# Appendix D

# Grading and Hydrology Study

Acorn Environmental

# Site Grading and Hydrology Study

Prepared by HydroScience Engineers


February 2023

HydroScience
Strategic Water Solutions

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# SECTION 1 – INTRODUCTION AND BACKGROUND

HydroScience Engineers, Inc. (HydroScience) was retained by Acorn Environmental (Acorn) to prepare a preliminary site grading plan and hydrology study for the Shiloh Resort and Casino Project (Project) proposed by the Koi Nation of Northern California.

The project site is located at the southeastern corner of Shiloh Road and Old Redwood Highway in an unincorporated area of Sonoma County, California (see **Figure 1-1**). This report, and associated plans are intended to provide information for the environmental analysis of the Project.

## 1.1 Project Description

The study has been prepared for three development alternatives for the project site. Alternative A – Proposed Resort and Casino Project consists of a resort hotel and casino with event center and conference space, parking structure, and surface parking lots. Alternative B – Reduced Intensity Resort and Casino Project consists of a similar sized hotel and casino, but will not construct the event center or conference space. Due to this reduced intensity, a smaller parking structure will be constructed accommodate the site parking demands. The third proposed site, Alternative C – Proposed Non Gaming Site Project consists of a hotel, restaurant and winery with a visitors center. Surface parking lots will be constructed that meet the non-gaming project parking demands. All three of the site alternatives will also construct a wastewater treatment plant in the southeasterly portion of the site.

The proposed property is divided by Pruitt Creek in the north-south direction. The preliminary grading plan will incorporate an area for storm water detention to mitigate the increase in storm runoff created by the development of the proposed gaming facility and site improvements. The plan for the existing site is to elevate the proposed facilities a minimum of one foot above the floodplain to allow storm water to drain to the detention basin. The storm water detention basins will attenuate the increase in peak flow created by the development.

## 1.2 Existing Site Description and Topography

The existing site encompasses approximately 68.6 acres of agricultural land consisting of grape vineyards and a single-family residential home. The site is generally bounded by East Shiloh Road to the north, Old Redwood Highway to the west, low density residential to the south, and agricultural land to the east. The existing site is split into two areas that are divided by Pruitt Creek crossing the site in the north-south direction encompassing 5.0 acres.

The existing topography of the site is relatively flat ranging in elevation from 135 feet to 160 feet and generally slopes towards Pruitt Creek that runs through the site. With the creek flowing in the south-southwesterly direction (see **Figure 1-2**).

**Figure 1-1: Vicinity and Project Location Map**

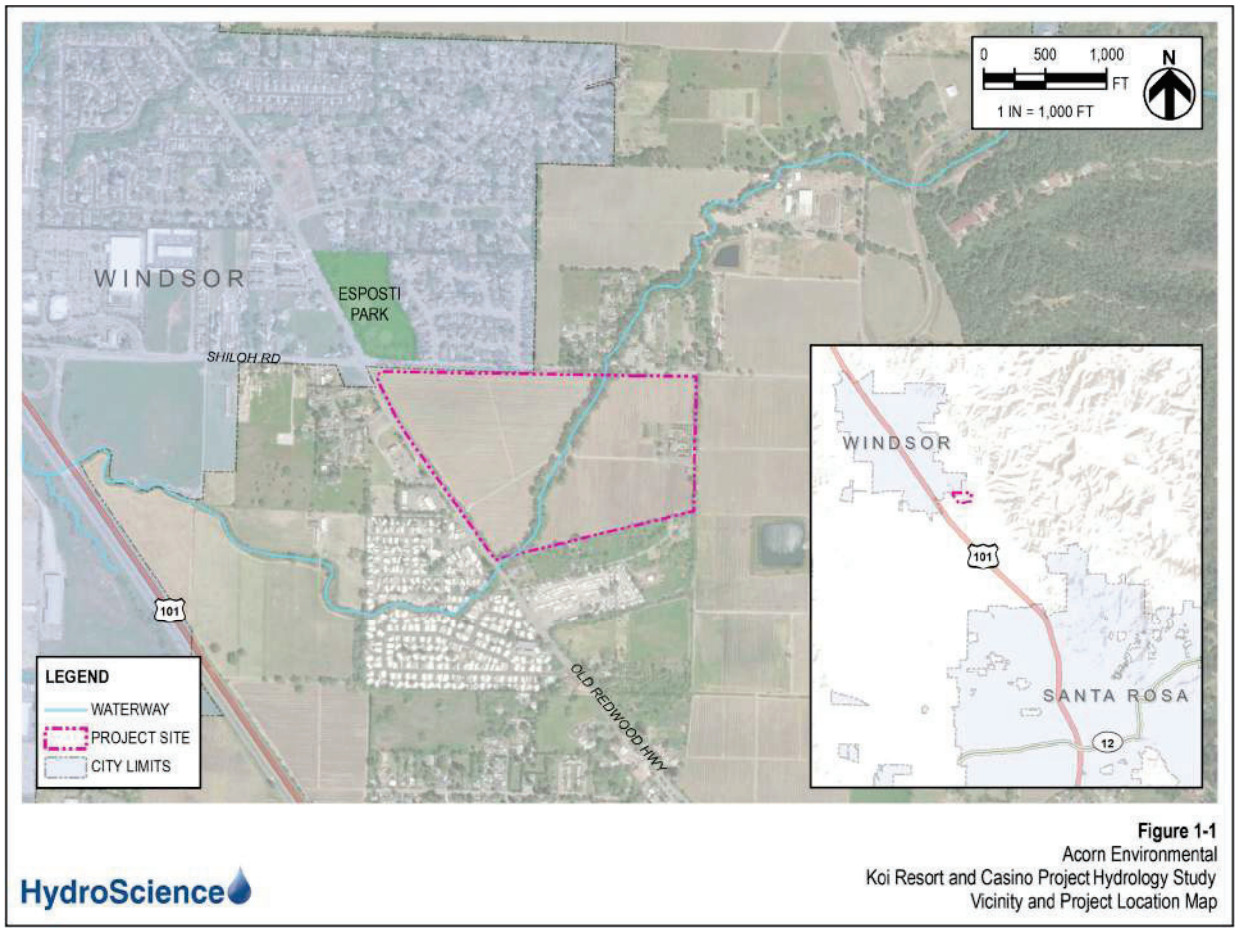
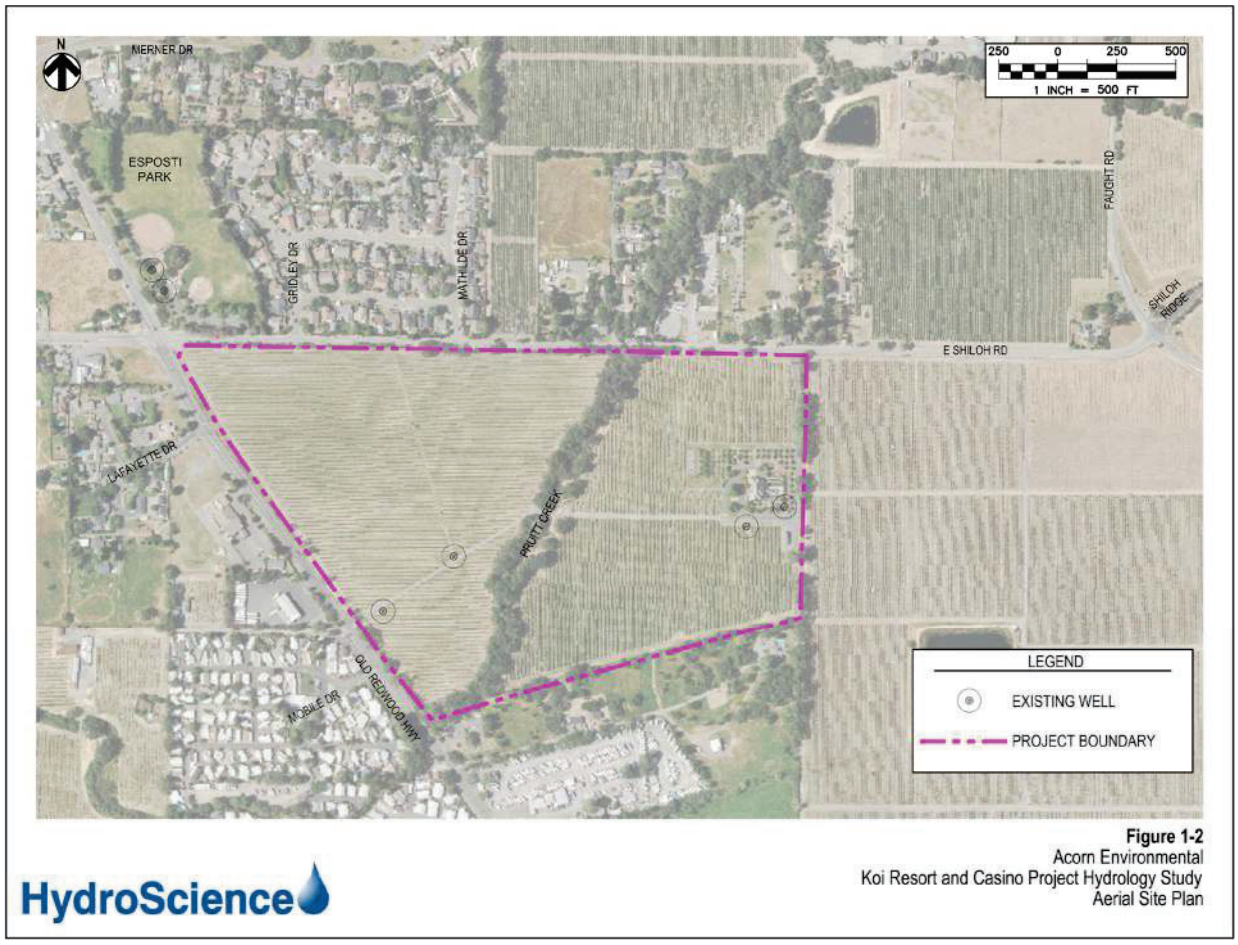


**Figure 1-2: Aerial Site Plan**



## 1.3 Flood Insurance Rate Map (FIRM) Floodplain

The property is in Flood Insurance Rate Map (FIRM) Panel 060375 entitled Sonoma County, California (Unincorporated Areas). A Firmette has been created for the project site from the FEMA Map Service Center and attached as **Appendix A**. The Firmette shows Pruitt Creek as a regulatory floodway with flood risk during any storm event and depicts the following Zones:

- Zone AE is the known base flood elevation for a 100-year storm event.
- Zone X (non-regulated) floodway is the area of a 100-year storm event with an average flood depth of less than one foot.
- Zone X are areas within a 500-year storm event.

Alternatives A, B and C have been developed to locate all structures outside of the regulatory floodplain and 100-year storm event flood limits.

## SECTION 2 – PROPOSED SITE IMPROVEMENT PLANS

With the Pruitt Creek dividing the site, Alternative A proposes to construct a resort facility that includes a casino, a food court, restaurants/ service bars, a 400-room hotel and spa, approximately 74,000 square feet of meeting space, and a 2,800-seat event center, on the west side of Pruitt Creek. On the east side of Pruitt Creek, a parking structure, parking lot, wastewater treatment facilities and other supporting infrastructure are proposed. Vehicular traffic will be able to cross the creek via a bridge and on-site roadway used for internal circulation. Pedestrian traffic will cross the creek using an aerial bridge that connects the parking structure and the casino. Various areas on both the east and west side of the site will remain as grape vineyards (see **Figure 2-1**).

Alternative B would include the development of a casino, a food court, restaurants/service bars, and a 400-room hotel and spa on the west side of Pruitt Creek. Alternative B would not include the development of the approximately 74,000 square feet of meeting space and 2,800-seat event center. On the east side of Pruitt Creek, a parking structure, wastewater treatment facilities and other supporting infrastructure are proposed. Alternative B would not include the surface parking lot proposed under Alternative A. Vehicular and pedestrian circulation elements remain the same as Alternative A. A larger portion of the site will remain as grape vineyards as well (see **Figure 2-2**).

Alternative C is a non-gaming site plan that consists of a 400-room hotel and spa, restaurant and a winery with visitors center on the west side of Pruitt Creek. Parking for the non-gaming site plan will consist of two surface parking lots on the west side of creek. The easterly side of the site will mostly remain as vineyards with only a wastewater treatment facility being constructed. (see Figure 2-3).

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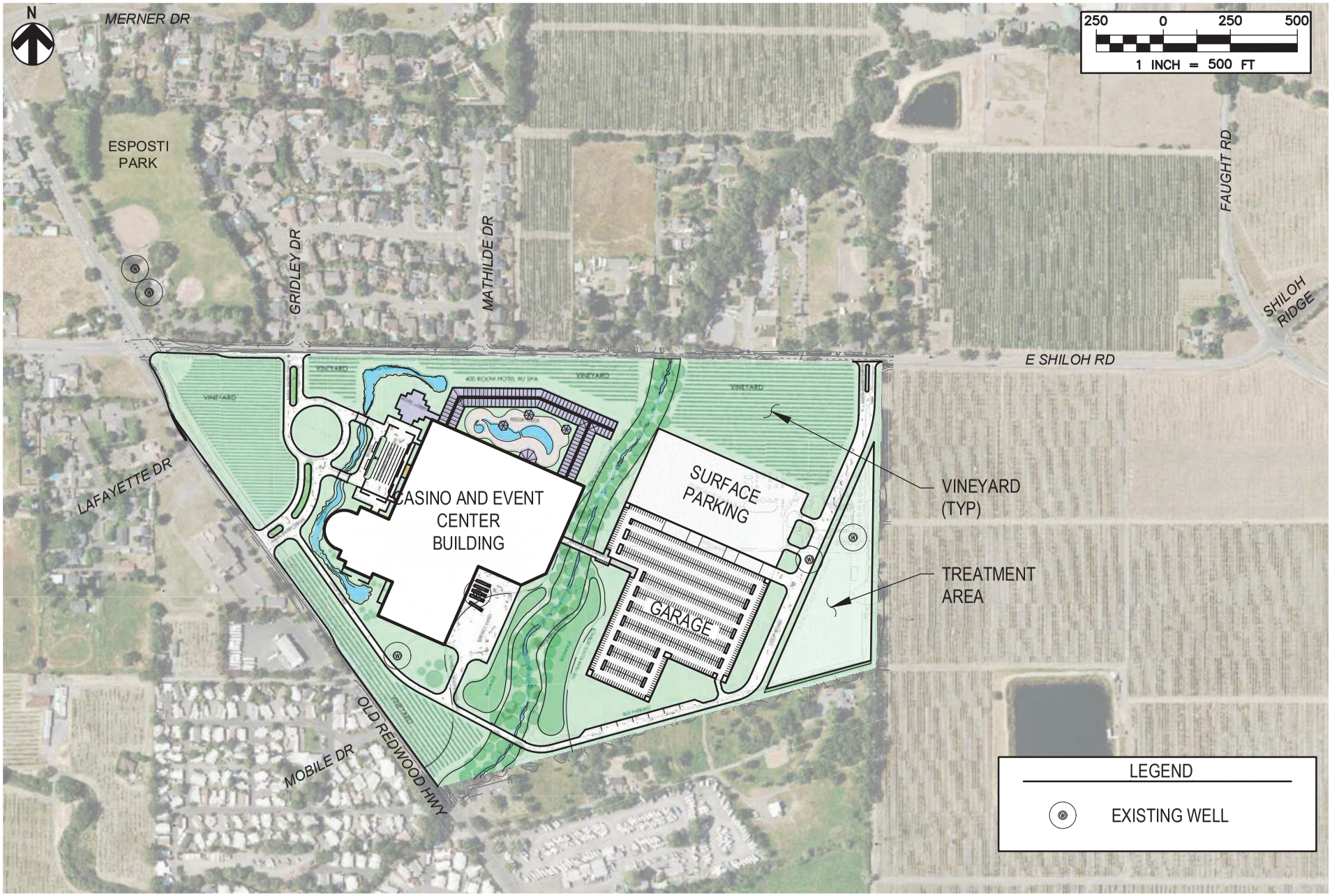


