









Flood Hazard Area Delineation

Sloan's Lake Drainageway and Tributaries

July 2018



Prepared for
Urban Drainage and Flood Control District
City and County of Denver
City of Lakewood
City of Wheat Ridge
City of Edgewater

Prepared by

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July 31, 2018

Mrs. Shea Thomas, PE
Watershed Services Program Manager
Urban Drainage & Flood Control District
2480 W. 26th Ave., Suite 156-B
Denver, Colorado 80211

RE: Sloan's Lake Flood Hazard Area Delineation
Agreement No. 15-11.18

Dear Mrs. Thomas:

Matrix Design Group, Inc. is pleased to submit the enclosed Sloan's Lake *Flood Hazard Area Delineation*. The enclosed report updates the floodplains previously established by the 1977 *Flood Hazard Area Delineation* for the Sloan's Lake Basin, along with various LOMR applications approved over the years.

This report provides a description of the watershed, hydrologic modeling, hydraulic modeling, and assessment of potential structures that may be impacted in a 100-year flood. The report format is intended to follow the requirements of the Urban Drainage & Flood Control District guidelines for Flood Hazard Area Delineation studies.

The 4.9 square mile Sloan's Lake watershed, a west bank tributary to the South Platte River extends from approximately Wadsworth Boulevard to the South Platte River along Colfax Avenue and is fully developed. The Sloan's Lake drainageway flows west to east generally between Colfax Avenue and 32nd Avenue. Feeding into Sloan's Lake are two major tributaries known as the Sloan's Lake Drainageway and the Ashland Drainageway. Sloan's Lake itself is a major regional detention pond that lowers the 100-year flood event from 2,904 cfs to a flow out of 34 cfs. Downstream of Sloan's Lake flow is underground in storm pipes and therefore is not anticipated to result in significant surface flooding.

One-dimensional and two-dimensional hydraulic models were utilized jointly in this study to complete the floodplain analysis. HEC-RAS, version 4.1.0, was used for all one-dimensional modeling, and FLO-2D Pro Model, Build No. 16.06.16, was used for two-dimensional modeling of more complex urban flood areas.

A total of 5.79 miles of drainageway and tributaries were studied with a detailed HEC-RAS hydraulic model. The Sloan's Lake Drainageway and its tributaries comprise 3.92 miles, and the Ashland Drainageway and its tributaries comprise 1.87 miles. The HEC-RAS model of Sloan's Lake Drainageway analyzed 2.74 miles of the Sloan's Lake Drainageway Main Stem and 1.18 miles of the Pierce Street Tributary. The HEC-RAS model of Ashland Drainageway analyzed 1.12 miles of the Ashland Drainageway and 0.75 miles of the Gray Street Tributary.

A total of 215 cross sections were used in the Sloan's Lake Drainageway hydraulic model which included 120 cross sections for the main stem hydraulic model and 95 cross sections for the Pierce Street Tributary hydraulic model. A total of 96 cross sections were used in the Ashland Drainageway hydraulic model which included 60 cross sections for the main stem hydraulic model and 36 cross sections for the Gray Street Tributary.

FLO-2D Pro was used to model complex urban flow in three locations. Within the City of Edgewater, FLO-2D Pro was used to model the overland flow study area generally bounded by Ingalls Street on the east, Pierce Street on the west, West 26th Avenue on the north and West 20th Avenue on the south. Within the City of Lakewood, FLO-2D Pro was used to analyze the floodplain between Dover Street and Wadsworth Boulevard to investigate the impact caused by trans-watershed flow from North Dry Gulch entering the Sloan's Lake Drainageway at Dover Street and 20th Avenue. Within the City and County of Denver, FLO-2D Pro was used to model the area downstream of Sloan's Lake to account for the potential overland split flows from West Colfax Avenue to help Denver manage zones noted as Potential Inundated Areas (PIA).

Floodplain limits were developed showing the detailed 100-year and 500-year floodplain delineations. The purpose of the Flood Hazard Area Delineation (FHAD) mapping was to identify areas, building structures, and properties which have the potential of being inundated in a 100-year flood event. A floodway was defined along the Sloan's Lake Drainageway and Pierce Street Tributary to establish the portion of the channel that must remain free from obstructions to preserve conveyance of the 100-year flood. The floodway was modeled in accordance with the updated Colorado Water Conservation Board Rules and Regulations, effective January 14, 2011.

A significant flood on Sloan's Lake drainageway would result in broad overland flooding through urban areas. According to this study, a total of 424 habitable structures could potentially be impacted by a 100-year flood.

The information contained in this report provides the project sponsors of the City & County of Denver, The City of Edgewater, the City of Lakewood, the City of Wheat Ridge, and the Urban Drainage & Flood Control District with a current assessment of the flood hazards.

We appreciate the opportunity to provide this watershed analysis and recommendations for management of the waterway.

Sincerely,

Matrix Design Group, Inc.

Hung-Teng Ho

Hung-Teng Ho, PE, CFM
Project Engineer

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1.0 INTRODUCTION

1.1 Authorization

Matrix Design Group, Inc. (Matrix) was retained to complete a Major Drainageway Plan (MDP) and a Flood Hazard Area Delineation (FHAD) update for the Sloan's Lake Drainageway and Tributaries. The project is co-sponsored by the Urban Drainage & Flood Control District (UDFCD), the City & County of Denver (Denver), the City of Edgewater, the City of Lakewood, and the City of Wheat Ridge. The Agreement regarding the MDP and FHAD study for the Sloan's Lake basin was executed on March 7, 2016 (Agreement No. 15-11.18).

1.2 Purpose and Scope

The purpose and scope of this project is to update the 1977 MDP and FHAD for the Sloan's Lake basin (Study Area). In October 1977, the *Flood Hazard Area Delineation, Sloan's Lake Basin,* was published by URS Co. for UDFCD, Denver, Edgewater, Lakewood and Wheat Ridge. The 100-year Sloan's Lake peak outflow at 17th Street and Newton Street was established as 134 cfs, as documented in the 1977 FHAD study and subsequently revised to 34 cfs in a Letter of Map Revision (LOMR) dated May 3, 1993.

Since many of the recommended improvements from the 1977 MDP have been installed by the various stakeholders, the 100-yr Flood Hazard Area Delineation has also changed. In addition, input parameters such as land use, land cover, percent impervious, and precipitation have all changed since the 1977 MDP, further justifying a need to review the FHAD. Stakeholder goals are to update the flood hazard identification, which will be adopted locally and by FEMA if desired.

The following tasks have been completed as part of this FHAD Report:

- Collect existing information, including the 1977 *Major Drainageway Plan (MDP)* and the *Flood Hazard Area Delineation* (FHAD) for Sloan's Lake.
- Solicit input from the project sponsors at the kickoff meeting.
- Obtain GIS information from UDFCD, the City & County of Denver, the City of Edgewater, the City of Lakewood, and the City of Wheat Ridge.
- Obtain existing and future land use mapping, Planned Development from the City & County of Denver, City of Edgewater, City of Lakewood, and the City of Wheat Ridge.
- Establish sub-watershed boundaries and parameters in accordance with the UDFCD criteria.
- Developed future (fully developed) conditions hydrologic models using CUHP 2005, version 2.0.0 and EPA SWMM 5.1, version 5.1.010.

1.3 Planning Process

Project sponsors are the Urban Drainage & Flood Control District, the City & County of Denver, the City of Edgewater, the City of Lakewood, and the City of Wheat Ridge. Participants from the project sponsors are listed in Section 1.6 Acknowledgements. A project advisory committee consisting of representatives from the project sponsors held a kickoff meeting March 29, 2016 at the offices of UDFCD. Progress meetings were held April 29, 2016, May 11, 2016, May 15, 2016, July 8, 2016, July 26, 2016, October 26, 2016, December 21, 2016, May 15, 2017, July 10, 2017, and August 23, 2017. A public meeting to gather input from residents, stakeholders and interested properties was conducted January 18, 2017. (See enclosed Meeting Minutes in **Appendix A**: Project Correspondence).

1.4 Mapping and Surveys

Mapping information for this project was obtained from several sources. Given the multi-jurisdictional makeup of the watershed, attempts were made to use the best available data. The following describes the various mapping components and their sources.

Topographic Contours

One-foot, LIDAR-derived topographic contour data collected by the United State Geological Survey (USGS) in the fall of 2013 and compiled in 2014 was used to delineate drainage basin boundaries (herein referred to as the 2014 LiDAR).

Aerial Photography

Color aerial ortho-photography from 2012, with a half-foot pixel resolution, was provided by the City & County of Denver. Areas outside of the City & County of Denver were supplemented with a 2009 color aerial photo, with a one-foot pixel resolution, provided by UDFCD.

Base Mapping

Base mapping information including street centerlines, parcels, zoning, jurisdictional boundaries, and park boundaries were provided by the City & County of Denver, the City of Edgewater, the City of Lakewood, and the City of Wheat Ridge.

Coordinate System and Datum

All GIS mapping and data for this study were developed using the Colorado State Plane, Central Zone coordinate system in U.S. feet. The horizontal datum is NAD83 and the vertical datum is NAVD88.

1.5 Data Collection

Existing drainage studies and construction documents were collected from the stakeholders. Flood Insurance Rate Maps (FIRMs) were obtained from the Federal Emergency Management Agency (FEMA). The previous Sloan's Lake Flood Hazard Area Delineation (FHAD) was obtained from UDFCD. The primary references used for this study are as follows:

- *City of Edgewater – 2013 Edgewater Comprehensive Plan*
- *City of Lakewood Zoning (2016)*
- *City & County of Denver, Storm Drainage Master Plan* (2014)
- *City & County of Denver, Land Use Zoning Data (2014)*
- *Envision Wheat Ridge Comprehensive Plan 2009 and Zoning Mapping (2016)*
- *UDFCD, Flood Hazard Area Delineation, Sloan's Lake Basin* (1977)
- *UDFCD, Major Drainageway Planning, Phase A, Sloan's Lake Basin* (1977)
- *UDFCD, Major Drainageway Planning, Phase B, Sloan's Lake Basin* (1977)
- *City of Wheat Ridge, Master Drainage Plan (1979)*
- *"Letter of Map Revision 92-08-04OP", effective May 5, 1993 (Sloan's Lake Overflow)*
- *"Letter of Map Revision 05-08-0046P", effective Nov 18, 2005 (Invesco Field LOMR)*
- *Rocky Mountain Ditch Evaluation Study, Matrix Design Group for Denver Parks & Recreation, 2009*
- *"Hydraulics Report for the Federal Boulevard Bridge (US287/SH88) over Colfax Avenue (US40)", revised May 20, 2011 and supplemental memo/revision dated June 6, 2011 (FHU for CDOT).*
- *"Letter of Map Revision 13-08-0332P" effective February 12, 2014 (RTD West Corridor Lakewood and Dry Gulch LOMR.*
- *Sloan's Lake Park Master Plan, Denver Department of Parks and Recreation, 2002*

1.6 Acknowledgements

Table 1-1 Project Participants

Name	Representing	Project Role
Shea Thomas	Urban Drainage & Flood Control District	Project Manager
Brooke Seymour	Urban Drainage & Flood Control District	Project Manager
Terri Fead	Urban Drainage & Flood Control District	Floodplain
Selena Klosowski	Denver Public Works - Capital Projects Planning	Sponsor
Jeremy Hamer	Denver Public Works – Floodplain Manager	Sponsor
Ashlee Grace	Denver Public Works - Water Quality	Sponsor
David Morrisey	Denver Public Works – Right of Way Services	Sponsor
Cincere Eades	Denver Parks Planning	Sponsor
Terry Rogers	Lakewood	Sponsor
Mark Westberg	Wheat Ridge	Sponsor
Scott Brink	Wheat Ridge	Sponsor
Dan Maples	Edgewater	Sponsor
John Enochs	Edgewater Consultant	Sponsor
Robert Krehbiel	Matrix Design Group, Inc.	Officer-in-Charge
Drew Beck	Matrix Design Group, Inc.	Project Manager
Hung Teng Ho	Matrix Design Group, Inc.	Project Engineer

2.0 STUDY AREA DESCRIPTION

2.1 Project Area

The Sloan's Lake watershed is located in the west-central portion of the UDFCD as shown on Figure 2-1. The study area includes the entire Sloan's Lake watershed, including multiple jurisdictions as shown on **Figure 2-2, Watershed Map**. Generally, the Sloan's Lake Basin can be sub-divided into a lower basin (below Sloan's Lake) and an upper basin (above Sloan's Lake). Denver's *Storm Drainage Master Plan* (SDMP) identifies the Sloan's Lake basin as Basin 4700-01. The watershed is generally bounded by Colfax Avenue on the south, 32nd Avenue on the north, and extends westerly from the South Platte River to Garrison Street in Lakewood. The Sloan's Lake outfall is a left-bank tributary of the South Platte River draining a 4.89 square mile basin located in west-central Denver. A majority of the basin is within the City & County of Denver (1.89 square miles), although the western upper watershed includes the City of Edgewater (0.70 square miles), City of Lakewood (1.15 square miles), and the City of Wheat Ridge (0.78 square miles). The Crown Hill Cemetery, which is located at the top of the watershed, is within unincorporated Jefferson County (0.37 square miles).

The basin is approximately 4.7 miles in length and 1.4 miles wide. The highest point of the basin is within the Crown Hill Cemetery at 5387 feet, and the lowest point is at the outlet to the South Platte River at 5179 feet. The upper and middle portions of the watershed generally have very mild slopes, while the lower portions of the watershed (between Sloan's Lake and the South Platte River) have steeper slopes. The average slope for the entire basin is approximately 1.28%.

Sloan's Lake is an efficient stormwater detention pond during storm events. The current regulatory inflow to Sloan's Lake during the 100-year event is 2,904 cfs, with a flow out of only 34 cfs. The flood pool depth is only 2 feet above the normal operational lake elevation. The Lake has two major inlets and over twenty minor inlets. The Sloan's Lake drainageway enters the lake on the southwest shoreline via an open channel, which is well defined up to Ingalls Street/20th Avenue as a 9' x 6' box culvert. The Ashland Drainageway enters the lake along the northwest shoreline via a 9' x 4' box culvert. The existing Sloan's Lake outlet structure is located along the southeasterly shoreline near Newton Street/17th Avenue and connects to the storm drain system via a 24-inch pipe. The storm drain main line continues down 16th Avenue; turns south in Federal Boulevard and discharges to an open channel in the Colfax Avenue/Federal Boulevard interchange, ultimately discharging to the South Platte River via a 54-inch pipe on the south side of Colfax Avenue. Significant flooding has not been recorded in the Sloan's Lake watershed, however, regulatory and non-regulatory floodplains exist within the basin along the major drainageways.

In addition to Sloan's Lake, the Rocky Mountain Ditch – South Branch (herein referred to as simply the Rocky Mountain Ditch or RMD) is another significant feature within the basin. The RMD is an open channel irrigation ditch which originates in Jefferson County and draws flows from Clear Creek, west of the City of Golden and contributes to Sloan's Lake inflow. The City & County of Denver holds water rights in the RMD and utilizes those water rights to fill Sloan's Lake for irrigation of the Sloan's Lake Park land, Rock Mountain Lake Park, and Berkley Lake Park. Several different diversion structures on the RMD deliver water to each park based on the senior appropriation process. Sloan's Lake irrigation water is delivered from the RMD to the Lake via the Sloan's Lake Drainageway. For additional information on the water budget and water rights see the *Rocky Mountain Ditch Systems Lake Water Budget Study* prepared for Denver Parks and Recreation by Matrix Design Group, October 19, 2009.

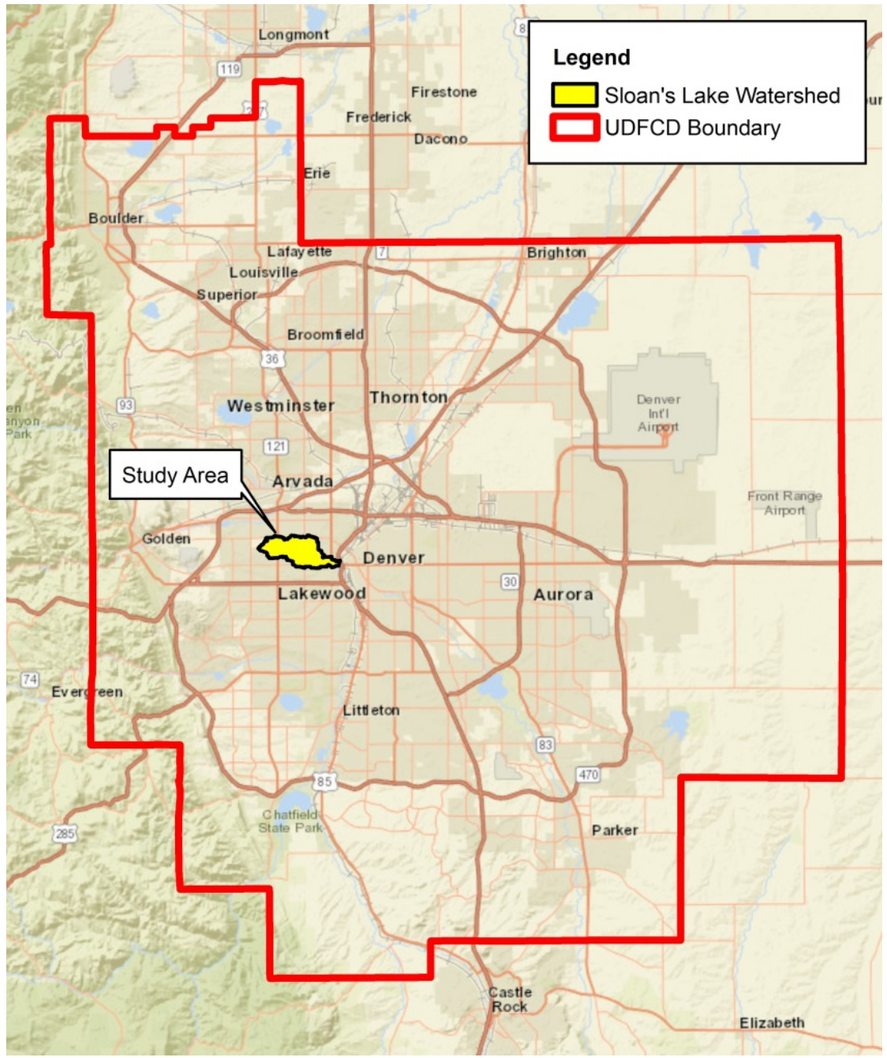

Figure 2-1 Vicinity Map

2.1.1 Lower Basin

Land use in the 1.0 square mile lower basin (downstream of the lake outfall) is predominately residential with commercial development along major transportation corridors (Federal Boulevard and Colfax Avenue) and is entirely within the City & County of Denver. In addition, Sports Authority Field is a substantial landmark/land use located along the west bank of the South Platte River. The basin is fully developed with some re-development opportunity, including the St. Anthony's hospital redevelopment located immediately south of Sloan's Lake.

Denver's Department of Community Planning and Development prepared the Decatur/Federal Station Area Plan, which was adopted in 2007, and is being used to guide decisions regarding appropriate public and private investment within ½-mile of the light rail station, which lies just south of the Sloan's Lake 100-year floodplain near the confluence of the Lakewood Gulch and South Platte River 100-year floodplains.

2.1.2 Upper Basin

Land use in the 3.91 square mile upper portion of the watershed (upstream of Sloan's Lake outfall at 17th Avenue and Newton Street) is primarily residential with commercial development along major transportation corridors (Sheridan Boulevard and Colfax Avenue). Notable parks are located along the Sloan's Lake Drainageway, such as Walker-Branch Park and Morse Park. Jefferson High School is also located along the drainageway. The Ashland Drainageway is conveyed in a mix of aboveground and underground systems without major open channel sections. The Crown Hill Cemetery is a notable large land use in the upper portion of the basin.

The Rocky Mountain Ditch flows across the Sloan's Lake watershed, which intercepts some storm flows from the headwaters. The City & County of Denver holds a water right on the Rocky Mountain Ditch and currently uses that right to maintain the Lake level at its 5310.30 feet operational water surface elevation. This is consistent with the Sloan's Lake LOMR dated January 2, 1992 which indicated that the weir elevation is 5307.25 feet. However, the LOMR was completed on the NGVD '29 vertical datum. To convert that elevation to the current NAVD '88 vertical datum, add 3.05 feet for the current water surface elevation of 5310.30 feet (5307.25 + 3.05 = 5310.30).

Denver's water right is one of the oldest held in the Clear Creek watershed. Flows are diverted from the Ditch at Headgate 221/222 near 24th Avenue and Yarrow Street. Flows then pass through the 48-inch and 72-inch storm drain system and into an existing detention facility at the southeast corner of Wadsworth Boulevard and 26th Avenue that is owned and maintained by the City of Lakewood. Flows continue eastward in the storm drain system and enter the open channel portion of the Sloan's Lake Drainageway near Jefferson High School, ultimately entering Sloan's Lake on the southwesterly shoreline at Sheridan Boulevard and 17th Avenue.

Rocky Mountain Ditch (North Branch)
Wadsworth Blvd
38th Ave
Harlan St
Sheridan Blvd
Tennyson St
Irving St
Zuni St
32nd Ave
Speer Blvd
Gray Street Tributary
Jefferson County (Unincorporated)
Wheat Ridge
City & County of Denver
29th Ave
Rocky Mountain Ditch (South Branch)
Pierce Street Tributary
Ashland Drainageway
26th Ave
Lowell Blvd
287
Clay St
Lakewood
Edgewater
23rd Ave
Federal Blvd
Sloan's Lake Drainageway
Sloan's Lake
Irving St
25
South Platte River
20th Ave
Trans-watershed Flow from North Dry Gulch
Carr St
121
17th Ave
Sloan's Lake Drainageway
40
Colfax Ave
14th Ave
Harlan St
86
Dry Gulch
Perry St
Knox Ct
Federal Blvd
13th Ave
Decatur St
Zuni St
10th Ave
Lakewood Gulch
Weir Gulch

0 800 1,600
Feet

Legend

- Study Reach
- Ditch/Gulch/River
- Highway
- Light Rail Line
- Sloan's Lake Watershed Boundary (4.9 Sq. Mi)
- City Boundary

Waterbody/Detention

- Publically Maintained
- Privately Maintained

Jurisdictions

- City & County of Denver
- Edgewater
- Lakewood
- Wheat Ridge
- Jefferson County (Unincorporated)

No.	DATE	DESCRIPTION	APPR.

Matrix DESIGN GROUP
AN EMPLOYEE-OWNED COMPANY

designed by:
drawn by: CM
checked by: RK
project no.: 16.155.026
date: 07/24/2018

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT, CITY AND COUNTY OF DENVER

FLOOD HAZARD AREA DELINEATION
SLOAN'S LAKE DRAINAGEWAY AND TRIBUTARIES

WATERSHED MAP

FIGURE 2-2

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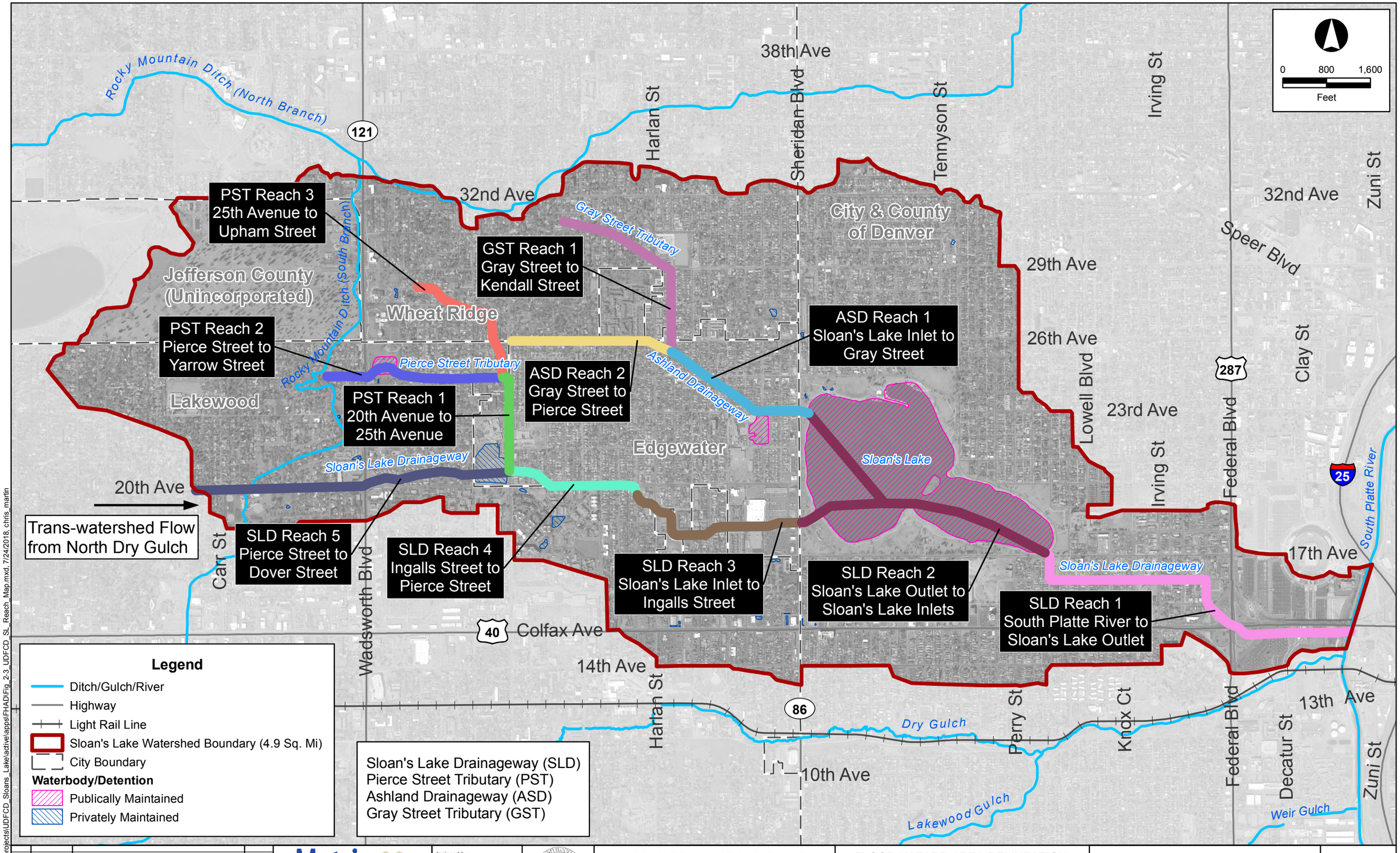

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No.	DATE	DESCRIPTION	APPR.

Matrix DESIGN GROUP
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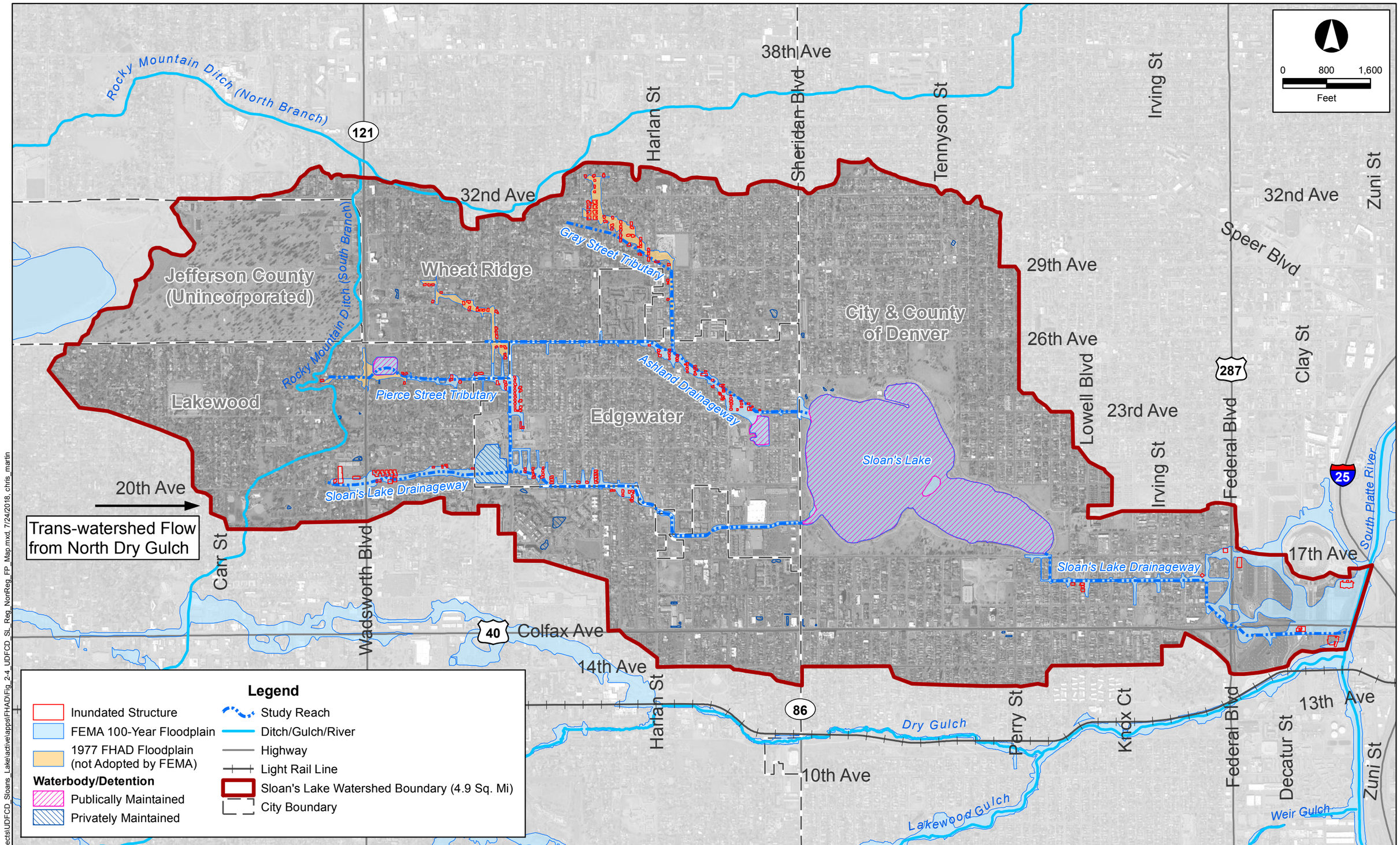
designed by:
drawn by: CM
checked by: RK
project no.: 16.155.026
date: 07/24/2018

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT, CITY AND COUNTY OF DENVER

FLOOD HAZARD AREA DELINEATION
SLOAN'S LAKE DRAINAGEWAY AND TRIBUTARIES

REACH MAP

FIGURE 2-3



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designed by:
drawn by: CM
checked by: RK
project no.: 16.155.026
date: 07/24/2018

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT, CITY AND COUNTY OF DENVER

FLOOD HAZARD AREA DELINEATION
SLOAN'S LAKE DRAINAGEWAY AND TRIBUTARIES

REGULATORY AND NON-REGULATORY FLOODPLAIN MAP

FIGURE 2-4

2.2 Land Use

In 1977, the Sloan's Lake FHAD noted that the drainage basin had already "essentially reached a full development condition with the exception of a few scattered, vacant lots." This basin is fully developed; however, some small areas are expected to redevelop as noted in ***Blueprint Denver*** as "Areas of Change". Because the vast majority of land use has been fully developed, the land use for the *Future Condition* is approximately the same as the *Existing Condition,* thus only the *Future Condition* hydrologic model was studied for this FHAD. Residential land uses comprise a majority of the basin, with a few isolated pockets of commercial land uses along major transportation corridors.

GIS land use zoning data were obtained from the City & County of Denver, the City of Edgewater, the City of Lakewood, and the City of Wheat Ridge. The Decatur/Federal Station Area Plan, Federal Blvd Corridor Plan, Sheridan Blvd Station Plan, and the West Colfax Plan were provided by the City & County of Denver and were incorporated into the land use analysis. Table RO-3 of UDFCD's Urban Storm Drainage Criteria Manual (USDCM) was used to determine the percent imperviousness for each land use zoning. The composite percent imperviousness for each sub-basin was calculated by overlaying the land use data within the sub-basin boundary. **Section 3.3.2** provides the detailed description of watershed imperviousness. **Figure B-1 Interactive Hydrology Map** in **Appendix B** shows the land use map, sub-basin boundaries and associated percent imperviousness.

2.3 Reach Description

For the purposes of this study, the Sloan's Lake watershed has been divided into 9 reaches totaling 6.78 miles. Descriptions of the reaches are provided in the sections below and reach limits are illustrated in **Figure 2-3**. Some key drainage features and hydraulic structures are shown in **Figures 2-5** through **2-19** and are listed in **Table 2-1**.

SLD (Sloan's Lake Drainageway) Reach 1 – South Platte River to Sloan's Lake

SLD Reach 1 is approximately 7,050 feet in length and extends from the outfall to the South Platte River up to the Sloan's Lake outlet structure. The reach is comprised of culverts ranging in size from 24-inch to 54-inch. Land uses are fairly evenly distributed between commercial and dense residential. Sports Authority field is adjacent to the reach along the northern edge. The Denver SDMP identifies the entire reach as undersized for the minor storm event. Sloan's Lake Major Drainageway Plan 2018 recommended pipe sizes ranging from 8-foot by 5-foot RCBC at the outfall to 36-inch at the Sloan's Lake outlet structure and would expand the system capacity to a 100-year event. The urban thalweg begins at the Sloan's Lake outlet structure and proceeds south along Newton Street and then easterly along 16th Avenue. A major split flow occurs near 16th Avenue and Federal Boulevard, with flows directing south towards the Federal Boulevard/Colfax Avenue interchange and northerly around Sports Authority Field.



Figure 2-5 Outfall to the South Platte River



Figure 2-6 View of 17th Avenue westerly from Lowell Blvd.

SLD Reach 2 – Sloan's Lake

SLD Reach 2 is approximately 4,500 feet in length and is comprised of Sloan's Lake itself which also has a surface area of approximately 176 acres. The lake shoreline is fairly stable with adequate vegetative cover. Denver Parks noted that the beach area immediately west of the Boathouse and Marina suffers from repeated erosion problems and sand is frequently trucked in to replace lost sand.



Figure 2-7 Sloan's Lake Outlet



Figure 2-8 Sloan's Lake

SLD Reach 3 – Southwest inlet to Sloan's Lake to 20th Avenue/Ingalls Street

SLD Reach 3 is approximately 3,700 feet in length and extends from the primary Sloan's Lake inlet located on the southwest shoreline up to the intersection of 20th Avenue and Ingalls Street. Reach 3 is mostly under the jurisdiction of Edgewater but is also within Lakewood and maintained by UDFCD. The drainageway partially consists of a concrete low flow channel and grass lined slopes while the remainder of the low flow is lined with boulders. The effective floodplain shown in Figure 2-4 is confined to the channel banks. There are several culvert/roadway crossings along SLD Reach 3 which are located at Harlan Street, Eaton Street, Depew Street, Sheridan Boulevard, and the commercial connections for the Target and King Soopers shopping centers. The channel invert slope is approximately 0.5 percent. The Walker-Branch Park constitutes a large part of the reach and includes a concrete trail along the entire reach.



Figure 2-9 Sloan's Lake SW inlet at Sheridan Blvd.



Figure 2-10 Open channel upstream of Sheridan Blvd.

SLD Reach 4 – 20th Avenue/Ingalls Street to Jefferson High School (20th Avenue/Pierce Street)

SLD Reach 4 is approximately 2,300 feet in length and extends from the intersection of 20th Avenue and Ingalls Street to Jefferson High School which is located at 20th Avenue and Pierce Street. The reach is comprised of 72-inch and 78-inch storm drain pipes. The effective floodplain is primarily contained within 20th Avenue but also cuts through a residential area at Newland Street before meeting Pierce Street.



Figure 2-11 Open channel downstream of 20th Ave/Ingalls St.



Figure 2-12 Box culvert at 20th Ave and Ingalls St.

SLD Reach 5 – Jefferson High School (20th Avenue/Pierce Street) to 20th Avenue/Dover Street

SLD Reach 5 is approximately 5,700 linear feet and extends from Jefferson High School to the intersection of 20th Avenue and Dover Street. (Jefferson High School is located at the downstream end of the reach and includes an on-line detention facility. However, the facility is not publicly maintained and thus was not included in the Baseline Hydrology analysis.) The reach contains an open channel section from Jefferson high School to Vance Street where the open channel ends and connects to a 48-in storm drain pipe. The upper portion of the reach is cutoff by the RMD and receives some trans-basin diversions along 20th Avenue when the RMD overtops. The 1977 FHAD did not include flow from the RMD or North Dry Gulch. The current model however includes flows from North Dry Gulch. Flows from RMD can be provided from the ditch company but were not included in the model. The open channel section of the reach is heavily vegetated and is not currently maintained due to a lack of ownership/easement rights. The effective floodplain shown in Figure 2-4 is generally contained in the historical thalwegs, however development has encroached into the floodplain.



Figure 2-13 Jefferson High School Detention



Figure 2-14 Open Channel at Teller St/Geneva Ct.

PST (Pierce Street Tributary) Reach 1, 2 and 3 - 20th Avenue/Pierce Street to 24th Avenue/Yarrow Street and 25th Avenue to Upham Street

PST Reach 1 and 2 are approximately 5,300 feet in length and extends from the intersection of 20th Avenue and Pierce Street to the intersection of 24th Avenue and Yarrow Street. Storm drain pipe sizes range from 66-inch to 42-inch. The effective floodplain is generally contained within the street; however, it spills into the residential area on the east side of Pierce Street between 24th Avenue and 26th Avenue. A non-regulatory floodplain extends further up 25th Avenue to Yarrow Street. A regional detention facility is located south of 26th Avenue between Vance Street and Wadsworth Boulevard and is owned by the City of Lakewood and maintained by UDFCD. The open channel between Saulsbury Street and Reed Street is maintained by UDFCD and the City of Lakewood.

PST Reach 3 is approximately 2,600 feet in length and extends from the intersection of 25th Avenue and Quay Street to the intersection of 27th Avenue and Upham Street. The effective floodplain is only approximately 265 feet in length from 25th Avenue to W 25th Place and is generally contained within the street; however, a non-regulatory floodplain extends further up Quay Street and 27th Avenue to Upham Street.



Figure 2-15 Sump in Pierce St. at Jefferson High School Outlet



Figure 2-16 Wadsworth Blvd/26th Ave detention basin outlet

ASD (Ashland Drainageway) Reach 1– Northwest inlet to Sloan's Lake up to 26th Avenue/Gray Street

ASD Reach 1 is approximately 3,800 feet in length and extends from the northwesterly inlet to Sloan's Lake up to the intersection of 26th Avenue and Gray Street. Storm drain sizes range from a 48-inch x 108-inch box culvert to a 66-inch diameter pipe. The effective floodplain is not contained in the street and spills through several residential neighborhoods from 26th Avenue to 24th Avenue. Citizens Park, owned and operated by Edgewater, is located along 24th Avenue at Chase Street and operates as an off-line regional detention basin. The storm drain network does not discharge into the basin and it only activates when flows exceed the street depths on the northwesterly portion of the park.



Figure 2-17 Pierce St southerly from 26th Ave.



Figure 2-18 Sloan's Lake NW inlet.

ASD Reach 2 – 26th Avenue/Gray Street to 26th Avenue/Pierce Street

ASD Reach 2 is approximately 3,000 feet in length and extends from the intersection of 26th Avenue and Gray Street up to the intersection of 26th Avenue and Pierce Street. Storm drains vary in size from 42-inch to 30-inch. The effective floodplain is generally contained in the street, however further investigation determined a split flow condition occurs between PST Reach 3 and ASD Reach 2 near the intersection of Pierce Street and 26th Avenue. A non-regulatory floodplain shown in Figure 2-4 extends up ASD Reach 2 to approximately 28th Avenue and Teller Street. The non-regulatory floodplain is contained in the street for a portion of the reach and spills into residential areas following existing topographic thalweg. The effective floodplain maps currently depict the two floodplains joining at the intersection of 26th Avenue and Pierce Street.



Figure 2-19 Pierce St northerly from 26th Ave.

GST (Gray Street Tributary) Reach 1 – 26th Avenue/Gray Street to 32nd Avenue/Kendall Street

GST Reach 1 is approximately 3,900 feet in length and extends from the intersection of 26th Avenue and Gray Street up to the intersection of 32nd Avenue and Kendall Street. Storm drains range in size from 24-inch to 36-inch. A non-regulatory floodplain is generally contained within Gray Street from 26th Avenue up to 29th Avenue where it begins to spill through residential areas following topographic thalweg toward 32nd Avenue.

2.4 Flood History

Recent significant floods have not been recorded in the Sloan's Lake watershed, though minor urbanized flooding has been noted along 20th Avenue, Pierce Street, and Depew Street. Significant flooding locations were not noted in the Denver 2014 *Storm Drainage Master Plan*, though it is noted that the system downstream of Sloan's Lake is undersized per Denver Criteria during the 5-year storm event of the local drainage area. Sloan's Lake Drainageway and its tributaries are made up of mostly culverts, with only a few small segments of open channel. Therefore, there are few scour or stream stability issues. There are gages within Sloan's Lake watershed, but the gage data is not being used to calibrate the hydrology. Irrigation diversions from the RMD are managed by the Ditch Company and include estimates during times of diversions but do not include flows during storm events. The irrigation diversion uses only a small portion of the pipe's available hydraulic carrying capacity. These irrigation diversions create a summer time baseflow condition within the Sloan's Lake Drainageway from the detention basin at Wadsworth and 26th Avenue to the primary lake inlet located on the southwest shoreline.

2.5 Environmental Assessment

Wetlands and Riparian Areas

Wetland and riparian areas along the Sloan's Lake Drainageway corridors are currently very limited**. Figure E-1** in **Appendix E** delineates significant potential wetland and riparian areas based on the National Wetlands Inventory, 2009 aerial photography and field observations. While the National Wetlands Inventory does not specifically identify wetlands around the perimeter of Sloan's Lake, the lake is likely home to important wetland and riparian areas along the banks. Sloan's Lake itself listed as a "lake" on the wetland registry.

There are some identified "emergent" wetlands around the detention facility located at Wadsworth Boulevard and 26th Avenue.

Threatened and Endangered Species

The U.S. Fish and Wildlife Service (USFWS) currently lists the following threatened and endangered species for Denver and Jefferson Counties (http://www.fws.gov/endangered/):

Denver County	Status	Jefferson County	Status
Piping plover	Threatened	Mexican spotted owl	Threatened
Least tern	Endangered	Piping plover	Threatened
Ute ladies'-tresses orchid	Threatened	Least tern	Endangered
Preble's jumping mouse	Threatened	Colorado butterfly plant	Threatened
		Pawnee montane skipper	Threatened
		Canada lynx	Threatened
		Preble's jumping mouse	Threatened

The entirety of the Sloan's Lake watershed is within the Denver metropolitan Block Clearance Zone (BCZ) for Ute ladies'-tresses orchid, Preble's meadow jumping mouse and the Colorado butterfly plant. The BCZ is an area that the USFWS has determined that the species in question is not likely to currently exist. As such, these species should not be a concern for projects within the watershed.

USFWS on-line maps currently indicate that the Canada lynx, Mexican spotted owl and the Pawnee montane skipper are not known or believed to occur within the Denver portion of the watershed east of Sheridan Avenue. Bird habitat resources for Piping plover, Least tern and the Mexican spotted owl within the Sloan's Lake watershed are currently limited because the watershed is fully urbanized and there is little riparian corridor adjacent to the piped drainageways. Future design projects will require more detailed assessments of any potential threatened and endangered species habitat resources within the project limits.

Landfills and Contamination

There are two known landfills in the lower Sloan's Lake area. The first is located on the Sports Authority Field Stadium site, and the second is located within Sloan's Lake Park near the northeast intersection of Sheridan Boulevard and 17th Avenue. There is also a suspected landfill along the western shoreline of Sloan's Lake between Sheridan Boulevard and the lake, as well as on the Target shopping mall site immediately west of Sheridan Boulevard. **Figure E-2** in **Appendix E** presents known and suspected historical landfill areas within the Sloan's Lake watershed. The source of this information is the City and County of Denver GIS.

Table 2-1 Sloan's Lake Basin Major Crossing Structure Inventory

Sloan's Lake Drainageway and Tributaries	Type of Conveyance	River Station			Reach Length (ft)	Structure Number	Location	Type of Crossing	Station of Structure	Structure Description	Type/Size of Structure	Estimated Capacity (Future Flow)
SLD Reach 1	Storm Drain	0+00	to	70+50	7,050	1	South Platte Outfall	Outlet	0+00	Culvert	54" RCP	< 5-year
SLD Reach 2	Storm Drain	70+50	to	120+50	5,000	2	Sloan's Lake Outlet @ Newton St. and W 17th Ave.	Roadway	70+60	Culvert	24" RCP	100-year
						3	Sloan's Lake Inlet @ Sheridan Blvd	Roadway	119+90	Culvert	4 - 7'x5'	< 100-year
SLD Reach 3	Open Channel	114+50	to	154+50	4,000	4	Target Access Road	Roadway	121+80	Culvert	2 - 13'x6' & 1-16'x6'	100-year
						5	Benton St. @ S side of Target	Roadway	126+50	Culvert	1 - 14'x7' 2 - 11'x6'	100-year
						6	Chase St. @ S side of Target	Roadway	129+60	Culvert	Low Flow	< 2-year
						7	W 18th Ave. and Depew St.	Roadway	133+00	Culvert	2 - 12'x5'	< 100-year
						8	Eaton St. between W 17th Ave. and W 18th Ave.	Roadway	136+50	Culvert	2 - 12'x5'	< 100-year
						9	Harlan St. between Newland Ct. and W 20th Ave.	Roadway	150+30	Culvert	2 - 12'x4'	< 50-year
SLD Reach 4	Storm Drain	154+50	to	180+00	2,550	10	Ingalls Street to the alley between Marshall St. and Newland St. on W 20th Ave.	Roadway	154+50 to 170+00	Storm Drain	78" RCP	< 25-year
						11	The alley between Marshall St. and Newland St to the alley between Otis St. and Pierce St.	Roadway	170+00 to 178+00	Storm Drain	72" RCP	< 25-year
SLD Reach 5	Pipe/Open Channel	180+00	to	215+50	3,550	12	Teller St. and Geneva Ct.	Roadway	193+50	Culvert	1-24" & 1-30" RCP	< 10-year
						13	W 20th Ave. between Vance St. and Wadsworth Blvd.	Roadway	200+40 to 208+80	Storm Drain	48" RCP	50-year
						14	W 20th Ave. and Yukon St.	Roadway	211+70	Culvert	Conspan Arch 142" x 56"	100-year
						15	W 20th Ave. and Yarrow St.	Roadway	207+25	Storm Drain	21" RCP	< 2-year
PST Reach 1 & 2	Pipe/Open Channel	0+00	to	53+20	5,320	16	W 24th Ave. and Yarrow St. to detention at 26th Avenue/Wadsworth Blvd; Detention to Pierce St/20th Avenue	Roadway	0+00 to 53+00	Storm Drain	42", 48" & 60" RCP	< 100-year
ASD Reach 1	Storm Drain	0+00	to	29+50	2,950	17	Sloan's Lake Inlet @ Sheridan Blvd. and W 22nd Ave.	Roadway	0+00	Storm Drain	54"	< 10-year
						18	Sloan's Lake Inlet @ Sheridan Blvd. and W 24th Ave. to Benton St. and W 24th Ave.	Roadway	0+00 to 9+00	Culvert	8' x 4'	< 100-year
						19	Benton St. and W 24th Ave. to Depew St between 24th Ave and 25th Ave	Roadway	9+00 to 17+00	Storm Drain	66" RCP	< 25-year
						20	Depew St between 24th Ave and 25th Ave to Gray St. and W 26th Ave.	Roadway	17+00 to 29+50	Storm Drain	60" to 54" RCP	< 25-year
ASD Reach 2	Storm Drain	29+50	to	59+00	2,950	21	Gray St. and W 26th Ave. to Harlan St. and W 26th Ave.	Roadway	29+50 to 33+50	Storm Drain	42" RCP	< 25-year
						22	Harlan St. and W 26th Ave. to Ingalls Street and 26th Ave	Roadway	33+50 to 36+90	Storm Drain	36" RCP	10-year
GST Reach 1	Storm Drain	0+00	to	39+80	3,980	23	Gray St. and W 26th Ave. to Gray St and W 29th Ave	Roadway	0+00 to 15+50	Storm Drain	36" RCP	< 10-year
						24	Gray St. and W 29th Ave. to 30th Ave and Ingalls St	Roadway	15+50 to 27+00	Storm Drain	42" RCP	25-year

3.0 HYDROLOGIC ANALYSES

3.1 Overview

The Sloan's Lake Drainageway drains a total watershed area of approximately 4.9 square miles to the South Platte River. While there is a flow gage upstream of the main inlet into Sloan's Lake, a Precipitation-Runoff modeling approach was used to estimate flows. The purpose of this study is to update the major drainageway design flood flows in Sloan's Lake Drainageway. The following sections describe the detailed study and findings.

3.1.1 FHAD Study (Original Hydrologic Modeling)

The first FHAD study was completed in 1977 using the Colorado Urban Hydrograph Procedure (CUHP) in accordance with the 1969 UDFCD Drainage Criteria Manual. The total watershed area studied was 5.5 square miles and was composed of 18 sub-basins. The 2-hour storm duration (1-hour storm precipitation distributed over 2 hours) was used for calculating frequency discharges. The 100-year frequency 1-hour rainfall depth used was 2.15 inches and an infiltration loss of, 0.5 inch/hour, a detention loss of 0.3 inches for pervious areas and 0.1 inches for impervious areas were used for effective runoff adjustment.

The 1977 FHAD study concluded that the Sloan's Lake Drainage Basin has moderate flood damage potential but may be reduced with structural improvements to outfalls, channels, and pipes. The 1977 study concluded that the 100-year discharge at the Colfax/Federal interchange was 757 cfs.

3.1.2 Hydrologic Modeling Methodology

The objective of the future condition hydrologic analysis is to study the Sloan's Lake basin using the Colorado Unit Hydrograph Procedure (CUHP 2005 Version 2.0.0) to generate hydrographs for each sub-watershed. Hydrographs for the sub-watersheds were routed using the Environmental Protection Agency Stormwater Management Model (EPA SWMM Version 5.1.011) to determine peak design rates to be used for infrastructure design.

Rocky Mountain Ditch flows across the Sloan's Lake watershed from the northwest corner and intercepts some storm flows from the headwaters. Section 3.3.4.2 of the City & County of Denver's Storm Drainage Design and Technical Criteria Manual states that "Drainage analysis shall assume that irrigation ditches do not intercept storm runoff from the upper basin ... ditches will generally be flowing therefore; the tributary basin runoff would flow across the ditch." Therefore, initial storm flows were modeled as being conveyed across the Rocky Mountain Ditch to the downstream storm drain network.

While the Trans-watershed split flow from North Dry Gulch was not shown or accounted for in the 1977 FHAD, it is incorporated into this study by integrating the tributary watersheds and routing elements of North Dry Gulch into the CUHP-SWMM of this study. North Dry Gulch contributes 118 cfs to the Sloan's Lake watershed.

A detailed hydrologic modeling approach to establish the baseline hydrology for this MDP and FHAD is described in Sections 3.2 through 3.5.

3.2 Design Rainfall

Rainfall depth and distribution has been updated. Rainfall duration and depth-area reduction factors (DARF's) applied to point rainfall depths used within CUHP vary with the size of the watershed being analyzed. The total contributing drainage area for the Sloan's Lake watershed to the South Platte River is 4.9 square miles. For watersheds less than 10 square miles, the UDFCD-USDCM stipulates that the 1-hour point precipitation depth be used and that no reduction in that depth for area be applied. Furthermore, the UDFCD-USDCM also stipulates that the 1-hour point precipitation depth be distributed over a 2-hour storm duration.

The one-hour point rainfall depths for the 2-, 5-, 10-, 25-, 50-, 100- and 500-year events were read from the Point Precipitation Frequency table from NOAA Atlas 14 for the approximate centroid of the basin (Latitude: 39.7528°, Longitude: -105.0671°). Selected point rainfall depths are given in **Table 3-1** below. **Table B-1** in **Appendix B** shows the detailed rainfall distributions for each event.

Table 3-1 NOAA Atlas 14 One-Hour Point Rainfall Depths (Inches)

Sloan's Lake Basin MDP & FHAD						
2-Year	**5-Year**	**10-Year**	**25-Year**	**50-Year**	**100-Year**	**500-Year**
0.78	1.04	1.28	1.63	1.91	2.21	2.97

3.3 Sub-watershed Characteristics

A summary of the CUHP model parameters can be found in **Appendix B, Table B-2**. For the sub-watersheds within the study area, 1-foot contour topography was used to determine the existing conditions flow path lengths and distance to centroid values. The highest watershed elevation is 5,387 feet at the Crown Hill Cemetery at the northwest corner of the watershed. The lowest watershed elevation is 5,179 feet at the South Platte River at the eastern edge of the watershed. The average watershed slope is 1.28 percent measured along the topographic thalweg.

3.3.1 Sub-watershed Delineation

The major watershed boundary was determined using 2014 1-foot contours; however, the major watershed boundaries from the 2011 North Dry Gulch OSP and 2013 Dry Gulch OSP Baseline Hydrology Reports were incorporated as the southwest boundary and a portion of the south boundary for this study. The sub-watersheds within the study area were delineated based on the 2014 *Denver Storm Drainage Master Plan* as well as the previous 1977 Sloan's Lake MDP and resulted in basins generally less than 130 acres in area. Individual sub-watersheds averaged no more than 100 acres per standard guidance from UDFCD. However, three sub-watersheds do not meet the general guidelines for area due to the land use condition and topographic features which do not warrant further sub-division. Sub-watershed 200 includes Sloan's Lake with a surface area of 176 acres. Sub-watershed 345 and 365 do not need further sub-division at this master planning level due to the land use condition. A trans-basin flow at Dover Street and 20th Avenue was identified

in the 2011 North Dry Gulch OSP Baseline Hydrology Report. Two sub-watersheds (41 and 42) in the North Dry Gulch watershed were incorporated into the Sloan's Lake baseline hydrologic model; however, these two sub-watersheds were not included in the basin map. A total of 54 sub-basins were delineated in the Sloan's Lake basin study area. The minimum, maximum and average sizes of the sub-watersheds are summarized in **Table 3-2**.

Table 3-2 Summary of Sub-watersheds Delineation

Total Area (sq. mi.)	Sub-basin Area (acre)			Total No. of Sub-basins
	Average	Minimum	Maximum	
4.89	58	5	266	54

3.3.2 Watershed Imperviousness

A GIS-based approach was used to calculate the percent of impervious area within the watershed based upon land use information. The land use data described in the previous section was used in conjunction with Table 6-3, from the UDFCD-USDCM, to create percent impervious values for each land use type. **Table 3-3** lists each land use type and the associated percent impervious values used in the analysis. GIS data representing land use was intersected with sub-basin polygons to calculate area-weighted, or composite, percent impervious values for each sub-watershed. To more accurately reflect imperviousness for planned developments, Area Plans were used to supplement the land use data where appropriate. Percent impervious values for future conditions are shown in **Figure B-1 Interactive Hydrology Map**. Future development conditions for the composite watershed were calculated to be 63 percent imperviousness.

Table 3-3 Summary of Future Land Use (FLU) Imperviousness

Future Land Use	Percent Imperviousness*	Percentage of Watershed Area
Cemetery	10%	7.5%
Park	10%	3.6%
Residential: Single-family, 0.75 - 2.5 acres	20%	0.0%
Residential: Single-family, 0.25 - 0.75 acres	30%	7.9%
Residential: Single-family, 0.25 acres or less	45%	35.2%
Residential: Apartments	75%	6.1%
Business: Suburban Areas	75%	4.3%
Business: Downtown Areas	95%	7.9%
Streets: Paved	100%	0.0%
Right-of-way	90%	21.6%
Water	100%	5.8%

* Percent imperviousness were determined using UDFCD-USDCM Table 6-3

3.3.3 Depression Loss

Depression losses were determined using Table 6-6 in the USDCM. A pervious depression loss of 0.35 inches and impervious depression loss of 0.1 inches were used for the watershed.

3.3.4 Infiltration

Approximately 40% of the watershed has an undefined hydrologic soil group (HSG) and was assumed as Soil Group C. This portion of the watershed is located within the City and County of Denver. The remaining 60% of the watershed has a Type C HSG, as defined by the NRCS. The soils are generally characterized by moderate (0.15-0.30 in/hr) to low (0.05-0.15 in/hr) infiltration rates. The initial and final infiltration rates used in the CUHP model are 3 in/hr and 0.5 in/hr as recommended in Table 6-7 of the UDFCD-DCM.

3.3.5 Directly Connected Impervious Area Level (DCIA)

It is standard practice to use a directly connected impervious area (DCIA) level of zero which was applied to a majority of the watershed. However, a DCIA Level 2 was inherited from the 2011 North Dry Gulch OSP and used for sub-watersheds 41 and 42.

3.4 Detention Basin Facilities

UDFCD's policy is to model only regional, publicly-owned facilities. Inadvertent detention areas are not modeled since their use and function cannot be predicted in the future. Furthermore, private detention is not modeled since those facilities cannot be guaranteed to remain in service or maintained. The Jefferson High School Detention Basin, an on-line facility, which is located on the Sloan's Lake Drainageway west of Pierce Street has approximately 10-acre-feet of storage volume at the spillway elevation of 5397.55 feet. However, this detention basin was not modeled due to the lack of an Intergovernmental Agreement (IGA) for this detention facility. An improved storm sewer system along 29th Avenue between Fenton Street and Sheridan Boulevard and a detention facility at the Richard Hart Estate between 27th and 28th Avenue along Ames Street were designed to alleviate overtopping during storm events. While this improved system does help prevent flooding concerns along 28th and 29th Avenue, and Sheridan Boulevard, it does not have a large impact on the major drainageway study and was not included in the model. Updates to this system will however be addressed in the alternative analysis.

The following three detention basin facilities were included in the hydrologic model:

1. Wadsworth Boulevard and 26th Avenue in Lakewood, 24 acre-feet storage
2. Citizen's Park in Edgewater, 12 acre-feet storage
3. Sloan's Lake, 394 acre-feet storage

Stage-storage-discharge curves were developed for the three facilities using information from as-built plans and the 2014 1-foot contours. EPA SWMM uses a stage-storage surface area curve and an outlet rating curve of head-discharge to simulate the detention system. The curves are included in **Table B-3** in **Appendix B**.

3.5 Hydrograph Routing

Parameters for the SWMM model conveyance elements were determined using the mapping described in Section 1.4 and GIS layers for the existing storm drainage system provided by the stakeholders. Manning's roughness values were determined based on aerial imagery and supplemented by field observation. **Table 3-4** provides the Manning's ***n*** values selected for use in the Baseline Hydrology Model. In the SWMM routing model, the Manning's ***n*** values were increased by 25 percent, except for estimating Manning's ***n*** for natural channels in accordance with the UDFCD-USDCM. EQ. 6-B in the USDCM was not used as it is applicable for more detailed hydraulic analysis. An excerpt from UDFCD USDCM Volume 1, January 2016 is attached below for reference.

> **4.2.2 Step 2: Estimate Coefficients and Functional/Tabular Characteristic of Storage and Outlets**
>
> For hydrologic routing through conveyance elements such as pipes, gutters, and channels, the resistance (Manning's n) coefficients should not necessarily be the same as those used in performing hydraulic design calculations. As a general rule, it was found that increasing the "typical" values of Manning's n by approximately 25 percent was appropriate when using UDSWM in the past and should be appropriate for use in SWMM as well. Thus, if a pipe is estimated to have $n = 0.013$ for hydraulic calculations, it is appropriate to use $n = 0.016$ in SWMM.

Table 3-4 Manning's Roughness Coefficients & Comparison

Routing Element Description	Original "n" value	Increased "n" value 25%
Reinforced Concrete Pipe	0.015	0.019
Asphalt Pavement	0.016	0.020
Street Combined Lawn Area	0.020	0.025
Engineered Channel, Ditch	0.025	0.031
Natural Drainageway with No Brush	0.035	-

Major underground storm system facilities were modeled, and overflow elements were added parallel to the storm pipes in the model to route surface flows exceeding the capacity of the storm pipes without counting inadvertent detention. At locations where split flows occur, this is the result of the storm system contravening topography where flows in the pipes are routed down streets and do not follow surface flows based upon topography.

Two trans-watershed split flows were identified and included in this Baseline Hydrology model. One trans-watershed flow was identified at Dover Street and 20th Avenue in the 2011 North Dry Gulch OSP Baseline Hydrology Report. Storm runoff originating from sub-watersheds 41 and 42 of the North Dry Gulch watershed was diverted partially away due to 20th Avenue acting as a barrier to low flows, which continue east along the north side of the road and enter the Sloan's Lake watershed. The parameters of sub-watersheds 41 and 42 and hydrograph routing elements from the 2011 OSP were incorporated in the CUHP-SWMM hydrologic model of this study. The other trans-watershed flow was identified at Lowell Street and Colfax Avenue where a 39-inch storm pipe intercepts approximately 46 cfs to outfall into Lakewood Gulch in Lowell Street.

EPA SWMM 5.1 model elements, including sub-watersheds, design points and conveyance elements are shown on **Figure B-1 Interactive Hydrology Map** in **Appendix B**.

3.6 Previous Study

The Sloan's Lake Basin *Major Drainageway Planning*, March 1977 by URS Co. documented the original hydrology for the Sloan's Lake basin and was adopted by FEMA as the regulatory discharges. Sloan's Lake Drainageway, Pierce Street Tributary, and Ashland Drainageway have FEMA regulated floodplains consisting of Zones A and AE as shown on the effective FIRM Panel No. 08059C0214F, 0218F, 0302F and 0306F, effective date February 5, 2014, FIRM Panel No. 0800460068G and No. 0800460181G effective date November 17, 2005 and FIRM Panel No. 0800460182H effective date November 20, 2013.

3.7 Result of Analysis

A summary of the updated peak flow rates at key design points are compared with the 1977 FHAD are provided in **Table 3-5**. The use of NOAA Atlas 14 and CUHP 2.0.0 resulted in lower peak flows as compared to previous versions of CUHP and NOAA Atlas. More detailed comparisons are provided in **Tables 3-6 to 3-9**.

Table 3-5 Sloan's Lake Hydrologic Comparison

Location	2018 FHAD SWMM Elements	Area	Future Condition		Difference*
			2018 FHAD	1977 FHAD	
		(sq.mi.)	(cfs)	(cfs)	(%)
Outfall at South Platte	OUTFALL_1030	4.8	1,159	1,108	5
Sloan's Lake outlet	JUNCT_SL_OUT	3.9	34	34	0
Sloan's Lake	Sloan's_Lake	3.9	3,703	2,904	28
24th St/Sheridan	JUNCT_NW_BASIN	0.7	782	851	-8
18th St/Sheridan	JUNCT_SW_BASIN	2.1	1,785	1,440	24
19th St/Harlan St	JUNCT_305	1.8	1,494	1234	21
21th St/Pierce St	JUNCT_1330	1.4	1,044	528	98
25th St/Pierce St	JUNCT_340	1.1	551	620	-11

* Differences were calculated with the equation of (2018 FHAD-1977 FHAD)/1977 FHAD.

Figures 3-1 to 3-4 show the peak discharge profile. The computed baseline peak discharges and volumes for the 2-, 5-, 10-, 25-, 50-, 100- and 500-year storm events for all of the EPA SWMM 5.1 design points can be found in **Table B-4** in **Appendix B**.

Figure B-2 in **Appendix B** shows hydrographs generated by EPA SWMM 5.1 for the 100-year storms at key design points in the study area.

Table 3-6 Sloan's Lake Baseline Hydrology Peak Flow at Key Design Points on Sloan's Lake Drainageway

Locations	Design Points / Conveyance Elements	Total Drainage Area		River Station	Existing/Future Conditions Peak Flow (cfs)						
		(acres)	(mi^2)	(ft)	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}
Sloans Lake Drainageway											
Outfall at South Platte River	Outfall_1030	3,078	4.81	0+00	224	357	475	751	936	1,159	1,656
Federal Blvd. and W. Colfax Ave.	Junct_1040	3,034	4.74	22+50	208	335	443	711	875	1,081	1,537
W. 16th Ave. and Federal Blvd.	Junct_1130	2,707	4.23	32+50	103	156	194	291	356	433	606
SL-Outfall	Junct_SL_OUT	2,480	3.87	70+50	25	25	26	30	32	34	360
Sloans Lake	Sloan's_Lake	2,480	3.87	75+00	843	1,230	1,634	2,504	3,053	3,703	5,491
Outfall into Sloans Lake	Outfall_300	1,277	2.00	116+00	344	521	672	1,046	1,299	1,646	2,380
N. Harlan St.	Junct_305	1,170	1.83	150+00	315	468	608	962	1,195	1,494	2,160
W 20th Ave. and Kendall St.	Junct_315	1,079	1.69	161+90	274	417	559	857	1,069	1,338	1,930
Pierce St. and W 20th Ave.	Junct_1330	916	1.43	180+00	222	321	436	678	839	1,044	1,493
Jefferson H.S. Football Field	Junct_330	201	0.31	181+00	66	102	152	255	328	417	624
Wadsworth Blvd. and W 20th Ave.	Junct_350	119	0.19	208+30	41	64	101	166	212	289	454
Wadsworth Blvd. and W 20th Ave.	Junct_999	253	0.40	241+70	2	15	27	71	100	137	219

Figure 3-1 Sloan's Lake _ Peak Discharges vs. Channel Stations on Sloan's Lake Drainageway

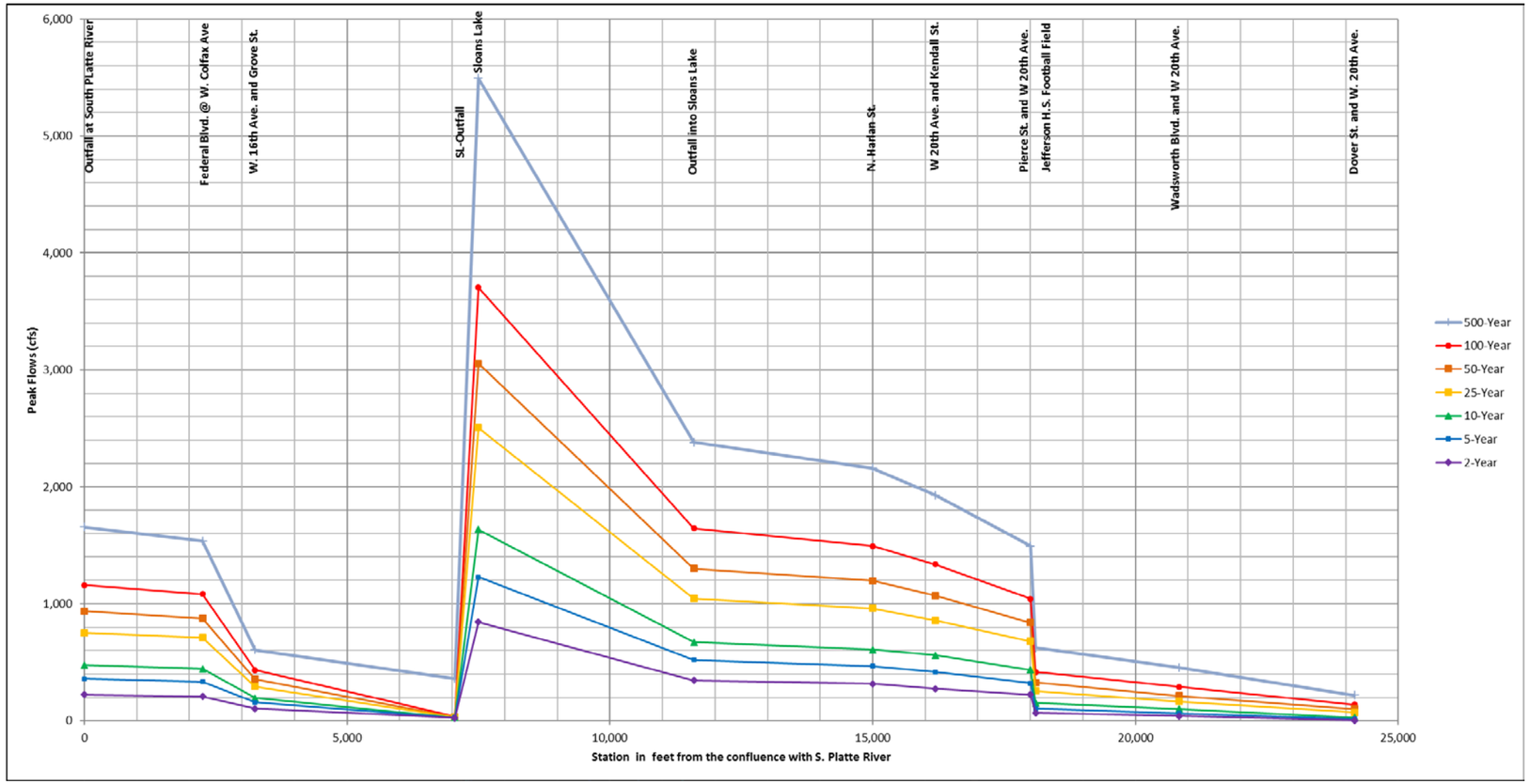


Table 3-7 Sloan's Lake Baseline Hydrology Peak Flow at Key Design Points on Pierce Street Tributary

Locations	Design Points / Conveyance Elements	Total Drainage Area		River Station	Existing/Future Conditions Peak Flow (cfs)						
		(acres)	(mi^2)	(ft)	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}
Pierce Street Tributary											
Pierce St. and W 20th Ave.	Junct_1330	916	1.43	0+00	222	321	436	678	839	1,044	1,493
Pierce St. and W 25th Ave.	Junct_340	677	1.06	17+00	146	199	256	380	454	551	944
Vance St. and W 25th Ave.	Junct_D1_Out	361	0.56	37+00	77	84	97	117	130	174	524
Wadsworth Blvd and W 26th Ave. Detention	Detention_1	361	0.56	37+90	63	101	162	310	398	511	761

Figure 3-2 Sloan's Lake _ Peak Discharges vs. Channel Stations on Pierce Street Tributary

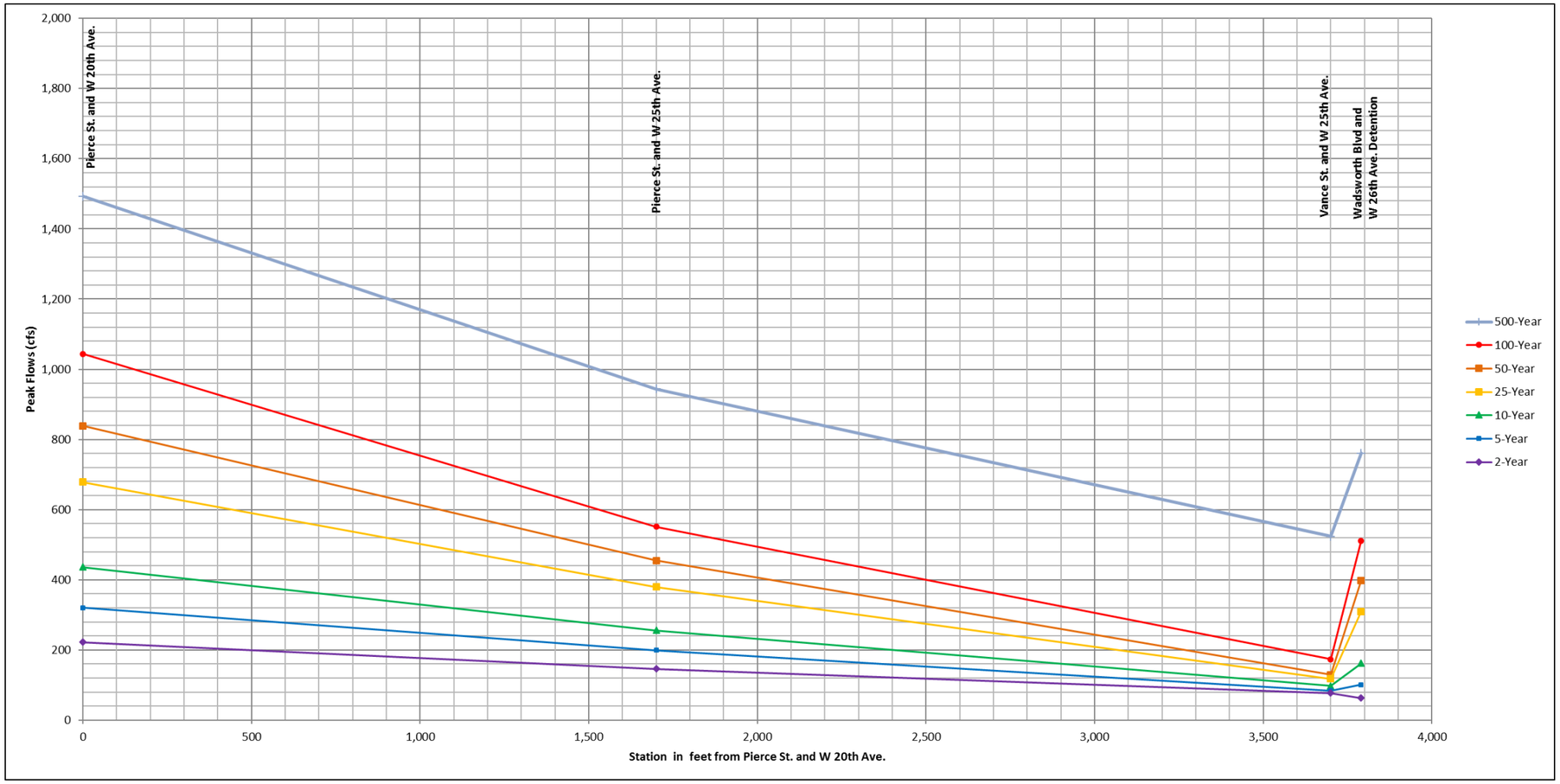


Table 3-8 Sloan's Lake Baseline Hydrology Peak Flow at Key Design Points on Ashland Drainageway

Locations	Design Points / Conveyance Elements	Total Drainage Area		River Station	Existing/Future Conditions Peak Flow (cfs)						
		(acres)	(mi^2)	(ft)	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}
Ashland Drainageway											
Outall into Sloans Lake @ W 24th Ave. and Sheridan	Outfall_600	450	0.70	0+00	207	282	409	509	586	646	772
Citizen's Park Detention	Detention_3	10	0.02	10+00	4	6	18	116	205	348	656
Depew St. and W 24th Ave.	Junct_620	312	0.49	12+00	145	213	291	438	551	689	989
Gray St. and W 26th Ave.	Junct_630	255	0.40	28+50	112	164	230	377	467	578	824

Figure 3-3 Sloan's Lake _ Peak Discharges vs. Channel Stations on Ashland Drainageway

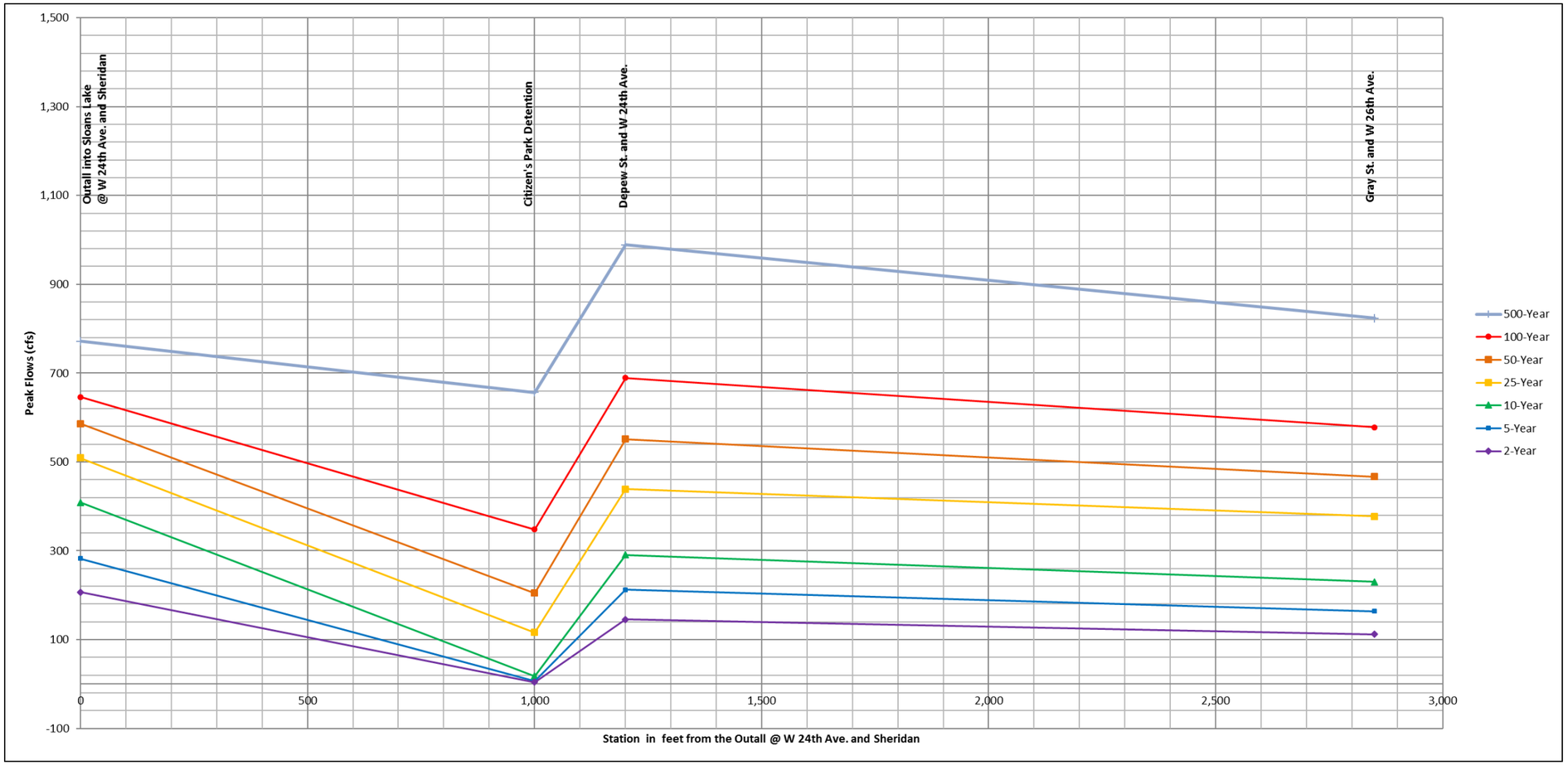
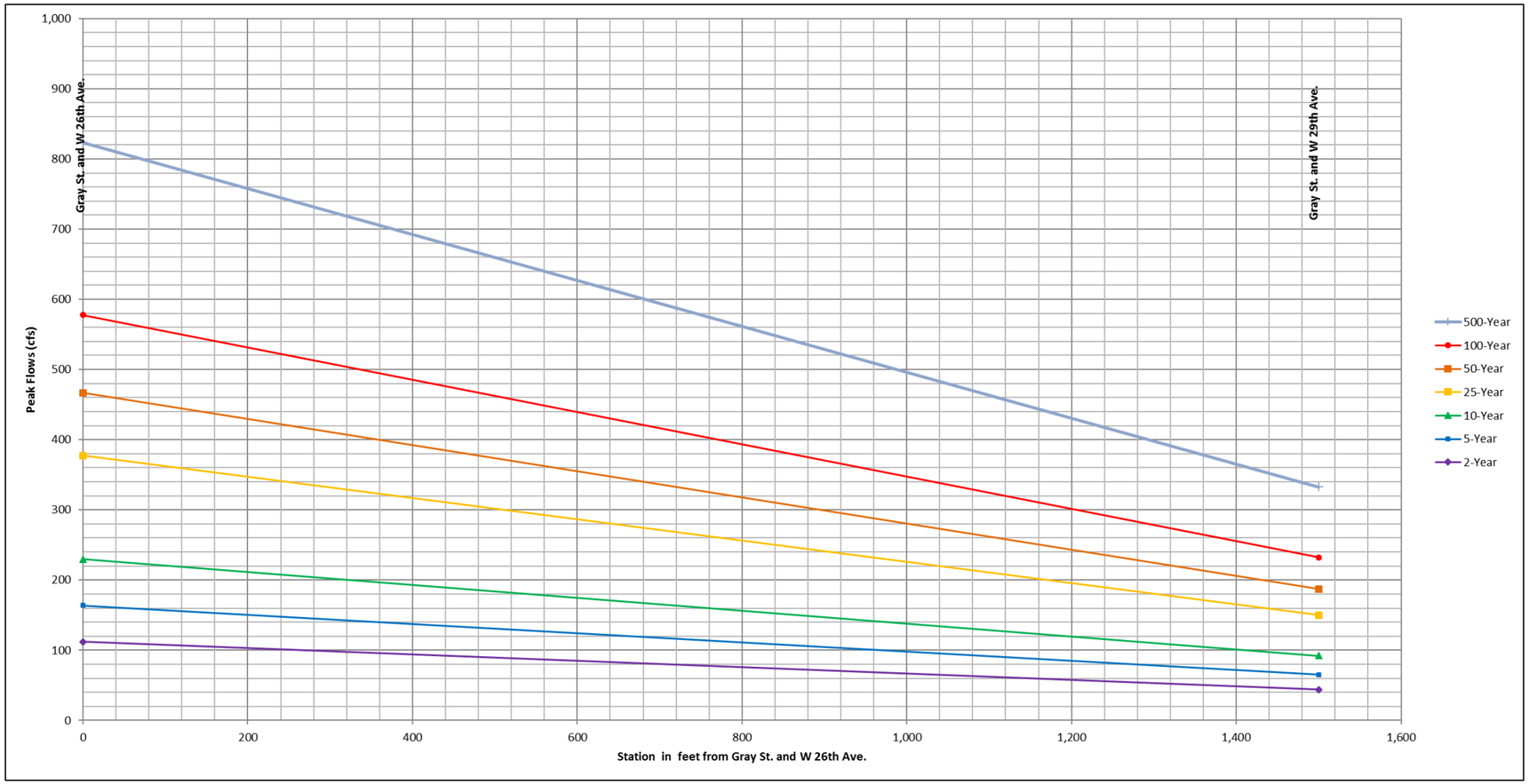


Table 3-9 Sloan's Lake Baseline Hydrology Peak Flow at Key Design Points on Gray Street Tributary

Locations	Design Points / Conveyance Elements	Total Drainage Area		River Station	Existing/Future Conditions Peak Flow (cfs)						
		(acres)	(mi^2)	(ft)	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}
Gray Street Tributary											
Gray St. and W 26th Ave.	Junct_630	255	0.40	0+00	112	164	230	377	467	578	824
Gray St. and W 29th Ave.	Junct_650	105	0.16	15+00	44	65	92	150	187	232	333

Figure 3-4 Sloan's Lake _ Peak Discharges vs. Channel Stations on Gray Street Tributary



4.0 HYDRAULIC ANALYSIS

One-Dimensional and Two-Dimensional Modeling

One-dimensional and two-dimensional hydraulic models were utilized jointly in this study to complete the floodplain analysis and capacity assessment of the culverts and crossing structures. The floodplain hydraulic analysis for the upper basin focused on a combination of HEC-RAS and FLO-2D modeling. The lower watershed was modeled with FLO-2D only.

Sloan's Lake is an efficient detention pond during storm events as described in Section 2.1. Since Sloan's Lake is a 100-year detention facility, there is very little flow out of Sloan's Lake. The current regulatory floodplain downstream of Sloan's Lake is not based on flood flows in the drainageway out of Sloan's Lake. Rather, the flood hazard is based upon local runoff from directly tributary areas. The 34 cfs that is released from the Lake during the 100-year flood event is contained in the existing underground storm drainage system. The tributary area immediately downstream of Sloan's Lake is substantially less than 1 square mile, which is generally accepted as the minimum area for a mapped floodplain. The existing effective FIRM Panel 0800460181G and 0800460182H show a Zone A Special Flood Hazard Area (SFHA) designation from the outlet of Sloan's Lake to the South Platte River. Denver intends to remove the Zone A designation for the area downstream of Sloan's Lake, replacing it with a Zone X (Shaded) area. Denver has been given conceptual approval of this by FEMA at the time of this study. Denver anticipates that the flood hazard mapping shown in the FHAD will be used in a request to FEMA to revise the FIRM. The flood hazard area delineation downstream of Sloan's Lake shown on flood map is the extent of flood hazards determined by the FLO-2D analysis and is intended to define the area to be mapped as Zone X (Shaded). After removal of the FEMA mapped floodplain, Denver will regulate development based on the flood risk determined from the FLO-2D analysis. Since the tributary area downstream of Sloan's Lake is approximately 1 square mile and fully developed, it is appropriate to only prepare a FLO-2D model instead of a one-dimensional HEC-RAS hydraulic model for Reach 1.

A two-dimensional model is a more appropriate approach for the area in the City of Edgewater (between Pierce St, Ingalls St, 26th Ave, and 20th Ave), in the City of Lakewood (between Wadsworth Blvd and Dover St), and in the City & County of Denver below the Sloan's Lake outfall rather than the one-dimensional hydraulic analysis for urban overland flow because water is moving in multiple directions instead of a single direction. The hydraulic conditions for the Sloan's Lake waterways in the upper watershed are complex because of significant development and multiple tributaries. A majority of the waterway is piped underground with only a few small segments of open channel. Due to a lack of open channels, a majority of the flood flow is conveyed via overland street flow, however the streets, traffic islands, curbs and gutters and cross pans divert and split flood flows into numerous flow paths which are too complicated to be accurately modeled using the one-dimensional HEC-RAS program. The flow centerline and cross sections required for a HEC-RAS model are not easily definable for the urbanized overland flow patterns.

The two-dimensional flood routing program FLO-2D Pro model, Build No. 16-06-16, of the FLO-2D Software, Inc. was chosen for this study. FLO-2D modeling is based on the conservation of fluid volume, numerically integrated with equations of motion, i.e. dynamic wave momentum. FLO-2D hydraulic analysis solves the full dynamic equations and balances the flow volumes in all directions at each grid cell to define the overland flow direction and flow splits. FLO-2D computes overland flow in eight directions, reports on mass conservation, utilizes a variable time step incrementing and decrementing scheme, incorporates efficient numerical stability criteria, has unlimited array allocation (unlimited grid elements), includes graphical editing, and has output display processor programs. The data required for FLO-2D modeling are readily available for this basin and include a Digital Terrain Model (DTM), aerial photography, land use data, structure footprint data, street data and hydrology. The mapping information is described in Chapter 1.4 and the land use, structure footprints and streets are in the format of shapefiles which were obtained from GIS database sets from the City and County of Denver, the City of Edgewater, the City of Lakewood, and the City of Wheat Ridge. The grid developer system program (GDS Pro) was utilized to import the DTM, imagery data, set up the grid system, define the calculation boundary and assign hydraulic factors at each grid for the overland flow analysis. The floodplain element attributes can be modified to add detail to the predicted area of inundation. Area reduction factors (ARFs) and width reduction factors (WRFs) are coefficients that modify the individual grid element surface area storage and flow width. ARFs can be used to reduce the flood volume storage on grid elements due to buildings or topography. Using the area reduction factors (ARFs), a grid element can be completely removed from receiving any inflow. WRFs can be assigned to any of the eight flow directions in a grid element and can partially or completely obstruct flow paths in any of the eight directions simulating floodwalls, buildings or berms. Both ARFs and WRFs were used in this model to represent flow obstruction of the buildings in this fully developed area. The surface storage area or flow path on grid elements was adjusted for the buildings footprints.

Using the 100-year peak flow outputs, from CUHP, FLO-2D moves the flood volume though the study area across a series of cells in a grid. The floodwater progression is controlled by topography and resistance to flow (friction factor) generated by land use, under a steady state flow method. **Figure 4-1** shows the study areas, limit of reaches studied with HEC-RAS one-dimensional hydraulic modeling and FLO-2D two-dimensional hydraulic modeling.

FLO-2D Overland Flow Floodplain – City of Edgewater

Two major flow diversions were identified in the study area. Flood flow from the Pierce Street Tributary (Reach 3) flows overland to the intersection of West 26th Avenue and Pierce Street/Quay Street where a portion of the flood flow overtops the crown of Pierce Street and flows easterly in West 26th Avenue. The diverted flood flow will eventually turn south following curb and gutters to enter the City of Edgewater. The rest of the flood flow continues south to join the Pierce Street Tributaries Reach 1 and 2 at West 25th Avenue and Pierce Street. The combined flood water flows south in Pierce Street Tributary Reach 1 on Pierce Street; however, the flood water will go into the City of Edgewater by overtopping the curb on the east and will be diverted easterly at the street intersections due to the mild roadway slope of Pierce Street and the sloping terrain to the east. A two-dimensional model was used for this area since the broad and shallow urban floodplain is too complicated to model with a one-dimensional model.

FLO-2D was used to model the overland flow study area generally bounded by Ingalls Street on the east, Pierce Street on the west, West 26th Avenue on the north and West 20th Avenue on the south. A smaller grid size of 10 feet by 10 feet was used for the study area in the City of Edgewater due the complexity of overland flow condition and to quantify the split flow more accurately. The ground surface was created using GDS by interpolating the elevation points from the DTM at each cell and assigned an elevation. Manning's n for each grid was defined by 0.08 for urbanized areas, 0.04 for parks and open space, and 0.016 for streets.

The peak inflows were derived from the Baseline Hydrology by subtraction of storm pipe capacity at West 26th Avenue/Pierce Street (design point 345), West 25th Avenue/Pierce Street (design point 340), West 24th Avenue/Pierce Street (design point 1335) and W 20th Avenue/Pierce Street (design point 1330). The peak flows of 100-year and 500-year storm were used to establish a steady flow hydrograph with a duration of 8.0 hours for input into the FLO-2D model, which were set up to avoid over-attenuation of the peak by minor inadvertent detention within the study area.

FLO-2D Overland Flow Floodplain – City and County of Denver

A FLO-2D 100-year computer model, using the steady state method, was analyzed with a grid size of 20 feet by 20 feet to develop a two-dimensional floodplain within Sloan's Lake Major Drainageway downstream of Sloan's Lake (SLD Reach 1). The FHAD mapping only shows the two-dimensional floodplain east of North Newton Street. However, the two-dimensional floodplain study area was expanded further west of North Newton Street along West Colfax Avenue to Sheridan Boulevard. The inclusion of the Colfax Corridor was meant to account for the potential overland split flows from West Colfax Avenue.

FLO-2D Overland Flow Floodplain – City of Lakewood

The existing regulatory floodplain terminates at Yarrow Street approximately 600 feet west of Wadsworth Boulevard; however, there is a confirmed trans-watershed flow from North Dry Gulch entering the Sloan's Lake Drainageway at Dover Street and 20th Avenue approximately 3,300 feet west of Wadsworth Boulevard. A floodplain analysis was prepared for this upper reach because the City of Lakewood wanted to investigate the impact caused by the trans-watershed flows. A two-dimensional model was determined as more appropriate than the one-dimensional model for this urbanized area which lacks curbs and gutters. A steady state FLO-2D 100-year model using a grid size of 20 feet by 20 feet was prepared to analyze the floodplain between Dover Street and Wadsworth Boulevard which meets the requirement for a FHAD.

HEC-RAS Floodplain

There are two major waterways in the upper Sloan's Lake watershed: 1) Sloan's Lake Drainageway with the Pierce Street Tributary, and 2) Ashland Drainageway with the Gray Street Tributary. **Figure 2-3** shows the definition of the reaches. A one-dimensional HEC-RAS model was set up to model the hydraulic condition of surface flow for the upper watershed. Four "rivers" were modeled in the hydraulic model: 1) Sloan's Lake Drainageway, 2) Pierce Street Tributary, 3) Ashland Drainageway and 4) Gray Street Tributary. Three junctions were used in the model to connect the rivers and reaches. The river centerlines used to model the surface flow were delineated following the existing open channels, existing alignments of the storm drain system, and in areas following the topographic thalweg. The goal was to replicate the study areas which were mapped in the 1977 FHAD.

A total of 5.79 miles of drainageway and tributaries were studied with a detailed HEC-RAS hydraulic model. The Sloan's Lake Drainageway and its tributaries comprise 3.92 miles, and the Ashland Drainageway and its tributaries comprise 1.87 miles. Separate models were developed for Sloan's Lake Drainageway and Ashland Drainageway due to the complexity of the confluence area. However, these models were included in the same geometry file, but a separate downstream control boundary condition was used to establish the initial water surface elevation for the backwater calculation. The HEC-RAS model of Sloan's Lake Drainageway analyzed 2.74 miles of the Sloan's Lake Drainageway Main Stem and 1.18 miles of the Pierce Street Tributary as shown in **Figure 4-1**. The HEC-RAS model of Ashland Drainageway analyzed 1.12 miles of the Ashland Drainageway and 0.75 miles of the Gray Street Tributary as shown in **Figure 4-1**.

Floodplain limits were developed showing the detailed 100-year and 500-year floodplain delineations. The purpose of the Flood Hazard Area Delineation (FHAD) mapping was to identify areas, building structures, and properties which have the potential of being inundated in a 100-year flood event. A floodway was defined along the Sloan's Lake Drainageway and Pierce Street Tributary Reach 1, 2 and Reach 3 within the City of Lakewood to establish the portion of the channel that must remain free from obstructions to preserve conveyance of the 100-year flood. A maximum of 0.5-foot rise in either the hydraulic or energy grade line elevation was utilized in this study to define the floodway, in accordance with the updated Colorado Water Conservation Board Rules and Regulations, effective January 14, 2011. No floodway will be defined for the overland flooding area within the City of Edgewater because there is not a distinct channel in the overland flow area or the floodplain. The consensus of extents of floodway modeling and mapping was agreed between the project sponsors and was documented in email correspondence included in Appendix A.

The U.S. Army Corps of Engineer's step backwater program HEC-RAS, Version 4.1.0, was used for the subcritical floodplain analysis of the drainageway. Cross sections for use in the HEC-RAS model were developed electronically by cutting the triangulated irregular network (TIN) developed from the one-foot, LIDAR-derived topographic contour data collected by the USGS in the fall of 2013.

A total of 215 cross sections were used in the Sloan's Lake Drainageway hydraulic model which includes 120 cross sections for the main stem hydraulic model and 95 cross sections for the Pierce Street Tributary hydraulic model. The junction option in the HEC-RAS program was used to connect the Pierce Street Tributary reach with the main stem reach at Pierce Street downstream of the Jefferson High School, and to connect Reach 3 of the Pierce Street Tributary with the Pierce Street Tributary main stem reach at the intersection of W 25th Avenue and Quay Street.

A total of 96 cross sections were used in the Ashland Drainageway hydraulic model which includes 60 cross sections for the main stem hydraulic model and 36 cross sections for the Gray Street Tributary. The junction option in the HEC-RAS program was used to connect the Gray Street Tributary reach with the main stem reach at Gray Street between W 25th Avenue and W 26th Avenue. Details of the hydraulic analyses, such as model

setup, flow data, geometry and parameters, are described in the following sections. Input data for the model is summarized in **Table 4-1** below:

Table 4-1 Summary of Geometry Input

Waterways	Type of Channel	HEC-RAS Hydraulic Reach	River Station	Reach Length (ft)	Manning's n		Number of Cross Sections	Average Spacing (ft)	Culvert	Bridge	Inline Structure	Lateral Structure	Average Slope
					Overbank	Channel							
Sloan's Lake Drainageway	Lake/Detention	Reach 1	70+63 to 180+14	10,951	0.035 - 0.2	0.02 - 0.1	77	142	6	1	0	0	0.70%
	Open Channel												
	Storm Pipe/Overland												
	Storm Pipe/Open Channel	Reach 2	180+14 to 215+49	3,535	0.02 – 0.15	0.02 – 0.1	43	82	2	0	1	0	2.10%
Pierce Street Tributary	Storm Pipe/Overland	Reach 1	0+00 to 18+51	1,851	0.035 – 0.15	0.02 – 0.15	20	93	0	0	0	4	0.91%
	Storm Pipe/Overland	Reach 2	18+51 to 53+18	3,467	0.02 – 0.15	0.02 – 0.15	45	77	0	0	0	0	2.37%
	Overland	Reach 3	0+00 to 26+05	2,605	0.035 - 0.15	0.035 - 0.15	30	87	0	0	0	1	2.08%
Ashland Drainageway	Storm Pipe/Overland	Reach 1	0+00 to 29+37	2,937	0.02 - 0.15	0.02 - 0.15	32	92	0	0	0	1	1.43%
	Storm Pipe/Overland	Reach 2	29+37 to 58+91	2,954	0.035 - 0.15	0.02 - 0.15	28	106	0	0	0	3	1.88%
Gray Street Tributary	Storm Pipe/Overland	Reach 1	0+00 to 39+72	3,972	0.035 - 0.15	0.02 - 0.15	36	110	0	0	0	0	2.11%

Flow data in the HEC-RAS model was derived from the results of the EPA SWMM 5.1 hydrograph routing for the future land-use based upon existing topographic conditions. A steady flow analysis was utilized to determine the flood profiles for the 10-, 50-, 100-, and 500-year storm events. Flow change locations were established at critical design points where there are significant changes in hydrology as determined by the EPA SWMM model. Between flow change locations, steady flow is maintained for defined channel segments along the reach.

The capacity of the existing storm drain in the study area was subtracted from the peak flows derived from the results of the EPA SWMM 5.1 hydrograph routing. Table C-2 in Appendix C describes the overland flow by subtraction of the capacity of the existing underground storm systems. Pipe capacity was calculated assuming a normal depth analysis using Manning's Equation in a spreadsheet (see the Technical Appendices for details of the spreadsheet calculations).

Due to several locations where flows split into the adjacent drainageway, the "lateral structure" option in the HEC-RAS hydraulic model was used to quantify the flows that were diverted away from the main stream. The weir coefficients in the lateral structure routing were calibrated to replicate the split flow conditions based on the FLO-2D two-dimensional floodplain hydraulic analysis. Figure C-1 in Appendix C shows the split flows at each flow split location per the FLO-2D modeling results. Table C-1 in Appendix C shows the calculation of the discharges split into the Ashland Drainageway from the Pierce Street Tributary at the intersection of W 26th Avenue and Pierce Street based on the FLO-2D modeling results. However, the discharges through the lateral structures were not subtracted from the peak flows in the main stem at the direction of project sponsors. The lateral structures were used to establish the split flows, and do not divert flows away from the main stem in the final floodplain modeling and mapping. Table 4-2 summarizes the hardwired hydrology used in the hydraulic model and the model cross sections where the flow change has been applied.

Table 4-2 Steady Flow Input in HEC-RAS model

HEC-RAS Rivers/Reaches/Stations/Reference Locations				Profile Names & Flow Rates			
River	Reach	Station	Reference Locations	Q_{10}	Q_{50}	Q_{100}	Q_{500}
Ashland Drain	Reach 02	58+91	26th Ave/Pierce St	26	56	73	111
		42+79	26th Ave/Kendall St	93	190	235	337
	Reach 01	29+06	Gray St	80	317	428	674
		15+95	Depew St	21	281	419	719
		9+29	24th Ave/Benton St	42	122	122	122
		2+68	24th Ave/Sheridan Blvd	195	362	423	559
Gray St Trib	Reach 01	39+72	32nd Ave/Kendall St	7	35	48	77
		30+53	30th Ave/Jay St	28	98	131	205
		15+66	29th Ave/Gray St	0	57	102	203
Pierce St Trib	Reach 03	26+05	28th Ave/Upham St	24	70	92	141
		15+65	27th Ave/Reed St	110	227	292	435
	Reach 02	53+18	24th Ave/Zephyr St	87	179	223	320
		50+24	24th Ave/Yarrow St	0	0	13	110
		44+01	24th Ave/S Wadsworth Blvd	0	0	101	351
		41+33	Detention Basin 1	162	398	511	761
		37+21	25th Ave/Vance St	0	0	34	384
	Reach 01	17+80	25th Ave/Pierce St	16	214	311	704
		10+32	Pierce St/24th Ave	16	233	338	713
Sloans Lake Main	Reach 02	215+49	20th Ave/Yarrow St	101	212	289	454
		186+48	West boundary of Jefferson High School	0	50	127	290
		181+89	East boundary of Jefferson High School	0	168	257	464
	Reach 01	179+96	Pierce St	0	339	544	993
		162+87	20th Ave/Kendall St	39	549	818	1,410
		154+41	Ingalls St	587	1,134	1,421	2,065
		151+11	Harlan St	608	1,195	1,494	2,160
		120+98	Sheridan Blvd	672	1,299	1,646	2,380
		106+68	Sloan's Lake	1,634	3,053	3,703	5,491
		70+79	Sloan's Lake	26	32	34	360

The downstream hydraulic control for the HEC-RAS model of Sloan's Lake Drainageway was set at the known water surface elevation in Sloan's Lake which was calculated using the weir equation at the outlet structure of Sloan's Lake. The downstream hydraulic control for the HEC-RAS model of the Ashland Drainageway was set at the known water surface elevation in the Sloan's Lake which was calculated by the Sloan's Lake HEC-RAS hydraulic model using the backwater analysis through Sloan's Lake. These downstream control elevations were set independently for each recurrence interval. The downstream hydraulic controls for the HEC-RAS model of the Pierce Street Tributary, Pierce Street Tributary Reach 3 and Gray Street Tributary were controlled by the junction condition at the confluence with Sloan's Lake Drainageway, Pierce Street Tributary and Ashland Drainageway, individually.

Estimates of channel roughness for existing conditions were made from aerial photographs and field observation. The Manning's ***n*** values were established based upon dense growth of natural areas for a healthier stream corridor, and not a regularly mowed turf grass. Refer to **Figure C-2** in the **Appendix C** for

pictures illustrating the Manning's ***n*** values for sample cross-sections. Estimates of overbank roughness are based upon the impact of the obstructions from buildings, landscape features and privacy fences. A generalized Manning's n of 0.15 was recommended to be used for residential areas due to the many obstructions such as buildings, fences and landscaping. The option for horizontal varied Manning's n was utilized on cross sections to represent parks and trails where applicable. Manning's n values in the hydraulic model are listed in **Table 4-1**.

Nine crossing structures were coded in the hydraulic model using field survey data, as-built plans and field measurement. **Table 4-3** lists the cross structures included in the HEC-RAS hydraulic model and summary of the existing capacity of these crossing structures.

Ineffective flow was utilized to account for flow areas with little or no flow conveyance. Blocked obstructions were utilized to block out the non-realistic flow distribution areas in sump condition areas within the overbank.

The hydraulic analysis for this study was based upon unobstructed flow through the openings of all bridge and culvert structures. The model was set up to assume that all bridges and channels remain free of silt and debris. Flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Normal depth calculations were utilized to determine the overland shallow flooding at W. 20th Avenue between Vance Street and Teller Street in the City of Lakewood and the neighborhood area at Citizen Park downstream between W. 24th Avenue and W. 22nd Avenue in the City of Edgewater. The calculations for overland shallow flow are provided in Appendix C. The areas impacted by the overland shallow flooding are show on the flood maps in Appendix G.

Floodways were defined along the Sloan's Lake Drainageway and Pierce Street Tributary Reach 1, 2 and Reach 3 within the City of Lakewood to establish the portion of the channel that must remain free from obstructions to preserve conveyance of the 100-year flood in the FHAD. The floodway was defined based on a 0.5-foot rise in hydraulic or energy grade elevations. There are three areas where portions of the floodway were set coincident with the floodplain. These were within the detention located at W 26th Avenue and Wadsworth Boulevard on Pierce Street Tributary Reach 2, Jefferson High School Detention on Sloan's Lake Drainageway Reach 2 and Sloan's Lake to preserve the storage volume of the existing detention basin. Floodways were delineated utilizing an approach of equal conveyance reduction of left and right overbanks. In certain isolated locations, equal encroachment is not appropriate where one bank is dramatically steeper than the other. Along those cross sections, the encroachment of the floodway is based upon encroaching more on the milder sloped bank. However, encroachment is limited to the overbank areas only, and is not allowed within the main channel conveyance area. No floodway was defined for the Pierce Street Tributary Reach 3 in the City of Wheat Ridge, Ashland Drainageway, and Gray Street Tributary as described in the previous section. No floodway was defined for the overland flooding area from split flows within the City of Edgewater because there is not a distinct channel in the overland flow area. No floodway was defined for the shallow flooding area downstream of Sloan's Lake in the City and County of Denver because the source of flooding is not from the major drainageway.

4.1 Evaluation of Existing Facilities

Existing drainage facilities within the project area consist of storm pipes, natural channel sections and eight culverts. **Table 4-3** shows existing hydraulic structures on Sloan's Lake Drainageway included in the HEC-RAS model, and shows the roadway classification, type of structure, and identifies the hydraulic capacity of the existing crossing structure. Four road crossing structures are undersized for the 100-year event and overtopping will occur during the 100-year event. Sheridan Boulevard is classified as arterial which should not overtop per the City of Denver's *Storm Drainage Design and Technical Criteria*. Depew Street and Eaton Street are classified as local streets and are overtopped with less than 6 inches. Per the City of Lakewood's *Storm Drainage Criteria Manual* streets are not allowed to overtop in the perpendicular direction. In addition, the backwater caused by the undersized culverts in Depew Street inundates two structures upstream of Depew Street. Harlan Street is classified as a collector street and is overtopped with a maximum flood depth of over 18 inches at the gutter flow line which exceeds perpendicular overtopping criteria per the City of Lakewood's *Storm Drainage Criteria Manual*.

Figure 4-2 identifies the location and type of all existing roadway crossing and hydraulic structures (culvert) included in the HEC-RAS hydraulic model along the channels of Sloan's Lake Drainageway within the study area.

HEC-RAS Analysis:
Gray Street Tributary 0.70 miles
HEC-RAS Reach GST 01

HEC-RAS Analysis:
Ashland Drainageway 0.54 miles
HEC-RAS Reach ASD 01

HEC-RAS Analysis:
Ashland Drainageway 0.56 miles
HEC-RAS Reach ASD 02

HEC-RAS Analysis:
Pierce Street Tributary 0.48 miles
HEC-RAS Reach PST 03

HEC-RAS Analysis:
Pierce Street Tributary 0.70 miles
HEC-RAS Reach PST 02

HEC-RAS Analysis:
Pierce Street Tributary 0.31 miles
HEC-RAS Reach PST 01

FLO-2D Analysis:
Reach PST 01

HEC-RAS Analysis:
Sloan's Lake Drainageway 0.64 miles
HEC-RAS Reach SLD 02

FLO-2D Analysis:
Sloan's Lake Drainageway
0.59 Miles

HEC-RAS Analysis:
Sloan's Lake Drainageway 2.06 miles
HEC-RAS Reach SLD 01

FLO-2D Analysis:
Sloan's Lake Drainageway 1.34 miles

Sloan's Lake Drainageway (SLD)
Pierce Street Tributary (PST)
Ashland Drainageway (ASD)
Gray Street Tributary (GST)

0 800 1,600
Feet

Legend
- FHAD Inundated Structure
- Ditch/Gulch/River
- Highway
- Light Rail Line
- Sloan's Lake Watershed Boundary (4.9 Sq. Mi)
- City Boundary
- 100-Year Floodplain (1% Annual Chance Flood)
- 500-Year Floodplain (0.2% Annual Chance Flood)

Waterbody/Detention
- Publically Maintained
- Privately Maintained

Maximum Flood Depths
- 3" - 6"
- 6" - 12"
- 1' - 1.5'
- 1.5' - 3'
- 3' - 4.5'
- 4.5' - 6'
- > 6'

No.	DATE	DESCRIPTION	APPR.

