe. It is important to check to ensure the orifice is in proper operating conditions and free of any obstructions. It is also important to assess the condition of the drain down filter media which utilizes a block form of the BioMediaGREEN. Assess in the same manner as the cubes in the Pre-Filter Cartridge as mentioned above. Generally, the discharge chamber will be clean and free of debris. Inspect the water marks on the side walls. If possible, inspect the discharge chamber during a rain event to assess the amount of flow leaving the system while it is at 100% capacity (pre-treatment chamber water level at peak hydraulic grade lines or HGL). The water level of the flowing water should be compared to the watermark level on the side walls which is an indicator of the highest discharge rate the system achieved when initially installed. Record on the form if there is any difference in level from watermark in inches.

- NOTE: During the first few storms the water level in the outflow chamber should be observed and a 6 inch long horizontal watermark line drawn (using a large permanent marker) at the water level in the discharge chamber while the system is operating at 100% capacity. The diagram below illustrates where a line should be drawn. This line is a reference point for future inspections of the system:



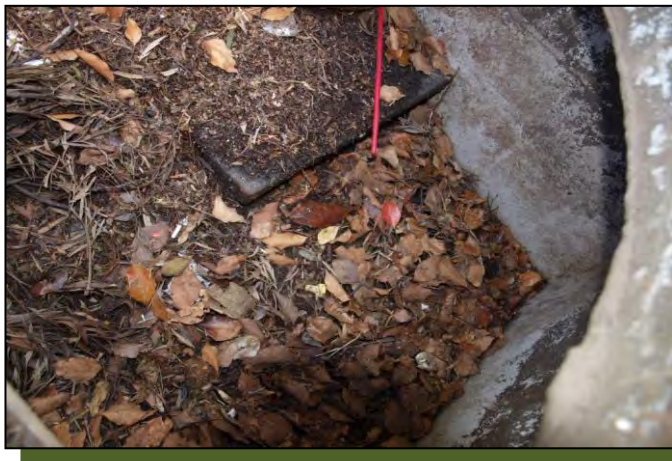
Using a permanent marker draw a 6 inch long horizontal line, as shown, at the higher water level in the MWS Linear discharge chamber.

- Water level in the discharge chamber is a function of flow rate and pipe size. Observation of water level during the first few months of operation can be used as a benchmark level for future inspections. The initial mark and all future observations shall be made when system is at 100% capacity (water level at maximum level in pre-treatment chamber). If future water levels are below this mark when system is at 100% capacity this is an indicator that maintenance to the pre-filter cartridges may be needed.
- *Finalize inspection report for analysis by the maintenance manager to determine if maintenance is required.*

## **Maintenance Indicators**

Based upon observations made during inspection, maintenance of the system may be required based on the following indicators:

- Missing or damaged internal components or cartridges.
- Obstructions in the system or its inlet or outlet.
- Excessive accumulation of floatables in the pre-treatment chamber in which the length and width of the chamber is fully impacted more than 18”.



Excessive accumulation of sediment in the pre-treatment chamber of more than 6 inches in depth.



- Excessive accumulation of sediment on the BioMediaGREEN media housed within the pre-filter cartridges. The following chart shows photos of the condition of the BioMediaGREEN contained within the pre-filter cartridges. When media is more than 85% clogged replacement is required.



- Excessive accumulation of sediment on the BioMediaGREEN media housed within the drain down filter. The following photos show of the condition of the BioMediaGREEN contained within the drain down filter. When media is more than 85% clogged replacement is required.



- Overgrown vegetation.



- Water level in discharge chamber during 100% operating capacity (pre-treatment chamber water level at max height) is lower than the watermark by 20%.



## **Inspection Notes**

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.
2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.
3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.
4. Entry into chambers may require confined space training based on state and local regulations.
5. No fertilizer shall be used in the Biofiltration Chamber.
6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may not require irrigation after initial establishment.