**Figure 2-1**
Acorn Environmental
Koi Resort and Casino Project Water and Wastewater Feasibility Study
Proposed Site Plan - Buildout

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**Figure 2-2**
Acorn Environmental
Koi Resort and Casino Site Grading and Drainage Plans
Proposed Site Plan - Reduced Intensity

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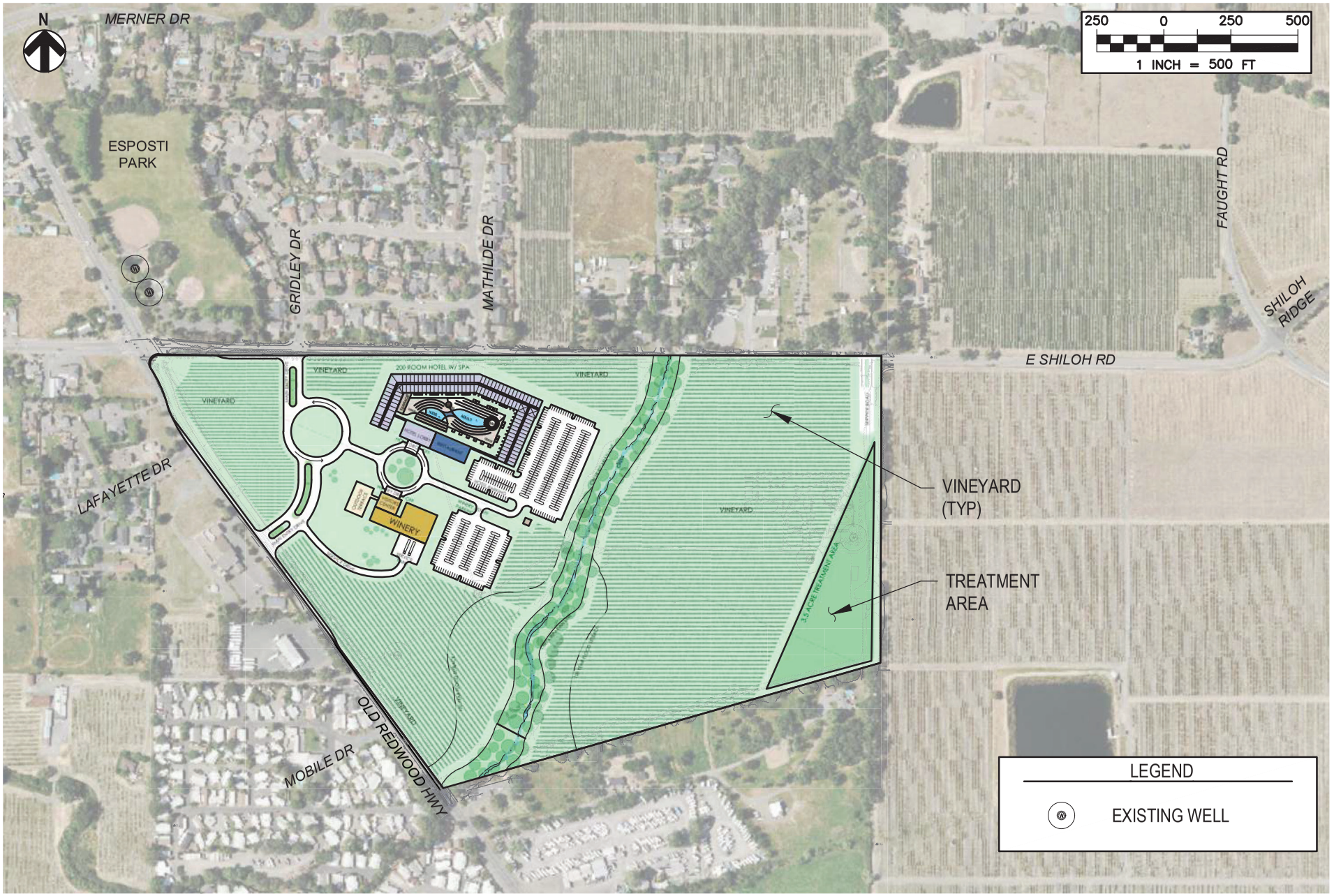


**Figure 2-3**
Acorn Environmental
Shiloh Resort and Casino Project Site Grading and Drainage Plans
Proposed Site Plan - Non Gaming Alternative

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# SECTION 3 – HYDROLOGY AND SITE GRADING

Although not required for tribal trust lands, local jurisdictional guidelines will be used for the site hydrology calculations. The Sonoma County Water Agency Flood Management Design Manual (FMDM) is intended to be used to guide public agencies and private entities in Sonoma County that are planning, designing, constructing, or maintaining waterways, channels, closed conduits, or culverts. It provides methods and criteria for analyzing storm drain systems and facilities that are necessary to convey rainfall run-off due to large storm events.

## 3.1 Methodology

The FMDM requires one of two hydrologic analysis methods for typical projects and facilities, depending on the size of the project/watershed area and the complexity of the situation:

- The Incremental Rational Method (IRM) – for projects less than 200 acres (ac) with no detention; or
- The Synthetic Unit Hydrograph Method (SUHM) – for all other projects

To mitigate the impacts, the stormwater drainage system for the alternatives will be designed to limit the peak flow and stormwater volume from the developed site to the undeveloped peak flows. Storm water detention basins are being proposed to attenuate the increase in peak flow and runoff volumes created by the development. Per the FMDM, SUHM shall be used as the method of hydrological analysis when using detention basins.

## 3.2 Hydrology Parameters

The FMDM describes the following parameters as needed for the hydrograph model and hydrology calculations. These parameters are described below and summarized in **Table 3-1**.

The Sonoma County FMDM SUHM methods require the 100-year probability, 24-hour duration storm event to be analyzed for calculating the peak design flows. In addition, the FMDM defaults the intensity duration of the rainfall hyetograph is assumed to be five minutes to develop the model. For these calculations, time of concentration is assumed to be 30 minutes for the existing condition due to the length of flow of the large hydrology subareas and 15 minutes for the proposed condition with smaller hydrology subareas.

The existing watershed areas of the site are divided into east and west and will be analyzed as an individual watershed. The area of each shed (Eastern and Western) is calculated from by the area outside the regulatory floodway. A hydrology map of the existing site is provided as **Appendix B**.

Rainfall intensities were determined by site specific data retrieved from NOAA Atlas 14 Precipitation frequency estimates to determine storm depth, included as **Appendix C**.

The site Hydrologic Soils Group for the site can be determined by FMDM Figure 3-8 Hydrologic Soils Group Map, included as **Appendix D.** The soils group for the site has been determined to be Group C.

Curve numbers (CNs) are used to represent the proportion of direct runoff associated with a rainfall event as a function of land cover and soil characteristics. USDA Technical Release 55 – Urban Hydrology Tables 2-2a through 2-2d using Soil Group C was used to determine the pre-development and post-development CN's, refer to **Appendix E**. A summary of the hydrologic parameters is provided in **Table 3-1**.

**Table 3-1: Hydrologic Model Parameters**

| Parameter | Value |
|---|---|
| Annual Storm Probability | 100 Year Storm (1% Probability) |
| Intensity Duration | 5 Minutes |
| Time of Concentration | 30 minutes (Existing)<br>15 minutes (Proposed) |
| Storm Duration | 24-Hour Storm Event |
| Watershed Areas | 31.76 Ac (East)<br>36.22 Ac (West)<br>3.99 (Floodway) |
| Storm Depth (NOAA Point Precipitation Frequency Data) | 0.327 inches/hour |
| Watershed Loss Curve Numbers (CN) | 85 (Existing)<br>Varies (Proposed) (Appendix E) |

## 3.3 Existing Hydrology

The hydrology model and calculations were based on Type IA rainfall distribution pursuant to FMDM standards. The hydrographs for the existing site conditions have been provided as **Appendix F**.

The hydrology results of the Eastern and Western sheds are provided in **Table 3-2** below. It should be noted that additional runoff volume for the Zone X' ponding has been added to the hydrologic volume.

**Table 3-2: Existing Hydrology**

| Drainage Shed | Peak Flow Rate (cfs) | Runoff Volume (cu. ft) |
|---|---|---|
| Western Shed | 47.18 | 754,274 |
| Western Flood Zone X' | n/a | 155,831 |
| Eastern Shed | 42.87 | 684,501 |
| Eastern Flood Zone X' | n/a | 91,701 |
| **Total** | **90.05** | **1,686,307** |

## 3.4 Conceptual Grading and Stormwater Pollution Prevention

The biggest concern to the site grading and drainage is the presence of the Pruitt Creek floodplain. To minimize cut/fill quantities and maintain a balanced earthwork site, while providing adequate protection from the floodplain, building finish floors were chosen approximately 1'-2' above existing 500-year floodplain elevations adjacent the creek. These range from 142.00' for the conference center, 144.00' for the casino and parking structure, and 146.00' for the Hotel. Although some vineyard areas will remain undisturbed, the roadway adjacent vineyards are intended as decorative landscape areas. These areas are to be graded with slopes not to exceed 4:1. Parking lot and roadways are to be designed between 1% and 5% slope. The site grading design has an overall earthwork volume estimated to be 115,000 CY. The grading concept accomplishes a near balanced site with less than 10,000 CY of fill required to be imported from off-site sources to develop the site. Cut areas include the wastewater treatment plant and foundations of the structures. Fill will primarily be placed on the southwesterly portion of the site near the floodplain.

It should be noted in this report, the wastewater treatment plant is assumed to construct an on-site storage tank for recycled water storage. In the event, an on-site reservoir is used for recycled water storage in lieu of a tank, the excavations volumes from the different sized reservoirs that would be required for Alternative A, B and C would create a fill scenario. The additional fill would be used throughout westerly side of the creek. In this scenario, the site would have balanced earthwork volumes, therefore no import and or export of soils would be required.

On the easterly side of the creek, the grading design will convey the stormwater from the vineyard areas, the parking structure and surface parking lot towards the roadway to a drainage system. The easterly drainage system will convey the runoff to a grassy bioswale prior to discharge to Pruitt Creek. The wastewater treatment plant will be graded to contain stormwater runoff within the treatment plant. Runoff in this area will be captured and used in the wastewater treatment plant processing.

On the westerly side of the creek, stormwater will be conveyed towards the decorative bioswale and then routed to a detention basin prior to discharging to the creek. Roof drains for the buildings will be connected to the storm drain system and conveyed to a bioswale adjacent to the creek. While the service area located behind the casino will drain into a bioswale within the floodplain. This particular bioswale shall be designed with an elevation at or above the floodplain elevation to allow for treatment of pollutants from the roof drains and service yard during a storm event.

Stormwater pollution will be primarily mitigated using drainage bioswales and a detention basin. The bioswales will be sized per Sonoma County LID requirements for pollutant reduction. Storm drain outfalls to the creek will be designed with rock slope protection to mitigate erosion. Additional erosion and sediment control best management practices will also be prescribed by a stormwater pollution prevention plan, that will be prepared for the project in compliance with the National Pollutant Discharge Elimination System (NPDES) Construction General Permit.

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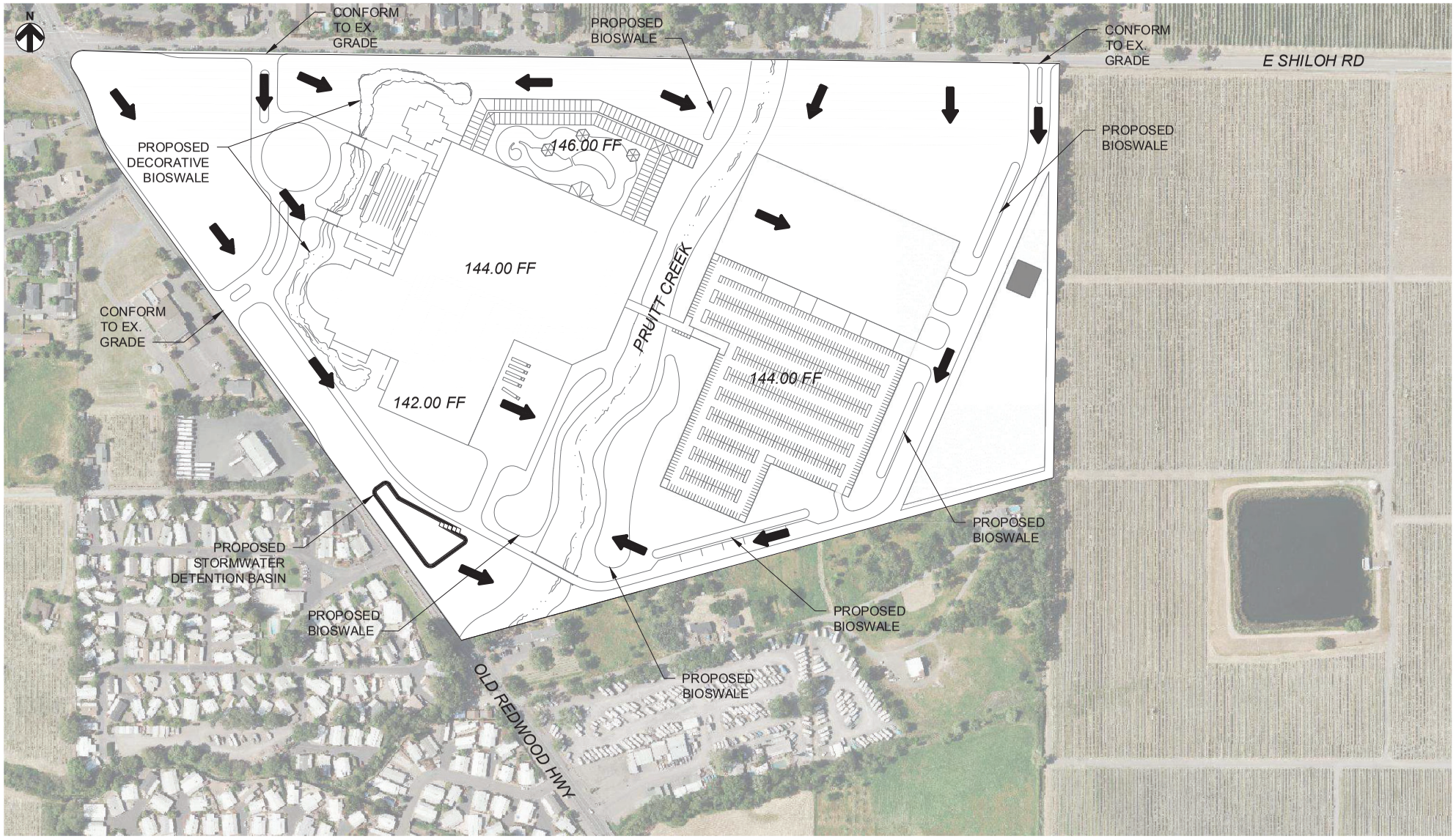


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FIGURE 3-1
Acorn Environmental
Koi Resort and Casino Site Grading and Drainage Plans
Conceptual Grading & Stormwater Plan

## 3.5 Proposed Hydrology

The analysis below focuses on the impacts associated with Alternative A. **Table 3-3** is a comparison of impervious areas of the various site alternatives. With the largest impervious area, Alternative A will have the most significant impact to grading and hydrology. To be conservative, results of this analysis can also be applied to Alternative B and Alternative C due having less impervious area and thus generating less runoff.