Matrix DESIGN GROUP
AN EMPLOYEE-OWNED COMPANY

designed by: _____
drawn by: CM
checked by: RK
project no.: 16.155.026
date: 07/24/2018

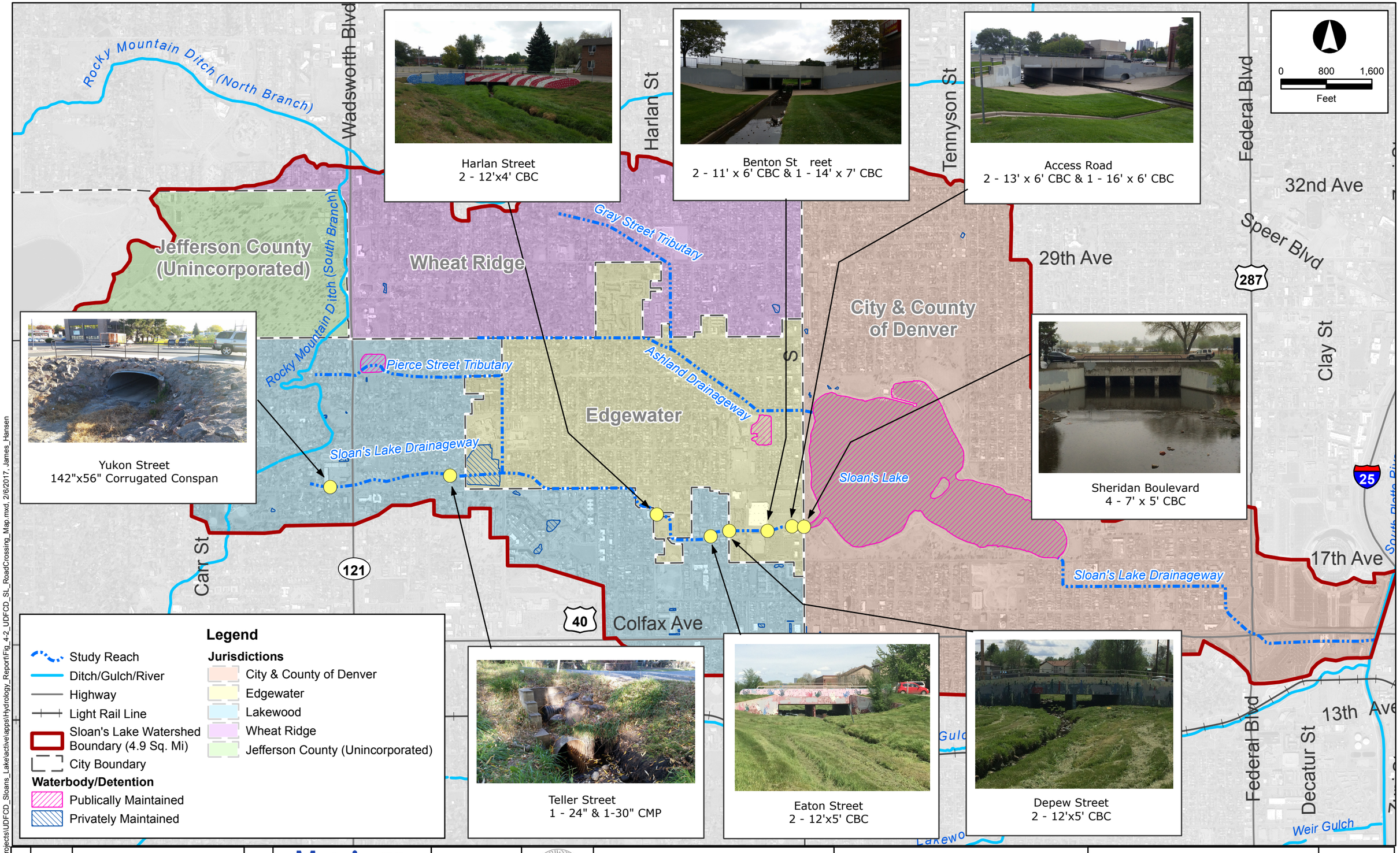
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT, CITY AND COUNTY OF DENVER

FLOOD HAZARD AREA DELINEATION
SLOAN'S LAKE DRAINAGEWAY AND TRIBUTARIES

FLOOD HAZARD STUDY EXTENTS MAP

FIGURE 4-1

FILE: G:\gis_projects\UDFCD_Sloans_Lake\active\apps\Hydrology_Report\Fig_4-1_UDFCD_SL_FldHzExtent_Map.mxd, 7/24/2018, chris_martin



Harlan Street
2 - 12'x4' CBC

Benton St reet
2 - 11' x 6' CBC & 1 - 14' x 7' CBC

Access Road
2 - 13' x 6' CBC & 1 - 16' x 6' CBC

Yukon Street
142"x56" Corrugated Conspan

Sheridan Boulevard
4 - 7' x 5' CBC

Teller Street
1 - 24" & 1-30" CMP

Eaton Street
2 - 12'x5' CBC

Depew Street
2 - 12'x5' CBC

Legend

- Study Reach
- Ditch/Gulch/River
- Highway
- Light Rail Line
- Sloan's Lake Watershed Boundary (4.9 Sq. Mi)
- City Boundary

Waterbody/Detention

- Publically Maintained
- Privately Maintained

Jurisdictions

- City & County of Denver
- Edgewater
- Lakewood
- Wheat Ridge
- Jefferson County (Unincorporated)

FILE: G:\gis_projects\UDFCD_Sloans_Lake\active\apps\Hydrology_Report\Fig_4-2_UDFCD_SL_RoadCrossing_Map.mxd, 2/6/2017, James_Hansen

No.	DATE	DESCRIPTION	APPR.

Matrix DESIGN GROUP
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designed by:
drawn by: CM
checked by: RK
project no.: 16.155.026
date: 07/22/2016

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT, CITY AND COUNTY OF DENVER

FLOOD HAZARD AREA DELINEATION SLOAN'S LAKE DRAINAGEWAY AND TRIBUTARIES

ROADWAY CROSSING STRUCTURES INVENTORY

FIGURE 4-2

Table 4-3 Roadway Crossing Structures Modeled in HEC-RAS

River/ Reaches		Type of Channel	HEC-RAS Hydraulic Reach	River Station of Structure	Street Name/ Location	Crossing Street Classification	Structure Description	Type/Size of Structure	Capacity (Future Flow)	Note
Sloan's Lake Drainageway	SLD Reach 2	Open Channel	Reach 1	119+90	Sheridan Blvd	Arterial	Culvert	4 - 7' x 5'	< 100-year	Denver Storm Drainageway Criteria, no overtopping is allowed for arterial roadway
	SLD Reach 3	Open Channel		121+80	Access Road	Local	Culvert	1 - 16'x6' 2 - 13'x6'	100-year	
				126+50	Benton St. @ South side of Target	Local	Culvert	1 - 14'x7' 2 - 11'x6'	100-year	The central culvert was coded in the HEC-RAS hydraulic model as 7 feet tall which includes the depth of a low flow channel of 1-foot deep and 7-foot wide. This culvert was blocked up to a depth of 0.5 feet at bottom in the HEC-RAS hydraulic model in order to remove the redundant flow areas outside of the low flow channel.
				133+00	Depew St.	Local	Culvert	2 - 12'x5'	< 100-year	The overtopping flood depth is less than the maximum allowable overtopping depth of 18" at gutter flow line for local roadway per the Storm Drainageway Criteria of the City of Lakewood. However, the backwater caused by the undersized culverts inundates two structures at upstream of Depew Street.
				136+50	Eaton St. b/w West 17th Ave. and West 18th Ave.	Local	Culvert	2 - 12'x5'	< 100-year	However, the overtopping flood depth is less than the maximum allowable overtopping depth of 18" at gutter flow line for local roadway per the Storm Drainageway Criteria of the City of Lakewood.
				150+30	Harlan St. b/w Newland Ct. and West 20th Ave.	Collector	Culvert	2 - 12'x4'	< 100-year	Overtopping flood depth exceeds maximum allowable overtopping depth of 18" at gutter flow line for collector roadway per the Storm Drainageway Criteria of the City of Lakewood.
	SLD Reach 5	Open Channel	Reach 2	193+50	Teller St. and Geneva Ct.	Local	Culvert	1-24" & 1-30" CMP	2-year	
				211+70	Yukon St. and West 20th Ave.	Local	Culvert	142" x 56" Corrugated Conspan	100-year	

4.2 Flood Hazards

The Sloan's Lake upper drainageway corridors are fully developed. Overall, this study identified 426 structures that may be inundated in a 100-year flood. On the Sloan's Lake Drainageway, there are 148 insurable structures identified within the 100-year floodplain. On the Pierce Street Tributary, there are 147 insurable structures within the overland flooding area between West 25th Avenue and West 20th Avenue, along West 25th Avenue between Pierce Street and Yarrow Street and identified in the 100-year floodplain upstream of West 25th Avenue and Pierce Street. On the Ashland Drainageway, there are 80 insurable structures identified within the 100-year floodplain. On Gray Street Tributary, there are 51 insurable structures identified in the 100-year floodplain.

4.3 Previous Analyses

Sloan's Lake Drainageway, Pierce Street Tributary, and Ashland Drainageway have FEMA regulated floodplains shown on the effective Flood Insurance Rate Map (FIRM) Panel No. 08059C0214F, 0218F, 0302F and 0306F effective date February 5, 2014, FIRM Panel No. 0800460068G and No. 0800460181G effective date November 17, 2005 and FIRM Panel No. 0800460182H effective date November 20, 2013.

The 2005, 2013 and 2014 FIRM panels are based on the Urban Drainage & Flood Control District's *Flood Hazard Area Delineation*, Sloan's Lake Basin, URS Company, October 1977. Sloan's Lake LOMR, Case No. 92-08-040P and Invesco Field LOMR, Case No. 05-08-0046P were the only two known LOMRs found within the study area since the date FEMA published the Flood Insurance Studies (FIS). There are also a total of 11 LOMA cases which demonstrated structures are elevated above the 100-year flood elevation.

Hydrology out of Sloan's Lake was revised in the LOMR Case No. 92-08-040P. The LOMR Case No. 92-08-040P floodplain delineation was published in the Denver 2005 and 2013 FEMA *Flood Insurance Studies* (FIS) which mapped a Zone A designated 100-year floodplain for the Sloan's Lake Drainageway from the South Platte River to Sheridan Boulevard. The hydrology downstream of Sloan's Lake is controlled by the normal operating water level in the lake. This was based upon a normal operating water level elevation of 5310.65 feet (NAVD 1988) determined by the Denver Department of Parks and Recreation, which is 0.9 feet lower than the normal operating water level used previously in the 1977 FHAD. The hydraulic analysis was modified to reflect the reduced 100-year flows downstream of Sloan's Lake and the grade changes along 17th Avenue. The elevations included in the following excerpt are on the 1929 NGVD vertical datum, which can be converted to the 1988 NAVD vertical datum by adding 3.05 feet. An excerpt of the hydrology from the LOMR is shown below.

"The previously adopted hydrologic analysis, documented in the FHAD, was used as the basis for this LOMR. The FHAD hydrology was based on a Sloan's Lake operating water level of 5308.5 mean sea level (msl). During the 100-year storm, the lake would rise to a level of 5310.4 msl with a total discharge of 166 cubic feet per second (cfs). Also, at the time of the FHAD, the storm sewer system along 17th Avenue had not yet been constructed. One of the purposes of this study was to review and revise, if necessary, the hydrology to incorporate the current operational conditions of Sloan's Lake as well as the 17th Avenue storm sewer system. The City and County of Denver's Parks and Recreation Department (owner of Sloan's Lake) and the UDFCD have agreed that Sloan's Lake's maximum operating water surface elevation will be maintained at 5307.6 msl rather than 5308.5 msl. With the additional storage capacity, the outflow from Sloan's Lake will be reduced from 166 cfs to 34 cfs with a 100-year water surface of 5309.7 msl. Please refer to Appendix A for documentation of the 100-year lake outflow. The overflow to 17th Avenue is reduced to O cfs since Sloan's Lake's 24" and 18" storm sewer outlets can convey the full 34 cfs."

In the City of Edgewater, the 2014 FEMA *Flood Insurance Study* (FIS) effective mapping was defined by a Zone A designated 100-year floodplain from Sheridan Boulevard to Depew Street, a Zone AE is defined without a floodway from Fenton Street to Pierce Street, and a Zone A at Jefferson High School for the Sloan's Lake Drainageway. In addition, a Zone A designated 100-year floodplain was defined from Sheridan Boulevard to Pierce Street for the Ashland Drainageway, and a Zone A designated 100-year floodplain was defined from West 20th Avenue to West 26th Avenue for the Pierce Street Tributary.

In the City of Lakewood, the 2014 FEMA *Flood Insurance Study* (FIS) effective mapping was defined by a Zone AE designated 100-year floodplain without a floodway from Depew Street to Pierce Street, and Reed Street to Yarrow Street for the Sloan's Lake Drainageway. A Zone A designated 100-year floodplain was defined from Pierce Street to Wadsworth Boulevard for the Pierce Street Tributary.

The Pierce Street Tributary Reach 3 from West 25th Avenue in Lakewood to Upham Street in Wheat Ridge and the Gray Street Tributary from West 26th Avenue to West 32nd Avenue in Wheat Ridge were studied in the 1977 FHAD, however these two areas were not adopted and regulated by FEMA.

A comparison was made between the information published in the FEMA FIS reports and this FHAD floodplain study. In general, the 100-year floodplain delineation along Sloan's Lake Drainageway, Pierce Street Tributary, Ashland Drainageway and Gray Street Tributary are similar; however, there are some areas where the floodplain is smaller, and some areas where the floodplain is larger compared to the effective FIS floodplain. The differences between the regulatory and study floodplains were caused by updated topography, the new hydraulic model and updated hydrology. The 2014 LiDAR topographic mapping provides a higher resolution of ground information than was used for the 1977 FHAD. In addition, new hydraulic software models improve the accuracy of the floodplain hydraulics. The effective floodplain was analyzed using an outdated HEC-2 hydraulic model; whereas, HEC-RAS is a more advanced software used for this study. HEC-RAS often calculates different water surface elevations at hydraulic structures than HEC-2. **Table 4-4** shows a comparison by reach of the building structures inundated by the FEMA effective 100-year floodplain, 1977 FHAD floodplain and the floodplain defined by this study. **Flood Maps** in **Appendix G** shows the potentially inundated structures identified by this study outlined in red.

Table 4-4 Comparison of Inundated Structures

Drainageway Name	Reach Number	Reach Description	FHAD 2018		FEMA* Floodplain	1977** FHAD
			HEC-RAS	FLO-2D		
Sloan's Lake Drainageway	1	South Platte River to Sloan's Lake outlet	0	45	13	-
	2	Sloan's Lake	0	-	0	-
	3	Sloan's Lake Inlet to Ingalls Street	8	-	0	-
	4	Ingalls Street to Pierce Street	44	-	29	-
	5	Pierce Street to Dover Street	6	45	9	-
Pierce Street Tributary	1	W. 20th Ave to W. 25th Ave	8	93	21	-
	2	Pierce Street to Yarrow Street	13	-	6	3
	3	W. 25th Ave to Upham Street	33	-	-	21
Ashland Drainageway	1	Sloan's Lake Inlet to Gray Street	68	-	36	-
	2	Gray Street to Pierce Street	12	-	8	-
Gray Street Tributary	1	Gray Street to Kendall Street	51	-	-	41
Total of Inundated Structures			**243**	**183**	**122**	**65**

* FEMA floodplain is based on the 1977 FHAD.

** Floodplain was studied in the 1977 FHAD, but was not adopted and regulated by FEMA.

5.0 REFERENCES

Colorado Department of Public Health and Environment – Water Quality Control Commission, Regulation #93, March 2016.

Colorado Department of Transportation, As-built plans for Federal Aid Project No. FBR-2873-160, State Highway 287 (Federal Boulevard Bridge over Colfax Ave), August 2013.

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Appendix A – Project Correspondence

Meeting Minutes

Appendix A – Project Correspondence

Matrix Design Group, Inc.
Integrated Design Solutions

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MEETING MINUTES
Sloan's Lake Drainageway and Tributaries
Major Drainageway Plan and Flood Hazard Area Delineation
Tuesday March 29, 2016, 10:30am – 12:00pm at UDFCD

Attendees:

Shea Thomas	UDFCD	303-455-6277	sthomas@udfcd.org
Terri Fead	UDFCD	303-455-6277	tfead@udfcd.org
Selena Klosowski	Denver Wastewater	303-446-3520	Selena.Klosowski@denvergov.org
Jeremy Hamer (via phone)	Denver Wastewater	720-913-0720	Jeremy.Hamer@denvergov.org
Cincere Eades	Denver Parks Planning	720-913-0655	Cincere.Eades@denvergov.org
Ashlee Grace	Denver Water Quality	720-865-3131	Ashlee.grace@denvergov.org
Brandi Battseveen	Denver Intern		
Mark Westberg	Wheat Ridge	303-235-2863	mwestberg@ci.wheatridge.co.us
Scott Brink	Wheat Ridge	303-235-2861	sbrink@ci.wheatridge.co.us
Jason Bray	Wheat Ridge	303-235-2868	jbray@ci.wheatridge.co.us
Dan Maples	Edgewater	720-763-3012	dmaples@edgewaterco.com
John Enochs	Edgewater Consultant	303-985-4204	johne@diamondbackeng.com
Terry Rogers	Lakewood	303-987-7934	TerRog@lakewood.org
Robert Krehbiel	Matrix Design Group	303-572-0200	robertk@matrixdesigngroup.com
Drew Beck	Matrix Design Group	303-572-0200	Drew_Beck@matrixdesigngroup.com
HungTeng Ho	Matrix Design Group	303-572-0200	hungteng_ho@matrixdesigngroup.com

1. **Project Goals**
   a. Updated flood hazard identification – either adopted locally or by FEMA
   b. Need to pay special attention to the flood hazard identification downstream of the lake. This is a unique situation because of the outlet works and the current mapped flood hazard is a remnant which pre-dates the outlet improvements. Could remove the flood hazard and re-label as a potential inundation area (PIA).
   c. Program capital improvements to reduce flood hazards – detention and conveyance
   d. Water quality improvement opportunities
   e. Channel stabilization opportunities, although most of the drainageway is piped
   f. A blend of a standard MDP and an OSP because of the watershed's unique characteristics.

2. **Sponsor Concerns**
   a. Include public input regarding capital improvements in the watershed
   b. Define changes to the floodplain
   c. Sedimentation in the open channel along 20th Avenue
   d. Sloan's Lake water quality and shallow water depth
   e. Wheat Ridge would like to better utilize the abandoned Denver Water line that they are currently using for detention.
   f. Edgewater would like to know how improvements that have been completed since the 1977 MDP have changed the flood hazards.
   g. Lakewood is doing their best to prevent sediment from reaching the lake. Lakewood is also interested in determining if the existing infrastructure has capacity for the 100-year event; and if not are their habitable structures that would be shown in the 100-yr floodplain
   h. Lakewood would also like a floodway delineated on the final FHAD

3. **Deficiencies**
   a. Water quality into Sloan's Lake and the South Platte River
   b. Urban floodplain due to limited conveyance capacity (flooding complaints)
   c. Condition of existing drainage infrastructure (5-year capacity)
   d. Channel stabilization, erosion and sedimentation/maintenance – especially along 20th Ave channel
   e. Sloan's Lake sedimentation over its 150 years
   f. Walker Park open channel needs maintenance. Lawns clippings are collecting in the channel. Could be impacting capacity. Edgewater, Lakewood, and UDFCD all perform some maintenance but need to better coordinate.
   g. Inlets on Sheridan are not maintained by CDOT (though they need maintenance).
   h. Denver to setup separate meeting with Maintenance staff re: Lake maintenance.

4. **Project Coordination**
   a. Meet as needed – typically every 6 weeks. Matrix to set the next meeting.
   b. Web Site. Matrix to set up the website.

5. **Data Gathering**
   a. Aerial and topographic base mapping (LiDAR 2014 flown in 2013)
   b. Land use information – existing and future for all municipalities. Generally, existing land use equals future land use, except townhomes in a vacant field in Edgewater. Wheat Ridge noted a decrease in imperviousness at the tank farm. General development for the Decatur-Federal Station Area. Denver has a newer 2014 data set for building footprints.
   c. Structure survey information for floodplain analysis
   d. Water quality data – Al Polonsky, Denver Environmental Health
   e. References:
      i. FHAD 1977
      ii. Major Drainageway Planning Phase B Sloan's Lake Basin", URS Company, December 1977
      iii. Letter of Map Revision 92-08-04OP, effective May 5, 1993 (Sloan's Lake Overflow)
      iv. Letter of Map Revision 05-08-0046P, effective Nov 18, 2005 (Invesco Field LOMR)
      v. Letter of Map Revision 13-08-0332P, effective February 12, 2014 (RTD West Corridor Lakewood and Dry Gulch LOMR)
      vi. City & County of Denver Storm Drainage Master Plan, adopted September 22, 2014.
      vii. Rocky Mountain Ditch Evaluation Study, Matrix Design Group for Denver Parks & Recreation, 2009
      viii. Dry Gulch OSP Baseline Hydrology Report May 2013
      (Items below are needed along with Sponsor responsible)
      ix. Dry Gulch digital file for watershed boundary - UDFCD
      x. Sloan's Lake Park Master Plan, 2002 - Denver
      xi. Sun Valley Neighborhood Decatur-Federal Station Area Plan, Adopted April 22, 2013. - Denver
      xii. West Colfax Plan, Adopted September 18, 2006 – Lakewood
      xiii. West Colfax Neighborhood Plan, March 1987 - Lakewood
      xiv. South Sloan's Lake General Development Plan (former Saint Anthony's Hospital site), Approved January 14, 2014 - Denver
      xv. Sheridan Station Area Plan, Sheridan Station – 20-minute neighborhood plan/Implementation Strategy (prepared in partnership with Lakewood), Approved December 17, 2008. This may not be within the watershed, Lakewood to verify.
      xvi. Berkeley Lake and Rocky Mountain Lake by Keith French – Denver
      xvii. As-builts for Richard Hart detention – Wheat Ridge
      xviii. As-builts for 42" line into Sheridan – Wheat Ridge

i. Potential Stakeholders

a. Rocky Mountain Ditch
b. Jewish Community
c. Sloan's Lake Recreation
d. 29th Avenue Business Association
e. Crown Hill
f. Jeffco School District
g. Stadium District

j. Project Schedule - 50 weeks by contract, concurrent FHAD

ESTIMATED SLOAN'S LAKE MDP & FHAD SCHEDULE

	Draft	Comments	Final/Second	Public Meeting	Selected Plan
Baseline Hydrology Report	5/2/2016	5/23/2016	6/13/2016		
Alternatives Analysis	8/22/2016	9/12/2016	10/3/2016	9/19/2016	10/31/2016
Concept Design	12/26/2016	1/16/2017	2/6/2017		
FHAD	8/8/2016	8/29/2016	9/19/2016		

k.Project Approach

a. Hydrology
   i. Update 1977 MDP with new rainfall and modeling
   ii. Land use, existing is full build-out
      1. Denver – BluePrint Denver
      2. Edgewater – Zoning Map May, 2013
      3. Lakewood – Zoning Map 2/17/2016
      4. Wheat Ridge – Official Zoning Map 1/4/2016
   iii. Sub-basin delineation
   iv. Detention
      1. Existing – Sloan's Lake 100-year detention
      2. Existing – Hart Estates
      3. Existing – Citizens Park detention
      4. Existing – Regional storm water detention at W. 26th Ave & Wadsworth
      5. Existing – Jefferson High School detention (No rating curve available). It was noted that it is difficult to get an agreement with the School District to maintain the detention in perpetuity, and may not be included in the Baseline Hydrology without such an agreement. Edgewater to investigate whether it should be incorporated into the model, as well as investigate if an agreement was previously established.
   v. Identify trans-basin flow into and out of Dry Gulch basin from 2013 OSP
   vi. Calibration
      1. UDFCD is recalibrating CUHP. The study will not be completed soon enough to incorporate the new models into this study.
      2. The near term fix is to adjust the Cp and Ct factors
      3. Use 2-3 square mile sub-watersheds. This would include 2 watersheds into Sloan's Lake and one for the outfall.

b. Hydraulics
   i. 2-D Modeling may be needed from Pierce St between 20th Ave and 25th Ave, and also from the outfall of Sloan's Lake to the South Platte River.
   ii. It may not be necessary to map a floodplain at the discharge of Sloan's Lake if the 100-year is fully contained within the outfall pipe.

   iii. A floodplain can be adopted by the State and administered locally, even if it is not submitted to FEMA for adoption.

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MEETING MINUTES
Sloan's Lake Drainageway and Tributaries
Major Drainageway Plan and Flood Hazard Area Delineation
Friday April 29, 2016, 1:30pm – 2:30pm at City & County of Denver

Attendees:

Selena Klosowski	Denver Wastewater	303-446-3520	Selena.Klosowski@denvergov.org
Michael McCown	Denver Parks	303-458-4787	Michael.McCown@denvergov.org
Cincere Eades	Denver Parks Planning	720-913-0655	Cincere.Eades@denvergov.org
Brandi Battseveen	Denver Intern	720-345-7202	Dulgunn.battseveen@denvergov.org
Drew Beck	Matrix Design Group	303-572-0200	Drew_Beck@matrixdesigngroup.com

Meeting Purpose

To discuss Denver Parks current maintenance activities and issues as they relate to the Major Drainageway Plan and Sloan's Lake Park. The marked up work map from the meeting accompanies these meeting minutes.

- There are 4 existing water quality facilities within the park. Park staff believes that they are only effective in removing gross pollutants such as trash and large sediment and not affective at removing nitrates or other dissolved pollutants.
  - There are 3 bioretention basins located adjacent to the 2 parking lots in the NW corner of the park. Parks maintains these by performing vegetative maintenance only. The easterly most basin is holding water a bit too long. The media may be slightly clogged causing the underdrain to perform poorly.
  - Wastewater maintains the large bioretention basin located about 500-ft east of the marina. Currently it is holding a bit of water and needs to be cleaned out. Parks typically calls Wastewater (either Darren or Raul) when maintenance is needed.
- The large grass area (i.e. football fields) between the boathouse and the northwesterly parking lots was a dredge material disposal site for a project in about 1995. Approximately 2-ft of dredged material was placed in the area. Grass grows on the field but for some reason it doesn't winter well, thus Parks overseeds every year.
- The alleys north of the fields between Zenobia, Yates, Xavier, Wolff, etc. historically were unpaved and contributed a lot of TSS to the lake. The alleys have been paved over the years and this is no longer a problem.
- The "beach" area adjacent to the football fields migrates annually. Wave and wind action on the lake pushes the beach northwesterly. In addition, runoff from the football fields sheet flows across the path and over the beach area causing erosion. Parks would like to have a permanent solution to the problem and stabilize the bank. The area is referred to as "beach" but is not officially a swim beach.
- The Park irrigation system is located immediately east of the beach. The pump intake is about 40-ft from the shoreline and leads to the wet well and pump house next to the boathouse. The entire park is irrigated from this system which functions well.
- Parks does not really track how much water they are using for irrigation. They rely on Wade (the Senior Ditch Manager for the Rocky Mountain Ditch) to operate the headgates on the Ditch. He adjusts which headgate flows are supposed to come from and is very sensitive about wasting water. All of it must be beneficially used.
- The irrigation water from the Ditch keeps the water level at its operational level. In the last 10 years +/- Parks has only closed water ski season early 3 weeks early due to low water once. Typically water ski season is about April 1 to October 1 and coincides with irrigation season.

- Parks usually issues 30 to 40 water ski permits per season. However, have only seen 20 boats on the water at a single time.
- In the past Parks has used copper sulfate (an algaecide) in the marina area to mitigate algae. However, no longer used.
- Parks inspects (2 – 3 times per year) and clears vegetation and debris around the outlet structure on an as needed basis.
- Goose population is still a big problem. Denver Natural Resources is actively working on a goose mitigation plan. Currently parks treats goose eggs to prevent further exacerbating the goose population.
- Parks is in the process of allowing all of the vegetative areas between the shoreline and the concrete walking path to go native (i.e. minimal mowing, no fertilizer, etc.). There are other areas of the park that could use this management technique. These are primarily non-programmed park areas.
- By far the biggest problem is the open channel inflow on the southwest shoreline. Inflow trash is a big problem. Parks has asked Edgewater to address the issue but they have been unresponsive. Parks suggested using a trash rack or other type of device just upstream of Sheridan. The inflow channel is very shallow due to years to sedimentation.
- Parks indicated the neighborhood group is very active and that we should reference the Park Master Plan in our MDP.
- The marina is very sensitive to lake level fluctuations. If the lake level were raised 8-in water would begin to flow back into storm drains. Could potentially use flapper gates.
- The previous dredging operation failed due to the high water content of the dredged material. The operation used non-mechanical methods to try and settle out sediment but could not get the sludge below 40% water content. The drying beds also occupied a very large area and began to stink within a few days. If this were investigated again need to consider mechanical separation methods such as presses, centrifuges, etc.

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MEETING MINUTES
Sloan's Lake Drainageway and Tributaries
Major Drainageway Plan and Flood Hazard Area Delineation
Wednesday May 11, 2016, 1:30pm – 3:00pm at UDFCD

Attendees:

Shea Thomas	UDFCD	303-455-6277	sthomas@udfcd.org
Terri Fead	UDFCD	303-455-6277	tfead@udfcd.org
Selena Klosowski	Denver Wastewater	303-446-3520	Selena.Klosowski@denvergov.org
David Morrisey	Denver Wastewater	720-913-8518	David.morrisey@denvergov.org
Cincere Eades	Denver Parks Natural Areas	720-913-0655	Cincere.Eades@denvergov.org
Ashlee Grace	Denver Water Quality	720-865-3131	Ashlee.grace@denvergov.org
Al Polonsky	Denver Environmental Health	720-865-5480	Alan.polonsky@denvergov.org
Mark Westberg	Wheat Ridge	303-235-2863	mwestberg@ci.wheatridge.co.us
Jason Bray	Wheat Ridge	303-235-2868	jbray@ci.wheatridge.co.us
Terry Rogers	Lakewood	303-987-7934	TerRog@lakewood.org
Robert Krehbiel	Matrix Design Group	303-572-0200	robertk@matrixdesigngroup.com
Drew Beck	Matrix Design Group	303-572-0200	Drew_Beck@matrixdesigngroup.com
HungTeng Ho	Matrix Design Group	303-572-0200	hungteng_ho@matrixdesigngroup.com

1. Project Coordination

a. Met with Denver Parks to discuss maintenance issues – trash is the #1 concern. #2 sedimentation
b. Data collection nearly complete

2. Data Gathering

a. Structure survey information
   i. Drainage Report and/or design report for detention basin at Wadsworth Blvd and 26th Ave [Lakewood]. Need to confirm tributary basin. Matrix has as-built data.
   ii. Drainage Report and/or design report for detention basin at Edgewater Elementary (Citizens Park) (24th Ave. and Depew St.) [Edgewater]. Matrix has as-built data.
   iii. Jefferson High School - ~8 AF of storage. Not included in the model now since there is not an IGA agreement to maintain detention in perpetuity
   iv. There are some pipe size discrepancies between as0built information and GIS data in several locations. Wheat Ridge will pop manholes/structures if needed. Matrix to review and coordinate with individual stakeholders.

3. Project Schedule

a. 50 weeks by contract, concurrent FHAD. To be updated based upon progress.

SLOAN'S LAKE MDP & FHAD APPROXIMATE SCHEDULE

	Draft	Comments	Final/Second	Public Meeting	Selected Plan
Baseline Hydrology Report	5/25/2016	6/15/2016	6/29/2016		
Alternatives Analysis	8/22/2016	9/12/2016	10/3/2016	September 2016	10/31/2016
Concept Design	12/26/2016	1/16/2017	2/6/2017		
FHAD	8/8/2016	8/29/2016	9/19/2016		

4. Baseline Hydrology

a. Preliminary Results. Review preliminary values (handout with table comparisons)
   i. FHAD is based upon 2,904 cfs flowing into Sloan's Lake. Preliminary results are 5,988 cfs. With calibration, the preliminary results are 4,181 cfs at the same design point.
   ii. Sloan's Lake does not overtop with calibration. FHAD listed 34 cfs and the preliminary hydrology indicates 92 cfs coming out of the lake.
b. Calibration.
   i. Comparison between small and large sub-basins for calibration. Small basins tend to have higher flows. Do not want to have higher flows simply due to discretization of the basin.
   ii. "Adjusted" flows noted on the table indicate adjustment of the Ct and Cp factors
   iii. Matrix to investigate unit runoff from similar basins
   iv. Matrix to consider different rainfall per the NOAA Atlas 14
   v. Report will be prepared and Sponsors have 3 weeks to review the report

5. Water Quality

a. 303(d) listing status - No longer considered an impaired water by the State. First time a Denver Lake has not been listed
b. Al Polonsky addressed the group
   a. Summary reports handout summarizing water quality testing. Data is from mid-summer
   b. Sloan's Lake is not very deep so temperature and dissolved oxygen are concerns
   c. Only 2 fish kill issues in Al's tenure
   d. Catfish and bass in lake
   e. Water clarity. Suspended solids problem. 10 years of data. Lake is big and shallow with 2-3 feet of fine sediment on the bottom. Floating material including algae. Sloan's Lake is higher compared with other Denver lakes. High suspended solids – similar to Aqua Golf. Boats are stirring up the water. Chlorophyll is not correlating with suspended solids.
   f. Measure bacteria every 2 weeks during boating season. If rainfall is greater than 0.2 inches, bacteria tends to go up. Within 48 hours, bacteria levels go down. Not managed as a swim beach so there are no closures due to water quality. E.Coli not correlated to boating activities stirring up the water.
   g. Denver Water accidentally flushed water into Sloan's Lake last week, which watched more sediment into the lake
   h. Past attempts to dredge the lake failed due to the fine material that did not dry out easily. Areas where sediment was placed have been difficult to sustain replanting.
   i. Water quality data used for recommendations to Parks algae control and evaluation for 303(d) listing status.
c. Cincere is on the "Go Bond" committee. She added dredging the lake as a suggested project.
d. Previous reports suggested two major forebays for the two major drainageways flowing into Sloan's Lake along Sheridan Blvd.
e. Possible water quality modeling integration. UDFCD has funds for an assessment of water quality evaluation. Matrix to develop a fee for water quality loading based on land use concentration model. Results would be checked with actual monitoring data. This evaluation cannot model the impact of Rocky Mountain Ditch inflows on water quality. Sponsors indicated a general interest and need for an assessment of water quality.

6. Hydraulics

a. Channel centerline and stationing
b. Model Limits - By scope, all tributaries are to be restudied.
c. Junctions
d. 2-D Modeling (Pierce St between 20th Ave and 25th Ave)
e. Floodplain – Regulatory and Non-Regulatory. Wheat Ridge is very interested in modeling the non-regulatory floodplain that was previously defined. Municipalities may elect not to submit floodplains to FEMA. Need to map floodplains currently defined by FEMA – it is difficult to remove the floodplain delineation from areas already defined by FEMA.
f. Denver would like to consider removing the floodplain out of Sloan's Lake if there is not a spill. It is important to note that the Sloan's Lake watershed is being modeled with a 2-hour storm. Since Sloan's Lake drains very slowly, it is possible that a long duration storm could cause a spill. Therefore, since there is a risk of flooding, it is important to note a flood hazard risk, although the modeling will not show a spill.

Inundated Structure Count by Jurisdiction based upon current Floodplain

Jurisdiction	FEMA 100-Year Floodplain	1977 FHAD Floodplain (not Adopted by FEMA)
City & County of Denver	13	0
Edgewater	86	0
Lakewood	23	8
Wheat Ridge	0	57

7. Alternatives Analysis

a. Outfall to South Platte – enlarge the outfall pipe to drain quicker after a storm.
b. Integration/expansion of existing detention basins
c. Proposed detention (limited land use)
d. Sedimentation issues in Sloan's Lake and potential dredging
e. Flood history and repeated inundation areas
f. Water Quality protection to Sloan's Lake and South Platte River

8. Action Items

a. Lakewood to look for drainage report for 26th & Wadsworth detention facility to define tributary area.
b. Edgewater and UDFCD to look for drainage report for Citizens Park detention facility to define tributary area.
c. Matrix to investigate unit runoff from similar basins for Hydrology
d. Matrix to consider different rainfall per the NOAA Atlas 14
e. Matrix to develop a fee for water quality loading land use based concentration model.
f. Matrix to evaluate where there is 1 square mile of tributary area for FEMA floodplain mapping.

Draft Baseline Hydrology Report Review Comments dated June 27, 2016 and Responses

Sloan's Lake Major Drainageway Plan _ Baseline Hydrology Report

Page	Comment #	Reviewer	Comments	Responses
iii	1	Lakewood - TR	Add Figures 3-2, 3-3, and 3-4 to "List of Figures"	Ok
iii	2	Lakewood - TR	In List of Tables change "coefficient" to "coefficients" in Table 3-4 description	Ok
1	3	UDFCD	In Section 1.2 change "Delineation Area" to "Area Delineation"	Ok
1	4	Denver - JH	In Section 1.3 change the progress meeting date to May 11, 2016	Ok
2	5	Denver - JH	In Table 1-1 add David Morrisey Denver Public Works - Right of Way Services	Ok
3	6	Denver - JH	In Section 2.1 of the first paragraph add acronym "(SDMP)" after "Denver Storm Drainage Master Plan"	Ok
3	7	UDFCD	In Section 2.1 add Figure 2-1 to the first sentence. Change Figure 2-1 to Figure 2-2 in the second sentence. In the third paragraph of Section 2.1 change "currently modeled" to "current regulatory". In second paragraph of Section 2.1.1 change "on" to "in"	Ok
3	8	UDFCD	Include total length of drainageways studied.	Ok. Lengths per centerline stationing. Total reach lengths mentioned in Section 2.3
3	9	Wheat Ridge - M	In Section 2.1, the individual areas total 4.84 square miles. In addition, the areas listed in 2.11 Lower Basin and 2.12 Upper Basin for each of those areas totals 5.1 square miles. In third paragraph of Section 2.1 use consistent naming of box culvert 9' x 4'	Ok. Basin descriptions and areas revised
3	10	Lakewood - TR	The 100-year event is 3405 cfs per page 16. Irrigation water from Clear Creek is discharged into Sloan's Lake Drainageway and contributes to inflow into Sloan's Lake? In Section 2.1.1, second paragraph change "and begins to merge with" to "near the confluence of"	Yes irrigation water from Clear Creek contributes to Sloan's Lake inflow. Text changed.
3	11	Denver - SK	In Section 2.1.1 the lower and the upper basin add up to 5.10 sq. miles, however the entire basin is 4.89 sq. miles, something is off.	Ok. Basin descriptions and areas revised
4	12	Wheat Ridge - M	In Section 2.1.2, first paragraph change "drains the northern portion of the upper basin and is contained in a storm drain network without major open channel sections" to "is conveyed in a mix of aboveground and underground systems without major open channel sections"	Ok
4	13	Denver - SK	Double check area of upper portion of watershed	Ok. Basin descriptions and areas revised
4	14	Lakewood - TR	Discussions of J North Tributary and FL Tributary? In Section 2.1.2, second paragraph change "has intercepted" to "intercepts". Also change "and" to "at"	See Section 2.3
4	15	UDFCD	Is a majority of the Sloan's Lake watershed within the City & County of Denver. Consider deleting this sentence.	Delete
4	16	Denver - JH	Irrigation water uses storm pipes, detention ponds and open channels for delivery to Sloan's Lake from RMD? In Section 2.1.2, first paragraph change "Figure 2-1" to "Figure 2-2"	Yes. Ok.
5	17	Denver - SK	In Figure 2-2 delete "x" above description of map.	Ok.
5	18	Denver - JH	In Figure 2-2 change "Study Area Map" to "Watershed Map" and "Figure 2-1" to "Figure 2-2"	Ok.

Draft Baseline Hydrology Report Review Comments dated June 27, 2016 and Responses

Sloan's Lake Major Drainageway Plan _ Baseline Hydrology Report

Page	Comment #	Reviewer	Comments	Responses
6	19	UDFCD	In Section 2.2 we should be accounting for areas expected to redevelop if they will have a higher imperviousness. Was that not done? In Section 2.3, add Figure "2-3, 2-5, 2-1". In Reach 3 Section add "effective" before "floodplain"	Land use is future condition, but the vast majority is existing condition. Text will be clarified that future conditions is being modeled.
6	20	Denver - JH	In Reach 3 section, change Reach 2 to Reach 3. Reach 3 is concrete only for a very limited stretch. Otherwise, low flow appears to be boulder lined. Include figure showing floodplain boundaries that are frequently referenced in text, both regulatory and non-FEMA.	Ok. See exhibit 2-4
6	21	Lakewood - TR	Change Figure 2-4 Outfall to the South Platte River to Figure 2-3 Outfall to the South Platte River and Figure 2-3 17th Ave westerly from Lowell Blvd to Figure 2-4 17th Ave westerly from Lowell Blvd. Change Figure 2-6 Sloan's Lake Outlet to Figure 2-5 Sloan's Lake Outlet and Figure 2-5 Sloan's Lake to Figure 2-6 Sloan's Lake	Ok.
7	22	UDFCD	Add slope to sentence describing Reach 3. Entire reach 3 owned by City of Edgewater? Maintained by UDFCD? In Reach 4 and Reach 5 section add "effective" before "floodplain". In Reach 4 section mention that detention pond at Jefferson High School is not publically maintained and therefore not included in the model. In Reach 5 Section, second sentence change "and" to "an"	Reach 3 is mostly Edgewater, but includes some within Lakewood. Jeffereson High School detention is not publically maintained.
7	23	Denver - JH	For reach 5, additional flows to Sloan's Lake Drainageway from sources other than tributary basin area? Show a figure of the floodplain	The 1977 FHAD did not include the split flow. Modeling includes flows. Mapping revised to indicate off-site flows.
7	24	Lakewood - TR	Change Figure 2-10 Open channel upstream of Sheridan Blvd. to Figure 2-8. Change Figure 2-8 Box culvert at 20th and Ingalls St. to Figure 2-10. In Figure 2-11 capitalize "high"	Ok.
8	25	UDFCD	Channel between Saulsbury and Reed is maintained by UDFCD. Regional detention facility b/w Vance Street and Wadsworth Boulevard is owned by Lakewood, maintained by UDFCD. Citizens Park is owned and maintained by Edgewater? In Reach 6 and Reach 7 sections add "effective" before "floodplain". In Reach 7 heading change Harlan to Gray Street also "Harlan" to "Gray" in first sentence.	Ok. Yes.
8	26	Lakewood - TR	In Reach 6 section change "at 35th" to "south of 26th". Change Figure 2-14 Sump in Pierce at Jefferson High School outlet to Figure 2-13 and Figure 2-13 to Figure 2-14.	Ok.
9	27	Denver - JH	For reach 8, when will the split flow condition be investigated further? Use a figure to show non-regulatory floodplain. In section 2.4 discuss how irrigation diversions affect hydrology	Split flow will be looked at during alternative analysis. FLO-2D will be used at Pierce and Depew. Text will discuss in general terms regarding how irrigation diversion partially takes up carrying capacity of system
9	28	UDFCD	In Section 2.4: there is a gage on the mainstem just upstream of Depew St. In Reach 8 and 9 headings as well as in body of both these sections change "Harlan" to "Gray". Delete "Reach" from heading description for Reach 9. In Reach 8 section add "effective" before floodplain and change "is" to "if" In Section 2.4 change "avoiding" to "avoided".	There are gages within the watershed. The gage data is not being used to calibrate the hydrology.
9	29	Denver - SK	In Section 2.4 change "is undersized for the minor storm per Denver criteria for its tributary area (excluding contributions from the Lake)" to "is undersized per Denver Criteria during the 5-year storm event of the local drainage area" (Use similar terminology as the Denver SDMP)	Ok.
10	30	Denver - SK	Explain what BCZ is, since this will be a publicly published document: ", which is an area that the USFWS has determined that the species in question is not likely to currently exist"	Ok.
10	31	Lakewood - TR	In the Landfills and Contamination section change "Sport" to "Sports"	Ok.

Draft Baseline Hydrology Report Review Comments dated June 27, 2016 and Responses

Sloan's Lake Major Drainageway Plan _ Baseline Hydrology Report

Page	Comment #	Reviewer	Comments	Responses
11	32	Lakewood - TR	Inventory crossings for reaches 7-9. In Type/Size of Structure column, change to 12'x5' more than one cell in size of structure?	Reaches 7-9 will be added to table.
11	33	Denver - JH	Are all of estimated capacities of all the reaches 1005 cfs	Matrix will confirm capacity. This will be revised.
12	34	UDFCD	In Section 3.1 mention that there is a gage just upstream of the main inlet. In Section 3.1.1 is the 2-hour storm duration a 1-hour storm precipitation distributed over 2 hours? Use CUHP Version 1.5 instead. In Section 3.1.2, second paragraph change "northeasterly" to "from the northwest"	Yes, the 2-hour storm duration is a 1-hour storm precipitation distributed over 2 hours.
12	35	Lakewood - TR	Mention that the trans-watershed split flow "was not shown or accounted for in the 1977 FHAD."	Ok.
12	36	Denver - JH	In Section 3.1.2 Not sure what trans-watershed split flow means, where flows originate from, how flows enter SLB system, or how modeled. In Table 3-1 Heading add "NOAA Atlas 14"	Reference North Dry Gulch MDP and model to obtain flows for this design point. Discussed in detail in Sections 3.2 through 3.5
12	37	Denver - SK	In Section 3.1.2 change "which" to "and". Also delete "Section 3.3.4.1" to "Section 3.3.4.2" and replace "Irrigation facilities such as ditches and reservoirs shall not be used as drainage facilities" to Drainage analysis shall assume that irrigation ditches do not intercept storm runoff from the upper basin ... ditches will generally be flowing therefore, the tributary basin runoff would flow across the ditch."	Ok.
13	38	Denver - JH	In Section 3.3.4 add "Initial and final infiltration rates used in the CUHP model are ___ and ___."	standard values for MDPs = 3-in to 0.5-in
14	39	Denver - JH	In Section 3.4 add "an online facility" after "The Jefferson High School Detention Basin" in the third sentence. Double check math of Sloan's Lake storage	Ok.
14	40	Denver - SK	Why are there more than three "waterbody/detention" shown in the Reach Map Figure 2-3 ? Can we show the detention facilities that were included in the hydrologic model in a different color?	We show all detention owned by all stakeholders, but we only modeled publicly maintained facilities. Will graphically differentiate public and private detention
14	41	Lakewood - TR	In Section 3.5 address if EQ. 6-B (USDCM) will be used for open channel roughness in this study? In Section 3.5 clarify where the split flow occurs and how this happens. In Section 3.6 add "Reach FL Tributary and Ashland Drainageway" in the second sentence	EQ. 6-B is not applicable for hydrologic calculations only for hydraulic calcualtions.
15	42	Denver - SK	In Table 3-5 regarding 2016 MDP Large Basin Values: Needs detailed explanation in the body of the report. Not even sure what this is being used for. I assume that we will be using the 2016 MDP values for the FHAD update? There is no explanation as to what this is being used for. From Shea: since we now have version 1.5, let's delete this.	2016 MDP Large Basin values will be deleted and the 2016 MDP values will be updated with the new flows from CUHP 1.5
15	43	Denver - JH	In regard to Table 3-5: By comparison with tabulated values provided in meeting on 05/10/16, flows are substantially lower in the above table. Is this reduction due entirely to use of NOAA Atlas 2014 for rainfall instead of USDCM, or due to other factors?	Partially to NOAA Atlas 14 and calibration of Cp and Ct
16	44	Denver - SK	In Figure 3-1 change "Outfall" label at station 0+00 to "Outfall at SPR" and second "Outfall" at station 113+50 to "Outfall into SL"	Ok.
17	45	Denver - SK	In Table 3-7 add "Detention" to "Wadsworth Blvd and W 26th Ave." Change label of x-axis to "Station In Feet from Pierce St. & W. 20th Ave"	Ok.
18	46	Denver - SK	Shouldn't Citizen's Park Detention Pond be a key design point to be reported in Table 3-8? In Table 3-8 change "Outfall" to "Outfall into SL". Change label of x-axis to "Station In Feet from the Outfall @ W. 24th Ave. and Sheridan"	Yes. Routing has been revised.
19	47	Lakewood - TR	In Table 3-9 change "Sloans Lake Drainageway" to "Reach J North Tributary" and change label of x-axis to "Station in feet from Gray St. and W 26th Ave."	Ok.

Draft Baseline Hydrology Report Review Comments dated June 27, 2016 and Responses

Sloan's Lake Major Drainageway Plan _ Baseline Hydrology Report

Page	Comment #	Reviewer	Comments	Responses
24	48	UDFCD	Be sure to include detention pond rating curve tables in appendix.	Citizens Park rating curve has been updated and is included in Appendix B - Hydrology
	49	UDFCD	Naming of tributaries. No need to continue with old names. Reference street names.	Reach J to be called Gray Street Tributary. Reach FL will be called Pierce Street Tributary.

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MEETING MINUTES
Sloan's Lake Drainageway and Tributaries
Major Drainageway Plan and Flood Hazard Area Delineation
Friday July 8, 2016, 10:00am – 11:30am at UDFCD

Attendees:

Shea Thomas	UDFCD	303-455-6277	sthomas@udfcd.org
Selena Klosowski	Denver Wastewater	303-446-3520	Selena.Klosowski@denvergov.org
Cincere Eades	Denver Parks Planning	720-913-0655	Cincere.Eades@denvergov.org
Ashlee Grace	Denver Water Quality	720-865-3131	Ashlee.grace@denvergov.org
David Morrisey	Denver Public Works	720-913-8518	David.morrisey@denvergov.org
Mark Westberg	Wheat Ridge	303-235-2863	mwestberg@ci.wheatridge.co.us
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Terry Rogers	Lakewood	303-987-7934	TerRog@lakewood.org
Robert Krehbiel	Matrix Design Group	303-572-0200	robertk@matrixdesigngroup.com
Drew Beck	Matrix Design Group	303-572-0200	Drew_Beck@matrixdesigngroup.com
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1. **Project Coordination**

a. Need to reschedule meeting with Denver Public Works re maintenance near the Lake to determine the work share between Parks and Public Works.

2. **Data Gathering**

a. Structure survey information. Much of the drainageway is piped and closed conduit. Matrix to inform UDFCD of structures that need to be surveyed. Pipes less than 36" are usually ignored. UDFCD to survey downstream of Depew St to Sloan's Lake.

3. **Project Schedule**

a. Matrix to reissue Baseline Hydrology Report.
b. Wednesdays are best for Wheat Ridge public meeting.

	Draft / First	Comments	Final/Second	Public Meetings	Selected Plan
Baseline Hydrology Report	5/27/2016	6/27/2016	7/25/2016		
Alternatives Analysis	10/3/2016	10/24/2016	11/14/2016	10/31/2016	12/1/2016
Concept Design	2/6/2017	2/27/2017	3/20/2017		
FHAD	9/19/2016	10/10/2016	10/31/2016		

4. **Baseline Hydrology**

a. NOAA Atlas 14 rainfall will be used in this study.
b. New CUHP vs. calibration. UDFCD has released the new version of CUHP. The draft report utilized a manual calibration of Cp and Ct. Matrix will now use the new CUHP software. A table was distributed to show minor differences between the previous results and the new results. The calibration test for large basins is no longer necessary. Discussion on the calibration will be removed from the final baseline hydrology report.
c. Review comments (see attached table)
d. Denver would like electronic models for the review. UDFCD to provide in future.

e. UDFCD will check on renaming tributaries. There may be issues on FEMA mapped floodplain. Matrix will rename Reach J to Gray Street Tributary and Reach FL to Pierce St Tributary. UDFCD to confirm with FEMA if renaming is allowed.

5. **Water Quality**

a. Incorporate hot spot analysis into Alternatives Analysis
b. Analysis will dictate potential different solutions at different locations/sub-basins
c. The amendment has been signed for additional water quality evaluation.
d. The existing bioretention basin located northeasterly of the marina is effectively removing pollutants prior to discharging to the lake but is in need of maintenance. City receives complaints re smell and appearance when not maintained.

6. **Hydraulics**

a. Channel centerline and stationing based on street centerline for most of the watershed
b. Model Limits consistent with 1977 FHAD
c. Split flow at Pierce and 20th and shallow flooding near Lumberg Elementary are critical areas and will require FLO2-D
d. HEC-RAS and FLO2-D models will subtract out pipe flow from flow in streets
e. The South Platte River FHAD has been submitted for first review. Matrix can use the 10-year elevations from that study for tie-in with the Sloan's Lake floodplain (UDFCD to provide). The hydrology CLOMR has been approved by FEMA.

7. **Alternatives Analysis**

a. Reach 1
    a. Flood hazard reduction: limited to pipe upsizing
    b. Water quality: majority of area is already being treated
    c. Matrix to look at 54" outfall into the South Platte River. – SDMP indicates entire system from Lake to River to be upsized to meet minor storm criteria.
b. Reach 2
    a. Dredging the lake
        i. More detention storage may be available if the lake were dredged, the operational lake level could be lowered to provide additional flood control storage. (Hydrologic model shows no overtopping of lake during 100-year event at current operational lake level and existing storage capacity.)
        ii. Improves water quality
    b. Water quality: pre-treatment at outfalls. The existing water quality swales are working to collect trash.
    c. Denver Parks in 2017 will be assessing "the beach area" along the northwest edge.
    d. Darren Mollendor and Raul Rodriguez are working on a maintenance plan for the entire Sloan's Lake.
c. Reach 3
    a. Main open channel area is functioning well
    b. Culvert crossings are already 100-year.
    c. Walker-Branch Park and channel maintenance
    d. Water quality: pre-treatment for trash removal. There have been issues with trash.
d. Reach 4
    a. Likely piped, slim chance of open channel. May extend open channel.
    b. Need to define floodplain to understand flood hazards.
e. Reach 5
    a. Jefferson High School detention. The detention could be formalized and include water quality.
    b. Open channel stabilization. Acquisition may be considered to improve channel.

c. Vegetation management may be needed.
d. Includes flow down 20th from North Dry Gulch.

f. Reach 6
   a. "Pierce Street Tributary"
   b. Split flow at 26th & Pierce
   c. Storm drain pipe
   d. Lumberg Elementary
   e. Water quality: modify 26th and Wadsworth detention

g. Reach 7
   a. All storm drain pipe. Limited options for open channel
   b. Water quality: Citizens park detention for peak shaving. May consider retrofit for water quality. Wheat Ridge noted that Parks would not likely allow water quality treatment in the Richard Hart Estates due to aesthetics.

h. Reach 8
   a. Storm drain
   b. Possible detention near Teller St and 27th Ave at the vacant lots.
   c. Large Denver Water line feeding Ashland Reservoir splits the lot and would likely preclude use as a detention basin.

i. Reach 9.
   a. 29th & Benton Street has a flow split. Flows less than ½ inch flow directly to Sheridan. Higher flows go in underground pipe. All smaller storms go to Sheridan.
   b. Many complaints that stormwater is washing away street landscaping. No curb and gutter in the area.
   c. Storm drain pipe
   d. Ashland Reservoir site
   e. Possible detention near Jay St and 29th Ave – has been submitted for apartment development
   f. Richard-Hart Estate – storm drain outlet and water quality
   g. Wheat Ridge would like to get a pipe from Richard-Hart Estate pond down to 24th Ave. Also evaluate pipes from 28th and Ames. Lots of stormwater coming down Ames and 28th. 36" outfall has a duck bill to prevent people crawling in pipe (did not want a grate on the downstream end of pipe). Water shoots out the duck bill past the riprap pad. Pond gets water 2-3 times per year.
   h. 42" former Denver Water pipe does a lot of detention underground. Discharges into Sheridan south of 29th Avenue. 11 cfs discharge. Dried up 29th Avenue.

8. Action Items

a. Matrix to address comments and reissue Baseline Hydrology Report.
b. UDFCD to begin structure survey from Depew St to Sloan's Lake
c. UDFCD will check on renaming tributaries
d. Matrix to setup meeting with Denver Public Works re: Lake maintenance
e. UDFCD to provide 10-yr WSEL to being hydraulic model

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Meeting Minutes
Sloan's Lake Drainageway and Tributaries
Major Drainageway Plan and Flood Hazard Area Delineation
Tuesday July 26, 2016, 11:15am – 12:15pm at Sloan's Lake Boathouse

Attendees:

Selena Klosowski	Denver Wastewater	303-446-3520	Selena.Klosowski@denvergov.org
Michael McCown	Denver Parks	303-458-4787	Michael.McCown@denvergov.org
Cincere Eades	Denver Parks Planning	720-913-0655	Cincere.Eades@denvergov.org
Darren Mollendor	Denver Wastewater	303-446-3588	Darren.mollendor@denvergov.org
Lisa Cherry	Denver Intern		Lisa.Cherry@denvergov.org
Ashlee Grace	Denver Water Quality	720-865-3131	Ashlee.grace@denvergov.org
Drew Beck	Matrix Design Group	303-572-0200	Drew_Beck@matrixdesigngroup.com

Meeting Purpose

To discuss Denver Wastewater current maintenance activities and issues as they relate to the Major Drainageway Plan and Sloan's Lake Park.

1. Overview of UDFCD Major Drainageway Planning process
    a. Primary focus is on flooding associated with the major storm event (100-yr). Sloan's Lake is a very good detention basin, Qin = 3000 cfs and Q out = 30 cfs
    b. MDP will consider water quality alternatives

2. Sloan's Lake water quality
    a. Ongoing water quality sampling. Bacteria is the primary pollutant of concern

3. What are current Maintenance activities and responsibilities?
    a. Parks is performing basic maintenance (i.e. vegetation management)
    b. Bruce and Saeed started to assemble maintenance plans for major park facilities which need wastewater attention. Wastewater is currently assembling maintenance plans for several park facilities. Expects to have the Sloan's plan in the next month. Doug Woods and Cincere will sign off on all maintenance plans.
    c. The large forebay/bioretention basin on the northern shore of the lake was built in 2012 and has not yet been cleaned. The team agreed that the forebay may be undersized. However, 4 years of sediment accumulation may exceed the likely 2 year removal schedule that could be established moving forward.
    d. UDFCD is currently maintaining the open channel west of Sloan's Lake within Edgewater.

4. Frequency of maintenance –
    a. Wastewater has not historically performed maintenance but will be establishing a schedule and activities soon. It is anticipated that designated facilities would receive annual inspection at a minimum.
    b. Currently discussing possible triggers from inspections which would require maintenance activities.
    c. Parks staff regularly trims vegetation and removes trash from small bioretention basins.
    d. Most other maintenance plans which are currently being developed indicate sediment removal every 1 to 2 years

Parks staff visually inspects outlet and removes debris as needed.

5. Equipment – Parks uses basic equipment. Wastewater will use skid steer or small excavator. Some hand work with shovels.

6. Challenges
    a. Pretreatment opportunities along the main inlet channel at the southwest corner of the lake at Sheridan Blvd.
        i. Open concrete channel portion west of Sheridan
        ii. Inlet between Sheridan and the pedestrian bridge within the park
    b. Dredging operations would be challenging due to soupy conditions
        i. Could increase lake depth but sacrifice surface area. Parks indicated boaters would not like sacrificing surface area but would be open to the discussion. Exporting material would be costly.
    c. Wastewater is open to constructing more forebays as long as they are designed and constructed with maintenance in mind.
    d. The lake around the outlet structure has significant sedimentation issues. Currently there is only about 1' of water at the outlet structure. May need a minor dredge operation between the pedestrian bridge and the outlet structure to ensure long term functioning of the outlet structure.

7. Action Items
    a. Lisa to send example Maintenance Plan from a similar park
    b. Darren/Lisa to send Sloan's Lake Maintenance Plan in August

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MEETING MINUTES
Sloan's Lake Drainageway and Tributaries
Major Drainageway Plan and Flood Hazard Area Delineation
Thursday October 26, 2016, 8:30am – 10:00am at UDFCD

Attendees:

Shea Thomas	UDFCD	303-455-6277	sthomas@udfcd.org
Terri Fead	UDFCD	303-455-6277	tfead@udfcd.org
Selena Klosowski	Denver Wastewater	303-446-3520	Selena.Klosowski@denvergov.org
Cincere Eades	Denver Parks Planning	720-913-0655	Cincere.Eades@denvergov.org
David Morrisey	Denver Public Works	720-913-8518	David.Morrisey@denvergov.org
Ashlee Grace	Denver Water Quality	720-865-3131	Ashlee.grace@denvergov.org
Jeremy Hamer	Denver Wastewater	720-913-0720	Jeremy.Hamer@denvergov.org
Mark Westberg	Wheat Ridge	303-235-2863	mwestberg@ci.wheatridge.co.us
Jason Bray	Wheat Ridge	303-235-2868	jbray@ci.wheatridge.co.us
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Terry Rogers	Lakewood	303-987-7934	TerRog@lakewood.org
Robert Krehbiel	Matrix Design Group	303-572-0200	robertk@matrixdesigngroup.com
Drew Beck	Matrix Design Group	303-572-0200	Drew_Beck@matrixdesigngroup.com
HungTeng Ho	Matrix Design Group	303-572-0200	hungteng_ho@matrixdesigngroup.com

1. Project Coordination

a. July met with Denver Wastewater and Parks to discuss maintenance at the Lake for the operations and maintenance plan. The O&M plan is not yet complete. Also look at facilities regarding water quality. Drew and Selena to coordinate with Darren and his team on additional info.

2. Data Gathering

a. Structure survey information needed for Sheridan area. Matrix to mark-up map for UDFCD to gather additional survey.

3. Baseline Hydrology Report

a. Finalized report to be posted to the website
b. Hydrology includes inflow from North Dry Gulch

4. Hydraulics

a. Split flow at Pierce and 20th and shallow flooding near Lumberg Elementary - FLO2-D
b. FLO2-D – steady vs. unsteady

5. FHAD

a. Model has been submitted but has not been reviewed yet. Floodplain mapping is very preliminary at this stage.
b. Reviewed preliminary results and comparison with effective floodplain map
c. Noted that the new FHAD shows more structures in the floodplain than the effective map
d. HEC-RAS model starts at the outlet of Sloan's Lake and progresses upstream
e. FLO-2D used at the outlet of Sloan's Lake and along the Ashland Tributary from Pierce to Ingalls Street
f. Detention pond at 26th & Wadsworth has 100-year capacity, so a floodplain may not be needed at the outlet down 25th Avenue.
g. Regulatory floodplain is the 1977 FHAD

h. FLO-2D area structures identified in the floodplain have been separated into buildings with basements and without. With basements it was considered inundated with 0.1' of depth and no basements with 0.5' depth.
i. Some split flow into Lakewood Gulch near Federal and Colfax.
j. Denver may note some areas as Potential Inundation Area rather than a FEMA floodplain, especially where the tributary area is less than 1 square mile (i.e. downstream of the Lake)
k. Denver would like to figure out if the area downstream of Sloan's Lake should have a FEMA floodplain. Denver would also like to get the FLO2D analysis as soon as possible, even before FHAD is finalized if possible.

6. Alternatives Analysis

a. Reach 1 – Downstream of Sloan's Lake
    a. Flood hazard reduction via pipe upsizing. 36" pipe to a box culvert down 17th Avenue.
    b. Water quality: majority of area already treated. Colfax and Federal water quality facility
    c. No improvements shown in Colfax; would likely be SDMP type of improvements
b. Reach 2 – Sloan's Lake
    a. Effective detention facility already
    b. Dredging the lake
        i. Lower operating lake level
        ii. More detention storage available
        iii. Improves water quality
    c. Water quality: pre-treatment at outfalls
c. Reach 3 – Sheridan to Ingalls Street
    a. Already an open channel with 100-year capacity. Do not need to evaluate options to replace the channel with a pipe – not a policy of UDFCD.
    b. Culvert crossing improvements
    c. Walker-Branch Park and channel maintenance. Restore the invert of the channel by removing accumulated sediment (at least a foot deep)
    d. Stakeholder witnessed a June 2016 storm that came within inches of overtopping the box culvert at Harlan St
    e. Water quality: pre-treatment trash removal
d. Reach 4 – Ingalls to Wadsworth
    a. Likely piped, slim chance of open channel
    b. Upsize pipe option along 20th Avenue
    c. Large diameter (63-in?) Denver Water transmission line in 20th would be a design constraint
e. Reach 5 – Wadsworth to Yarrow Street
    a. Jefferson High School detention today
    b. Open channel stabilization
    c. Keep as open channel
    d. No easements today so difficult to improve the existing open channel
f. PST Reach 1
    a. Pipe along Pierce
    b. Water quality: modify 26th and Wadsworth detention
g. AST Reach 1
    a. Rename to Pierce #2
    b. Pipe upsizing
h. ASD Reach 1
    a. Storm drain pipe
    b. Water quality: Citizens park detention retrofit
i. ASD Reach 2

   a. Storm drain pipe
   b. Detention at High School could be expanded. Existing is 10 AF but could expand to 15 AF without excavation. Existing 54" pipe through ballfield can convey the 10-year. Does not eliminate downstream pipe upsizing.
   c. Expanding high School detention only relates to outlet modifications and does not consider re-grading

j. PST Reach 1
   a. Storm drain pipe
   b. Richard-Hart Estate – storm drain outlet and water quality
   c. Consider running a pipe down Ames to pick up discharges of Richard-Hart Estate detention facility that currently discharges to the street.

k. Rocky Mountain Ditch interception
   a. Upsize pipes and extend upstream if ditch does not intercept flows

7. Water Quality

a. Water quality priority analysis. Applied approach completed for City & County of Denver. Develops a scorecard for water quality improvements by sub-basin. Isolated just the water quality parameters to help improve the determination of priority areas. Approaches may include:
   a. Detention in Jefferson High School to activate in a lesser storm event.
   b. No curb and gutter in the upper basin so could improve swales for water quality. Generally roadside shoulders rather than roadside swales ("unimproved shoulders"). It may be hard to convert to swales for water quality. Shoulders today may be contributing to water quality sediment loading. Difficult to get grass to grown along shoulders – people parking on them, rather than watering and mowing.
b. Incorporate hot spot analysis for loading into Alternatives Analysis
c. Analysis will dictate potential different solutions at different locations/sub-basins
d. Pre-treatment at outfalls. Trash and sediment removal at main inlet to Sloan's Lake. Need to talk to Denver about need for a big forebay. What is being done now, and what is needed? Existing forebays growing grass indicating the frequency of maintenance has been limited.

8. Approximate Updated Project Schedule

	Draft / First	Comments	Final/Second	Public Meetings	Selected Plan
Baseline Hydrology Report	5/27/2016	6/27/2016	7/25/2016		
Alternatives Analysis	11/21/2016	12/5/2016	1/16/2016	January 2017	Feb 2017
Concept Design	3/20/2017	4/3/2017	4/10/2017		
FHAD	9/19/2016	Dec 2016	April 2017		

Reviews are generally 3 weeks for sponsors

9. Action Items

a. Matrix to mark-up map for UDFCD to gather additional survey.
b. Matrix to talk to Denver about the acceptability for a big forebay at entrance into Sloan's Lake.
c. Matrix to update schedule on the website
d. Matrix to start Doodle poll for December meeting

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Meeting Minutes
Sloan's Lake Drainageway and Tributaries
Major Drainageway Plan and Flood Hazard Area Delineation
Wednesday December 21, 2016, 1:00pm – 2:30pm at UDFCD

Attendees:

Shea Thomas	UDFCD	303-455-6277	sthomas@udfcd.org
Terri Fead	UDFCD	303-455-6277	tfead@udfcd.org
Selena Klosowski	Denver Wastewater	303-446-3520	Selena.Klosowski@denvergov.org
David Morrisey	Denver Public Works	720-913-8518	David.morrisey@denvergov.org
Jeremy Hamer	Denver Wastewater	720-913-0720	Jeremy.Hamer@denvergov.org
Mark Westberg	Wheat Ridge	303-235-2863	mwestberg@ci.wheatridge.co.us
John Enochs	Edgewater – Diamondback Eng.	303-985-4204	johne@diamondbackeng.com
Terry Rogers	Lakewood	303-987-7934	TerRog@lakewood.org
Robert Krehbiel	Matrix Design Group	303-572-0200	robertk@matrixdesigngroup.com
Drew Beck	Matrix Design Group	303-572-0200	Drew_Beck@matrixdesigngroup.com
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1. **Hydraulics**
   a. FLO-2D modeling downstream of Sloan's Lake. This has not been included in the preliminary FHAD submittal, but will be modeled by this study.
   b. Floodplain mapping downstream of the lake – Denver is currently pursuing removal of the SFHA designation by FEMA for the area downstream of Sloan's Lake, SLD Reach 1 in the MDP, currently defined as Zone A. Denver prefers to be able to regulate flood hazards locally in that area using products from a 2-dimensional analysis (FLO-2D) as Potential Inundation Areas (PIA). Although Denver hopes to have the SFHA (Zone A) designation removed from the FEMA FIRM, flood hazard areas should be determined for the areas "downstream" of Sloan's Lake and included in the FHAD and MDP. If FEMA agrees to the removal of the Zone A designation, Denver will rely on the FLO-2D analysis to regulate areas where there are flood hazards. If FEMA does not remove the Zone A designation, Denver requests mapping of newly defined flood hazard areas as areas with a detailed study. In that case, Matrix would use HEC-RAS to define the flood hazard boundaries and BFE's. Some further discussion will be necessary to define the best presentation of flood hazard information developed using HEC-RAS if the decision from FEMA is to not allow removal of SFHA. It is appropriate that the FHAD be adopted by the State in either scenario. For a future PMR, the FHAD will be used, but with certain flood hazard areas identified for not being shown on the new FIRM. It is agreed that Matrix will incorporate all flood hazard mapping in the FHAD and MDP using results of a FLO-2D analysis and that there may be additional analysis and mapping using HEC-RAS, pending the decision from FEMA.
   c. Topography used for hydraulic analyses – was the surface used for hydraulic analysis created from the 2014 LiDAR point data or from contours? Matrix used the raw LiDAR point data for the FLO-2D analysis, but, the surface used to cut HEC-RAS cross sections was created from contours, not from the LiDAR point data. Contour data smoothes out some of the random variability (noise) in the topographic data. Denver expressed concern about the use of a surface created from contours, recognizing that the magnitude of the potential error may result in properties being mapped into or out of the flood hazard area. Denver pointed out that there is a potential error of as much as 1.5 feet. This is especially important in the urban areas of Denver, areas of shallow flooding, where much of the flooded area is less than 1 foot. UDFCD requested that Matrix compare the surfaces. A decision was not reached whether any changes will be made to address this issue. Agreement was reached that on future studies in Denver, surface creation will be based on LiDAR point data as standard procedure.

   d. Comments on the technical model to be coming to Matrix by the end of the year.
   e. It was agreed that all FHAD milestone submittals except the initial model and maps submittal (currently being reviewed by UD&FCD only) will be circulated for review/comment. The milestones are defined as a 5 step process on the UD&FCD "FHAD SUBMITTAL FORM."

2. **Data Gathering**
   a. Structure survey information – Matrix to send a request to UDFCD for structure survey
   b. Matrix may need manhole survey to determine pipe size

3. **Baseline Hydrology Comments made in the Alternatives Analysis Submittal**
   a. Future condition is approximately equal to existing condition. There is not an existing conditions model – only future fully developed conditions.
   b. CUHP 1.5.2b (current model) vs. 2.0 (most recent version). Matrix prepared a summary and the flows did go up slightly (approximately 4%). Options presented are to stay with the CUHP 1.5.2b, convert to 2.0, or switch in the middle of the study so the Concept Design is based upon 2.0. Matrix to provide the comparison table to Denver to review and advise whether the newer hydrologic model should be used.
   c. Reach 5 limits to edge of basin - North Dry Gulch spill. Spills from North Dry Gulch impact the area. 20th Avenue flows spill across the area since there is no curb and gutter. This area would be included in the FHAD, but may not be sent to FEMA. Run that portion of the model in 1.5.2.
   d. Comment on the hydrology flow figures, on whether they should be oriented low to high (left to right). Left to right stationing was used by Matrix (north arrow down). UDFCD wants the profile to match the map direction if the north arrow is up for the Conceptual Design.

4. **Water Quality**
   a. Hot spot analysis was presented in the Alternatives Analysis report, which was purely based upon water quality loading.
   b. BMPs in the tributary area are maintaining the detention capabilities and recreation opportunities into the lake
   c. Alternatives present a toolbox that each Stakeholder could use in hotspot areas. Selected plan only recommends large forebays at the Lake

5. **Alternatives Analysis Comments –**
   a. General –
      i. Mapping logistics, and overall readability. The mapping should be schematic at the alternatives analysis level.
      ii. Parcel acquisition costs are very approximate at this stage – use 2x the assessor's value plus 30% for relocation costs. Lakewood is using assessor's value plus 20%, plus relocation. No contingency on the computed acquisition fee. Easement acquisition should only be 1x the assessor's value plus 30% relocation.
      iii. Difficult to print portions of the large overall Alternatives Map. Can we add instructions on how to print at scale (similar process as the Concept Plan). Matrix to add to maps.
   a. SLD Reach 1
      a. 3 projects. 17th Avenue and Colfax. Costs are showing more for 5-year and less for the 100-year pipe. Note that the major drainageway should be designed for 100-year so there is not a need to consider a 5-year in this MDP. See the Denver Storm Drainage Master Plan for 5-year option.
      b. Minor storm (5-yr) analyzed separately as a part of Denver SDMP.
   b. SLD Reach 2
      a. No major comments
   c. SLD Reach 3

   a. Culvert crossings – over topping occurs at some of the crossings. Lakewood does not allow overtopping.
   b. Water quality: pre-treatment trash removal

d. SLD Reach 4
   a. Jefferson High School detention – located in Reach 5 but affects Reach 4. Detention is not in the baseline. Detention eliminates overtopping at Sheridan, Harlan and Depew.

e. SLD Reach 5
   a. Extend limits up to edge of basin at Dover St
   b. Open channel alternative from Vance to Wads on north side of 20th Ave
   c. Easement acquisition versus parcel acquisition. Existing channel now. Lakewood avoids acquisition and obtains an easement to improve the hydraulic capacity. The UD-COST spreadsheet can be modified in the notes to define an easement rather than acquisition. May be good to identify if there is redevelopment. Include an alternative of an open channel along 20th Avenue.
   d. Could consider detention at Jefferson High School. It helps with overtopping and pipe downsizing. Formalize the existing system for peak shaving. No water quality proposed due to existing land uses. Team recommends pursuing formalizing detention.

f. PST Reach 1
   a. No major comments
   b. FLO 2D analysis used for this reach
   c.

g. PST Reach 2
   a. No major comments

h. PST Reach 3
   a. Clarify limits of reach
   b. Detention alternatives at Teller/28th and Wads/29th . Hayworth Park is not a good location for detention. Matrix to contact Wheat Ridge GIS to see if they have better data on the existing storm pipe. Potential to combine 4 lots near 27th Avenue & Teller for detention. There are some vacant lots that have an easement encumbrance so they cannot be developed. It could also include water quality. Wheat Ridge Parks could take over management of a detention facility in this area.

i. ASD Reach 1
   a. No major comments

j. ASD Reach 2
   a. No major comments

k. GST Reach 1
   a. No major comments
   b. Richard-Hart Estate – storm drain outlet and water quality. Will not have a major impact for the 100-year, but is beneficial for the minor storm. There is no pipe in the area today. Wheat Ridge built the detention because of the opportunity with a Denver Water pipe.

l. Rocky Mountain Ditch disconnect for the 100-year system. Standalone alternative. Reduces the risk of the flood hazards. There is a UDFCD master plan specifically for this ditch.

m. Selected Plan
   a. Separate capital, acquisition, and O&M within narrative.

6. Schedule

APPROXIMATE SLOANS LAKE MDP & FHAD SCHEDULE					
	Draft / First	**Comments**	**Final/Second**	**Public Meetings**	**Selected Plan**
Baseline Hydrology Report	5/27/2016	6/27/2016	7/25/2016		
Alternatives Analysis	11/21/2016	12/5/2016	1/16/2017	January 2017	February 2017
Concept Design	3/20/2017	4/3/2017	4/10/2017		

FHAD Schedule:

1st Technical on floodplain modeling submittal	9/19/16
Comments on 1st technical submittal	December 2016
Resubmittal of floodplain model with floodway	February 2017
Comments on 2nd technical submittal	April 2017
Resubmittal of floodplain model and mapping	May 2017
Comments on 3rd technical submittal	June 2017
Resubmittal of floodplain model and mapping	July 2017

7. Public Meeting

   a. Hold at the Wheat Ridge City Hall
   b. One public meeting
   c. Format – 15 minute formal presentation, then
   d. 1 hour long meeting. Start at 6 or 6:30
   e. Tuesdays and Wednesday work best

8. Action Items

   a. UDFCD requested that Matrix compare the tin surfaces. Matrix to provide a fee for this additional work. Matrix to advise on whether to investigate a small demonstration area or the entire study area.
   b. Matrix to provide the Hydrology table comparison to Denver for review and to advise whether the newer hydrologic model (2.0) should be used.
   c. Matrix to advise of a fee to extend the floodplain limits for the North Dry Gulch spill. The contract was based upon the current limits of the floodplain, and this would be an extension of the floodplain model.
   d. Matrix to request structure survey by UDFCD
   e. UDFCD to send Matrix the new model for the spill from North Dry Gulch in CUHP 2.0.
   f. Matrix to contact Wheat Ridge GIS to see if they have better data on the existing storm pipe.
   g. Matrix to address comments, but do not publish a new report until the public meeting occurs.
   h. UDFCD to send out a Doodle poll to determine date of public meeting.
   i. Matrix to show refined preliminary floodplain
   j. Mark Westberg to check availability of a public meeting venue and work with Shea to make arrangements.

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DRAFT MEETING MINUTES
Sloan's Lake Drainageway and Tributaries
Major Drainageway Plan and Flood Hazard Area Delineation
Monday, May 15, 10:00am – 11:30am at UDFCD

Attendees:

Shea Thomas	UDFCD	303-455-6277	sthomas@udfcd.org
Terri Fead	UDFCD	303-455-6277	tfead@udfcd.org
Brooke Seymour	UDFCD	303-455-6277	bseymour@udfcd.org
Selena Klosowski	Denver Wastewater	303-446-3520	Selena.Klosowski@denvergov.org
David Morrisey	Denver PW	720-913-8518	David.morrisey@denvergov.org
Mark Westberg	Wheat Ridge	303-235-2863	mwestberg@ci.wheatridge.co.us
John Enochs	Edgewater – Diamondback Eng.	303-985-4204	johne@diamondbackeng.com
Terry Rogers	Lakewood	303-987-7934	TerRog@lakewood.org
Robert Krehbiel	Matrix Design Group	303-572-0200	robertk@matrixdesigngroup.com
Drew Beck	Matrix Design Group	303-572-0200	Drew_Beck@matrixdesigngroup.com
HungTeng Ho	Matrix Design Group	303-572-0200	hungteng_ho@matrixdesigngroup.com

1. **Selected Plan**
   a. Issued April 19, 2017
   b. Some modifications to the Recommended Plan
   c. Update baseline hydrology
   d. Wheat Ridge detention – 27th Ave and Teller St.
   e. LiDAR point data
   f. FLO 2D steady and unsteady
   g. UDFCD cannot pay for dredging Sloan's Lake because it does not impact flood control storage, which is the surcharge above the normal pool.

2. **Baseline Hydrology**
   a. Updated to CUHP from 1.5.2b to 2.0 (both using NOAA14) – flows increased slightly. Goal is to be current with other studies being completed at same time.
   b. Alternatives
      i. Open channels are sufficiently sized
      ii. Pipe size increases – typically 1 pipe size increase
      iii. Previously no improvements for these two locations:
         1. Wadsworth and 26th Ave detention – 23 cfs spills into the road. Outfall is 48" now. May need to go up a pipe size, or flow in the street. Or increase the volume of the facility, or raise the spillway.
         2. Sheridan Blvd culverts for main stem – 22 cfs spills over Sheridan and spills north. Could have a new low flow pipe to a forebay to gain the additional capacity.

3. **Wheat Ridge detention ("L" shaped site) – impractical**
   a. Not feasible to get the water to the site
   b. Too much slope to capture the flow

4. **LiDAR point data**
   a. Contours for delineation
   b. Point data used for all FLO2D (HEC-RAS using contour data)
   c. Does not affect Potential Inundation Areas

5. **FHAD – Matrix resubmittal May 15, 2017 (second submittal)**
   a. Difference between Shaded Zone X and Zone AO1. Shaded Zone X is non-regulatory showing the risk is higher than usual. Zone AO1 is regulatory by FEMA and gives the local community more opportunity to regulate development in the floodplain. Structures not required to obtain flood insurance in Shaded Zone X; if they obtain insurance it is a preferred risk policy. The average depth of flooding must be less than 1' to qualify for shaded zone X.
   b. Reach 1: FLO 2D – steady state. Grid size 20x20.
   c. Need to determine if area downstream of Sloan's Lake is a regulatory floodplain. Email stating FEMA may accept a Shaded Zone X (average depth less than 1.0 foot) to replace existing mapped floodplain.
   d. Denver could use two different delineations downstream of Sloan's Lake:
      i. Potential Inundation Area based upon unsteady state model
      ii. FEMA floodplain based upon steady state model.
   e. Shallow flooding east of Citizens Park may need shaded Zone X. UDFCD to review the area and comment.
   f. Flow splits
      i. Federal and 17th – north and straight east. Proposing 100-year pipe – upsize existing pipe.
      ii. Sheridan along main stem
      iii. Pierce from 22nd Avenue to 26th Avenue. Used FLO2D with 10x10 grid. Used lateral weir structure to model many spills.
      iv. Lakewood requested Shaded Zone X for shallow flooding so the City can regulate it.
      v. Ashland Tributary Reach 1 – all flow leaves 26th Avenue and flows south
      vi. Citizen's Park. No rating curve entered in FLO2D. Modeled for the flow split at Sheridan.
   g. Inundated structures
      i. Only updating count, not values since BCA will not significantly change
      ii. Mostly shallow flooding
   h. Floodways – only on the main stem (not on shallow split flows)
      i. The Wheat Ridge floodplains to be Shaded Zone X so no floodway
      ii. Not needed on shallow split flows.

6. **Anticipated Schedule** – Concept Design expected to be complete mid-July 2017, and adopted by the Board in August. FHAD may be later.

APPROXIMATE SLOANS LAKE MDP & FHAD SCHEDULE

	Draft / First	Comments	Final/Second	Public Meeting	Selected Plan
Baseline Hydrology Report	5/27/2016	6/27/2016	7/25/2016		
Alternatives Analysis	11/21/2016	12/5/2016	1/27/2017	January 2017	April 2017
Concept Design	6/13/2017	6/27/2017	7/4/2017		
FHAD	9/19/2016	March 2017	May 2017		

7. **Action Items**
   a. Matrix to look into the Detention Facility at 26th & Wadsworth. This hydrology is much lower than regulatory hydrology so it is surprising that the facility is overtopping. Matrix to compare design hydrology with this study hydrology.
   b. Municipalities to look at flow splits to determine how they want to regulate floodplains. No Shaded Zone X defined to-date. Communities need to decide if they want some of the floodplain mapping as Shaded Zone X.
   c. Matrix to note spelling of Wheat Ridge is two words.
   d. UDFCD to provide direction where floodways will be required.
   e. Matrix to start scheduling comments on the Draft Concept Design.
   f. Matrix to send Draft FHAD maps to Stakeholders along with these meeting minutes.

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MEETING MINUTES
Sloan's Lake Drainageway and Tributaries
Major Drainageway Plan and Flood Hazard Area Delineation
Monday, July 10, 1:30pm – 3:00pm at UDFCD

Attendees:

Shea Thomas	UDFCD	303-455-6277	sthomas@udfcd.org
Brooke Seymour	UDFCD	303-455-6277	bseymour@udfcd.org
Selena Klosowski	Denver Wastewater	303-446-3520	Selena.Klosowski@denvergov.org
Ashlee Grace	Denver Water Quality	720-865-3131	Ashlee.grace@denvergov.org
David Morrisey	Denver PW	720-913-8518	David.morrisey@denvergov.org
Mark Westberg	Wheat Ridge	303-235-2863	mwestberg@ci.wheatridge.co.us
Terry Rogers	Lakewood	303-987-7934	TerRog@lakewood.org
Robert Krehbiel	Matrix Design Group	303-572-0200	robertk@matrixdesigngroup.com
Drew Beck	Matrix Design Group	303-572-0200	Drew_Beck@matrixdesigngroup.com
HungTeng Ho	Matrix Design Group	303-572-0200	hungteng_ho@matrixdesigngroup.com

1. **Concept Plan Comments**
   a. Denver comments from previous submittal had not been transmitted to Matrix.
   b. Ashlee has water quality comments. Confusion as to how much water quality is addressed in the master plan. What is actually recommended for water quality? Don't typically include a detailed discussion of water quality, but Matrix had an evaluation approach for Denver that could be used on this watershed. The alternatives deal with flood control. No detailed conceptual design of water quality facilities. Discuss the regulatory reasons for water quality – MS4 compliance and Mayor's initiative of swimmable waterways. Water quality discussion in the conceptual design section of the report should refer back to the detailed analysis in the alternatives analysis.
   c. David Morrisey discussed pipe alignments in Federal to avoid deep cuts. Shift proposed pipe in the street. Look at other options to complete the storm pipe outfalls.
   d. Matrix to add some technical discussion on how the hydrology is spread over multiple cells int eh FLO 2D analysis.
   e. Matrix to remove all discussion related to PIAs and unsteady modeling.
   f. The minor overflow (10 cfs) that occurs at the Wadsworth and 26th Ave pond is caused by reduced capacity in the pond. If maintenance is performed then the overflow should be eliminated. Matrix to note in the narrative.
   g. This is likely the last meeting for the Master Plan portion of the study
   h. FHAD is on the second submittal.
   i. MDP comments versus FHAD comments
      i. How a structure is deemed inundated is will be included in the FHAD report. Structures identified as inundated in the MDP are only to support the BCR calculations. However, will add some narrative, especially about the flood depths less than 6-in.
   j. Number of structures in the floodplain
      i. Portions of the FLO-2D modeled floodplain west of Newton should be clipped out. This should reduce the number of structures down from 100 back to approximately 38
   k. Cost sharing
      i. The RCBC at Sheridan should be 50/50 cost share with Denver. CDOT could be potential partner and should be discussed in narrative.
      ii. Forebays at Sloan's Lake are regional facilities that benefit all stakeholders. Revise cost estimate accordingly.
      iii. Beef up the traffic control assumption for the Sheridan RCBC
      iv. The base LF costs for pipe assumes patch back only. Add costs for street reconstruction if the pipe/RCBC is going to impact at least half of the street. This mostly effects Reach 1.

   l. Cross check values
      i. Cross check quantities listed in the conceptual design of each reach with those listed in the cost estimate.
      ii. Cross check number of inundated structures in each reach.

2. **FHAD**
   a. FHAD is on the second submittal. Need to get comments back from UDFCD. Then submit floodway and 500-year
   b. Review status
      i. HEC-RAS review - COMPLETE
      ii. 100-yr delineation review – IN PROCESS
      iii. Floodway modeling & full delineation. (Recommend floodway for open channel portion only)
      iv. Full Review
      v. Final Review

3. **Schedule**
   a. Submit Final Concept Plan 7/31/17
   b. FHAD comments expected – 7/15/17??
      i. Approx. 2-week turnaround for floodway and 500-yr floodplain

4. **Action Items**
   a. UDFCD to send previous redlines from Denver to Matrix.
   b. UDFCD to provide comments on FHAD #2 submittal
   c. Shea to review content of the Executive Summary with Matrix to make it shorter without completely re-wording.
   d. Ask CDOT for structure report for
   e. Matrix to look to see if unsteady state model is in the budget.
   f. Bump up Reach 2 Water Quality costs per Selena and Cincere.
   g. Brooke to find out status of FHAD review.
   h. Setup a separate meeting to discuss FHAD questions after UDFCD returns comments to Matrix.

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MEETING MINUTES
Sloan's Lake Drainageway and Tributaries
Major Drainageway Plan and Flood Hazard Area Delineation
Wednesday, August 23, 1:30pm – 3:00pm at UDFCD

Attendees:

Shea Thomas	UDFCD	303-455-6277	sthomas@udfcd.org
Brooke Seymour	UDFCD	303-455-6277	bseymour@udfcd.org
Selena Klosowski	Denver Wastewater	303-446-3520	Selena.Klosowski@denvergov.org
Jeremy Hamer	Denver PW	720-913-0720	Jeremy.Hamer@denvergov.org
David Morrisey	Denver PW	720-913-8518	David.morrisey@denvergov.org
Mark Westberg	Wheat Ridge	303-235-2863	mwestberg@ci.wheatridge.co.us
Terry Rogers	Lakewood	303-987-7934	TerRog@lakewood.org
Robert Krehbiel	Matrix Design Group	303-572-0200	robertk@matrixdesigngroup.com
Drew Beck	Matrix Design Group	303-572-0200	Drew_Beck@matrixdesigngroup.com
HungTeng Ho	Matrix Design Group	303-572-0200	hungteng_ho@matrixdesigngroup.com

1. FHAD SUBMITTALS

1. Technical submittal - DONE
2. Mapping submittal – comments back (100-year model is done) (WHERE WE ARE NOW)
3. Floodway & 500-year & draft report (NEXT STEP)
4. Report and profiles
5. Final

2. FHAD

a. Review comments
   i. Gray St & 26th tributary storm drain effects. 36" pipe. Will full pipe capacity be used in a 10-year (flow is divided for 10-year) or 100-year? Will it all be intercepted. Assume water will get to pipe and be intercepted. Use engineer's judgement whether to divide flow into pipe. An issue for the 10-year model. Roughly 60 cfs in 1200 cfs flow.
   ii. BFE placement. WSE labels. A new option by FEMA. Can label just the cross section. Check with UDFCD for policy.
   iii. Hydraulic disconnects and shallow flooding. Two areas of concern. Few islands not connected to the drainageway floodplain. Shaded Zone X or AO. Specify depth of flooding in this report. Need to connect to main stem floodplain and label as shallow flooding. Look at outlet pipe and note whether there is a backwater effect.
   iv. Jefferson High School. Concrete wall not shown on mapping. Decision that water is confined by the walls.

b. Floodway limits for Reach 2
   i. Not currently a floodway defined (Zone A and Zone AE).
   ii. An encroachment issue.
   iii. Recommendation to have floodway for only the open channel reach.
   iv. Could just map floodway as the right-of-way.
   v. Beneficial to look at velocities and depths.

   vi. Lakewood – definitely want to create a floodway. Edgewater shares roadway so they would also get a floodway.
   vii. A particular concern east of Pierce and north of 20th. Boulder maps a high hazard area as the product of depth x velocity. High hazard within floodway. No redevelopment can occur. Target acquisition of properties in high hazard zone. Would require regulations for high hazard area.
   viii. 26th & Pierce. Keep minimum area open. Good to know if it can be confined to the street.
   ix. Better to go all or nothing with floodway.
   x. No floodway today. (if there is already a floodway, then must have a floodway)
   xi. Could map floodway, but not include in the FEMA package. Once it is on a FEMA floodplain map, then there will always be a floodway.
   xii. Denver can only regulate to FEMA maps.
   xiii. Cannot regulate to a lesser floodplain condition.
   xiv. Recommend Matrix map the floodway and decide later if want to submit floodway to FEMA.

c. Trim FLO-2D limits
   i. Denver: downstream of Sloan's Lake. 16th Avenue. Local flooding. Not from upstream drainage area. Compromise FEMA will not allow the complete deletion of a designated floodplain so a reasonable compromise is to change to a Shaded Zone X. Buy in from FEMA to remove Zone A and replace with Zone X (shaded) downstream of Sloan's Lake. Support information showing average depth is less than 1 foot across a cross section. Need to define where the floodplain ends. Colfax flooding is from area to the west – not Sloan's Lake. Intermingling flows. Take out 6-inch depth or less. Matrix to create a map and sponsors will comment on floodplain limits.
   ii. Lakewood: Map the full floodplain area – do not remove the area less than 6-inch depth.
   iii. Edgewater: Delineate and send out for comment.

3. Schedule

a. Submit Final Concept Plan after floodplain map accepted.
b. Address FHAD comments add floodway and 500-yr floodplain – 9/29/17

4. Action Items

a. Hold off on Concept Design Report until floodplain boundary established to be consistent on number of structures in the floodplain.
b. Recommend Matrix map the floodway and decide later if want to submit floodway to FEMA.

Emails

Extents of Floodway Delineation

Hung Teng Ho

From: Brooke Seymour <bseymour@udfcd.org>
Sent: Tuesday, October 17, 2017 2:09 PM
To: Drew Beck; Shea Thomas; Terri Fead; Terry Rogers; Mark Westberg; John Enochs (johne@diamondbackeng.com); Dan Maples
Cc: Robert Krehbiel; Hung Teng Ho
Subject: RE: Sloan's Lake Floodway

All:

I believe that we have reached a consensus to move forward with mapped floodways for Pierce Street Tributary 01, Sloan's Lake Drainageway (01) and Sloan's Lake Drainageway (02), while the remaining drainageways would not have a floodway on the FEMA map. At Lakewood's request, all drainageways within Lakewood will have floodway delineation in the FHAD, but only the drainageways mentioned above would have a floodway defined on the FEMA map.

Please let us know if you have any concerns with this approach.

Thank you,
Brooke

Brooke Seymour, P.E., CFM
Project Manager | Watershed Services
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
Protecting people, property, and the environment

From: Drew Beck [mailto:Drew_Beck@matrixdesigngroup.com]
Sent: Thursday, September 28, 2017 2:59 PM
To: Shea Thomas <sthomas@udfcd.org>; Brooke Seymour <bseymour@udfcd.org>; Terri Fead <tfead@udfcd.org>; Terry Rogers <TerRog@lakewood.org>; Mark Westberg <mwestberg@ci.wheatridge.co.us>; John Enochs (johne@diamondbackeng.com) <johne@diamondbackeng.com>; Dan Maples <dmaples@edgewaterco.com>
Cc: Robert Krehbiel <Robert_Krehbiel@matrixdesigngroup.com>; Hung Teng Ho <hungteng_ho@matrixdesigngroup.com>
Subject: Sloan's Lake Floodway

Team,
At our last meeting we discussed the next steps in the FHAD process which includes the delineation of a floodway. This is only pertinent to the tributaries upstream of the lake since it has already been determined that the area within Denver, downstream of the lake, will be designated as a shaded zone X (thus no floodway). We have prepared the attached exhibit which indicates overall risk of the tributaries as defined by the depth of flow multiplied by the velocity. The exhibit only reflects the risk within the "channel section", however I am also attaching a table which also indicates risk in the "overbank areas" which are generally described as outside the curb.
In order to be as efficient as possible we are recommending to complete floodway calculations for:

- Sloan's Lake Drainageway 1 and 2 because the channel risk is high and the overbank risk is generally medium. Both reaches include a well-defined channel by either the streets or the existing open swales (only a small portion passes through houses). In addition, these reaches are currently a regulated floodplain, though not as a floodway. [Effects Edgewater and Lakewood]
- Pierce St Tributary 1 because the channel risk is high [Edgewater]

We are not recommending a floodway for:

- Pierce St Tributary 2 because the channel risk is medium to low with minimal overbank flow. Furthermore, the flows are local flows only since the upstream detention basin is a 100-yr facility. Per the attached cross sections flood depths are wide and shallow. [Lakewood]
- Pierce St Tributary 3 because the channel risk is generally medium with minimal overbank flow. Furthermore, the flow in this area is only partially contained by curbs, thus flows spread out in multiple directions and are not contained in a typical channel type floodway as shown on the attached cross sections. [Lakewood and Wheat Ridge]
- Gray St Tributary because channel risk is medium to low with minimal overbank flows. Per the attached cross sections flood depths are wide and shallow. [Wheat Ridge]
- Ashland Drainageway 2 because channel risk is medium with minimal overbank flows. Per the attached cross sections flood depths are wide and shallow. [Edgewater and Wheat Ridge]

We are not recommending a floodway for Ashland Drainageway reach 1. However, Edgewater can certainly make the case that a floodway is warranted, even though it passes through homes in this reach, in order to help regulate. We could go either way on this reach.
Please respond if you agree with our recommendation or if you would like us to take a different direction.
Thanks.

Drew Beck, P.E., CFM
Deputy Director, Water Resources
Matrix Design Group, Inc.
1601 Blake St. , Suite 200 | Denver, CO 80202 | Office 303.572.0200 | Cell 303.803.7308
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Definition of Water Flood Intensity			
Flood Intensity	Maximum Depth (ft)	Logical Operation	Product of maximum depth h times maximum velocity v
High	4.918 ≤ h	OR	4.918 ≤ v*h
Medium	1.639 ≤ h < 4.918	OR	1.639 ≤ v*h < 4.918
Low	0.328 ≤ h < 1.639	AND	0.328 ≤ v*h < 1.639

Source: Swiss method (OFEE et al. 1997)

0 350 700
Feet

Wheat Ridge
Jefferson County (Unincorporated)
Edgewater
City & County of Denver

32Nd Ave
29Th Ave
26Th Ave
20Th Ave

Gray Street Tributary
Pierce Street Tributary (03)
Pierce Street Tributary (02)
Pierce Street Tributary (01)
Ashland Drainageway (02)
Ashland Drainageway (01)
Sloan's Lake Drainageway (02)
Sloan's Lake Drainageway (01)
Sloan's Lake

Wadsworth Blvd
Harlan St
Sheridan Blvd

Flood Intensity Level
- High
- Medium
- Low

FILE: G:\gis_projects\UDFCD_Sloans_Lake\active\apps\UDFCD_SL_Flood_Intensity.mxd, 9/14/2017, Andrea_Santoro

No.	DATE	DESCRIPTION	APPR.

