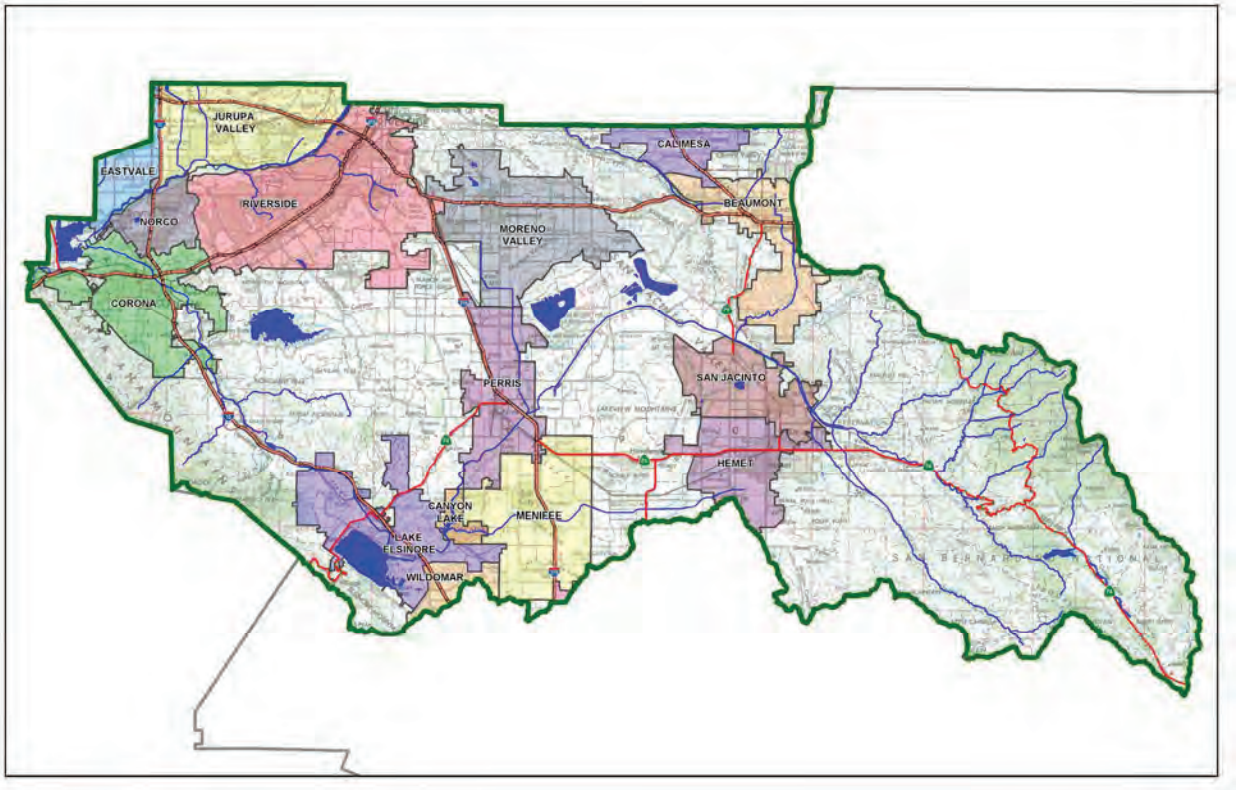
Project Specific Water Quality Management Plan

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

Project Title: NWC Van Buren Blvd. & Washington St.

Development No:

Design Review/Case No: CUP250008 PPT240018



☒ **Preliminary**
☐ **Final**

Original Date Prepared: 3/20/25

Revision Date(s): 6/4/2026

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

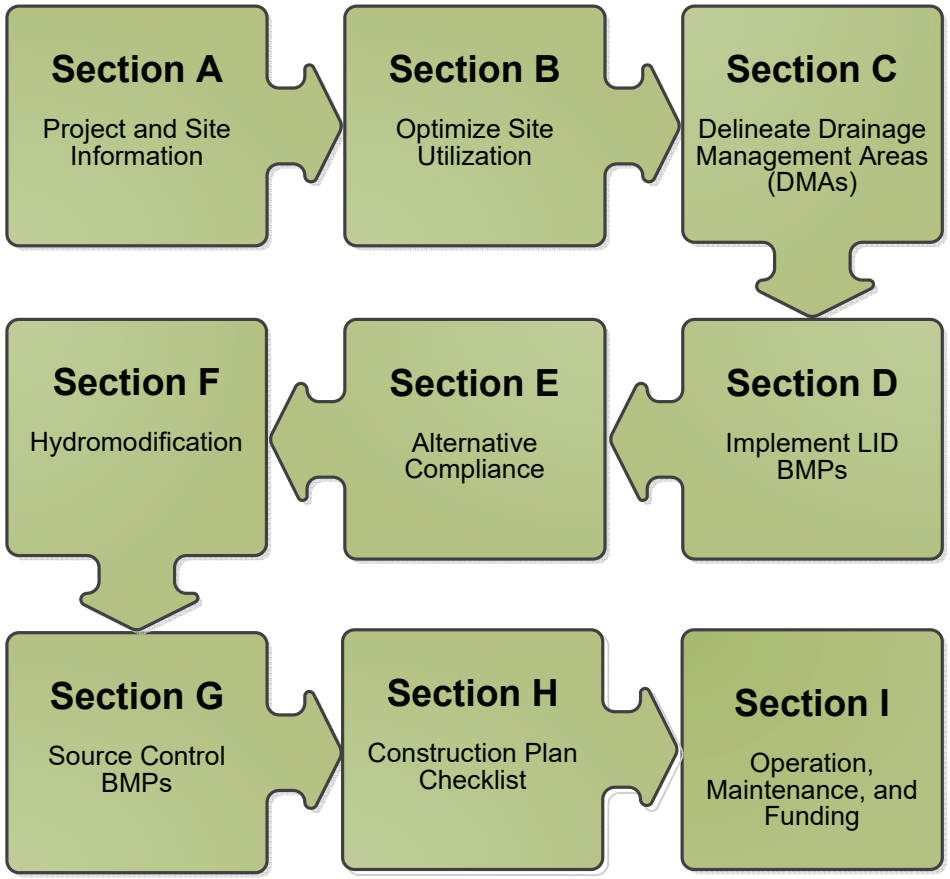
Contact Information:

Prepared for: LJC Enterprises, P.O. Box 2739, Mammoth Lakes, CA 93546, Contact: Larry Canale, 951-760-0760, ljcenterprise10@gmail.com

Prepared by: DRC Engineering, Inc., 160 S. Old Springs Rd., Ste. 210, Anaheim Hills, CA 92808, 714-685-6860
Rene Varga: rvarga@drc-eng.com
Drew Gates: dgates@drc-eng.com

A Brief Introduction

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



OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for LJC Enterprises by DRC Engineering, Inc. for the NWC of Van Buren/Washington project.

This WQMP is intended to comply with the requirements of Riverside County for Riverside County ordinance 754 which includes the requirement for the preparation and implementation of a Project-Specific WQMP.

The undersigned, while owning the property/project described in the preceding paragraph, shall be responsible for the implementation and funding of this WQMP and will ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site. In addition, the property owner accepts responsibility for interim operation and maintenance of Stormwater BMPs until such time as this responsibility is formally transferred to a subsequent owner. This WQMP will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party (or parties) having responsibility for implementing portions of this WQMP. At least one copy of this WQMP will be maintained at the project site or project office in perpetuity. The undersigned is authorized to certify and to approve implementation of this WQMP. The undersigned is aware that implementation of this WQMP is enforceable under Riverside County Water Quality Ordinance (Municipal Code Chapter 13.12 Stormwater Drainage System Protection Regulations).

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

Owner's Signature	Date
Larry J. Canale	President
Owner's Printed Name	Owner's Title/Position

PREPARER'S CERTIFICATION

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

Preparer's Signature	Date
Drew J. Gates	Project Manager
Preparer's Printed Name	Preparer's Title/Position

Preparer's Licensure:

Table of Contents

Section A: Project and Site Information 6

A.1 Maps and Site Plans 6
A.2 Identify Receiving Waters 7
A.3 Additional Permits/Approvals required for the Project: 7

Section B: Optimize Site Utilization (LID Principles) 8

Section C: Delineate Drainage Management Areas (DMAs) 10

Section D: Implement LID BMPs 13

D.1 Infiltration Applicability 13
D.2 Harvest and Use Assessment 14
D.3 Bioretention and Biotreatment Assessment 16
D.4 Feasibility Assessment Summaries 17
D.5 LID BMP Sizing 18

Section E: Alternative Compliance (LID Waiver Program) 24

E.1 Identify Pollutants of Concern 25
E.2 Stormwater Credits 26
E.3 Sizing Criteria 26
E.4 Treatment Control BMP Selection 27

Section F: Hydromodification 28

F.1 Hydrologic Conditions of Concern (HCOC) Analysis 28
F.2 HCOC Mitigation 29

Section G: Source Control BMPs 30

Section H: Construction Plan Checklist 34

Section I: Operation, Maintenance and Funding 35

List of Tables

Table A.1 Identification of Receiving Waters 7
Table A.2 Other Applicable Permits 7
Table C.1 DMA Classifications 10
Table C.2 Type 'A', Self-Treating Areas 11
Table C.3 Type 'B', Self-Retaining Areas 11
Table C.4 Type 'C', Areas that Drain to Self-Retaining Areas 11
Table C.5 Type 'D', Areas Draining to BMPs 12
Table D.1 Infiltration Feasibility 13
Table D.2 LID Prioritization Summary Matrix 17
Table D.3 DCV Calculations for LID BMPs 18
Table E.1 Potential Pollutants by Land Use Type 25
Table E.2 Water Quality Credits 26
Table E.3 Treatment Control BMP Sizing 26
Table E.4 Treatment Control BMP Selection 27
Table F.1 Hydrologic Conditions of Concern Summary 28
Table G.1 Permanent and Operational Source Control Measures 30
Table H.1 Construction Plan Cross-reference 34

List of Appendices

Appendix 1: Maps and Site Plans 36
Appendix 2: Construction Plans 38
Appendix 3: Soils Information 39
Appendix 4: Historical Site Conditions 40
Appendix 5: LID Infeasibility 41
Appendix 6: BMP Design Details 42
Appendix 7: Hydromodification 43
Appendix 8: Source Control 44
Appendix 9: O&M 45
Appendix 10: Educational Materials ..... - 6 -

Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	Commercial
Planning Area:	Commercial/Retail
Community Name:	N/A
Development Name:	NWC of Van Buren/Washington
PROJECT LOCATION	
Latitude & Longitude (DMS): 33°53'00.30" N/117°22'02.19" W	
Project Watershed and Sub-Watershed: Santa Ana River / Middle Santa Ana River Subwatershed	
Gross Acres: 9.69 AC APN(s): 273-130-014, 273-130-019, 273-141- 003 to 007 Map Book and Page No.: Fertile Acres MB 11 Page 71, PM 6059 Book 14 Page 55	
PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	Commercial Retail
Proposed or Potential SIC Code(s)	5411, 5812, 5541
Area of Impervious Project Footprint (SF)	355,288
Total Area of proposed Impervious Surfaces within the Project Footprint (SF)/or Replacement	355,288
Does the project consist of offsite road improvements?	☒ Y ☐ N
Does the project propose to construct unpaved roads?	☐ Y ☒ N
Is the project part of a larger common plan of development (phased project)?	☐ Y ☒ N
EXISTING SITE CHARACTERISTICS	
Total area of existing Impervious Surfaces within the Project limits Footprint (SF)	78,223
Is the project located within any MSHCP Criteria Cell?	☐ Y ☒ N
If so, identify the Cell number:	N/A
Are there any natural hydrologic features on the project site?	☐ Y ☒ N
Is a Geotechnical Report attached?	☒ Y ☐ N
If no Geotech Report, list the NRCS soils type(s) present on the site (A, B, C and/or D)	
What is the Water Quality Design Storm Depth for the project?	0.51 (Woodcrest)

A.1 Maps and Site Plans

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

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

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

A.2 Identify Receiving Waters

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

Table A.1 Identification of Receiving Waters

Receiving Waters	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
Lake Mathews	None Listed	Warm Freshwater Habitat, Commercial or recreational collection of fish, shellfish, or organisms	N/A

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

Table A.2 Other Applicable Permits

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

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

Section B: Optimize Site Utilization (LID Principles)

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

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

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

Site Optimization

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

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

For the northerly undeveloped area, the existing drainage pattern surface flows from the northeast corner to the southwest corner of the site and discharges to a sump condition. In the proposed condition, surface drainage is conveyed to the storm drain system onsite and discharges directly to the existing storm drain infrastructure in Van Buren Blvd. It is infeasible to discharge to the existing sump.

For the southerly areas of redevelopment, the existing drainage patterns surface flow to the south and to Van Buren Blvd. In the proposed condition, surface drainage is conveyed to the storm drain system onsite and discharges directly to the existing storm drain infrastructure in Van Buren Blvd and closely matches the existing drainage pattern.

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

The existing site is mostly barren undeveloped land. The portion of vegetated area with assorted trees surrounds a residential site and is infeasible to protect with the proposed commercial site.

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

The site does not infiltrate. See the attached soils report.

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

Yes, drive aisles and parking areas are designed to the minimum requirements for the commercial development.

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

The majority of the proposed improvements surface drain to curb openings and into above-ground pervious bioretention ponds.

Section C: Delineate Drainage Management Areas (DMAs)

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

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)[1][2]	Area (Sq. Ft.)	DMA Type
DMA A-1	Ornamental Landscaping	21,855	D
DMA A-2	Concrete or Asphalt	7,482	D
DMA A-3	Roofs	22,326	D
DMA B1-1	Concrete or Asphalt	84,304	D
DMA B1-2	Ornamental Landscaping	8,409	D
DMA B1-3	Roofs	21,077	D
DMA B2-1	Concrete or Asphalt	17,196	D
DMA B2-2	Ornamental Landscaping	10,358	D
DMA C-1	Concrete or Asphalt	30,971	D
DMA C-2	Ornamental Landscaping	5,613	D
DMA D-1	Concrete or Asphalt	9,709	D
DMA D-2	Ornamental Landscaping	5,811	D
DMA D-3	Roofs	2,509	D
DMA E-1	Concrete or Asphalt	5,737	D
DMA E-2	Ornamental Landscaping	424	D
DMA E-3	Roofs	4,229	D
DMA F-1	Concrete or Asphalt	9,322	D
DMA F-2	Ornamental Landscaping	1,933	D
DMA F-3	Roofs	5,374	D
DMA G1-1	Concrete or Asphalt	7,661	D
DMA G1-2	Ornamental Landscaping	775	D
DMA G2-1	Concrete or Asphalt	8,463	D
DMA G2-2	Ornamental Landscaping	3,676	D
DMA G3-1	Concrete or Asphalt	3,989	D
DMA G3-2	Ornamental Landscaping	1,628	D
DMA G3-3	Roofs	2,679	D
DMA H-1	Concrete or Asphalt	17,656	D
DMA H-2	Ornamental Landscaping	1,624	D
DMA I-1	Concrete or Asphalt	23,801	D
DMA I-2	Ornamental Landscaping	6,725	D
DMA I-3	Roofs	8,695	D
DMA J-1	Concrete or Asphalt	12,676	D
DMA J-2	Ornamental Landscaping	2,137	D
DMA K-1	Concrete or Asphalt	2,693	D
DMA K-2	Ornamental Landscaping	1,379	D
DMA L-1	Concrete or Asphalt	8,174	D
DMA L-2	Ornamental Landscaping	3,115	D
DMA S-1	Concrete or Asphalt	24,192	D
DMA S-2	Ornamental Landscaping	5,641	D

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

[2]If multi-surface provide back-up

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

DMA Name or ID	Area (Sq. Ft.)	Stabilization Type	Irrigation Type (if any)

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

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

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

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

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

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

DMA Name or ID	BMP Name or ID
DMA A-1	Bioretention Basin A
DMA A-2	Bioretention Basin A
DMA A-3	Bioretention Basin A
DMA B1-1	Bioretention Basin B
DMA B1-2	Bioretention Basin B
DMA B1-3	Bioretention Basin B
DMA B2-1	Bioretention Basin B
DMA B2-2	Bioretention Basin B
DMA C-1	Bioretention Basin C
DMA C-2	Bioretention Basin C
DMA D-1	Bioretention Basin D
DMA D-2	Bioretention Basin D
DMA D-3	Bioretention Basin D
DMA E-1	Bioretention Basin E
DMA E-2	Bioretention Basin E
DMA E-3	Bioretention Basin E
DMA F-1	Bioretention Basin F
DMA F-2	Bioretention Basin F
DMA F-3	Bioretention Basin F
DMA G1-1	Bioretention Basin G1
DMA G1-2	Bioretention Basin G1
DMA G2-1	Bioretention Basin G2
DMA G2-2	Bioretention Basin G2
DMA G3-1	Bioretention Basin G3
DMA G3-2	Bioretention Basin G3
DMA G3-3	Bioretention Basin G3
DMA H-1	Bioretention Basin H
DMA H-2	Bioretention Basin H
DMA I-1	Bioretention Basin I
DMA I-2	Bioretention Basin I
DMA I-3	Bioretention Basin I
DMA J-1	Bioretention Basin J
DMA J-2	Bioretention Basin J
DMA K-1	Bioretention Basin K
DMA K-2	Bioretention Basin K
DMA L-1	Proprietary Biofiltration MWS "L"
DMA L-2	Proprietary Biofiltration MWS "L"
DMA S	Bioretention Basin B (*Equivalent Offset Treatment*)
DMA S	Bioretention Basin B (*Equivalent Offset Treatment*)

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

Section D: Implement LID BMPs

D.1 Infiltration Applicability

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

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

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

Geotechnical Report

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

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

Infiltration Feasibility

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

Table D.1 Infiltration Feasibility

Does the project site…	YES	NO
…have any DMAs with a seasonal high groundwater mark shallower than 10 feet?		✓
If Yes, list affected DMAs:		
…have any DMAs located within 100 feet of a water supply well?		✓
If Yes, list affected DMAs:		
…have any areas identified by the geotechnical report as posing a public safety risk where infiltration of stormwater could have a negative impact?		✓
If Yes, list affected DMAs:		
…have measured in-situ infiltration rates of less than 1.6 inches / hour?	✓	
If Yes, list affected DMAs: **Overall Site ranges from 0.09 in/hr to 0.41 in/hr per Geotechnical Report**		
…have significant cut and/or fill conditions that would preclude in-situ testing of infiltration rates at the final infiltration surface?		✓
If Yes, list affected DMAs:		
…geotechnical report identify other site-specific factors that would preclude effective and safe infiltration?	✓	
Describe here: **Perched groundwater and relatively shallow bedrock.**		

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

D.2 Harvest and Use Assessment

Please check what applies*:*

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

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

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

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

Irrigation Use Feasibility

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

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

Total Area of Irrigated Landscape: 61,089 sf = 1.40 acres

Type of Landscaping (Conservation Design or Active Turf): Conservation Design

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

Total Area of Impervious Surfaces: 331,096 sf = 7.60 acres

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

Enter your EIATIA factor: EIATIA Factor = 0.26

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

Minimum required irrigated area: 0.26 x 7.60 acres = 1.98 acres

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

Minimum required irrigated area (Step 4)	Available Irrigated Landscape (Step 1)
1.98 acres	1.40 acres

Toilet Use Feasibility

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

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

Projected Number of Daily Toilet Users: Number of daily Toilet Users

Project Type: Enter 'Residential', 'Commercial', 'Industrial' or 'Schools'

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

Total Area of Impervious Surfaces: Insert Area (Acres)

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

Enter your TUTIA factor: TUTIA Factor

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

Minimum number of toilet users: Required number of toilet users

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

Minimum required Toilet Users (Step 4)	**Projected number of toilet users (Step 1)**
Insert Area (Acres)	Insert Area (Acres)

Other Non-Potable Use Feasibility

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

Insert narrative description here.

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

Average Daily Demand: Projected Average Daily Use (gpd)

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

Total Area of Impervious Surfaces: Insert Area (Acres)

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

Enter the factor from Table 2-4: Enter Value

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

Minimum required use: Minimum use required (gpd)

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

Minimum required non-potable use (Step 4)	**Projected average daily use (Step 1)**
Minimum use required (gpd)	Projected Average Daily Use (gpd)

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

D.3 Bioretention and Biotreatment Assessment

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

Select one of the following:

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

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

D.4 Feasibility Assessment Summaries

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

Table D.2 LID Prioritization Summary Matrix

DMA Name/ID	LID BMP Hierarchy				No LID (Alternative Compliance)
	1. Infiltration	2. Harvest and use	3. Bioretention	4. Biotreatment	
DMA A-1	☐	☐	☒	☐	☐
DMA A-2	☐	☐	☒	☐	☐
DMA B1-1	☐	☐	☒	☐	☐
DMA B1-2	☐	☐	☒	☐	☐
DMA B1-3	☐	☐	☒	☐	☐
DMA B2-1	☐	☐	☒	☐	☐
DMA B2-2	☐	☐	☒	☐	☐
DMA C-1	☐	☐	☒	☐	☐
DMA C-2	☐	☐	☒	☐	☐
DMA D-1	☐	☐	☒	☐	☐
DMA D-2	☐	☐	☒	☐	☐
DMA D-3	☐	☐	☒	☐	☐
DMA E-1	☐	☐	☒	☐	☐
DMA E-2	☐	☐	☒	☐	☐
DMA E-3	☐	☐	☒	☐	☐
DMA F-1	☐	☐	☒	☐	☐
DMA F-2	☐	☐	☒	☐	☐
DMA F-3	☐	☐	☒	☐	☐
DMA G1-1	☐	☐	☒	☐	☐
DMA G1-2	☐	☐	☒	☐	☐
DMA G2-1	☐	☐	☒	☐	☐
DMA G2-2	☐	☐	☒	☐	☐
DMA G3-1	☐	☐	☒	☐	☐
DMA G3-2	☐	☐	☒	☐	☐
DMA G3-3	☐	☐	☒	☐	☐
DMA H-1	☐	☐	☒	☐	☐
DMA H-2	☐	☐	☒	☐	☐
DMA I-1	☐	☐	☒	☐	☐
DMA I-2	☐	☐	☒	☐	☐
DMA I-3	☐	☐	☒	☐	☐
DMA J-1	☐	☐	☒	☐	☐
DMA J-2	☐	☐	☒	☐	☐
DMA K-1	☐	☐	☒	☐	☐
DMA K-2	☐	☐	☒	☐	☐
DMA L-1	☐	☐	☐	☒	☐
DMA L-2	☐	☐	☐	☒	☐
DMA S-1	☐	☐	☒	☐	☐
DMA S-2	☐	☐	☒	☐	☐

D.5 LID BMP Sizing

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

Table D.3 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA A* *BMP ID: Bioretention Basin A*		
	[A]		[B]	[C]	[A] x [C]			
A-1	*21,855*	*Concrete or Asphalt*	*1.00*	*0.892*	*19,494.7*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
A-2	*7,482*	*Ornamental Landscaping*	*0.10*	*0.110*	*826.4*			
A-3	*22,326*	*Roofs*	*1.00*	*0.892*	*19,194.8*			
TOTAL	29,337.0				40,235.9	0.51	1,710.0	***2,654.2***

Table D.4 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA B* *BMP ID: Bioretention Basin B*		
	[A]		[B]	[C]	[A] x [C]			
B1-1	*84,304*	*Concrete or Asphalt*	*1.00*	*0.892*	*75,199.2*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
B1-2	*8,409*	*Ornamental Landscaping*	*0.10*	*0.110*	*928.8*			
B1-3	*21,077*	*Roofs*	*1.00*	*0.892*	*18,800.7*			
B2-1	*17,196*	*Concrete or Asphalt*	*1.00*	*0.892*	*15,338.8*			
B2-2	*10,358*	*Ornamental Landscaping*	*0.10*	*0.110*	*1,144.1*			
TOTAL	141,344.0				111,411.6	0.51	4,735.0	***6,519.0***

Table D.5 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA C* *BMP ID: Bioretention Basin C*		
	[A]		[B]	[C]	[A] x [C]			
C-1	*30,971*	*Concrete or Asphalt*	*1.00*	*0.892*	*27,626.1*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
C-2	*5,613*	*Ornamental Landscaping*	*0.10*	*0.110*	*620.0*			
TOTAL	36,584				28,246.1	0.51	1,200.5	***2,467.9***

Table D.6 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA D* *BMP ID: Bioretention Basin D*		
	[A]		[B]	[C]	[A] x [C]			
D-1	*9,709*	*Concrete or Asphalt*	*1.00*	*0.892*	*8,660.4*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
D-2	*5,811*	*Ornamental Landscaping*	*0.10*	*0.110*	*641.9*			
D-3	*2,509*	*Roofs*	*1.00*	*0.892*	*2,238.0*			
TOTAL	18,029				**TOTAL**	11,540.3	490.5	***1,210.5***

Table D.7 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA E* *BMP ID: Bioretention Basin E*		
	[A]		[B]	[C]	[A] x [C]			
E-1	*5,737*	*Concrete or Asphalt*	*1.00*	*0.892*	*5,117.4*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
E-2	*424*	*Ornamental Landscaping*	*0.10*	*0.110*	*46.8*			
E-3	*4,229*	*Roofs*	*1.00*	*0.892*	*3,772.3*			
TOTAL	10,390				8,936.5	0.51	379.8	***379.8****

*Note: Due to limited landscape area within DMA E, Basin E provides 321.2 cubic feet of treatment volume compared to the required DCV of 379.8 cubic feet, resulting in a remaining deficit of 58.6 cubic feet. Basin B provides 1,784 cubic feet of excess treatment volume above its required DCV. The remaining 58.6 cubic feet required for DMA E is proposed to be mitigated through equivalent offset treatment within Basin B.

Table D.8 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA F* *BMP ID: Bioretention Basin F*		
	[A]		[B]	[C]	[A] x [C]			
F-1	*9,322*	*Concrete or Asphalt*	*1.00*	*0.892*	*8,315.2*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
F-2	*1,933*	*Ornamental Landscaping*	*0.10*	*0.110*	*213.5*			
F-3	*5,374*	*Roofs*	*1.00*	*0.892*	*4,793.6*			
TOTAL	16,629				13,322.3	0.51	566.2	***1,030.5***

Table D.9 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA G1* *BMP ID: Bioretention Basin G1*		
	[A]		[B]	[C]	[A] x [C]			
G1-1	*7,661*	*Concrete or Asphalt*	*1.00*	*0.892*	*6,833.6*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
G1-2	*775*	*Ornamental Landscaping*	*0.10*	*0.110*	*85.6*			
TOTAL	8,436				6,919.2	0.51	294.1	***351.6***

Table D.10 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA G2* *BMP ID: Bioretention Basin G2*		
	[A]		[B]	[C]	[A] x [C]			
G2-1	*8,463*	*Concrete or Asphalt*	*1.00*	*0.892*	*7,549.0*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
G2-2	*3,676*	*Ornamental Landscaping*	*0.10*	*0.110*	*406.0*			
TOTAL	12,139				7,955.0	0.51	338.1	***338.1****

*Note: Due to limited landscape area within DMA G2, Basin G2 provides 203.6 cubic feet of treatment volume compared to the required DCV of 338.1 cubic feet, resulting in a remaining deficit of 134.5 cubic feet. Basin B provides 1,784 cubic feet of excess treatment volume above its required DCV. The remaining 134.5 cubic feet required for DMA G2 is proposed to be mitigated through equivalent offset treatment within Basin B.

Table D.11 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA G3* *BMP ID: Bioretention Basin G3*		
	[A]		[B]	[C]	[A] x [C]			
G3-1	*3,989*	*Concrete or Asphalt*	*1.00*	*0.892*	*3,558.2*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
G3-2	*1,628*	*Ornamental Landscaping*	*0.10*	*0.110*	*179.8*			
G3-3	*2,679*	*Roofs*	*1.00*	*0.892*	*2,389.7*			
TOTAL	8,296				6,127.7	0.51	260.4	***535.9***

Table D.12 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA H* *BMP ID: Bioretention Basin H*		
	[A]		[B]	[C]	[A] x [C]			
H-1	*17,656*	*Concrete or Asphalt*	*1.00*	*0.892*	*15,749.2*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
H-2	*1,624*	*Ornamental Landscaping*	*0.10*	*0.110*	*179.4*			
TOTAL	19,280				15,928.5	0.51	677.0	***677.0****

*Note: Due to limited landscape area within DMA H, Basin H provides 301.4 cubic feet of treatment volume compared to the required DCV of 667.0 cubic feet, resulting in a remaining deficit of 365.6 cubic feet. Basin B provides 1,784 cubic feet of excess treatment volume above its required DCV. The remaining 365.6 cubic feet required for DMA H is proposed to be mitigated through equivalent offset treatment within Basin B.

Table D.13 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA I* *BMP ID: Bioretention Basin I*		
	[A]		[B]	[C]	[A] x [C]			
I-1	*23,801*	*Concrete or Asphalt*	*1.00*	*0.892*	*21,230.5*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
I-2	*6,725*	*Ornamental Landscaping*	*0.10*	*0.110*	*742.8*			
I-3	*8,695*	*Roofs*	*1.00*	*0.892*	*7,755.9*			
TOTAL	39,221				29,729.3	0.51	1,263.5	***1,273.6***

Table D.14 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA J* *BMP ID: Bioretention Basin J*		
	[A]		[B]	[C]	[A] x [C]			
J-1	*12,676*	*Concrete or Asphalt*	*1.00*	*0.892*	*11,307.0*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
J-2	*2,137*	*Ornamental Landscaping*	*0.10*	*0.110*	*236.0*			
TOTAL	14,813				11,543	0.51	490.6	***1,290.6***

Table D.15 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA K* *BMP ID: Bioretention Basin K*		
	[A]		[B]	[C]	[A] x [C]			
K-1	*2,693*	*Concrete or Asphalt*	*1.00*	*0.892*	*2,402.2*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
K-2	*1,379*	*Ornamental Landscaping*	*0.10*	*0.110*	*152.3*			
TOTAL	4,072				2,554.5	0.51	108.6	***154.6***

Table D.16 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA L* *BMP ID: MWS L* *MWS Model No MWS-L-4-4*		
	[A]		[B]	[C]	[A] x [C]			
L-1	*8,198*	*Concrete or Asphalt*	*1.00*	*0.892*	*7,312.6*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
L-2	*2,092*	*Ornamental Landscaping*	*0.10*	*0.110*	*231.1*			
TOTAL	10,290				7,543.7	0.51	320.6	***1,140***

Table D.17 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA K* *BMP ID: Bioretention Basin B (Equivalent Offset Treatment)*		
	[A]		[B]	[C]	[A] x [C]			
S-1	*24,192*	*Concrete or Asphalt*	*1.00*	*0.892*	*21,579.3*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
S-2	*5,641*	*Ornamental Landscaping*	*0.10*	*0.110*	*623.1*			
TOTAL	29,833				22,202.4	0.51	943.6	***943.6****

*Note: Due to site constraints, offsite area DMA S does not propose a separate bioretention basin. Basin B provides 1,784 cubic feet of excess treatment volume above its required DCV. The required V_{BMP} for DMA S is satisfied through equivalent offset treatment provided by Basin B.

[B], [C] is obtained as described in Section 2.3.1 of the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

Section E: Alternative Compliance (LID Waiver Program)

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

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

- Or -

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

All runoff from the DMA's are designed to be treated by LID BMPs. Concrete/Asphalt, Ornamental Landscaping, and Roof areas for Areas A through K are treated by above-ground bioretention basins. Concrete/Asphalt, Ornamental Landscaping, and Roof areas for Area L is treated by proprietary biofiltration unit (Modular Wetlands).

E.1 Identify Pollutants of Concern

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

Table E.1 Potential Pollutants by Land Use Type

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

P = Potential

N = Not Potential

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

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

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

(4) Specifically petroleum hydrocarbons

(5) Specifically solvents

(6) Bacterial indicators are routinely detected in pavement runoff

E.2 Stormwater Credits

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

Table E.2 Water Quality Credits

Qualifying Project Categories	Credit Percentage[2]
N/A	N/A
Total Credit Percentage[1]	

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

E.3 Sizing Criteria

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

Table E.3 Treatment Control BMP Sizing

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

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

E.4 Treatment Control BMP Selection

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

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

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

Table E.4 Treatment Control BMP Selection

Selected Treatment Control BMP Name or ID[1]	Priority Pollutant(s) of Concern to Mitigate[2]	Removal Efficiency Percentage[3]
N/A	N/A	N/A

[1] Treatment Control BMPs must not be constructed within Receiving Waters. In addition, a proposed Treatment Control BMP may be listed more than once if they possess more than one qualifying pollutant removal efficiency.

[2] Cross Reference Table E.1 above to populate this column.

[3] As documented in a Co-Permittee Approved Study and provided in Appendix 6.

Section F: Hydromodification

F.1 Hydrologic Conditions of Concern (HCOC) Analysis

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

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

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

If Yes, HCOC criteria do not apply.

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

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

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

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

Table F.1 Hydrologic Conditions of Concern Summary

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

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

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

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

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

INSERT TEXT HERE

F.2 HCOC Mitigation

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

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

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

c. Mimicking the pre-development hydrograph with the post-development hydrograph, for a 2-year return frequency storm. Generally, the hydrologic conditions of concern are not significant, if the post-development hydrograph is no more than 10% greater than pre-development hydrograph. In cases where excess volume cannot be infiltrated or captured and reused, discharge from the site must be limited to a flow rate no greater than 110% of the pre-development 2-year peak flow.

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

Section G: Source Control BMPs

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

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

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

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

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

Table G.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs
On-site storm drain inlets	☒ Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch Basin Markers may be available from the Riverside County Flood Control and Water Conservation District, call 951.955.1200 to verify. **Apply to atrium grates.**
Interior floor drains and elevator shafts sump pumps	☒ State that interior floor drains and elevator shafts sump pumps will be plumbed to sanitary sewer. ***Interior floor drains will be plumbed to sanitary sewer. There is no elevator shaft.***

Landscape/ Outdoor Pesticide Use	State that final landscape plans will accomplish all of the following. ☒ Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. ☒ Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution. ☒ Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions. ☒ Consider using pest-resistant plants, especially adjacent to hardscape. ☒ To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions. **("Efficient Irrigation")**
Refuse areas	☒ State how site refuse will be handled and provide supporting detail to what is shown on plans. ***Refuse will be picked up by local waste management company on a weekly basis. Detail of the trash enclosure will be provided in the final WQMP.*** ☒ State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar. **(CASQA BMP SD-32, "Trash Enclosures")**
Vehicle and Equipment Cleaning	☒ 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.
Vehicle / Equipment Repair and Maintenance	☒ State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area. ***There is a gas station onsite.*** ☒ 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. ***There are floor drains in the restrooms in the buildings. The floor drains are discharged into sanitary sewer line.*** ☒ 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. ***There are not tanks, containers or sinks to be used for parts cleaning or rinsing.***
Loading Docks	**(CASQA BMP SC-30, "Outdoor Loading/Unloading")**
Fire Sprinkler Test Water	☒ Provide a means to drain fire sprinkler test water to the sanitary sewer. ***The drain line for fire sprinkler test water will be connected to the sanitary sewer line per plumbing plan.***
Miscellaneous Drain or Wash Water or Other Sources ☐ Boiler drain lines ☒ Condensate drain lines ☒ Rooftop equipment ☐ Drainage sumps ☐ Roofing, gutters, and trim ☐ Other sources	☐ Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system. ☒ Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system. ☒ Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment. ☐ Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water. ☒ Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff. **(CASQA BMP SD-10, "Site Design and Landscape Planning" and SD-11, "Roof Runoff Controls")**
Plazas, sidewalks, and parking lots	☒ Control the number of points for vehicle access ☒ Inspect BMP's prior to forecast rain, daily during extended rain events, after rain

	events, weekly during rainy season and at two-week intervals during the non-rainy season ☒ Do not sweep up any unknown substance or any object that may be potentially hazardous ☒ After sweeping is finished, properly dispose of sweeper wastes **(CASQA BMP SE-7, "Street Sweeping and Vacuuming")**
Activity Restriction	If a property owners association (POA) is formed, conditions, covenants and restrictions shall include measures listed in BMPs for the purpose of surface water quality protection.

Section H: Construction Plan Checklist

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

Table H.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)	BMP Location (Lat/Long)
Basin A	Bioretention Basin A	WQMP Map	33°53'02.08"N/ 117°22'05.55"W
Basin B	Bioretention Basin B	WQMP Map	33°52’58.95"N/ 117°22'02.45"W
Basin C	Bioretention Basin C	WQMP Map	33°53'03.46"N/ 117°22'02.00"W
Basin D	Bioretention Basin D	WQMP Map	33°53'03.89"N/ 117°21'59.50"W
Basin E	Bioretention Basin E	WQMP Map	33°53'00.26"N/ 117°22'00.64"W
Basin F	Bioretention Basin F	WQMP Map	33°52'59.43"N/ 117°22'03.95"W
Basin G1	Bioretention Basin G1	WQMP Map	33°52'58.83"N/ 117°22'05.38"W
Basin G2	Bioretention Basin G2	WQMP Map	33°52'58.83"N/ 117°22'05.38"W
Basin G3	Bioretention Basin G3	WQMP Map	33°52'58.83"N/ 117°22'05.38"W
Basin H	Bioretention Basin H	WQMP Map	33°52'57.96"N/ 117°22'04.13"W
Basin I	Bioretention Basin I	WQMP Map	33°52'57.21"N/ 117°21'59.43"W
Basin J	Bioretention Basin J	WQMP Map	33°52'59.42"N/ 117°22'01.60"W
Basin K	Bioretention Basin K	WQMP Map	33°53'00.50"N/ 117°21'58.75"W
MWS L	MWS L – Proprietary biotreatment unit Model MWS-L-4-4	WQMP Map	33°52'59.54"N/ 117°22'05.83"W

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

Section I: Operation, Maintenance and Funding

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

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

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

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

Maintenance Mechanism: Insert text here.

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

☒ Y ☐ N

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

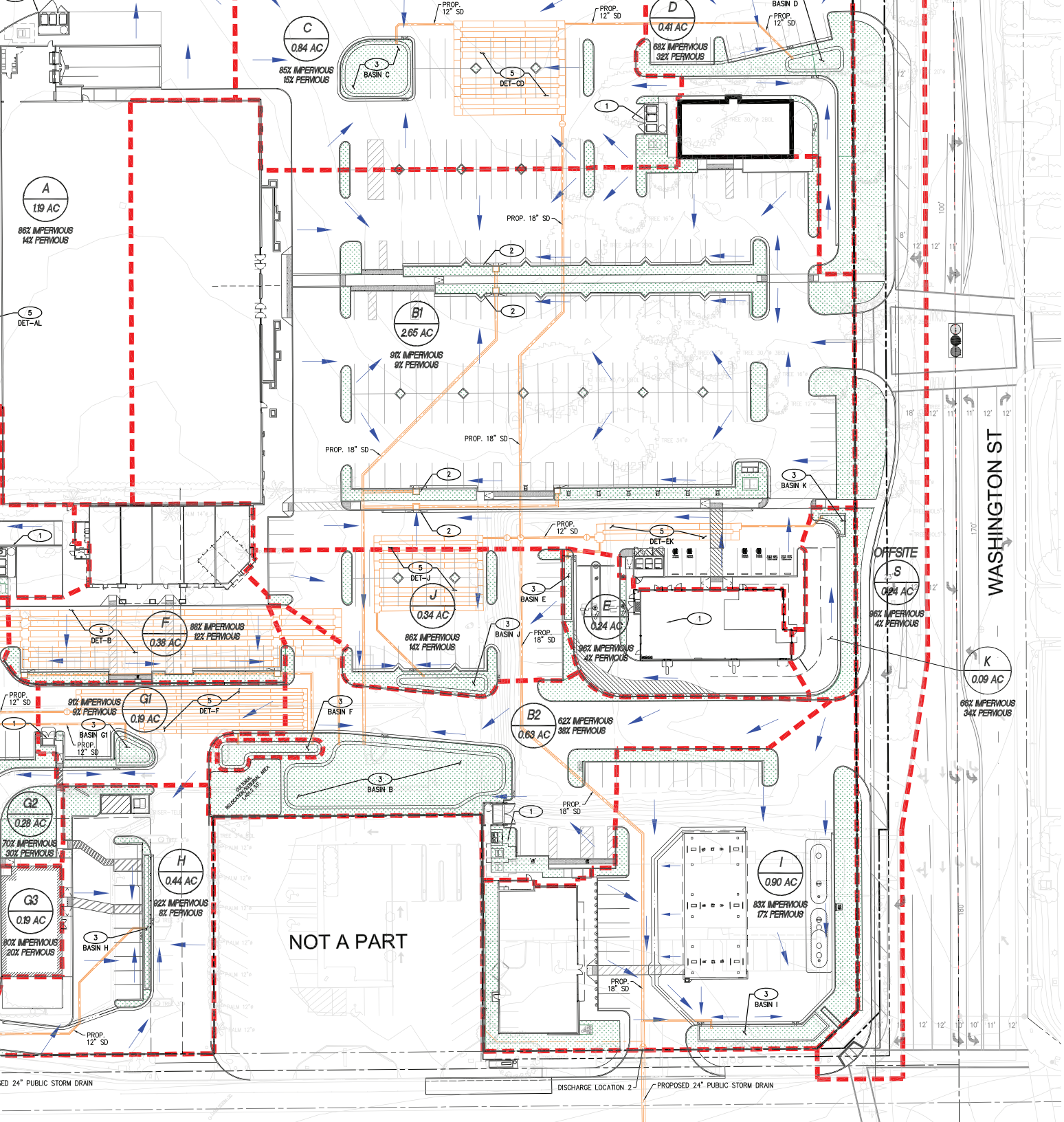
Property Owner will provide annual budget for the maintenance of the BMP.

Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map

Vicinity Map

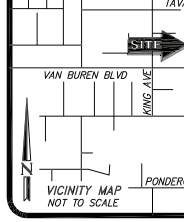


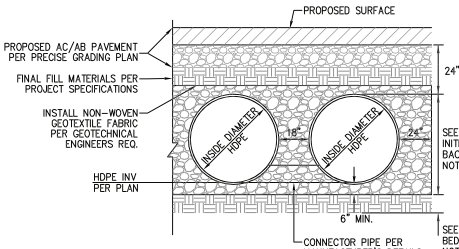


DIRECTION OF RUNOFF

SOURCE CONTROL BMPS

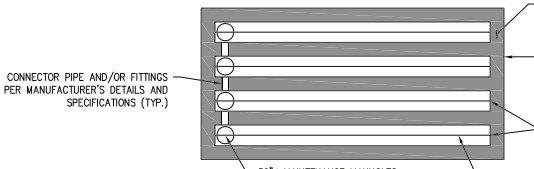
1. TRASH STORAGE AREAS – KEEP LIDS CLOSED & CLEAN
2. STORM DRAIN SIGNAGE
3. BIOFILTRATION POND – KEEP AREAS CLEAN
   NOTE: ALL ROCK OR SAND TO BE PLACED IN POST-CONSTRUCTION BMPs SHALL BE CLEAN-WASHED ROCK TO THE SATISFACTION OF THE GRADING INSPECTOR
4. MODULAR WETLANDS LINEAR BIO-FILTRATION SYSTEM
   NOTE: UNIT MUST HAVE OPEN VEGETATION TOP
5. UNDERGROUND PIPE DETENTION CHAMBERS
   NOTE: PROPOSED DETENTION CHAMBER PIPES SHOULD PROVIDE MINIMUM 50-YEAR SERVICE LIFE.





SECTION

NOTES:
- DETENTION PIPES BACKFILL PER MANUFACTURER'S DETAILS AND SPECIFICATIONS
- BEDDING: SUITABLE MATERIAL SHALL BE CLASS I. THE CONTRACTOR SHALL PROVIDE DOCUM MATERIAL SPECIFICATION TO ENGINEER. UNLESS OTHERWISE NOTED, MINIMUM BEDDING THICK
- INITIAL BACKFILL: SUITABLE MATERIAL SHALL BE CLASS I IN THE PIPE ZONE EXTENDING NOT CROWN OF PIPE. THE CONTRACTOR SHALL PROVIDE DOCUMENTATION FOR MATERIAL SPECIFIC MATERIAL SHALL BE INSTALL AS REQUIRED IN ASTM D2321, LATEST EDITION.

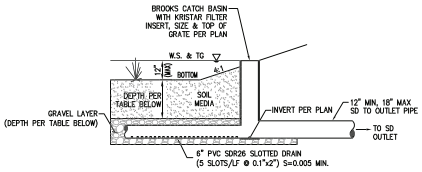


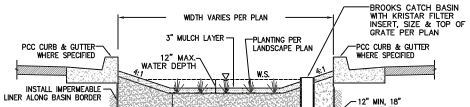
TYPICAL HDPE PIPE DETENTION SYSTEM
NTS

BASIN CALCULATIONS

DMA	BASIN	V_{BMP}	VOLUME PROVIDED	PONDING DEPTH	PONDING VOLUME	SOIL MEDIA DEPTH	SOIL MEDIA POROSITY	SOIL MEDIA VOLUME	SAND DEPTH	GRAVEL DEPTH
NAME	*NAME*	*CU-FT*	*CU-FT*	*INCHES*	*CU-FT*	*INCHES*	*%*	*CU-FT*	*INCHES*	*INCHES*
A	A	1,710.0	2,654.2	6	635.5	36	30.0%	1,397.6	3	12
B	B	4,735.0	6,519.6*	6	2,312.4	18	30.0%	2,227.3	3	12
C	C	1,200.5	2,467.9*	6	637.7	36	30.0%	1,267.1	3	12
D	D	490.5	1,210.5	6	288.4	36	30.0%	638.4	3	12
E	E	379.8	321.2**	6	89.2	36	30.0%	160.6	3	12
F	F	566.2	1,030.5	6	282.2	26	30.0%	463.2	3	12
G1	G1	294.1	351.6	6	135.6	15	30.0%	126.2	3	8
G2	G2	338.1	203.6**	6	62.0	18	30.0%	75.0	3	12
G3	G3	260.4	535.9	4.5	92.3	34	30.0%	301.6	3	12
H	H	677.0	535.8**	3.75	99.6	24	30.0%	261.7	3	12
I	I	1,263.5	1,273.6	6	353.8	36	30.0%	636.8	3	12
J	J	490.6	1,290.6	6	358..5	36	30.0%	645.3	3	12
K	K	108.6	154.6	6	43.0	36	30.0%	77.3	3	12
S	***	943.6	***							

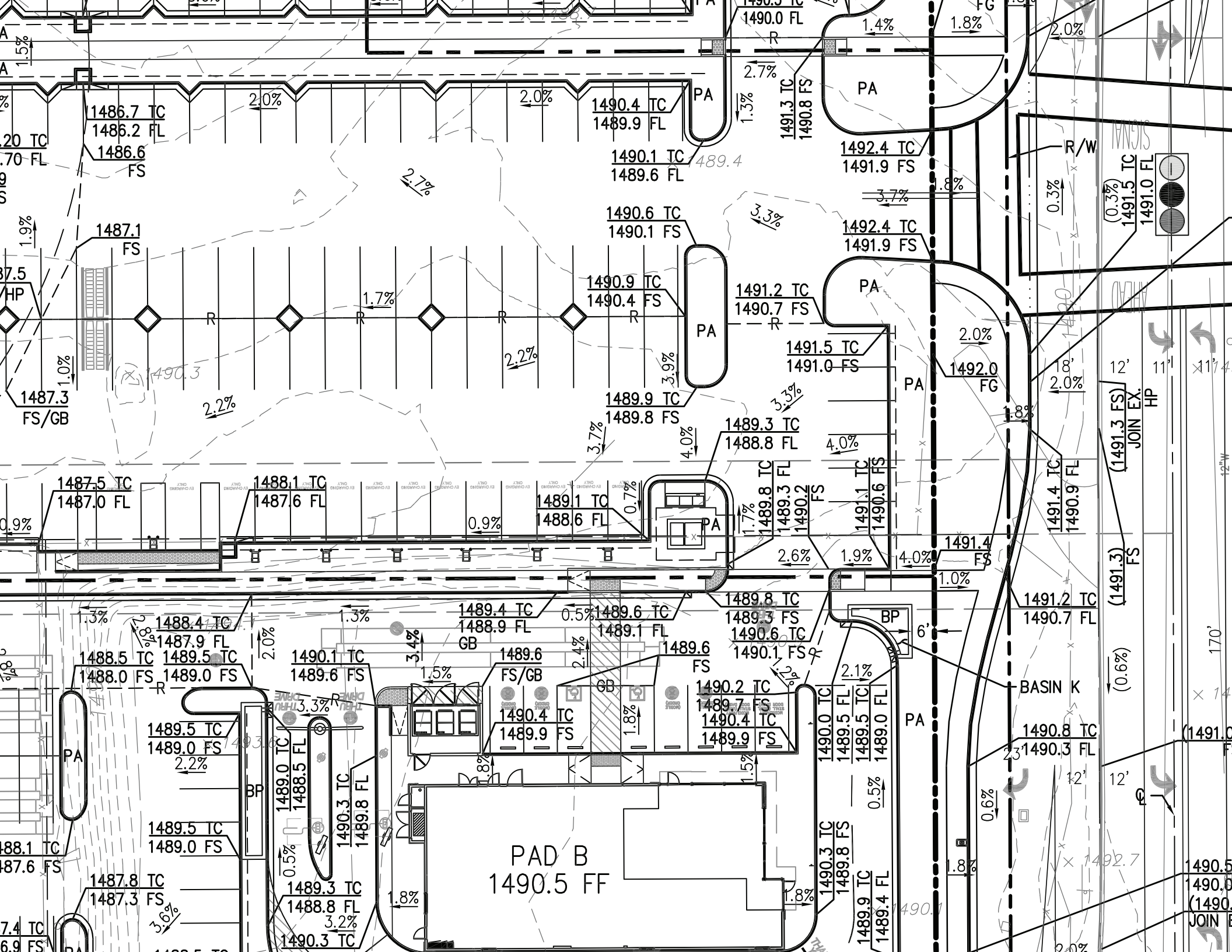
*BASIN "B" PROVIDES AN EXCESS TREATMENT VOLUME OF 1,784.6 CU-FT ABOVE THE REQUIRED V_{BMP}.
**BASINS "E", "G2", AND "H" PROVIDE A COMBINED TREATMENT VOLUME DEFICIT OF 334.3 CU-FT. THIS DEFICIT IS SATISFIED THROUGH OFFSET TREATMENT PROVIDED BY BASIN "B".
***OFFSITE AREA "DMA S" DOES NOT PROPOSE A SEPARATE BIORETENTION BASIN. THE REQUIRED V_{BMP} OF 943.6 CU-FT IS SATISFIED THROUGH EQUIVALENT OFFSET TREATMENT PROVIDED BY BASIN "B".

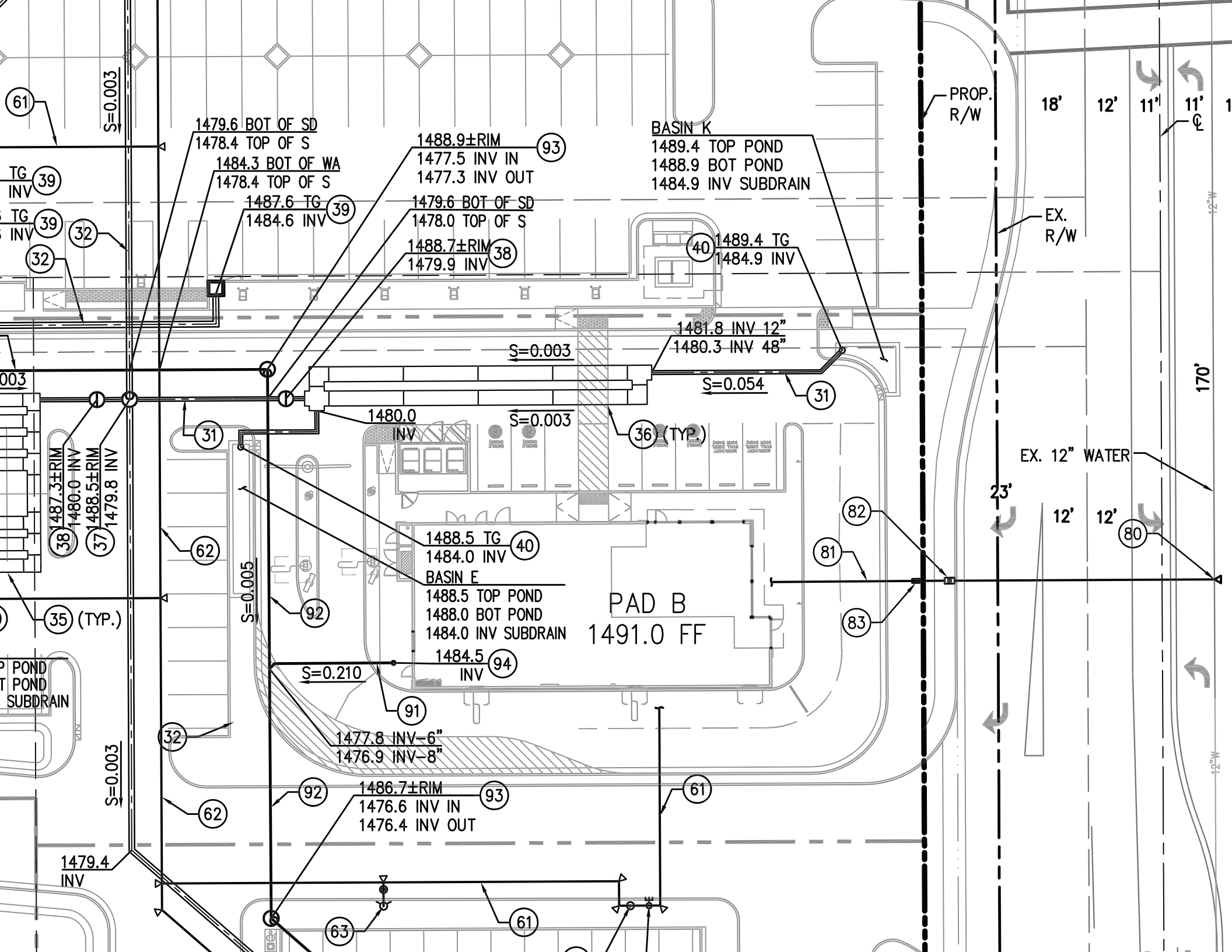




Appendix 2: Construction Plans

Grading and Drainage Plans


PAD B
1490.5 FF
BASIN K
PA
BP
R
GB
1486.7 TC
1486.2 FL
1486.6 FS
1490.4 TC
1489.9 FL
1490.1 TC
1489.6 FL
1490.6 TC
1490.1 FS
1490.9 TC
1490.4 FS
1491.2 TC
1490.7 FS
1491.5 TC
1491.0 FS
1489.9 TC
1489.8 FS
1489.3 TC
1488.8 FL
1487.1 FS
1487.3 FS/GB
1487.5 TC
1487.0 FL
1488.1 TC
1487.6 FL
1489.1 TC
1488.6 FL
1488.4 TC
1487.9 FL
1488.5 TC
1488.0 FS
1489.5 TC
1489.0 FS
1490.1 TC
1489.6 FS
1489.4 TC
1488.9 FL
1489.6 TC
1489.1 FL
1489.6 FS/GB
1490.2 TC
1489.7 FS
1490.4 TC
1489.9 FS
1489.8 TC
1489.3 FS
1490.6 TC
1490.1 FS
1490.0 TC
1489.5 FL
1489.5 TC
1489.0 FL
1489.0 TC
1488.5 FL
1490.3 TC
1489.8 FL
1487.8 TC
1487.3 FS
1489.3 TC
1488.8 FL
1490.3 TC
1490.0 FL
1492.4 TC
1491.9 FS
1491.3 TC
1490.8 FS
1491.4 TC
1490.9 FL
1491.1 TC
1490.6 FS
1491.4
FS
1492.0
FG
1490.8 TC
1490.3 FL
1491.2 TC
1490.7 FL
1491.5 TC
1491.0 FL
(1491.3 FS)
JOIN EX. HP
(1491.3)
FS
R/W
BP
6'
18'
12'
11'
23'
170'
1.5%
2.0%
1.4%
1.8%
2.7%
1.3%
1.9%
1.7%
2.2%
1.0%
3.9%
3.3%
3.7%
4.0%
0.7%
0.9%
2.6%
1.9%
1.3%
2.8%
3.4%
2.4%
1.5%
1.2%
2.1%
1.8%
0.5%
3.6%
3.2%
0.6%
0.3%
(0.3%)
(0.6%)


PAD B
1491.0 FF
BASIN K
1489.4 TOP POND
1488.9 BOT POND
1484.9 INV SUBDRAIN
BASIN E
1488.5 TOP POND
1488.0 BOT POND
1484.0 INV SUBDRAIN
1479.6 BOT OF SD
1478.4 TOP OF S
1484.3 BOT OF WA
1478.4 TOP OF S
1487.6 TG
1484.6 INV
1488.9±RIM
1477.5 INV IN
1477.3 INV OUT
1479.6 BOT OF SD
1478.0 TOP OF S
1488.7±RIM
1479.9 INV
1489.4 TG
1484.9 INV
1481.8 INV 12"
1480.3 INV 48"
1480.0
INV
1488.5 TG
1484.0 INV
1484.5
INV
1477.8 INV-6"
1476.9 INV-8"
1486.7±RIM
1476.6 INV IN
1476.4 INV OUT
1479.4
INV
1487.3±RIM
1480.0 INV
1488.5±RIM
1479.8 INV
S=0.003
S=0.054
S=0.005
S=0.210
PROP.
R/W
EX.
R/W
EX. 12" WATER
18'
12'
11'
11'
23'
12'
12'
170'
(TYP.)

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

GEOTECHNICAL PROFESSIONALS INC.

GEOTECHNICAL INVESTIGATION
WOODCREST RETAIL CENTER
NWC VAN BUREN BOULEVARD AND WASHINGTON STREET
WOODCREST, RIVERSIDE COUNTY, CALIFORNIA

Prepared for:
VBSB, LLC
c/o LJC Enterprises
P.O. Box 2739
Mammoth Lakes, California 93456

Prepared by:
Geotechnical Professionals Inc.
5736 Corporate Avenue
Cypress, California 90630
(714) 220-2211

GPI Project No. 2995.I

April 24, 2026

GPI GEOTECHNICAL PROFESSIONALS INC.

April 24, 2026

VBSB, LLC
c/o LJC Enterprises
P.O. Box 2739
Mammoth Lakes, CA 93456

Attention: Mr. Larry Canale

Subject: Report of Geotechnical Investigation
Woodcrest Retail Center
NWC Van Buren Boulevard and Washington Street
Woodcrest, Riverside County, California

Dear Mr. Canale:

Transmitted herewith is a copy of our geotechnical investigation report for the proposed project at the subject site. We understand that you will distribute this report to the appropriate Design Team members and regulatory agencies.

We appreciate the opportunity of providing our services to the Team and look forward to seeing the project through its successful completion. Please do not hesitate to contact us if you have questions on the contents of our report or need further geotechnical assistance.

Very truly yours,
Geotechnical Professionals Inc.

Patrick I.F. McGervey, G.E.
Senior Engineer

Donald A. Cords, G.E.
Principal

Thomas Hill, CEG
Consulting Geologist

5736 Corporate Avenue • Cypress, CA 90630 • (714) 220-2211 , FAX (714) 220-2122

TABLE OF CONTENTS

PAGE

1.0 INTRODUCTION 1
1.1 GENERAL 1
1.2 PROJECT DESCRIPTION 1
1.3 PURPOSE OF INVESTIGATION 1
2.0 SCOPE OF WORK 2
3.0 SITE CONDITIONS 3
3.1 SURFACE CONDITIONS 3
3.2 SUBSURFACE SOIL CONDITIONS 3
3.3 GROUNDWATER CONDITIONS 4
4.0 GEOLOGIC – SEISMIC HAZARDS 5
4.1 OVERVIEW 5
4.2 REGIONAL AND LOCAL GEOLOGIC SETTING 5
4.3 FAULTING 5
4.3.1 Nearby Seismoegnic Sources 5
4.3.2 Active Faulting Evaluation 6
4.4 SEISMIC EXPOSURE 6
4.5 LIQUEFACTON AND LATERAL SPREADING 6
4.6 SEISMIC SUBSIDENCE 6
4.7 LANDSLIDING 6
4.8 EXPANSIVE AND COLLAPSE POTENTIAL 7
4.9 FLOODING 7
4.10 SEDIMENTATION AND EROSION 8
5.0 CONCLUSIONS AND RECOMMENDATIONS 9
5.1 OVERVIEW 9
5.2 SEISMIC DESIGN 10
5.2.1 General 10
5.2.2 Strong Ground Motion Potential 10
5.2.3 Potential for Ground Rupture 11
5.3 EARTHWORK 11
5.3.1 Clearing 11
5.3.2 Excavations 11
5.3.3 Subgrade Preparation 13
5.3.4 Material for Fill 13
5.3.5 Placement and Compaction of Fills 14
5.3.6 Shrinkage and Subsidence 14
5.3.7 Trench/Wall Backfill 14
5.3.8 Observation and Testing 15
5.4 FOUNDATIONS 15
5.4.1 Foundation Type 15
5.4.2 Allowable Bearing Pressures 15
5.4.3 Minimum Footing Width and Embedment 15
5.4.4 Estimated Settlements 16
5.4.5 Lateral Load Resistance 16
5.4.6 Foundation Inspection 16
5.5 BUILDING FLOOR SLABS 16
5.6 RETAINING STRUCTURES 17
5.7 EXTERIOR CONCRETE AND MASONRY FLATWORK 18
5.8 PAVEMENTS 18
5.9 CORROSION 19
5.10 DRAINAGE 19
5.11 INFILTRATION TESTING 19
5.12 GEOTECHNICAL OBSERVATION AND TESTING 19
6.0 LIMITATIONS 21

REFERENCES

APPENDICES

A LOG OF BORINGS
B LOG OF TEST PITS
C LABORATORY TESTING
D SEISMIC SHEAR WAVE TESTING

LIST OF FIGURES

FIGURE NO.

