
Appendix F

Hydrology Report

HYDROLOGY REPORT

ATWOOD MULTIPURPOSE TRAIL PROJECT

May 2, 2023

PRESENTED TO



City of Placentia

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1 INTRODUCTION AND EXISTING CONDITIONS

1.1 Project Background

This Hydrology Report has been prepared in support of the Atwood Multipurpose Trail Project (proposed project) located in the City of Placentia (City), Orange County, California. This Hydrology Report will be used as supporting environmental documentation and as reference in the decision-making process to be undertaken by the Orange County Transportation Authority (OCTA), the project sponsor, and the California Department of Transportation (Caltrans), the administering agency for this proposed project. The City will act as the Lead Agency pursuant to the California Environmental Quality Act (CEQA). OCTA approved the City's request for federal funds as part of the Bicycle Corridor Improvement Program (BCIP) through the Federal-Aid Congestion Mitigation Air Quality Program. OCTA awarded funding to begin the preliminary engineering and environmental analysis phase to connect the Orange County Flood Control District (District) maintenance access roads to future installed City sidewalks.

1.1.1 Project Goal and Objectives

The proposed project would involve the construction of a multiuse trail along the Atwood Channel, maintained by the District, within the community of Atwood in the City (Figure 1.1, Site Vicinity Map). The proposed project site is comprised of portions of two gravel paved vacant access roads that are located along the northern and southern sides of the Atwood Channel, paved streets that cross over the channel, a gated intersection with the fenced pedestrian bridge to access Parque De Los Niños, and the southwestern edge of the existing Lakeview Loop roadway. The project site is generally bounded by Orangethorpe Avenue to the north, Lakeview Avenue to the east, Miraloma Avenue to the south, and Jefferson Street to the west. The proposed project would be centrally located and in close proximity to existing bikeways (Class I, Class II, and Class III), railroad tracks, and recreational facilities. The proposed trail would stretch east of the BNSF railroad tracks, approximately 600 feet east of Jefferson Street, to Lakeview Avenue and continue east adjacent to the Parque de Los Niños and the Placentia Veterans Village housing development along the Atwood Channel, alternating between north and south sides of the maintenance easement.

The proposed project includes the construction of a 1.0-mile-long trail stretching from east of the BNSF railroad tracks to Lakeview Avenue. The proposed trail would include a paved multiuse path; new midblock crossings with ADA accessibility including modified sidewalks and curb ramps at Richfield Road, South Van Buren Street, and Fee Ana Street; a trailhead at Parque De Los Niños; new street signs and striping; wayfinding signage; and a staging area to the east of S. Van Buren Street between the channel and Vicente Avenue.

The City is considering three project elements:

1. Trail fencing along the edge of the channel,
2. A trail extension from Jefferson Street to the BNSF rail line, and
3. A bridge or grade separation crossing over the existing BNSF railroad tracks.

Of the three elements, the potential trail extension and the bridge or grade separation crossing, a 0.1-mile length, are considered "Optional To Be Determined" by the City and Caltrans and neither is a part of the project's limits of work.

Crossing options at intersections, a connection on the eastern end from Lakeview Loop to the Class II bike lane on Lakeview Avenue, and local access points along the trail alignment have been identified to provide residents with connection to residential areas and parks.

1.2 Existing Site Conditions

1.2.1 Site View

The Atwood Trail LID would be located at areas of runoff accumulation on approximately 0.9 miles of maintenance roads adjacent to the Atwood Channel. The side of the channel on which the Trail will occupy alternates between certain subsections. The LID would likely be located on the sides of the Trail closest to the channel. **Figure 1-1** shows the Site Vicinity Map. The proposed trail would connect residents to the nearby El Camino Real High School, Parque De Los Niños, and the Placentia Veterans Village. Two existing uncontrolled street crossings, at Van Buren Street and Richfield Road, would be redesigned to allow for the safe passage of pedestrians.

1.2.2 Storm Drain Data Review and Mapping

Digital storm drain utility inventories made available by Orange County Public Works were used to assess existing storm drain infrastructure relevant to the Atwood Trail (**Figure 1-2**). Storm drainpipes and inlets are primarily located at nearby street crossings, with one main drain entering the channel within the maintenance road area. Local drainage collectors are located on or adjacent to the maintenance roads. Strategically placed LID along the Trail could reduce and partially treat runoff that would normally enter these inlets.

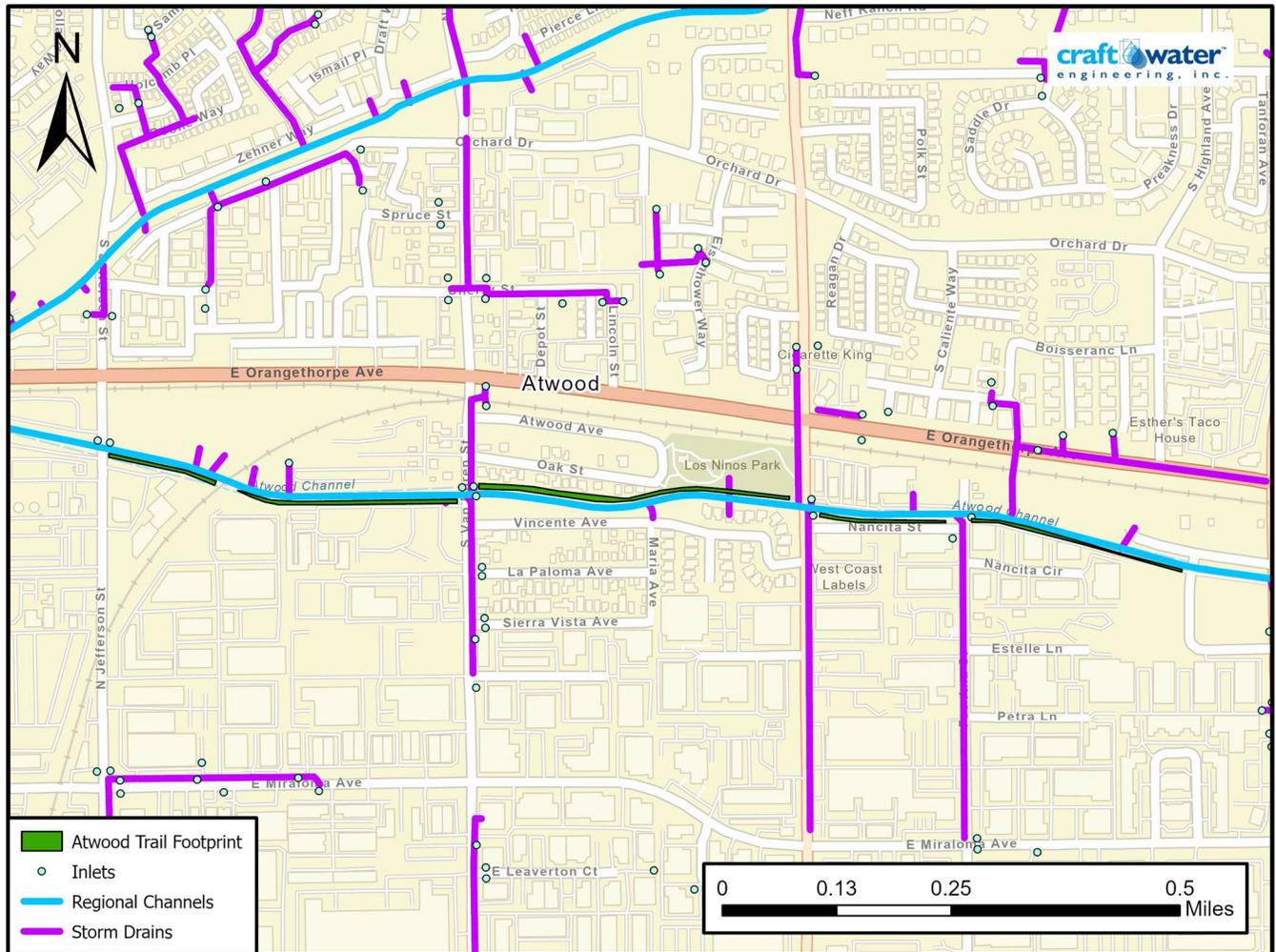


Figure 1-2. Existing Storm Drain Infrastructure at the Atwood Trail Location.

1.2.3 Non-Stormwater Infrastructure

An oil derrick and multiple oil pipes are located within the proposed footprint for the Atwood Trail. Oil pipes run across the channel but mainly intersect the channel slopes (**Figure 1-3**). However, there are a few that intersect the edge of the maintenance road. When designing and constructing the Atwood Trail, extra care should be taken to prevent the puncture or weakening of these pipes. These pipes will likely be adjacent to LID, where a rupture would directly pollute the channel and potentially harm landscaping and pedestrians.



Figure 1-3. Oil Pipes Crossing the Channel at multiple locations

1.2.4 Infiltration Feasibility

An infiltration feasibility study of the Atwood Trail Project Site was conducted via a desktop analysis to determine potential infiltration rates for an Atwood Trail BMP.

NRCS Custom Soil Resource Report

NRCS Hydrologic Soil Type classifications were used to determine the infiltration potential for the Atwood Trail LID. The USDA web soil survey tool was used to create a custom soil resource report to determine the Project’s NRCS Hydrologic Soil type (**Figure 1-4**). The project location primarily contains NRCS Type B soil. **Table 1-1** lists the range of minimum infiltration rates based on NRCS soil type (Water Resources Engineering, Mays, 2019). Since the project site contains Type B soil, partial infiltration is possible. However, a site-specific geotechnical evaluation is recommended for further verification of this before final project sizing is defined.

Table 1-1. NRCS Soil Type Minimum Infiltration Rates

NRCS Soil Type	Minimum Infiltration Rate(in/hr)
A	0.30-0.45
B	0.15-0.30
C	0.05-0.15
D	0.0-0.05

While the minimum infiltration rate ranges indicate the likely feasibility for infiltration at this site, these alone do not provide a cap on potential performance. The custom soil resource report details the capacity of the most

limiting layer to transmit water (K_{sat}) as moderately high, with a value anywhere between 0.57-1.98 in/hr. While these rates are still provided in ranges, this information reaffirms the project's infiltration feasibility.

1.2.5 Physical Site Conditions

Groundwater Conditions

The historic high groundwater map was published as part of the California Geographical Survey (CGS) seismic hazard report for the Orange Quadrangle was reviewed (**Figure 1-5**), and it indicates a historic high groundwater level to be approximately 15-18 feet below ground surface at the project site. Additional investigations will be needed to confirm groundwater presence and infiltration feasibility.

Liquefaction Potential

GIS Data from the California Geographical Survey's (CGS) Seismic Hazard Report on the Orange Quadrangle identifies potential hazards within approximately 90 square miles surrounding the project site (**Figure 1-6**). The Atwood Trail is at risk of liquefaction, as it is in the middle of a 43 sq. mi. liquefaction zone. While earthquake-induced landslide zones are present in the Orange Quadrangle, none of these zones overlap with the Trail footprint. According to the CGS report, methods for mitigating permanent ground displacements will be required as according to Public Resources Code Section 2693(c). Review of the Figure 4.8-2 of the Environmental Impact Report for the City of Placentia (dated July 2019) confirmed that the Atwood Trail is within a liquefaction zone.

Site Contamination

The California GeoTracker tool developed by the State Water Resources Control Board was used to identify any potential contamination issues near the Atwood Trail Site. Contamination within the project footprint would require remediation and/or consideration of project alternatives. Contamination near the project footprint poses less of a risk, but might still impact the feasibility of a project. Within a 2,000 ft buffer of the Project footprint, 20 cleanup instances were found (**Figure 1-7**). **Table 1-2** lists relevant details for these projects.

Most of the projects within the search radius are completed, indicating no immediate contamination risk when constructing or utilizing infiltrative LID. The only projects not marked complete, ExxonMobil Atwood terminal and PBF Energy Atwood Terminal, are still open and of Public Community Category Type 2 and 1. Per GeoTracker definitions, Open – Site Assessment projects are still in the site characterization and risk investigation stage. Open – Verification Monitoring projects have completed their remediation activities and are in the process of monitoring to prove compliance. A Type 2 project typically includes larger industrial or commercial sites with significant soil and groundwater contamination. The groundwater plume of a Type 2 project extends beyond the public right of way and are generally sites of moderate public concern. A Type 1 project typically includes small facilities with soil contamination that does not extend off-site and groundwater contamination that extends only into the public right of way.

It should be noted that both open projects are located adjacent to each other and approximately 1,000 ft from the western most part of the Trail. Contamination is not widespread, but instead concentrated in a known area of concern. The PBF Energy site has already been treated and is awaiting confirmation. While the ExxonMobil Site is cause for concern, recent documents available on the GeoTracker site indicate that soil borings from 2015 yielded no appreciable contamination. Coupled with additional separation provided by Jefferson Street, the contamination at these sites should have minimal impact on the construction of the Trail. If groundwater presence is sufficiently high, then groundwater samples at the Trail should be analyzed to determine if contamination is widespread. If so, then alternative BMP placement and/or types will need to be re-discussed.