Matrix DESIGN GROUP
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designed by:
drawn by: AS
checked by:
project no.: 16.155.026
date: 09/13/2017

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT, CITY AND COUNTY OF DENVER

MAJOR DRAINAGEWAY PLAN
SLOAN'S LAKE DRAINAGEWAY AND TRIBUTARIES

FLOOD INTENSITY

FIGURE X

Flood Hazard Intensity

River	Reach	River Station	Flood Intensity		
			Left Overbank	Channel	Right Overbank
Ashland Drainageway	Reach 01	5	NA	Medium	NA
		30	NA	Medium	Low
		58	NA	Medium	NA
		93	NA	Medium	NA
		197	NA	High	Low
		268	Low	High	NA
		368	NA	Medium	NA
		460	NA	Medium	NA
		535	NA	Medium	NA
		602	NA	Medium	NA
		671	NA	Medium	Low
		701	NA	Medium	Low
		738	NA	High	Low
		861	NA	High	NA
		929	NA	Medium	NA
		1150	Low	High	Low
		1355	Low	Medium	Low
		1481	NA	Medium	Low
		1595	NA	Medium	Low
		1724	NA	Medium	NA
		1912	Low	Medium	NA
		2067	NA	High	NA
		2152	Low	High	Low
		2351	NA	Medium	Medium
		2417	Low	Low	Medium
		2520	NA	High	Low
		2581	Low	Low	Medium
		2631	NA	Medium	Medium
		2703	NA	Medium	Low
		2781	Low	High	NA
		2842	Medium	Medium	Low
		2906	NA	Medium	NA
	Reach 02	3003	NA	High	NA
		3118	Low	Medium	Low
		3196	NA	Medium	Low
		3273	NA	Medium	NA
		3342	NA	Medium	Low
		3379	NA	High	Low
		3526	NA	High	NA
		3634	NA	High	NA
		3686	NA	High	Medium
		3764	NA	High	NA
		3847	NA	High	NA
		3879	NA	High	NA
		3952	NA	High	NA
		4000	NA	High	NA
		4058	NA	High	NA
		4097	NA	High	NA
		4235	NA	High	NA
		4279	NA	High	NA
		4341	NA	Medium	Low
		4382	NA	Medium	NA
		4591	NA	Medium	NA
		4791	NA	Medium	NA
		4990	NA	Medium	NA
		5192	NA	Medium	NA
		5479	NA	Medium	NA
		5841	NA	Medium	NA
		5890	NA	Medium	NA
		5891	NA	Medium	NA

River	Reach	River Station	Flood Intensity		
			Left Overbank	Channel	Right Overbank
Gray Street Tributary	Reach 01	261	NA	Medium	NA
		299	NA	Medium	NA
		477	NA	Medium	NA
		573	NA	Medium	NA
		737	NA	Medium	NA
		934	NA	Medium	NA
		1033	NA	Medium	NA
		1121	NA	High	Low
		1198	NA	Medium	Low
		1339	NA	Medium	Low
		1491	NA	Medium	NA
		1566	NA	Medium	Low
		1642	NA	Medium	Low
		1720	NA	Medium	NA
		1782	Low	Medium	Low
		1842	Low	Medium	NA
		1939	NA	Medium	NA
		2040	Low	Medium	NA
		2157	NA	Medium	NA
		2297	NA	Medium	NA
		2417	Low	Low	Medium
		2613	Low	Low	Low
		2791	NA	Medium	Low
		2862	Low	Medium	NA
		2952	NA	Low	Low
		3053	NA	Medium	NA
		3239	NA	Low	NA
		3341	NA	Medium	NA
		3398	NA	Low	NA
		3525	NA	Medium	NA
		3624	NA	Medium	NA
		3662	NA	Medium	NA
		3704	NA	Medium	NA
		3756	NA	Medium	NA
		3843	NA	Low	NA
		3972	NA	Low	NA
Pierce Street Tributary	Reach 01	156	NA	High	NA
		199	NA	High	NA
		244	NA	High	NA
		279	NA	High	NA
		351	NA	High	NA
		413	Low	High	NA
		663	NA	High	NA
		753	NA	High	NA
		827	NA	High	NA
		890	NA	High	NA
		975	Low	High	NA
		1032	NA	High	Low
		1096	NA	High	NA
		1267	NA	High	NA
		1388	NA	High	NA
		1452	NA	High	NA
		1539	NA	High	NA
		1611	Low	High	NA
		1706	Low	High	Low
		1780	Low	High	NA

River	Reach	River Station	Flood Intensity		
			Left Overbank	Channel	Right Overbank
Pierce Street Tributary	Reach 02	1973	NA	Low	NA
		2200	NA	Medium	NA
		2271	NA	Medium	NA
		2313	NA	Medium	NA
		2468	NA	Medium	NA
		2535	NA	Low	NA
		2561	NA	Medium	NA
		2588	NA	NA	NA
		2606	Low	Low	NA
		2691	NA	Medium	NA
		2777	Low	Low	NA
		2845	NA	Medium	NA
		2884	NA	Low	NA
		2930	NA	Low	NA
		3016	NA	Low	NA
		3105	NA	Medium	NA
		3163	NA	Medium	NA
		3220	NA	Medium	NA
		3301	NA	Medium	NA
		3403	NA	Medium	NA
		3449	NA	High	NA
		3501	NA	Low	NA
		3574	NA	Low	NA
		3629	NA	Medium	NA
		3659	NA	Low	NA
		3702	NA	NA	NA
		3721	NA	NA	NA
		3789	Medium	High	Medium
		4133	Medium	High	Medium
		4230	NA	Medium	NA
		4298	NA	Low	NA
		4305	NA	Medium	NA
		4323	NA	Low	NA
		4366	NA	Low	NA
		4401	NA	Medium	NA
		4481	NA	Low	NA
		4586	NA	Low	NA
		4836	NA	Low	NA
		5024	NA	NA	NA
		5082	Low	High	Low
		5128	Low	Medium	Low
		5169	NA	Medium	Low
		5220	Low	Medium	Low
		5282	Medium	High	NA
		5318	Low	Medium	Low
	Reach 03	76	Low	High	NA
		137	Low	High	NA
		228	Low	High	NA
		282	Low	Medium	NA
		343	Low	Medium	NA
		475	Low	Medium	NA
		615	Low	Medium	Low
		687	Low	Medium	NA
		755	Low	High	NA
		926	Low	High	NA
		1075	NA	High	NA
		1173	NA	High	NA
		1269	NA	High	Low
		1356	NA	High	Low
		1419	NA	High	Low
		1500	Low	High	NA
		1565	NA	Medium	NA
		1643	NA	Medium	NA
		1688	NA	Low	NA
		1754	NA	Medium	NA
		1832	Low	Low	NA
		1913	Low	Medium	NA
		1999	NA	Low	NA
		2108	NA	Medium	NA
		2189	Low	Low	NA
		2246	NA	Low	NA
		2348	NA	Medium	NA
		2413	NA	Medium	NA
		2487	NA	Medium	NA
		2605	NA	Medium	NA

River	Reach	River Station	Flood Intensity		
			Left Overbank	Channel	Right Overbank
Sloans Lake Main	Reach 01	7063	NA	Medium	NA
		7079	NA	Medium	NA
		10668	NA	Medium	NA
		11597	Low	High	Low
		11618	Low	High	Low
		11719	Low	High	NA
		11818	NA	High	Low
		11916	NA	High	NA
		12053	Medium	High	Low
		12098	NA	High	Low
		12154	NA	High	NA
		12233	High	High	Medium
		12280	Medium	High	Medium
		12508	Medium	High	Medium
		12588	Medium	High	High
		12718	Medium	High	Low
		12756	Medium	High	Medium
		12884	Medium	High	Medium
		12929	High	High	Low
		12960	High	High	High
		13001	High	High	Medium
		13114	Medium	High	Medium
		13175	Medium	High	Low
		13253	Medium	High	High
		13350	High	High	High
		13395	Medium	High	Medium
		13514	Medium	High	Medium
		13582	Low	High	Medium
		13722	Low	High	Medium
		13819	Low	High	Medium
		13934	Low	High	Medium
		13986	Medium	High	Medium
		14031	Low	High	Medium
		14132	Medium	High	Medium
		14333	Medium	High	Low
		14552	Medium	High	Medium
		14676	Medium	High	Low
		14750	Medium	High	Medium
		14873	Medium	High	Medium
		14945	Medium	High	Medium
		15111	Medium	High	Low
		15186	High	High	Medium
		15259	High	High	Medium
		15441	Medium	High	Medium
		15452	Medium	High	Medium
		15491	Low	High	Medium
		15504	Medium	High	Medium
		15563	Low	High	Medium
		15625	Medium	Medium	Medium
		15742	High	High	Low
		15862	Medium	High	Low
		15941	NA	High	NA
		16027	Low	High	NA
		16131	NA	High	NA
		16192	Medium	High	NA
		16287	NA	High	NA
		16348	Low	High	Low
		16455	NA	High	NA
		16520	Low	High	Low
		16611	Low	High	NA
		16681	Low	High	NA
		16734	NA	High	NA
		16836	Low	High	NA
		16904	NA	High	NA
		17012	Low	High	Low
		17115	NA	High	NA
		17194	Low	Medium	NA
		17324	Low	Medium	Medium
		17431	Medium	Medium	Medium
		17544	Low	High	Low
		17608	Medium	Medium	Medium
		17701	NA	High	Low
		17765	Medium	Medium	Medium
		17813	Medium	Medium	Medium
		17899	Low	High	NA
		17967	Low	Medium	Medium
		17996	Low	Medium	Low

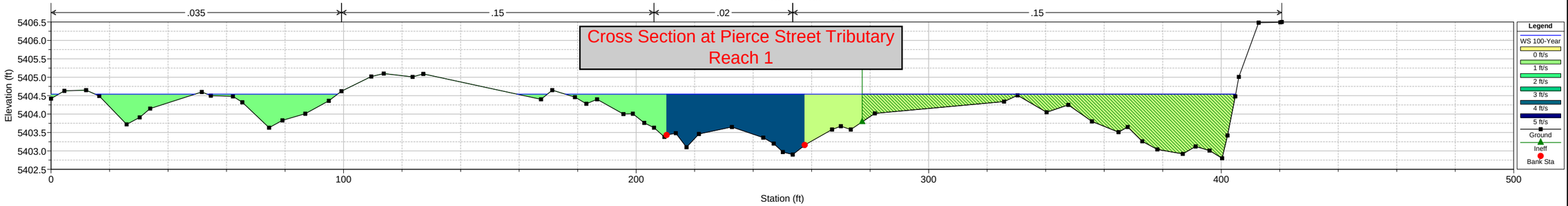
River	Reach	River Station	Flood Intensity		
			Left Overbank	Channel	Right Overbank
Sloan's Lake main	Reach 02	18024	Low	Medium	Low
		18053	NA	NA	NA
		18095	Medium	High	Medium
		18189	Medium	High	Medium
		18450	Medium	Medium	Medium
		18648	NA	Medium	Medium
		18706	NA	High	Medium
		18771	Low	High	Low
		18851	Low	Medium	Low
		19004	Low	High	Low
		19193	Medium	Medium	Low
		19295	Low	High	Low
		19324	Low	High	NA
		19378	Low	High	NA
		19441	Low	High	Medium
		19562	Medium	High	Medium
		19679	Low	High	Medium
		19736	Low	High	Medium
		19812	Medium	High	Medium
		19982	Medium	High	Medium
		20044	High	High	NA
		20112	Low	High	High
		20204	High	High	Low
		20259	High	High	Medium
		20419	Medium	Medium	Low
		20447	Medium	Medium	Medium
		20554	Medium	Medium	NA
		20644	Low	Medium	Low
		20689	NA	Medium	Low
		20709	NA	High	Low
		20740	Low	Medium	NA
		20831	NA	Medium	NA
		20873	Low	Medium	Low
		20904	Low	High	Low
		21068	Low	High	Low
		21127	NA	High	Medium
		21210	NA	High	Low
		21254	Low	High	NA
		21340	Low	High	NA
		21421	NA	High	NA
		21514	Low	Medium	Low
		21533	Medium	Medium	Low
		21549	Medium	Medium	Low

Definition of Water Flood Intensity			
Flood Intensity	Maximum Depth (ft)	Logical Operation	Product of maximum depth h times maximum velocity v
High	4.918 ≤ h	OR	4.918 ≤ v*h
Medium	1.639 ≤ h < 4.918	OR	1.639 ≤ v*h < 4.918
Low	0.328 ≤ h < 1.639	AND	0.328 ≤ v*h < 1.639

Source: Swiss method (OFEE et al. 1997)

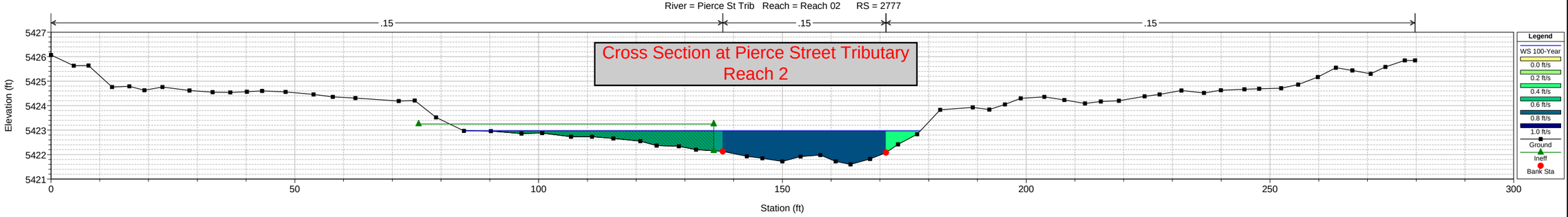
SloansLakeFHAD2017 Plan: Sloans Lake FHAD 2017_Floodplain 5/11/2017

River = Pierce St Trib Reach = Reach 01 RS = 1706



SloansLakeFHAD2017 Plan: Sloans Lake FHAD 2017_Floodplain 5/11/2017

River = Pierce St Trib Reach = Reach 02 RS = 2777

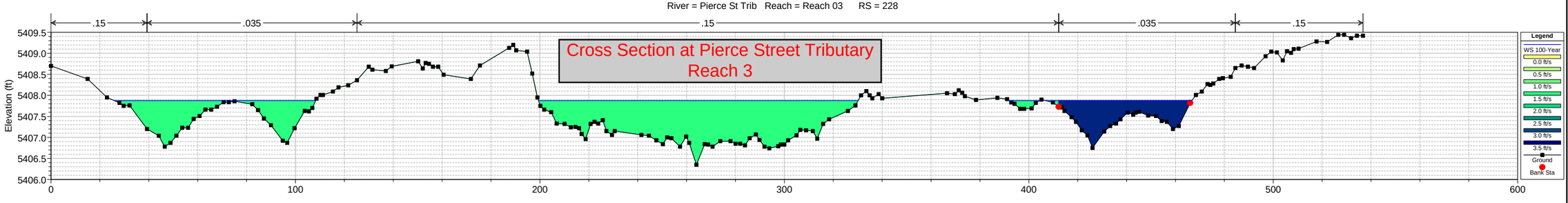


SloansLakeFHAD2017 Plan: Sloans Lake FHAD 2017_Floodplain 5/11/2017

Station (ft)

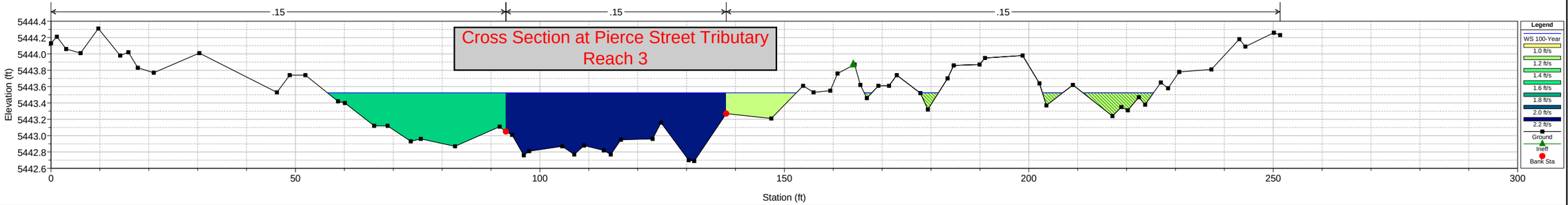
SloansLakeFHAD2017 Plan: Sloans Lake FHAD 2017_Floodplain 5/11/2017

River = Pierce St Trib Reach = Reach 03 RS = 228



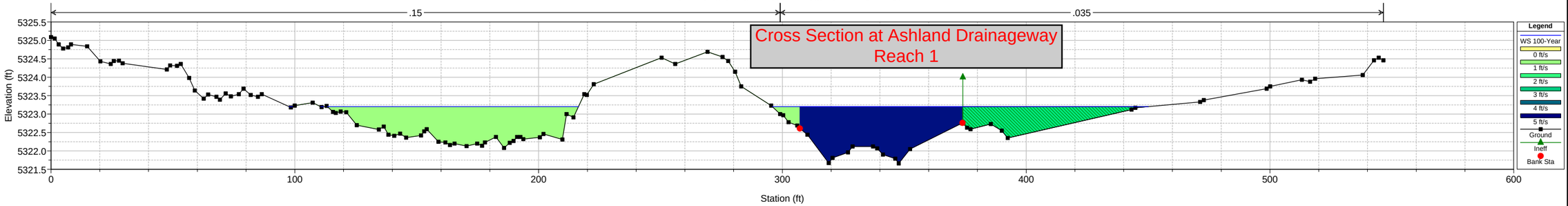
SloansLakeFHAD2017 Plan: Sloans Lake FHAD 2017_Floodplain 5/11/2017

River = Pierce St Trib Reach = Reach 03 RS = 1913



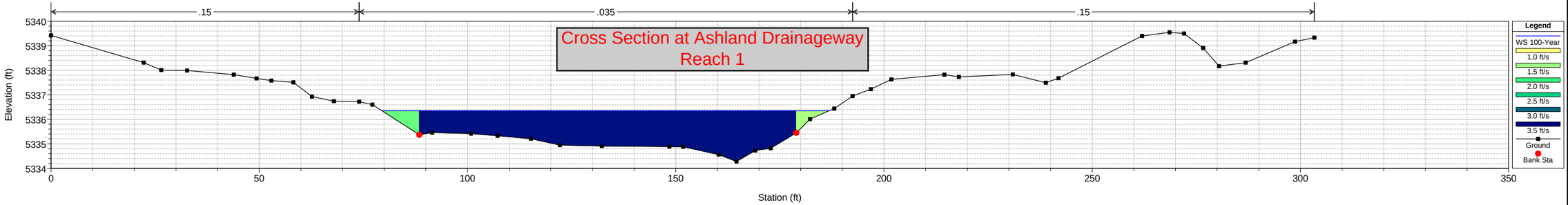
SloansLakeFHAD2017 Plan: Sloans Lake FHAD 2017_Floodplain 5/11/2017

River = Ashland Drain Reach = Reach 01 RS = 1150



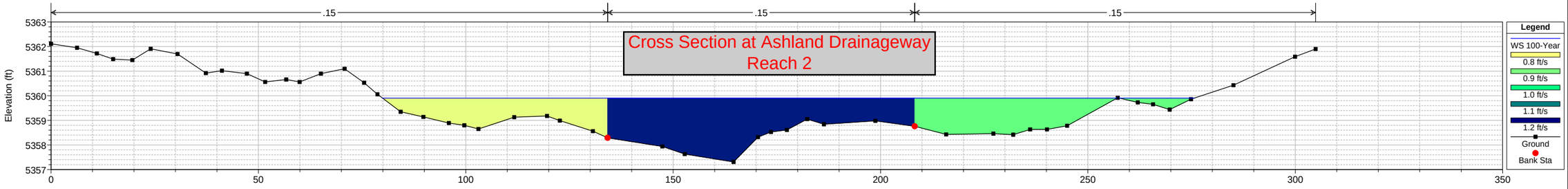
SloansLakeFHAD2017 Plan: Sloans Lake FHAD 2017_Floodplain 5/11/2017

River = Ashland Drain Reach = Reach 01 RS = 2152



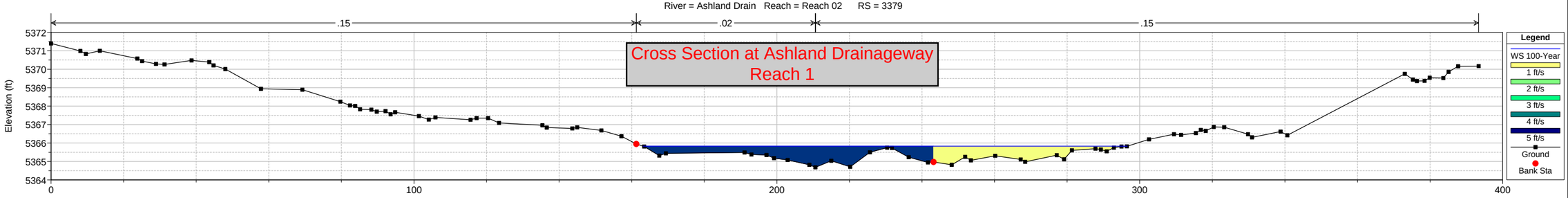
SloansLakeFHAD2017 Plan: Sloans Lake FHAD 2017_Floodplain 5/11/2017

River = Ashland Drain Reach = Reach 02 RS = 3118



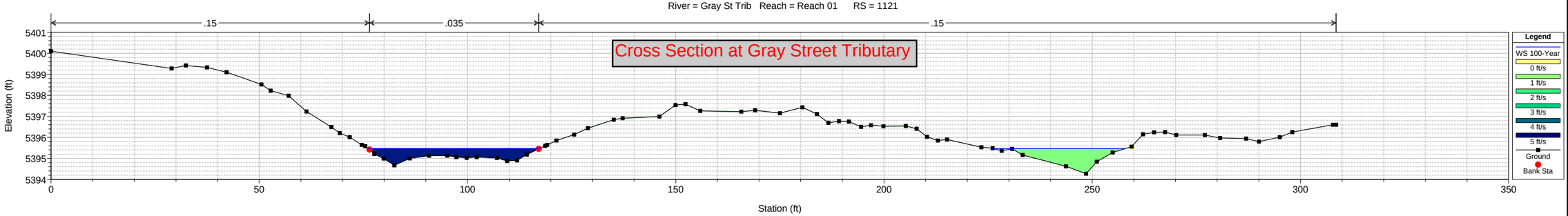
SloansLakeFHAD2017 Plan: Sloans Lake FHAD 2017_Floodplain 5/11/2017

River = Ashland Drain Reach = Reach 02 RS = 3379



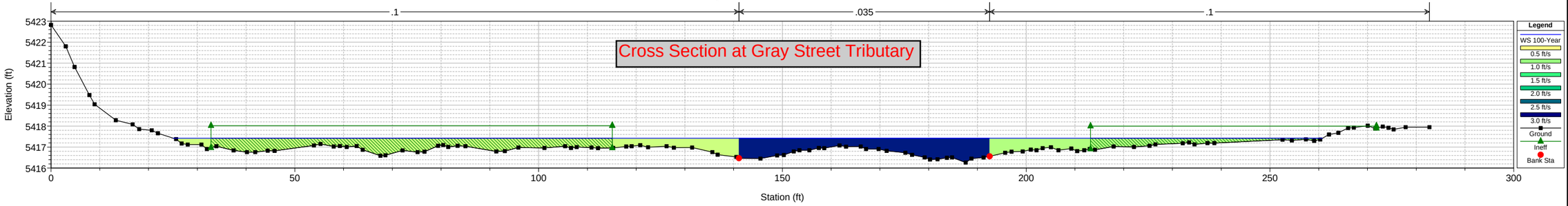
SloansLakeFHAD2017 Plan: Sloans Lake FHAD 2017_Floodplain 5/11/2017

River = Gray St Trib Reach = Reach 01 RS = 1121



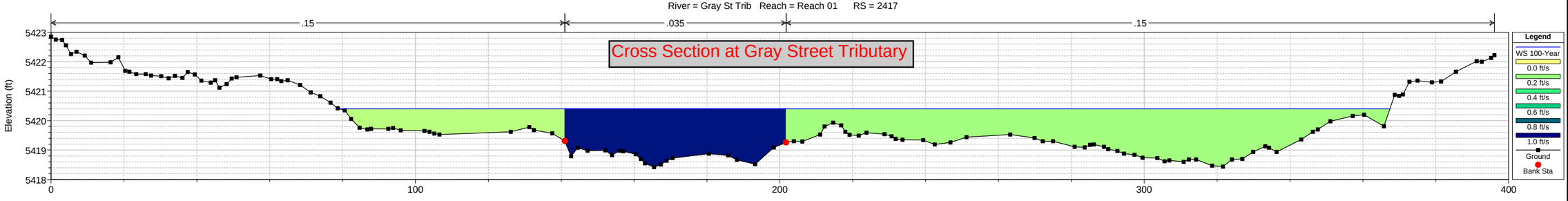
SloansLakeFHAD2017 Plan: Sloans Lake FHAD 2017_Floodplain 5/11/2017

River = Gray St Trib Reach = Reach 01 RS = 1782



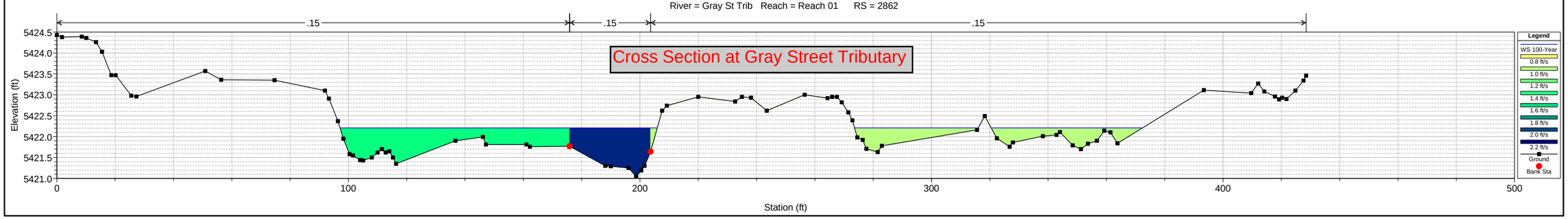
SloansLakeFHAD2017 Plan: Sloans Lake FHAD 2017_Floodplain 5/11/2017

River = Gray St Trib Reach = Reach 01 RS = 2417



SloansLakeFHAD2017 Plan: Sloans Lake FHAD 2017_Floodplain 5/11/2017

River = Gray St Trib Reach = Reach 01 RS = 2862



Review Comments _ 03-09-2017

1st Submittal _ Model Review

Appendix A – Project Correspondence

Responses to Comments on 03/09/2017
Flood Hazard Area Delineation _ Sloan's Lake

		Comments	Responses
General			
	1	Please ensure FLO-2D is run with a steady state condition to adequately estimate flow quantities, and major flow paths for modeling reaches. Once have good representation of velocity and depth information, Stakeholders will need to use the results to discuss priorities and potential flow paths.	1. A steady state condition FLO-2D model was prepared and ran with 8 hours of simulation time to insure that inadvertent detention has minimum to no impact on the flood volume. This steady state condition FLO-2D model adequately estimates the major flow path, flow diversion and flow quantity and was used as a guidance for calibrating the 1-D HEC-RAS model. 2. An unsteady state condition FLO-2D model was also prepared and ran with 6 hours of simulation time. The unsteady state condition FLO-2D model calculates a lower limit of flow distribution quantity which collabrates with flow discharges from the steady state condition model and sets a reasonable diversion flow discharge range. The weir coefficients of lateral structures were adjusted in the HEC-RAS model to closely replicate the diversion flow quantities from FLO-2D. 3. **Figure C-1** shows FLO-2D overland flow floodplain calculation, floodplain cross sections, and lateral structure locations from HEC-RAS model, flow direction and quantities for both steady state and unsteady state conditions. 4. The FLO-2D model enclosed in this submittal was used as a guidance for calculating diversion flow and cut cross sections for 1-D HEC-RAS model. This FLO-2D model encompasses bigger area and some hydraulic details of channel and detention were not included in the model, so, the result was not intended using for floodplain delineation downstream. The significant split flow on Sloan's Lake Main Channel at the Target Shopping Center and overtopping the Citizen Park Detention are not correct and the example due to lacking hydraulic details. 5. A final FLO-2D analysis will be prepared for shallow overland floodplain delineation through the City of Edgewater only. The final model will be trimmed to show only the study area.
	2	Typically, the hydraulic modeling accounts for the total flow along the main flow paths with the optimized discharges used to determine flood extents for spill reaches. Current modeling collectively removes discharges along main flow paths.	The revised hydraulic model run, *Sloans Lake FHAD 2017_Floodplain* , has hardwired discharges which accounts for the total flow along the main flow paths. Two other hydraulic model runs, *SL_FHAD_Flow Diversion_Ashland Drainage* & *SL_FHAD_Flow Diversion_Pierce St Trib* , calculate flow diversion with the optimized discharges to determine flood spill for each reach which are also included in the hydraulic model.
	3	Table C1 – Sloan's Lake Main Stem Reaches 01 and 02 appear reversed. Please verify.	Addressed
HEC-RAS Hydraulic Models			
	1	Once have flow information, please verify XS alignments and orientations – especially through developed areas; meet with UDFCD to discuss prior to extensive revisions.	The river centerline has been carefully re-aligned to avoid cutting through the buildings. The cross section alignments and orientations were revised using the overland floodplain information from FLO-2D calculation.
	2	Please verify optimized discharge values from Table C1 with HEC-RAS; and ensure hard-wired flows match optimized values (i.e., Sloan's Lake Main Stem XS 16416).	**Table C-2** shows the hardwired flow discharges which account the total flow in the main flow paths.
	3	There appear to be convergence issues for the optimized modeling. Please ensure the optimized feature results converge to obtain reasonable results.	Usually, the failing to converge issues for the optimized model are caused from zero flow at the upstream of lateral structure or minor inflow through an overly long lateral weir. To improve the stability of the hydraulic model, the lateral structure locations and lengths were carefully adjusted to achieve a stable convergence and replicate the diversion discharges from the FLO-2D calculation. Due to flow diversions between two distinctive flow systems, two hydraulic model runs, SL_FHAD_Flow Diversion_Ashland Drainage & SL_FHAD_Flow Diversion_Pierce St Trib, were set up and included in the hydraulic modeling as described below. 1. Plan Name: SL_FHAD_Flow Diversion_Ashland Drainage File Name: SloansLakeFHAD2017.p02 This plan was used to determine flow diversion on Pierce St Reach 03 and Ashland Drainageway Reach 01 & 02. The Flow Optimization at following lateral structures was checked to determine flow diversion. Pierce St Tributary Reach 03, Lateral Structure 470 Ashland Drainageway Reach 01, Lateral Structure 735 Ashland Drainageway Reach 02, Lateral Structure 4980 Ashland Drainageway Reach 02, Lateral Structure 5475 The Lateral Structure 4380 on Ashland Drainageway Reach 02 was unchecked due to no 10-, 50- and 100-year inflows from upstream. The 10-year flow optimization was failed at the Lateral Structure 4980 on Ashland Drainageway Reach 02 due to no 10-year inflow from upstream. 2. Plan Name: SL_FHAD_Flow Diversion_Pierce St Trib File Name: SloansLakeFHAD2017.p03 This plan was used to determine flow diversion on Pierce St Reach 01. The Flow Optimization at following lateral structures was checked to determine flow diversion. Pierce St Tributary Reach 01, Lateral Structure 750 Pierce St Tributary Reach 01, Lateral Structure 1095 Pierce St Tributary Reach 01, Lateral Structure 1535 Pierce St Tributary Reach 01, Lateral Structure 1770 The Lateral Structure 470 on Pierce St Tributary Reach 03 was unchecked due to account for the total flow along the main flow paths.
	4	Please verify entrance loss coefficients for culvert modeling; revise as necessary.	The entrance loss coefficients for culvert modeling were determined carefully based on the entrance conditions including headwall, wingwall and degrees of flare, with or without bevels.

Responses to Comments on 03/09/2017
Flood Hazard Area Delineation _ Sloan's Lake

Comments			Responses
	5	Please ensure XS IE data near all crossings reflects survey data.	The invert elevations near all crossings were checked and reflect the survey data or as-built plan wherever available and appropriate.
	6	Please verify that high n-values are warranted where used for entire XS (i.e., Gray Street Trib north of W. 29th Ave.). Also consider locations where using low n-value at street, but immediately d/s have significant development.	Checked and weighted Manning's n was used as appropriate.
	7	Please do not use n-value for paving less than 0.02.	Checked and lowest Manning's n of 0.02 was used for paved street.
	8	Please verify bank stations for all XSs; ensure stations include alignment and low area.	Checked and the stations include alignment and low area, however, there are some low areas in overbank were excluded in the stations due to not a realistic flow conveyance.
	9	Please verify flow change location on Ashland Drainageway Reach 02 for XS 4047 or XS 4328.	The flow change location was moved further upstream than the design point in the hydrologic analysis to more closely present the location where the majority of flow concentration happens.
Floodplain Work Map and Flood Profile			
General	**1**	Please use consistent labels for reaches between work map/model/GIS data.	The name of reaches have been revised consistently matching the reach designation in the MDP report.
	2	Ensure Ashland Tributary labeled.	Addressed
	3	Please investigate numerous discontinuities in floodplain prior to resubmittal.	This is a complete urbanized shallow flooding condition on a steep sloping terrain. The most flooding depths at overbank areas are less than 1-foot deep which increase the chance of discontinuities in floodplain while utilizing the automatic mapping method for floodplain delineation. The interpolated WSEs between the physical cross sections show lower than ground elevations are becoming a common situation. The density of cross section cut lines has been increased intensely in the revised hydraulic model to minimize the discontinuity in floodplain. The median reach length through the urbanized areas is approximately 78 feet with maximum reach length of 362 feet. However, there are some lingering discontinuities in floodplain which need engineering judgement and manually adjustment.
	4	Please review all XS locations and alignments (particularly through overland flow areas) once have accounted for appropriate flows, and results from steady state 2D modeling. XSs should cross perpendicular to stream alignment.	The cross section alignments and orientations were revised using the overland floodplain information from FLO-2D calculation. The cross sections are perpendicular to stream alignment at the most locations, however, there are some exceptions due to the river centerline curved dramatically to avoid cutting through major structures.
	5	In the City of Edgewater, please use steady state 2D analysis to help better define prominent flow paths.	The steady state 2D analysis was prepared in the City of Edgewater.
Ashland Drainageway	**6**	Ashland Drainageway around confluence with Gray St Tributary. Please review modeling (alignment, XSs location & orientation) in these areas, and revise as necessary. Please try to minimize alignment cutting through buildings where possible.	The river centerline has been carefully re-aligned to avoid cutting through the buildings and includes the low points. The cross section alignments and orientations were revised using the overland floodplain information from FLO-2D calculation.
	7	Ashland Drainageway Reach 1 from cross sections 1161 to 2132, Please review alignment to ensure following low points, and minimize cutting through buildings where possible.	
	8	Ashland Drainageway Reach 1 at Sheridan Blvd, Please review modeling here - revisions/additional XS needed?	Additional cross sections were added and cross section alignments have been revised.
	9	Ashland Drainageway Reach 2, review once have discharges.	The flood flow diversion into Ashland Tributary Reach 2 from Pierce Street Tributary Reach 3 at the intersection of Pierce St and 26th Avenue has be determined utilizing lateral structure in HEC-RAS model. The weir coefficient of 2.4 was used on Lateral structure at Pierce St and W 26th Ave to calibrate the diversion flows match FLO-2D flow diversion calculation. The majority of the diverted flows in W 26th Avenue will be diverted southwardly into City of Edgewater at Newland Street and Lamar Street and leaves nearly no flow continuing in W 26th Avenue to Reach 1 of Ashland Drainageway. **Figure C-1** shows results of the 100-year FLO-2D flow diversion calculation. **Table C-1** shows calculation for quantifying the 10-, 50- and 500-year diversion flows base on 100-year FLO-2D analysis.
Gray Street Tributary	**10**	Gray Street Tributary at north of 29th Avenue. Please review alignment and XSs, as requested elsewhere. Also review n-values here - development less dense.	The river centerline has been carefully re-aligned to avoid cutting through the buildings and includes the low points. The cross section alignments and orientations were revised using the overland floodplain information from FLO-2D calculation. Manning's n-values have been revised accordingly to the development.
Pierce Street Tributary	**11**	Pierce St Tributary 1 at cross section 251 & 320, Please review n-value for consistency with other paving areas/flow conditions.	Checked and Manning's n of 0.02 was used for asphalt pavement.
	12	Pierce St Tributary 2 at Wadsworth, Please ensure adequate transition from overland flow to pond area, IEFAs, n-value appropriateness; may need to either move XS 4400 slightly u/s or add a XS to transition from street to development.	Additional cross sections were added and cross section alignments have been revised to provide transition from development to street to detention.
	13	Pierce St Tributary 2 at Yarrow Street upstream, Please obstruct canals in XSs; verify areas of IEFA; review n-values.	The canal was obstructed in cross sections. Areas of IEFA and n-values have been reviewed and adjusted accordingly.
	14	Pierce St Tributary 2 from cross section 2198 to 2604, Please account for transitions between channel flow and overland flow. Please verify n-values for flow conditions.	Additional cross sections were added and cross section alignments have been revised to provide transition between channel flow and overland flow. Manning's n-values have been reviewed and revised accordingly.
	15	Pierce St Tributary 2, at outlet structure of Wadsworth Blvd and 26th Avenue detention, Please verify n-values used here. Please also verify modeling XSs and IEs through here. Weird profile - using rating curve for WSELs.	1. Manning's n-value of 0.02 was used at the concrete crest of spillway and 0.2 was used at the baffled spillway at the toe. 2. Detention at Wadsworth Blvd/26th Ave has 50-year of capacity and releases flow through a 48-inch storm system that was not modeled in HEC-RAS. During 100- and 500-year events, the excess runoff will overtops spillway which was modeled as open channel. Permanent IEFA was used to block flow area below the elevation of spillway. The known W.S.Es in the detention were determined from the rating curve in hydrologic calculation and used for setting up the internal changes in WSE.
	16	Pierce St Tributary 3, Same alignment/XS concerns as elsewhere from W. 25th Avenue to W. 27th Avenue.	The river centerline has been carefully re-aligned to avoid cutting through the buildings and includes the low points. The cross section alignments and orientations were revised using the overland floodplain information from FLO-2D calculation.

Responses to Comments on 03/09/2017
Flood Hazard Area Delineation _ Sloan's Lake

		Comments	Responses
	17	Pierce St Tributary 3. Fixing flows should help with floodplain discontinuities	Same as Item 3 above.
Sloan's Lake Main Drainageway	**18**	Sloan's Lake Main Reach 1 at Sloan's Lake. If using a rating curve for Sloan's Lake, please only have XSs at u/s and d/s ends with WSELs based on rating curve. Intermediate XSs are not helpful, and do not account for IEFAs - WSELs controlled by reservoir routing.	1. Cross sections through Sloan's Lake have been reviewed and removed the redundant cross sections. 2. At XS 7603, invert elevation was adjusted and set to equal the weir crest elevation of the outlet structure per LOMR Case No. 92-08-040P. 3. At XS 7603 & 7079, blocked obstruction was used to model the top of bike path at elevation of 5313.05 per LOMR Case No. 92-08-040P. 4. Invert elevations through Sloan's Lake were adjusted with surveyed invert elevation at the upstream pedestrian bridge. 5. Permanent IEFAs were used to represent the permanent wet pool elevation from XS 7079 through 12053. 6. The known W.S.Es in the detention were determined from the rating curve in hydrologic calculation and used for setting up the internal changes in WSE.
	19	Sloan's Lake Main Reach 1 at Sloan's Lake. Pedestrian Bridge, Even if not in model, include on profile based on survey data.	Two pedestrian Bridge at downstream and upstream of the lake, only the upstream pedestrian bridge was surveyed and coded in the HEC-RAS model.
	20	Sloan's Lake Main Reach 1 at XS 7080, Recommend have lake XSs reflect IEFA below embankment	Check and address
	21	Sloan's Lake Main Reach 1 at XS 12960, Not modeled? Insignificant? FLO-2D indicates potential flow split, but not accounted for in 1D model. Please verify 2D modeling here.	Driveway low flow crossing, 72"x15" rectangular opening which was insignificant and ignored in 1-D HEC-RAS model. The FLO-2D model is not intentionally used for this area because no details of channel and crossing structure were incorporated into the FLO-2D model.
	22	Sloan's Lake Main Reach 1 from XS 12718 to 13175, Please use survey data to assist in determining IEs through this reach.	No survey and as-built plan can be used.
	23	Sloan's Lake Main Reach 1 from XS 13934 to 15186, Please review and re-evaluate XS placement - especially through heavily urbanized areas; ensure enough XSs for transitions; please don't completely ignore roadways, etc. to ensure reasonable representation of flooding extents.	Checked and addressed
	24	Sloan's Lake Main Reach 1 from XS 15429 to 15663, Please ensure alignment follows low points, and please minimize running through structures.	
	25	Sloan's Lake Main Reach 1 from XS 15429 to 15663, Recommend capture crown of roadway; and also make provision for abrupt transition between overland flow and channel.	
	26	Sloan's Lake Main Reach 1 from XS 17085 to 17851, Please verify alignment follows low points (or other indicators), and please minimize running through structures.	
	27	Sloan's Lake Main Reach 2 at cross section 19276 & 19342, Crossing not modeled, please ensure capture crown of roadway with XS, and that IEs for XS either side correspond to survey data.	The 2-24-inch CMPs have been surveyed and incorporated into hydraulic model.
	28	Sloan's Lake Main Reach 2 at cross section 19276 & 19342, Is this still channel, or overland flow? If overland ensure have accounted for transitions.	
	29	Sloan's Lake Main Reach 2 at cross section 19967 & 20012, Please review modeling here to ensure enough XSs and appropriate locations to account for transition between overland flow and drop to channel. Recommend capture crown of roadway with a XS.	Checked and addressed
	30	Sloan's Lake Main Reach 2 at Jefferson High School, Please review XSs in this area and account for IEFAs. If not accounting for pond, consider IEFA below embankment (all XSs). Depressed area in ROB XS should be obstructed or permanent IEFA.	Checked and addressed
	31	Sloan's Lake Main Reach 2 at junction, Recommend adjust/add XS to capture crown of roadway	Checked and addressed
	32	Sloan's Lake Main Reach 2 at XS 20946 & 21029, Crossing? Add XS to capture high point?	CMP conspan was surveyed and added in hydraulic model.
	33	Sloan's Lake Main Reach 2 from XS 18802 to 19967, Please ensure that n-values are appropriate for heavily vegetated areas. Some concern with IEs for channels through heavy vegetated areas.	Checked and addressed
	34	Sloan's Lake Main Reach 2 from cross section 20293 to cross section 20723, Please verify alignment.	Checked and addressed

Review Comments 08-09-2017

2nd Submittal _ 100-year Floodplain Delineation

Responses to Comments on 08/08/2017
Flood Hazard Area Delineation _ Sloan's Lake

Comments			Responses
Hydraulics Review Comments			
	Previous Comment	Sloan's Lake Main Reach 2 at Jefferson High School, Please review XSs in this area and account for IEFAs. If not accounting for pond, consider IEFA below embankment (all XSs). Depressed area in ROB XS should be obstructed or permanent IEFA.	The delineation of 100-year floodplain between HCE-RAS cross section 18053, 18095, 18189 and 18450 at Jefferson High School was supplemented with as-built plan of Jefferson High School Detention Pond. A copy of the as-built plan "Upper Sloan's Lake Storm Drainage Project Schedule II" was included in Appendix C.
	Follow-up Comment	The Sloan's Lake Drainageway 1% Annual Chance floodplain does not follow the topography between Cross-sections 18450 and 18189. Additionally, cross-section 18189 would not contain the 1% A.C. floodplain if extended to the true floodplain limits. It currently terminates at a local high point on the north bank. This, in turn, may have implications for Pierce Street Tributary and/or shallow flooding areas between the two reaches.	
New Hydraulic Comments			
	1	It is unclear why the floodplain is delineated in an apparently disconnected area on the north overbank of Ashland Drainageway (cross-sections 4097-4235). Unless there is a hydraulic connection, such as via a drain pipe, this floodplain area should be removed. If removed, an explanation may be provided in the agreement table.	The left overbank ponding at cross sections 4235 and 4097 on Ashland Drainageway was removed from 100-year floodplain delineation and included in the 500-year floodplain. The left overbank ponding is a potential 100-year floodplain with an average flood depth less than one foot.
	2	Please review the contraction and expansion coefficients at Sloan's Lake Drainageway hydraulic cross-sections 11597, 11618, 11916, 12053, 13819, 17899, and 17967, and ensure appropriate contraction and expansion coefficients throughout the hydraulic model. Why increased contraction/expansion here? (UDFCD comment)	1. Cross sections 11597, 11618, 11916 and 12053 are the bounding cross sections for pedestrian bridge and Sheridan Blvd Culverts where the standard higher contraction/expansion coefficients have been revised to 0.3/0.5 to create more restrict hydraulic condition. 2. The high contraction/expansion coefficients of 0.3/0.8 were used to remove a deep dip on the 100-year flood profile at cross section 13819. 3. The higher contraction/expansion coefficients of 0.3/0.5 were used to represent the fast transition of flow areas through cross sections 17967, 17899 and 17813.
	3	It is not clear whether some flow subtractions attributed to underground conveyance in pipes would be possible to the extent currently modeled. For example, at cross-section 1642 of Gray Street Tributary, flow is divided for the 10% A.C. event, yet the entire discharge is subtracted at the cross-section downstream, which also shows a divided flow condition.	The division of 10-year flood flow is not likely true at cross section 1642 which has been proven with the updated HEC-RAS hydraulic model. The right overbank 10-year flow area at cross section 1642 was updated and modeled with IEFA. The 10-year floodplain is confined in the street with an average flood depth less than one foot. The extended cross section cutline to the far right overbank area is majorly for modeling the high flow condition. The assumption of flow subtraction has minimum impact on the 10-year floodplain because the 10-year floodplain was majorly street flow.
		Please check that the full capacity assumed for the pipe can actually be intercepted due to split flows. (UDFCD Comment)	
	4	The right overbank orientation of Ashland Drain cross-section 1595 appears to exaggerate the effective conveyance capacity of that portion of the cross-section. Please adjust this segment of the cross-section accordingly.	The cutline of Ashland Drain cross section 1595 has been revised per review comment.
	5	Some closed off areas, such as the right bank of Ashland Drainage Way cross-section 268, are currently modeled as effective conveyance. Please ensure that any areas that do not contribute to active conveyance in the direction of flow are modeled using ineffective flow areas or blocked obstructions.	The right overbank of Ashland Drainageway cross section 268 has very limited conveyance for 50- and 100-year events. The right overbank flow areas of 50- and 100-year have been updated and modeled as IEFA. A potential shallow flooding with an average depth less than 1 feet has been added to connect the right overbank floodplain to downstream cross section.
Agreement Checks and Work map Review			
	1	Cross-section distances appeared to match consistently between the model and map.	No action needed
	2	BFE placement did not appear to match at some locations, including but not necessarily limited to 1. Sloan's Lake Drainageway BFEs 5344, 5443, and 5450; along 2. Pierce St Tributary Reach 2 BFE 5475; along Pierce St Tributary Reach 3 BFE 5457; and along 3. Ashland Drainageway BFEs 5352 (shown only on left overbank) and 5351 (downstream of section 2781 on right overbank). Let's discuss the possibility of switching to WSEL labels at cross sections. (UDFCD comment)	Sloan's Lake Drainageway BFE 5344 has been located correctly at river station 14956 which was derived from the flood profile. No change was make to the BFE of 5344. The other placement of BFEs have been checked and revised accordingly. The placement of WSELs at cross section would be the best way to describe flood profiles on a floodplain map. Because the profile inflection points are always at where the cross sections are, and the WSELs were interpolated between cross sections. However, the whole foot BFEs were still used in this study.
	3	Floodplain extents did not match in some locations, including but not necessarily limited to Ashland Drainageway sections 4235 and 4097 (left overbank ponding should not be included in floodplain unless hydraulically connected with channel i.e.. by drain pipe), 3003 (see right bank), 2781, 2703, 2520, 58, and 30; and Sloan's Lake Drainageway _ sections 12154, 14676 and 14750 (if there is any hydraulic connection between channel and water quality pond, such as via backwater through drain pipe), and 16287 and 16348 (if there is any hydraulic connection between channel and water quality pond, such as via backwater through drain pipe). Where the delineation is determined reasonable and an explanation is necessary, please add the explanation to the agreement table.	*Ashland Drainageway* The left overbank ponding at cross sections 4235 and 4097 on Ashland Drainageway was removed from 100-year floodplain delineation and included in the 500-year floodplain. The left overbank ponding is a potential 100-year floodplain with an average flood depth less than one foot. The floodplain top width was manually adjusted to include right overbank shallow flooding continues from upstream at cross sections 3003, 2781, 2703 and 2520 on Ashland Drainageway. The floodplain top width was manually adjusted to include left overbank shallow flooding continues from upstream at cross sections 58 and 30 on Ashland Drainageway. The IEFA areas at right overbank show ponding water at west side to Sheridan Boulevard due to the barrier from roadway crown. *Sloan's Lake Drainageway* The floodplain top width at cross section 12154 on Sloan's Lake Drainageway was manually adjusted to include the potential left overbank flooding continues from upstream cross section. The right overbank ponding areas at cross section 14676 and 14750 on Sloan's Lake Drainageway were updated to be blocked in the HEC-RAS hydraulic model. The ponding area is not hydraulic connected to the flood flow and the average flood depth is less than one foot. The right overbank ponding areas at cross section 16287 and 16348 on Sloan's Lake Drainageway were updated to be blocked in the HEC-RAS hydraulic model. The ponding area is not likely hydraulic connected through drain pipe to the flood flow.

Review Comments 1-30-2018

3rd Submittal _ Floodway Model, 500-year Floodplain

Responses to Comments on 01/30/2018
Flood Hazard Area Delineation _ Sloan's Lake

Comments			Responses
Follow up on 2nd Submittal Review Comments			
Previous Comment	1	Sloan's Lake Main Reach 2 at Jefferson High School, Please review XSs in this area and account for IEFAs. If not accounting for pond, consider IEFA below embankment (all XSs). Depressed area in ROB XS should be obstructed or permanent IEFA.	Permanent IEFA has been added below the weir elevation. Previous comments also requested lateral IEFA, but these are irrelevant because the entire detention basin is delineated as floodway. These lateral IEFA have been removed because they were causing a rise within the detention area. Similarly, the weir elevation is 5397.55, but IEFA to this elevation caused a rise to occur within the detention basin. After trial and error with engineering judgement, it was determined that the vertical elevation for permanent IEFA should be 5397 to produce an even ponding depth within the detention facility.
Follow-up Comment	2	The Upper Sloan's Lake Storm Drainage Project as-built plans have been reviewed and do support the FHAD delineation. It is recommended that a comment be added to the Hec-RAS cross-section description to avoid future comments and direct future users to the appropriate information.	Add a note that as-built information is available into HEC-RAS cross section description.
New Hydraulic Comments (numbering corresponds to 8/8/17 response Excel table)			
	1	It is unclear why the floodplain is delineated in an apparently disconnected area on the north overbank of Ashland Drainageway (cross-sections 4097-4235). Unless there is a hydraulic connection, such as via a drain pipe, this floodplain area should be removed. If removed, an explanation may be provided in the agreement table. **Additional Comments:** It was documented in the 3rd submittal transmittal memo that "Shallow ponding (less than 1-foot average flow depth) was identified on the left overbank at River Stations 42+35 to 40+97 on Reach 2 of Ashland Drainageway. This area is not hydraulically connected with the main channel and shallow flooding is less than 1-foot, on average, during the 100-year event. As a result, this area was removed from the 100-year floodplain and included as a minimum flood hazard area in the 500-year floodplain." It was noted that the comment in the Agreement Table D-2 indicted that the LOB area should be considered as a possible shallow flooding area. There is no mention of the area being hydraulically disconnected. Please update the agreement table comment or update the floodplain mapping accordingly. If the area is not hydraulically connected then no shallow flooding delineation is needed. Also, note that the full comment is not shown in the pdf version of the table D-1 in the appendix. Please modify the table accordingly.	It was determined that the area is hydraulically disconnected so the shallow flooding delineation has been removed from the mapping. Comment that reflects the justification has been added to the Agreement Table.
	2	Please review the contraction and expansion coefficients at Sloan's Lake Drainageway hydraulic cross-sections ~~11597, 11618, 11916, 12053, 13819, 17899, and 17967~~, and ensure appropriate contraction and expansion coefficients throughout the hydraulic model. **Additional Comments:** Please review the contraction and expansion coefficients at Sloan's Lake Drainageway hydraulic cross-sections 13934. It is recommended that a contraction and expansion coefficient comment be added to the Hec-RAS cross-section description for section 13819 to assist future users. The 8/8/17 comment response indicates changes to section 17813. No changes are apparent.	1. Add comment "The high contraction/expansion coefficients of 0.3/0.8 were used to remove a deep dip on the 100-year flood profile at cross section 13819." to HEC-RAS cross section description. 3. The higher contraction/expansion coefficients of 0.3/0.5 has been changed to represent the fast transition of flow areas through cross sections 17813.
Agreement Checks and Work map Review			
	1	2. For future BFE placement, UDFCD is in support of placing BFEs at cross sections and utilizing supplemental BFE lines as needed to depict distinct breaks in the channel HGLs.	No action needed
	2	Floodplain extents did not match in some locations, including but not necessarily limited to Ashland Drainageway sections 3003 (see right bank); and Sloan's Lake Drainageway sections 16287 and 16348 (if there is any hydraulic connection between channel and water quality pond, such as via backwater through drain pipe). **Additional Comments:** Perhaps additional cross section or floodplain delineation consideration is needed in the area of the Ashland 3003 ROB upstream area. Also, please consider hydraulic connection for the ROB pond near Sloan's 16287. Would the storm sewer surcharge into the pond? **Additional Comment:** Please verify that the floodplain mapping width and the model width meets the project requirements of being within 25 feet of each other or 5% Map width (whichever is greatest), or that an appropriate explanation is added to the Agreement table. **Additional Comment:** Note that the overland spill discussions presented by Matrix in the 12/19/17 transmittal memo for Sloan's Lake Drainageway in the area of section 20419, as well as Ashland Drainageway in the area of Citizen Park have been presented to the local governments for consideration.	For XS 3003, the 2-foot topographic contours were indicating that between cross sections spilling could occur, hence the inquiry into additional cross sections. However, upon further consideration of the flood profile, the floodplain delineation has been revised to match the model results. For XS 16287, the adjacent WQ pond was initially shown as part of the floodplain, then later removed based upon comments. Yes, the WQ pond is hydraulically connected, so the basin has been included in the floodplain delineation. Will double check floodplain mapping meets UDFCD DFHAD guideline. For XS 20419, Lakewood has directed that the floodplain delineation will continue down the street. For Ashland Drainageway in the area of Citizen Park, the depth of potential 100-year shallow flooding was estimated to be less than 1-foot but more than 6-inch. The area was shown as shallow flooding with average flood depth less than one-foot on the FHAD.
3rd Submittal Review Comments			
Modeling Approach Comments			
	1	Ashland section 3764. Should an IEFA be utilized on the LOB similar to the upstream section?	Add IEFA at the LOB
	2	Ashland section 3118. Should an IEFA be utilized on the far ROB?	Add IEFA at the far ROB

Responses to Comments on 01/30/2018
Flood Hazard Area Delineation _ Sloan's Lake

		Comments	Responses
	3	Ashland section 2581. Should an IEFA or OB be utilized on the LOB similar to the upstream approach? Also, should the far ROB be IEFA?	Add IEFA at the LOB and add IEFA at the far ROB
	4	Sloan's 20447 and 20419. What is the purpose of the IEFA on the far ROB? Consider the use of an IEFA at downstream sections for the 500-yr modeling if an IEFA is needed here. Maybe the IEFA should be moved to the crown of the road?	This is a potential flow split location. The flood flow in 20th Avenue will be barred by curb and roadway crown causing it to flow east. However, due to the shallow flow condition and the 100-, 500-year flows do not appear at ROB of the downstream cross section 20259, the IEFAs were used at ROB of cross section 20447 and 20419 to represent the discontinued flow condition, conservatively.
	5	Sloan's 1. A raised IEFA is shown at section 16027 and 16192 on the LOB. It is thought that this is for the 500-yr modeling and is intended to represent a flow contraction toward section 15941. Should this same approach be applied to section 16131?	We concur. IEFA was added in the LOB of cross section 16131 for the 500-year.
	6	Sloan's 1. Should Sheridan Blvd be shown as overtopping between 12053 and 11916?	Only 22 cfs in the 100-year will not pass through the culvert, but will be contained within the curb & gutter (no overtopping in the 100-year). In the 500-year flood, overtopping of Sheridan will occur. The 500-year delineation has been revised accordingly.
GIS File Comments			
	1	Please ensure that the WSEL attributes of the GIS cross sections are correct. Specifically, the upper portions of Pierce Street Tributary Reach 2 do not appear to match the modeling or agreement tables.	We will re-run the geo-ras and republish the floodplain maps.
Floodway Comments			
		It is preferred that there are no negative (regardless of significant digit rounding) HGL delta for the Floodway runs. o Sloan's 18024-17967. If the ROB encroachment is partially expanded to the right will the negative HGL delta be corrected? If not keep current delineation. o Sloan's 16455. If the ROB encroachment for the surrounding cross sections is eliminated does this correct the negative HGL delta? If not keep current delineation.	We are very aware that negative surcharges exist. However, we have already spent many hours trying to remove the negative surcharges for the floodway modeling and have not been able to eliminate them.
Floodway Mapping			
	1	Sloan's section 20419. The Map does not match the LOB encroachment. Should LOB encroachment be modified to match the map? This would make for a smooth FW.	We are not able to smooth out the floodway in the model. The horizontal difference is 3.5 feet between the model and the map, however, we have revised the model to match the map.
	2	Pierce 2. Section 2200. The FW limits indicate minor encroachment on LOB. The model does not reflect this. Revise as needed.	We concur. We have revised the floodway mapping to remove the 0.2' discrepancy to match the model in the LOB.
	3	Pierce 2. Section 3105 & 3220. The FW limits indicate encroachment on ROB. The model does not reflect this. Revise as needed.	We concur. We have revise the floodway and floodplain mapping as appropriate.
	4	Pierce 2. Section 3403. The Model limits indicate encroachment on LOB. The map does not reflect this. Revise as needed.	We concur. We have revise the floodway mapping in the LOB to reflect the encroachment.
	5	Please verify that the Floodway limits are inside of the Floodplain limits. This primarily applies to Pierce 2.	We concur. The Floodway limits have been verified to be equal to or inside the Floodplain limits.
500-yr Mapping and General Comments			
	1	Sloan's 2. Verify the 500-yr delineation in the far ROB from 21549 to 21533. Should floodplain be to the north of the current delineation?	We concur. The 500-year delineation has been revised accordingly.
	2	Sloan's 2. Verify the 500-yr delineation in the ROB from 21068 to 20873. Should limits enter road d/s of 21068 and match model at 20904? The mapped floodplain on the ROB at section 20904 and 20873 seem to be too far south.	We concur. We have revised 500-year floodplain boundary per review comment.
	3	Sloan's 1. Should Sheridan Blvd be shown as overtopping between 12053 and 11916? This comment applies to both the 100-yr and 500-yr delineations.	Only 22 cfs in the 100-year will not pass through the culvert, but will be contained within the curb & gutter (no overtopping in the 100-year). In the 500-year flood, overtopping of Sheridan will occur. The 500-year delineation has been revised accordingly.
	4	Ashland between 2906 and 2520. Should see 500-yr beyond limits of 100-yr in the ROB island area.	We concur. We have revise 500-year floodplain to beyond the limits of 100-year floodplain.
	5	Pierce 3. What are island lines on the 500-yr layer between sections 475 and 78? Should 500-yr hatch be trimmed?	We concur. We have trimmed the 500-year hatch.
	6	Pierce 2. The upper portions of the delineation do not closely match the Hec-RAS extents. See 5082 through 4481.	We concur. The 500-year delineation has been revised accordingly.
	7	The work maps in the FHAD appendix do not seem to reflect 500-yr information for the FLO-2D modeling areas. Was a FLO-2D run for the 500-yr storm?	We concur. The 500-year FLO-2D floodplain delineation in the City of Edgewater was added in the floodplain mapping. The 100-year FLO-2D floodplain delineation in the City of Lakewood is proposed to be included on the FHAD for City's regulatory information only and project sponsor agreed no need for 500-year FLO-2D floodplain.
	8	Please note that the work maps in the FHAD appendix show multiple structures as being inundated. However, the structures do not appear to be in a floodplain that is depicted on the work maps. Please revise the line work as needed.	We concur. We are reviewing the inundation of structures and removed the structures that do not appear to be in a floodplain.

Review Comments 7-6-2018

4th Submittal _ Full Review

Responses to Comments on 07/06/2018
Flood Hazard Area Delineation _ Sloan's Lake Drainageway and Tributaries

Comments			Responses
Follow up on 2nd Submittal Review Comments			
Follow-up Comment	1	2. For future BFE placement UDFCD is in support of placing BFEs at cross sections and utilizing BFE lines as needed to depict distinct breaks in the channel HGLs. a. The previous comment regarding the BFEs was intended to see the work map for this project updated with BFE labeling added at the cross section lines and the BFE lines mostly removed from the work map. It is anticipated that some BFE linework would remain on the map to indicate distinct breaks in the HGL. These distinct breaks would primarily occur at ponding areas or near roadway embankments.	We concur. The work maps have been updated with BFE labeling added at the cross section lines and the BFE lines mostly removed from the work map. Some BFE lineworks were remained on the map to indicate distinct breaks in the HGL.
Follow up on 3rd Submittal Review Comments			
Modeling Approach Comments	2	3. Ashland section 2581. Should an IEFA or OB be utilized on the LOB similar to the upstream approach? Also, should the far ROB be IEFA? a. The added LOB IEFA does not cover the 500-yr floodplain.	We conur. The LOB IEFA has been adjusted to cover 500-year floodplain. Cross-section cutline has been revised and extended accordingly at ROB to contain the 500-year floodplain.
	3	4. Sloan's 20447 and 20419. What is the purpose of the IEFA on the far ROB? Consider the use of an IEFA at downstream sections for the 500-yr modeling if an IEFA is needed here. Maybe the IEFA should be moved to the crown of the road? a. The 20447 and 20419 approach for the modeling should be the consistent in the ROB for sections 20259 and 20204.	We concur. The same modeling approach for 500-year at ROB has been applied at cross-section 20259 and 20204.
500-yr Mapping and General Comments	4	4. Ashland between 2906 and 2520. Should see 500-yr beyond limits of 100-yr in the ROB island area. a. Please verify the 500-yr limits in the ROB island of Ashland 2906 to 2520. Section 2842 specifically appears to need updating.	We concur. The 500-yr limits in the ROB island of Ashland 2906 to 2520 has been revised to match model output
	5	5. Pierce 3. What are island lines on the 500-yr layer between sections 475 and 78? Should 500-yr hatch be trimmed? a. The islands for reach Pierce 3 have not been addressed.	We concur. The 500-year hatches have been trimmed.
	6	7. The work maps in the FHAD appendix do not seem to reflect 500-yr information for the FLO-2D modeling areas. Was a FLO-2D run for the 500-yr storm? a. The 500-yr FLO-2D model has not been provided for review.	The 500-year FLO-2D model has been included as a part of the 5th Submitttal.
Denver Comments from 3rd Review.	7	Is the name of the 1st reach on the agreement table correct? Note that the reach does not extend to Pierce Street.	The names of river reach are not necessary the same as the names of hydraulic reach defined in the HEC-RAS hydraulic model. However, the names have been revised to avoid the confusion.
4th Submittal Review Comments			
Report Comments			
	1	1. It is recommended that the report be given a through qa/qc process. UDFCD suggestions have been provided via a pdf with comments.	We concur. Comments have been incorporated into the report.
	2	2. Cover: a. Similar to the header in the body of the report, please add "& Tributaries" to the name of the study. This comment should apply to other sections of the study as well. b. The Lakewood logo on the cover needs improvement.	2. Cover: a. Addressed. b. The Lakewood logo has been replaced.
	3	Note that the final version of the study will require a PE seal on the transmittal letter	PE stamps will be included.
	4	In the transmittal letter please list the version of the FLO-2D	The Version of FLO-2D Pro has been added.
	5	5. Table of Contents: a. Please verify that the naming scheme in the TOC matches the actual document. b. Apdx B. Is EPA SWMM 5.0 or 5.1 used? This comment should be applied to the entire document. c. Apdx D. There is no Table D-2. There is D-3 d. Apdx D. Name in Apdx does not match e. Apdx E. No Figure E-2 f. Apdx G and H. The maps and profiles are not labeled with a G or H identification.	5. Table of Contents: a. Reivewed and addressed. b. EPA SWMM 5.1 used. c.Rename Tabel D-3 to Table D-2. d. Reviewed and revised. e. Added Figure E-2 f. Rename the flood maps and Profiles.

Responses to Comments on 07/06/2018
Flood Hazard Area Delineation _ Sloan's Lake Drainageway and Tributaries

		Comments	Responses
	6	6. List of Figures: a. Verify all names. Specifically 2-4, 2-6, 4-1, & 4-2 b. Figure 5-1 and 5-2 are missing	6. List of Figures: a. Reviewed and revised. b. Remove Figure 5-1 and 5-2 which are not parts of this FHAD.
	7	7. List of Tables: a. Table B-3 name b. For tables that occur on multiple sheets please add a page number and a total set page number (1/3…3/3). This same comment also applies to figures that occur on multiple sheets (Fig B-2)	7. List of Tables: a. Table B-3 name has been renamed. b. Page number and a total set page number has been added.
	8	8. Reach Map (Fig 2-3) does not show linework for GST Reach 1. Also the UDFCD Logo is missing. This also applies to the MDP.	We concur. Figure 2-3 has been updated.
	9	9. Figure 2-4. What does the name “Current Floodplain Map” indicate? This will be viewed in the future by others and possibly after other modifications. Please add more description to the name or rename.	We concur. Figure 2-4 has been renamed to be "REGULATORY AND NON-REGULATORY FLOODPLAIN MAP".
	10	10. Section 2.3 Reach Description. Please add the name of the drainageway for the reach description. In addition, all the reaches should be related to the naming scheme introduced in Figure 2-3.	We conur. The reach names in Section 2.3 have been revised to be related to the naming scheme introduced in Figure 2-3
	11	11. For figures 2-5 through 2-19 please add the drainageway reach to the pictures. Some pictures do not appear to be aligned with their respective reaches.	We concur. The sentence has been revised to be more clear.
	12	12. Report Section 2.5 Environmental Assessment. It is discussed that wetlands are present around Sloan’s Lake. This is not evident on Figure E-1 due to the drawing scale. A blow up of the area, additional figures, or a note are is needed.	The National Wetland Inventory database does not include wetlands around Sloan's Lake. Since the figure represents the National Wetland Inventory database, we did not edit the figure. However, we made edits to the text to note the potential presence of wetlands along the bank.
	13	13. Section 2.5 references Figure E-2. This does not exist.	Figure E-2 has been added.
	14	14. For the Major Crossing summary table, please refer to the marked up report which has been provided by UDFCD. Of primary concern is that some of the listed structure sizes do not match the project hec-ras modeling. Please verify culvert sizes throughout the report. Also, please list the upstream and downstream limits of culverts listed in this table.	We concur. Table 2 1 Sloan’s Lake Basin Major Crossing Structure Inventory has been revised to provide correct culvert sizes and upstream and downstream limits of the culverts.
	15	15. Please add 500-yr storm information to the hydrology discussion.	We concur. The 500-year storm information have been added in hydrology section.
	16	16. For Table 3-5, please show the % difference between the two studies.	We concur. % differences between the two studies have been added.
	17	17. See FLO-2D discussion in the Hydraulics section. Also, please specify the build version of FLO-2D.	We concur. The Version of FLO-2D Pro has been added. The FLO-2D discussion in the hydraulic section has been revised.
	18	18. Figure 4-1. Note that the drainageway and floodplain information on this figure are difficult to see. Also, please ensure that floodplain information shown on this figure is correct (inundated structures).	Figure 4-1 focuses on providing information of the extends of flood hazard study and hydraulic methods used. The floodplain and inundated structures are supplementary. Please see floodplain work map for detailed information.
	19	19. Verify culvert sizes in Figure 4-2 and Table 4-3.	We concur. The culvert sizes have been reviewed and revised in Figure 4-2 and Table 4-3.
	20	20. Section 4-2 does not match with Table 4-4 information. Please verify Table 4-4 numbers. Do the Table 4-4 updated values match the recently completed master plan?	We concur. The information in Table 4-4 is up-to-date. Section 4-2 has been revised to match Table 4-4.
Profiles			
	1	Remove “Digital” from the figure name. Add “and Tributaries” to the name.	Addressed.
	2	Verify that the Legend matches the linetypes used. The 500yr and 50-yr WSEL in the Legend do not match the profiles.	Addressed.
	3	Check stream distance notes at the beginning of Pierce Street and Sloan’s Lake profiles.	Addressed.
	4	Sloan’s Lake: A major culvert runs from Reed to Ingalls. Please add a note to the profile indicate the presence and approximate limits of the system.	We concur. The note to indicate the limits of the system have been added.
	5	Sloan’s Lake: Please specify the location that the Pierce Street Tributary joins the profile.	Note added.
	6	Sloan’s Lake: Please identify the office hallway bridge in the profile. It appears to be drawn in the profile.	Note added.
	7	Pierce St Trib 1&2, & 3: Extend Profiles to station 0+00	Addressed.
	8	Pierce St Trib 1&2. Change note to Q10 and Q50 Contained in Storm Drainage System.	Note changed.
	9	Pierce St Trib 1&2 Sta 4200 to 5000. The Q50 WSEL is shown on the profile despite the note stating that the flows are in the storm system. Also, note that the reported Q50 is 0 cfs. Please verify the flows and/or the hgl.	Q50 WSEL has been removed from the profile.
	10	Ashland Drain title should be listed as Ashland Drainageway on the Ashland profile, the confluence note on the Gray profile, and the stream distance note on the Gray profile.	Addressed.
	11	Extend Gray profile to station 0+00.	Addressed.

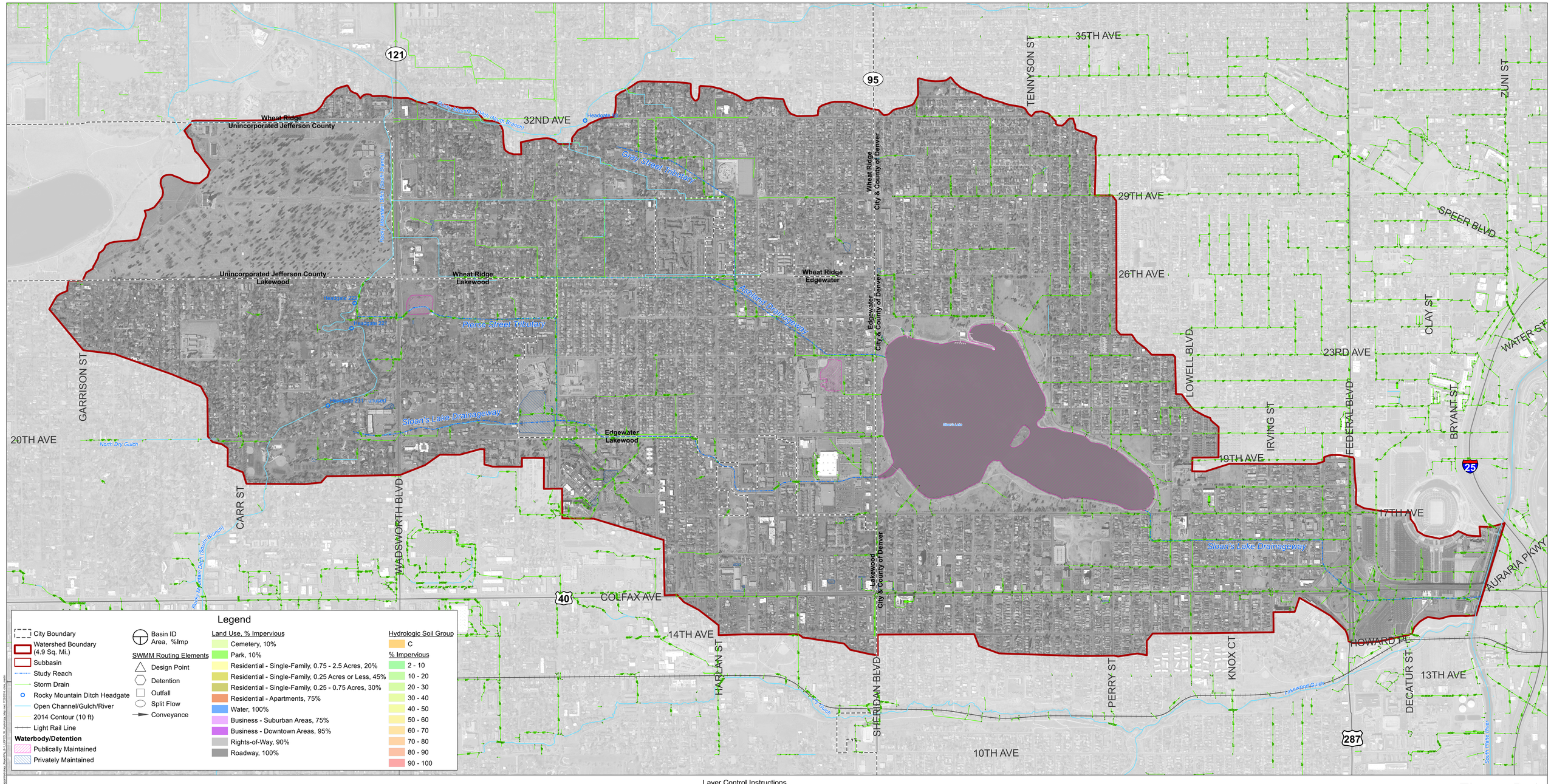
Review Comments _ 09-10-2018

5th Submittal _ Final Review

Responses to Comments on 09/10/2018
Flood Hazard Area Delineation _ Sloan's Lake Drainageway and Tributaries

Comments			Responses
Follow up on 4th Submittal Review Comments			
	4	In the transmittal letter please list the version of the FLO-2D	The Version of FLO-2D Pro Model, Build No. 16.06.16 has been added.
Profiles			
	2	Verify that the Legend matches the linetypes used. The 500yr and 50-yr WSEL in the Legend do not match the profiles.	Addressed.

Appendix B – Hydrologic Analysis



Legend

- City Boundary
- Watershed Boundary (4.9 Sq. Mi.)
- Subbasin
- Study Reach
- Storm Drain
- Rocky Mountain Ditch Headgate
- Open Channel/Gulch/River
- 2014 Contour (10 ft)
- Light Rail Line

Waterbody/Detention

- Publically Maintained
- Privately Maintained

Basin ID
Area, %Imp

SWMM Routing Elements

- Design Point
- Detention
- Outfall
- Split Flow
- Conveyance

Land Use, % Impervious

- Cemetery, 10%
- Park, 10%
- Residential - Single-Family, 0.75 - 2.5 Acres, 20%
- Residential - Single-Family, 0.25 Acres or Less, 45%
- Residential - Single-Family, 0.25 - 0.75 Acres, 30%
- Residential - Apartments, 75%
- Water, 100%
- Business - Suburban Areas, 75%
- Business - Downtown Areas, 95%
- Rights-of-Way, 90%
- Roadway, 100%

Hydrologic Soil Group

- C

% Impervious

- 2 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100

0 200 400 800 Feet

Layer Control Instructions

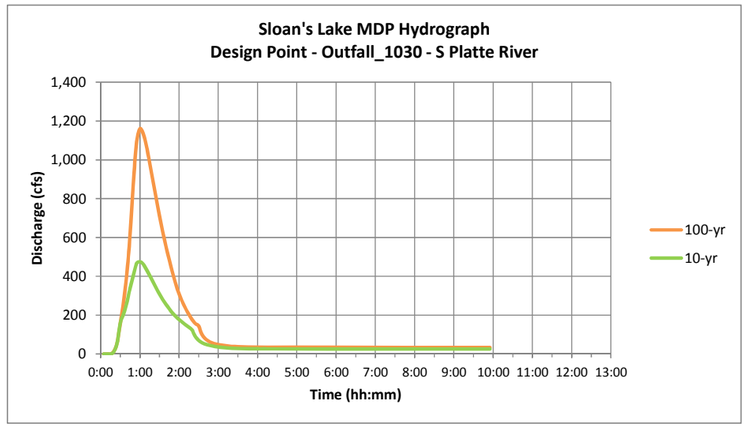
The Map Controls above set the visibility of the layers automatically for the selected map. Additional layer control is available through the "Layers" Navigation Panel which can be accessed from the View Menu under Navigation Panels. In the Panel, the visibility of layers and layer groups can be changed by clicking the square left of the layer/group. An eye in the square indicates that the layer is on. An empty square indicates that the layer is off. Layer groups can be expanded and reduced by clicking the +/- symbol left of the layer/group.

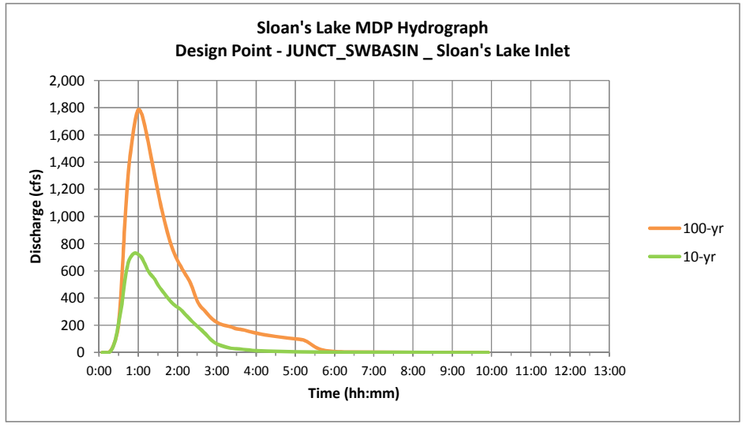
Interactive Figures (Select from Below)

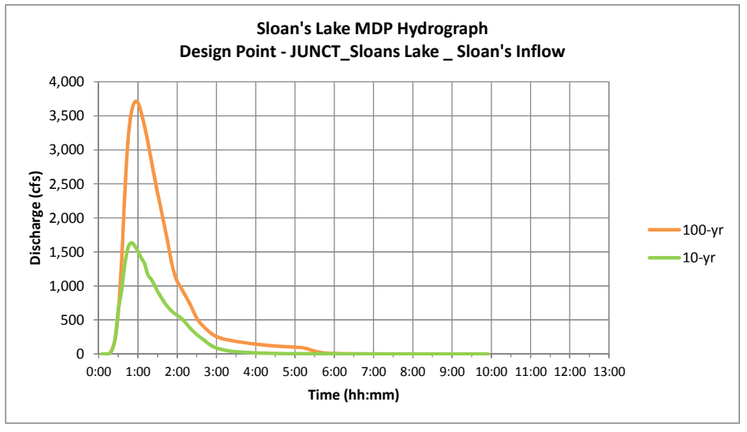
- Study Area Map
- Future Land Use Map
- Hydrologic Soil Groups Map
- Future Condition Subwatershed Imperviousness Map
- Baseline Hydrology SWMM Routing Map

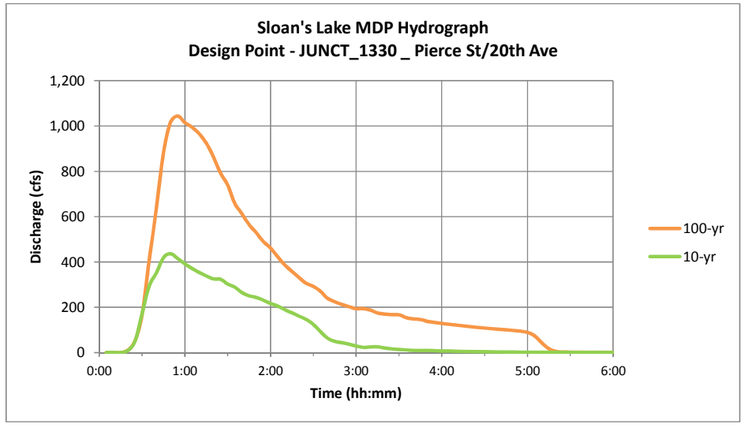
Figure B-1
Hydrology Map
Flood Hazard Area Delineation Sloan's Lake Drainageway and Tributaries

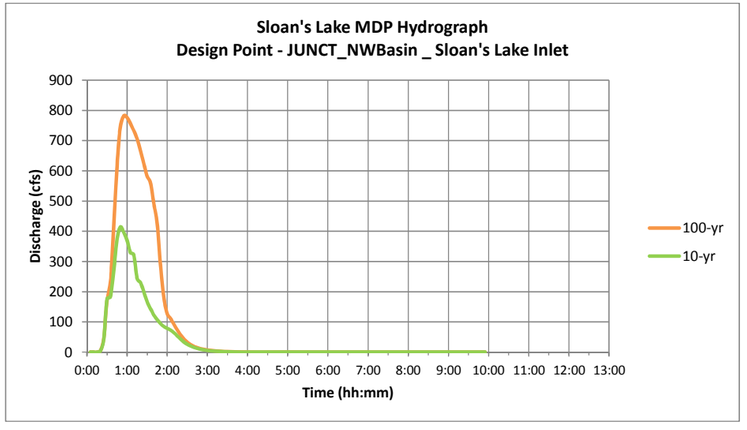
Figure B-2 Storm Hydrographs at Key Design Points











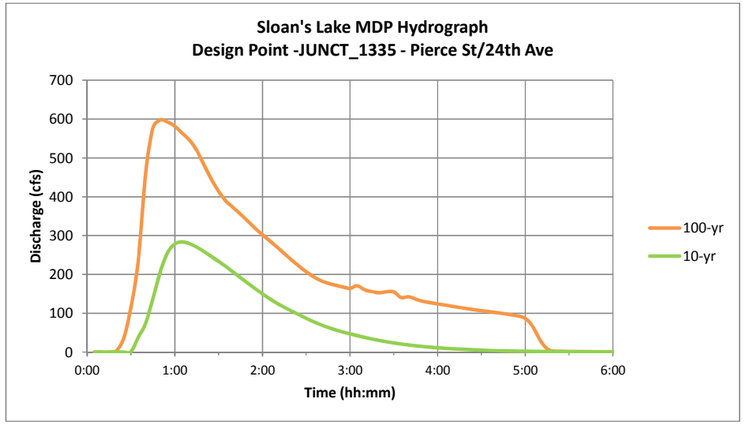
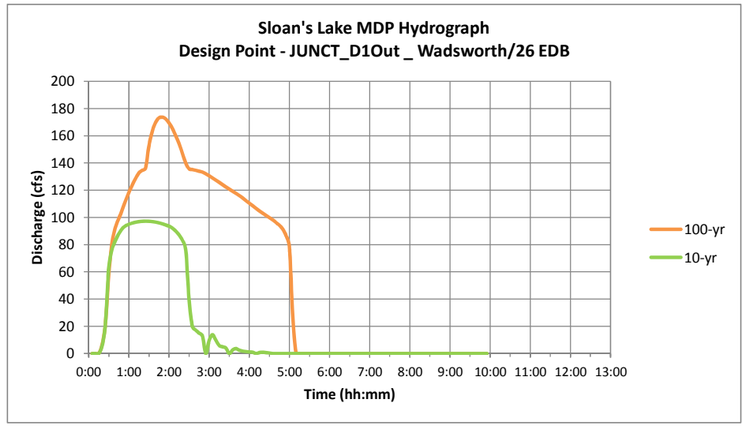


Figure B-2 Storm Hydrographs at Key Design Points



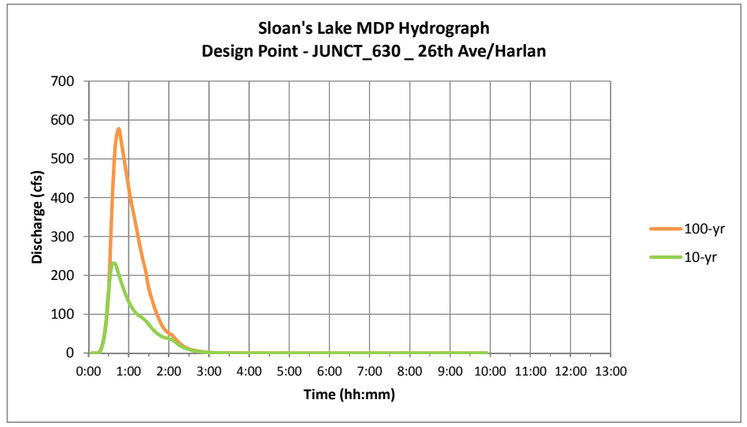


Table B-1 Rainfall Distribution (2-hour Distribution)

Return Period	2-Year
1Hr Depth	0.78 Inches
6Hr Depth	1.20 Inches
Area Adjust	0 sq. mi.
Time	Depth
0:05	0.016
0:15	0.066
0:20	0.125
0:25	0.195
0:30	0.109
0:35	0.049
0:40	0.039
0:45	0.023
0:50	0.023
0:55	0.023
1:00	0.023
1:05	0.023
1:10	0.016
1:15	0.016
1:20	0.016
1:25	0.016
1:30	0.016
1:35	0.016
1:40	0.016
1:45	0.016
1:50	0.016
1:55	0.008
2:00	0.008
2:05	0.000
Total Depth	**0.87** (in)

Return Period	5-Year
1Hr Depth	1.04 Inches
6Hr Depth	1.58 Inches
Area Adjust	0 sq. mi.
Time	Depth
0:05	0.021
0:15	0.090
0:20	0.159
0:25	0.260
0:30	0.135
0:35	0.060
0:40	0.046
0:45	0.037
0:50	0.037
0:55	0.031
1:00	0.031
1:05	0.031
1:10	0.031
1:15	0.026
1:20	0.023
1:25	0.023
1:30	0.023
1:35	0.023
1:40	0.016
1:45	0.016
1:50	0.016
1:55	0.016
2:00	0.014
2:05	0.000
Total Depth	**1.17** (in)

Return Period	10-Year
1Hr Depth	1.28 Inches
6Hr Depth	1.93 Inches
Area Adjust	0 sq. mi.
Time	Depth
0:05	0.026
0:15	0.105
0:20	0.192
0:25	0.320
0:30	0.154
0:35	0.072
0:40	0.055
0:45	0.049
0:50	0.041
0:55	0.041
1:00	0.041
1:05	0.041
1:10	0.041
1:15	0.041
1:20	0.032
1:25	0.024
1:30	0.024
1:35	0.024
1:40	0.024
1:45	0.024
1:50	0.024
1:55	0.022
2:00	0.017
2:05	0.000
Total Depth	**1.43** (in)

Return Period	25-Year
1Hr Depth	1.63 Inches
6Hr Depth	2.44 Inches
Area Adjust	0 sq. mi.
Time	Depth
0:05	0.021
0:15	0.082
0:20	0.130
0:25	0.245
0:30	0.408
0:35	0.196
0:40	0.130
0:45	0.082
0:50	0.082
0:55	0.052
1:00	0.052
1:05	0.052
1:10	0.039
1:15	0.039
1:20	0.029
1:25	0.029
1:30	0.023
1:35	0.023
1:40	0.023
1:45	0.023
1:50	0.023
1:55	0.023
2:00	0.023
2:05	0.000
Total Depth	**1.83** (in)

Return Period	50-Year
1Hr Depth	1.91 Inches
6Hr Depth	2.86 Inches
Area Adjust	0 sq. mi.
Time	Depth
0:05	0.025
0:15	0.096
0:20	0.153
0:25	0.287
0:30	0.478
0:35	0.229
0:40	0.153
0:45	0.096
0:50	0.096
0:55	0.061
1:00	0.061
1:05	0.061
1:10	0.046
1:15	0.046
1:20	0.034
1:25	0.034
1:30	0.027
1:35	0.027
1:40	0.027
1:45	0.027
1:50	0.027
1:55	0.027
2:00	0.027
2:05	0.000
Total Depth	**2.15** (in)

Return Period	100-Year
1Hr Depth	2.21 Inches
6Hr Depth	3.31 Inches
Area Adjust	0 sq. mi.
Time	Depth
0:05	0.022
0:15	0.102
0:20	0.177
0:25	0.309
0:30	0.553
0:35	0.309
0:40	0.177
0:45	0.137
0:50	0.111
0:55	0.088
1:00	0.088
1:05	0.088
1:10	0.044
1:15	0.044
1:20	0.027
1:25	0.027
1:30	0.027
1:35	0.027
1:40	0.027
1:45	0.027
1:50	0.027
1:55	0.027
2:00	0.027
2:05	0.000
Total Depth	**2.49** (in)

Return Period	500-Year
1Hr Depth	2.97 Inches
6Hr Depth	4.46 Inches
Area Adjust	0 sq. mi.
Time	Depth
0:05	0.030
0:15	0.137
0:20	0.238
0:25	0.416
0:30	0.743
0:35	0.416
0:40	0.238
0:45	0.184
0:50	0.149
0:55	0.119
1:00	0.119
1:05	0.119
1:10	0.059
1:15	0.059
1:20	0.036
1:25	0.036
1:30	0.036
1:35	0.036
1:40	0.036
1:45	0.036
1:50	0.036
1:55	0.036
2:00	0.036
2:05	0.000
Total Depth	**3.43**

Table B-2 CUHP Input Parameters

Catchment Name	Area	Area	Distance to Centroid	Length	Slope	Future Percent Imperviousness	Depression Storage on Pervious	Depression Storage on Impervious	Initial Infiltration Rate	Horton's Decay Coefficient	Final Infiltration Rate
	acres	mi2	mi	mi	ft/ft	%	in	in	in/hr	1/seconds	in/hr
20	49	0.0765	0.2653	0.6356	0.0265	95	0.35	0.10	3.00	0.0018	0.50
30	45	0.0702	0.2564	0.4663	0.0337	92	0.35	0.10	3.00	0.0018	0.50
40	52	0.0819	0.2841	0.6345	0.0161	82	0.35	0.10	3.00	0.0018	0.50
42	94	0.1466	0.3497	0.8049	0.0080	70	0.35	0.10	3.00	0.0018	0.50
44	60	0.0931	0.1781	0.4549	0.0096	80	0.35	0.10	3.00	0.0018	0.50
46	100	0.1558	0.2948	0.6651	0.0111	88	0.35	0.10	3.00	0.0018	0.50
50	9	0.0140	0.0947	0.1705	0.0200	91	0.35	0.10	3.00	0.0018	0.50
60	7	0.0113	0.0663	0.1894	0.0080	92	0.35	0.10	3.00	0.0018	0.50
70	5	0.0079	0.1136	0.2273	0.0050	67	0.35	0.10	3.00	0.0018	0.50
80	11	0.0173	0.1004	0.2462	0.0077	73	0.35	0.10	3.00	0.0018	0.50
90	11	0.0168	0.1231	0.2462	0.0169	63	0.35	0.10	3.00	0.0018	0.50
100	12	0.0190	0.1136	0.2462	0.0215	60	0.35	0.10	3.00	0.0018	0.50
110	7	0.0107	0.0947	0.1799	0.0189	62	0.35	0.10	3.00	0.0018	0.50
120	14	0.0223	0.1326	0.3220	0.0176	69	0.35	0.10	3.00	0.0018	0.50
130	39	0.0606	0.2652	0.5682	0.0073	72	0.35	0.10	3.00	0.0018	0.50
140	34	0.0537	0.2462	0.5114	0.0104	83	0.35	0.10	3.00	0.0018	0.50
150	16	0.0256	0.1894	0.3788	0.0050	74	0.35	0.10	3.00	0.0018	0.50
160	22	0.0347	0.1515	0.3504	0.0119	71	0.35	0.10	3.00	0.0018	0.50
170	13	0.0204	0.1383	0.2746	0.0145	51	0.35	0.10	3.00	0.0018	0.50
180	47	0.0737	0.1087	0.3453	0.0088	55	0.35	0.10	3.00	0.0018	0.50
200	266	0.4156	0.6250	1.0800	0.0018	73	0.35	0.10	3.00	0.0018	0.50
210	34	0.0538	0.1326	0.3693	0.0144	61	0.35	0.10	3.00	0.0018	0.50
220	31	0.0492	0.2273	0.4640	0.0041	63	0.35	0.10	3.00	0.0018	0.50
230	31	0.0478	0.2083	0.4072	0.0084	44	0.35	0.10	3.00	0.0018	0.50
240	49	0.0758	0.2367	0.4735	0.0184	60	0.35	0.10	3.00	0.0018	0.50
250	63	0.0977	0.1894	0.6061	0.0263	51	0.35	0.10	3.00	0.0018	0.50
260	36	0.0557	0.1515	0.3314	0.0217	59	0.35	0.10	3.00	0.0018	0.50
265	47	0.0728	0.1748	0.4154	0.0383	59	0.35	0.10	3.00	0.0018	0.50
270	44	0.0681	0.2367	0.4545	0.0342	59	0.35	0.10	3.00	0.0018	0.50
280	44	0.0693	0.2746	0.7008	0.0249	57	0.35	0.10	3.00	0.0018	0.50
290	22	0.0347	0.2273	0.4167	0.0382	57	0.35	0.10	3.00	0.0018	0.50
300	107	0.1668	0.2512	0.6278	0.0229	75	0.35	0.10	3.00	0.0018	0.50
305	43	0.0672	0.1635	0.3538	0.0300	69	0.35	0.10	3.00	0.0018	0.50
310	48	0.0749	0.1962	0.4719	0.0152	59	0.35	0.10	3.00	0.0018	0.50
315	56	0.0868	0.3421	0.5078	0.0231	76	0.35	0.10	3.00	0.0018	0.50
320	108	0.1687	0.3234	0.7500	0.0129	59	0.35	0.10	3.00	0.0018	0.50
325	13	0.0210	0.0828	0.2706	0.0301	77	0.35	0.10	3.00	0.0018	0.50
330	83	0.1291	0.2701	0.5698	0.0253	55	0.35	0.10	3.00	0.0018	0.50
335	24	0.0370	0.1718	0.4363	0.0269	56	0.35	0.10	3.00	0.0018	0.50

Table B-2 CUHP Input Parameters

Catchment Name	Area	Area	Distance to Centroid	Length	Slope	Future Percent Imperviousness	Depression Storage on Pervious	Depression Storage on Impervious	Initial Infiltration Rate	Horton's Decay Coefficient	Final Infiltration Rate
	acres	mi2	mi	mi	ft/ft	%	in	in	in/hr	1/seconds	in/hr
340	80	0.1258	0.3075	0.6608	0.0246	53	0.35	0.10	3.00	0.0018	0.50
345	135	0.2112	0.4407	0.8830	0.0178	56	0.35	0.10	3.00	0.0018	0.50
350	119	0.1858	0.3080	0.7178	0.0198	46	0.35	0.10	3.00	0.0018	0.50
355	103	0.1615	0.3105	0.6827	0.0194	51	0.35	0.10	3.00	0.0018	0.50
360	98	0.1534	0.3331	0.8227	0.0166	45	0.35	0.10	3.00	0.0018	0.50
365	160	0.2499	0.3936	1.0245	0.0192	14	0.35	0.10	3.00	0.0018	0.50
370	100	0.1564	0.4141	0.9384	0.0159	20	0.35	0.10	3.00	0.0018	0.50
400	77	0.1197	0.2199	0.6791	0.0153	76	0.35	0.10	3.00	0.0018	0.50
500	10	0.0156	0.0820	0.1533	0.0259	47	0.35	0.10	3.00	0.0018	0.50
600	47	0.0738	0.2759	0.5333	0.0316	69	0.35	0.10	3.00	0.0018	0.50
610	91	0.1418	0.4655	0.7568	0.0295	60	0.35	0.10	3.00	0.0018	0.50
620	57	0.0898	0.2006	0.4271	0.0248	62	0.35	0.10	3.00	0.0018	0.50
630	39	0.0606	0.1247	0.2538	0.0440	61	0.35	0.10	3.00	0.0018	0.50
640	111	0.1735	0.3778	0.7799	0.0245	52	0.35	0.10	3.00	0.0018	0.50
650	105	0.1637	0.2655	0.6623	0.0146	53	0.35	0.10	3.00	0.0018	0.50

Detention 1 (Wadsworth Blvd. & E 26th Ave.)

Stage	Elevation (NAVD)	Surface Area*		Incremental Volume	Accumulated Volume	Discharge**
(ft)	(ft)	(ft^2)	(acre)	(ac-ft)	(ac-ft)	(cfs)
0	5438	5883	0.14	0	0	72
1	5439	27851	0.64	0.36	0.36	82
2	5440	80214	1.84	1.19	1.54	93
3	5441	93166	2.14	1.99	3.53	99
4	5442	98109	2.25	2.20	5.73	104
5	5443	102749	2.36	2.31	8.03	110
6	5444	107663	2.47	2.41	10.45	116
7	5445	112953	2.59	2.53	12.98	121
8	5446	118551	2.72	2.66	15.64	127
9	5447	124313	2.85	2.79	18.43	133
10	5448	132002	3.03	2.94	21.37	136
11	5449	142454	3.27	3.15	24.52	182
12	5450	150874	3.46	3.37	27.88	500
13	5451	158793	3.65	3.55	31.44	943

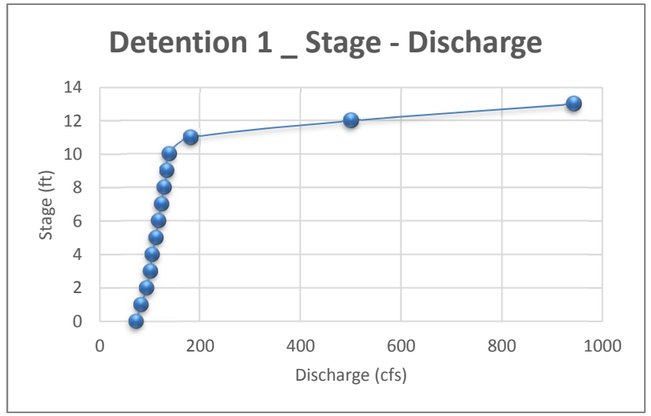
Detention 3 (Citizens Park)

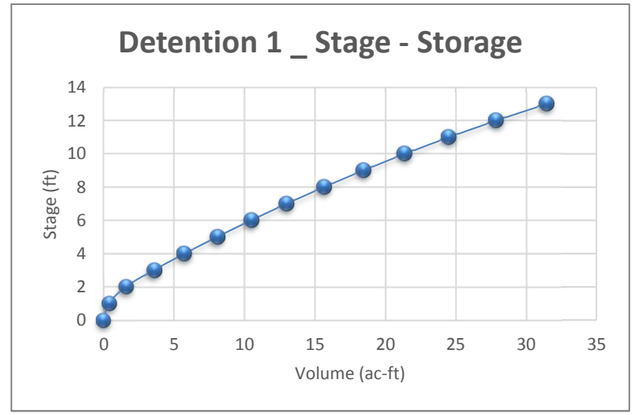
Stage	Elevation (NAVD)	Surface Area*		Incremental Volume	Accumulated Volume	Discharge**
(ft)	(ft)	(ft^2)	(acre)	(ac-ft)	(ac-ft)	(cfs)
0	5314	0	0.00	0	0	0
0.3	5314.3	341	0.01	0.00	0.00	50
1	5315	1135	0.03	0.01	0.01	72
2	5316	9139	0.21	0.10	0.11	91
3	5317	29522	0.68	0.42	0.53	108
4	5318	56929	1.31	0.98	1.51	123
5	5319	101062	2.32	1.79	3.30	135
6	5320	149037	3.42	2.85	6.15	146
7	5321	193782	4.45	3.92	10.08	1,102
8	5322	224199	5.15	4.79	14.87	3,176

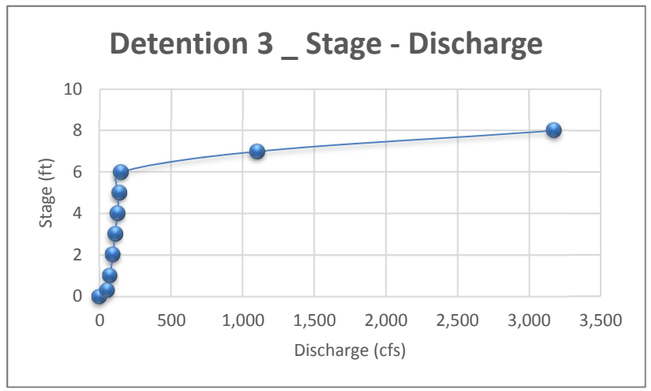
Sloan's Lake

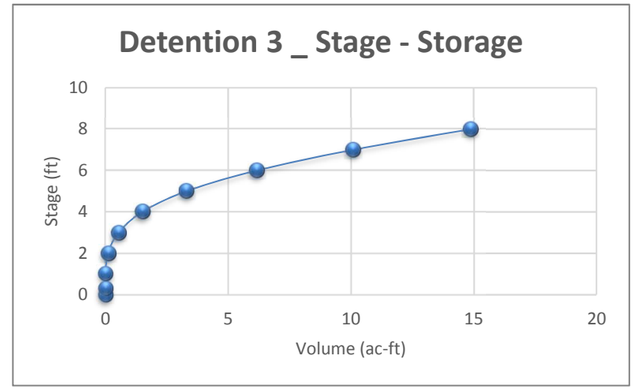
Stage	Elevation (NAVD)	Surface Area*		Incremental Volume	Accumulated Volume	Discharge**
(ft)	(ft)	(ft^2)	(acre)	(ac-ft)	(ac-ft)	(cfs)
0	5310.65	7703940	176.86	0.00	0.00	0
0.40	5311.05	7724239	177.32	70.84	70.84	25
0.90	5311.55	7754910	178.03	88.84	159.67	26
1.40	5312.05	7791732	178.87	89.23	248.90	30
2.40	5313.05	8002128	183.70	181.28	430.18	36
2.50	5313.15	8064670	185.14	18.44	448.63	66
3.35	5314.00	8597528	197.37	162.92	611.55	919

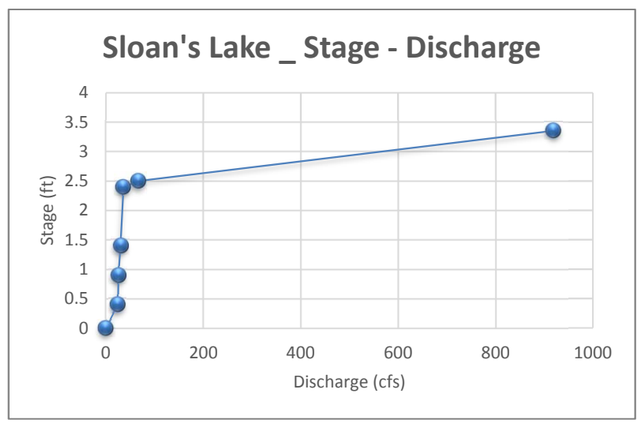
Table B-3 Detention Rating Curves

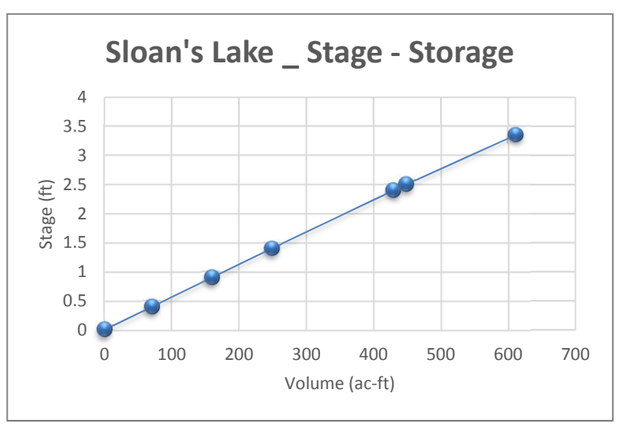












*Surface area was measured from 2014 1-foot contours.
** Discharge was derived from as-built plans (attached on next two sheets).

Table B-3 Detention Rating Curves

Sloan's Lake (Surface Area was measured from 2014 1-foot contours)

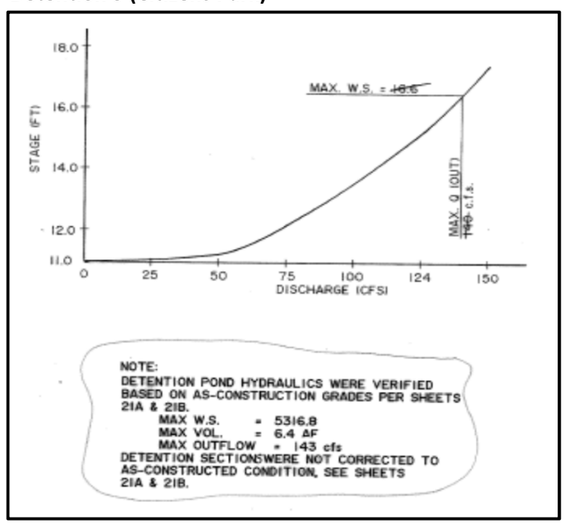
Stage	Elevation	Area (I) - Area (II)		Incremental Volume	Accumulated Volume	Area includes Island (I)	Area of Island (II)
(ft)	(ft)	(ft^2)	(acre)	(ac-ft)	(ac-ft)	(ft^2)	(ft^2)
0	5310.65	7703940	176.86	0.00	0.00	7768305	64365
0.35	5311	7721294	177.26	61.97	61.97	7784567	63272
1.35	5312	7782637	178.66	177.96	239.93	7844043	61406
2.35	5313	7972108	183.01	180.84	420.77	8031344	59236
3.35	5314	8597528	197.37	190.15	610.91	8653490	55962

Sloan's Lake Rating Curve (LOMR Case No. 92-08-040P)

Datum Adjustment 3.048

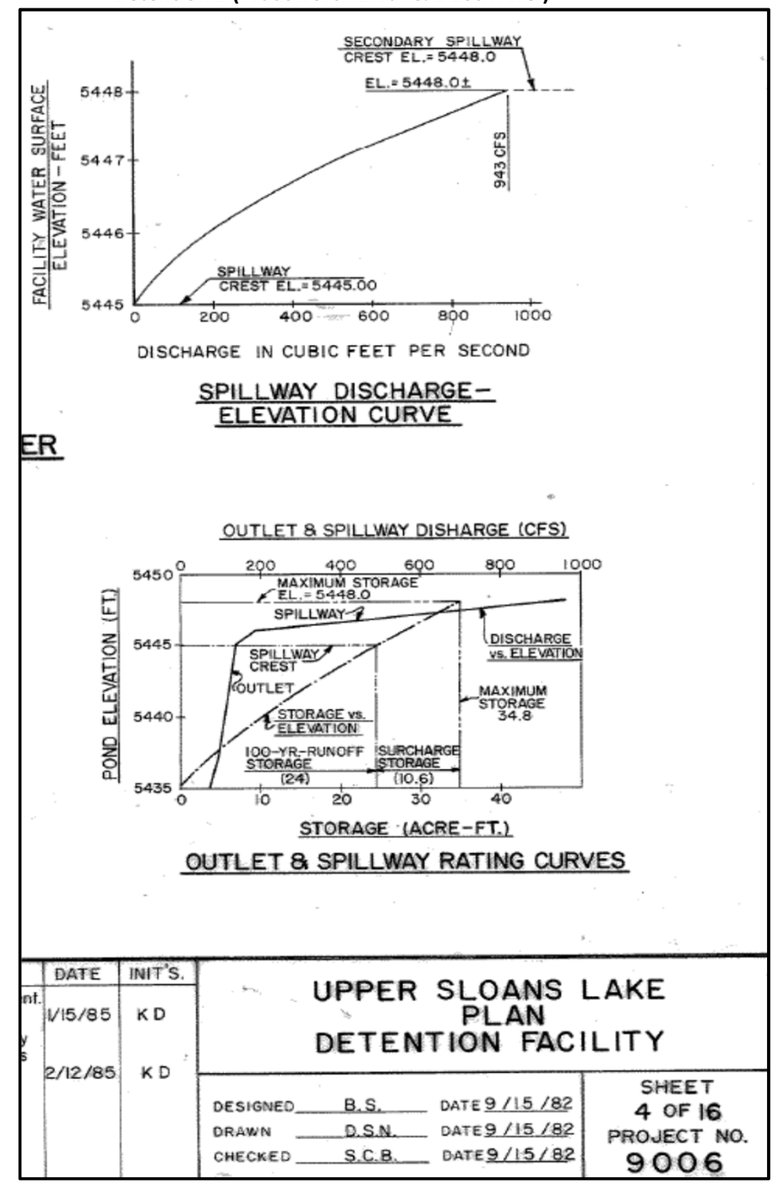
Elevation (NGVD)	Elevation (NAVD)	Volume (ac-ft)	Discharge (cfs)	
5307.6	5310.65	0	0	
5308.0	5311.05	72	25	
5308.5	5311.55	62	26	
5309.0	5312.05	252	30	
5310.0	5313.05	432	36	
5310.1	5313.15	-	66	Overtopping 0.1', weir flow 30 cfs; estimated weir length 308'
5311.0	***5314.00***	***-***	***919***	Extrapolated with overtopping height 0.95', weir length 308'; estimated weir flow 878 cfs

Detention 3 (Citizens Park)



Source: North Branch Upper Sloan's Lake Basin Storm Sewer Improvements - Schedule I, as-constructed drawing December 1991.

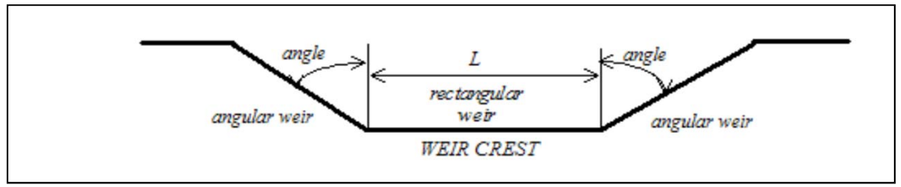
Detention 1 (Wadsworth Blvd. & E 26th Ave.)



Source: Upper Sloan's Lake Storm Drainage Project Schedule III, as-constructed June 1986.