1	Site Location Map
2	Site Plan (Proposed Conditions)
3	Site Plan (Existing Conditions)
4	Regional Geologic Map
5.1 & 5.2	Geologic Cross Sections

APPENDIX A

A-1 to A-10	Log of Borings

APPENDIX B

B-1 to B-12	Log of Test Pits

APPENDIX C

C-1 to C-4	Direct Shear Test Results
Table 1	Soil Corrosivity Test Results

APPENDIX D

Seismic Line SW-1

1.0 INTRODUCTION

1.1 GENERAL

This report presents the results of a geotechnical investigation performed by Geotechnical Professionals Inc. (GPI) for the proposed retail center at the subject site in Woodcrest, California. The site location is shown on the Site Location Map, Figure 1.

1.2 PROJECT DESCRIPTION

We understand a new retail center is planned for the site covering 9.0 acres. Based on the Conceptual Site Plan by GK Pierce Architects, dated January 21, 2026, the retail center will include a Market (Stater Bros.), a shops building (Shops A), two restaurant buildings with drive-throughs (Pad B and Pad C), and a gas station with associated concession store (Pad A). The existing Farmer Boys and Bank buildings and surrounding drives within the southwest corner of the property are not a part of this report. The buildings will be single-story structures. The Market will cover a footprint of approximately 43,400 square feet (sf) and the other buildings range from 2,500 to 4,700 sf. New paved and landscaped areas are also planned. The proposed site configuration is shown on the Site Plan, Figure 2.

Proposed finish floor elevations and structural loads were not finalized at the time this report was prepared. We have assumed that proposed grades for the buildings will be similar to existing grades with cuts and fills of up to 3 feet. Based on similar past projects, we assume that maximum column and wall loads will be on the order of 100 to 150 kips and 3 to 5 kips per lineal foot, respectively (dead plus live loads).

Our recommendations are based upon the above structural and finish grade information. We should be notified if the actual loads and/or grades differ or change during the project design to either confirm or modify our recommendations. Also, when the project grading and foundation plans become available, we should be provided with copies for review and comment.

1.3 PURPOSE OF INVESTIGATION

The primary purpose of this investigation and report is to provide an evaluation of the existing geotechnical conditions at the site as they relate to the design and construction of the proposed development. More specifically, this investigation was aimed at providing geotechnical recommendations for earthwork, and design of foundations and pavements.

2.0 SCOPE OF WORK

Our scope of work included review of existing data, subsurface exploration, laboratory testing, engineering analysis and the preparation of this report.

Our subsurface exploration for this site consisted of 10 hollow stem auger borings and 12 exploratory test pits. The borings and test pits were performed as part of our feasibility investigations for the site in July 2020 and October 2020 (respectively) and were utilized in developing the recommendations provided in this report. The exploratory borings were advanced to depths of 6 to 21 feet below existing grades and the test pits to depths of 2 to 9½-feet below existing grades. A description of field procedures and logs of the explorations are presented in the attached Appendices A, and B. The approximate locations of the subsurface explorations are shown on Site Plans, Figures 2 and 3.

Laboratory soil tests were performed on selected representative samples as an aid in soil classification and to evaluate the engineering properties of the soils. The geotechnical laboratory testing program included determinations of moisture content and dry density, grain size analyses, shear strength, expansion potential, corrosivity, R-value and maximum density. Laboratory testing procedures and results are summarized in Appendix C.

Corrosivity testing was performed by HDR under subcontract to GPI. R-value testing was performed by Geologic Associates under subcontract to GPI. Their test results are presented Appendix C.

GPI subcontracted Terra Geosciences to perform a seismic shear-wave study. One seismic shear-wave line was conducted to measure shear wave velocities to a depth of at least 100 feet below the existing ground surface. The results of the seismic survey are presented in Appendix D.

GPI conducted a site reconnaissance and conducted a geologic review of reports in our files, and readily available published geologic information and maps, to assess the potential geologic hazards that could impact the site, including faulting and liquefaction. The results of our review are summarized in this report.

Engineering evaluations were performed to provide earthwork criteria, foundation design parameters, and assessments of seismic hazards. The results of our evaluations are presented in the remainder of the report.

3.0 SITE CONDITIONS

3.1 SURFACE CONDITIONS

The site is bounded on the north by a residential neighborhood with several single-family homes, to the east by Washington Street, to the south by Van Buren Boulevard, and to the west by single-family homes and an undeveloped lot.

The site is mostly undeveloped except directly adjacent to the corner of Van Buren Boulevard and Washington Street where there is an existing single-story retail center which includes a gas station. The site is relatively flat with sparse vegetation and isolated areas of mature trees.

Based on historical aerial photographs (historicaerials.com), the site was predominately undeveloped in 1948 (oldest available photograph) with the exception of single family homes and landscaping along Washington Street. The existing single-story retail center was constructed between 1967 and 1978, replacing one of the single family home lots. The single-family home formerly located near the northeast portion of the site along Washington street appears to have been demolished between 2016 and 2018.

In general, the site is relatively flat and slopes gently downward from east to west, with a change in ground surface elevation from about Elevation +1,500 feet to +1,490 feet across the site.

3.2 SUBSURFACE SOIL CONDITIONS

Our field investigation disclosed a subsurface profile consisting of a thin layer of fill soils overlying natural soils. Detailed descriptions of the conditions encountered are shown on the Log of Borings in Appendix A, and the Log of Test Pits in Appendix B.

With the exception of TP-12, the soils consisted of a thin (½ to 1-foot thick) layer of sandy clay fill soils over natural soils. We encountered sandy clay fill soils in TP-12 to a depth of approximately 7 feet.

The underlying natural soils consist of a layer of residual soil deposits underlain by slightly to moderately weathered bedrock. The residual soils consist predominately of silty sands, sandy clays and clayey sands and were highly variable in depths, extending from approximately 1 to 11 feet below the existing grade with the average being approximately 5 feet. The residual soils were relatively easy to excavate using the backhoe, and consist of decomposed granite formed by the weathering over time of the underlying bedrock.

The underlying weathered bedrock is moderately weathered near the ground surface with less weathering with depth. In general, at depths of 1½ to 11 feet below existing grades, the bedrock becomes less weathered, more intact, and very dense or hard. The weathered bedrock was difficult to excavate using the backhoe with the 24-inch bucket until refusal, and our hollow stem auger borings refused on the bedrock at depths between 6 and 16 feet below existing grades. The geologic map of Riverside shown on Figure 4 characterizes the bedrock at the site as tonalite. We have provided two geologic cross sections bisecting the site detailing the subsurface conditions in Figures 5.1 and 5.2.

We did not encounter significant amounts of clay soils in our borings at the site. The majority of the near surface soils are sandy and based on our laboratory testing exhibit very low expansion potential (EI = 10).

3.3 GROUNDWATER CONDITIONS

The historical high groundwater has not been determined in the Woodcrest area by the State of California. Groundwater was not measured at depths of 21 feet below existing grade in the borings however, we encountered a perched groundwater condition in several borings near the bottom of the residual soils or near the depth of refusal to drilling at intact bedrock. Perched groundwater can be anticipated in areas of the site overlying the intact bedrock. Other consultants (Stantec, 2009) have identified a perched groundwater condition at a depth of approximately 14 feet below existing grade at the southeast corner of the site.

4.0 GEOLOGIC - SEISMIC HAZARDS

4.1 OVERVIEW

GPI conducted a site reconnaissance and a geologic review of reports in our files and readily available published geologic information and maps, to assess potential geologic hazards that could impact the site, including faulting and liquefaction. The results of our review are summarized in this section of the report.

4.2 REGIONAL AND LOCAL GEOLOGIC SETTING

Regional Geology

The subject site is located within an uplifted, low relief plain known as Perris Plain. This area is generally bounded by the Box Springs Mountains to the northwest, the San Timoteo Badlands (mountain range) to the northeast, the Bernasconi Hills and Lake Perris (Perris Reservoir) to the east, and Sycamore Canyon to the west. In general, the Perris Plain in the area of the subject site drains to the southwest towards Lake Elsinore.

The subject site is at the eastern margin of a Peninsular Ranges Geomorphic Province structural block known as the Perris Block (Dyett et al., 2021). The Perris structural block is separated from the Santa Ana block to the west by the Elsinore Fault Zone and separated from the San Jacinto Block to the east by the San Jacinto Fault Zone.

In general, the Peninsular Ranges are characterized by northwesterly trending active faults and mountain ranges related to the San Andreas and other major fault systems in the province, such as the Chino, Elsinore, and San Jacinto Faults in relatively near proximity to the site. The province extends from the Santa Monica-Hollywood-Raymond Fault System, within the Los Angeles Basin, southeast to Baja California.

Local Geologic Conditions

Based on our current explorations and regional geologic maps by USGS, the site is underlain by Val Verde tonalite consisting of relatively homogenous, massive to well-foliated, medium to coarse grained biotite-hornblende tonalite. The geologic conditions in the site area are shown on the Regional Geologic Map, Figure 4.

4.3 FAULTING

4.3.1 Nearby Seismogenic Sources

We reviewed the California Geologic Survey (CGS) Fault Activity Map of California and results from the USGS Unified Hazard Tool to identify known nearby active faults. The names and distances of the faults lying within 15 miles of the project site are provided in the following table:

Table 1 – Significant Nearby Faults

Fault Name	Approximate Distance* (mi)
Elsinore	10.7
San Jacinto	11.9
San Andreas	20.1

* Defined as the closest distance to projection of rupture area along fault trace.

4.3.2 Active Faulting Evaluation

The site does not lie within an Alquist-Priolo Earthquake Fault Zone or have a fault located onsite or trending towards the site according to the California Geologic Survey Seismic Hazard Map.

Based on our investigation onsite, the available fault maps of the region, arial photographs, and our current explorations, there is no evidence of surficial fault ruptures onsite, and the potential for fault rupture at the site is low.

4.4 SIESMIC EXPOSURE

The subject site is located in a seismically active area of southern California. The type and magnitude of seismic hazards that may affect the site are dependent on both the distance to causative faults and the intensity and duration of the seismic event. The subject site will likely experience strong ground shaking caused by earthquakes on active, regional faults in the future. The proposed project should be designed and constructed in accordance with the seismic design parameters provided in the applicable building code and presented in the “Seismic Design” section of this report.

4.5 LIQUEFACTION AND LATERAL SPREADING

The site is not located within a zone identified as having a potential for liquefaction by the State, as the quadrangle has not yet been assessed. The site is not located in a zone identified as having a potential for liquefaction by the County of Riverside (Riverside, 2018). Based on the presence of near surface bedrock and significant depth to groundwater, liquefaction will not impact the site.

4.6 SEISMIC SUBSIDENCE

Seismic ground subsidence or dry sand settlement (not related to liquefaction induced settlements) occurs when strong earthquake shaking results in densification of loose to medium dense sandy soils above groundwater. Based on the relatively high density of the natural residual soils encountered above the bedrock and the relatively shallow depths to bedrock, the potential for dry sand seismic settlement to adversely affect the site is considered to be negligible.

4.7 LANDSLIDING

Secondary effects of seismic activity normally considered as possible hazards to a particular site which might occur as a consequence of severe ground shaking include

landsliding and ground lurching. The probability of occurrence depends on the severity of the earthquake, distance from faults, topography, subsoils, and groundwater conditions, in addition to other factors. Based on a review of available published literature, landsliding and ground lurching are considered unlikely at the site.

4.8 EXPANSIVE AND COLLAPSE POTENTIAL

Expansive soils generally consist of clays that can shrink and swell with changes in moisture content. Movement of soils in response to shrinkage and swelling has the potential to impact near-surface improvements such as lightly loaded foundations, floor slabs, and flatwork.

Based on the soils encountered in our explorations and laboratory testing, near surface soils are anticipated to have a low expansion potential when subject to changes in moisture content.

Collapsible soils generally consist of relatively dry, low-density materials that become weaker and more compressible with the addition of water or excessive loading. Based on our the soils encountered onsite, the potential for collapse of soils at this site to impact the project is considered low.

4.9 FLOODING AND EROSION

Various types of seismically induced flooding, which may be considered as potential hazards to a particular site, include flooding due to a tsunami (seismic sea wave), a seiche, or failure of a major water retention structure upstream of the project. The subject site is located approximately 33 miles inland from the Pacific Ocean at an elevation of approximately 1,490 feet above mean sea level. Based on the above, the probability of flooding due to a tsunami is considered to be nonexistent.

The subject site does lie in proximity to two notable bodies of water: Lake Perris (Perris Reservoir) to the east and Lake Matthews to the west. Lake Perris is an artificial lake having an approximate area of 3 square miles and is located approximately 3.5 miles east of the site at closest approach. Lake Perris lies at an elevation of roughly +1560 feet, which is comparable to the ground surface elevation of the proposed development. However, the subject site and Lake Perris are separated by a valley with an elevation of approximately 1450 at its lowest. As such, the probability of flooding due to seiche from Lake Perris is considered to be negligible.

Lake Matthews is located roughly 9.5 miles west of the site and lies at an elevation of approximately +1400 feet (about 100 feet below the ground surface elevation of the site).

Based on the significant elevation difference between the lake and the subject site, the probability of flooding due to seiche from Lake Matthews is considered to be negligible.

According to a flood map (Map 06065C1410G, dated August 28, 2008) prepared by the Federal Emergency Management Agency (FEMA), the project site is located in Zone D, which is defined as being an area with possible but undetermined flood hazards as not flood hazard analysis has been conducted.

4.10 SEDIMENTATION AND EROSION

The majority of the ground surface at the site is relatively level and is, or will be, covered with asphalt or concrete pavements. As such, erosion is not considered a hazard at the site.

During construction, provisions should be in place to address potential temporary erosion and sedimentation conditions. These provisions will be provided in the design-level geotechnical report and incorporated into the project civil and landscaping plans.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 OVERVIEW

Based on the results of our investigation, it is our opinion that from a geotechnical viewpoint it is feasible to develop the site as proposed, provided the geotechnical constraints discussed below are mitigated. The most significant geotechnical issues that will affect the design and construction of the proposed building are as follows:

- Undocumented fills and disturbed/tilled soils were generally encountered to depths of up to 1 foot below existing grade at the site. The fill soils are not considered to be suitable for direct support of foundations or floor slabs without remedial earthwork. For the proposed improvements, we recommend removal and recompaction of the fill and a portion of the upper low-density natural soils to provide uniform support for the planned foundations, and floor slab.

- Significant ripping and slow earthwork operations should be anticipated for excavations deeper than about 3 to 6 feet from the existing ground surface in portions of the site. While not encountered in our borings, buried boulders or outcrops of hard granitic rock near the existing surface may be encountered and may require chipping, blasting, and/or special handling.

- Rock greater than 12 inches in greatest dimension generated from removal of rock outcrops, buried boulders, or ripping of the weathered bedrock will need to be broken to achieve smaller sizes, removed from the site, or incorporated into landscape areas.

- Trench and tank excavations greater than 6 to 8 feet below existing grade may be difficult and will likely require large excavators with rock breakers in portions of the excavations.

- Static groundwater is anticipated to be significantly deeper than any excavations at the site. However, localized perched groundwater may be encountered in trench and tank excavations underlying the residual soils or weathered bedrock. The Contractor should be prepared to control perched groundwater in deeper excavations.

- Storm water infiltration is not to be feasible at the site. The presence of the perched groundwater indicates very poor conditions with respect to subsurface water infiltration.

Our recommendations related to the geotechnical aspects of the development of the site are presented in the subsequent sections of this report.

5.2 SEISMIC DESIGN

5.2.1 General

GPI retained Terra Geosciences to perform a seismic shear-wave survey to a depth of at least 100 feet below the existing ground surface (see Appendix D). Terra performed one seismic line to measure shear-wave velocity at the site, located on the southeast side of the site. The location of the seismic shear-wave survey line is shown on the attached Site Plans, Figures 2 and 3. Analysis of the data obtained during the seismic shear-wave survey indicate that the "weighted average" shear-wave velocity within the upper 100 feet of the subject site, V_{S30}, is 2,056 feet per second. The results of the shear-wave velocity testing is presented in Appendix D. In accordance with ASCE 7-22, this shear-wave velocity corresponds to a **Site Class C**.

We understand the seismic design of the proposed development will be in accordance with the California Building Code (CBC), 2025 edition and ASCE 7-22. For the referenced codes, we recommend a Site Class C be used.

Using the Site Class and the appropriate seismic design maps or pertinent website (e.g., https://ascehazardtool.org/), the corresponding seismic design parameters from the CBC are as follows:

2025 CBC:

S_S = 1.50g	S_{MS} = 1.54g	S_{DS} = 1.03g
S_1 = 0.56g	S_{M1} = 0.80g	S_{D1} = 0.54g

Other seismic code values can be obtained directly from the tables in the building code using the above Site Class and pertinent website (e.g., https://ascehazardtool.org/).

The above seismic code values should be confirmed by the Project Structural Engineer using the Site Class above and the pertinent internet website and tables from the building code. The seismic design method for the structures should be determined by the Project Structural Engineer.

5.2.2 Strong Ground Motion Potential

During the life of the project, the site will likely be subject to strong ground motions due to earthquakes on nearby faults. Based on the ASCE Hazard Tool website (https://ascehazardtool.org/), and the USGS Earthquake Hazard Toolbox website (https://earthquake.usgs.gov/nshmp/), we computed that the site could be subjected to a peak ground acceleration (PGA_M) of 0.55g and a mean magnitude 6.8 earthquake.

This acceleration has been computed using the mapped Maximum Considered Geometric Mean peak ground acceleration from ASCE 7-22 (ASCE, 2022) based on Site Class. The predominant earthquake magnitude was determined using a 2-percent probability of exceedance in a 50-year period, or an average return period of 2,475 years. The structural design will need to incorporate measures to mitigate the effects of strong ground motion.

5.2.3 Potential for Ground Rupture

There are no known active faults crossing or projecting through the site. The site is not located in an Alquist-Priolo Earthquake Fault Zone. Therefore, ground rupture at this site due to faulting is considered unlikely.

5.3 EARTHWORK

The earthwork for the planned improvements is anticipated to consist of clearing and excavation of undocumented fill and upper natural soils, subgrade preparation, and the placement and compaction of fill.

5.3.1 Clearing

Prior to grading, performing excavations or constructing the proposed improvements, the areas to be developed should be stripped of vegetation and cleared of debris and pavements. Buried obstructions, such as footings, abandoned utilities, and tree roots should be removed from areas to be developed. Deleterious material generated during clearing should be removed from the site. Existing vegetation should not be mixed into the soils.

Although not encountered in our explorations, cesspools or septic systems are likely to be encountered during grading due to the prior houses on the site. If cesspools or septic systems are encountered, they should be removed in their entirety. The resulting excavation should be backfilled with properly compacted fill soils. As an alternative, cesspools can be backfilled with lean sand-cement slurry. At the conclusion of the clearing operations, a representative of GPI should observe and accept the site prior to further grading.

5.3.2 Excavations

Excavations at this site will include removals of undocumented fill and disturbed low-density natural soils, footing excavations, and trenching for proposed utility lines.

To provide uniform support for the planned buildings, prior to placement of fills or construction of the buildings, the existing fill within the proposed building pads should be removed and replaced as properly compacted fill. For planning purposes, removals for the building pads should extend to a depth of 3 feet below existing grades or 2 feet below the base of foundations, whichever is deeper. If bedrock materials or competent dense natural soils are encountered shallower than the recommendations above, the foundations may be supported directly on undisturbed bedrock or competent dense natural soils.

In the building pads, overexcavation to the maximum depth of the planned pad utilities with large excavating equipment may be a preferred construction method to the local use of lighter backhoes. Utility subcontractors may have difficulties excavating the narrow plumbing lines in the moderately weathered bedrock underlying the building pad.

Removals below minor structures, such as free-standing walls and trash enclosures, should extend to a depth of 2 feet below existing grades or 1 foot below the base of the foundation, whichever is deeper. If bedrock materials or competent natural dense soils are encountered shallower than the recommended removals, the foundations may be supported directly on the bedrock materials or competent dense soils. For pavement and flatwork subgrade, removals are not anticipated to be required unless loose or disturbed soils are encountered.

The actual depths of removals should be determined in the field during grading by GPI. The soils exposed at the base of the overexcavation should be processed in place as described in the “Subgrade Preparation” section of this report.

The Project Surveyor should accurately stake the corners of the areas to be overexcavated in the field. Where space is available, the base of the excavations should extend laterally at least 5 feet beyond the building lines or edge of foundations, or a minimum distance equal to the depth of overexcavation/compaction below finish grade (i.e., a 1:1 projection below the top outside edge of footings), whichever is greater. Building lines include the footprint of the building and other foundation supported improvements, such as canopies and attached site walls.

The contractor should determine the best method for removal based on the subsurface conditions outlined herein. Significant ripping and slow earthwork operations should be anticipated for excavations greater than about 3 to 6 feet or deeper from the existing ground surface in portions of the site. While not encountered in our borings, buried boulders or outcrops of hard granitic rock near the existing surface may be encountered and may require chipping, blasting, and/or special handling. The weathered granitic bedrock encountered could possibly be excavated using a larger excavator, by using a hydraulic concrete attachment, or ripping with D8R or D9R shank ripper.

Where not removed by the aforementioned excavations, existing utility trench backfill should be removed and replaced as properly compacted fill within the building pads. For planning purposes, removals over the utilities should extend to within 1-foot of the top of the pipe. For utilities that are 5 feet or shallower, the removal should extend laterally 1-foot beyond both sides of the pipe. For deeper utilities, the removals should include a zone defined by a 1:1 projection upward (and away from the pipe) from each side of the pipe. The actual limits of removal will be confirmed in the field. We recommend that known utilities be shown on the grading plan. Wet utilities left in-place outside building areas should be capped to reduce the potential for water to infiltrate into the building pad.

The upper soils at the site are expected to have a slight caving potential when exposed in open cuts. Temporary construction excavations may be made vertically into the undisturbed natural soils without shoring to a depth of 4 feet below adjacent grade. For cuts up to 9 feet deep, the slopes should be properly shored or sloped back to at least ¾:1 (horizontal:vertical) or flatter. For deeper cuts up to 15 feet, the slopes should be properly shored or sloped back to at least 1:1 or flatter. The allowable slope inclinations are measured from the toe to the top of the cut. Even at these inclinations, some raveling should be anticipated. The exposed slope face should be kept moist (but not saturated) during construction to reduce local sloughing. Surcharge loads should not be permitted within a horizontal distance equal to the height of cut from the top of the excavation or 5

feet from the top of the slopes, whichever is greater, unless the cut is properly shored. Excavations that extend below an imaginary plane inclined at 45 degrees below the edge of adjacent existing site facilities should be properly shored to maintain support of adjacent elements. Excavations and shoring systems should meet the minimum requirements given in the State of California Occupational Safety and Health Standards.

Deeper removals along property lines or adjacent to existing improvements will require shoring or slot cuts. Recommendations for shoring are provided in the “Retaining Structures” section of the report. Removals that will undermine existing adjacent pavements or hardscape may utilize “ABC” slot cuts to depths not greater than 8 feet. Unsurcharged slot cuts up to 8 feet in height should not be wider than 6 feet and should be backfilled to finished grade prior to excavation of the adjacent four slots (two on each side of the excavated slot). A test slot should be performed prior to production slots to confirm the stability of the planned cuts.

5.3.3 Subgrade Preparation

After the recommended cuts and removals are performed and prior to placing fills or construction of the proposed improvements, the subgrade soils should be scarified to a depth of 12 inches, moisture conditioned, and compacted to at least 90 percent of the maximum dry density, determined in accordance with ASTM D1557. Where bedrock materials are encountered at the base of removals, subgrade processing may be omitted.

5.3.4 Material for Fill

The on-site soils are, in general, suitable for use as compacted fill, except for oversized materials greater than 8 inches in diameter. Fills within the depths of the planned footings should not contain particles greater than 3 inches in diameter to reduce difficulties in excavating footings in oversized materials.

Retaining wall backfill and fill placed directly beneath flatwork should consist of granular and non-expansive soils. If encountered, the limited on-site clayey soils should not be placed behind retaining walls or within one foot of finished grade in flatwork areas.

Imported fill material should be predominately granular (contain no more than 40 percent fines - portion passing No. 200 sieve) and non-expansive (E.I. less than 20). The import should also exhibit an R-value of at least 20 if used in proposed paved areas. GPI should be provided with a sample (at least 50 pounds) and notified of the location of soils proposed for import at least 72 hours prior to importing. Each proposed import source should be sampled, tested and accepted for use prior to delivery of the soils to the site. Soils imported prior to acceptance by GPI may be rejected if not suitable.

Both imported and existing on-site soils to be used as fill should be free of debris and pieces larger than 8 inches in greatest dimension (3 inches if placed within the depth of the planned footings). If the on-site concrete is crushed to be re-used in compacted fill, we recommend the material be crushed to 3-inch minus in size and blended with the onsite soils prior to use.

5.3.5 Placement and Compaction of Fills

Fill soils within the footprints of the building pads should be placed in horizontal lifts, moisture-conditioned, and mechanically compacted to densities equal to at least 95 percent of the maximum dry density, determined in accordance with ASTM D1557. Backfill placed outside of the building footprints should be compacted to densities equal to at least 90 percent of the maximum dry density. The optimum lift thickness will depend on the compaction equipment used and can best be determined in the field.

The following uncompacted lift thickness can be used as preliminary guidelines.

Plate compactors	4-6 inches
Small vibratory or static rollers (5-ton±) or track equipment	6-9 inches
Scrapers, Heavy loaders, and large vibratory rollers	9-12 inches

The maximum lift thickness should not be greater than 12 inches and each lift should be thoroughly compacted and accepted prior to subsequent lifts.

In general, on-site soils should be placed at moisture contents of 1 to 3 percent over the optimum moisture content. Current moisture contents of the upper soils are generally highly variable with moistures ranging from approximately 1.5 to 17 percent. Moisture conditioning (drying and wetting) will likely be required.

Compacted fills should not be allowed to dry out prior to covering. If the fills are allowed to dry out prior to covering, additional moisture conditioning and processing (scarification/recompaction) will be required. A representative of GPI should observe and test the finished subgrade within 24 hours of concrete placement for floor slabs, hardscape, and pavements.

5.3.6 Shrinkage and Subsidence

Shrinkage is the loss of soil volume caused by compaction of fills to a higher density than before grading. Subsidence is the settlement of in-place subgrade soils caused by loads generated by large earthmoving equipment. For earthwork volume estimating purposes, an average shrinkage value of 0 to 5 percent may be assumed for the surficial soils. Subsidence is expected to be negligible. These values are estimates only and exclude losses due to removal of vegetation, boulders or debris. Actual shrinkage and subsidence will depend on the types of earthmoving equipment used and should be determined during grading.

5.3.7 Trench/Wall Backfill

Utility trench backfill consisting of the on-site materials or imported soil, or wall backfill consisting of granular material should be mechanically compacted in lifts. The limited on-site clays are not suitable for placement as retaining wall backfill. Lift thickness should not exceed those values given in the "Placement and Compaction of Fills" section of this report. Moisture conditioning (wetting and drying) of the on-site soils will be required prior to re-use as backfill. Jetting or flooding of backfill materials should not be permitted. A representative of GPI should observe and test trench and wall backfill as they are placed.

In backfill areas where mechanical compaction of soil backfill is impractical due to space constraints, sand-cement slurry may be substituted for compacted backfill. The slurry should contain two sacks of cement per cubic yard and have a maximum slump of 5 inches.

If open-graded rock is used as backfill, the material should be placed in lifts and mechanically densified. Open-graded rock should be separated from the on-site soils by a suitable filter fabric (Mirafi 140N or equivalent).

5.3.8 Observation and Testing

A representative of GPI should observe excavations, subgrade preparation, and fill placement activities. Sufficient in-place field density tests should be performed during fill placement and in-place compaction to evaluate the overall compaction of the soils. If foundations are to be supported on dense natural soils, in-place density testing should be performed to confirm the soil density prior to placement of concrete. Soils that do not meet minimum compaction requirements should be reworked and tested prior to placement of additional fill.

5.4 FOUNDATIONS

5.4.1 Foundation Type

As discussed previously, the proposed structures can be supported on conventional spread footings founded on either properly compacted fill or competent natural materials.

5.4.2 Allowable Bearing Pressures

Based on the shear strength and elastic settlement characteristics of the natural and recompacted on-site soils, a static allowable net bearing pressure of up to 5,000 pounds per square foot (psf) may be used for both continuous footings and isolated column footings for the buildings. These bearing pressures are for dead-plus-live-loads, and may be increased one-third for short-term, transient, wind and seismic loading. The actual bearing pressure used may be less than the value presented above and can be based on economics and structural loads to determine the minimum width for footings as discussed below. The maximum edge pressures induced by eccentric loading or overturning moments should not be allowed to exceed these recommended values.

For minor structures, such as site walls and property line screen walls, where reduced excavation depths have been recommended, we recommend a maximum allowable bearing capacity of 2,000 psf be used with minimum footing widths and depths of 18 inches.

5.4.3 Minimum Footing Width and Embedment

The following minimum footing widths and embedments are recommended for the corresponding allowable bearing pressure.

STATIC BEARING PRESSURE (psf)	MINIMUM FOOTING WIDTH (inches)	MINIMUM FOOTING* EMBEDMENT (inches)
5,000	48	24
4,000	36	24
3,000	24	18
2,000	12	18

* Refers to minimum depth below lowest adjacent grade at the time of foundation construction. If the floor slab is in-place prior to fully loading the footings, depth of interior footings may be taken from the top of the floor slab.

A minimum footing width of 12 inches and embedment of 18 inches should be used even if the actual bearing pressure is less than 2,000 psf.

5.4.4 Estimated Settlements

Total static settlement of isolated pad or continuous wall footings (up to 150 kips for columns and 3 to 5 kips per lineal foot for walls) is expected to be less than ¾-inch. Differential static settlement between similarly loaded column footings or along a 40-foot span of a continuous footing is expected to be on the order of ¼-inch or less.

The above estimates are based on the assumption that the recommended earthwork will be performed and that the footings will be sized in accordance with our recommendations.

5.4.5 Lateral Load Resistance

Soil resistance to lateral loads will be provided by a combination of frictional resistance between the bottom of footings and underlying soils and by passive soil pressures acting against the embedded sides of the footings. For frictional resistance, a coefficient of friction of 0.40 may be used for design. In addition, an allowable lateral bearing pressure equal to an equivalent fluid weight of 350 pounds per cubic foot may be used, provided the footings are poured tight against compacted fill. These values may be used in combination without reduction.

5.4.6 Foundation Inspection

Prior to placement of concrete and reinforcing steel, a representative of GPI should observe and approve foundation excavations.

5.5 BUILDING FLOOR SLABS

A vapor/moisture retarder should be placed under slabs that are to be covered with moisture-sensitive floor coverings (parquet, vinyl tile, etc.) or will be storing moisture sensitive supplies. Currently, common practice is to use a 15-mil polyolefin product such as Stego Wrap for this purpose. Whether to place the concrete slab directly on the vapor barrier or place a clean sand layer between the slab and vapor barrier is a decision for the Project Architect, as it is not a geotechnical issue. If covered by sand, the sand layer should be about 2 inches thick and contain less than 5 percent by weight passing the No. 200 sieve. Based on our explorations and laboratory testing, the soils at the site are not

suitable for this purpose. The function of the sand layer is to protect the vapor retarder during construction and to aid in the uniform curing of the concrete. This layer should be nominally compacted using light equipment. The sand placed over the vapor retarder should only be slightly moist. If the sand gets wet (for example as a result of rainfall or excessive moistening) it must be allowed to dry prior to placing concrete. Care should be taken to avoid infiltration of water into the sand layer after placement of the concrete slab, such as at slab cut-outs and other exposures. A sand layer is not required beneath the vapor retarder, but we take no exception if one is provided.

It should be noted that the material used as a vapor retarder is only one of several factors affecting the prevention of moisture accumulation under floor coverings. Other factors include maintaining a low water to cement ratio for the concrete used for the floor slab, effective sealing of joints and edges (particularly at pipe penetrations), as well as excess moisture in the concrete. The manufacturer of the floor coverings should be consulted for establishing acceptable criteria for the condition of floor surface prior to placing moisture-sensitive floor coverings.

5.6 RETAINING STRUCTURES

The following recommendations are provided for walls or shoring less than 8 feet in height. We recommend that walls be backfilled with non-expansive, granular soils (less than 40 percent passing the No. 200 sieve). Based on our subsurface explorations, such material is anticipated to be readily available onsite.

Active earth pressures can be used for designing cantilevered walls or shoring that can yield laterally at least ½-percent of the wall height under the imposed loads. For level, drained backfill, derived from granular, non-expansive soils, a lateral pressure of an equivalent fluid weighing of 36 pounds per cubic foot may be used. This value can also be used for design of temporary cantilevered shoring.

At-rest pressures should be used for restrained walls that remain rigid enough to be essentially non-yielding. For select, non-expansive, level, drained backfill, a lateral pressure of an equivalent fluid weighing 56 pounds per cubic foot can be used.

As outlined in the California Building Code, site retaining walls 6 feet or taller should be designed to resist seismic lateral earth pressures. A lateral pressure equivalent to a fluid with a unit weight of 20 pounds per cubic foot may be used. This pressure should be combined with the active earth pressure presented above. If the retaining walls are designed using the at-rest pressure provided above, only the difference between the active plus seismic pressures and the at-rest pressure needs to be included as the seismic pressure.

The recommended pressures are based on the assumption that the supported earth will be fully drained, preventing the build-up of hydrostatic pressures. For traditional backfilled retaining walls, a drain consisting of perforated pipe and 1 cubic foot of gravel per lineal foot, wrapped in filter fabric should be used. The fabric (non-woven filter fabric, Mirafi 140N or equivalent) should be lapped at the top.

Walls subject to surcharge loads should be designed for an additional uniform lateral pressure equal to one-third and one-half the anticipated surcharge pressure for unrestrained and restrained walls, respectively.

The Structural Engineer should specify the use of select, granular wall backfill on the plans. Wall footings should be designed as discussed in the “Foundations” section.

5.7 EXTERIOR CONCRETE AND MASONRY FLATWORK

Exterior concrete and masonry flatwork should be supported on non-expansive, compacted fill which appears to be readily available onsite. This includes the slabs for trash enclosures, generators, etc. The use of the clayey soils within 2-feet of the slab subgrade should not be permitted unless the client indicates that differential heave is tolerable (if so, this should be stated on the project civil plans). This includes exterior sidewalks, stamped concrete, trash enclosures, non-traffic pavement, pavers, etc. Prior to placement of concrete, the subgrade should be prepared as recommended in the "Subgrade Preparation" section of this report.

5.8 PAVEMENTS

A test on the upper soils resulted in an R-value of 64. To account for the variability of the onsite soils an R-value of 50 was used in the design of the onsite pavements. The California Division of Highways Design Method was used for design of the recommended preliminary pavement sections. The following preliminary pavement sections are recommended for planning purposes only.

PAVEMENT AREA	TRAFFIC INDEX	SECTION THICKNESS (inches)	
		ASPHALT/PORTLAND CONCRETE	AGGREGATE BASE COURSE
Asphalt Concrete			
Automobile Parking & Drives	4.0/5.0	3.0	4.0
Truck/Bus Drives	6.0	4.0	4.0
Heavy Truck/Bus Drives	7.0	4.0	5.0
Portland Cement Concrete			
Automobile Parking & Drives	4.0	5.5	--
Truck/Bus Drives	6.0	6.0	--
Heavy Truck/Bus Drives	7.0	6.5	--

If vehicular pavers are to be used for the project, the paver and leveling sand should be supported on at least the thickness of aggregate base shown above for the appropriate asphalt concrete traffic index.

The pavement subgrade underlying the aggregate base should be properly prepared and compacted in accordance with the recommendations outlined under "Subgrade Preparation".

The portland cement concrete used for paving should have a compressive strength of at least 3,500 psi at the time the pavement is subjected to vehicular traffic.

The pavement base course should be compacted to at least 95 percent of the maximum dry density (ASTM D1557). Aggregate base should conform to the requirements of Section 26 of the California Department of Transportation Standard Specifications for Class II aggregate base (three-quarter-inch maximum) or Section 200-2 of the Standard Specifications for Public Works Construction (Green Book) for untreated base materials (except Processed Miscellaneous Base).

The above recommendations assume that the base course will be properly drained. The design of paved areas should incorporate measures to prevent moisture build-up within the base course and subgrade, which can otherwise lead to premature pavement failure. For example, curbing adjacent to landscaped areas should be deep enough to act as a barrier to infiltration of irrigation water into the adjacent base course.

5.9 CORROSION

Laboratory testing by HDR (Appendix C) on a selected sample indicates soluble sulfate content of 22 mg/kg. For the 2025 CBC, foundation concrete should conform to the requirements outlined in ACI 318, Section 4.3 for category S0 levels of soluble sulfate exposure. Chloride levels in the sample tested was found to be 56 mg/kg. Due to the potential exposure to moisture, we recommend at least a Category C1 be used in design.

Resistivity testing of representative samples of the onsite soils indicates that they are moderately corrosive to buried ferrous metals. GPI does not practice corrosion protection engineering. If corrosion protection recommendations are required, a corrosion engineer should be consulted to provide recommendations to protect these elements from corrosion.

5.10 DRAINAGE

Positive surface gradients should be provided adjacent to structures so as to direct surface water run-off and roof drainage away from foundations and slabs toward suitable discharge facilities. Long-term ponding of surface water should not be allowed on pavements or adjacent to buildings. We also recommend landscape areas adjacent to the building or hardscape areas be drained, with consideration of installing an impermeable liner.

5.11 STORMWATER INFILTRATION

Based on the presence of the perched groundwater and relatively shallow bedrock, storm water infiltration is not to be feasible at the site. Guidelines for storm water infiltration by the County of Riverside (Riverside, 2011) requires that infiltration should be at least 5 feet higher than the bedrock (impermeable layer) which was encountered as shallow as 1½ feet below existing grades in our explorations.

5.12 GEOTECHNICAL OBSERVATION AND TESTING

We recommend that a representative of GPI observe earthwork during construction to confirm that the recommendations provided in our report are applicable during construction. The earthwork activities include grading, compaction of fills, subgrade

preparation, pavement construction and foundation excavations. If conditions are different than expected, we should be afforded the opportunity to provide an alternate recommendation based on the actual conditions encountered.

6.0 LIMITATIONS

This report, exploration logs, and other materials resulting from GPI's efforts were prepared exclusively for VBSB, LLC and their consultants in designing the proposed development. The report is not intended to be suitable for reuse on extensions or modifications of the project or for use on projects other than the currently proposed development, as it may not contain sufficient or appropriate information for such uses. If this report or portions of this report are provided to contractors or included in specifications, it should be understood that they are provided for information only. This report cannot be utilized by another entity without the express written permission of GPI.

Soil deposits may vary in type, strength, and many other important properties between points of exploration due to non-uniformity of the geologic formations or to man-made cut and fill operations. While we cannot evaluate the consistency of the properties of materials in areas not explored, the conclusions drawn in this report are based on the assumption that the data obtained in the field and laboratory are reasonably representative of field conditions and are conducive to interpolation and extrapolation.

Furthermore, our recommendations were developed with the assumption that a proper level of field observation and construction review will be provided by GPI during grading, excavation, and foundation construction. If field conditions during construction appear to be different than is indicated in this report, we should be notified immediately so that we may assess the impact of such conditions on our recommendations. If others perform the construction phase services, they must accept full responsibility for all geotechnical aspects of the project, including this report.

Our investigation and evaluations were performed using generally accepted engineering approaches and principles available at this time and the degree of care and skill ordinarily exercised under similar circumstances by reputable geotechnical engineers practicing in this area. No other representation, either express or implied, is included or intended in our report.

Respectfully submitted,
Geotechnical Professionals Inc.

Patrick I.F. McGervey, G.E.
Senior Engineer

REGISTERED PROFESSIONAL ENGINEER
PATRICK I.F. MCGERVEY
No. 3255
GEOTECHNICAL
STATE OF CALIFORNIA

Donald A. Cords, G.E.
Principal

REGISTERED PROFESSIONAL ENGINEER
DONALD A. CORDS
No. GE 2529
GEOTECHNICAL
STATE OF CALIFORNIA

Thomas Hill, CEG
Consulting Geologist

REGISTERED GEOLOGIST
THOMAS G. HILL
No. 1100
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

REFERENCES

American Society of Civil Engineers (2022), "Minimum Design Loads and Associated Criteria for Buildings and Other Structures," ASCE/SEI 7-22.

California Office of Statewide Health Planning and Development (OSHPD), Seismic Design Maps Website, https://seismicmaps.org/

NETR Online, Historical Aerials, www.historicalaerials.com

United States Geologic Survey, 2008 National Seismic Hazard Maps – Source Parameters, http://earthquake.usgs.gov/cfusion/hazfaults_search

United States Geologic Survey (USGS), Unified Hazard Tool website, https://earthquake.usgs.gov/hazards/interactive/

California Department of Water Resources, Water Data Library, http://www.water.ca.gov/waterdatalibrary/

County of Riverside, "Infiltration Testing", Appendix A, Low Impact Development BMP Design Handbook, rev. September 2011

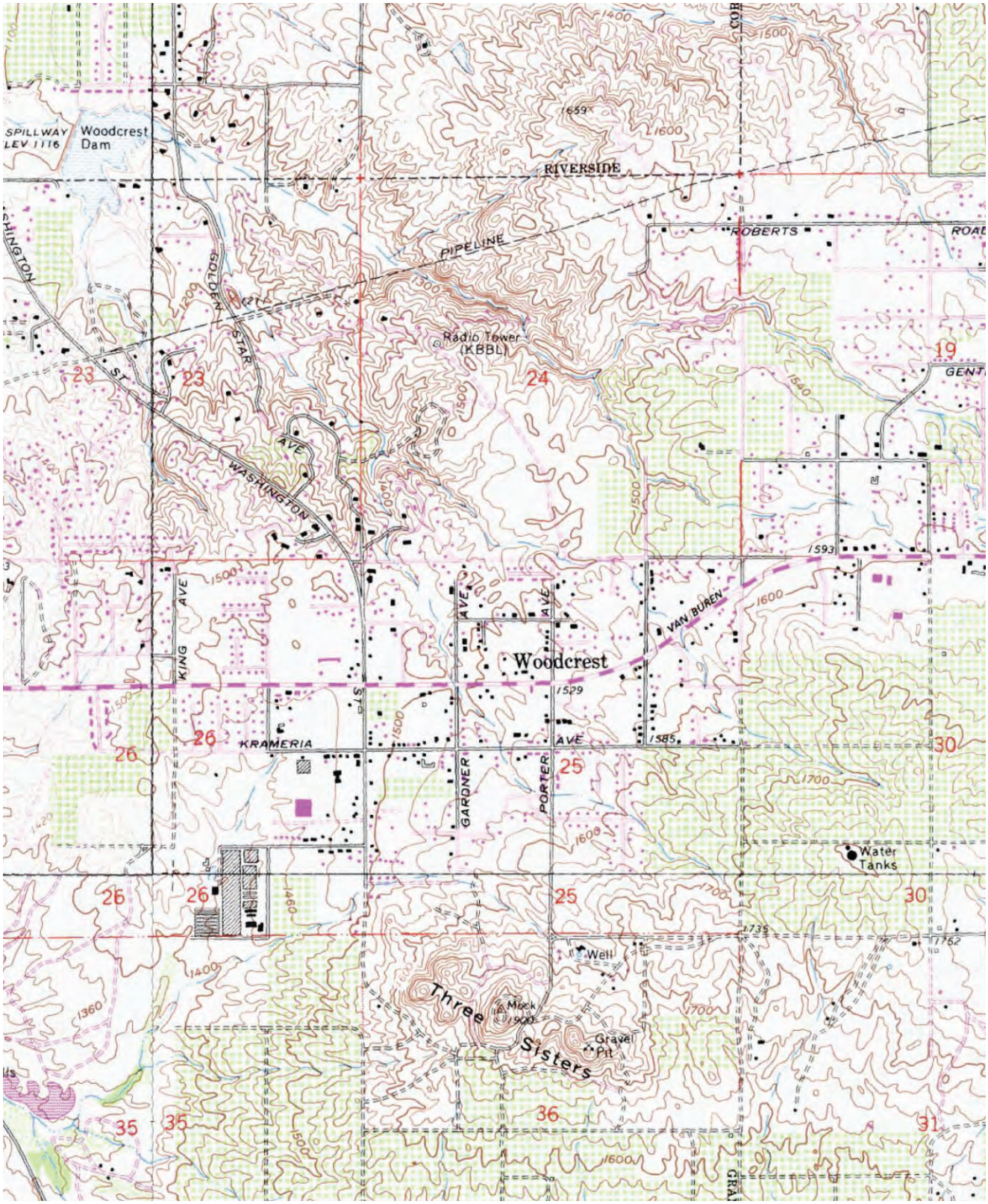
California Office of Statewide Health Planning and Development (OSHPD), Seismic Design Maps Website, https://seismicmaps.org/

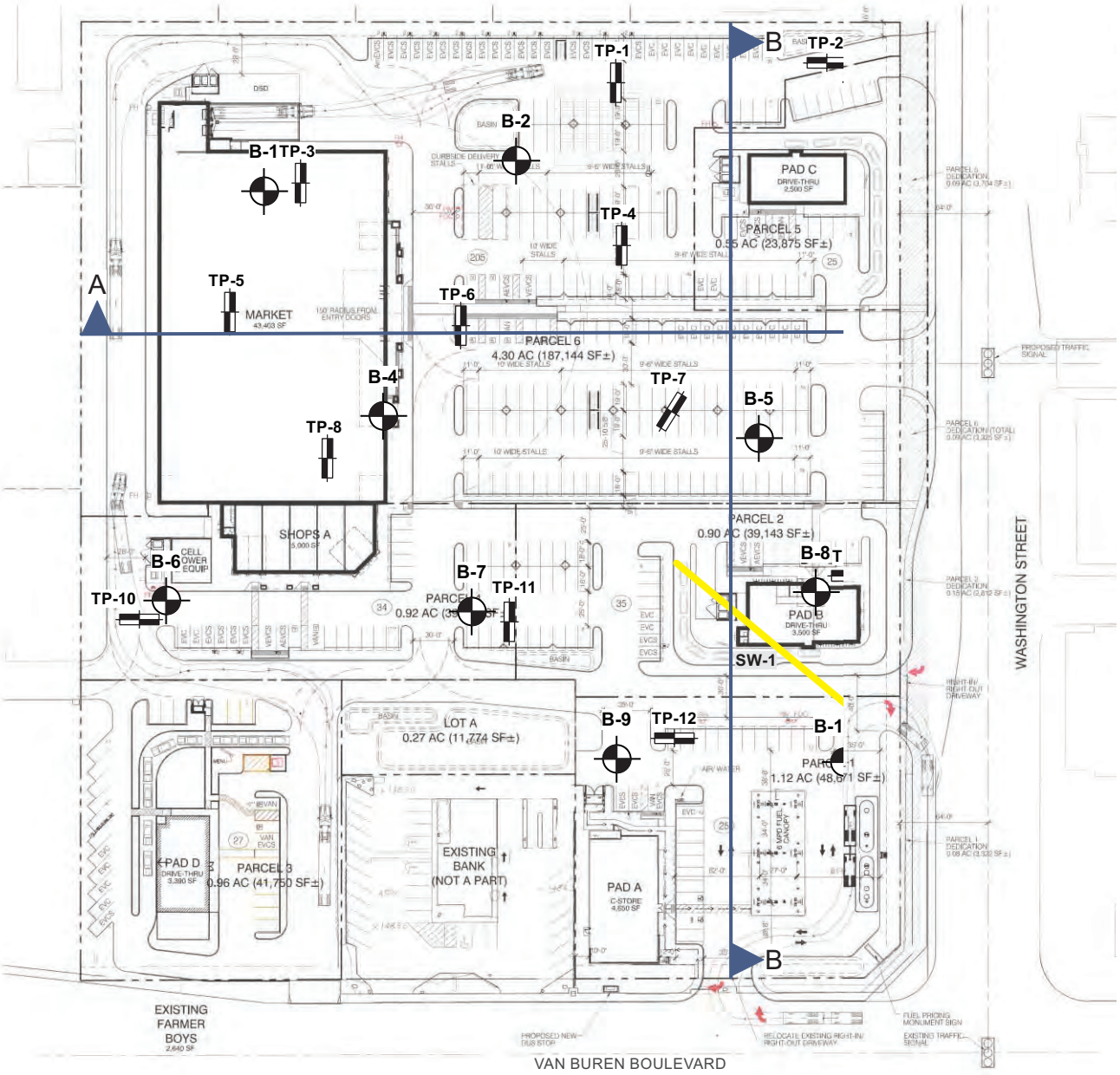
Morton, D.M., Cox, B.F., "Geologic Map of the Riverside East 7.5' quadrangle, Riverside County, California" Open File Report OF-2001-452, published 2002.

Riverside County, "Liquefaction Map Overlays", developed by Earth Consultants International, https://koordinates.com/layer/96846-riverside-county-ca-liquefaction, September 12, 2018.

Stantec, 2009 "Site Assessment Report, 7-Eleven Store #16552, 16971 Van Buren Boulevard, Riverside, California 92504" Site # 200828088, dated July 24, 2009

United States Geologic Survey, "Geologic Map of the Riverside East 7.5' Quadrangle, Riverside County, California," Open File Report 01-452, Version 1.0, Martin, D. and Cox, B., 2001.


SPILLWAY ELEV 1116
Woodcrest Dam
RIVERSIDE
PIPELINE
ROBERTS
GOLDEN STAR
Radio Tower (KBBL)
WASHINGTON ST
AVE
KING AVE
Woodcrest
VAN BUREN
KRAMERIA
GARDNER
PORTER
Water Tanks
Well
Three Sisters
Mock
Gravel Pit
23
24
19
26
25
30
35
36
31


B-1
TP-3
B-2
TP-1
TP-2
B
PAD C
DRIVE-THRU
2,500 SF
PARCEL 5
0.55 AC (23,875 SF±)
TP-4
A
TP-5
MARKET
43,403 SF
TP-6
PARCEL 6
4.30 AC (187,144 SF±)
B-4
TP-7
B-5
TP-8
SHOPS A
5,000 SF
PARCEL 2
0.90 AC (39,143 SF±)
B-6
CELL TOWER EQUIP
B-7
TP-11
B-8
TP-10
PAD B
DRIVE-THRU
3,500 SF
SW-1
WASHINGTON STREET
LOT A
0.27 AC (11,774 SF±)
B-9
TP-12
B-1
PARCEL 1
1.12 AC (48,971 SF±)
PAD D
DRIVE-THRU
3,390 SF
PARCEL 3
0.96 AC (41,750 SF±)
EXISTING
BANK
(NOT A PART)
PAD A
C-STORE
4,650 SF
B
EXISTING
FARMER
BOYS
2,440 SF
VAN BUREN BOULEVARD



EXPLANATION

B-10 — APPROXIMATE LOCATION AND NUMBER OF EXPLORATORY BORING

TP-12 — APPROXIMATE LOCATION, NUMBER, AND ORIENTATION OF EXPLORATORY TEST PIT

SW-1 — APPROXIMATE LOCATION OF SEISMIC SHEAR WAVE LINE

APPROXIMATE LOCATION OF CROSS SECTION

N

0 120 240 FEET

BASE PLAN REPRODUCED FROM GOOGLE EARTH 2025

GPI GEOTECHNICAL PROFESSIONALS, INC.

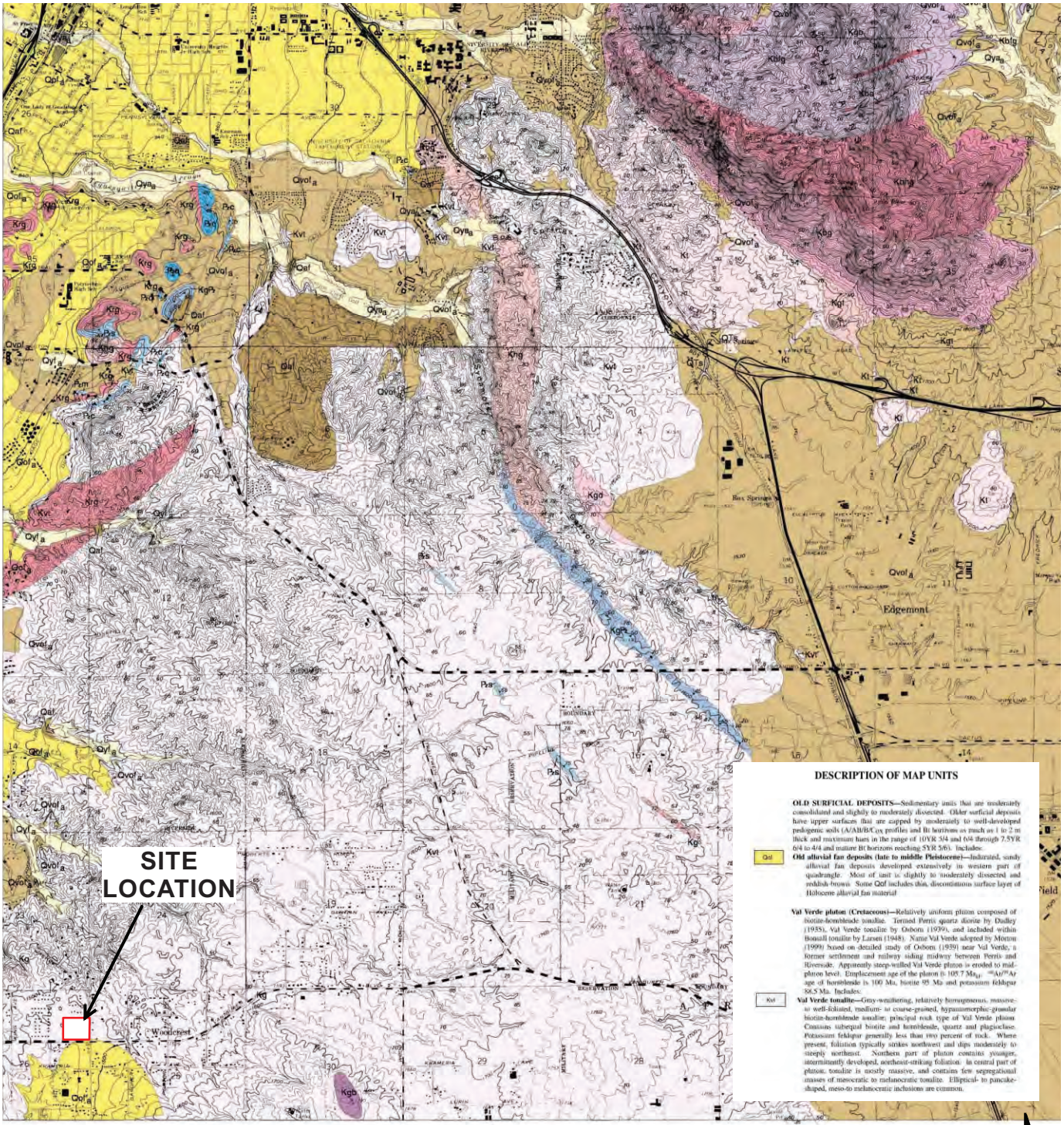
WOODCREST RETAIL

GPI PROJECT NO.: 2995.I | SCALE: 1" = 120'

SITE PLAN

(Existing)

FIGURE 3



BASE MAP REPRODUCED FROM THE GEOLOGIC MAP OF THE RIVERSIDE EAST 7.5' QUADRANGLE PREPARED BY DOUGLAS M. MORTON & BRETT COX: DATED 1988

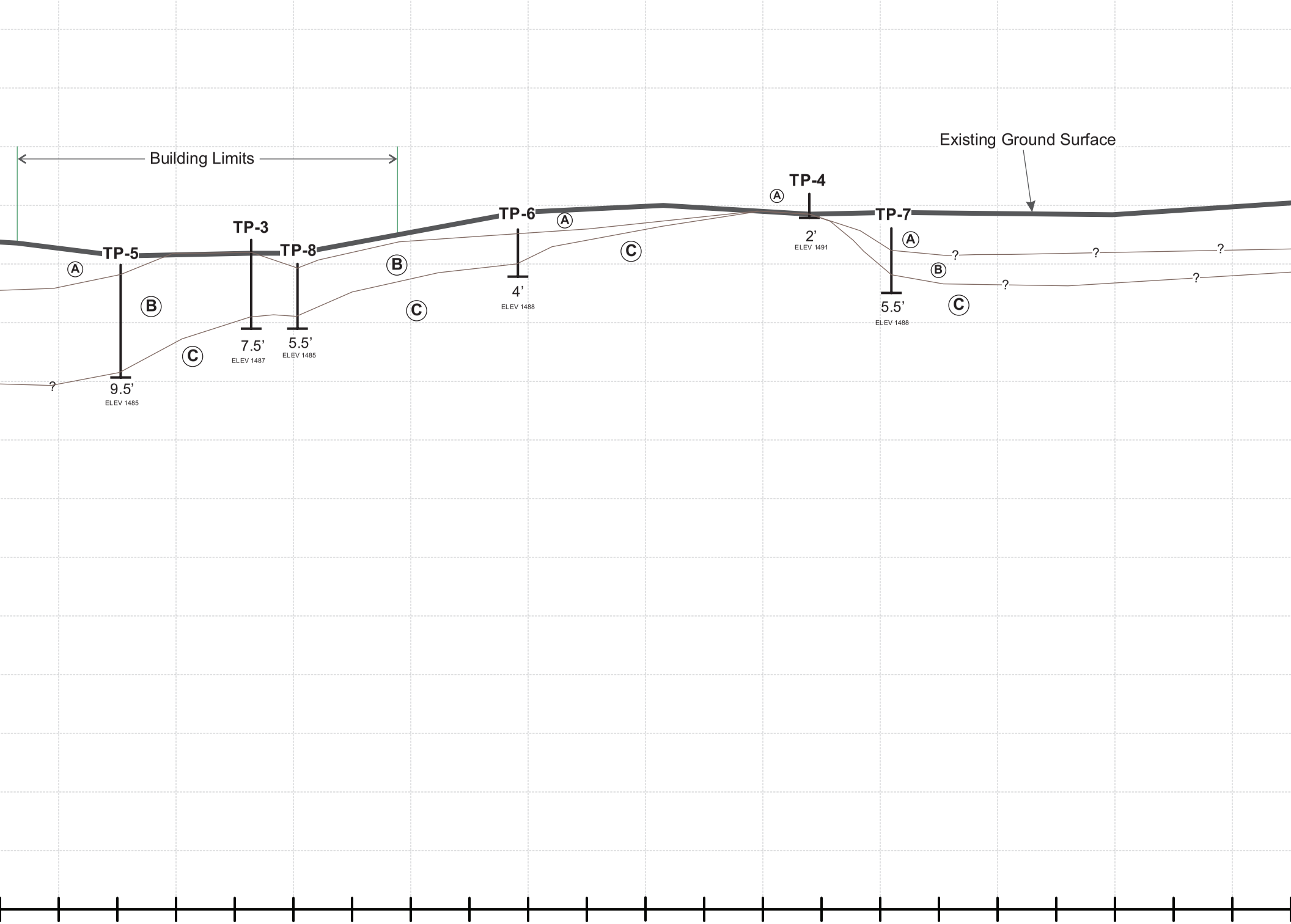
GPI GEOTECHNICAL PROFESSIONALS, INC.