Table 1-2. Details for Cleanup Sites within 2,000 feet of the Atwood Trail AOI

Project Name	Project Location	Site Type	Status	Last Update	Public Category
EXXONMOBIL ATWOOD TERMINAL	1477 JEFFERSON ST., N.	CLEANUP PROGRAM SITE	OPEN - SITE ASSESSMENT	3/27/2009	2
PBF ENERGY ATWOOD TERMINAL (FORMERLY MOBIL)	1477 N. JEFFERSON STREET	CLEANUP PROGRAM SITE	OPEN - VERIFICATION MONITORING	2/1/2016	1
PLACENTIA DEVELOPMENT COMPANY	6061 JEFFERSON ST	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	7/31/2013	None Specified
TOSCO - 76 #5251	1801 ORANGETHORPE	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	4/10/2013	None Specified
HARTWELL CORPORATION	900 RICHFIELD	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	10/19/2012	None Specified
PLACENTIA-YORBA LINDA USD	1301 ORANGETHORPE	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	5/10/2006	None Specified
REDU PROPERTY (NEFF RANCH)	1091 RICHFIELD RD	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	6/21/1999	None Specified
GAMBINO PROPERTY	300 LINCOLN ST	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	11/6/1996	None Specified
SABA PETROLEUM	1920 ORCHARD	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	2/2/1996	None Specified
METRONIC	4633 E LA PALMA AVE	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	4/13/1995	None Specified
RICHFIELD FIELD GARAGE /UNION	6071 JEFFERSON ST	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	12/13/1993	None Specified
UNOCAL	6071 JEFFERSON	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	11/3/1993	None Specified
PLACENTIA TRUCK VAN AND 4 WHEEL DRIVE WRECKING	461 VAN BUREN	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1/6/1993	None Specified
STEPHENSON EQUIPMENT RENTAL	6591 JEFFERSON	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1/30/1991	None Specified
ROOFING WHOLESALE CO	633 VAN BUREN	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	1/10/1991	None Specified
RYDER TRUCK RENTAL	736 RICHFIELD	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	6/6/1990	None Specified

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Project Name	Project Location	Site Type	Status	Last Update	Public Category
ROOFING WHOLESALE CO INC	633 S VAN BUREN ST	CLEANUP PROGRAM SITE	COMPLETED - CASE CLOSED	12/19/1988	None Specified
JAMES MOCK INC	700 RICHFIELD	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	9/15/1988	None Specified
TEXACO OIL	1701 ORANGETHORPE	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	3/9/1987	None Specified
HARTWELL CORP	900 RICHFIELD	LUST CLEANUP SITE	COMPLETED - CASE CLOSED	7/8/1986	None Specified

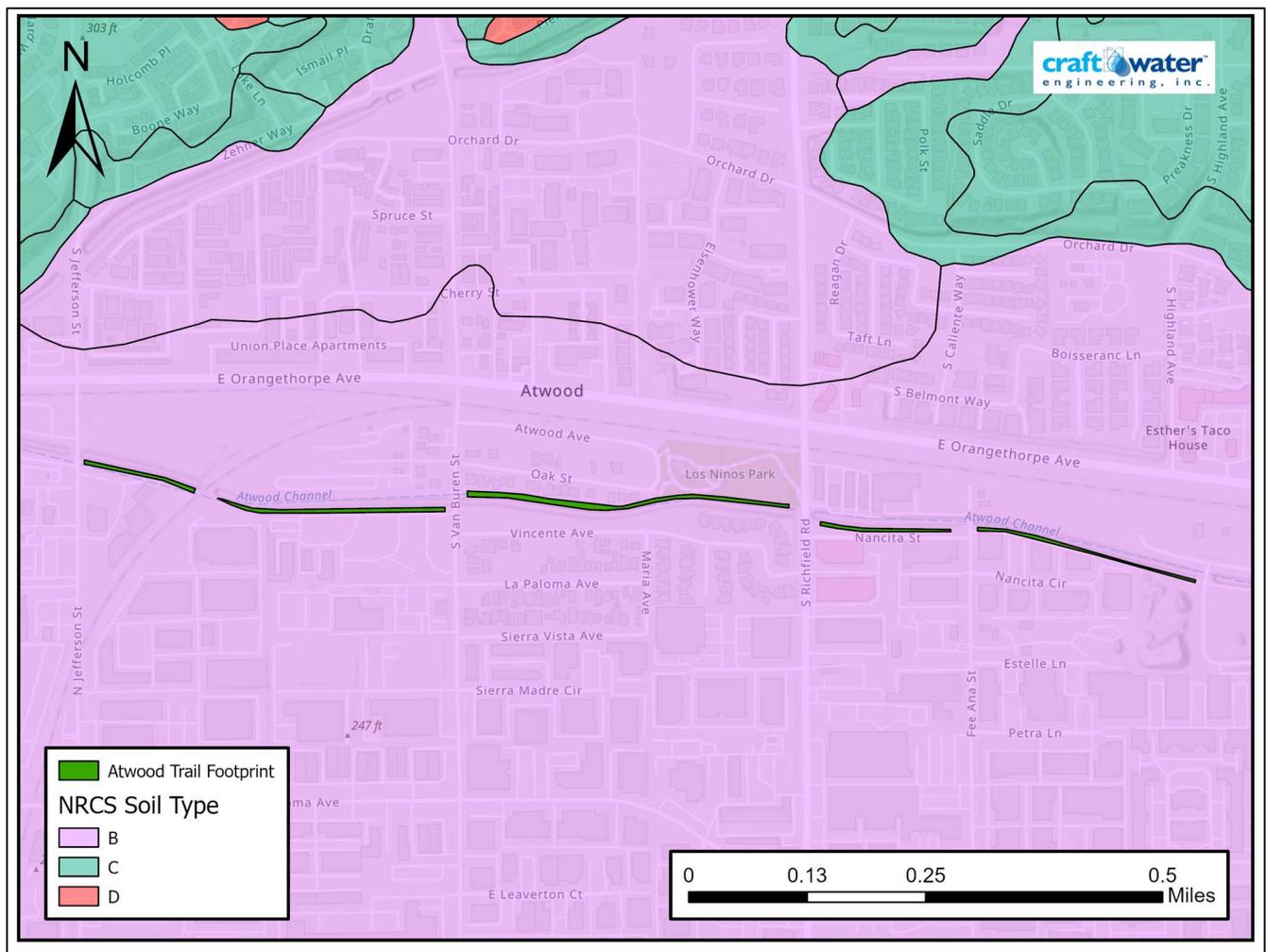


Figure 1-4. Spatial Distribution of NRCS Soil Types at the Atwood Trail Location

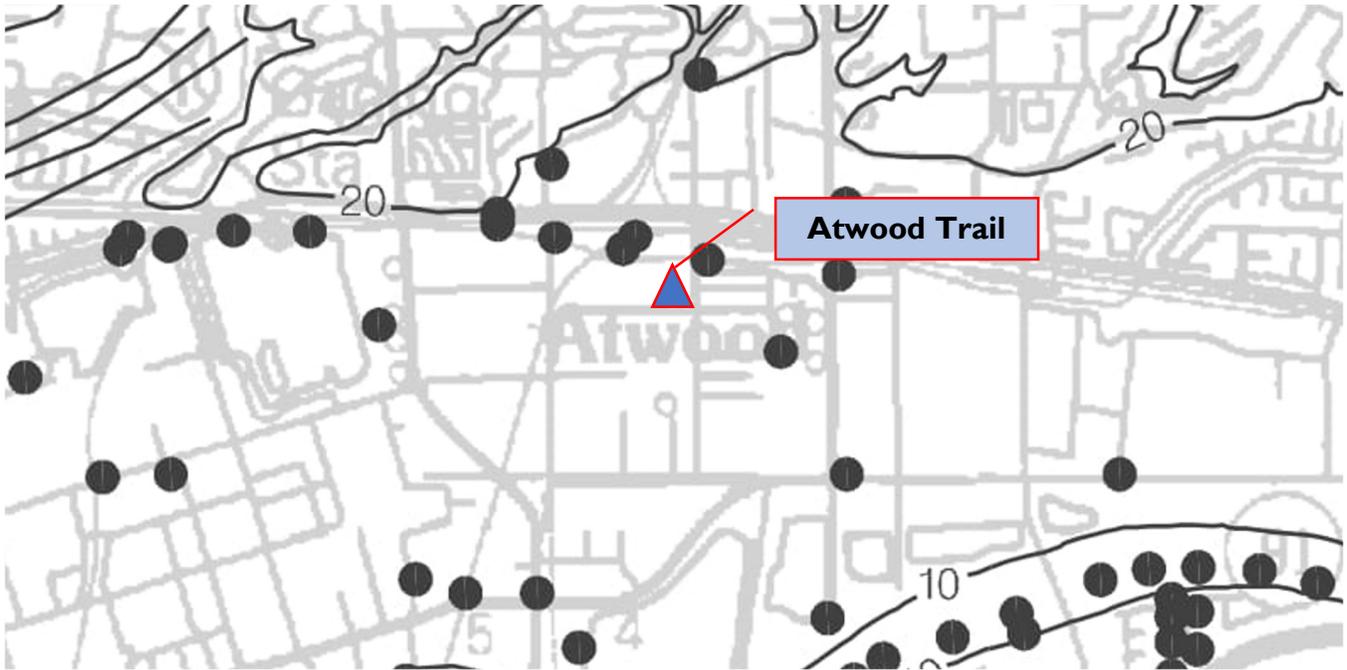


Figure 1-5. Map of Historically Highest Groundwater Levels from the CGS Seismic Hazard Report.

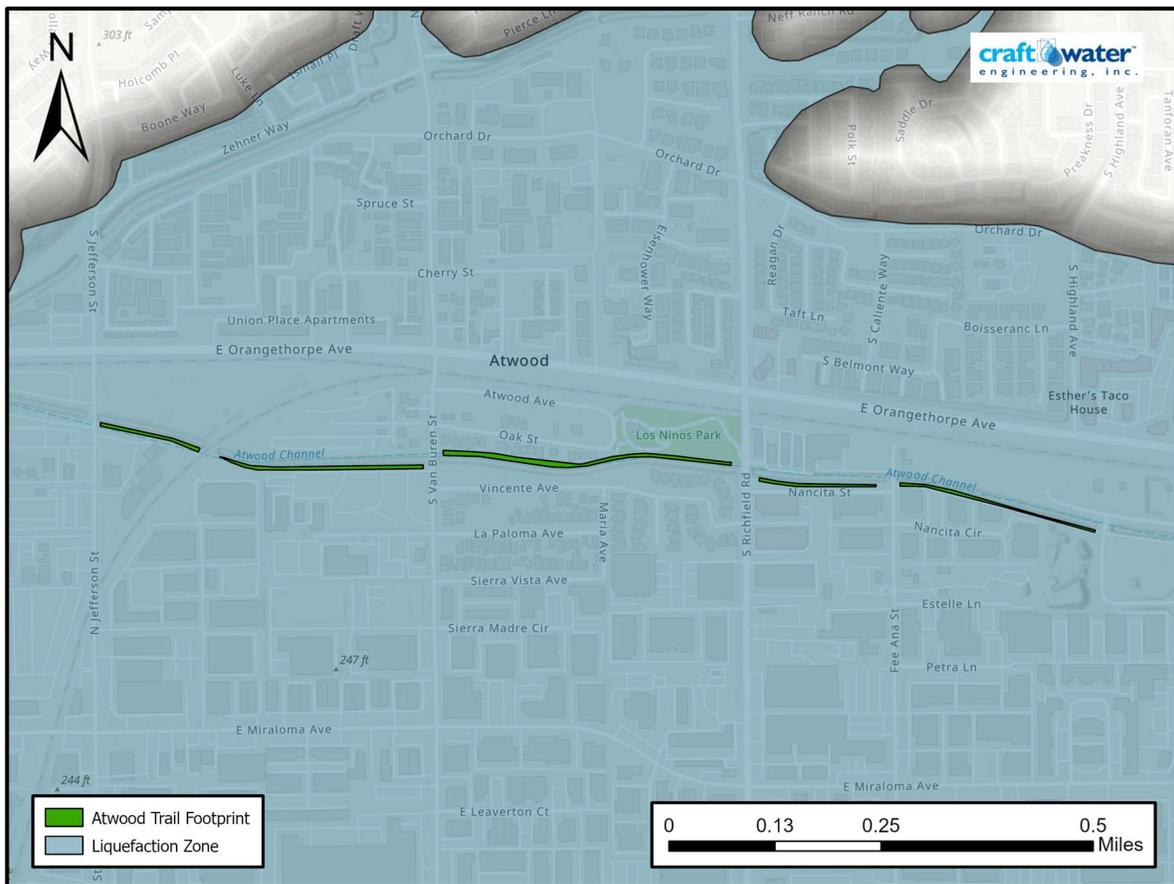


Figure 1-6. Map of Orange Quadrangle Geological Hazards from the CGS Seismic Hazard Report

2 HYDRAULIC AND HYDROLOGIC ANALYSIS

2.1 Existing Site Hydrology

The drainage area delineations for the project site (**Figure 2-2**) were developed using drainage notes from an on-site visit and high-resolution Light Detection and Ranging (LiDAR) elevation data for verification of surface flow paths. The delineated drainage areas were used to determine the hydrology of the 85th percentile storm.

The Orange County Hydrology Manual was used to determine runoff volume and flow rate associated with the 24-hour 85th percentile storm for the Atwood Trail Drainage Areas. **Figure 2-1** displays the 24-hour storm distribution. **Table 2-1** details drainage area characteristics and total runoff volumes generated by the 85th Percentile Storm, which was 0.87 in. Hydrographs for each subdrainage area are in the appendix.

The Atwood Trail footprint is split into five (5) main drainage areas, separated by channel sections. Drainage within each of these sections can alternate between flowing directly into the channel and flowing away from the channel to a nearby inlet. All but one drainage area has multiple flow paths to the channel, allowing them to be further split into subdrainage areas. All drainage areas contain the existing access road. Observations made during a site visit revealed that additional runoff from a portion of the Los Ninos Park flows onto the adjacent access road for subdrainage 3B. **Figure 2-3** through **Figure 2-5** contain the subdrainage areas.

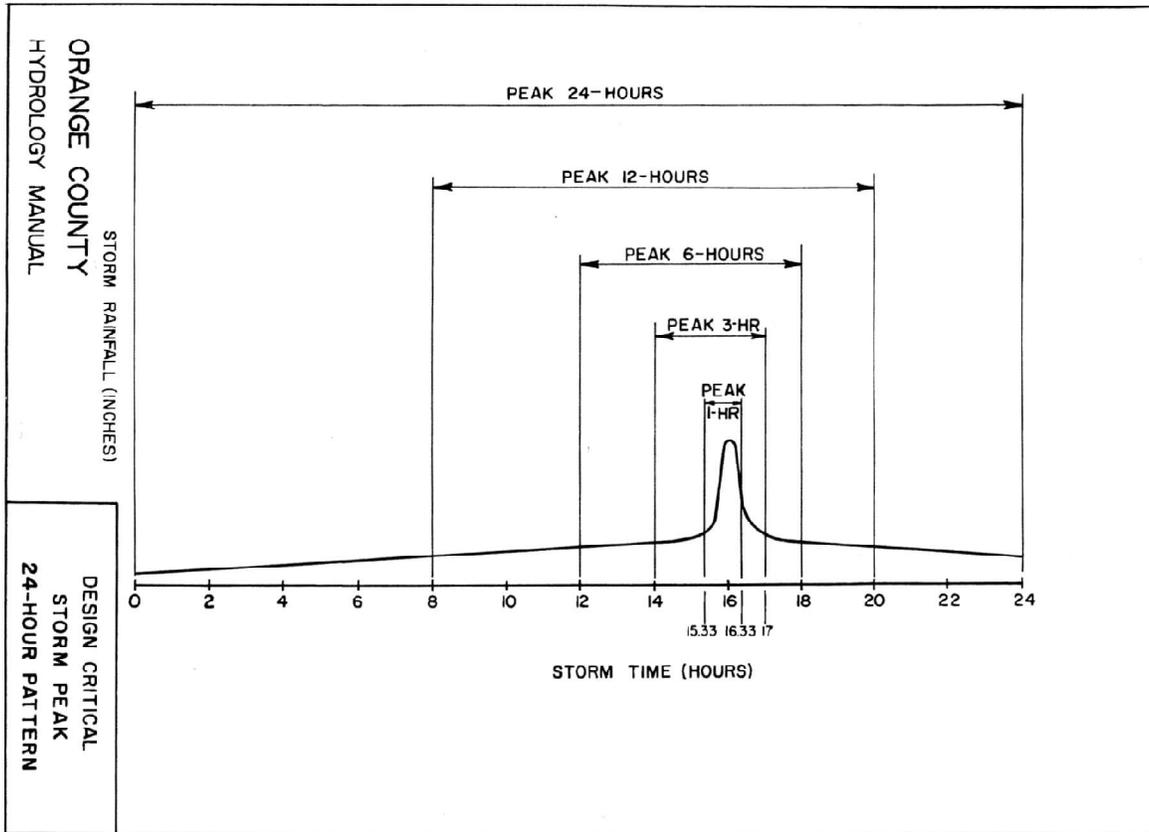


Figure 2-1. 24-Hour Design Storm from the Orange County Hydrology Manual

Table 2-1. Drainage Areas and 85th Percentile Runoff Volumes

Drainage Area	Drainage Direction	Drainage Area (Acres)	85 th Percentile Runoff (ft ³)
1A	Away from Channel	0.24	624.4
1B	Away from Channel	0.08	215.9
2A	Away from Channel	0.59	1526.6
3A	Into Channel	0.70	1787.0
3B	Away from Channel	1.59	1489.4
3C	Into Channel	0.03	79.5
4A	Away from Channel	0.16	406.4
4B	Into Channel	0.12	307.6
5A	Away from Channel	0.13	330.4
5B	Away from Channel	0.22	561.1
5C	Away from Channel	0.13	325.6
TOTAL		3.99	7653.9