**Table 3-3: Site Impervious Areas**

| Site Feature | Impervious Area (S.F.) | | |
|---|---|---|---|
| | Alternative A | Alternative B | Alternative C |
| Hotel | 134,248 | 134,248 | 151,897 |
| Casino/Entertainment | 420,675 | 310,475 | |
| Parking Structure | 308,758 | 233,573 | |
| Winery & Misc. Facilities | | | 34,940 |
| WWTP | 163,337 | 163,337 | 163,337 |
| Parking Lot | 183,090 | | 159,967 |
| Roadway | 281,337 | 287,375 | 95,345 |
| Service Area | 55,550 | 55,550 | 25,231 |
| **Total Impervious Area** | **1,546,995** | **1,175,558** | **630,717** |

The proposed grading for the Western shed will have three different sub-area watersheds with differing locations discharging stormwater to the creek. The largest shed, Sub Area A, will collect runoff from vineyards, roadways, and building roof drainage and convey the flows to the water feature in the front entrance of the casino, that will act as a decorative bioswale. For analysis, multiple subdrainage areas were routed in the model to create a single output hydrograph for the various sub areas.

Sub Area B will collect runoff from roof drainage and some landscape/vineyards into a direct discharge into the creek. Additional runoff volume from flood Zone X' will be added to Sub Area(s) A and B, respectively. Sub Area C will also collect runoff from roof drainage and the loading dock area and convey the flows through a bioswale and then discharge into the creek.

The Easterly shed will have four different sub-area watersheds. Three watersheds, Sub Area D, E, and F will convey all drainage runoff from the parking, roadways, and landscape areas into bioswales and then discharged into the creek. Sub Area E and F will also have additional runoff volume from flood Zone X'.

The Wastewater Treatment Plant (WWTP) area is the fourth sub area of the Easterly shed. Due to potential for sanitary sewer spill contamination of potential overflows, runoff in this area will be captured and conveyed to the WWTP disposal system, thus mitigating stormwater flow from the Eastern shed.

A hydrology map of the proposed site plan is provided as **Appendix G**. Proposed site hydrographs, **Appendix H**, were modeled for the sub areas as described above and results are provided in **Table 3-4: Proposed Hydrology Alternative A**

below.

**Table 3-4: Proposed Hydrology Alternative A**

| Drainage Shed | Peak Flow Rate (cfs) | Runoff Volume (cu ft) |
|---|---|---|
| Western Shed Sub Area A | 40.81 | 571,089 |
| Western Shed Sub Area A (Zone X') | n/a | 32,105 |
| Western Shed Sub Area B | 13.91 | 195,223 |
| Western Shed Sub Area B (Zone X') | n/a | 123,700 |
| Western Shed Sub Area C | 5.63 | 78,974 |
| Eastern Shed Sub Area D | 43.74 | 620,202 |
| Eastern Shed Sub Area E | 3.73 | 53,863 |
| Eastern Shed Sub Area E (Zone X') | n/a | 78,800 |
| Eastern Shed Sub Area F | 0.25 | 3,544 |
| Eastern Shed Sub Area F (Zone X') | n/a | 12,901 |
| Eastern Shed Sub Area WWTP | 8.27 | 117,875 |
| **Total** | **116.34** | **1,888,274** |

## 3.6 Peak Flow Mitigation

To mitigate the impacts of the proposed improvements, storm drain improvements will be designed to limit the flow to the creek to pre-developed conditions. The pre- and post-development flow rates and volumes are summarized in **Table 3-5: Pre and Post Development Flows**

below.

**Table 3-5: Pre and Post Development Flows**

| Description | Peak Flow Rate (cfs) | Runoff Volume (cu ft) |
|---|---|---|
| Pre-Development Flows | 90.05 | 1,686,307 |
| Post Development Flows | 116.34 | 1,888,274 |
| Site Mitigation Required | 26.29 | 201,967 |

As stated above, the WWTP will provide some mitigation for the Easterly shed by capturing all runoff in the area within the WWTP site area. For the Westerly shed, Detention Basin A will need to reduce peak flow by 18.02 cfs and have a minimum storage capacity of 84,092 cu ft. This will be achieved by using an outlet pipe sized to attenuate the Sub Area A hydrograph peak flow from 40.81 cfs to 22.79 cfs.

Attenuation of the Sub Area A hydrograph with a detention basin can be analyzed in the model to reduce the peak flow rate to produce an outfall hydrograph for peak flow rate mitigation, included

as **Appendix I**. Further analysis of the volume differential in hydrographs shows the basin storage volume needs to be a minimum of 103,975 cu ft, larger than what is required for the overall site mitigation. The model produces a pond depth versus outlet orifice sizing to achieve the time-lag and drawdown times required for mitigation, refer to **Appendix J**. Basin A is proposed to be five feet (5 ft) in depth, with a storage capacity of 103,975 cu ft. Based on the model, the basin will require a 21-inch outlet pipe to mitigate the peak flow.

**Table 3-6: Proposed Mitigation**

| Drainage Shed Mitigation | Reduction in Peak Flow Rate (cfs) | Mitigation Volume (cu ft) |
|---|---|---|
| Eastern Shed Sub Area WWTP (Capture) | 8.27 | 117,875 |
| Western Shed Sub Area A (Basin A) | 18.02 | 103,975 |
| **Mitigation** | **26.29** | **221,850** |

## 3.7 Summary

The proposed drainage plan for each of the alternatives includes various storm drain improvements consisting of a decorative swale, catch basins with underground storm drain pipe, building roof drains, and a detention basin (Basin A). The proposed development of the alternatives increases runoff and peak flow rates. This will be mitigated by capture of flow by the WWTP and temporary storage in the detention basin that will limit the peak flow. Detention basin sizing and outlet piping will meter the flow into the creek to pre-development levels.

**APPENDIX A**
Acorn Environmental
Grading & Hydrology Report
FEMA Firmette

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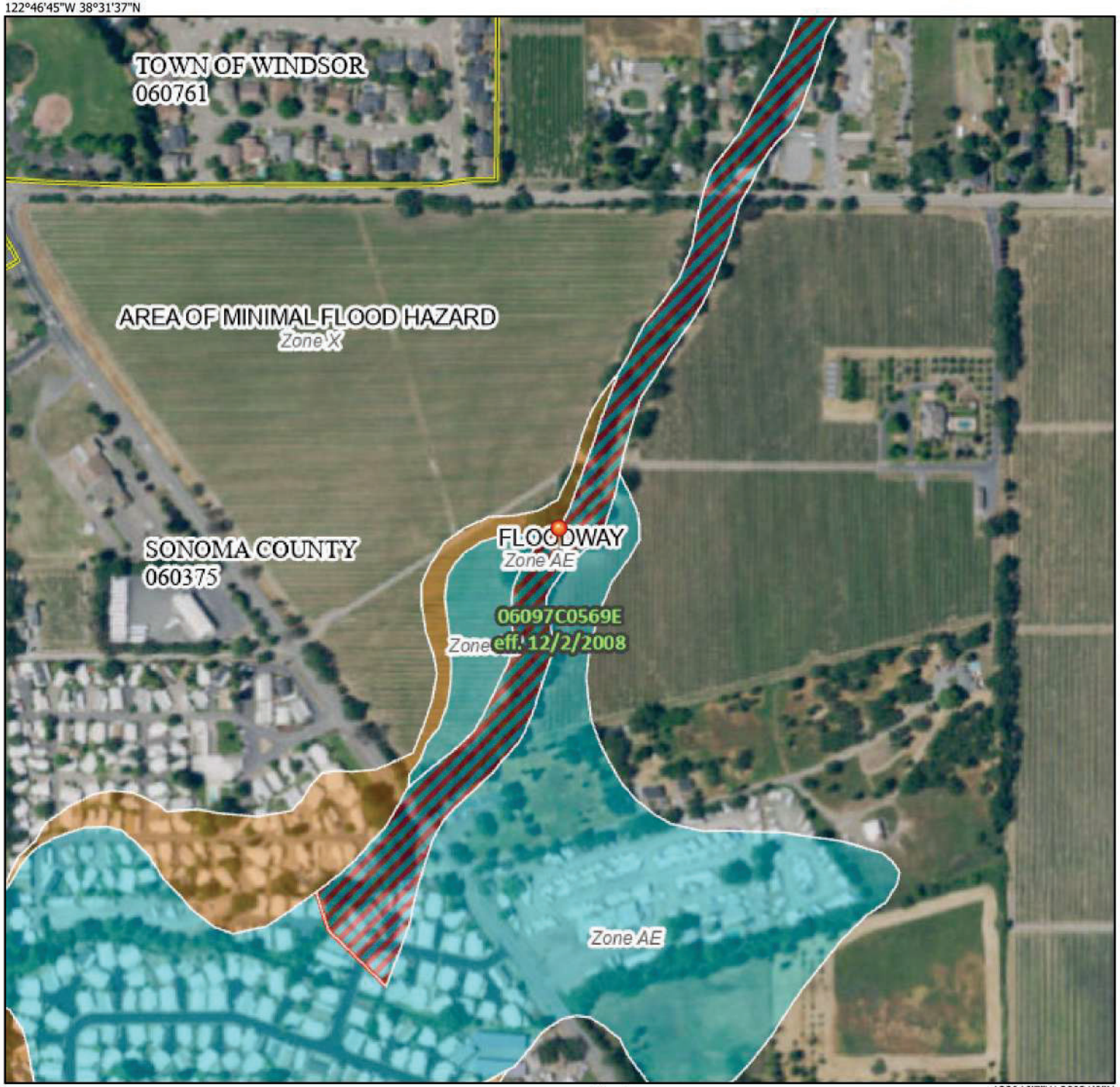
# National Flood Hazard Layer FIRMette

FEMA

122°46'45"W 38°31'37"N




122°46'7"W 38°31'9"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

*Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020*

## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

**SPECIAL FLOOD HAZARD AREAS**
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

**OTHER AREAS OF FLOOD HAZARD**
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

**OTHER AREAS**
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

**GENERAL STRUCTURES**
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

**OTHER FEATURES**
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

**MAP PANELS**
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/23/2022 at 11:45 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

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# APPENDIX B

Acorn Environmental
Grading & Hydrology Report
Pre-Development Hydrology Map

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APPENDIX B
Acorn Environmental
Koi Resort and Casino Site Grading and Drainage Plans
Pre-Development Hydrology Map

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**APPENDIX C**
Acorn Environmental
Grading & Hydrology Report
NOAA Precipitation Estimates

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NOAA Atlas 8 8lume 6 ersi n 2 8
L 8cati n name: Calif rnia USA* 8
Latitude: 3 852 8° L 8ngitude: - 22.7759° 8
Elevati n: 82.32 ft** 8
* source: ESRI Maps 8
** source: USGS8

## POINT PRECIPITATION FREQUENCY ESTIMATES 8

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra 8
Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey 8
Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan 8

NOAA, National Weather Service, Silver Spring, Maryland 8

PF_tabular | PF_graphical | Maps_&_aerials 8

## PF tabular 8

PDS-based p 8nt precipitati n frequency estimates with 90% c 8nfidence intervals (in inches/h 8ur) 8

| Durati n 8 | Average recurrence interval (years) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 8 | 80 8 | 25 8 | 50 1 8 | 00 | 200 | 500 1 8 | 000 8 |
| 5-min 8 | .97 8 (1.75-2.24) 8 | 2. 8 (2.14-2.74) 8 | 2.96 8 (2.63-3.38) 8 | 3. 8 (2.99-3.94) 8 | .0 8 (3.38-4.81) 8 | . 6 8 (3.67-5.48) 8 | .92 8 (3.92-6.22) 8 | 5.3 8 (4.15-7.02) 8 | 5.99 8 (4.42-8.21) 8 | 6. 6 8 (4.57-9.20) 8 |
| 0-min 8 | . 2 8 (1.26-1.61) 8 | .72 8 (1.53-1.96) 8 | 2. 2 8 (1.88-2.42) 8 | 2. 5 8 (2.14-2.82) 8 | 2. 7 8 (2.42-3.44) 8 | 3.20 8 (2.63-3.93) 8 | 3.52 8 (2.81-4.45) 8 | 3. 5 8 (2.98-5.03) 8 | .29 8 (3.16-5.88) 8 | .62 8 (3.28-6.59) 8 |
| 5-min 8 | . 8 (1.01-1.30) 8 | .39 8 (1.24-1.58) 8 | .7 8 (1.52-1.96) 8 | .97 8 (1.73-2.27) 8 | 2.32 8 (1.95-2.78) 8 | 2.5 8 (2.12-3.17) 8 | 2. 8 (2.27-3.59) 8 | 3. 0 8 (2.40-4.06) 8 | 3. 6 8 (2.55-4.74) 8 | 3.73 8 (2.64-5.32) 8 |
| 30-min 8 | 0. 00 8 (0.712-0.908) 8 | 0.976 8 (0.866-1.11) 8 | .20 8 (1.06-1.37) 8 | .3 8 (1.21-1.59) 8 | .63 8 (1.37-1.95) 8 | . 8 (1.49-2.22) 8 | .99 8 (1.59-2.52) 8 | 2. 8 (1.69-2.85) 8 | 2. 3 8 (1.79-3.33) 8 | 2.62 8 (1.85-3.73) 8 |
| 60-min | 0.562 8 (0.500-0.639) | 0.6 6 8 (0.609-0.780) | 0. 85 8 (0.748-0.965) 8 | 0.973 8 (0.853-1.12) 8 | . 8 (0.963-1.37) 8 | .27 8 (1.05-1.56) 8 | . 0 8 (1.12-1.77) 8 | .53 8 (1.19-2.00) 8 | .7 8 (1.26-2.34) 8 | . 8 (1.30-2.62) 8 |
| 2-hr | 0. 25 8 (0.378-0.483) | 0.5 8 (0.457-0.586) | 0.62 8 (0.556-0.716) | 0.7 6 8 (0.628-0.825) | 0. 32 8 (0.701-0.996) | 0.9 7 8 (0.754-1.13) 8 | .00 8 (0.800-1.26) 8 | .0 8 (0.838-1.41) 8 | . 9 8 (0.877-1.63) 8 | .27 8 (0.899-1.81) 8 |
| 3-hr | 0.36 8 (0.321-0.410) | 0. 36 8 (0.387-0.496) | 0.529 8 (0.469-0.604) | 0.602 8 (0.527-0.693) | 0.696 8 (0.586-0.833) | 0.76 8 (0.628-0.939) 8 | 0. 3 8 (0.664-1.05) 8 | 0. 96 8 (0.693-1.17) 8 | 0.9 8 (0.722-1.34) 8 | .0 8 (0.737-1.48) 8 |
| 6-hr | 0.273 8 (0.243-0.310) | 0.329 8 (0.293-0.375) | 0.399 8 (0.353-0.455) | 0. 52 8 (0.397-0.521) | 0.520 8 (0.439-0.624) | 0.569 8 (0.468-0.699) | 0.6 7 8 (0.493-0.779) | 0.662 8 (0.512-0.865) | 0.720 8 (0.531-0.987) | 0.762 8 (0.540-1.09) 8 |
| 2-hr | 0. 92 8 (0.171-0.218) | 0.235 8 (0.209-0.268) | 0.2 8 (0.255-0.329) | 0.32 8 (0.288-0.378) | 0.379 8 (0.320-0.454) | 0. 85 8 (0.341-0.510) | 0. 50 8 (0.359-0.568) | 0. 83 8 (0.374-0.631) | 0.525 8 (0.387-0.719) | 0.555 8 (0.393-0.791) 8 |
| 2 8hr | 0. 32 8 (0.119-0.150) | 0. 66 8 (0.149-0.188) | 0.206 8 (0.184-0.234) | 0.236 8 (0.210-0.271) | 0.27 8 (0.237-0.324) | 0.30 8 (0.255-0.362) | 0.327 8 (0.271-0.402) | 0.352 8 (0.285-0.443) | 0.3 8 8 (0.299-0.500) | 0. 05 8 (0.307-0.546) 8 |
| 2-day 8 | 0.0 7 8 (0.078-0.099) | 0. 80 8 (0.099-0.125) | 0. 3 8 (0.124-0.157) | 0. 59 8 (0.141-0.182) | 0. 85 8 (0.160-0.219) | 0.20 8 (0.173-0.245) | 0.222 8 (0.184-0.272) | 0.239 8 (0.193-0.301) | 0.260 8 (0.203-0.340) | 0.275 8 (0.208-0.371) 8 |
| 3-day 8 | 0.067 8 (0.060-0.076) | 0.0 5 8 (0.076-0.097) | 0. 07 8 (0.096-0.122) | 0. 2 8 (0.110-0.142) | 0. 8 (0.125-0.170) | 0. 59 8 (0.135-0.191) | 0. 73 8 (0.144-0.213) | 0. 86 8 (0.151-0.235) | 0.203 8 (0.159-0.265) | 0.2 5 8 (0.163-0.290) 8 |
| -day 8 | 0.056 8 (0.050-0.063) | 0.07 8 (0.064-0.081) | 0.090 8 (0.080-0.102) | 0. 03 8 (0.092-0.119) | 0. 2 8 (0.105-0.143) | 0. 33 8 (0.113-0.160) | 0. 85 8 (0.120-0.178) | 0. 56 8 (0.127-0.197) | 0. 7 8 (0.133-0.223) | 0. 8 (0.137-0.244) 8 |
| 7-day 8 | 0.039 8 (0.035-0.045) | 0.050 8 (0.045-0.057) | 0.063 8 (0.057-0.072) | 0.073 8 (0.065-0.084) | 0.0 5 8 (0.074-0.101) | 0.09 8 (0.080-0.113) | 0. 03 8 (0.085-0.126) | 0. 8 (0.090-0.139) | 0. 2 8 (0.094-0.158) | 0. 2 8 (0.097-0.173) 8 |
| 0-day 8 | 0.03 8 (0.028-0.036) | 0.0 8 8 (0.036-0.046) | 0.050 8 (0.045-0.057) | 0.05 8 (0.052-0.067) | 0.06 8 (0.059-0.080) | 0.075 8 (0.064-0.090) | 0.0 2 8 (0.068-0.100) | 0.0 8 (0.071-0.1 8) | 0.096 8 (0.075-0.125) | 0. 02 8 (0.077-0.137) 8 |
| 20-day 8 | 0.02 8 (0.019-0.024) | 0.027 8 (0.024-0.030) | 0.033 8 (0.030-0.038) | 0.039 8 (0.034-0.044) | 0.0 5 8 (0.039-0.053) | 0.0 9 8 (0.042-0.059) | 0.05 8 (0.044-0.066) | 0.05 8 (0.047-0.073) | 0.063 8 (0.049-0.082) | 0.066 8 (0.050-0.089) 8 |
| 30-day 8 | 0.0 7 8 (0.015-0.019) | 0.02 8 (0.019-0.024) | 0.027 8 (0.024-0.030) | 0.03 8 (0.027-0.035) | 0.036 8 (0.031-0.042) | 0.039 8 (0.033-0.047) | 0.0 8 8 (0.035-0.052) | 0.0 5 8 (0.037-0.058) | 0.0 9 8 (0.039-0.065) | 0.052 8 (0.039-0.070) 8 |
| 5-day 8 | 0.0 8 (0.012-0.015) | 0.0 7 8 (0.016-0.020) | 0.022 8 (0.019-0.025) | 0.025 8 (0.022-0.029) | 0.029 8 (0.025-0.034) | 0.032 8 (0.027-0.038) | 0.03 8 (0.028-0.042) | 0.037 8 (0.030-0.046) | 0.0 8 8 (0.031-0.052) | 0.0 2 8 (0.031-0.056) 8 |
| 60-day 8 | 0.0 2 8 (0.011-0.014) | 0.0 5 8 (0.014-0.017) | 0.0 9 8 (0.017-0.022) | 0.022 8 (0.020-0.025) | 0.025 8 (0.022-0.030) | 0.02 8 (0.024-0.033) | 0.030 8 (0.025-0.037) | 0.032 8 (0.026-0.040) | 0.03 8 (0.027-0.045) | 0.036 8 (0.027-0.049) 8 |