WOODCREST RETAIL

GPI PROJECT NO.: 2995.I | SCALE: 1" = 5000'

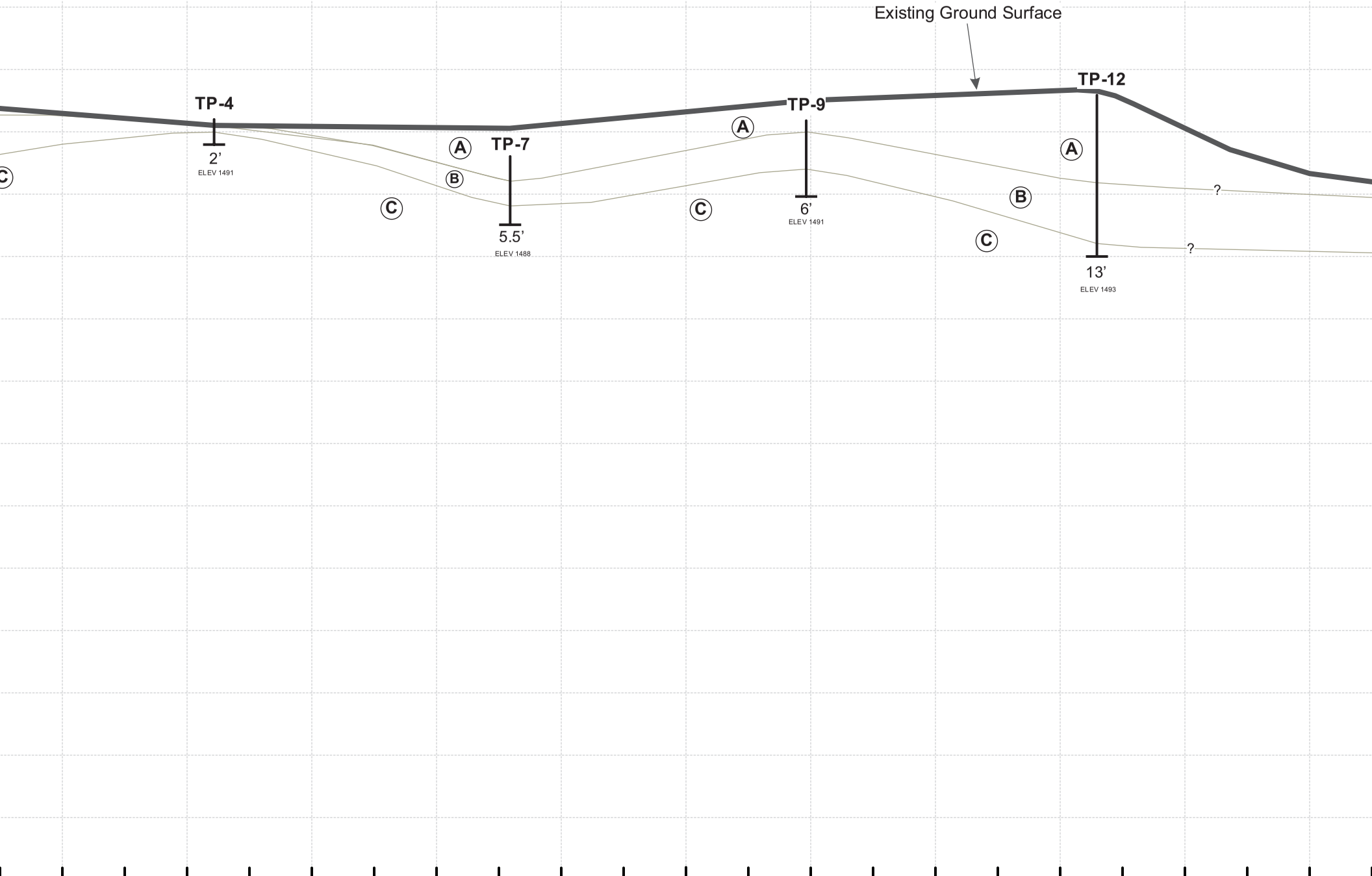
REGIONAL GEOLOGIC MAP

FIGURE 4



EXPLANATION

A Fi Sa



EXPLANATION

A Fi Sa

GEOTECHNICAL

APPENDIX A

APPENDIX A

EXPLORATORY BORINGS

The subsurface conditions at the site were investigated by drilling and sampling ten exploratory borings. The borings were advanced to depths of 6 to 21 feet below the existing ground surface. The exploration locations are shown on the Site Plans, Figures 2 and 3.

The borings were drilled using truck-mounted hollow-stem auger equipment. Relatively undisturbed samples were obtained using a brass-ring lined sampler (ASTM D 3550). The brass-rings have an inside diameter of 2.42 inches. The ring samples were driven into the soil by a 140-pound hammer dropping 30 inches. The number of blows needed to drive the sampler into the soil was recorded as the penetration resistance.

At selected locations, disturbed samples were obtained using a split-spoon sampler by means of the Standard Penetration Test (SPT, ASTM D 6066). The spoon sampler was driven into the soil by a 140-pound hammer dropping 30 inches, employing two turns of rope around the cathead. After an initial seating drive of 6 inches, the number of blows needed to drive the sampler into the soil a depth of 12 inches was recorded as the penetration resistance. These values are the raw uncorrected blowcounts.

The field exploration for the investigation was performed under the continuous technical supervision of GPI's representative, who visually inspected the site, maintained detailed logs of the borings, classified the soils encountered, and obtained relatively undisturbed samples for examination and laboratory testing. The soils encountered in the boring were classified in the field and through further examination in the laboratory in accordance with the Unified Soils Classification System. Detailed logs of the borings are presented in Figures A-1 to A-10 in this appendix.

The boring locations were laid out in the field by measuring from existing features at the site. The borings were backfilled with the excavated soil cuttings. The ground surface elevations at the boring locations were estimated from Google Earth and should be considered approximate.

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
			B	0	Residual Soils: **SILTY SAND (SM)** brown, moist, very dense, decomposed granite	1490
10.5 17.4	102 96	50/5"	D	5	**SANDY CLAY (CL)** red brown, moist, hard, decomposed granite	1485
5.5		76	S		Weathered Granitic Bedrock: **SAND WITH SILT (SP-SM)** light brown, slightly moist, very dense, highly weathered	
3.6		50/5"	S	10	**SAND (SP)** light brown, slightly moist to dry, very dense, highly weathered	1480
2.2		50/3"	S		@ 12 feet, brown- grey, moderately weathered	
2.2		50/4"	S	15	@ 15 feet, perched groundwater	
					Refusal @ 15.5 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 7-17-20

EQUIPMENT USED: 8 " Hollow Stem Auger

GROUNDWATER LEVEL (ft): Not Encountered

GPI

PROJECT NO.: 2995.I

WOODCREST RETAIL

LOG OF BORING NO. B-1

FIGURE A-1

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
				0	This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
					Residual Soils:	
					SILTY SAND (SM) brown, moist, decomposed granite	
13.0	112	90/8"	D		Weathered Granitic Bedrock:	
3.6	122				**CLAYEY SAND (SC)/SILTY SAND (SM)** orange brown, moist to slightly moist, very dense, moderately weathered	1490
3.7	121	50/4"	D	5		
					SAND WITH SILT (SP-SM) brown, slightly moist to dry, very dense, hard rock pieces, moderately weathered	
2.3	109	50'/4"	D			
2.6	116	51	D	10		1485
					@ 14 feet, perched groundwater	
10.8	119	50/4"	D	15	@ 15 feet, grey, very moist, slightly weathered, difficult drilling and chattering	1480
					Total Depth 16 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 7-17-20

EQUIPMENT USED: 8 " Hollow Stem Auger

GROUNDWATER LEVEL (ft): Not Encountered

GPI

PROJECT NO.: 2995.I

WOODCREST RETAIL

LOG OF BORING NO. B-2

FIGURE A-2

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
				0	This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
					Residual Soils:	
					SILTY SAND (SM) brown, moist, decomposed granite	
16.1	107	64	D		Weathered Granitic Bedrock:	
13.7	110				**SILTY SAND (SM)** brown, wet to very moist, very dense, moderately weathered	1500
6.5	110	98/9"	D	5	**SAND (SP)** light brown, moist, very dense, moderately weathered	
1.3	117	80//10"	D		@ 7 feet, dry	
						1495
2.2	116	50/4"	D	10		
						1490
8.3	116	50/2"	D	15	@ 15 feet, moist, slightly weathered	
						1485
2.6	120	50/3"	D	20	@ 20 feet, observed wet soils, difficult drilling and chattering	
					Total Depth 21 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 7-17-20

EQUIPMENT USED: 8 " Hollow Stem Auger

GROUNDWATER LEVEL (ft): Not Encountered

GPI

PROJECT NO.: 2995.I

WOODCREST RETAIL

LOG OF BORING NO. B-3

FIGURE A-3

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
				0	Residual Soils:	
4.3	136	80/10"	D		**SILTY SAND (SM)** orange brown, slightly moist. decomposed granite	
					Weathered Granitic Bedrock:	
					SAND WITH SILT (SP-SM) orange brown, slightly moist to moist, very dense	1485
		50/4"	D	5		
		50/4"	D			1480
		50/4"	D	10		
						1475
		50/3"	D	15	@ 15 feet, grey, wet, perched groundwater	
					Refusal @ 16 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 7-17-20

EQUIPMENT USED: 8 " Hollow Stem Auger

GROUNDWATER LEVEL (ft): Not Encountered

GPI

PROJECT NO.: 2995.I

WOODCREST RETAIL

LOG OF BORING NO. B-4

FIGURE A-4

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
			B	0	Residual Soil:	
					SAND WITH SILT (SP-SM) brown, moist, decomposed granite	1495
7.7	106	80/10"	D			
1.5	113				Weathered Granitic Bedrock:	
				5	**SILTY SAND (SM)** orange brown, moist to dry, very dense, moderately weathered	
2.5	122	90/9"	D		**SAND WITH SILT (SP-SM)** grey, dry, very dense	
						1490
2.8	103	50/4"	D		@ 7 feet, difficult drilling and chattering, pieces of rock, slightly weathered	
					Total Depth 8 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 7-17-20

EQUIPMENT USED: 8 " Hollow Stem Auger

GROUNDWATER LEVEL (ft): Not Encoutered

GPI

PROJECT NO.: 2995.I

WOODCREST RETAIL

LOG OF BORING NO. B-5

FIGURE A-5

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	*DESCRIPTION OF SUBSURFACE MATERIALS*	ELEVATION (FEET)
					This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
				0	Residual Soils: **SILTY SAND (SM)** brown, moist, decomposed granite	
2.9	124	50/4"	D		Weathered Granitic Bedrock: **SAND WITH SILT (SP-SM)** gray brown, dry, very dense, moderately weathered	
		50/4"	D	5		1480
					Refusal @ 6 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 7-17-20

EQUIPMENT USED: 8 " Hollow Stem Auger

GROUNDWATER LEVEL (ft): Not Encoutered

GPI

PROJECT NO.: 2995.I

WOODCREST RETAIL

LOG OF BORING NO. B-6

FIGURE A-6

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
				0	Residual Soils:	
3.3	129	87/9"	D		**SILTY SAND (SM)** brown, moist, decomposed granite	
					Weathered Granitic Bedrock:	
					SAND WITH SILT (SP-SM) orange brown, dry, very dense, moderately weathered	1485
4.6	120	92/10"	D	5	@ 5 feet, slightly moist	
8.1	120	82/11"	D		@ 7 feet, moist, slightly weathered, hard drilling and chattering	
					Total Depth 8 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 7-17-20

EQUIPMENT USED: 8 " Hollow Stem Auger

GROUNDWATER LEVEL (ft): Not Encoutered

GPI

PROJECT NO.: 2995.I

WOODCREST RETAIL

LOG OF BORING NO. B-7

FIGURE A-7

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
				0	Residual Soils:	
16.2	105	29	D		**SILTY SAND (SM)** brown, moist, decomposed granite	
					Weathered Granitic Bedrock:	
					SAND WITH SILT (SP-SM) light brown, slightly moist, medium dense, highly weathered	
4.4	174	50/4"	D	5	@ 5 feet, very dense, moderately weathered	1490
32.9	86	73	D		@ 7 feet, with clay, wet, slightly weathered, hard drilling and chattering	
					Total Depth 8 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 7-17-20

EQUIPMENT USED: 8 " Hollow Stem Auger

GROUNDWATER LEVEL (ft): Not Encoutered

GPI

PROJECT NO.: 2995.I

WOODCREST RETAIL

LOG OF BORING NO. B-8

FIGURE A-8

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
				0	This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
					Residual Soils:	
					SILTY SAND (SM) brown, moist, decomposed granite	
7.9	123	30	D		Weathered Granitic Bedrock:	
					SILTY SAND (SM) brown, moist to very moist, medium dense, highly weathered	1490
9.0	123	30	D	5		
17.4	110	20	D		@ 7 feet, wet	
						1485
14.6	119	58/11"	D	10	**SAND WITH SILT (SP-SM)** brown, wet, very dense, slighltly weathered, difficult drilling and chattering	
					Total Depth 11 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 7-17-20

EQUIPMENT USED: 8 " Hollow Stem Auger

GROUNDWATER LEVEL (ft): Not Encoutered

GPI

PROJECT NO.: 2995.I

WOODCREST RETAIL

LOG OF BORING NO. B-9

FIGURE A-9

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
				0	Residual Soils:	
16.6	110	31	D		**SILTY SAND (SM)** brown, moist, decomposed granite	
					Weathered Granitic Bedrock:	
					SANDY CLAY (CL) brown, moist, stiff, highly weathered	1490
5.3	59	50/4"	D	5	**SILTY SAND (SM)** brown, slightly moist to dry, very dense, moderately weathered	
2.6	60					
		50/3"	D		**SAND WITH SILT (SP-SM)** gray, moist, very dense, slightly weathered, difficult drilling and chattering	
					Total Depth @ 8 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 7-17-20

EQUIPMENT USED: 8 " Hollow Stem Auger

GROUNDWATER LEVEL (ft): Not Encoutered

GPI

PROJECT NO.: 2995.I

WOODCREST RETAIL

LOG OF BORING NO. B-10

FIGURE A-10

APPENDIX B

APPENDIX B

EXPLORATORY TEST PITS

The subsurface conditions at the site were investigated by excavating and sampling 12 exploratory test pits. The excavations were advanced to depths of approximately 2 to 9 ½ feet below the existing ground surface using a JCB 1400 Site Master Backhoe with a 24-inch wide bucket. The approximate locations of the explorations are shown on the Site Plans, Figures 2 and 3.

The field explorations were performed under the continuous technical supervision of GPI's representative, who visually inspected the site, maintained detailed logs of the test pits, and classified the soils encountered. Bulk samples of the subsurface soils were obtained and bagged at select locations within the excavations. The soils encountered in the test pits were classified in the field and through further examination in the laboratory in accordance with the Unified Soils Classification System. Detailed logs of the explorations are presented in Figures B-1 to B-12 in this Appendix.

The test pit locations were laid out in the field by measuring from existing site features. The ground surface elevations at the boring locations were estimated from Google Earth and should be considered approximate. The test pit excavations were backfilled as temporary fill without proper compaction. We placed a PVC pipe in the temporary fill of each test pit location prior to backfilling.

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	*DESCRIPTION OF SUBSURFACE MATERIALS*	ELEVATION (FEET)
					This summary applies only at the location of this test pit and at the time of trenching. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
				0	Fill: **SANDY CLAY (CL)** red brown, moist, with brush	
					Residual Soils: **SANDY CLAY (CL)** red brown, moist to very moist, decomposed granite	1490
			B	5	Weathered Granitic Bedrock: **SAND WITH SILT (SP-SM)** grey, slightly moist, moderately weathered, difficulty excavating	
					Backhoe refused @ 7.5 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE TRENCHED: 10-28-20

EQUIPMENT USED: 24" Backhoe Bucket

GROUNDWATER LEVEL: Not Encoutered

GPI

PROJECT NO.: 2995.I
WOODCREST RETAIL

LOG OF TEST PIT NO. TP-01

FIGURE B-1

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	*DESCRIPTION OF SUBSURFACE MATERIALS*	ELEVATION (FEET)
					This summary applies only at the location of this test pit and at the time of trenching. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
				0	Fill: **SANDY CLAY (CL)** red brown, moist, with brush	
					Residual Soils: **SANDY CLAY (CL)** red brown, moist to very moist, decomposed granite	1490
			B		Residual Soils: **SILTY SAND (SM)** brown, moist to very moist, decomposed granite	
				5	Weathered Granitic Bedrock: **SAND WITH SILT (SP-SM)** grey, slightly moist, moderately weathered, difficulty excavating	
					Backhoe refused @ 5.5 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE TRENCHED: 10-28-20

EQUIPMENT USED: 24" Backhoe Bucket

GROUNDWATER LEVEL: Not Encoutered

GPI

PROJECT NO.: 2995.I
WOODCREST RETAIL

LOG OF TEST PIT NO. TP-02

FIGURE B-2

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					This summary applies only at the location of this test pit and at the time of trenching. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
				0	Fill: **SANDY CLAY (CL)** red brown, moist, with brush	
					Residual Soils: **SANDY CLAY (CL)** red brown, moist to very moist, decomposed granite	1485
			B			
					CLAYEY SAND (SC) red brown, moist, decomposed granite	
				5		
					Weathered Granitic Bedrock: **SAND WITH SILT (SP-SM)** grey, slightly moist, moderately weathered, difficulty excavating	1480
					Backhoe refused @ 7.5 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE TRENCHED: 10-28-20

EQUIPMENT USED: 24" Backhoe Bucket

GROUNDWATER LEVEL: Not Encoutered

GPI

PROJECT NO.: 2995.I
WOODCREST RETAIL

LOG OF TEST PIT NO. TP-03

FIGURE B-3

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	*DESCRIPTION OF SUBSURFACE MATERIALS*	ELEVATION (FEET)
					This summary applies only at the location of this test pit and at the time of trenching. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
				0	Fill: **SANDY CLAY (CL)** red brown, moist, with brush	
					Residual Soils:	1490
					SANDY CLAY (CL) red brown, slightly moist, decomposed granite	
					Weathered Granitic Bedrock:	
					SAND WITH SILT (SP-SM) grey, slightly moist, moderately weathered, difficulty excavating	
					Backhoe refused @ 2 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE TRENCHED: 10-28-20

EQUIPMENT USED: 24" Backhoe Bucket

GROUNDWATER LEVEL: Not Encoutered

GPI

PROJECT NO.: 2995.I
WOODCREST RETAIL

LOG OF TEST PIT NO. TP-04

FIGURE B-4

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	*DESCRIPTION OF SUBSURFACE MATERIALS*	ELEVATION (FEET)
					This summary applies only at the location of this test pit and at the time of trenching. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
				0	Fill: **SANDY CLAY (CL)** red brown, moist, with brush	
			B		Residual Soils: **SANDY CLAY (CL)** red brown, moist to very moist, decomposed granite	
				5	**CLAYEY SAND (SC)** red brown, moist, decomposed granite	1480
					Weathered Granitic Bedrock: **SAND WITH SILT (SP-SM)** grey, slightly moist, moderately weathered, difficulty excavating	
					Backhoe refused @ 9.5 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE TRENCHED: 10-28-20

EQUIPMENT USED: 24" Backhoe Bucket

GROUNDWATER LEVEL: Not Encoutered

GPI

PROJECT NO.: 2995.I
WOODCREST RETAIL

LOG OF TEST PIT NO. TP-05

FIGURE A-5

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	*DESCRIPTION OF SUBSURFACE MATERIALS*	ELEVATION (FEET)
					This summary applies only at the location of this test pit and at the time of trenching. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
				0	Fill: **SANDY CLAY (CL)** red brown, moist, with brush	
					Residual Soils: **CLAYEY SAND (SC)** red brown, moist to very moist, decomposed granite	
					Weathered Granitic Bedrock: **SAND WITH SILT (SP-SM)** grey, moist, moderately weathered, difficulty excavating	1485
					Backhoe refused @ 4 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE TRENCHED: 10-28-20

EQUIPMENT USED: 24" Backhoe Bucket

GROUNDWATER LEVEL: Not Encoutered

GPI

PROJECT NO.: 2995.I
WOODCREST RETAIL

LOG OF TEST PIT NO. TP-06

FIGURE B-6

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	*DESCRIPTION OF SUBSURFACE MATERIALS*	ELEVATION (FEET)
					This summary applies only at the location of this test pit and at the time of trenching. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
				0	Natural: **SANDY CLAY (CL)** brown, moist	
					Residual Soils: **CLAYEY SAND (SC)** red brown, moist, decomposed granite	1485
			B	5	Weathered Granitic Bedrock: **SAND WITH SILT (SP-SM)** grey, slightly moist, moderately weathered, difficulty excavating	
					Backhoe refused @ 5.5 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE TRENCHED: 10-28-20

EQUIPMENT USED: 24" Backhoe Bucket

GROUNDWATER LEVEL: Not Encoutered

GPI

PROJECT NO.: 2995.I
WOODCREST RETAIL

LOG OF TEST PIT NO. TP-07

FIGURE B-7

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	*DESCRIPTION OF SUBSURFACE MATERIALS*	ELEVATION (FEET)
					This summary applies only at the location of this test pit and at the time of trenching. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
				0	Fill: **SANDY CLAY (CL)** red brown, moist, with brush	
			B		Residual Soils: **CLAYEY SAND (SC)** red brown, moist, decomposed granite	
				5	Weathered Granitic Bedrock: **SAND WITH SILT (SP-SM)** grey, slightly moist, moderately weathered, difficulty excavating	1480
					Backhoe refused @ 5.5 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE TRENCHED: 10-28-20

EQUIPMENT USED: 24" Backhoe Bucket

GROUNDWATER LEVEL: Not Encoutered

GPI

PROJECT NO.: 2995.I
WOODCREST RETAIL

LOG OF TEST PIT NO. TP-08

FIGURE B-8

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	*DESCRIPTION OF SUBSURFACE MATERIALS*	ELEVATION (FEET)
					This summary applies only at the location of this test pit and at the time of trenching. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
				0	Fill: **CLAYEY SAND (SC)** brown, moist	1490
					Residual Soils: **SILTY SAND (SM)** white with brown streaks, dry to slightly moist, decomposed granite	
					CLAYEY SAND (SC) red brown, moist, decomposed granite	
				5	Weathered Granitic Bedrock: **SAND WITH SILT (SP-SM)** grey, slightly moist, moderately weathered, difficulty excavating	
					Backhoe refused @ 6 feet	1485

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE TRENCHED: 10-28-20

EQUIPMENT USED: 24" Backhoe Bucket

GROUNDWATER LEVEL: Not Encoutered

GPI

PROJECT NO.: 2995.I
WOODCREST RETAIL

LOG OF TEST PIT NO. TP-09

FIGURE B-9

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	*DESCRIPTION OF SUBSURFACE MATERIALS*	ELEVATION (FEET)
					This summary applies only at the location of this test pit and at the time of trenching. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
			B	0	Residual Soils: **CLAYEY SAND (SC)** red brown, slightly moist to moist	
					Weathered Granitic Bedrock: **SAND WITH SILT (SP-SM)** grey, slightly moist, moderately weathered, difficulty excavating	
					Backhoe refused @ 2 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE TRENCHED: 10-28-20

EQUIPMENT USED: 24" Backhoe Bucket

GROUNDWATER LEVEL: Not Encoutered

GPI

PROJECT NO.: 2995.I
WOODCREST RETAIL

LOG OF TEST PIT NO. TP-10

FIGURE B-10

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	*DESCRIPTION OF SUBSURFACE MATERIALS*	ELEVATION (FEET)
					This summary applies only at the location of this test pit and at the time of trenching. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
				0	Residual Soils: **CLAYEY SAND (SC)** red brown, moist, decomposed granite	
					Weathered Granitic Bedrock: **SAND WITH SILT (SP-SM)** grey, moist, moderately weathered, difficulty excavating	1480
				5	Backhoe refused @ 5 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE TRENCHED: 10-28-20

EQUIPMENT USED: 24" Backhoe Bucket

GROUNDWATER LEVEL: Not Encoutered

GPI

PROJECT NO.: 2995.I
WOODCREST RETAIL

LOG OF TEST PIT NO. TP-11

FIGURE B-11

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	*DESCRIPTION OF SUBSURFACE MATERIALS*	ELEVATION (FEET)
					This summary applies only at the location of this test pit and at the time of trenching. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
				0	Fill: **SANDY CLAY (CL)** red brown, moist, trace debris	1490
				5		
					Residual Soils: **SANDY CLAY (CL)** red brown, moist to very moist, decomposed granite	1485
				10	**CLAYEY SAND (SC)** red brown, very moist, decomposed granite	
					Weathered Granitic Bedrock: **SAND WITH SILT (SP-SM)** grey, slightly moist, moderately weathered, difficulty excavating	1480
					Backhoe refused @ 13 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE TRENCHED: 10-28-20

EQUIPMENT USED: 24" Backhoe Bucket

GROUNDWATER LEVEL: Not Encoutered

GPI

PROJECT NO.: 2995.I
WOODCREST RETAIL

LOG OF TEST PIT NO. TP-12

FIGURE B-12

APPENDIX C

APPENDIX C

LABORATORY TESTS

INTRODUCTION

Representative undisturbed soil samples and bulk samples were carefully packaged in the field and sealed to prevent moisture loss. The samples were then transported to our Cypress office for examination and testing assignments. Laboratory tests were performed on selected representative samples as an aid in classifying the soils and to evaluate the physical properties of the soils affecting foundation design and construction procedures. Detailed descriptions of the laboratory tests are presented below under the appropriate test headings. Test results are presented in the figures that follow.

MOISTURE CONTENT AND DRY DENSITY

Moisture content and dry density were determined from a number of the ring samples from the borings. The samples were first trimmed to obtain volume and wet weight and then were dried in accordance with ASTM D 2216. After drying, the weight of each sample was measured, and moisture content and dry density were calculated. Moisture content and dry density values are presented on the boring logs in Appendix A.

GRAIN SIZE DISTRIBUTION

Selected soil samples were dried, weighed, soaked in water until individual soil particles were separated, and then washed on the No. 200 sieve. That portion of the material retained on the No. 200 sieve was oven-dried and weighed to determine the percentage of the material passing the No. 200 sieve. The percentages passing the No. 200 sieve are tabulated below.

BORING NO.	DEPTH (ft)	SOIL DESCRIPTION	PERCENT PASSING No. 200 SIEVE
B-2	2	Silty Sand (SM)	14
TP-2	3-5	Clayey Sand (SC)	45
TP-10	0-2	Clayey Sand (SC)	34

DIRECT SHEAR

Direct shear tests were performed on undisturbed and remolded bulk samples in accordance with ASTM D3080. The bulk sample was remolded to approximately 95 percent of the maximum dry density. The test specimens were placed in the shear machine, and a normal load comparable to the in-situ overburden stress was applied. The samples were inundated, allowed to consolidate, and then were sheared to failure. The tests were repeated on additional test specimens under increased normal loads. Shear stress and sample deformation were monitored throughout the tests. The results of the direct shear tests are presented in Figures B-1 to B-4.

COMPACTION TEST

Maximum dry density/optimum moisture tests were performed in accordance with ASTM D 1557 on a representative bulk sample of the site soils. The test result are as follows:

BORING NO.	DEPTH (ft)	SOIL DESCRIPTION	OPIMUM MOISTURE ( )	MAXIMUM DRY DENSITY (pcf)
B-1	0-5	Silty Sand (SM)	8.5	137
TP-2, 5 & 10	0-5	Silty Sand (SM)	9.0	135

EXPANSION INDEX TEST

An expansion index tests was performed on representative bulk samples. The test was performed in accordance with ASTM D4829 to assess the expansion potential of the on-site fill soils. The results of the tests are summarized below.

BORING NO.	DEPTH (ft)	SOIL DESCRIPTION	EXPANSION INDEX EI	EXPANSION POTENTIAL
TP-2, 5 & 10	0-5	Silty Sand (SM)	10	Very Low

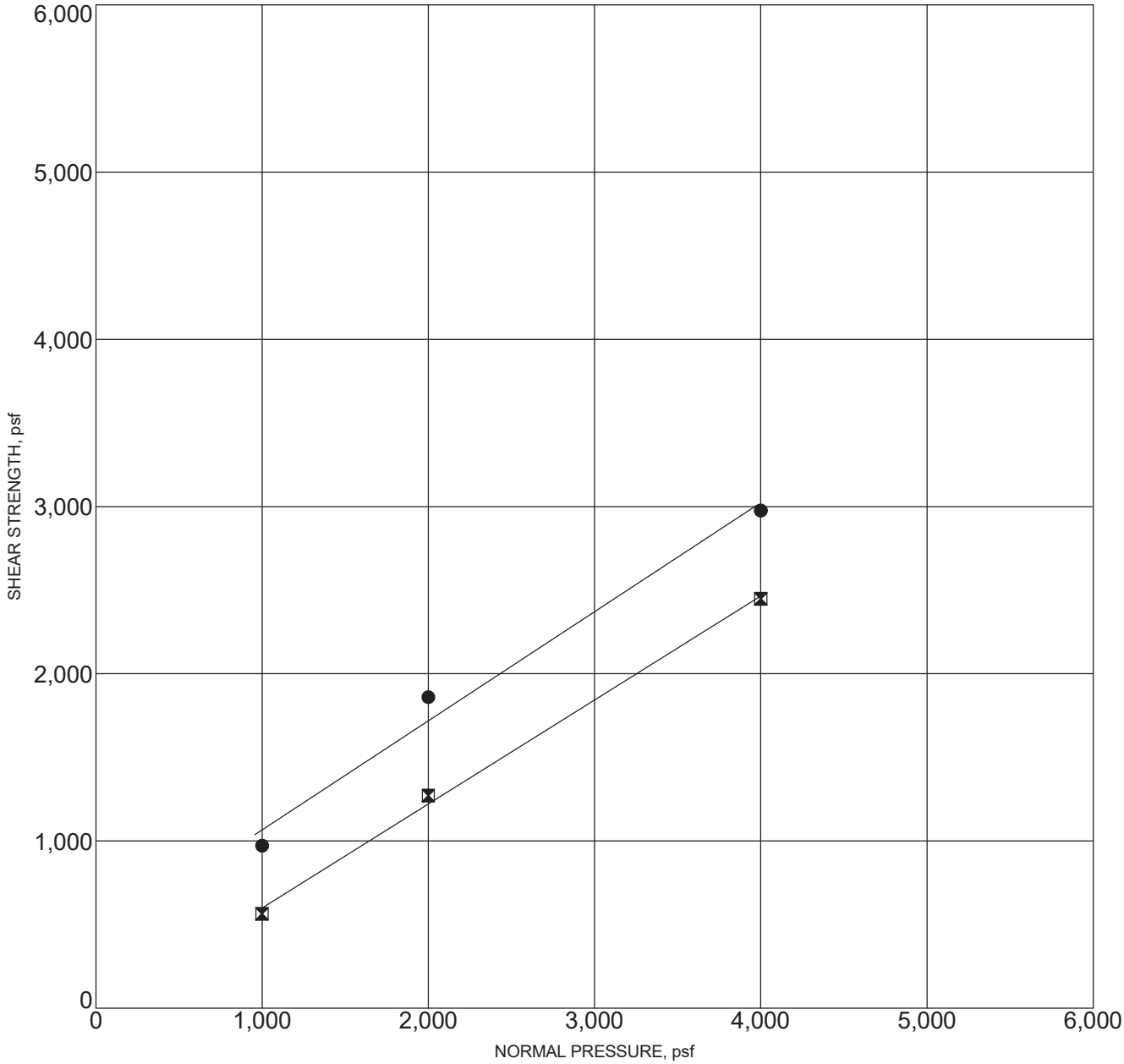
R-VALUE

Suitability of the near-surface soils for pavement was evaluated by conducting an R-value test. The test was performed in accordance with ASTM D 2844 by GeoLogic Associates under subcontract to GPI. The result of the test is as follows:

BORING NO.	DEPTH (ft)	SOIL DESCRIPTION	R-VALUE BY EXPANSION
TP-10	0-2	Clayey Sand (SC)	64

CORROSIVITY

Soil corrosivity testing was performed by HDR a soil sample provided by GPI. The test results are summarized in Table 1 of this Appendix.



● **PEAK STRENGTH**
Friction Angle= 33 degrees
Cohesion= 414 psf

⊠ **ULTIMATE STRENGTH**
Friction Angle= 32 degrees
Cohesion= 0 psf

Note: Samples remolded to 95% of maximum dry density

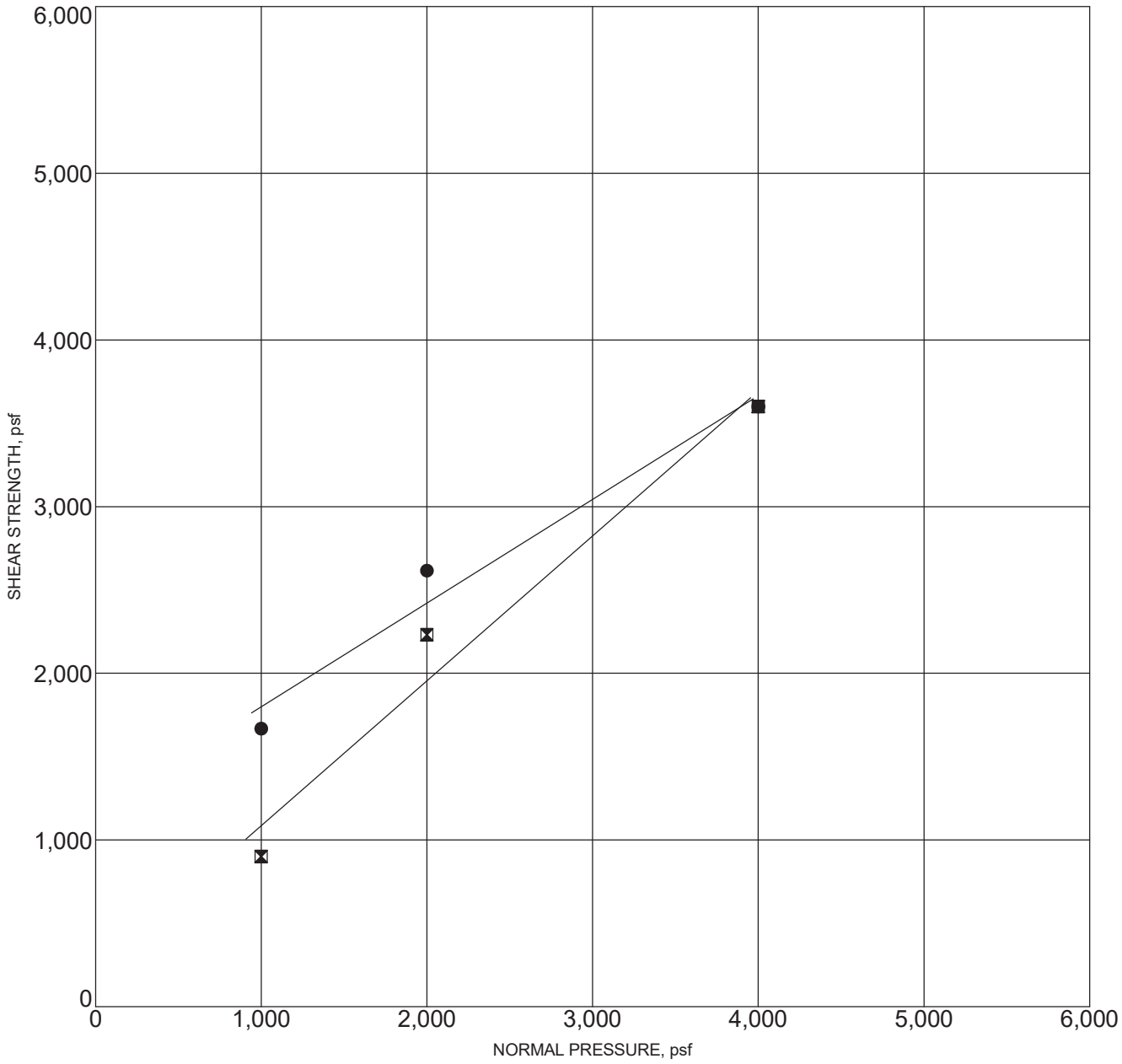
Sample Location		Classification	DD,pcf	MC,%
B-1	0-5	SILTY SAND (SM)	130	8.5

PROJECT: WOODCREST RETAIL PROJECT NO.: 2995.I

GPI

DIRECT SHEAR TEST RESULTS

FIGURE C-1



● **PEAK STRENGTH**
Friction Angle= 32 degrees
Cohesion= 1176 psf

⊠ **ULTIMATE STRENGTH**
Friction Angle= 41 degrees
Cohesion= 216 psf

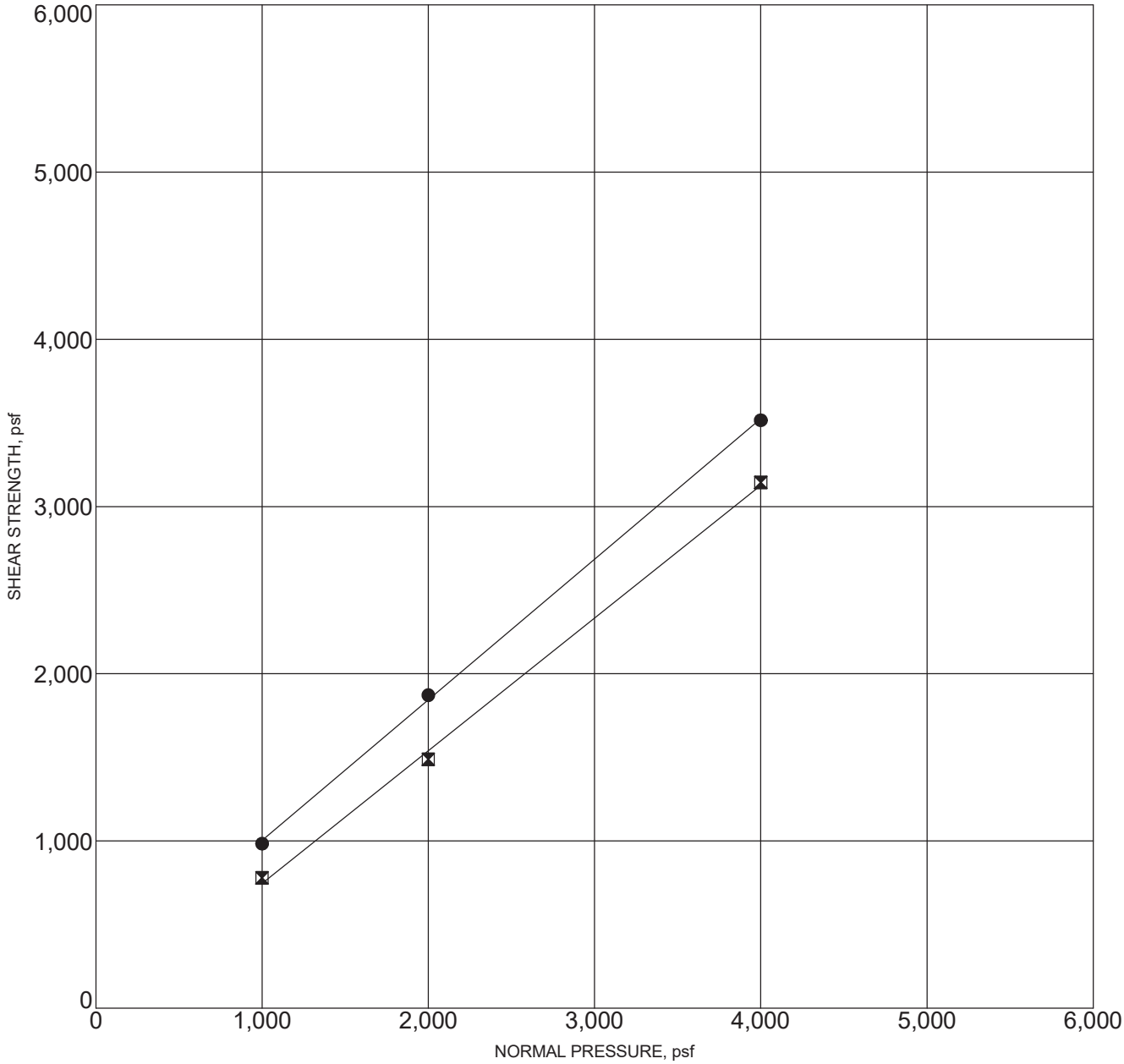
Sample Location		Classification	DD,pcf	MC,%
B-4	1.0	Weathered Bedrock SAND WITH SILT (SP-SM)	136	4.3

PROJECT: WOODCREST RETAIL PROJECT NO.: 2995.I

GPI

DIRECT SHEAR TEST RESULTS

FIGURE C-2



● **PEAK STRENGTH**
Friction Angle= 40 degrees
Cohesion= 162 psf

⧓ **ULTIMATE STRENGTH**
Friction Angle= 38 degrees
Cohesion= 0 psf

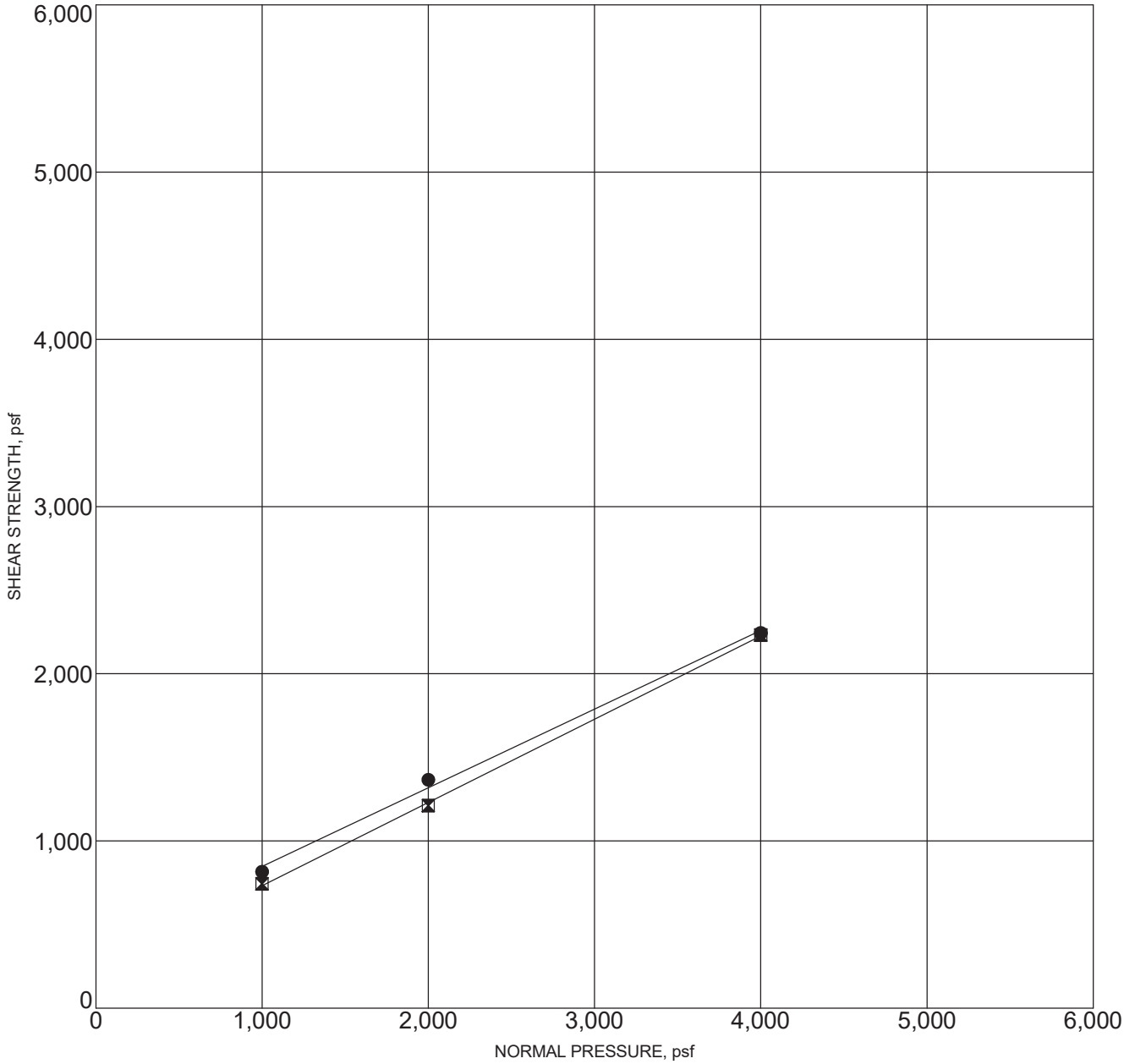
Sample Location		Classification	DD,pcf	MC,%
B-9	5.0	Weathered Bedrock SILTY SAND (SM)	123	9.0

PROJECT: WOODCREST RETAIL PROJECT NO.: 2995.I

GPI

DIRECT SHEAR TEST RESULTS

FIGURE C-3



● **PEAK STRENGTH**
Friction Angle= 25 degrees
Cohesion= 377 psf

⧓ **ULTIMATE STRENGTH**
Friction Angle= 26 degrees
Cohesion= 234 psf

Note: Samples remolded to 90% of maximum dry density.

Sample Location	Classification	DD,pcf	MC,%
TP-10,15,& 2 0-5	SILTY SAND (SM)	122	9.0

PROJECT: WOODCREST RETAIL PROJECT NO.: 2995.I

GPI

DIRECT SHEAR TEST RESULTS

FIGURE C-4

Table 1 - Laboratory Tests on Soil Samples

Geotechnical Professionals, Inc.
Woodcrest Retail
Your #2995.I, HDR Lab #21-0097LAB
19-Feb-21

Sample ID			TP-5 @ 0.5-2
Resistivity		**Units**	
as-received		ohm-cm	3,240
saturated		ohm-cm	2,040
pH			7.3
Electrical Conductivity		mS/cm	0.11
Chemical Analyses			
Cations			
calcium	Ca^{2+}	mg/kg	38
magnesium	Mg^{2+}	mg/kg	12
sodium	Na^{1+}	mg/kg	77
potassium	K^{1+}	mg/kg	5.8
ammonium	NH_4^{1+}	mg/kg	ND
Anions			
carbonate	CO_3^{2-}	mg/kg	ND
bicarbonate	HCO_3^{1-}	mg/kg	174
fluoride	F^{1-}	mg/kg	19
chloride	Cl^{1-}	mg/kg	56
sulfate	SO_4^{2-}	mg/kg	22
nitrate	NO_3^{1-}	mg/kg	20
phosphate	PO_4^{3-}	mg/kg	ND
Other Tests			
sulfide	S^{2-}	qual	na
Redox		mV	na

Resistivity per ASTM G187, pH per ASTM G51, Cations per ASTM D6919, Anions per ASTM D4327, and Alkalinity per APHA 2320-B.

Electrical conductivity in millisiemens/cm and chemical analyses were made on a 1:5 soil-to-water extract.

mg/kg = milligrams per kilogram (parts per million) of dry soil.

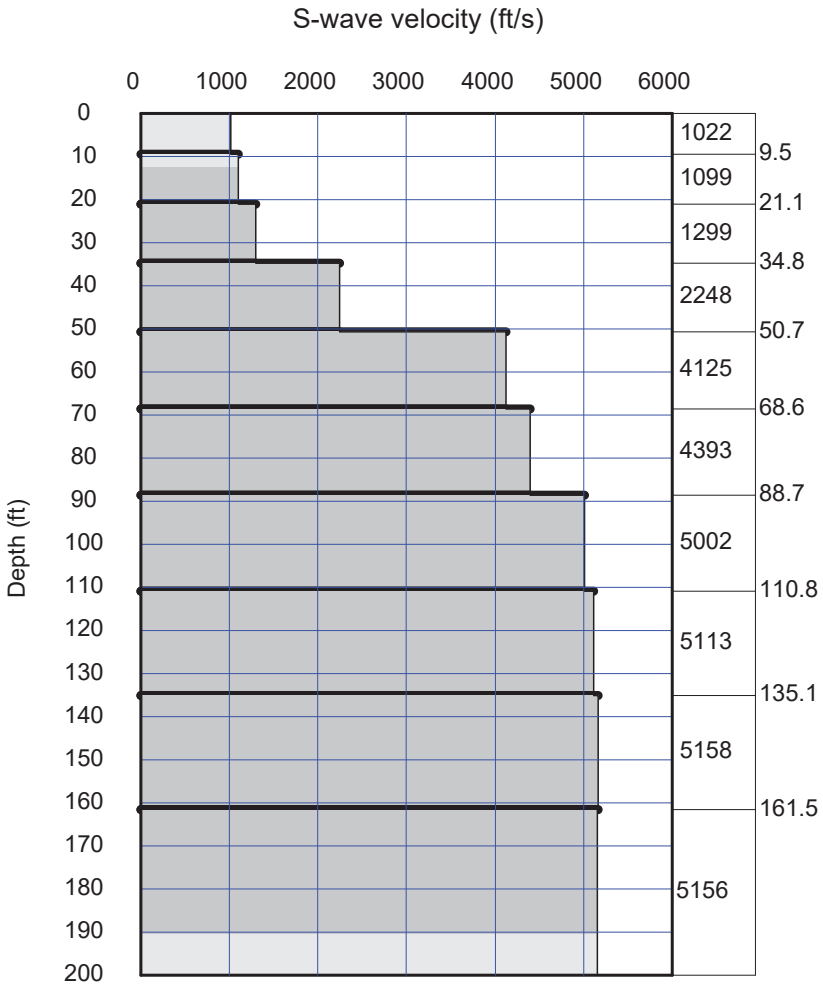
Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

APPENDIX D

SEISMIC LINE SW-1



SHEAR-WAVE VELOCITY MODEL: Average Vs 100ft = 2,056.1 ft/sec

Site Classification (ASCE 7-22 Ch. 20)- "C" ("Very Dense Sand or Hard Clay" profile)

Client: Geotechnical Professionals Inc.

Project Name: Woodcrest Retail Center, Woodcrest, California

Survey Line End Coordinates: 33.88334, -117.36695 / 33.88303, -117.36647

Date: 4/7/26

TG Project No. 264231-1

TERRA GEOSCIENCES
P.O. Box 1090
Loma Linda, CA 92354

PROFESSIONAL GEOPHYSICIST
DONN C. SCHWARTZKOPF
No. 1002
STATE OF CALIFORNIA

Appendix 4: Historical Site Conditions

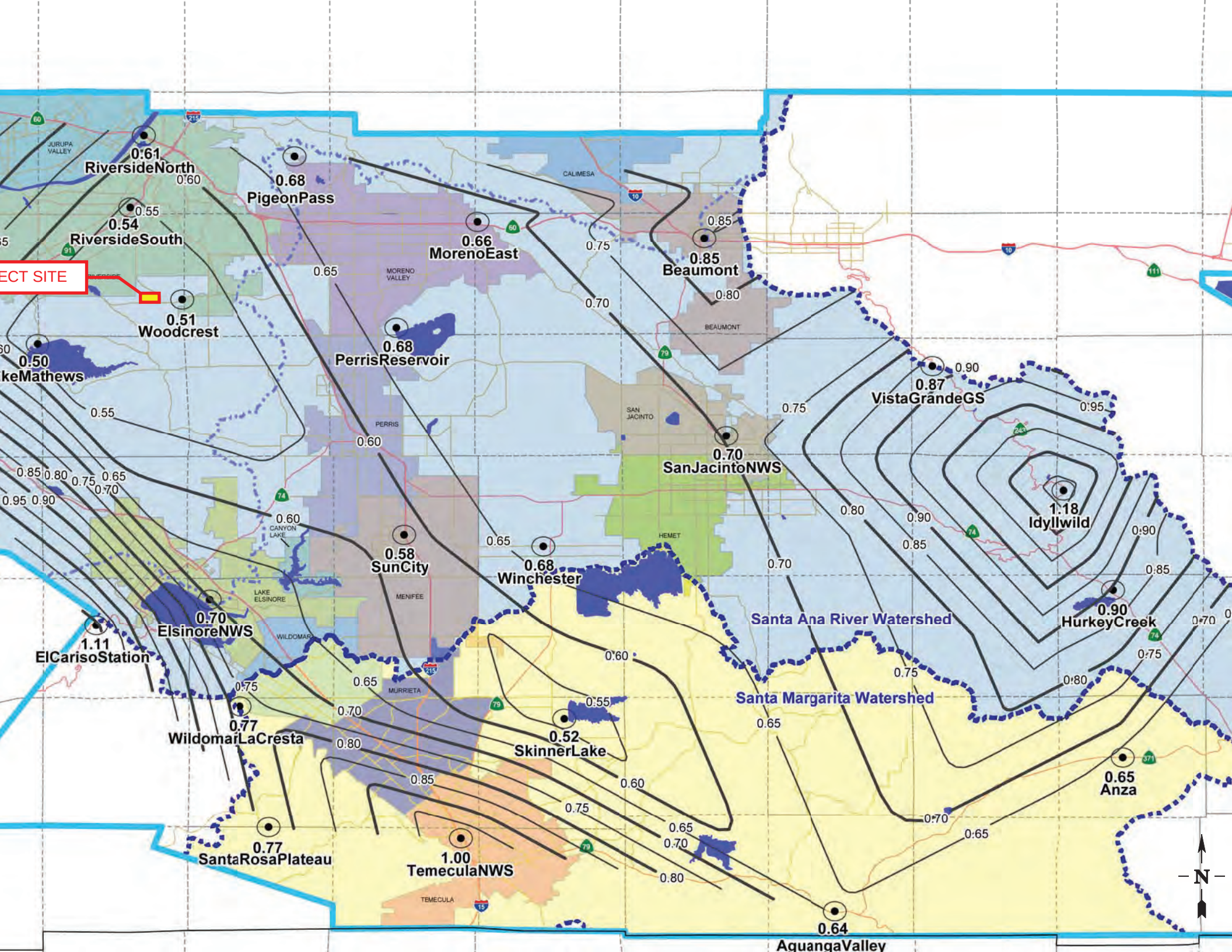
N/A

Appendix 5: LID Infeasibility

N/A

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation


ECT SITE
0.61
RiversideNorth
0.54
RiversideSouth
0.68
PigeonPass
0.66
MorenoEast
0.85
Beaumont
0.51
Woodcrest
0.68
PerrisReservoir
0.50
keMathews
0.87
VistaGrandeGS
0.70
SanJacintoNWS
1.18
Idyllwild
0.58
SunCity
0.68
Winchester
0.70
ElsinoreNWS
1.11
ElCarisoStation
0.90
HurkeyCreek
0.77
WildomarLaCresta
0.52
SkinnerLake
0.65
Anza
0.77
SantaRosaPlateau
1.00
TemeculaNWS
0.64
AguangaValley
Santa Ana River Watershed
Santa Margarita Watershed
JURUPA VALLEY
CALIMESA
MORENO VALLEY
BEAUMONT
PERRIS
SAN JACINTO
CANYON LAKE
HEMET
LAKE ELSINORE
MENIFEE
WILDOMAR
MURRIETA
TEMECULA
N

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	DRC Engineering, Inc.	Date	6/1/2026
Designed by	DRC Engineering, Inc.	Case No	
Company Project Number/Name	19-267 NWC Van Buren Blvd. &Washington St.		

BMP Identification

BMP NAME / ID: BIORETENTION BASIN A

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}= 0.51 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)*
A-1	*21,855*	*Concrete or Asphalt*	*1*	*0.89*	*19494.7*			
A-2	*7,482*	*Ornamental Landscaping*	*0.1*	*0.11*	*826.4*			
A-3	*22,326*	*Roofs*	*1*	*0.89*	*19914.8*			
	51663		***Total***		**40235.9**	**0.51**	***1710***	***2,654***

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 DRC Engineering, Inc. Date 6/1/2026

Designed by DRC Engineering, Inc. Case No

Company Project Number/Name 19-267 NWC Van Buren Blvd. &Washington St.

BMP Identification

BMP NAME / ID BIORETENTION BASIN B

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}= 0.51 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 Impervious 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)*
B1-1	*84,304*	*Concrete or Asphalt*	*1*	*0.89*	*75199.2*			
B1-2	*8,409*	*Ornamental Landscaping*	*0.1*	*0.11*	*928.8*			
B1-3	*21,077*	*Roofs*	*1*	*0.89*	*18800.7*			
B2-1	*17,196*	*Concrete or Asphalt*	*1*	*0.89*	*15338.8*			
B2-2	*10,358*	*Ornamental Landscaping*	*0.1*	*0.11*	*1144.1*			
	141344	***Total***			**111411.6**	**0.51**	***4735***	***6,519***

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	DRC Engineering, Inc.	Date	6/1/2026
Designed by	DRC Engineering, Inc.	Case No	
Company Project Number/Name	19-267 NWC Van Buren Blvd. &Washington St.		

BMP Identification

BMP NAME / ID: BIORETENTION BASIN C

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}= 0.51 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)*
C-1	*30,971*	*Concrete or Asphalt*	*1*	*0.89*	*27626.1*			
C-2	*5,613*	*Ornamental Landscaping*	*0.1*	*0.11*	*620*			
	36584		*Total*		*28246.1*	*0.51*	*1200.5*	*2,468*

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	DRC Engineering, Inc.	Date	6/1/2026
Designed by	DRC Engineering, Inc.	Case No	
Company Project Number/Name	19-267 NWC Van Buren Blvd. &Washington St.		

BMP Identification

BMP NAME / ID: BIORETENTION BASIN D

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}= 0.51 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
D-1	*9,709*	*Concrete or Asphalt*	*1*	*0.89*	*8660.4*			
D-2	*5,811*	*Ornamental Landscaping*	*0.1*	*0.11*	*641.9*			
D-3	*2,509*	*Roofs*	*1*	*0.89*	*2238*			
	18029	*Total*			*11540.3*	*0.51*	*490.5*	*1,211*

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	DRC Engineering, Inc.	Date	6/1/2026
Designed by	DRC Engineering, Inc.	Case No	
Company Project Number/Name	19-267 NWC Van Buren Blvd. &Washington St.		

BMP Identification

BMP NAME / ID: BIORETENTION BASIN E

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}= 0.51 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)*
E-1	*5,737*	*Concrete or Asphalt*	*1*	*0.89*	*5117.4*			
E-2	*424*	*Ornamental Landscaping*	*0.1*	*0.11*	*46.8*			
E-3	*4,229*	*Roofs*	*1*	*0.89*	*3772.3*			
	10390	***Total***			**8936.5**	**0.51**	***379.8***	***380***

Notes:

*Note: Due to limited landscape area within DMA E, Basin E provides 321.2 cubic feet of treatment volume compared to the required DCV of 379.8 cubic feet, resulting in a remaining deficit of 58.6 cubic feet. Basin B provides 1,784 cubic feet of excess treatment volume above its required DCV. The remaining 58.6 cubic feet required for DMA E is proposed to be mitigated through equivalent offset treatment within Basin B.

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: DRC Engineering, Inc. Date: 6/1/2026

Designed by: DRC Engineering, Inc. Case No:

Company Project Number/Name: 19-267 NWC Van Buren Blvd. &Washington St.

BMP Identification

BMP NAME / ID: BIORETENTION BASIN F

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}= 0.51 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)*
F-1	*9,322*	*Concrete or Asphalt*	*1*	*0.89*	*8315.2*			
F-2	*1,933*	*Ornamental Landscaping*	*0.1*	*0.11*	*213.5*			
F-3	*5,374*	*Roofs*	*1*	*0.89*	*4793.6*			
	16629	***Total***			**13322.3**	**0.51**	***566.2***	***1,031***

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	DRC Engineering, Inc.	Date	6/1/2026
Designed by	DRC Engineering, Inc.	Case No	
Company Project Number/Name	19-267 NWC Van Buren Blvd. &Washington St.		

BMP Identification

BMP NAME / ID: BIORETENTION BASIN G1

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}= 0.51 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)*
G1-1	*7,661*	*Concrete or Asphalt*	*1*	*0.89*	*6833.6*			
G1-2	*775*	*Ornamental Landscaping*	*0.1*	*0.11*	*85.6*			
	8436		*Total*		*6919.2*	*0.51*	*294.1*	*352*

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: DRC Engineering, Inc. — Date: 6/1/2026

Designed by: DRC Engineering, Inc. — Case No:

Company Project Number/Name: 19-267 NWC Van Buren Blvd. &Washington St.

BMP Identification

BMP NAME / ID: BIORETENTION BASIN G2

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}= 0.51 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 Imprevious 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)*
G2-1	*8,463*	*Concrete or Asphalt*	*1*	*0.89*	*7549*			
G2-2	*3,676*	*Ornamental Landscaping*	*0.1*	*0.11*	*406*			
	12139	***Total***			**7955**	**0.51**	***338.1***	***338***

Notes:

*Note: Due to limited landscape area within DMA G2, Basin G2 provides 203.6 cubic feet of treatment volume compared to the required DCV of 338.1 cubic feet, resulting in a remaining deficit of 134.5 cubic feet. Basin B provides 1,784 cubic feet of excess treatment volume above its required DCV. The remaining 134.5 cubic feet required for DMA G2 is proposed to be mitigated through equivalent offset treatment within Basin B.

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	DRC Engineering, Inc.	Date	6/1/2026
Designed by	DRC Engineering, Inc.	Case No	
Company Project Number/Name	19-267 NWC Van Buren Blvd. &Washington St.		