Table B-3 Detention Rating Curves

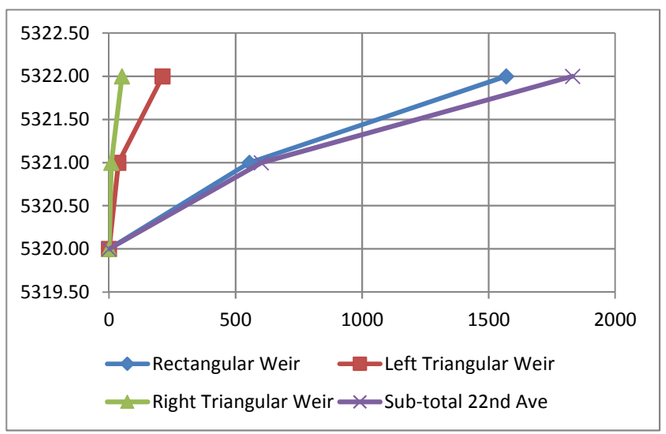
Detention 3 (Citizens Park) _ Spillway Calculation



South Spillway at 22nd Avenue

Bottom Length of Weir	L =	185.00			
Angle of Side Slope Weir (Left)	Left Angle =	87.71	H:V =	25.00	
Angle of Side Slope Weir (Right)	Right Angle =	80.54	H:V =	6.00	
Elev. for Weir Crest	EL. Crest =	5,320.00			
Coef. for Rectangular Weir	C_w =	3.00			
Coef. for Trapezoidal Weir	C_t =	3.00			

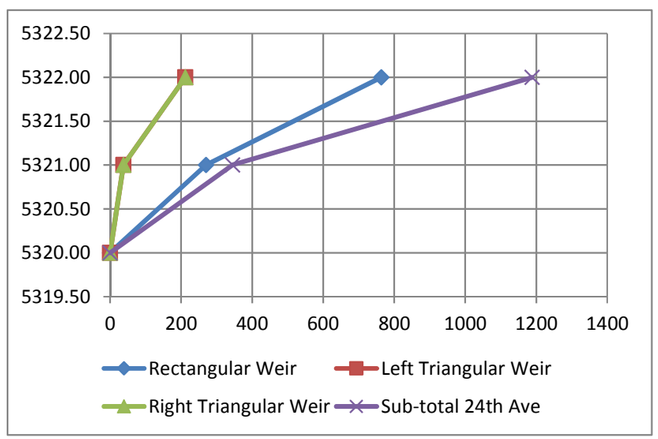
W.S.E.	Rectangular Weir	Left Triangular Weir	Right Triangular Weir	Sub-total 22nd Ave
	(cfs)	(cfs)	(cfs)	(cfs)
5320.00	0	0	0	0
5321.00	555	37	9	602
5322.00	1570	212	51	1833



North Spillway at 24th Avenue

Bottom Length of Weir	L =	90.00			
Angle of Side Slope Weir (Left)	Left Angle =	87.71	H:V =	25.00	
Angle of Side Slope Weir (Right)	Right Angle =	87.71	H:V =	25.00	
Elev. for Weir Crest	EL. Crest =	5,320.00			
Coef. for Rectangular Weir	C_w =	3.00			
Coef. for Trapezoidal Weir	C_t =	3.00			

W.S.E.	Rectangular Weir	Left Triangular Weir	Right Triangular Weir	Sub-total 24th Ave
	(cfs)	(cfs)	(cfs)	(cfs)
5320.00	0	0	0	0
5321.00	270	37	37	345
5322.00	764	212	212	1188



Stage	Elevation (NAVD)	Outlet Discharge	Spillway Discharge	Total Discharge
(ft)	(ft)	(cfs)	(cfs)	(cfs)
0	5314	0	0	0
0.3	5314.3	50	0	50
1	5315	72	0	72
2	5316	91	0	91
3	5317	108	0	108
4	5318	123	0	123
5	5319	135	0	135
6	5320	146	0	146
7	5321	155	947	1,102
8	5322	155	3,021	3,176

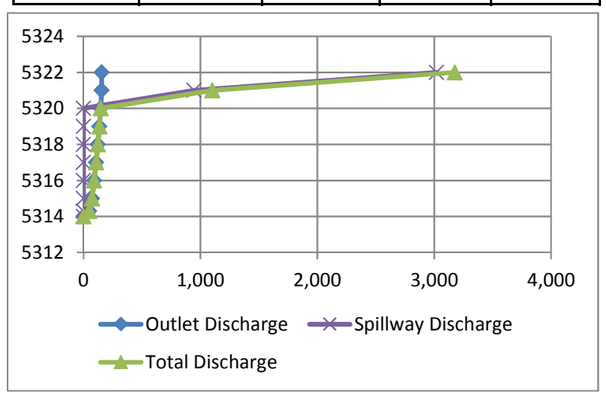


Table B-4 Peak Discharges and Runoff Volumes (All Design Points)

Design Point		Drainage Area	Future Conditions Peak Flow (cfs)							Future Conditions Runoff Volume (ac-ft)						
Number	Type	(acres)	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}	V_2	V_5	V_{10}	V_{25}	V_{50}	V_{100}	V_{500}
JUNCT_20	JUNCTION	49	45	61	75	101	120	142	193	3	4	5	7	8	9	13
JUNCT_30	JUNCTION	45	44	60	74	100	119	142	194	3	4	5	6	7	8	11
JUNCT_40	JUNCTION	52	35	49	62	88	106	127	175	3	4	5	6	8	9	13
JUNCT_42	JUNCTION	94	47	67	88	132	162	196	275	4	6	8	11	13	16	22
JUNCT_44	JUNCTION	60	49	68	87	123	148	178	246	3	4	5	7	9	10	15
JUNCT_46	JUNCTION	100	83	115	144	199	239	283	388	5	8	10	13	15	18	25
JUNCT_50	JUNCTION	9	9	12	14	20	23	28	38	0	1	1	1	1	2	2
JUNCT_60	JUNCTION	7	7	9	11	15	18	21	29	0	1	1	1	1	1	2
JUNCT_70	DIVIDER	5	2	3	4	6	7	8	12	0	0	0	1	1	1	1
JUNCT_80	JUNCTION	11	7	9	12	18	21	26	36	0	1	1	1	2	2	3
JUNCT_90	JUNCTION	11	5	8	11	16	20	24	34	0	1	1	1	1	2	2
JUNCT_100	DIVIDER	12	6	9	12	19	24	29	41	0	1	1	1	2	2	3
JUNCT_110	JUNCTION	7	4	5	7	11	13	16	23	0	0	0	1	1	1	2
JUNCT_120	DIVIDER	14	8	12	15	22	28	34	47	1	1	1	2	2	2	3
JUNCT_130	JUNCTION	39	19	26	34	51	62	75	105	2	2	3	4	5	6	9
JUNCT_140	JUNCTION	34	22	29	37	54	65	78	108	2	2	3	4	5	6	8
JUNCT_142	DIVIDER	253	132	189	245	382	467	572	803	13	18	23	31	38	45	62
JUNCT_144	DIVIDER	159	112	155	201	296	358	430	599	8	12	15	20	24	29	40
JUNCT_146	DIVIDER	100	83	115	144	199	239	283	388	5	8	10	13	15	18	25
JUNCT_150	JUNCTION	16	7	10	13	20	24	29	41	1	1	1	2	2	3	4
JUNCT_160	DIVIDER	22	13	19	25	36	44	54	75	1	1	2	3	3	4	5
JUNCT_170	JUNCTION	13	5	7	10	16	20	25	35	0	1	1	1	2	2	3
JUNCT_180	DIVIDER	47	26	38	53	83	103	128	183	2	2	3	5	6	7	10
JUNCT_200	JUNCTION	266	106	149	193	294	357	435	608	12	17	22	31	38	45	63
JUNCT_210	JUNCTION	34	20	29	39	59	73	91	129	1	2	2	4	4	5	8
JUNCT_220	JUNCTION	31	11	17	22	35	43	53	75	1	2	2	3	4	5	7
JUNCT_230	JUNCTION	31	8	12	17	30	38	47	69	1	1	2	3	3	4	6
JUNCT_240	JUNCTION	49	24	34	47	73	90	110	158	2	2	3	5	6	8	11
JUNCT_250	JUNCTION	63	27	40	57	92	116	144	209	2	3	4	6	7	9	13
JUNCT_260	JUNCTION	36	21	30	41	63	78	97	138	1	2	2	4	4	5	8
JUNCT_265	JUNCTION	47	29	41	57	87	107	133	188	2	2	3	5	6	7	10
JUNCT_270	JUNCTION	44	23	34	46	71	88	108	154	2	2	3	4	5	7	10
JUNCT_280	DIVIDER	44	17	25	35	56	70	86	122	1	2	3	4	6	7	10
JUNCT_290	JUNCTION	22	9	14	19	30	37	46	65	1	1	1	2	3	3	5
JUNCT_300	JUNCTION	1,277	344	521	672	1,046	1,299	1,646	2,380	37	57	81	127	162	201	297
JUNCT_305	DIVIDER	1,170	315	468	608	962	1,195	1,494	2,160	32	49	72	114	146	183	270
JUNCT_306	DIVIDER	1,127	296	444	587	916	1,134	1,421	2,065	30	47	68	110	141	176	261
JUNCT_310	JUNCTION	48	23	34	47	73	91	111	159	2	2	3	5	6	7	11
JUNCT_315	DIVIDER	1,079	274	417	559	857	1,069	1,338	1,930	28	44	65	105	134	169	250
JUNCT_320	JUNCTION	108	49	71	98	155	192	236	336	4	6	7	11	14	17	24
JUNCT_325	JUNCTION	13	11	16	20	28	34	42	58	1	1	1	2	2	2	3
JUNCT_330	DIVIDER	201	66	102	152	255	328	417	624	6	10	16	26	34	44	66

Table B-4 Peak Discharges and Runoff Volumes (All Design Points)

Design Point		Drainage Area	Future Conditions Peak Flow (cfs)							Future Conditions Runoff Volume (ac-ft)						
Number	Type	(acres)	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}	V_2	V_5	V_{10}	V_{25}	V_{50}	V_{100}	V_{500}
JUNCT_332	DIVIDER	119	37	61	92	158	210	287	450	3	6	10	18	24	31	47
JUNCT_335	JUNCTION	24	10	15	21	33	40	50	71	1	1	2	2	3	4	5
JUNCT_340	DIVIDER	677	146	199	256	380	454	551	944	14	23	34	57	73	92	138
JUNCT_345	JUNCTION	235	54	79	110	180	227	292	435	5	8	12	20	26	33	49
JUNCT_350	JUNCTION	119	41	64	101	166	212	289	454	3	6	10	18	24	31	47
JUNCT_355	JUNCTION	103	41	61	87	144	179	223	320	3	5	6	10	12	15	22
JUNCT_360	JUNCTION	98	28	43	64	108	137	171	249	3	4	6	9	11	14	21
JUNCT_365	JUNCTION	160	8	17	38	88	119	158	243	1	2	4	10	13	18	28
JUNCT_370	JUNCTION	100	7	13	24	53	70	92	141	1	2	3	7	9	12	18
JUNCT_400	JUNCTION	77	56	79	102	146	177	212	296	4	5	7	9	11	13	18
JUNCT_500	JUNCTION	10	4	6	9	15	19	24	35	0	0	1	1	1	1	2
JUNCT_600	DIVIDER	450	209	307	435	522	602	663	799	15	22	31	43	51	58	73
JUNCT_610	JUNCTION	91	41	60	81	128	158	194	276	3	5	6	9	12	14	20
JUNCT_615	JUNCTION	312	145	213	282	335	362	362	362	10	15	20	28	32	35	42
JUNCT_620	DIVIDER	312	145	213	291	438	551	689	989	10	15	21	31	39	47	68
JUNCT_630	DIVIDER	255	112	164	230	377	467	578	824	8	12	16	25	31	38	55
JUNCT_640	JUNCTION	111	44	66	93	152	190	235	337	3	5	7	11	13	16	24
JUNCT_650	DIVIDER	105	44	65	92	150	187	232	333	3	5	7	10	12	16	23
JUNCT_999	DIVIDER	253	2	15	27	71	100	137	219	0	2	3	7	10	14	22
JUNCT_1040	DIVIDER	3,034	208	335	443	711	875	1,081	1,537	36	48	59	80	95	112	252
JUNCT_1050	DIVIDER	2,728	115	167	209	315	384	468	655	28	34	40	50	58	67	186
JUNCT_1060	DIVIDER	12	8	11	14	19	23	28	38	1	1	1	1	2	2	3
JUNCT_1080	DIVIDER	94	48	67	88	133	166	201	285	4	6	7	10	13	15	22
JUNCT_1110	DIVIDER	83	41	58	77	117	144	176	248	3	5	6	9	11	13	19
JUNCT_1130	DIVIDER	2,707	103	156	194	291	356	433	606	27	33	38	48	55	63	181
JUNCT_1170	DIVIDER	2,613	70	99	133	208	256	313	442	23	27	30	37	42	47	158
JUNCT_1230	JUNCTION	126	56	82	116	188	235	290	416	4	6	8	13	16	19	28
JUNCT_1240	DIVIDER	95	50	73	100	157	193	239	339	3	5	7	10	12	15	21
JUNCT_1250	JUNCTION	186	84	114	159	261	325	406	574	6	9	12	19	23	28	41
JUNCT_1260	DIVIDER	124	59	85	113	184	228	281	387	4	6	8	13	16	19	27
JUNCT_1270	DIVIDER	88	39	57	79	125	154	189	268	3	4	6	9	11	13	19
JUNCT_1330	DIVIDER	916	222	321	436	678	839	1,044	1,493	22	35	53	87	112	142	212
JUNCT_1335	DIVIDER	701	158	215	276	411	493	598	973	15	24	36	59	76	96	143
JUNCT_1442	DIVIDER	253	86	143	199	336	421	525	757	5	10	14	23	29	36	53
JUNCT_D1_OUT	DIVIDER	361	77	84	97	117	130	174	524	6	10	16	29	37	47	71
JUNCT_D3_OUT	DIVIDER	10	4	6	18	98	123	142	594	0	0	1	4	7	13	29
JUNCT_SL_OUT	DIVIDER	2,480	25	25	26	30	32	34	360	18	19	20	22	24	26	127
JUNCT_N_BASIN	JUNCTION	365	156	225	316	504	629	781	1,129	12	18	25	37	45	56	80
JUNCT_NW_BASIN	JUNCTION	460	211	287	414	605	706	782	1,328	16	23	33	48	59	72	103
JUNCT_SW_BASIN	JUNCTION	1,354	377	568	732	1,124	1,410	1,785	2,573	40	62	88	136	173	215	314
OUTFALL_1030	OUTFALL	3,078	224	357	475	751	936	1,159	1,656	39	52	64	86	102	121	263
OUTFALL_1230	JUNCTION	126	56	82	116	188	235	290	416	4	6	8	13	16	19	28
OUTFALL_1250	JUNCTION	186	84	114	159	261	325	406	574	6	9	12	19	23	28	41

Table B-4 Peak Discharges and Runoff Volumes (All Design Points)

Design Point		Drainage Area	Future Conditions Peak Flow (cfs)							Future Conditions Runoff Volume (ac-ft)						
Number	Type	(acres)	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}	V_2	V_5	V_{10}	V_{25}	V_{50}	V_{100}	V_{500}
OUTFALL_20	OUTFALL	49	45	61	75	101	120	142	193	3	4	5	7	8	9	13
OUTFALL_210	JUNCTION	34	20	29	39	59	73	91	129	1	2	2	4	4	5	8
OUTFALL_220	JUNCTION	31	11	17	22	35	43	53	75	1	2	2	3	4	5	7
OUTFALL_290	JUNCTION	22	9	14	19	30	37	46	65	1	1	1	2	3	3	5
OUTFALL_300	JUNCTION	1,277	344	521	672	1,046	1,299	1,646	2,380	37	57	81	127	162	201	297
OUTFALL_400	JUNCTION	77	56	79	102	146	177	212	296	4	5	7	9	11	13	18
OUTFALL_500	JUNCTION	10	4	6	15	98	123	142	579	0	0	1	4	7	14	29
OUTFALL_600	JUNCTION	450	207	282	409	509	586	646	772	16	23	32	44	51	58	74
OUTFALL_LOWELL	OUTFALL	SPLIT	47	48	46	48	47	46	46	8	8	9	9	9	9	10
DETENTION_1	STORAGE	361	63	101	162	310	398	511	761	7	10	16	28	37	47	71
DETENTION_3	STORAGE	10	4	6	18	116	205	348	656	0	0	1	4	7	13	29
SLOAN'S_LAKE	STORAGE	2,480	843	1,230	1,634	2,504	3,053	3,703	5,491	82	122	169	255	317	394	569

EPA SWMM 5.1 Input Parameters

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;;Project Title/Notes
Sloan's Lake Drainageway
Major Drainageway Plan, Baseline Hydrology Report, May 2016
Matrix Design Group, Inc.

[OPTIONS]
;;Option             Value
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INFILTRATION         HORTON
FLOW_ROUTING         KINWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

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START_TIME           00:00:00
REPORT_START_DATE    01/01/2005
REPORT_START_TIME    00:00:00
END_DATE             01/01/2005
END_TIME             10:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:05:00
WET_STEP             00:05:00
DRY_STEP             00:05:00
ROUTING_STEP         0:05:00

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NORMAL_FLOW_LIMITED  BOTH
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LENGTHENING_STEP     0
MIN_SURFAREA         12.557
MAX_TRIALS           8
HEAD_TOLERANCE       0.005
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              1

[FILES]
;;Interfacing Files
USE INFLOWS "R:\16.155.026 (Sloan's
Lake)\Drainage\Hydrology\SL_CUHP_SWMM_2016\SL_MDP_2016_CUHP1.5.2b_NOAA14\CUHP\6_Fut_100yr_0mi^2_SL_MDP_2016_Ver152b_14.
txt"

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[JUNCTIONS]
;;Name           Elevation  MaxDepth   InitDepth  SurDepth   Aponded
;;-------------- ---------- ---------- ---------- ---------- ----------
JUNCT_110        5308       0          0          0          0
JUNCT_1230       5312.85    0          0          0          0
JUNCT_1250       5310.66    0          0          0          0
JUNCT_130        5308       0          0          0          0
JUNCT_140        5330       0          0          0          0
JUNCT_150        5336       0          0          0          0
JUNCT_170        5340       0          0          0          0
JUNCT_20         5281       0          0          0          0
JUNCT_200        5315       0          0          0          0
JUNCT_210        5356       0          0          0          0
JUNCT_220        5320       0          0          0          0
JUNCT_230        5336       0          0          0          0
JUNCT_240        5378       0          0          0          0
JUNCT_250        5350       0          0          0          0
JUNCT_260        5390       0          0          0          0
;The names are derived from the swmm element IDs
JUNCT_270        5472       0          0          0          0
JUNCT_290        5320       0          0          0          0
JUNCT_30         5281       0          0          0          0
JUNCT_40         5312       0          0          0          0
JUNCT_50         5290       0          0          0          0
JUNCT_60         5304       0          0          0          0
JUNCT_80         5294       0          0          0          0
JUNCT_90         5320       0          0          0          0
JUNCT_265        5392       0          0          0          0
JUNCT_300        5310.05    0          0          0          0
JUNCT_325        5412       0          0          0          0
JUNCT_350        5448       0          0          0          0
JUNCT_400        5314       0          0          0          0
JUNCT_310        5351       0          0          0          0
JUNCT_320        5359       0          0          0          0
JUNCT_335        5398       0          0          0          0
JUNCT_355        5460       0          0          0          0
JUNCT_360        5517       0          0          0          0
JUNCT_500        5320       0          0          0          0
OUTFALL_600      5308.69    0          1.96       0          0
JUNCT_640        5365       0          0          0          0
JUNCT_345        5412       0          0          0          0
JUNCT_365        5480       0          0          0          0
JUNCT_370        5491       0          0          0          0
JUNCT_610        5360       0          0          0          0
OUTFALL_500      5306.5     0          4.15       0          0
OUTFALL_400      5310.65    0          0          0          0
OUTFALL_300      5308.85    10         1.8        0          0
OUTFALL_210      5310.65    0          0          0          0
OUTFALL_290      5310.65    0          0          0          0
Outfall_1250     5310.65    0          0          0          0
Outfall_1230     5310.65    0          0          0          0
Outfall_220      5310.65    0          0          0          0
JUNCT_NW_BASIN   5310.65    0          0          0          0
JUNCT_N_BASIN    5310.65    0          0          0          0
JUNCT_SW_BASIN   5310.65    0          0          0          0
JUNCT_141_NDG    5555       0          0          0          0
JUNCT_142_NDG    5509       0          0          0          0
JUNCT_42         5310       0          0          0          0
JUNCT_44         5340       0          0          0          0
JUNCT_46         5360       0          0          0          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
OUTFALL_20       5192       NORMAL                      NO
OUTFALL_1030     5188.91    NORMAL                      NO
OUTFALL_LOWELL   5299.91    NORMAL                      NO
OUTFALL_242      5484.26    NORMAL                      NO

[DIVIDERS]
;;Name           Elevation  Diverted Link    Type       Parameters
;;-------------- ---------- ---------------- ---------- ----------
JUNCT_160        5316.48    1660-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_1130       5273.37    1630-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_1270       5378.75    1770-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_100        5302.36    1500-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_1170       5302.24    1670-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_180        5306.71    1680-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_1240       5321.08    1740-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_1060       5284.32    1560-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_120        5296.16    1520-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_280        5386.12    1780-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_1080       5276.73    1580-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_SL_OUT     5309.31    1662-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_1110       5280.59    1610-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_1040       5244.27    1540-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_70         5293.3     1570-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_1050       5262.91    1550-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_1260       5344.38    1760-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_142        5304.64    142              OVERFLOW   0          0          0          0
JUNCT_1442       5301.91    1442-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_144        5327.66    1444-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_146        5346.91    1446-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_315        5350.47    315-OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_306        5339.65    306-OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_305        5338.05    305-OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_1330       5376.99    1330-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_330        5385.6     330-OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_332        5389.25    332-OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_340        5394.66    340-OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_1335       5390.17    1335-OVERFLOW    OVERFLOW   0          0          0          0
JUNCT_D1_OUT     5425.93    D1_OUT-OVERFLOW  OVERFLOW   0          0          0          0
JUNCT_D3_OUT     5311.08    D3_OUT-OVERFLOW  OVERFLOW   0          0          0          0
JUNCT_620        5314.55    620_DIV          TABULAR    DIVCURVE_620     0          0          0          0
JUNCT_600        5309.28    600-OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_650        5405.67    650-OVERFLOW     OVERFLOW   0          0          0          0
JUNCT_241__NDG   5554       241-OVERFLOW_NDG OVERFLOW   0          0          0          0
```

SPLIT_142_NDG	5508.9	142-DIV_NDG	TABULAR	DIVCURVE_142_NDG	0	0	0	0
JUNCT_630	5351.71	630-OVERFLOW	OVERFLOW	0	0	0	0	
JUNCT_999	5508	999-OVERFLOW	OVERFLOW	0	0	0	0	
JUNCT_615	5314.54	615-OVERFLOW	OVERFLOW	0	0	0	0	

[STORAGE]

;;Name	Elev.	MaxDepth	InitDepth	Shape	Curve Name/Params	N/A	Fevap	Psi	Ksat	IMD
Sloan's_Lake	5310.65	5	0	TABULAR	Sloan's_Lake	0	0			
DETENTION_1	5438	13	0	TABULAR	Detention_1	0	0			
DETENTION_3	5314.15	8	0	TABULAR	Detention_3	0	0			

[CONDUITS]

;;Name	From Node	To Node	Length	Roughness	InOffset	OutOffset	InitFlow	MaxFlow
110	JUNCT_110	JUNCT_1110	400	.01	0	0	0	0
130	JUNCT_130	JUNCT_1110	400	.01	0	0	0	0
1330-OVERFLOW	JUNCT_1330	JUNCT_315	2010	0.025	9.01	10.53	0	0
140	JUNCT_140	JUNCT_1170	400	.01	0	0	0	0
141_NDG	JUNCT_141_NDG	JUNCT_241__NDG	400	0.01	0	0	0	0
142	JUNCT_142	JUNCT_1442	400	0.01	6.36	9.09	0	0
1230	JUNCT_1230	Outfall_1230	400	.01	0	0	0	0
1250	JUNCT_1250	Outfall_1250	1	.01	0	0	0	0
1330	JUNCT_1330	JUNCT_315	2010	0.019	0	0	0	0
1335	JUNCT_1335	JUNCT_1330	1060	0.019	0	0	0	0
142_LOWELL	JUNCT_142	OUTFALL_LOWELL	710	0.019	0	0	0	0
142_NDG	JUNCT_142_NDG	SPLIT_142_NDG	400	0.01	0	0	0	0
142-DIV_NDG	SPLIT_142_NDG	JUNCT_999	400	0.01	0	0	0	0
1442	JUNCT_1442	JUNCT_1040	2636	0.019	0	0	0	0
1442-OVERFLOW	JUNCT_1442	JUNCT_1040	2636	0.025	9.09	8.27	0	0
1444	JUNCT_144	JUNCT_142	3280	0.019	0	0	0	0
1444-OVERFLOW	JUNCT_144	JUNCT_142	3280	0.025	9.34	6.36	0	0
1446	JUNCT_146	JUNCT_144	1930	0.019	0	0	0	0
1446-OVERFLOW	JUNCT_146	JUNCT_144	1930	0.025	8.09	9.34	0	0
1500-OVERFLOW	JUNCT_100	JUNCT_1110	1320	0.02	5.64	6.41	0	0
1520-OVERFLOW	JUNCT_120	JUNCT_1110	890	0.02	6.84	6.41	0	0
1540-OVERFLOW	JUNCT_1040	OUTFALL_1030	2150	0.02	8.27	9.1	0	0
1550-OVERFLOW	JUNCT_1050	JUNCT_1040	430	0.02	12.11	8.27	0	0
1560-OVERFLOW	JUNCT_1060	JUNCT_1050	400	0.02	9.68	12.11	0	0
1570-OVERFLOW	JUNCT_70	JUNCT_1060	1000	0.02	8.7	9.68	0	0
1580-OVERFLOW	JUNCT_1080	JUNCT_1130	450	0.02	7.27	10.63	0	0
1610-OVERFLOW	JUNCT_1110	JUNCT_1080	460	0.02	6.41	6.27	0	0
1630-OVERFLOW	JUNCT_1130	JUNCT_1050	430	0.02	11.63	12.11	0	0
1660-OVERFLOW	JUNCT_160	JUNCT_1170	1850	0.02	3.52	5.76	0	0
1662-OVERFLOW	JUNCT_SL_OUT	JUNCT_1170	840	0.02	3.69	5.76	0	0
1670-OVERFLOW	JUNCT_1170	JUNCT_1130	3000	0.02	5.76	11.63	0	0
1680-OVERFLOW	JUNCT_180	JUNCT_1170	1270	0.02	7.29	5.76	0	0
1740-OVERFLOW	JUNCT_1240	JUNCT_1230	970	0.03	12.92	5.15	0	0
1760-OVERFLOW	JUNCT_1260	JUNCT_1250	1820	0.025	7.62	5.35	0	0
1770-OVERFLOW	JUNCT_1270	JUNCT_1260	1300	0.025	11.25	7.62	0	0
1780-OVERFLOW	JUNCT_280	JUNCT_1270	400	0.025	5.88	11.25	0	0
20	JUNCT_20	OUTFALL_20	400	.01	0	0	0	0
241_NDG	JUNCT_241__NDG	JUNCT_142_NDG	1950	0.016	0	0	0	0
241-OVERFLOW_NDG	JUNCT_241__NDG	JUNCT_142_NDG	1950	0.035	0	0	0	0
30	JUNCT_30	OUTFALL_1030	400	.01	0	0	0	0
305-OVERFLOW	JUNCT_305	JUNCT_300	2955	0.035	5	5	0	0
306-OVERFLOW	JUNCT_306	JUNCT_305	510	0.035	6	6	0	0
315-OVERFLOW	JUNCT_315	JUNCT_306	842	0.025	10.53	6	0	0
40	JUNCT_40	JUNCT_1040	400	.01	0	0	0	0
42	JUNCT_42	JUNCT_142	400	0.01	0	0	0	0
44	JUNCT_44	JUNCT_144	400	0.01	0	0	0	0
46	JUNCT_46	JUNCT_146	400	0.01	0	0	0	0
50	JUNCT_50	JUNCT_1050	400	.01	0	0	0	0
60	JUNCT_60	JUNCT_1060	400	.01	0	0	0	0
80	JUNCT_80	JUNCT_1080	400	.01	0	0	0	0
90	JUNCT_90	JUNCT_1110	400	.01	0	0	0	0
150	JUNCT_150	JUNCT_1170	400	.01	0	0	0	0
170	JUNCT_170	JUNCT_1170	400	.01	0	0	0	0
200	JUNCT_200	Sloan's_Lake	400	.01	0	0	0	0
210	JUNCT_210	OUTFALL_210	400	.01	0	0	0	0
220	JUNCT_220	Outfall_220	400	.01	0	0	0	0
230	JUNCT_230	JUNCT_1230	400	.01	0	0	0	0
240	JUNCT_240	JUNCT_1240	400	.01	0	0	0	0
250	JUNCT_250	JUNCT_1250	400	.01	0	0	0	0
260	JUNCT_260	JUNCT_1260	400	.01	0	0	0	0
265	JUNCT_265	JUNCT_1240	1665	0.025	0	12.92	0	0
270	JUNCT_270	JUNCT_1270	400	.01	0	0	0	0
290	JUNCT_290	OUTFALL_290	400	.01	0	0	0	0
300	JUNCT_300	OUTFALL_300	400	0.01	0	0	0	0
305	JUNCT_305	JUNCT_300	2955	0.0375	0	0	0	0
306	JUNCT_306	JUNCT_305	510	0.0375	0	0	0	0
310	JUNCT_310	JUNCT_306	400	0.01	0	0	0	0
315	JUNCT_315	JUNCT_306	842	0.019	0	0	0	0
320	JUNCT_320	JUNCT_315	400	0.01	0	0	0	0
325	JUNCT_325	JUNCT_1330	400	0.01	0	0	0	0
330	JUNCT_330	JUNCT_1330	215	0.019	0	0	0	0
330-OVERFLOW	JUNCT_330	JUNCT_1330	215	0.02	8.4	9.01	0	0
332	JUNCT_332	JUNCT_330	520	0.019	0	0	0	0
332-OVERFLOW	JUNCT_332	JUNCT_330	520	0.025	7.5	8.4	0	0
335	JUNCT_335	JUNCT_1335	400	0.01	0	0	0	0
340	JUNCT_340	JUNCT_1335	650	0.019	0	0	0	0
345	JUNCT_345	JUNCT_340	690	0.025	0	0	0	0
350	JUNCT_350	JUNCT_332	2090	0.055	0	0	0	0
355	JUNCT_355	DETENTION_1	400	0.01	0	0	0	0
360	JUNCT_360	DETENTION_1	3530	0.025	0	0	0	0
365	JUNCT_365	DETENTION_1	400	0.01	0	0	0	0
370	JUNCT_370	JUNCT_345	5255	0.025	0	0	0	0
400	JUNCT_400	OUTFALL_400	400	0.01	0	0	0	0
500	JUNCT_500	DETENTION_3	400	0.01	0	0	0	0
600	JUNCT_600	OUTFALL_600	178	0.019	0	0	0	0
600-OVERFLOW	JUNCT_600	OUTFALL_600	178	0.025	5.72	6.31	0	0
610	JUNCT_610	JUNCT_600	1350	0.022	0	5.72	0	0
615	JUNCT_615	JUNCT_600	1000	0.019	0	0	0	0
615-OVERFLOW	JUNCT_615	JUNCT_600	1000	0.025	9.45	5.72	0	0
630	JUNCT_630	JUNCT_620	2465	0.019	0	0	0	0
640	JUNCT_640	JUNCT_630	400	0.01	0	0	0	0
650	JUNCT_650	JUNCT_630	1290	0.019	0	0	0	0
999	JUNCT_999	JUNCT_350	3110	0.016	0	0	0	0
1500	JUNCT_100	JUNCT_1110	1320	0.019	0	0	0	0
1520	JUNCT_120	JUNCT_1110	890	0.019	0	0	0	0
1540	JUNCT_1040	OUTFALL_1030	2150	0.019	0	0	0	0
1550	JUNCT_1050	JUNCT_1040	430	0.019	0.31	0	0	0
1560	JUNCT_1060	JUNCT_1050	400	0.019	0	0.31	0	0
1570	JUNCT_70	JUNCT_1060	1000	0.019	0	0	0	0
1580	JUNCT_1080	JUNCT_1130	450	0.019	0	0	0	0
1610	JUNCT_1110	JUNCT_1080	460	0.019	0	0	0	0
1630	JUNCT_1130	JUNCT_1050	430	0.019	0	0	0	0

;Overflow elements are now comprised by 2 conduits and 1 divider.
;The additional conduit will have -OVERFLOW appended.
;Diversion elements areo now comprised by 2 conduits and 1 divider.
;The additional conduit will have -DIV appended.

1660	JUNCT_160	JUNCT_1170	1850	0.019	0	1.69	0	0
1662	JUNCT_SL_OUT	JUNCT_1170	840	0.019	0	1.69	0	0
1670	JUNCT_1170	JUNCT_1130	3000	0.019	0	0	0	0
1680	JUNCT_180	JUNCT_1170	1270	0.019	0	2.36	0	0
1740	JUNCT_1240	JUNCT_1230	970	0.019	0	0	0	0
1760	JUNCT_1260	JUNCT_1250	1820	0.019	0	0	0	0
1770	JUNCT_1270	JUNCT_1260	1300	0.019	0	0.49	0	0
1780	JUNCT_280	JUNCT_1270	400	0.019	0	1.32	0	0
2220	Outfall_220	JUNCT_N_BASIN	400	0.01	0	0	0	0
2230	Outfall_1230	JUNCT_N_BASIN	400	0.01	0	0	0	0
2250	Outfall_1250	JUNCT_N_BASIN	400	0.01	0	0	0	0
2290	OUTFALL_290	JUNCT_N_BASIN	400	0.01	0	0	0	0
2300	OUTFALL_300	JUNCT_SW_BASIN	400	0.01	0	0	0	0
2400	OUTFALL_400	JUNCT_SW_BASIN	400	0.01	0	0	0	0
2500	OUTFALL_500	JUNCT_NW_BASIN	400	0.01	0	0	0	0
2600	OUTFALL_600	JUNCT_NW_BASIN	400	0.01	0	0	0	0
630-OVERFLOW	JUNCT_630	JUNCT_620	2465	0.025	9.29	9.45	0	0
650-OVERFLOW	JUNCT_650	JUNCT_630	1290	0.025	11.33	9.29	0	0
999-OVERFLOW	JUNCT_999	JUNCT_350	3110	0.035	0	0	0	0
D1_OUT	JUNCT_D1_OUT	JUNCT_340	2150	0.019	0	0	0	0
D3_OUT	JUNCT_D3_OUT	OUTFALL_500	618.5	0.01	0	0	0	0
N_BASIN	JUNCT_N_BASIN	Sloan's_Lake	400	0.01	0	0	0	0
NW_BASIN	JUNCT_NW_BASIN	Sloan's_Lake	400	0.01	0	0	0	0
D3_OUT-OVERFLOW	JUNCT_D3_OUT	OUTFALL_500	618.5	0.025	6.2	6.55	0	0
1335-OVERFLOW	JUNCT_1335	JUNCT_1330	1060	0.025	7.33	9.01	0	0
340-OVERFLOW	JUNCT_340	JUNCT_1335	650	0.025	8.34	7.33	0	0
D1_OUT-OVERFLOW	JUNCT_D1_OUT	JUNCT_340	2150	0.025	11.07	8.34	0	0
S-BASIN	OUTFALL_210	Sloan's_Lake	400	0.01	0	0	0	0
SPLIT_142_NDG	SPLIT_142_NDG	OUTFALL_242	400	0.01	0	0	0	0
SW_BASIN	JUNCT_SW_BASIN	Sloan's_Lake	400	0.01	0	0	0	0
620_DIV	JUNCT_620	DETENTION_3	400	0.01	0	0	0	0
620	JUNCT_620	JUNCT_615	400	0.01	0	0	0	0

[OUTLETS]

;;Name	From Node	To Node	Offset	Type	QTable/Qcoeff	Qexpon	Gated
SL_OUTLET	Sloan's_Lake	JUNCT_SL_OUT	0	TABULAR/DEPTH	SloansLake_Outlet		NO
D1_OUTLET	DETENTION_1	JUNCT_D1_OUT	0	TABULAR/DEPTH	Detention_1_Outlet		NO
D3_OUTLET	DETENTION_3	JUNCT_D3_OUT	0	TABULAR/DEPTH	Detention_3_Outlet		NO

```
[XSECTIONS]
;;Link           Shape        Geom1           Geom2      Geom3      Geom4      Barrels    Culvert
;;-------------- ------------ --------------- ---------- ---------- ---------- ---------- ----------
110              DUMMY        0               0          0          0          1
130              DUMMY        0               0          0          0          1
1330-OVERFLOW    TRAPEZOIDAL  20              50         20         20         1
140              DUMMY        0               0          0          0          1
141_NDG          DUMMY        0               0          0          0          1
142              DUMMY        0               0          0          0          1
1230             DUMMY        0               0          0          0          1
1250             DUMMY        0               0          0          0          1
1330             CIRCULAR     6.5             0          0          0          1
1335             CIRCULAR     5               0          0          0          1
142_LOWELL       CIRCULAR     3.25            0          0          0          1
142_NDG          DUMMY        0               0          0          0          1
142-DIV_NDG      DUMMY        0               0          0          0          1
1442             CIRCULAR     2               0          0          0          1
1442-OVERFLOW    TRAPEZOIDAL  20              50         20         20         1
1444             CIRCULAR     3               0          0          0          1
1444-OVERFLOW    TRAPEZOIDAL  20              50         20         20         1
1446             CIRCULAR     2               0          0          0          1
1446-OVERFLOW    TRAPEZOIDAL  20              50         20         20         1
1500-OVERFLOW    TRAPEZOIDAL  20              2.5        20         20         1
1520-OVERFLOW    TRAPEZOIDAL  20              3.25       20         20         1
1540-OVERFLOW    TRAPEZOIDAL  20              4.5        20         20         1
1550-OVERFLOW    TRAPEZOIDAL  20              3.83       20         20         1
1560-OVERFLOW    TRAPEZOIDAL  20              3          20         20         1
1570-OVERFLOW    TRAPEZOIDAL  20              3          20         20         1
1580-OVERFLOW    TRAPEZOIDAL  20              4.33       20         20         1
1610-OVERFLOW    TRAPEZOIDAL  20              3.5        20         20         1
1630-OVERFLOW    TRAPEZOIDAL  20              3.83       20         20         1
1660-OVERFLOW    TRAPEZOIDAL  20              2.5        20         20         1
1662-OVERFLOW    TRAPEZOIDAL  20              3          20         20         1
1670-OVERFLOW    TRAPEZOIDAL  20              3.25       20         20         1
1680-OVERFLOW    TRAPEZOIDAL  20              2.25       20         20         1
1740-OVERFLOW    TRAPEZOIDAL  20              30         20         20         1
1760-OVERFLOW    TRAPEZOIDAL  20              30         20         20         1
1770-OVERFLOW    TRAPEZOIDAL  20              30         20         20         1
1780-OVERFLOW    TRAPEZOIDAL  20              40         20         20         1
20               DUMMY        0               0          0          0          1
241_NDG          TRAPEZOIDAL  0.5             0.5        12         1          1
241-OVERFLOW_NDG TRAPEZOIDAL  20              8          70         70         1
30               DUMMY        0               0          0          0          1
305-OVERFLOW     TRAPEZOIDAL  10              68         20         20         1
306-OVERFLOW     TRAPEZOIDAL  10              72         20         20         1
315-OVERFLOW     TRAPEZOIDAL  20              50         20         20         1
40               DUMMY        0               0          0          0          1
42               DUMMY        0               0          0          0          1
44               DUMMY        0               0          0          0          1
46               DUMMY        0               0          0          0          1
50               DUMMY        0               0          0          0          1
60               DUMMY        0               0          0          0          1
80               DUMMY        0               0          0          0          1
90               DUMMY        0               0          0          0          1
150              DUMMY        0               0          0          0          1
170              DUMMY        0               0          0          0          1
200              DUMMY        0               0          0          0          1
210              DUMMY        0               0          0          0          1
220              DUMMY        0               0          0          0          1
230              DUMMY        0               0          0          0          1
240              DUMMY        0               0          0          0          1
250              DUMMY        0               0          0          0          1
260              DUMMY        0               0          0          0          1
265              TRAPEZOIDAL  20              30         20         20         1
270              DUMMY        0               0          0          0          1
290              DUMMY        0               0          0          0          1
300              DUMMY        0               0          0          0          1
305              TRAPEZOIDAL  5               28         4          4          1
306              TRAPEZOIDAL  6               24         4          4          1
310              DUMMY        0               0          0          0          1
315              CIRCULAR     6.5             0          0          0          1
320              DUMMY        0               0          0          0          1
325              DUMMY        0               0          0          0          1
330              CIRCULAR     4.5             0          0          0          1
330-OVERFLOW     TRAPEZOIDAL  20              250        2.5        2.5        1
332              CIRCULAR     4.5             0          0          0          1
332-OVERFLOW     TRAPEZOIDAL  20              100        20         20         1
335              DUMMY        0               0          0          0          1
340              CIRCULAR     5               0          0          0          1
345              TRAPEZOIDAL  20              50         20         20         1
350              TRAPEZOIDAL  10              10         20         10         1
355              DUMMY        0               0          0          0          1
360              TRAPEZOIDAL  20              40         20         20         1
365              DUMMY        0               0          0          0          1
370              TRAPEZOIDAL  20              30         20         20         1
400              DUMMY        0               0          0          0          1
500              DUMMY        0               0          0          0          1
600              RECT_CLOSED  4               8          0          0          1
600-OVERFLOW     TRAPEZOIDAL  20              30         20         20         1
610              TRAPEZOIDAL  20              60         20         20         1
615              RECT_CLOSED  4               8          0          0          1
615-OVERFLOW     TRAPEZOIDAL  20              30         20         20         1
630              CIRCULAR     5               0          0          0          1
640              DUMMY        0               0          0          0          1
650              CIRCULAR     3               0          0          0          1
999              TRAPEZOIDAL  0.5             0.5        12         1          1
1500             CIRCULAR     1.5             0          0          0          1
1520             CIRCULAR     2.25            0          0          0          1
1540             CIRCULAR     3.5             0          0          0          1
1550             CIRCULAR     2.83            0          0          0          1
1560             CIRCULAR     2               0          0          0          1
1570             CIRCULAR     2               0          0          0          1
1580             CIRCULAR     3.33            0          0          0          1
1610             CIRCULAR     2.5             0          0          0          1
1630             CIRCULAR     2.83            0          0          0          1
1660             CIRCULAR     1.5             0          0          0          1
1662             CIRCULAR     2               0          0          0          1
1670             CIRCULAR     2.25            0          0          0          1
1680             CIRCULAR     1.25            0          0          0          1
1740             CIRCULAR     2.5             0          0          0          1
1760             CIRCULAR     3               0          0          0          1
1770             CIRCULAR     3               0          0          0          1
1780             CIRCULAR     3.5             0          0          0          1
2220             DUMMY        0               0          0          0          1
2230             DUMMY        0               0          0          0          1
2250             DUMMY        0               0          0          0          1
2290             DUMMY        0               0          0          0          1
2300             DUMMY        0               0          0          0          1
2400             DUMMY        0               0          0          0          1
2500             DUMMY        0               0          0          0          1
2600             DUMMY        0               0          0          0          1
630-OVERFLOW     TRAPEZOIDAL  20              30         20         20         1
650-OVERFLOW     TRAPEZOIDAL  20              30         20         20         1
999-OVERFLOW     TRAPEZOIDAL  20              8          70         70         1
D1_OUT           CIRCULAR     4               0          0          0          1
D3_OUT           CIRCULAR     4.5             0          0          0          1
N_BASIN          DUMMY        0               0          0          0          1
NW_BASIN         DUMMY        0               0          0          0          1
D3_OUT-OVERFLOW  TRAPEZOIDAL  20              30         20         20         1
1335-OVERFLOW    TRAPEZOIDAL  20              50         20         20         1
340-OVERFLOW     TRAPEZOIDAL  20              50         20         20         1
D1_OUT-OVERFLOW  TRAPEZOIDAL  20              30         20         20         1
S-BASIN          DUMMY        0               0          0          0          1
SPLIT_142_NDG    DUMMY        0               0          0          0          1
SW_BASIN         DUMMY        0               0          0          0          1
620_DIV          DUMMY        0               0          0          0          1
620              DUMMY        0               0          0          0          1

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
DIVCURVE_142_NDG Diversion  0          0
DIVCURVE_142_NDG            24         24
DIVCURVE_142_NDG            280        230
;
;Diversion curve to Citizens Park was derived from
;CLOMR North Branch of the Uppper Sloan Lake Basin
;Shedule I - Edgewater
;June 22, 1990
;Centennial Engineering Inc.
DIVCURVE_620     Diversion  0          0
DIVCURVE_620                277        0
DIVCURVE_620                514        152
DIVCURVE_620                769        407
DIVCURVE_620                813        451
DIVCURVE_620                1100       738
DIVCURVE_620                1400       1038
DIVCURVE_620                1700       1338
;
;Source: Upper Sloan's Lake Storm Drainage Project Schedule III, as-constructed June 1986.
Detention_1_Outlet Rating     0          72
```

```
Detention_1_Outlet           1         82
Detention_1_Outlet           2         93
Detention_1_Outlet           3         99
Detention_1_Outlet           4         104
Detention_1_Outlet           5         110
Detention_1_Outlet           6         116
Detention_1_Outlet           7         121
Detention_1_Outlet           8         127
Detention_1_Outlet           9         133
Detention_1_Outlet           10        136
Detention_1_Outlet           11        182
Detention_1_Outlet           12        500
Detention_1_Outlet           13        943
;
;Source: North Branch Upper Sloan's Lake Basin Storm Sewer Improvements - Schedule I, as-constructed drawing December
1991.
Detention_3_Outlet Rating    0         0
Detention_3_Outlet           0.3       50
Detention_3_Outlet           1         72
Detention_3_Outlet           2         91
Detention_3_Outlet           3         108
Detention_3_Outlet           4         123
Detention_3_Outlet           5         135
Detention_3_Outlet           6         146
Detention_3_Outlet           7         1102
Detention_3_Outlet           8         3176
;
;Source: LOMR Case No. 92-08-040P
SloansLake_Outlet Rating     0         0
SloansLake_Outlet            0.40      25
SloansLake_Outlet            0.90      26
SloansLake_Outlet            1.40      30
SloansLake_Outlet            2.40      36
SloansLake_Outlet            2.50      66
SloansLake_Outlet            3.35      919
;
;Detention facility is located at southeast of Wadsworth Boulevard & E 26th Avenue in the City of Lakewood.
;Surface area was measured from 2014 1-foot contours.
Detention_1      Storage     0         5883
Detention_1                  1         27851
Detention_1                  2         80214
Detention_1                  3         93166
Detention_1                  4         98109
Detention_1                  5         102749
Detention_1                  6         107663
Detention_1                  7         112953
Detention_1                  8         118551
Detention_1                  9         124313
Detention_1                  10        132002
Detention_1                  11        142454
Detention_1                  12        150874
Detention_1                  13        158793
;
;Detention facility is located at Citizens Park in the City of Edgewater.
;Surface area was measured from 2014 1-foot contours.
Detention_3      Storage     0         0
Detention_3                  0.3       341
Detention_3                  1         1135
Detention_3                  2         9139
Detention_3                  3         29522
Detention_3                  4         56929
Detention_3                  5         101062
Detention_3                  6         149037
Detention_3                  7         193782
;
;Surface area was measured from 2014 1-foot contours.
Sloan's_Lake     Storage     0         7703940
Sloan's_Lake                 0.40      7724239
Sloan's_Lake                 0.90      7754910
Sloan's_Lake                 1.40      7791732
Sloan's_Lake                 2.40      8002128
Sloan's_Lake                 2.50      8064670
Sloan's_Lake                 3.35      8597528

[REPORT]
;;Reporting Options
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 3111292.873 1691798.428 3136513.858 1706210.419
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
JUNCT_110        3132367.430        1696399.841
JUNCT_1230       3127926.112        1699191.273
JUNCT_1250       3127581.452        1699510.402
JUNCT_130        3132180.710        1695921.712
JUNCT_140        3130366.682        1695388.427
JUNCT_150        3129796.531        1695826.768
JUNCT_170        3130607.572        1696780.618
JUNCT_20         3134498.600        1695544.743
JUNCT_200        3126682.346        1697114.547
JUNCT_210        3126215.578        1695827.647
JUNCT_220        3128769.135        1698559.184
JUNCT_230        3129132.422        1699446.576
JUNCT_240        3129131.154        1700721.102
JUNCT_250        3127341.453        1700190.820
JUNCT_260        3127268.705        1701074.137
JUNCT_270        3126126.221        1702312.360
JUNCT_290        3125969.859        1699650.341
JUNCT_30         3134073.414        1694417.458
JUNCT_40         3131564.189        1694774.520
JUNCT_50         3133272.300        1695622.970
JUNCT_60         3132501.647        1695245.575
JUNCT_80         3133314.331        1696959.513
JUNCT_90         3132605.186        1696902.196
JUNCT_265        3128595.773        1701460.437
JUNCT_300        3125578.090        1696802.920
JUNCT_325        3120309.480        1697431.506
JUNCT_350        3117641.586        1697556.264
JUNCT_400        3125565.584        1697500.646
JUNCT_310        3122668.476        1697654.865
JUNCT_320        3121941.444        1697658.537
JUNCT_335        3120259.726        1698844.552
JUNCT_355        3117667.383        1699700.099
JUNCT_360        3115041.993        1698793.146
JUNCT_500        3124540.157        1698584.973
OUTFALL_600      3125978.110        1698736.148
JUNCT_640        3122914.143        1700197.168
JUNCT_345        3120275.960        1700222.214
JUNCT_365        3117570.987        1700197.168
JUNCT_370        3117579.335        1702768.562
JUNCT_610        3125543.978        1700230.562
OUTFALL_500      3125811.136        1698126.694
OUTFALL_400      3125903.397        1697541.037
OUTFALL_300      3126005.145        1697028.443
OUTFALL_210      3126357.372        1696647.111
OUTFALL_290      3126204.407        1699125.158
Outfall_1250     3127545.408        1699237.333
Outfall_1230     3127887.031        1698921.204
Outfall_220      3128228.655        1698350.131
JUNCT_NW_BASIN   3126153.095        1698364.674
JUNCT_N_BASIN    3127439.129        1697984.767
JUNCT_SW_BASIN   3126166.783        1697479.547
JUNCT_141_NDG    3112192.657        1697599.645
JUNCT_142_NDG    3114317.147        1697473.572
JUNCT_42         3129111.321        1694325.811
JUNCT_44         3126363.885        1694581.823
JUNCT_46         3123541.518        1694800.369
OUTFALL_20       3135911.996        1695654.877
OUTFALL_1030     3135649.549        1694769.255
OUTFALL_LOWELL   3130870.693        1693986.276
OUTFALL_242      3114596.952        1696711.210
JUNCT_160        3128855.476        1696173.150
JUNCT_1130       3133520.089        1695759.737
JUNCT_1270       3126558.951        1701478.943
JUNCT_100        3132185.959        1696637.695
JUNCT_1170       3130544.471        1695725.613
JUNCT_180        3130256.330        1696856.718
JUNCT_1240       3128551.606        1699855.062
JUNCT_1060       3133160.503        1695308.667
JUNCT_120        3132180.639        1696197.867
JUNCT_280        3127562.631        1701483.999
JUNCT_1080       3133526.726        1696164.170
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JUNCT_SL_OUT     3130130.652       1696255.914
JUNCT_1110       3133148.970       1696162.397
JUNCT_1040       3133522.378       1694837.610
JUNCT_70         3132087.492       1695318.436
JUNCT_1050       3133537.788       1695304.383
JUNCT_1260       3126973.569       1700558.692
JUNCT_142        3130827.507       1694888.370
JUNCT_1442       3130957.063       1694888.370
JUNCT_144        3127564.616       1694873.975
JUNCT_146        3125587.687       1694849.983
JUNCT_315        3121950.522       1697441.103
JUNCT_306        3122675.076       1697297.152
JUNCT_305        3123006.164       1697062.032
JUNCT_1330       3120381.455       1697709.812
JUNCT_330        3120165.529       1697705.013
JUNCT_332        3119661.700       1697685.820
JUNCT_340        3120344.179       1699446.739
JUNCT_1335       3120388.242       1698840.880
JUNCT_D1_OUT     3118320.977       1699472.443
JUNCT_D3_OUT     3125168.288       1698154.800
JUNCT_620        3124434.253       1698848.975
JUNCT_600        3125543.978       1698886.425
JUNCT_650        3123306.531       1701474.516
JUNCT_241__NDG   3112423.550       1697489.218
SPLIT_142_NDG    3114500.889       1697404.048
JUNCT_630        3123289.834       1700213.865
JUNCT_999        3114893.204       1697399.082
JUNCT_615        3124594.026       1698850.350
Sloan's_Lake     3128311.161       1697324.422
DETENTION_1      3118060.273       1699674.396
DETENTION_3      3124767.551       1698505.445

[VERTICES]
;;Link            X-Coord           Y-Coord
;;--------------  ----------------- ------------------
1330-OVERFLOW    3120573.390       1697685.820
1330-OVERFLOW    3120621.374       1697513.078
1330             3120501.415       1697676.223
1330             3120515.810       1697431.506
1442-OVERFLOW    3131825.568       1695065.910
1444-OVERFLOW    3128807.394       1695041.918
1446-OVERFLOW    3126470.587       1695037.119
1500-OVERFLOW    3132931.141       1696683.614
1520-OVERFLOW    3132888.934       1696246.348
1540-OVERFLOW    3134245.290       1694909.632
1550-OVERFLOW    3133287.317       1694950.191
1560-OVERFLOW    3133410.488       1695406.635
1570-OVERFLOW    3132487.557       1695369.661
1580-OVERFLOW    3133595.892       1695958.444
1610-OVERFLOW    3133437.331       1696261.789
1630-OVERFLOW    3133579.623       1695565.045
1660-OVERFLOW    3129640.733       1696222.303
1662-OVERFLOW    3130332.964       1696111.844
1670-OVERFLOW    3132186.710       1695837.714
1680-OVERFLOW    3130434.119       1696461.291
1740-OVERFLOW    3127921.802       1699524.405
1760-OVERFLOW    3126815.541       1699516.785
1770-OVERFLOW    3126617.804       1700840.413
1780-OVERFLOW    3126795.138       1701682.750
241-OVERFLOW_NDG 3113362.178       1697770.305
305-OVERFLOW     3123346.848       1696951.669
305-OVERFLOW     3123385.235       1696678.162
305-OVERFLOW     3123884.266       1696682.960
305-OVERFLOW     3124090.596       1696822.113
305-OVERFLOW     3125107.850       1696788.524
305-OVERFLOW     3125280.591       1696860.500
306-OVERFLOW     3122857.414       1697201.184
306-OVERFLOW     3123006.164       1697191.588
315-OVERFLOW     3122580.351       1697522.677
90               3133069.193       1696783.318
305              3123294.066       1696908.484
305              3123313.260       1696586.993
305              3123917.854       1696572.598
305              3124143.378       1696745.339
305              3125127.044       1696730.944
305              3125270.995       1696798.121
306              3122775.842       1697167.596
306              3122948.583       1697124.410
315              3122579.109       1697441.103
330-OVERFLOW     3120280.690       1697834.569
332-OVERFLOW     3119853.635       1697839.368
360              3117638.008       1698771.115
360              3117685.742       1699410.021
370              3118981.914       1702718.470
370              3118998.611       1701432.773
370              3119958.710       1701441.121
370              3120025.499       1700205.516
600-OVERFLOW     3125811.136       1698953.214
615-OVERFLOW     3124825.992       1699095.142
630              3123323.229       1699454.135
630              3124308.373       1699454.135
630              3124308.373       1698827.984
1500             3132888.959       1696633.762
1660             3129612.612       1696136.366
1760             3126924.045       1699542.315
630-OVERFLOW     3123515.248       1699646.155
630-OVERFLOW     3124425.255       1699612.760
650-OVERFLOW     3123515.248       1700906.806
999-OVERFLOW     3115927.094       1697669.916
D3_OUT-OVERFLOW  3125493.886       1698488.747
1335-OVERFLOW    3120553.476       1698403.927
340-OVERFLOW     3120498.398       1699156.661
D1_OUT-OVERFLOW  3119213.242       1699593.614