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). 8

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a 8 given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not 8 checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. 8

Please refer to NOAA Atlas 14 document for more information. 8

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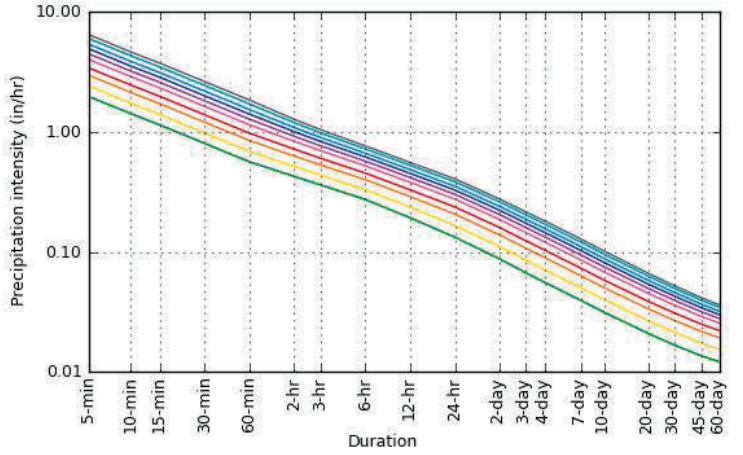
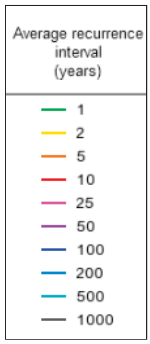
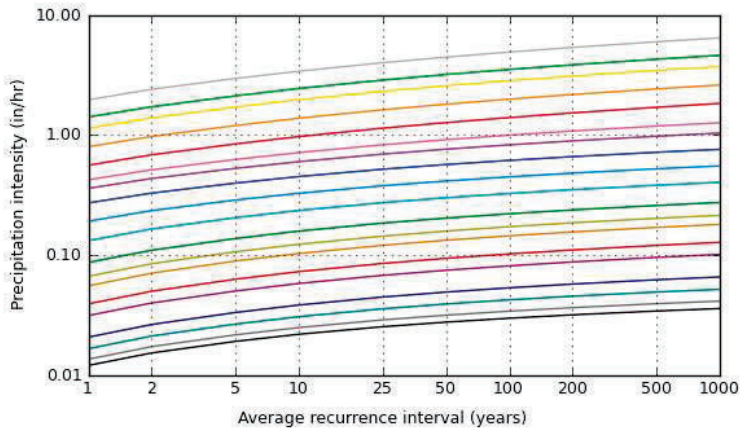
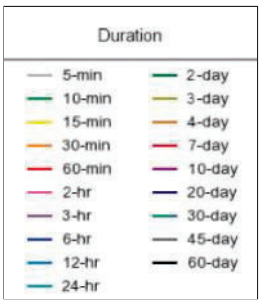
## PF graphical 8

PDS-based intensity-duration-frequency (IDF) curves
Latitude: 38.5243°, Longitude: -122.7759°




NOAA Atlas 14, Volume 6, Version 2

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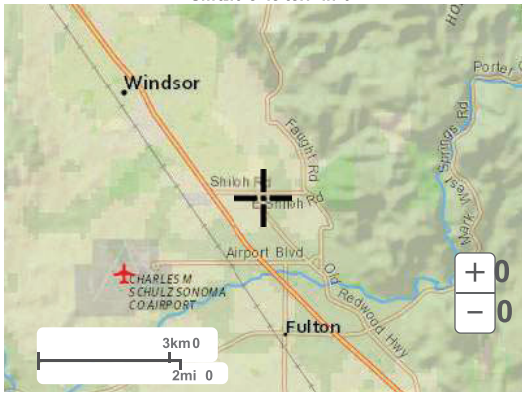


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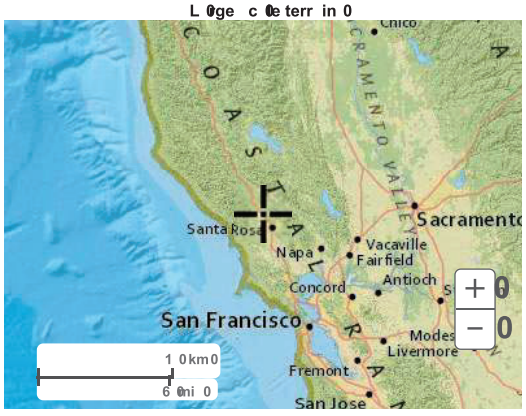

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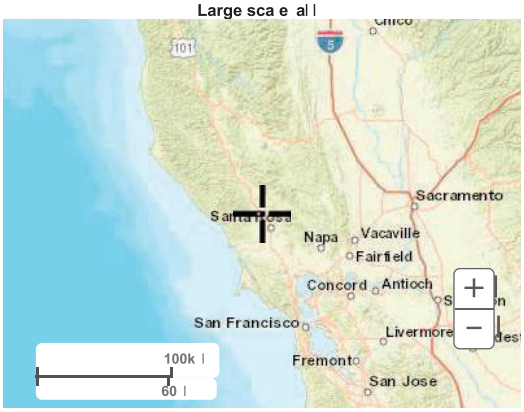


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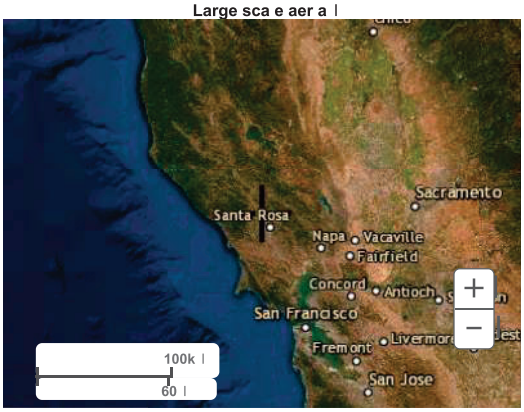


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US Department of Commerce |
Nationa  Oceanic and Atmospheric Administration |
Nationa  Weather Service |
Nationa  Water Center |
1325 East West Highway |
Si ver Spring, MD 20910 |
Questions?: HDSC.Questions@noaa.gov |

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**APPENDIX D**
Acorn Environmental
Grading & Hydrology Report
Sonoma County Hydrologic Soils Group Map

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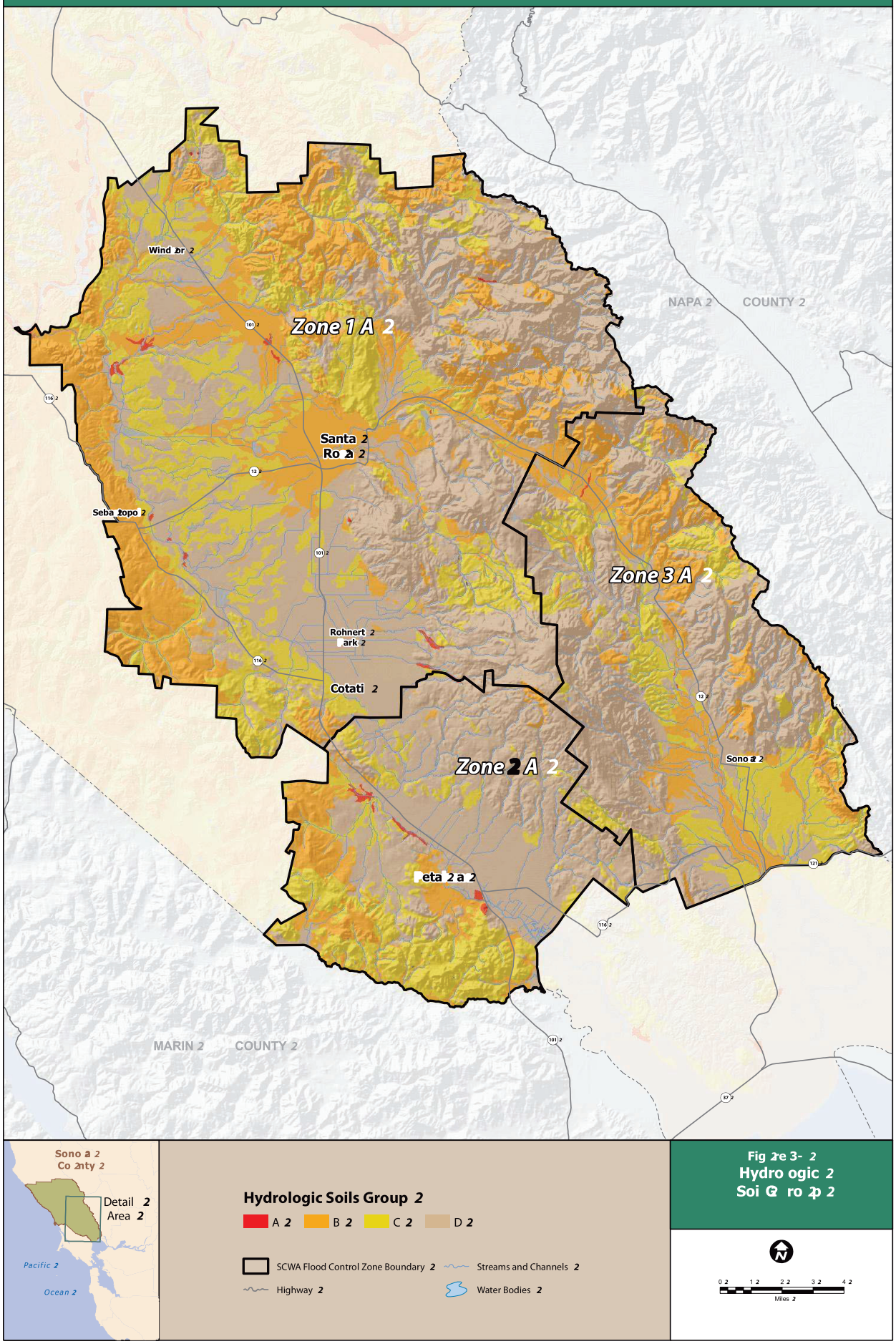
# Sonoma County Water Agency 2 F ood Mana 2 ment 2 Desi n Manua (FMDM) 2

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**APPENDIX E**
Acorn Environmental
Grading & Hydrology Report
TR-55 Table 2-2a through 2-2d: Curve Numbers

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Table - a Runoff curve numbers for urban areas 1/

| Cover description — Cover type and hydrologic condition | Average percent impervious area 2/ | Curve numbers for hydrologic soil group — A | B | C | D |
|---|---|---|---|---|---|
| ***Fully* c *l p* c *urban ar as ( cg tati n cstablish* c*)* c | | | | | |
| Open spa e (lawns, parks, golf ourses, emeteries, et .) 3/: | | | | | |
| Poor ondition (grass over < 50%) | | 68 | 79 | 86 | 89 |
| Fair ondition (grass over 50% to 75%) | | 49 | 69 | 79 | 84 |
| Good condition (grass over > 75%) | | 39 | 61 | 74 | 80 |
| Impervious areas: | | | | | |
| Paved parking lots, roofs, driveways, et . | | | | | |
| (ex luding right-of-way) | | 98 | 98 | 98 | 98 |
| Streets and roads: | | | | | |
| Paved; urbs and storm sewers (ex luding right-of-way) | | 98 | 98 | 98 | 98 |
| Paved; open dit hes (in luding right-of-way) | | 83 | 89 | 92 | 93 |
| Gravel (in luding right-of-way) | | 76 | 85 | 89 | 91 |
| Dirt (in luding right-of-way) | | 72 | 82 | 87 | 89 |
| Western desert urban areas: | | | | | |
| Natural desert lands aping (pervious areas only) 4/ | | 63 | 77 | 85 | 88 |
| Artifi ial desert lands aping (impervious weed barrier, desert shrub with 1- to 2-in h sand or gravel mul h and basin borders) | | 96 | 96 | 96 | 96 |
| Urban distri ts: | | | | | |
| Commer ial and business | 85 | 89 | 92 | 94 | 95 |
| Industrial | 72 | 81 | 88 | 91 | 93 |
| Residential distri ts by average lot size: | | | | | |
| 1/8 a re or less (town houses) | 65 | 77 | 85 | 90 | 92 |
| 1/4 a re | 38 | 61 | 75 | 83 | 87 |
| 1/3 a re | 30 | 57 | 72 | 81 | 86 |
| 1/2 a re | 25 | 54 | 70 | 80 | 85 |
| 1 a re | 20 | 51 | 68 | 79 | 84 |
| 2 a res | 12 | 46 | 65 | 77 | 82 |
| ***D* c *l ping urban ar as*** c | | | | | |
| Newly graded areas | | | | | |
| (pervious areas only, no vegetation) 5/ | | 77 | 86 | 91 | 94 |
| Idle lands (CN's are determined using over types similar to those in table 2-2 ). | | | | | |

1 Average runoff ondition, and $I_a$ = 0.2S.

2 The average per ent impervious area shown was used to develop the omposite CN's. Other assumptions are as follows: impervious areas are dire tly onne ted to the drainage system, impervious areas have a CN of 98, and pervious areas are onsidered equivalent to open spa e in good hydrologi ondition. CN's for other ombinations of onditions may be omputed using figure 2-3 or 2-4.