BMP Identification

BMP NAME / ID: BIORETENTION BASIN G3

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}= 0.51 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)*
G3-1	*3,989*	*Concrete or Asphalt*	*1*	*0.89*	*3558.2*			
G3-2	*1,628*	*Ornamental Landscaping*	*0.1*	*0.11*	*179.8*			
G3-3	*2,679*	*Roofs*	*1*	*0.89*	*2389.7*			
	8296		***Total***		**6127.7**	**0.51**	***260.4***	***536***

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: DRC Engineering, Inc. — Date: 6/1/2026

Designed by: DRC Engineering, Inc. — Case No:

Company Project Number/Name: 19-267 NWC Van Buren Blvd. &Washington St.

BMP Identification

BMP NAME / ID: BIORETENTION BASIN H

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}= 0.51 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)*
H-1	*17,656*	*Concrete or Asphalt*	*1*	*0.89*	*15749.2*			
H-2	*1,624*	*Ornamental Landscaping*	*0.1*	*0.11*	*179.4*			
	19280	***Total***			**15928.6**	**0.51**	***677***	***677***

Notes: *Note: Due to limited landscape area within DMA H, Basin H provides 301.4 cubic feet of treatment volume compared to the required DCV of 667.0 cubic feet, resulting in a remaining deficit of 365.6 cubic feet. Basin B provides 1,784 cubic feet of excess treatment volume above its required DCV. The remaining 365.6 cubic feet required for DMA H is proposed to be mitigated through equivalent offset treatment within Basin B.

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 DRC Engineering, Inc. Date 6/1/2026
Designed by DRC Engineering, Inc. Case No
Company Project Number/Name 19-267 NWC Van Buren Blvd. &Washington St.

BMP Identification

BMP NAME / ID BIORETENTION BASIN I

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}= 0.51 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)*
I-1	*23,801*	*Concrete or Asphalt*	*1*	*0.89*	*21230.5*			
I-2	*6,725*	*Ornamental Landscaping*	*0.1*	*0.11*	*742.8*			
I-3	*8,695*	*Roofs*	*1*	*0.89*	*7755.9*			
	39221	***Total***			**29729.2**	**0.51**	***1263.5***	***1,274***

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	DRC Engineering, Inc.	Date	6/1/2026
Designed by	DRC Engineering, Inc.	Case No	
Company Project Number/Name	19-267 NWC Van Buren Blvd. &Washington St.		

BMP Identification

BMP NAME / ID: BIORETENTION BASIN J

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}= 0.51 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)*
J-1	*12,676*	*Concrete or Asphalt*	*1*	*0.89*	*11307*			
J-2	*2,137*	*Ornamental Landscaping*	*0.1*	*0.11*	*236*			
	14813	***Total***			**11543**	**0.51**	***490.6***	***991***

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: DRC Engineering, Inc. | Date: 6/1/2026

Designed by: DRC Engineering, Inc. | Case No:

Company Project Number/Name: 19-267 NWC Van Buren Blvd. &Washington St.

BMP Identification

BMP NAME / ID: BIORETENTION BASIN K

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}= 0.51 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 Impervious 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)*
K-1	*2,693*	*Concrete or Asphalt*	*1*	*0.89*	*2402.2*			
K-2	*1,379*	*Ornamental Landscaping*	*0.1*	*0.11*	*152.3*			
	4072	***Total***			**2554.5**	**0.51**	***108.6***	***155***

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: DRC Engineering, Inc. Date: 6/1/2026

Designed by: DRC Engineering, Inc. Case No:

Company Project Number/Name: 19-267 NWC Van Buren Blvd. &Washington St.

BMP Identification

BMP NAME / ID: MWS L (Model No. MWS-L-4-4)

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}= 0.51 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)*
L-1	*8,198*	*Concrete or Asphalt*	*1*	*0.89*	*7312.6*			
L-2	*2,092*	*Ornamental Landscaping*	*0.1*	*0.11*	*231.1*			
	10290	***Total***			**7543.7**	**0.51**	***320.6***	***1,140***

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: DRC Engineering, Inc.
Date: 6/1/2026
Designed by: DRC Engineering, Inc.
Case No:
Company Project Number/Name: 19-267 NWC Van Buren Blvd. &Washington St.

BMP Identification

BMP NAME / ID: BIORETENTION BASIN S

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}= 0.51 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)*
S-1	*24,192*	*Concrete or Asphalt*	*1*	*0.89*	*21579.3*			
S-2	*5,641*	*Ornamental Landscaping*	*0.1*	*0.11*	*623.1*			
	29833	***Total***			**22202.4**	**0.51**	***943.6***	***944***

Notes: *Note: Due to site constraints, offsite area DMA S does not propose a separate bioretention basin. Basin B provides 1,784 cubic feet of excess treatment volume above its required DCV. The required VBMP for DMA S is satisfied through equivalent offset treatment provided by Basin B.

Bioretention Facility - Design Procedure	BMP ID: BASIN A	Legend:	Required Entries / Calculated Cells

Company Name:	DRC Engineering, Inc.	Date:	6/1/2026
Designed by:	DRC Engineering, Inc.	County/City Case No.:	

Design Volume

Enter the area tributary to this feature	A_T=	1.186	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	1,710	ft^3

Type of Bioretention Facility Design

(●) Side slopes required (parallel to parking spaces or adjacent to walkways)

( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	3.0	ft
Top Width of Bioretention Facility, excluding curb	w_T =	10.0	ft
Total Effective Depth, d_E $d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$	d_E =	1.73	ft
Minimum Surface Area, A_m $A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$	A_M =	989	ft^2
Proposed Surface Area	A=	989	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0	%
6" Check Dam Spacing		0	feet
Describe Vegetation:			

Notes: Proposed Surface Area meets Minimum Surface Area requirement.

Bioretention Facility - Design Procedure	BMP ID: BASIN B	Legend:	Required Entries / Calculated Cells
Company Name:	DRC Engineering, Inc.	Date:	6/1/2026
Designed by:	DRC Engineering, Inc.	County/City Case No.:	

Design Volume

Enter the area tributary to this feature	A_T=	3.245	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	4,735	ft^3

Type of Bioretention Facility Design

(●) Side slopes required (parallel to parking spaces or adjacent to walkways)

( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	1.5	ft
Top Width of Bioretention Facility, excluding curb	w_T =	37.0	ft
Total Effective Depth, d_E $d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$	d_E =	1.33	ft
Minimum Surface Area, A_m $A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$	A_M =	3,558	ft^2
Proposed Surface Area	A=	4,300	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0	%
6" Check Dam Spacing		0	feet
Describe Vegetation:			

Notes: Basin B provides an excess of 742 sq-ft of the required minimum Surface Area

Basins B and C provide a total excess of 1,210 sq-ft of Proposed Surface Area

Basins B and C provide sufficient surface area via offset treatment for Areas E, G1, G2, G3, H and S.

Bioretention Facility - Design Procedure	BMP ID: BASIN C	Legend:	Required Entries / Calculated Cells
Company Name:	DRC Engineering, Inc.	Date:	6/1/2026
Designed by:	DRC Engineering, Inc.	County/City Case No.:	

Design Volume

Enter the area tributary to this feature	A_T=	0.84	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	1,201	ft^3

Type of Bioretention Facility Design

(●) Side slopes required (parallel to parking spaces or adjacent to walkways)

( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	3.0	ft
Top Width of Bioretention Facility, excluding curb	w_T =	35.0	ft
Total Effective Depth, d_E $d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$	d_E =	1.78	ft
Minimum Surface Area, A_m $A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$	A_M =	675	ft^2
Proposed Surface Area	A=	1,143	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0	%
6" Check Dam Spacing		0	feet
Describe Vegetation:			

Notes: Basin B provides an excess of 468 sq-ft of the required minimum Surface Area

Basins B and C provide a total excess of 1,210 sq-ft of Proposed Surface Area

Basins B and C provide sufficient surface area via offset treatment for Areas E, G1, G2, G3, H and S.

Bioretention Facility - Design Procedure	BMP ID: BASIN D	Legend:	Required Entries / Calculated Cells

Company Name:	DRC Engineering, Inc.	Date:	6/1/2026
Designed by:	DRC Engineering, Inc.	County/City Case No.:	

Design Volume

Enter the area tributary to this feature	A_T=	0.414	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	491	ft^3

Type of Bioretention Facility Design

(●) Side slopes required (parallel to parking spaces or adjacent to walkways)

( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	3.0	ft
Top Width of Bioretention Facility, excluding curb	w_T =	17.0	ft
Total Effective Depth, d_E $d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$	d_E =	1.76	ft
Minimum Surface Area, A_m $A_M\,(ft^2) = \frac{V_{BMP}\,(ft^3)}{d_E\,(ft)}$	A_M =	279	ft^2
Proposed Surface Area	A=	444	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0	%
6" Check Dam Spacing		0	feet
Describe Vegetation:			

Notes: Proposed Surface Area is greater than the Minimum Surface Area requirement.

Bioretention Facility - Design Procedure	BMP ID: BASIN E	Legend:	Required Entries / Calculated Cells

Company Name:	DRC Engineering, Inc.	Date:	6/1/2026
Designed by:	DRC Engineering, Inc.	County/City Case No.:	

Design Volume

Enter the area tributary to this feature	A_T=	0.239	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	380	ft^3

Type of Bioretention Facility Design

- ○ Side slopes required (parallel to parking spaces or adjacent to walkways)
- ◉ No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	3.0	ft
Top Width of Bioretention Facility, excluding curb	w_T =	4.5	ft
Total Effective Depth, d_E			
$d_E = [(0.3) \times d_S + (0.4) \times 1] + 0.5$	d_E =	1.80	ft
Minimum Surface Area, A_m			
$A_M\,(ft^2) = \frac{V_{BMP}\,(ft^3)}{d_E\,(ft)}$	A_M =	211	ft^2
Proposed Surface Area	A=	211	ft^2
Minimum Required Length of Bioretention Facility, L	L =	46.9	ft

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =		:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0	%
6" Check Dam Spacing		0	feet
Describe Vegetation:			

Notes: Due to site constraints, Basin E does not independently satisfy the calculated Minimum Surface Area. Basin E provides 178 sq-ft of surface area. The remaining deficit of 33 sq-ft is provided via offset treatment by the excess Surface Area provided in Basins B and C.

Bioretention Facility - Design Procedure	BMP ID: BASIN F	Legend:	Required Entries / Calculated Cells

Company Name:	DRC Engineering, Inc.	Date:	6/1/2026
Designed by:	DRC Engineering, Inc.	County/City Case No.:	

Design Volume

Enter the area tributary to this feature	A_T=	0.382	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	566	ft^3

Type of Bioretention Facility Design

(●) Side slopes required (parallel to parking spaces or adjacent to walkways)

( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	2.2	ft
Top Width of Bioretention Facility, excluding curb	w_T =	9.0	ft
Total Effective Depth, d_E $d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$	d_E =	1.47	ft
Minimum Surface Area, A_m $A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$	A_M =	385	ft^2
Proposed Surface Area	A=	416	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0	%
6" Check Dam Spacing		0	feet
Describe Vegetation:			

Notes: Proposed Surface Area is greater than the Minimum Surface Area requirement.

Bioretention Facility - Design Procedure	BMP ID: BASIN G1	Legend:	Required Entries / Calculated Cells

Company Name:	DRC Engineering, Inc.	Date:	6/1/2026
Designed by:	DRC Engineering, Inc.	County/City Case No.:	

Design Volume

Enter the area tributary to this feature — A_T = 0.194 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook — V_{BMP} = 294 ft^3

Type of Bioretention Facility Design

(●) Side slopes required (parallel to parking spaces or adjacent to walkways)

( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer — d_S = 1.5 ft

Top Width of Bioretention Facility, excluding curb — w_T = 6.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ — d_E = 1.23 ft

Minimum Surface Area, A_m

$$A_M\,(ft^2) = \frac{V_{BMP}\,(ft^3)}{d_E\,(ft)}$$

A_M = 239 ft^2

Proposed Surface Area — A= 239 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility — z = 4 :1

Diameter of Underdrain — 6 inches

Longitudinal Slope of Site (3% maximum) — 0 %

6" Check Dam Spacing — 0 feet

Describe Vegetation:

Notes: Due to site constraints, Basin G1 does not independently satisfy the calculated Minimum Surface Area. Basin G1 provides 206 sq-ft of surface area. The remaining deficit of 33 sq-ft is provided via offset treatment by the excess Surface Area provided in Basins B and C.

Bioretention Facility - Design Procedure	BMP ID: BASIN G2	Legend:	Required Entries / Calculated Cells

Company Name:	DRC Engineering, Inc.	Date:	6/1/2026
Designed by:	DRC Engineering, Inc.	County/City Case No.:	

Design Volume

Enter the area tributary to this feature — A_T = 0.279 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook — V_{BMP} = 338 ft^3

Type of Bioretention Facility Design

(●) Side slopes required (parallel to parking spaces or adjacent to walkways)

( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer — d_S = 1.5 ft

Top Width of Bioretention Facility, excluding curb — w_T = 6.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ — d_E = 1.23 ft

Minimum Surface Area, A_m

$$A_M\,(ft^2) = \frac{V_{BMP}\,(ft^3)}{d_E\,(ft)}$$

A_M = 275 ft^2

Proposed Surface Area — A= 275 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility — z = 4 :1

Diameter of Underdrain — 6 inches

Longitudinal Slope of Site (3% maximum) — 0 %

6" Check Dam Spacing — 0 feet

Describe Vegetation:

Notes: Due to site constraints, Basin G2 does not independently satisfy the calculated Minimum Surface Area. Basin G2 provides 81 sq-ft of surface area. The remaining deficit of 194 sq-ft is provided via offset treatment by the excess Surface Area provided in Basins B and C.

Bioretention Facility - Design Procedure	BMP ID: BASIN G3	Legend:	Required Entries / Calculated Cells

Company Name:	DRC Engineering, Inc.	Date:	6/1/2026
Designed by:	DRC Engineering, Inc.	County/City Case No.:	

Design Volume

Enter the area tributary to this feature — A_T = 0.19 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook — V_{BMP} = 260 ft^3

Type of Bioretention Facility Design

(●) Side slopes required (parallel to parking spaces or adjacent to walkways)

( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer — d_S = 2.8 ft

Top Width of Bioretention Facility, excluding curb — w_T = 6.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ — d_E = 1.62 ft

Minimum Surface Area, A_m

$$A_M\,(ft^2) = \frac{V_{BMP}\,(ft^3)}{d_E\,(ft)}$$

A_M = 161 ft^2

Proposed Surface Area — A= 161 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility — z = 4 :1

Diameter of Underdrain — 6 inches

Longitudinal Slope of Site (3% maximum) — 0 %

6" Check Dam Spacing — 0 feet

Describe Vegetation:

Notes: Due to site constraints, Basin G3 does not independently satisfy the calculated Minimum Surface Area. Basin G3 provides 137 sq-ft of surface area. The remaining deficit of 24 sq-ft is provided via offset treatment by the excess Surface Area provided in Basins B and C.

Bioretention Facility - Design Procedure	BMP ID: BASIN H	Legend:	Required Entries / Calculated Cells
Company Name: DRC Engineering, Inc.		Date: 6/1/2026	
Designed by: DRC Engineering, Inc.		County/City Case No.:	

Design Volume

Enter the area tributary to this feature	A_T=	0.443	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	677	ft^3

Type of Bioretention Facility Design

- ○ Side slopes required (parallel to parking spaces or adjacent to walkways)
- ◉ No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	2.0	ft
Top Width of Bioretention Facility, excluding curb	w_T =	2.9	ft
Total Effective Depth, d_E			
$d_E = [(0.3) \times d_S + (0.4) \times 1] + 0.5$	d_E =	1.50	ft
Minimum Surface Area, A_m			
$A_M\,(ft^2) = \frac{V_{BMP}\,(ft^3)}{d_E\,(ft)}$	A_M =	452	ft^2
Proposed Surface Area	A=	452	ft^2
Minimum Required Length of Bioretention Facility, L	L =	156.4	ft

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0	%
6" Check Dam Spacing		0	feet
Describe Vegetation:			

Notes: Due to site constraints, Basin H does not independently satisfy the calculated Minimum Surface Area. Basin H provides 230 sq-ft of surface area. The remaining deficit of 222 sq-ft is provided via offset treatment by the excess Surface Area provided in Basins B and C.

Bioretention Facility - Design Procedure	BMP ID: BASIN I	Legend:	Required Entries / Calculated Cells

Company Name:	DRC Engineering, Inc.	Date:	6/1/2026
Designed by:	DRC Engineering, Inc.	County/City Case No.:	

Design Volume

Enter the area tributary to this feature	A_T=	0.9	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	1,264	ft^3

Type of Bioretention Facility Design

- ○ Side slopes required (parallel to parking spaces or adjacent to walkways)
- ◉ No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	3.0	ft
Top Width of Bioretention Facility, excluding curb	w_T =	12.0	ft
Total Effective Depth, d_E			
$d_E = [(0.3) \times d_S + (0.4) \times 1] + 0.5$	d_E =	1.80	ft
Minimum Surface Area, A_m			
$A_M\,(ft^2) = \frac{V_{BMP}\,(ft^3)}{d_E\,(ft)}$	A_M =	702	ft^2
Proposed Surface Area	A=	708	ft^2
Minimum Required Length of Bioretention Facility, L	L =	58.5	ft

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =		:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0	%
6" Check Dam Spacing		0	feet
Describe Vegetation:			

Notes: Proposed Surface Area is greater than the Minimum Surface Area requirement.

Bioretention Facility - Design Procedure	BMP ID: BASIN J	Legend:	Required Entries / Calculated Cells

Company Name:	DRC Engineering, Inc.	Date:	6/1/2026
Designed by:	DRC Engineering, Inc.	County/City Case No.:	

Design Volume

Enter the area tributary to this feature	A_T=	0.34	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	491	ft^3

Type of Bioretention Facility Design

(●) Side slopes required (parallel to parking spaces or adjacent to walkways)

( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	3.0	ft
Top Width of Bioretention Facility, excluding curb	w_T =	8.6	ft
Total Effective Depth, d_E $d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$	d_E =	1.72	ft
Minimum Surface Area, A_m $A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$	A_M =	286	ft^2
Proposed Surface Area	A=	338	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0	%
6" Check Dam Spacing		0	feet
Describe Vegetation:			

Notes: Proposed Surface Area is greater than the Minimum Surface Area requirement.

Bioretention Facility - Design Procedure	BMP ID: BASIN K	Legend:	Required Entries / Calculated Cells

Company Name:	DRC Engineering, Inc.	Date:	6/1/2026
Designed by:	DRC Engineering, Inc.	County/City Case No.:	

Design Volume

Enter the area tributary to this feature	A_T=	0.093	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	109	ft^3

Type of Bioretention Facility Design

- ○ Side slopes required (parallel to parking spaces or adjacent to walkways)
- ◉ No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	3.0	ft
Top Width of Bioretention Facility, excluding curb	w_T =	2.0	ft
Total Effective Depth, d_E			
$d_E = [(0.3) \times d_S + (0.4) \times 1] + 0.5$	d_E =	1.80	ft
Minimum Surface Area, A_m			
$A_M\,(ft^2) = \frac{V_{BMP}\,(ft^3)}{d_E\,(ft)}$	A_M =	61	ft^2
Proposed Surface Area	A=	86	ft^2
Minimum Required Length of Bioretention Facility, L	L =	30.5	ft

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =		:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0	%
6" Check Dam Spacing		0	feet
Describe Vegetation:			

Notes: Proposed Surface Area is greater than the Minimum Surface Area requirement.

Bioretention Facility - Design Procedure	BMP ID	Legend:	Required Entries	
			Calculated Cells	

Company Name:	DRC Engineering, Inc.	Date:	6/1/2026
Designed by:	DRC Engineering, Inc.	County/City Case No.:	

Design Volume

Enter the area tributary to this feature	A_T=	0.685	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	944	ft^3

Type of Bioretention Facility Design

- ○ Side slopes required (parallel to parking spaces or adjacent to walkways)
- ◉ No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	3.0	ft
Top Width of Bioretention Facility, excluding curb	w_T =	6.0	ft
Total Effective Depth, d_E			
$d_E = [(0.3) \times d_S + (0.4) \times 1] + 0.5$	d_E =	1.80	ft
Minimum Surface Area, A_m			
$A_M\,(ft^2) = \frac{V_{BMP}\,(ft^3)}{d_E\,(ft)}$	A_M =	525	ft^2
Proposed Surface Area	A=	525	ft^2
Minimum Required Length of Bioretention Facility, L	L =	87.5	ft

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =		:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0	%
6" Check Dam Spacing		0	feet
Describe Vegetation:			

Notes: Due to site constraints, Offsite Area DMA S does not provide a proposed basin.
Basins B and C provide sufficient surface area via offset treatment for Area S.

Effective Impervious Fraction

Developed Cover Types	Effective Impervious Fraction
Roofs	1.00
Concrete or Asphalt	1.00
Grouted or Gapless Paving Blocks	1.00
Compacted Soil (e.g. unpaved parking)	0.40
Decomposed Granite	0.40
Permeable Paving Blocks w/ Sand Filled Gap	0.25
Class 2 Base	0.30
Gravel or Class 2 Permeable Base	0.10
Pervious Concrete / Porous Asphalt	0.10
Open and Porous Pavers	0.10
Turf block	0.10
Ornamental Landscaping	0.10
Natural (A Soil)	0.03
Natural (B Soil)	0.15
Natural (C Soil)	0.30
Natural (D Soil)	0.40
Mixed Surface Types	

Use this table to determine the effective impervious fraction for the V_{BMP} and Q_{BMP} calculation sheets

MWS Linear 2.0 Volume Based Sizing Calculations - *All States*

Model #	Physical Depth of Model from TC, FS, TC to INVERT OUT	Wetland Perimiter (ft)	**Wetland Chamber Max HGL Height (ft)	Wetland Surface Area (sq ft)	Treatment Capacity (cu ft) for Volume Based Design **VOLUME DESIGN**	
					24 Hour Drain Down	48 Hour Drain Down
MWS-L-4-4	4.13'	6.7	3.40	22.78	**1139.96**	**2279.93**
MWS-L-4-6	4.13'	9.4	3.40	31.96	**1599.35**	**3198.71**
MWS-L-4-8	4.13'	14.8	3.40	50.32	**2518.13**	**5036.26**
MWS-L-4-13	4.13'	18.4	3.40	62.56	**3130.65**	**6261.30**
MWS-L-4-15	4.13'	22.4	3.40	76.16	**3811.22**	**7622.45**
MWS-L-4-17	4.13'	26.4	3.40	89.76	**4491.80**	**8983.60**
MWS-L-4-19	4.13'	30.4	3.40	103.36	**5172.37**	**10344.75**
MWS-L-4-21	4.13'	34.4	3.40	116.96	**5852.95**	**11705.90**
MWS-L-8-12	4.13'	44.4	3.40	150.96	**7554.39**	**15108.78**
MWS-L-8-16	4.13'	59.2	3.40	201.28	**10072.52**	**20145.04**
MWS-L-8-20	4.13'	74.0	3.40	251.60	**12590.65**	**25181.30**
MWS-L-8-24	4.13'	88.8	3.40	301.92	**15108.78**	**30217.56**

Shallow or Deeper Units Available. Change in Height Will Affect Treatment Capacity

** Not the physical height of the unit but the max HGL in the system at peak treatment flow rate

Based on loading rate of 25 in/hr or 0.26 gpm/sq ft

Modular Wetland Systems, Inc. **Copyright 2013** **www.modularwetlands.com**

info@modularwetlands.com **P: 760-433-7640** **2972 San Luis Rey Rd, Oceanside CA 92058**

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

PRELIMINARY HYDROLOGY ANALYSIS

For:

Stater Bros. Relocation

NWC Van Buren Blvd & Washington St.
Riverside, CA 92504

Lead Agency:

County Of Riverside

4080 Lemon Street – 8th Floor
Riverside, CA 92501

Prepared by:

DRC Engineering, Inc.

160 S. Old Springs Rd., Suite 210
Anaheim Hills, CA 92808
(714) 685-6860
Drew Gates, RCE 94249

Original Date Prepared: June 4, 2026

DRC Project No. 19-267

TABLE OF CONTENTS

SECTION I **INTRODUCTION**

SECTION II **HYDROLOGY METHODOLOGY**

SECTION III **DRAINAGE AREA CHARACTERISTICS**

SECTION IV **HYDROLOGIC RESULTS**

SECTION V **PRELIMINARY DETENTION FEASIBILITY ANALYSIS**

SECTION VI **CONCLUSIONS**

APPENDIX A **SITE INFORMATION**

Location Map
USDA Natural Resources Conservation Service – Web Soil Survey
RCFC&WCD – Plate D-5.5 – Runoff Index Numbers for Pervious Area
RCFC&WCD – Plate E.5 – Rainfall Depth

APPENDIX B **SITE HYDROLOGY MAPS AND EXHIBITS**

Existing Hydrology Map
Proposed Hydrology Map

APPENDIX C **UNIT HYDROGRAPH RESULTS**

Existing Condition
2-year return – 1-, 3-, 6-, 24-hour duration
5-year return – 1-, 3-, 6-, 24-hour duration
10-year return – 1-, 3-, 6-, 24-hour duration
Proposed Condition
2-year return – 1-, 3-, 6-, 24-hour duration
5-year return – 1-, 3-, 6-, 24-hour duration
10-year return – 1-, 3-, 6-, 24-hour duration

APPENDIX D **HYDRAFLOW ANALYSIS**

2-year return
5-year return
10-year return

SECTION I Introduction

The proposed Stater Bros. Relocation project is located on approximately 9.69 acres of partially developed land containing two (2) existing buildings at the northwest corner of Van Buren Boulevard and Washington Street in the Woodcrest area of unincorporated Riverside County, California.

The project includes demolition of one (1) existing building and construction of five (5) new buildings, along with associated paved drive aisles, parking areas, landscaping, and site improvements.

This preliminary report has been prepared to evaluate existing and proposed hydrologic conditions, including peak stormwater runoff rates and runoff volumes.

SECTION II Hydrology Methodology

For both the existing and proposed conditions, unit hydrographs were generated using Riverside County Unit Hydrograph software (UNRIV) to calculate the peak storm water runoff rates, and runoff volumes for the overall site and drainage subareas. As required by Riverside County, calculations were generated for the 1-, 3-, 6-, and 24-hour duration storm events for the 2-, 5-, and 10-year return periods.

Rainfall depths were determined using NOAA Atlas 14 and Riverside County Hydrology Manual Plate E-5. Soil group classification was determined to be Soil Group D by USDA National Resources Conservation Service Web Soil Survey online mapping tool. Runoff Index numbers were determined using Plate D-5. The table below summarizes the rainfall depths utilized as UNRIV inputs for the project.

Return period (year), duration (hour)	**Depth (inches)**
2-year, 1-hour	0.419
100-year, 1-hour	1.220
2-year, 3-hour	0.708
100-year, 3-hour	1.750
2-year, 6-hour	0.954
100-year, 6-hour	2.260
2-year, 24-hour	1.660
100-year, 24-hour	4.100

Existing and proposed drainage patterns are illustrated on the hydrology maps in Appendix B.

A preliminary detention feasibility analysis was performed using the overall site hydrology results. The total storage volume required to mitigate post-development peak flows to be at or below pre-development conditions was estimated using Autodesk Hydraflow software. The required storage volume was then proportionally allocated among the six proposed detention systems based on tributary drainage areas and associated runoff characteristics. The resulting detention volumes are intended to demonstrate feasibility of the proposed drainage concept. Final discharge routing, outlet structure sizing, and detailed detention calculations will be provided with the final hydrology report.

SECTION III Drainage Area Characteristics

Existing Site Conditions: The Project Site Consists of approximately 9.69 acres of partially developed land and is divided into four (4) separate hydrologic drainage areas, as described below.

- **Area 100** is located in the northern portion of the Site and consists of approximately 5.90 acres of undeveloped land with natural grass cover (0% impervious). Runoff generally drains via sheet flow to the southwest and ultimately enters Area 200.
- **Area 200** is located in the southwest portion of the Site and consists of approximately 1.51 acres of developed land that is approximately 81% impervious. Existing improvements include a quick-service drive-through restaurant, paved parking areas, drive aisles, and commercial landscaping. Runoff drains west and south through concrete gutters to an existing onsite catch basin, which discharges via storm drain pipe to the existing public storm drain system within Van Buren Boulevard.
- **Area 300** is located along the eastern portion of the Site adjacent to Washington Street and south of Area 100. Area 300 consists of approximately 1.48 acres of undeveloped land with natural grass cover (0% impervious). Runoff generally drains southeast via sheet flow before entering the existing curb and gutter along Washington Street, where it continues south toward Van Buren Boulevard. Flows ultimately discharge to an existing public catch basin and storm drain system.
- **Area 400** is located in the southeast corner of the Site and consists of approximately 0.80 acres of developed land that is approximately 97% impervious. Existing improvements include paved surfaces and commercial landscaping. Runoff drains southwest toward the existing driveway and then offsite to the northerly curb and gutter along Van Buren Boulevard, ultimately discharging to an existing public catch basin and storm drain system.

See the Existing Hydrology Map in Appendix B for an illustration of the Existing Site conditions.

The table below summarizes the drainage characteristics of each existing drainage area.

EXISTING CONDITION

Area	Area (acres)	U/S elev	D/S elev	Δ elev	Flowpath Length (ft)	Centroid Length (ft)	Pervious Area	Impervious %
100	5.897	1491.10	1483.90	7.20	695	375	256,888	0%
200	1.512	1483.90	1482.20	1.70	518	173	12,762	81%
300	1.484	1494.10	1485.79	8.31	501	364	61,777	4%
400	0.795	1489.20	1484.20	5.00	257	133	945	97%
Site	9.688	1491.10	1483.90	7.20	695	375	332,372	21%

Proposed Site Development: In the Proposed Condition, the Project Site will consist of 9.69 acres of fully developed land. Proposed improvements include five (5) new buildings and one (1) existing building, paved surfaces, commercial landscaping, storm drain improvements, biofiltration facilities, and detention systems. The Site is divided into nine (9) separate hydrologic drainage areas, as described below.

- **Area AL** is located in the northwest corner of the Site and consists of approximately 1.45 acres of developed land that is approximately 90% impervious. Runoff is collected by curb and gutter and directed to a proposed biofiltration planter for LID treatment before entering detention system DET-AL. Flows are then discharged through a proposed outlet control structure to the existing public storm drain system.
- **Area B** is located in the central portion of the Site and consists of approximately 3.25 acres of developed land that is approximately 87% impervious. Runoff is collected by catch basins and conveyed through the onsite storm drain system to a proposed biofiltration planter for LID treatment before entering detention system DET-B. Flows are then discharged through a proposed outlet control structure to the existing public storm drain system.
- **Area CD** is located in the northern portion of the Site and consists of approximately 1.25 acres of developed land that is approximately 79% impervious. Runoff is collected by curb and gutter and directed to a proposed biofiltration planter for LID treatment before entering detention system DET-CD. Flows are then discharged through a proposed outlet control structure to the existing public storm drain system.
- **Area EK** is located in the east-central portion of the Site and consists of approximately 0.33 acres of developed land that is approximately 88% impervious. Runoff is collected by curb and gutter and directed to a proposed biofiltration planter for LID treatment before entering detention system DET-EK. Flows are then discharged through a proposed outlet control structure to the existing public storm drain system.
- **Area GH** is located in the southwest corner of the Site and consists of approximately 1.11 acres of developed land that is approximately 84% impervious. Runoff is collected by curb and gutter and directed to proposed biofiltration planters for LID treatment before entering the onsite storm drain system and discharging to the existing public storm drain system. No dedicated detention facility is proposed for Area GH.
- **Area F** is located in the central portion of the Site north of Area GH, and consists of approximately 0.38 acres of developed land that is approximately 88% impervious. Runoff is collected by catch basins and conveyed through the onsite storm drain system to a proposed biofiltration planter for LID treatment before entering detention system DET-F. Flows are then discharged through a proposed outlet control structure to the existing public storm drain system.
- **Area I** is located in the southeast corner of the Site and consists of approximately 0.90 acres of developed land that is approximately 83% impervious. Runoff is collected by curb and gutter and directed to proposed biofiltration planters for LID treatment before entering the onsite storm drain system and discharging to the existing public storm drain system. No dedicated detention facility is proposed for Area I.
- **Area J** is located in the central portion of the Site and consists of approximately 0.34 acres of developed land that is approximately 86% impervious. Runoff is collected by curb and gutter and directed to a proposed biofiltration planter for LID treatment before entering detention system DET-J. Flows are then discharged through a proposed outlet control structure to the existing public storm drain system.
- **Offsite Area S** is located along the eastern boundary of the Site and consists of approximately 0.69 acres of proposed public street improvements that are approximately 96% impervious. Runoff is collected within the proposed public curb and gutter along Washington Street and conveyed

south toward Van Buren Boulevard, ultimately discharging to the existing public storm drain system.

The table below summarizes the drainage characteristics of each proposed drainage area.

PROPOSED CONDITION

Area	Area (acres)	U/S elev	D/S elev	Δ elev	Flowpath Length (ft)	Centroid Length (ft)	Pervious Area	Impervious %
AL	1.445	1488.30	1487.00	1.30	176	96	7,482	90%
B	3.245	1490.50	1485.90	4.60	242	63	8,409	87%
CD	1.254	1491.30	1486.40	4.90	185	45	5,613	79%
EK	0.332	1490.00	1488.50	1.50	224	94	424	88%
F	0.382	1487.80	1485.40	2.40	115	114	1,933	88%
GH	1.105	1482.70	1481.90	0.80	179	25	1,624	84%
I	0.900	1488.00	1485.00	3.00	239	157	6,725	83%
J	0.340	1487.80	1485.60	2.20	130	50	2,137	86%
S	0.685	1490.13	1485.79	4.34	755	399	5,641	81%
Site	9.688	1490.50	1485.90	4.60	242	63	66,730	84%

SECTION IV Hydrologic Results

Existing Condition: The tables below summarize the Peak Q (cfs) and total Flood Volume (cubic-feet) results calculated in UNRIV software for the 2-, 5-, 10-year return, 1-, 3-, 6-, 24-hour duration periods.

2-Year Return

Existing Area	2-year Peak Q (cfs)				2-year Flood Volume (cu-ft)			
	1-hour	*3-hour*	*6-hour*	*24-hour*	*1-hour*	*3-hour*	*6-hour*	*24-hour*
100	5.27	2.22	1.81	0.13	3,838.6	3,550.5	3,589.0	3,553.4
200	1.66	0.80	0.70	0.25	1,861.1	2,944.9	3,938.3	6,833.2
300	1.44	0.58	0.48	0.04	1,018.0	1,016.8	1,085.0	1,251.9
400	1.06	0.49	0.44	0.15	1,099.2	1,806.8	2,426.2	4,215.6
Site	9.19	4.17	3.51	0.59	7,898.4	9,434.5	11,119.9	15,761.7

5-Year Return

Existing Area	5-year Peak Q (cfs)				5-year Flood Volume (cu-ft)			
	1-hour	*3-hour*	*6-hour*	*24-hour*	*1-hour*	*3-hour*	*6-hour*	*24-hour*
100	9.26	4.43	3.80	1.08	9,957.7	11,519.2	11,586.3	13,069.3
200	2.58	1.23	1.08	0.35	2,898.3	4,203.9	5,418.4	9,198.5
300	2.48	1.13	0.98	0.27	2,533.4	2,980.9	3,071.8	3,641.4
400	1.26	0.70	0.62	0.21	1,305.7	2,492.4	3,260.8	5,671.4
Site	15.47	7.55	6.51	2.00	17,298.3	21,675.0	23,809.2	32,241.4

10-Year Return

Existing Area	10-year Peak Q (cfs)				10-year Flood Volume (cu-ft)			
	1-hour	*3-hour*	*6-hour*	*24-hour*	*1-hour*	*3-hour*	*6-hour*	*24-hour*
100	11.62	5.46	4.66	1.43	12,995.6	15,383.2	15,336.5	19,042.5
200	3.22	1.50	1.30	0.44	3,661.3	5,118.6	6,513.2	11,043.9
300	3.11	1.39	1.20	0.36	3,298.0	3,953.2	4,021.5	5,177.4
400	1.96	0.84	0.74	0.26	2,049.8	3,001.1	3,885.6	6,789.9
Site	19.36	9.23	7.91	2.57	22,289.0	28,050.2	30,344.2	43,072.9

Proposed Condition: The tables below summarize the Peak Q (cfs) and total Flood Volume (cubic-feet) results calculated in UNRIV software for the 2-, 5-, 10-year return, 1-, 3-, 6-, 24-hour duration periods.

2-Year Return

Proposed Area	2-year Peak Q (cfs)				2-year Flood Volume (cu-ft)			
	1-hour	*3-hour*	*6-hour*	*24-hour*	*1-hour*	*3-hour*	*6-hour*	*24-hour*
AL	1.91	0.85	0.76	0.27	1,898.2	3,069.6	4,112.9	7,140.0
B	4.81	1.92	1.74	0.59	4,182.2	6,723.8	9,009.1	15,642.9
CD	1.81	0.69	0.62	0.20	1,515.8	2,382.1	3,181.1	5,516.1
EK	0.43	0.19	0.17	0.06	428.8	689.3	922.5	1,600.5
F	0.56	0.22	0.20	0.07	493.4	793.1	1,061.5	1,841.5
GH	1.62	0.64	0.57	0.19	1,387.6	2,209.9	2,955.5	5,127.0
I	1.13	0.50	0.44	0.15	1,120.2	1,778.3	2,376.8	4,121.6
J	0.50	0.20	0.18	0.06	434.5	696.3	932.4	1,618.5
S	0.68	0.35	0.31	0.11	843.2	1,334.2	1,784.2	3,095.8
Site	13.34	5.24	4.82	1.69	11,787.1	19,171.1	25,832.4	44,950.2

5-Year Return

Proposed Area	5-year Peak Q (cfs)				5-year Flood Volume (cu-ft)			
	1-hour	*3-hour*	*6-hour*	*24-hour*	*1-hour*	*3-hour*	*6-hour*	*24-hour*
AL	2.88	1.25	1.11	0.37	2,890.7	4,299.1	5,586.9	9,610.4
B	7.12	2.71	2.41	0.79	6,169.5	9,183.1	11,992.3	21,028.4
CD	2.77	1.07	0.96	0.28	2,378.5	3,423.8	4,399.6	7,428.8
EK	0.65	0.28	0.25	0.08	657.6	971.1	1,258.8	2,155.1
F	0.85	0.33	0.30	0.09	756.6	1,117.4	1,448.4	2,479.6
GH	2.46	0.96	0.86	0.26	2,147.6	3,138.5	4,053.9	6,903.5
I	1.73	0.75	0.67	0.21	1,740.2	2,533.7	3,268.0	5,551.0
J	0.76	0.29	0.26	0.08	667.7	982.7	1,272.9	2,178.4
S	1.02	0.51	0.43	0.15	1,250.9	1,831.4	2,381.3	4,161.6
Site	21.13	7.95	7.07	2.28	18,005.3	26,546.4	34,567.6	60,425.7

10-Year Return

Proposed Area	10-year Peak Q (cfs)				10-year Flood Volume (cu-ft)			
	1-hour	*3-hour*	*6-hour*	*24-hour*	*1-hour*	*3-hour*	*6-hour*	*24-hour*
AL	3.58	1.51	1.33	0.45	3,626.2	5,202.3	6,683.7	11,527.3
B	9.01	3.44	3.06	1.00	8,048.9	11,465.1	14,694.9	25,235.8
CD	3.45	1.30	1.15	0.36	3,011.6	4,177.5	5,298.1	8,931.7
EK	0.81	0.34	0.30	0.10	826.5	1,176.1	1,508.3	2,588.4
F	1.06	0.40	0.36	0.11	951.0	1,354.7	1,735.4	2,978.2
GH	3.06	1.16	1.03	0.33	2,707.8	3,814.8	4,867.0	8,292.5
I	2.15	0.91	0.80	0.26	2,196.5	3,082.8	3,926.9	6,672.6
J	0.94	0.36	0.32	0.10	840.0	1,192.1	1,525.6	2,613.3
S	1.32	0.66	0.57	0.20	1,658.7	2,318.9	2,950.8	5,003.4
Site	26.82	10.20	9.06	2.92	23,738.7	33,444.5	42,669.2	72,702.8

Existing vs. Proposed Comparison: Results indicate that the proposed development increases runoff rates and runoff volumes relative to existing conditions due to the increase in impervious area across the project site. As a result, runoff mitigation is required to reduce post-development peak discharges to at or below existing condition levels.

SECTION V Preliminary Detention Feasibility Analysis

Preliminary Detention Sizing: A preliminary detention feasibility analysis was performed for the 9.69-acre project site using the results generated with UNRIV. Based on preliminary routing analyses and conceptual outlet control assumptions with Hydraflow software, approximately 40,220 cubic-feet of detention storage is required for the overall site to mitigate post-development peak discharges to be at or below existing condition peak discharges for the required 2-, 5-, and 10- year return storm events.

To evaluate feasibility of the proposed drainage concept, the total required detention volume was distributed among the six (6) proposed detention systems based on the tributary drainage areas and associated runoff characteristics contributing to each system. The resulting detention volumes are intended to demonstrate feasibility of the proposed stormwater mitigation strategy and establish a preliminary basis for sizing the detention facilities. The table below summarizes the preliminary detention storage volumes allocated to each proposed detention facility.

Detention System	Volume (cu-ft)
DET-AL	8,690
DET-B	15,990
DET-CD	7,400
DET-EK	2,300
DET-F	4,450
DET-J	4,900
Total Provided	43,730
Total Required	40,220

The six proposed detention systems provide a combined detention storage volume of approximately 43,730 cubic feet, which exceeds the preliminary required detention volume of 40,220 cubic feet by approximately 3,510 cubic feet. Accordingly, the proposed detention concept provides sufficient storage capacity to demonstrate the feasibility of the proposed runoff mitigation strategy at this stage of design.

Final detention routing calculations & outlet control sizing will be provided with the final hydrology report.

Preliminary Outlet Control: Preliminary outlet control structures were evaluated using Hydraflow routing analyses to demonstrate the feasibility of the proposed detention concept. Based on the preliminary routing analyses, a conceptual outlet configuration consisting of staged low-flow and high-flow orifices with an overflow weir was found to provide sufficient attenuation of post-development peak discharges for the required storm events.

The preliminary outlet control configuration evaluated for the overall site (based on a relative detention system invert elevation of 100.00) consisted of a 1.7-inch diameter orifice at Elevation 100.00, a 3-inch diameter orifice at Elevation 101.20, a 4-inch diameter orifice at Elevation 102.40, and a 5-foot wide rectangular weir at Elevation 103.40. These outlet control elements are preliminary in nature and are intended solely to demonstrate feasibility of the proposed detention strategy. Final outlet control sizing and stage-storage-discharge analyses will be provided with the final hydrology report.

Preliminary Drawdown Discussion: Preliminary routing of the overall detention concept indicates that approximately 40,220 cubic feet of total storage is feasible for peak flow mitigation. The routing model is intended for preliminary peak flow attenuation only and is not intended to represent the final drawdown time of each individual detention facility. Final detention facilities will be individually designed with outlet controls to provide drawdown within 72 hours, and supporting calculations will be provided with the final hydrology report.

SECTION VI Conclusions

A preliminary hydrologic analysis was performed for the proposed 9.69-acre development in accordance with Riverside County requirements. Existing and proposed runoff conditions were evaluated using Riverside County Unit Hydrograph software (UNRIV) for the 1-, 3-, 6-, and 24-hour duration storm events associated with the 2-, 5-, and 10-year return periods.

Based on the preliminary analyses, the proposed development will increase runoff rates and runoff volumes relative to existing conditions due to the increase in impervious area. To mitigate these impacts, a preliminary detention feasibility analysis was performed using conceptual outlet control assumptions and Hydraflow routing analyses. Results indicate that approximately 40,220 cubic feet of detention storage distributed among the six proposed detention systems provides a feasible basis for mitigating post-development peak discharges to at or below existing condition peak discharges for the required storm events.

The detention facilities, outlet control structures, and associated storm drain infrastructure presented herein are preliminary in nature and are intended to demonstrate the feasibility of the proposed drainage concept during the entitlement stage of project development. Final detention routing calculations, outlet control sizing, drawdown evaluations, and supporting hydrologic analyses will be provided with the final hydrology report.

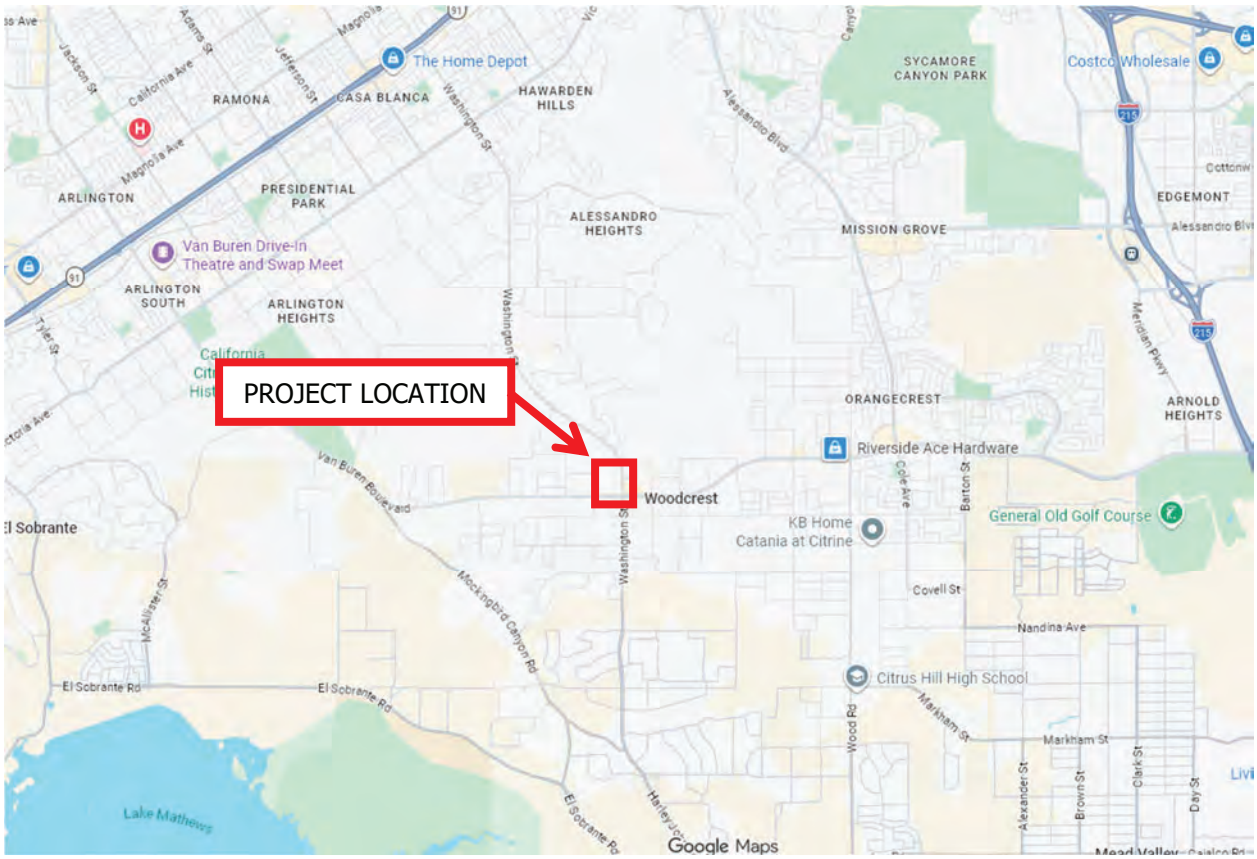
APPENDIX A - SITE INFORMATION

Location Map

USDA Natural Resources Conservation Service – Web Soil Survey

RCFC&WCD – Plate D-5.5 – Runoff Index Numbers for Pervious Area

RCFC&WCD – Plate E.5 – Rainfall Depth


PROJECT LOCATION
The Home Depot
RAMONA
CASA BLANCA
HAWARDEN HILLS
SYCAMORE CANYON PARK
Costco Wholesale
ARLINGTON
PRESIDENTIAL PARK
ALESSANDRO HEIGHTS
MISSION GROVE
EDGEMONT
Van Buren Drive-In Theatre and Swap Meet
ARLINGTON SOUTH
ARLINGTON HEIGHTS
ORANGECREST
ARNOLD HEIGHTS
Riverside Ace Hardware
Woodcrest
KB Home Catania at Citrine
General Old Golf Course
El Sobrante
Covell St
Nandina Ave
Citrus Hill High School
Markham St
Lake Mathews
Google Maps

Search

Properties and Qualities Ratings

Open All | Close All

- Soil Chemical Properties
- Soil Erosion Factors
- Soil Health Properties
- Soil Physical Properties

Soil Qualities and Features

- AASHTO Group Classification (Surface)
- AASHTO Group Index
- Depth to a Selected Soil Restrictive Layer
- Depth to Any Soil Restrictive Layer
- Depth to Bedrock
- Drainage Class
- Frost Action
- Frost-Free Days
- **Hydrologic Soil Group**

View Description | View Rating

View Options

Map ☑ Table ☑ Description of Rating ☑ Rating Options ☐ Detailed Description

Advanced Options

Aggregation Method: Dominant Condition

Component Percent Cutoff:

Tie-break Rule: Lower / Higher

View Description | View Rating

- Map Unit Name
- Parent Material Name
- Representative Slope
- Soil Slippage Potential
- Subsidence, Initial
- Subsidence, Total
- Unified Soil Classification (Selected Depth)
- Unified Soil Classification (Surface)

Water Features

Map — Hydrologic Soil Group

Scale (not to scale)



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

You have zoomed in beyond the scale at which the soil map for this area is intended to be used. Mapping of soils is done at a particular scale. The soil surveys that comprise your AOI were mapped at 1:15,800. The design of map units and the level of detail shown in the resulting soil map are dependent on that map scale. Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Tables — Hydrologic Soil Group — Summary By Map Unit

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

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

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BdC	Bonsall fine sandy loam, 2 to 8 percent slopes	D	5.7	58.9%
BuC2	Buren fine sandy loam, 2 to 8 percent slopes, eroded	C	3.5	36.8%
FaD2	Fallbrook sandy loam, 8 to 15 percent slopes, eroded	C	0.4	4.3%
Totals for Area of Interest			**9.6**	**100.0%**

Description — Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options — Hydrologic Soil Group

Aggregation Method: Dominant Condition
Component Percent Cutoff: *None Specified*
Tie-break Rule: Higher

USDA National Resources Conservation Service
WebSoilSurvey
DRC Project: 19-267
Date: 6/4/2026
Project Soil Group: D

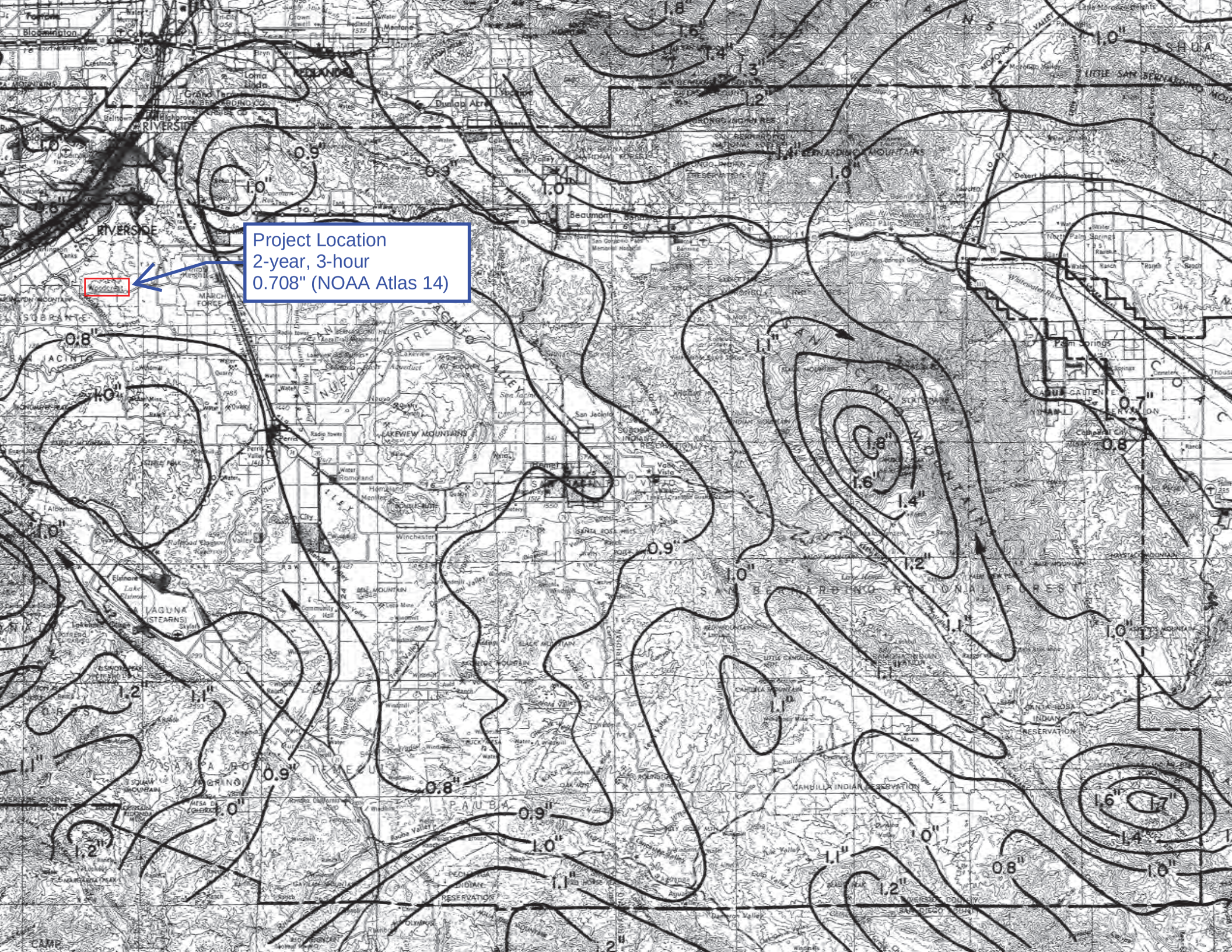
RUNOFF INDEX NUMBERS OF HYDROLOGIC SOIL-COVER COMPLEXES FOR PERVIOUS AREAS-AMC II

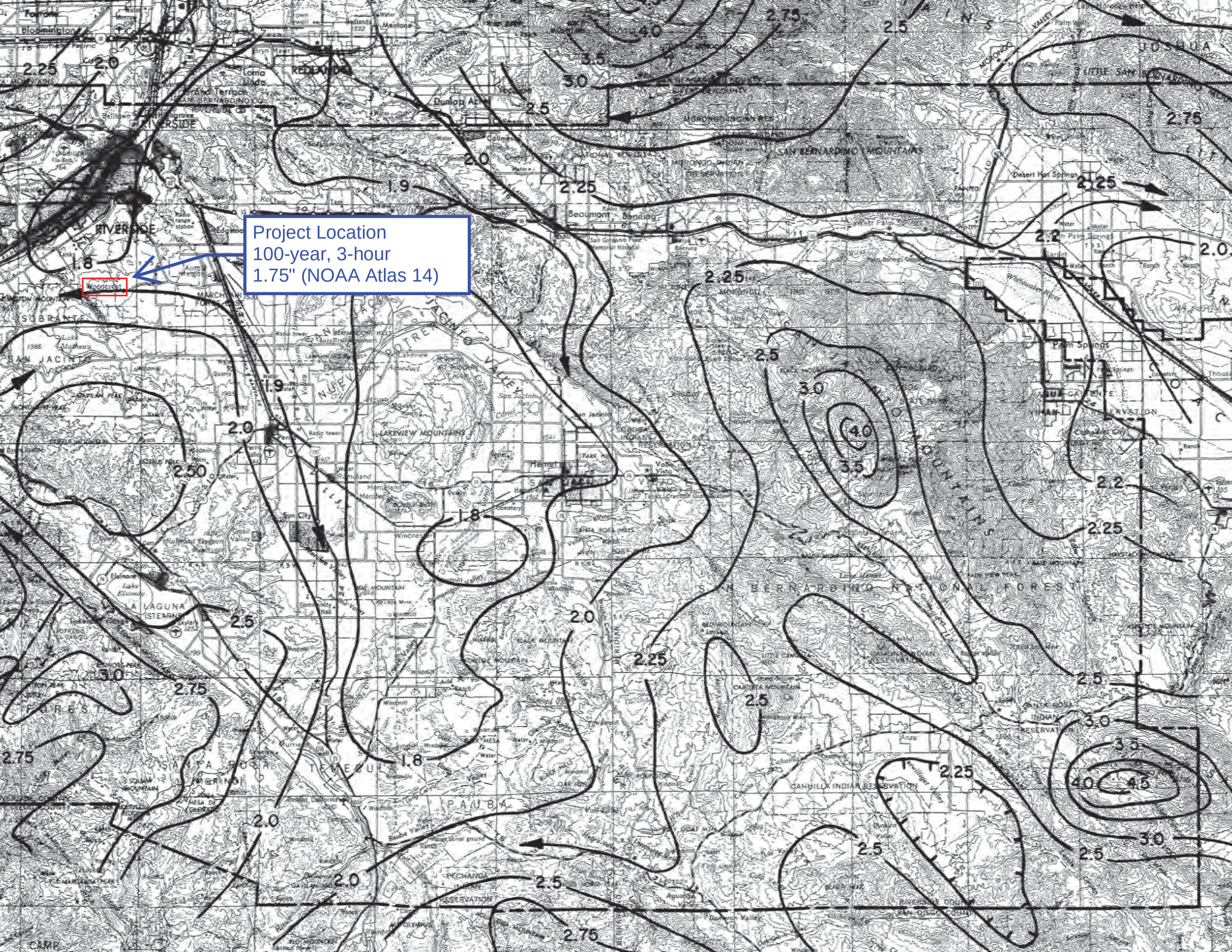
Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparrel, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparrel, Narrowleaf (Chamise and redshank)	Poor	71	82	88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