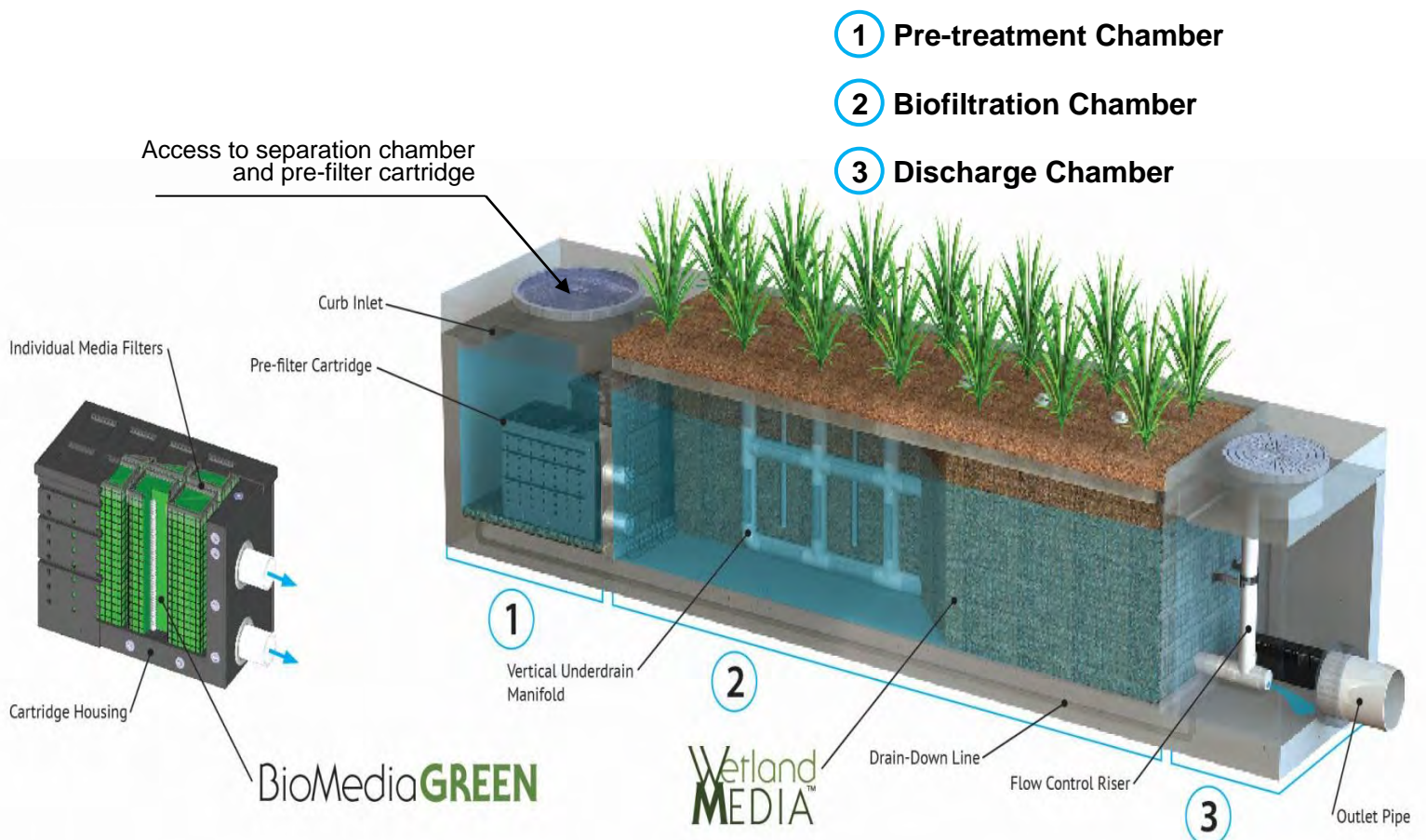


# Maintenance Guidelines for Modular Wetland System - Linear

## Maintenance Summary

- Remove Sediment from Pre-Treatment Chamber – average maintenance interval is 12 to 24 months.
  - (10 minute average service time).
- Replace Pre-Filter Cartridge Media – average maintenance interval 12 to 24 months.
  - (10-15 minute per cartridge average service time).
- Trim Vegetation – average maintenance interval is 6 to 12 months.
  - (Service time varies).