3 CN's shown are equivalent to those of pasture. Composite CN's may be omputed for other ombinations of open spa e over type.

4 Composite CN's for natural desert lands aping should be omputed using figures 2-3 or 2-4 based on the impervious area per entage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologi ondition.

5 Composite CN's to use for the design of temporary measures during grading and onstru tion should be omputed using figure 2-3 or 2-4 based on the degree of development (impervious area per entage) and the CN's for the newly graded pervious areas.

Table 2-2b R n unoff curve number for cultivated agricultural land n1/ n

| Cover de cription n | | | Curve number for n hydrologic oil group n | | | |
|---|---|---|---|---|---|---|
| Cover type n | Treatment 2/ n | Hydrologic n condition 3/ n | A n | B n | C n | D |
| Fallow n | Bare oil n | —n | 77 n | 86 n | 91 n | 94 n |
| | Crop re idue cover (C n) n | Poor n | 76 n 9 | 8 n | 0 n | 93 n |
| | | Good n | 74 n | 83 n | 88 | 90 n |
| S ow crop n | traight row (S n) n | Poor n | 72 n | 81 n | 88 n | 91 n |
| | | Good n | 67 n | 78 8 | 8 n | 9 n |
| P | S n+ C n | oor n | 71 n | 80 n | 87 n | 90 n |
| | | Good n | 64 n 8 | 7 n | 2 | 8 n |
| | Contoured (C) n | Poor n | 70 n | 79 n | 84 n | 88 n |
| | | Good n 7 n | 6 n 8 | | 2 | 86 n |
| P | C + C n | oor n | 69 n | 78 n | 83 n | 87 n |
| | | Good n | 64 n | 74 n | 81 n | 8 n |
| | Contoured & terraced (C&T) n | Poor n | 66 n | 74 n | 80 n | 82 n |
| | | Good n | 62 n | 71 n | 78 n | 81 n |
| P | C&T+ C n | oor n 7 | 6 n | 3 n | 79 n | 81 n |
| | | Good n | 61 n | 70 n | 77 | 80 n |
| P Small grain n | S n | oor n 7 | 6 n | 6 n | 84 n | 88 n |
| | | Good n | 63 n 8 | 7 n | 3 | 87 n |
| P | S + C n | oor n | 64 n 8 | 7 n | 3 | 86 n |
| | | Good n | 60 n | 72 n | 80 n | 84 n |
| | C n | Poor n | 63 n | 74 n | 82 n | 8 n |
| | | Good n | 61 n | 73 n | 81 n | 84 n |
| P | C + C n | oor n | 62 n | 73 n | 81 n | 84 n |
| | | Good n | 60 n | 72 n | 80 n | 83 n |
| | C&T n | Poor n | 61 n | 72 n | 79 n | 82 n |
| | | Good 5 n | 9 n | 70 | 78 n | 81 n |
| P | C&T+ C n | oor n | 60 n | 71 n | 78 n | 81 n |
| | | Good 5 n | 8 n | 69 n | 77 | 80 n |
| P Clo e- eeded n | S n | oor n | 66 n | 77 n8 | 8 n | 9 n |
| or broadca t n | | Good 5 n | 8 n | 72 n | 81 n | 8 n |
| legume or n | C n | Poor n | 64 n 8 | 7 n | 3 n | 8 n |
| rotation n | | Good 5 n 6 | | 9 n | 78 n | 83 n |
| meadow n | C&T n | Poor n | 63 n | 73 n | 80 n | 83 n |
| | | Good 5 n | 1 n | 67 | 76 n | 80 n |

1 Average runoff condition, and $I_a = 0.2S$

2 Crop re idue cover applie only if re idue i on at lea t % of the urface throughout the year. n

3 Hydraulic condition i ba ed on combination factor that affect infiltration and runoff, including (a) den ity and canopy of vegetative area , n (b) amount of year-round cover, (c) amount of gra nor clo e- eeded legume , (d) percent of re idue cover on the land urface (good ≥ 20%), n and (e) degree of urface roughne n n

Poor: Factor impair infiltration and tend to increa e runoff. n

Good: Factor encourage average and better than average infiltration and tend to decrea e runoff. n

Table - c R noff c rve n mbers for other agric lt ral lands 1/

| Cover description | | Curve numbers for hydrologic soil group | | | |
|---|---|---|---|---|---|
| Cover type | Hydrologic condition | A | B | C | D |
| Past re, grassland, or range—contin o s forage for grazing. 2/ | Poor | 68 | 79 | 86 | 89 |
| | Fair | 49 | 69 | 79 | 84 |
| | Good | 39 | 61 | 74 | 80 |
| Meadow—contin o s grass, protected from grazing and generally mowed for hay. | —u | 30 | 58 | 71 | 78 |
| Br sh—br sh-weed-grass mixt re with br sh the major element. 3/ | Poor | 48 | 67 | 78 | 83 |
| | Fair | 35 | 56 | 70 | 77 |
| | Good | 30 4/ | 48 | 65 | 73 |
| Woods—grass combination orchard or tree farm). 5/ | Poor | 57 | 73 | 82 | 86 |
| | Fair | 43 | 65 | 76 | 82 |
| | Good | 32 | 58 | 72 | 79 |
| Woods. 6/ | Poor | 45 | 66 | 77 | 83 |
| | Fair | 36 | 60 | 73 | 79 |
| | Good | 30 4/ | 55 | 70 | 77 |
| Farmsteads—b ildings, lanes, driveways, and s rro nding lots. | —u | 59 | 74 | 82 | 86 |

1 u Average r noff condition, and $I_a = 0.2S$. u
*Poor:* <50%) gro nd cover or heavily grazed with no m lch. u
*Fair:* 50 to 75% gro nd cover and not heavily grazed. u
*Good:* > 75% gro nd cover and lightly or only occasionally grazed. u
3 u *Poor:* <50% gro nd cover. u
*Fair:* 50 to 75% gro nd cover. u
*Good:* > 75% gro nd cover. u
4 u Act al c rve n mber is less than 30; se CN = 30 for r noff comp tations. u
5 u CN's shown were comp ted for areas with 50% woods and 50% grass past re) cover. Other combinations of conditions may be comp ted u from the CN's for woods and past re. u
6 u *Poor:* Forest litter, small trees, and br sh are destroyed by heavy grazing or reg lar b rning. u
*Fair:* Woods are grazed b t not b rned, and some forest litter covers the soil. u
*Good:* Woods are protected from grazing, and litter and br sh adeq ately cover the soil. u

Table 2-2d R n unoff curve number for arid and emiarid rangeland n1/ n

| Cover de cription n | Hydrologic n condition 2/ nn | Curve number for n hydrologic oil group n | | | |
|---|---|---|---|---|---|
| Cover type n | | A 3/ n | B n | C n | D |
| Herbaceou —mixture of gra , weed , and n | Poor n | | 80 n | 87 n | 93 n |
| low-growing bru h, with bru h the n | Fair n | | 71 n | 81 n | 89 n |
| minor element. n | Good n | | 62 n | 74 n | 8 n |
| Oak-a pen—mountain bru h mixture of oak bru h, n | Poor n | | 66 n | 74 n | 79 n |
| a pen, mountain mahogany, bitter bru h, maple, n | Fair n | | 48 5 n | 7 n | 63 n |
| and other bru h. n | Good n | | 30 n | 41 n | 48 n |
| Pinyon-juniper—pinyon, juniper, or both; n | Poor n | 8 n | 7 n 8 | | 9 n |
| gra nunder tory. n | Fair 5 n | | 8 n | 73 n | 80 n |
| | Good n | | 41 n | 61 n | 71 n |
| Sagebru h with gra nunder tory. n | Poor n | | 67 n | 80 n | 8 n |
| | Fair 5 n | | 1 | 63 n | 70 n |
| | Good n | 4 | 3 n | 7 5 n | |
| De ert hrub—major plant include altbu h, n | Poor n | 63 n | 77 n5 8 | 8 n | 8 n |
| grea ewood, creo otebu h, blackbru h, bur age, n | Fair 5 n 7 | | 2 n | 81 n | 86 n |
| palo verde, me quite, and cactu . n | Good n | 49 n | 68 n | 79 n | 84 n |

1 n Average runoff condition, and $I_a$, = 0.2S. For range in humid region , u e table 2-2c. n
2 n Poor: <30% ground cover (litter, gra n, and bru h over tory). n
Fair: n30 to 70% ground cover. n
Good: > 70% ground cover. n
3 n Curve number for group A have been developed only for de ert hrub. n

**APPENDIX F**
Acorn Environmental
Grading & Hydrology Report
Pre-Development Hydrographs

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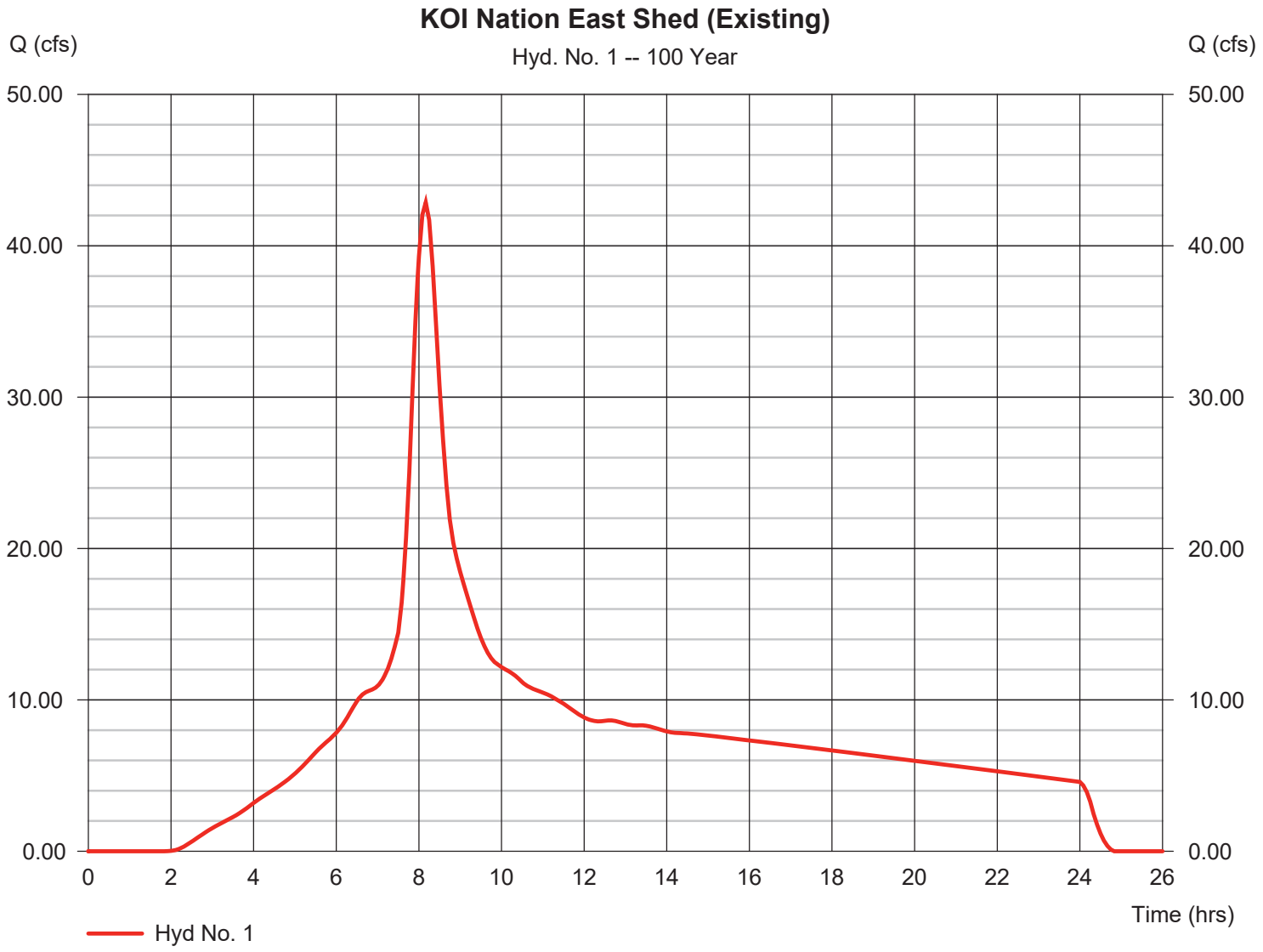
# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Monday, 05 / 9 / 2022

## Hyd. No. 1

KOI Nation East Shed (Existing)

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 42.87 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 8.17 hrs |
| Time interval | = 5 min | Hyd. volume | = 684,501 cuft |
| Drainage area | = 29.660 ac | Curve number | = 85 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 30.00 min |
| Total precip. | = 7.95 in | Distribution | = Type IA |
| Storm duration | = 24 hrs | Shape factor | = 484 |