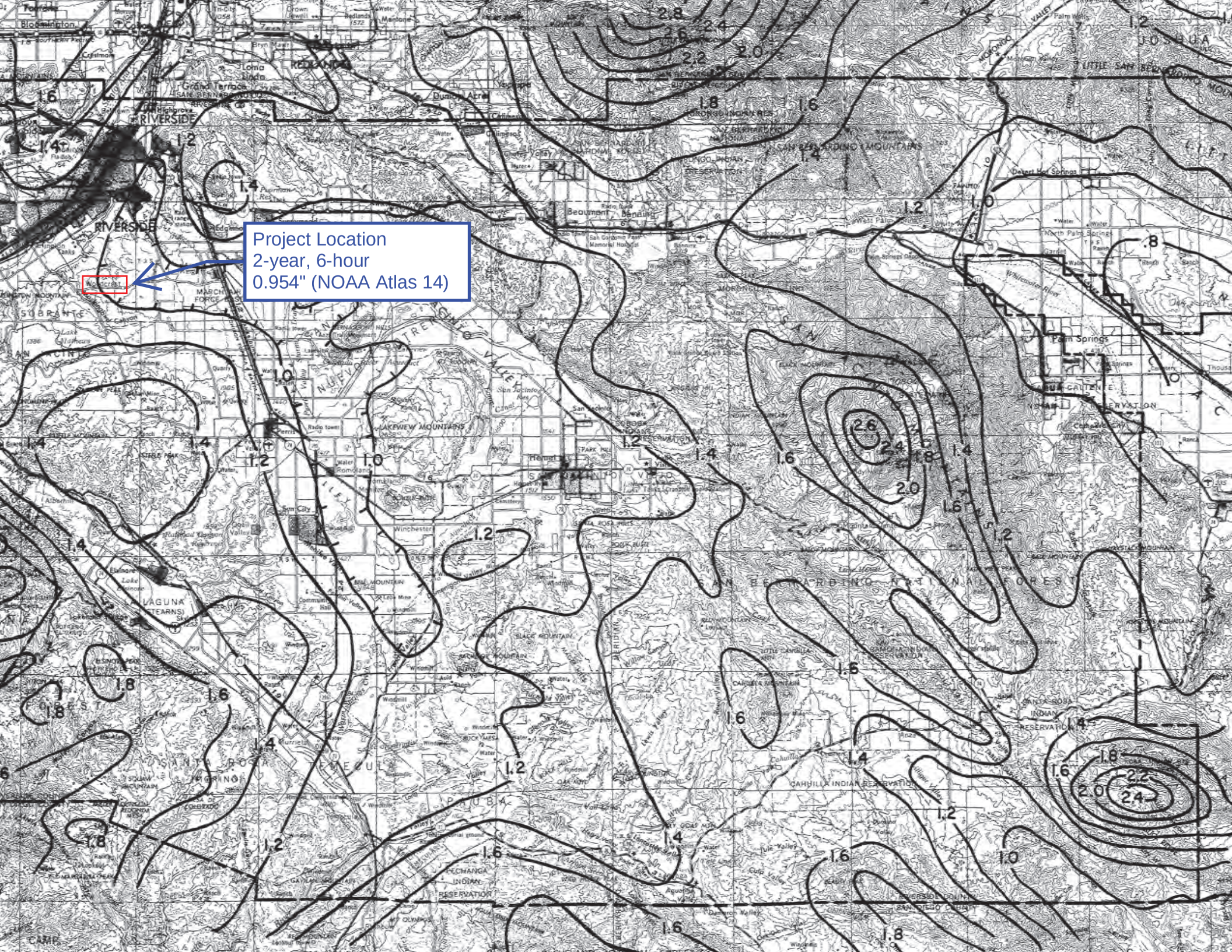
RCFC & WCD
HYDROLOGY MANUAL

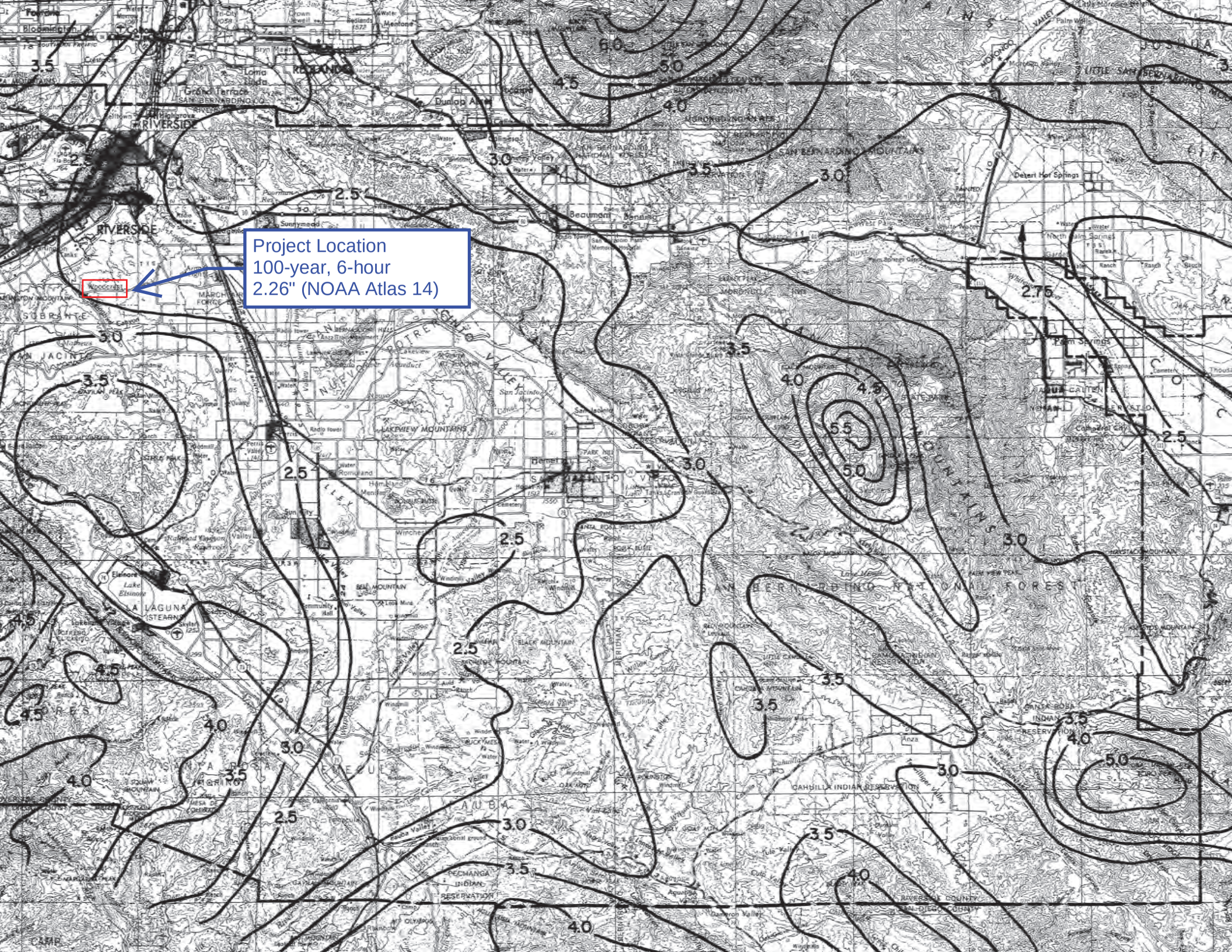
RUNOFF INDEX NUMBERS FOR PERVIOUS AREA

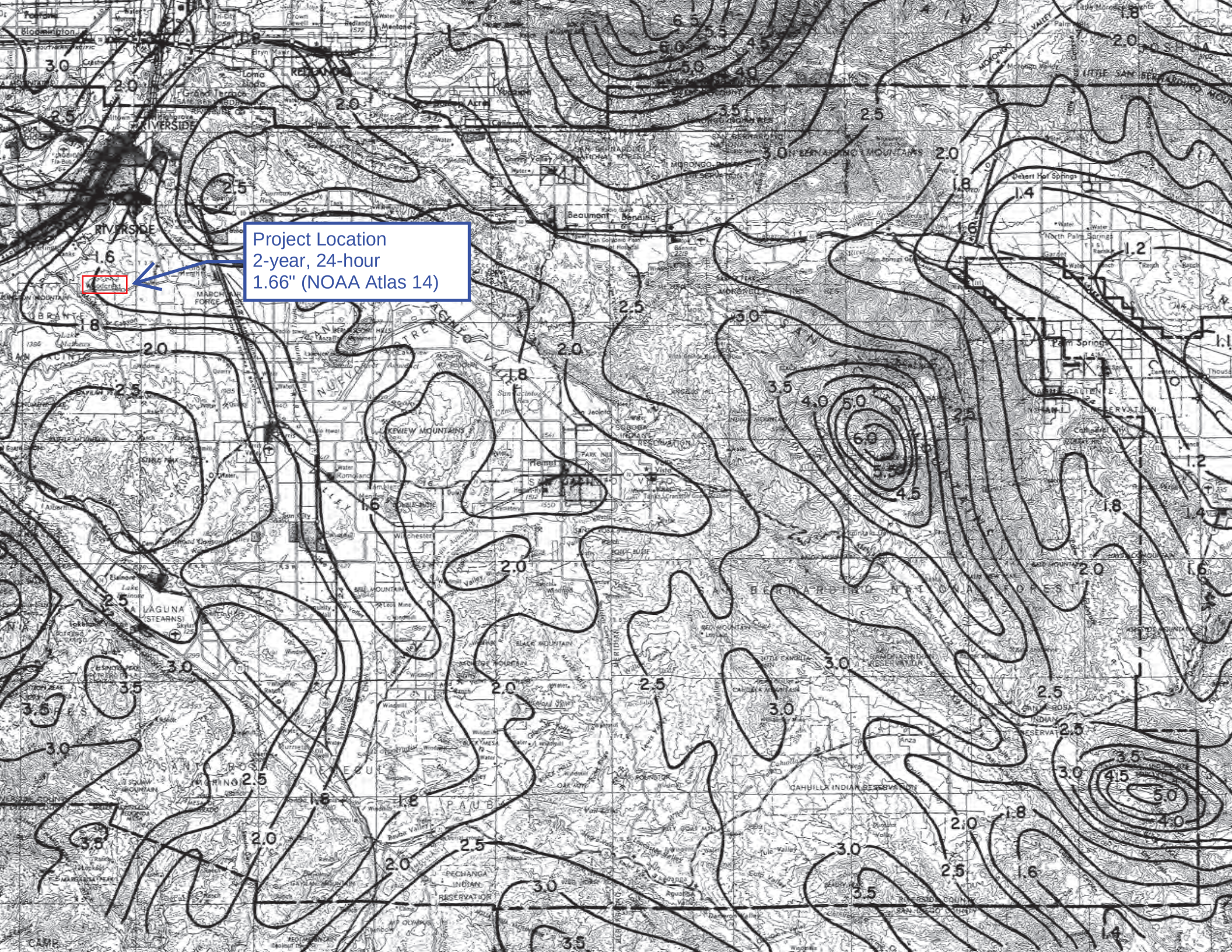
PLATE D-5.5 (1 of 2)

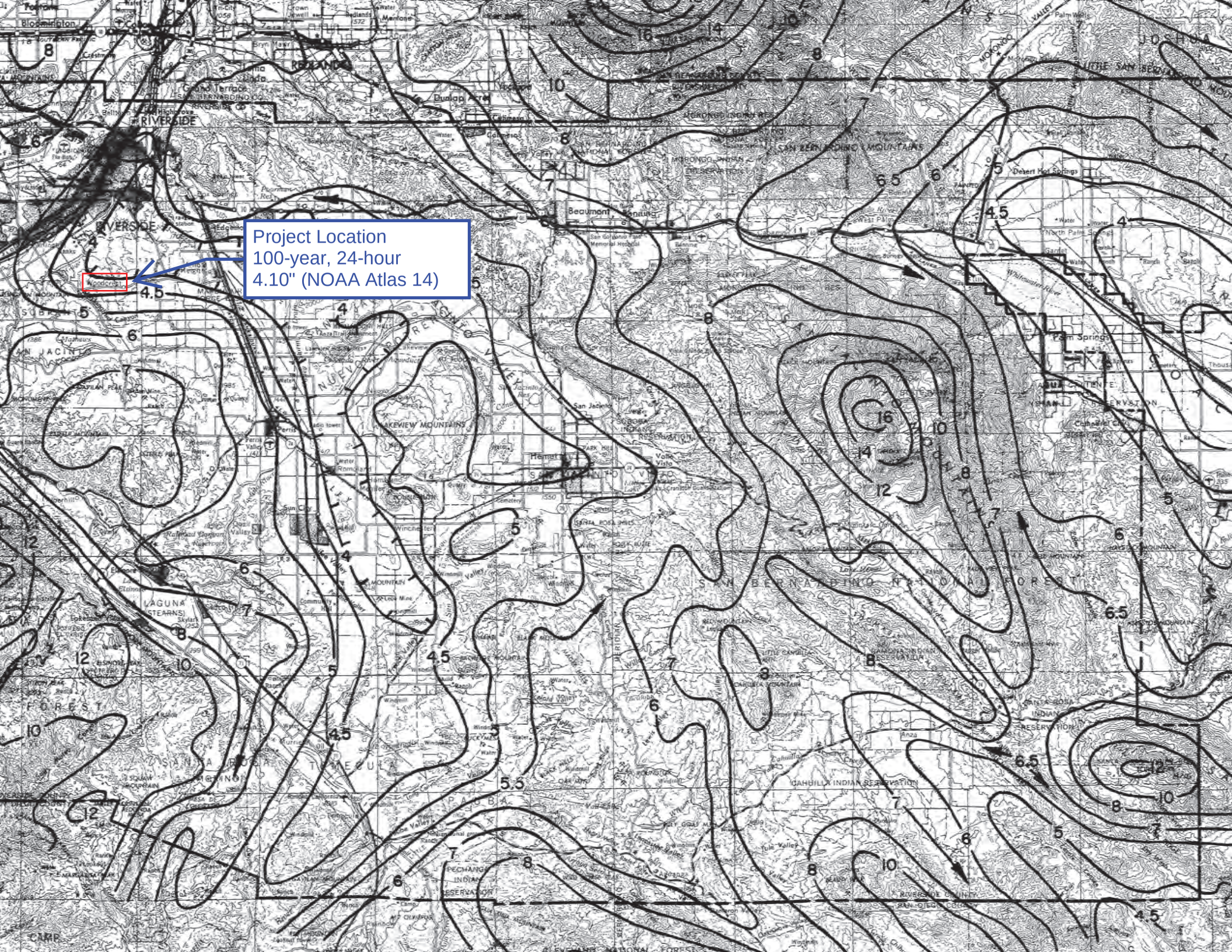

Project Location
2-year, 3-hour
0.708" (NOAA Atlas 14)


Project Location
100-year, 3-hour
1.75" (NOAA Atlas 14)


Project Location
2-year, 6-hour
0.954" (NOAA Atlas 14)
Norco
RIVERSIDE
Moreno Valley
Perris
Lake Elsinore
Corona
Temecula
Hemet
San Jacinto
Beaumont
Banning
Palm Springs
Desert Hot Springs
North Palm Springs
Cathedral City
Indio
Coachella
Thermal
Mecca
Blythe
Winchester
Romoland
Homeland
Sun City
Lake Mathews
Lake Perris
Lake Cahuilla
Salton Sea
Salton City
Bombay Beach
Niland
Calipatria
Brawley
Imperial
El Centro
Holtville
Calexico
Yuma
Gila Bend
Ajo
Organ Pipe Cactus National Monument
Tinajas Altas Mountains
Cabeza Prieta Mountains
Sand Tank Mountains
Mohawk Mountains
Gila Mountains
Laguna Mountains
Jacumba Mountains
Santa Rosa Mountains
San Jacinto Mountains
San Bernardino Mountains
Little San Bernardino Mountains
Orocopia Mountains
Chocolate Mountains
Palo Verde Mountains
Eagle Mountains
Coxcomb Mountains
Pinto Mountains
Joshua Tree National Park
Cleveland National Forest
Agua Caliente Indian Reservation
Cahuilla Indian Reservation
Santa Rosa Indian Reservation
Pechanga Indian Reservation
Morongo Indian Reservation
Colorado River Indian Reservation
Fort Yuma Indian Reservation
Gila River Indian Reservation
Salton Sea National Wildlife Refuge
Imperial Sand Dunes Recreation Area
Anza-Borrego Desert State Park
Lake Cahuilla Recreation Area
Lake Havasu City
Parker
Quartzsite
Wickenburg
Aguila
Salome
Wenden
Tonopah
Arlington
Buckeye
Gila Bend
Ajo
Why
Lukeville
Sonoyta
Mexicali
San Luis Rio Colorado
Puerto Peñasco
Gulf of California
Colorado River
Whitewater River
Coachella Valley
Imperial Valley
Yuma Valley
Gila River
Salt River
Hassayampa River
Agua Caliente Springs
Desert Hot Springs
Palm Springs
Indio
Coachella
Thermal
Mecca
Blythe
Winchester
Romoland
Homeland
Sun City
Lake Mathews
Lake Perris
Lake Cahuilla
Salton Sea
Salton City
Bombay Beach
Niland
Calipatria
Brawley
Imperial
El Centro
Holtville
Calexico
Yuma
Gila Bend
Ajo
Organ Pipe Cactus National Monument
Tinajas Altas Mountains
Cabeza Prieta Mountains
Sand Tank Mountains
Mohawk Mountains
Gila Mountains
Laguna Mountains
Jacumba Mountains
Santa Rosa Mountains
San Jacinto Mountains
San Bernardino Mountains
Little San Bernardino Mountains
Orocopia Mountains
Chocolate Mountains
Palo Verde Mountains
Eagle Mountains
Coxcomb Mountains
Pinto Mountains
Joshua Tree National Park
Cleveland National Forest
Agua Caliente Indian Reservation
Cahuilla Indian Reservation
Santa Rosa Indian Reservation
Pechanga Indian Reservation
Morongo Indian Reservation
Colorado River Indian Reservation
Fort Yuma Indian Reservation
Gila River Indian Reservation
Salton Sea National Wildlife Refuge
Imperial Sand Dunes Recreation Area
Anza-Borrego Desert State Park
Lake Cahuilla Recreation Area
Lake Havasu City
Parker
Quartzsite
Wickenburg
Aguila
Salome
Wenden
Tonopah
Arlington
Buckeye
Gila Bend
Ajo
Why
Lukeville
Sonoyta
Mexicali
San Luis Rio Colorado
Puerto Peñasco
Gulf of California
Colorado River
Whitewater River
Coachella Valley
Imperial Valley
Yuma Valley
Gila River
Salt River
Hassayampa River
Agua Caliente Springs


Project Location
100-year, 6-hour
2.26" (NOAA Atlas 14)

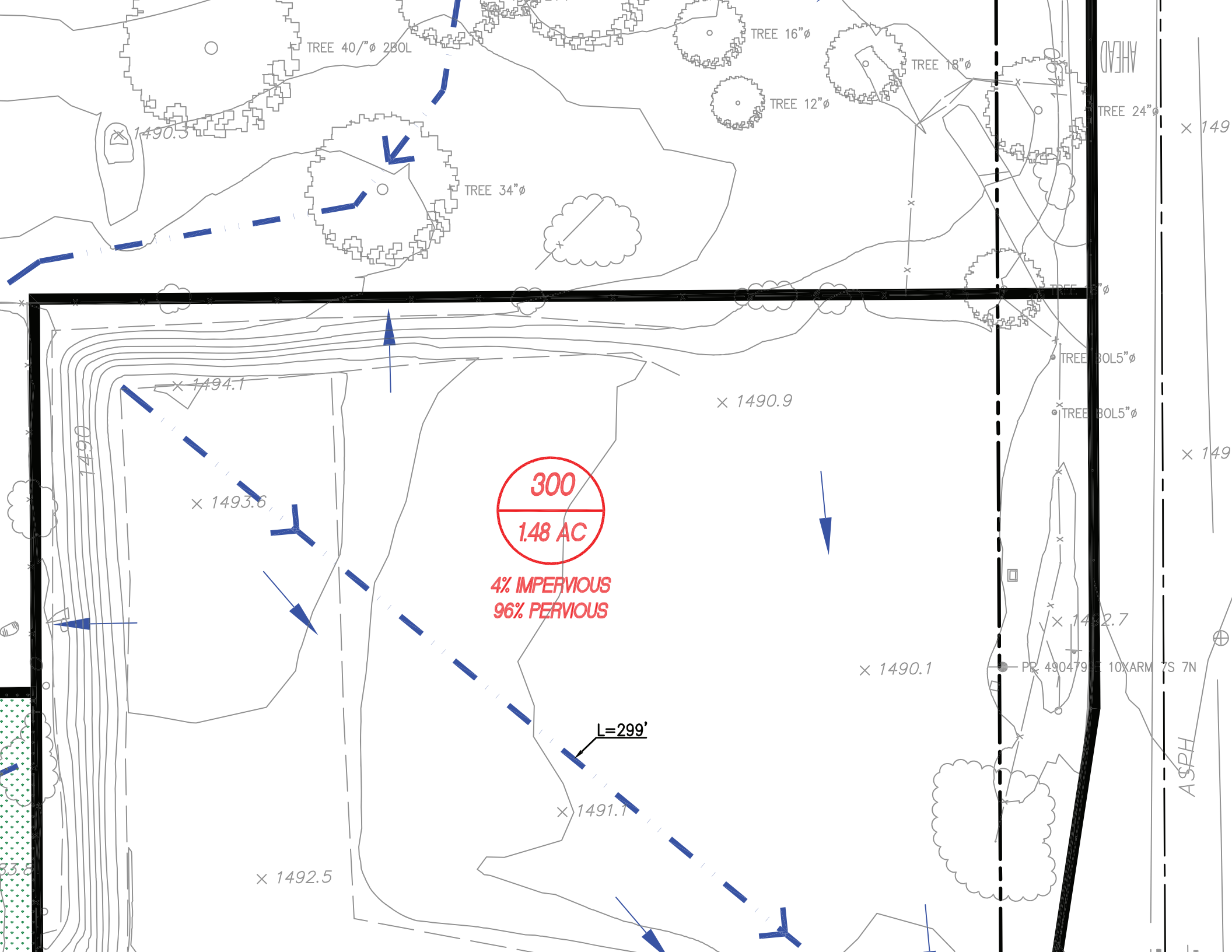

Project Location
2-year, 24-hour
1.66" (NOAA Atlas 14)

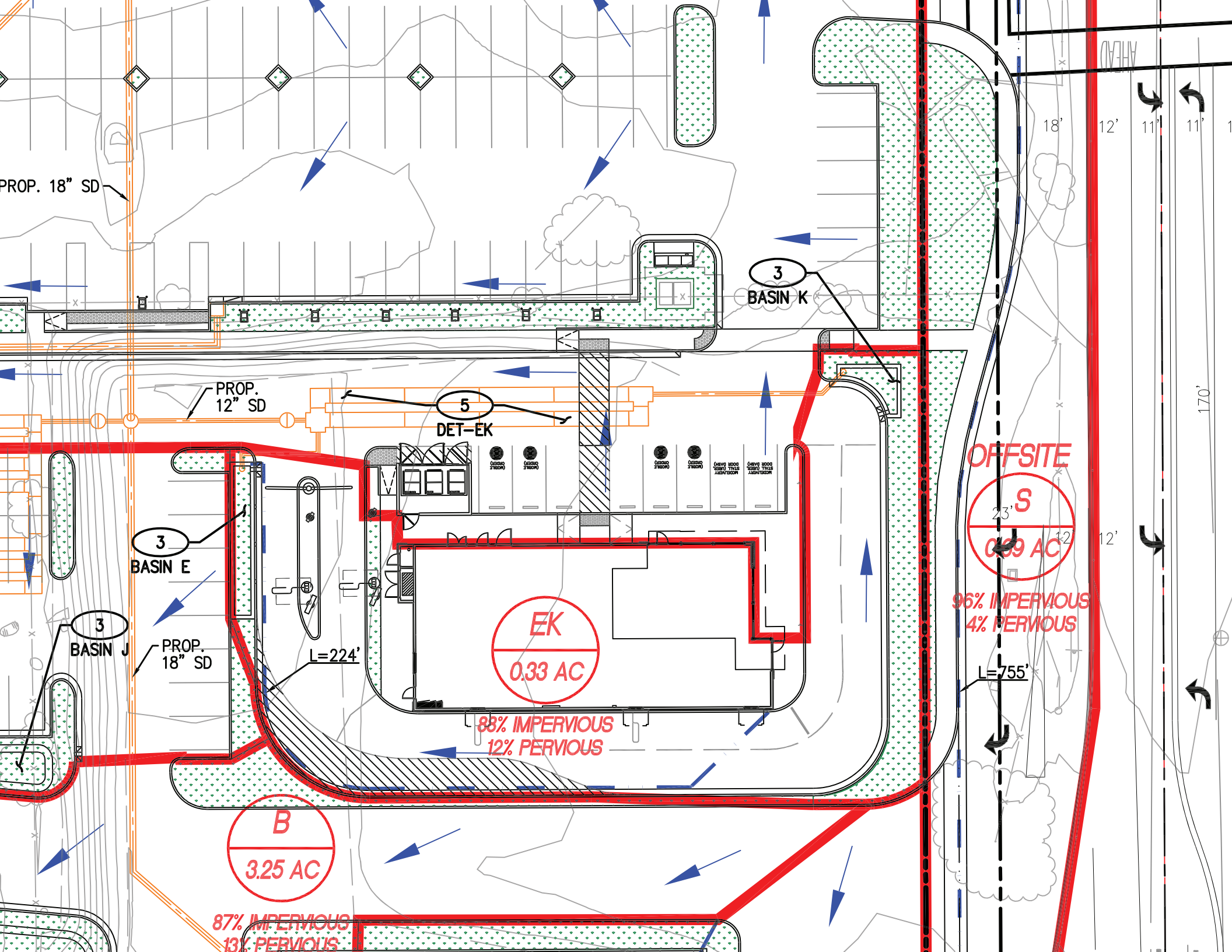

Project Location
100-year, 24-hour
4.10" (NOAA Atlas 14)
Woodcrest
RIVERSIDE
Beaumont
Palm Springs
SAN BERNARDINO NATIONAL FOREST
SAN JACINTO MOUNTAINS
LAKEVIEW MOUNTAINS
SAN GORGONIO MOUNTAINS
SAN TIMOTEO CANYON
SAN GABRIEL MOUNTAINS
SAN BERNARDINO MOUNTAINS
SAN JACINTO FAULT ZONE
SAN ANDREAS FAULT ZONE
MORONGO INDIAN RESERVATION
SAN MANUEL INDIAN RESERVATION
SAN GORGONIO INDIAN RESERVATION
AGUA CALIENTE INDIAN RESERVATION
CABAZON INDIAN RESERVATION
MORONGO INDIAN RESERVATION
CAHUILLA INDIAN RESERVATION
SANTA ROSA INDIAN RESERVATION
PECHANGA INDIAN RESERVATION
RIVERSIDE COUNTY
JOSHUA TREE NATIONAL PARK
LITTLE SAN BERNARDINO MOUNTAINS
Desert Hot Springs
North Palm Springs
Whitewater River
Whitewater Canyon
Garnet
Cabazon
Banning
Loma Linda
Redlands
Grand Terrace
Colton
Highgrove
Bloomington
Mentone
Yucaipa
Dunlap Acres
Calimesa
Cherry Valley
San Jacinto
Hemet
Valle Vista
Sun City
Romoland
Menifee
Perris
Quail Valley
Railroad Canyon
Lake Elsinore
Winchester
Homeland
Green River
Temescal Canyon
Corona
Norco
Eastvale
Jurupa Valley
Mira Loma
Pedley
Riverside Municipal Airport
March Air Reserve Base
Box Spring Mountains
Reche Canyon
Badlands
Alessandro
Moreno Valley
Sunnymead
Edgemont
Highland
Patton
Mount Rubidoux
Jurupa Mountains
Pyrite Canyon
Temescal Wash
Santa Ana River
Santa Ana Mountains
Laguna Mountain
Laguna (Stearns)
Skyland
Squaw Peak
Indian Canyon
Indian Creek
Palm Wells
Mission Creek
Morongo Wash
Big Morongo Canyon Preserve
Painted Hills
Whitewater Hills
Mission Hills
Thousand Palms
Indio
Coachella Canal
Cathedral City
Rancho Mirage
Palm Desert
Indian Wells
La Quinta
Coachella
Thermal
Oasis
Mecca
Salton Sea
Chiriaco Summit
Desert Center
Eagle Mountains
Orocopia Mountains
Chocolate Mountains
Pinto Mountain
Dillon Road
Cottonwood Springs
Mountain Center
Idyllwild
Pine Cove
Fern Valley
Keen Camp
Black Mountain
Tahquitz Peak
Lily Peak
Thomas Mountain
Martinez Canyon
Toro Canyon
Gilman Hot Springs
Hog Canyon
Bautista Creek
Bautista Canyon
Hall Canyon
Potrero Creek
Potrero
Beaumont Avenue
Oak Glen
Forest Falls
Mill Creek
Barton Flats
Big Bear Lake
Big Bear City
Fawnskin
Angelus Oaks
Seven Oaks
Arrowhead Lake
Lake Arrowhead
Crestline
Running Springs
Arrowbear Lake
Lytle Creek
Devore
Cajon Pass
Cajon Creek
Glen Helen
Devil Canyon
Waterman Canyon
Waterman Mountain
Sugarloaf Mountain
Kelso
Kelso Valley
Baldwin Lake
Hesperia
Victorville
Apple Valley
Lucerne Valley
Johnson Valley
Yucca Valley
Twentynine Palms
Morongo Valley
Joshua Tree
Pioneertown
Landers
Yucca Mesa
Pinto Basin
Cottonwood Mountains
Cottonwood Spring
Cottonwood Canyon
Eagle Mountain
Eagle Mountain Wilderness
Orocopia Wilderness
Chocolate Mountains Aerial Gunnery Range
Chocolate Mountains Gunnery Range
Salton Sea National Wildlife Refuge
Salton Sea State Recreation Area
Salton Sea Test Base
Salton Sea Naval Air Facility
Salton City
Desert Shores
Bombay Beach
Niland
Calipatria
Imperial County
Riverside County
San Bernardino County
Orange County
Los Angeles County
Camp
Camp Pendleton
Marine Corps Base Camp Pendleton
Marine Corps Air Station Miramar
Marine Corps Air Station Yuma
Yuma Proving Ground
Yuma
Arizona
California
Nevada
Mexico
Baja California
Sonora
Gila River
Colorado River
Colorado River Indian Reservation
Fort Mojave Indian Reservation
Fort Yuma Indian Reservation
Cocopah Indian Reservation
Quechan Indian Reservation
Chemehuevi Indian Reservation
Havasu National Wildlife Refuge
Cibola National Wildlife Refuge
Imperial National Wildlife Refuge
Bill Williams River National Wildlife Refuge
Kofa National Wildlife Refuge
Kofa Mountains
Castle Dome Mountains
Castle Dome Landing
Castle Dome Peak
Gila Bend Mountains
Gila Bend
Gila Bend Indian Reservation
Ajo
Ajo Mountains
Organ Pipe Cactus National Monument
Cabeza Prieta National Wildlife Refuge
Cabeza Prieta Mountains
Tinajas Altas Mountains
Tinajas Altas
Tinajas Altas Pass
Sierra Pinacate
Sierra Pinacate Wilderness
Sierra Pinacate Volcanic Field
Sierra Pinacate Peak
Sierra Pinacate Cinder Cone
Sierra Pinacate Lava Flow
Sierra Pinacate Lava Tube
Sierra Pinacate Lava Tube Cave
Sierra Pinacate Lava Tube Cave Entrance
Sierra Pinacate Lava Tube Cave Exit
Sierra Pinacate Lava Tube Cave Passage
Sierra Pinacate Lava Tube Cave Chamber
Sierra Pinacate Lava Tube Cave Collapse
Sierra Pinacate Lava Tube Cave Skylight
Sierra Pinacate Lava Tube Cave Speleothem
Sierra Pinacate Lava Tube Cave Stalactite
Sierra Pinacate Lava Tube Cave Stalagmite
Sierra Pinacate Lava Tube Cave Column
Sierra Pinacate Lava Tube Cave Flowstone
Sierra Pinacate Lava Tube Cave Rimstone
Sierra Pinacate Lava Tube Cave Helictite
Sierra Pinacate Lava Tube Cave Soda Straw
Sierra Pinacate Lava Tube Cave Cave Coral
Sierra Pinacate Lava Tube Cave Cave Popcorn
Sierra Pinacate Lava Tube Cave Cave Pearl
Sierra Pinacate Lava Tube Cave Cave Bacon
Sierra Pinacate Lava Tube Cave Cave Curtain
Sierra Pinacate Lava Tube Cave Cave Ribbon
Sierra Pinacate Lava Tube Cave Cave Shield
Sierra Pinacate Lava Tube Cave Cave Anthodite
Sierra Pinacate Lava Tube Cave Cave Aragonite
Sierra Pinacate Lava Tube Cave Cave Calcite
Sierra Pinacate Lava Tube Cave Cave Gypsum
Sierra Pinacate Lava Tube Cave Cave Halite
Sierra Pinacate Lava Tube Cave Cave Hydromagnesite
Sierra Pinacate Lava Tube Cave Cave Nesquehonite
Sierra Pinacate Lava Tube Cave Cave Niter
Sierra Pinacate Lava Tube Cave Cave Thenardite
Sierra Pinacate Lava Tube Cave Cave Trona
Sierra Pinacate Lava Tube Cave Cave Whewellite
Sierra Pinacate Lava Tube Cave Cave Wupatkiite
Sierra Pinacate Lava Tube Cave Cave Zaherite
Sierra Pinacate Lava Tube Cave Cave Zeolite
Sierra Pinacate Lava Tube Cave Cave Clinoptilolite
Sierra Pinacate Lava Tube Cave Cave Heulandite
Sierra Pinacate Lava Tube Cave Cave Mordenite
Sierra Pinacate Lava Tube Cave Cave Natrolite
Sierra Pinacate Lava Tube Cave Cave Phillipsite
Sierra Pinacate Lava Tube Cave Cave Stilbite
Sierra Pinacate Lava Tube Cave Cave Thomsonite
Sierra Pinacate Lava Tube Cave Cave Wairakite
Sierra Pinacate Lava Tube Cave Cave Yugawaralite
Sierra Pinacate Lava Tube Cave Cave Zeolite
Sierra Pinacate Lava Tube Cave Cave Clinoptilolite
Sierra Pinacate Lava Tube Cave Cave Heulandite
Sierra Pinacate Lava Tube Cave Cave Mordenite
Sierra Pinacate Lava Tube Cave Cave Natrolite
Sierra Pinacate Lava Tube Cave Cave Phillipsite
Sierra Pinacate Lava Tube Cave Cave Stilbite
Sierra Pinacate Lava Tube Cave Cave Thomsonite
Sierra Pinacate Lava Tube Cave Cave Wairakite
Sierra Pinacate Lava Tube Cave Cave Yugawaralite

APPENDIX B – SITE HYDROLOGY MAPS AND EXHIBITS

Existing Hydrology Map

Proposed Hydrology Map


TREE 40/"ø 2BOL
TREE 16"ø
TREE 18"ø
TREE 12"ø
TREE 24"ø
TREE 34"ø
× 1490.3
× 1494.1
× 1490.9
× 1493.6
1490
300
1.48 AC
4% IMPERVIOUS
96% PERVIOUS
× 1492.7
× 1490.1
L=299'
× 1491.1
× 1492.5
ASPH
AHEAD


PROP. 18" SD
3
BASIN K
PROP.
12" SD
5
DET-EK
3
BASIN E
3
BASIN J
PROP.
18" SD
L=224'
EK
0.33 AC
88% IMPERVIOUS
12% PERVIOUS
B
3.25 AC
87% IMPERVIOUS
13% PERVIOUS
OFFSITE
S
0.09 AC
96% IMPERVIOUS
4% PERVIOUS
L=755'
18'
12'
11'
11'
23'
12'
12'
170'

APPENDIX D - UNIT HYDROGRAPH CALCULATIONS

2-year return

5-year return

10-year return

2-Year Summary

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Manual	9.200	5	50	7,896	------	------	------	Ex Site 2-year, 1-hour
2	Manual	13.35	5	50	11,790	------	------	------	Pr Site 2-year, 1-hour
3	Reservoir	0.076	5	65	11,667	2	101.32	11,654	DET 2-year, 1-hour
5	Manual	4.180	5	155	9,438	------	------	------	Ex Site 2-year, 3-hour
6	Manual	5.240	5	155	19,176	------	------	------	Pr Site 2-year, 3-hour
7	Reservoir	0.212	5	180	19,053	6	101.87	18,413	DET 2-year, 3-hour
9	Manual	3.510	5	330	11,112	------	------	------	Ex Site 2-year, 6-hour
10	Manual	4.820	5	330	25,830	------	------	------	Pr Site 2-year, 6-hour
11	Reservoir	0.278	5	355	25,707	10	102.30	23,983	DET 2-year, 6-hour
13	Manual	0.600	5	795	15,792	------	------	------	Ex Site 2-year, 24-hour
14	Manual	1.700	5	785	45,000	------	------	------	Pr Site 2-year, 24-hour
15	Reservoir	0.588	5	960	44,877	14	103.01	32,407	DET 2-year, 24-hour
18	Manual	0.000	5	n/a	0	------	------	------	Ex Site 5-year, 1-hour
19	Manual	0.000	5	n/a	0	------	------	------	Pr Site 5-year, 1-hour
20	Reservoir	0.000	5	n/a	0	19	100.00	0.000	DET 5-year, 1-hour
22	Manual	0.000	5	n/a	0	------	------	------	Ex Site 5-year, 3-hour
23	Manual	0.000	5	n/a	0	------	------	------	Pr Site 5-year, 3-hour
24	Reservoir	0.000	5	n/a	0	23	100.00	0.000	DET 5-year, 3-hour
26	Manual	0.000	5	n/a	0	------	------	------	Ex Site 5-year, 6-hour
27	Manual	0.000	5	n/a	0	------	------	------	Pr Site 5-year, 6-hour
28	Reservoir	0.000	5	n/a	0	27	100.00	0.000	DET 5-year, 6-hour
30	Manual	0.000	5	n/a	0	------	------	------	Ex Site 5-year, 24-hour
31	Manual	0.000	5	n/a	0	------	------	------	Pr Site 5-year, 24-hour
32	Reservoir	0.000	5	n/a	0	31	100.00	0.000	DET 5-year, 24-hour
35	Manual	0.000	5	n/a	0	------	------	------	Ex Site 10-year, 1-hour
36	Manual	0.000	5	n/a	0	------	------	------	Pr Site 10-year, 1-hour
37	Reservoir	0.000	5	n/a	0	36	100.00	0.000	DET 10-year, 1-hour
39	Manual	0.000	5	n/a	0	------	------	------	Ex Site 10-year, 3-hour
40	Manual	0.000	5	n/a	0	------	------	------	Pr Site 10-year, 3-hour

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020.4

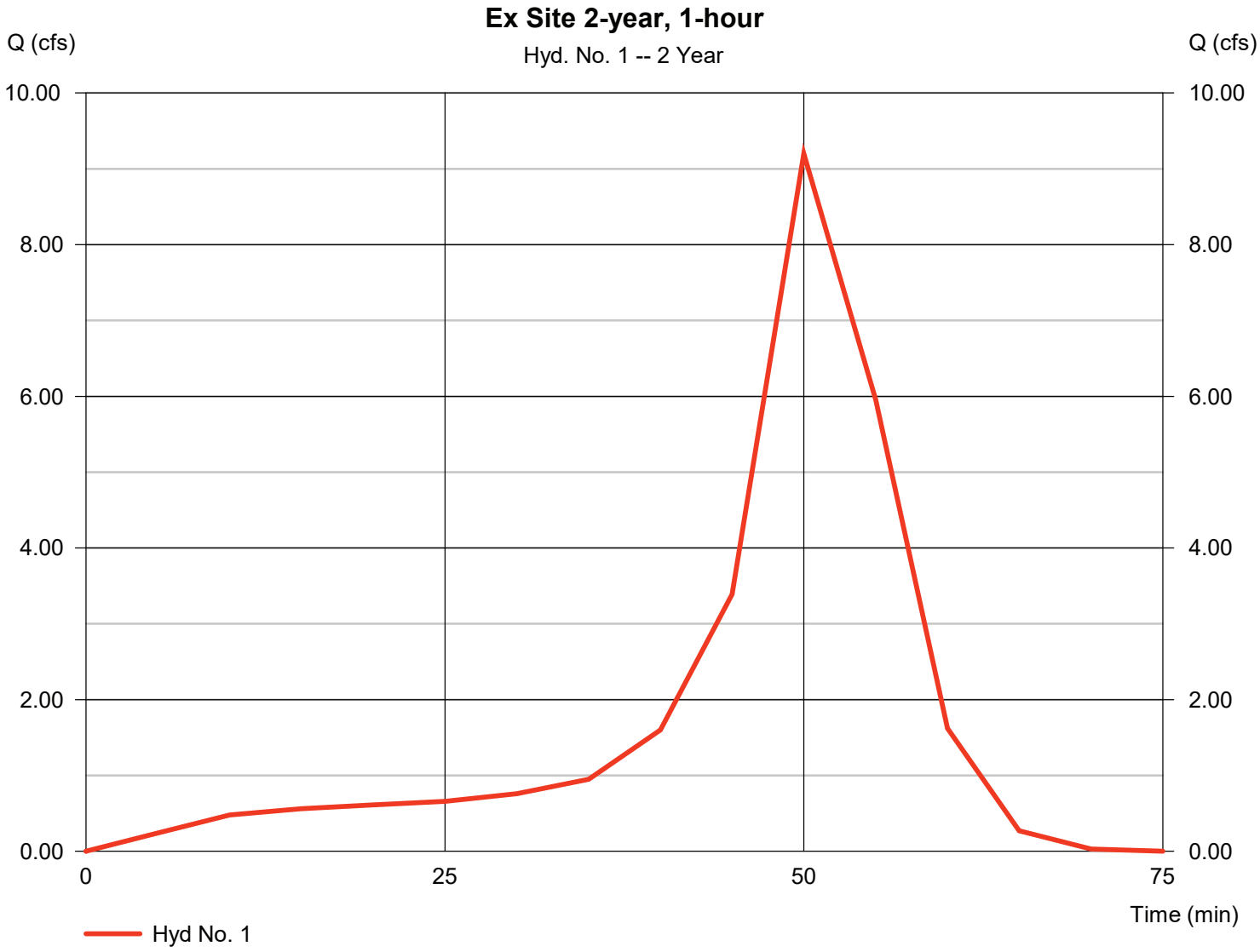
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
41	Reservoir	0.000	5	n/a	0	40	100.00	0.000	DET 10-year, 3-hour
43	Manual	0.000	5	n/a	0	------	------	------	Ex Site 10-year, 6-hour
44	Manual	0.000	5	n/a	0	------	------	------	Pr Site 10-year, 6-hour
45	Reservoir	0.000	5	n/a	0	44	100.00	0.000	DET 10-year, 6-hour
47	Manual	0.000	5	n/a	0	------	------	------	Ex Site 10-year, 24-hour
48	Manual	0.000	5	n/a	0	------	------	------	Pr Site 10-year, 24-hour
49	Reservoir	0.000	5	n/a	0	48	100.00	0.000	DET 10-year, 24-hour

Hydrograph Report

Hyd. No. 1

Ex Site 2-year, 1-hour

Hydrograph type	= Manual	Peak discharge	= 9.200 cfs
Storm frequency	= 2 yrs	Time to peak	= 50 min
Time interval	= 5 min	Hyd. volume	= 7,896 cuft

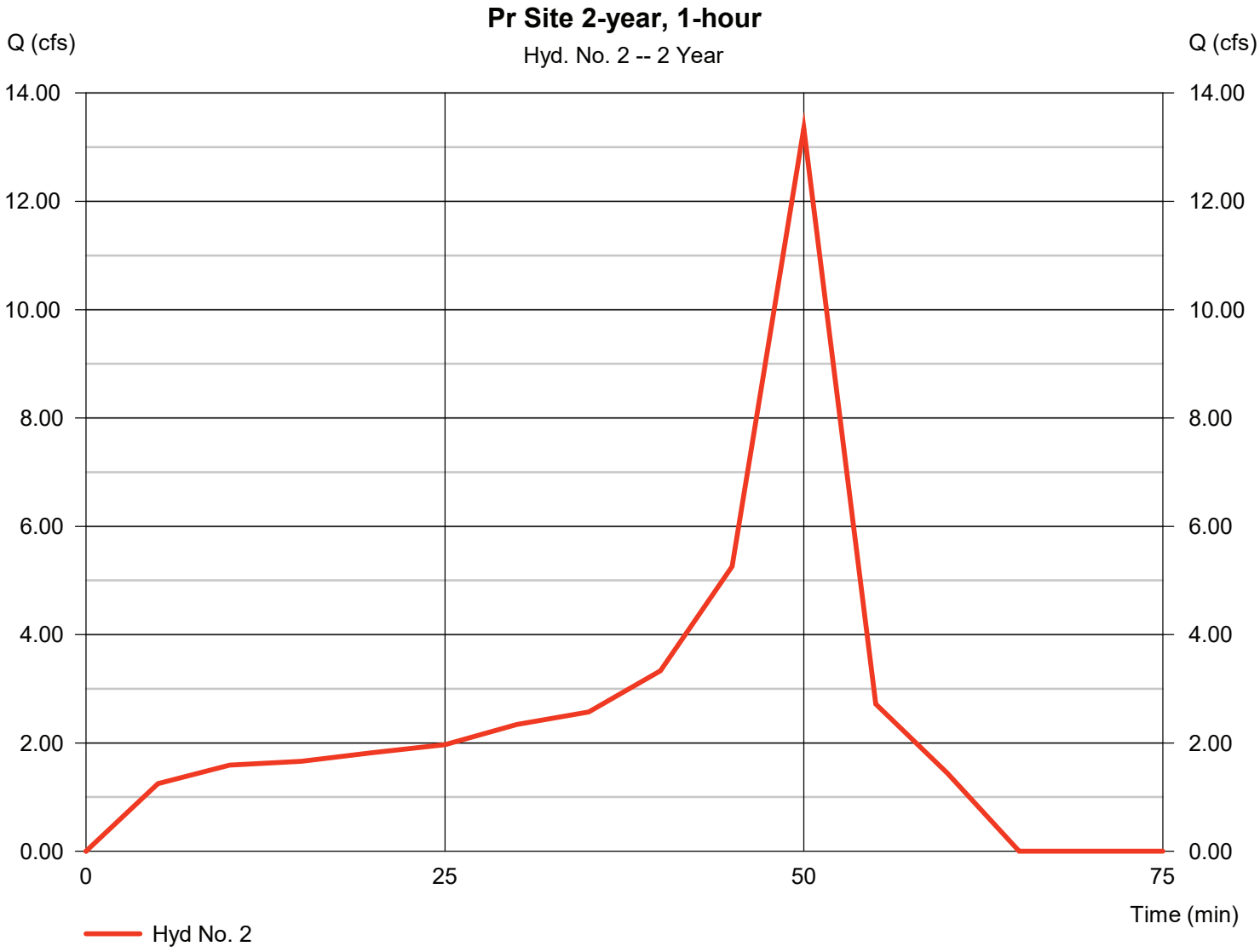


Hydrograph Report

Hyd. No. 2

Pr Site 2-year, 1-hour

Hydrograph type	= Manual	Peak discharge	= 13.35 cfs
Storm frequency	= 2 yrs	Time to peak	= 50 min
Time interval	= 5 min	Hyd. volume	= 11,790 cuft



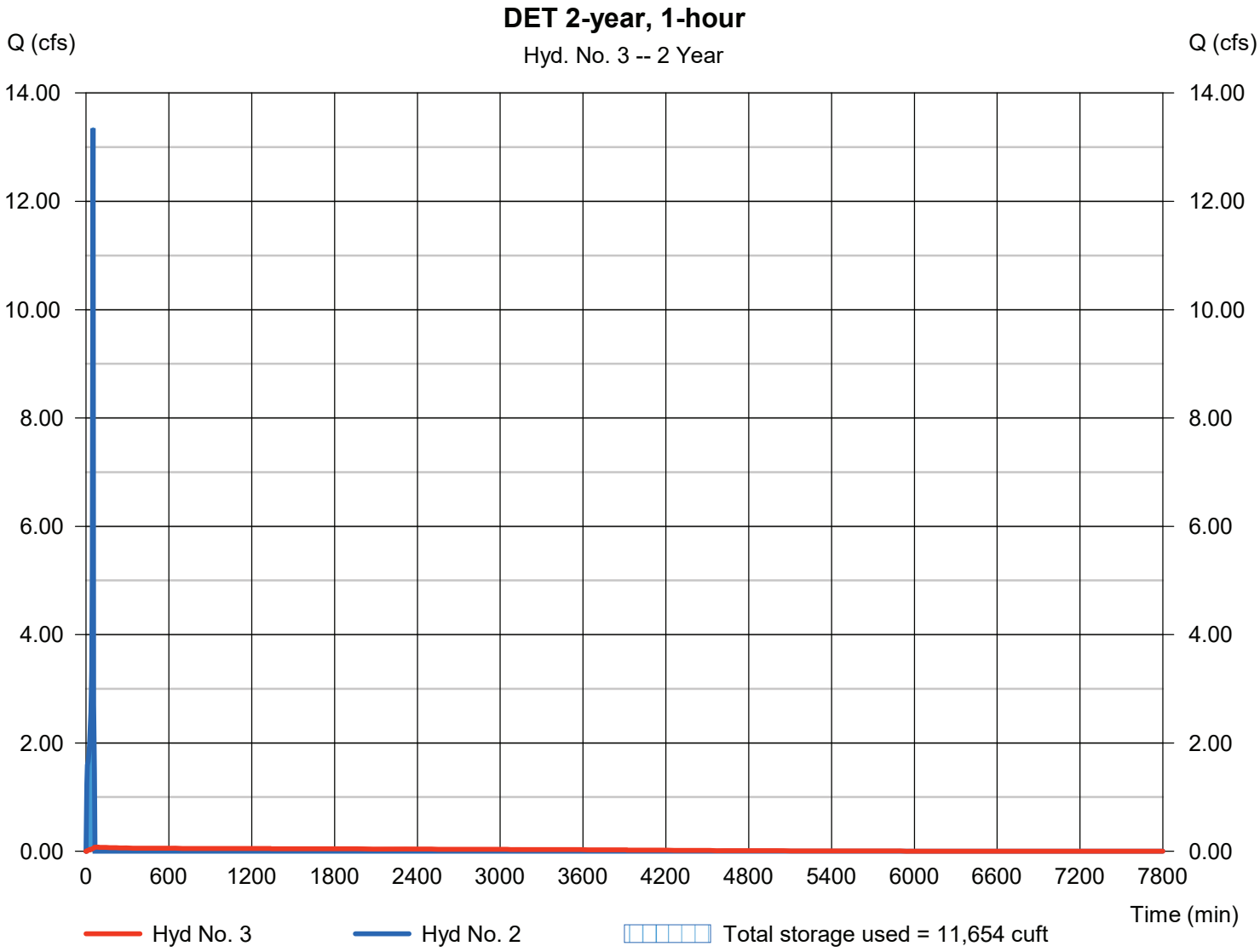
Hydrograph Report

Hyd. No. 3

DET 2-year, 1-hour

Hydrograph type	=	Reservoir	Peak discharge	=	0.076 cfs
Storm frequency	=	2 yrs	Time to peak	=	65 min
Time interval	=	5 min	Hyd. volume	=	11,667 cuft
Inflow hyd. No.	=	2 - Pr Site 2-year, 1-hour	Max. Elevation	=	101.32 ft
Reservoir name	=	DET-Site	Max. Storage	=	11,654 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - DET-Site

Pond Data

UG Chambers -Invert elev. = 100.00 ft, Rise x Span = 4.00 x 4.00 ft, Barrel Len = 100.00 ft, No. Barrels = 32, Slope = 0.00%, Headers = No

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	n/a	0	0
0.40	100.40	n/a	2,098	2,098
0.80	100.80	n/a	3,632	5,730
1.20	101.20	n/a	4,423	10,153
1.60	101.60	n/a	4,872	15,025
2.00	102.00	n/a	5,090	20,115
2.40	102.40	n/a	5,090	25,204
2.80	102.80	n/a	4,871	30,075
3.20	103.20	n/a	4,421	34,496
3.60	103.60	n/a	3,634	38,130
4.00	104.00	n/a	2,090	40,220

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 1.70	3.00	4.00	0.00
Span (in)	= 1.70	3.00	4.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 100.00	101.20	102.40	0.00
Length (ft)	= 10.00	10.00	10.00	0.00
Slope (%)	= 0.30	0.30	0.30	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

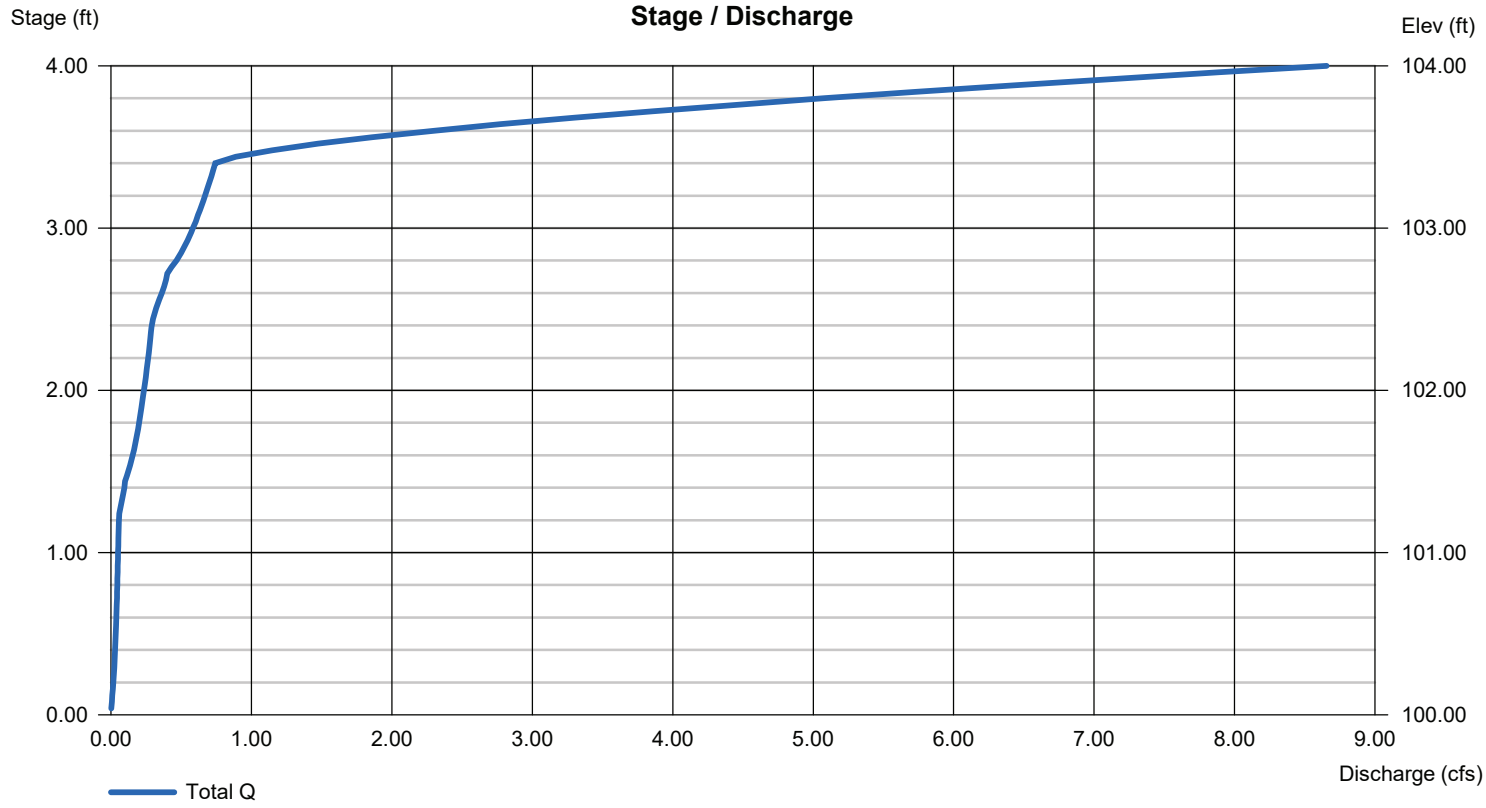
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 5.00	0.00	0.00	0.00
Crest El. (ft)	= 103.40	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

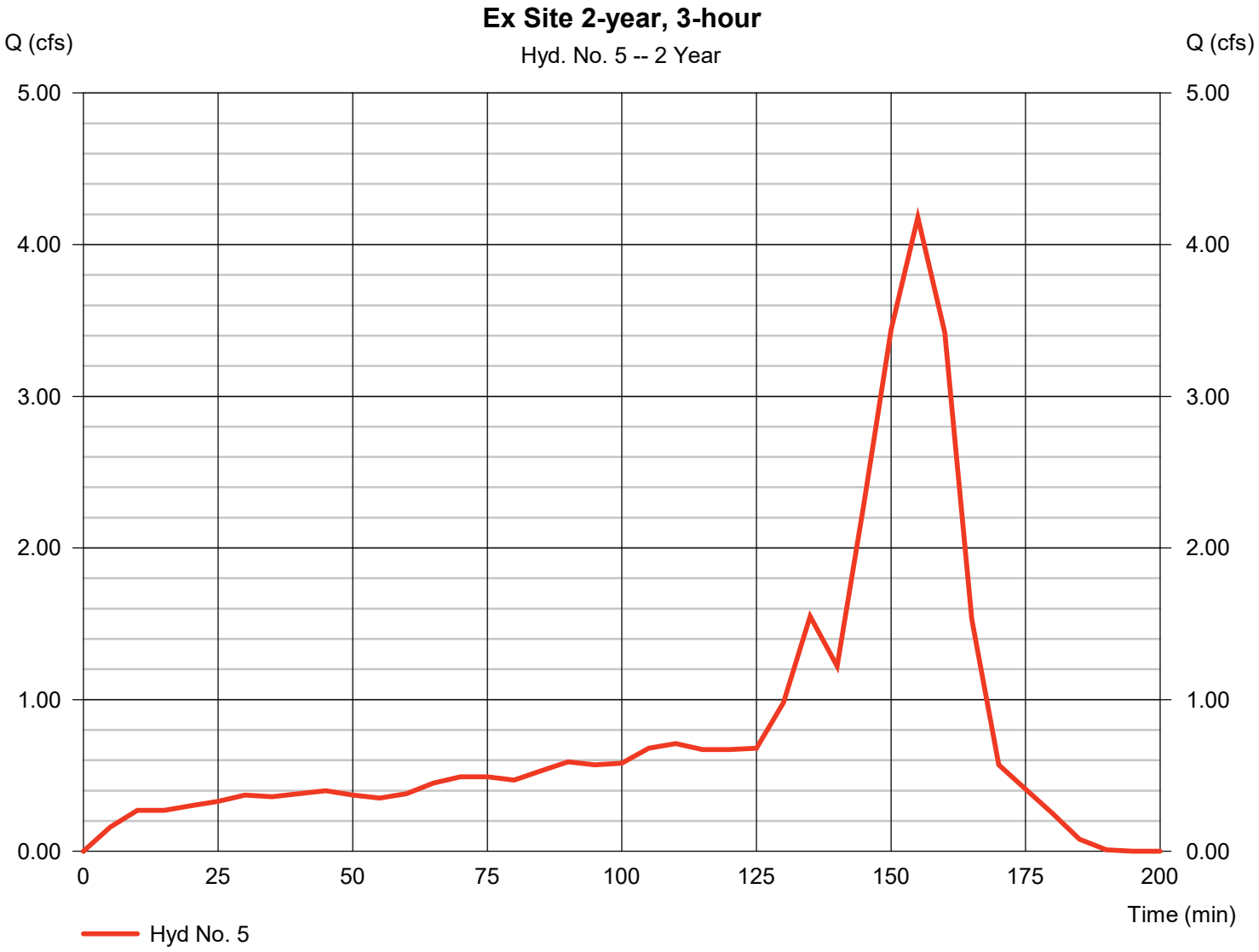


Hydrograph Report

Hyd. No. 5

Ex Site 2-year, 3-hour

Hydrograph type	= Manual	Peak discharge	= 4.180 cfs
Storm frequency	= 2 yrs	Time to peak	= 155 min
Time interval	= 5 min	Hyd. volume	= 9,438 cuft

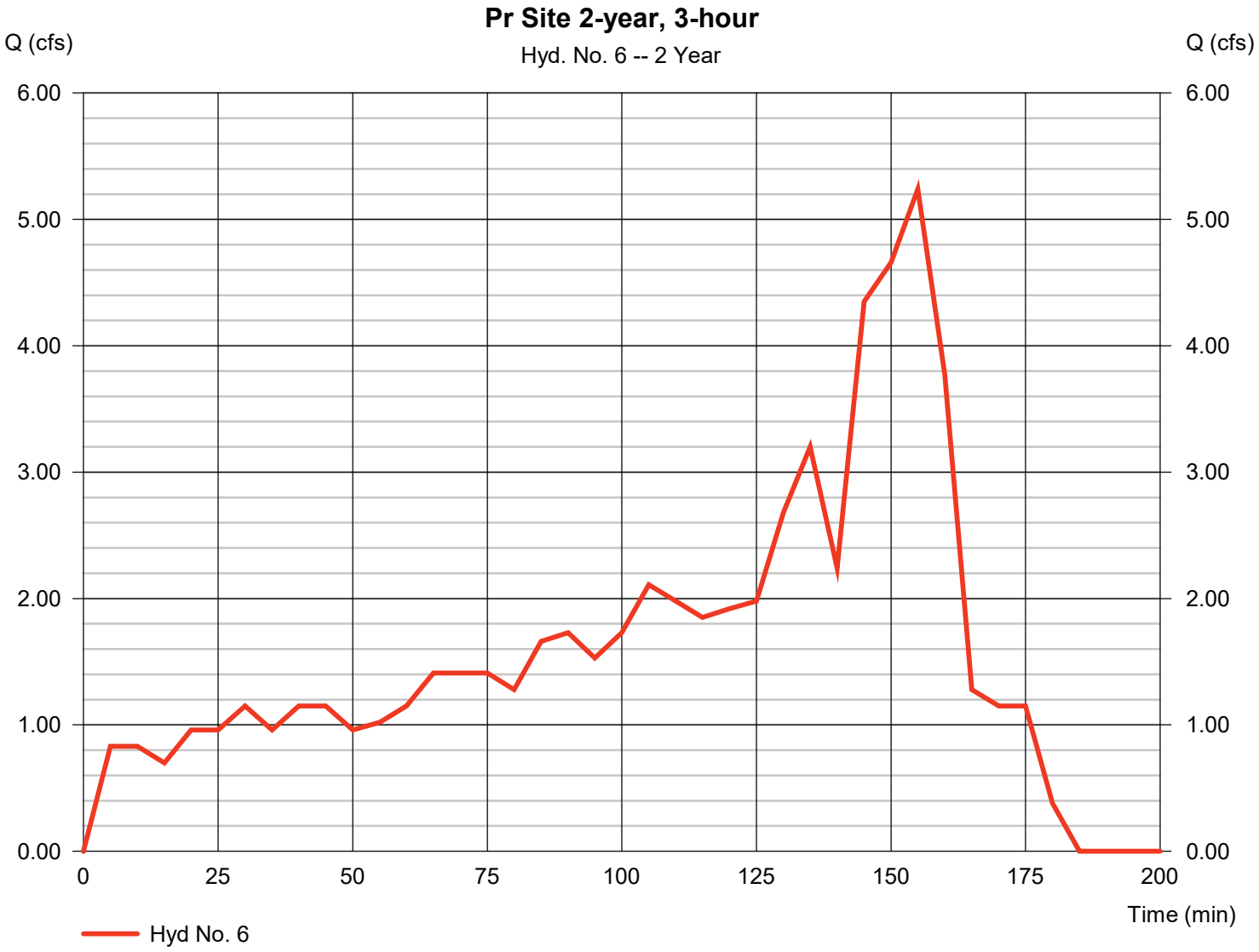


Hydrograph Report

Hyd. No. 6

Pr Site 2-year, 3-hour

Hydrograph type	= Manual	Peak discharge	= 5.240 cfs
Storm frequency	= 2 yrs	Time to peak	= 155 min
Time interval	= 5 min	Hyd. volume	= 19,176 cuft