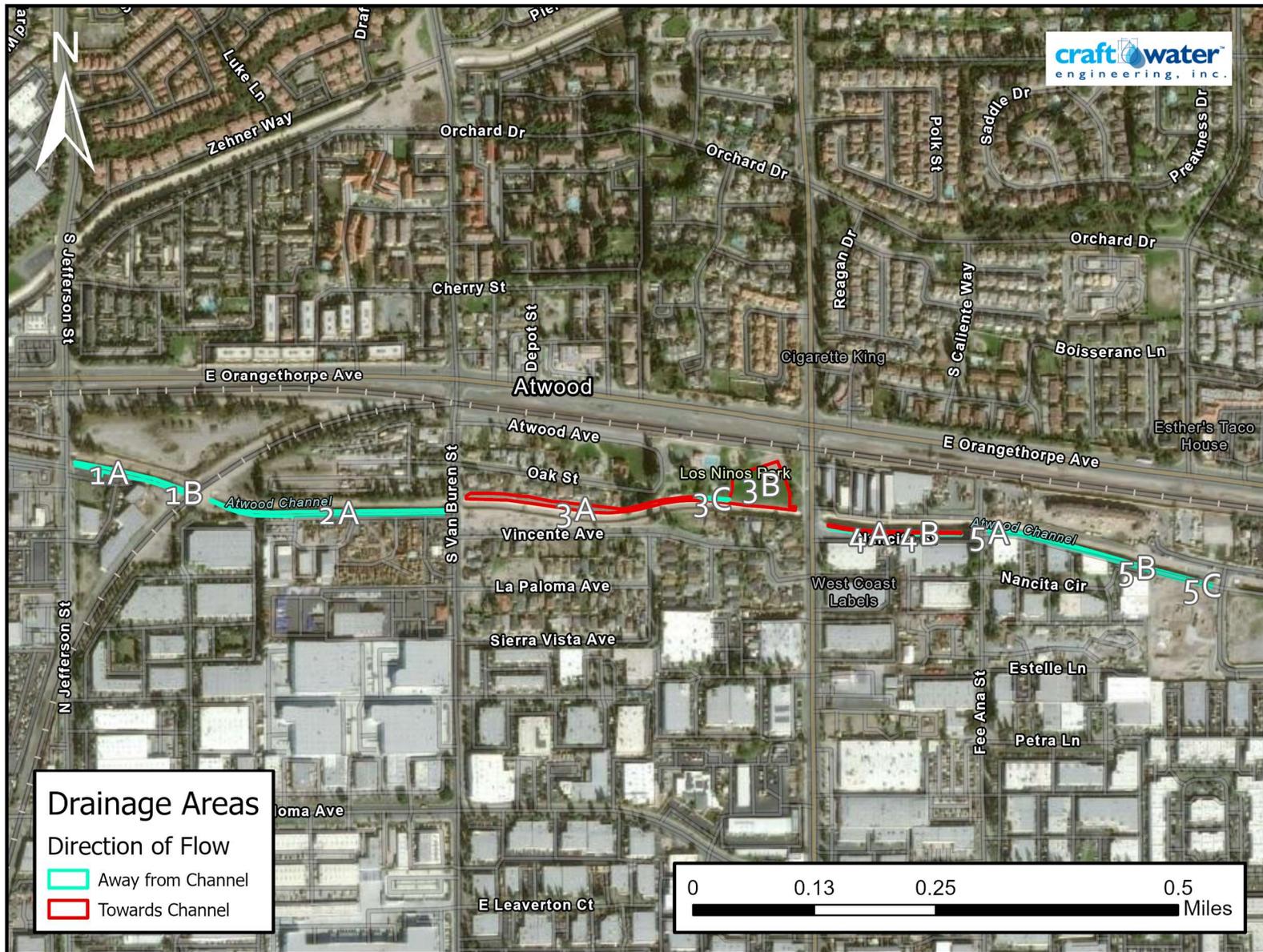


Figure 2-2. All Drainage Areas for the Atwood Trail



Figure 2-3. Drainage Areas 1 and 2 for the Atwood Trail



Figure 2-4. Drainage Area 3 for the Atwood Trail

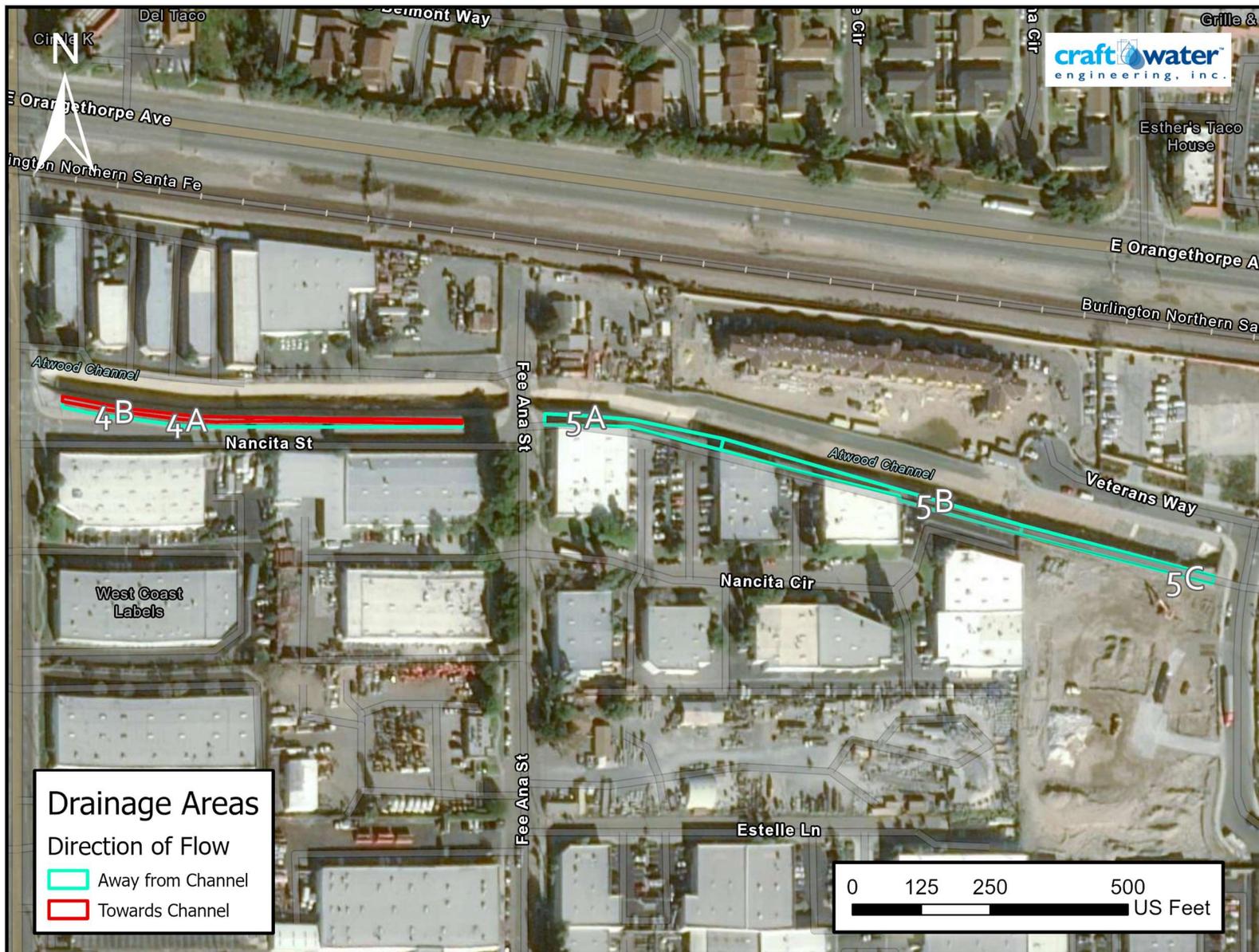


Figure 2-5. Drainage Areas 4 and 5 for the Atwood Trail

2.2 Floodplain Risk Assessment

2.2.1 Existing Regulated Flood Areas

Portions of the project site are located within a special flood hazard area (SFHA) subject to inundation by the 1% annual chance flood also referred to as the base flood or 100-year storm event. The SFHA is shown on the Flood Insurance Rate Map (FIRM) # 060509C0152J published on December 3, 2009 by the Federal Emergency Management Agency (FEMA). The portion of the FIRM where the project is located was selected and shown in **Figure 2-6** below. The complete FEMA FIRM is included in Appendix A.

A Flood Insurance Study (FIS #06059CV002C) was also completed by FEMA for all special flood hazard areas of Orange County including Atwood Channel. The FIS determined actual base flood elevations (BFE) at various locations along Atwood Channel. The BFEs are shown on the FEMA FIRM, the Flood profile map and the Floodway Data Table included in Appendix A.

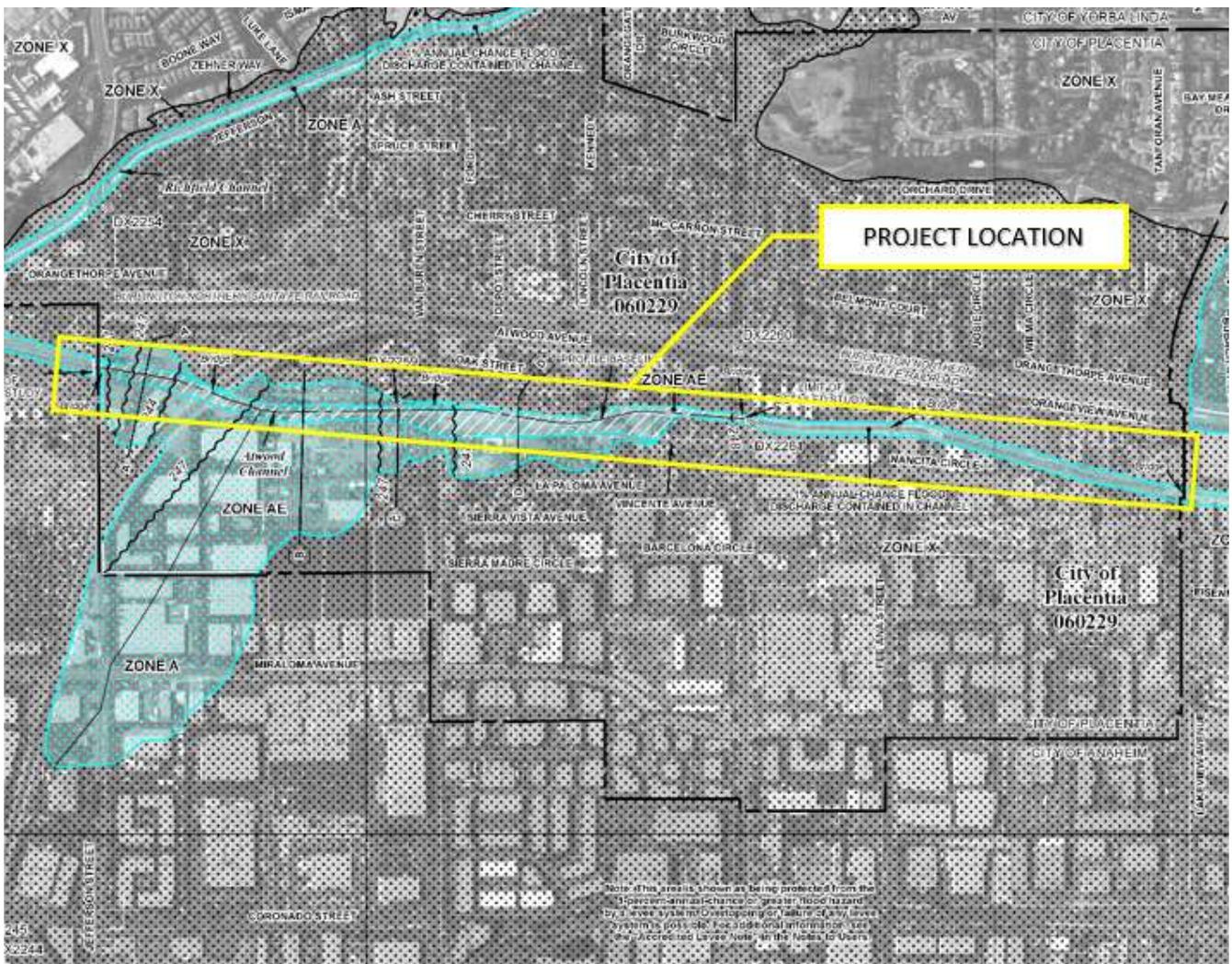


Figure 2-6. Piece of FEMA FIRM 0152J with General Project Location

As shown on the FIRM and in **Figure 2-6**, the floodplain and floodway boundaries sometimes extend over the tops of the channel banks and encroach on adjacent properties. According to the FIS, flooding problems along Atwood Channel are associated with inadequate channel capacities and undersized culvert or bridge crossings.

2.2.2 Development Requirements

Any proposed land disturbing activity within a SFHA will require a development permit from the City of Placentia. It is recommended to contact the City Floodplain Administrator for required permit application materials to be reviewed.

Floodplain Mitigation

Fill within the 100-year floodplain is sometimes allowed but will likely require mitigation in the form of compensatory storage somewhere along the project length. This means that if you raise the ground elevation within a floodplain, you will have to lower the elevation somewhere else and maintain hydraulic connectivity. Careful consideration of impacts to adjacent properties and the existing channel banks should be given before filling in the floodplain.