[BACKDROP]
FILE       "R:\16.155.026 (Sloan's Lake)\Drainage\Hydrology\SL_CUHP_SWMM_2016\Background\Sloans
Lake_SWMM_Background_Large Basins.jpg"
DIMENSIONS 3111292.873 1691798.428 3136513.858 1706210.419
```

EPA SWMM 5.1 100-year, Future Conditions Output

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.010)
--------------------------------------------------------------

Sloan's Lake Drainageway
Major Drainageway Plan
Baseline Hydrology Report
WARNING 04: minimum elevation drop used for Conduit 142
WARNING 04: minimum elevation drop used for Conduit 1580-OVERFLOW
WARNING 04: minimum elevation drop used for Conduit 600-OVERFLOW
WARNING 04: minimum elevation drop used for Conduit 2220
WARNING 04: minimum elevation drop used for Conduit 2230
WARNING 04: minimum elevation drop used for Conduit 2250
WARNING 04: minimum elevation drop used for Conduit 2290
WARNING 04: minimum elevation drop used for Conduit 2400
WARNING 04: minimum elevation drop used for Conduit N_BASIN
WARNING 04: minimum elevation drop used for Conduit NW_BASIN
WARNING 04: minimum elevation drop used for Conduit S-BASIN
WARNING 04: minimum elevation drop used for Conduit SW_BASIN

*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

***************
Analysis Options
***************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ NO
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... KINWAVE
Starting Date ............ JAN-01-2005 00:00:00
Ending Date .............. JAN-01-2005 10:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Routing Time Step ........ 300.00 sec


*************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
*************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.000         0.000
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........       500.441       163.076
External Outflow .........       140.740        45.862
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......       368.086       119.946
Continuity Error (%) .....        -1.675


*******************************
Highest Flow Instability Indexes
*******************************
Link D1_OUT (18)
Link D1_OUTLET (17)
Link 1335 (11)
Link 340 (11)
Link 315 (9)

************************
Routing Time Step Summary
************************
Minimum Time Step           :   299.00 sec
Average Time Step           :   299.99 sec
Maximum Time Step           :   300.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.03
Percent Not Converging      :     0.00


*****************
Node Depth Summary
*****************

-------------------------------------------------------------------------------------
                                 Average  Maximum  Maximum  Time of Max    Reported
                                   Depth    Depth      HGL   Occurrence   Max Depth
Node                 Type          Feet     Feet     Feet  days hr:min        Feet
-------------------------------------------------------------------------------------
JUNCT_110            JUNCTION      0.00     0.00  5308.00     0  00:00         0.00
JUNCT_1230           JUNCTION      5.23     6.01  5318.86     0  00:45         6.01
JUNCT_1250           JUNCTION      5.41     6.09  5316.75     0  00:50         6.09
JUNCT_130            JUNCTION      0.00     0.00  5308.00     0  00:00         0.00
JUNCT_140            JUNCTION      0.00     0.00  5330.00     0  00:00         0.00
JUNCT_150            JUNCTION      0.00     0.00  5336.00     0  00:00         0.00
JUNCT_170            JUNCTION      0.00     0.00  5340.00     0  00:00         0.00
JUNCT_20             JUNCTION      0.00     0.00  5281.00     0  00:00         0.00
JUNCT_200            JUNCTION      0.00     0.00  5315.00     0  00:00         0.00
JUNCT_210            JUNCTION      0.00     0.00  5356.00     0  00:00         0.00
JUNCT_220            JUNCTION      0.00     0.00  5320.00     0  00:00         0.00
JUNCT_230            JUNCTION      0.00     0.00  5336.00     0  00:00         0.00
JUNCT_240            JUNCTION      0.00     0.00  5378.00     0  00:00         0.00
JUNCT_250            JUNCTION      0.00     0.00  5350.00     0  00:00         0.00
JUNCT_260            JUNCTION      0.00     0.00  5390.00     0  00:00         0.00
JUNCT_270            JUNCTION      0.00     0.00  5472.00     0  00:00         0.00
JUNCT_290            JUNCTION      0.00     0.00  5320.00     0  00:00         0.00
JUNCT_30             JUNCTION      0.00     0.00  5281.00     0  00:00         0.00
JUNCT_40             JUNCTION      0.00     0.00  5312.00     0  00:00         0.00
JUNCT_50             JUNCTION      0.00     0.00  5290.00     0  00:00         0.00
JUNCT_60             JUNCTION      0.00     0.00  5304.00     0  00:00         0.00
JUNCT_80             JUNCTION      0.00     0.00  5294.00     0  00:00         0.00
JUNCT_90             JUNCTION      0.00     0.00  5320.00     0  00:00         0.00
JUNCT_265            JUNCTION      0.05     0.50  5392.50     0  00:40         0.50
JUNCT_300            JUNCTION      5.00     5.00  5315.05     0  00:05         5.00
JUNCT_325            JUNCTION      0.00     0.00  5412.00     0  00:00         0.00
JUNCT_350            JUNCTION      0.40     1.67  5449.67     0  01:10         1.67
JUNCT_400            JUNCTION      0.00     0.00  5314.00     0  00:00         0.00
JUNCT_310            JUNCTION      0.00     0.00  5351.00     0  00:00         0.00
JUNCT_320            JUNCTION      0.00     0.00  5359.00     0  00:00         0.00
JUNCT_335            JUNCTION      0.00     0.00  5398.00     0  00:00         0.00
JUNCT_355            JUNCTION      0.00     0.00  5460.00     0  00:00         0.00
JUNCT_360            JUNCTION      0.09     0.55  5517.55     0  00:50         0.55
JUNCT_500            JUNCTION      0.00     0.00  5320.00     0  00:00         0.00
OUTFALL_600          JUNCTION      7.22    13.50  5322.19     0  01:00        13.50
JUNCT_640            JUNCTION      0.00     0.00  5365.00     0  00:00         0.00
JUNCT_345            JUNCTION      0.18     0.64  5412.64     0  00:55         0.64
JUNCT_365            JUNCTION      0.00     0.00  5480.00     0  00:00         0.00
JUNCT_370            JUNCTION      0.14     0.46  5491.46     0  01:10         0.46
JUNCT_610            JUNCTION      0.06     0.40  5360.40     0  00:45         0.40
OUTFALL_500          JUNCTION      6.55     6.55  5313.05     0  00:05         6.55
OUTFALL_400          JUNCTION      0.00     0.00  5310.65     0  00:00         0.00
OUTFALL_300          JUNCTION      0.00     0.00  5308.85     0  00:00         0.00
OUTFALL_210          JUNCTION      0.00     0.00  5310.65     0  00:00         0.00
OUTFALL_290          JUNCTION      0.00     0.00  5310.65     0  00:00         0.00
Outfall_1250         JUNCTION      0.00     0.00  5310.65     0  00:00         0.00
Outfall_1230         JUNCTION      0.00     0.00  5310.65     0  00:00         0.00
Outfall_220          JUNCTION      0.00     0.00  5310.65     0  00:00         0.00
JUNCT_NW_BASIN       JUNCTION      0.00     0.00  5310.65     0  00:00         0.00
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JUNCT_N_BASIN	JUNCTION	0.00	0.00	5310.65	0	00:00	0.00
JUNCT_SW_BASIN	JUNCTION	0.00	0.00	5310.65	0	00:00	0.00
JUNCT_141_NDG	JUNCTION	0.00	0.00	5555.00	0	00:00	0.00
JUNCT_142_NDG	JUNCTION	0.15	0.59	5509.59	0	01:05	0.59
JUNCT_42	JUNCTION	0.00	0.00	5310.00	0	00:00	0.00
JUNCT_44	JUNCTION	0.00	0.00	5340.00	0	00:00	0.00
JUNCT_46	JUNCTION	0.00	0.00	5360.00	0	00:00	0.00
OUTFALL_20	OUTFALL	0.00	0.00	5192.00	0	00:00	0.00
OUTFALL_1030	OUTFALL	9.36	10.94	5199.85	0	01:05	10.94
OUTFALL_LOWELL	OUTFALL	0.87	3.25	5303.16	0	00:30	3.25
OUTFALL_242	OUTFALL	0.00	0.00	5484.26	0	00:00	0.00
JUNCT_160	DIVIDER	3.60	4.27	5320.75	0	00:45	4.27
JUNCT_1130	DIVIDER	12.47	15.45	5288.82	0	01:20	15.45
JUNCT_1270	DIVIDER	11.28	11.71	5390.46	0	00:45	11.71
JUNCT_100	DIVIDER	5.67	6.07	5308.43	0	00:40	6.07
JUNCT_1170	DIVIDER	6.40	7.23	5309.47	0	00:50	7.23
JUNCT_180	DIVIDER	7.43	8.47	5315.18	0	00:40	8.47
JUNCT_1240	DIVIDER	13.00	13.79	5334.87	0	00:45	13.79
JUNCT_1060	DIVIDER	9.68	9.68	5294.00	0	00:05	9.68
JUNCT_120	DIVIDER	6.84	7.00	5303.16	0	00:45	7.00
JUNCT_280	DIVIDER	5.88	5.88	5392.00	0	00:05	5.88
JUNCT_1080	DIVIDER	7.77	12.67	5289.40	0	00:45	12.67
JUNCT_SL_OUT	DIVIDER	4.20	4.26	5313.57	0	05:55	4.26
JUNCT_1110	DIVIDER	6.53	7.50	5288.09	0	00:45	7.50
JUNCT_1040	DIVIDER	8.53	10.11	5254.38	0	01:00	10.11
JUNCT_70	DIVIDER	8.70	8.70	5302.00	0	00:05	8.70
JUNCT_1050	DIVIDER	12.31	13.41	5276.32	0	01:05	13.41
JUNCT_1260	DIVIDER	7.68	8.36	5352.74	0	00:45	8.36
JUNCT_142	DIVIDER	6.48	7.37	5312.01	0	01:00	7.37
JUNCT_1442	DIVIDER	9.19	10.00	5311.91	0	00:55	10.00
JUNCT_144	DIVIDER	9.45	10.39	5338.05	0	00:50	10.39
JUNCT_146	DIVIDER	8.18	8.90	5355.81	0	00:45	8.90
JUNCT_315	DIVIDER	10.69	11.85	5362.32	0	01:00	11.85
JUNCT_306	DIVIDER	6.16	7.32	5346.97	0	01:00	7.32
JUNCT_305	DIVIDER	6.00	6.00	5344.05	0	00:05	6.00
JUNCT_1330	DIVIDER	9.15	10.17	5387.16	0	00:55	10.17
JUNCT_330	DIVIDER	8.45	8.91	5394.51	0	01:15	8.91
JUNCT_332	DIVIDER	7.55	8.01	5397.26	0	01:15	8.01
JUNCT_340	DIVIDER	8.51	9.38	5404.04	0	00:55	9.38
JUNCT_1335	DIVIDER	7.50	8.37	5398.54	0	00:55	8.37
JUNCT_D1_OUT	DIVIDER	11.11	11.27	5437.20	0	02:05	11.27
JUNCT_D3_OUT	DIVIDER	6.20	6.20	5317.28	0	00:05	6.20
JUNCT_620	DIVIDER	9.52	10.41	5324.96	0	00:50	10.41
JUNCT_600	DIVIDER	6.52	13.02	5322.30	0	00:50	13.02
JUNCT_650	DIVIDER	11.36	11.78	5417.45	0	00:45	11.78
JUNCT_241_NDG	DIVIDER	0.14	0.60	5554.60	0	00:50	0.60
SPLIT_142_NDG	DIVIDER	0.00	0.00	5508.90	0	00:00	0.00
JUNCT_630	DIVIDER	9.35	10.29	5362.00	0	00:45	10.29
JUNCT_999	DIVIDER	0.21	0.66	5508.66	0	01:05	0.66
JUNCT_615	DIVIDER	9.52	10.24	5324.78	0	00:45	10.24
Sloan's_Lake	STORAGE	1.78	2.11	5312.76	0	05:55	2.11
DETENTION_1	STORAGE	2.96	9.51	5447.51	0	02:05	9.51
DETENTION_3	STORAGE	0.47	5.04	5319.19	0	01:10	5.04

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Node Inflow Summary
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Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
JUNCT_110	JUNCTION	15.06	15.06	0 00:40	0.349	0.349	0.000
JUNCT_1230	JUNCTION	0.00	255.96	0 00:50	0	6.25	0.000
JUNCT_1250	JUNCTION	0.00	368.71	0 00:50	0	9.18	0.000
JUNCT_130	JUNCTION	67.06	67.06	0 00:50	2.11	2.11	0.000
JUNCT_140	JUNCTION	70.61	70.61	0 00:45	1.98	1.98	0.000
JUNCT_150	JUNCTION	26.75	26.75	0 00:50	0.9	0.9	0.000
JUNCT_170	JUNCTION	22.44	22.44	0 00:45	0.626	0.626	0.000
JUNCT_20	JUNCTION	125.35	125.35	0 00:40	3	3	0.000
JUNCT_200	JUNCTION	383.09	383.09	0 01:00	14.6	14.6	0.000
JUNCT_210	JUNCTION	80.46	80.46	0 00:40	1.74	1.74	0.000
JUNCT_220	JUNCTION	47.24	47.24	0 00:50	1.62	1.62	0.000
JUNCT_230	JUNCTION	42.12	42.12	0 00:50	1.4	1.4	0.000
JUNCT_240	JUNCTION	99.70	99.70	0 00:45	2.45	2.45	0.000
JUNCT_250	JUNCTION	127.63	127.63	0 00:45	2.97	2.97	0.000
JUNCT_260	JUNCTION	87.35	87.35	0 00:40	1.78	1.78	0.000
JUNCT_270	JUNCTION	94.48	94.48	0 00:45	2.18	2.18	0.000
JUNCT_290	JUNCTION	41.92	41.92	0 00:45	1.1	1.1	0.000
JUNCT_30	JUNCTION	129.60	129.60	0 00:40	2.72	2.72	0.000
JUNCT_40	JUNCTION	115.74	115.74	0 00:45	3.01	3.01	0.000
JUNCT_50	JUNCTION	27.00	27.00	0 00:40	0.524	0.524	0.000
JUNCT_60	JUNCTION	20.19	20.19	0 00:40	0.434	0.434	0.000
JUNCT_80	JUNCTION	23.81	23.81	0 00:45	0.602	0.602	0.000
JUNCT_90	JUNCTION	22.01	22.01	0 00:45	0.551	0.551	0.000
JUNCT_265	JUNCTION	121.20	121.20	0 00:40	2.34	2.34	0.000
JUNCT_300	JUNCTION	297.70	1516.57	0 01:05	5.9	65.6	0.000
JUNCT_325	JUNCTION	39.30	39.30	0 00:40	0.731	0.731	0.000
JUNCT_350	JUNCTION	210.54	261.13	0 01:10	5.48	10.1	0.000
JUNCT_400	JUNCTION	183.86	183.86	0 00:45	4.24	4.24	0.000
JUNCT_310	JUNCTION	99.76	99.76	0 00:45	2.4	2.4	0.000
JUNCT_320	JUNCTION	203.49	203.49	0 00:45	5.42	5.42	0.000
JUNCT_335	JUNCTION	45.57	45.57	0 00:45	1.17	1.17	0.000
JUNCT_355	JUNCTION	194.27	194.27	0 00:45	4.94	4.94	0.000
JUNCT_360	JUNCTION	148.90	148.90	0 00:50	4.53	4.53	0.000
JUNCT_500	JUNCTION	22.91	22.91	0 00:40	0.456	0.456	0.000
OUTFALL_600	JUNCTION	0.00	612.66	0 01:00	0	19.7	0.000
JUNCT_640	JUNCTION	201.76	201.76	0 00:45	5.35	5.35	0.000
JUNCT_345	JUNCTION	237.16	251.62	0 00:55	6.67	10.6	0.000
JUNCT_365	JUNCTION	90.56	90.56	0 01:15	5.83	5.83	0.000
JUNCT_370	JUNCTION	67.60	67.60	0 01:10	3.85	3.85	0.000
JUNCT_610	JUNCTION	167.73	167.73	0 00:45	4.6	4.6	0.000
OUTFALL_500	JUNCTION	0.00	135.22	0 01:10	0	3.8	0.000
OUTFALL_400	JUNCTION	0.00	183.86	0 00:45	0	4.24	0.000
OUTFALL_300	JUNCTION	0.00	1516.57	0 01:05	0	65.6	0.000
OUTFALL_210	JUNCTION	0.00	80.46	0 00:40	0	1.74	0.000
OUTFALL_290	JUNCTION	0.00	41.92	0 00:45	0	1.1	0.000
Outfall_1250	JUNCTION	0.00	368.71	0 00:50	0	9.18	0.000
Outfall_1230	JUNCTION	0.00	255.96	0 00:50	0	6.25	0.000
Outfall_220	JUNCTION	0.00	47.24	0 00:50	0	1.62	0.000
JUNCT_NW_BASIN	JUNCTION	0.00	745.67	0 01:00	0	23.5	0.000
JUNCT_N_BASIN	JUNCTION	0.00	712.50	0 00:50	0	18.1	0.000
JUNCT_SW_BASIN	JUNCTION	0.00	1641.90	0 01:05	0	69.9	0.000
JUNCT_141_NDG	JUNCTION	102.53	102.53	0 00:50	3.27	3.27	0.000
JUNCT_142_NDG	JUNCTION	40.75	140.36	0 01:05	1.89	5.22	0.000
JUNCT_42	JUNCTION	170.30	170.30	0 00:50	5.05	5.05	0.000
JUNCT_44	JUNCTION	157.73	157.73	0 00:40	3.39	3.39	0.000
JUNCT_46	JUNCTION	249.08	249.08	0 00:45	5.89	5.89	0.000
OUTFALL_20	OUTFALL	0.00	125.35	0 00:40	0	3	0.000
OUTFALL_1030	OUTFALL	0.00	1066.02	0 01:05	0	39.1	0.000
OUTFALL_LOWELL	OUTFALL	0.00	46.39	0 02:35	0	3.07	0.000
OUTFALL_242	OUTFALL	0.00	22.73	0 01:05	0	0.663	0.000
JUNCT_160	DIVIDER	48.30	48.30	0 00:45	1.2	1.2	0.000
JUNCT_1130	DIVIDER	0.00	405.42	0 01:05	0	20.6	0.000
JUNCT_1270	DIVIDER	0.00	168.97	0 00:45	0	4.39	0.000
JUNCT_100	DIVIDER	26.59	26.59	0 00:40	0.611	0.611	0.000
JUNCT_1170	DIVIDER	0.00	283.80	0 00:50	0	15.2	0.000
JUNCT_180	DIVIDER	114.02	114.02	0 00:40	2.31	2.31	0.000
JUNCT_1240	DIVIDER	0.00	219.02	0 00:45	0	4.82	0.000
JUNCT_1060	DIVIDER	0.00	26.29	0 00:45	0	0.702	0.000
JUNCT_120	DIVIDER	30.38	30.38	0 00:45	0.757	0.757	0.000
JUNCT_280	DIVIDER	75.09	75.09	0 00:45	2.2	2.2	0.000
JUNCT_1080	DIVIDER	0.00	183.65	0 00:45	0	5.01	0.000
JUNCT_SL_OUT	DIVIDER	0.00	34.24	0 05:55	0	8.25	0.000
JUNCT_1110	DIVIDER	0.00	160.30	0 00:45	0	4.4	0.000
JUNCT_1040	DIVIDER	0.00	990.88	0 01:00	0	36.4	0.000
JUNCT_70	DIVIDER	7.66	7.66	0 00:50	0.268	0.268	0.000
JUNCT_1050	DIVIDER	0.00	439.08	0 01:05	0	21.8	0.000
JUNCT_1260	DIVIDER	0.00	251.44	0 00:45	0	6.2	0.000

JUNCT_142	DIVIDER	0.00	513.70	0	00:55	0	14.6	0.000
JUNCT_1442	DIVIDER	0.00	467.59	0	00:55	0	11.5	0.000
JUNCT_144	DIVIDER	0.00	382.12	0	00:50	0	9.33	0.000
JUNCT_146	DIVIDER	0.00	249.08	0	00:45	0	5.89	0.000
JUNCT_315	DIVIDER	126.18	1202.34	0	01:00	3.08	54.9	0.000
JUNCT_306	DIVIDER	0.00	1285.41	0	01:00	0	57.4	0.000
JUNCT_305	DIVIDER	123.38	1366.84	0	01:00	2.27	59.7	0.000
JUNCT_1330	DIVIDER	0.00	929.60	0	00:55	0	46.2	0.000
JUNCT_330	DIVIDER	175.80	370.38	0	01:00	4.04	14.2	0.000
JUNCT_332	DIVIDER	0.00	259.29	0	01:15	0	10.1	0.000
JUNCT_340	DIVIDER	151.76	493.04	0	00:55	3.89	30	0.000
JUNCT_1335	DIVIDER	0.00	534.39	0	00:55	0	31.2	0.000
JUNCT_D1_OUT	DIVIDER	0.00	134.52	0	02:05	0	15.4	0.000
JUNCT_D3_OUT	DIVIDER	0.00	135.39	0	01:10	0	3.81	0.000
JUNCT_620	DIVIDER	144.32	614.72	0	00:50	2.93	15.5	0.000
JUNCT_600	DIVIDER	105.26	629.88	0	00:50	2.51	19.5	0.000
JUNCT_650	DIVIDER	204.90	204.90	0	00:45	5.05	5.05	0.000
JUNCT_241_NDG	DIVIDER	0.00	102.53	0	00:50	0	3.27	0.000
SPLIT_142_NDG	DIVIDER	0.00	140.36	0	01:05	0	5.22	0.000
JUNCT_630	DIVIDER	121.60	511.12	0	00:45	1.93	12.4	0.000
JUNCT_999	DIVIDER	0.00	117.63	0	01:05	0	4.55	0.000
JUNCT_615	DIVIDER	0.00	362.00	0	00:45	0	12.2	0.000
Sloan's_Lake	STORAGE	0.00	3436.39	0	01:00	0	128	-0.002
DETENTION_1	STORAGE	0.00	398.77	0	00:55	0	15.3	-0.465
DETENTION_3	STORAGE	0.00	272.83	0	00:50	0	3.75	-1.365

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Node Surcharge Summary
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Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Feet	Min. Depth Below Rim Feet
JUNCT_110	JUNCTION	10.00	0.000	0.000
JUNCT_1230	JUNCTION	10.00	6.008	19.142
JUNCT_1250	JUNCTION	10.00	6.086	19.264
JUNCT_130	JUNCTION	10.00	0.000	0.000
JUNCT_140	JUNCTION	10.00	0.000	0.000
JUNCT_150	JUNCTION	10.00	0.000	0.000
JUNCT_170	JUNCTION	10.00	0.000	0.000
JUNCT_20	JUNCTION	10.00	0.000	0.000
JUNCT_200	JUNCTION	10.00	0.000	0.000
JUNCT_210	JUNCTION	10.00	0.000	0.000
JUNCT_220	JUNCTION	10.00	0.000	0.000
JUNCT_230	JUNCTION	10.00	0.000	0.000
JUNCT_240	JUNCTION	10.00	0.000	0.000
JUNCT_250	JUNCTION	10.00	0.000	0.000
JUNCT_260	JUNCTION	10.00	0.000	0.000
JUNCT_270	JUNCTION	10.00	0.000	0.000
JUNCT_290	JUNCTION	10.00	0.000	0.000
JUNCT_30	JUNCTION	10.00	0.000	0.000
JUNCT_40	JUNCTION	10.00	0.000	0.000
JUNCT_50	JUNCTION	10.00	0.000	0.000
JUNCT_60	JUNCTION	10.00	0.000	0.000
JUNCT_80	JUNCTION	10.00	0.000	0.000
JUNCT_90	JUNCTION	10.00	0.000	0.000
JUNCT_265	JUNCTION	10.00	0.502	19.498
JUNCT_300	JUNCTION	10.00	5.000	10.000
JUNCT_325	JUNCTION	10.00	0.000	0.000
JUNCT_350	JUNCTION	10.00	1.673	18.327
JUNCT_400	JUNCTION	10.00	0.000	0.000
JUNCT_310	JUNCTION	10.00	0.000	0.000
JUNCT_320	JUNCTION	10.00	0.000	0.000
JUNCT_335	JUNCTION	10.00	0.000	0.000
JUNCT_355	JUNCTION	10.00	0.000	0.000
JUNCT_360	JUNCTION	10.00	0.554	19.446
JUNCT_500	JUNCTION	10.00	0.000	0.000
OUTFALL_600	JUNCTION	10.00	13.498	12.812
JUNCT_640	JUNCTION	10.00	0.000	0.000
JUNCT_345	JUNCTION	10.00	0.644	19.356
JUNCT_365	JUNCTION	10.00	0.000	0.000
JUNCT_370	JUNCTION	10.00	0.459	19.541
JUNCT_610	JUNCTION	10.00	0.398	19.602
OUTFALL_500	JUNCTION	10.00	6.550	20.000
OUTFALL_400	JUNCTION	10.00	0.000	0.000
OUTFALL_300	JUNCTION	10.00	0.000	10.000
OUTFALL_210	JUNCTION	10.00	0.000	0.000
OUTFALL_290	JUNCTION	10.00	0.000	0.000
Outfall_1250	JUNCTION	10.00	0.000	0.000
Outfall_1230	JUNCTION	10.00	0.000	0.000
Outfall_220	JUNCTION	10.00	0.000	0.000
JUNCT_NW_BASIN	JUNCTION	10.00	0.000	0.000
JUNCT_N_BASIN	JUNCTION	10.00	0.000	0.000
JUNCT_SW_BASIN	JUNCTION	10.00	0.000	0.000
JUNCT_141_NDG	JUNCTION	10.00	0.000	0.000
JUNCT_142_NDG	JUNCTION	10.00	0.592	19.408
JUNCT_42	JUNCTION	10.00	0.000	0.000
JUNCT_44	JUNCTION	10.00	0.000	0.000
JUNCT_46	JUNCTION	10.00	0.000	0.000
JUNCT_160	DIVIDER	10.00	4.267	19.253
JUNCT_1130	DIVIDER	10.00	15.452	16.178
JUNCT_1270	DIVIDER	10.00	11.711	19.539
JUNCT_100	DIVIDER	10.00	6.070	19.570
JUNCT_1170	DIVIDER	10.00	7.230	18.530
JUNCT_180	DIVIDER	10.00	8.468	18.822
JUNCT_1240	DIVIDER	10.00	13.788	19.132
JUNCT_1060	DIVIDER	10.00	9.680	20.000
JUNCT_120	DIVIDER	10.00	7.005	19.835
JUNCT_280	DIVIDER	10.00	5.880	20.000
JUNCT_1080	DIVIDER	10.00	12.665	14.605
JUNCT_SL_OUT	DIVIDER	10.00	4.259	19.431
JUNCT_1110	DIVIDER	10.00	7.503	18.907
JUNCT_1040	DIVIDER	10.00	10.108	18.162
JUNCT_70	DIVIDER	10.00	8.700	20.000
JUNCT_1050	DIVIDER	10.00	13.411	18.699
JUNCT_1260	DIVIDER	10.00	8.364	19.256
JUNCT_142	DIVIDER	10.00	7.369	18.991
JUNCT_1442	DIVIDER	10.00	10.005	19.085
JUNCT_144	DIVIDER	10.00	10.392	18.948
JUNCT_146	DIVIDER	10.00	8.905	19.185
JUNCT_315	DIVIDER	10.00	11.847	18.683
JUNCT_306	DIVIDER	10.00	7.320	18.680
JUNCT_305	DIVIDER	10.00	6.000	10.000
JUNCT_1330	DIVIDER	10.00	10.171	18.839
JUNCT_330	DIVIDER	10.00	8.910	19.490
JUNCT_332	DIVIDER	10.00	8.011	19.489
JUNCT_340	DIVIDER	10.00	9.375	18.965
JUNCT_1335	DIVIDER	10.00	8.365	18.965
JUNCT_D1_OUT	DIVIDER	10.00	11.269	19.801
JUNCT_D3_OUT	DIVIDER	10.00	6.200	20.000
JUNCT_620	DIVIDER	10.00	10.412	19.038
JUNCT_600	DIVIDER	10.00	13.022	12.698
JUNCT_650	DIVIDER	10.00	11.781	19.549
JUNCT_241_NDG	DIVIDER	10.00	0.600	19.400
SPLIT_142_NDG	DIVIDER	10.00	0.000	0.000
JUNCT_630	DIVIDER	10.00	10.293	18.997
JUNCT_999	DIVIDER	10.00	0.664	19.336
JUNCT_615	DIVIDER	10.00	10.238	19.212
Sloan's_Lake	STORAGE	10.00	2.107	2.893
DETENTION_1	STORAGE	10.00	9.506	3.494
DETENTION_3	STORAGE	10.00	5.035	2.965

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
Sloan's_Lake	13830.884	33	0	0	16409.456	39	0 05:50	34.24
DETENTION_1	238.919	17	0	0	870.498	63	0 02:05	134.52
DETENTION_3	9.669	1	0	0	151.114	23	0 01:10	135.39

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
OUTFALL_20	30.00	37.10	125.35	2.997
OUTFALL_1030	97.50	149.17	1066.02	39.126
OUTFALL_LOWELL	84.17	13.56	46.39	3.073
OUTFALL_242	21.67	11.36	22.73	0.663
System	58.33	211.19	1220.20	45.859

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
110	DUMMY	15.06	0 00:40			
130	DUMMY	67.06	0 00:50			
1330-OVERFLOW	CONDUIT	513.95	0 01:00	6.10	0.00	0.06
140	DUMMY	70.61	0 00:45			
141_NDG	DUMMY	102.53	0 00:50			
142	DUMMY	467.59	0 00:55			
1230	DUMMY	255.96	0 00:50			
1250	DUMMY	368.71	0 00:50			
1330	CONDUIT	436.61	0 02:05	14.52	1.06	1.00
1335	CONDUIT	204.41	0 02:35	11.78	1.03	1.00
142_LOWELL	CONDUIT	46.39	0 02:35	6.66	1.01	1.00
142_NDG	DUMMY	140.36	0 01:05			
142-DIV_NDG	DUMMY	117.63	0 01:05			
1442	CONDUIT	23.07	0 02:30	18.33	1.01	1.00
1442-OVERFLOW	CONDUIT	438.61	0 01:00	7.19	0.00	0.05
1444	CONDUIT	40.53	0 00:30	7.22	1.06	1.00