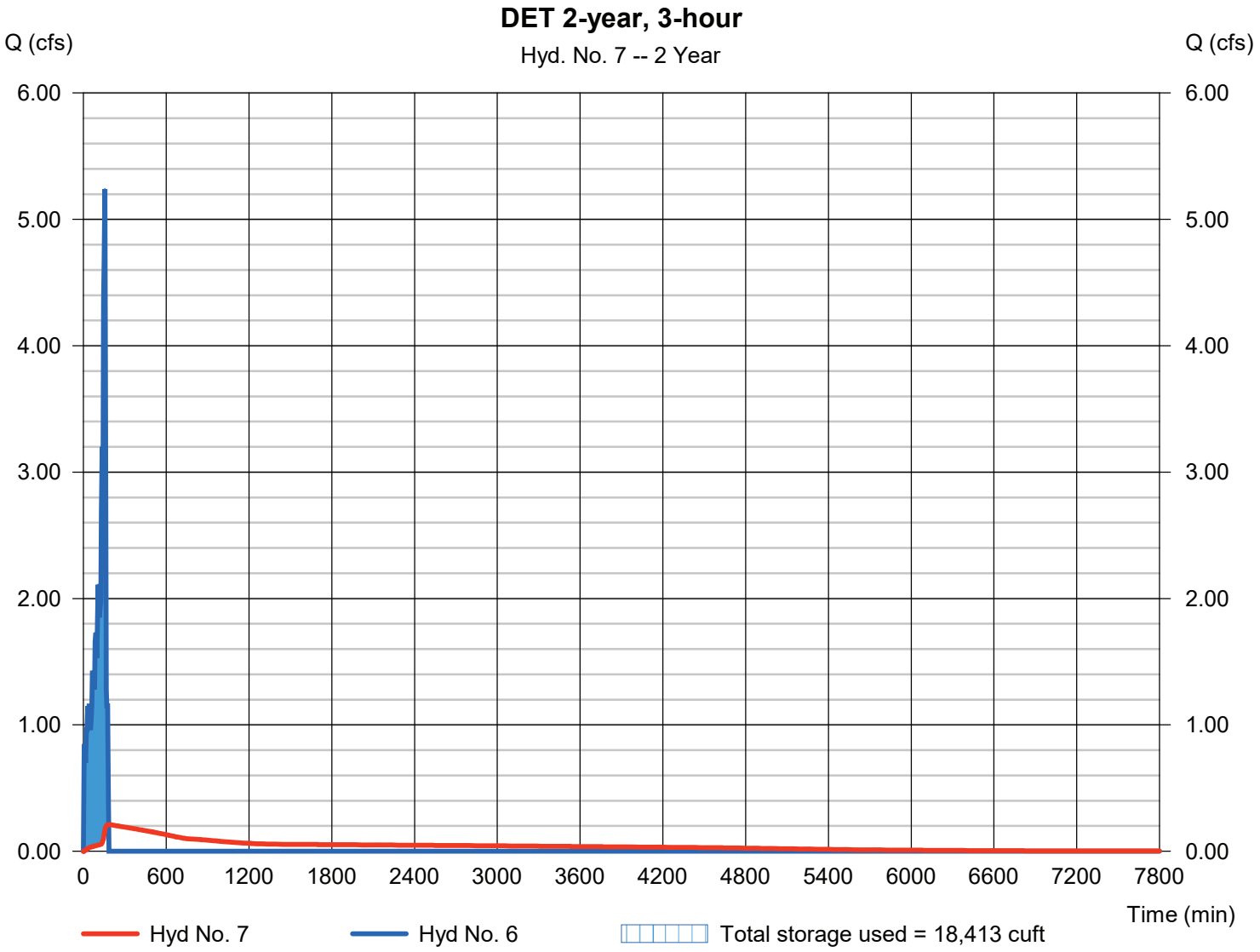
Hydrograph Report

Hyd. No. 7

DET 2-year, 3-hour

Hydrograph type	=	Reservoir	Peak discharge	=	0.212 cfs
Storm frequency	=	2 yrs	Time to peak	=	180 min
Time interval	=	5 min	Hyd. volume	=	19,053 cuft
Inflow hyd. No.	=	6 - Pr Site 2-year, 3-hour	Max. Elevation	=	101.87 ft
Reservoir name	=	DET-Site	Max. Storage	=	18,413 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - DET-Site

Pond Data

UG Chambers -Invert elev. = 100.00 ft, Rise x Span = 4.00 x 4.00 ft, Barrel Len = 100.00 ft, No. Barrels = 32, Slope = 0.00%, Headers = No

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	n/a	0	0
0.40	100.40	n/a	2,098	2,098
0.80	100.80	n/a	3,632	5,730
1.20	101.20	n/a	4,423	10,153
1.60	101.60	n/a	4,872	15,025
2.00	102.00	n/a	5,090	20,115
2.40	102.40	n/a	5,090	25,204
2.80	102.80	n/a	4,871	30,075
3.20	103.20	n/a	4,421	34,496
3.60	103.60	n/a	3,634	38,130
4.00	104.00	n/a	2,090	40,220

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 1.70	3.00	4.00	0.00
Span (in)	= 1.70	3.00	4.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 100.00	101.20	102.40	0.00
Length (ft)	= 10.00	10.00	10.00	0.00
Slope (%)	= 0.30	0.30	0.30	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

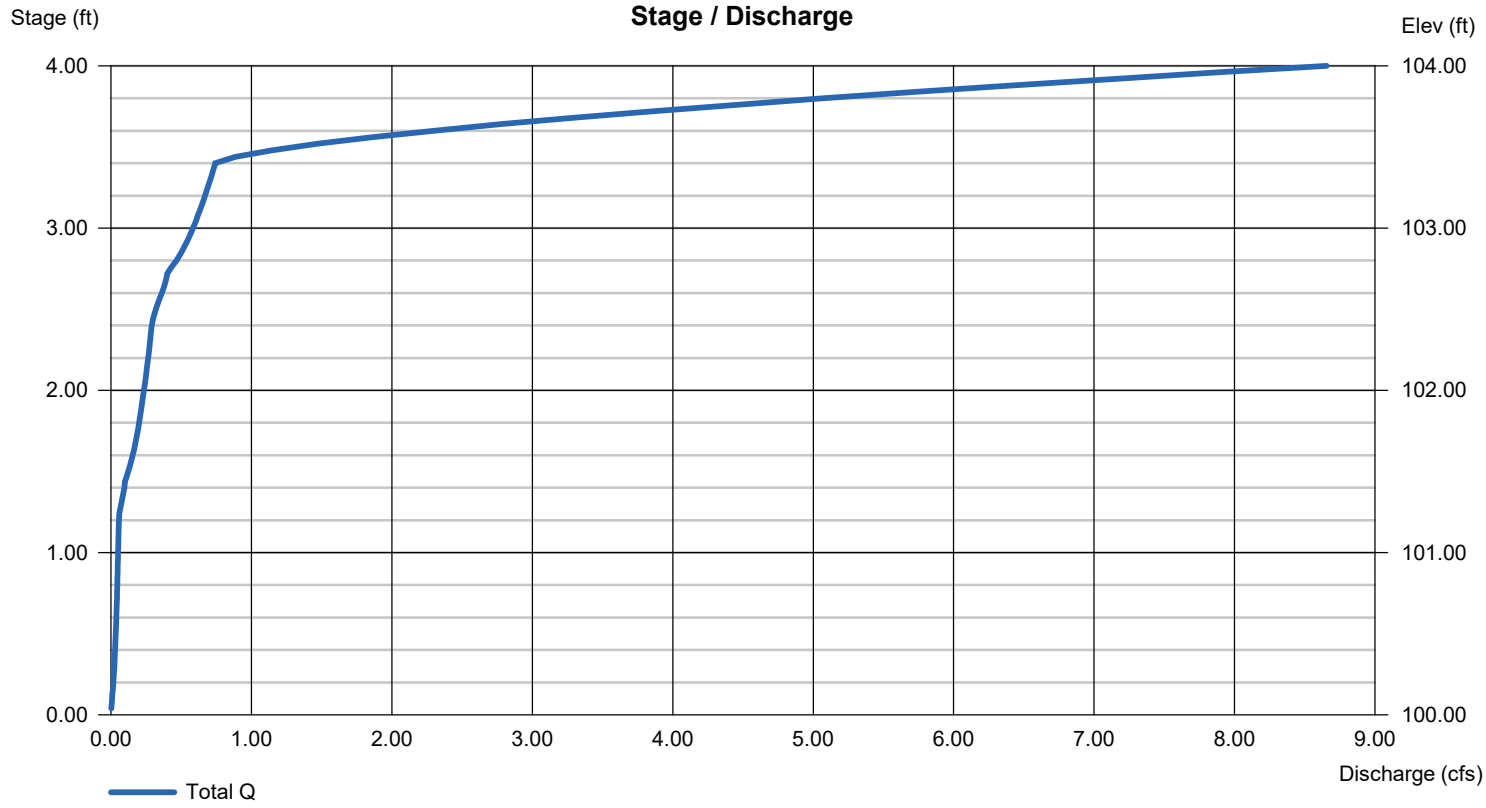
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 5.00	0.00	0.00	0.00
Crest El. (ft)	= 103.40	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

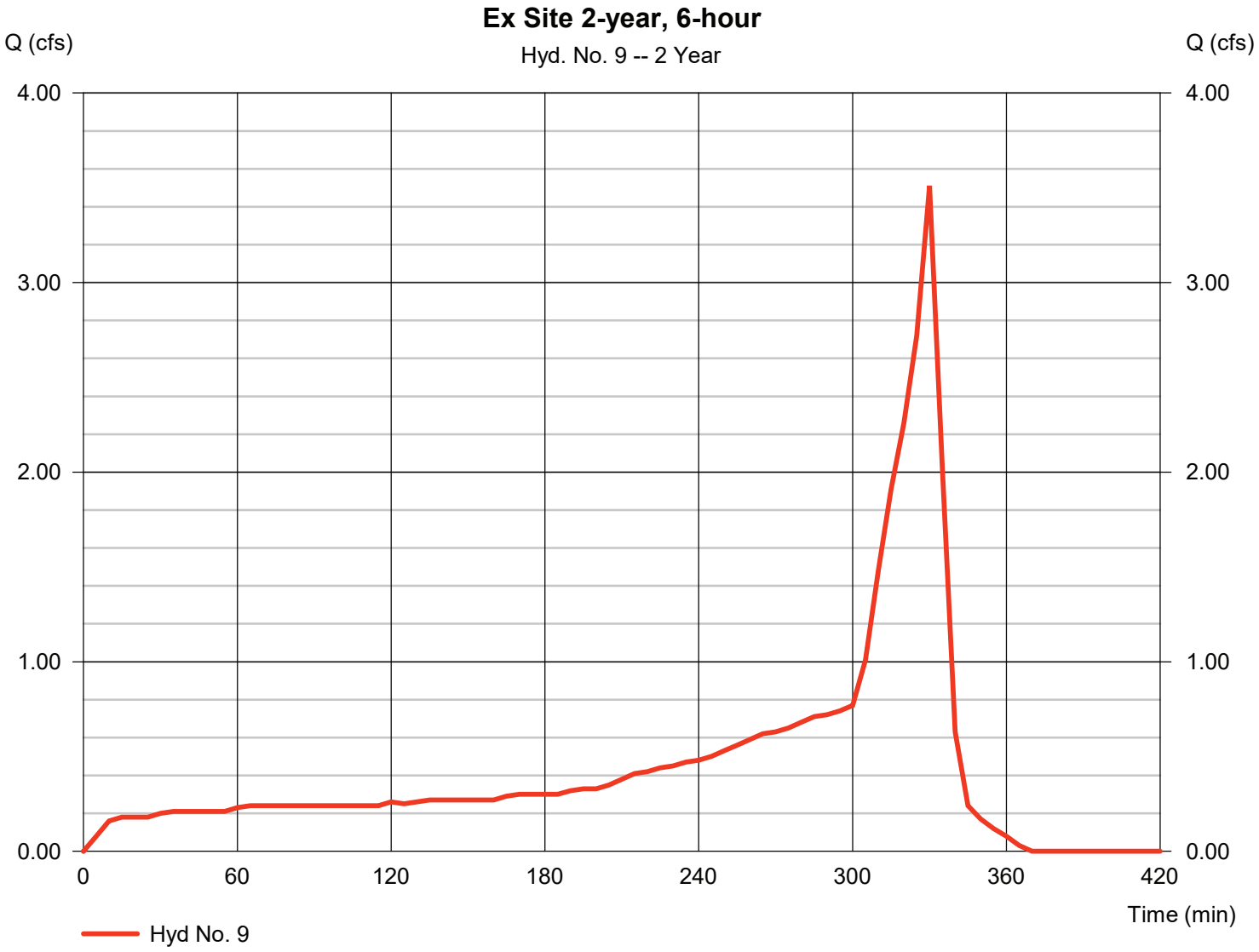


Hydrograph Report

Hyd. No. 9

Ex Site 2-year, 6-hour

Hydrograph type	= Manual	Peak discharge	= 3.510 cfs
Storm frequency	= 2 yrs	Time to peak	= 330 min
Time interval	= 5 min	Hyd. volume	= 11,112 cuft

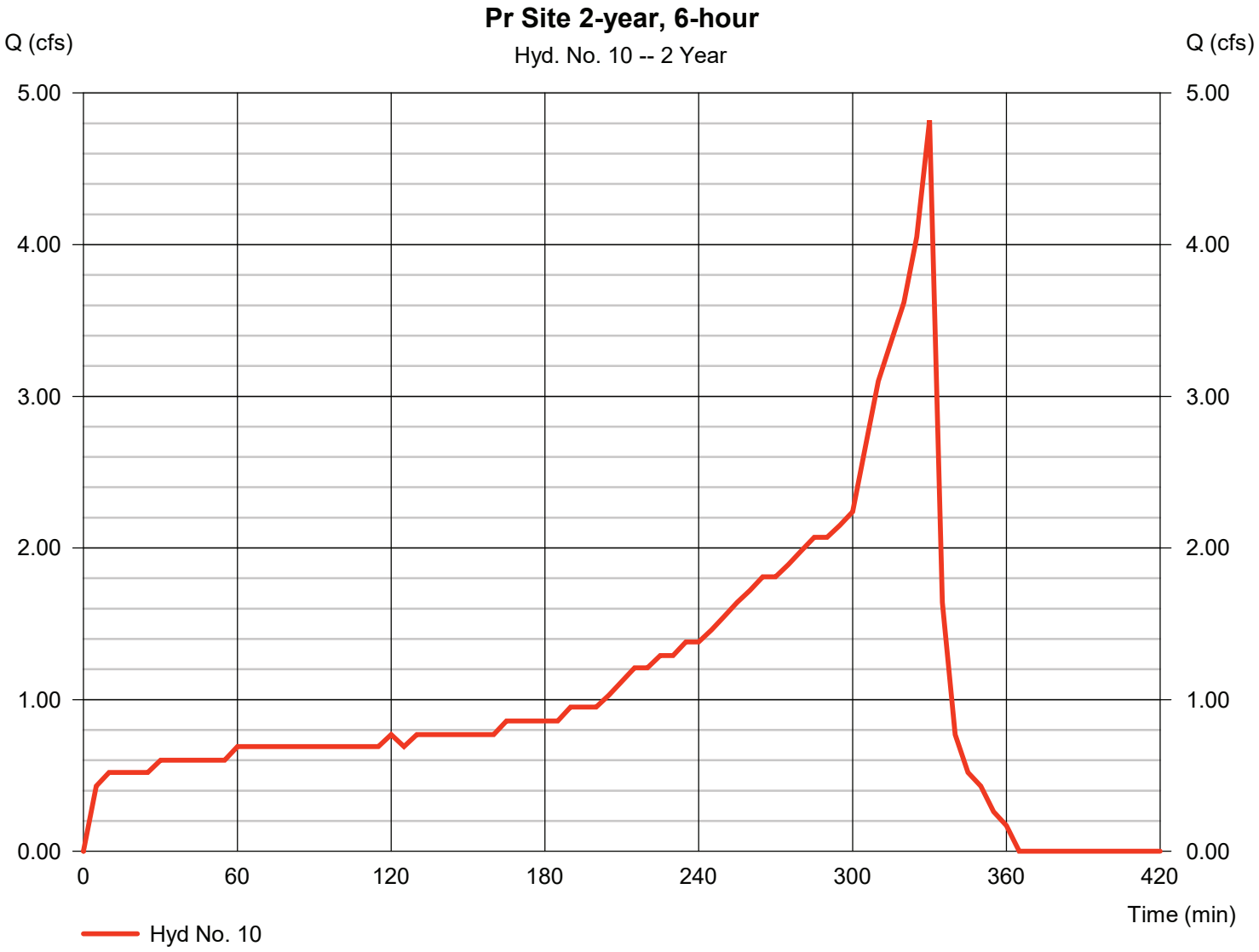


Hydrograph Report

Hyd. No. 10

Pr Site 2-year, 6-hour

Hydrograph type	= Manual	Peak discharge	= 4.820 cfs
Storm frequency	= 2 yrs	Time to peak	= 330 min
Time interval	= 5 min	Hyd. volume	= 25,830 cuft



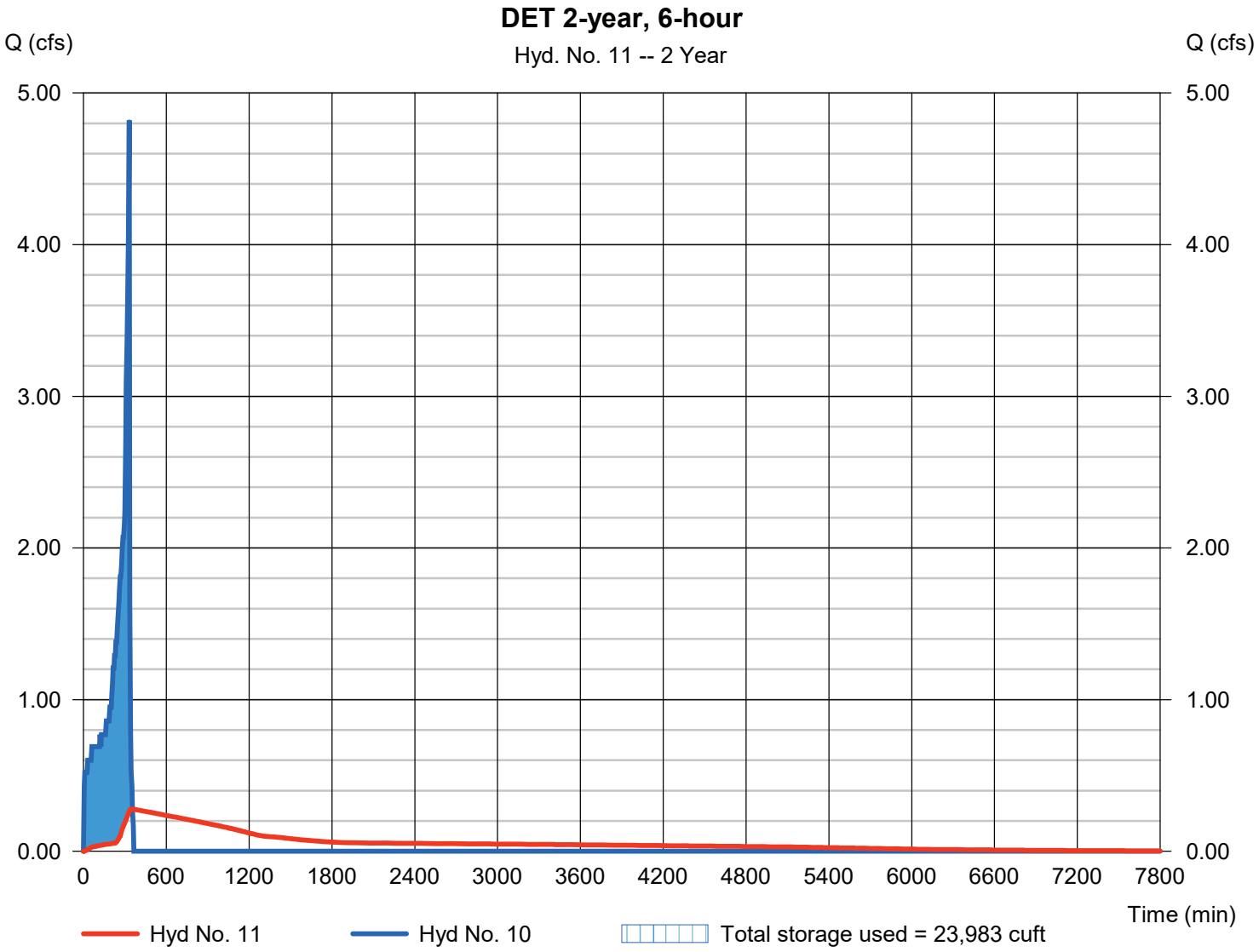
Hydrograph Report

Hyd. No. 11

DET 2-year, 6-hour

Hydrograph type	=	Reservoir	Peak discharge	=	0.278 cfs
Storm frequency	=	2 yrs	Time to peak	=	355 min
Time interval	=	5 min	Hyd. volume	=	25,707 cuft
Inflow hyd. No.	=	10 - Pr Site 2-year, 6-hour	Max. Elevation	=	102.30 ft
Reservoir name	=	DET-Site	Max. Storage	=	23,983 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - DET-Site

Pond Data

UG Chambers -Invert elev. = 100.00 ft, Rise x Span = 4.00 x 4.00 ft, Barrel Len = 100.00 ft, No. Barrels = 32, Slope = 0.00%, Headers = No

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	n/a	0	0
0.40	100.40	n/a	2,098	2,098
0.80	100.80	n/a	3,632	5,730
1.20	101.20	n/a	4,423	10,153
1.60	101.60	n/a	4,872	15,025
2.00	102.00	n/a	5,090	20,115
2.40	102.40	n/a	5,090	25,204
2.80	102.80	n/a	4,871	30,075
3.20	103.20	n/a	4,421	34,496
3.60	103.60	n/a	3,634	38,130
4.00	104.00	n/a	2,090	40,220

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 1.70	3.00	4.00	0.00
Span (in)	= 1.70	3.00	4.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 100.00	101.20	102.40	0.00
Length (ft)	= 10.00	10.00	10.00	0.00
Slope (%)	= 0.30	0.30	0.30	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

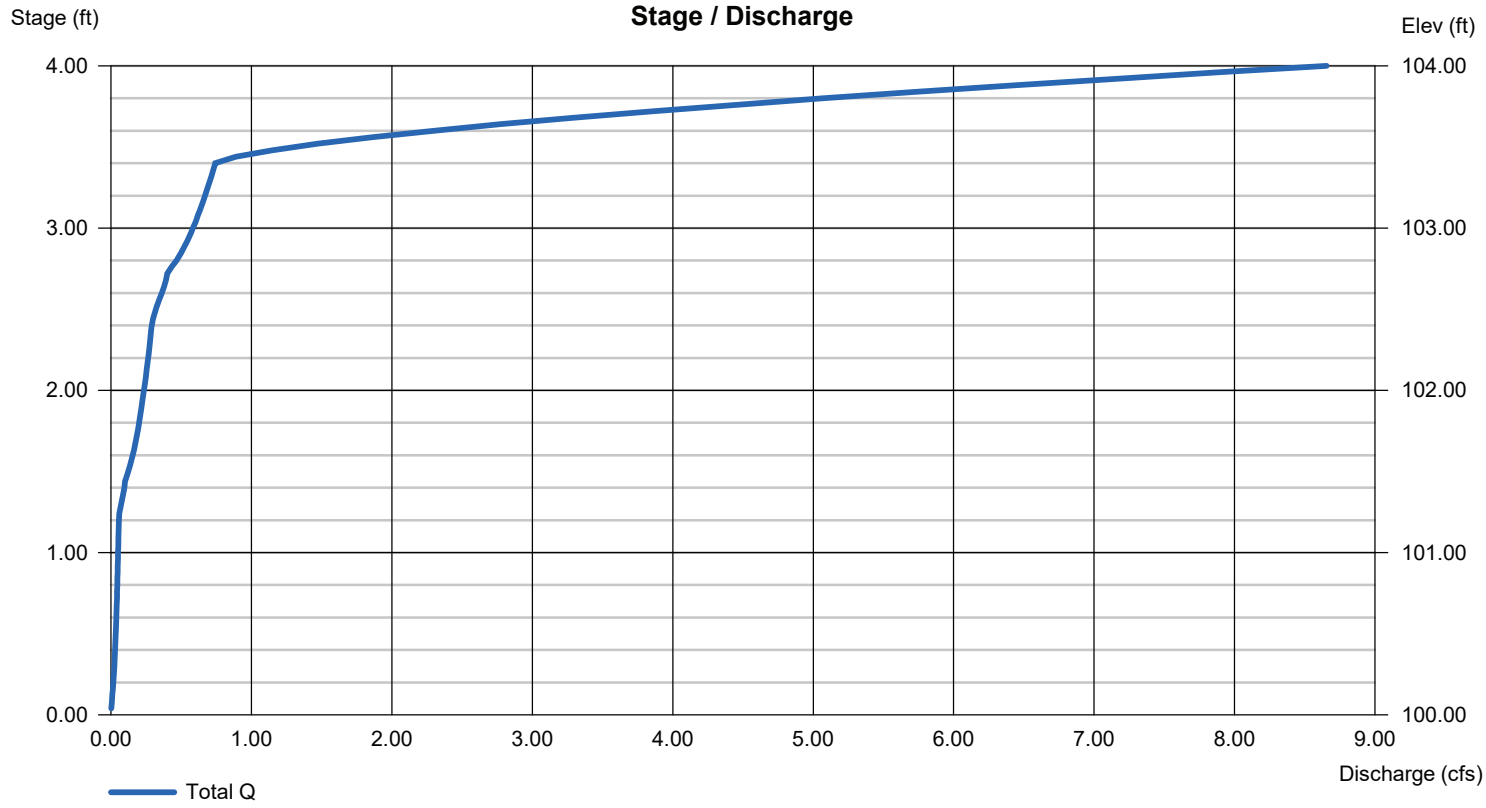
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 5.00	0.00	0.00	0.00
Crest El. (ft)	= 103.40	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

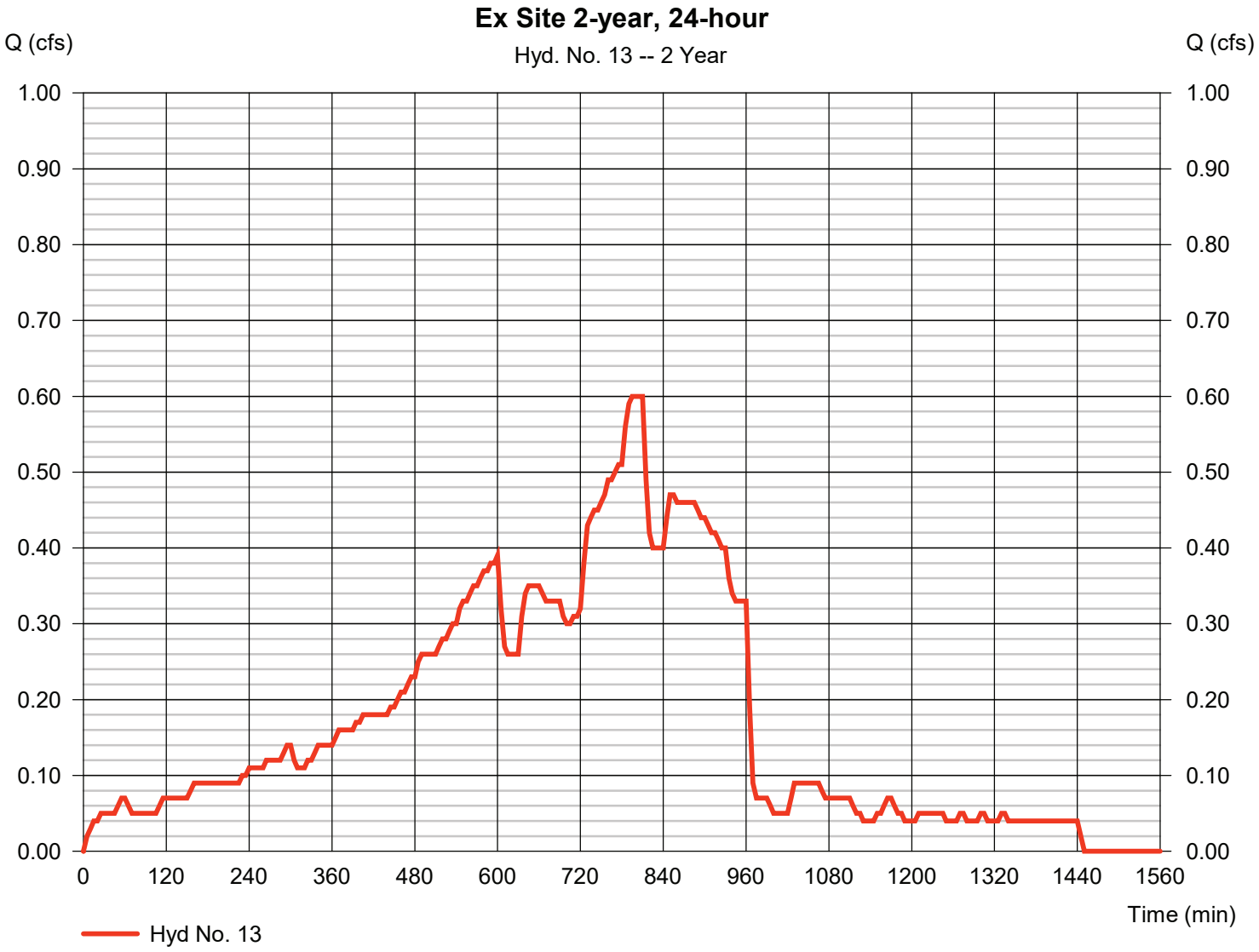


Hydrograph Report

Hyd. No. 13

Ex Site 2-year, 24-hour

Hydrograph type	= Manual	Peak discharge	= 0.600 cfs
Storm frequency	= 2 yrs	Time to peak	= 795 min
Time interval	= 5 min	Hyd. volume	= 15,792 cuft

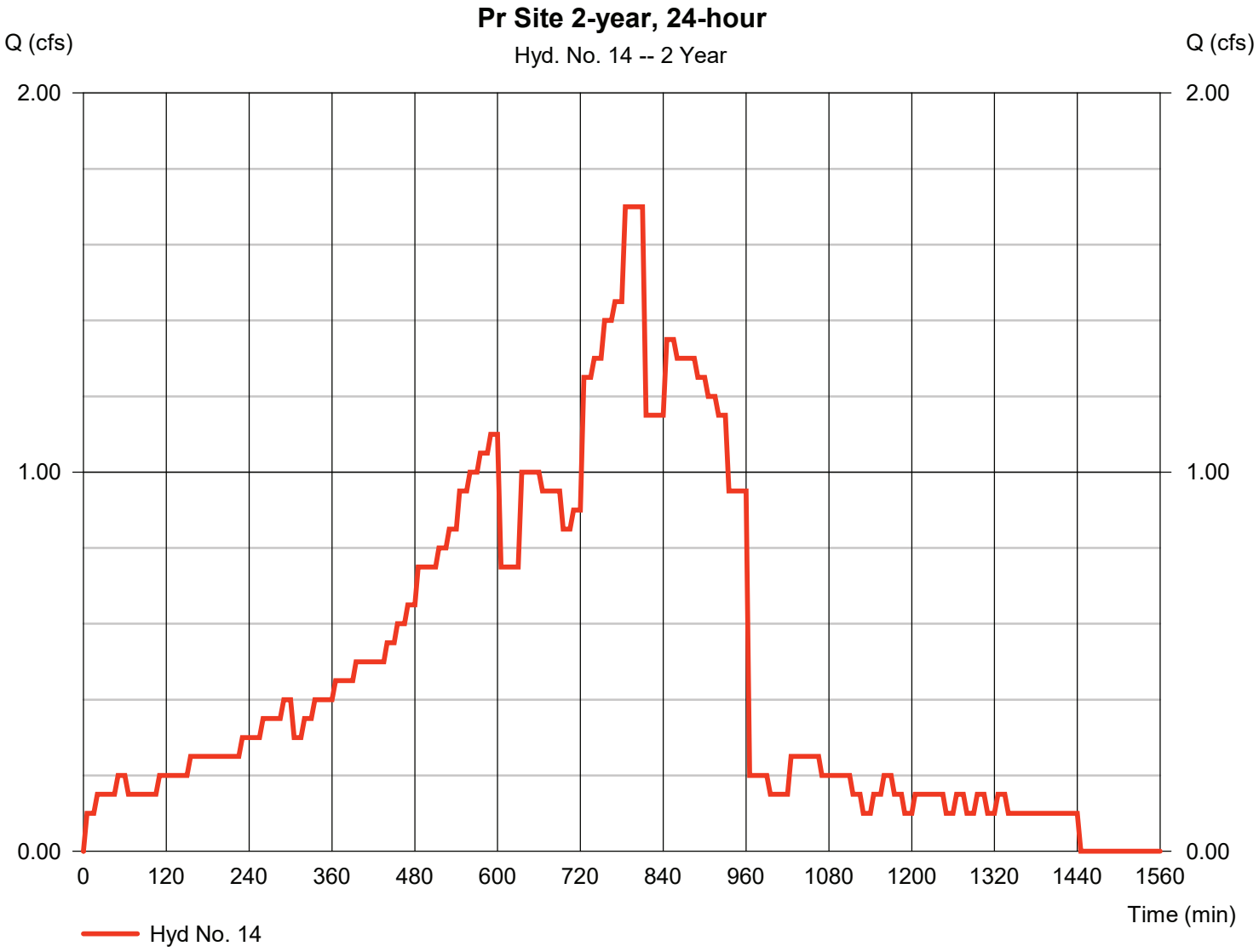


Hydrograph Report

Hyd. No. 14

Pr Site 2-year, 24-hour

Hydrograph type	= Manual	Peak discharge	= 1.700 cfs
Storm frequency	= 2 yrs	Time to peak	= 785 min
Time interval	= 5 min	Hyd. volume	= 45,000 cuft



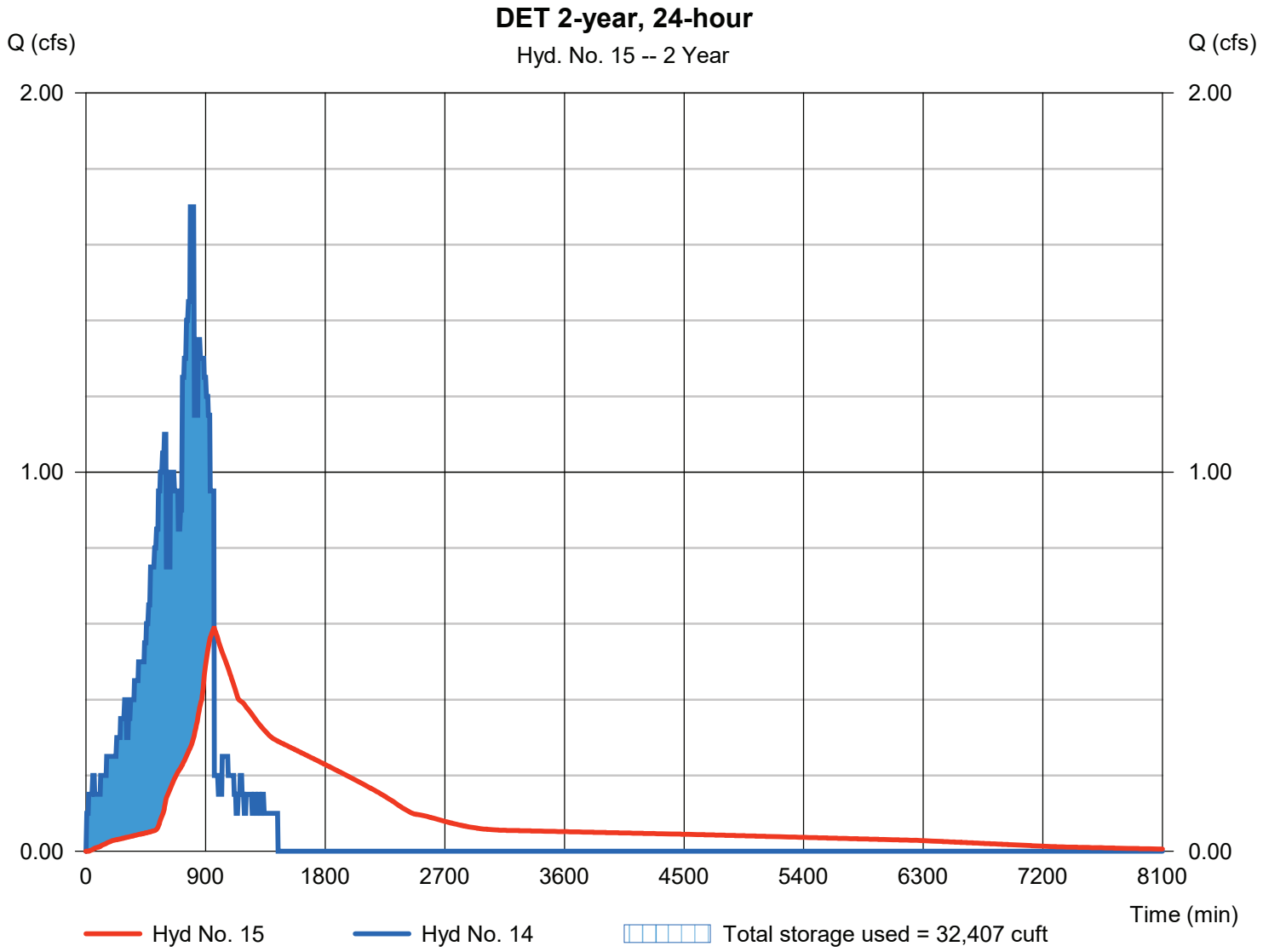
Hydrograph Report

Hyd. No. 15

DET 2-year, 24-hour

Hydrograph type	=	Reservoir	Peak discharge	=	0.588 cfs
Storm frequency	=	2 yrs	Time to peak	=	960 min
Time interval	=	5 min	Hyd. volume	=	44,877 cuft
Inflow hyd. No.	=	14 - Pr Site 2-year, 24-hour	Max. Elevation	=	103.01 ft
Reservoir name	=	DET-Site	Max. Storage	=	32,407 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - DET-Site

Pond Data

UG Chambers -Invert elev. = 100.00 ft, Rise x Span = 4.00 x 4.00 ft, Barrel Len = 100.00 ft, No. Barrels = 32, Slope = 0.00%, Headers = No

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	n/a	0	0
0.40	100.40	n/a	2,098	2,098
0.80	100.80	n/a	3,632	5,730
1.20	101.20	n/a	4,423	10,153
1.60	101.60	n/a	4,872	15,025
2.00	102.00	n/a	5,090	20,115
2.40	102.40	n/a	5,090	25,204
2.80	102.80	n/a	4,871	30,075
3.20	103.20	n/a	4,421	34,496
3.60	103.60	n/a	3,634	38,130
4.00	104.00	n/a	2,090	40,220

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 1.70	3.00	4.00	0.00
Span (in)	= 1.70	3.00	4.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 100.00	101.20	102.40	0.00
Length (ft)	= 10.00	10.00	10.00	0.00
Slope (%)	= 0.30	0.30	0.30	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

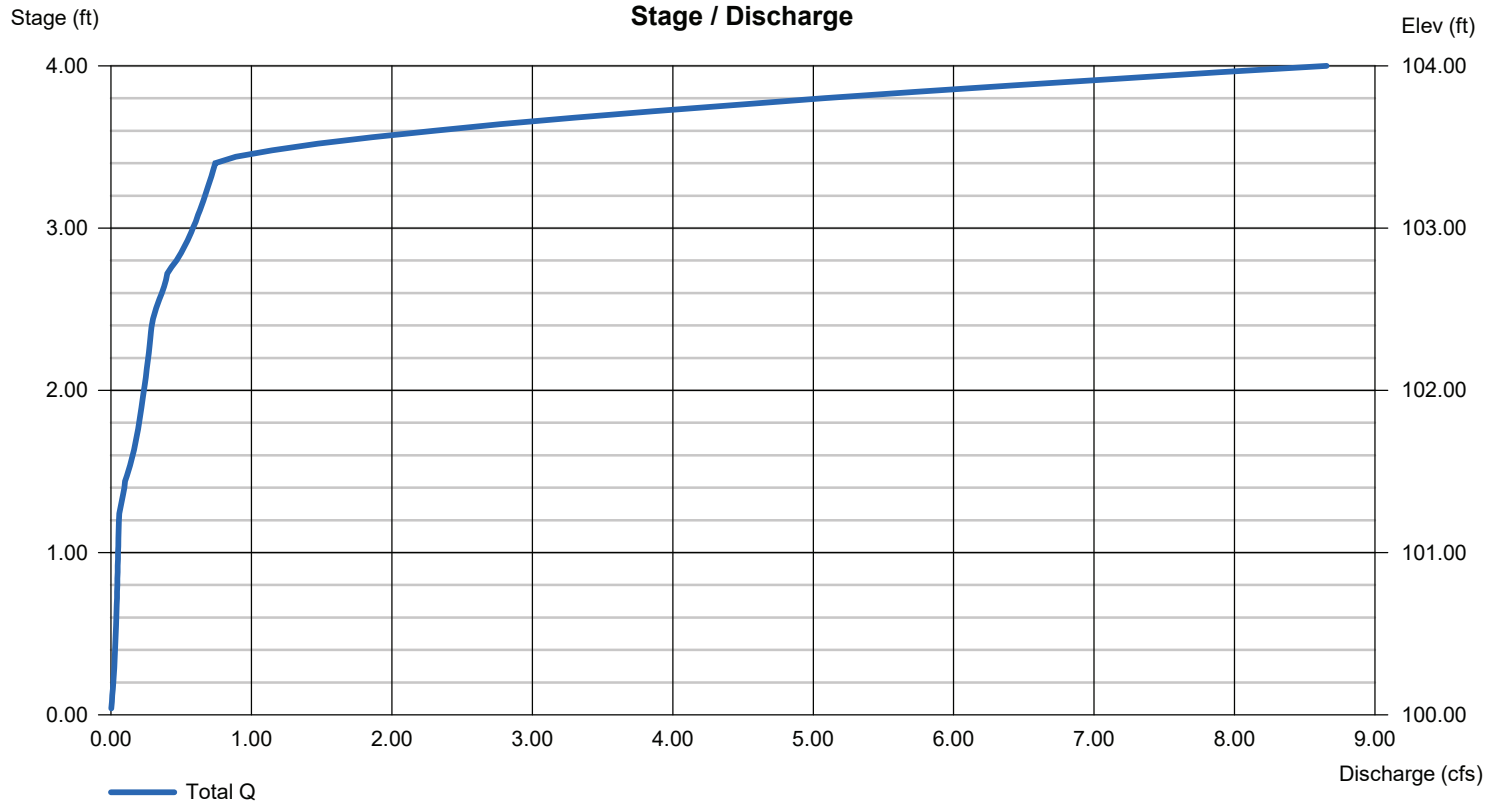
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 5.00	0.00	0.00	0.00
Crest El. (ft)	= 103.40	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Manual	0.000	5	n/a	0	------	------	------	Ex Site 2-year, 1-hour
2	Manual	0.000	5	n/a	0	------	------	------	Pr Site 2-year, 1-hour
3	Reservoir	0.000	5	n/a	0	2	100.00	0.000	DET 2-year, 1-hour
5	Manual	0.000	5	n/a	0	------	------	------	Ex Site 2-year, 3-hour
6	Manual	0.000	5	n/a	0	------	------	------	Pr Site 2-year, 3-hour
7	Reservoir	0.000	5	n/a	0	6	100.00	0.000	DET 2-year, 3-hour
9	Manual	0.000	5	n/a	0	------	------	------	Ex Site 2-year, 6-hour
10	Manual	0.000	5	n/a	0	------	------	------	Pr Site 2-year, 6-hour
11	Reservoir	0.000	5	n/a	0	10	100.00	0.000	DET 2-year, 6-hour
13	Manual	0.000	5	n/a	0	------	------	------	Ex Site 2-year, 24-hour
14	Manual	0.000	5	n/a	0	------	------	------	Pr Site 2-year, 24-hour
15	Reservoir	0.000	5	n/a	0	14	100.00	0.000	DET 2-year, 24-hour
18	Manual	15.48	5	50	17,298	------	------	------	Ex Site 5-year, 1-hour
19	Manual	21.13	5	50	18,003	------	------	------	Pr Site 5-year, 1-hour
20	Reservoir	0.202	5	65	17,880	19	101.81	17,745	DET 5-year, 1-hour
22	Manual	7.550	5	155	21,675	------	------	------	Ex Site 5-year, 3-hour
23	Manual	7.960	5	155	26,556	------	------	------	Pr Site 5-year, 3-hour
24	Reservoir	0.294	5	180	26,433	23	102.42	25,443	DET 5-year, 3-hour
26	Manual	6.520	5	330	23,820	------	------	------	Ex Site 5-year, 6-hour
27	Manual	7.080	5	330	34,572	------	------	------	Pr Site 5-year, 6-hour
28	Reservoir	0.557	5	350	34,449	27	102.95	31,719	DET 5-year, 6-hour
30	Manual	2.000	5	805	32,235	------	------	------	Ex Site 5-year, 24-hour
31	Manual	2.280	5	785	60,408	------	------	------	Pr Site 5-year, 24-hour
32	Reservoir	1.628	5	905	60,285	31	103.54	37,549	DET 5-year, 24-hour
35	Manual	0.000	5	n/a	0	------	------	------	Ex Site 10-year, 1-hour
36	Manual	0.000	5	n/a	0	------	------	------	Pr Site 10-year, 1-hour
37	Reservoir	0.000	5	n/a	0	36	100.00	0.000	DET 10-year, 1-hour
39	Manual	0.000	5	n/a	0	------	------	------	Ex Site 10-year, 3-hour
40	Manual	0.000	5	n/a	0	------	------	------	Pr Site 10-year, 3-hour

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020.4

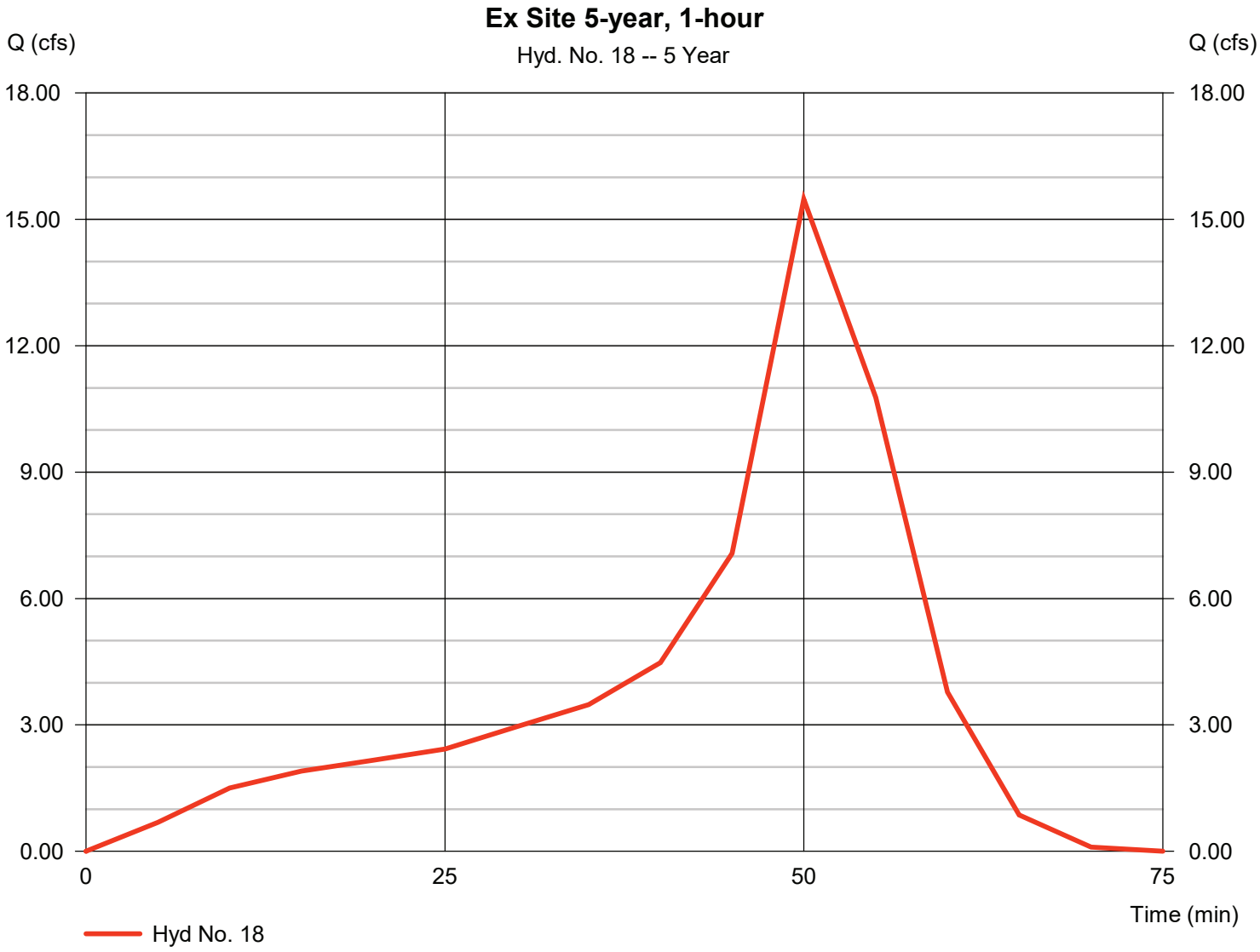
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
41	Reservoir	0.000	5	n/a	0	40	100.00	0.000	DET 10-year, 3-hour
43	Manual	0.000	5	n/a	0	------	------	------	Ex Site 10-year, 6-hour
44	Manual	0.000	5	n/a	0	------	------	------	Pr Site 10-year, 6-hour
45	Reservoir	0.000	5	n/a	0	44	100.00	0.000	DET 10-year, 6-hour
47	Manual	0.000	5	n/a	0	------	------	------	Ex Site 10-year, 24-hour
48	Manual	0.000	5	n/a	0	------	------	------	Pr Site 10-year, 24-hour
49	Reservoir	0.000	5	n/a	0	48	100.00	0.000	DET 10-year, 24-hour

Hydrograph Report

Hyd. No. 18

Ex Site 5-year, 1-hour

Hydrograph type	= Manual	Peak discharge	= 15.48 cfs
Storm frequency	= 5 yrs	Time to peak	= 50 min
Time interval	= 5 min	Hyd. volume	= 17,298 cuft

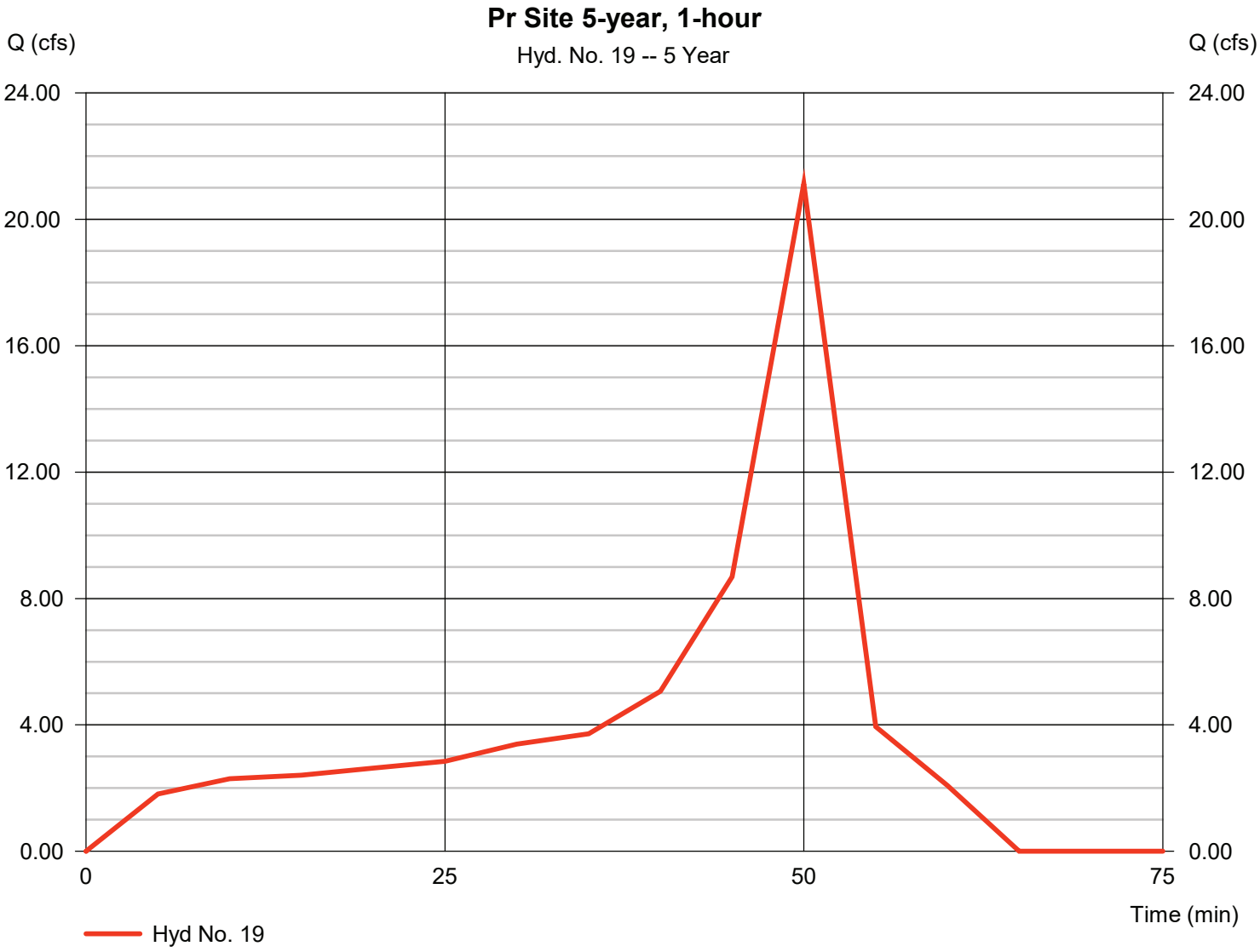


Hydrograph Report

Hyd. No. 19

Pr Site 5-year, 1-hour

Hydrograph type	= Manual	Peak discharge	= 21.13 cfs
Storm frequency	= 5 yrs	Time to peak	= 50 min
Time interval	= 5 min	Hyd. volume	= 18,003 cuft



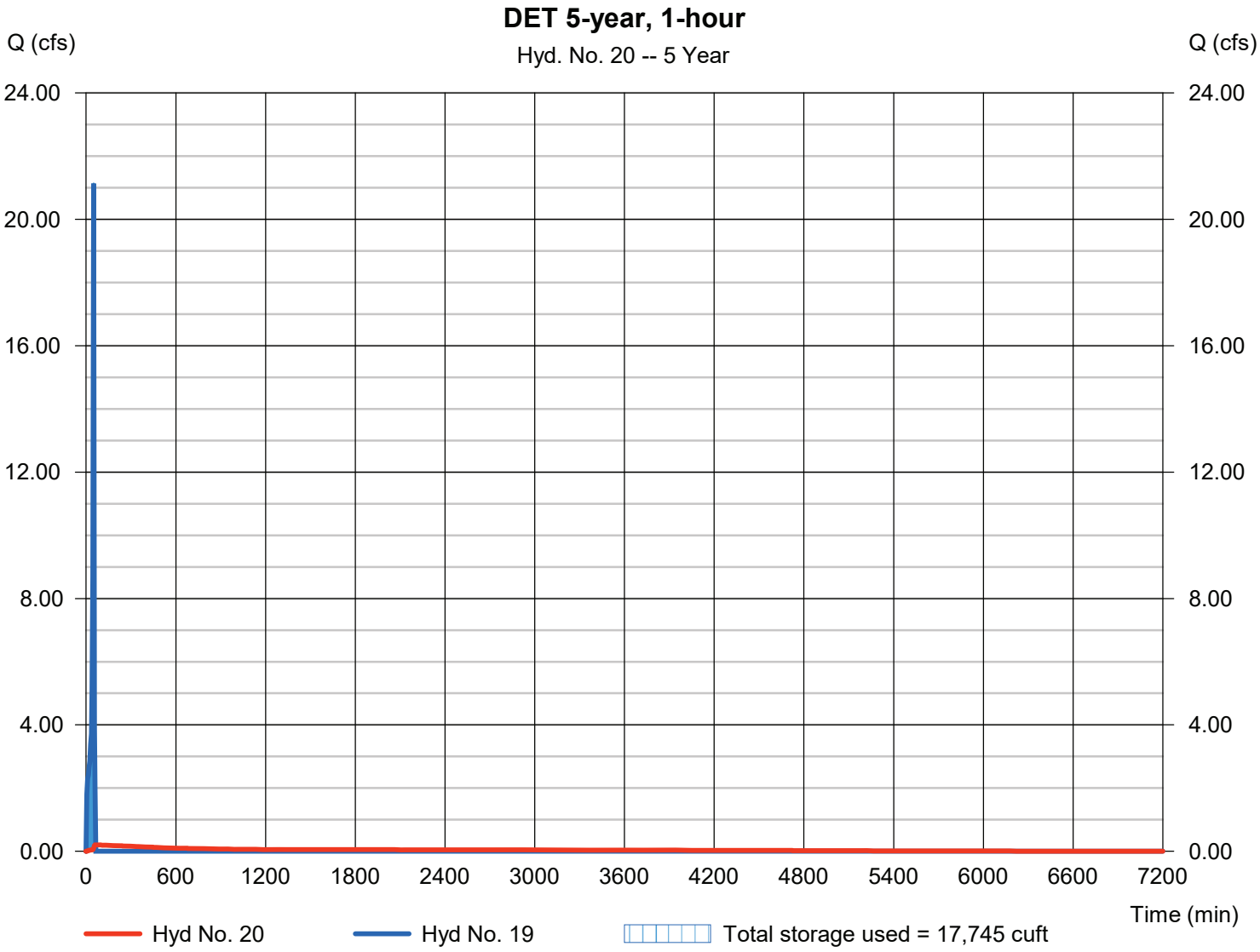
Hydrograph Report

Hyd. No. 20

DET 5-year, 1-hour

Hydrograph type	=	Reservoir	Peak discharge	=	0.202 cfs
Storm frequency	=	5 yrs	Time to peak	=	65 min
Time interval	=	5 min	Hyd. volume	=	17,880 cuft
Inflow hyd. No.	=	19 - Pr Site 5-year, 1-hour	Max. Elevation	=	101.81 ft
Reservoir name	=	DET-Site	Max. Storage	=	17,745 cuft

Storage Indication method used.