Floodway Mitigation

The floodway includes the channel and adjacent land areas that must be reserved to convey the base flood without increasing the water surface elevation more than a previously determined allowable height. Chapter 21.20 of the City of Placentia Municipal Code expressly prohibits any increase in flood levels within the floodway, therefore areas of the project located within the floodway **must** maintain existing elevations.

3 LID IMPLEMENTATION ANALYSIS

According to the EPA, LID is an approach to land development (or re-development) that works with nature to manage stormwater as close to its source as possible. In urban environments, LID is typically instituted on small scales as large areas for stormwater management are limited. A goal of this project is to implement LID strategies to the maximum extent feasible within the project limits to maintain or improve existing onsite stormwater conditions.

The most common examples of LID are installing stormwater best management practices (BMPs) such as bioretention gardens, infiltration basins, bioswales, and pervious pavement. These structural BMPs intercept and treat stormwater runoff. Sections 3.1 and 3.2 discuss the possibility of implementing BMPs as part of the project alongside the trail to minimize the total impervious surface area, provide basic treatment, and promote a naturalized aesthetic.

3.1 BMP Modeling Setup and Assumptions

EPA’s System for Urban Stormwater Treatment and Analysis Integration (SUSTAIN) model was used for this analysis to automatically evaluate many different BMP configurations. The model was run using the 24-Hour 85th Percentile runoff hydrographs generated for each subdrainage area. During this modeling, multiple storage volumes were simulated to capture approximate BMP throughflow rates. Modeling efforts investigated the range of BMP configurations as detailed in the following subsections.

3.1.1 Storage Volume and Footprint

As previously mentioned, the portions of Atwood Trail alongside the channel are approximately 0.9 miles (4752 ft) long. **Table 3-1** presents the access road area available for each subdrainage area. While a majority of the access road will be reserved for the bike trail, these values still serve as useful benchmarks for feasibility. BMP area configurations were modeled in approximately 4 sq ft. increments to pinpoint the area required for runoff capture. BMP would likely be located directly alongside the channel, but a wide variety of BMP channel configurations are possible (trapezoidal, box, etc.). For this feasibility study, a 0.5 ft total runoff storage depth was used as a conservative estimate to ensure that any chosen cross-section can be used within an area.

Table 3-1. Access Road Area Available for Each Subdrainage Area

Drainage Area	Access Road Area (Acres)
1A	0.24
1B	0.08
2A	0.59
3A	0.7
3B	0.34
3C	0.03
4A	0.16
4B	0.16
5A	0.13

5B	0.22
5C	0.13

3.1.2 Infiltration Rate

The infiltration feasibility study indicated that the BMP has potential infiltration rates between 0.15-1.98 in/hr. An infiltration rate of 0.3 in/hr was used to model the BMP as an optimistic estimate, since the custom soil report indicated minimum infiltration rates greater than 0.3 in/hr. Future infiltration studies could verify infiltration rates.

3.1.3 BMP Modeling Results and Considerations

Table 3-2 breaks down the required BMP footprint for each subdrainage area to treat the 85th percentile storm. As stated in Section 3.1, the storage depth was assumed to be 0.5 ft.

Table 3-2. LID Footprint Required to Capture the 85th Percentile Storm, by Subdrainage Area

Subdrainage Area	LID Area Required (sq ft)	% of Area Required for LID
1A	571	5.5%
1B	200	5.8%
2A	1,394	5.4%
3A	1,625	5.3%
3B	1,359	9.2%
3C	74	5.7%
4A	370	5.3%
4B	283	4.1%
5A	301	5.3%
5B	514	5.4%
5C	296	5.2%
Total	6,987	5.8%

Every subdrainage area, except for 3B, requires approximately 5% of the access road area to install LID that manages the 85th percentile storm. Unfortunately, BMP opportunities are limited along the trail since the final trail width is not wide enough for maintenance vehicles to traverse. In lieu of this, the main opportunities to install BMP are located at the trail gates at the South Van Buren Street (Subdrainage 3A) and immediately north where the access road is wider than average. Concept plans for these specific areas are presented in **Figure 3-1** and **Figure 3-2**. However, the limited area available for BMP at each of these areas is not enough to fully manage the design storm for those subareas.

3.2 Additional LID Strategies

While BMP opportunities are limited, the project does follow other LID strategies:

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- ***Reduce or maintain existing impervious surfaces***

The existing access road is impervious, just as the planned bike trail will be. There is ultimately no impervious area being added to the project. As a result, there is no BMP requirement to manage runoff since no major hydrological changes to the site will occur. Therefore, any partial capture by new BMP will improve stormwater conditions while supporting the projects main BCIP goals.

- ***Maintain existing drainage patterns***

While slight alterations to flow patterns might be made during the construction process the overall drainage patterns will be maintained.

- ***Runoff volume match***

By maintaining existing impervious surfaces and drainage patterns, the existing site hydrology including runoff volume and rates are unchanged. The addition of landscaped areas where possible would decrease runoff volumes and rates.

Overall, the proposed Atwood Trail does little to change existing site hydrology which is in line with LID strategies.

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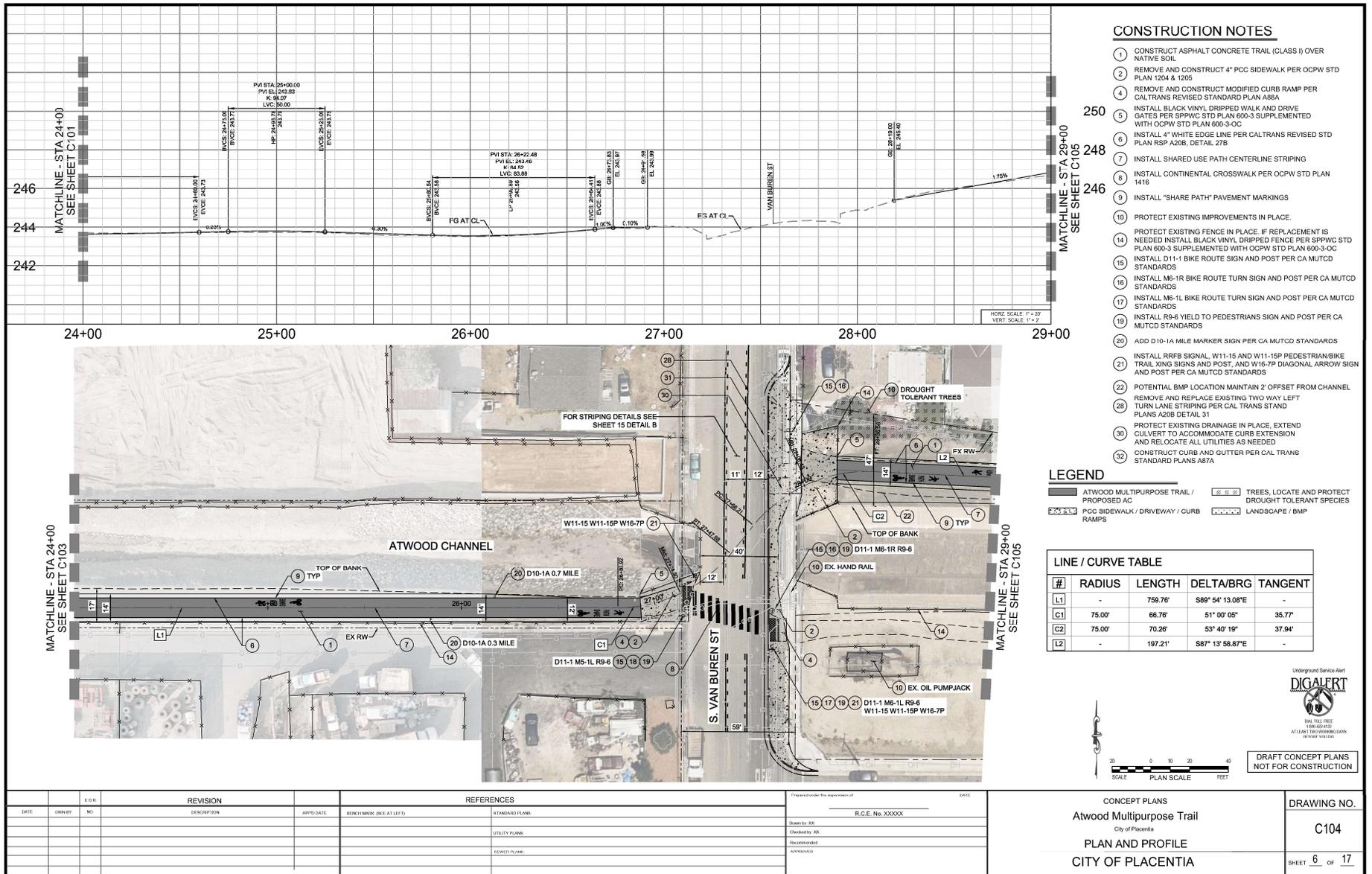


Figure 3-1. Atwood Trail Concept Plan for the South Van Buren Street Crossing

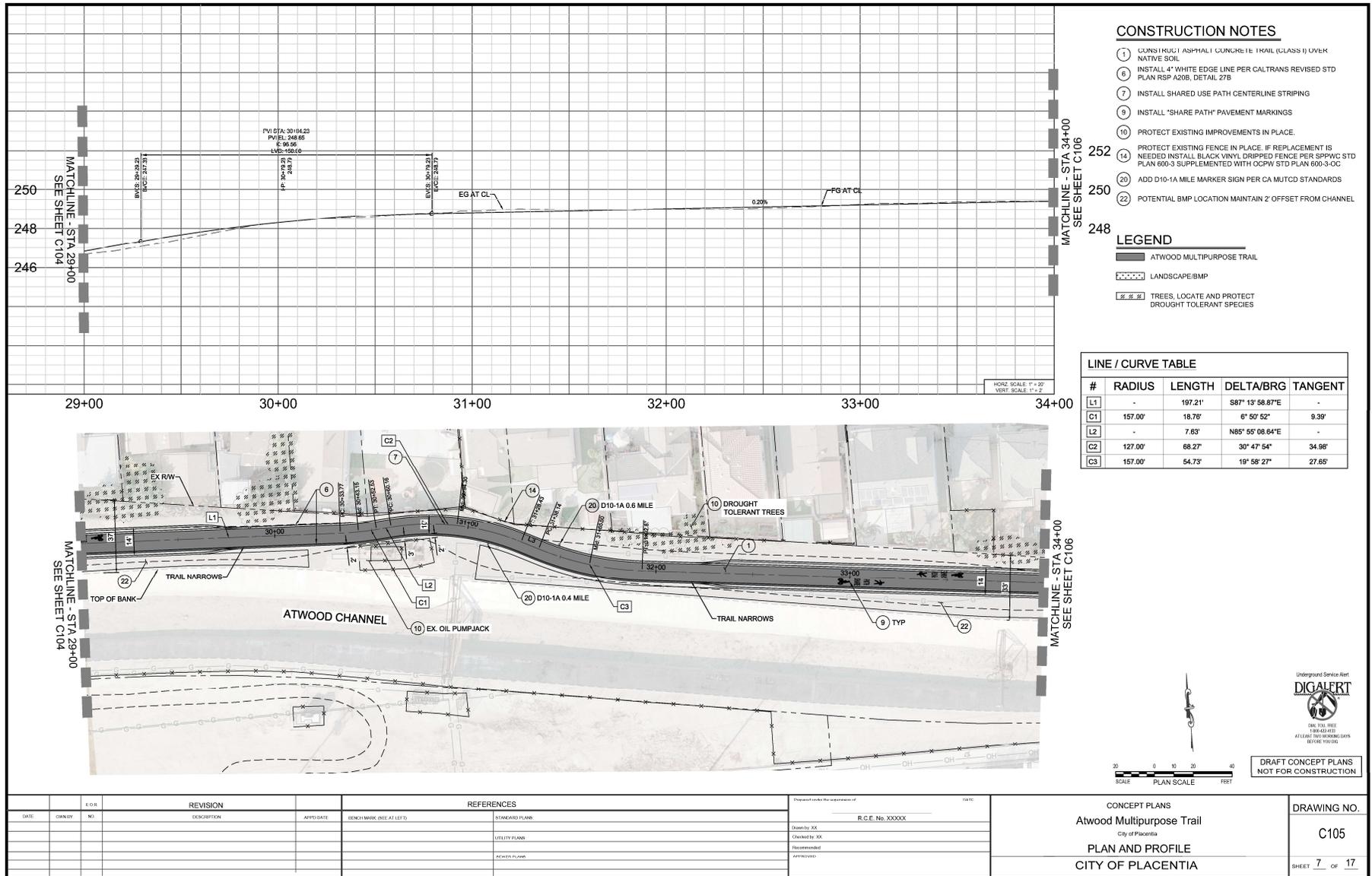


Figure 3-2. Atwood Trail Concept Plan just north of the South Van Buren Street Crossing

4 CONCLUSIONS

This hydrology report was prepared for the Atwood Multipurpose Trail Project to advance progress towards the implementation of LID as part of the Project and understand floodplain impacts.

LID Implementation

The existing site, stormwater utilities, geotechnical conditions, and hydrology were characterized to determine the feasibility of LID implementation and runoff management.

The primary issue preventing full-scale LID implementation is the trail's width. The trail width required for maintenance and landscaping vehicles is wider than the feasible footprint for the trail. Therefore, minimal BMPs can be installed along the trail. There is space for partial landscaping and BMP installation at the Jefferson Street and Van Buren Street trail gates, but the limited footprint hinders the ability to effectively manage runoff.

While BMPs may be relatively infeasible, it must be noted that the proposed project does not severely alter existing hydrology. The existing access road is already impervious with no landscaping. Newly constructed asphalt would not change the overall imperviousness of the site, and any additional BMPs or landscaping will manage more runoff than existing conditions do. Therefore, BMPs should be constructed wherever feasible, with the primary opportunities for this being at the South Van Buren street crossing and immediately to the north .

In any case, further verification of infiltration rates should be conducted to confirm BMP feasibility. Project costs will vary depending on the final infiltration rate and should be weighed before further stages of design to determine which option best meets the water quality needs for the drainage area, ongoing maintenance options, and capital as well as full project costs.

Floodplain Risk Assessment

In areas located within the 100-year SFHA floodplain, raising of existing grades should be avoided, however, small changes may be allowed. Coordination with the City of Placentia's Floodplain Administrator should be conducted to determine the allowable fill and it is likely that compensatory storage will be required. An analysis to determine the impacts to the floodplain limits will be required to ensure no flooding of adjacent properties will occur. For areas within the 100-year SFHA floodway, existing grades must be maintained. Refer to Appendix A for the FEMA FIRM that shows the limits of the floodplain and floodway within the project vicinity.