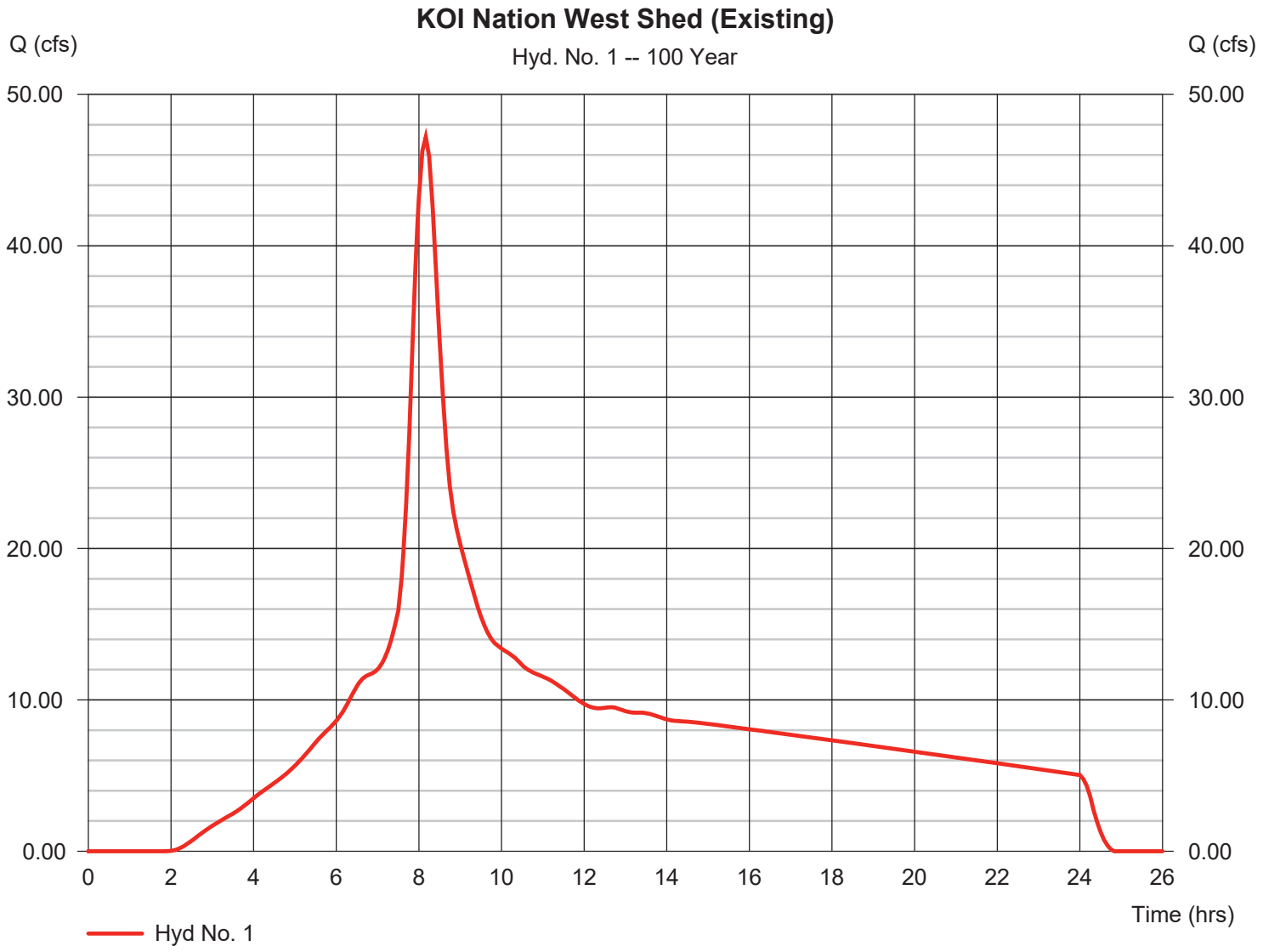
# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 06 / 15 / 2022

## Hyd. No. 1

KOI Nation West Shed (Existing)

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | SCS Runoff | Peak discharge | = | 47.18 cfs |
| Storm frequency | = | 100 yrs | Time to peak | = | 8.17 hrs |
| Time interval | = | 5 min | Hyd. volume | = | 753,274 cuft |
| Drainage area | = | 32.640 ac | Curve number | = | 85 |
| Basin Slope | = | 0.0 % | Hydraulic length | = | 0 ft |
| Tc method | = | User | Time of conc. (Tc) | = | 30.00 min |
| Total precip. | = | 7.95 in | Distribution | = | Type IA |
| Storm duration | = | 24 hrs | Shape factor | = | 484 |



**APPENDIX G**
Acorn Environmental
Grading & Hydrology Report
Post-Development Hydrology Map

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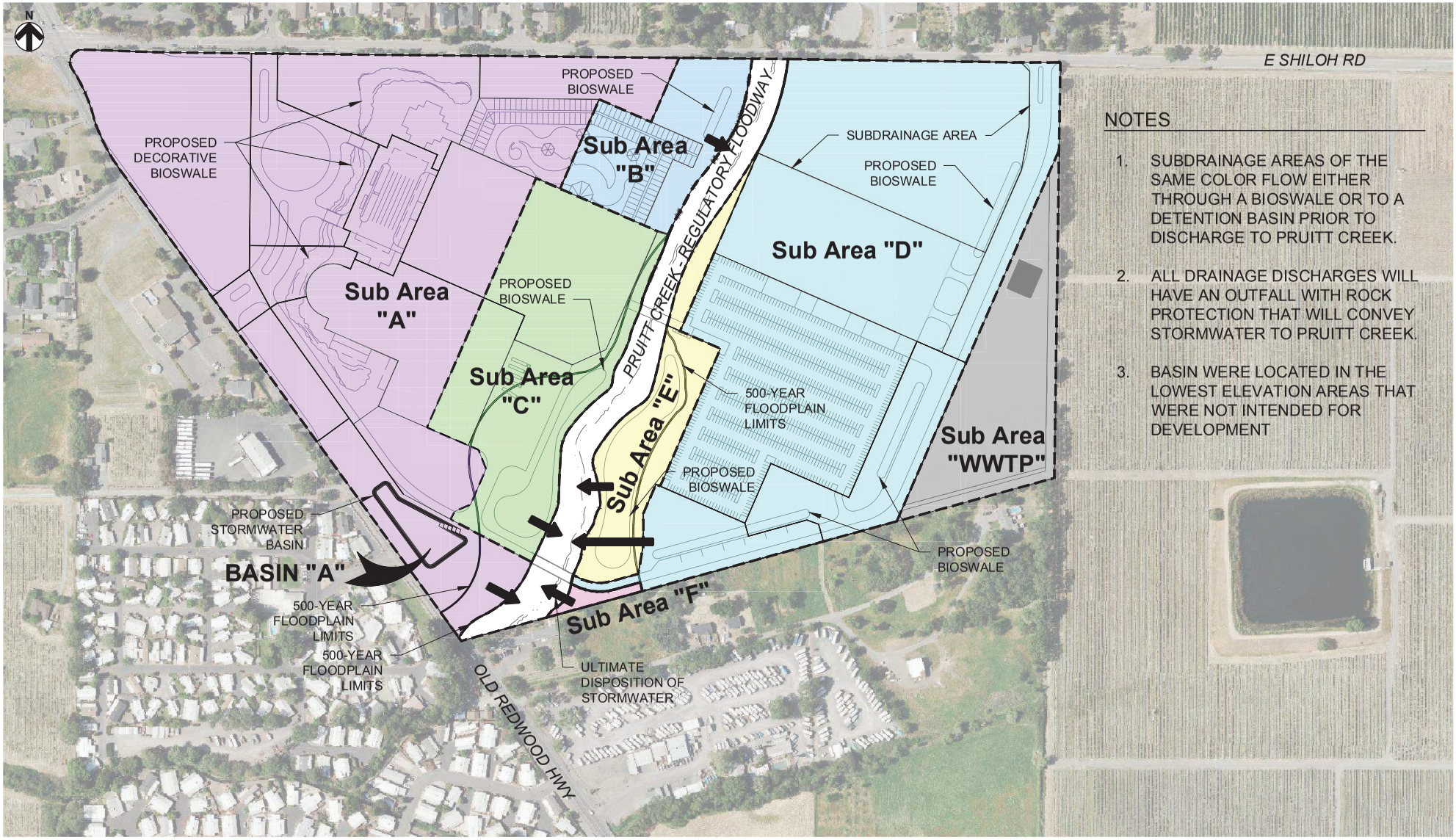


NOTES

1. SUBDRAINAGE AREAS OF THE SAME COLOR FLOW EITHER THROUGH A BIOSWALE OR TO A DETENTION BASIN PRIOR TO DISCHARGE TO PRUITT CREEK.
2. ALL DRAINAGE DISCHARGES WILL HAVE AN OUTFALL WITH ROCK PROTECTION THAT WILL CONVEY STORMWATER TO PRUITT CREEK.
3. BASIN WERE LOCATED IN THE LOWEST ELEVATION AREAS THAT WERE NOT INTENDED FOR DEVELOPMENT

HydroScience

APPENDIX G
Acorn Environmental
Koi Resort and Casino Site Grading and Drainage Plans
Post-Development Hydrology Map

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**APPENDIX H**
Acorn Environmental
Grading & Hydrology Report
Post-Development Hydrographs

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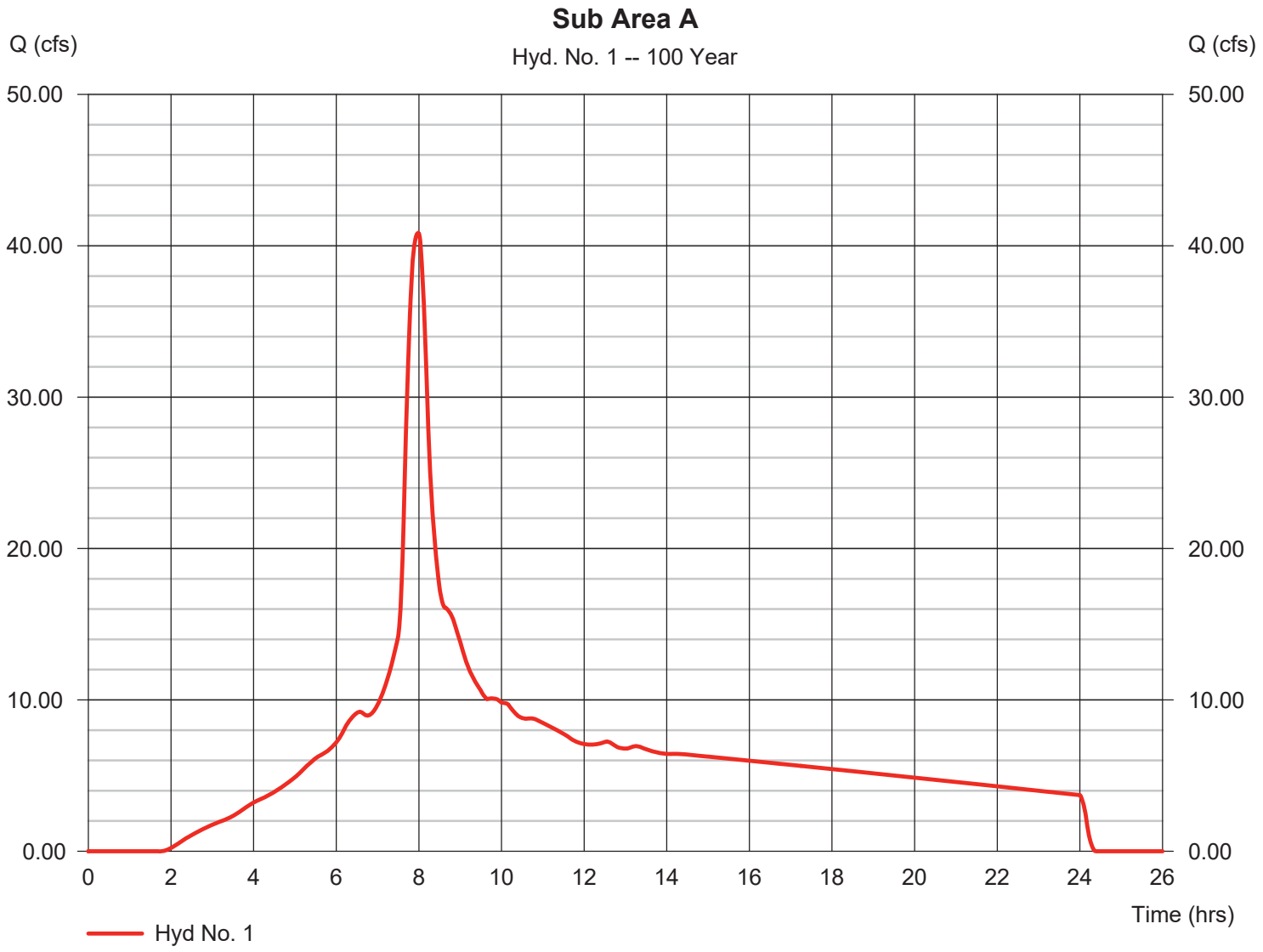
# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Thursday, 06 / 16 / 2022

## Hyd. No. 1

Sub Area A

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | SCS Runoff | Peak discharge | = | 40.84 cfs |
| Storm frequency | = | 100 yrs | Time to peak | = | 7.98 hrs |
| Time interval | = | 1 min | Hyd. volume | = | 571,089 cuft |
| Drainage area | = | 25.040 ac | Curve number | = | 86 |
| Basin Slope | = | 0.0 % | Hydraulic length | = | 0 ft |
| Tc method | = | User | Time of conc. (Tc) | = | 15.00 min |
| Total precip. | = | 7.95 in | Distribution | = | Type IA |
| Storm duration | = | 24 hrs | Shape factor | = | 484 |



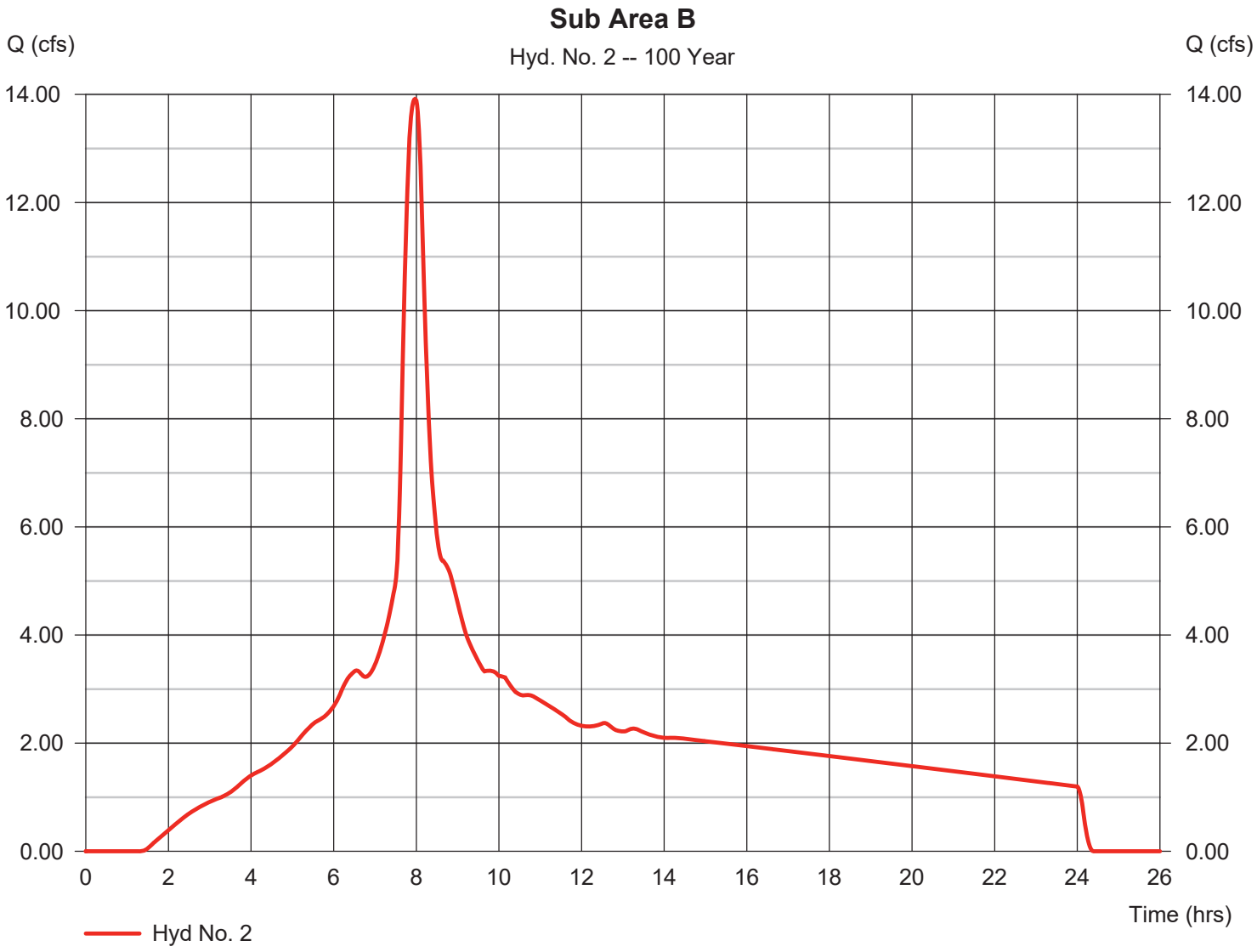
# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Thursday, 06 / 16 / 2022