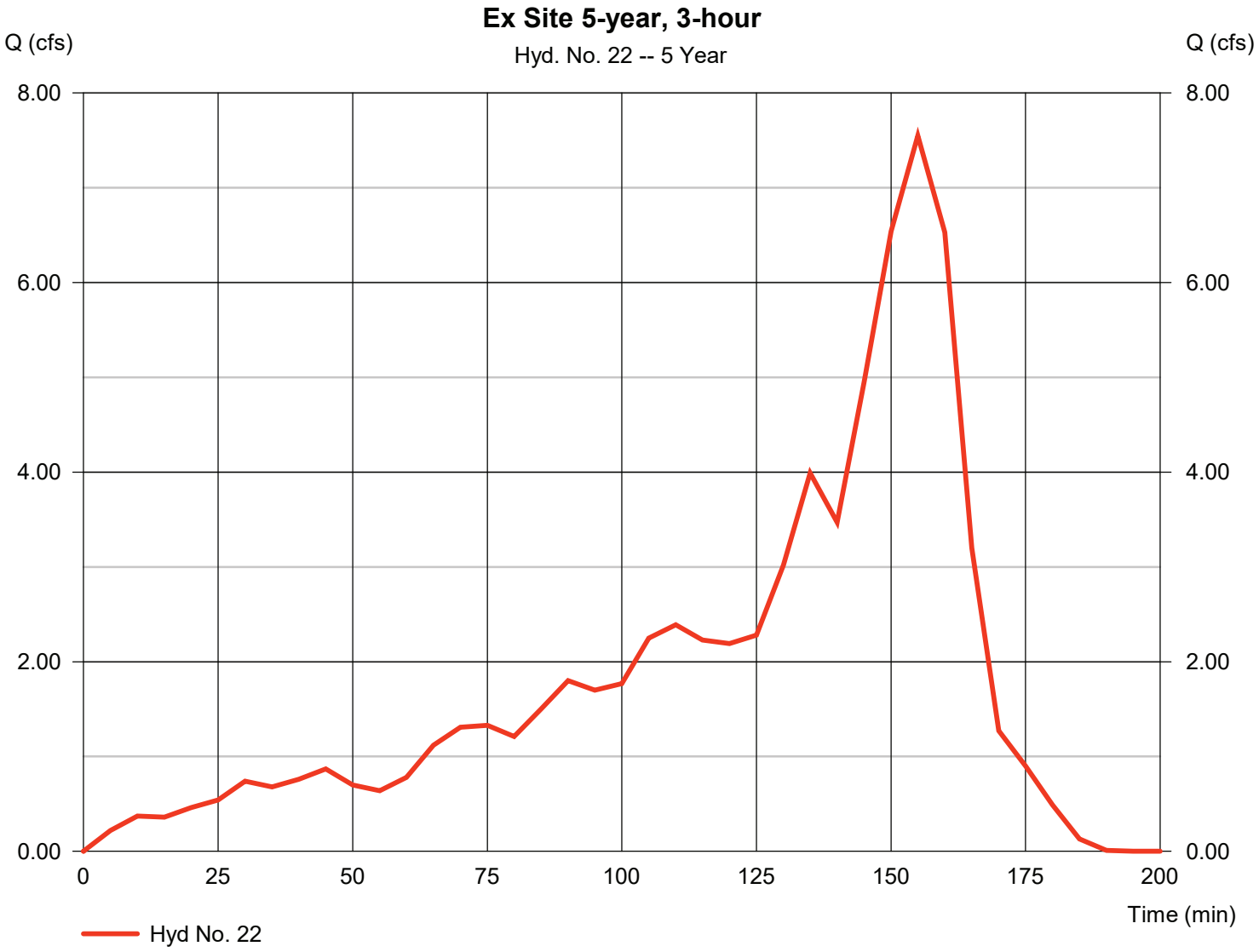


Hydrograph Report

Hyd. No. 22

Ex Site 5-year, 3-hour

Hydrograph type	= Manual	Peak discharge	= 7.550 cfs
Storm frequency	= 5 yrs	Time to peak	= 155 min
Time interval	= 5 min	Hyd. volume	= 21,675 cuft

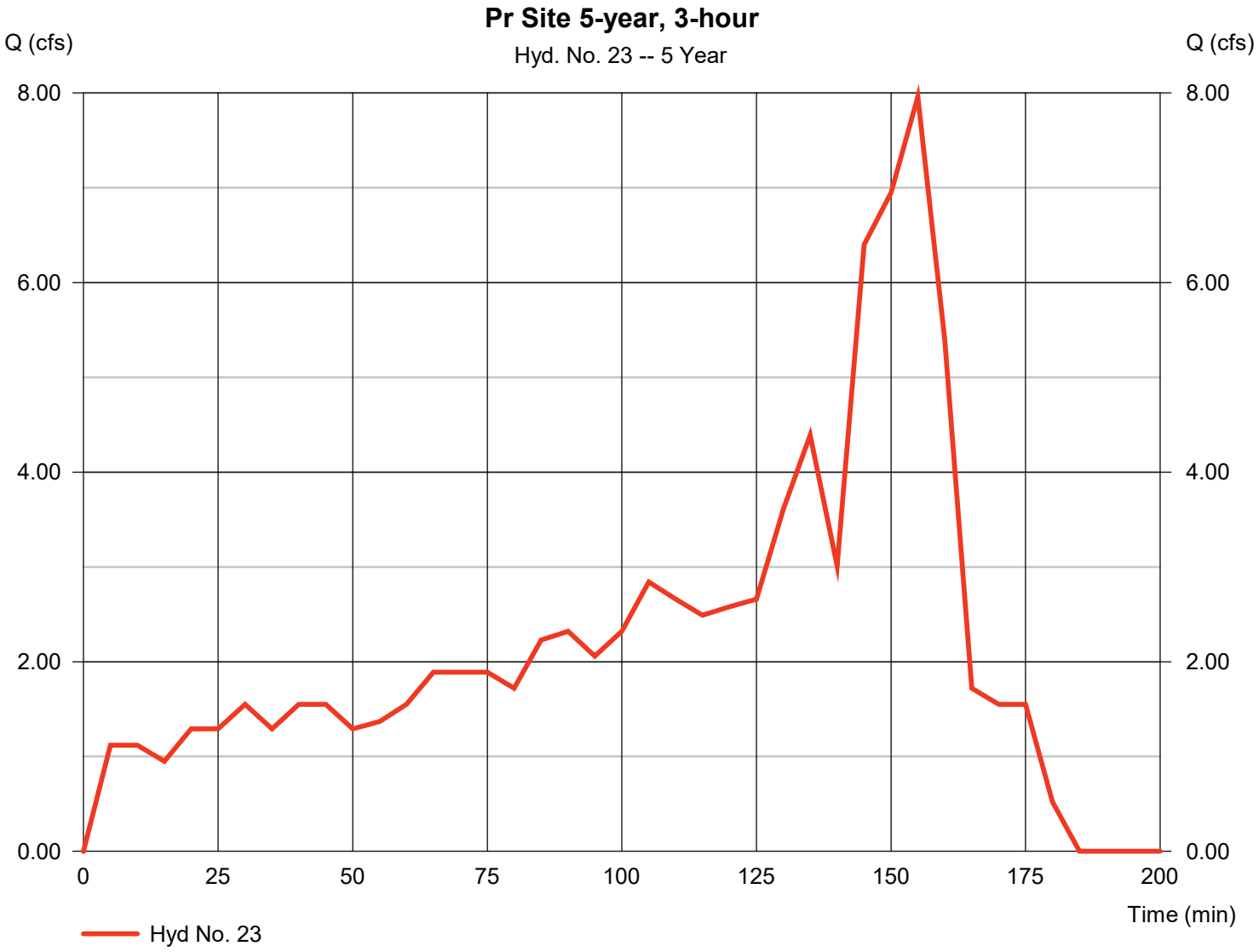


Hydrograph Report

Hyd. No. 23

Pr Site 5-year, 3-hour

Hydrograph type	= Manual	Peak discharge	= 7.960 cfs
Storm frequency	= 5 yrs	Time to peak	= 155 min
Time interval	= 5 min	Hyd. volume	= 26,556 cuft



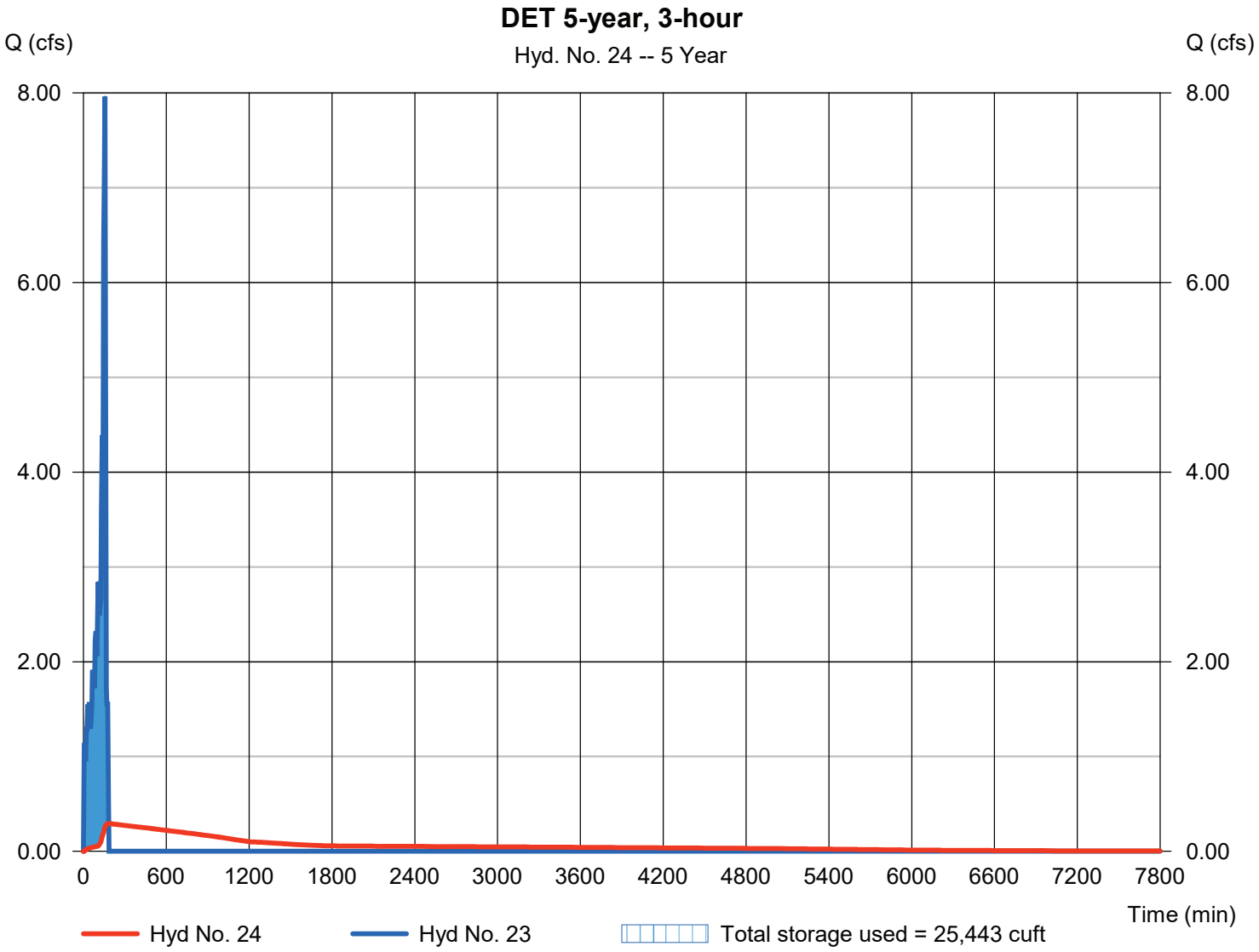
Hydrograph Report

Hyd. No. 24

DET 5-year, 3-hour

Hydrograph type	=	Reservoir	Peak discharge	=	0.294 cfs
Storm frequency	=	5 yrs	Time to peak	=	180 min
Time interval	=	5 min	Hyd. volume	=	26,433 cuft
Inflow hyd. No.	=	23 - Pr Site 5-year, 3-hour	Max. Elevation	=	102.42 ft
Reservoir name	=	DET-Site	Max. Storage	=	25,443 cuft

Storage Indication method used.

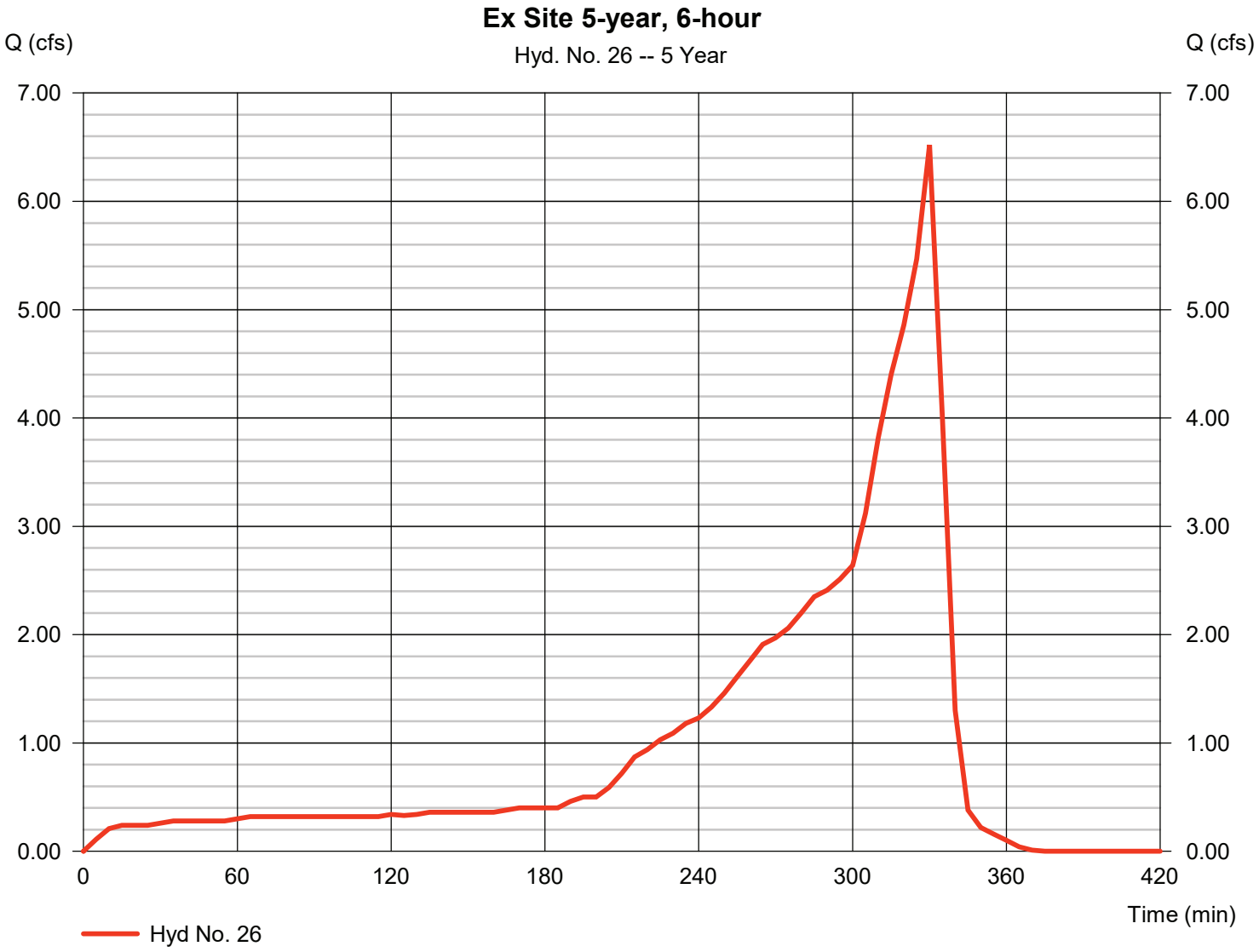


Hydrograph Report

Hyd. No. 26

Ex Site 5-year, 6-hour

Hydrograph type	= Manual	Peak discharge	= 6.520 cfs
Storm frequency	= 5 yrs	Time to peak	= 330 min
Time interval	= 5 min	Hyd. volume	= 23,820 cuft

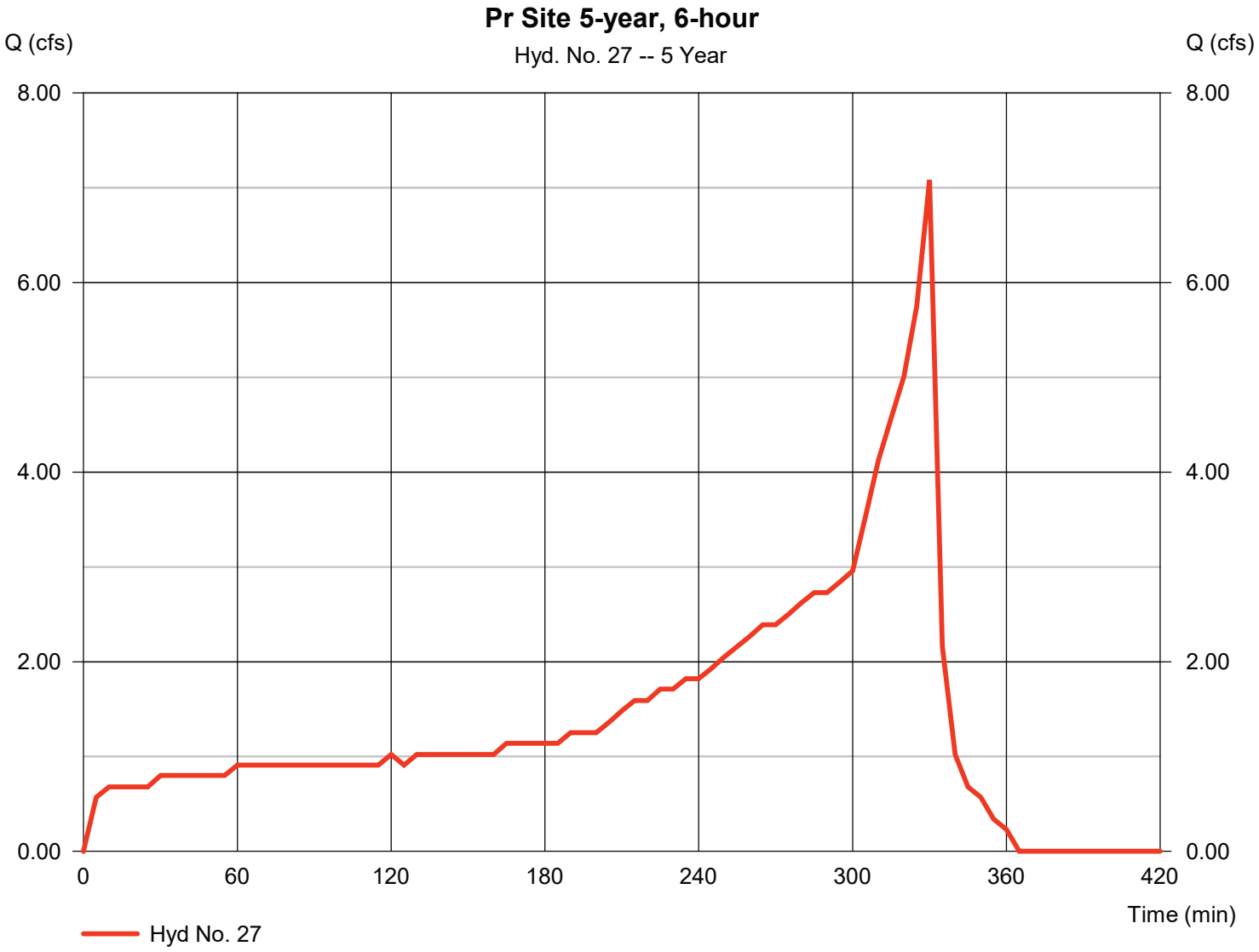


Hydrograph Report

Hyd. No. 27

Pr Site 5-year, 6-hour

Hydrograph type	= Manual	Peak discharge	= 7.080 cfs
Storm frequency	= 5 yrs	Time to peak	= 330 min
Time interval	= 5 min	Hyd. volume	= 34,572 cuft



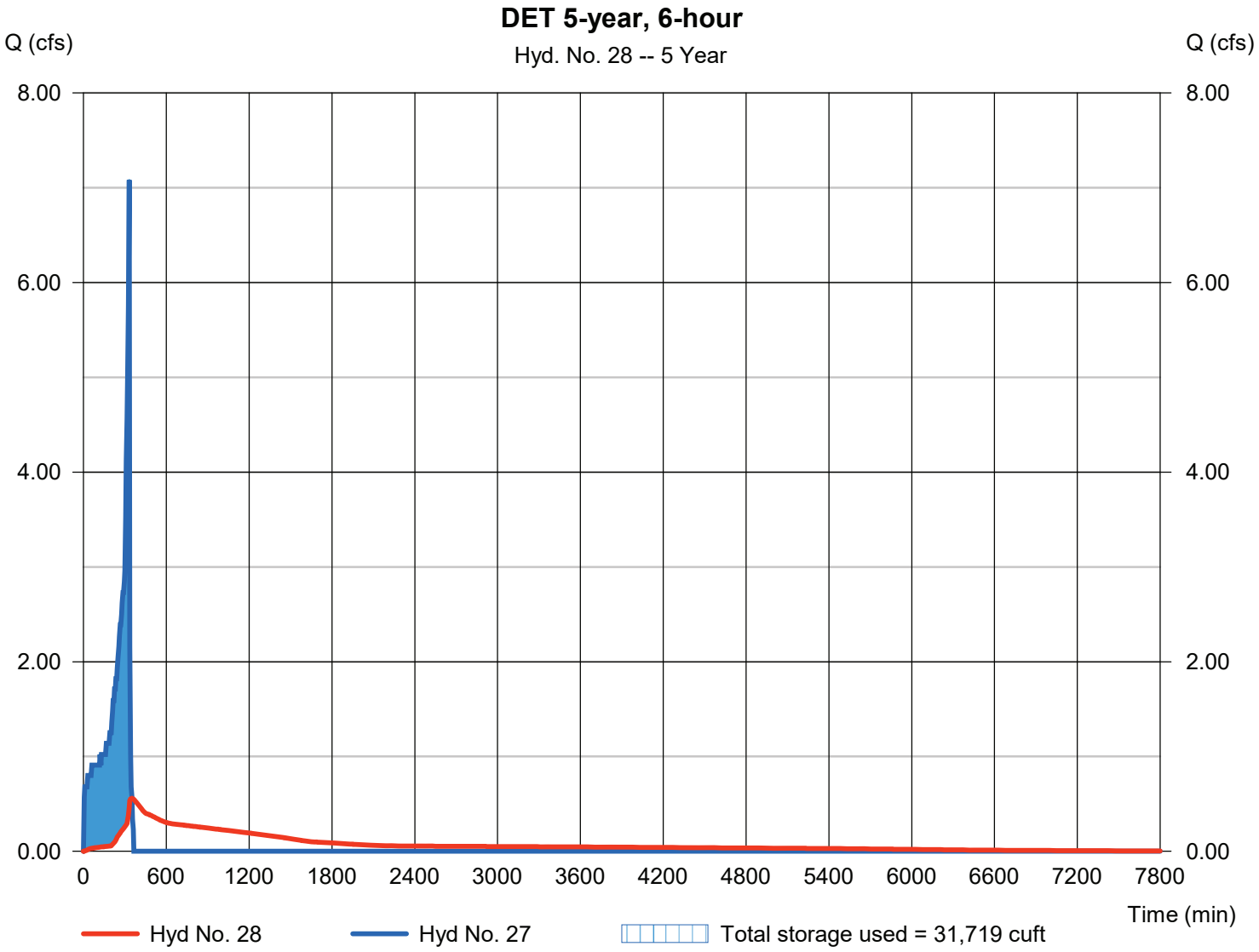
Hydrograph Report

Hyd. No. 28

DET 5-year, 6-hour

Hydrograph type	=	Reservoir	Peak discharge	=	0.557 cfs
Storm frequency	=	5 yrs	Time to peak	=	350 min
Time interval	=	5 min	Hyd. volume	=	34,449 cuft
Inflow hyd. No.	=	27 - Pr Site 5-year, 6-hour	Max. Elevation	=	102.95 ft
Reservoir name	=	DET-Site	Max. Storage	=	31,719 cuft

Storage Indication method used.

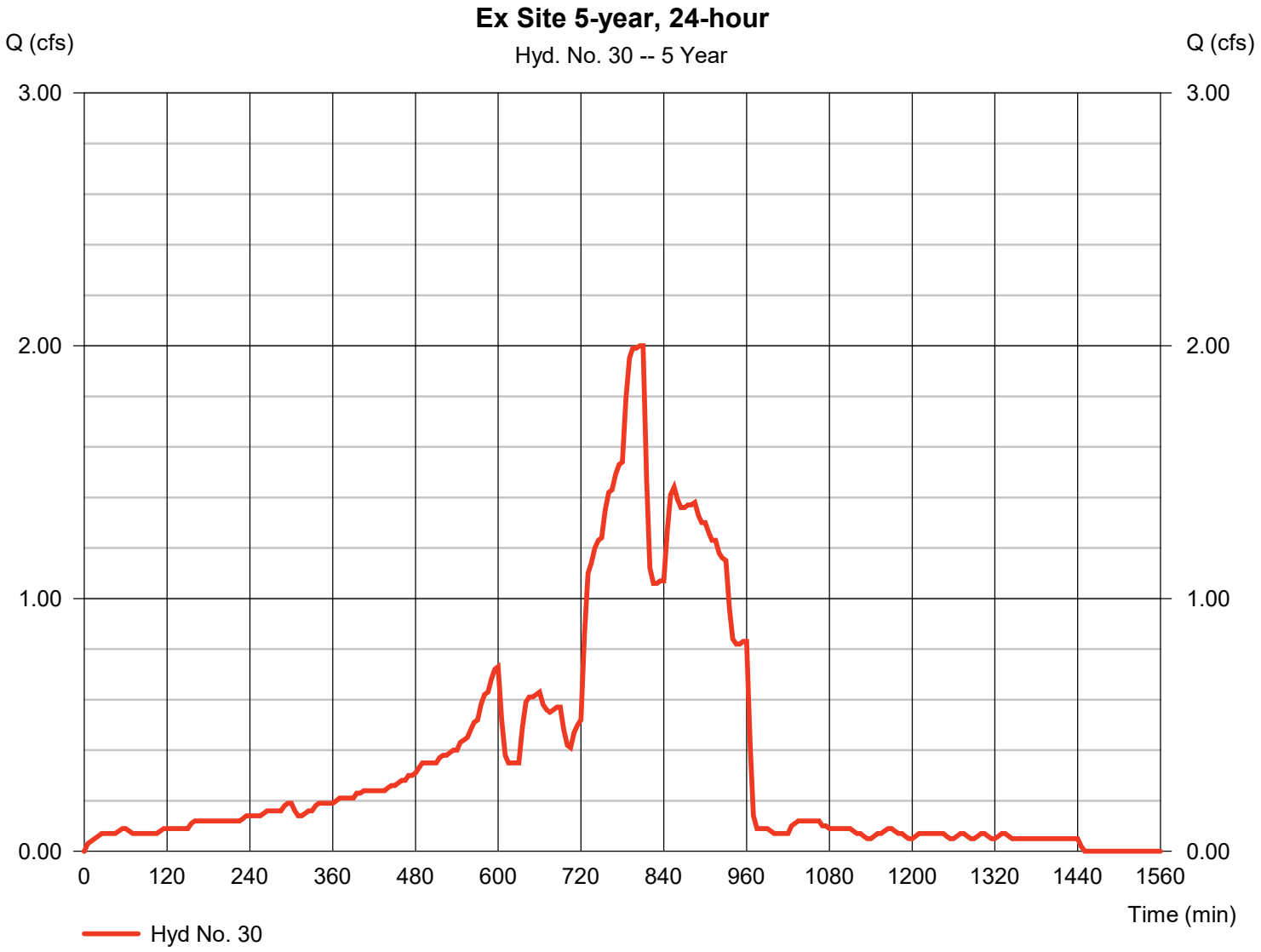


Hydrograph Report

Hyd. No. 30

Ex Site 5-year, 24-hour

Hydrograph type	= Manual	Peak discharge	= 2.000 cfs
Storm frequency	= 5 yrs	Time to peak	= 805 min
Time interval	= 5 min	Hyd. volume	= 32,235 cuft

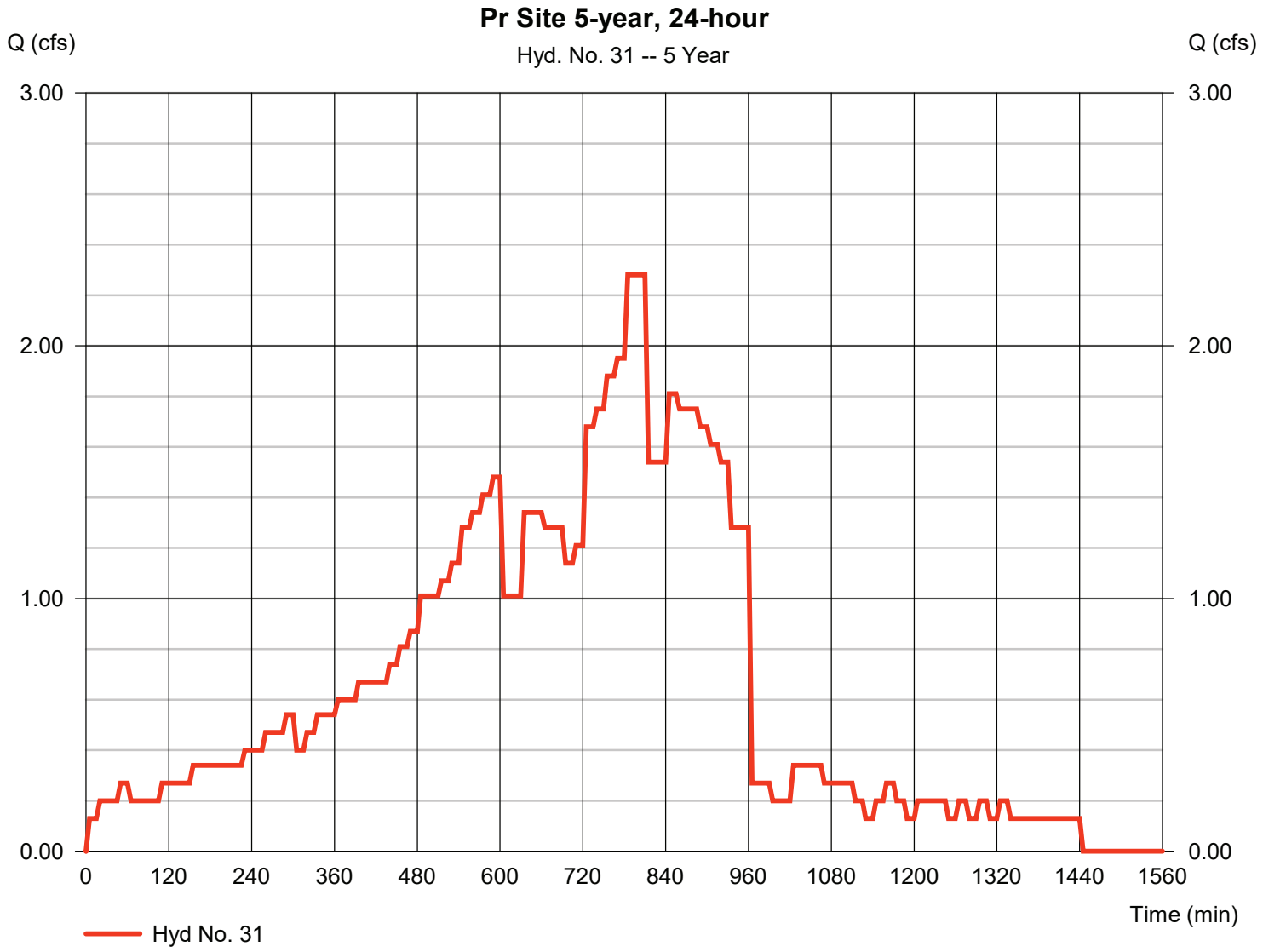


Hydrograph Report

Hyd. No. 31

Pr Site 5-year, 24-hour

Hydrograph type	= Manual	Peak discharge	= 2.280 cfs
Storm frequency	= 5 yrs	Time to peak	= 785 min
Time interval	= 5 min	Hyd. volume	= 60,408 cuft



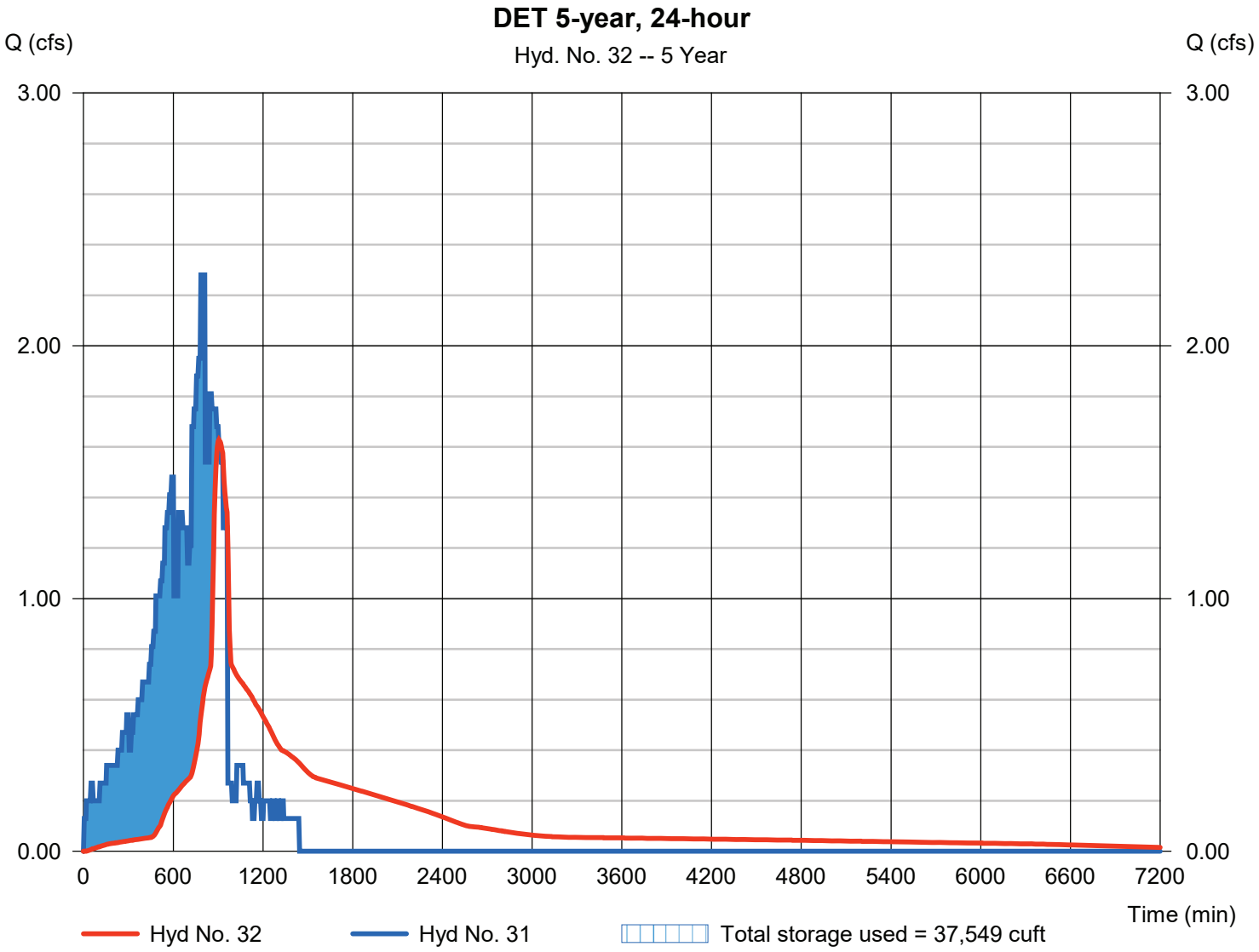
Hydrograph Report

Hyd. No. 32

DET 5-year, 24-hour

Hydrograph type	=	Reservoir	Peak discharge	=	1.628 cfs
Storm frequency	=	5 yrs	Time to peak	=	905 min
Time interval	=	5 min	Hyd. volume	=	60,285 cuft
Inflow hyd. No.	=	31 - Pr Site 5-year, 24-hour	Max. Elevation	=	103.54 ft
Reservoir name	=	DET-Site	Max. Storage	=	37,549 cuft

Storage Indication method used.



10-Year Summary

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Manual	0.000	5	n/a	0	------	------	------	Ex Site 2-year, 1-hour
2	Manual	0.000	5	n/a	0	------	------	------	Pr Site 2-year, 1-hour
3	Reservoir	0.000	5	n/a	0	2	100.00	0.000	DET 2-year, 1-hour
5	Manual	0.000	5	n/a	0	------	------	------	Ex Site 2-year, 3-hour
6	Manual	0.000	5	n/a	0	------	------	------	Pr Site 2-year, 3-hour
7	Reservoir	0.000	5	n/a	0	6	100.00	0.000	DET 2-year, 3-hour
9	Manual	0.000	5	n/a	0	------	------	------	Ex Site 2-year, 6-hour
10	Manual	0.000	5	n/a	0	------	------	------	Pr Site 2-year, 6-hour
11	Reservoir	0.000	5	n/a	0	10	100.00	0.000	DET 2-year, 6-hour
13	Manual	0.000	5	n/a	0	------	------	------	Ex Site 2-year, 24-hour
14	Manual	0.000	5	n/a	0	------	------	------	Pr Site 2-year, 24-hour
15	Reservoir	0.000	5	n/a	0	14	100.00	0.000	DET 2-year, 24-hour
18	Manual	0.000	5	n/a	0	------	------	------	Ex Site 5-year, 1-hour
19	Manual	0.000	5	n/a	0	------	------	------	Pr Site 5-year, 1-hour
20	Reservoir	0.000	5	n/a	0	19	100.00	0.000	DET 5-year, 1-hour
22	Manual	0.000	5	n/a	0	------	------	------	Ex Site 5-year, 3-hour
23	Manual	0.000	5	n/a	0	------	------	------	Pr Site 5-year, 3-hour
24	Reservoir	0.000	5	n/a	0	23	100.00	0.000	DET 5-year, 3-hour
26	Manual	0.000	5	n/a	0	------	------	------	Ex Site 5-year, 6-hour
27	Manual	0.000	5	n/a	0	------	------	------	Pr Site 5-year, 6-hour
28	Reservoir	0.000	5	n/a	0	27	100.00	0.000	DET 5-year, 6-hour
30	Manual	0.000	5	n/a	0	------	------	------	Ex Site 5-year, 24-hour
31	Manual	0.000	5	n/a	0	------	------	------	Pr Site 5-year, 24-hour
32	Reservoir	0.000	5	n/a	0	31	100.00	0.000	DET 5-year, 24-hour
35	Manual	19.36	5	50	22,287	------	------	------	Ex Site 10-year, 1-hour
36	Manual	26.83	5	50	23,739	------	------	------	Pr Site 10-year, 1-hour
37	Reservoir	0.272	5	65	23,616	36	102.26	23,383	DET 10-year, 1-hour
39	Manual	9.230	5	155	28,056	------	------	------	Ex Site 10-year, 3-hour
40	Manual	10.20	5	155	33,453	------	------	------	Pr Site 10-year, 3-hour

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020.4

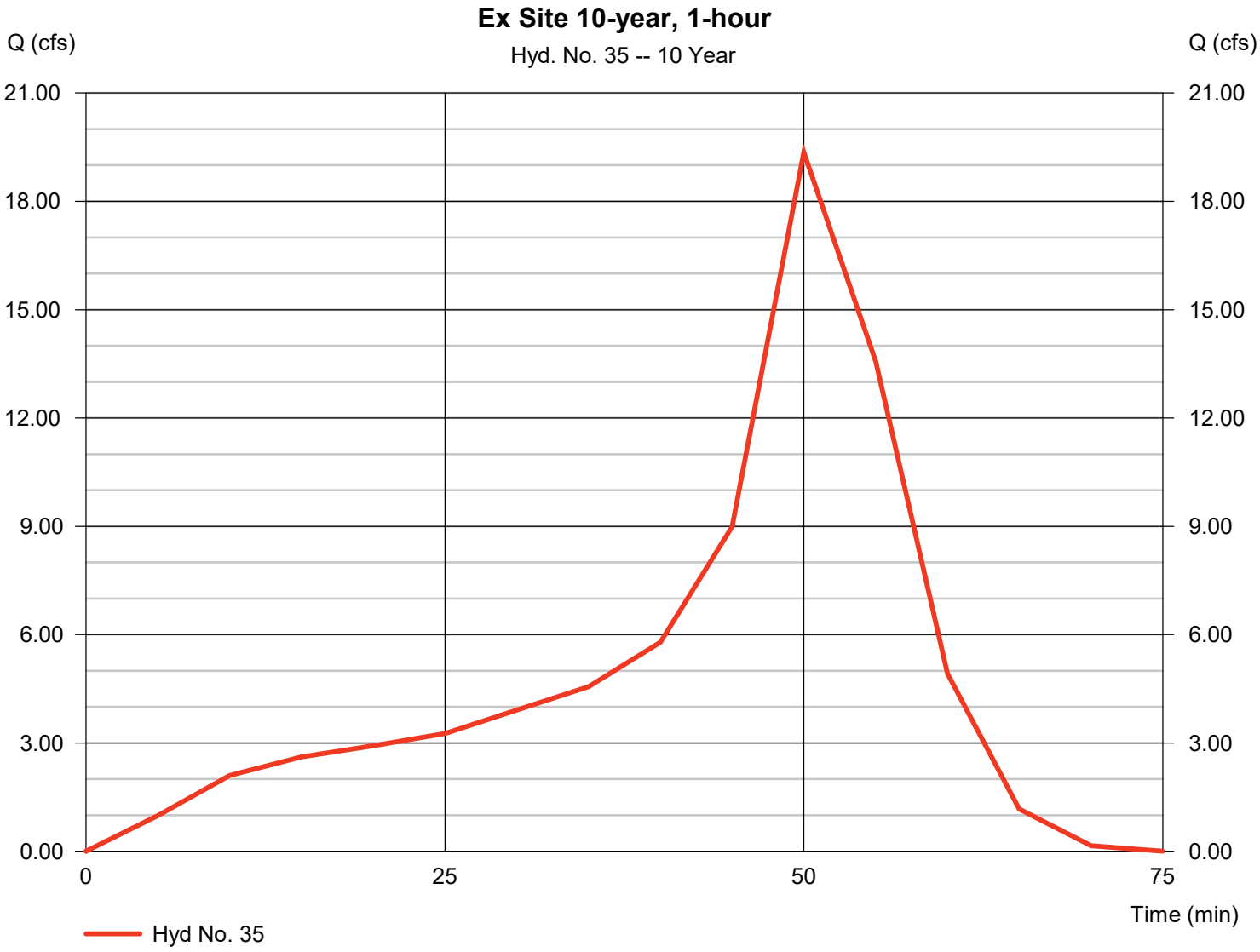
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
41	Reservoir	0.561	5	180	33,330	40	102.96	31,805	DET 10-year, 3-hour
43	Manual	7.920	5	330	30,351	------	------	------	Ex Site 10-year, 6-hour
44	Manual	9.070	5	330	42,675	------	------	------	Pr Site 10-year, 6-hour
45	Reservoir	2.252	5	335	42,552	44	103.60	38,095	DET 10-year, 6-hour
47	Manual	2.580	5	810	43,035	------	------	------	Ex Site 10-year, 24-hour
48	Manual	2.920	5	805	72,603	------	------	------	Pr Site 10-year, 24-hour
49	Reservoir	2.542	5	810	72,480	48	103.62	38,238	DET 10-year, 24-hour

Hydrograph Report

Hyd. No. 35

Ex Site 10-year, 1-hour

Hydrograph type	= Manual	Peak discharge	= 19.36 cfs
Storm frequency	= 10 yrs	Time to peak	= 50 min
Time interval	= 5 min	Hyd. volume	= 22,287 cuft

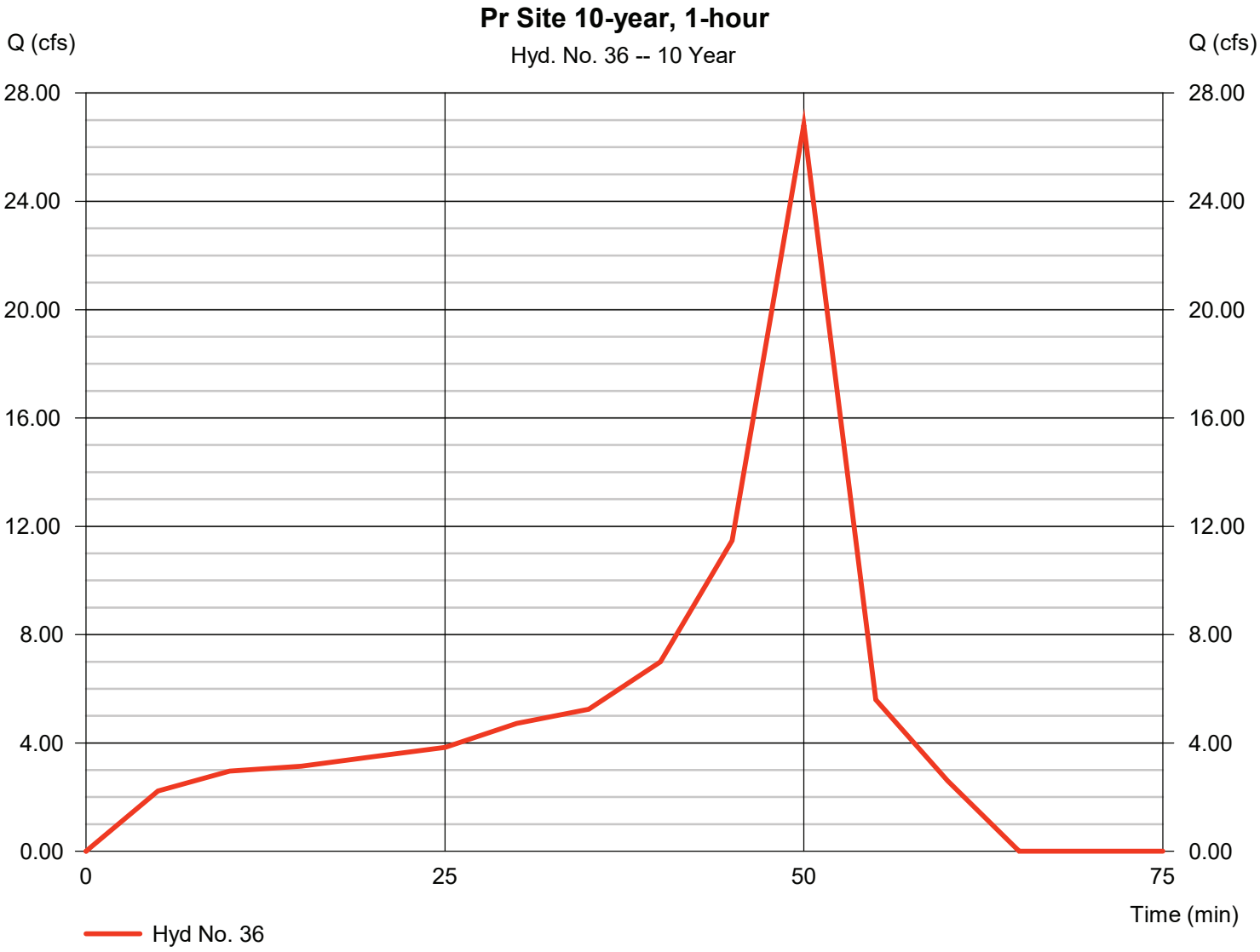


Hydrograph Report

Hyd. No. 36

Pr Site 10-year, 1-hour

Hydrograph type	= Manual	Peak discharge	= 26.83 cfs
Storm frequency	= 10 yrs	Time to peak	= 50 min
Time interval	= 5 min	Hyd. volume	= 23,739 cuft



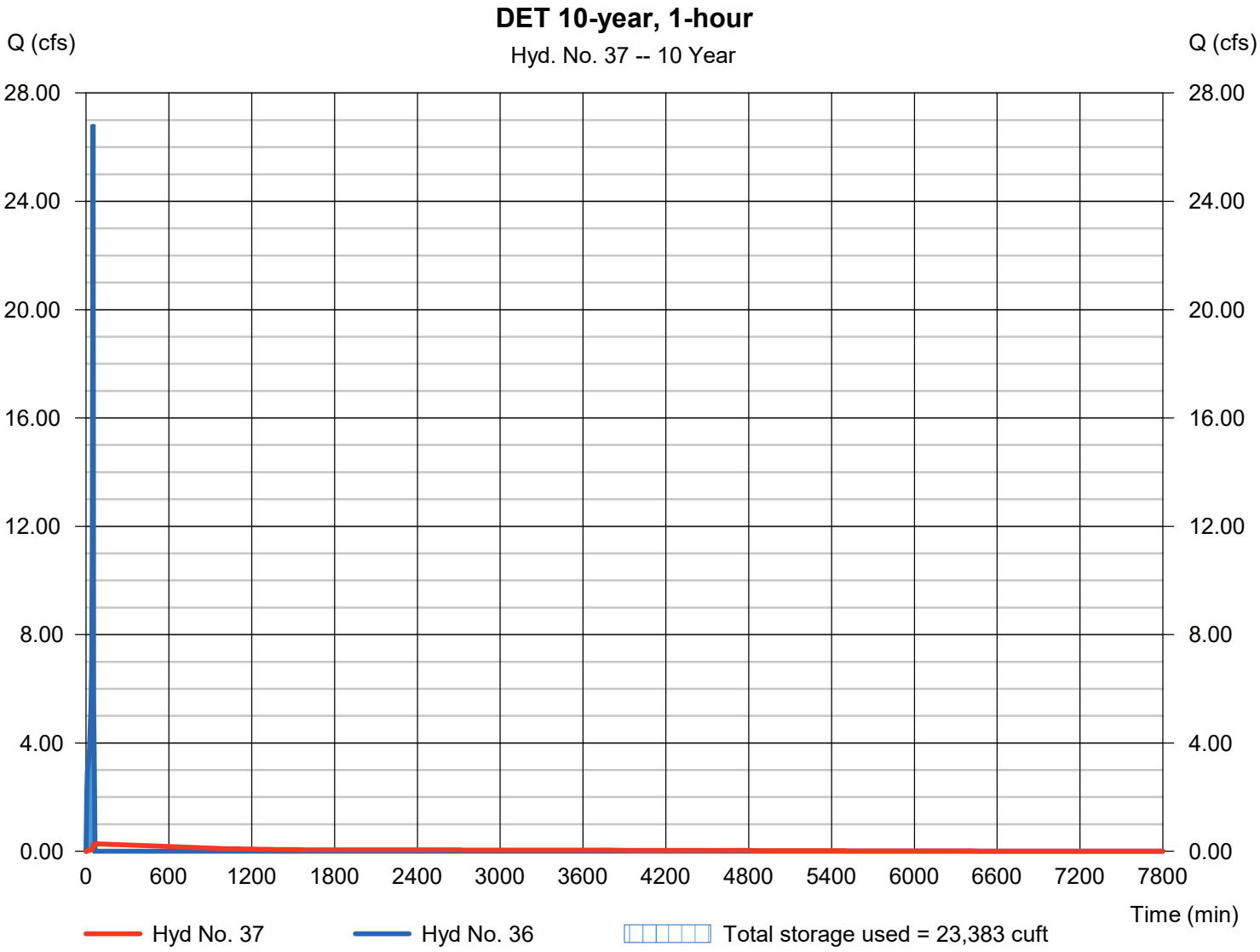
Hydrograph Report

Hyd. No. 37

DET 10-year, 1-hour

Hydrograph type	=	Reservoir	Peak discharge	=	0.272 cfs
Storm frequency	=	10 yrs	Time to peak	=	65 min
Time interval	=	5 min	Hyd. volume	=	23,616 cuft
Inflow hyd. No.	=	36 - Pr Site 10-year, 1-hour	Max. Elevation	=	102.26 ft
Reservoir name	=	DET-Site	Max. Storage	=	23,383 cuft

Storage Indication method used.

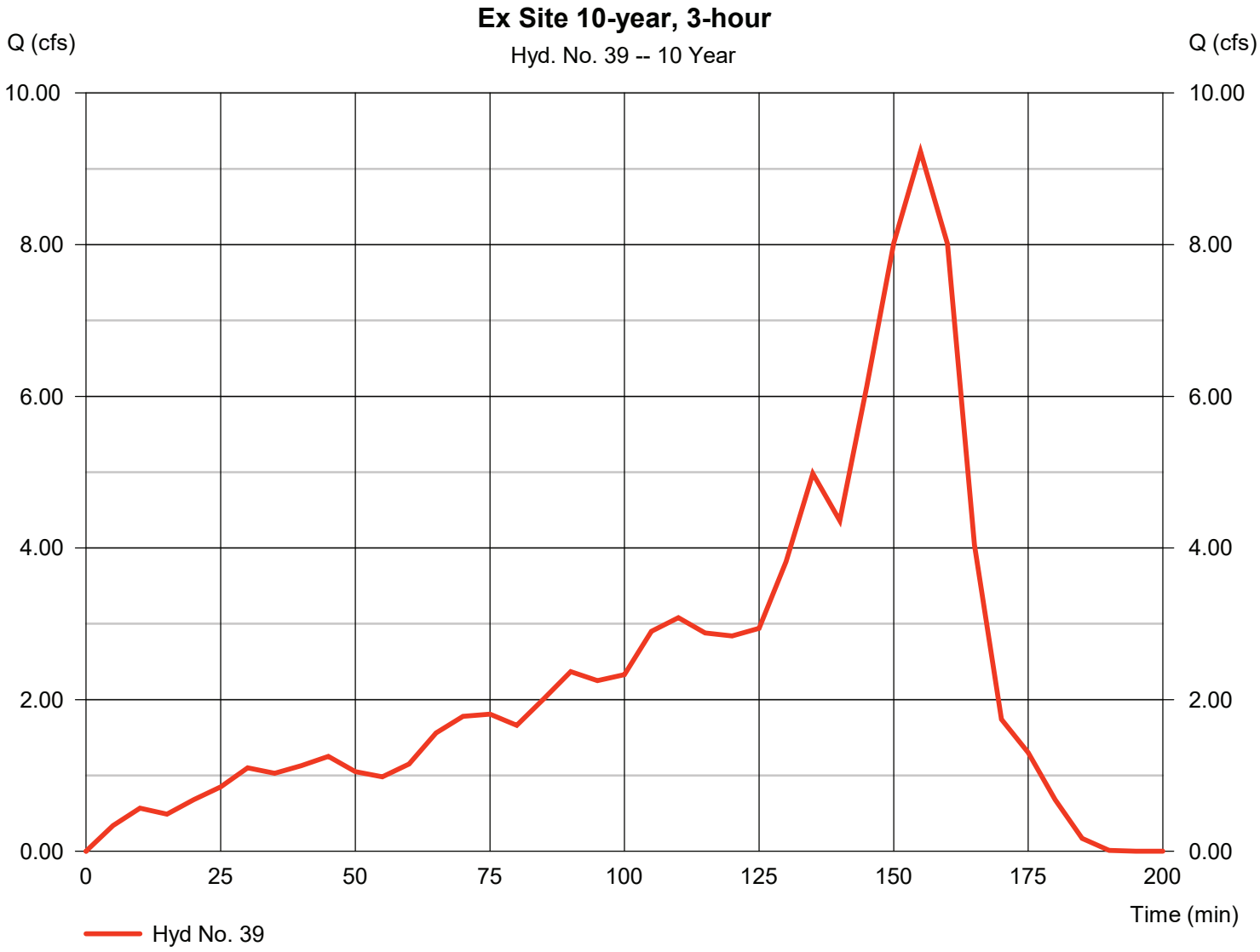


Hydrograph Report

Hyd. No. 39

Ex Site 10-year, 3-hour

Hydrograph type	= Manual	Peak discharge	= 9.230 cfs
Storm frequency	= 10 yrs	Time to peak	= 155 min
Time interval	= 5 min	Hyd. volume	= 28,056 cuft

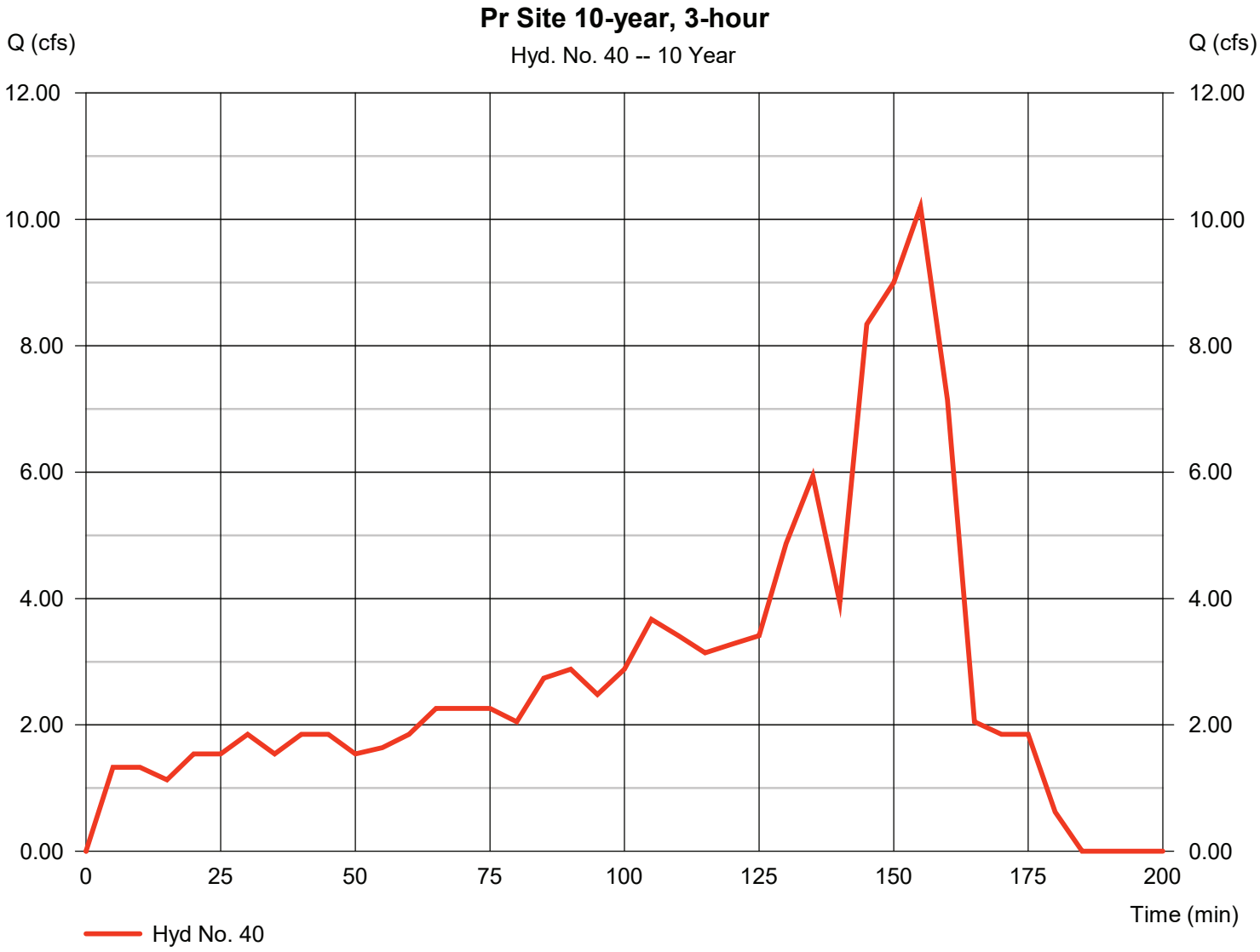


Hydrograph Report

Hyd. No. 40

Pr Site 10-year, 3-hour

Hydrograph type	= Manual	Peak discharge	= 10.20 cfs
Storm frequency	= 10 yrs	Time to peak	= 155 min
Time interval	= 5 min	Hyd. volume	= 33,453 cuft



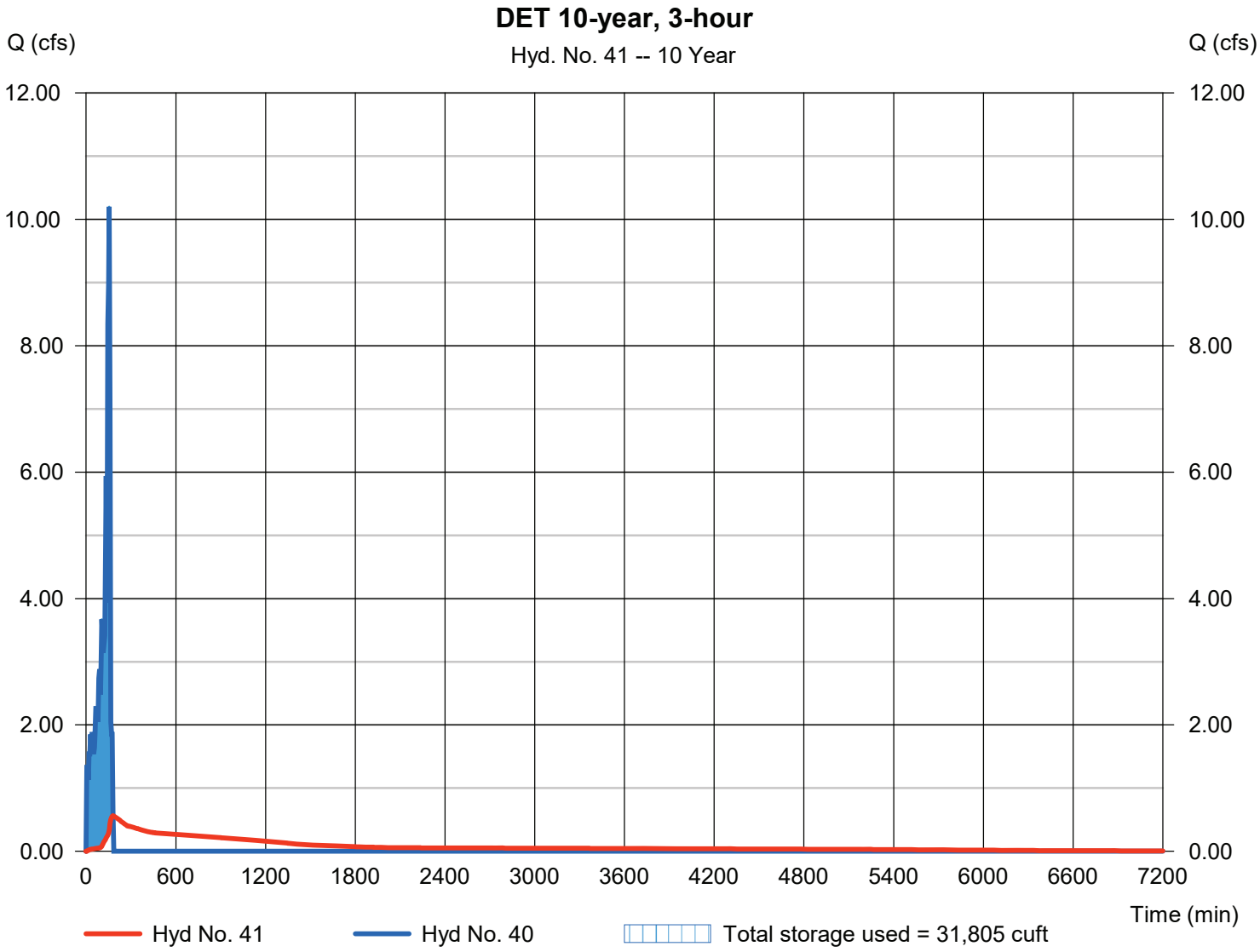
Hydrograph Report

Hyd. No. 41

DET 10-year, 3-hour

Hydrograph type	=	Reservoir	Peak discharge	=	0.561 cfs
Storm frequency	=	10 yrs	Time to peak	=	180 min
Time interval	=	5 min	Hyd. volume	=	33,330 cuft
Inflow hyd. No.	=	40 - Pr Site 10-year, 3-hour	Max. Elevation	=	102.96 ft
Reservoir name	=	DET-Site	Max. Storage	=	31,805 cuft

Storage Indication method used.