APPENDIX A – FEMA FIRM AND FIS FLOOD PROFILE GRAPH AND TABLE

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not represent an official FEMA map. It is intended to provide information to the community about flood damage sources of special risk. The community map repository should be consulted for updates to additional flood hazard information.

To obtain more detailed information in areas where Base Flood Elevations (BFEs) and/or Floodway Limits have been determined, users are encouraged to contact the Flood Profile and Floodway Data source. Community of Disaster Elevations (CDEs) are also available. For more information, please refer to the Flood Profile and Floodway Data source. The community map repository should be consulted for updates to additional flood hazard information.

The FEMA Users should be aware that BFEs shown on the FIRMs represent computed hydraulic elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation data. Accordingly, flood elevation data presented in the FIRM report should be utilized in conjunction with the Flood Hazard Assessment and Floodway Determination Report prepared for the community by the FIRM.

Coastal Base Flood Elevations shown on this map apply only pursuant to 42 North American Vertical Datum (NAVD) 83. Users of this map should be aware that coastal flood elevations are also provided in the Summary of Elevations shown in the Summary of Elevation Tables should be used for coordination and flood insurance rating purposes when they are higher than the elevations shown on the FIRM.

Boundaries of the Floodways were compiled at cross sections and interpolated between cross sections. The Floodways were based on hydraulic considerations with regard to regression of the National Flood Insurance Program Floodway widths and other pertinent data are provided in the Flood Insurance Study report for the jurisdiction.

Cross sections used in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for the jurisdiction.

The projection used in the preparation of this map was Universal Transverse Mercator (UTM) Zone 11. The horizontal datum was NAD 83 (GRS80) spheroid. Differences in datum and projection may cause slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1983. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding vertical datum differences, users are encouraged to contact the Flood Profile and Floodway Data source. The community map repository should be consulted for updates to additional flood hazard information.

NGD Information Services
 NOAA, NWS
 National Geospatial Survey
 SDC-3, #102
 3335 East-West Highway
 Silver Spring, Maryland 20910-3282
 (301) 751-3242

To obtain current elevation, description, and/or location information for bench marks shown on this map, please contact the Information Services Branch of the National Geospatial Survey at (301) 751-3242, or visit its website at <http://www.ngd.noaa.gov>.

Base map information shown on the FIRM was derived from the National Agriculture Imagery Program, dated 2008.

This map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for the jurisdiction. The floodways and floodways that were transferred from the previous FIRM may have been adjusted to conform to these more detailed stream channel configurations. As a result, the Flood Profile and Floodway Data tables in the Flood Insurance Study Report contain authoritative hydraulic data that reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes in corporate or de-incorporation may have occurred after this map was published, map users should contact appropriate community officials to verify correct corporate limit locations.

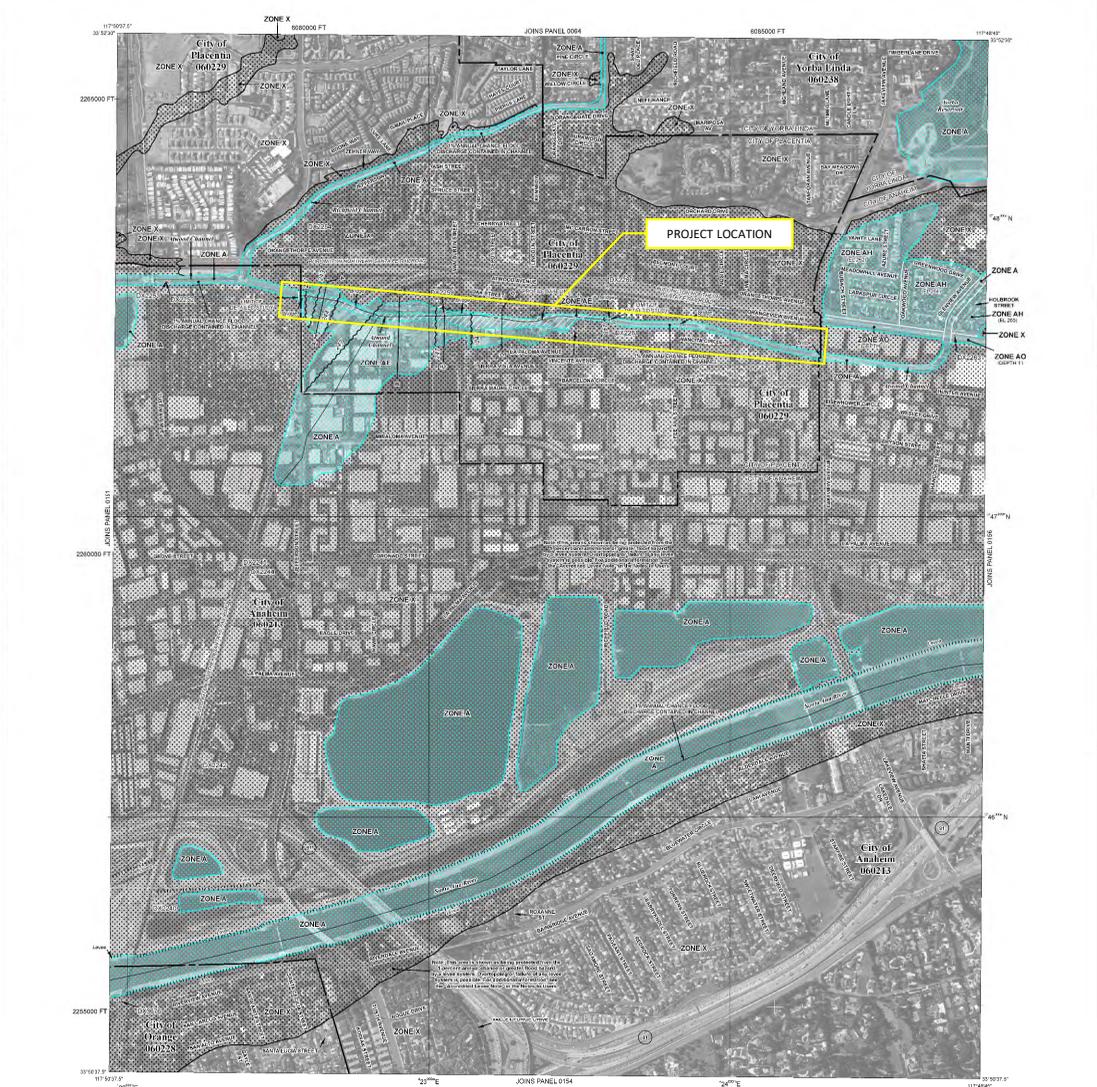
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map sheets, community map repository addresses, and a listing of communities with corresponding National Flood Insurance Program data for each community as well as a listing of the sheets on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with the FIRM. Available products may include printed station orders or maps, large scale maps, and/or digital data. For more information, please contact the FEMA Map Service Center at 1-800-358-9616 and visit <http://www.fema.gov>.

If you have questions about this map or need assistance accessing the National Flood Insurance Program in general, please call 1-877-FEMA-9AM (1-877-358-2627) or visit the FEMA website at <http://www.fema.gov>.

Accredited Level Notes to Users: Check with your local community to obtain more information, such as the estimated level of protection provided, which may exceed the 1-percent annual-chance level and Emergency Action Plan, or the lowest system of levees providing protection for areas on this sheet. To mitigate flood risk in residential areas, please refer to the National Flood Insurance Program website for more information on flood insurance. For more information on flood insurance and flood insurance, please refer to the National Flood Insurance Program website at <http://www.fema.gov/business/flood-insur>.

30°16'10" N
 117°50'00" W
 22° E



PROJECT LOCATION

LEGEND

- SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNERATION BY THE ANNUAL CHANCE FLOOD**
- The 1% annual chance (100-year) flood is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to 1% annual chance flood. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood.
- ZONE A** No Base Flood Elevation determined.
 - ZONE AH** Flood depths of 1 to 3 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH1** Flood depths of 4 to 6 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH2** Flood depths of 7 to 9 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH3** Flood depths of 10 to 12 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH4** Flood depths of 13 to 15 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH5** Flood depths of 16 to 18 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH6** Flood depths of 19 to 21 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH7** Flood depths of 22 to 24 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH8** Flood depths of 25 to 27 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH9** Flood depths of 28 to 30 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH10** Flood depths of 31 to 33 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH11** Flood depths of 34 to 36 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH12** Flood depths of 37 to 39 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH13** Flood depths of 40 to 42 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH14** Flood depths of 43 to 45 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH15** Flood depths of 46 to 48 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH16** Flood depths of 49 to 51 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH17** Flood depths of 52 to 54 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH18** Flood depths of 55 to 57 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH19** Flood depths of 58 to 60 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH20** Flood depths of 61 to 63 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH21** Flood depths of 64 to 66 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH22** Flood depths of 67 to 69 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH23** Flood depths of 70 to 72 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH24** Flood depths of 73 to 75 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH25** Flood depths of 76 to 78 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH26** Flood depths of 79 to 81 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH27** Flood depths of 82 to 84 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH28** Flood depths of 85 to 87 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH29** Flood depths of 88 to 90 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH30** Flood depths of 91 to 93 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH31** Flood depths of 94 to 96 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH32** Flood depths of 97 to 99 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH33** Flood depths of 100 to 102 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH34** Flood depths of 103 to 105 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH35** Flood depths of 106 to 108 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH36** Flood depths of 109 to 111 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH37** Flood depths of 112 to 114 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH38** Flood depths of 115 to 117 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH39** Flood depths of 118 to 120 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH40** Flood depths of 121 to 123 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH41** Flood depths of 124 to 126 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH42** Flood depths of 127 to 129 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH43** Flood depths of 130 to 132 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH44** Flood depths of 133 to 135 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH45** Flood depths of 136 to 138 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH46** Flood depths of 139 to 141 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH47** Flood depths of 142 to 144 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH48** Flood depths of 145 to 147 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH49** Flood depths of 148 to 150 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH50** Flood depths of 151 to 153 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH51** Flood depths of 154 to 156 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH52** Flood depths of 157 to 159 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH53** Flood depths of 160 to 162 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH54** Flood depths of 163 to 165 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH55** Flood depths of 166 to 168 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH56** Flood depths of 169 to 171 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH57** Flood depths of 172 to 174 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH58** Flood depths of 175 to 177 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH59** Flood depths of 178 to 180 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH60** Flood depths of 181 to 183 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH61** Flood depths of 184 to 186 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH62** Flood depths of 187 to 189 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH63** Flood depths of 190 to 192 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH64** Flood depths of 193 to 195 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH65** Flood depths of 196 to 198 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH66** Flood depths of 199 to 201 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH67** Flood depths of 202 to 204 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH68** Flood depths of 205 to 207 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH69** Flood depths of 208 to 210 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH70** Flood depths of 211 to 213 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH71** Flood depths of 214 to 216 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH72** Flood depths of 217 to 219 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH73** Flood depths of 220 to 222 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH74** Flood depths of 223 to 225 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH75** Flood depths of 226 to 228 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH76** Flood depths of 229 to 231 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH77** Flood depths of 232 to 234 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH78** Flood depths of 235 to 237 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH79** Flood depths of 238 to 240 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH80** Flood depths of 241 to 243 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH81** Flood depths of 244 to 246 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH82** Flood depths of 247 to 249 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH83** Flood depths of 250 to 252 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH84** Flood depths of 253 to 255 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH85** Flood depths of 256 to 258 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH86** Flood depths of 259 to 261 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH87** Flood depths of 262 to 264 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH88** Flood depths of 265 to 267 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH89** Flood depths of 268 to 270 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH90** Flood depths of 271 to 273 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH91** Flood depths of 274 to 276 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH92** Flood depths of 277 to 279 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH93** Flood depths of 280 to 282 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH94** Flood depths of 283 to 285 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH95** Flood depths of 286 to 288 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH96** Flood depths of 289 to 291 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH97** Flood depths of 292 to 294 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH98** Flood depths of 295 to 297 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH99** Flood depths of 298 to 300 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH100** Flood depths of 301 to 303 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH101** Flood depths of 304 to 306 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH102** Flood depths of 307 to 309 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH103** Flood depths of 310 to 312 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH104** Flood depths of 313 to 315 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH105** Flood depths of 316 to 318 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH106** Flood depths of 319 to 321 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH107** Flood depths of 322 to 324 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH108** Flood depths of 325 to 327 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH109** Flood depths of 328 to 330 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH110** Flood depths of 331 to 333 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH111** Flood depths of 334 to 336 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH112** Flood depths of 337 to 339 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH113** Flood depths of 340 to 342 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH114** Flood depths of 343 to 345 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH115** Flood depths of 346 to 348 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH116** Flood depths of 349 to 351 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH117** Flood depths of 352 to 354 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH118** Flood depths of 355 to 357 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH119** Flood depths of 358 to 360 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH120** Flood depths of 361 to 363 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH121** Flood depths of 364 to 366 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH122** Flood depths of 367 to 369 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH123** Flood depths of 370 to 372 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH124** Flood depths of 373 to 375 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH125** Flood depths of 376 to 378 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH126** Flood depths of 379 to 381 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH127** Flood depths of 382 to 384 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH128** Flood depths of 385 to 387 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH129** Flood depths of 388 to 390 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH130** Flood depths of 391 to 393 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH131** Flood depths of 394 to 396 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH132** Flood depths of 397 to 399 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH133** Flood depths of 400 to 402 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH134** Flood depths of 403 to 405 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH135** Flood depths of 406 to 408 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH136** Flood depths of 409 to 411 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH137** Flood depths of 412 to 414 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH138** Flood depths of 415 to 417 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH139** Flood depths of 418 to 420 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH140** Flood depths of 421 to 423 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH141** Flood depths of 424 to 426 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH142** Flood depths of 427 to 429 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH143** Flood depths of 430 to 432 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH144** Flood depths of 433 to 435 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH145** Flood depths of 436 to 438 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH146** Flood depths of 439 to 441 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH147** Flood depths of 442 to 444 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH148** Flood depths of 445 to 447 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH149** Flood depths of 448 to 450 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH150** Flood depths of 451 to 453 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH151** Flood depths of 454 to 456 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH152** Flood depths of 457 to 459 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH153** Flood depths of 460 to 462 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH154** Flood depths of 463 to 465 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH155** Flood depths of 466 to 468 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH156** Flood depths of 469 to 471 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH157** Flood depths of 472 to 474 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH158** Flood depths of 475 to 477 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH159** Flood depths of 478 to 480 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH160** Flood depths of 481 to 483 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH161** Flood depths of 484 to 486 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH162** Flood depths of 487 to 489 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH163** Flood depths of 490 to 492 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH164** Flood depths of 493 to 495 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH165** Flood depths of 496 to 498 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH166** Flood depths of 499 to 501 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH167** Flood depths of 502 to 504 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH168** Flood depths of 505 to 507 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH169** Flood depths of 508 to 510 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH170** Flood depths of 511 to 513 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH171** Flood depths of 514 to 516 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH172** Flood depths of 517 to 519 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH173** Flood depths of 520 to 522 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH174** Flood depths of 523 to 525 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH175** Flood depths of 526 to 528 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH176** Flood depths of 529 to 531 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH177** Flood depths of 532 to 534 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH178** Flood depths of 535 to 537 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH179** Flood depths of 538 to 540 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH180** Flood depths of 541 to 543 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH181** Flood depths of 544 to 546 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH182** Flood depths of 547 to 549 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH183** Flood depths of 550 to 552 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH184** Flood depths of 553 to 555 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH185** Flood depths of 556 to 558 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH186** Flood depths of 559 to 561 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH187** Flood depths of 562 to 564 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH188** Flood depths of 565 to 567 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH189** Flood depths of 568 to 570 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH190** Flood depths of 571 to 573 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH191** Flood depths of 574 to 576 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH192** Flood depths of 577 to 579 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH193** Flood depths of 580 to 582 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH194** Flood depths of 583 to 585 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH195** Flood depths of 586 to 588 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH196** Flood depths of 589 to 591 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH197** Flood depths of 592 to 594 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH198** Flood depths of 595 to 597 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH199** Flood depths of 598 to 600 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH200** Flood depths of 601 to 603 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH201** Flood depths of 604 to 606 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH202** Flood depths of 607 to 609 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH203** Flood depths of 610 to 612 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH204** Flood depths of 613 to 615 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH205** Flood depths of 616 to 618 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH206** Flood depths of 619 to 621 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH207** Flood depths of 622 to 624 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH208** Flood depths of 625 to 627 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH209** Flood depths of 628 to 630 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH210** Flood depths of 631 to 633 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH211** Flood depths of 634 to 636 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH212** Flood depths of 637 to 639 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH213** Flood depths of 640 to 642 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH214** Flood depths of 643 to 645 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH215** Flood depths of 646 to 648 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH216** Flood depths of 649 to 651 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH217** Flood depths of 652 to 654 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH218** Flood depths of 655 to 657 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH219** Flood depths of 658 to 660 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH220** Flood depths of 661 to 663 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH221** Flood depths of 664 to 666 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH222** Flood depths of 667 to 669 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH223** Flood depths of 670 to 672 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH224** Flood depths of 673 to 675 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH225** Flood depths of 676 to 678 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH226** Flood depths of 679 to 681 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH227** Flood depths of 682 to 684 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH228** Flood depths of 685 to 687 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH229** Flood depths of 688 to 690 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH230** Flood depths of 691 to 693 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH231** Flood depths of 694 to 696 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH232** Flood depths of 697 to 699 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH233** Flood depths of 700 to 702 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH234** Flood depths of 703 to 705 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH235** Flood depths of 706 to 708 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH236** Flood depths of 709 to 711 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH237** Flood depths of 712 to 714 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH238** Flood depths of 715 to 717 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH239** Flood depths of 718 to 720 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH240** Flood depths of 721 to 723 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH241** Flood depths of 724 to 726 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH242** Flood depths of 727 to 729 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH243** Flood depths of 730 to 732 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH244** Flood depths of 733 to 735 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH245** Flood depths of 736 to 738 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH246** Flood depths of 739 to 741 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH247** Flood depths of 742 to 744 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH248** Flood depths of 745 to 747 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH249** Flood depths of 748 to 750 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH250** Flood depths of 751 to 753 feet (usually areas of overland); Base Flood Elevation determined.
 - ZONE AH251</**