## System Diagram



## Maintenance Overview

The time has come to maintain your Modular Wetland System Linear (MWS Linear). To ensure successful and efficient maintenance on the system we recommend the following. The MWS Linear can be maintained by removing the access hatches over the systems various chambers. All necessary pre-maintenance steps must be carried out before maintenance occurs, especially traffic control and other safety measures to protect the inspector and near-by pedestrians from any dangers associated with an open access hatch or manhole. Once traffic control has been set up per local and state regulations and access covers have been safely opened the maintenance process can begin. It should be noted that some maintenance activities require confined space entry. All confined space requirements must be strictly followed before entry into the system. In addition the following is recommended:

- Prepare the maintenance form by writing in the necessary information including project name, location, date & time, unit number and other info (see maintenance form).
- Set up all appropriate safety and cleaning equipment.
- Ensure traffic control is set up and properly positioned.
- Prepare a pre-checks (OSHA, safety, confined space entry) are performed.

### Maintenance Equipment

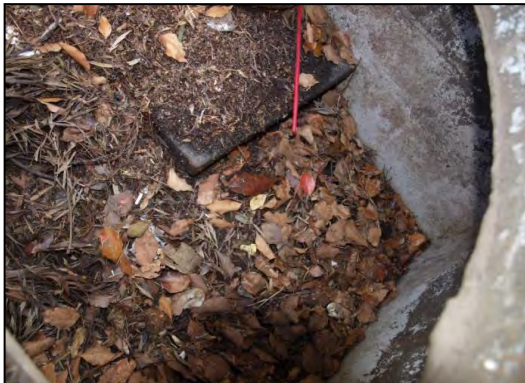
Following is a list of equipment required for maintenance of the MWS Linear:

- Modular Wetland Maintenance Form
- Manhole hook or appropriate tools to access hatches and covers
- Protective clothing, flashlight and eye protection.
- 7/16" open or closed ended wrench.
- Vacuum assisted truck with pressure washer.
- Replacement BioMediaGREEN for Pre-Filter Cartridges if required (order from manufacturer).



## Maintenance Steps

1. Pre-treatment Chamber (bottom of chamber)
  - A. Remove access hatch or manhole cover over pre-treatment chamber and position vacuum truck accordingly.
  - B. With a pressure washer spray down pollutants accumulated on walls and pre-filter cartridges.
  - C. Vacuum out Pre-Treatment Chamber and remove all accumulated pollutants including trash, debris and sediments. Be sure to vacuum the floor until pervious pavers are visible and clean.
  - D. If Pre-Filter Cartridges require media replacement move onto step 2. If not, replace access hatch or manhole cover.



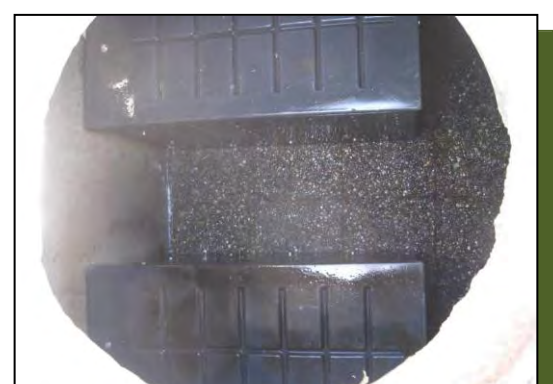
Removal of access hatch to gain access below.



Insertion of vacuum hose into separation chamber.



Removal of trash, sediment and debris.



Fully cleaned separation chamber.

2. Pre-Filter Cartridges (attached to wall of pre-treatment chamber)

- A. After finishing step 1 enter pre-treatment chamber.
- B. Unscrew the two bolts holding the lid on each cartridge filter and remove lid.