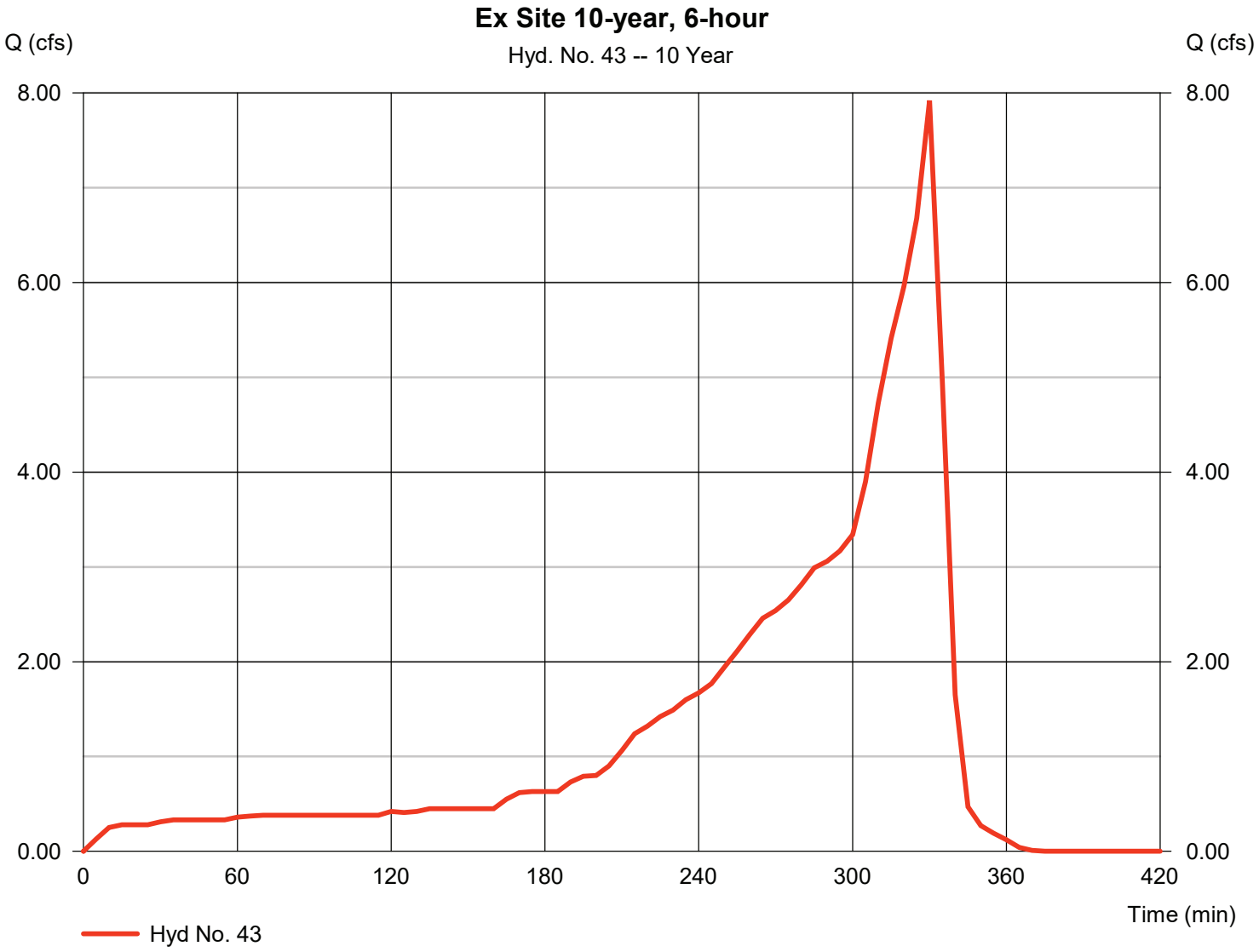


Hydrograph Report

Hyd. No. 43

Ex Site 10-year, 6-hour

Hydrograph type	= Manual	Peak discharge	= 7.920 cfs
Storm frequency	= 10 yrs	Time to peak	= 330 min
Time interval	= 5 min	Hyd. volume	= 30,351 cuft

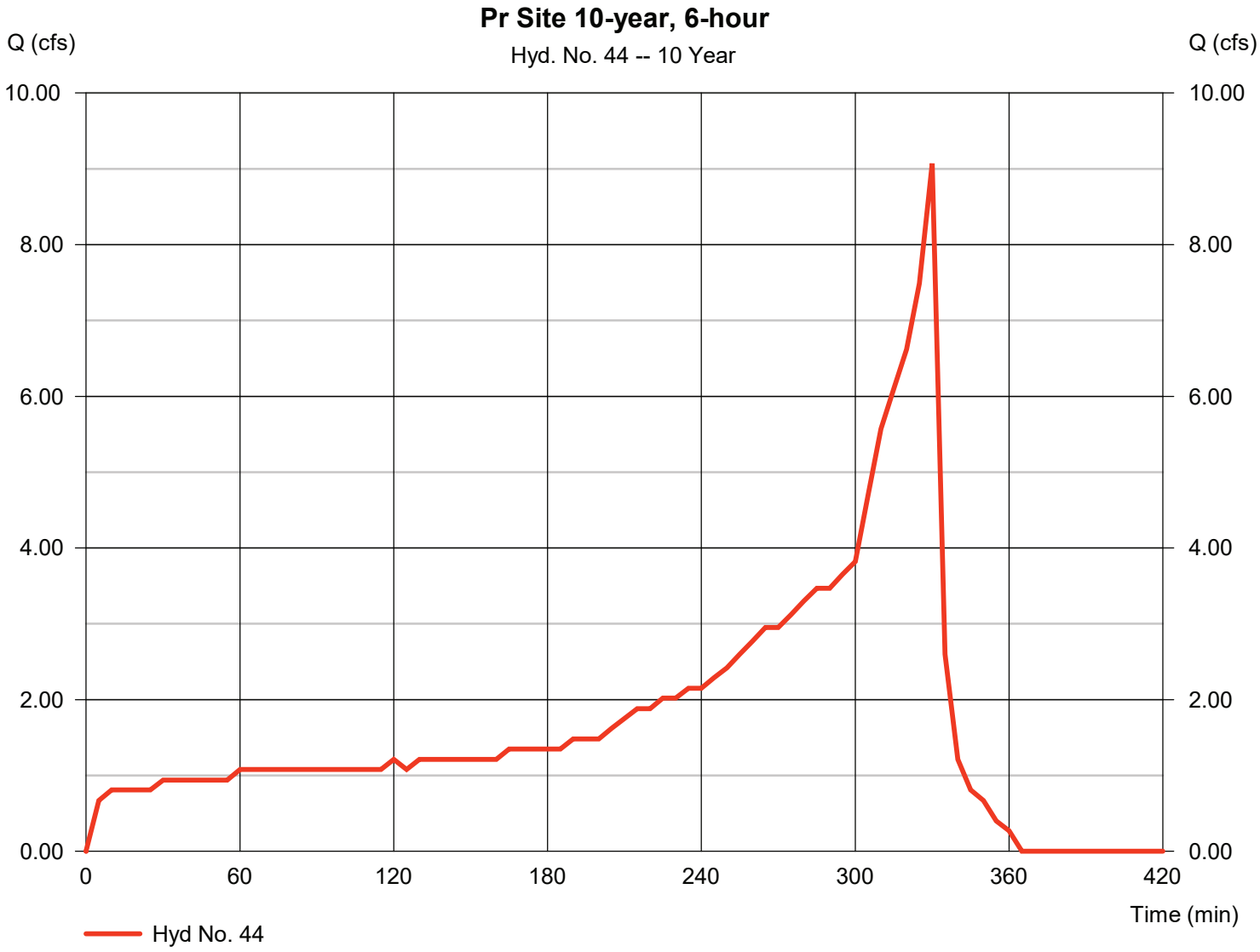


Hydrograph Report

Hyd. No. 44

Pr Site 10-year, 6-hour

Hydrograph type	= Manual	Peak discharge	= 9.070 cfs
Storm frequency	= 10 yrs	Time to peak	= 330 min
Time interval	= 5 min	Hyd. volume	= 42,675 cuft



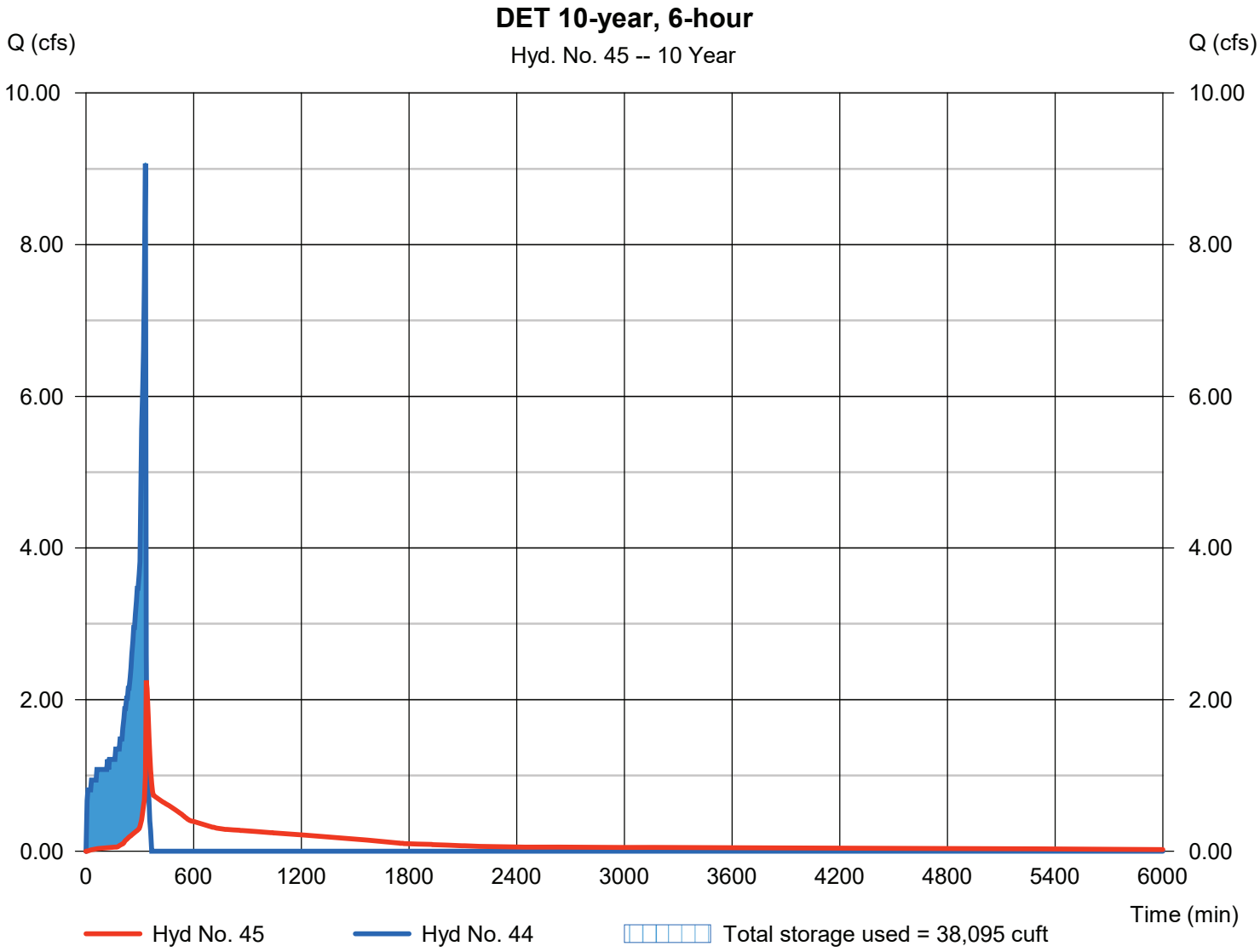
Hydrograph Report

Hyd. No. 45

DET 10-year, 6-hour

Hydrograph type	=	Reservoir	Peak discharge	=	2.252 cfs
Storm frequency	=	10 yrs	Time to peak	=	335 min
Time interval	=	5 min	Hyd. volume	=	42,552 cuft
Inflow hyd. No.	=	44 - Pr Site 10-year, 6-hour	Max. Elevation	=	103.60 ft
Reservoir name	=	DET-Site	Max. Storage	=	38,095 cuft

Storage Indication method used.

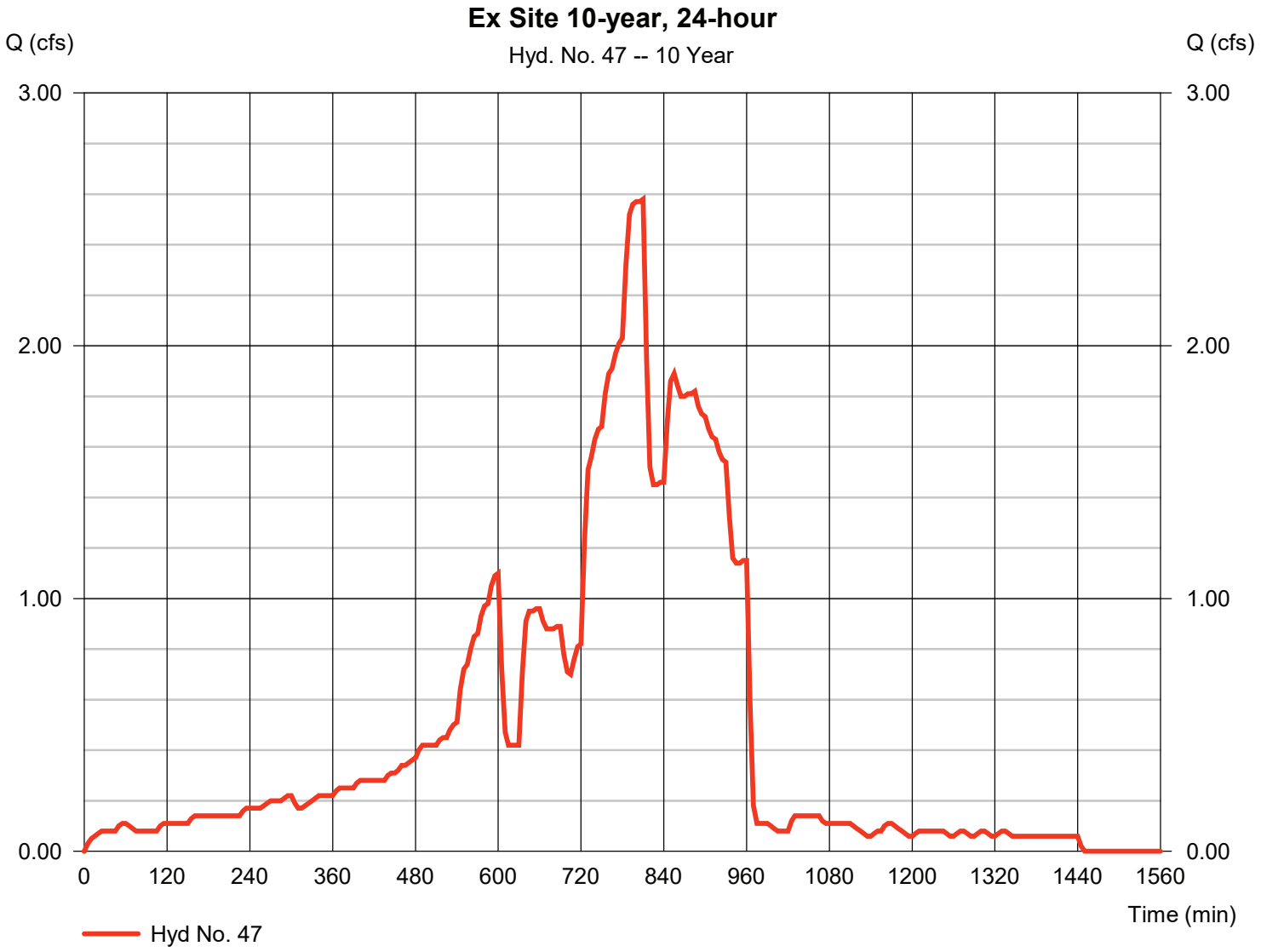


Hydrograph Report

Hyd. No. 47

Ex Site 10-year, 24-hour

Hydrograph type	= Manual	Peak discharge	= 2.580 cfs
Storm frequency	= 10 yrs	Time to peak	= 810 min
Time interval	= 5 min	Hyd. volume	= 43,035 cuft

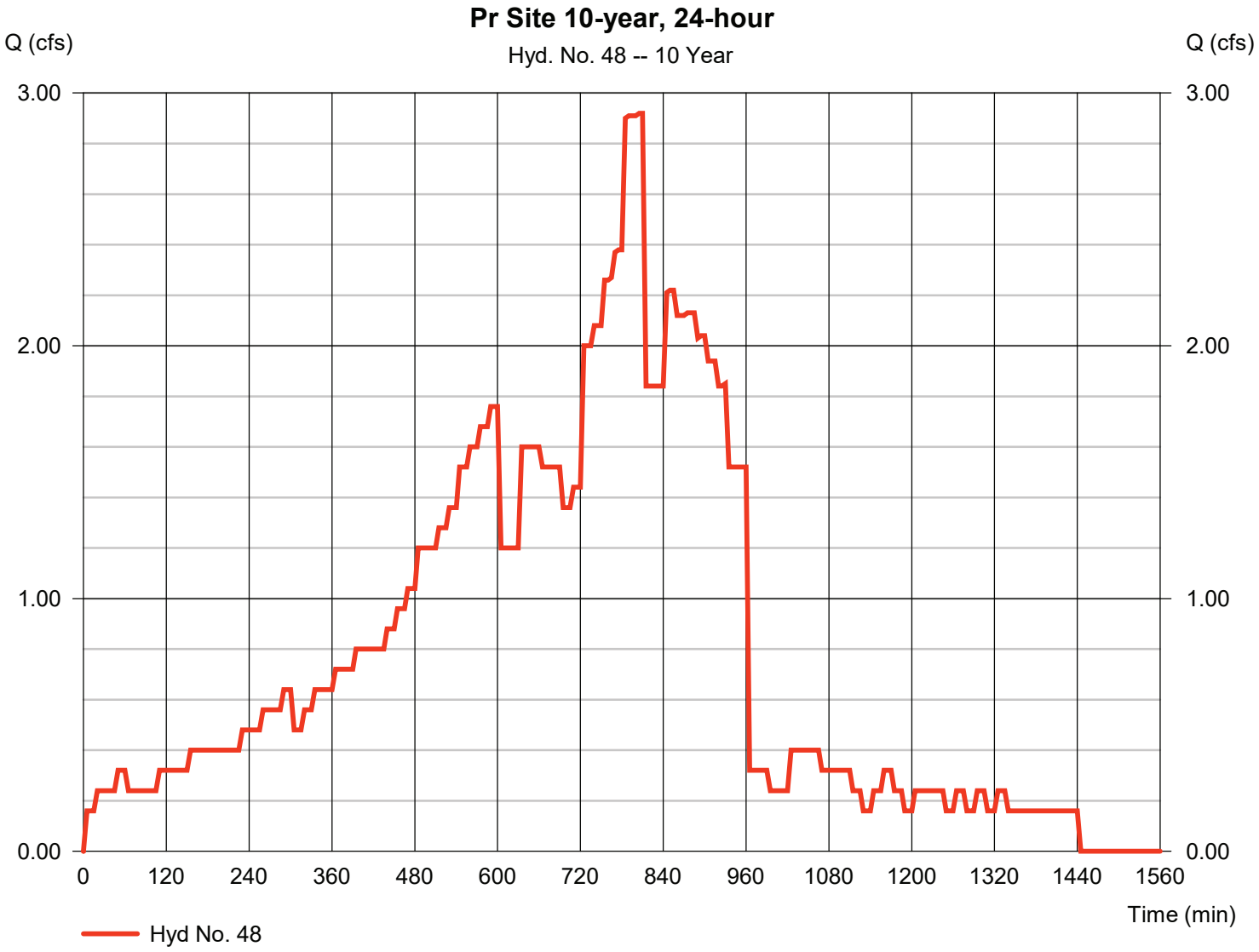


Hydrograph Report

Hyd. No. 48

Pr Site 10-year, 24-hour

Hydrograph type	= Manual	Peak discharge	= 2.920 cfs
Storm frequency	= 10 yrs	Time to peak	= 805 min
Time interval	= 5 min	Hyd. volume	= 72,603 cuft



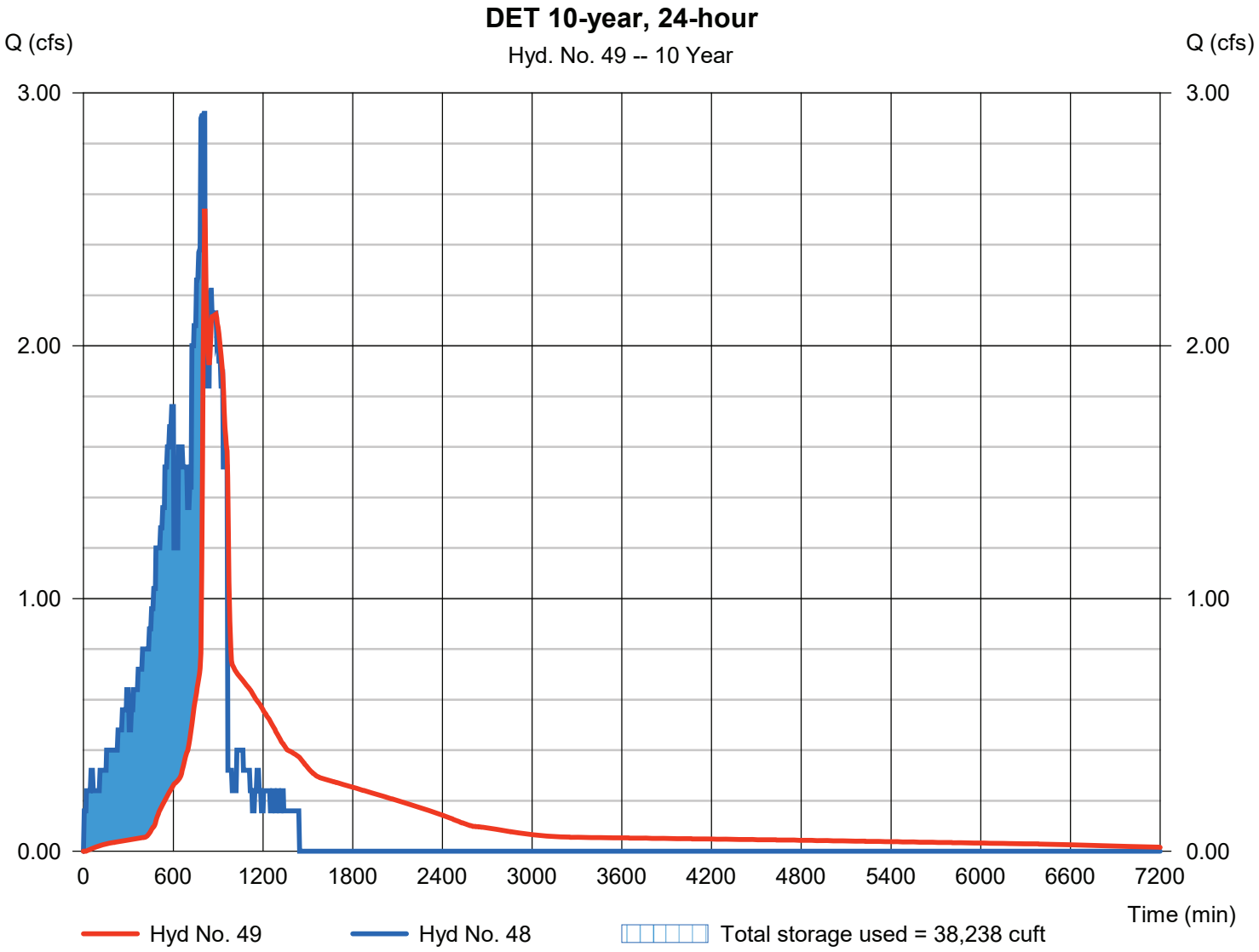
Hydrograph Report

Hyd. No. 49

DET 10-year, 24-hour

Hydrograph type	=	Reservoir	Peak discharge	=	2.542 cfs
Storm frequency	=	10 yrs	Time to peak	=	810 min
Time interval	=	5 min	Hyd. volume	=	72,480 cuft
Inflow hyd. No.	=	48 - Pr Site 10-year, 24-hour	Max. Elevation	=	103.62 ft
Reservoir name	=	DET-Site	Max. Storage	=	38,238 cuft

Storage Indication method used.



Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

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

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

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

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

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ I. **Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.)**	❑ **Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or run-off from area.** ❑ **Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults.** ❑ **Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.**	**Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains.** **Where appropriate, reference documentation of compliance with the requirements of Hazardous Materials Programs for:** ▪ **Hazardous Waste Generation** ▪ **Hazardous Materials Release Response and Inventory** ▪ **California Accidental Release (CalARP)** ▪ **Aboveground Storage Tank** ▪ **Uniform Fire Code Article 80 Section 103(b) & (c) 1991** ▪ **Underground Storage Tank** www.cchealth.org/groups/hazmat/	❑ **See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials " in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

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

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

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

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

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

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☒ N. **Fire Sprinkler Test Water**		☒ **Provide a means to drain fire sprinkler test water to the sanitary sewer.**	☒ **See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**
O. **Miscellaneous Drain or Wash Water or Other Sources** ☐ **Boiler drain lines** ☒ **Condensate drain lines** ☒ **Rooftop equipment** ☐ **Drainage sumps** ☒ **Roofing, gutters, and trim.** ☐ **Other sources**		☐ **Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system.** ☒ **Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system.** ☐ **Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment.** ☐ **Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water.** ☒ **Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.** **Include controls for other sources as specified by local reviewer.**	

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

Appendix 9: O&M

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

Recorded at the request of: COUNTY
OF RIVERSIDE TRANSPORTATION
DEPARTMENT

THIS INSTRUMENT IS FOR THE BENEFIT
OF THE COUNTY OF RIVERSIDE AND
ENTITLED TO BE RECORDED WITHOUT
FEE.(GOV. CODE 6103)

RETURN TO:
RIVERSIDE COUNTY TRANSPORTATION
DEPARTMENT.
4080 Lemon Street, 8th Floor
Riverside, CA 92501

COVENANT AND AGREEMENT REGARDING WATER QUALITY MANAGEMENT PLAN BMP, CONSENT TO INSPECT, MAINTENANCE AND INDEMNIFICATION

APN:_____ PROJECT No._____ IP No._____

OWNER(S):_____

PROPERTY ADDRESS:_____

LEGAL DESCRIPTION:_____
:_____
:_____

THIS AGREEMENT is made and entered into in Riverside County, California, this _____ day of _____ Year_____, by and between_____
_____
(hereinafter referred to as "Covenantor" or "Owner") and the COUNTY OF RIVERSIDE via its Department of Transportation, a political subdivision of the State of California (hereinafter referred to as "County"). The Covenantor and County may collectively be known as "Parties" or individually as "Part.

RECITALS

WHEREAS, the Covenantor owns real property ("Property") in the County of Riverside, State of California, more specifically described in Exhibit "A" and depicted in Exhibit "B", each of these exhibits is attached, and incorporated herein by this reference;

WHEREAS, the County is the owner of interests in that certain real property within the unincorporated area of the County of Riverside, State of California, containing storm drains, pipelines, and related appurtenances constituting the County's municipal separate storm sewer system (the County's "MS4");

WHEREAS, Covenantor intends to develop, improve, and/or use the Property in such a way that approval by the County for such development, improvement, and/or use is required pursuant to applicable laws;

WHEREAS, As a condition for said approval by the County, County required Covenantor, and Covenantor desires to, restrict the use of the Property according to the conditions, covenants, equitable servitudes, and restrictions contained herein for the express benefit of the County's MS4, which include requirements that the Property incorporate post construction on-site stormwater quality control measures;

WHEREAS, the Covenantor/Owner has chosen to install one or more _____ _____ hereinafter referred to as "Device", as the on-site control measure to minimize pollutants in urban runoff;

WHEREAS, said Device has been installed in accordance with plans and specifications accepted by the County;

WHEREAS, said Device, with installation on private property is a private facility with all maintenance or replacement, therefore, the sole responsibility of the Covenantor/Owner in accordance with the terms of this Agreement;

WHEREAS, the Covenantor/Owner is aware that periodic and continuous maintenance, including, but not necessarily limited to, filter material replacement and sediment removal, is required to assure peak performance of Device and that, furthermore, such maintenance activity will require compliance with all Local, State, or Federal laws and regulations, including those pertaining; to confined space and waste disposal methods, in effect at the time such maintenance occurs;

NOW THEREFORE, incorporating the foregoing Recitals and in consideration of the covenants and conditions contained herein, and for other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, and expressly for the benefit of, and to bind, their sucessors in interest, the Parties hereto agree as follows:

1. Covenantor/Owner hereby provides the County or County's designee complete access to the Device and its immediate vicinity and such access onto the property to permit access to the devise at any time, upon twenty-four *(24)* hour advance notice in writing, of any duration for the purpose of inspection, sampling and testing of the Device. County shall make every effort at all times to minimize or avoid interference with Owner's use of the Property.

2. Covenantor/Owner shall use its best efforts diligently to maintain the Device in a manner assuring peak performance at all times. All reasonable precautions shall be exercised by Owner and Owner's representative or contractor in the removal and extraction of material(s) from the Device and the ultimate disposal of the material(s) in a manner consistent with all relevant laws and regulations in effect at the time. As may be requested

from time to time by the County / Regional Water Quality Control Board (RWQCB), the Owner shall provide the RWQCB with documentation identifying the material(s) removed, the quantity, and disposal destination.

3. In the event Covenantor/Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this Agreement, within five (5) days of being given written notice by the County, the County is hereby authorized to cause any maintenance necessary to be done and charge the entire cost and expense to the Owner or Owner's successors or assigns, including administrative costs and interest thereon at the maximum rate authorized by the Civil Code from the date of notice of expense until paid in full.

4. The County may require the Covenantor/Owner to post security in a form and for a time period satisfactory to the County to guarantee the performance of the obligations stated herein. Should the Owner fail to perform the obligations under this Agreement, the County may, in the case of a cash deposit, certificate of deposit or letter of credit, act for the Owner using the proceeds from it, or in the case of a surety bond, require the sureties to perform the obligations of the Agreement.

5. The County may, but shall not be obligated to, enforce this Agreement by a proceeding at law or in equity against any person or persons violating or attempting to violate any condition, covenant, equitable servitude, or restriction provided for herein, either to restrain such violation or to recover damages.

6. This Agreement constitutes the entire agreement and understanding between the Parties with respect to the subject matter of this Agreement and supersedes all prior or contemporaneous agreements and understandings with respect to the subject matter hereof, whether oral or written.

7. If any part of this Agreement is declared by a final decision of a court of competent jurisdiction to be invalid for any reason, such shall not affect the validity of the rest of the Agreement. The other parts of this Agreement shall remain in effect as if this Agreement had been executed without the invalid parts(s). The Parties declare that they intend and desire that the remaining parts of this Agreement continue to be effective without any part(s) that have been declared invalid.

8. This Agreement may be executed in counterparts, each of which so executed shall, irrespective of the date of its execution and delivery, be deemed an orginal, and all such counterparts together shall constitute one and the same instrument.

9. This Agreement shall be recorded in the Office of the Recorder of Riverside County, California and shall constitute notice to all successors and assigns of the title to said Property of the obligation herein set forth.

10. In the event of legal action occasioned by any default or action of the Covenantor/Owner, or its successors or assigns, then the Covenantor/Owner and its

successors or assigns agree(s) to pay all costs incurred by the County in enforcing the terms of this Agreement, including reasonable attorney's fees and costs, and that the same shall become a part of the lien against said Property.

11. Covenantor/Owner agrees to indemnify, defend, and hold harmless the County, its elected officers, employees, agents, and contractors from and against any and all liability, expense, including costs and reasonable legal fees, and claims of damage of any nature whatsoever including, but not limited to, death, bodily injury, personal injury, or property damage arising from or connected with the County inspection of the Property except where such liability, expense, or claim for damage results from the sole negligence or willful misconduct of the County.

12. It is the intent of the Parties hereto that burdens and benefits herein undertaken shall constitute covenants that run with said Property and constitute a lien thereon against.

13. The obligations herein undertaken shall be binding upon the heirs, successors, executors, administrators and assigns of the Parties hereto and any other present or future interest holders or estate holders in the property. The term "Owner" shall include not only the present Owner, but also its heirs, successors in interest and in title to the property, executors, administrators, and assigns. Owner shall notify any successor to title of all or part of the Property about the existence of this Agreement. Owner shall provide such notice prior to such successor obtaining an interest in all or part of the Property. Owner shall provide a copy of such notice to the County at the same time such notice is provided to the successor. Notwithstanding the foregoing, and subject to Section 12, subsequent to any sale of the Property, the prior owner of the property shall be released of any liability thereafter accruing for the breach of the agreement.

14. Time is of the essence in the performance of this Agreement.

/ / /
/ / /
/ / /
/ / /
/ / /
/ / /
/ / /
/ / /
/ / /
/ / /
/ / /
/ / /
/ / /
/ / /
/ / /
/ / /
/ / /

15. Any notice to a Party required or called for in this Agreement shall be served in person, or by deposit in the U.S. Mail, first class postage prepaid, to the address set forth below. Notice(s) shall be deemed effective upon receipt, or seventy-two *(72)* hours after deposit in the U.S. Mail, whichever is earlier. A Party may change a notice address only by providing written notice thereof to the other Party.

COVENANTOR/OWNER:

COUNTY:

Riverside County Department of Transportation
Attn: Transportation Director
4080 Lemon Street, 8th Floor
Riverside, CA

COUNTY OF RIVERSIDE
TRANSPORTATION DEPARTMENT

_____ _____
Date

Director of Transportation

_____
(Attest) Date

_____
(Print Name)

_____
(Print Title)

COVENANTOR/OWNER

_____
Signature

_____
Company/Corporation/Partnership

_____
(Print Name)

_____
(Print Title)

Attach Notary

Technical Note

TN 6.01 Retention/Detention System Maintenance

This document is provided for informational purposes only and is meant only to be a guide. Individuals using this information should make their own decisions as to suitability of this guideline for their individual projects and adjust accordingly.

Introduction

A retention/detention system is comprised of a series of pipes and fittings that form an underground storage area, which retains or detains storm water runoff from a given area. As sediment and debris settle out of the detained stormwater, build up occurs that requires the system to be regularly inspected and cleaned in order for the system to perform as originally designed. The following provides the available fittings and guidelines for inspection and maintenance of an HDPE underground storage system.

System Accessories and Fittings

Concentric Reducers

Concentric Reducers are fittings that transition between two pipes, either in line with one another or at perpendicular angles. The centerlines of the two pipes are at the same elevation. When a concentric reducer is used to connect the manifold pipe to the lateral pipes, most debris will be trapped in the manifold pipe.



Eccentric Reducers

Eccentric Reducers are fittings that transition between two pipes, either in line with one another or at perpendicular angles. The inverts of the two pipes are at the same elevations. When an eccentric reducer is used to connect the manifold pipe to the lateral pipes, most debris will follow the flow of the storm water into the lateral pipes.

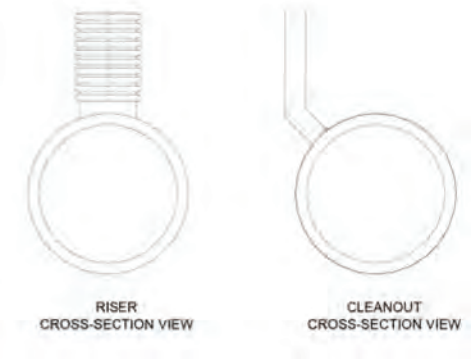


Riser

Each retention/detention system typically has risers strategically placed for maintenance and inspection of the system. These risers are typically 24" (600 mm) in diameter or larger and are placed on the manifold fittings.

Cleanouts

Cleanout ports are usually 4" (100 mm), 6" (150 mm), or 8" (200 mm) in diameter pipe and are placed on the manifold fittings. They are used for entrance of a pipe from a vacuum truck or a water-jetting device.
For a complete listing of available fittings and components please refer to the *ADS Fittings Manual.*



Maintenance Overview of a Retention/Detention System

Maintaining a clean and obstruction-free retention/detention system helps to ensure the system performs the intended function of the primary design. Build up of debris may obstruct flow through the laterals in a retention system or block the entranceway of the outlet pipe in a detention system. This may result in ineffective operation or complete failure of the system. Additionally, surrounding areas may potentially run the risk of damage due to flooding or other similar issues.

Inspection/Maintenance Frequency

Concentric Reducers are fittings that transition between two pipes, either in line with one another or at perpendicular angles. The centerlines of the two pipes are at the same elevation. When a concentric reducer is used to connect the manifold pipe to the lateral pipes, most debris will be trapped in the manifold pipe.

Pre-Inspection

A post-installation inspection should be performed to allow the owner to measure the invert prior to accumulation of sediment. This survey will allow the monitoring of sediment build-up without requiring access to the retention/detention system.

The following is the recommended procedure for pre-inspections:

1. Locate the riser section or cleanouts of the retention/detention system. The riser will typically be 24" (600 mm) in diameter or larger and the cleanouts are usually 4" (100 mm), 6" (150 mm) or 8" (200 mm) in diameter.
2. Remove the lid of the riser or clean outs.
3. Insert a measuring device into the opening and make note to a point of reference on the stick or string. (This is done so that sediment build up can be determined in the future without having to enter the system.)

Inspection/Maintenance

A retention/detention system should be inspected at a minimum of one time a year or after major rain events if necessary.

The following is the recommended procedure to inspect system in service:

1. Locate the riser section of the retention/detention system. The riser will typically be 24" (600 mm) in diameter or larger. Remove the lid of the riser or clean outs.
2. Remove the lid from the riser.
3. Measure the sediment buildup at each riser and cleanout location. Only certified confined space entry personnel having appropriate equipment should be permitted to enter the retention/detention System.
4. Inspect each manifold, all laterals, and outlet pipes for sediment build up, obstructions, or other problems. Obstructions should be removed at this time.
5. If measured sediment build up is between 5% - 20% of the pipe diameter, cleaning should be considered; if sediment build up exceeds 20%, cleaning should be performed at the earliest opportunity. A thorough cleaning of the system (manifolds and laterals) shall be performed by either manual methods or by a vacuum truck.

adspipe.com
800-821-6710

ADS "Terms and Conditions of Sale" are available on the ADS website, www.adspipe.com. The ADS logo and the Green Stripe are registered trademarks of Advanced Drainage Systems, Inc. StormTech® is a registered trademark of StormTech, Inc.
© 2022 Advanced Drainage Systems, Inc. 05/22 TN 6.01 AB

Bio Clean

A Forterra Company

Modular Wetlands® Linear

A Stormwater Biofiltration Solution

OPERATION & MAINTENANCE MANUAL

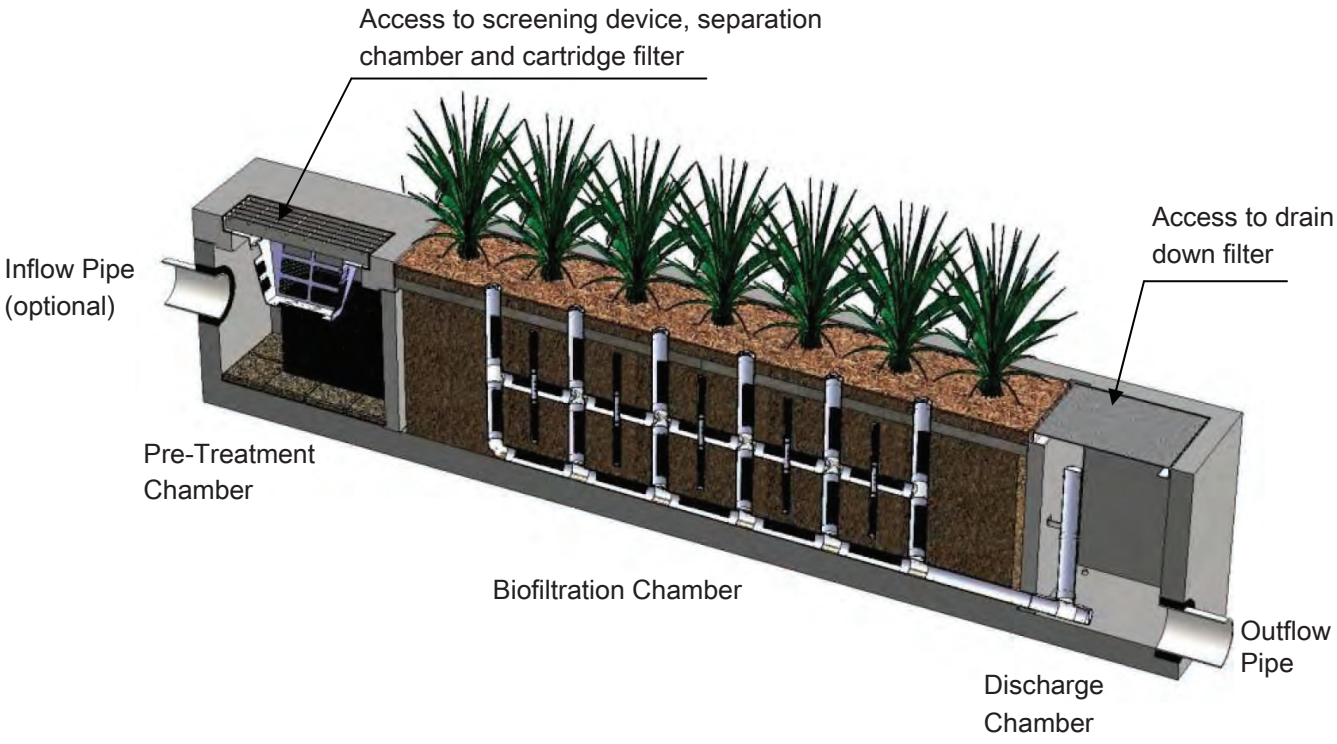


Maintenance Guidelines for Modular Wetlands Linear

Maintenance Summary

- Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
  - (*5 minute average service time*).
- Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
  - (*10 minute average service time*).
- Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
  - (*10-15 minute per cartridge average service time*).
- Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
  - (*5 minute average service time*).
- Trim Vegetation – average maintenance interval is 6 to 12 months.
  - (*Service time varies*).

System Diagram



Maintenance Procedures

Screening Device

1. Remove grate or manhole cover to gain access to the screening device in the Pre-Treatment Chamber. Vault type units do not have screening device. Maintenance can be performed without entry.
2. Remove all pollutants collected by the screening device. Removal can be done manually or with the use of a vacuum truck. The hose of the vacuum truck will not damage the screening device.
3. Screening device can easily be removed from the Pre-Treatment Chamber to gain access to separation chamber and media filters below. Replace grate or manhole cover when completed.

Separation Chamber

1. Perform maintenance procedures of screening device listed above before maintaining the separation chamber.
2. With a pressure washer spray down pollutants accumulated on walls and cartridge filters.
3. Vacuum out Separation Chamber and remove all accumulated pollutants. Replace screening device, grate or manhole cover when completed.

Cartridge Filters

1. Perform maintenance procedures on screening device and separation chamber before maintaining cartridge filters.
2. Enter separation chamber.
3. Unscrew the two bolts holding the lid on each cartridge filter and remove lid.
4. Remove each of 4 to 8 media cages holding the media in place.
5. Spray down the cartridge filter to remove any accumulated pollutants.
6. Vacuum out old media and accumulated pollutants.
7. Reinstall media cages and fill with new media from manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase.
8. Replace the lid and tighten down bolts. Replace screening device, grate or manhole cover when completed.

Drain Down Filter

1. Remove hatch or manhole cover over discharge chamber and enter chamber.
2. Unlock and lift drain down filter housing and remove old media block. Replace with new media block. Lower drain down filter housing and lock into place.
3. Exit chamber and replace hatch or manhole cover.

Maintenance Notes

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.

2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.

3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.

4. Entry into chambers may require confined space training based on state and local regulations.

5. No fertilizer shall be used in the Biofiltration Chamber.

6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may require irrigation.

Maintenance Procedure Illustration

Screening Device

The screening device is located directly under the manhole or grate over the Pre-Treatment Chamber. It's mounted directly underneath for easy access and cleaning. Device can be cleaned by hand or with a vacuum truck.



Separation Chamber

The separation chamber is located directly beneath the screening device. It can be quickly cleaned using a vacuum truck or by hand. A pressure washer is useful to assist in the cleaning process.

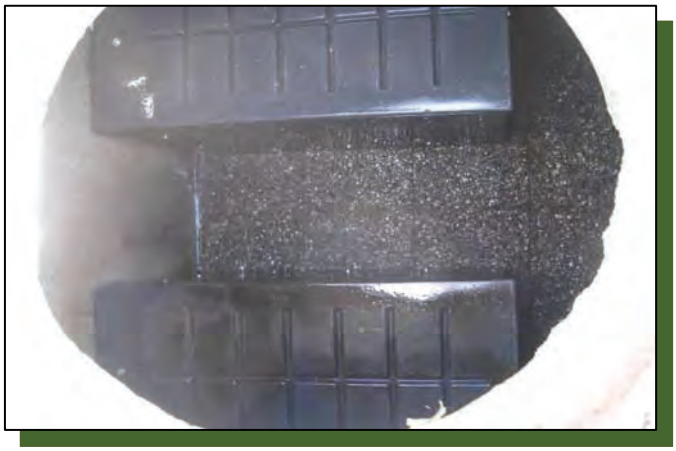






Cartridge Filters

The cartridge filters are located in the Pre-Treatment chamber connected to the wall adjacent to the biofiltration chamber. The cartridges have removable tops to access the individual media filters. Once the cartridge is open media can be easily removed and replaced by hand or a vacuum truck.







Drain Down Filter

The drain down filter is located in the Discharge Chamber. The drain filter unlocks from the wall mount and hinges up. Remove filter block and replace with new block.

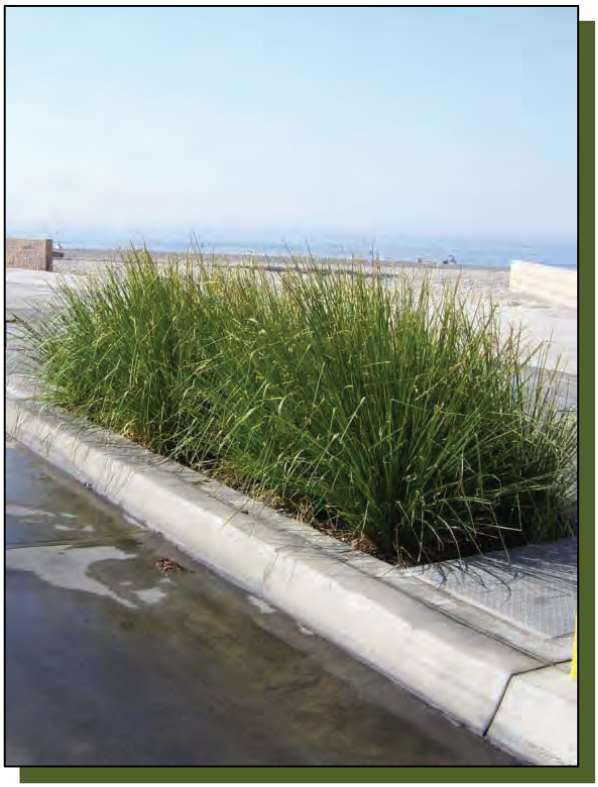


Trim Vegetation

Vegetation should be maintained in the same manner as surrounding vegetation and trimmed as needed. No fertilizer shall be used on the plants. Irrigation per the recommendation of the manufacturer and or landscape architect. Different types of vegetation requires different amounts of irrigation.









Inspection Report
Modular Wetlands Linear

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ___/___/___ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): _____ Size (22', 14' or etc.): _____

Structural Integrity:	**Yes**	**No**	**Comments**
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?			
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?			
Working Condition:			
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?			
Is there standing water in inappropriate areas after a dry period?			
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?			
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes, specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.			Depth:
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber:
Any signs of improper functioning in the discharge chamber? Note issues in comments section.			
Other Inspection Items:			
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?			
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.			
Is there a septic or foul odor coming from inside the system?			

Waste:	**Yes**	**No**
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes:

Cleaning and Maintenance Report
Modular Wetlands Linear

Project Name _____

Project Address _____ (city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:	MWS Catch Basins						
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:

Appendix 10: Educational Materials

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

Outdoor Loading/Unloading SC-30



Objectives

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

Description

The loading/unloading of materials usually takes place outside on docks or terminals; therefore, materials spilled, leaked, or lost during loading/unloading may collect in the soil or on other surfaces and have the potential to be carried away by stormwater runoff or when the area is cleaned. Additionally, rainfall may wash pollutants from machinery used to unload or move materials. Loading and unloading of material may include package products, barrels, and bulk products. Implementation of the following protocols will prevent or reduce the discharge of pollutants to stormwater from outdoor loading/unloading of materials.

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Approach

Pollution Prevention

- Keep accurate maintenance logs to evaluate materials removed and improvements made.
- Park tank trucks or delivery vehicles in designated areas so that spills or leaks can be contained.
- Limit exposure of materials with the potential to contaminate stormwater.
- Prevent stormwater runon.
- Regularly check equipment for leaks.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

Suggested Protocols

Loading and Unloading – General Guidelines

- Develop an operations plan that describes procedures for loading and/or unloading.
- Do not conduct loading and unloading during wet weather, whenever possible.
- Cover designated loading/unloading areas to reduce exposure of materials to rain.
- A seal or door skirt between delivery vehicles and building can reduce or prevent exposure to rain.
- Design loading/unloading area to prevent stormwater runon which would include grading or berming the area, and positioning roof downspouts so they direct stormwater away from the loading/unloading areas.
- If feasible, load and unload all materials and equipment in covered areas such as building overhangs at loading docks.
- Load/unload only at designated loading areas.
- Use drip pans underneath hose and pipe connections and other leak-prone spots during liquid transfer operations, and when making and breaking connections. Several drip pans should be stored in a covered location near the liquid transfer area so that they are always available, yet protected from precipitation when not in use. Drip pans can be made specifically for railroad tracks. Drip pans must be cleaned periodically, and drip collected materials must be disposed of properly.
- Pave loading areas with concrete instead of asphalt.
- Avoid placing storm drains in the area.
- Grade and/or berm he loading/ unloading area to a drain that is connected to a dead-end sump.

Inspection

- Check loading and unloading equipment regularly for leaks, including valves, pumps, flanges and connections.
- Look for dust or fumes during loading or unloading operations.

Training

- Train employees (e.g. fork lift operators) and contractors on proper spill containment and cleanup.
- Employees trained in spill containment and cleanup should be present during the loading/unloading.
- Train employees in proper handling techniques during liquid transfers to avoid spills.

- Make sure forklift operators are properly trained on loading and unloading procedures.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Keep your spill prevention Control and countermeasure (SPCC) Plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- Space, material characteristics and/or time limitations may preclude all transfers from being performed indoors or under cover.

Requirements

Costs

- Should be low except when covering a large loading/unloading area.

Maintenance

- Conduct regular inspections and make repairs as necessary. The frequency of repairs will depend on the age of the facility.
- Check loading and unloading equipment regularly for leaks.
- Regular broom dry-sweeping of area.
- Conduct major clean-out of loading and unloading area and sump prior to October 1 of each year.

Supplemental Information

Further Detail of the BMP

Special Circumstances for Indoor Loading/Unloading of Materials

As appropriate loading or unloading of liquids should occur indoors so that any spills that are not completely retained can be discharged to the sanitary sewer, treatment plant, or treated in a manner consistent with local sewer authorities and permit requirements.

- For loading and unloading tank trucks to above and below ground storage tanks, the following procedures should be used:
  - The area where the transfer takes place should be paved. If the liquid is reactive with the asphalt, Portland cement should be used to pave the area.
  - Transfer area should be designed to prevent runon of stormwater from adjacent areas. Sloping the pad and using a curb, like a speed bump, around the uphill side of the transfer area should reduce run-on.

- Transfer area should be designed to prevent runoff of spilled liquids from the area. Sloping the area to a drain should prevent runoff. The drain should be connected to a dead-end sump or to the sanitary sewer (if allowed). A positive control valve should be installed on the drain.

- For transfer from rail cars to storage tanks that must occur outside, use the following procedures:

  - Drip pans should be placed at locations where spillage may occur, such as hose connections, hose reels, and filler nozzles, Use drip pans when making and breaking connections.

  - Drip pan systems should be installed between the rails to collect spillage from tank cars.

References and Resources

http://www.stormwatercenter.net/

King County - ftp://dnr.metrokc.gov/wlr/dss/spcm/Chapter%203.PDF

Orange County Stormwater Program
http://www.ocwatersheds.com/StormWater/swp_introduction.asp

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP) -
http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf

Drainage System Maintenance SC-44



Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and stormwater that may contain certain pollutants. The protocols in this fact sheet are intended to reduce pollutants reaching receiving waters through proper conveyance system operation and maintenance.

Targeted Constituents

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

Approach

Pollution Prevention

Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Suggested Protocols

Catch Basins/Inlet Structures

- Staff should regularly inspect facilities to ensure compliance with the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC34 Waste Handling and Disposal).

CASQA California Stormwater Quality Association

- Clean catch basins, storm drain inlets, and other conveyance structures before the wet season to remove sediments and debris accumulated during the summer.
- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed. Do not dewater near a storm drain or stream.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect and pump flushed effluent to the sanitary sewer for treatment whenever possible.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge to reach the storm drain system when cleaning a storm drain pump station or other facility.
- Conduct routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

Open Channel

- Modify storm channel characteristics to improve channel hydraulics, increase pollutant removals, and enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a Steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies (SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS.

Illicit Connections and Discharges

- Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:
  - Is there evidence of spills such as paints, discoloring, etc?

- Are there any odors associated with the drainage system?
- Record locations of apparent illegal discharges/illicit connections?
- Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
- Eliminate the discharge once the origin of flow is established.

- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

- Inspect and clean up hot spots and other storm drainage areas regularly where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties
- Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Allow only properly trained individuals to handle hazardous materials/wastes.
- Have staff involved in detection and removal of illicit connections trained in the following:
  - OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).

- OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).

- Procedural training (field screening, sampling, smoke/dye testing, TV inspection).

Spill Response and Prevention

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- Clean up all spills and leaks using "dry" methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.
- Refer to fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Other Considerations (Limitations and Regulations)

- Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.
- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and prohibition against disposal of flushed effluent to sanitary sewer in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget.
- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The primary cost is for staff time. Cost depends on how aggressively a program is implemented. Other cost considerations for an illegal dumping program include:

  - Purchase and installation of signs.

  - Rental of vehicle(s) to haul illegally-disposed items and material to landfills.

  - Rental of heavy equipment to remove larger items (e.g., car bodies) from channels.

  - Purchase of landfill space to dispose of illegally-dumped items and material.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.

Supplemental Information

Further Detail of the BMP

Storm Drain Flushing

Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in storm drainage systems. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as an open channel, another point where flushing will be initiated, or the sanitary sewer and the treatment facilities, thus preventing resuspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. Deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, thereby releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce impacts of stormwater pollution, a second inflatable device placed well downstream may be used to recollect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to recollect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75% for organics and 55-65% for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm sewer flushing.

References and Resources

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

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

Ferguson, B.K. 1991. Urban Stream Reclamation, p. 324-322, Journal of Soil and Water Conservation.

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

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

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

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

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line:
http://www.epa.gov/npdes/menuofbmps/poll_16.htm

Site Design & Landscape Planning SD-10



Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- ☑ Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.
- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.
- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.
- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.
- Promote natural vegetation by using parking lot islands and other landscaped areas.
- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.
- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of “ redevelopment” must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under “designing new installations” above should be followed.

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Efficient Irrigation SD-12



Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Storm Drain Signage SD-13



Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include “NO DUMPING

– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Trash Storage Areas SD-32

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Street Sweeping and Vacuuming SE-7



Objectives

EC	Erosion Control	
SE	Sediment Control	✓
TC	Tracking Control	✓
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents

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

Potential Alternatives

None

Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

Limitations

Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.

- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.
- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from $58/hour (3 yd^3 hopper) to $88/hour (9 yd^3 hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- When actively in use, points of ingress and egress must be inspected daily.
- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- Adjust brooms frequently; maximize efficiency of sweeping operations.
- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Department of Transportation (Caltrans), April 1, 2002 – March 31, 2003.

Bioretention TC-32



Maintenance Concerns, Objectives, and Goals

- Clogged Soil or Outlet Structures
- Invasive Species
- Vegetation/Landscape Maintenance
- Erosion
- Channelization of Flow
- Aesthetics

General Description

The bioretention best management practice (BMP) functions as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. The runoff's velocity is reduced by passing over or through a sand bed and is subsequently distributed evenly along a ponding area. Exfiltration of the stored water in the bioretention area planting soil into the underlying soils occurs over a period of days.

Targeted Constituents

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

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

Inspection/Maintenance Considerations

Bioretention requires frequent landscaping maintenance, including measures to ensure that the area is functioning properly, as well as maintenance of the landscaping on the practice. In many cases, bioretention areas initially require intense maintenance, but less maintenance is needed over time. In many cases, maintenance tasks can be completed by a landscaping contractor, who may already be hired at the site. In cold climates the soil may freeze, preventing runoff from infiltrating into the planting soil.

CASQA California Stormwater Quality Association

Inspection Activities	Suggested Frequency
■ Inspect soil and repair eroded areas.	Monthly
■ Inspect for erosion or damage to vegetation, preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the strips are ready for winter. However, additional inspection after periods of heavy runoff is desirable.	Semi-annual inspection
■ Inspect to ensure grass is well established. If not, either prepare soil and reseed or replace with alternative species. Install erosion control blanket. ■ Check for debris and litter, and areas of sediment accumulation. ■ Inspect health of trees and shrubs.	
Maintenance Activities	**Suggested Frequency**
■ Water plants daily for 2 weeks.	At project completion
■ Remove litter and debris.	Monthly
■ Remove sediment. ■ Remulch void areas. ■ Treat diseased trees and shrubs. ■ Mow turf areas. ■ Repair erosion at inflow points. ■ Repair outflow structures. ■ Unclog underdrain. ■ Regulate soil pH regulation.	As needed
■ Remove and replace dead and diseased vegetation.	Semi-annual
■ Add mulch. ■ Replace tree stakes and wires.	Annual
■ Mulch should be replaced every 2 to 3 years or when bare spots appear. Remulch prior to the wet season.	Every 2-3 years, or as needed

Additional Information

Landscaping is critical to the function and aesthetic value of bioretention areas. It is preferable to plant the area with native vegetation, or plants that provide habitat value, where possible. Another important design feature is to select species that can withstand the hydrologic regime they will experience. At the bottom of the bioretention facility, plants that tolerate both wet and dry conditions are preferable. At the edges, which will remain primarily dry, upland species will be the most resilient. It is best to select a combination of trees, shrubs, and herbaceous materials.

References

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, revised February, 2002.

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm

Ventura Countywide Stormwater Quality Management Program, Technical Guidance Manual for Stormwater Quality Control Measures. July, 2002.