## Hyd. No. 2

Sub Area B

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 13.91 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 7.97 hrs |
| Time interval | = 1 min | Hyd. volume | = 195,223 cuft |
| Drainage area | = 7.960 ac | Curve number | = 90 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 15.00 min |
| Total precip. | = 7.95 in | Distribution | = Type IA |
| Storm duration | = 24 hrs | Shape factor | = 484 |



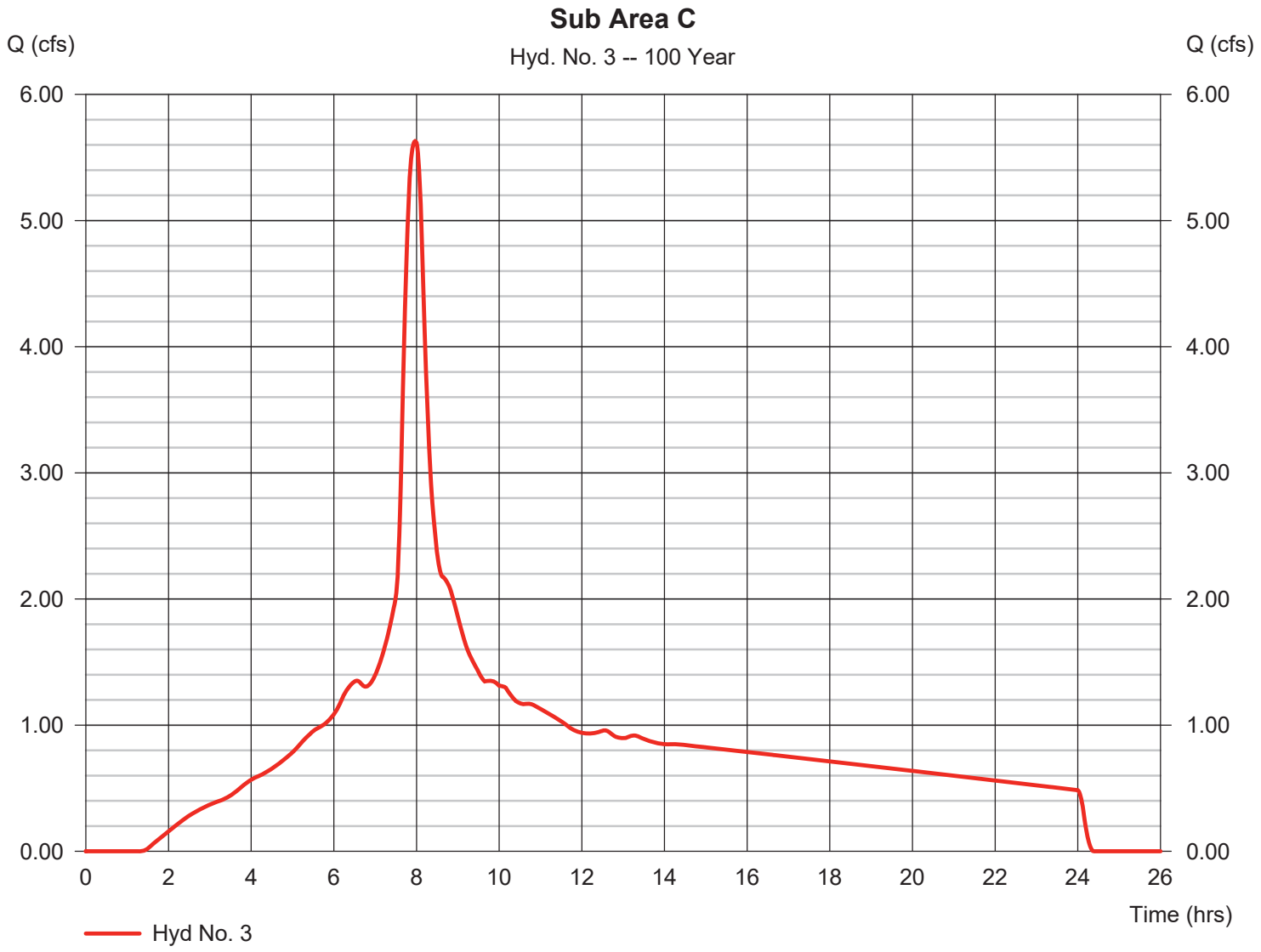
# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Thursday, 06 / 16 / 2022

## Hyd. No. 3

Sub Area C

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 5.629 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 7.97 hrs |
| Time interval | = 1 min | Hyd. volume | = 78,972 cuft |
| Drainage area | = 3.220 ac | Curve number | = 90 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 15.00 min |
| Total precip. | = 7.95 in | Distribution | = Type IA |
| Storm duration | = 24 hrs | Shape factor | = 484 |



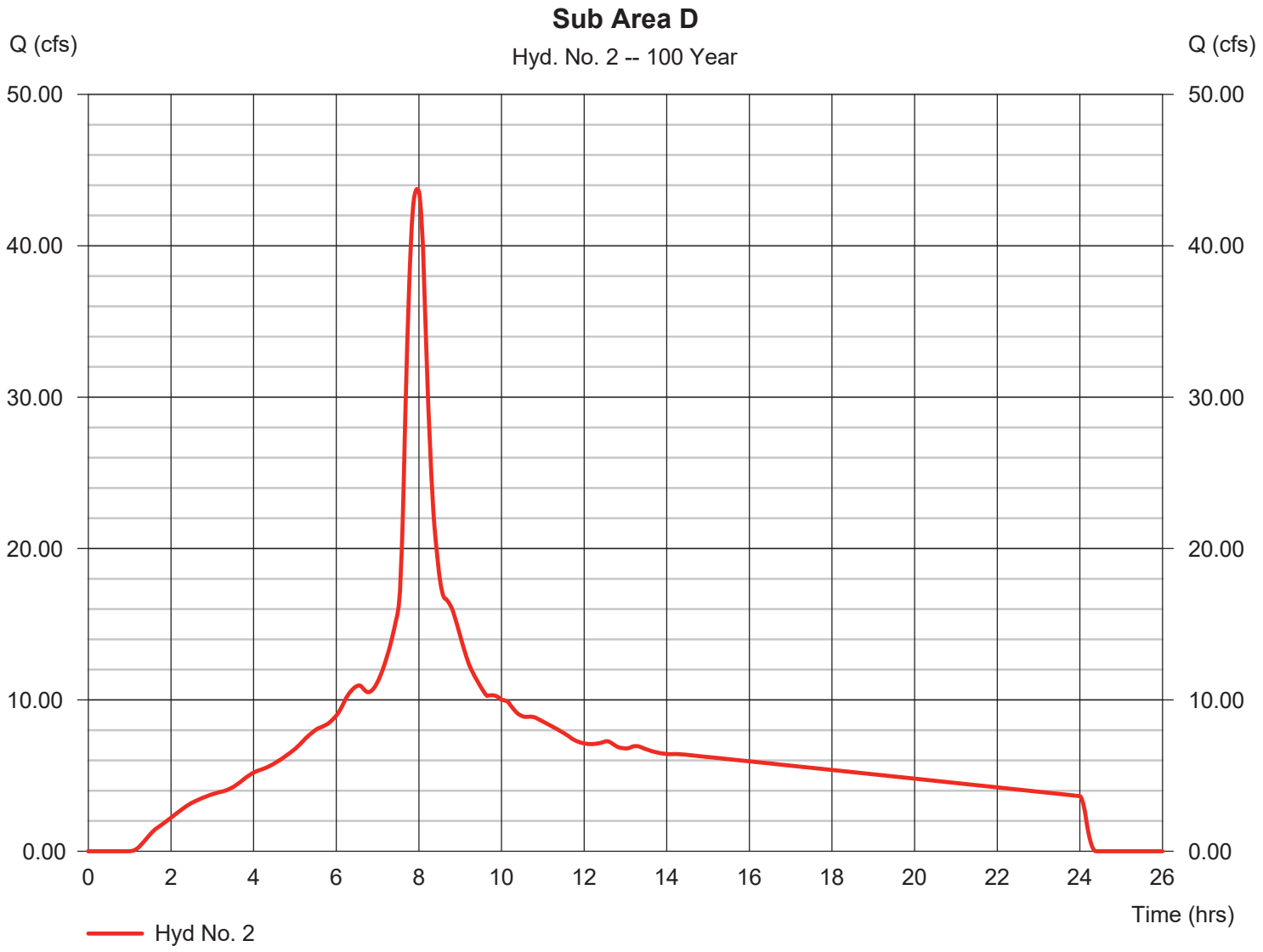
# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Thursday, 06 / 16 / 2022

## Hyd. No. 2

Sub Area D

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 43.74 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 7.97 hrs |
| Time interval | = 1 min | Hyd. volume | = 620,202 cuft |
| Drainage area | = 24.020 ac | Curve number | = 93 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 15.00 min |
| Total precip. | = 7.95 in | Distribution | = Type IA |
| Storm duration | = 24 hrs | Shape factor | = 484 |



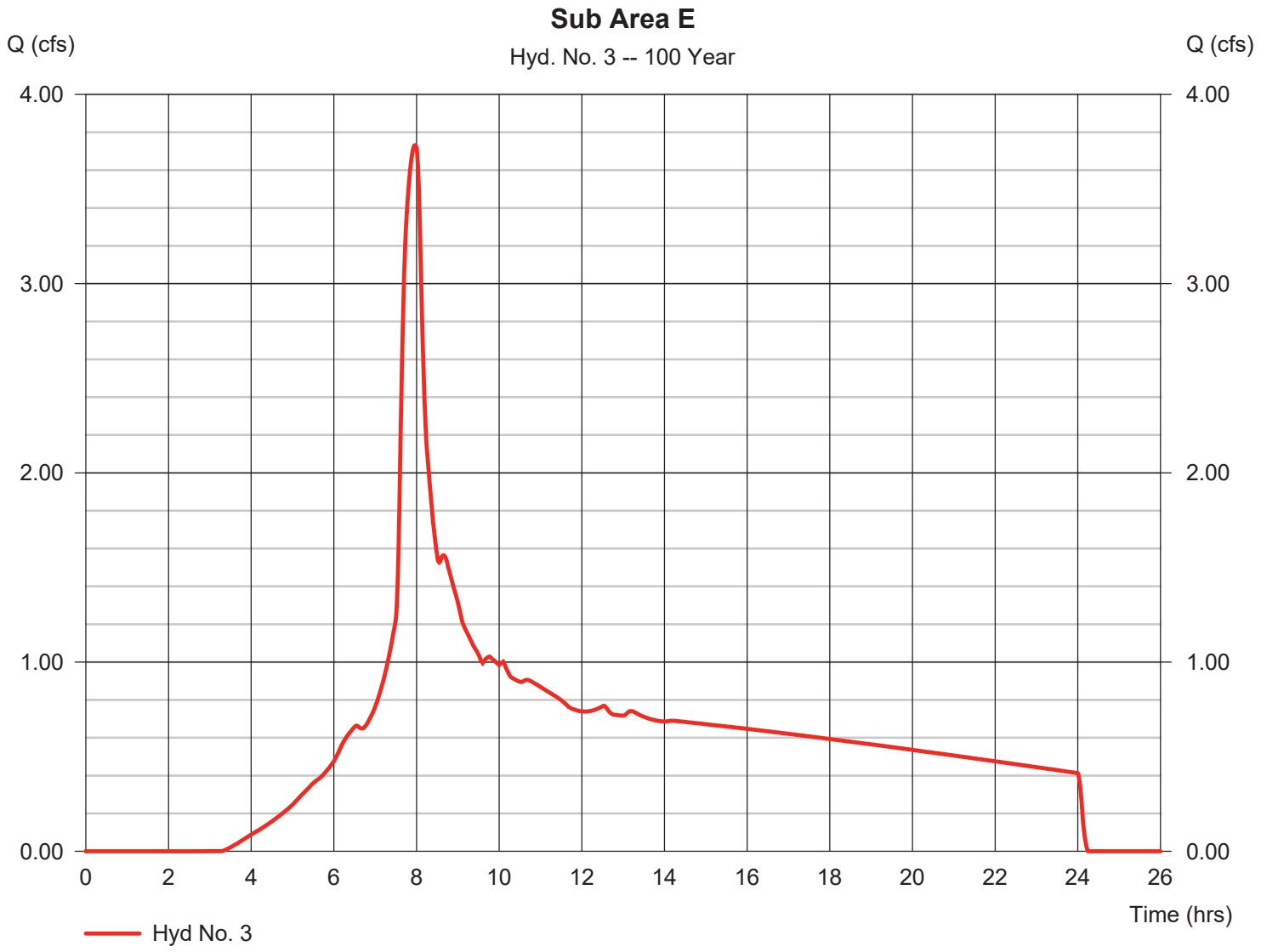
# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Thursday, 06 / 16 / 2022

## Hyd. No. 3

Sub Area E

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 3.731 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 7.97 hrs |
| Time interval | = 1 min | Hyd. volume | = 53,863 cuft |
| Drainage area | = 3.040 ac | Curve number | = 74 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 10.00 min |
| Total precip. | = 7.95 in | Distribution | = Type IA |
| Storm duration | = 24 hrs | Shape factor | = 484 |



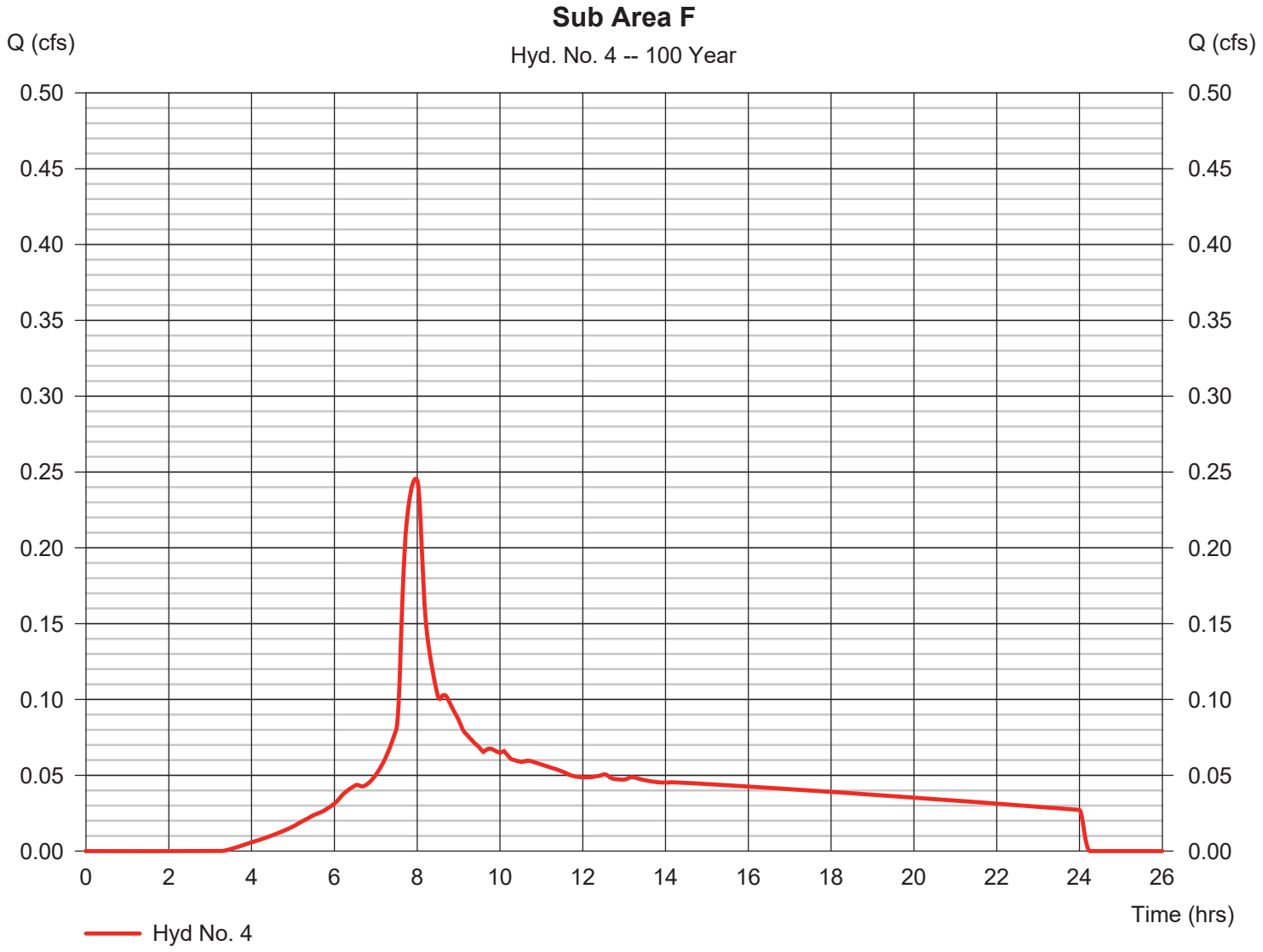
# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Thursday, 06 / 16 / 2022