LOCATION		FLOODWAY				1% ANNUAL CHANGE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE	
Aliso Creek (Continued)	81,492 ¹	69	394	7.6	708.7	708.7	708.8	0.1	
	81,851 ¹	115	413	7.3	710.7	710.7	711.0	0.3	
	82,273 ¹	130	574	4.5	711.9	711.9	712.0	0.1	
	82,352 ¹	246	652	4.0	712.4	712.4	712.9	0.5	
	82,452 ¹	66	240	10.8	715.1	715.1	715.1	0.0	
	83,181 ¹	68	262	9.9	728.2	728.2	728.2	0.0	
	83,413 ¹	66	239	10.9	737.8	737.8	737.8	0.0	
	83,582 ¹	108	411	6.3	741.4	741.4	741.4	0.0	
	83,831 ¹	69	243	10.7	744.0	744.0	744.0	0.0	
	84,132 ¹	84	329	7.9	748.4	748.4	748.7	0.3	
	85,177 ¹	50	207	11.6	765.3	765.3	765.3	0.0	
	86,275 ¹	119	321	7.5	783.0	783.0	783.3	0.3	
	86,476 ¹	155	304	7.9	786.9	786.9	786.9	0.0	
	Atwood Channel	5,100 ²	73	320	7.2	243.4	243.4	243.4	0.0
		5,950 ²	85	482	4.8	246.5	246.5	246.5	0.0
		6,450 ²	85	432	5.3	246.5	246.5	246.6	0.1
7,061 ²		115	497	4.6	246.9	246.9	247.4	0.5	

¹Feet above mouth at Pacific Ocean

²Feet above confluence with Miller Retarding Basin (Carbon Canyon Channel)

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

ORANGE COUNTY, CA
AND INCORPORATED AREAS

FLOODWAY DATA

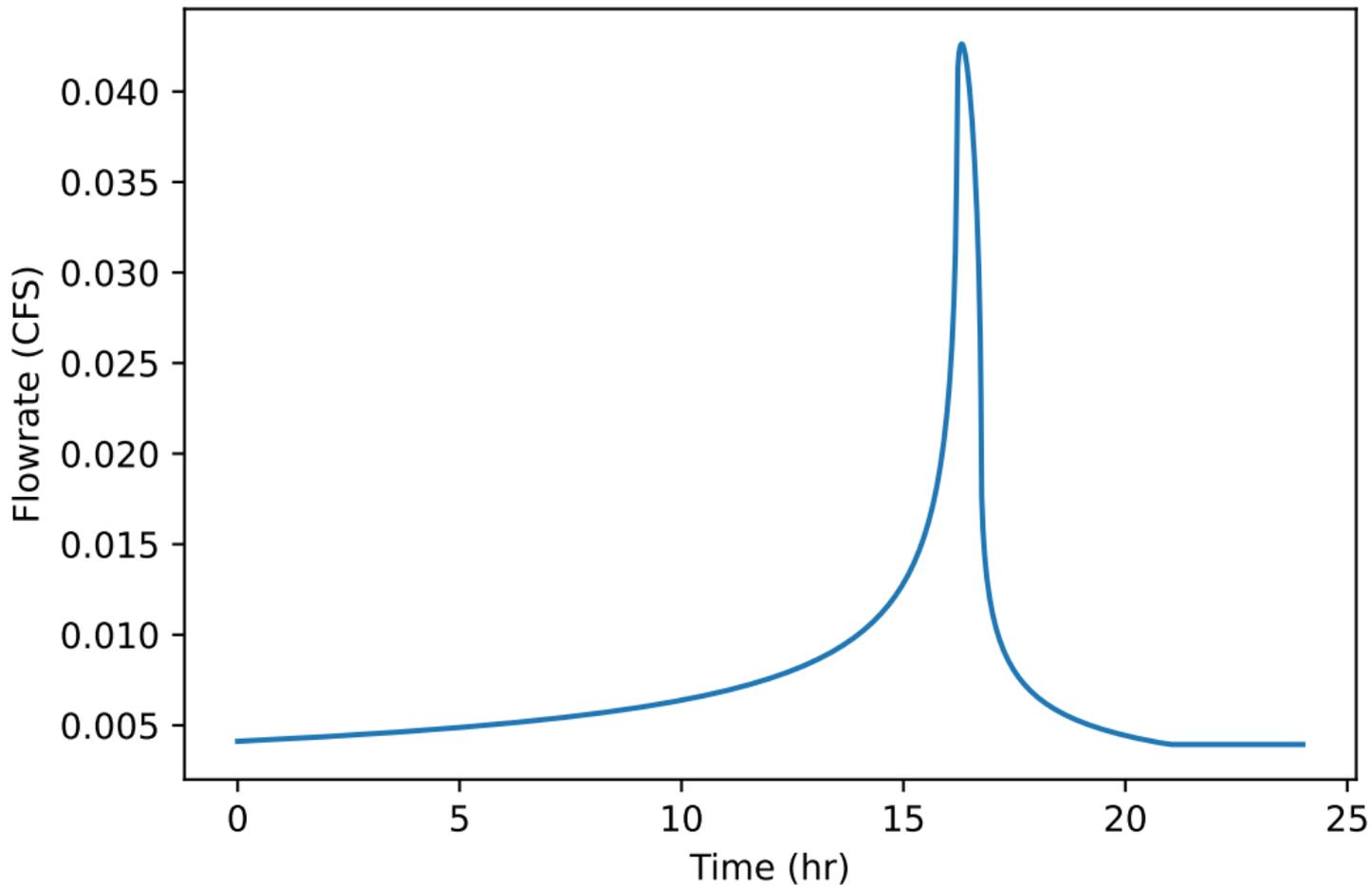
FLOODING SOURCE: ALISO
CREEK – ATWOOD CHANNEL