1444-OVERFLOW	CONDUIT	318.14	0 01:00	4.69	0.00	0.05
1446	CONDUIT	15.46	0 00:25	6.36	1.00	1.00
1446-OVERFLOW	CONDUIT	227.11	0 00:50	4.36	0.00	0.04
1500-OVERFLOW	CONDUIT	16.76	0 00:45	6.11	0.00	0.02
1520-OVERFLOW	CONDUIT	2.42	0 00:45	4.83	0.00	0.01
1540-OVERFLOW	CONDUIT	880.57	0 01:05	15.62	0.00	0.09
1550-OVERFLOW	CONDUIT	357.23	0 01:05	12.15	0.00	0.06
1560-OVERFLOW	CONDUIT	0.00	0 00:00	0.00	0.00	0.00
1570-OVERFLOW	CONDUIT	0.00	0 00:00	0.00	0.00	0.00
1580-OVERFLOW	CONDUIT	98.12	0 01:20	0.68	0.02	0.24
1610-OVERFLOW	CONDUIT	134.14	0 00:45	4.92	0.00	0.05
1630-OVERFLOW	CONDUIT	344.98	0 01:05	8.88	0.00	0.07
1660-OVERFLOW	CONDUIT	39.88	0 00:55	4.96	0.00	0.04
1662-OVERFLOW	CONDUIT	21.86	0 06:00	2.67	0.00	0.03
1670-OVERFLOW	CONDUIT	254.24	0 01:00	5.58	0.00	0.07
1680-OVERFLOW	CONDUIT	108.39	0 00:45	3.99	0.00	0.06
1740-OVERFLOW	CONDUIT	188.92	0 00:45	4.73	0.00	0.04
1760-OVERFLOW	CONDUIT	185.27	0 00:50	5.69	0.00	0.04
1770-OVERFLOW	CONDUIT	93.60	0 00:50	5.35	0.00	0.02
1780-OVERFLOW	CONDUIT	0.00	0 00:00	0.00	0.00	0.00
20	DUMMY	125.35	0 00:40			
241_NDG	CONDUIT	10.76	0 00:35	6.08	1.00	1.00
241-OVERFLOW_NDG	CONDUIT	88.85	0 01:05	4.24	0.00	0.03
30	DUMMY	129.60	0 00:40			
305-OVERFLOW	CONDUIT	0.00	0 00:00	0.00	0.00	0.00
306-OVERFLOW	CONDUIT	0.00	0 00:00	0.00	0.00	0.00
315-OVERFLOW	CONDUIT	798.45	0 01:00	7.93	0.00	0.07
40	DUMMY	115.74	0 00:45			
42	DUMMY	170.30	0 00:50			
44	DUMMY	157.73	0 00:40			
46	DUMMY	249.08	0 00:45			
50	DUMMY	27.00	0 00:40			
60	DUMMY	20.19	0 00:40			
80	DUMMY	23.81	0 00:45			
90	DUMMY	22.01	0 00:45			
150	DUMMY	26.75	0 00:50			
170	DUMMY	22.44	0 00:45			
200	DUMMY	383.09	0 01:00			
210	DUMMY	80.46	0 00:40			
220	DUMMY	47.24	0 00:50			
230	DUMMY	42.12	0 00:50			
240	DUMMY	99.70	0 00:45			
250	DUMMY	127.63	0 00:45			
260	DUMMY	87.35	0 00:40			
265	CONDUIT	119.32	0 00:45	6.08	0.00	0.02
270	DUMMY	94.48	0 00:45			
290	DUMMY	41.92	0 00:45			
300	DUMMY	1516.57	0 01:05			
305	CONDUIT	1348.63	0 01:05	7.82	0.64	0.79
306	CONDUIT	1294.32	0 01:00	5.23	0.81	0.90
310	DUMMY	99.76	0 00:45			
315	CONDUIT	428.65	0 02:15	14.11	1.05	1.00
320	DUMMY	203.49	0 00:45			
325	DUMMY	39.30	0 00:40			
330	CONDUIT	288.24	0 01:30	19.42	1.07	1.00
330-OVERFLOW	CONDUIT	101.80	0 01:00	3.45	0.00	0.01
332	CONDUIT	116.75	0 02:05	8.22	1.04	1.00
332-OVERFLOW	CONDUIT	146.13	0 01:15	2.60	0.00	0.03
335	DUMMY	45.57	0 00:45			
340	CONDUIT	159.31	0 03:20	8.70	1.08	1.00
345	CONDUIT	251.61	0 00:55	6.21	0.00	0.03
350	CONDUIT	259.29	0 01:15	4.52	0.01	0.17
355	DUMMY	194.27	0 00:45			
360	CONDUIT	142.76	0 01:00	5.28	0.00	0.03
365	DUMMY	90.56	0 01:15			
370	CONDUIT	64.34	0 01:25	3.82	0.00	0.02
400	DUMMY	183.86	0 00:45			
500	DUMMY	22.91	0 00:40			
600	CONDUIT	211.27	0 01:50	6.79	1.21	1.00
600-OVERFLOW	CONDUIT	438.11	0 01:00	0.57	0.08	0.36
610	CONDUIT	167.49	0 00:50	6.22	0.00	0.02
615	CONDUIT	232.02	0 00:35	8.98	1.06	1.00
615-OVERFLOW	CONDUIT	143.01	0 00:50	5.67	0.00	0.04
630	CONDUIT	229.09	0 01:25	13.48	1.05	1.00
640	DUMMY	201.76	0 00:45			
650	CONDUIT	93.59	0 01:25	15.74	1.00	1.00
999	CONDUIT	9.84	0 00:40	5.45	1.00	1.00
1500	CONDUIT	9.62	0 01:30	6.34	1.04	1.00
1520	CONDUIT	28.96	0 00:55	8.32	1.03	1.00
1540	CONDUIT	111.41	0 02:35	13.85	1.01	1.00
1550	CONDUIT	88.08	0 02:30	14.87	1.07	1.00
1560	CONDUIT	26.31	0 00:45	12.40	0.74	0.64
1570	CONDUIT	7.61	0 00:50	4.73	0.52	0.51
1580	CONDUIT	52.09	0 00:35	7.01	1.00	1.00

1610	CONDUIT	26.23	0	02:10	6.12	1.02	1.00
1630	CONDUIT	60.93	0	02:45	11.13	1.00	1.00
1660	CONDUIT	6.29	0	02:10	4.32	1.06	1.00
1662	CONDUIT	12.39	0	00:50	3.94	1.00	1.00
1670	CONDUIT	20.79	0	00:30	5.23	1.00	1.00
1680	CONDUIT	1.80	0	00:25	2.76	1.00	1.00
1740	CONDUIT	26.92	0	01:55	6.36	1.04	1.00
1760	CONDUIT	62.17	0	01:45	10.55	1.00	1.00
1770	CONDUIT	76.01	0	01:30	12.34	1.03	1.00
1780	CONDUIT	75.32	0	00:50	9.95	0.89	0.73
2220	DUMMY	47.24	0	00:50			
2230	DUMMY	255.96	0	00:50			
2250	DUMMY	368.71	0	00:50			
2290	DUMMY	41.92	0	00:45			
2300	DUMMY	1516.57	0	01:05			
2400	DUMMY	183.86	0	00:45			
2500	DUMMY	135.22	0	01:10			
2600	DUMMY	612.66	0	01:00			
630-OVERFLOW	CONDUIT	269.55	0	00:50	6.81	0.00	0.05
650-OVERFLOW	CONDUIT	110.41	0	00:45	6.36	0.00	0.02
999-OVERFLOW	CONDUIT	102.23	0	01:20	5.21	0.00	0.03
D1_OUT	CONDUIT	126.05	0	03:15	14.77	1.06	1.00
D3_OUT	CONDUIT	135.22	0	01:10	14.53	0.61	0.57
N_BASIN	DUMMY	712.50	0	00:50			
NW_BASIN	DUMMY	745.67	0	01:00			
D3_OUT-OVERFLOW	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
1335-OVERFLOW	CONDUIT	335.66	0	00:55	5.10	0.00	0.05
340-OVERFLOW	CONDUIT	345.06	0	00:55	4.71	0.00	0.05
D1_OUT-OVERFLOW	CONDUIT	15.92	0	02:15	2.99	0.00	0.01
S-BASIN	DUMMY	80.46	0	00:40			
SPLIT_142_NDG	DUMMY	22.73	0	01:05			
SW_BASIN	DUMMY	1641.90	0	01:05			
620_DIV	DUMMY	252.72	0	00:50			
620	DUMMY	362.00	0	00:45			
SL_OUTLET	DUMMY	34.24	0	05:55			
D1_OUTLET	DUMMY	134.52	0	02:05			
D3_OUTLET	DUMMY	135.39	0	01:10			

1660	1.67	1.67	1.67	1.75	1.67
1662	9.33	9.33	9.33	0.01	9.33
1670	9.58	9.58	9.58	9.58	9.58
1680	2.17	2.17	2.17	0.01	2.17
1740	1.50	1.50	1.50	1.58	1.50
1760	1.25	1.25	1.25	0.08	1.25
1770	0.92	0.92	0.92	1.00	0.92
D1_OUT	2.50	2.50	2.50	2.50	2.50

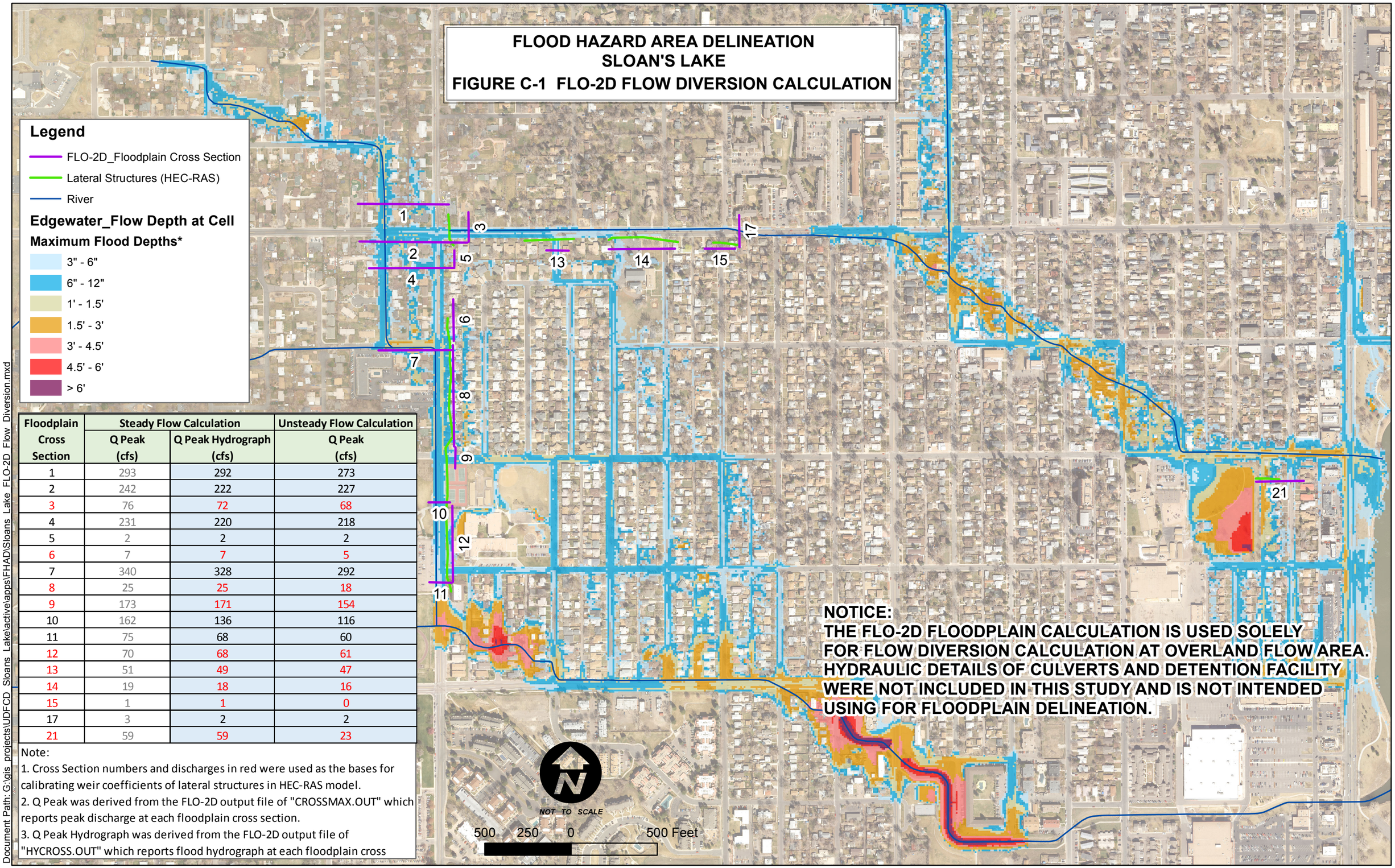
Analysis begun on: Thu Jul 07 14:37:06 2016
Analysis ended on: Thu Jul 07 14:37:06 2016
Total elapsed time: < 1 sec

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
1330	1.50	1.50	1.50	1.58	1.50
1335	2.00	2.00	2.00	0.17	2.00
142_LOWELL	2.08	2.08	2.08	2.17	2.08
1442	2.00	2.00	2.00	0.08	2.00
1444	1.92	1.92	1.92	0.17	1.92
1446	1.92	1.92	1.92	0.01	1.92
241_NDG	2.17	2.17	2.17	2.17	2.17
315	1.75	1.75	1.75	1.67	1.75
330	0.83	0.83	0.83	0.08	0.83
332	1.42	1.42	1.42	1.42	1.42
340	3.00	3.00	3.00	3.08	3.00
600	1.42	1.42	1.42	1.33	1.42
615	1.08	1.08	1.08	1.08	1.08
630	0.92	0.92	0.92	1.00	0.92
650	0.92	0.92	0.92	0.08	0.92
999	2.67	2.67	2.67	2.58	2.67
1500	0.92	0.92	0.92	1.00	0.92
1520	0.25	0.25	0.25	0.33	0.25
1540	2.08	2.08	2.08	2.08	2.08
1550	2.00	2.00	2.00	2.00	2.00
1580	1.25	1.25	1.25	1.25	1.25
1610	1.67	1.67	1.67	1.75	1.67
1630	2.17	2.17	2.17	2.25	2.17

Appendix C – Hydraulic Analysis

FLOOD HAZARD AREA DELINEATION
SLOAN'S LAKE
FIGURE C-1 FLO-2D FLOW DIVERSION CALCULATION



Floodplain Cross Section	Steady Flow Calculation		Unsteady Flow Calculation
	Q Peak (cfs)	Q Peak Hydrograph (cfs)	Q Peak (cfs)
1	293	292	273
2	242	222	227
3	76	72	68
4	231	220	218
5	2	2	2
6	7	7	5
7	340	328	292
8	25	25	18
9	173	171	154
10	162	136	116
11	75	68	60
12	70	68	61
13	51	49	47
14	19	18	16
15	1	1	0
17	3	2	2
21	59	59	23

Note:
1. Cross Section numbers and discharges in red were used as the bases for calibrating weir coefficients of lateral structures in HEC-RAS model.
2. Q Peak was derived from the FLO-2D output file of "CROSSMAX.OUT" which reports peak discharge at each floodplain cross section.
3. Q Peak Hydrograph was derived from the FLO-2D output file of "HYCROSS.OUT" which reports flood hydrograph at each floodplain cross

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Figure C-2 Recommended Manning's Roughness



Manning's Roughness

n = 0.1 – Channel, n = 0.05 to 0.15 – Overbank Area



Manning's Roughness

n = 0.035 – Channel, n = 0.03 to 0.15 – Overbank Area



Manning's Roughness

n = 0.02 – Channel, n = 0.15 – Overbank Area



Manning's Roughness

n = 0.02 – Street, 0.35 to 0.05 Lawn & shrub, n = 0.15 – Residential/fence

Figure C-3 - Existing Roadway/ Pedestrian Crossing Inventory



Sloan's Lake Outlet Structure _ Station 70+60



Sheridan Boulevard _ Station 119+90



Pedestrian Bridge _ Station 116+05



Access Road _ Station 121+80



Benton St. @ South side of Target _ Station 126+50



Eaton Street _ Station 136+50



Depew Street _ Station 133+00



Harlan Street _ Station 150+30



Jefferson High School Detention Weir Structure _ Station 180+53



Yukon Street _ Station 209+90



Teller Street _ Station 193+15



Spillway at 26th Avenue/Wadsworth Boulevard Detention

Office Hallway Bridge Sloan's Lake Drainageway Main Stream _ Reach 2 (Station 202+00)



Looking Downstream



Looking upstream



Opening Measurement

***The obstruction was modeled using in-line structure in the HEC-RAS hydraulic model.**

Table C-1 _ Rating Curve of Split Flow _ FLO-2D Analysis

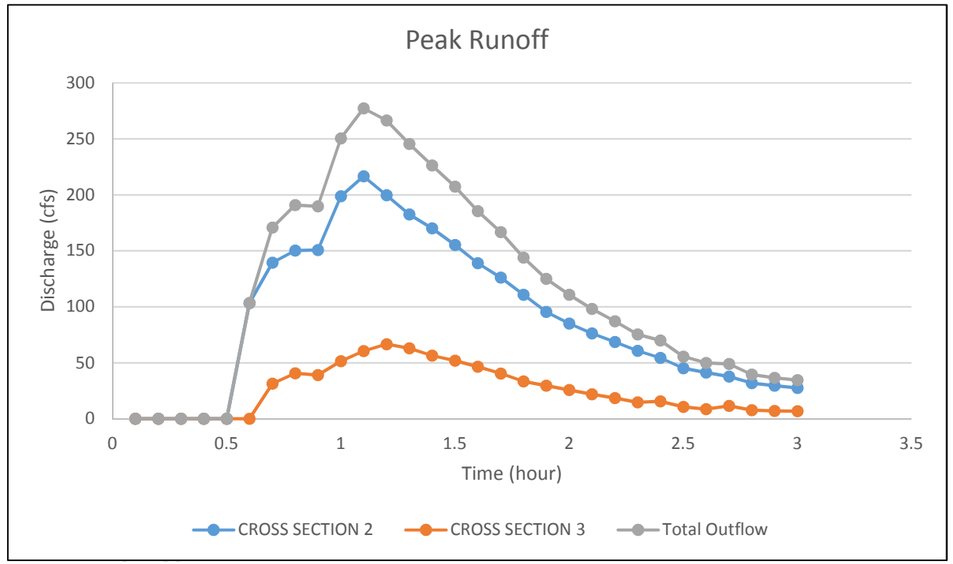
Flood Hazard Area Delineation _ Sloan's Lake Drainageway

Design Point **Junct_345**
Location 26th Ave/Pierce St
FLO-2D Cross Section 2 represents the diverted flow which flows southward mainly in Quay St, Alley Quay St/Pierce St and Pierce St.
FLO-2D Cross Section 3 represents the diverted flow which flows eastward mainly in 26th Avenue.

CROSS SECTION	2		CROSS SECTION	3		
MAXIMUM	215	CFS	MAXIMUM	66.66	CFS	Total Outflow
TOTAL VOLUME	12.67	AF	TOTAL VOLUME	26.09	AF	(CFS)
AT TIME:	0.9	HOURS	AT TIME:	1.1	HOURS	
TIME	DISCHARGE	Percent	TIME	DISCHARGE	Percent	
(HRS)	(CFS)	(%)	(HRS)	(CFS)	(%)	
0.1	0	#DIV/0!	0.1	0	#DIV/0!	0
0.2	0	#DIV/0!	0.2	0	#DIV/0!	0
0.3	0	#DIV/0!	0.3	0	#DIV/0!	0
0.4	0	#DIV/0!	0.4	0	#DIV/0!	0
0.5	0	1.00	0.5	0	0.00	0
0.6	103	1.00	0.6	0	0.00	103
0.7	139	0.82	0.7	31	0.18	171
0.8	150	0.79	0.8	41	0.21	191
0.9	151	0.79	0.9	39	0.21	190
1	199	0.79	1	52	0.21	250
1.1	217	0.78	1.1	61	0.22	277
1.2	200	0.75	1.2	67	0.25	266
1.3	183	0.74	1.3	63	0.26	246
1.4	170	0.75	1.4	56	0.25	226
1.5	155	0.75	1.5	52	0.25	207
1.6	139	0.75	1.6	47	0.25	185
1.7	126	0.76	1.7	40	0.24	167
1.8	111	0.77	1.8	33	0.23	144
1.9	95	0.76	1.9	30	0.24	125
2	85	0.77	2	26	0.23	111
2.1	76	0.78	2.1	22	0.22	98
2.2	69	0.79	2.2	19	0.21	87
2.3	61	0.81	2.3	15	0.19	75
2.4	54	0.78	2.4	16	0.22	70
2.5	45	0.81	2.5	11	0.19	56
2.6	41	0.83	2.6	9	0.17	50
2.7	38	0.77	2.7	11	0.23	49
2.8	32	0.81	2.8	8	0.19	40
2.9	30	0.81	2.9	7	0.19	37
3	28	0.80	3	7	0.20	35

Rating Curve at Junct_345

Inflow	Cross Section	
	2	3
(cfs)	(cfs)	(cfs)
0	0	0
50	40	10
100	78	22
110	85	25
150	114	36
200	151	49
227	170	57
250	186	64
292	216	76
300	222	78
350	257	93
400	292	108
435	316	119
450	327	123
500	361	139



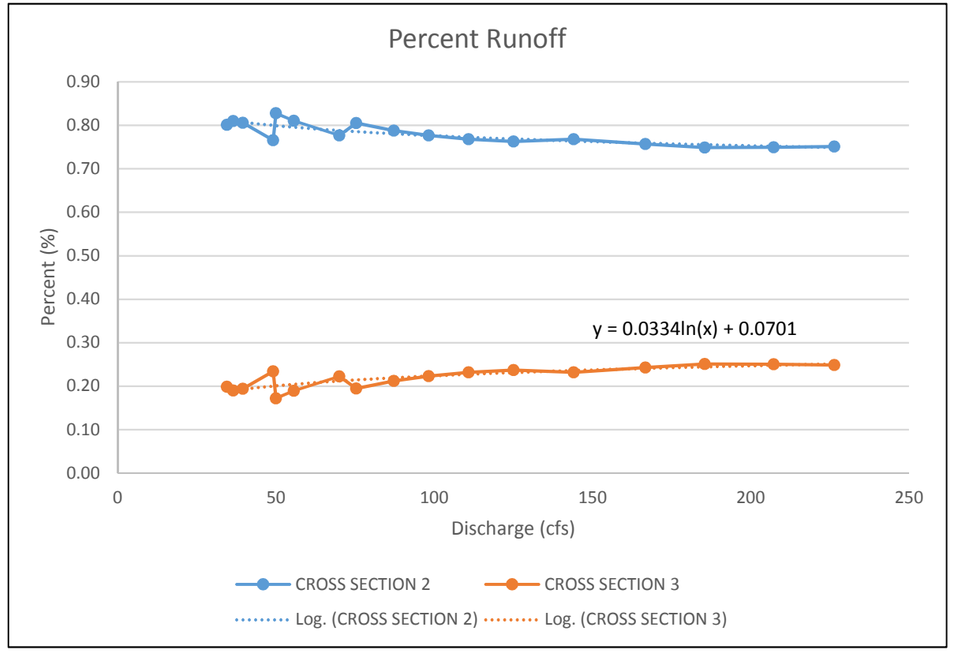


Table C-2 Peak Flows and Flow Change Locations - Future Condition

River	Reach	HEC-RAS River Station	Location	Hydrologic Design Points	*Peak Flow for HEC-RAS Model* (cfs)*				Peak Flow from 2016 Baseline Hydrology (cfs)				Existing Storm Drain Size (inch)	Manning's n	Pipe Slope/ Weighted Slope (ft/ft)	Pipe Full Capacity** (cfs)	Estimated Capacity of Storm Drain (cfs)	Note/ Existing Storm System
					Q_{10}	Q_{50}	Q_{100}	Q_{500}	Q_{10}	Q_{50}	Q_{100}	Q_{500}						
Ashland Drain	Reach 02	5890	26th Ave/Pierce St	-	***26***	***56***	***73***	***111***	26	56	73	111	0	0	0	0	0	Lateral Structure/FLO-2D Split flow Analysis
		4279	26th Ave/Kendall St	JUNCT_640	***93***	***190***	***235***	***337***	93	190	235	337	0	0	0	0	0	
	Reach 01	2906	Gray St	JUNCT_630	***80***	***317***	***428***	***674***	230	467	578	824	54	0.013	0.0059	151	150	RCP 54" @ S=0.0085 to 0.0059
		1595	Depew St	JUNCT_620	***21***	***281***	***419***	***719***	291	551	689	989	66	0.013	0.0063	267	270	RCP 66" @ S=0.0063
		929	24th Ave/Benton St	JUNCT_615	***42***	***122***	***122***	***122***	282	362	362	362	8'X4'	0.013	0.003	243	240	CBC 8'x4' @ S=0.003 to 0.0079
		268	24th Ave/Sheridan Blvd	JUNCT_600	***195***	***362***	***423***	***559***	435	602	663	799	8'X4'	0.013	0.003	243	240	CBC 8'x4' @ S=0.003
Gray Street Tributary	Reach 01	3972	32nd Ave/Kendall St	JUNCT_650	***7***	***35***	***48***	***77***	27	55	68	97	24	0.013	0.0079	20	20	Peak flows were calculated using unit area peak runoff with tributary area of 1229 acres. RCP 24" @ S=0.0079 to 0.02
		3053	30th Ave/Jay St	JUNCT_650	***28***	***98***	***131***	***205***	68	138	171	245	36	0.013	0.0036	40	40	Peak flows were calculated using weighted tributary area. RCP 36" @ S=0.0036
		1566	29th Ave/Gray St	JUNCT_650	***0***	***57***	***102***	***203***	92	187	232	333	36	0.013	0.0402	134	130	RCP 36" @ S=0.0459 to 0.0093
Pierce Street Tributary	Reach 03	2605	28th Ave/Upham St	JUNCT_370	***24***	***70***	***92***	***141***	24	70	92	141	0	0	0	0	0	
		1565	27th Ave/Reed St	JUNCT_345	***110***	***227***	***292***	***435***	110	227	292	435	0	0	0	0	0	
	Reach 02	5318	24th Ave/Zephyr St	JUNCT_355	***87***	***179***	***223***	***320***	87	179	223	320	0	0	0	0	0	
		5024	24th Ave/Yarrow St	JUNCT_355	***0***	***0***	***13***	***110***	87	179	223	320	48	0.013	0.022	214	210	RCP 48" @ S=0.022
		4401	24th Ave/S Wadsworth Blvd	DETENTION_1	***0***	***0***	***101***	***351***	162	398	511	761	72	0.013	0.0095	414	410	RCP 72" @ S=0.0095 to 0.0433
		4133	Detention Basin 1	DETENTION_1	***162***	***398***	***511***	***761***	162	398	511	761	0	0.013	0.0095	0	0	Detention Basin
		3721	25th Ave/Vance St	JUNCT_D1_OUT	***0***	***0***	***34***	***384***	97	130	174	524	48	0.013	0.0094	140	140	RCP 48" @ S=0.0094 to 0.0404
	Reach 01	1780	25th Ave/Pierce St	JUNCT_340	***16***	***214***	***311***	***704***	256	454	551	944	60	0.013	0.0083	238	240	RCP 60" @ S=0.0083
		1032	Pierce St/24th Ave	JUNCT_1335	***16***	***233***	***338***	***713***	276	493	598	973	60	0.013	0.01	261	260	RCP 60" @ S=0.01 to 0.0141
Sloan's Lake Main Stream	Reach 02	21549	20th Ave/Yarrow St	JUNCT_350	***101***	***212***	***289***	***454***	101	212	289	454	0	0.000	0.00000	0	0	
		18648	West boundary of Jefferson High School	JUNCT_332	***0***	***50***	***127***	***290***	92	210	287	450	54	0.013	0.00625	156	160	RCP 54" @ S=0.00625 to 0.0385
		18189	East boundary of Jefferson High School	JUNCT_330	***0***	***168***	***257***	***464***	152	328	417	624	54	0.013	0.00625	156	160	RCP 54" @ S=0.00625 to 0.0385
	Reach 01	17996	Pierce St	JUNCT_1330	***0***	***339***	***544***	***993***	436	839	1044	1493	72	0.013	0.01360	495	500	RCP 72" @ S=0.016 to 0.0218, RCP 78" @ S=0.0102, RCP 72" @ S=0.0136
		16287	20th Ave/Kendall St	JUNCT_315	***39***	***549***	***818***	***1410***	559	1069	1338	1930	78	0.013	0.00980	520	520	RCP 72" @ S=0.0189, RCP 78" @ S=0.0098, CBC 8'x6' @ S=0.00667
		15441	Ingalls St	JUNCT_306	***587***	***1134***	***1421***	***2065***	587	1134	1421	2065	0	0.000	0.00000	0	0	Open channel
		15111	Harlan St	JUNCT_305	***608***	***1195***	***1494***	***2160***	608	1195	1494	2160	0	0.000	0.00000	0	0	Open channel
		12098	Sheridan Blvd	JUNCT_300	***672***	***1299***	***1646***	***2380***	672	1299	1646	2380	0	0.000	0.00000	0	0	Open channel
		10668	Sloan's Lake	Sloan's_Lake	***1634***	***3053***	***3703***	***5491***	1634	3053	3703	5491	0	0.000	0.00000	0	0	Open channel
		7079	Sloan's Lake	JUNCT_SL_OUT	***26***	***32***	***34***	***360***	26	32	34	360	0	0.000	0.00000	0	0	Weir/Outlet Structure

* Peak flows for HEC-RAS model are surface flow only. The capacity of storm drain was subtracted from the Baseline Hydrology.

** Full flow capacity was based on normal depth calculation using Manning's Equation which was coded in this column in Excel spreadsheet. Please see the Excel spreadsheet in Technical Appendices for details

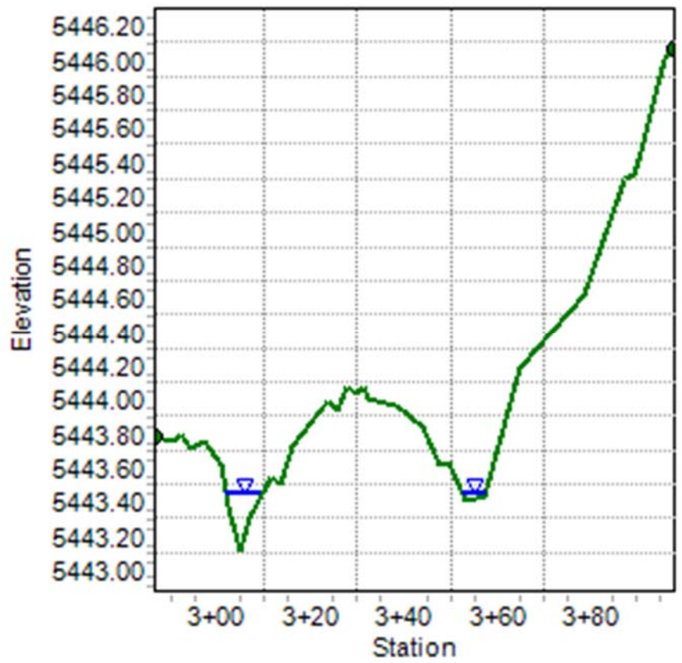
Shallow Overland Flooding Analysis

Normal Depth Calculation

Street Split Flow Analysis

W 20th Avenue at Sloan's Lake Main – Reach 02 – HEC-RAS Cross Section 20419

10-Year Event



Worksheet for SL Main_R2_XS_20419_St_Flow_10YR

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.01350	ft/ft
Normal Depth	0.33	ft (Derived from HEC-RAS Output)

Section Definitions

Station (ft)	Elevation (ft)
2+87	5443.78
2+91	5443.75
2+92	5443.79
2+94	5443.71
2+97	5443.76
3+01	5443.61
3+02	5443.37
3+05	5443.12
3+07	5443.31
3+12	5443.55
3+14	5443.51
3+16	5443.73
3+23	5443.99
3+26	5443.94
3+28	5444.07
3+30	5444.03
3+31	5444.07
3+32	5444.01
3+38	5443.97
3+44	5443.84
3+48	5443.62
3+49	5443.63
3+53	5443.40
3+57	5443.43
3+64	5444.09
3+65	5444.19
3+79	5444.62

Worksheet for SL Main_R2_XS_20419_St_Flow_10YR

Input Data

Station (ft)	Elevation (ft)
3+87	5445.30
3+89	5445.33
3+90	5445.41
3+96	5446.01
3+98	5446.06

Start Station	Ending Station	Roughness Coefficient
(2+87, 5443.78)	(3+98, 5446.06)	0.020

Options

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

Results

Discharge	2.64	ft³/s
Elevation Range	5443.12 to 5446.06 ft	
Flow Area	1.37	ft²
Wetted Perimeter	12.92	ft
Hydraulic Radius	0.11	ft
Top Width	12.89	ft
Normal Depth	0.33	ft
Critical Depth	0.33	ft
Critical Slope	0.01227	ft/ft
Velocity	1.93	ft/s
Velocity Head	0.06	ft
Specific Energy	0.39	ft
Froude Number	1.05	

Worksheet for SL Main_R2_XS_20419_St_Flow_10YR

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

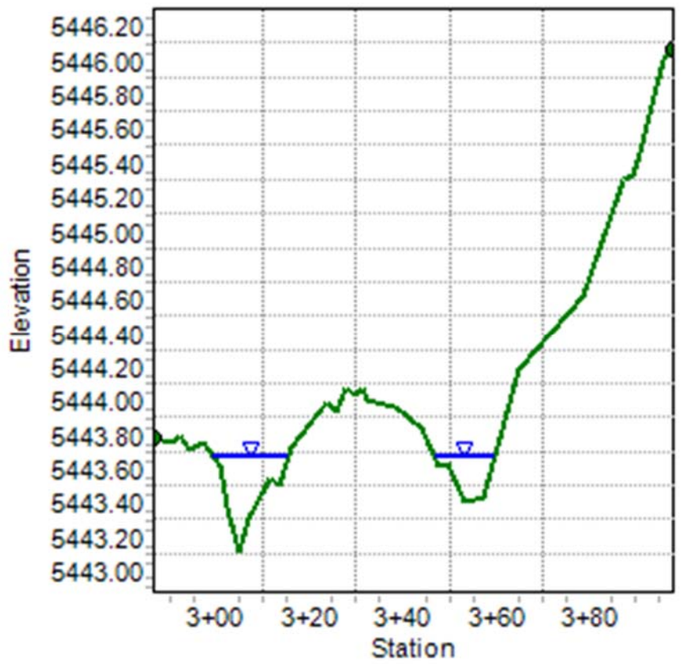
GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.33	ft
Critical Depth	0.33	ft
Channel Slope	0.01350	ft/ft
Critical Slope	0.01227	ft/ft

Street Split Flow Analysis

W 20th Avenue at Sloan's Lake Main – Reach 02 – HEC-RAS Cross Section 20419

50-Year Event



Worksheet for SL Main_R2_XS_20419_St_Flow_50YR

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.01350	ft/ft
Normal Depth	0.55	ft (Derived from HEC-RAS Output)

Section Definitions

Station (ft)	Elevation (ft)
2+87	5443.78
2+91	5443.75
2+92	5443.79
2+94	5443.71
2+97	5443.76
3+01	5443.61
3+02	5443.37
3+05	5443.12
3+07	5443.31
3+12	5443.55
3+14	5443.51
3+16	5443.73
3+23	5443.99
3+26	5443.94
3+28	5444.07
3+30	5444.03
3+31	5444.07
3+32	5444.01
3+38	5443.97
3+44	5443.84
3+48	5443.62
3+49	5443.63
3+53	5443.40
3+57	5443.43
3+64	5444.09
3+65	5444.19
3+79	5444.62

Worksheet for SL Main_R2_XS_20419_St_Flow_50YR

Input Data

Station (ft)	Elevation (ft)
3+87	5445.30
3+89	5445.33
3+90	5445.41
3+96	5446.01
3+98	5446.06

Start Station	Ending Station	Roughness Coefficient
(2+87, 5443.78)	(3+98, 5446.06)	0.020

Options

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

Results

Discharge		17.48	ft^3/s
Elevation Range	5443.12 to 5446.06 ft		
Flow Area		5.86	ft^2
Wetted Perimeter		28.88	ft
Hydraulic Radius		0.20	ft
Top Width		28.80	ft
Normal Depth		0.55	ft
Critical Depth		0.58	ft
Critical Slope		0.00973	ft/ft
Velocity		2.98	ft/s
Velocity Head		0.14	ft
Specific Energy		0.69	ft
Froude Number		1.17	

Worksheet for SL Main_R2_XS_20419_St_Flow_50YR

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

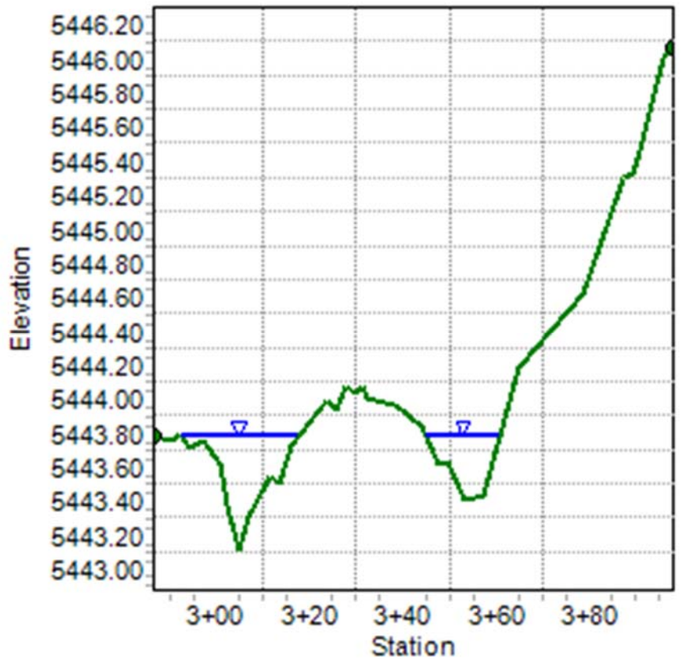
GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.55	ft
Critical Depth	0.58	ft
Channel Slope	0.01350	ft/ft
Critical Slope	0.00973	ft/ft

Street Split Flow Analysis

W 20th Avenue at Sloan's Lake Main – Reach 02 – HEC-RAS Cross Section 20419

100-Year Event



Worksheet for SL Main_R2_XS_20419_St_Flow_100YR

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.01350	ft/ft
Normal Depth	0.66	ft (Derived from HEC-RAS Output)

Section Definitions

Station (ft)	Elevation (ft)
2+87	5443.78
2+91	5443.75
2+92	5443.79
2+94	5443.71
2+97	5443.76
3+01	5443.61
3+02	5443.37
3+05	5443.12
3+07	5443.31
3+12	5443.55
3+14	5443.51
3+16	5443.73
3+23	5443.99
3+26	5443.94
3+28	5444.07
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3+31	5444.07
3+32	5444.01
3+38	5443.97
3+44	5443.84
3+48	5443.62
3+49	5443.63
3+53	5443.40
3+57	5443.43
3+64	5444.09
3+65	5444.19
3+79	5444.62

Worksheet for SL Main_R2_XS_20419_St_Flow_100YR

Input Data

Station (ft)	Elevation (ft)
3+87	5445.30
3+89	5445.33
3+90	5445.41
3+96	5446.01
3+98	5446.06

Start Station	Ending Station	Roughness Coefficient
(2+87, 5443.78)	(3+98, 5446.06)	0.020

Options

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

Results

Discharge		29.66	ft³/s
Elevation Range	5443.12 to 5446.06 ft		
Flow Area		9.69	ft²
Wetted Perimeter		45.94	ft
Hydraulic Radius		0.21	ft
Top Width		45.84	ft
Normal Depth		0.66	ft
Critical Depth		0.69	ft
Critical Slope		0.00957	ft/ft
Velocity		3.06	ft/s
Velocity Head		0.15	ft
Specific Energy		0.81	ft
Froude Number		1.17	

Worksheet for SL Main_R2_XS_20419_St_Flow_100YR

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

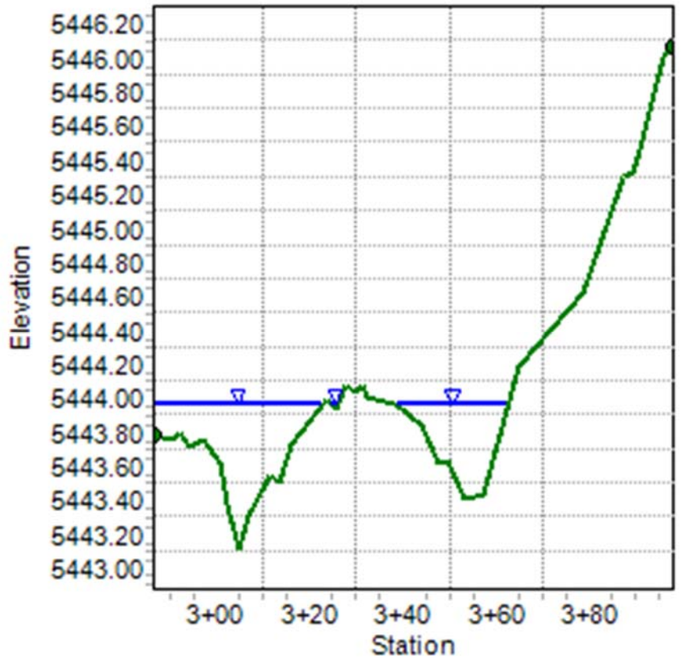
GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.66	ft
Critical Depth	0.69	ft
Channel Slope	0.01350	ft/ft
Critical Slope	0.00957	ft/ft

Street Split Flow Analysis

W 20th Avenue at Sloan's Lake Main – Reach 02 – HEC-RAS Cross Section 20419

500-Year Event



Worksheet for SL Main_R2_XS_20419_St_Flow_500YR

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.01350	ft/ft
Normal Depth	0.84	ft (Derived from HEC-RAS Output)

Section Definitions

Station (ft)	Elevation (ft)
2+87	5443.78
2+91	5443.75
2+92	5443.79
2+94	5443.71
2+97	5443.76
3+01	5443.61
3+02	5443.37
3+05	5443.12
3+07	5443.31
3+12	5443.55
3+14	5443.51
3+16	5443.73
3+23	5443.99
3+26	5443.94
3+28	5444.07
3+30	5444.03
3+31	5444.07
3+32	5444.01
3+38	5443.97
3+44	5443.84
3+48	5443.62
3+49	5443.63
3+53	5443.40
3+57	5443.43
3+64	5444.09
3+65	5444.19
3+79	5444.62

Worksheet for SL Main_R2_XS_20419_St_Flow_500YR

Input Data

Station (ft)	Elevation (ft)
3+87	5445.30
3+89	5445.33
3+90	5445.41
3+96	5446.01
3+98	5446.06

Start Station	Ending Station	Roughness Coefficient
(2+87, 5443.78)	(3+98, 5446.06)	0.020

Options

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

Results

Discharge		76.33	ft³/s