## Hyd. No. 4

Sub Area F

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.245 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 7.97 hrs |
| Time interval | = 1 min | Hyd. volume | = 3,544 cuft |
| Drainage area | = 0.200 ac | Curve number | = 74 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 10.00 min |
| Total precip. | = 7.95 in | Distribution | = Type IA |
| Storm duration | = 24 hrs | Shape factor | = 484 |



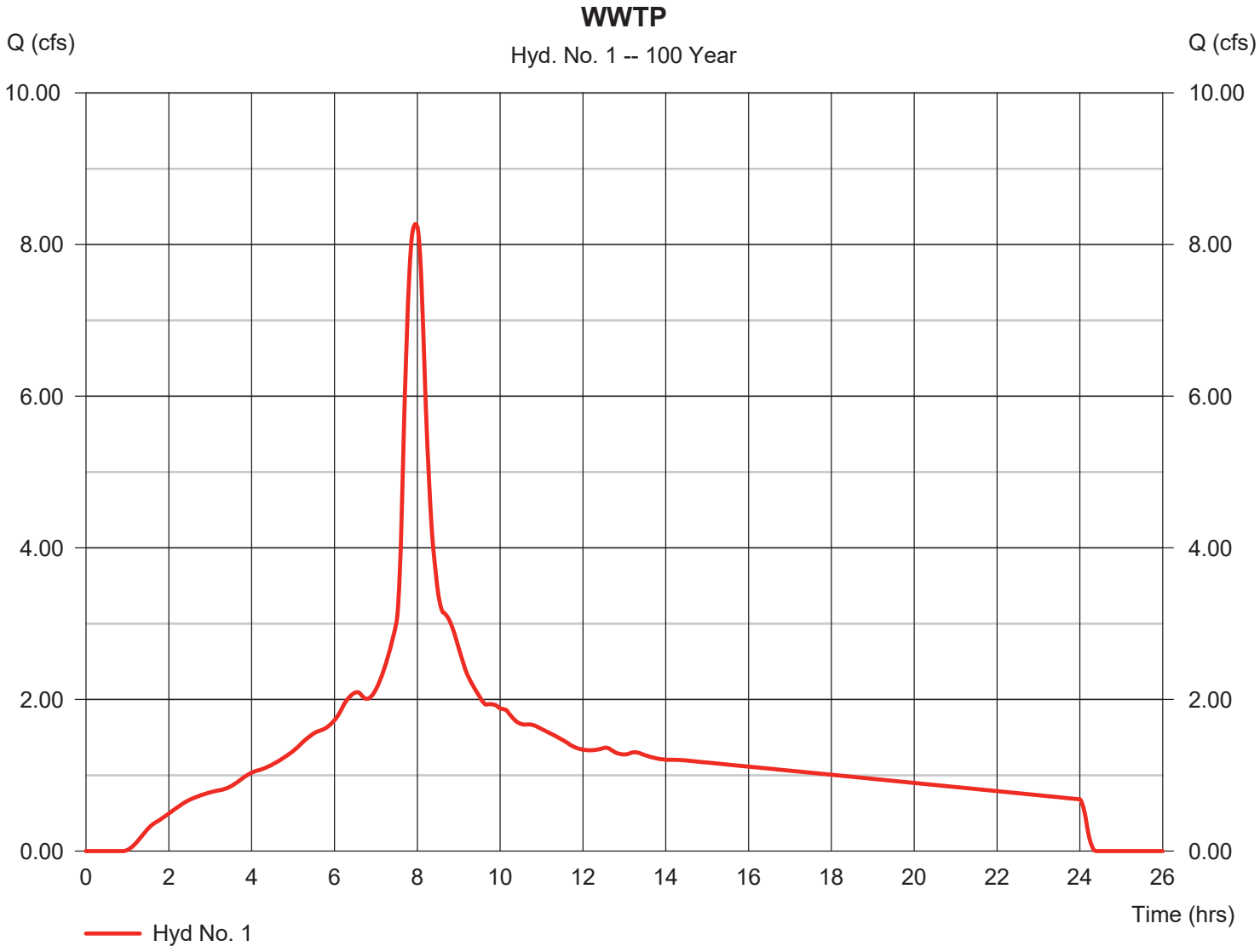
# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Thursday, 06 / 16 / 2022

## Hyd. No. 1

WWTP

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | SCS Runoff | Peak discharge | = | 8.268 cfs |
| Storm frequency | = | 100 yrs | Time to peak | = | 7.95 hrs |
| Time interval | = | 1 min | Hyd. volume | = | 117,875 cuft |
| Drainage area | = | 4.490 ac | Curve number | = | 94 |
| Basin Slope | = | 0.0 % | Hydraulic length | = | 0 ft |
| Tc method | = | User | Time of conc. (Tc) | = | 15.00 min |
| Total precip. | = | 7.95 in | Distribution | = | Type IA |
| Storm duration | = | 24 hrs | Shape factor | = | 484 |



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# APPENDIX I

Acorn Environmental
Grading & Hydrology Report
Peak Flow Rate Mitigation Hydrograph

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# Hydrology Report

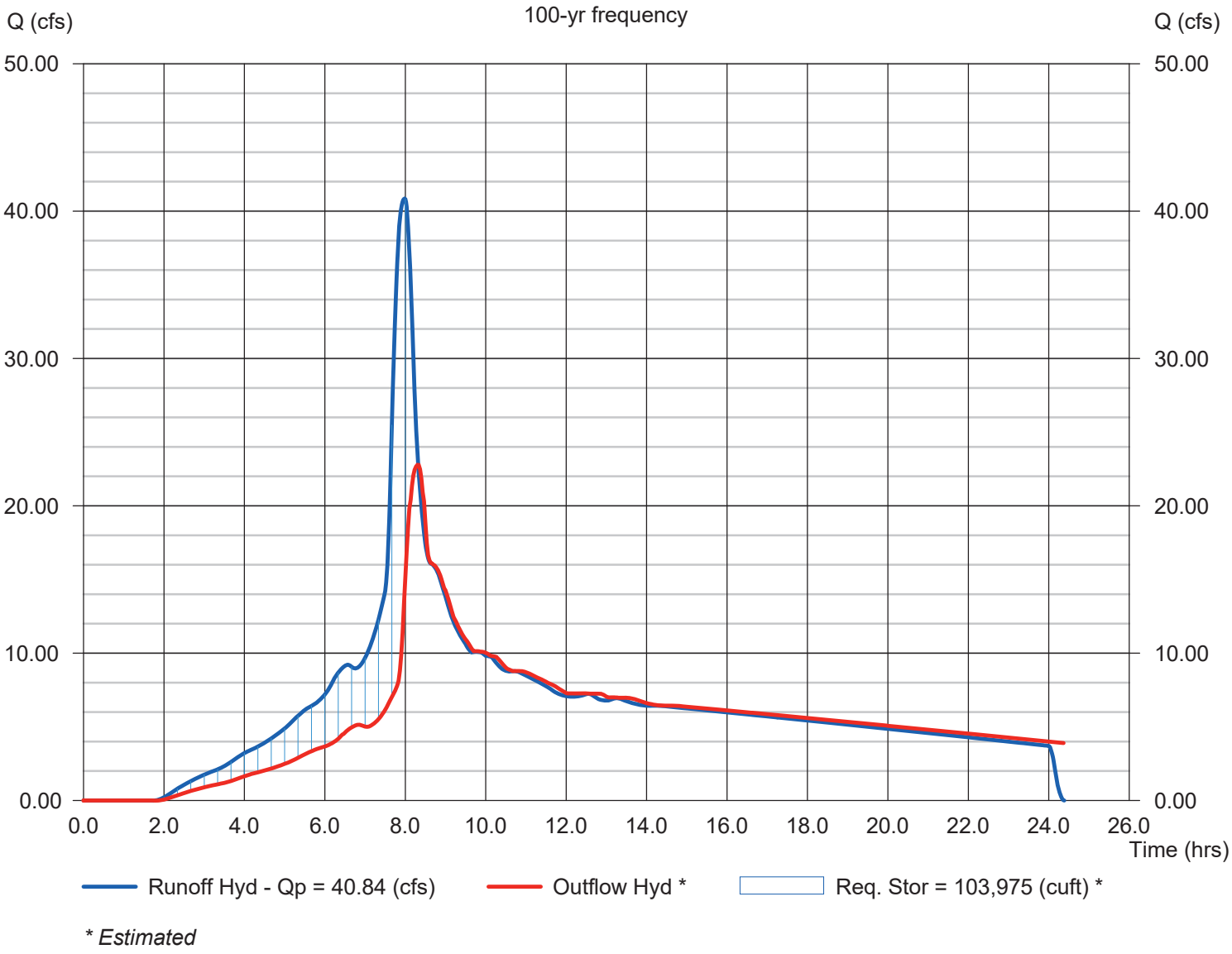
Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Jun 16 2022

## Proposed West - Peak Flow Rate Mitigation

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS | Peak discharge (cfs) | = 40.84 |
| Storm frequency (yrs) | = 100 | Time interval (min) | = 1 |
| Drainage area (ac) | = 25.040 | Curve number (CN) | = 86 |
| Basin Slope (%) | = n/a | Hydraulic length (ft) | = n/a |
| Tc method | = User | Time of conc. (min) | = 15 |
| Total precip. (in) | = 7.95 | Storm Distribution | = Type IA |
| Storm duration (hrs) | = 24 | Shape factor | = 484 |

Hydrograph Volume = 571,089 (cuft); 13.110 (acft)

### Runoff Hydrograph




** Estimated*

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# APPENDIX J

Acorn Environmental
Grading & Hydrology Report
Detention Basin and Outlet Pipe Sizing

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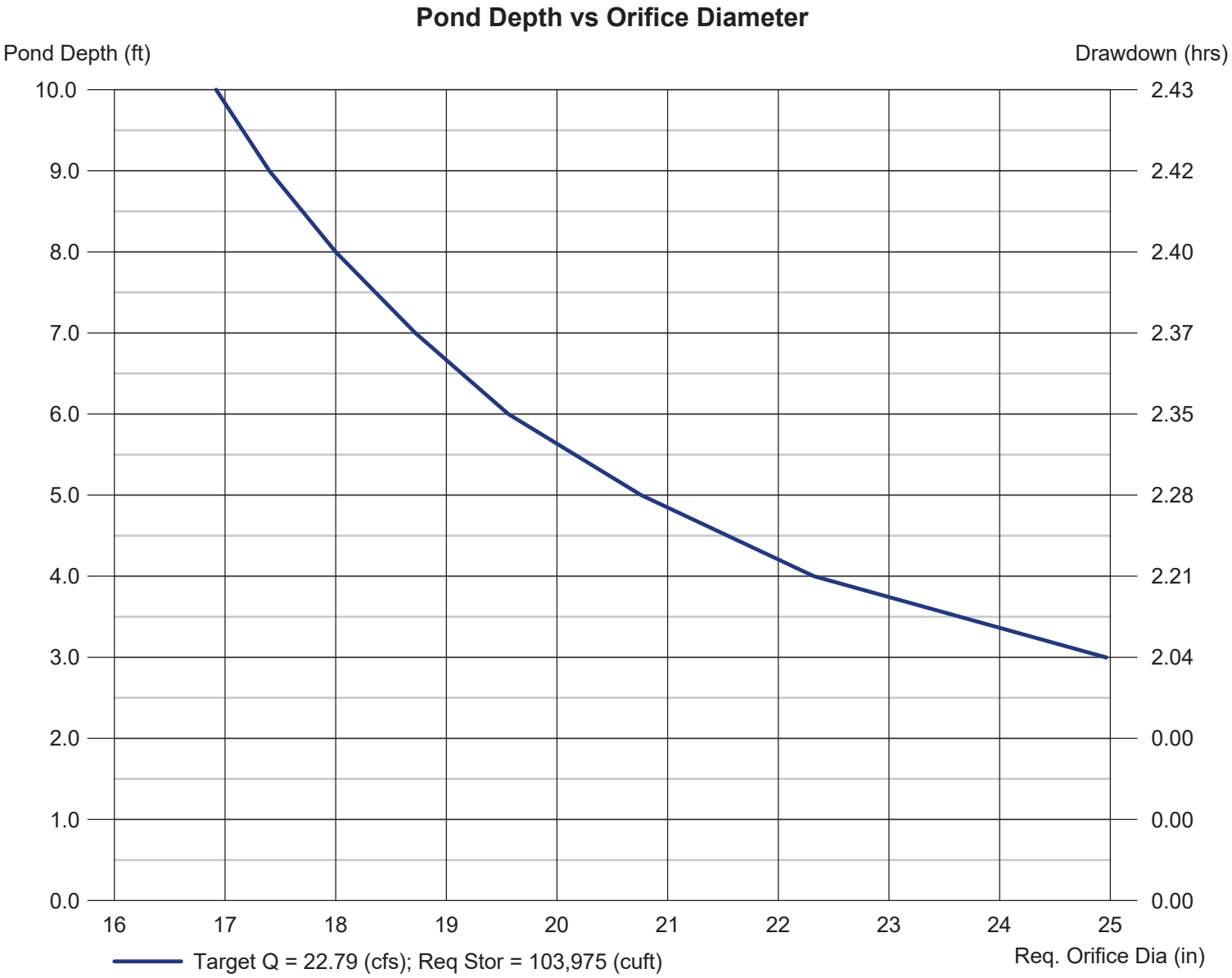
# Hydrology Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Jun 21 2022

## Proposed West - Peak Flow Rate Mitigation

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS | Peak discharge (cfs) | = 40.84 |
| Storm frequency (yrs) | = 100 | Time interval (min) | = 1 |
| Drainage area (ac) | = 25.040 | Curve number (CN) | = 86 |
| Basin Slope (%) | = n/a | Hydraulic length (ft) | = n/a |
| Tc method | = User | Time of conc. (min) | = 15 |
| Total precip. (in) | = 7.95 | Storm Distribution | = Type IA |
| Storm duration (hrs) | = 24 | Shape factor | = 484 |

Hydrograph Volume = 571,089 (cuft); 13.110 (acft)



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