FLOOD PROFILES
 ATWOOD CHANNEL

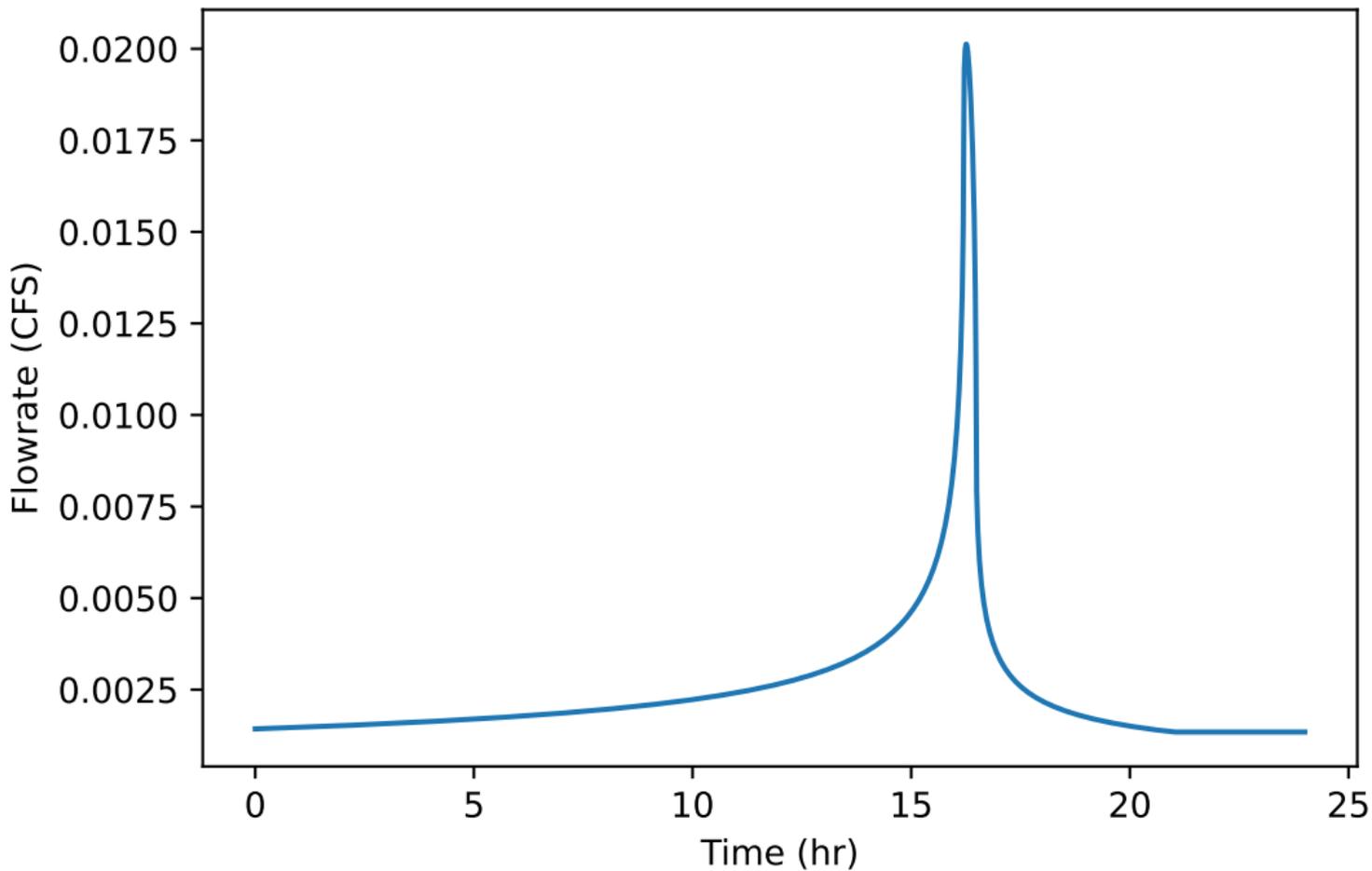


APPENDIX B – DRAINAGE AREA HYDROGRAPHS

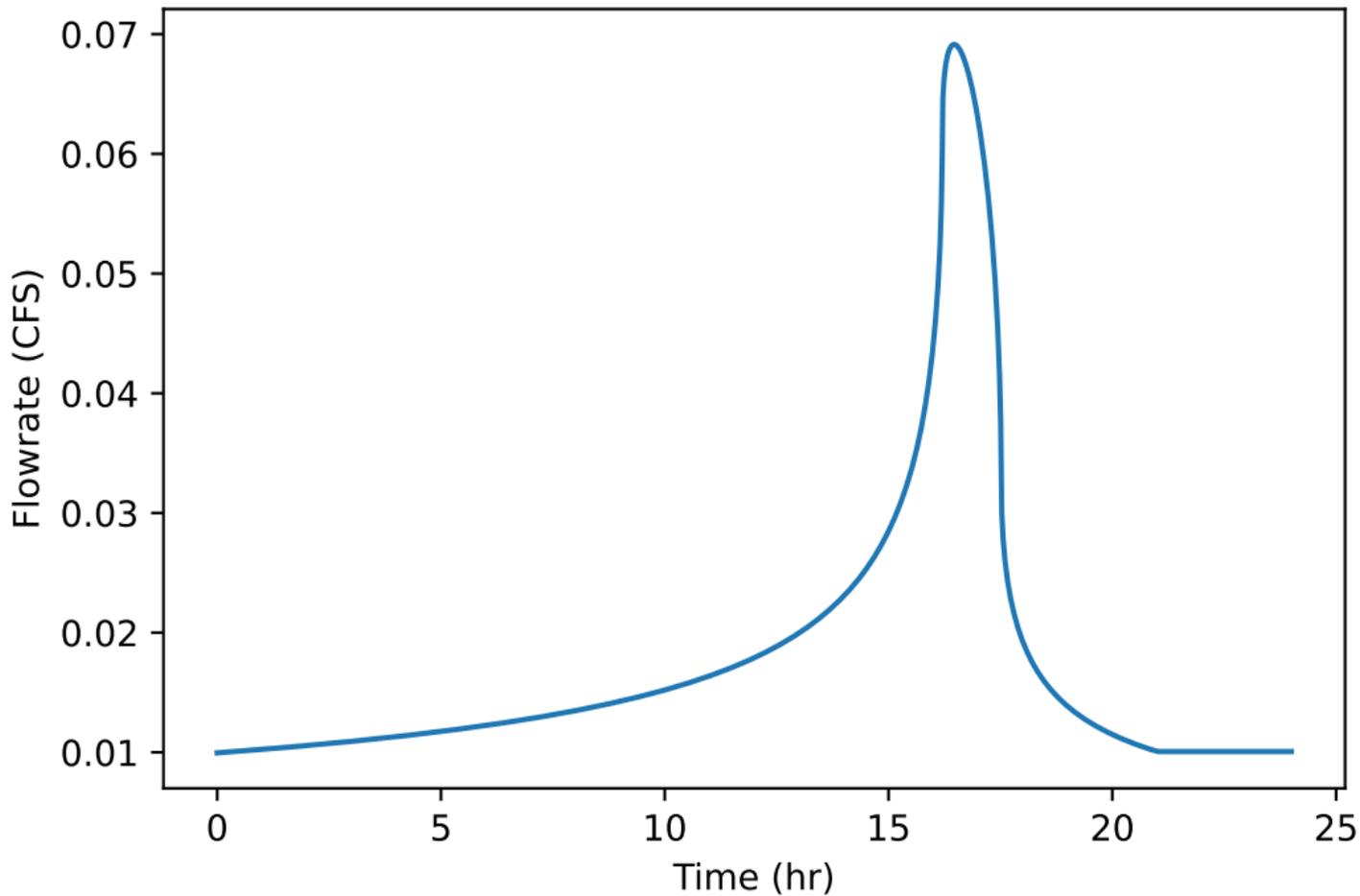
Atwood Subarea 1A Hydrograph



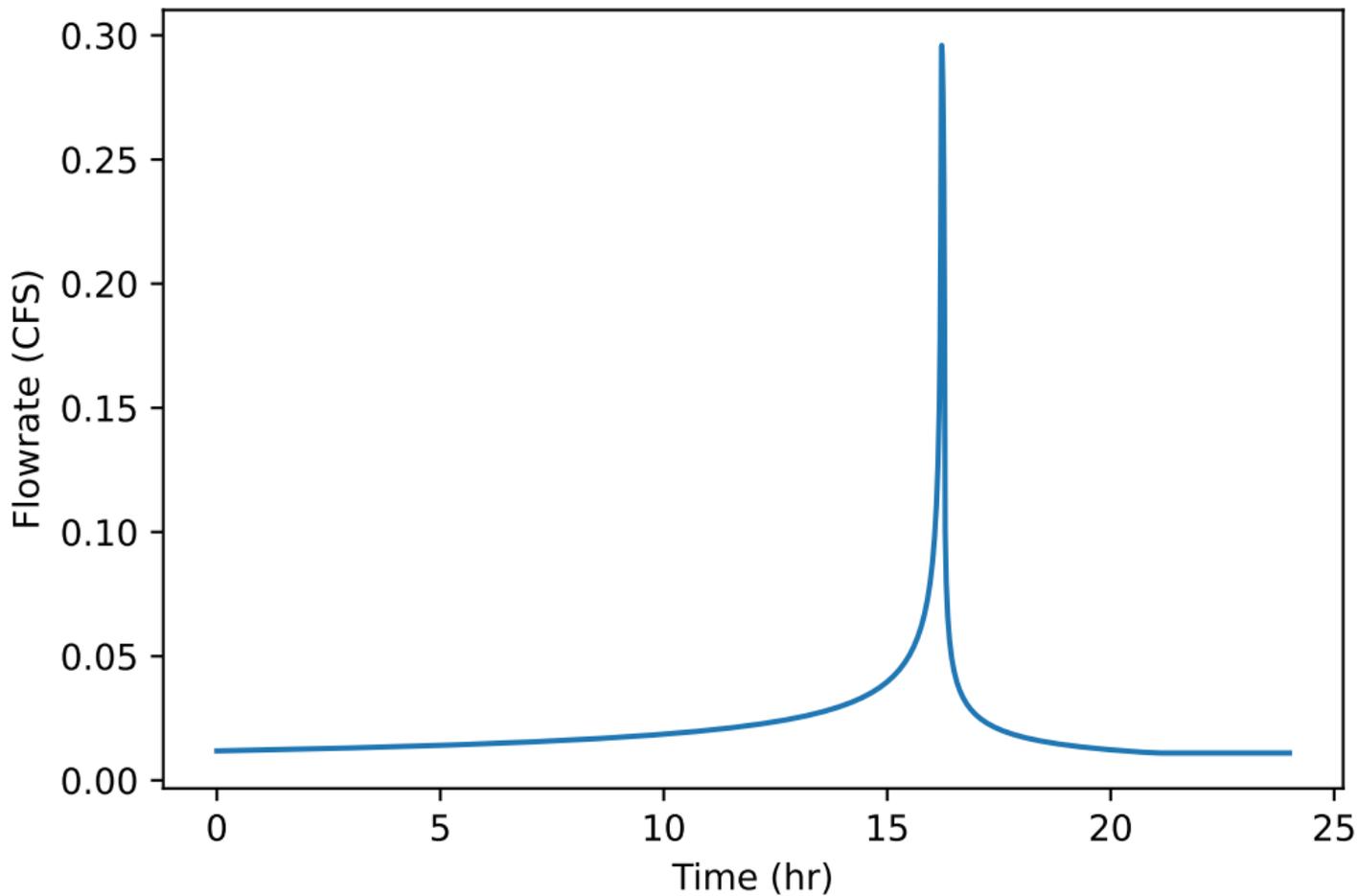
Atwood Subarea 1B Hydrograph



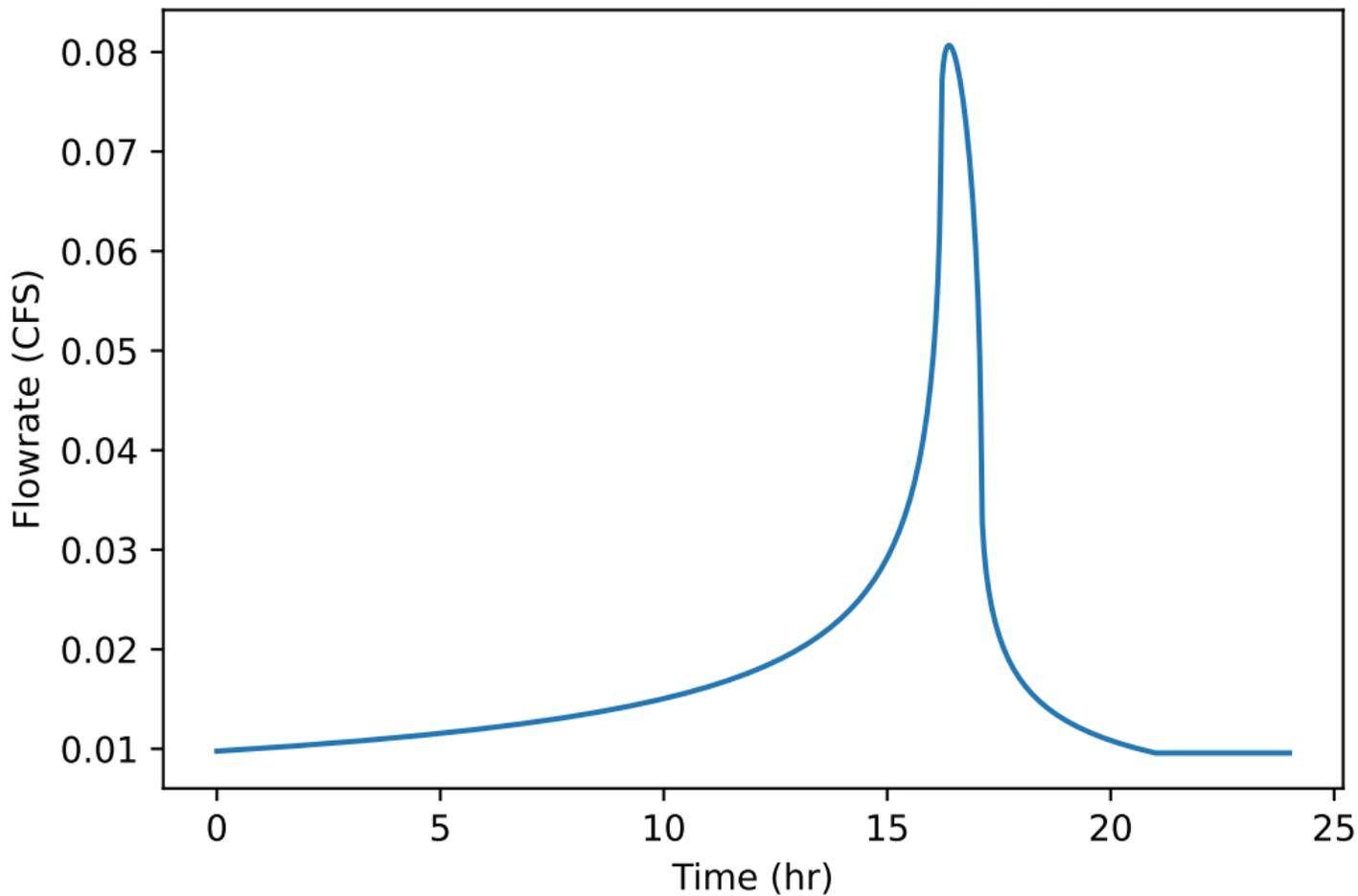
Atwood Subarea 2A Hydrograph



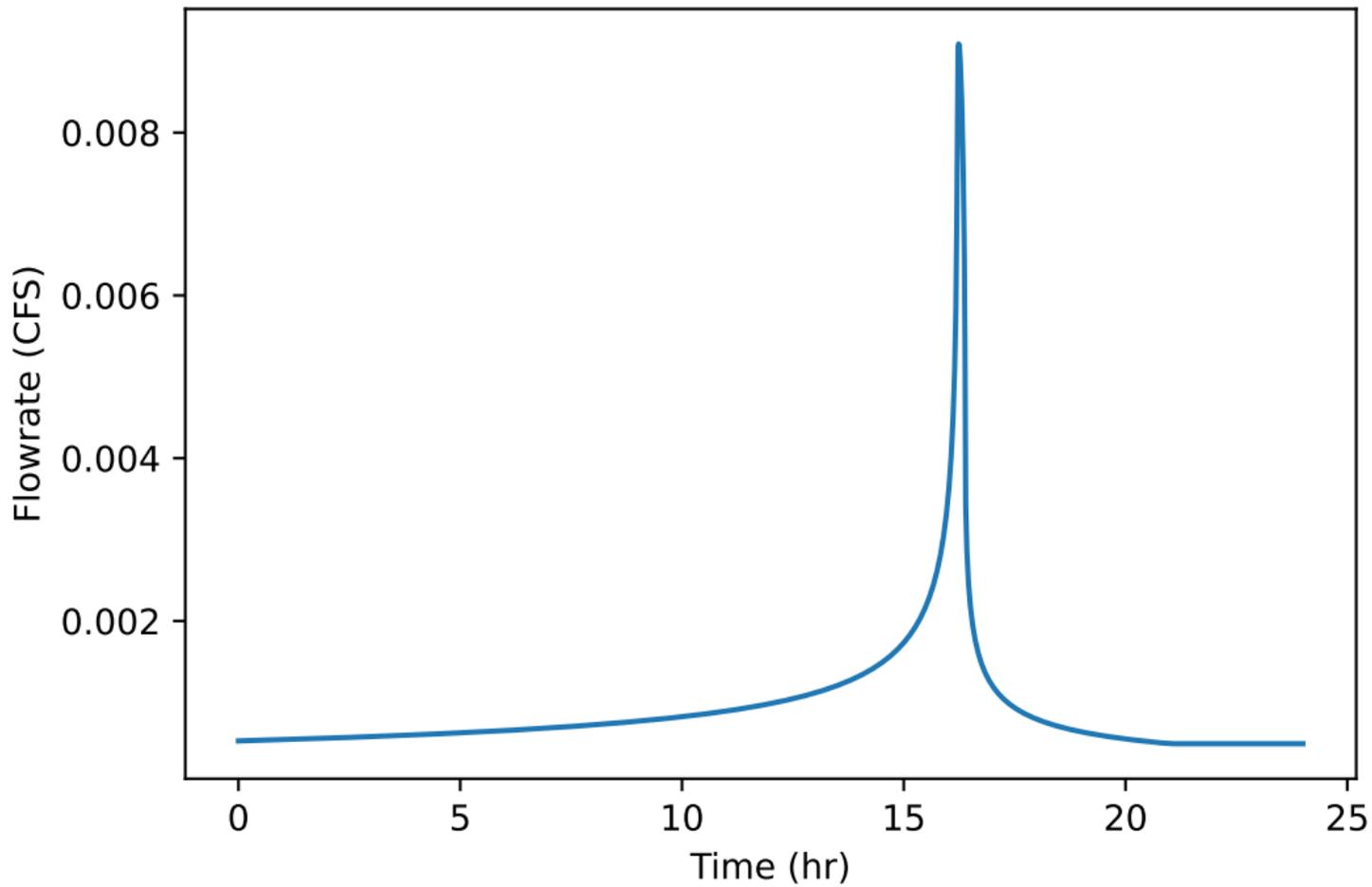
Atwood Subarea 3A Hydrograph