Elevation Range	5443.12 to 5446.06 ft		
Flow Area		19.15	ft²
Wetted Perimeter		61.05	ft
Hydraulic Radius		0.31	ft
Top Width		60.76	ft
Normal Depth		0.84	ft
Critical Depth		0.90	ft
Critical Slope		0.00850	ft/ft
Velocity		3.99	ft/s
Velocity Head		0.25	ft
Specific Energy		1.09	ft
Froude Number		1.25	

Worksheet for SL Main_R2_XS_20419_St_Flow_500YR

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

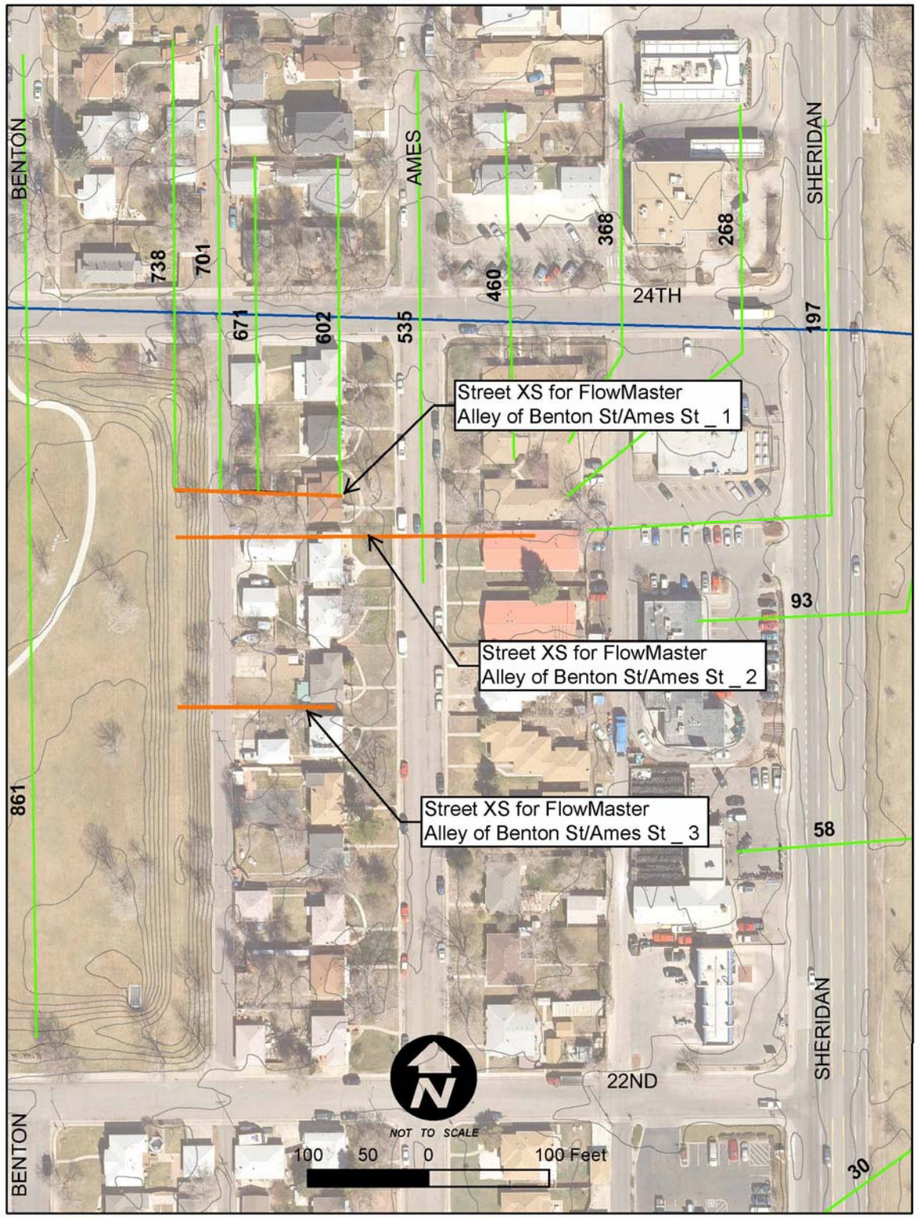
GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.84	ft
Critical Depth	0.90	ft
Channel Slope	0.01350	ft/ft
Critical Slope	0.00850	ft/ft

Street Capacity Analysis

Alley of Benton St/Ames St and Ames St

Ashland Drainageway – Reach 01 _ River Station 7+38 to 6+02



Cross Section for Alley of Benton St/Ames St_1

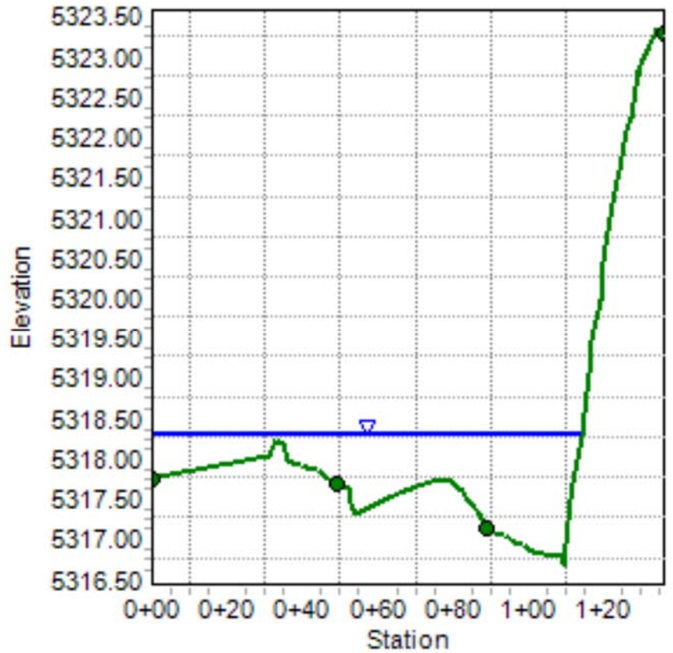
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00200	ft/ft
Normal Depth	1.61	ft
Discharge	54.00	ft³/s

Cross Section Image



Bentley Systems, Inc. Haestad Methods Solution Center
Bentley FlowMaster V8i (SELECTseries 1) [08.11.01.03]
5/8/2017 1:53:52 PM 27 Siemons Company Drive Suite 200 W Watertown, CT 06795 USA +1-203-755-1666 Page 1 of 1

Worksheet for Alley of Benton St/Ames St_1

Results

Hydraulic Radius		0.68	ft
Top Width		113.92	ft
Normal Depth		1.61	ft
Critical Depth		0.85	ft
Critical Slope		0.11377	ft/ft
Velocity		0.69	ft/s
Velocity Head		0.01	ft
Specific Energy		1.61	ft
Froude Number		0.15	
Flow Type	Subcritical		

Average Floodplain Depth > 6-inch

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.61	ft
Critical Depth	0.85	ft
Channel Slope	0.00200	ft/ft
Critical Slope	0.11377	ft/ft

Cross Section for Alley of Benton St/Ames St_2

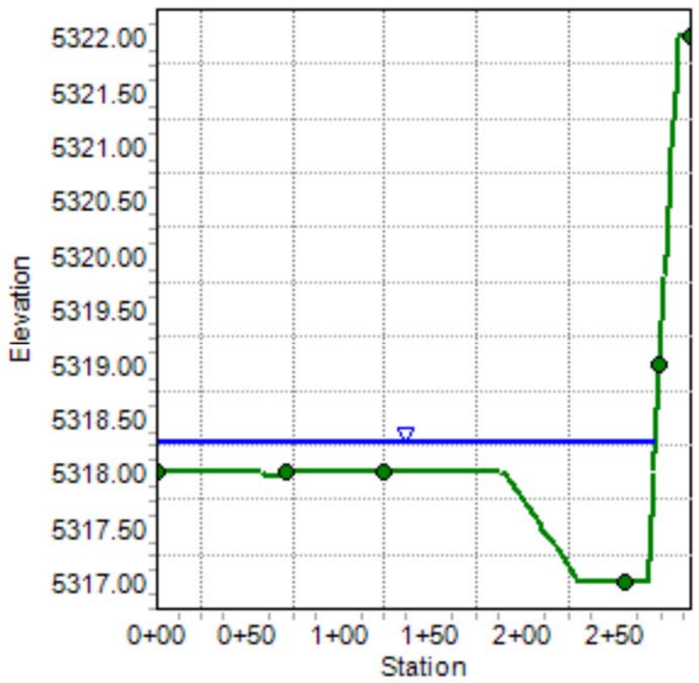
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00300	ft/ft
Normal Depth	1.28	ft
Discharge	54.00	ft³/s

Cross Section Image



Worksheet for Alley of Benton St/Ames St_2

Input Data

Start Station	Ending Station	Roughness Coefficient
(0+00, 5318.00)	(0+71, 5318.00)	0.150
(0+71, 5318.00)	(1+24, 5318.00)	0.020
(1+24, 5318.00)	(2+56, 5317.00)	0.150
(2+56, 5317.00)	(2+75, 5319.00)	0.020
(2+75, 5319.00)	(2+92, 5322.01)	0.035

Options

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

Results

Normal Depth		1.28	ft
Elevation Range	5317.00 to 5322.01 ft		
Flow Area		136.70	ft²
Wetted Perimeter		273.18	ft
Hydraulic Radius		0.50	ft
Top Width		272.69	ft
Normal Depth		1.28	ft
Critical Depth		0.38	ft
Critical Slope		0.36071	ft/ft
Velocity		0.40	ft/s
Velocity Head		0.00	ft
Specific Energy		1.29	ft
Froude Number		0.10	
Flow Type	Subcritical		

Average Floodplain Depth ≥ 6-inch

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

Cross Section for Alley of Benton St/Ames St_3

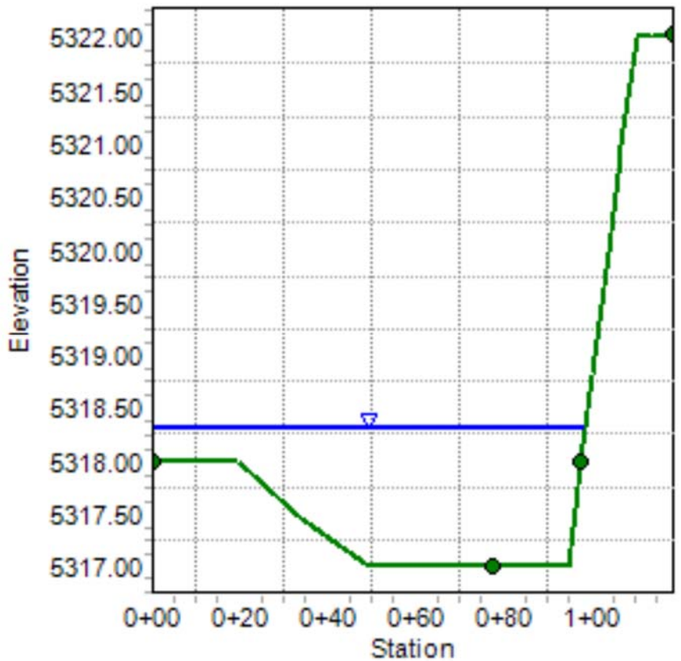
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00300	ft/ft
Normal Depth	1.31	ft
Discharge	54.00	ft³/s

Cross Section Image



Worksheet for Alley of Benton St/Ames St_3

Input Data

Station (ft)	Elevation (ft)
1+08	5321.29
1+10	5322.00
1+14	5322.02
1+18	5322.04
1+19	5322.04

Start Station	Ending Station	Roughness Coefficient
(0+00, 5318.00)	(0+78, 5317.00)	0.150
(0+78, 5317.00)	(0+98, 5318.00)	0.020
(0+98, 5318.00)	(1+19, 5322.04)	0.035

Options

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

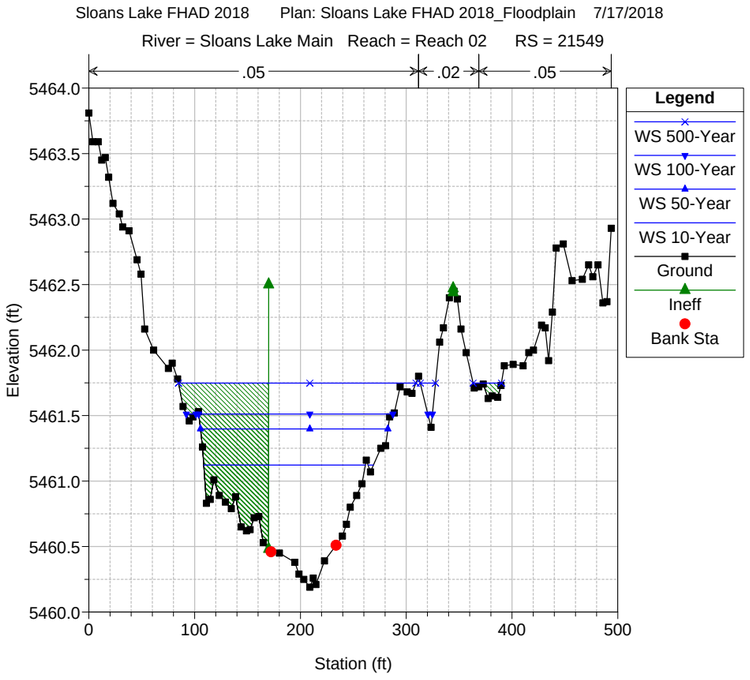
Results

Normal Depth		1.31	ft
Elevation Range	5317.00 to 5322.04 ft		
Flow Area		92.60	ft²
Wetted Perimeter		99.05	ft
Hydraulic Radius		0.93	ft
Top Width		98.52	ft
Normal Depth		1.31	ft
Critical Depth		0.34	ft
Critical Slope		0.38727	ft/ft
Velocity		0.58	ft/s
Velocity Head		0.01	ft

Average Floodplain Depth > 6-inch

HEC-RAS Sections

Sloan's Lake Drainageway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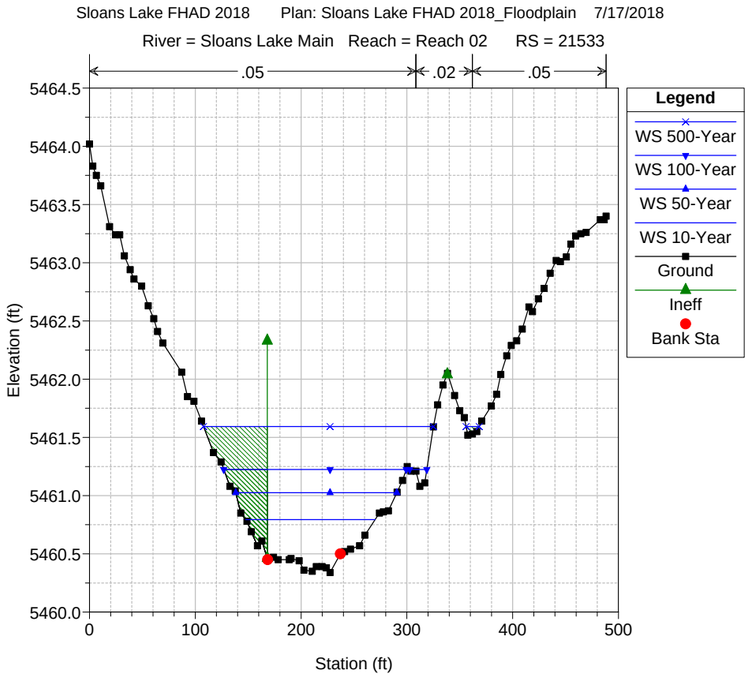
River = Sloans Lake Main Reach = Reach 02 RS = 21549
.05
.02
.05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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River = Sloans Lake Main Reach = Reach 02 RS = 21533
.05
.02
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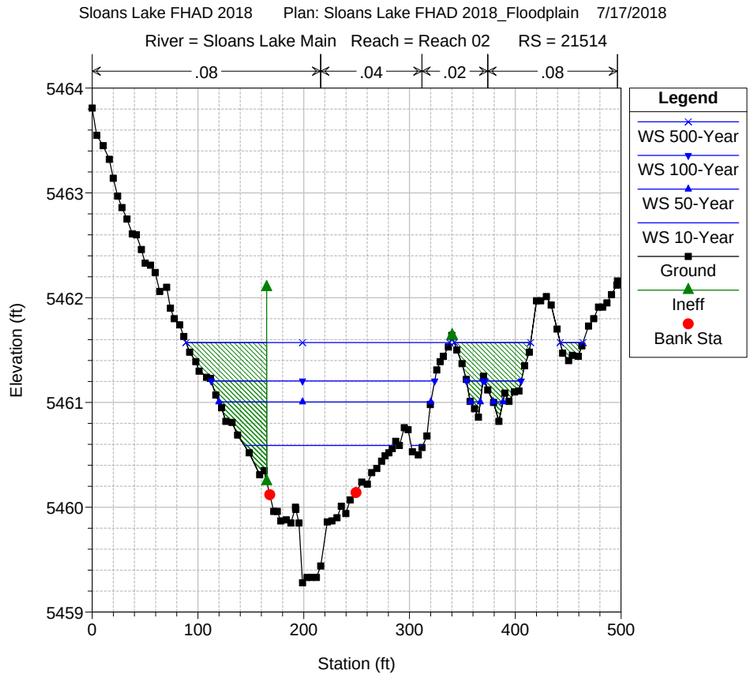
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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.08
.04
.02
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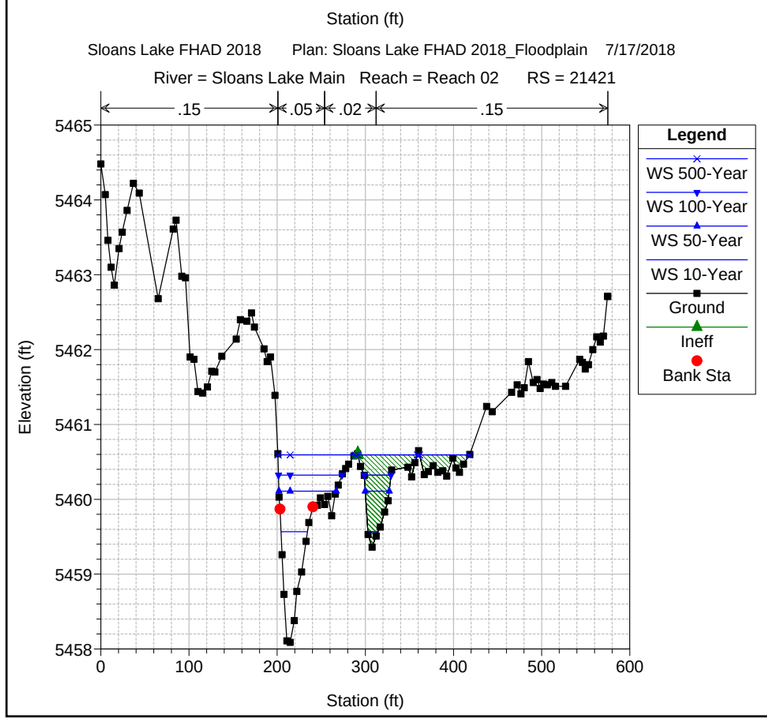
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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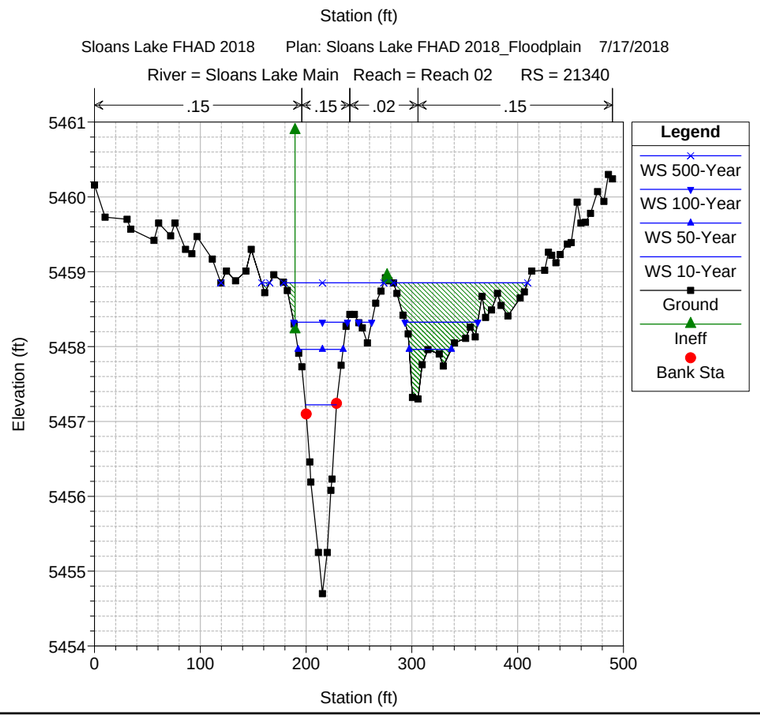
River = Sloans Lake Main Reach = Reach 02 RS = 21421
.15
.05
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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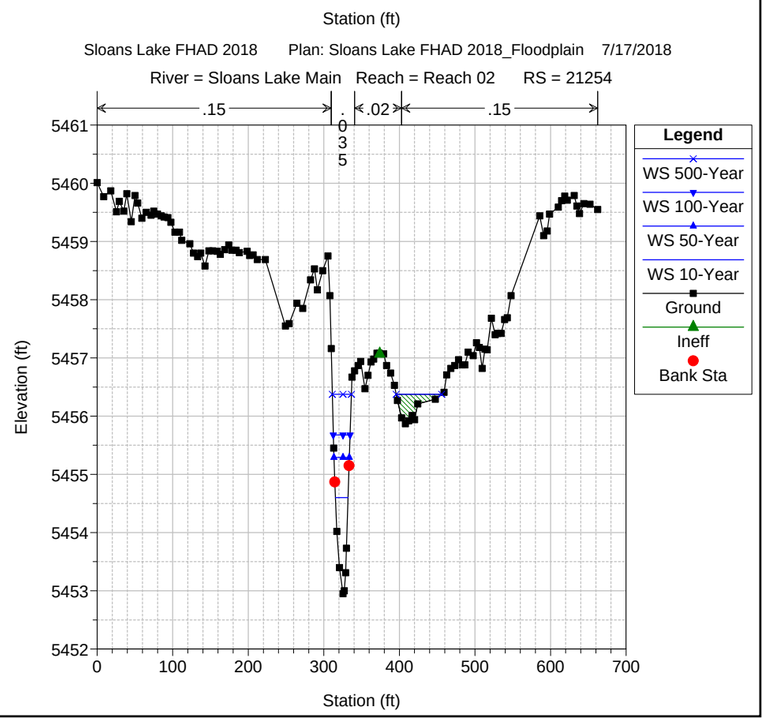
River = Sloans Lake Main Reach = Reach 02 RS = 21340
.15
.15
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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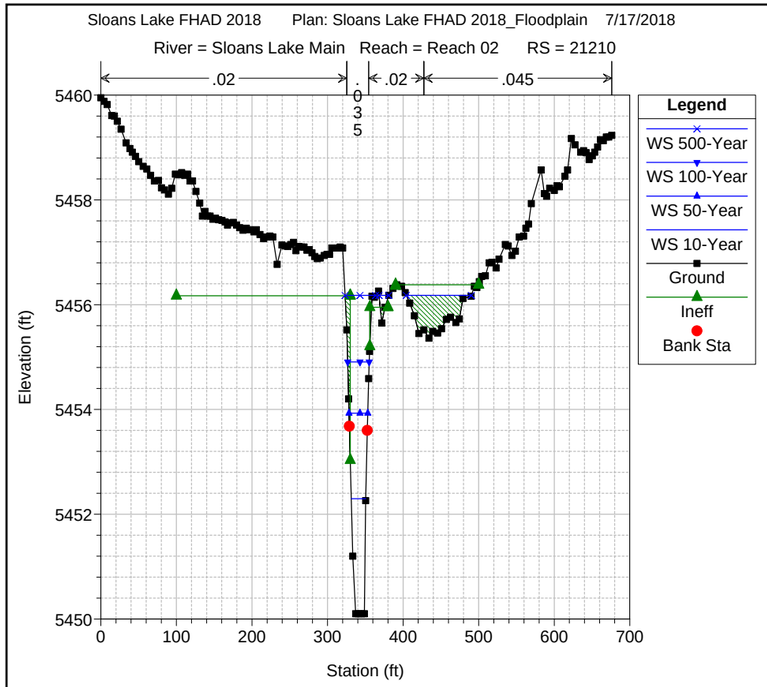
River = Sloans Lake Main Reach = Reach 02 RS = 21254
.15
.035
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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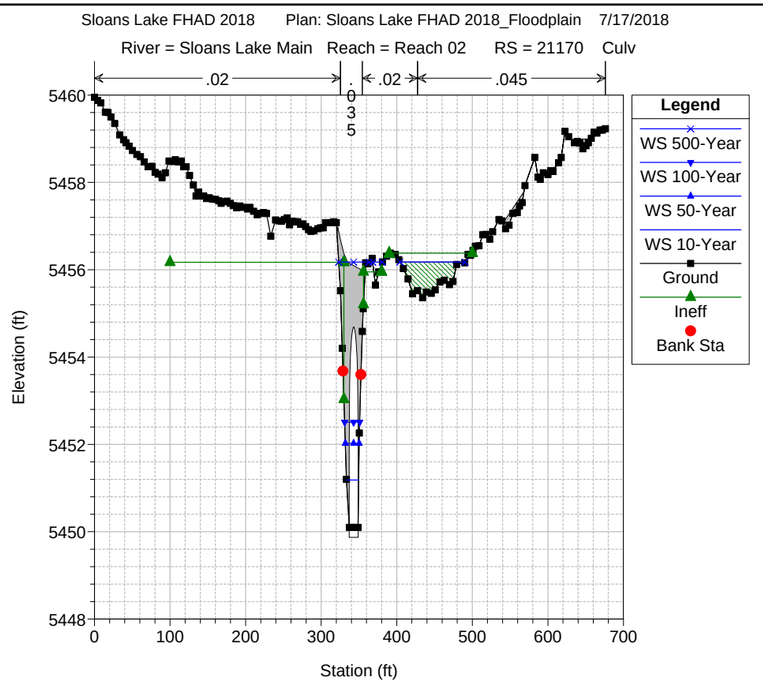
River = Sloans Lake Main Reach = Reach 02 RS = 21210
.02
.035
.02
.045
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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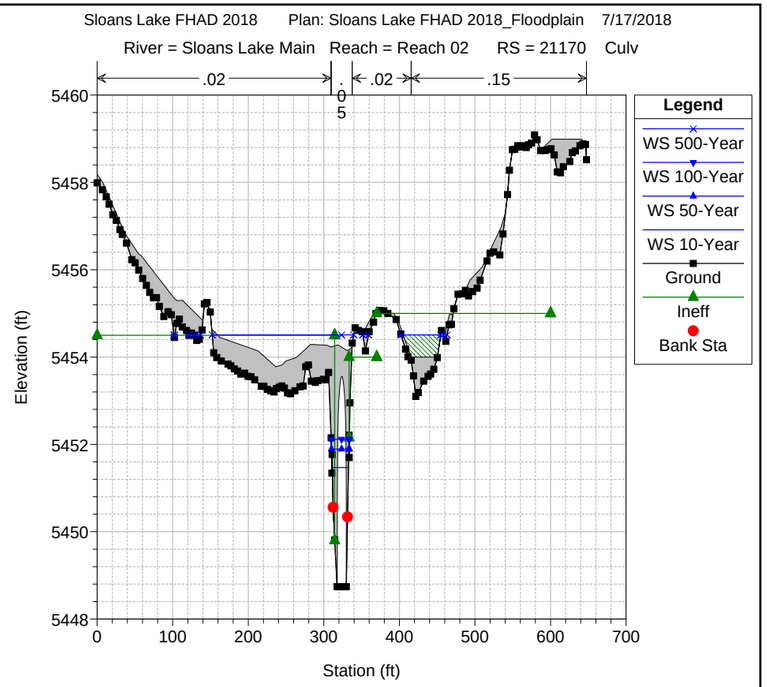
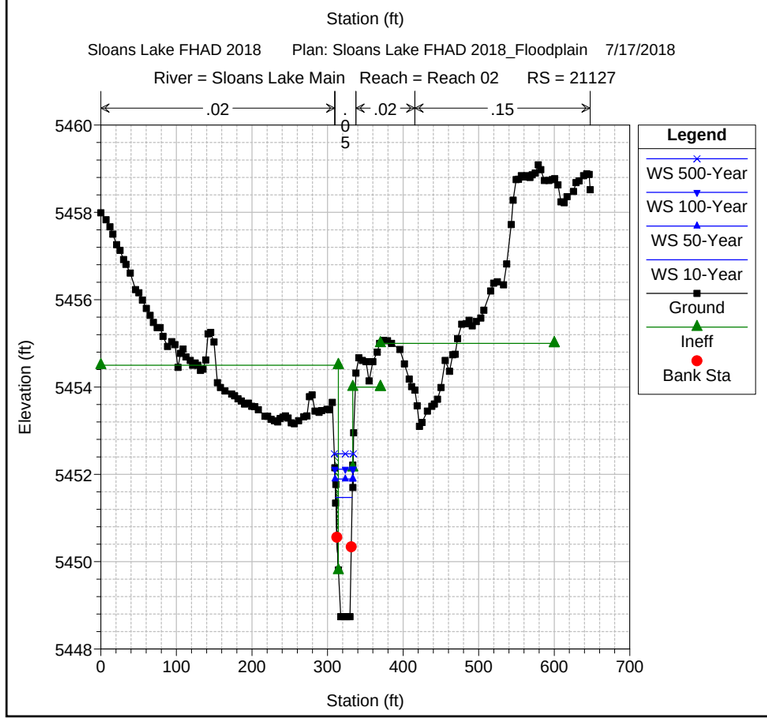
River = Sloans Lake Main Reach = Reach 02 RS = 21170 Culv
.02
.035
.02
.045
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 21170 Culv
.02
.05
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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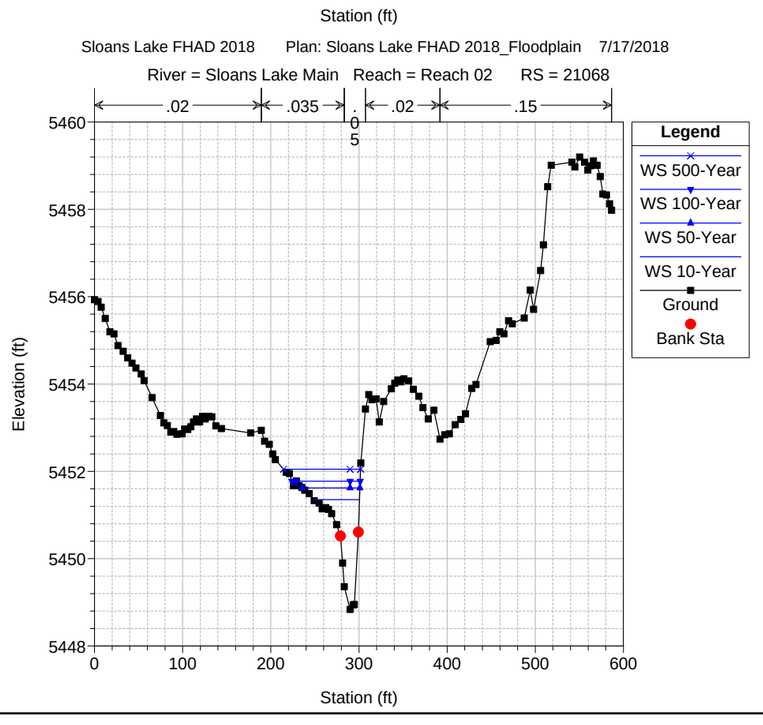
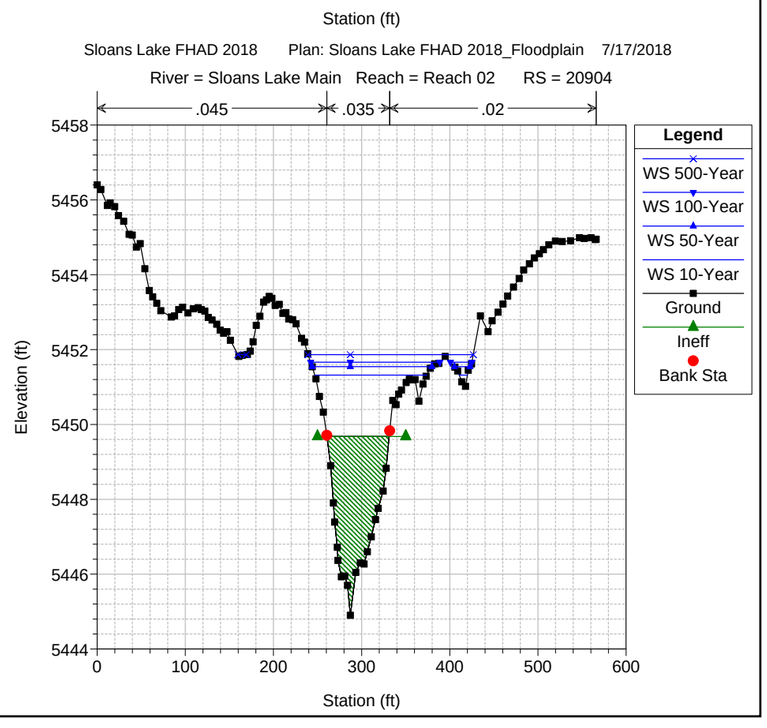
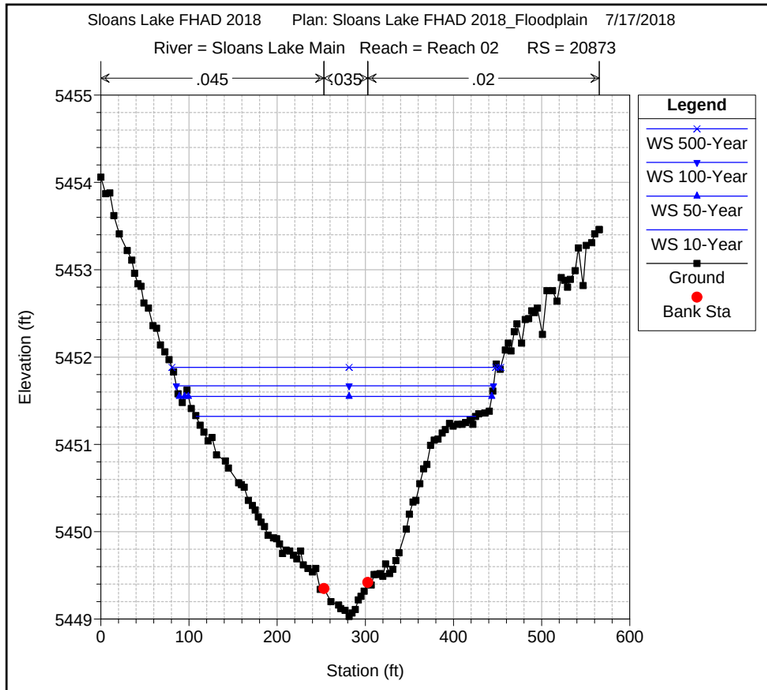
River = Sloans Lake Main Reach = Reach 02 RS = 21127
.02
.05
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 21068
.02
.035
.05
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 20904
.045
.035
.02
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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River = Sloans Lake Main Reach = Reach 02 RS = 20873
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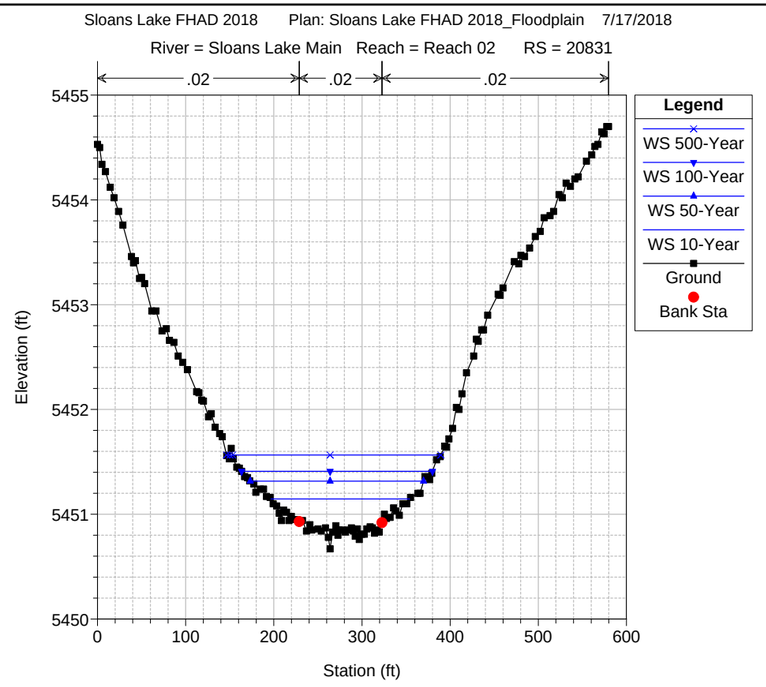
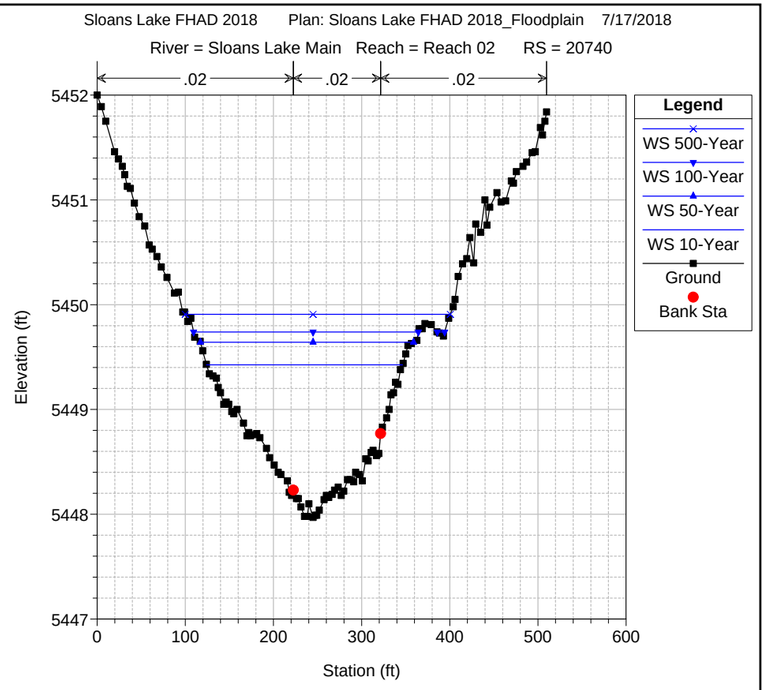
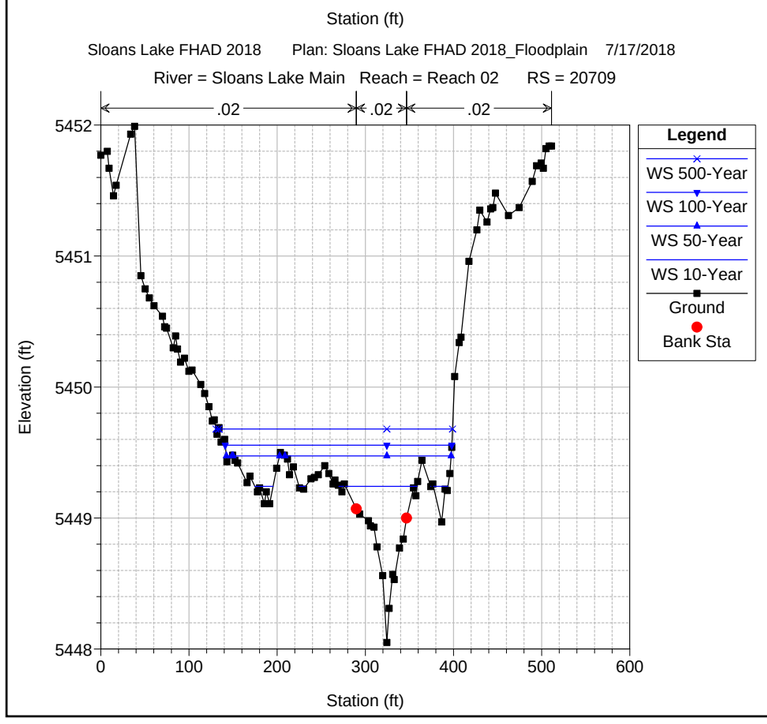
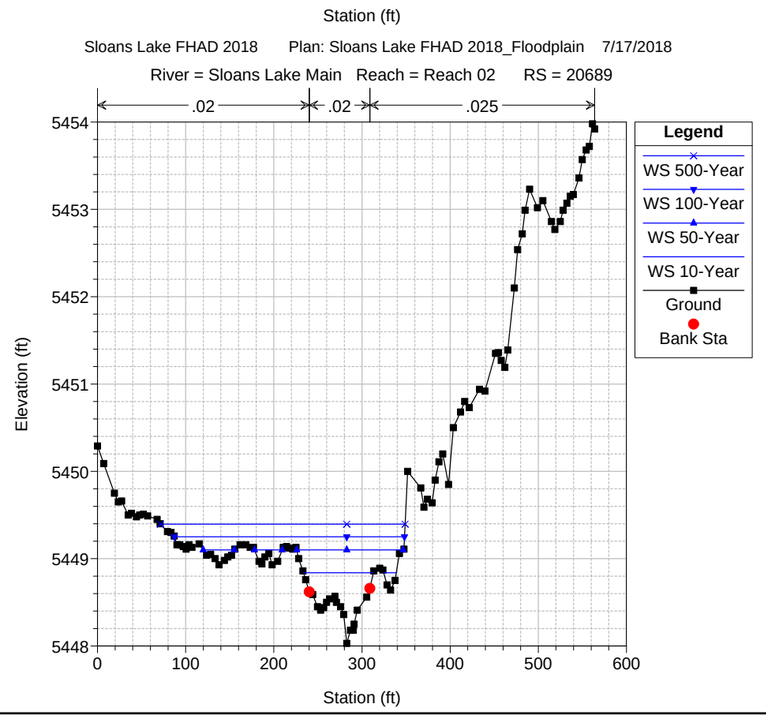
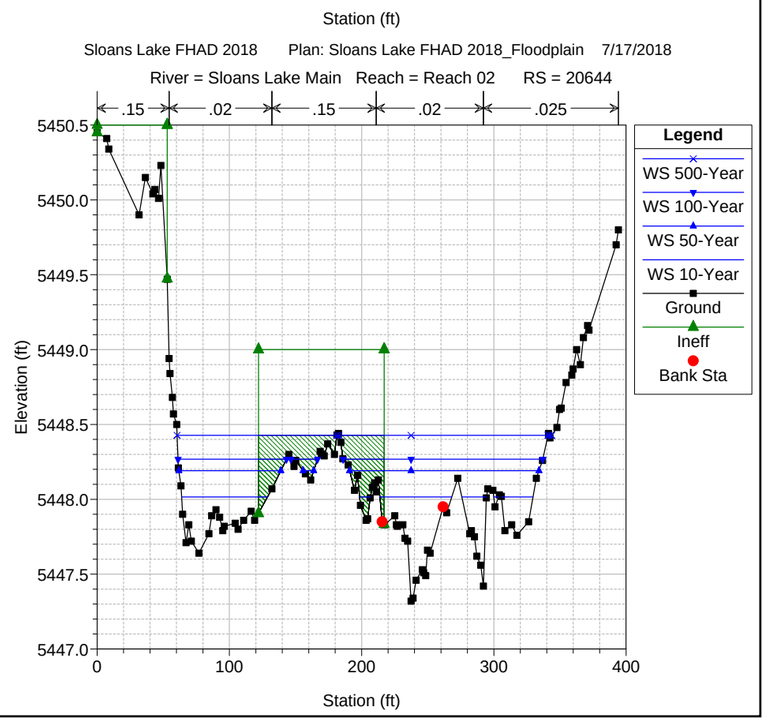
.035
.02
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

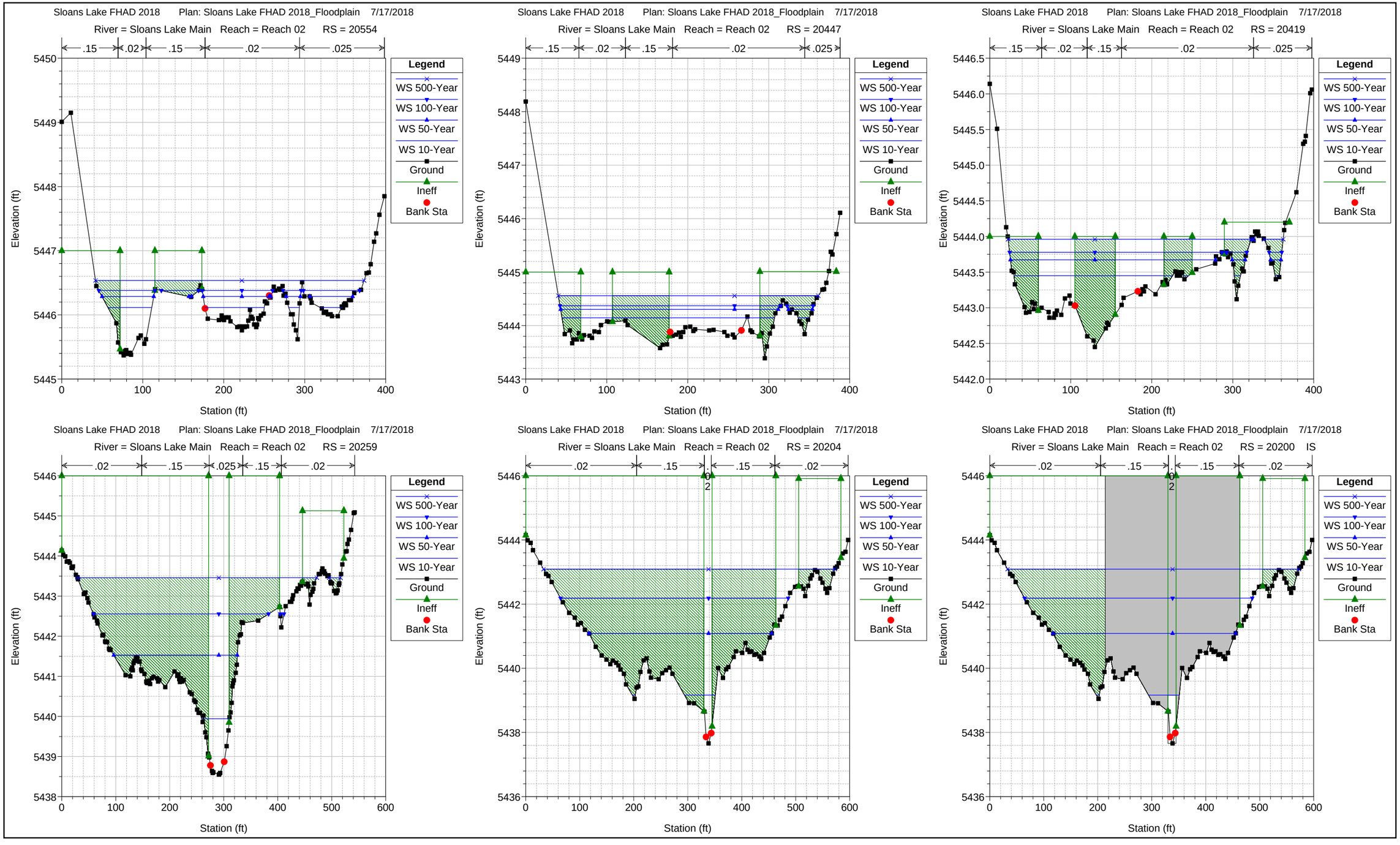

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 20831
.02
.02
.02
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 20740
.02
.02
.02
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 20709
.02
.02
.02
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 20689
.02
.02
.025
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 20644
.15
.02
.15
.02
.025
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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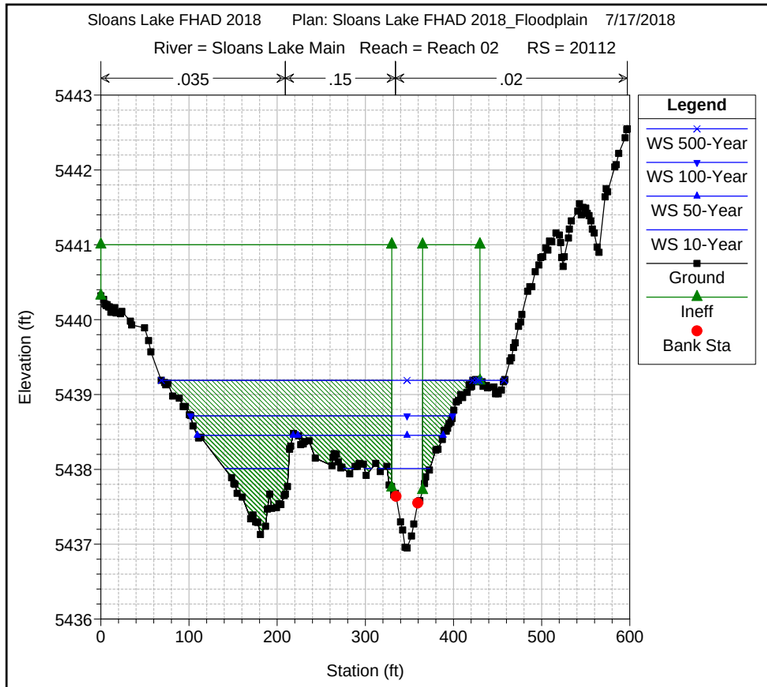
River = Sloans Lake Main Reach = Reach 02 RS = 20554
.15 .02 .15 .02 .025
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 20447
.15 .02 .15 .02 .025
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 20419
.15 .02 .15 .02 .025
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 20259
.02 .15 .025 .15 .02
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 20204
.02 .15 .15 .02
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 20200 IS
.02 .15 .15 .02
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta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River = Sloans Lake Main Reach = Reach 02 RS = 20112
.035
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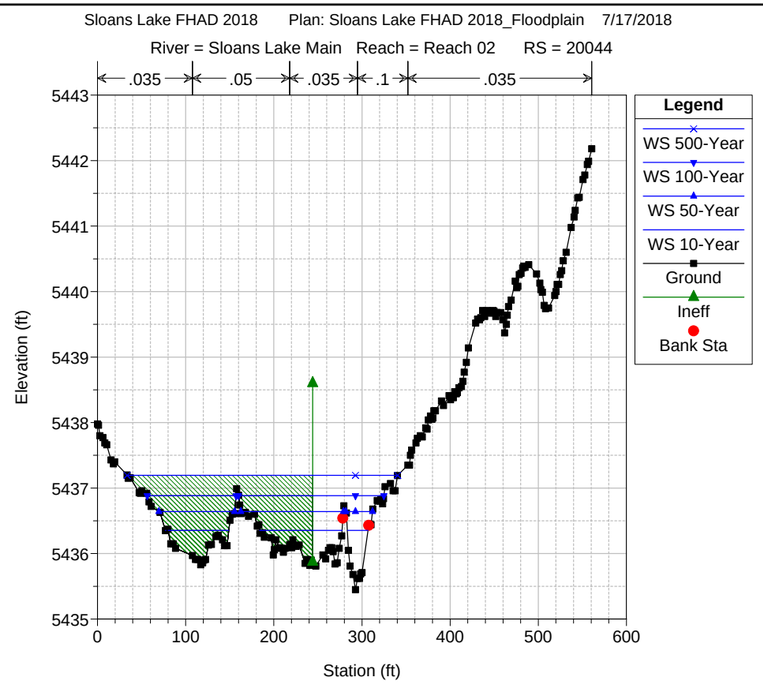
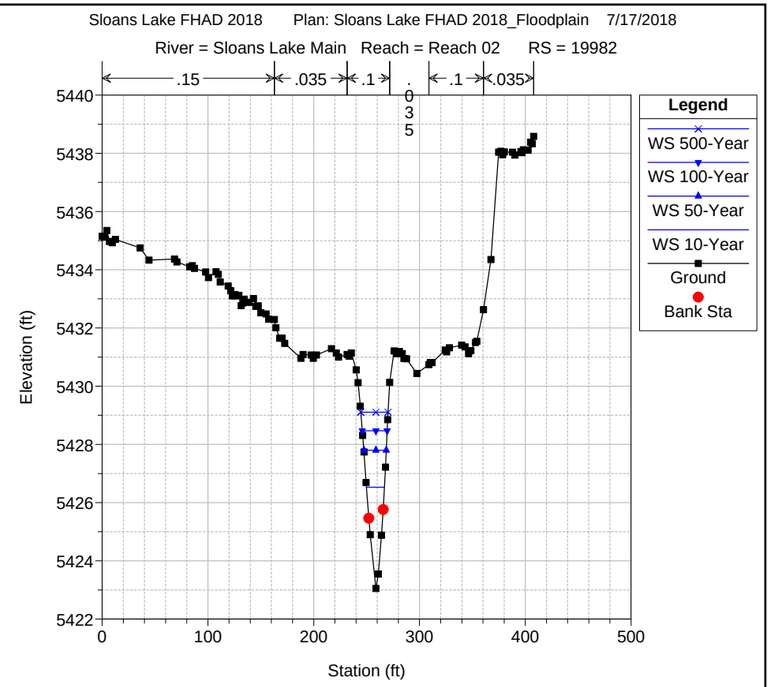
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 20044
.035
.05
.035
.1
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 19982
.15
.035
.1
.035
.1
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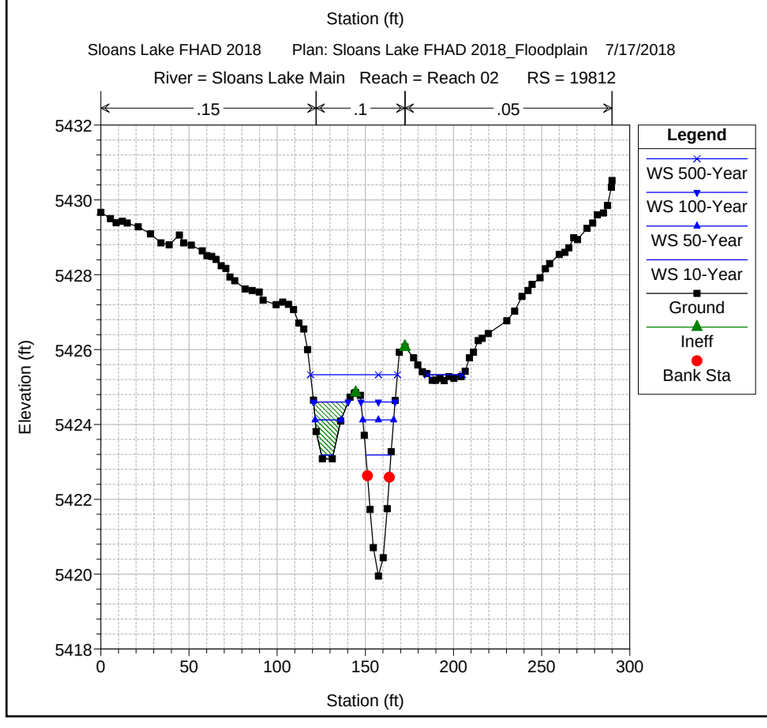
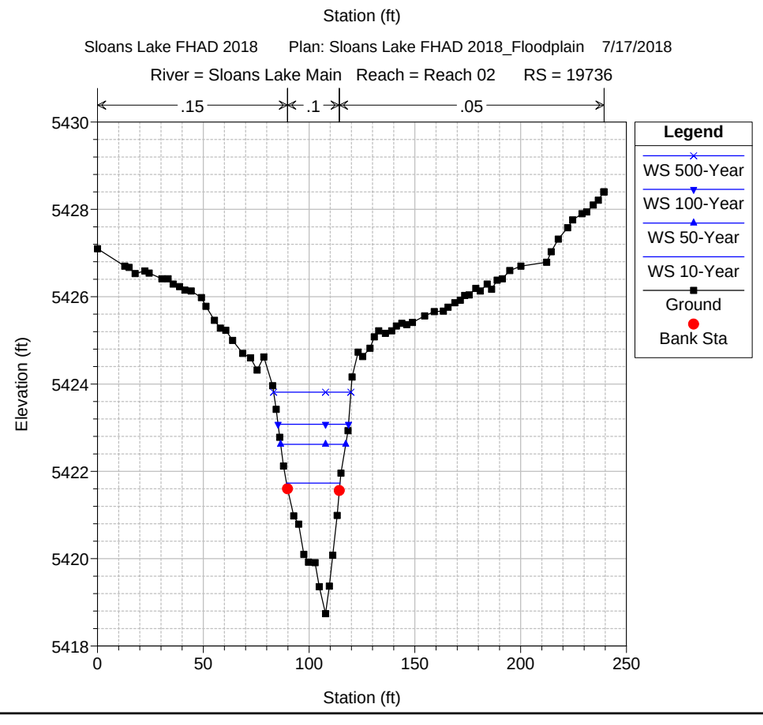
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 19812
.15
.1
.05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 19736
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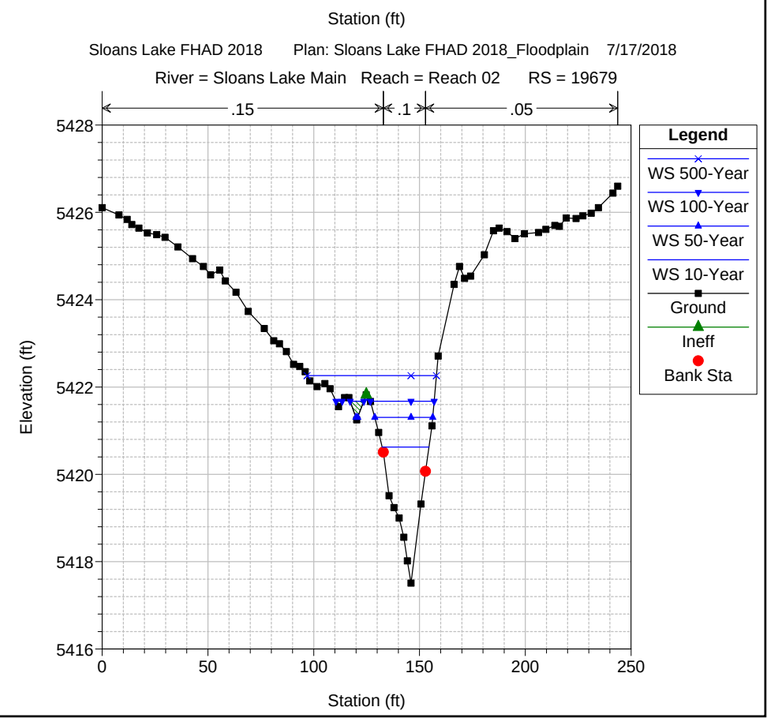
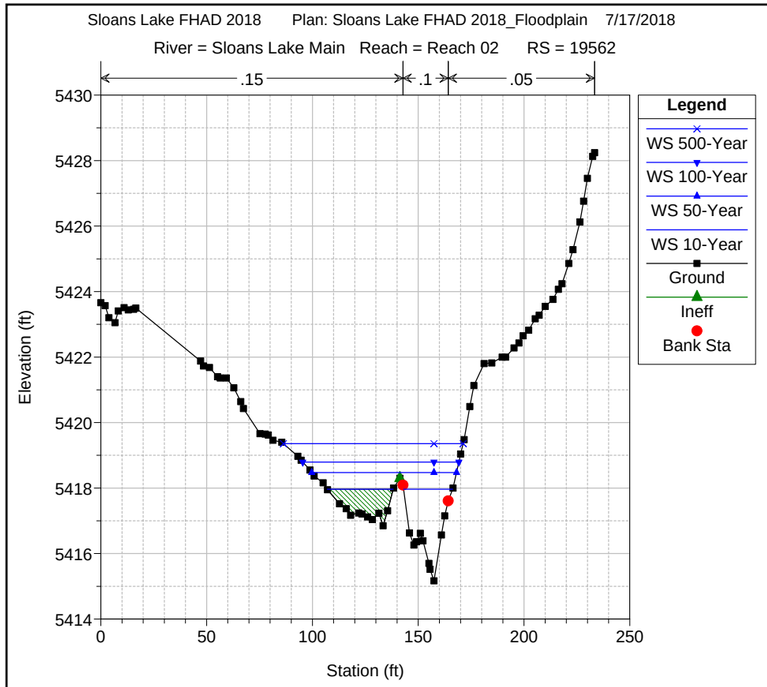
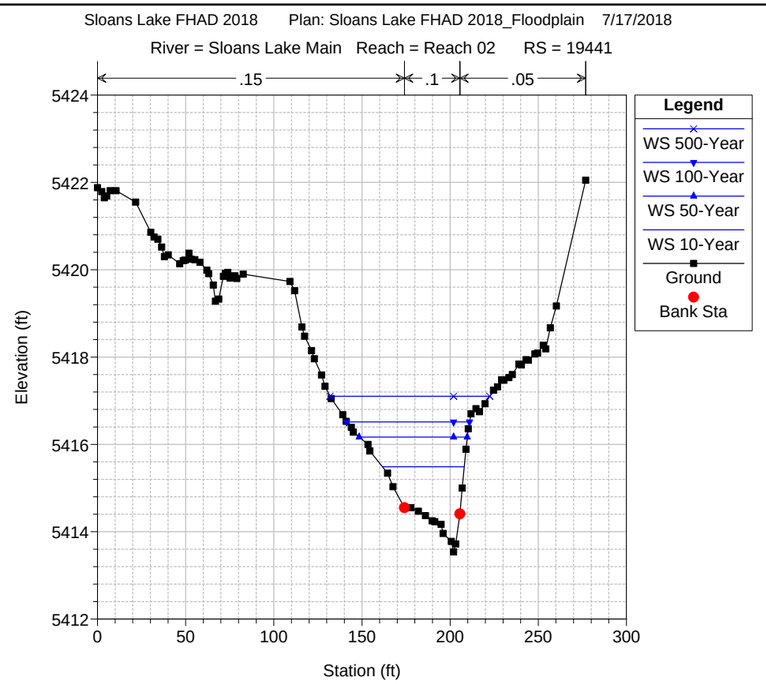
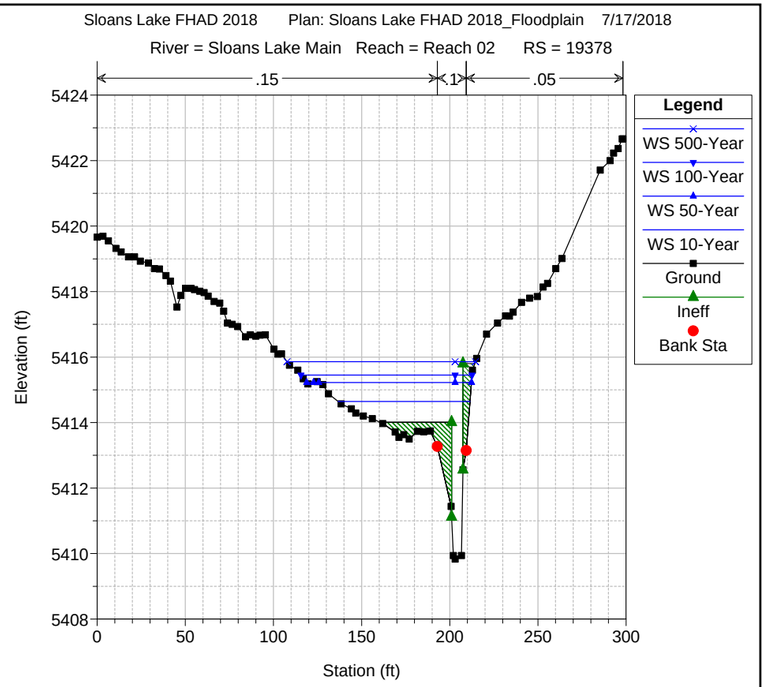
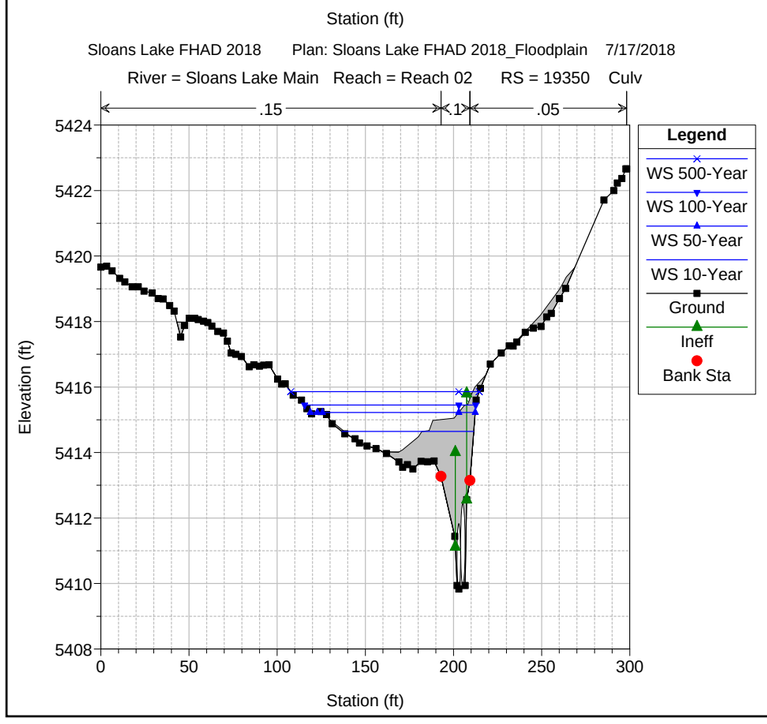
.1
.05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 19679
.15
.1
.05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 19562
.15
.1
.05
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 19441
.15
.1
.05
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 19378
.15
.1
.05
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 19350 Culv
.15
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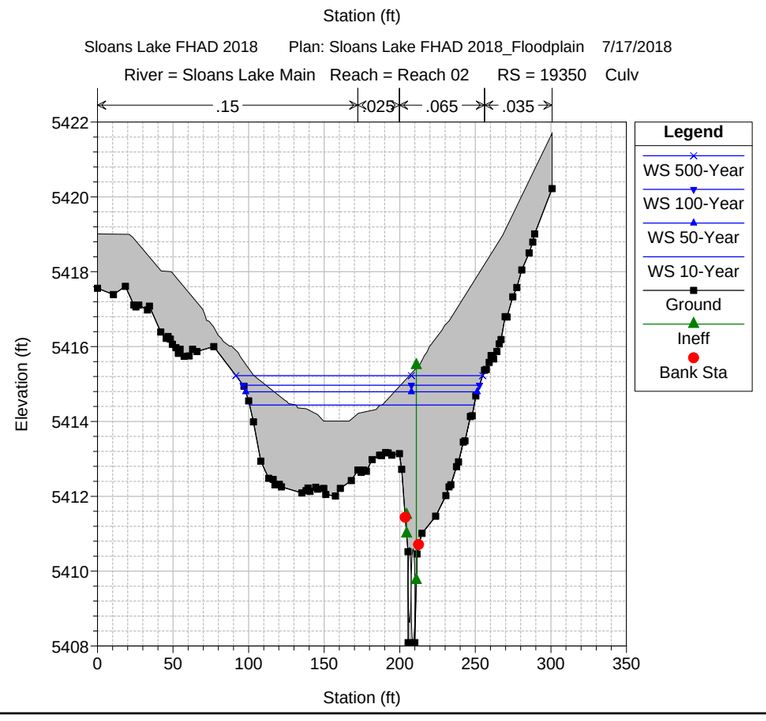
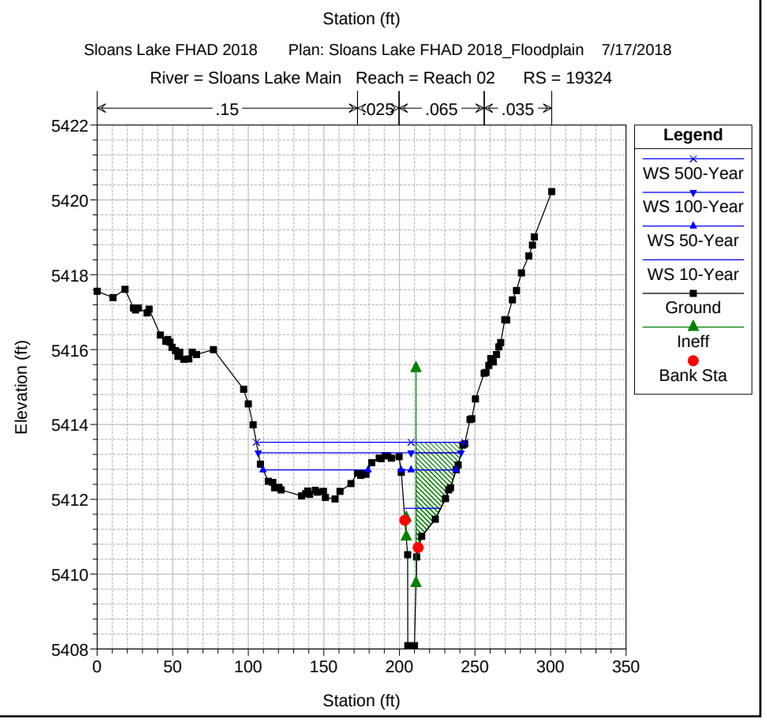
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 19350 Culv
.15
.025
.065
.035
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 19324
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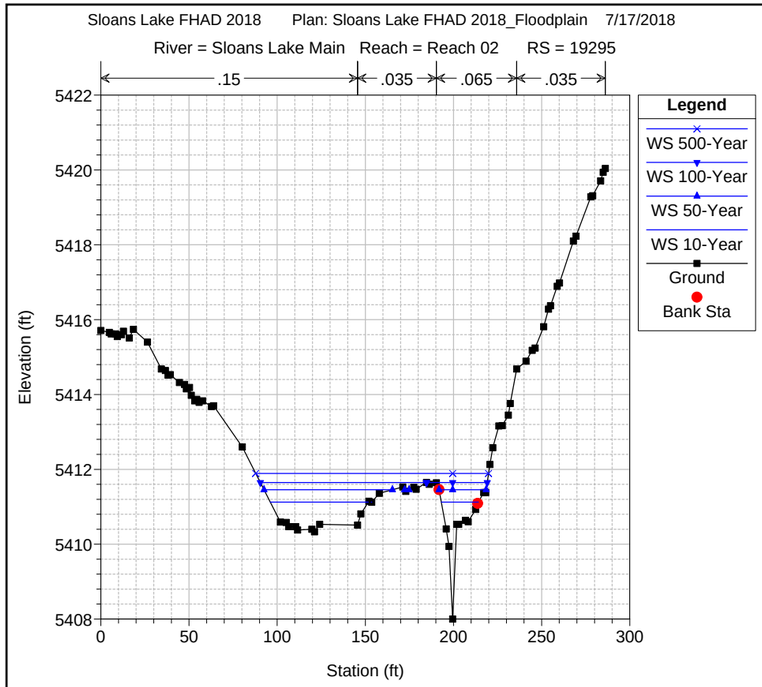
.025
.065
.035
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 19295
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.035
.065
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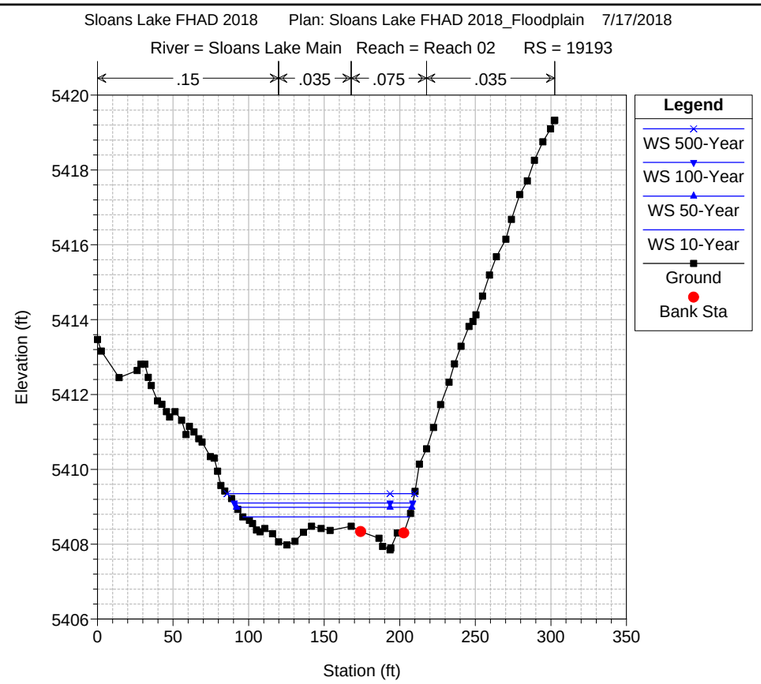
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 19193
.15
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.075
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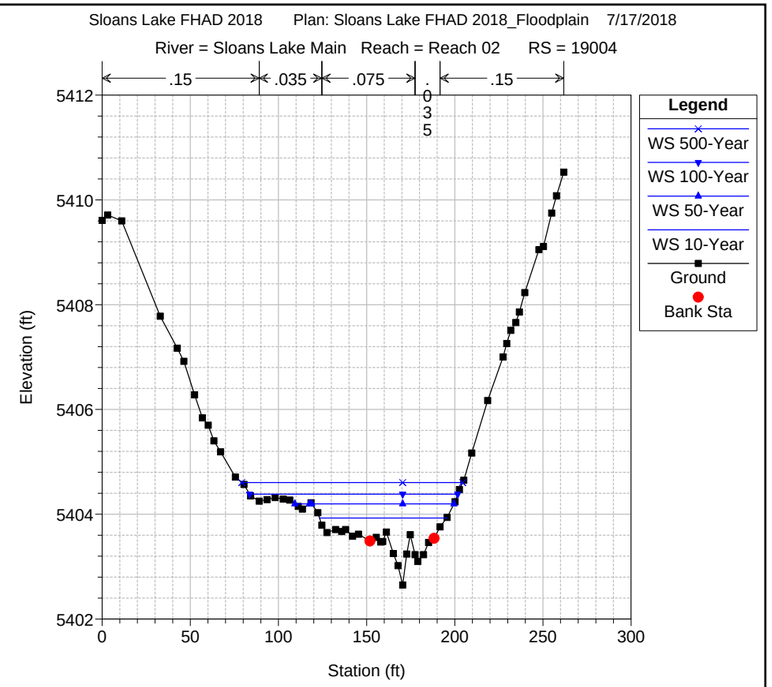
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 19004
.15
.035
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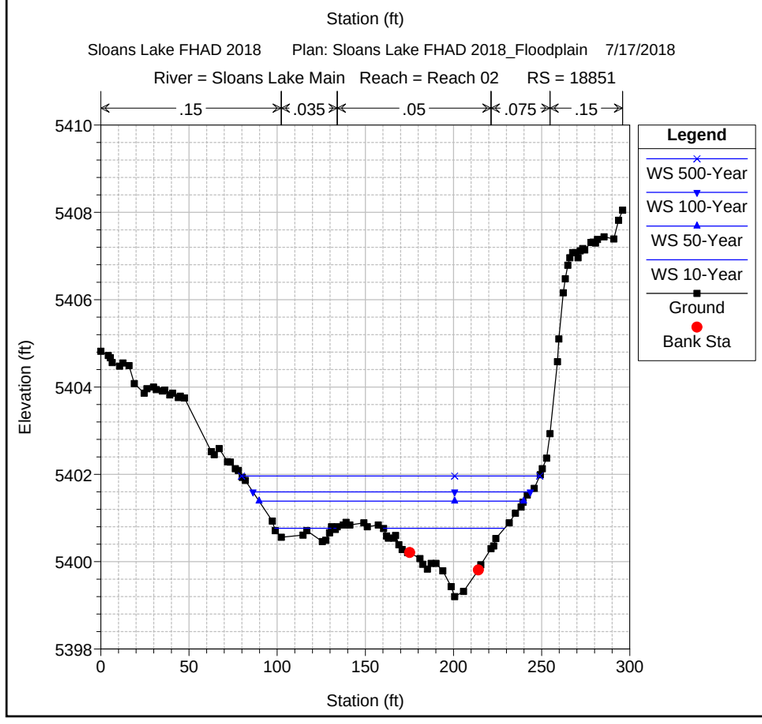
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 18851
.15
.035
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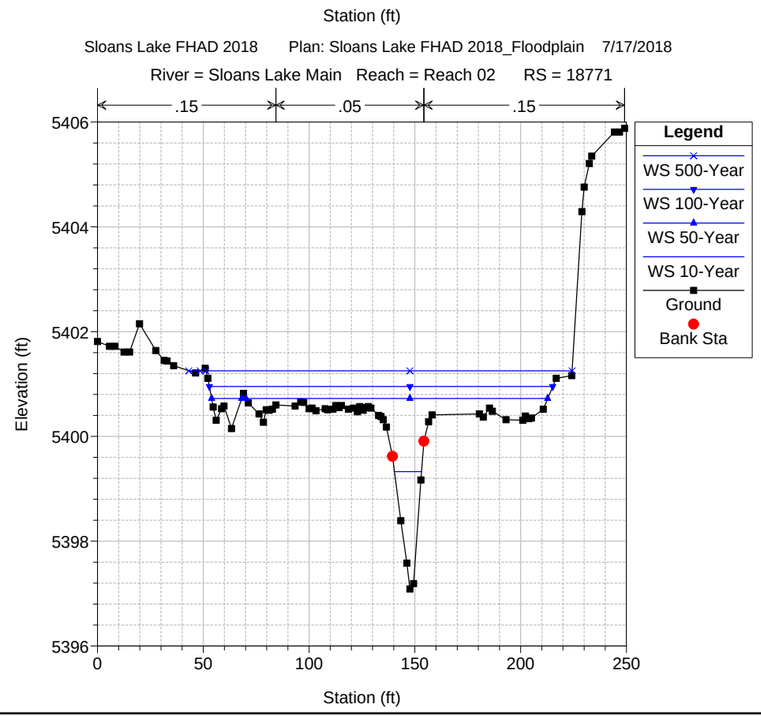
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 18771
.15
.05
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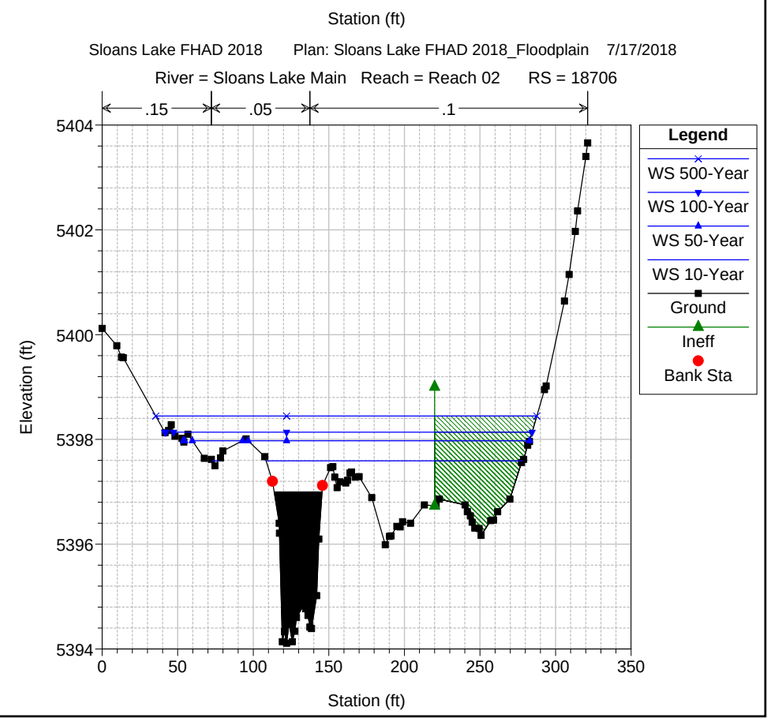
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 18706
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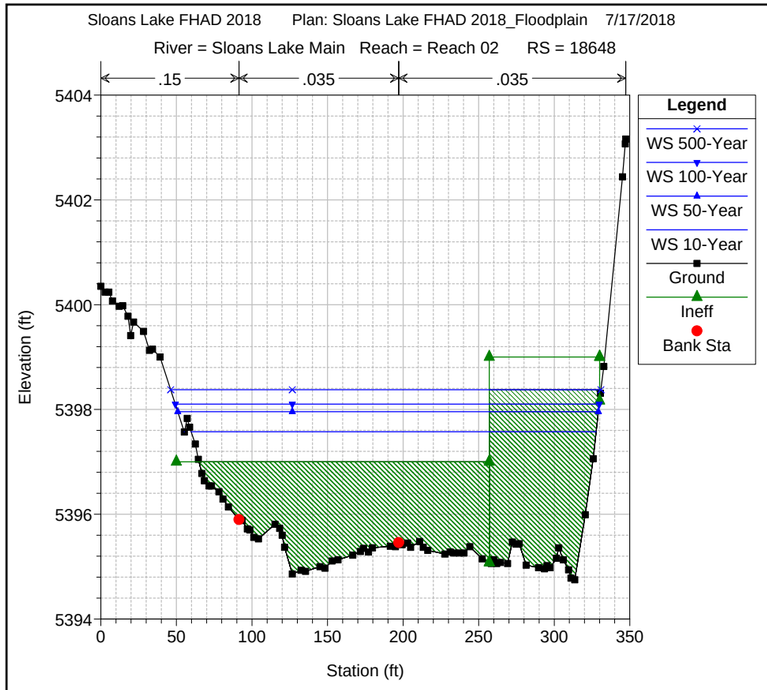
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 18648
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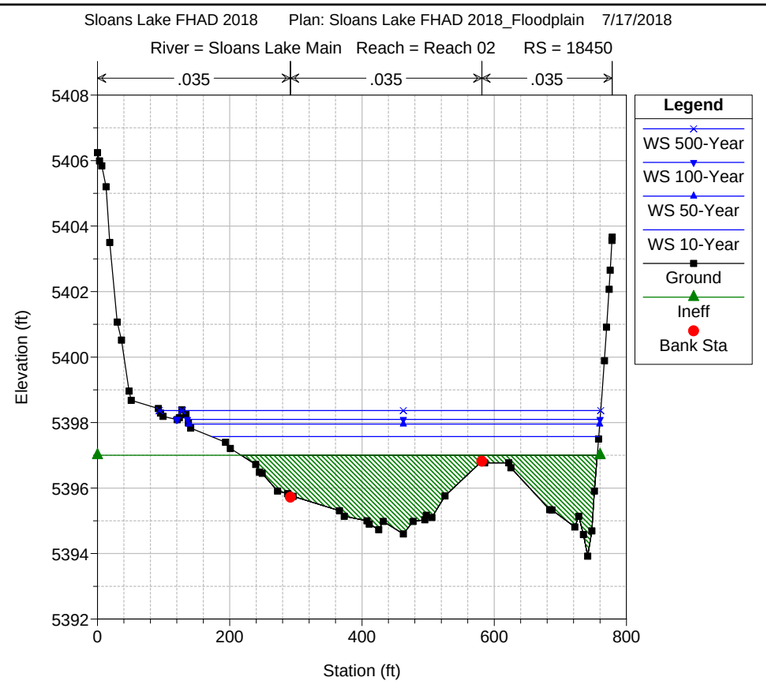
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 18450
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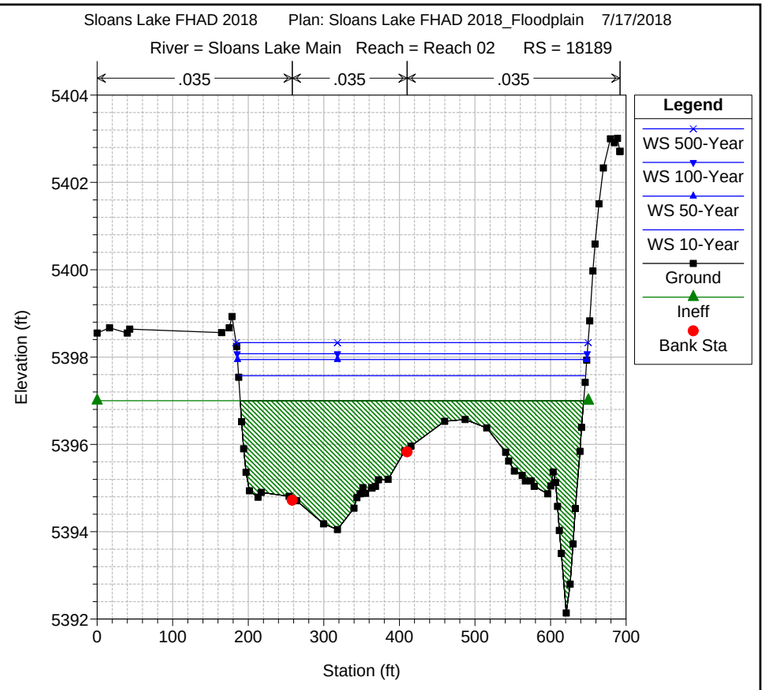
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 18189
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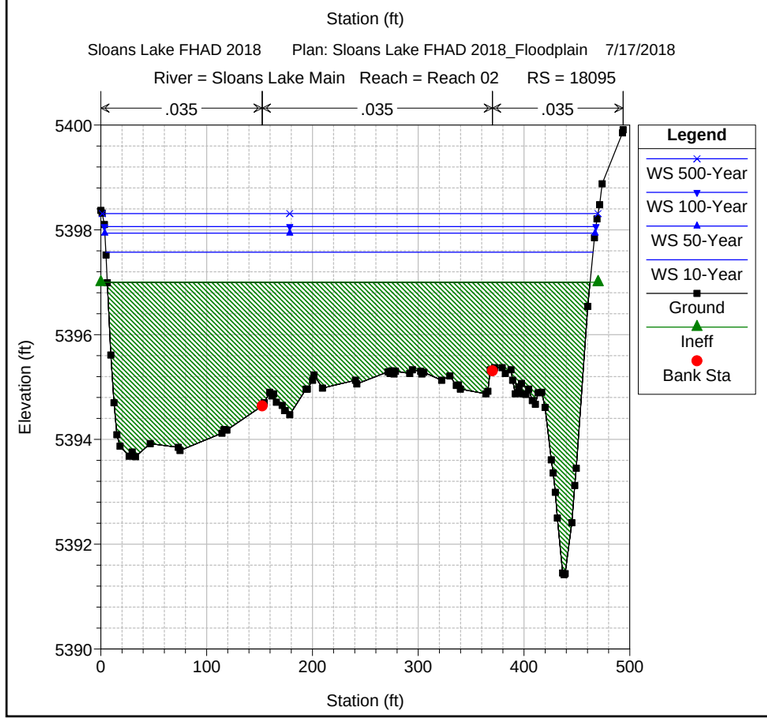
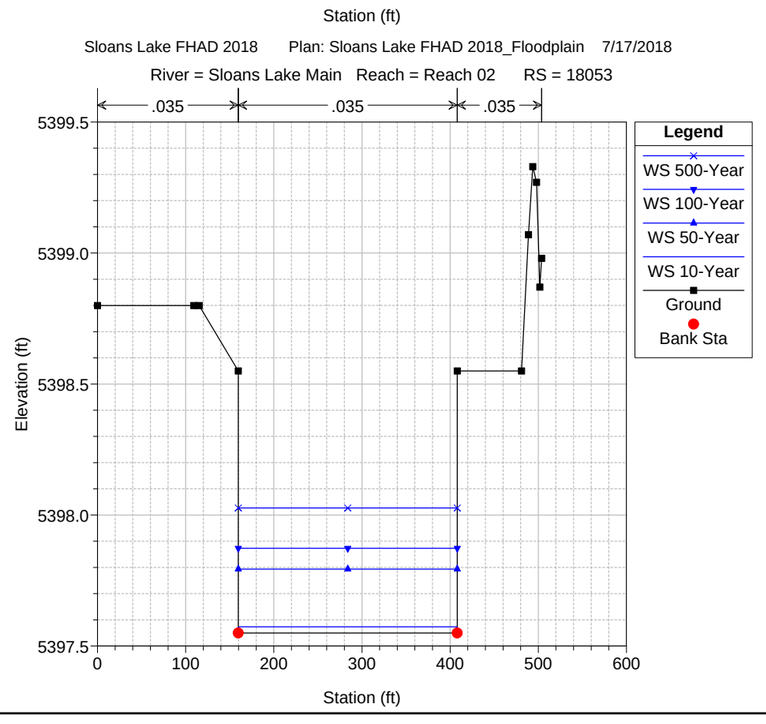
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 18095
.035
.035
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 18053
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.035
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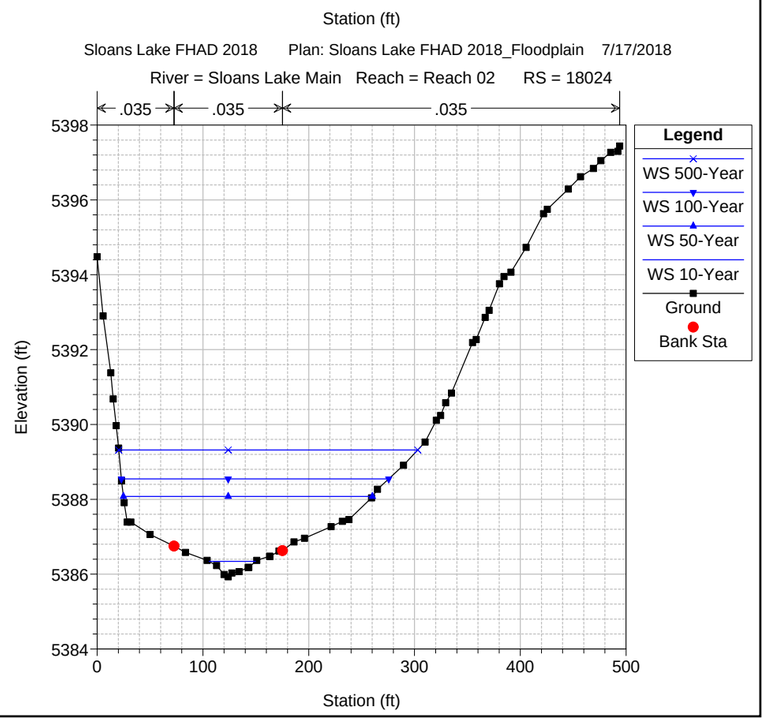
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 02 RS = 18024
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.035
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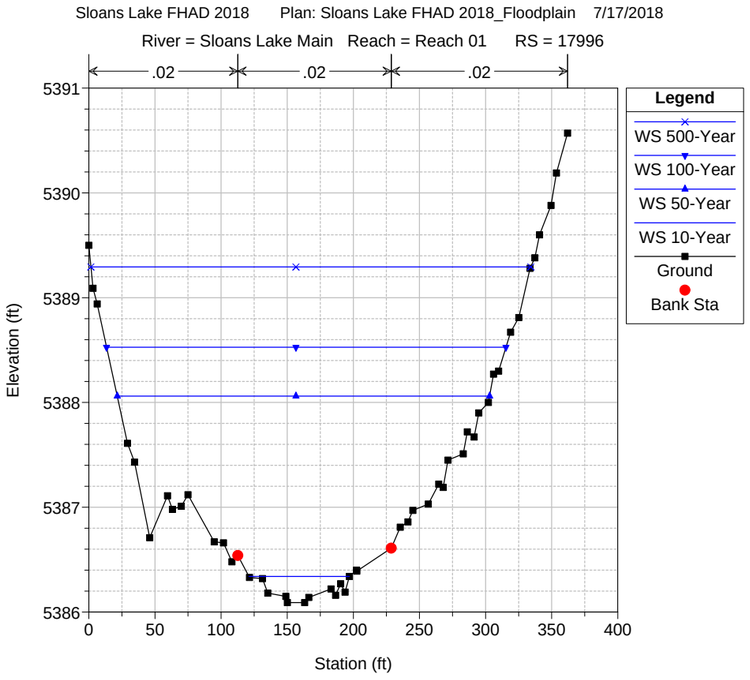
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 17996
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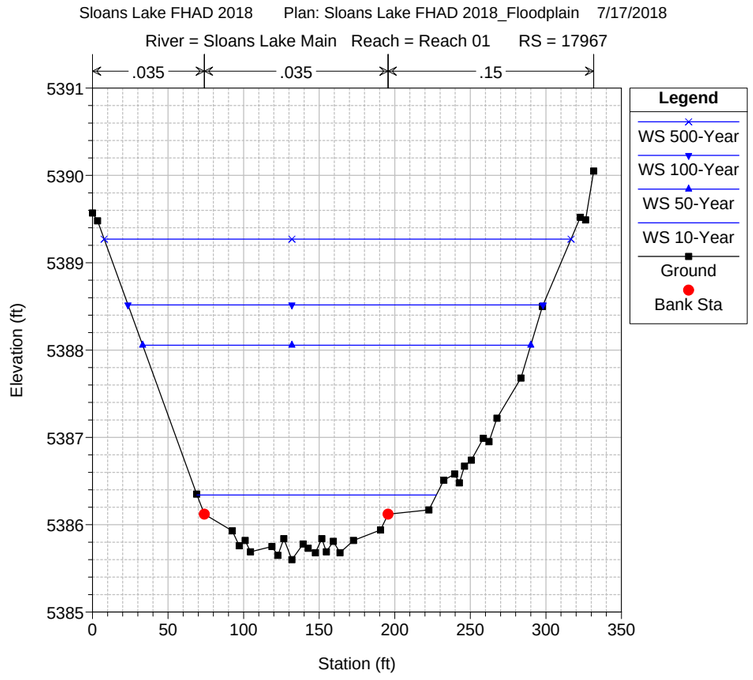
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 17967
.035
.035
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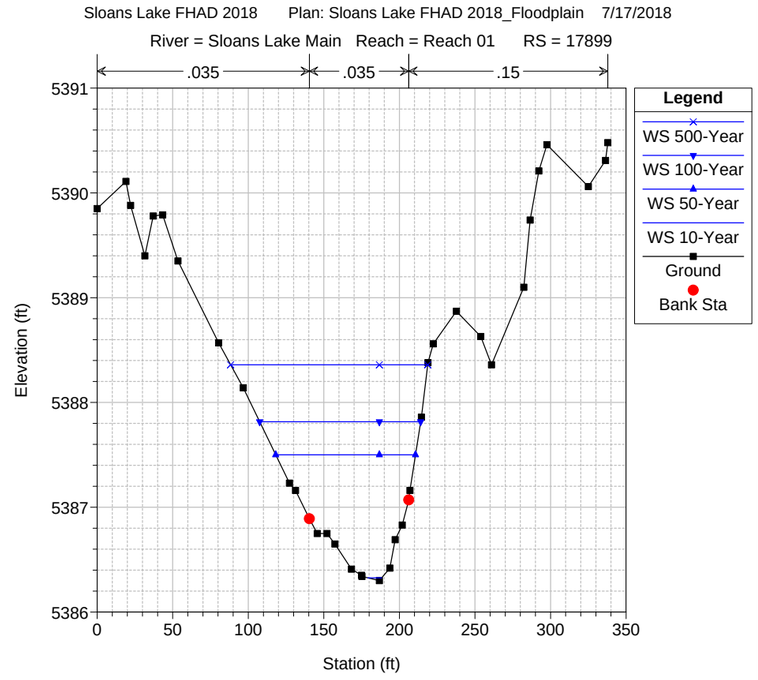
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 17899
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.035
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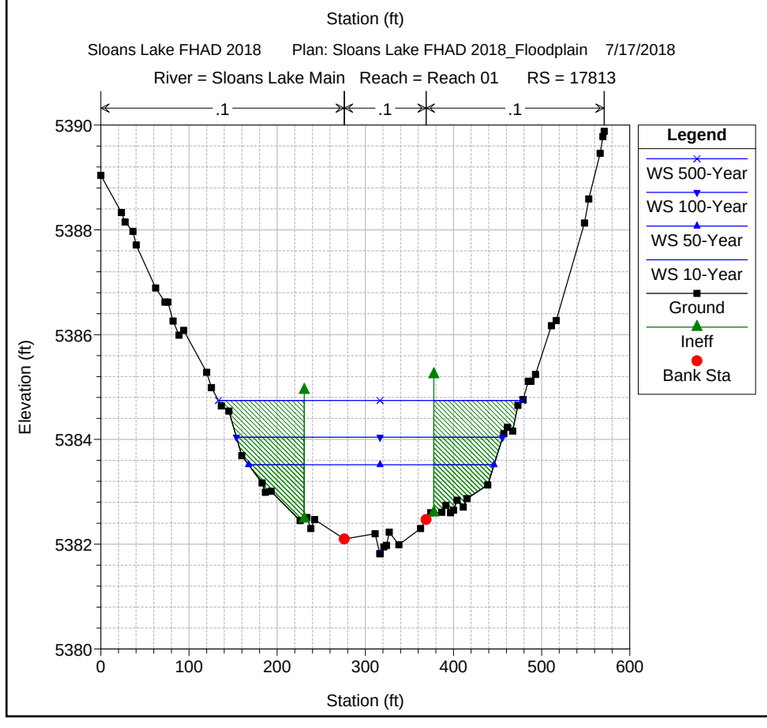
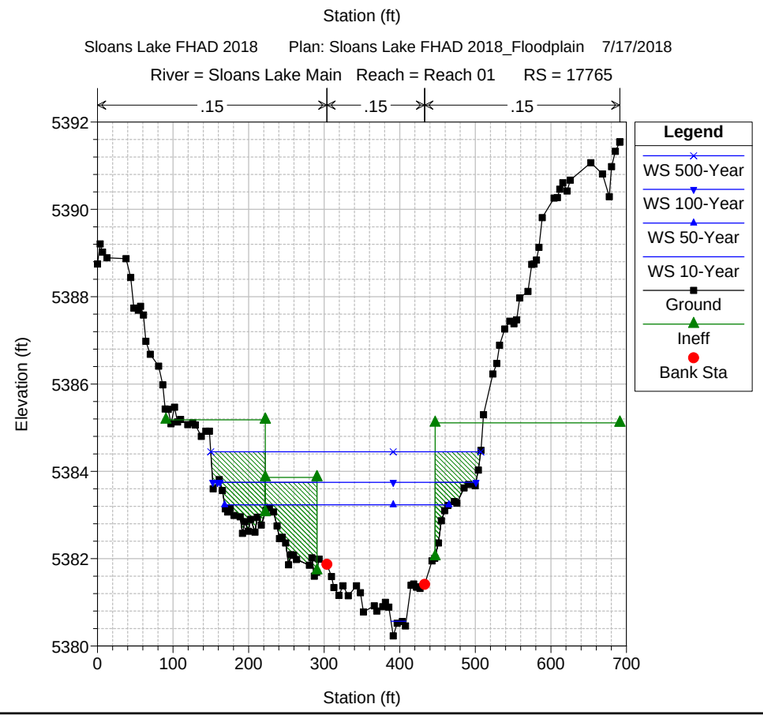
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 17813
.1
.1
.1
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 17765
.15
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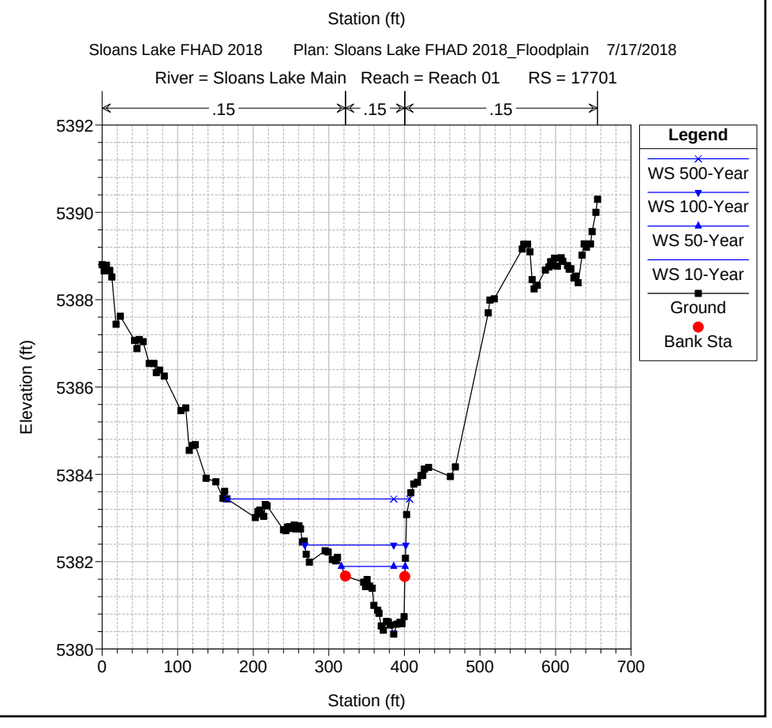
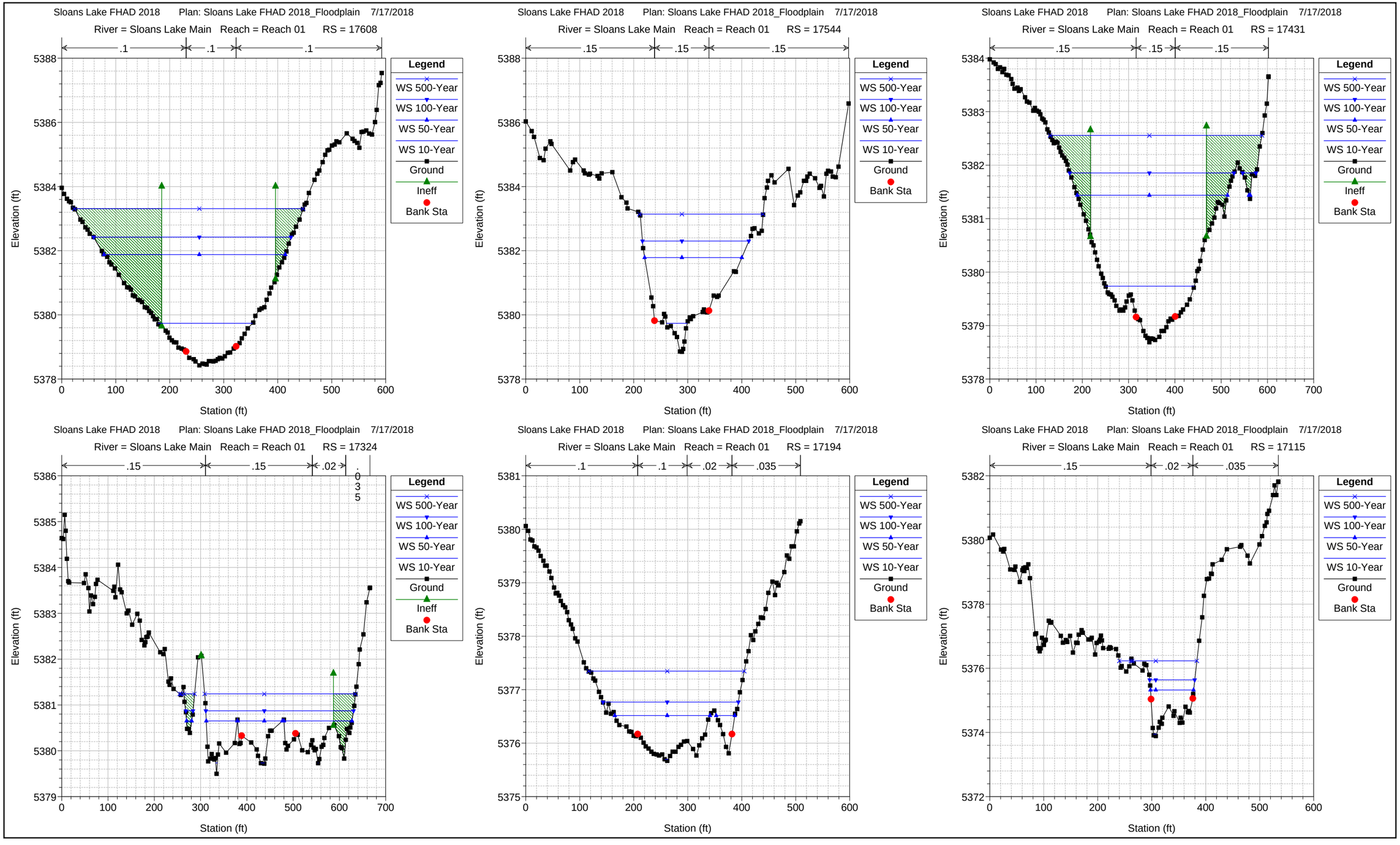
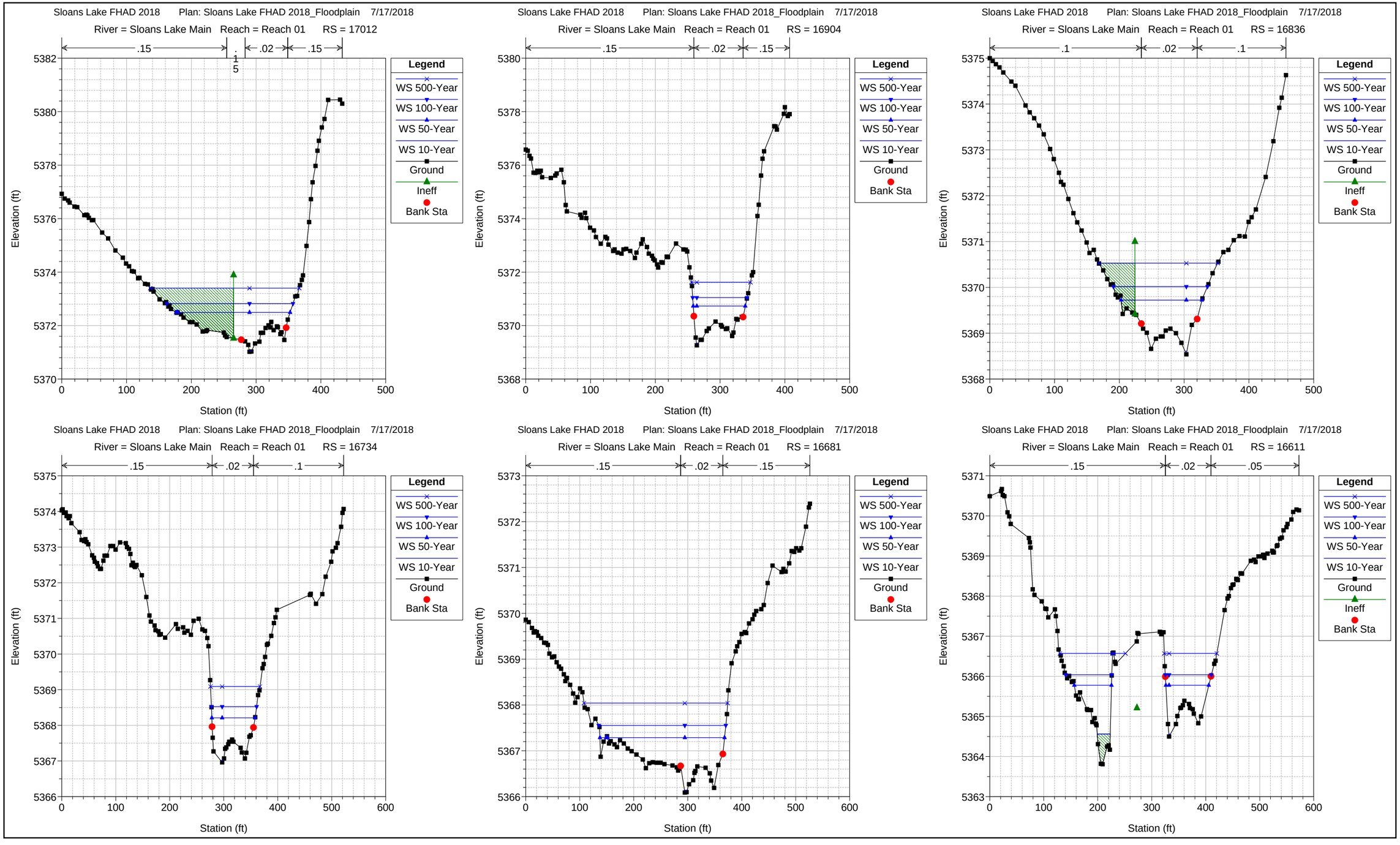
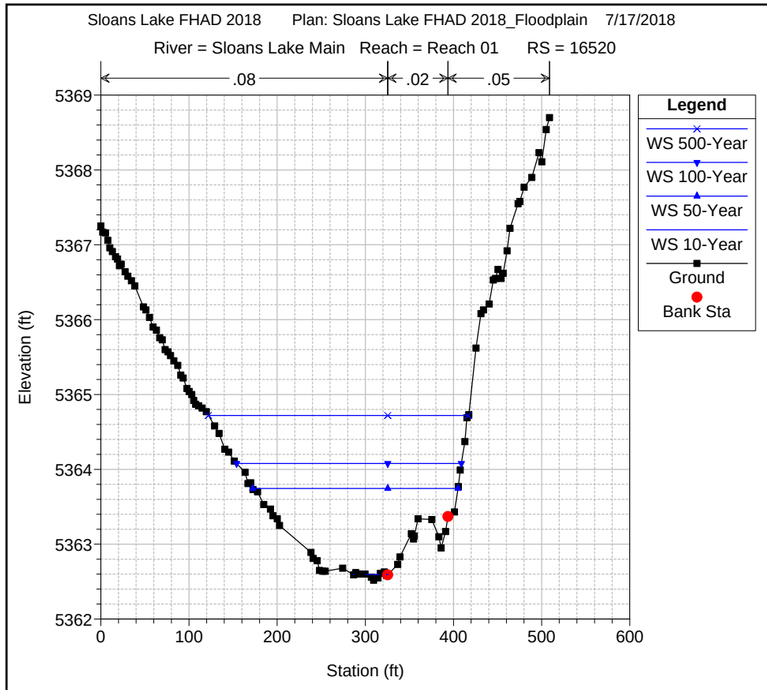
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 17701
.15
.15
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 17608
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 17544
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 17431
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 17324
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 17194
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 17115
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 17012
.15 .15 .02 .15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 16904
.15 .02 .15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 16836
.1 .02 .1
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 16734
.15 .02 .1
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 16681
.15 .02 .15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 16611
.15 .02 .05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 16520
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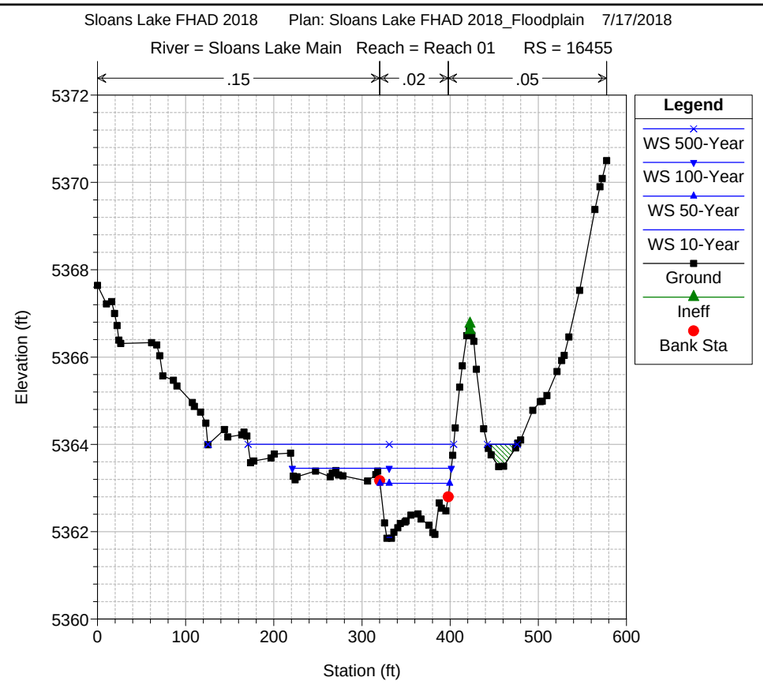
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 16455
.15
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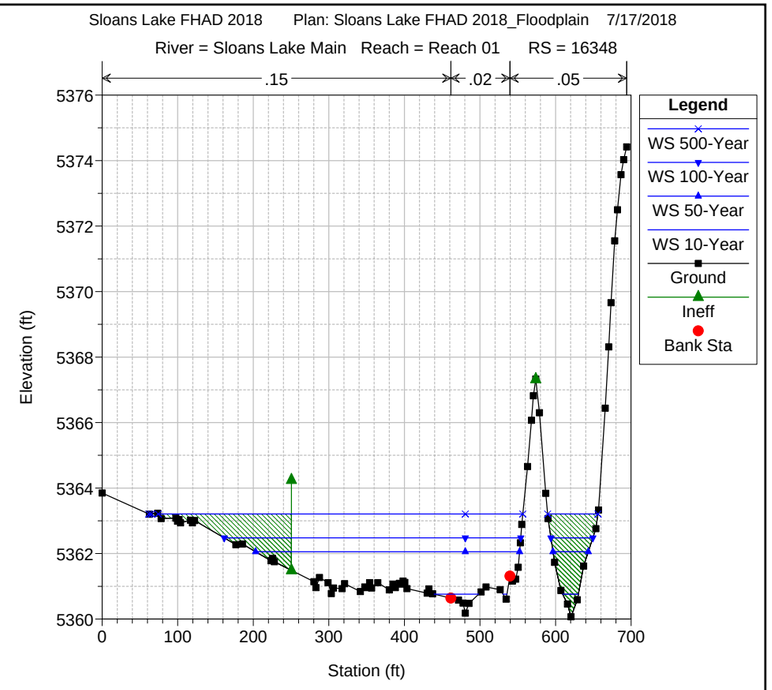
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 16348
.15
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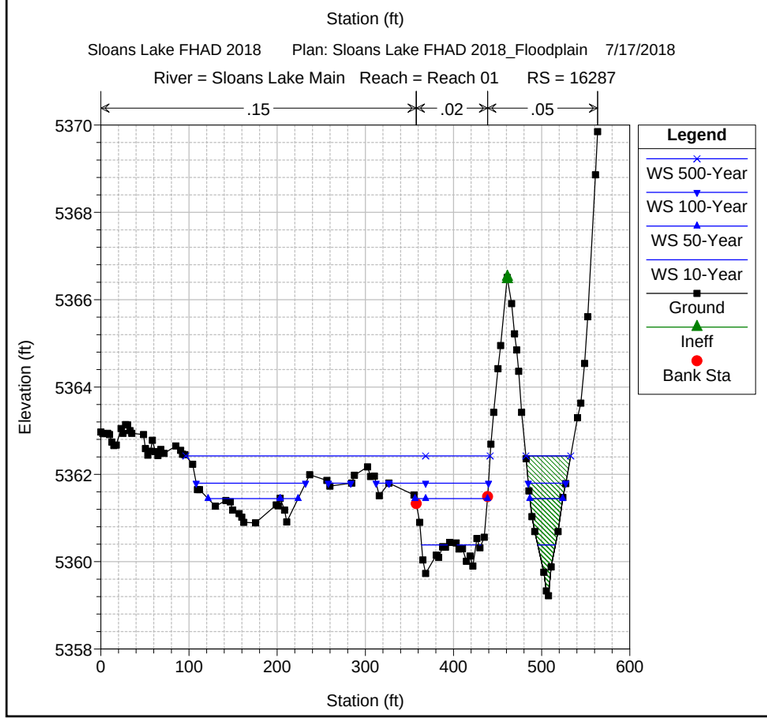
.05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 16287
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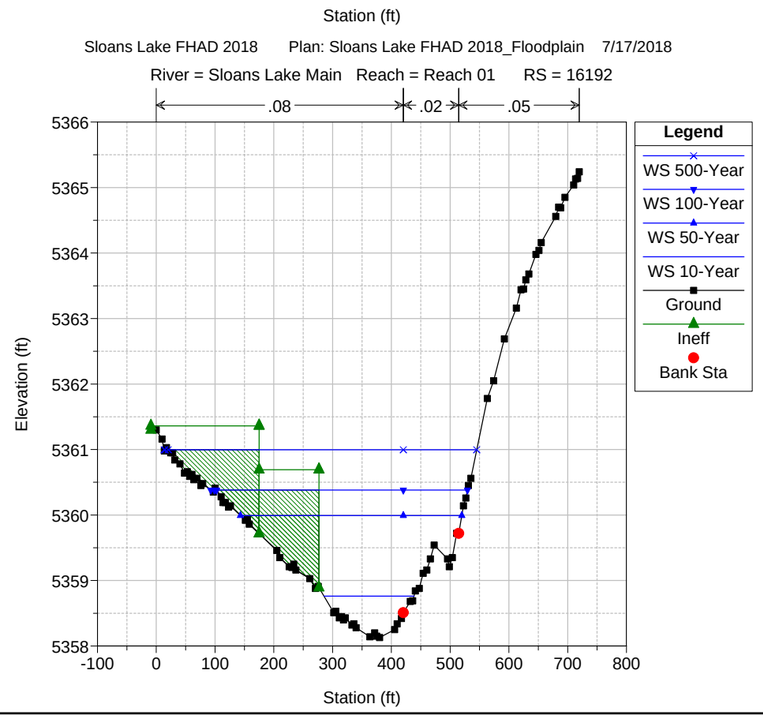
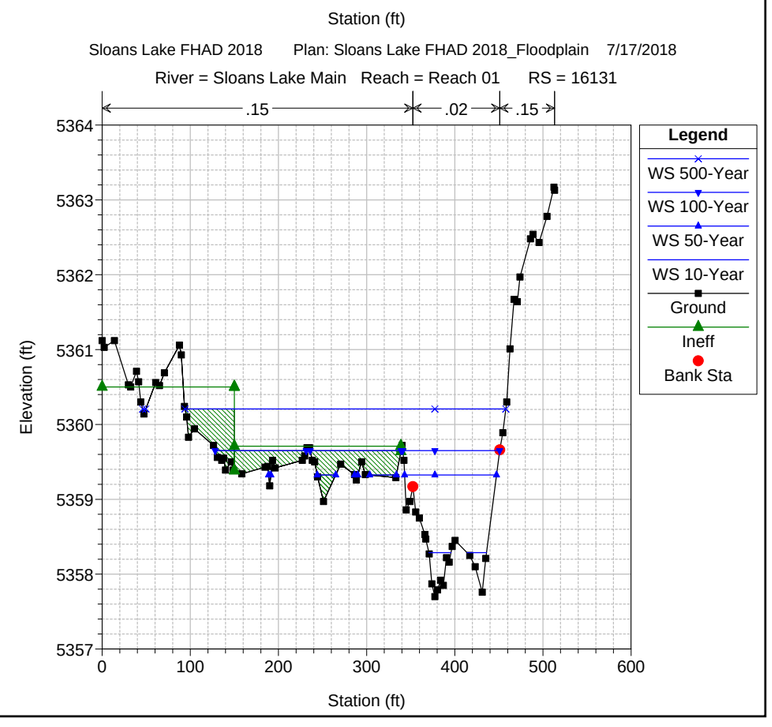
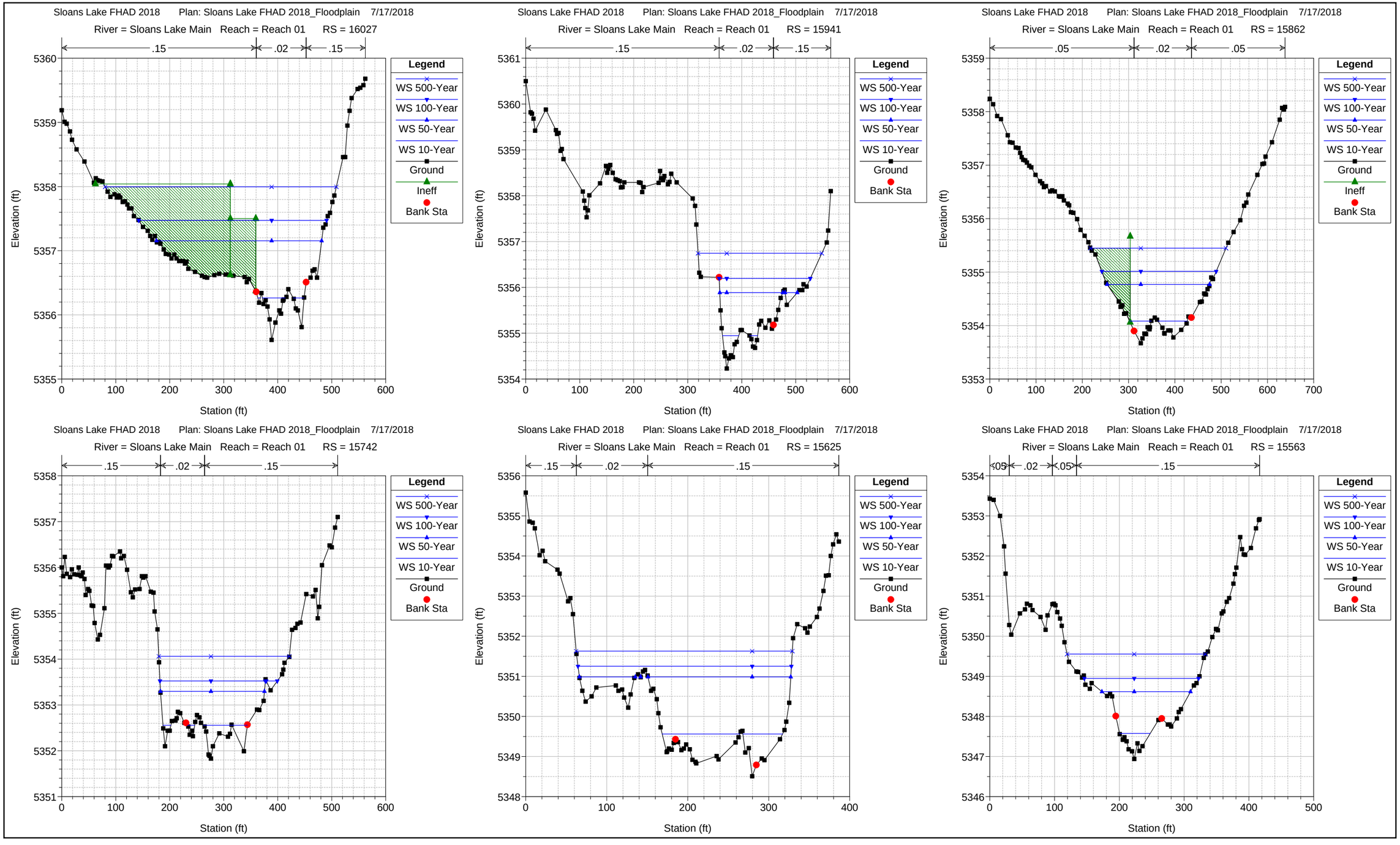
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 16192
.08
.02
.05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 16131
.15
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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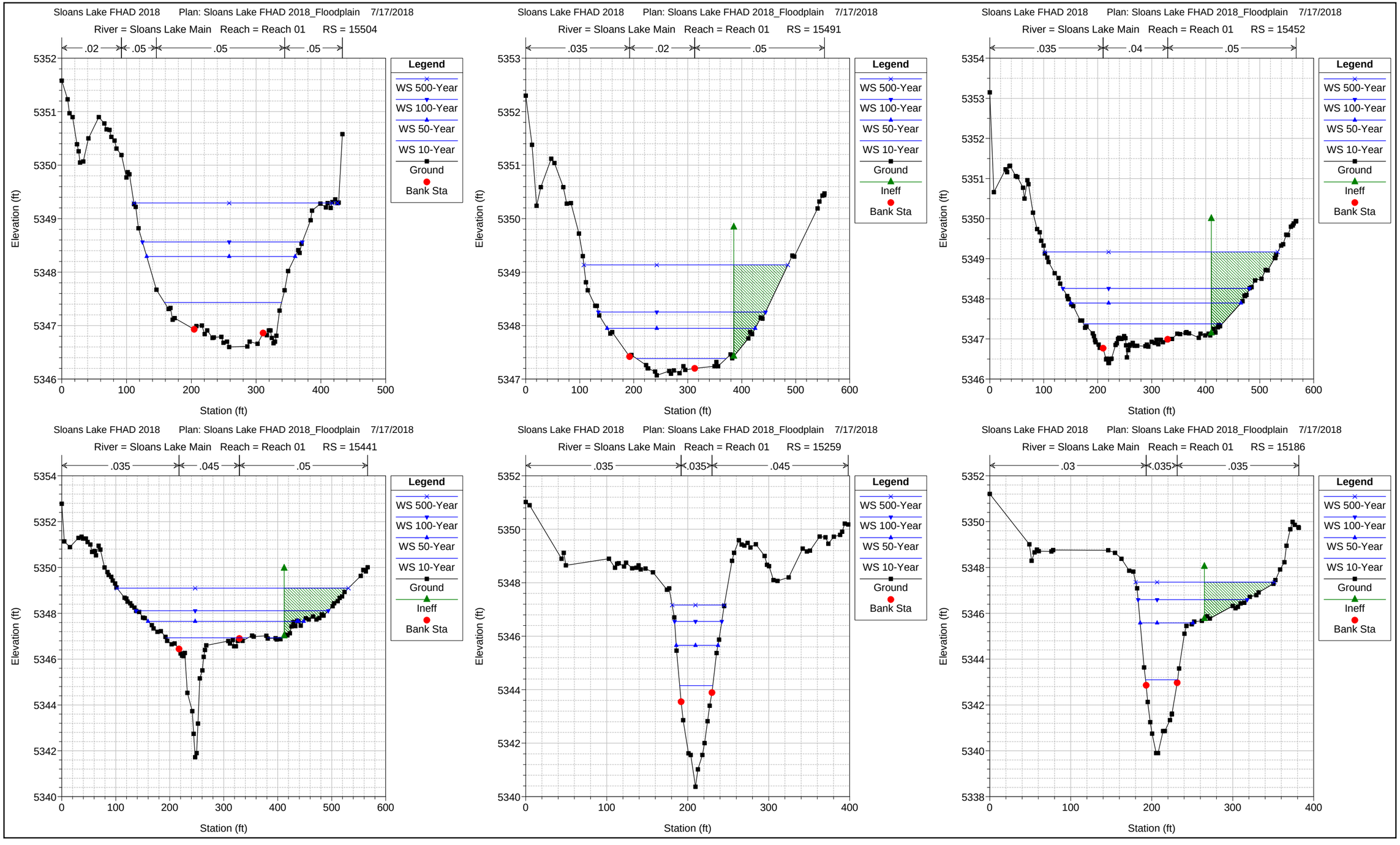
River = Sloans Lake Main Reach = Reach 01 RS = 16027
.15 .02 .15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 15941
.15 .02 .15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 15862
.05 .02 .05
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 15742
.15 .02 .15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 15625
.15 .02 .15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 15563
.05 .02 .05 .15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta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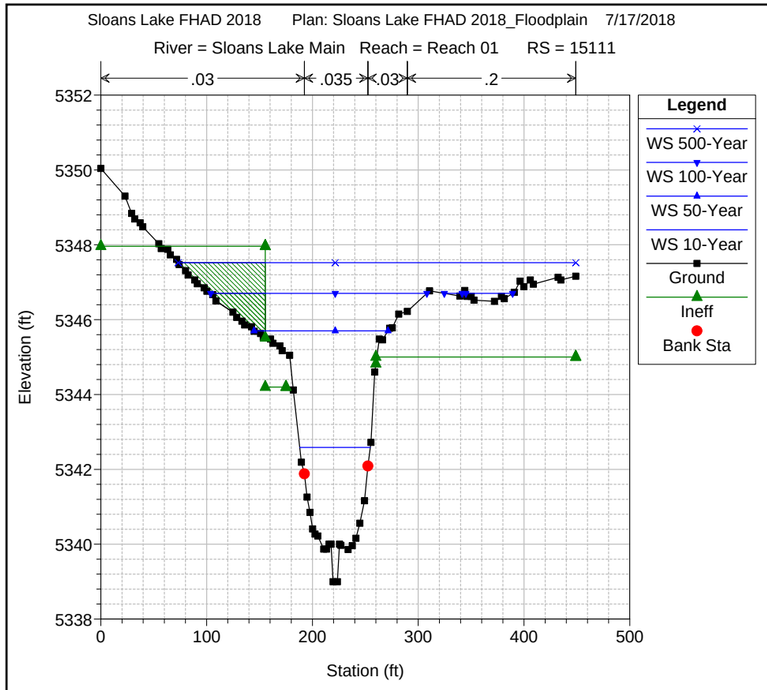
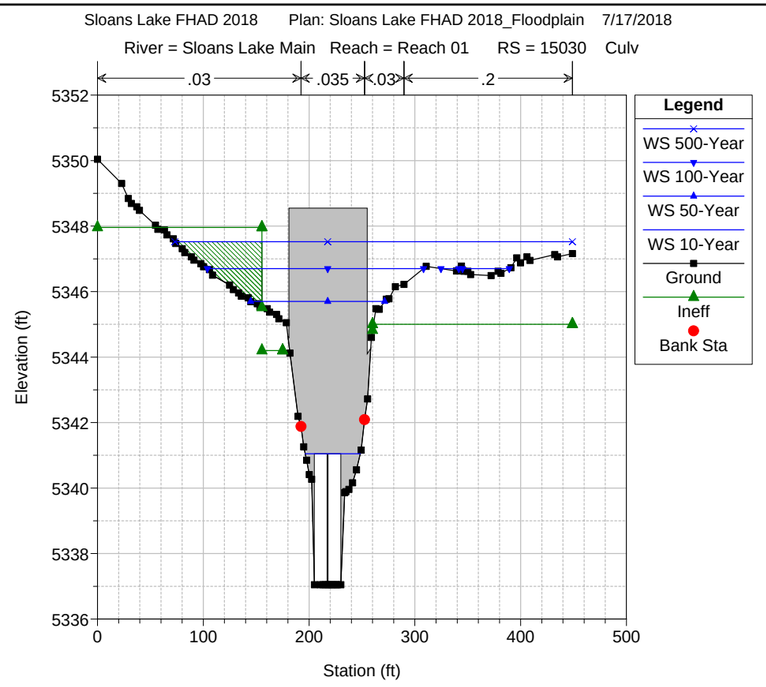
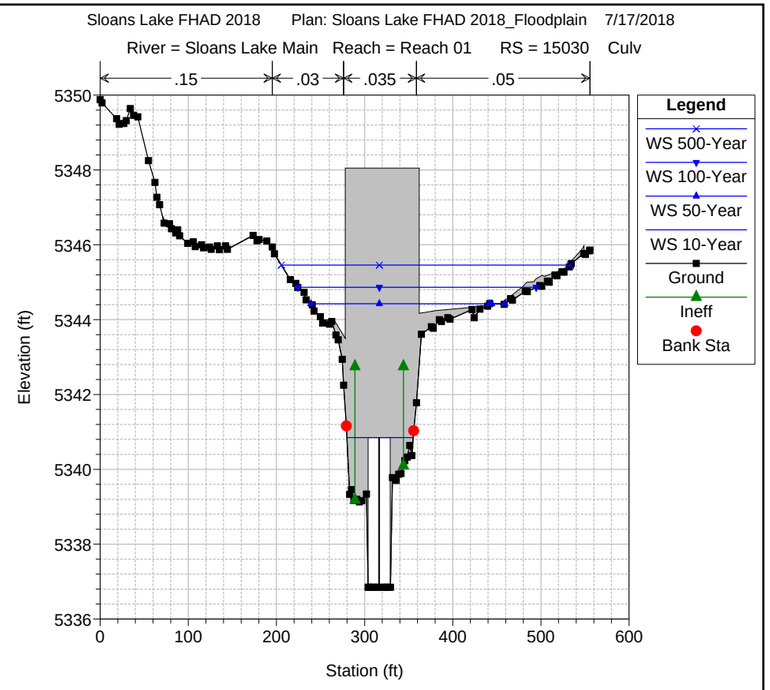
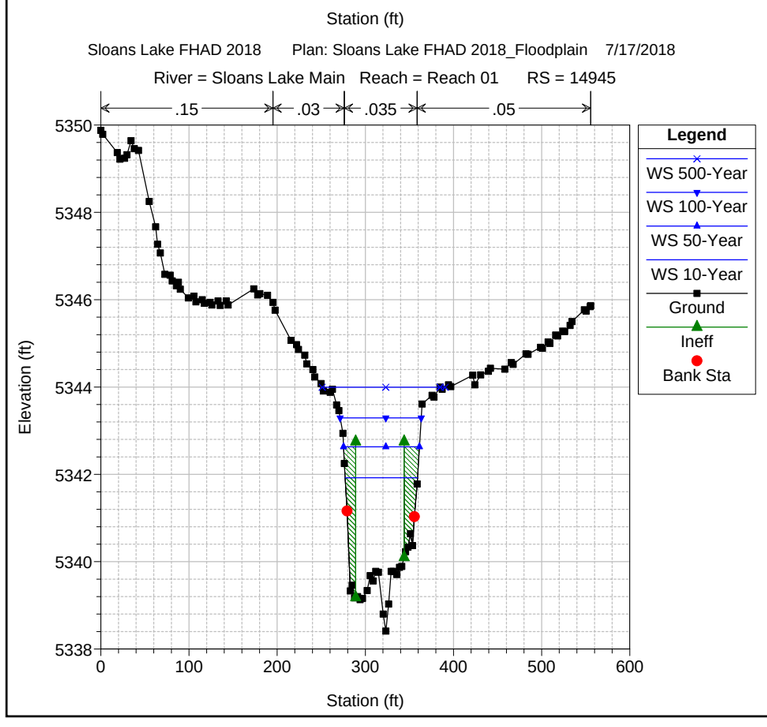
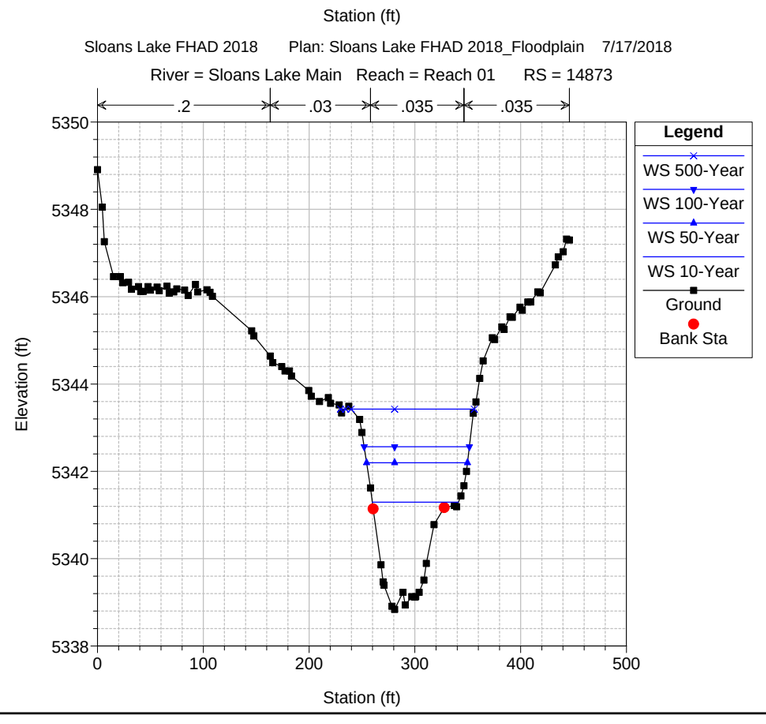
River = Sloans Lake Main Reach = Reach 01 RS = 15504
.02 .05 .05 .05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 15491
.035 .02 .05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 15452
.035 .04 .05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 15441
.035 .045 .05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 15259
.035 .035 .045
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 15186
.03 .035 .035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

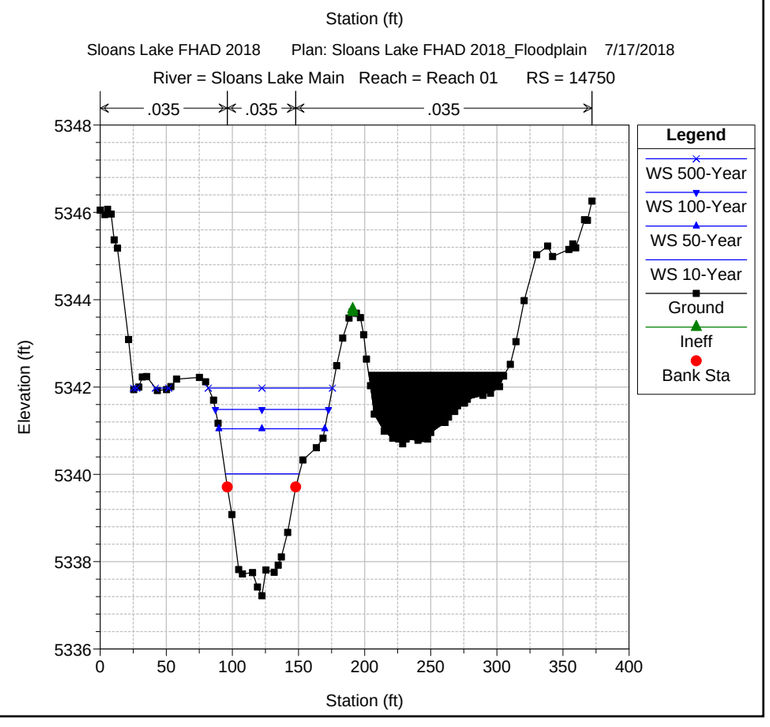

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 15111
.03
.035
.03
.2
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

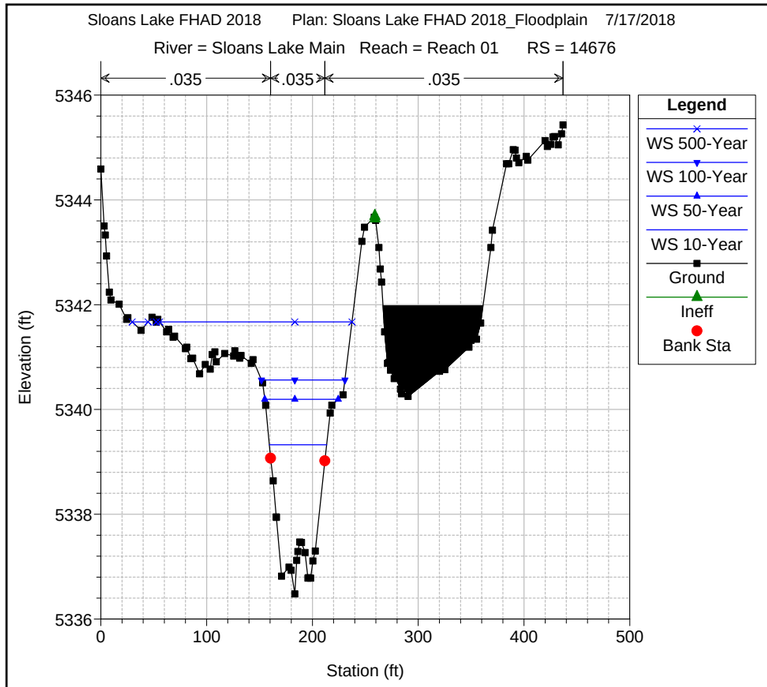

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 15030 Culv
.03
.035
.03
.2
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

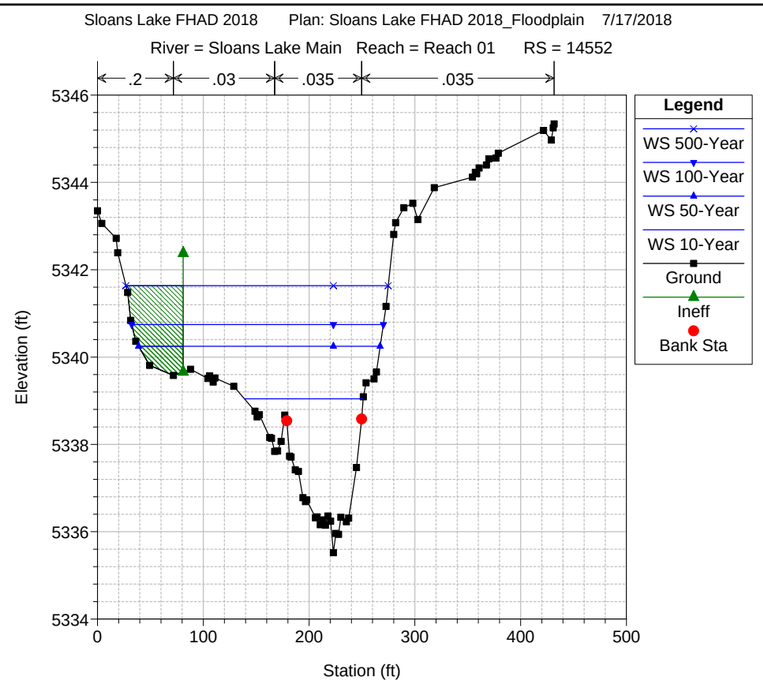

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 15030 Culv
.15
.03
.035
.05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

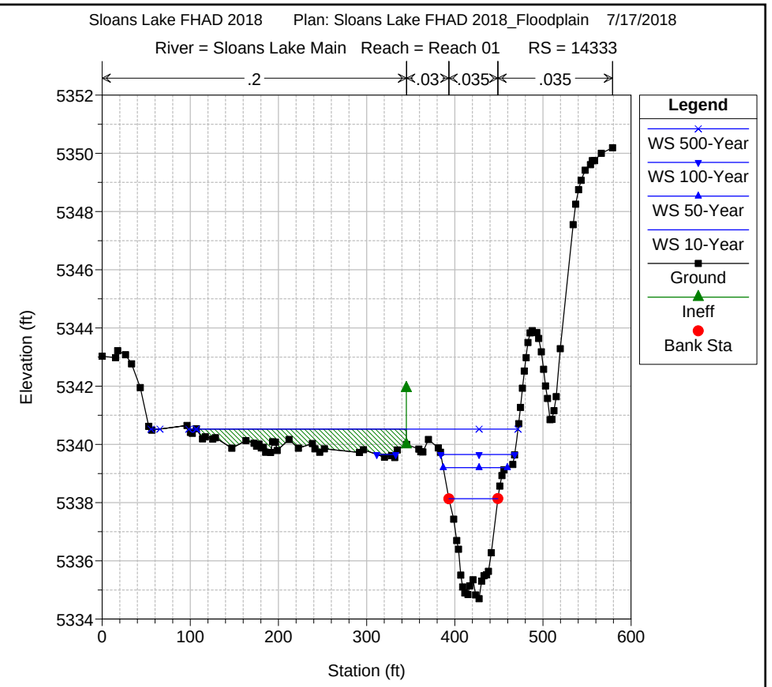

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 14945
.15
.03
.035
.05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

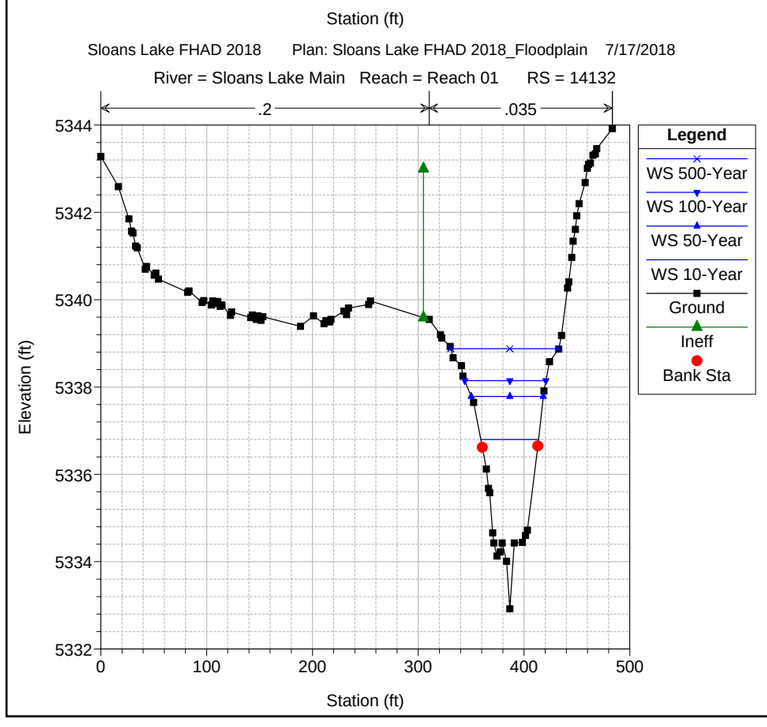

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 14873
.2
.03
.035
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

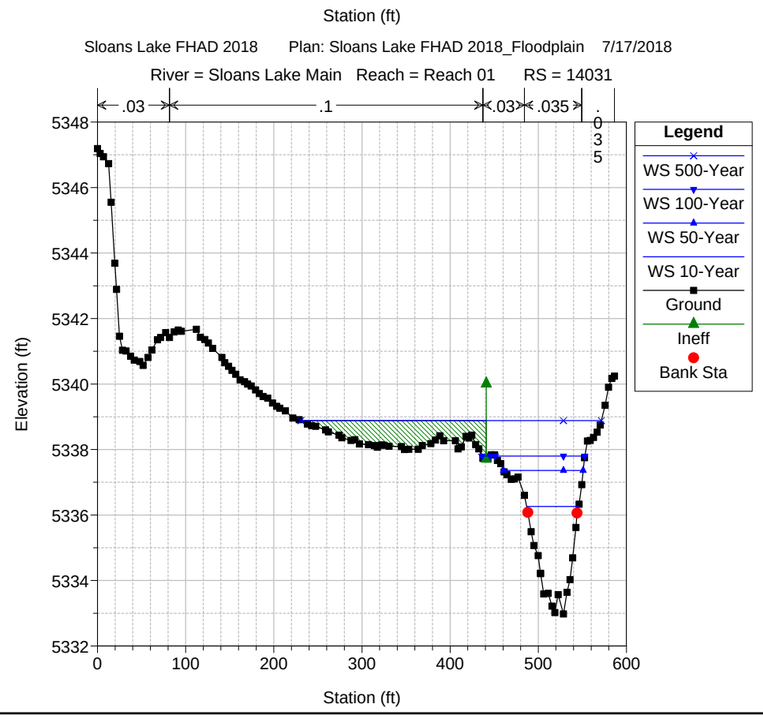

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 14750
.035
.035
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

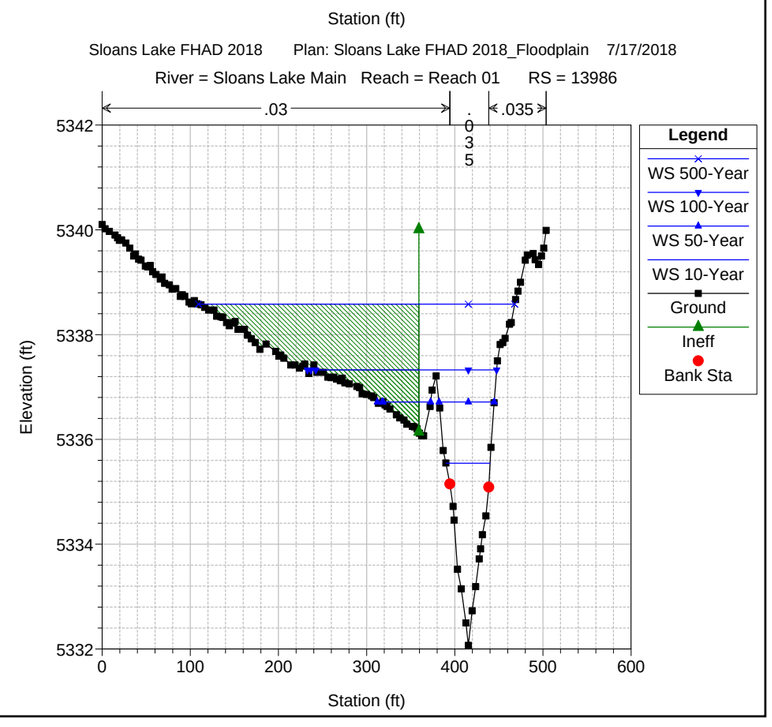

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 14676
.035
.035
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

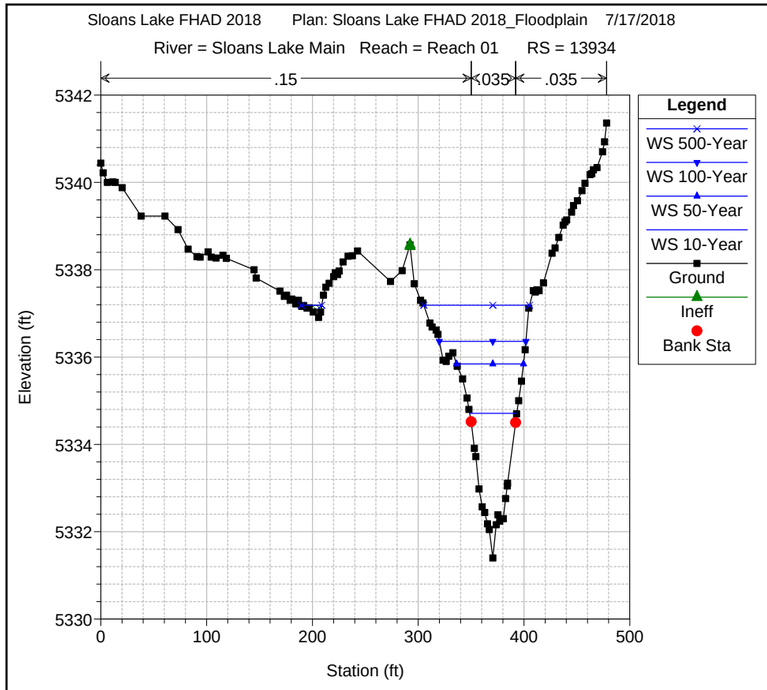

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 14552
.2
.03
.035
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 14333
.2
.03
.035
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 14132
.2
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 14031
.03
.1
.03
.035
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 13986
.03
.035
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 13934
.15
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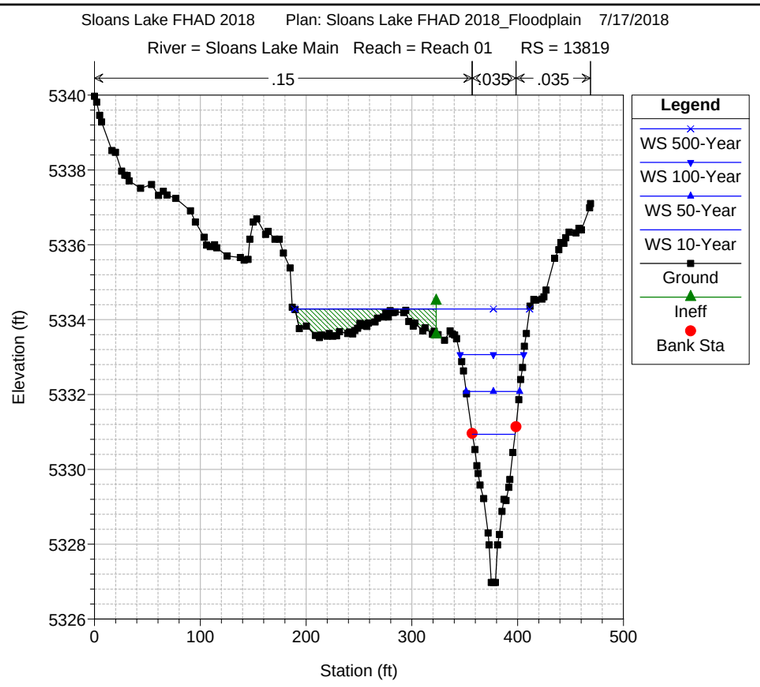
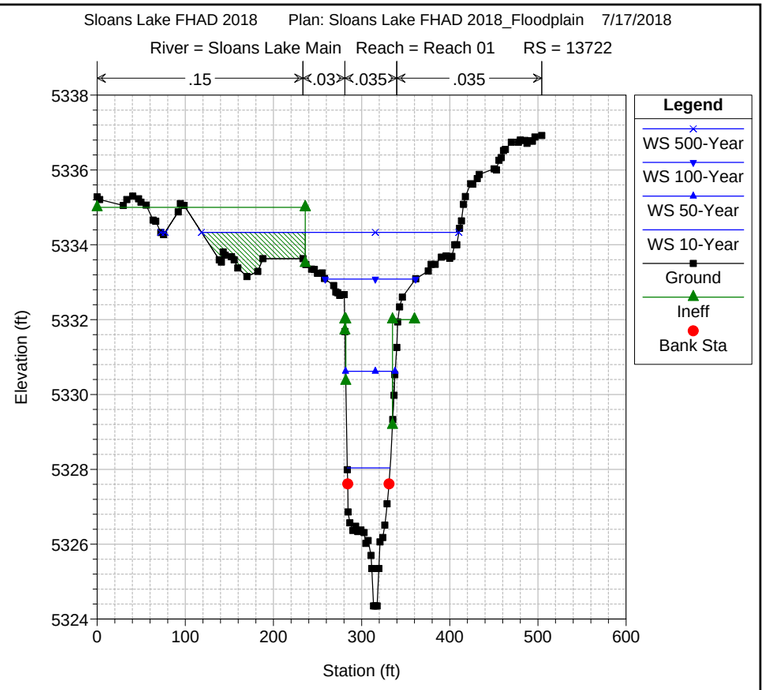
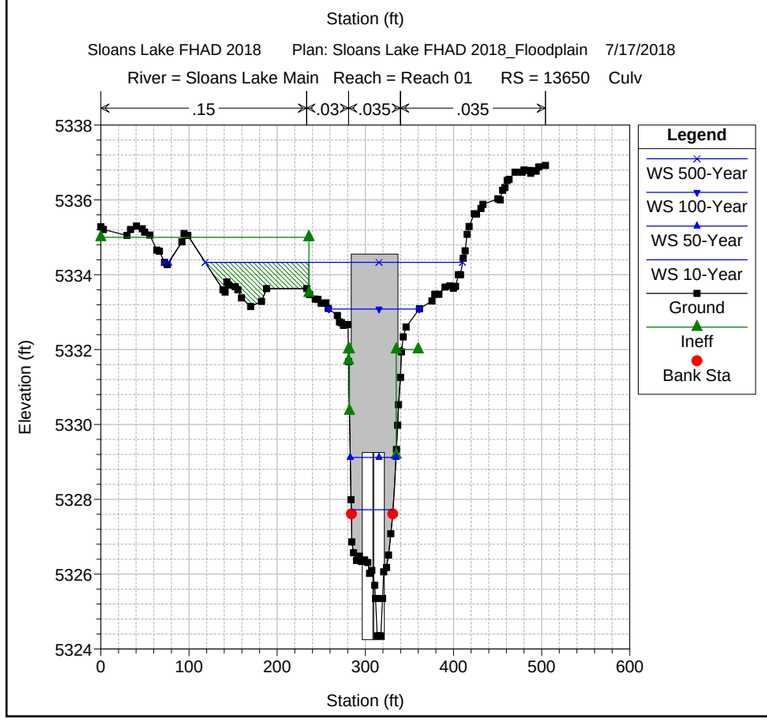
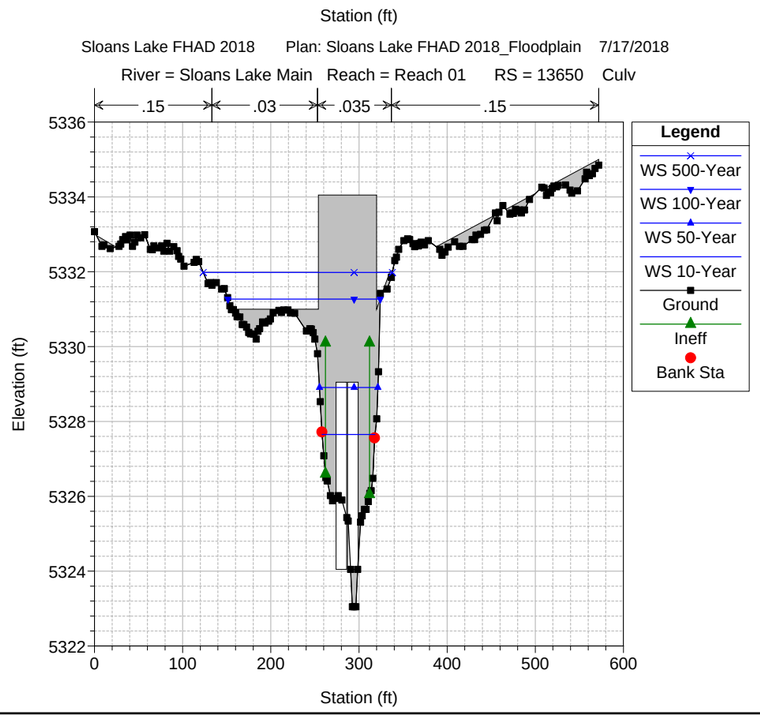
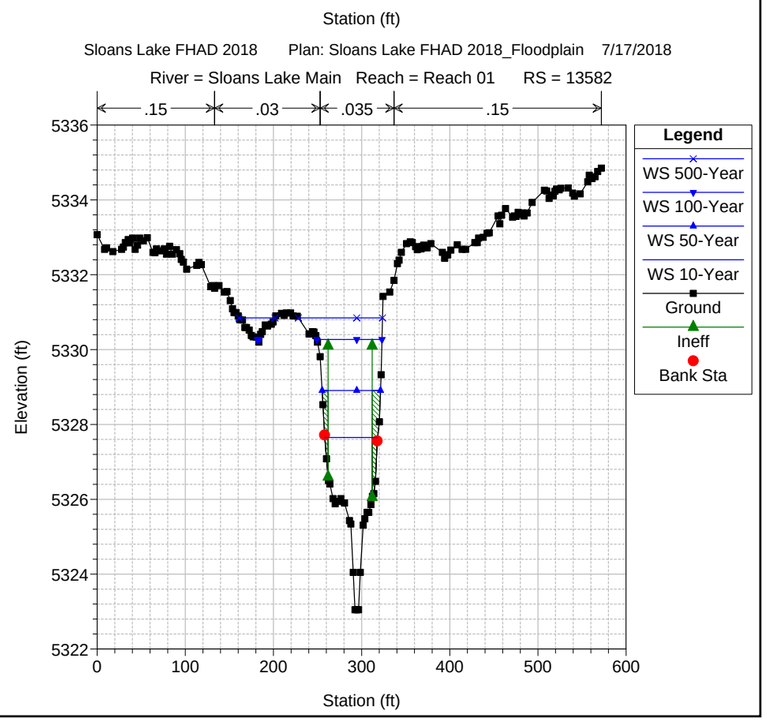
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

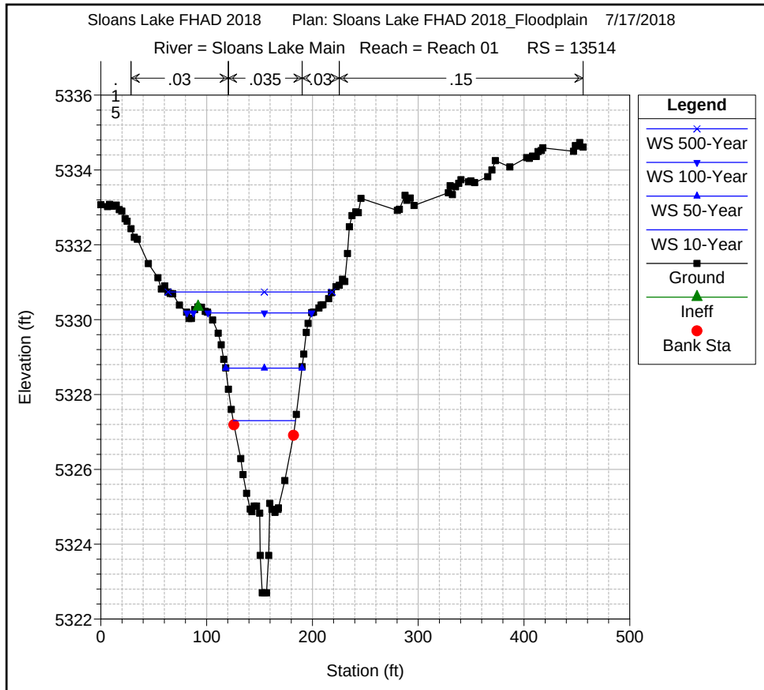

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 13819
.15
.035
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

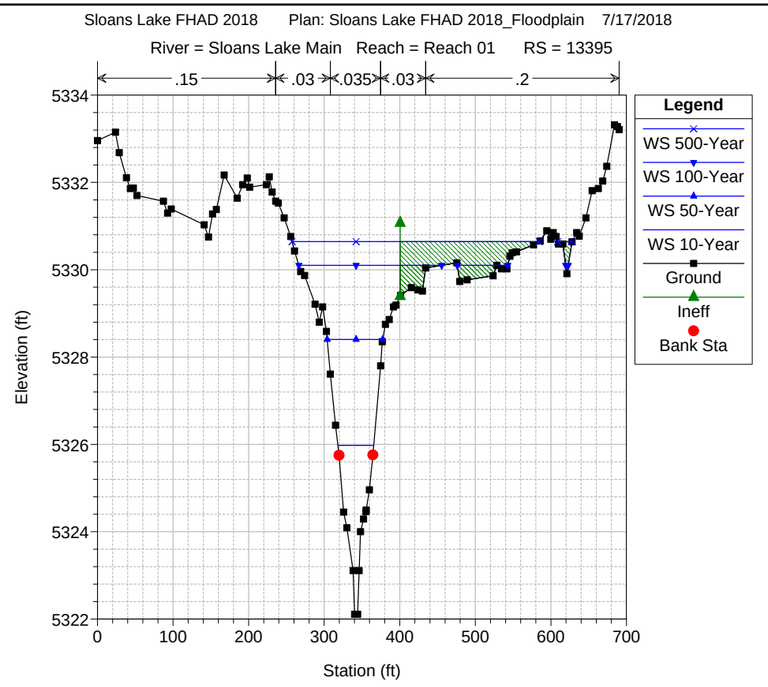

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 13722
.15
.03
.035
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

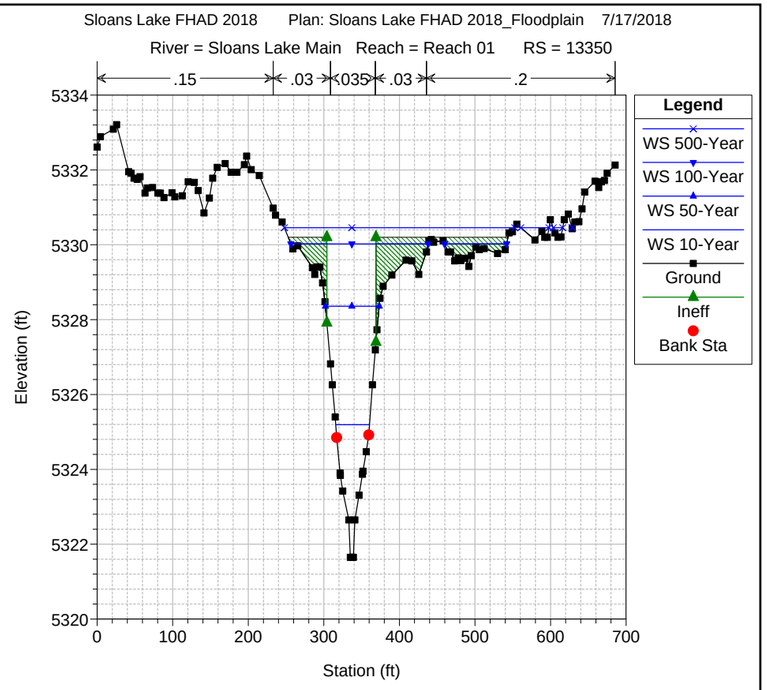

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 13650 Culv
.15
.03
.035
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

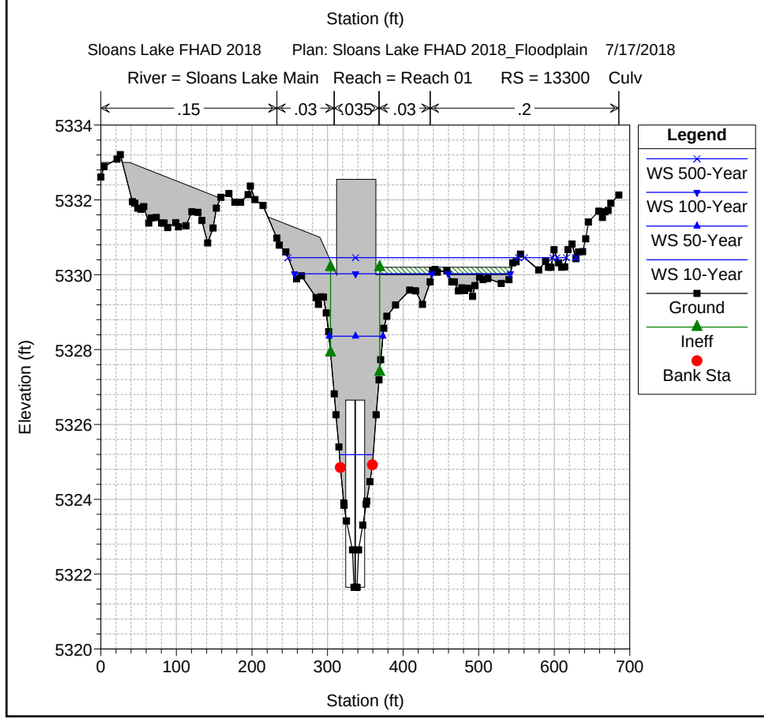

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 13650 Culv
.15
.03
.035
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

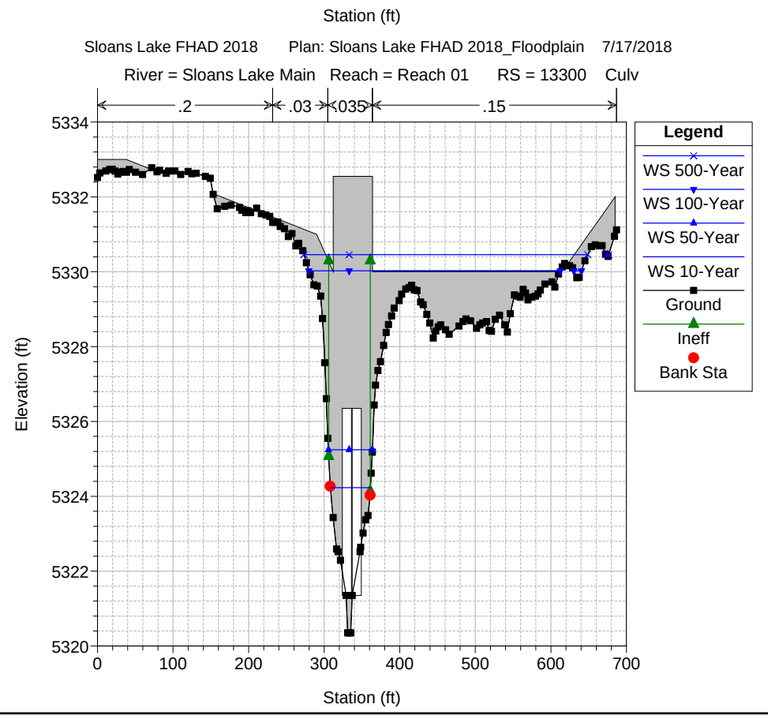

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 13582
.15
.03
.035
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

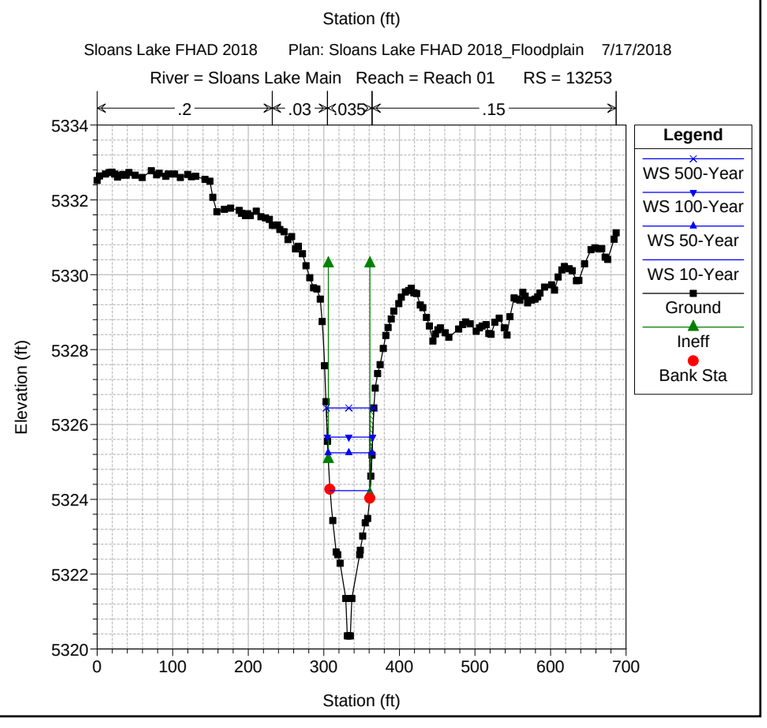

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 13514
.15
.03
.035
.03
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

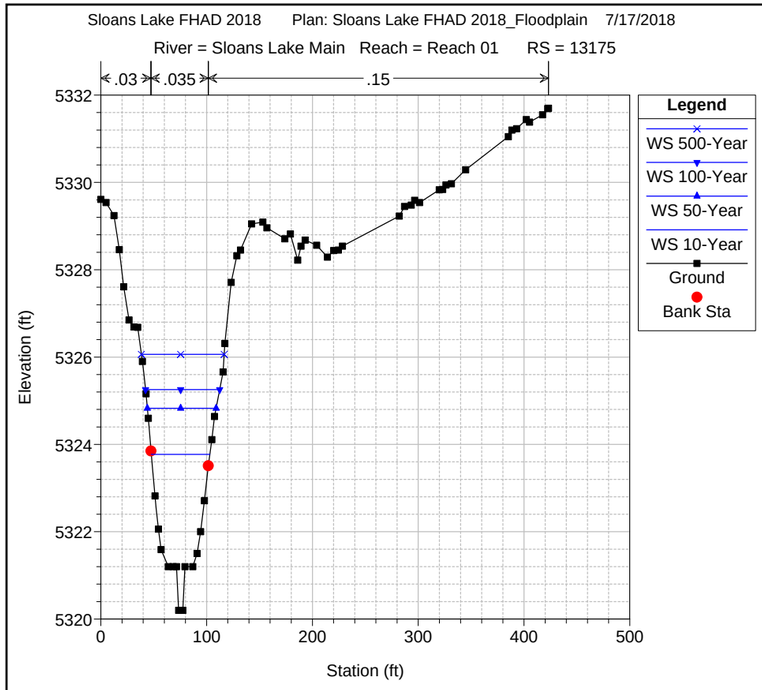

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 13395
.15
.03
.035
.03
.2
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

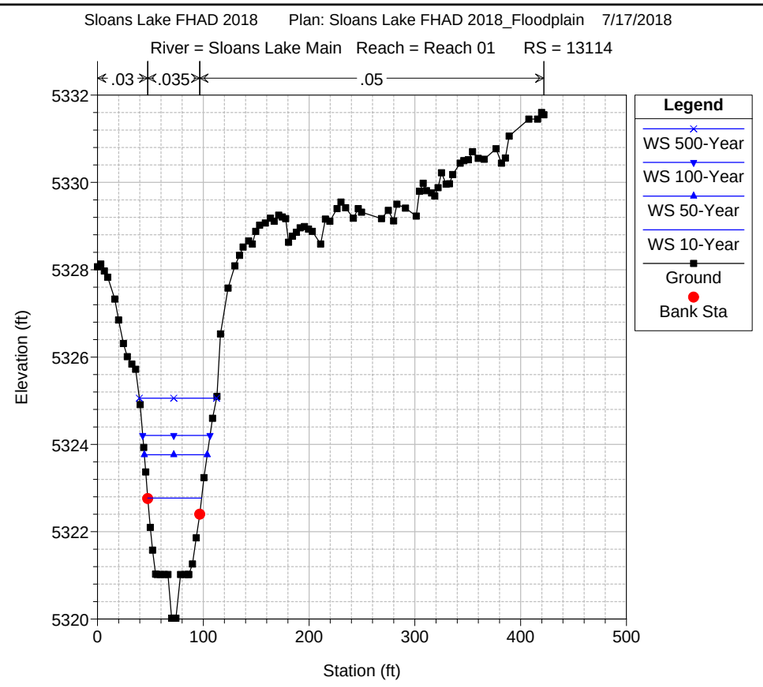

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 13350
.15
.03
.035
.03
.2
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

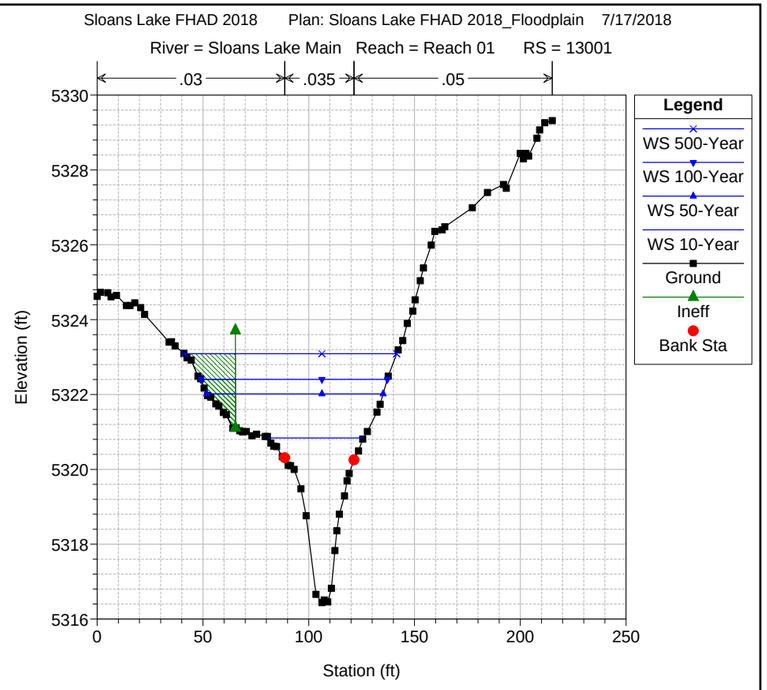

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 13300 Culv
.15
.03
.035
.03
.2
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 13300 Culv
.2
.03
.035
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 13253
.2
.03
.035
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 13175
.03
.035
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 13114
.03
.035
.05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 13001
.03
.035
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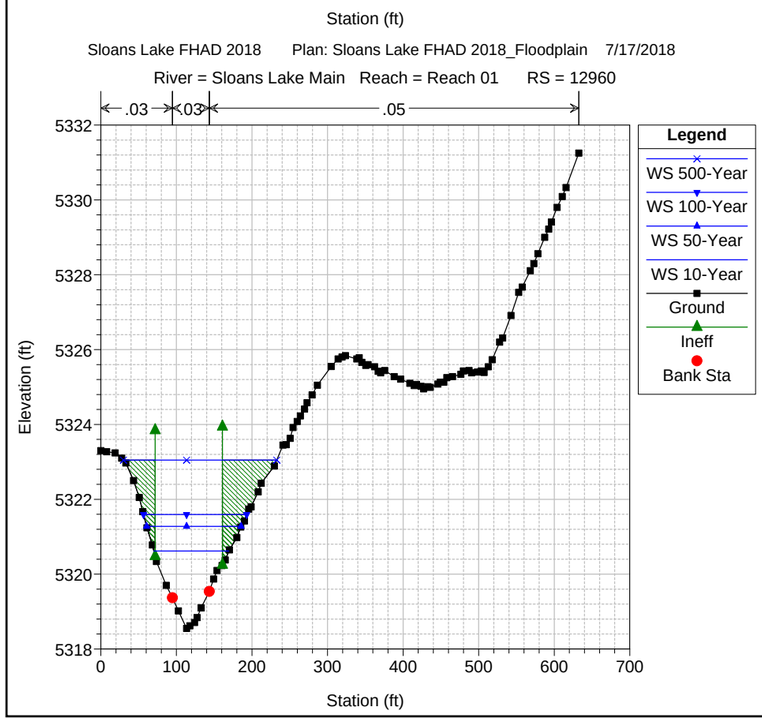
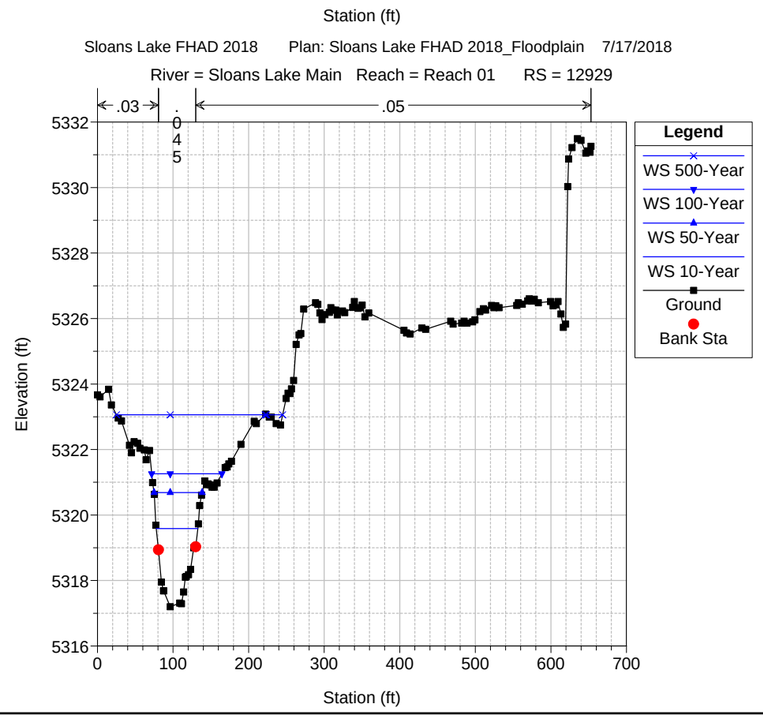
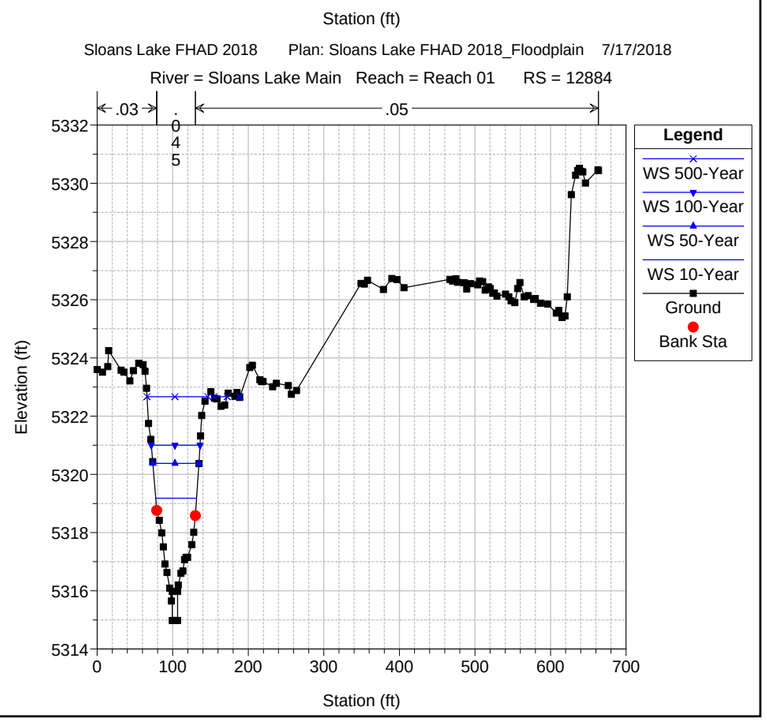
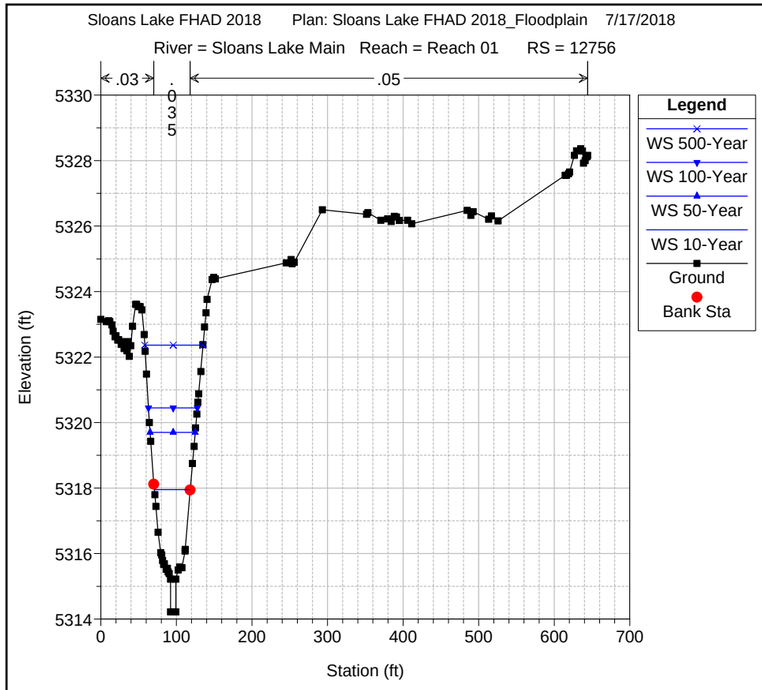
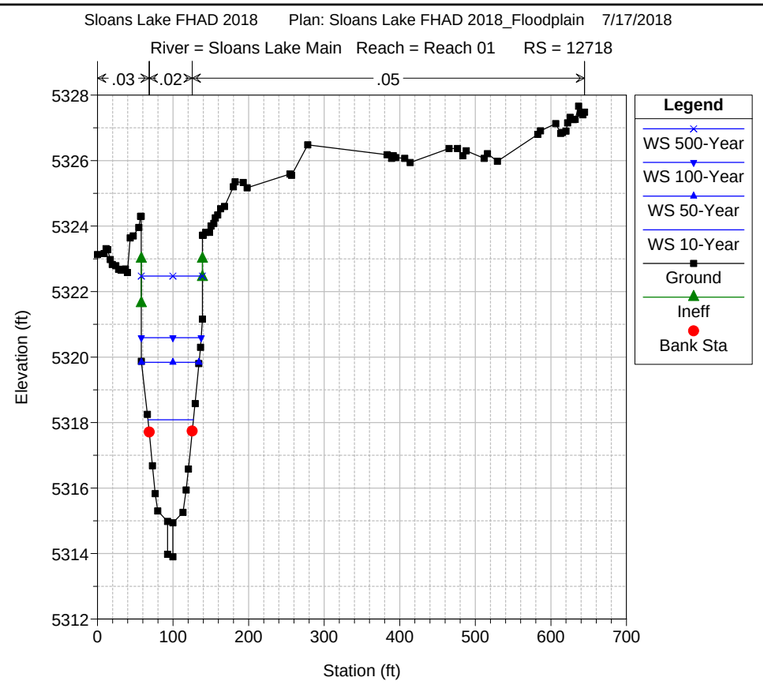
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

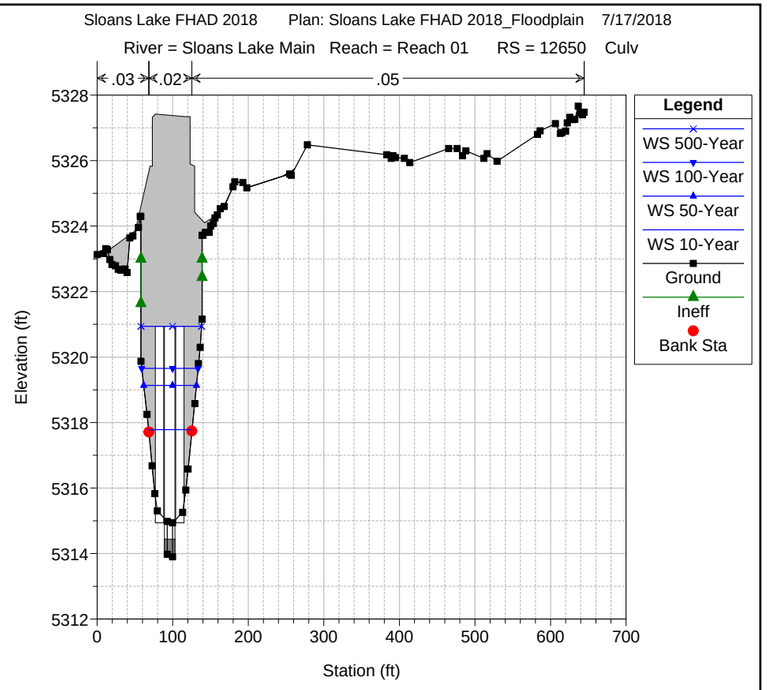

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 12960
.03
.03
.05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

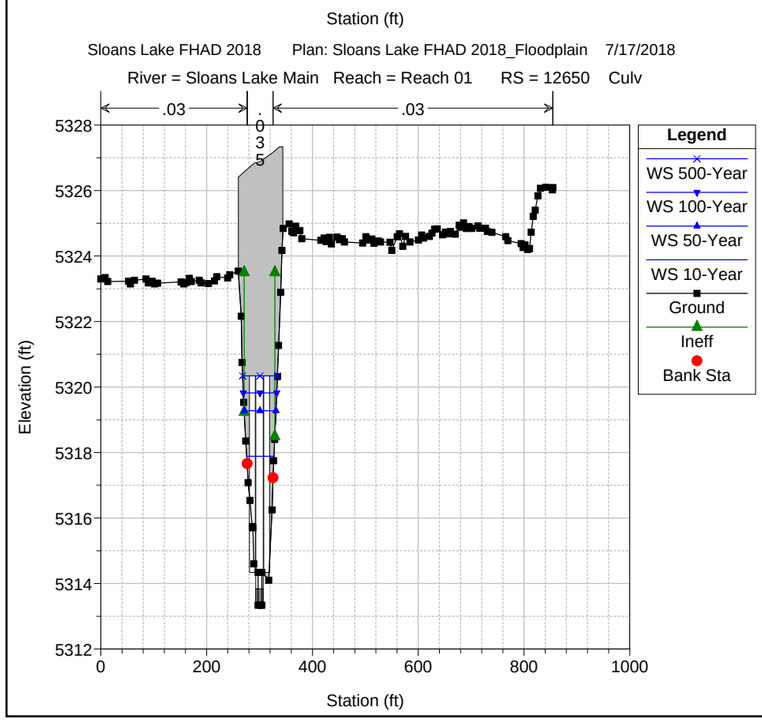

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 12929
.03
.045
.05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 12884
.03
.045
.05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 12756
.03
.035
.05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 12718
.03
.02
.05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 12650 Culv
.03
.02
.05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 12650 Culv
.03
.035
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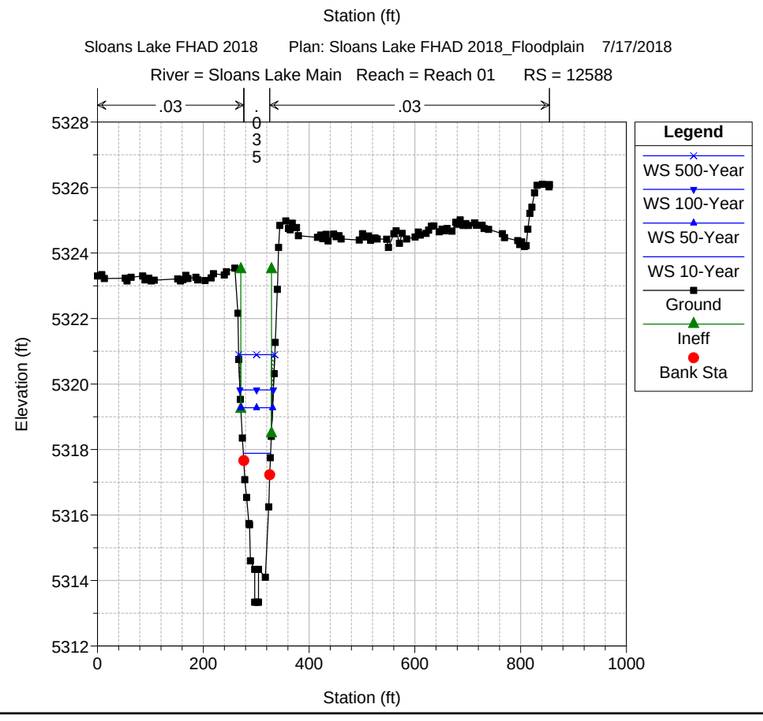
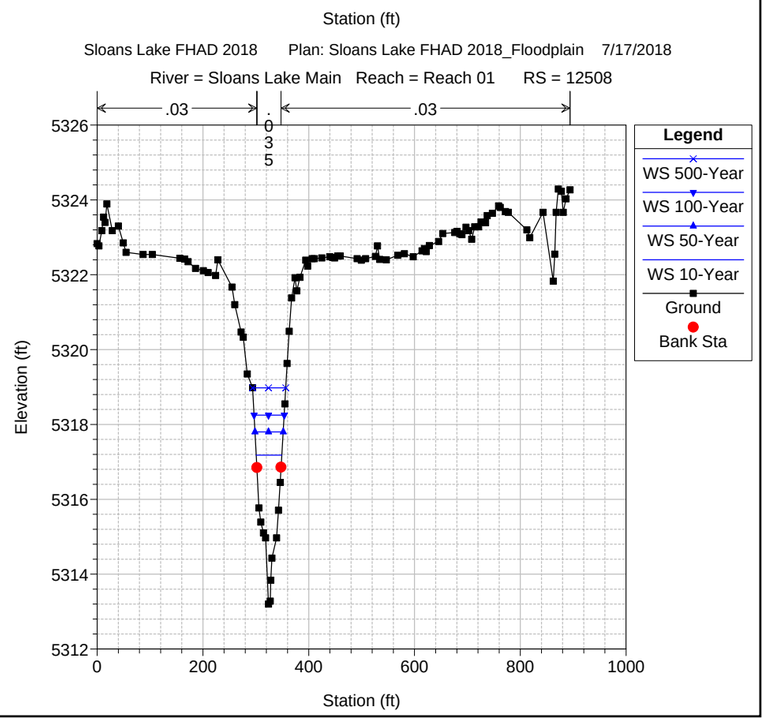
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 12588
.03
.035
.03
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 12508
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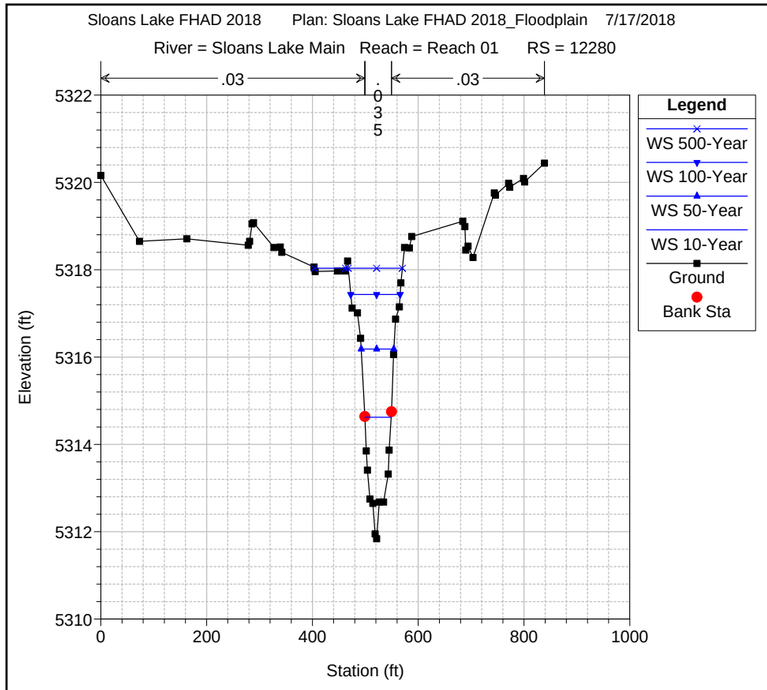
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 12280
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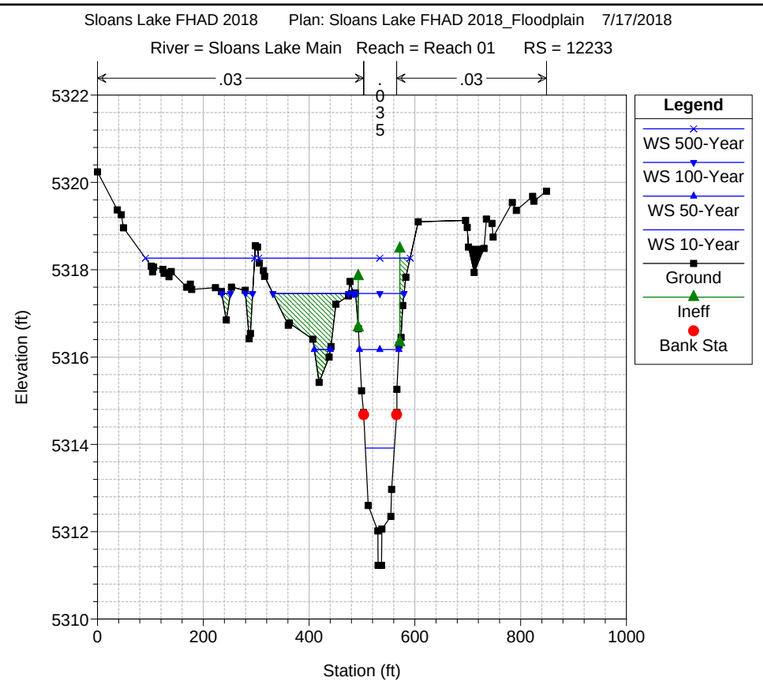
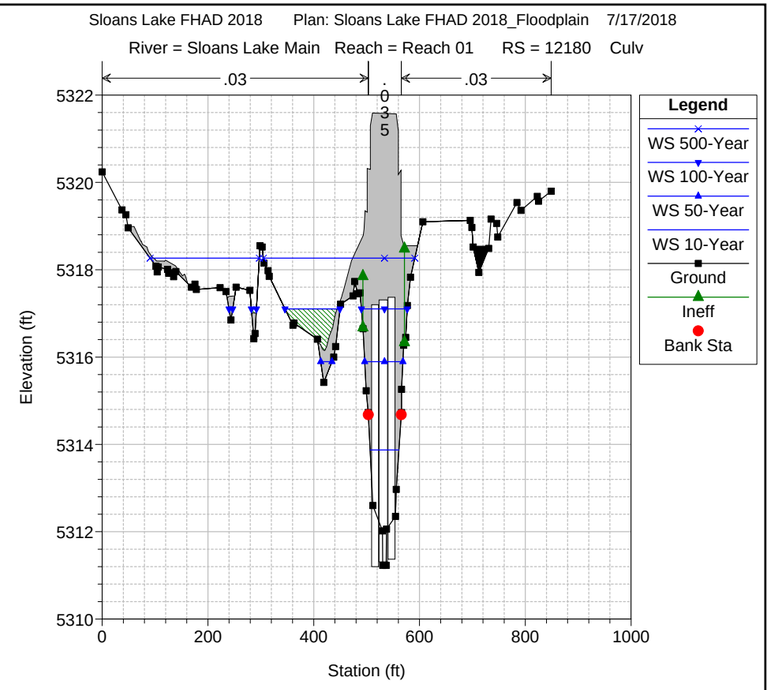
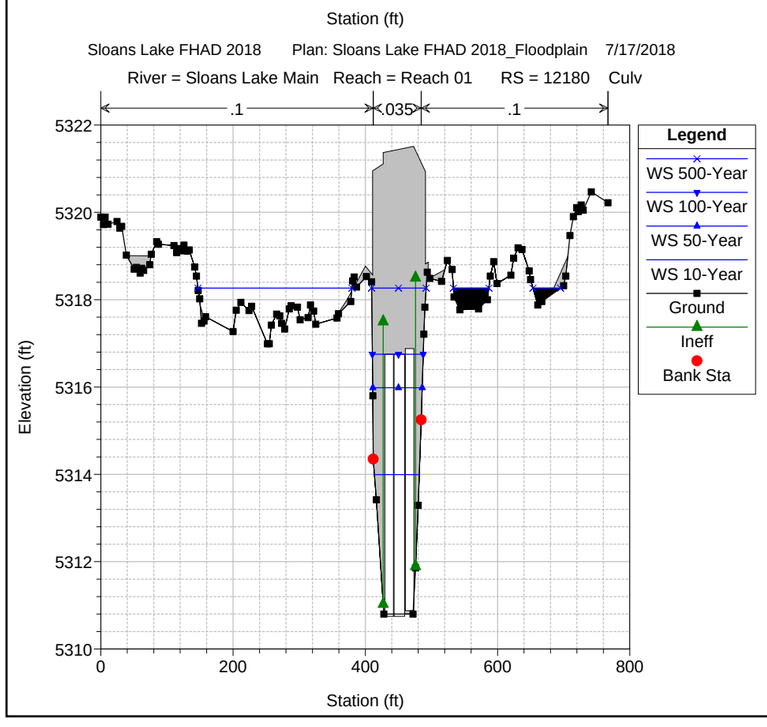