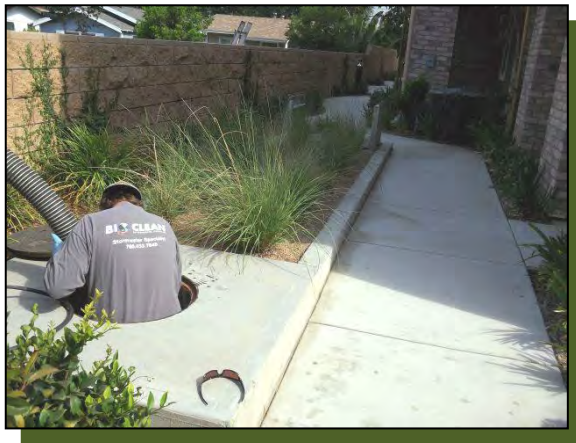


Pre-filter cartridges with tops on.



Inside cartridges showing media filters ready for replacement.

- C. Place the vacuum hose over each individual media filter to suck out filter media.



Vacuuming out of media filters.

- D. Once filter media has been sucked use a pressure washer to spray down inside of the cartridge and it's containing media cages. Remove cleaned media cages and place to the side. Once removed the vacuum hose can be inserted into the cartridge to vacuum out any remaining material near the bottom of the cartridge.

- E. Reinstall media cages and fill with new media from manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase. Utilize the manufacture provided refilling tray and place on top of cartridge. Fill tray with new bulk media and shake down into place. Using your hands slightly compact media into each filter cage. Once cages are full removed refilling tray and replace cartridge top ensuring bolts are properly tightened.



Refilling tray for media replacement.



Refilling tray on cartridge with bulk media.



- F. Exit pre-treatment chamber. Replace access hatch or manhole cover.

### 3. Biofiltration Chamber (middle vegetated chamber)

- A. In general, the biofiltration chamber is maintenance free with the exception of maintaining the vegetation. Using standard gardening tools properly trim back the vegetation to healthy levels. The MWS Linear utilizes vegetation similar to surrounding landscape areas therefore trim vegetation to match surrounding vegetation. If any plants have died replace plants with new ones:



B. Over time, sediment will accumulate in the perimeter void area and will need to be vacuumed out. The media surface may also require power washing if it becomes occluded with sediment. In addition, the wetland media will eventually need to be replaced after 10 plus years of service. A vacuum truck is recommended to fully remove all wetland media. Once old media is removed the entire chamber, media cage, and netting should be power washed. The netting may require replacement before installing new media. New wetland media should be purchased directly from the manufacture. It can be delivered either in bulk or in super sacks for easy installation.

4. Discharge Chamber (contains drain down cartridge & connected to pipe)

- A. Remove access hatch or manhole cover over discharge chamber.
- B. Enter chamber to gain access to the drain down filter. Unlock the locking mechanism and lift up drain down filter housing to remove used BioMediaGREEN filter block as shown below:



- C. Insert new BioMediaGREEN filter block and lock drain down filter housing back in place. Replace access hatch or manhole cover over discharge chamber.



## **Inspection Notes**

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.
2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.
3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.
4. Entry into chambers may require confined space training based on state and local regulations.
5. No fertilizer shall be used in the Biofiltration Chamber.
6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may not require irrigation after initial establishment.



## Inspection Form



Modular Wetland System, Inc.

P. 760.433-7640

F. 760-433-3176

E. [Info@modularwetlands.com](mailto:Info@modularwetlands.com)

[www.modularwetlands.com](http://www.modularwetlands.com)



## Maintenance Report



**Modular Wetland System, Inc.**

**P. 760.433-7640**

**F. 760-433-3176**

**E. [Info@modularwetlands.com](mailto:Info@modularwetlands.com)**

**[www.modularwetlands.com](http://www.modularwetlands.com)**