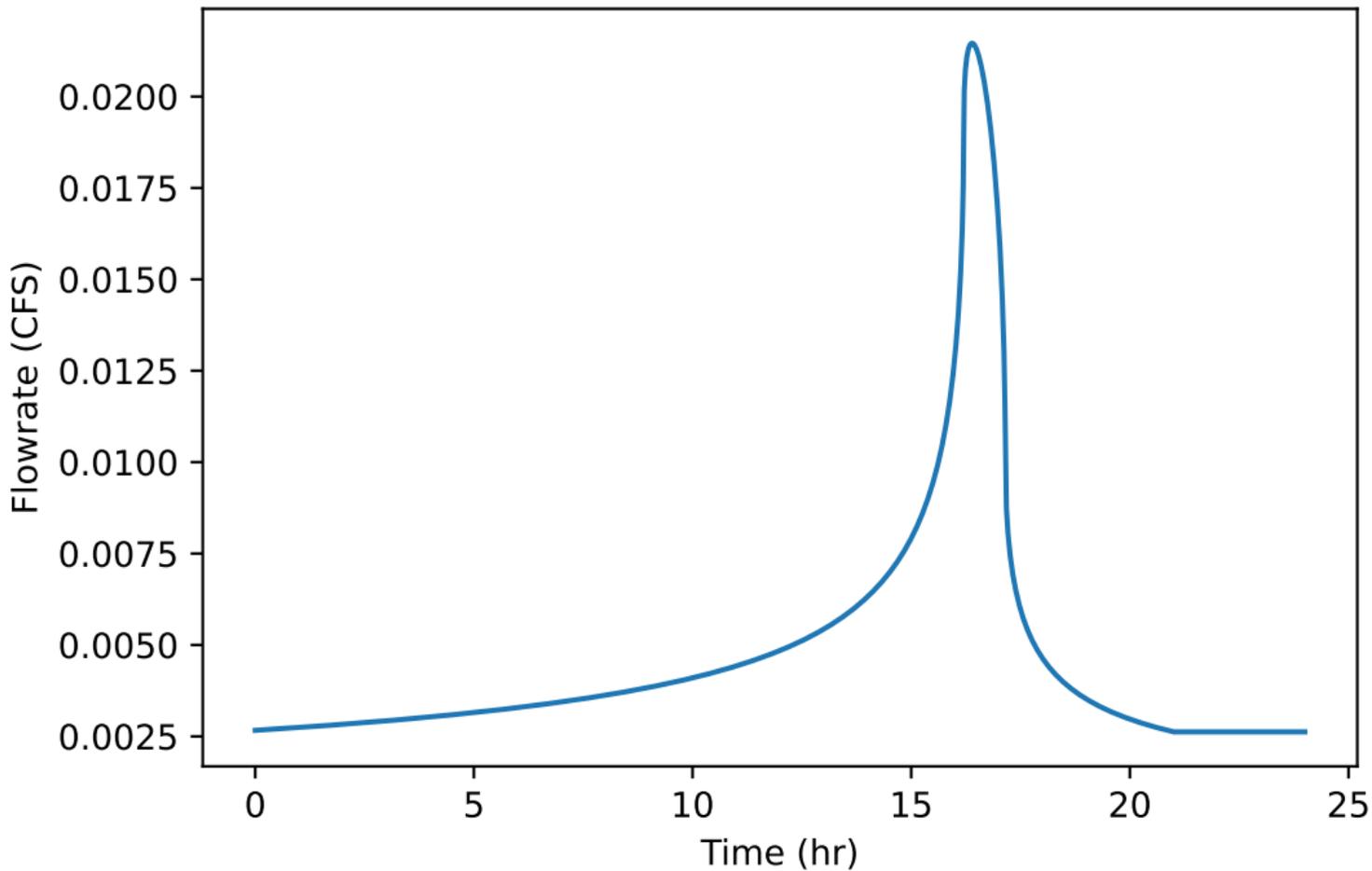
Atwood Subarea 3B Hydrograph



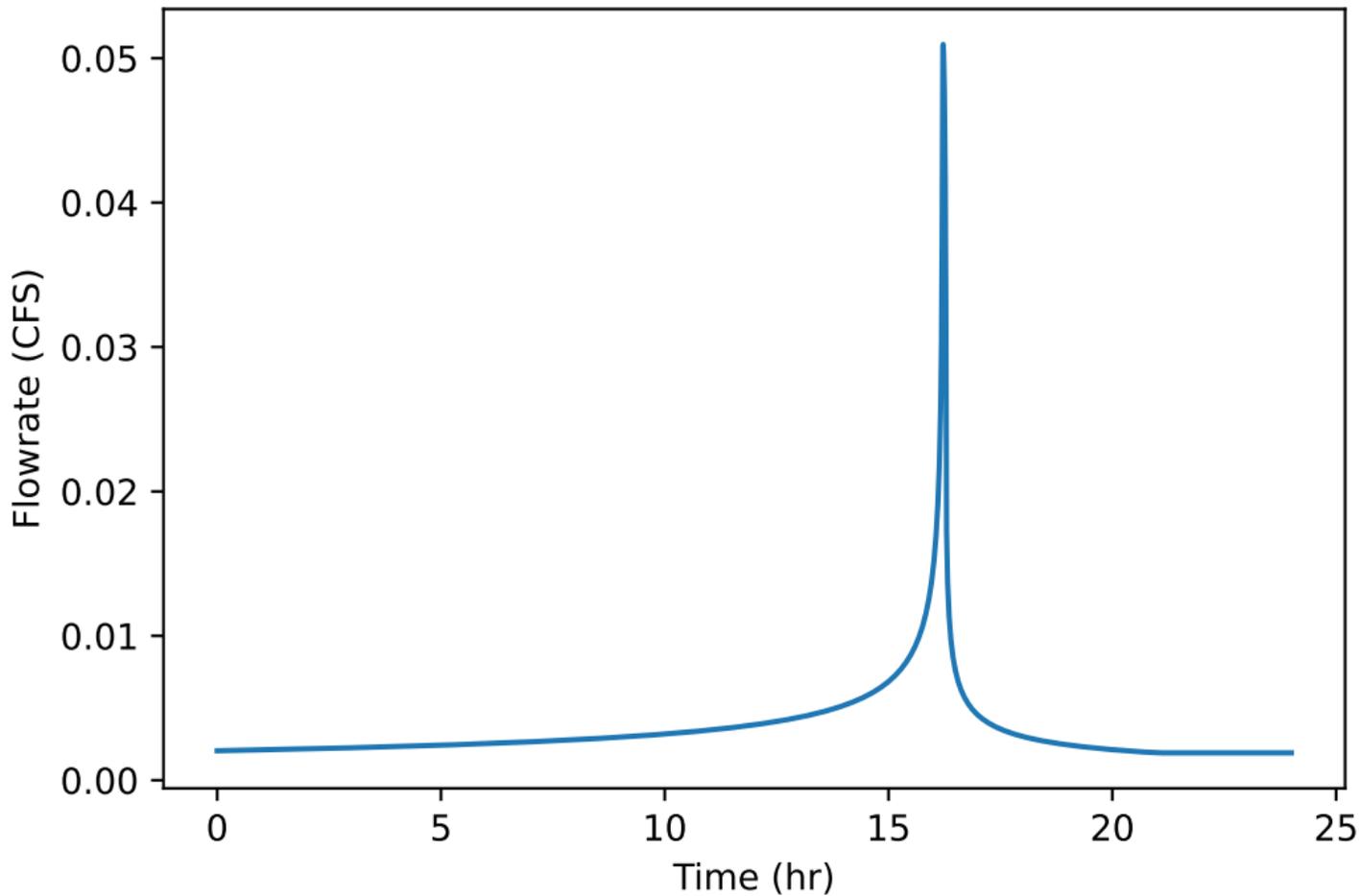
Atwood Subarea 3C Hydrograph



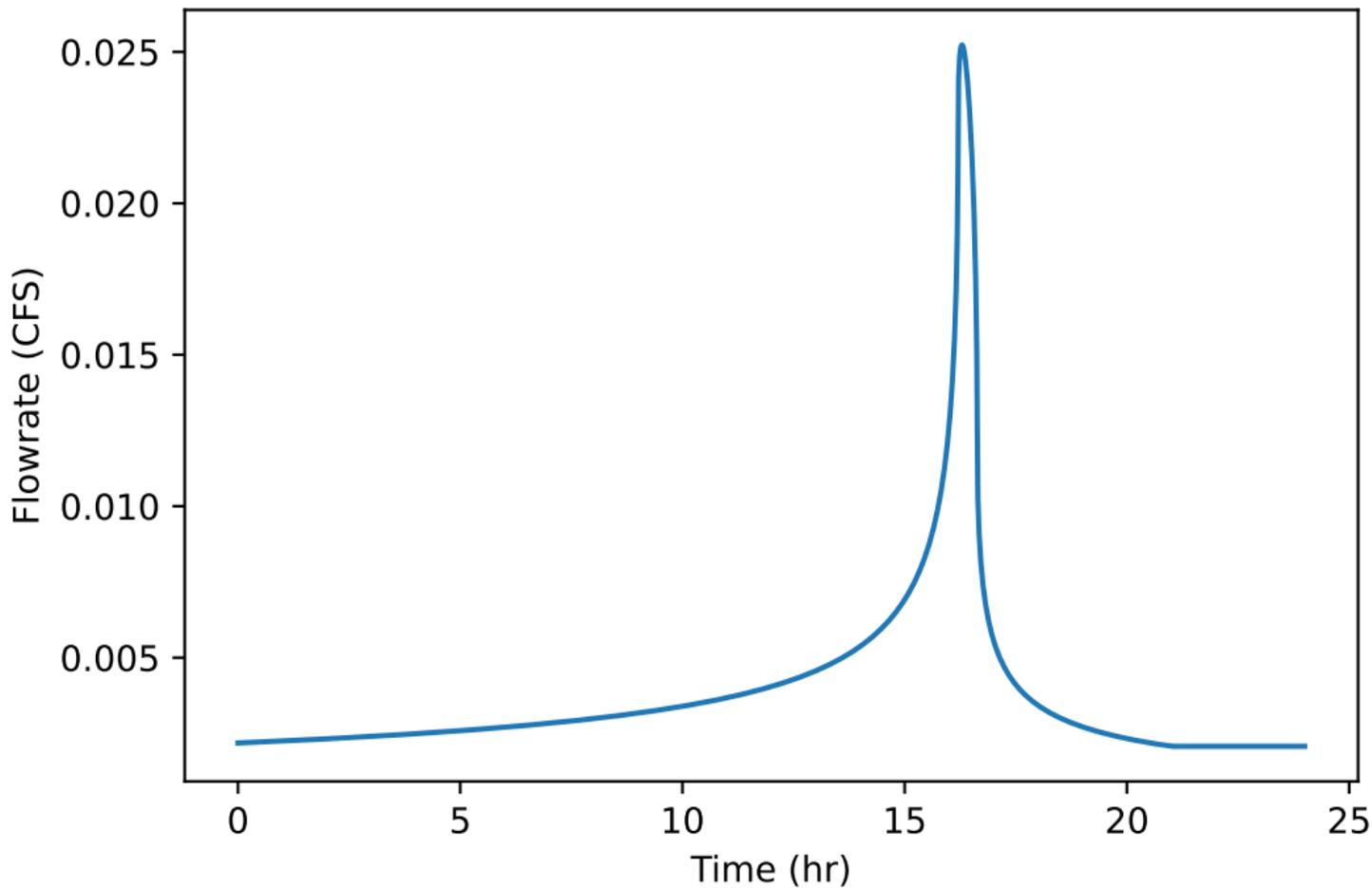
Atwood Subarea 4A Hydrograph



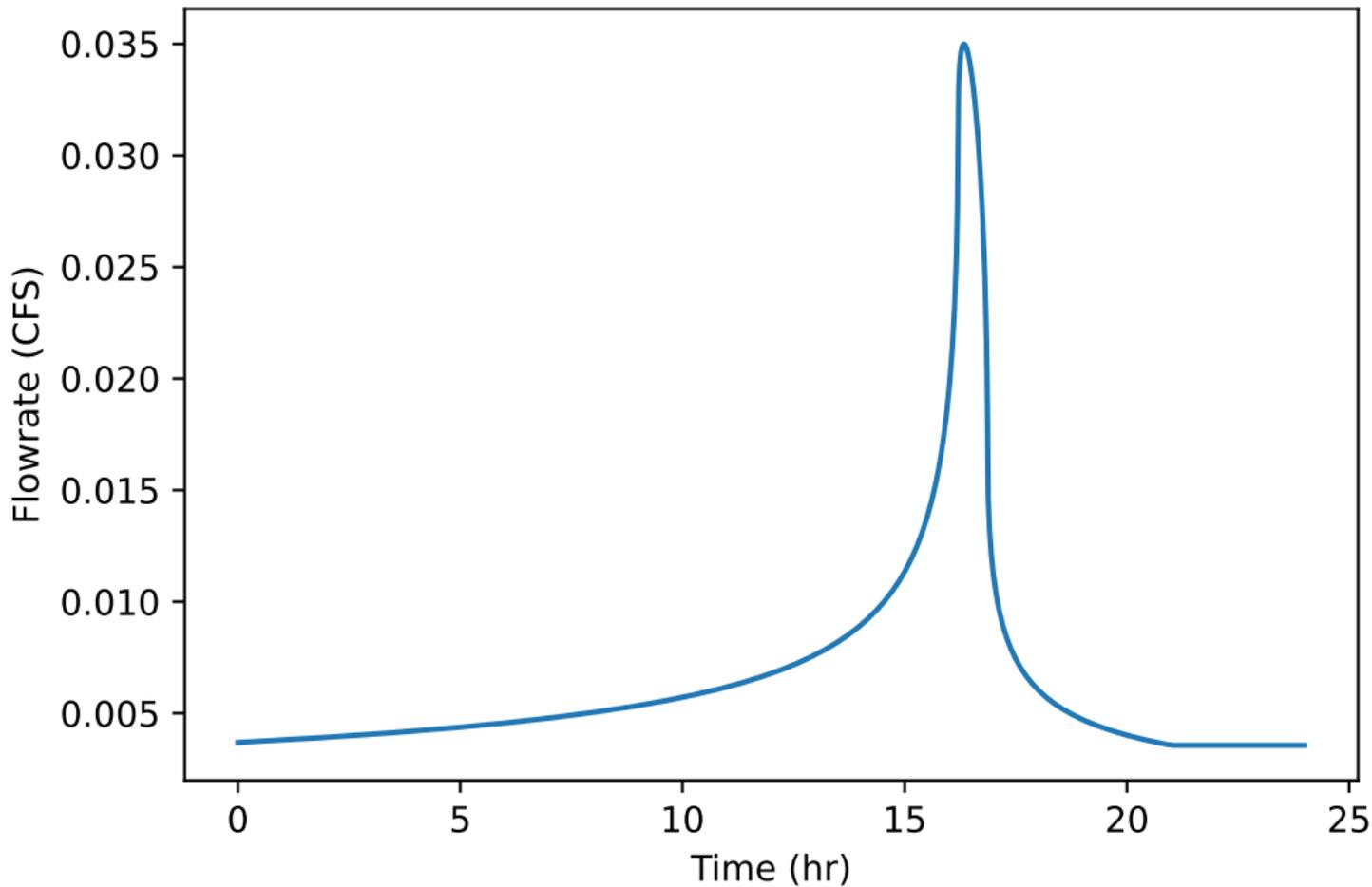
Atwood Subarea 4B Hydrograph



Atwood Subarea 5A Hydrograph



Atwood Subarea 5B Hydrograph



Atwood Subarea 5C Hydrograph