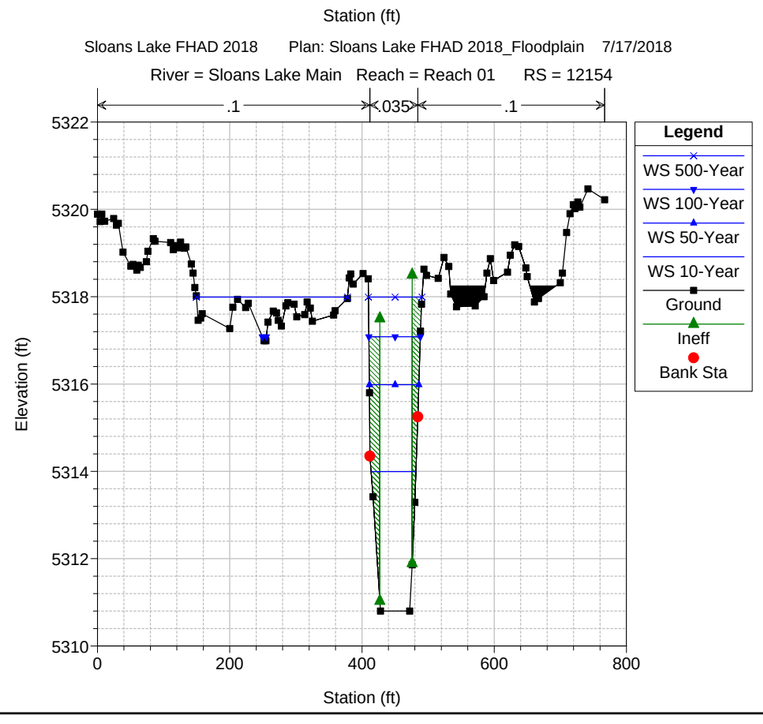
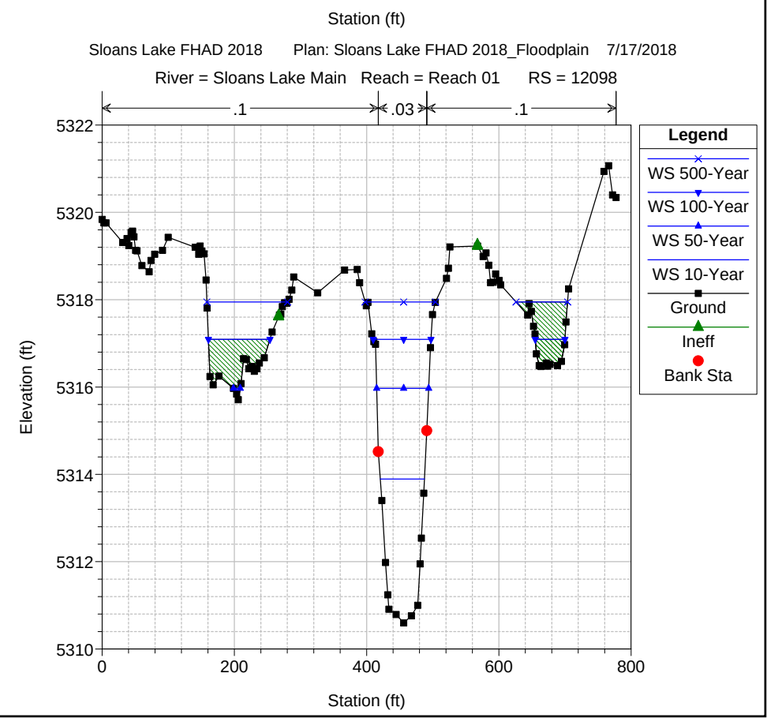
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 12233
.03
.035
.03
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 12180 Culv
.03
.035
.03
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 12180 Culv
.1
.035
.1
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 12154
.1
.035
.1
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 12098
.1
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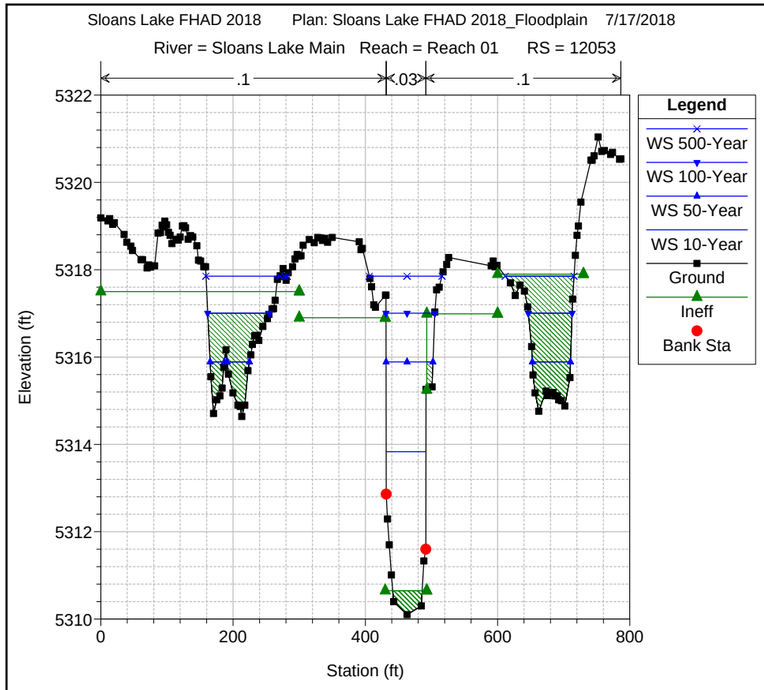
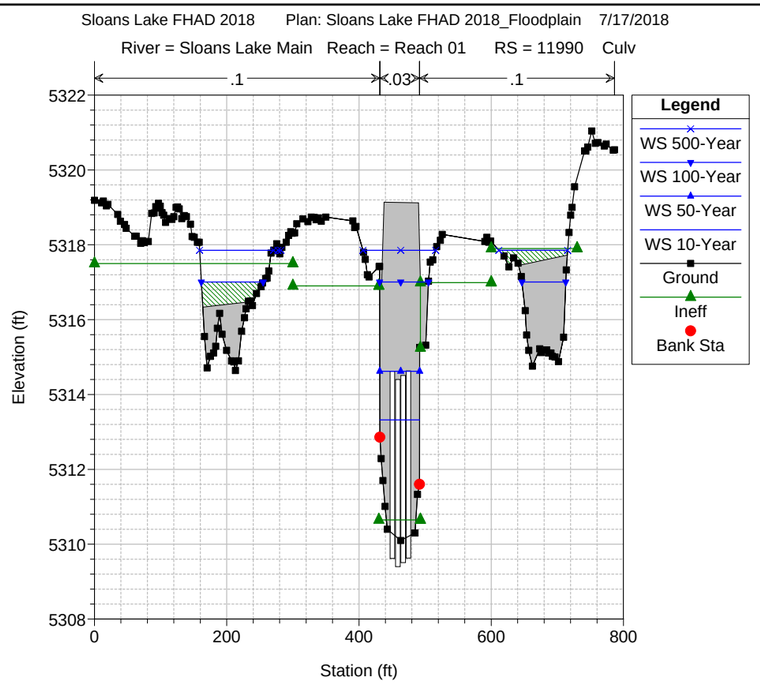
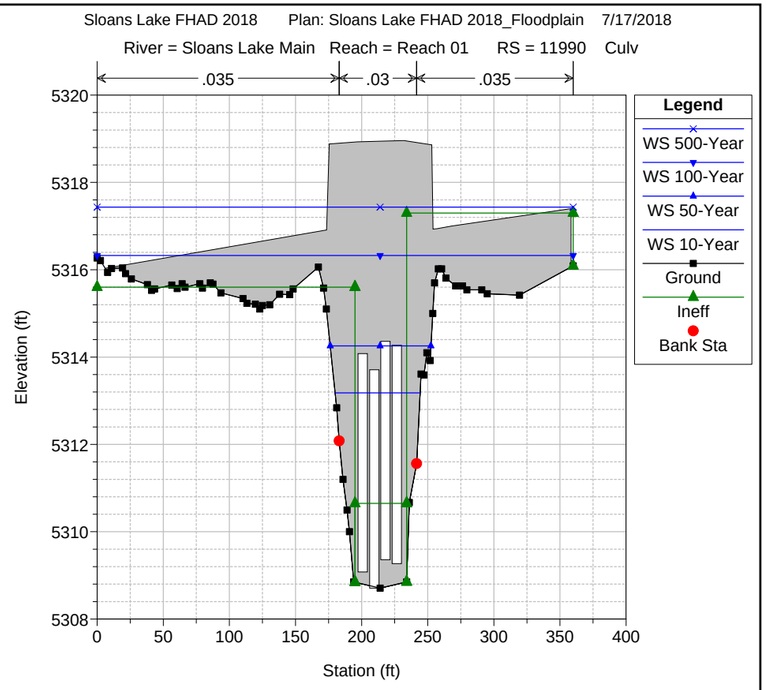
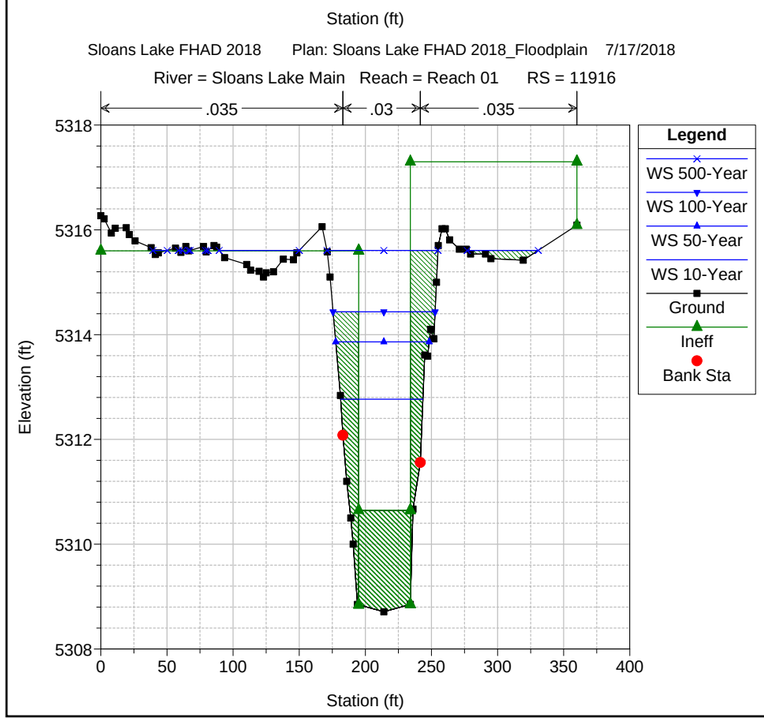
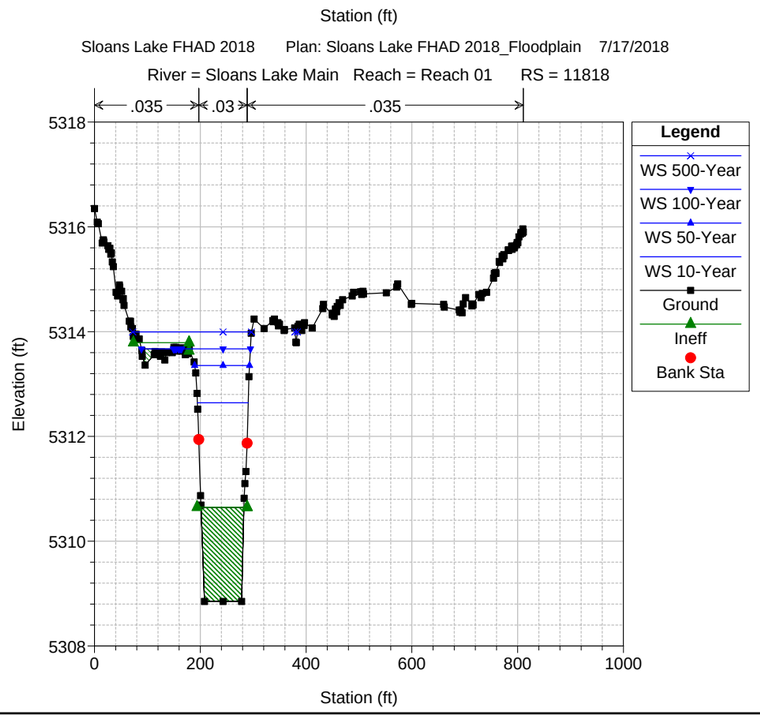
.1
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

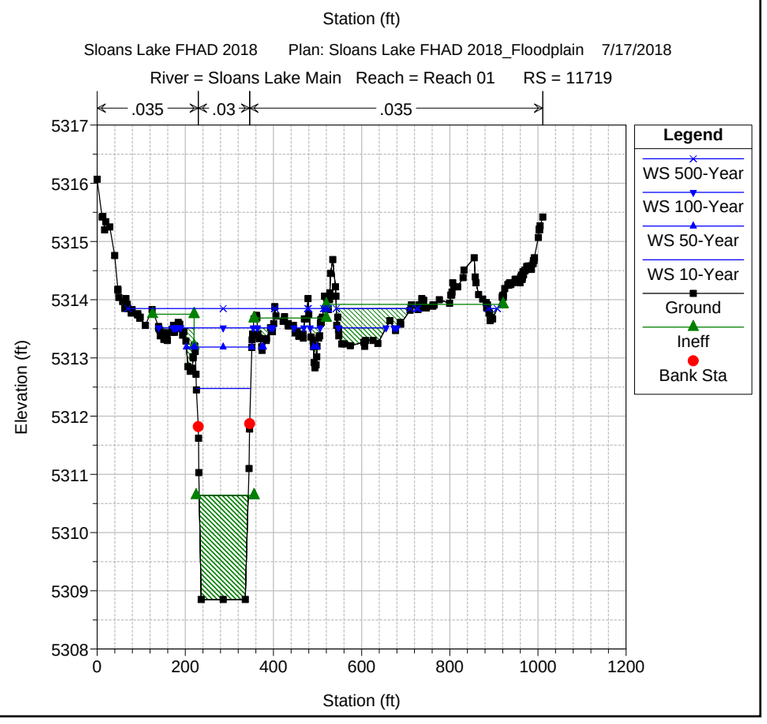

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 12053
.1
.03
.1
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

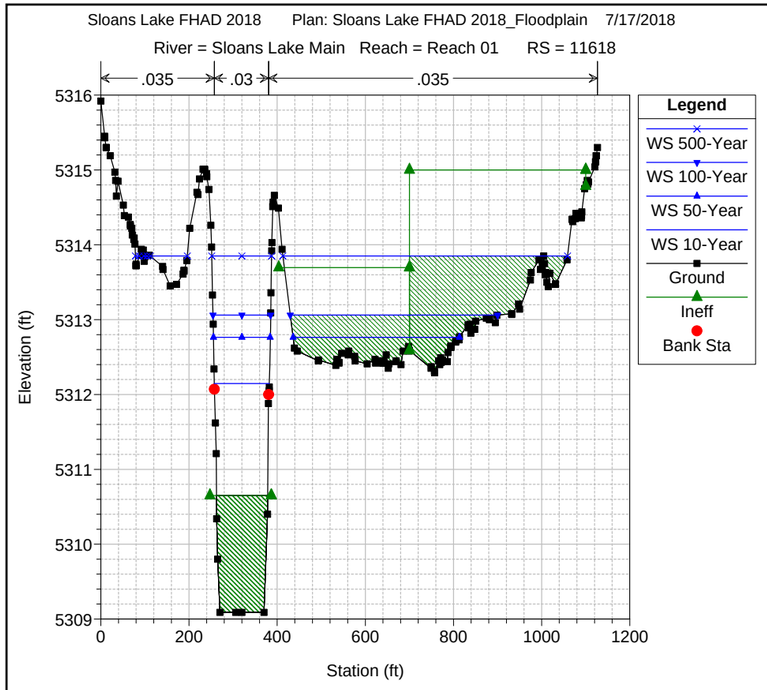

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 11990 Culv
.1
.03
.1
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

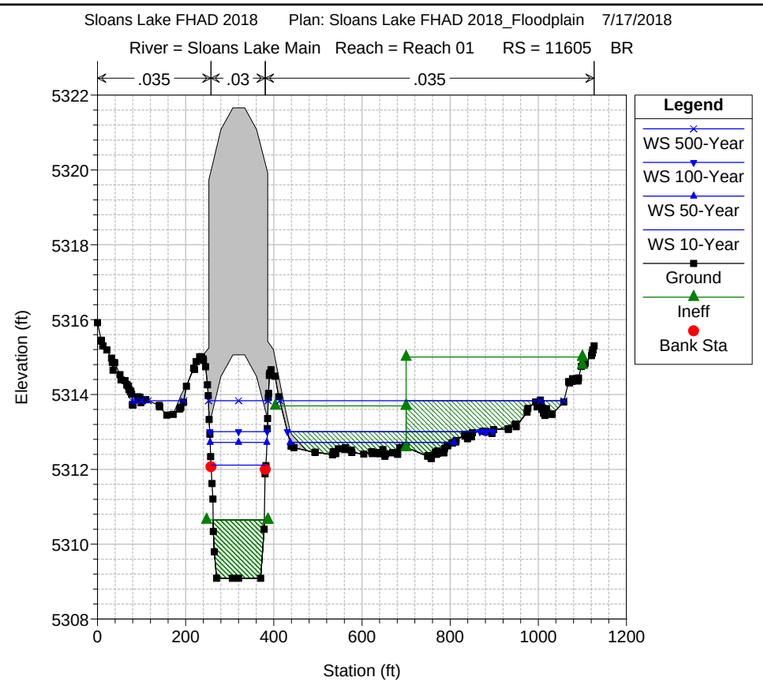

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 11990 Culv
.035
.03
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 11916
.035
.03
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 11818
.035
.03
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 11719
.035
.03
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 11618
.035
.03
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 11605 BR
.035
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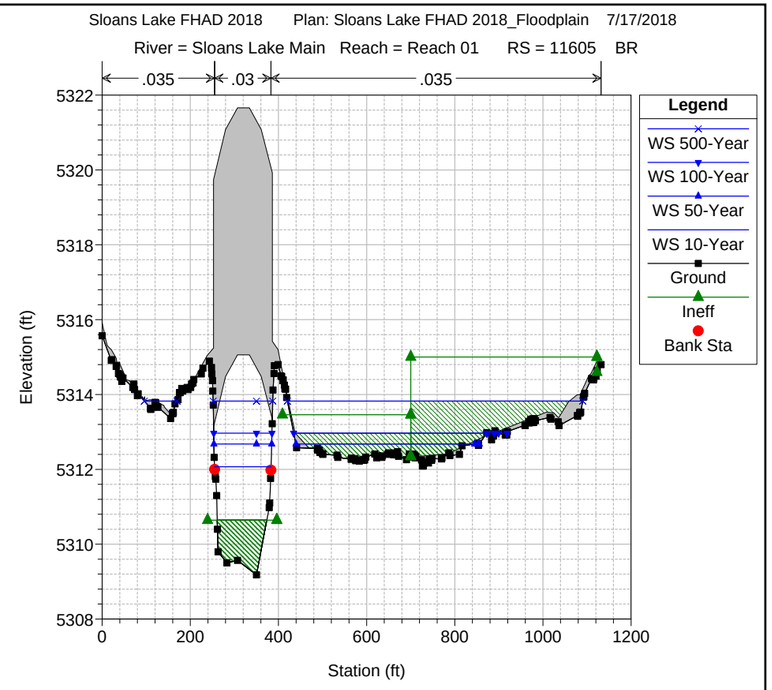
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 11605 BR
.035
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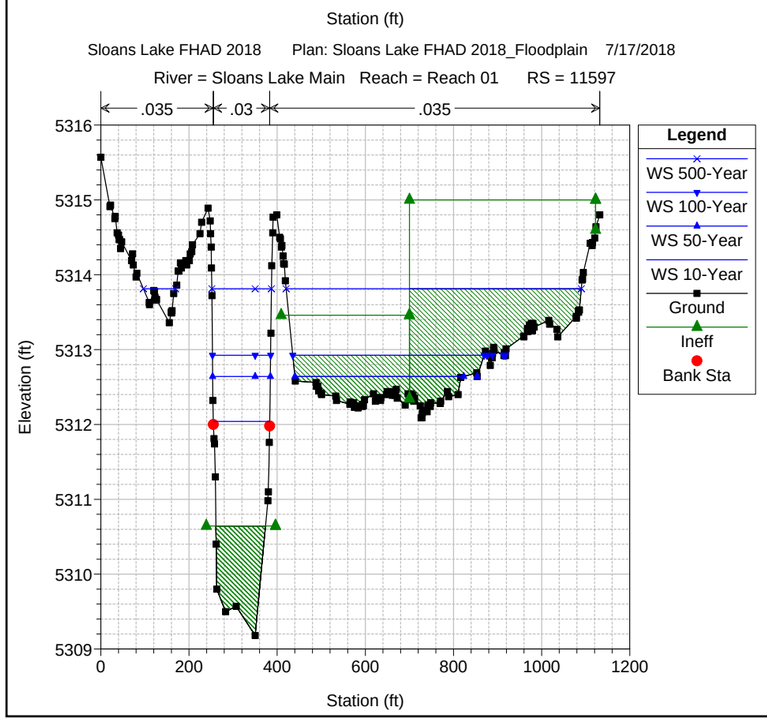
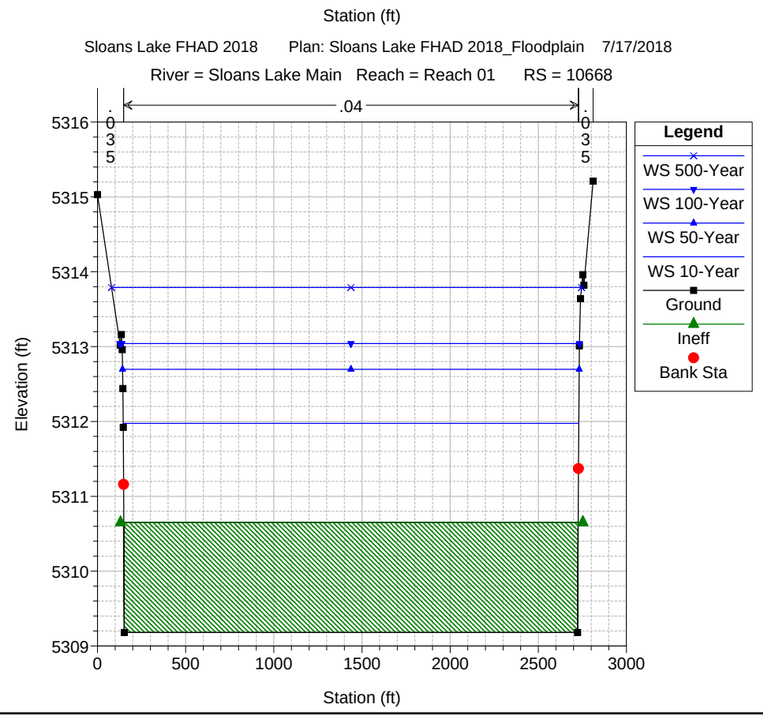
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 11597
.035
.03
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 10668
.035
.04
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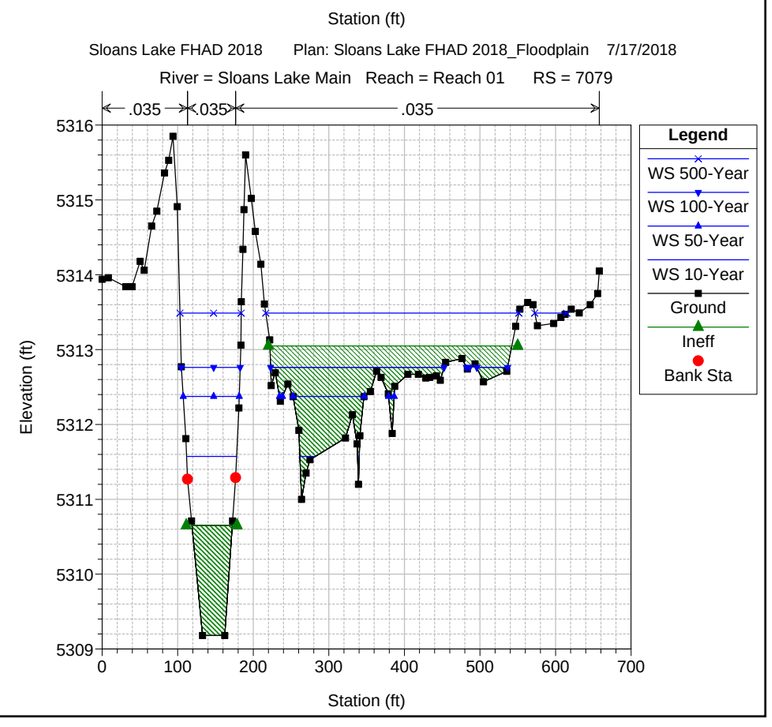
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 7079
.035
.035
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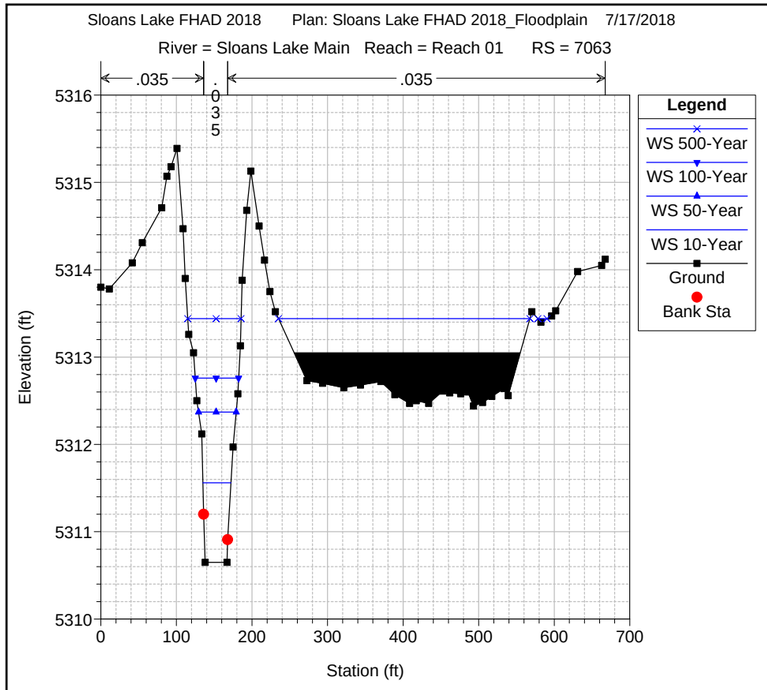
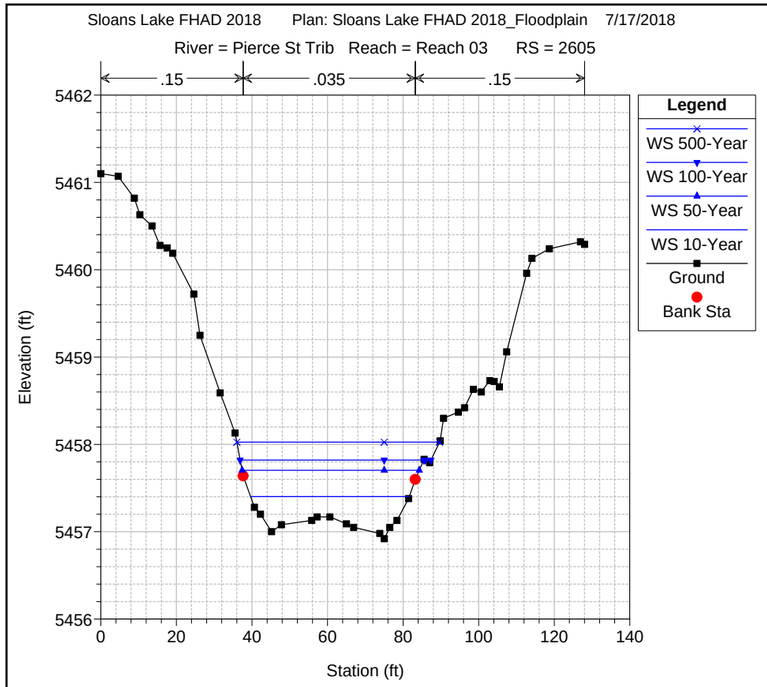
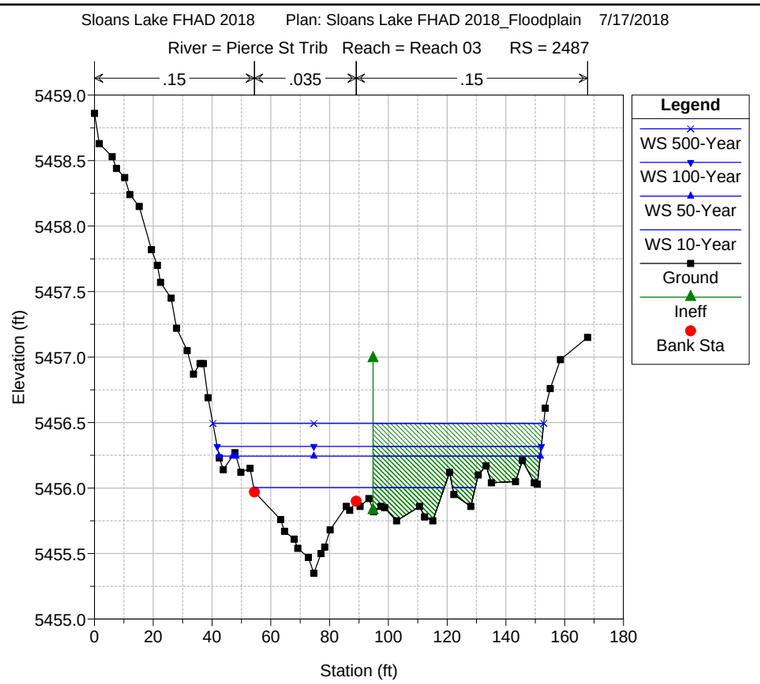
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Sloans Lake Main Reach = Reach 01 RS = 7063
.035
.035
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
5316
5315
5314
5313
5312
5311
5310
0
100
200
300
400
500
600
700
Station (ft)

HEC-RAS Sections

Pierce Street Tributary


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 2605
.15
.035
.15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 2487
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.035
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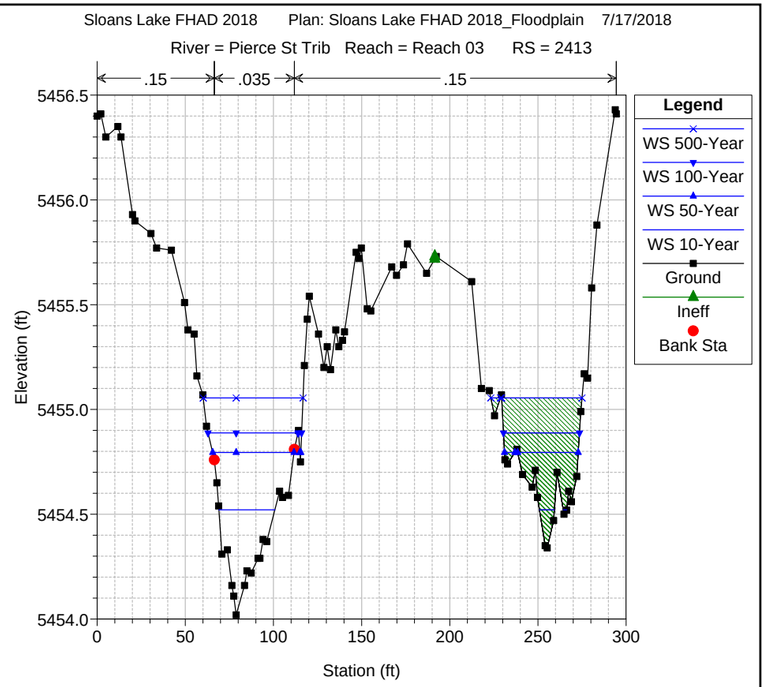
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 2413
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.035
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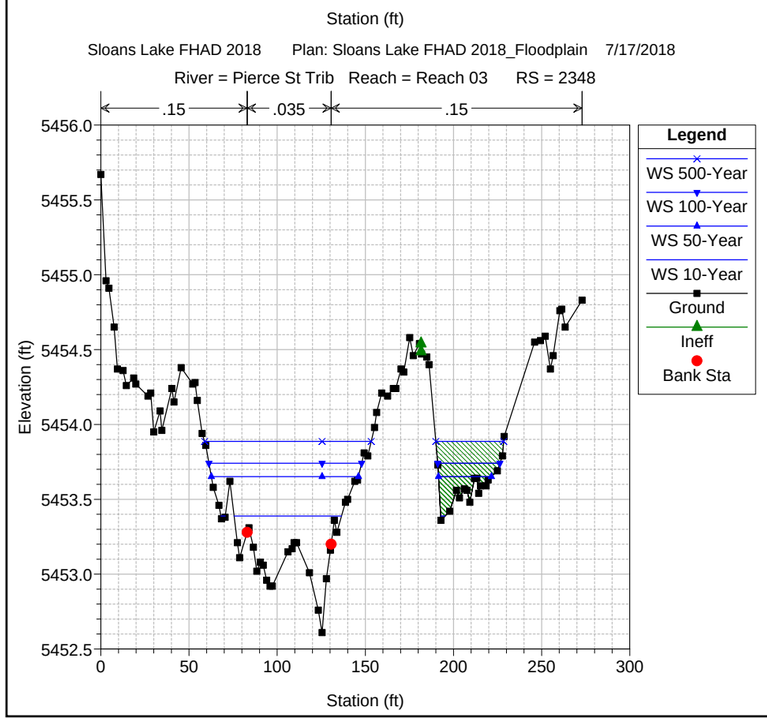
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 2348
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.035
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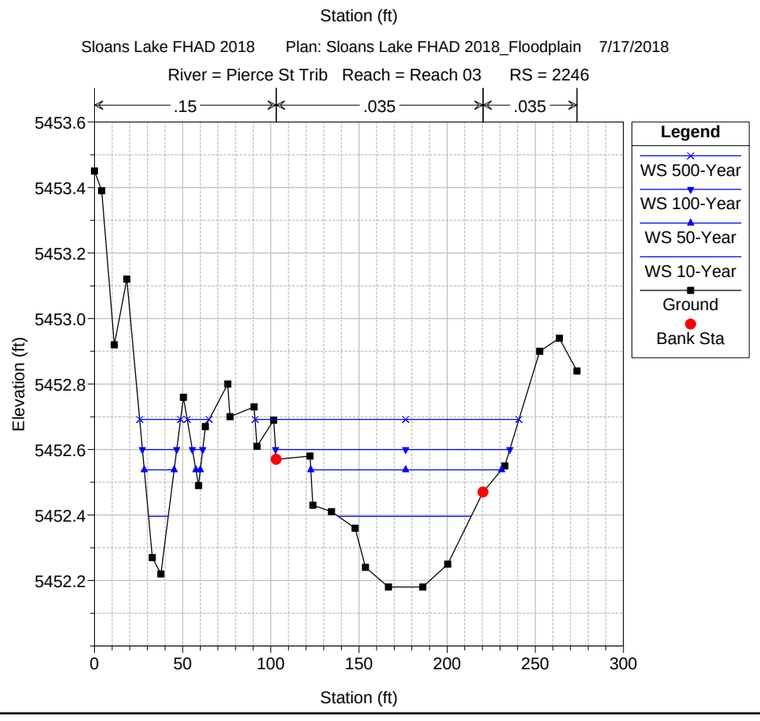
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 2246
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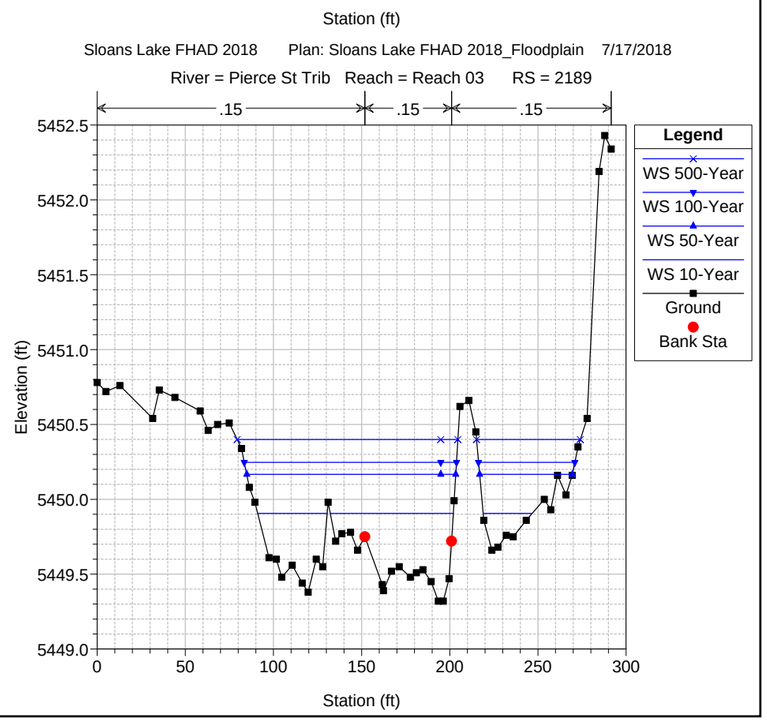
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 2189
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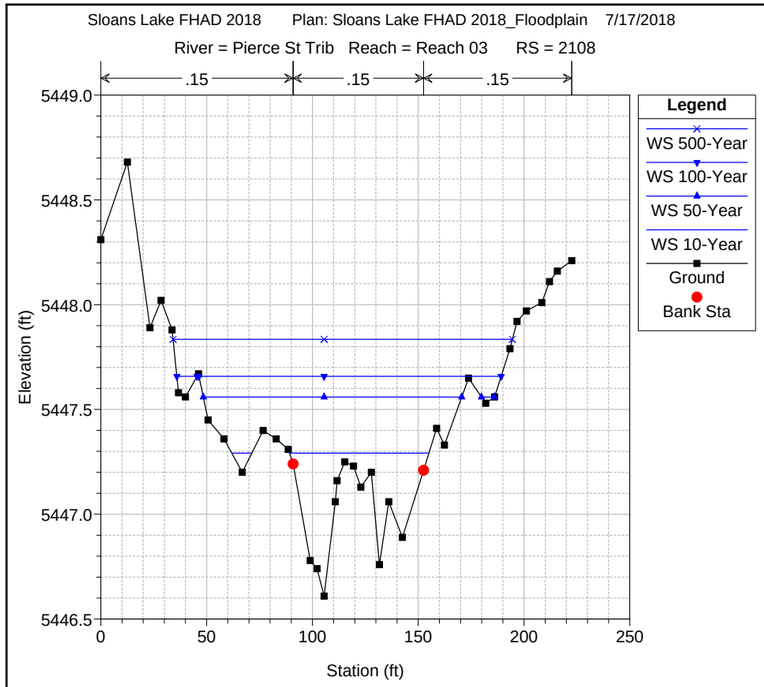
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 2108
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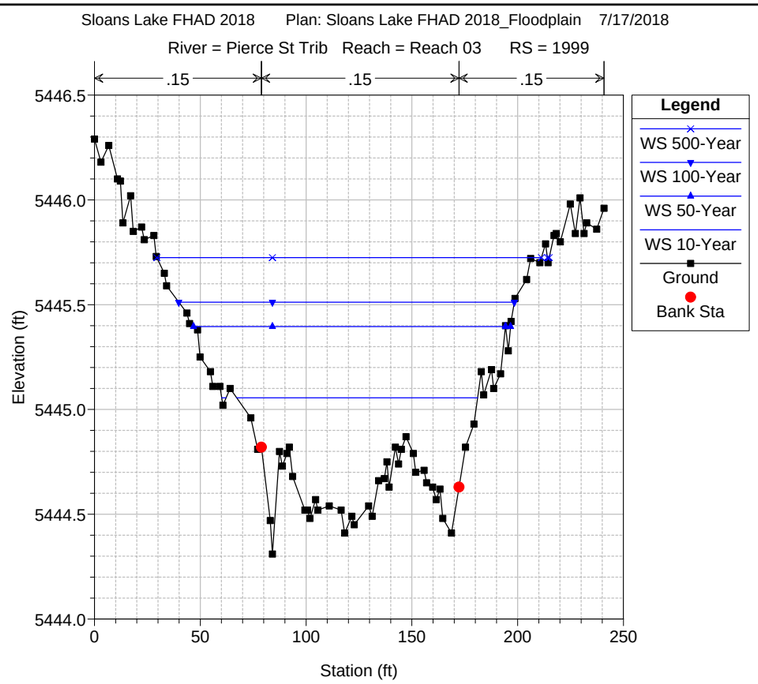
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 1999
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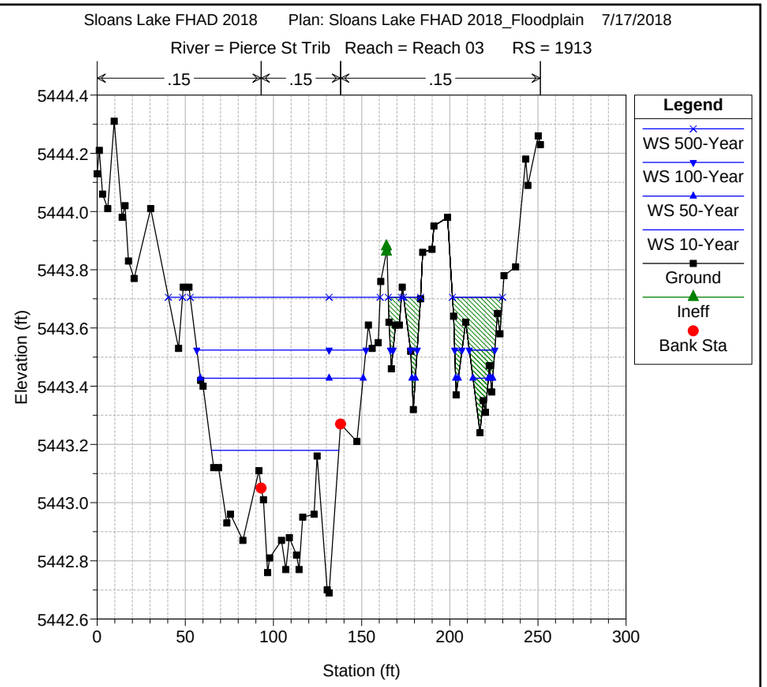
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 1913
.15
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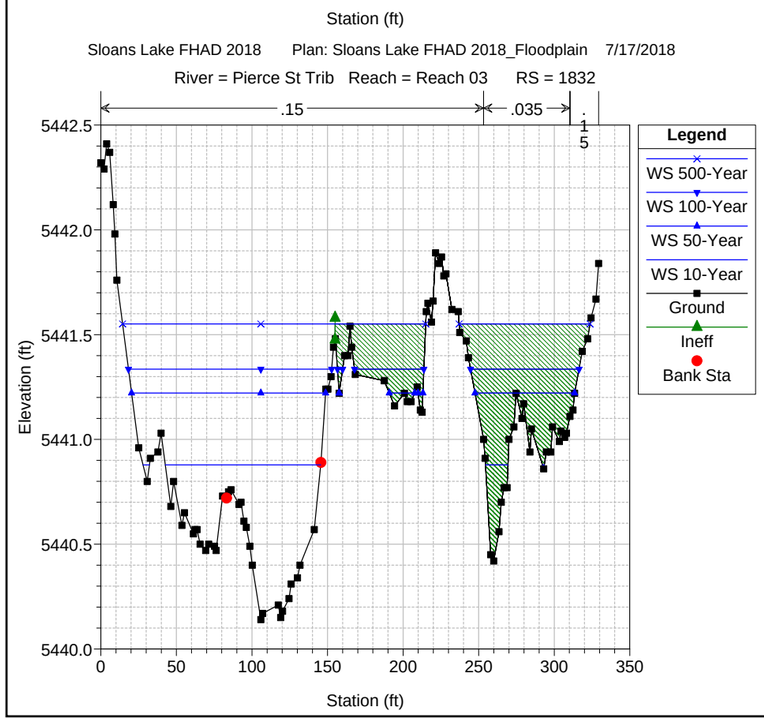
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 1832
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.035
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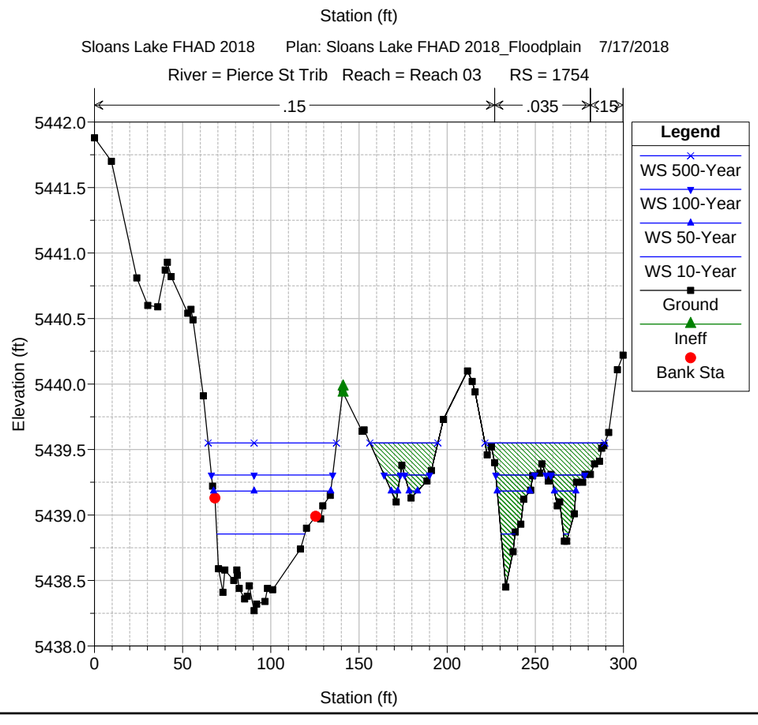
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 1754
.15
.035
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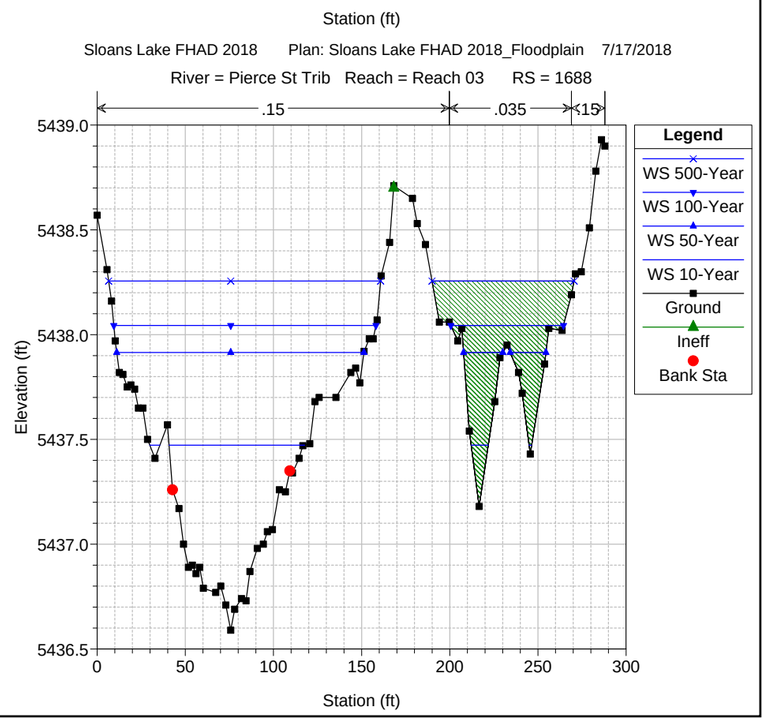
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 1688
.15
.035
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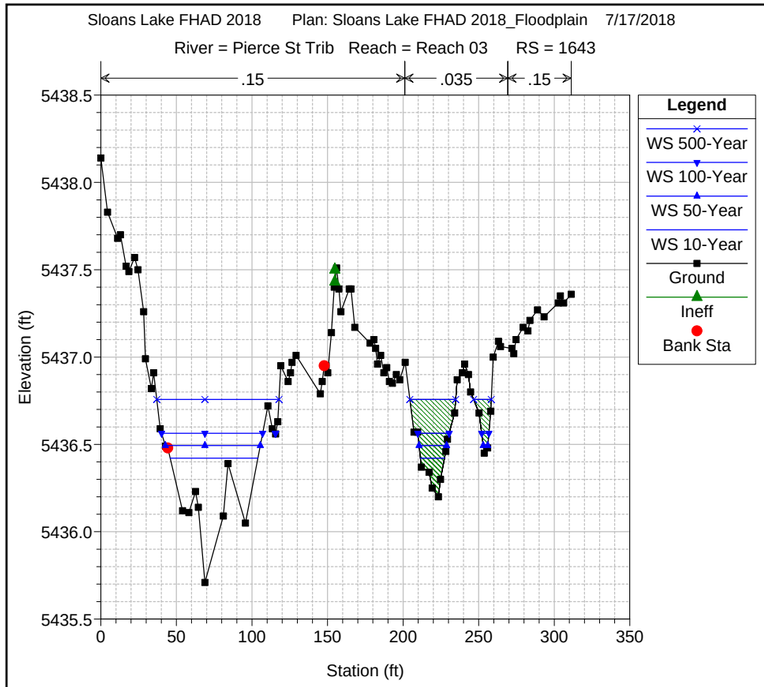
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 1643
.15
.035
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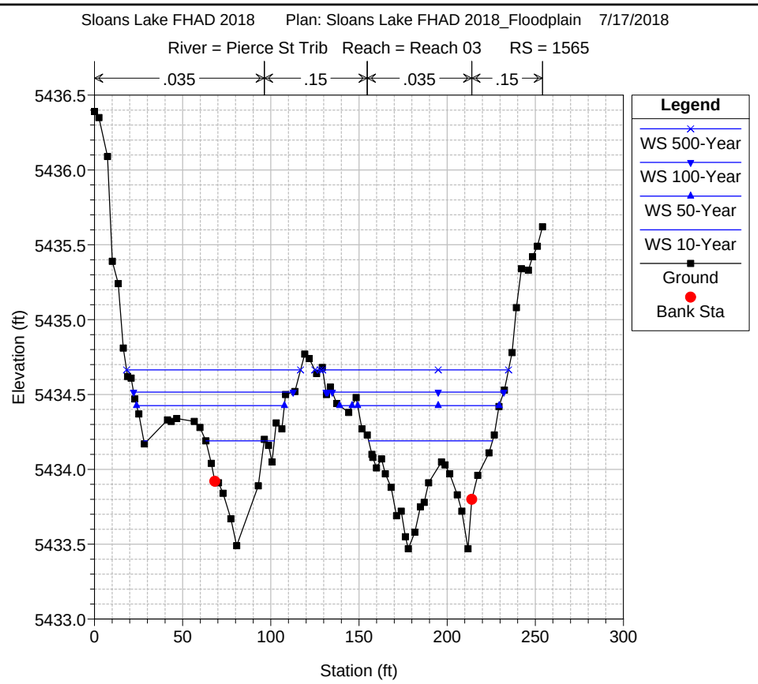
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 1565
.035
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.035
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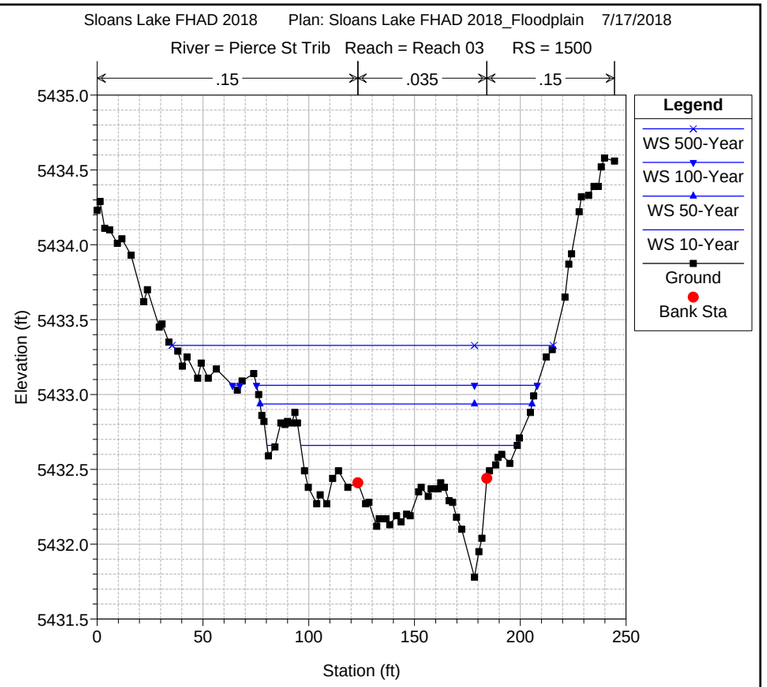
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 1500
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.035
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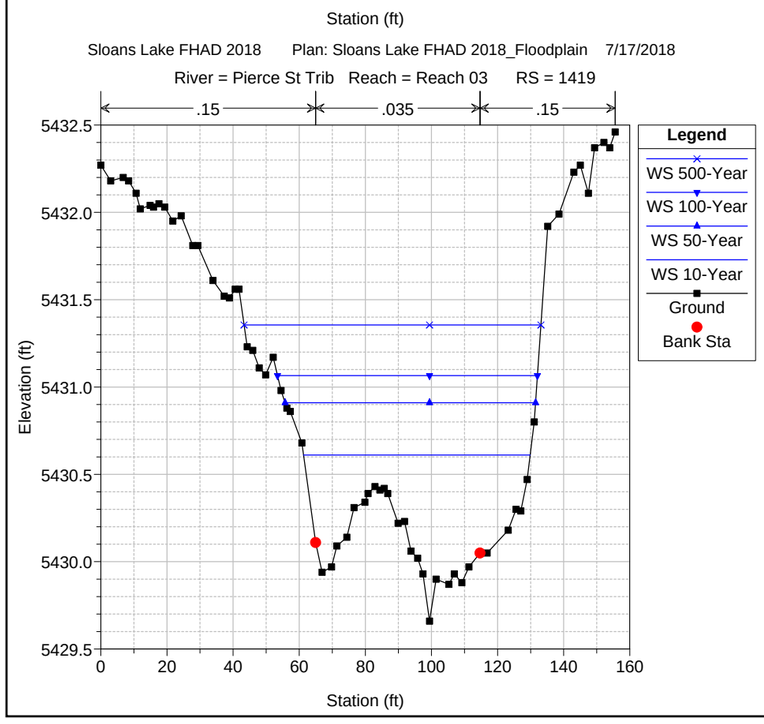
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 1419
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.035
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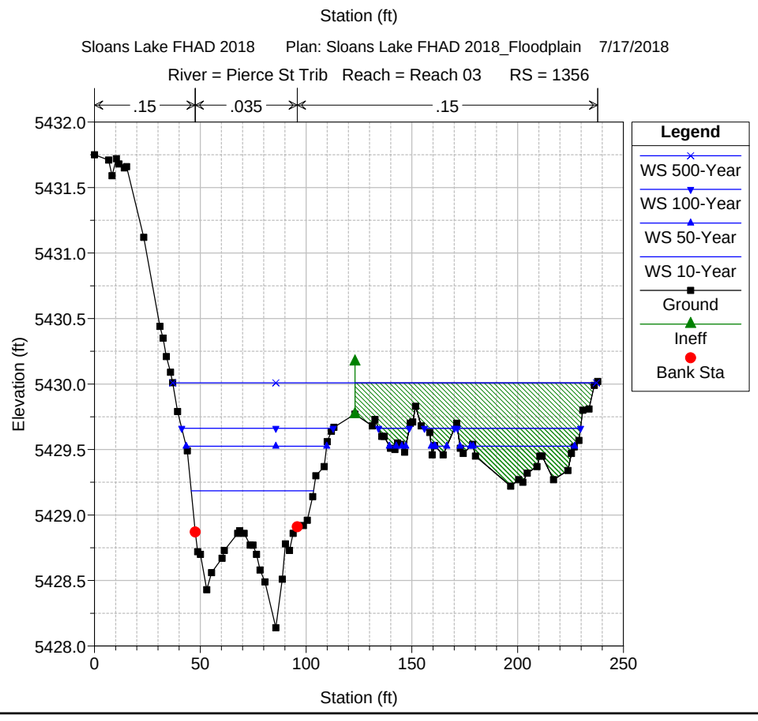
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 1356
.15
.035
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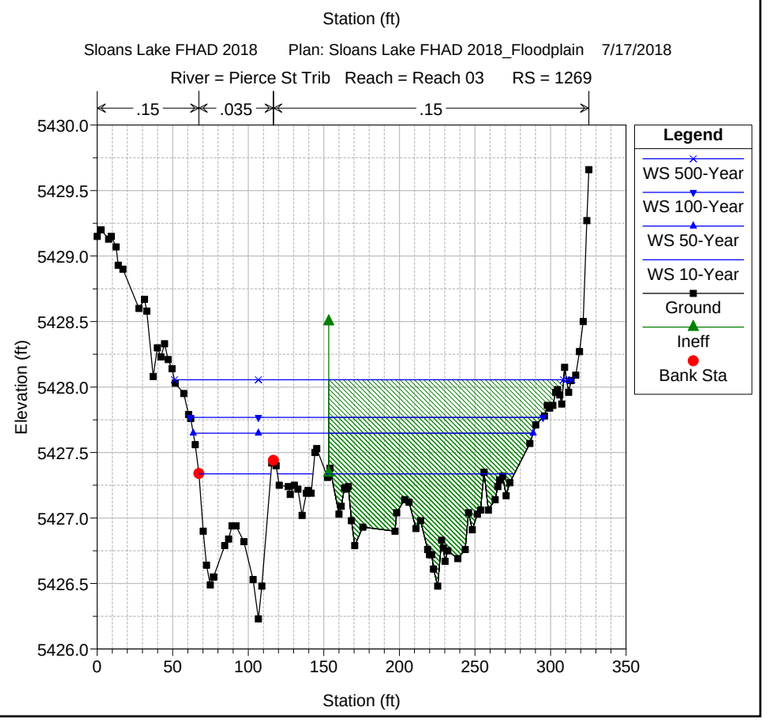
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 1269
.15
.035
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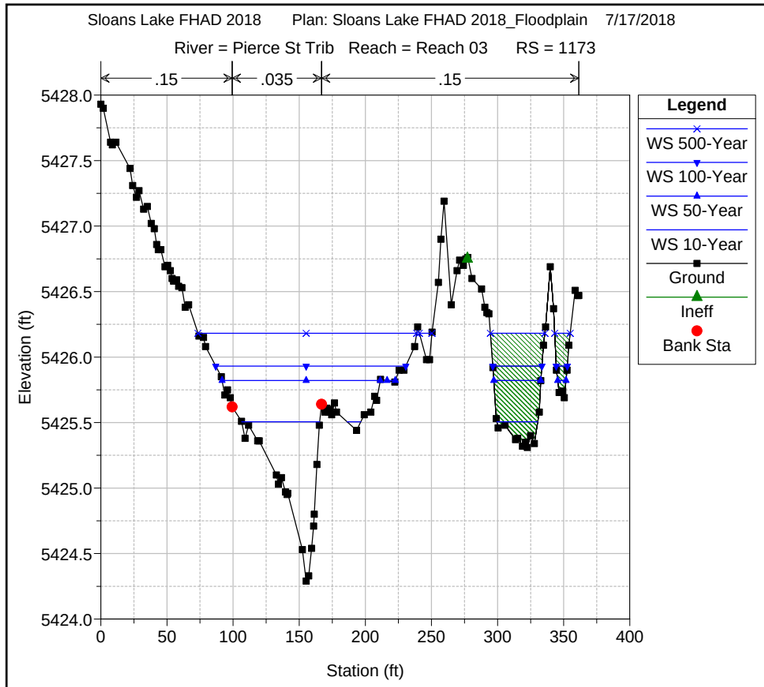
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 1173
.15
.035
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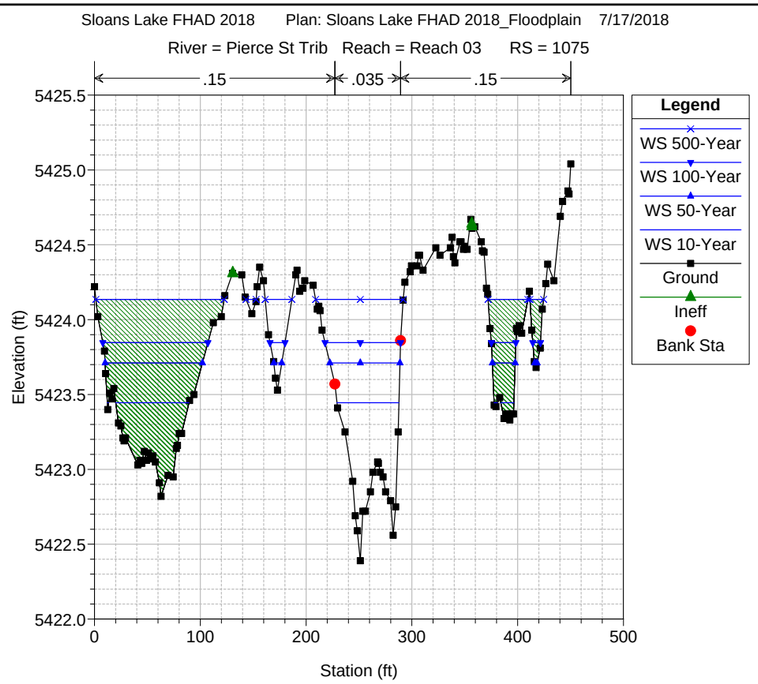
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 1075
.15
.035
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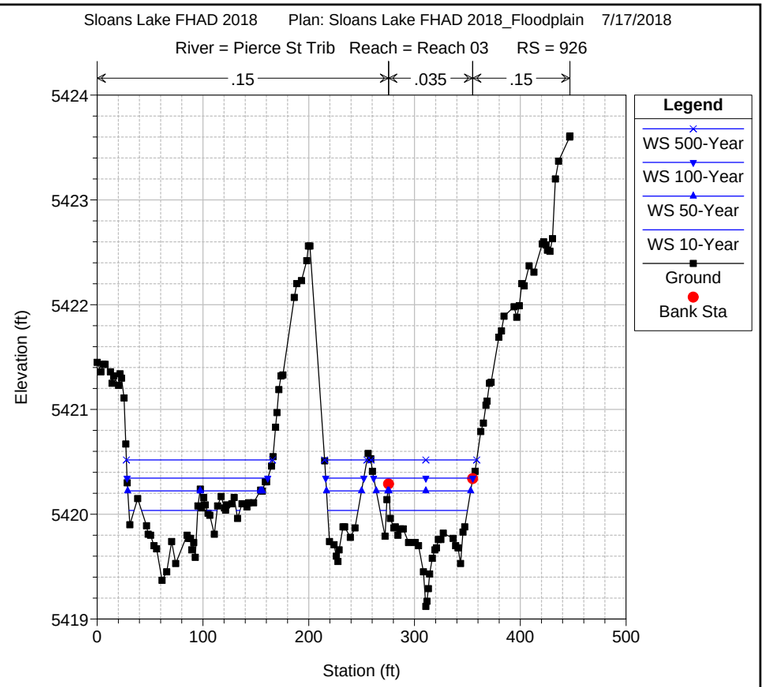
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 926
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.035
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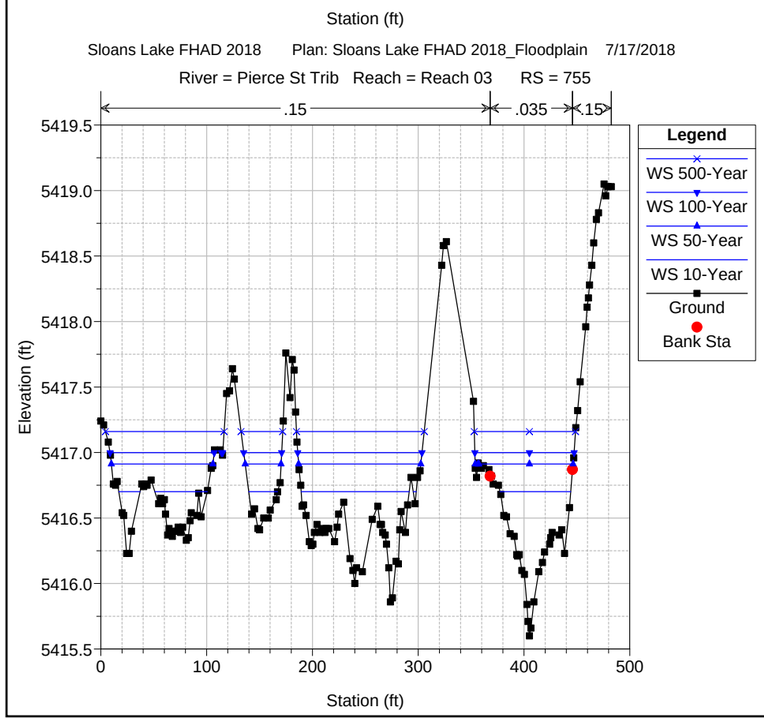
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 755
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.035
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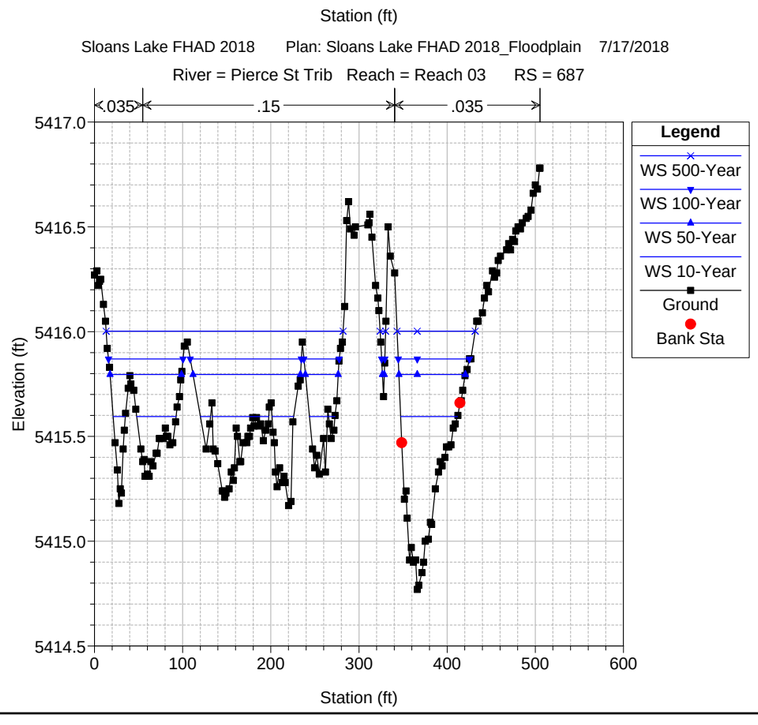
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 687
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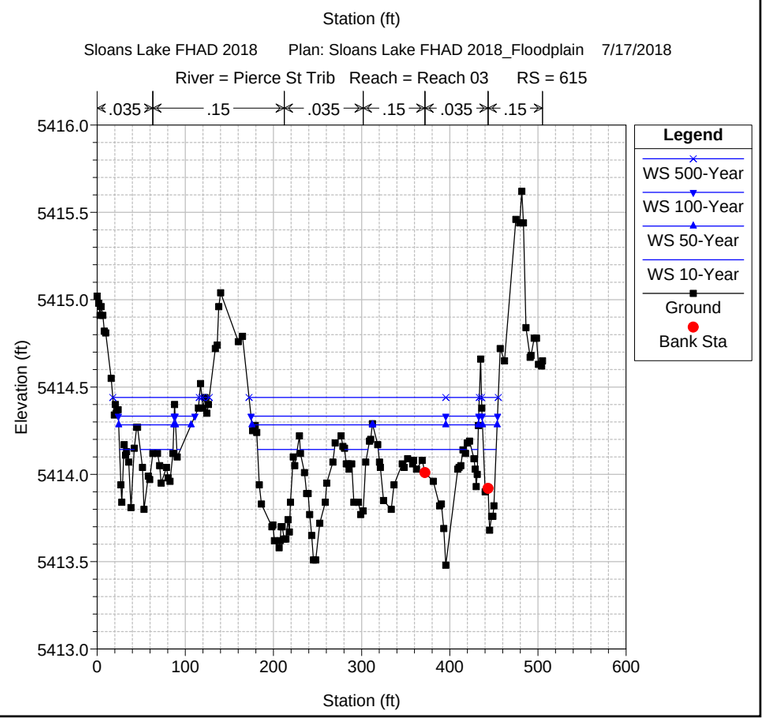
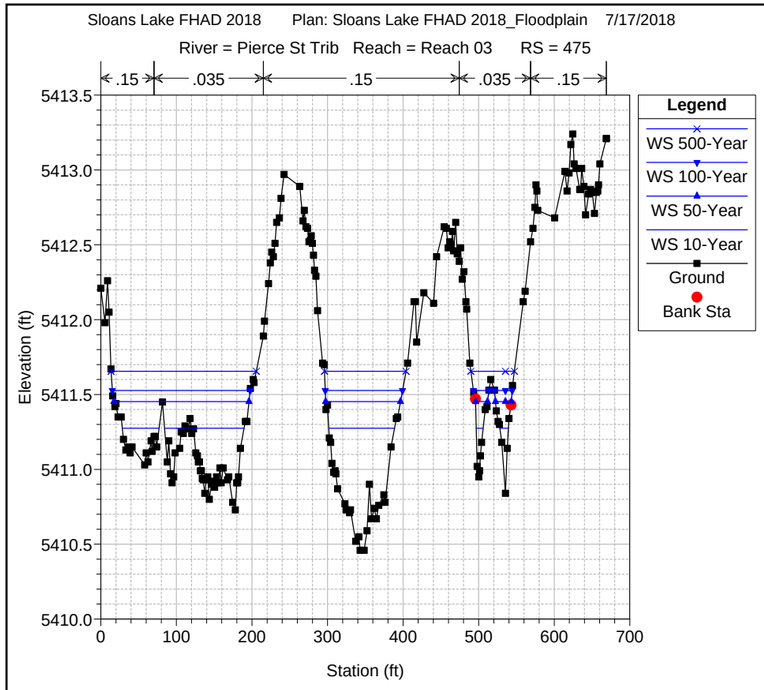
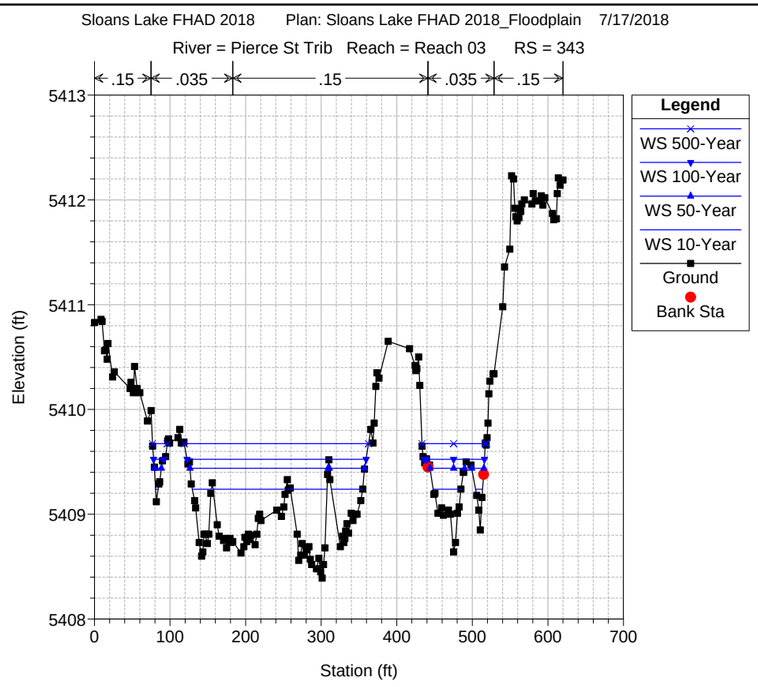
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 615
.035
.15
.035
.15
.035
.15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 475
.15 .035 .15 .035 .15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 343
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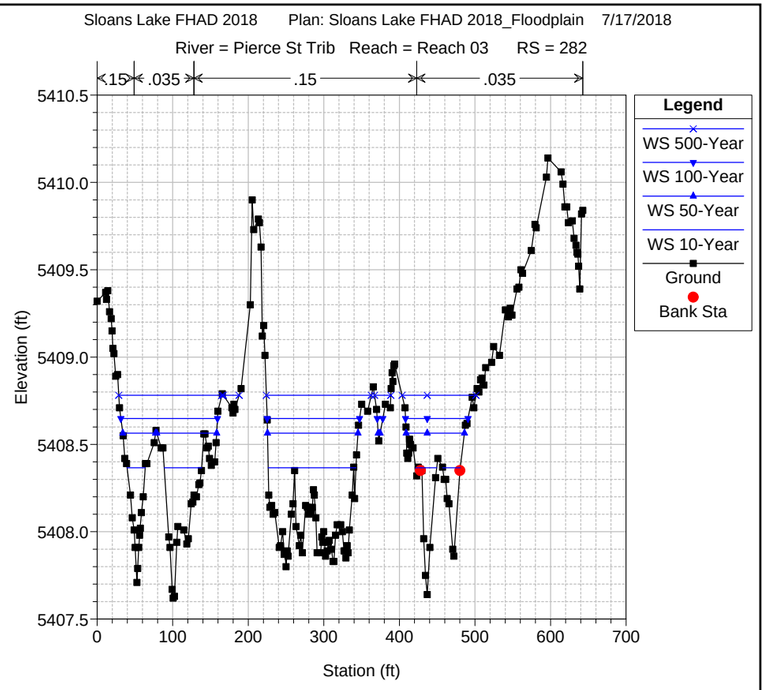
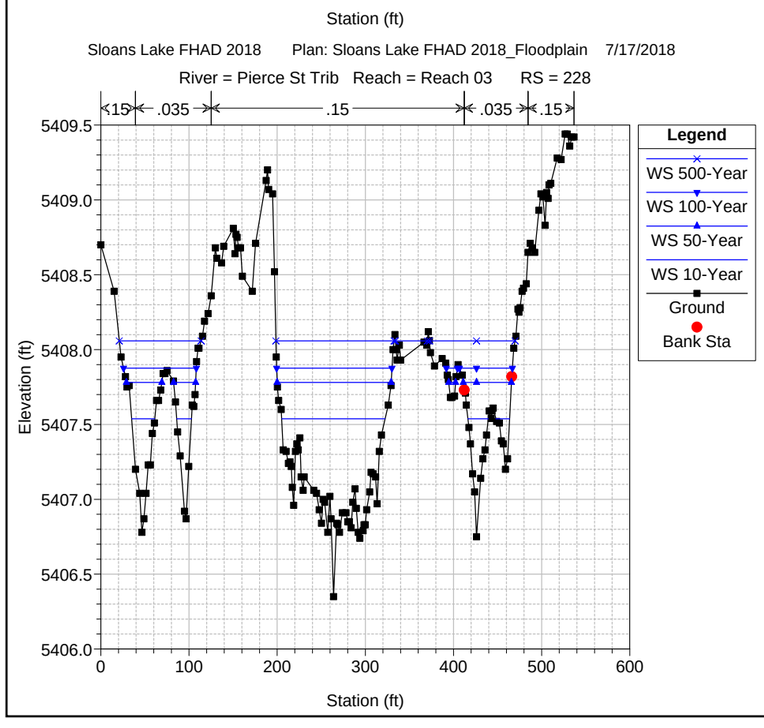
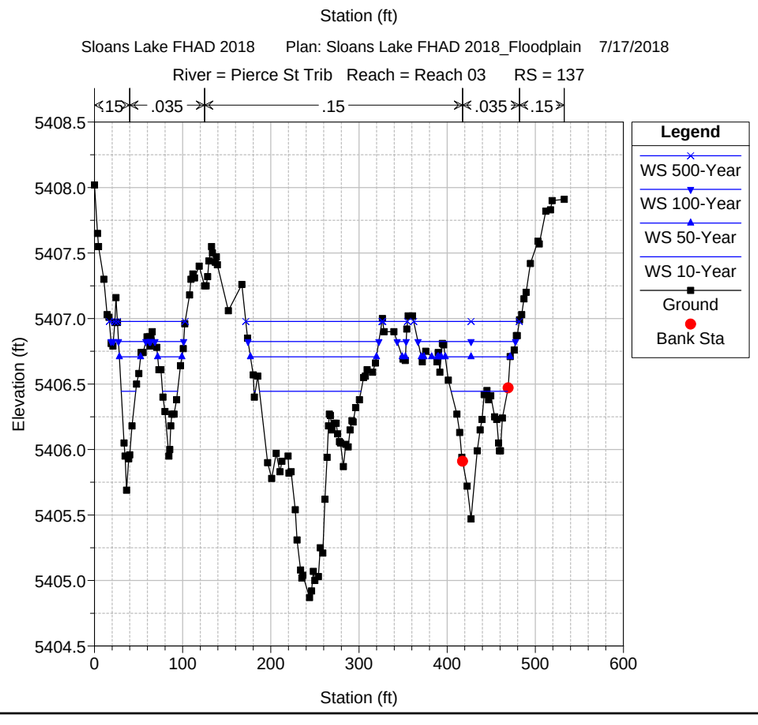
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 282
.15 .035 .15 .035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 228
.15 .035 .15 .035 .15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 137
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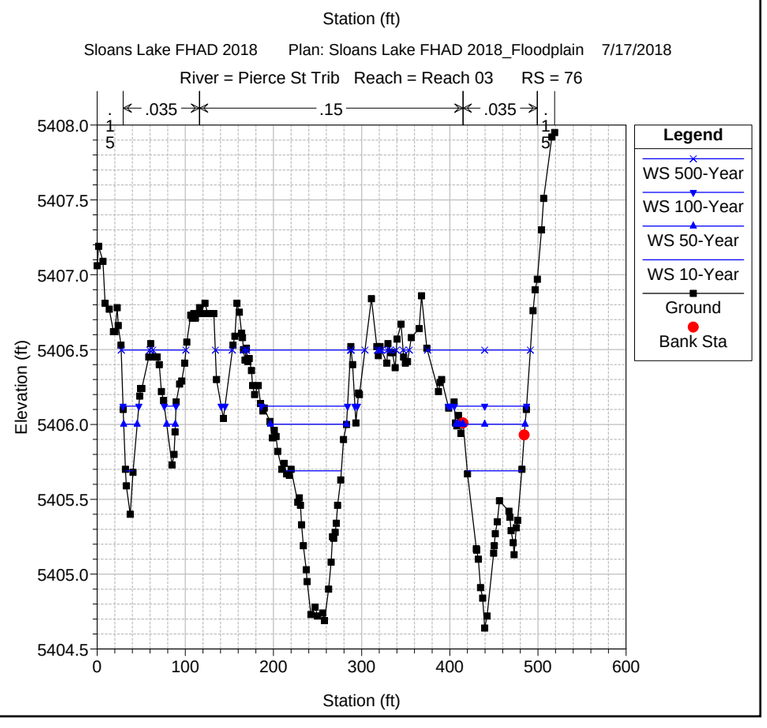
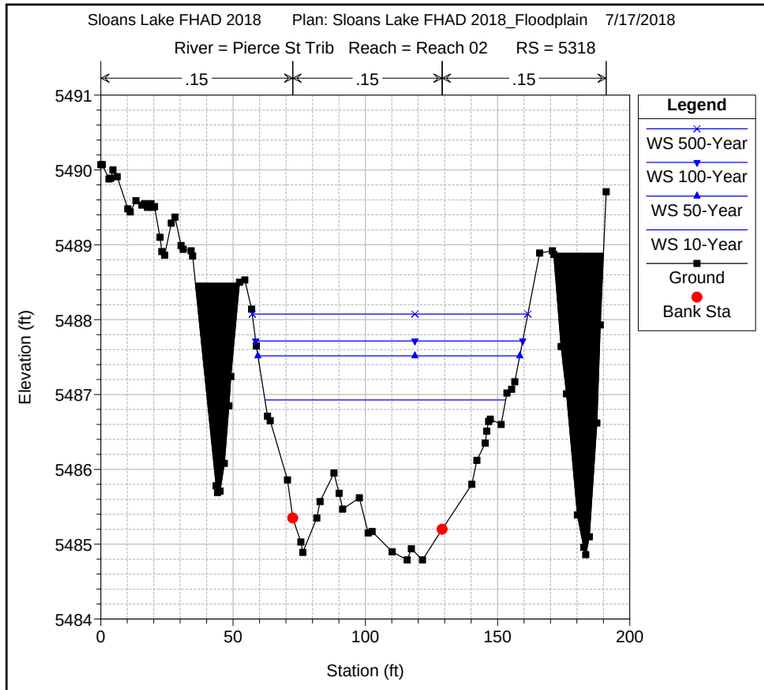
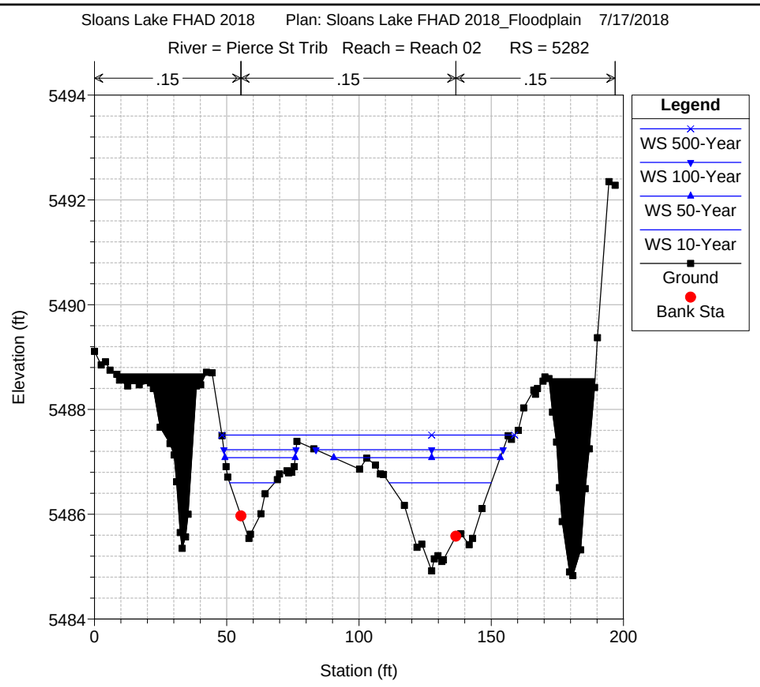
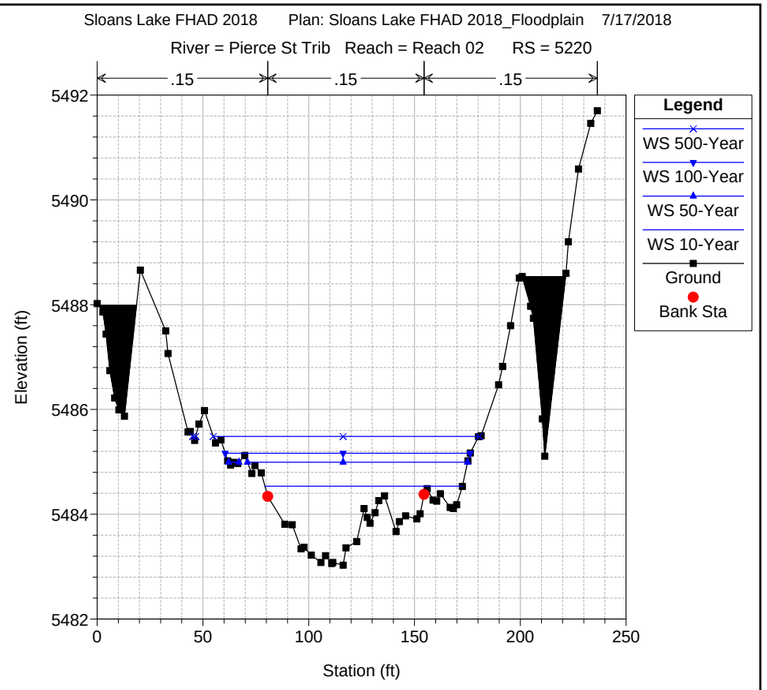
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 03 RS = 76
.15 .035 .15 .035 .15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 5318
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 5282
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 5220
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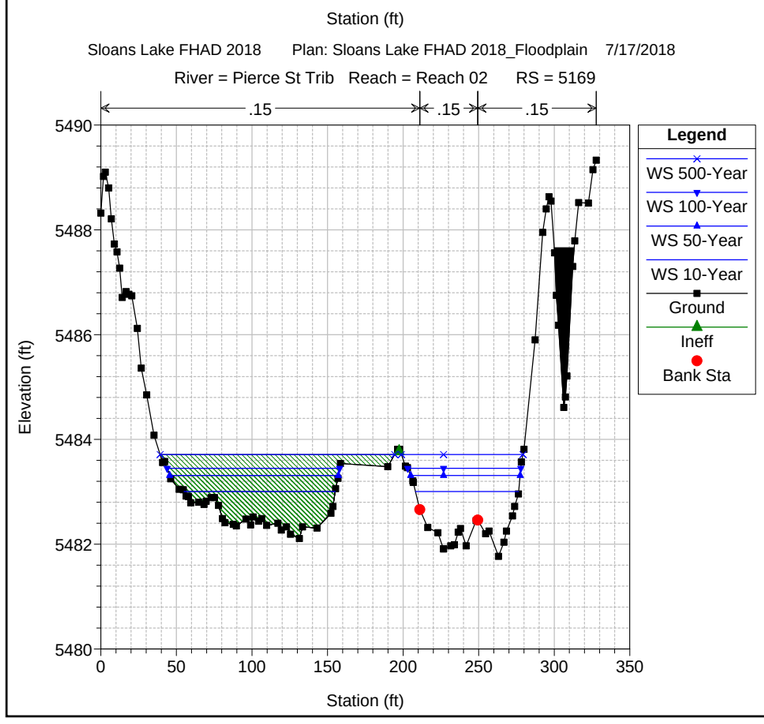
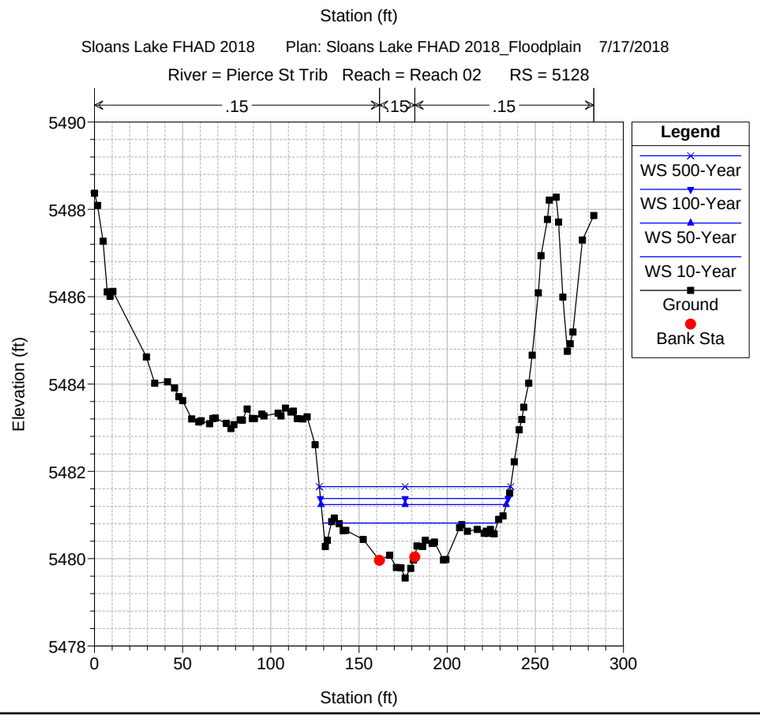
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 5169
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 5128
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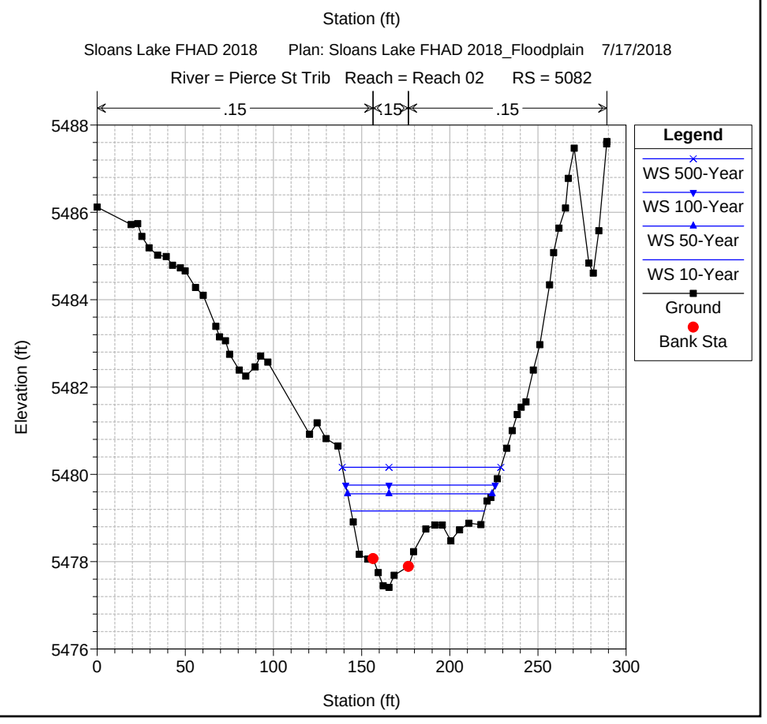
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 5082
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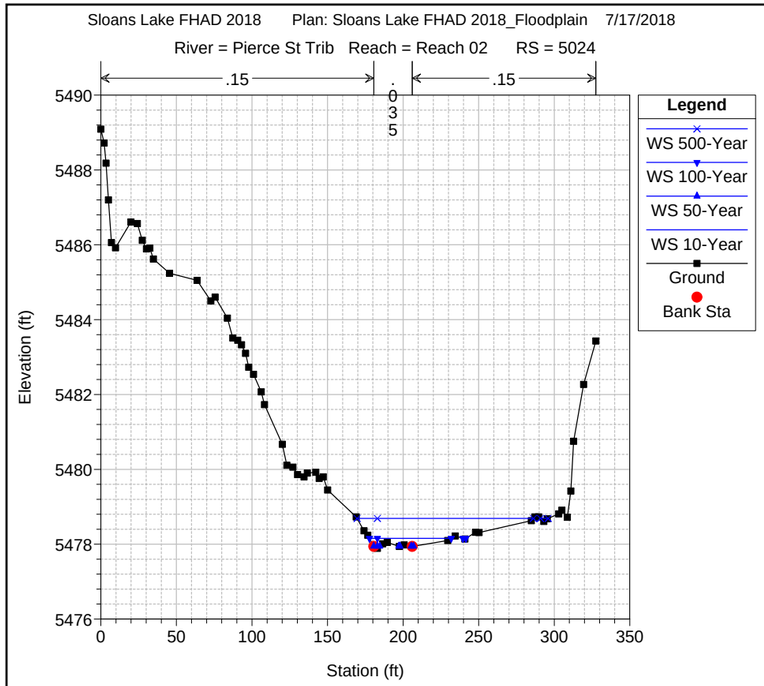
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 5024
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.035
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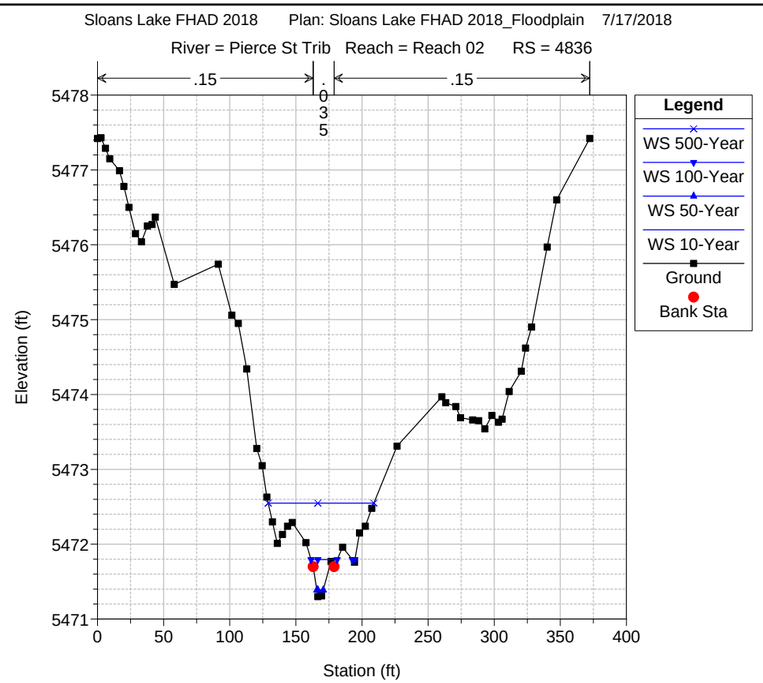
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 4836
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.035
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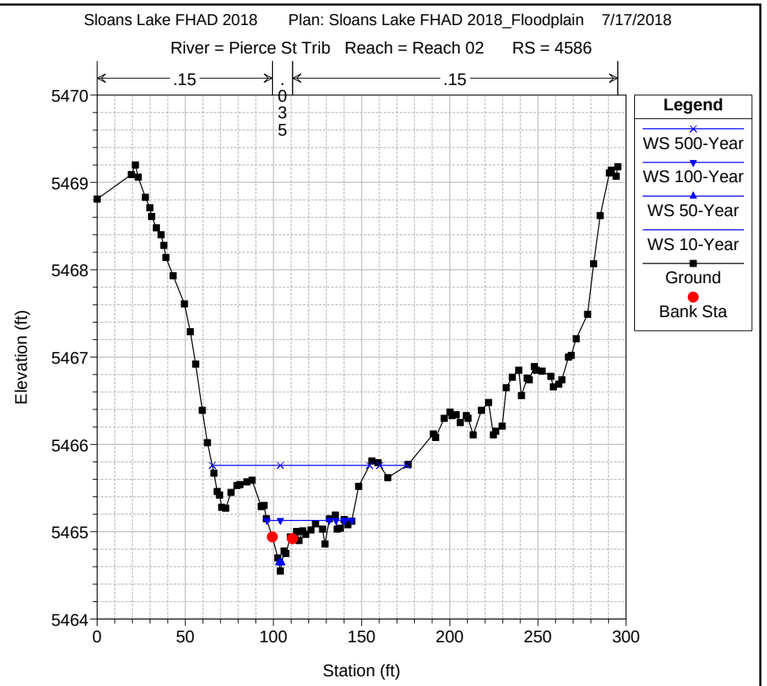
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 4586
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.035
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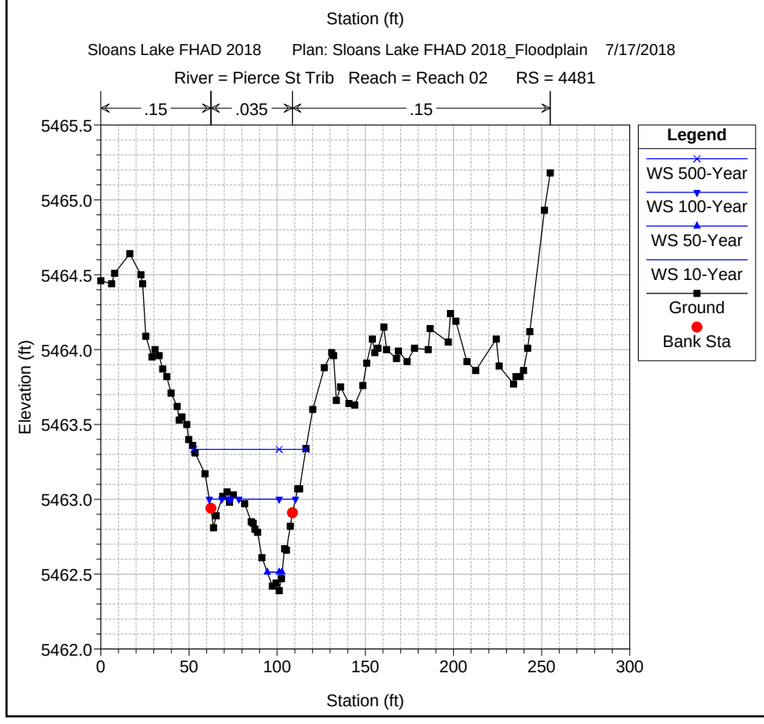
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 4481
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.035
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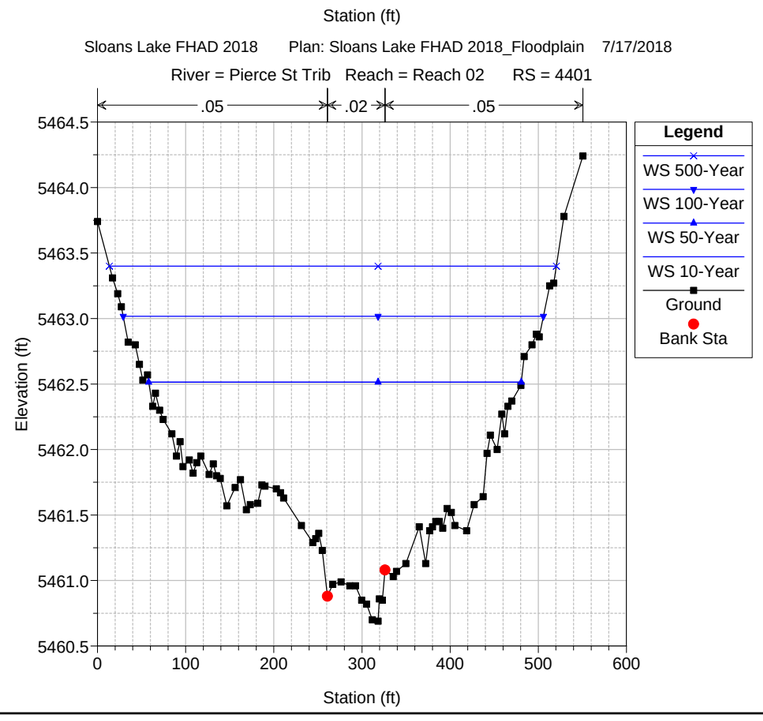
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 4401
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.02
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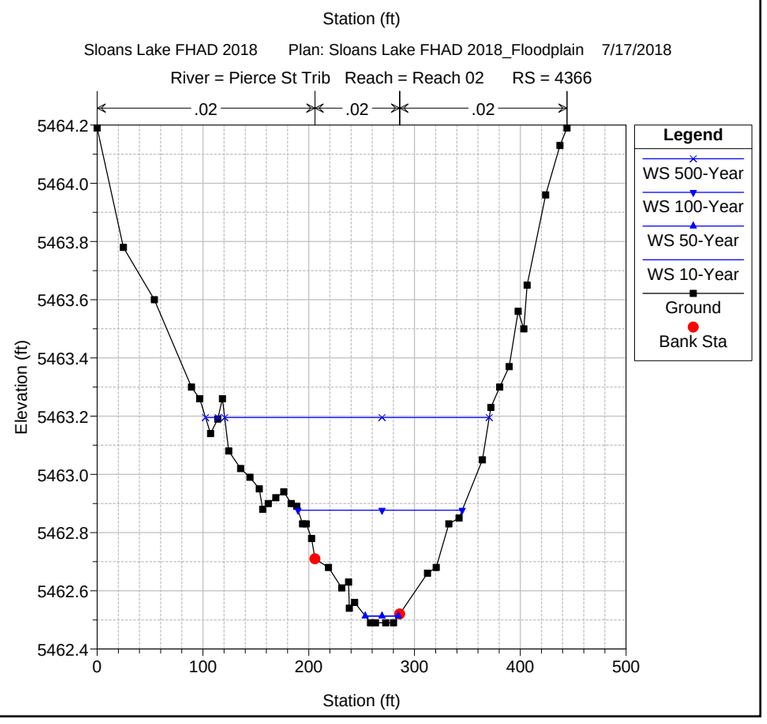
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 4366
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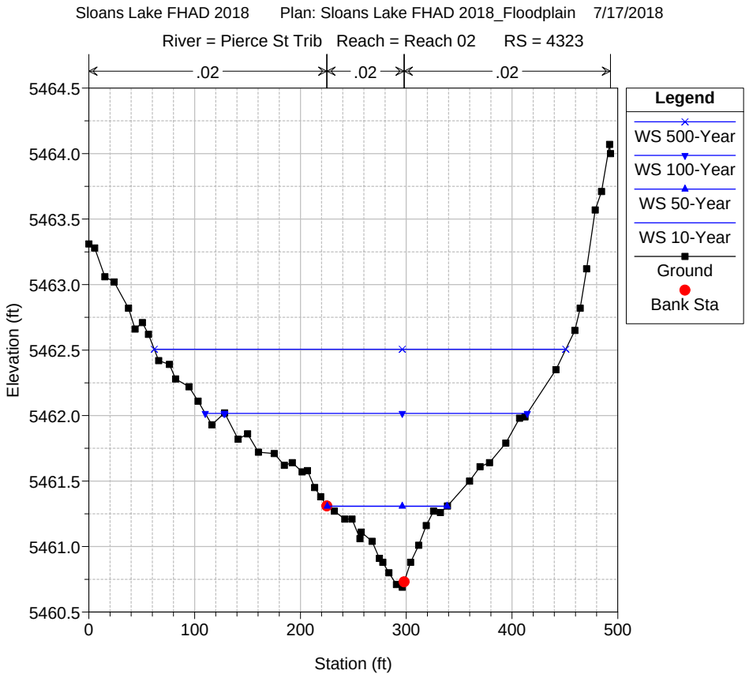
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 4323
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.02
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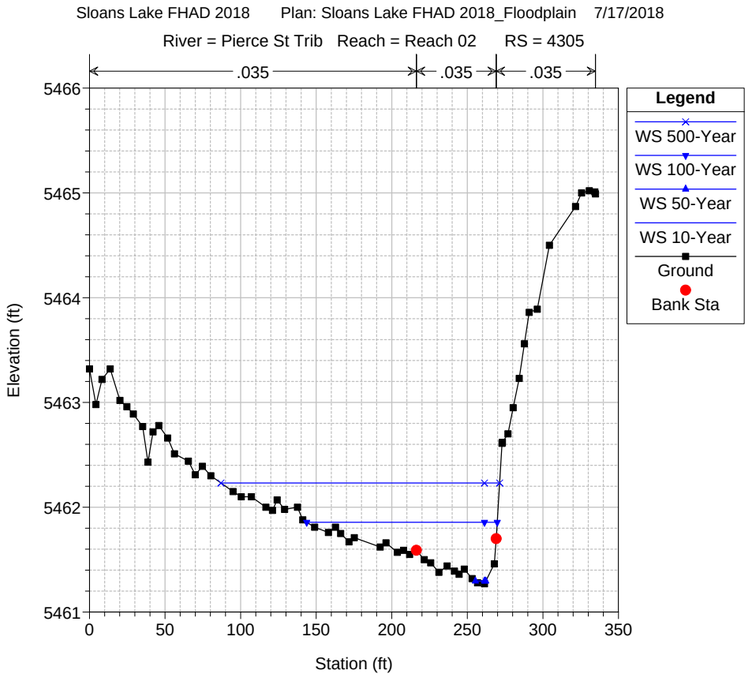
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 4305
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.035
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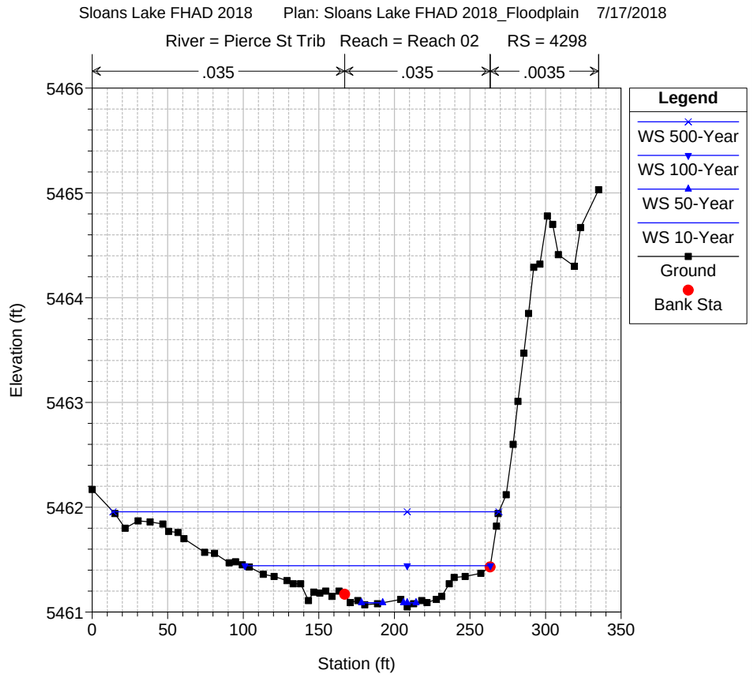
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 4298
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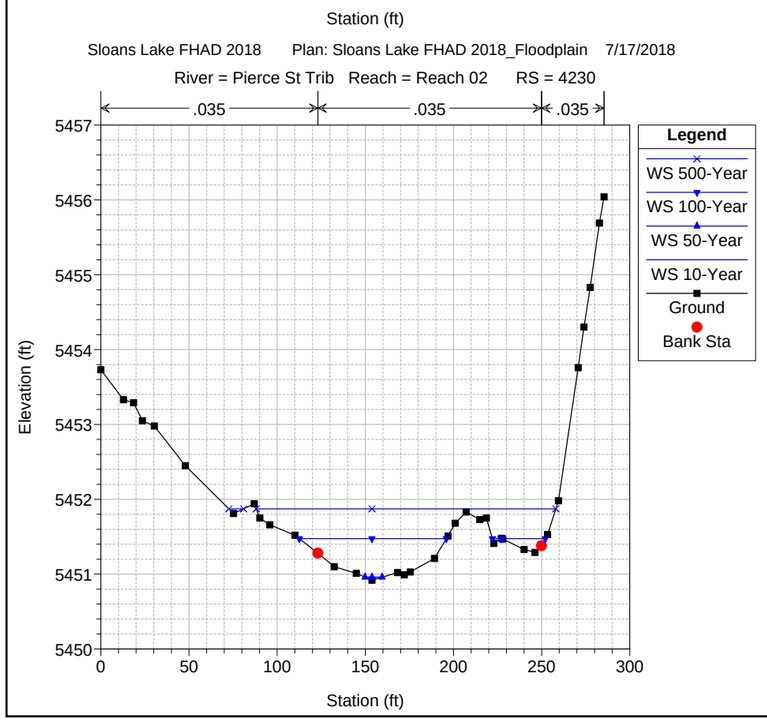
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 4230
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.035
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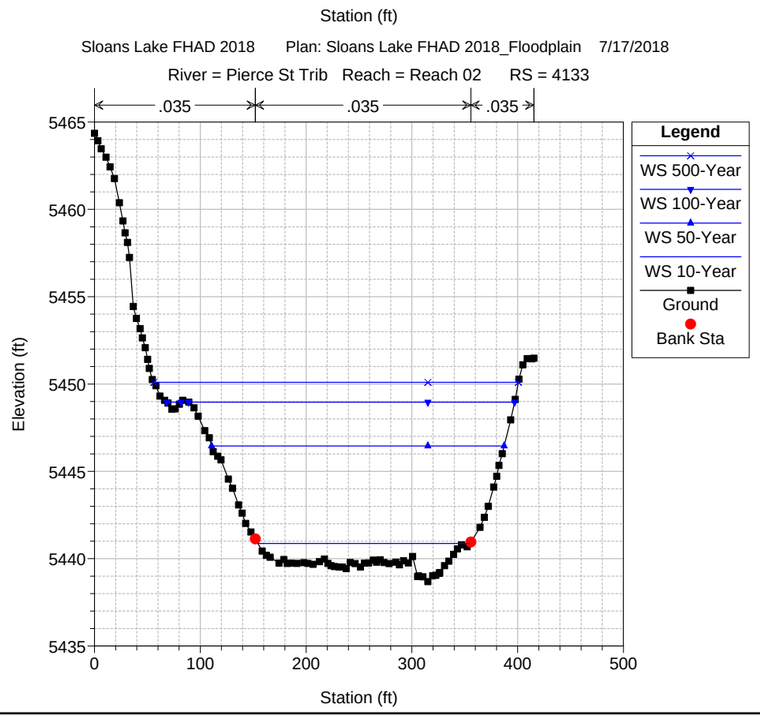
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 4133
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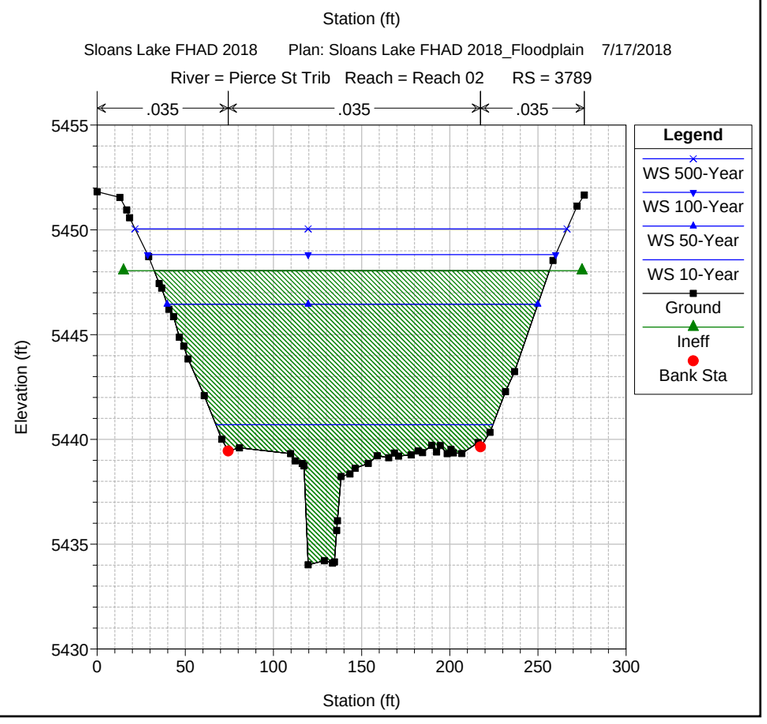
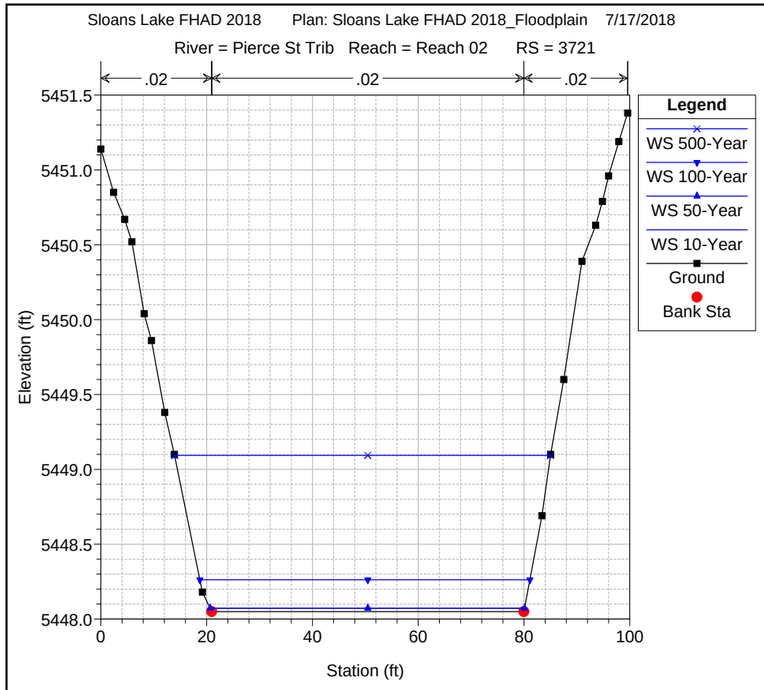
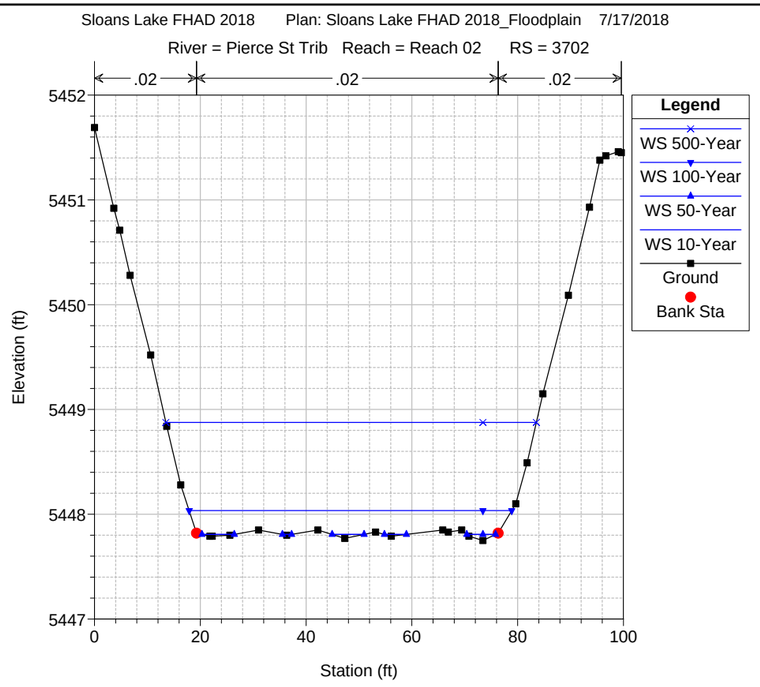
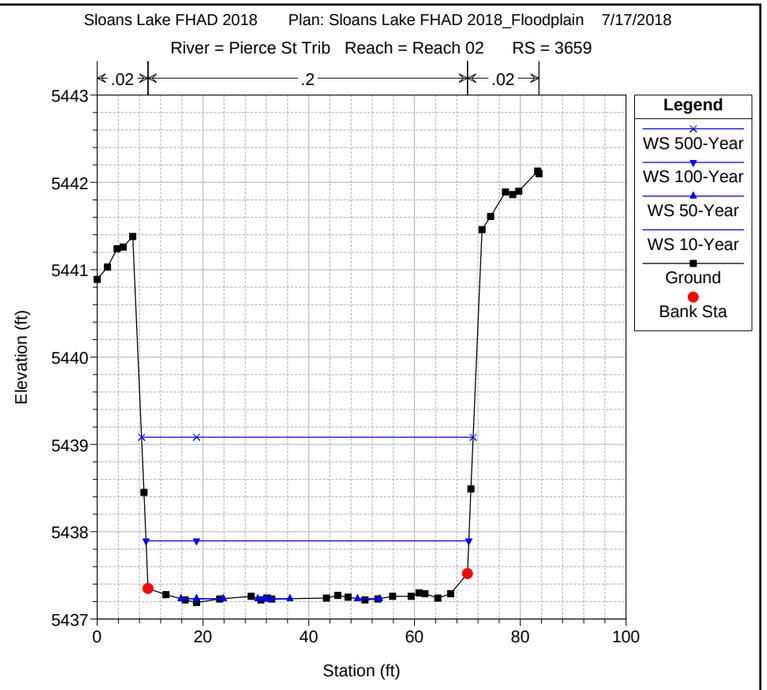
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 3789
.035
.035
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 3721
.02
.02
.02
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 3702
.02
.02
.02
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 3659
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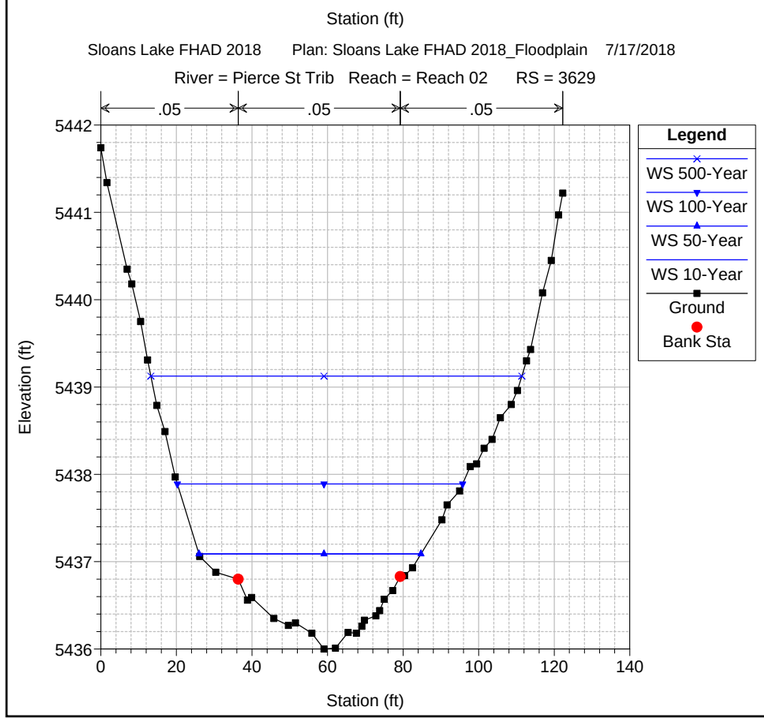
.2
.02
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 3629
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.05
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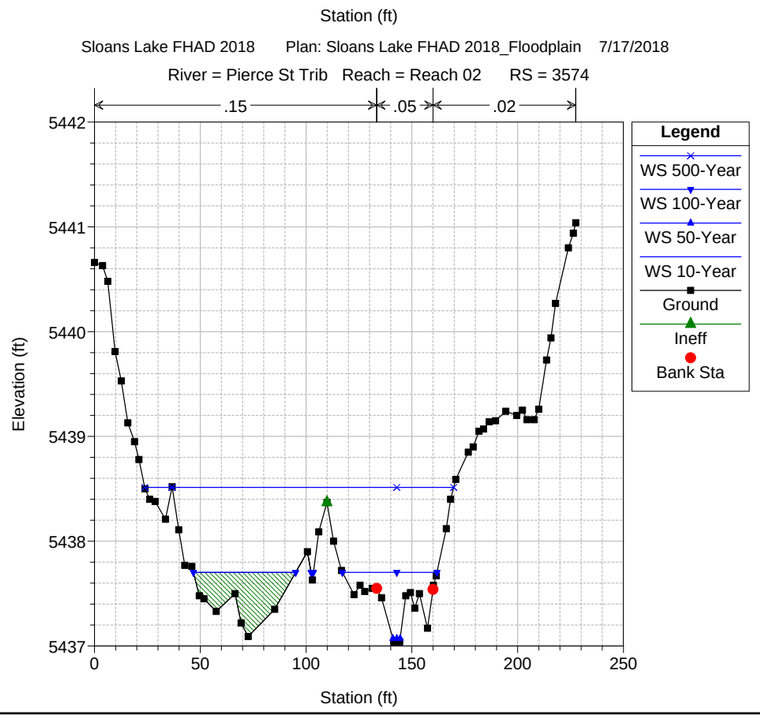
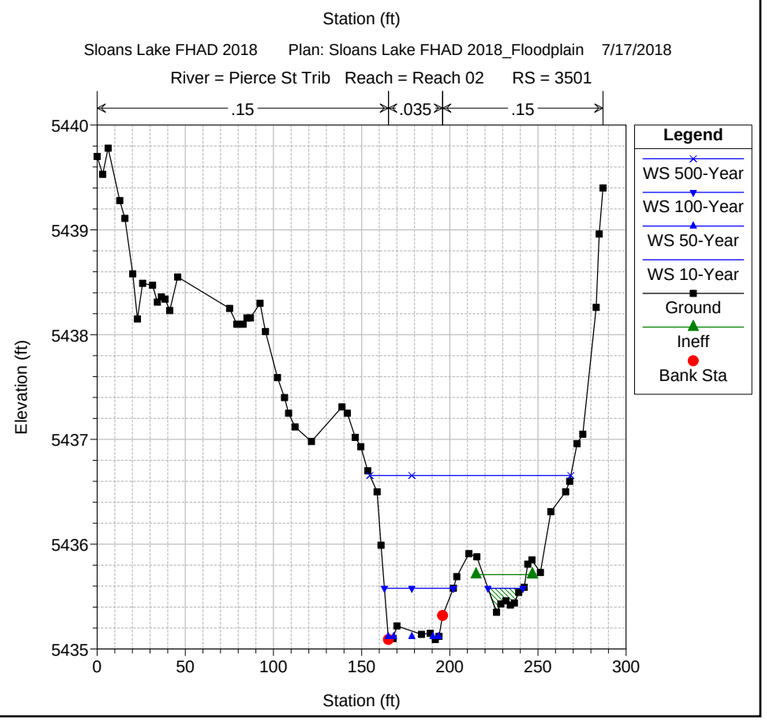
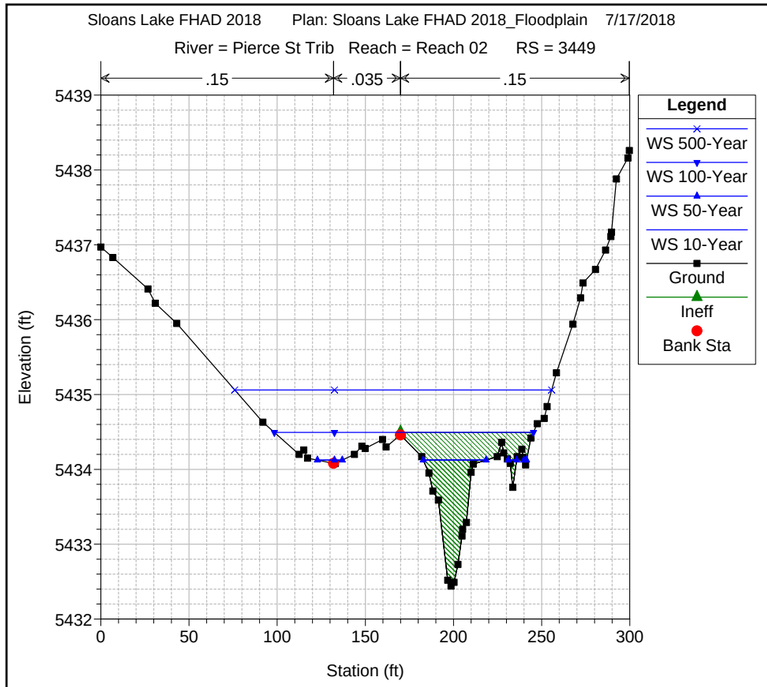
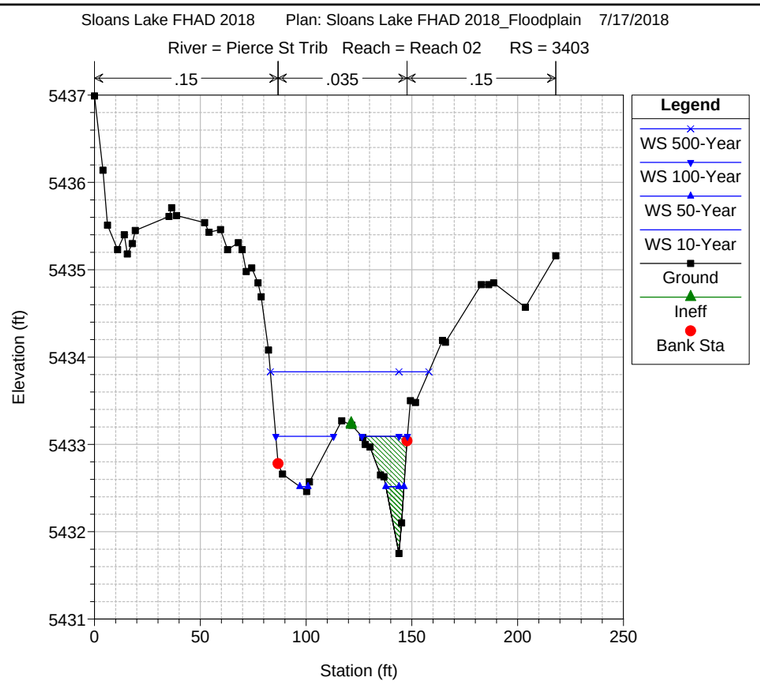
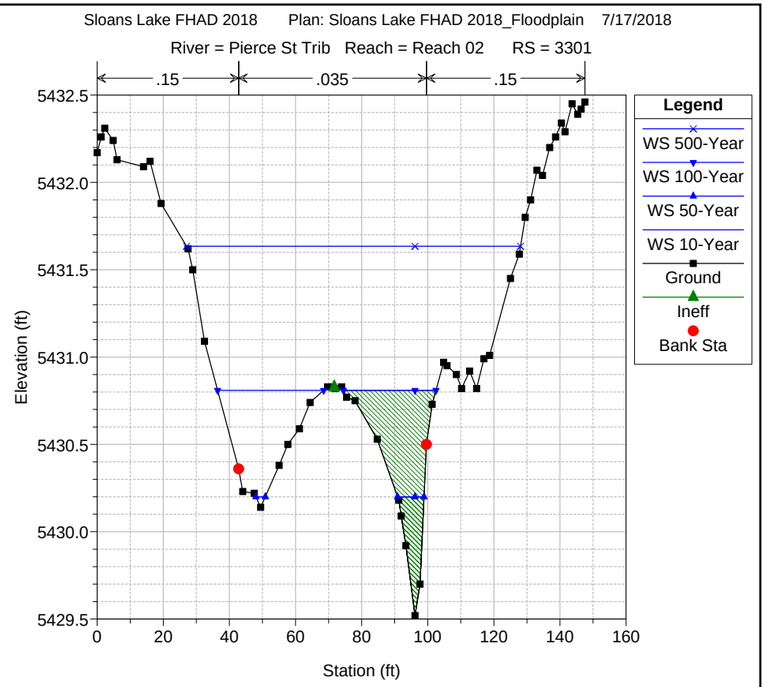
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 3574
.15
.05
.02
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 3501
.15
.035
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 3449
.15
.035
.15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 3403
.15
.035
.15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 3301
.15
.035
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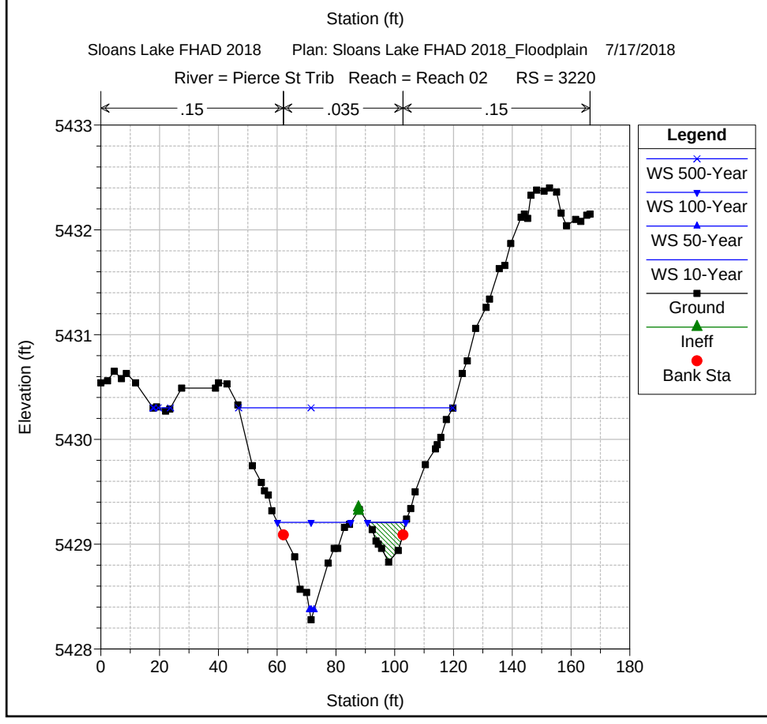
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 3220
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.035
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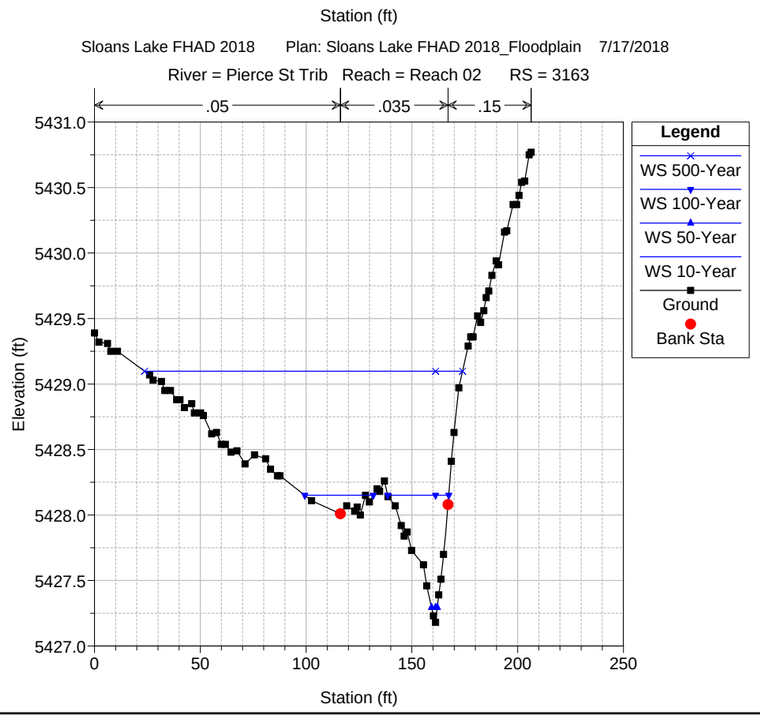
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 3163
.05
.035
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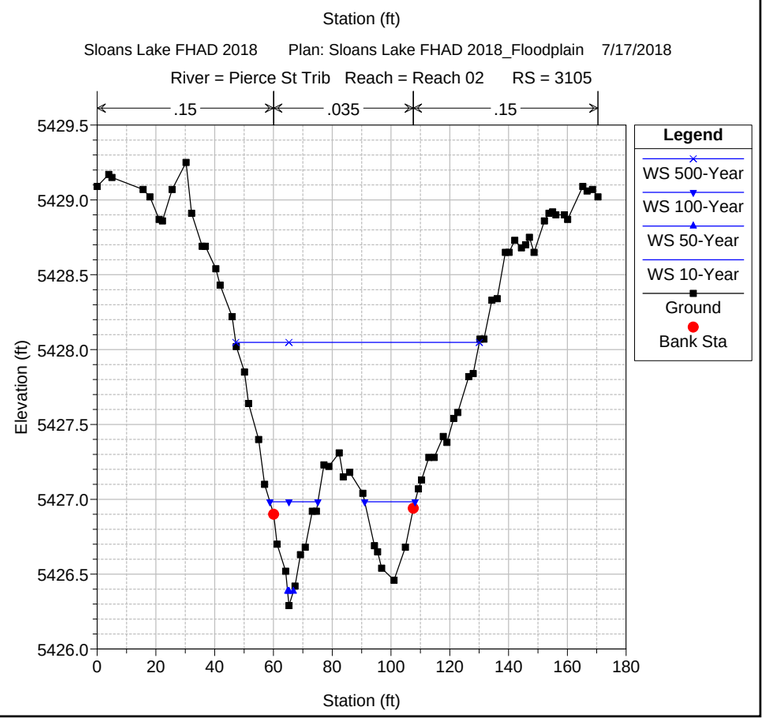
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 3105
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.035
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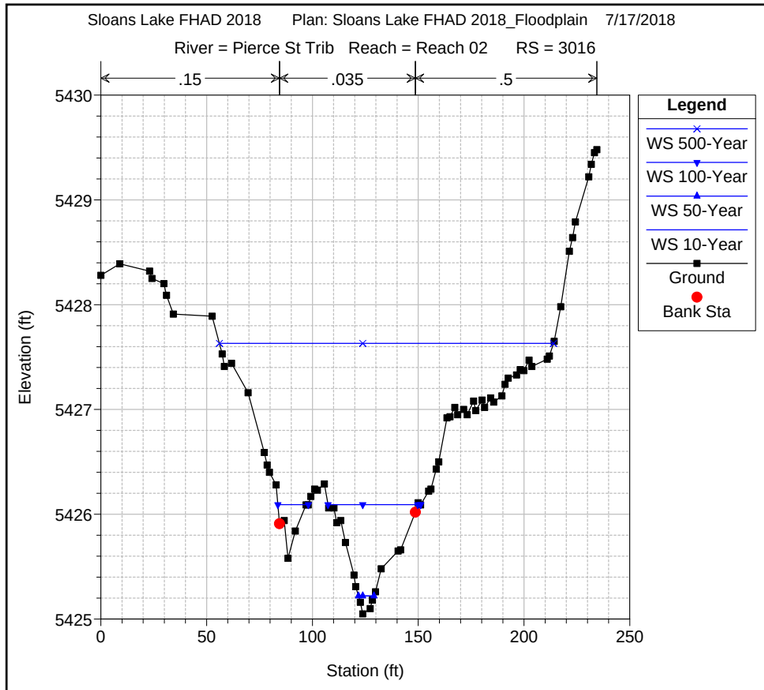
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 3016
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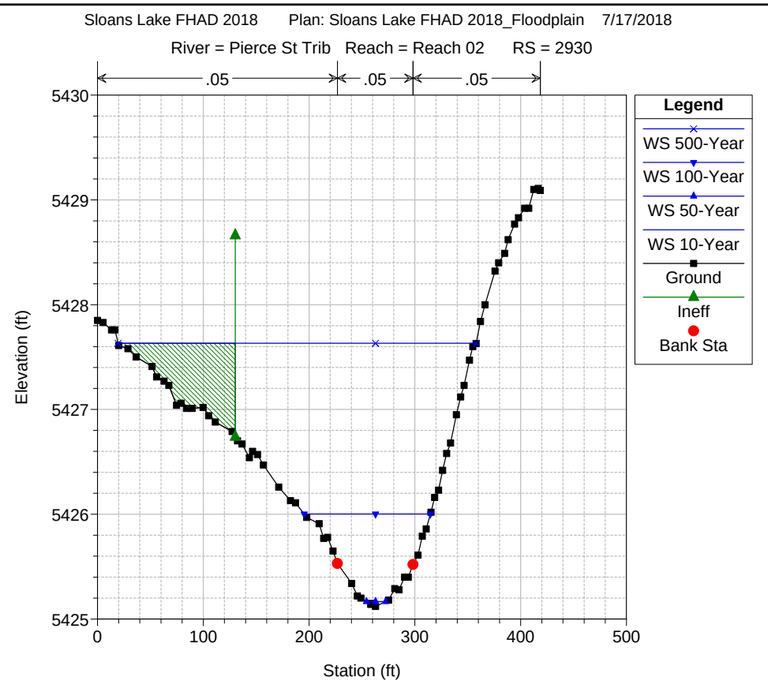
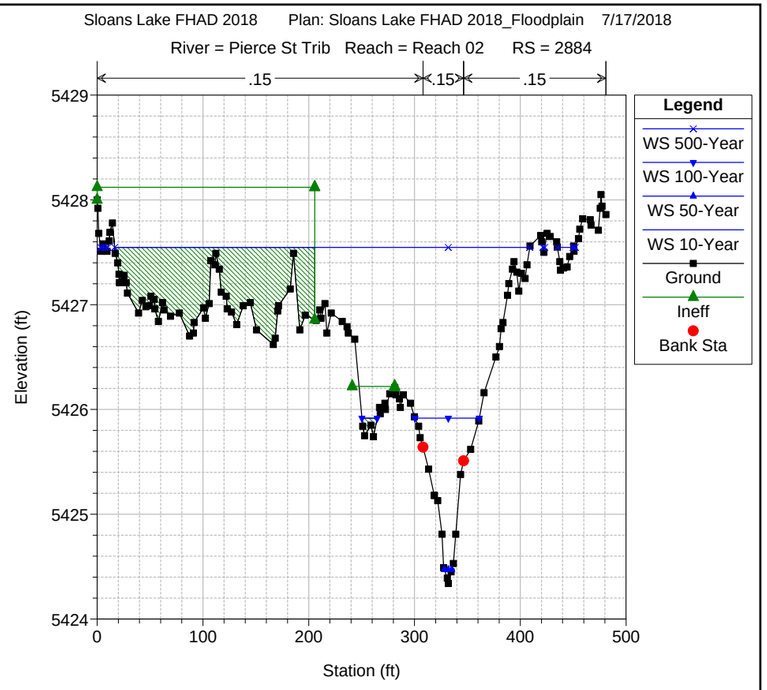
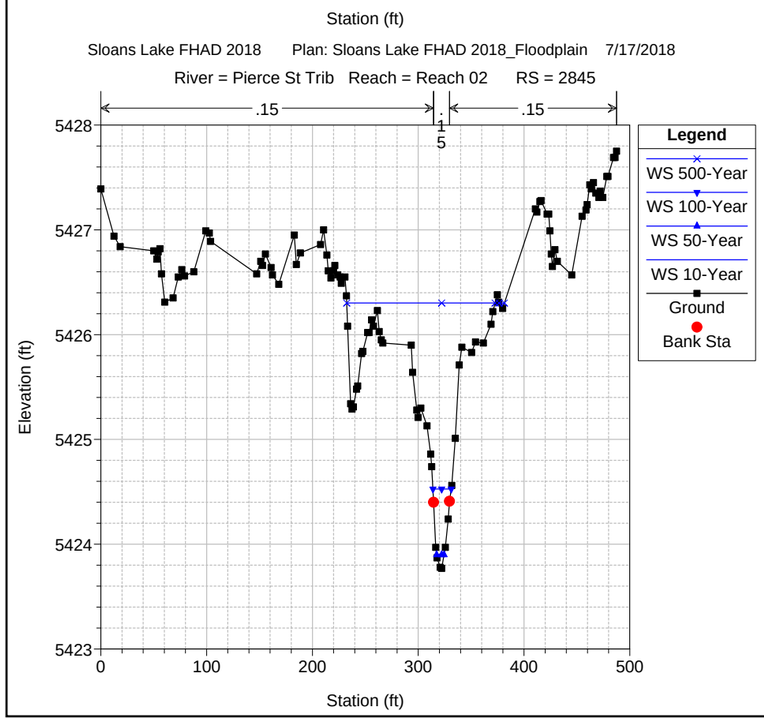
.035
.5
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 2930
.05
.05
.05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 2884
.15
.15
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 2845
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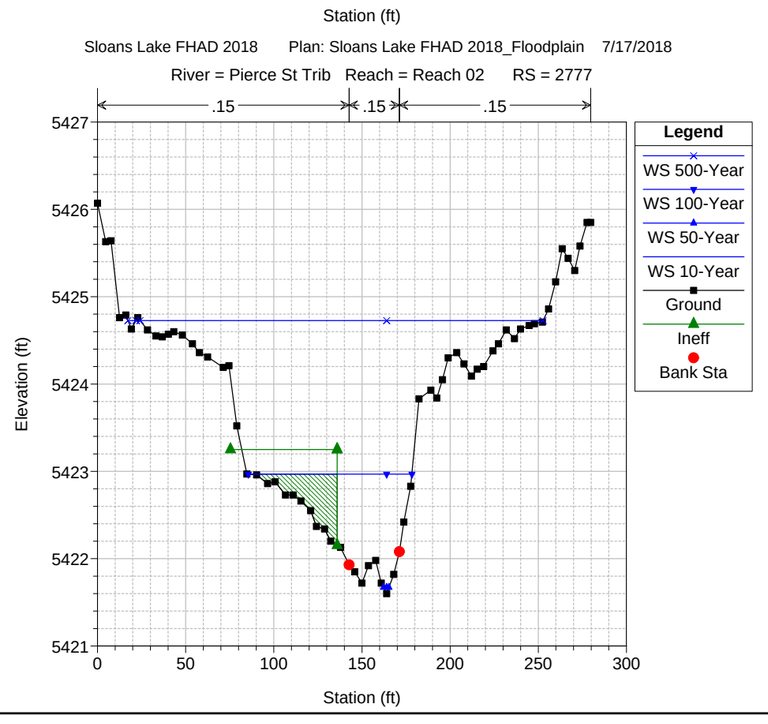
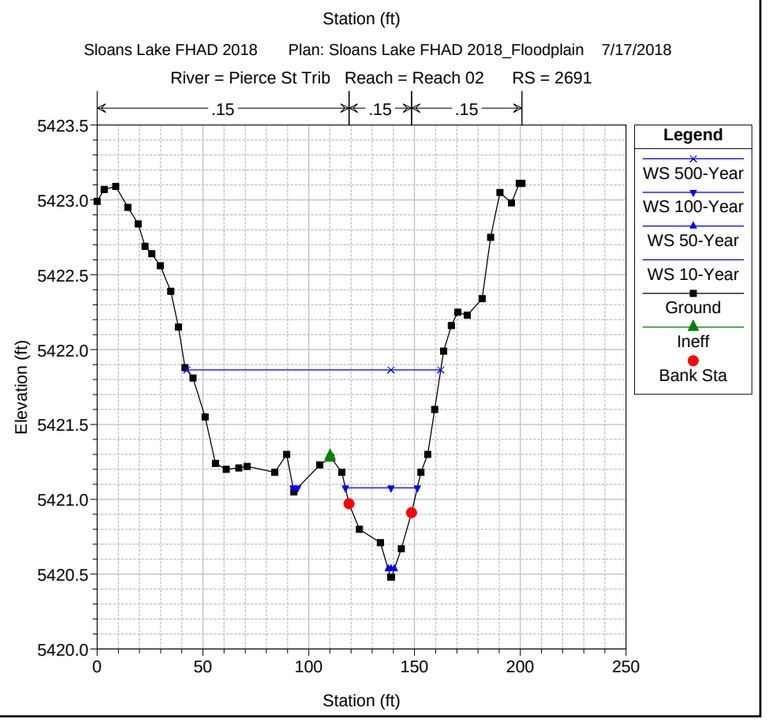
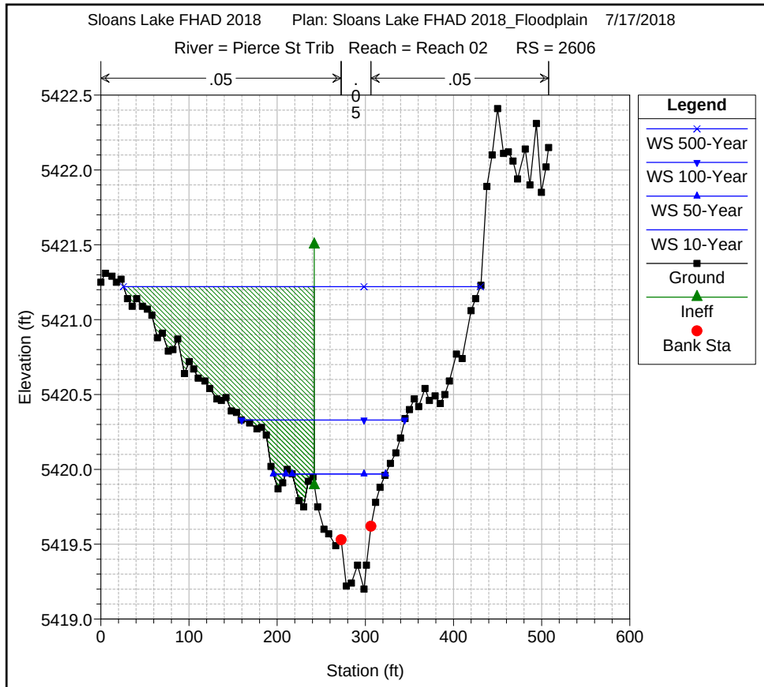
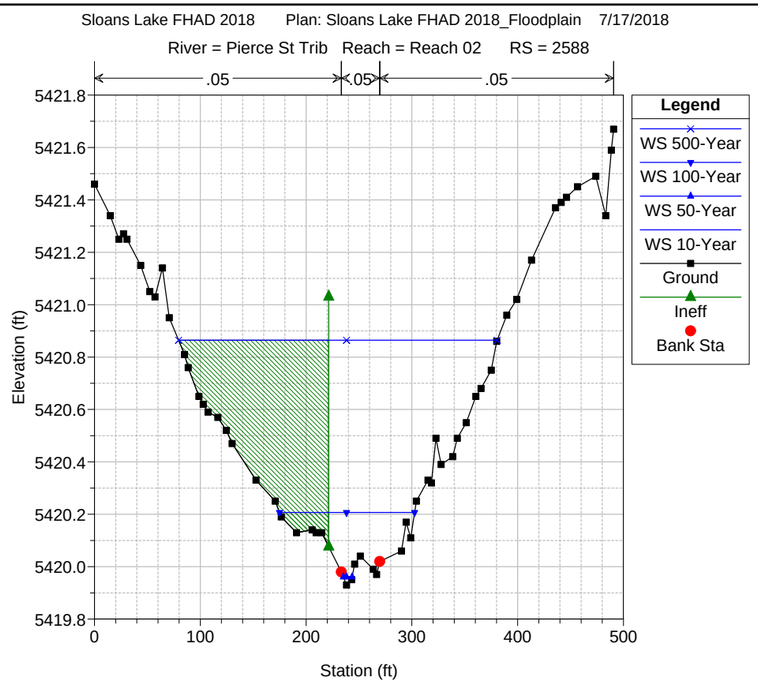
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 2777
.15
.15
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 2691
.15
.15
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 2606
.05
.05
.05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 2588
.05
.05
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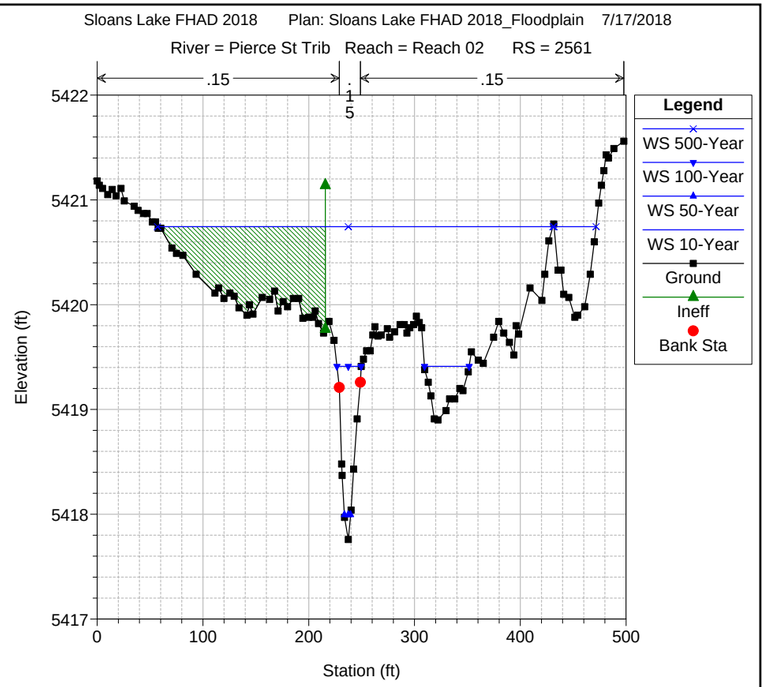
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 2561
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.15
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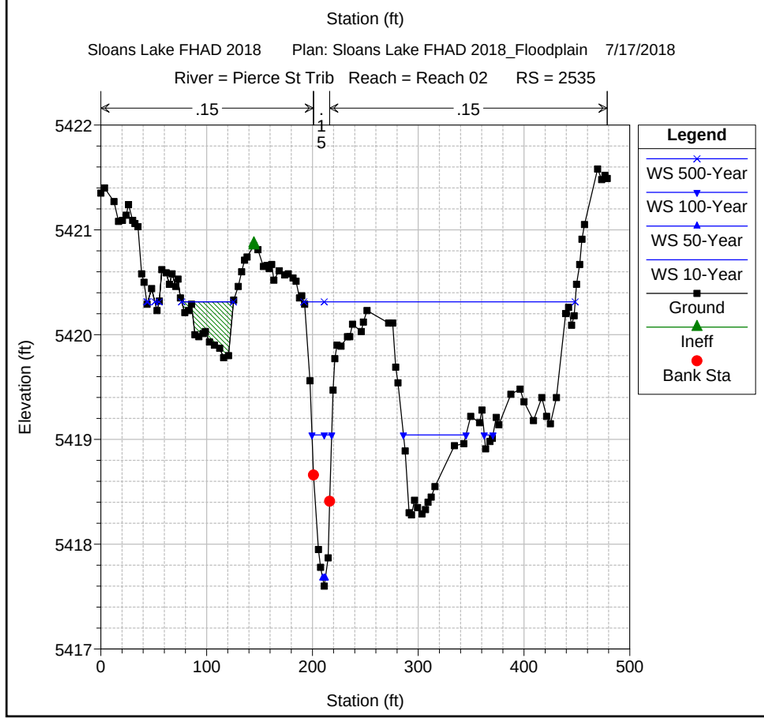
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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River = Pierce St Trib Reach = Reach 02 RS = 2535
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.15
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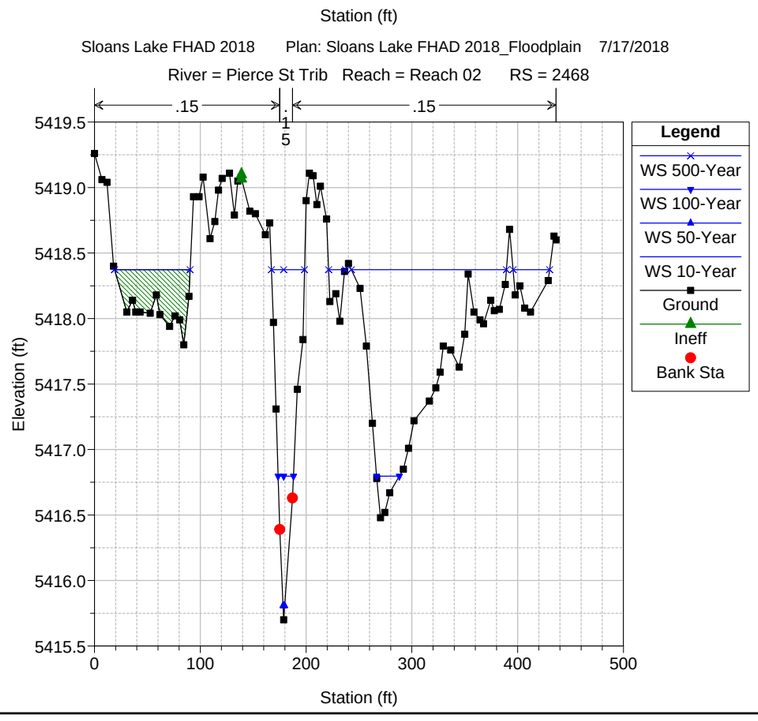
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 2468
.15
.15
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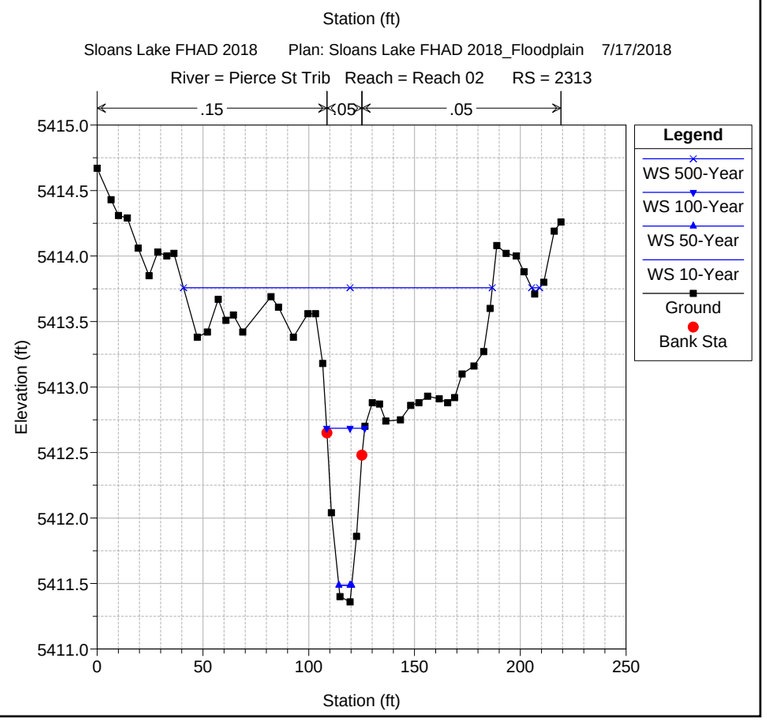
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 2313
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.05
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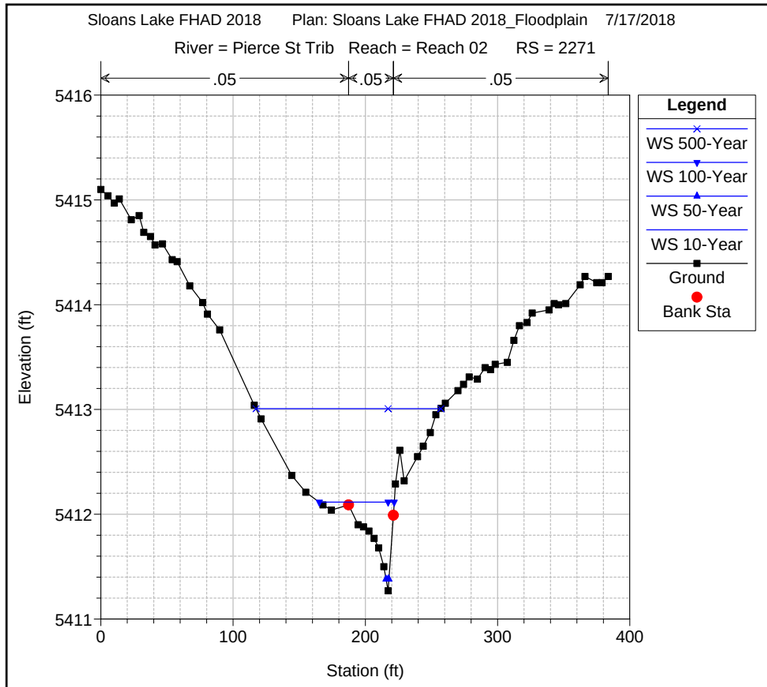
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 2271
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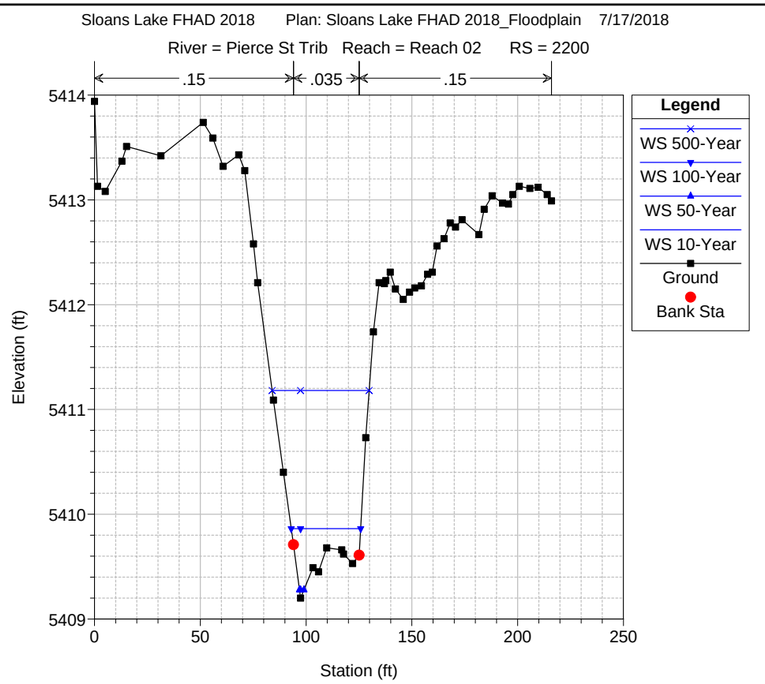
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 2200
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.035
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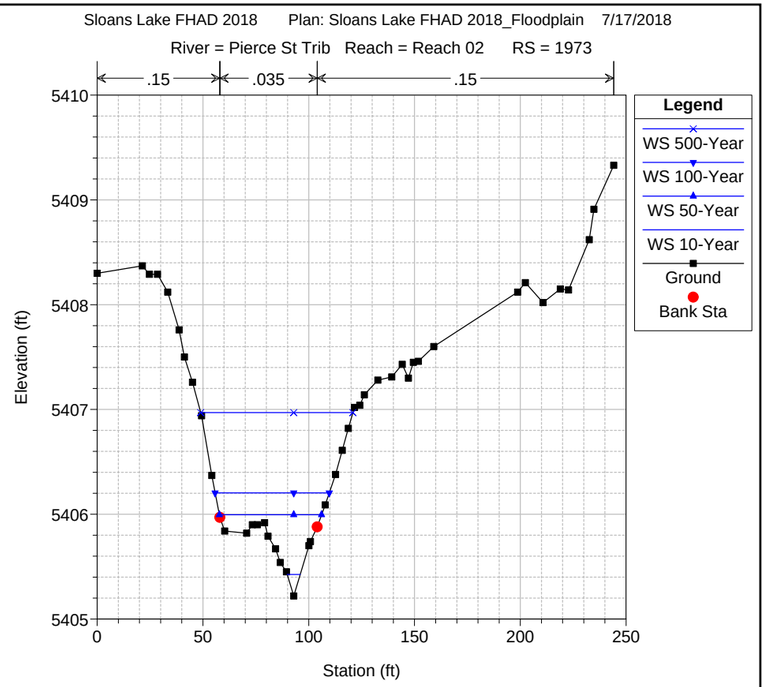
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 02 RS = 1973
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.035
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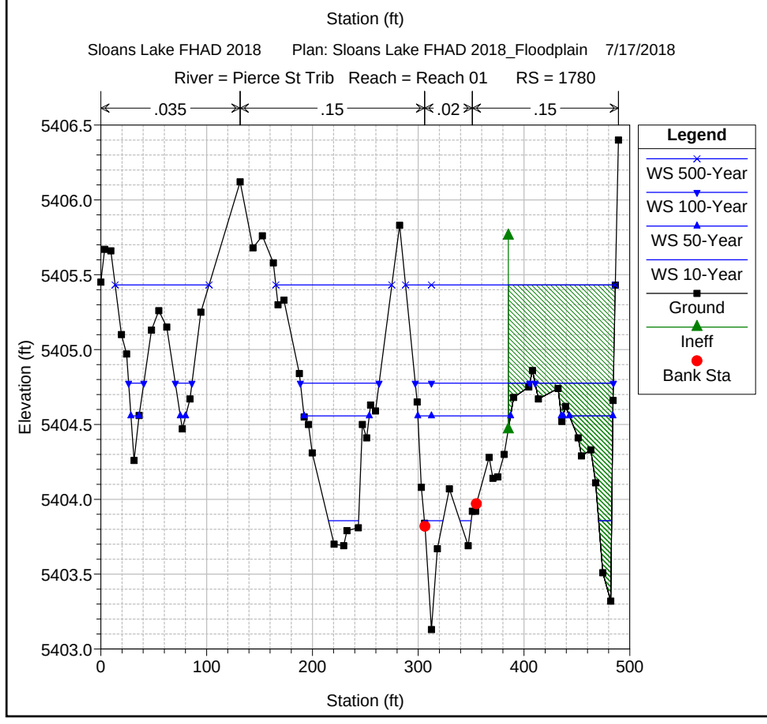
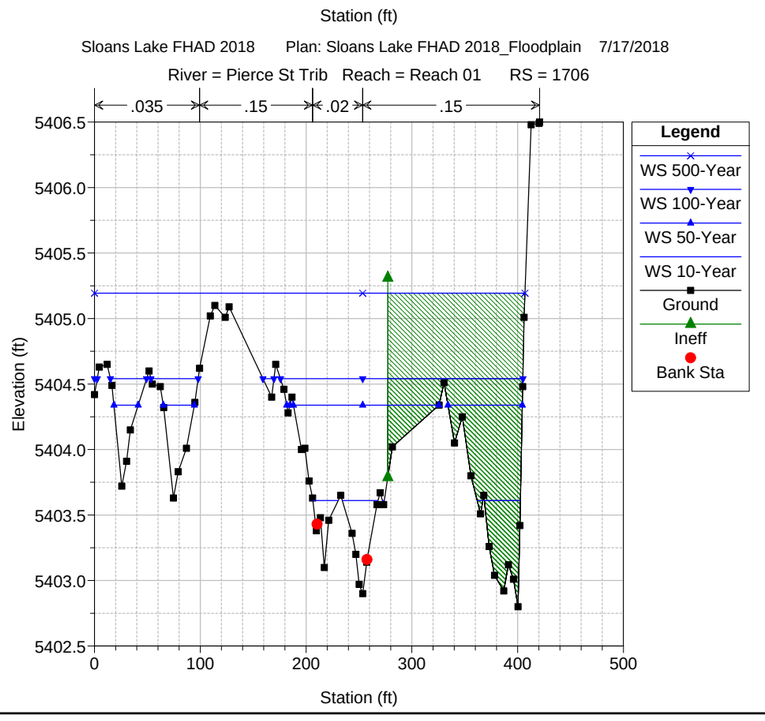
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 01 RS = 1780
.035
.15
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 01 RS = 1706
.035
.15
.02
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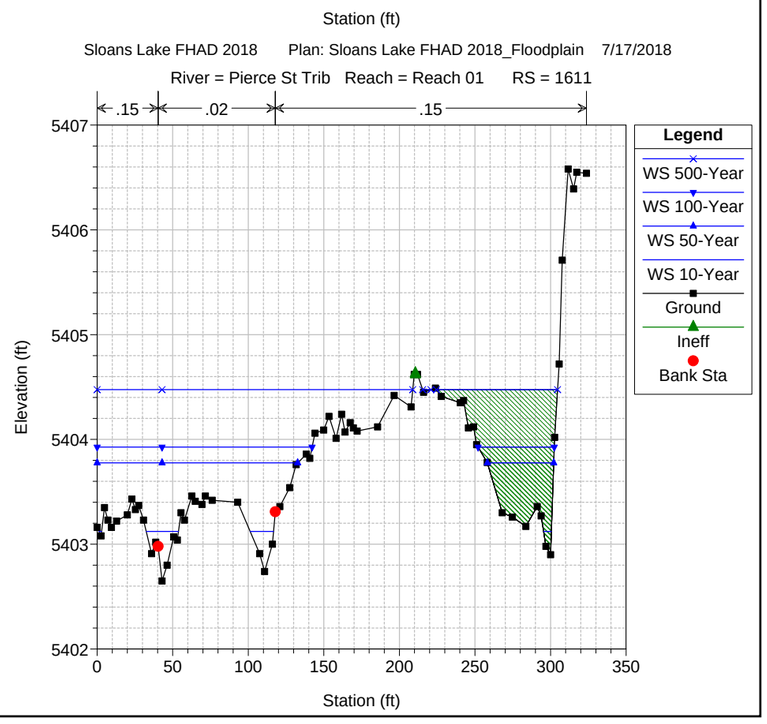
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 01 RS = 1611
.15
.02
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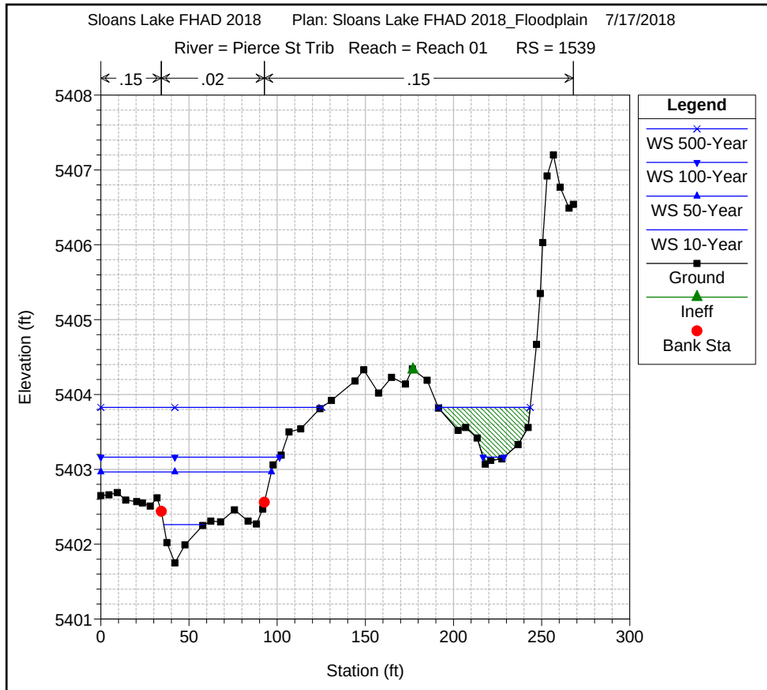
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 01 RS = 1539
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.02
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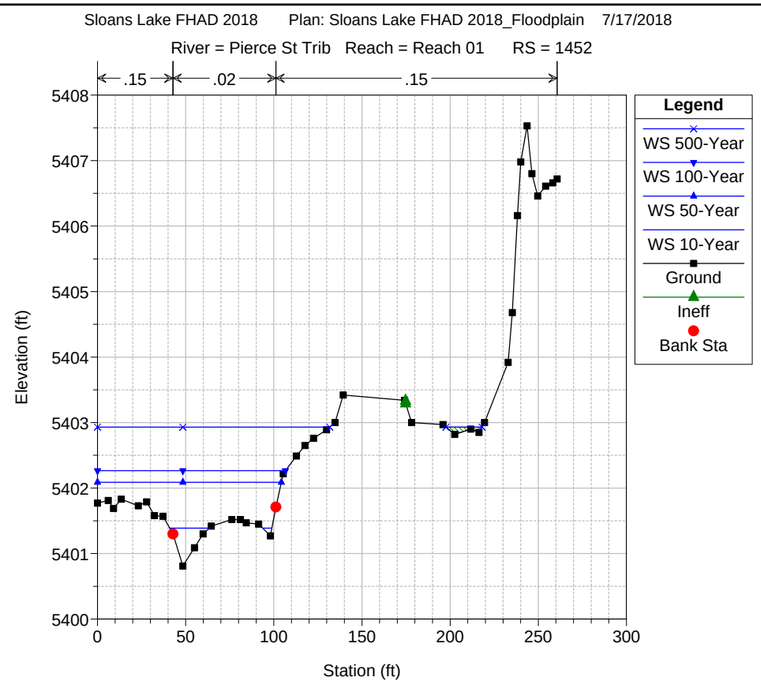
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 01 RS = 1452
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.02
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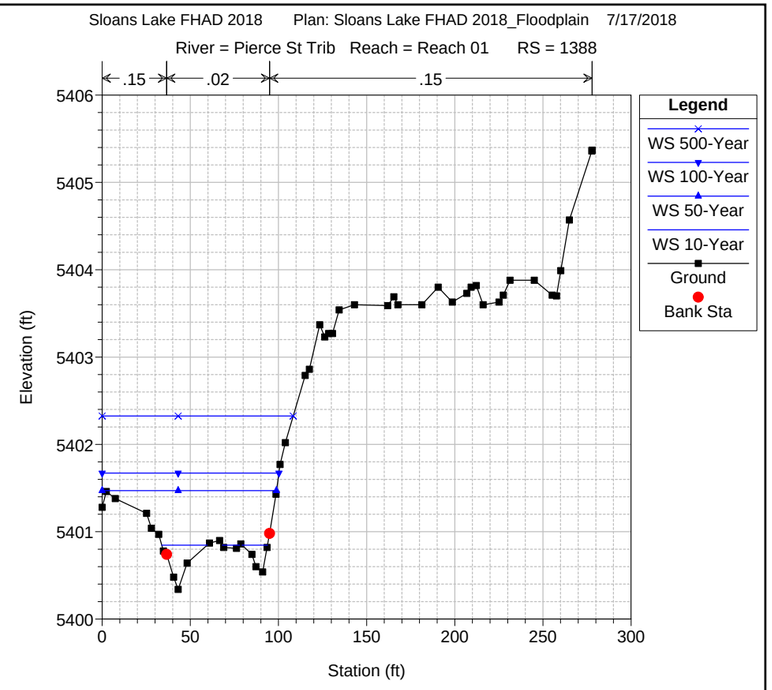
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 01 RS = 1388
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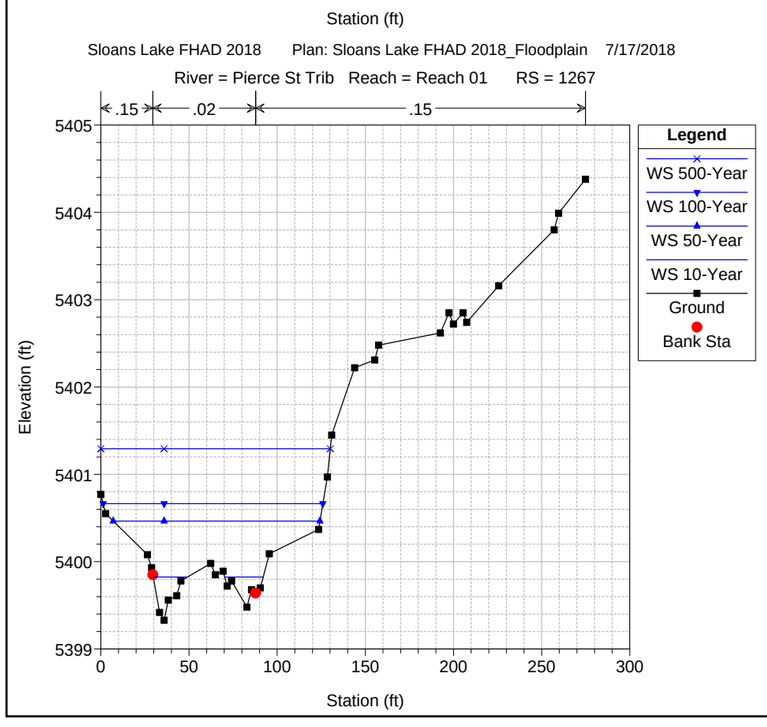
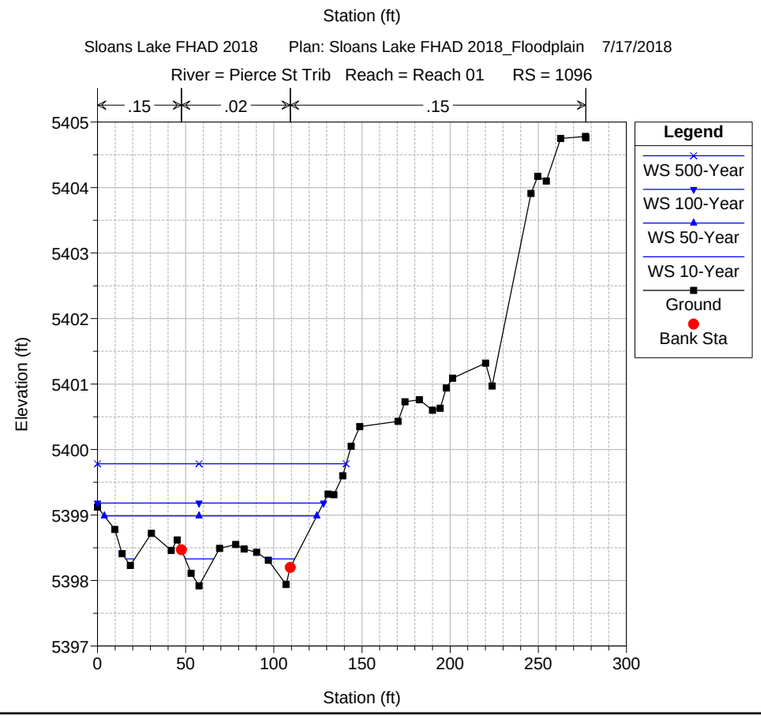
.02
.15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 01 RS = 1267
.15
.02
.15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 01 RS = 1096
.15
.02
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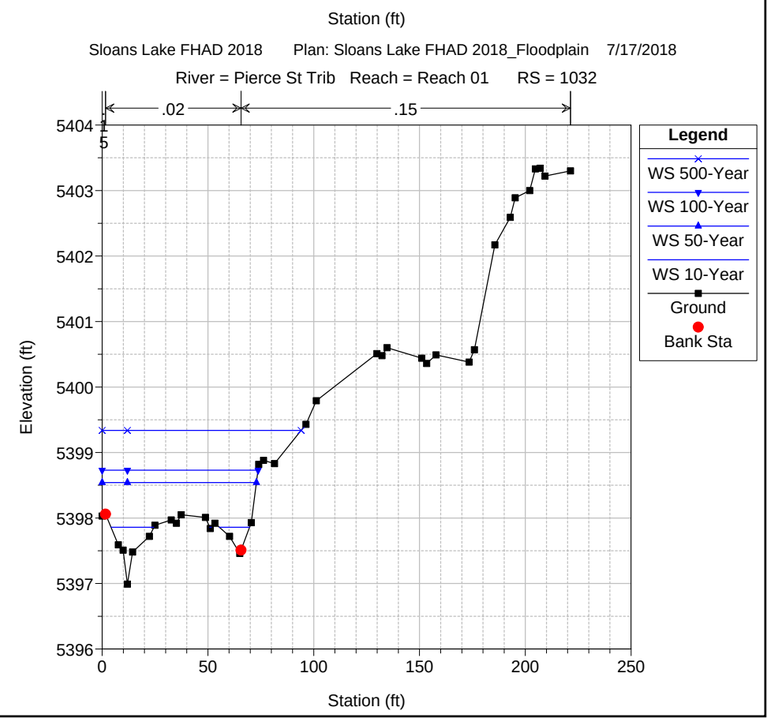
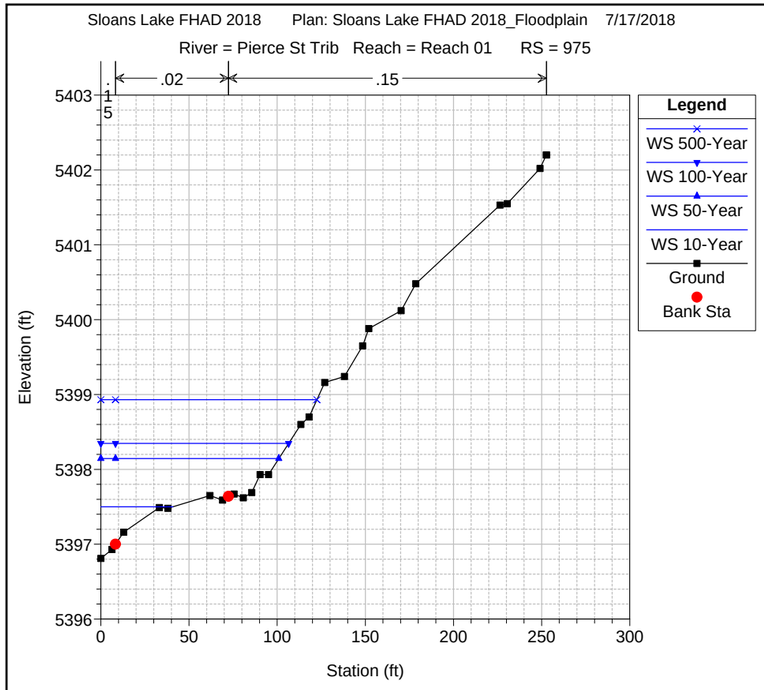
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 01 RS = 1032
.02
.15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta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River = Pierce St Trib Reach = Reach 01 RS = 975
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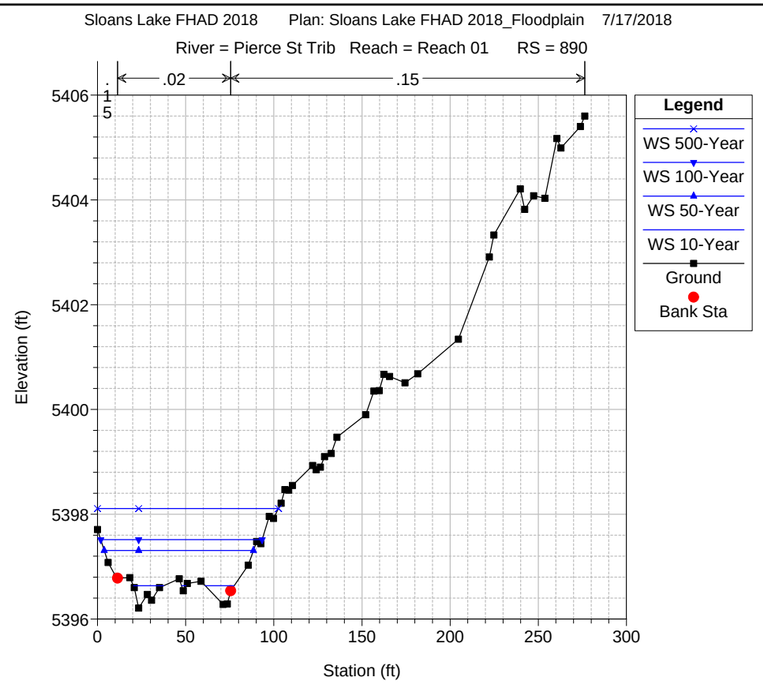
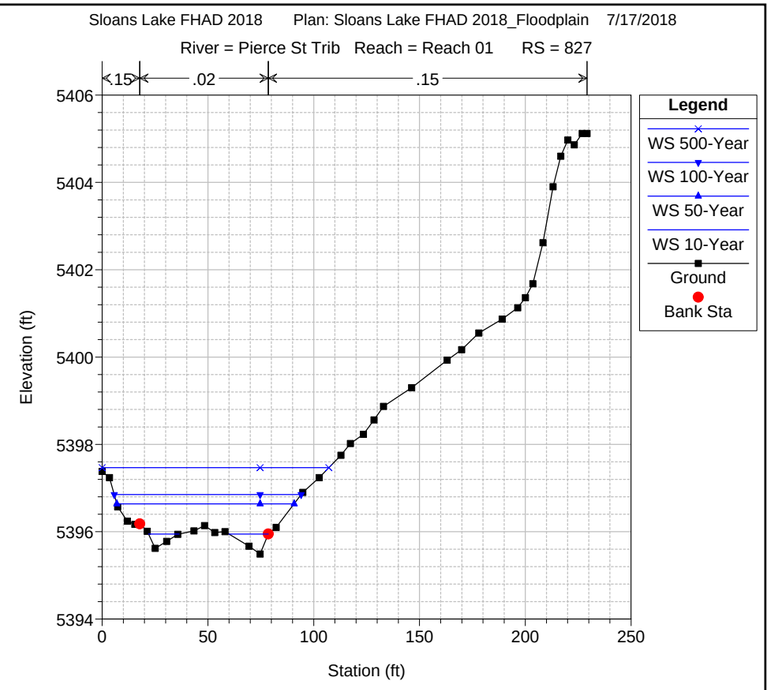
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 01 RS = 890
.15 .02 .15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)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River = Pierce St Trib Reach = Reach 01 RS = 827
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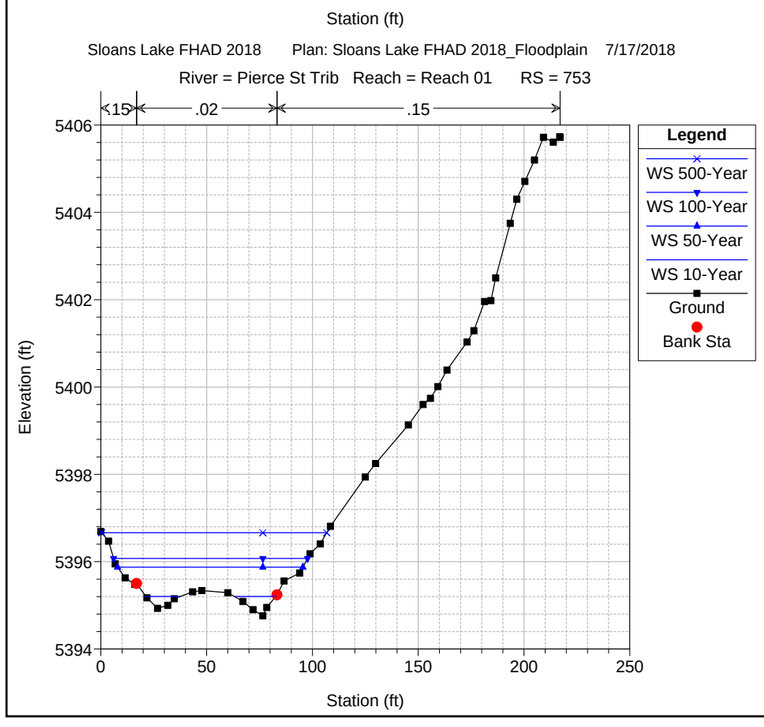
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 01 RS = 753
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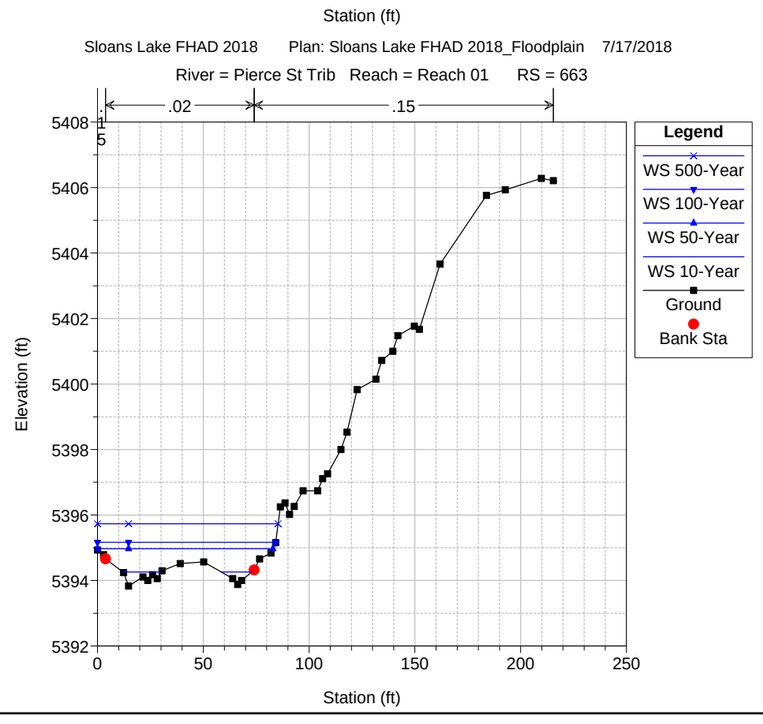
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 01 RS = 663
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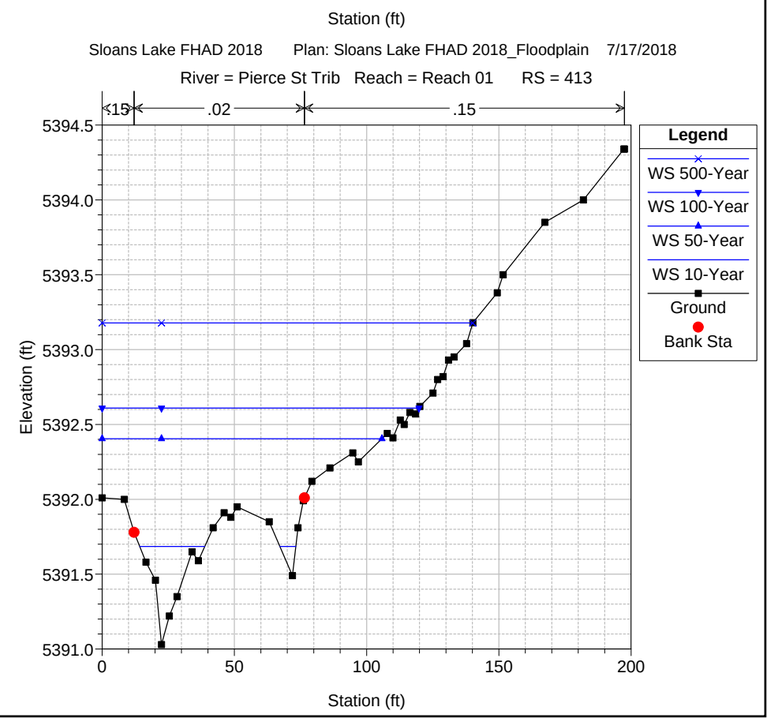
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 01 RS = 413
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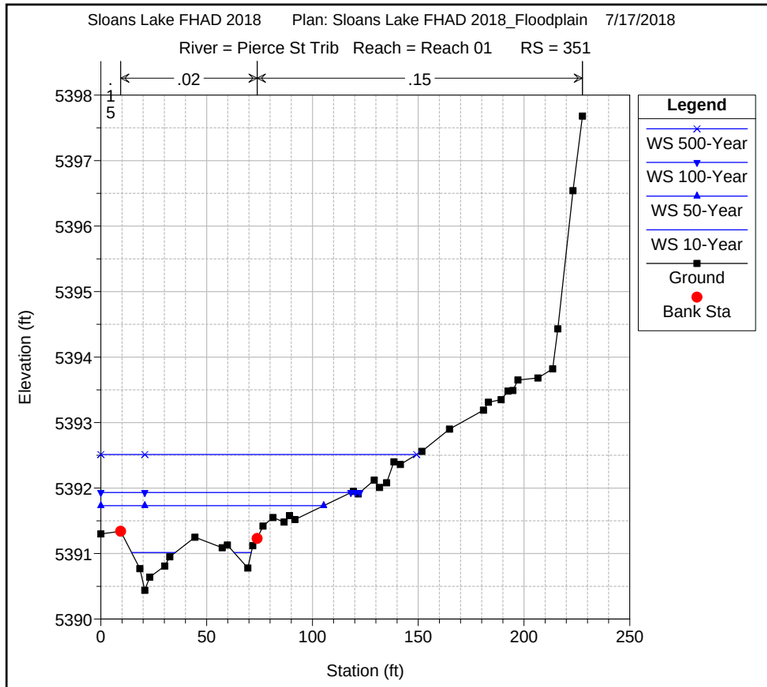
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 01 RS = 351
.15
.02
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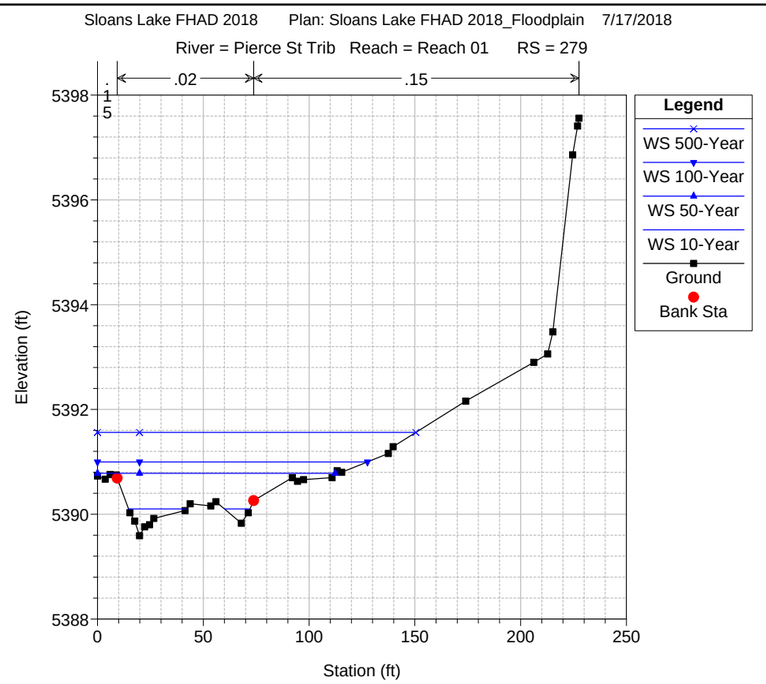
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 01 RS = 279
.15
.02
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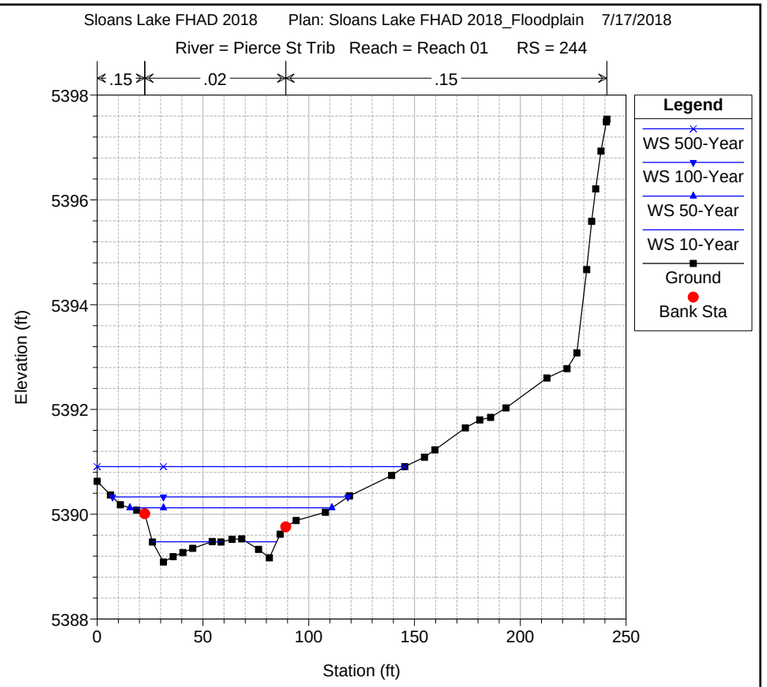
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 01 RS = 244
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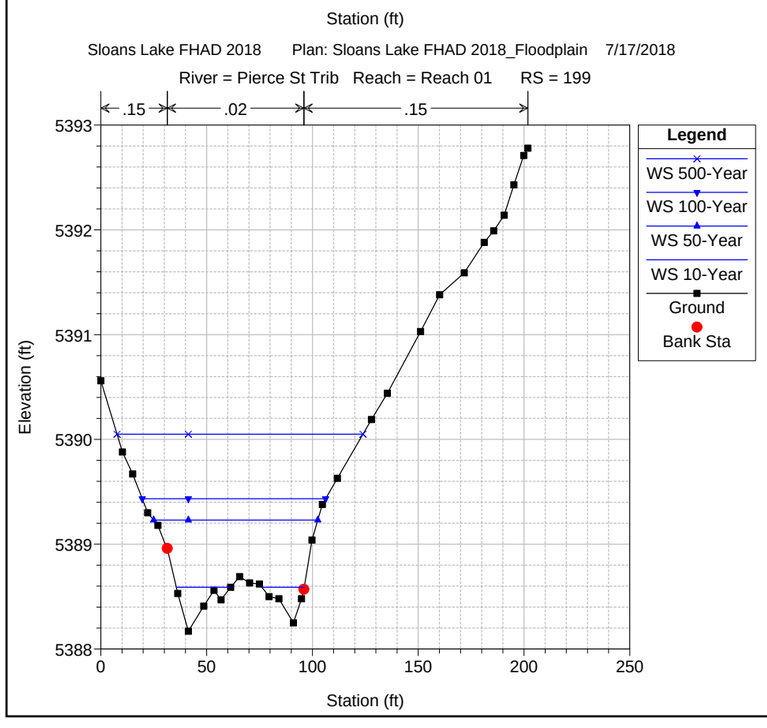
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)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River = Pierce St Trib Reach = Reach 01 RS = 199
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.02
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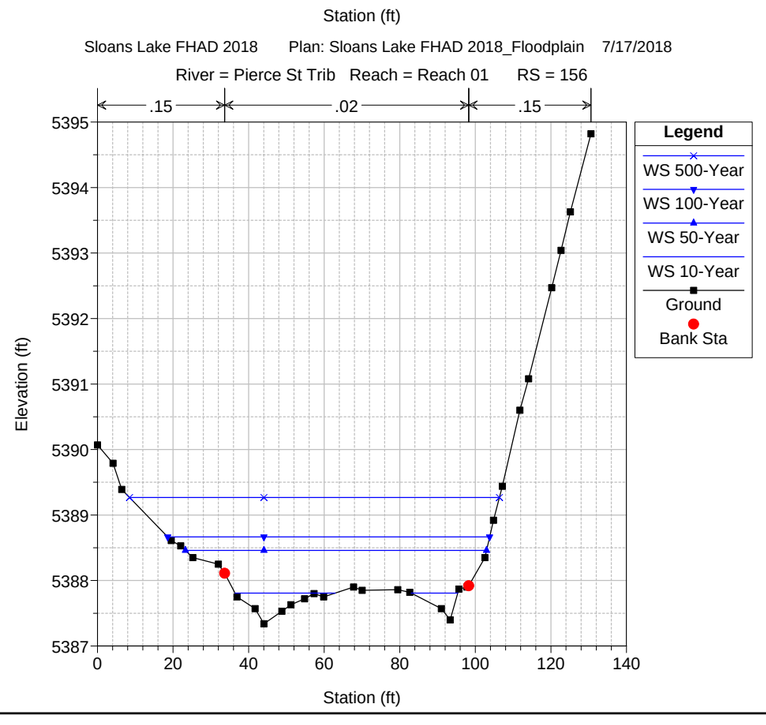
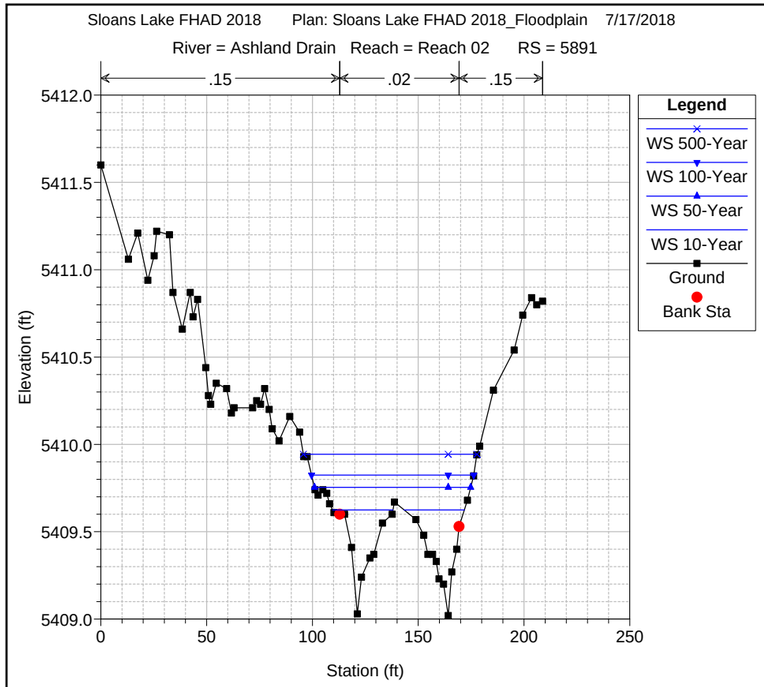
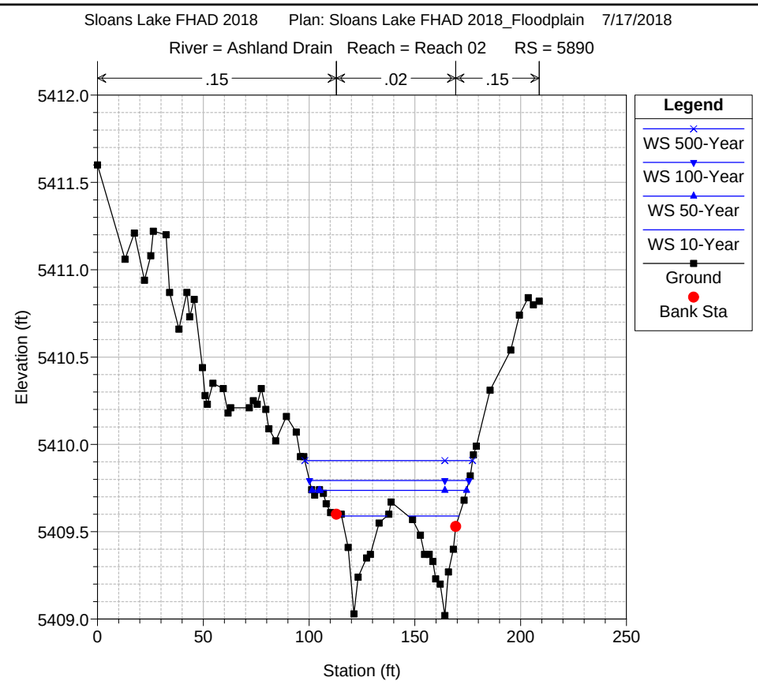
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Pierce St Trib Reach = Reach 01 RS = 156
.15
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

HEC-RAS Sections

Ashland Drainageway


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 5891
.15
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)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River = Ashland Drain Reach = Reach 02 RS = 5890
.15
.02
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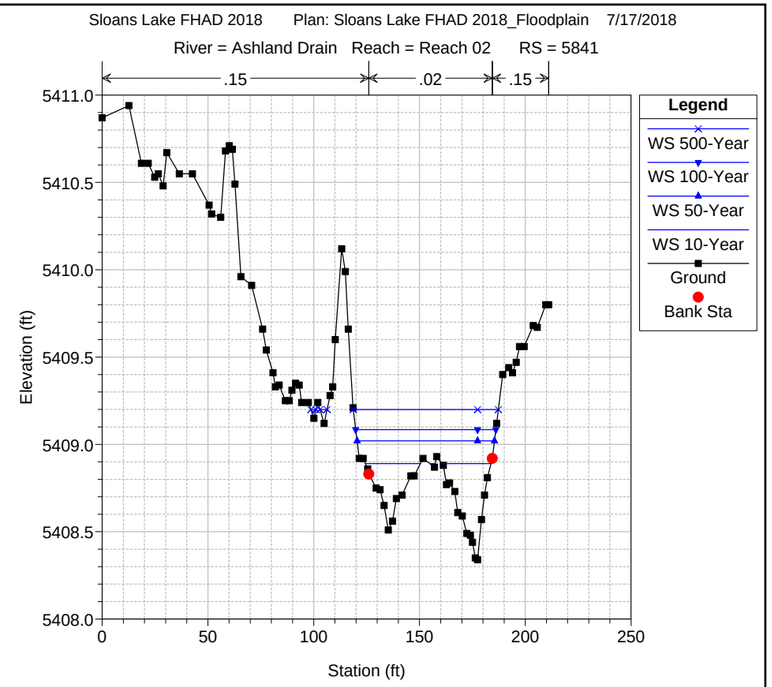
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)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River = Ashland Drain Reach = Reach 02 RS = 5841
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.02
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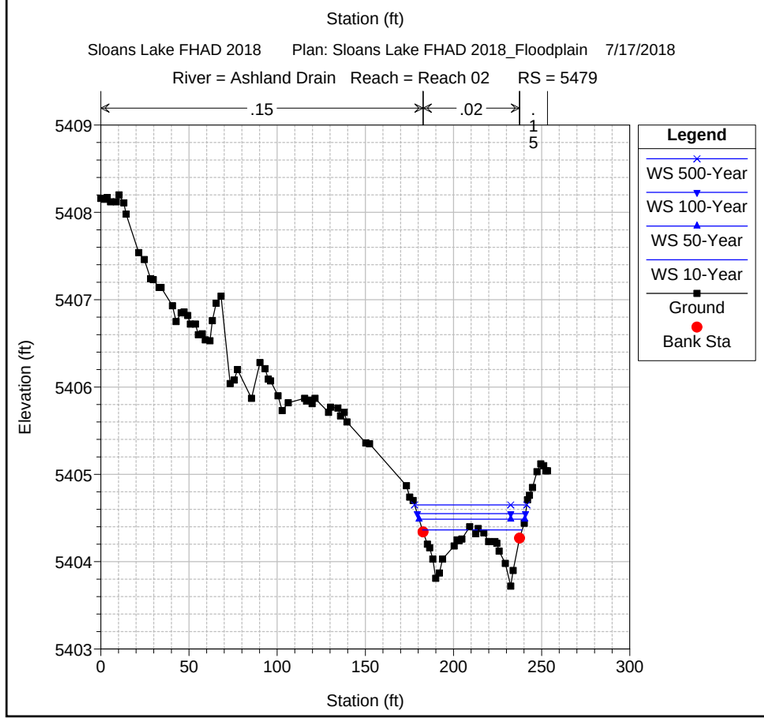
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)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River = Ashland Drain Reach = Reach 02 RS = 5479
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.02
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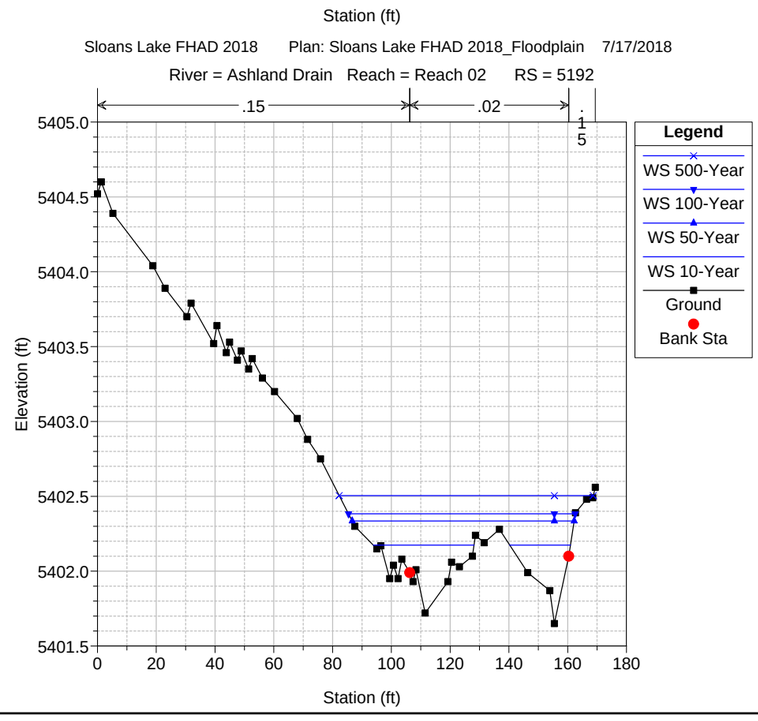
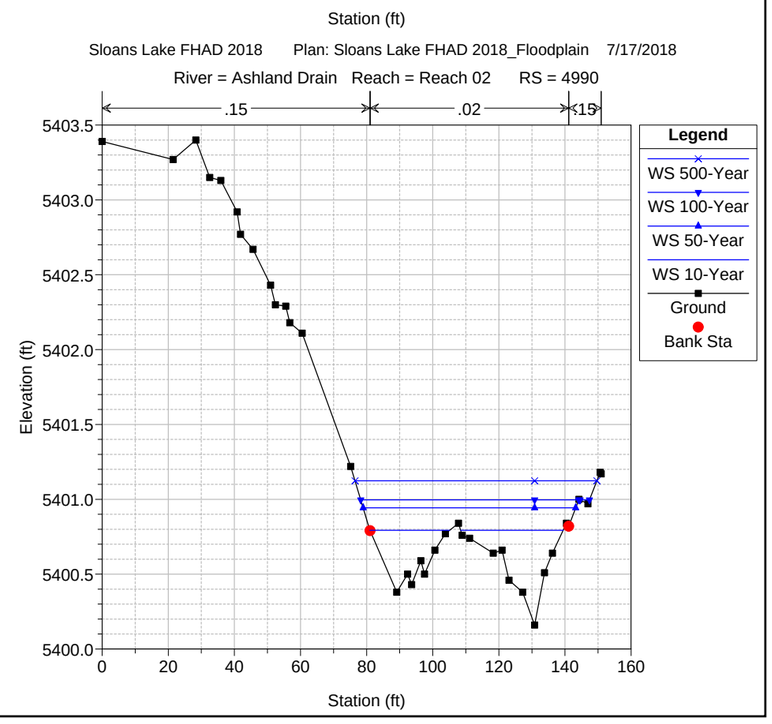
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 5192
.15
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 4990
.15
.02
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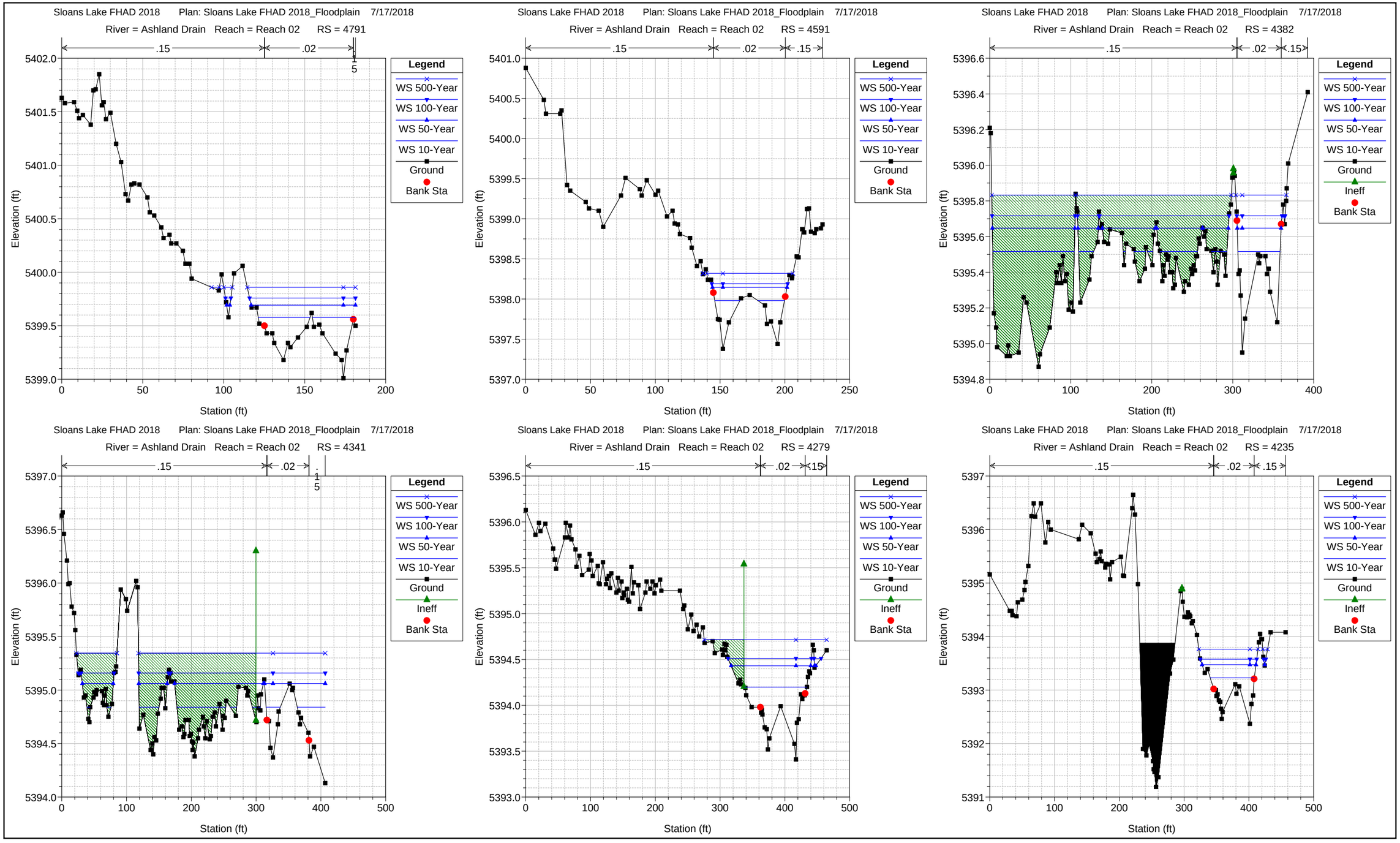
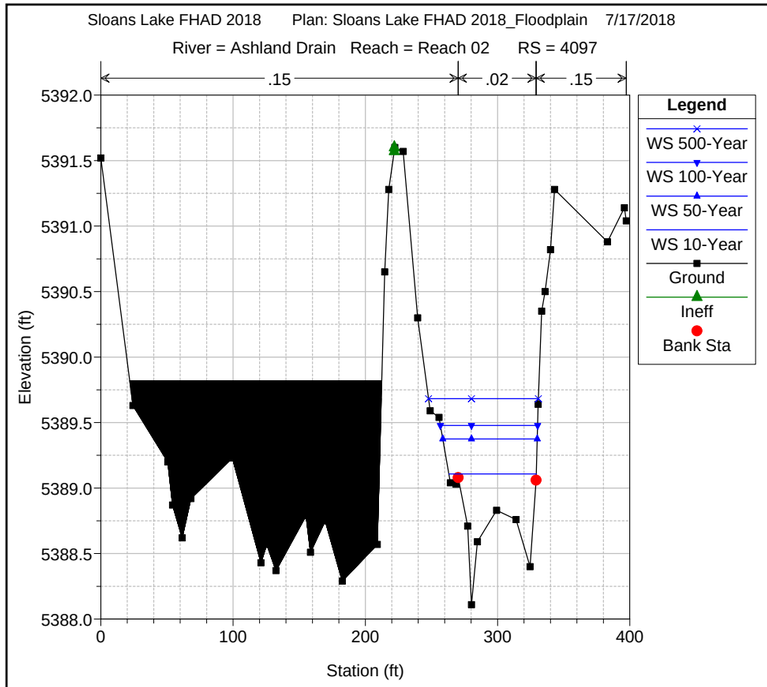
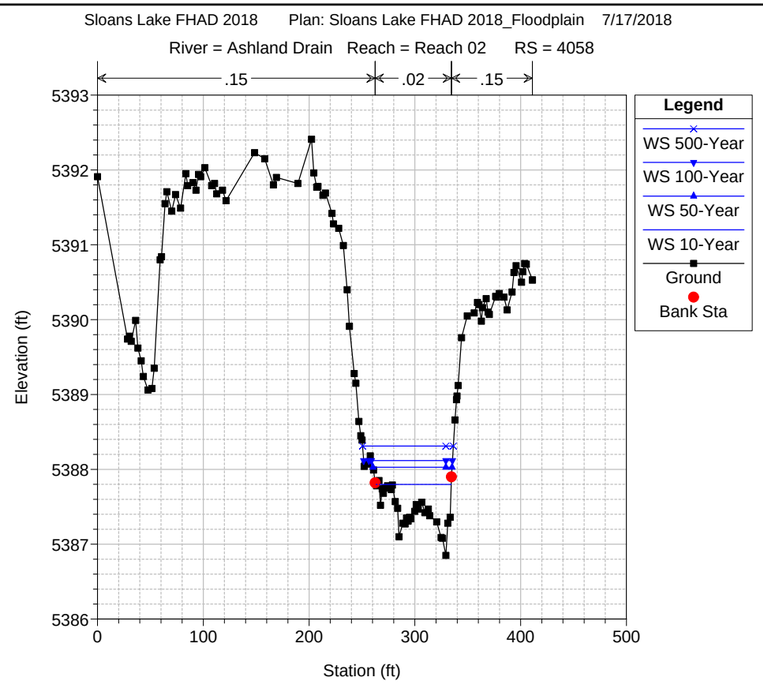
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 4791
.15
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 4591
.15
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 4382
.15
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 4341
.15
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 4279
.15
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 4235
.15
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 4097
.15
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 4058
.15
.02
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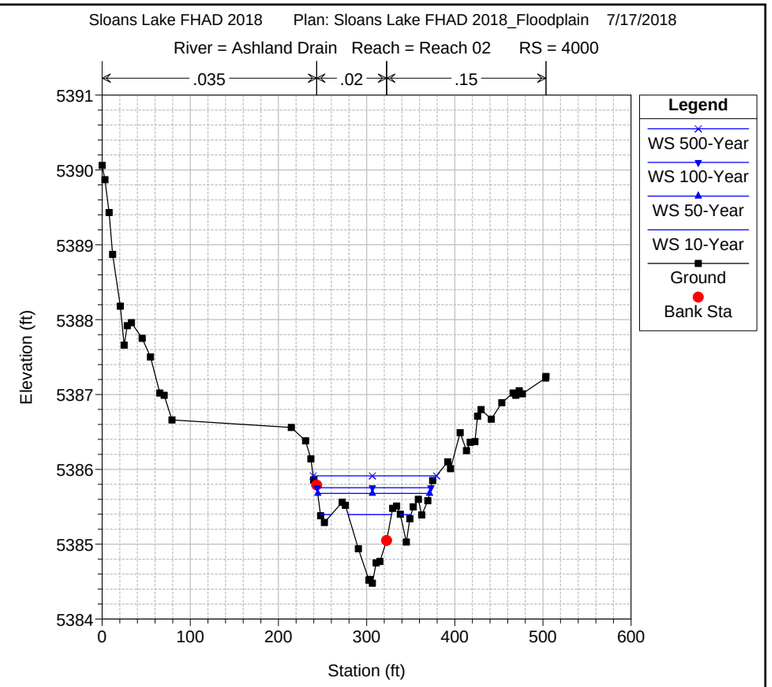
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 4000
.035
.02
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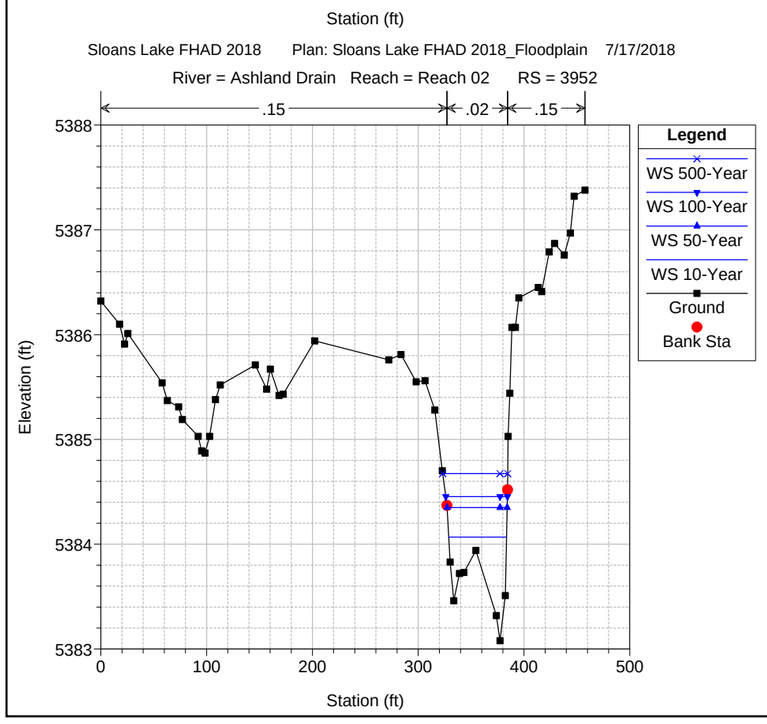
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 3952
.15
.02
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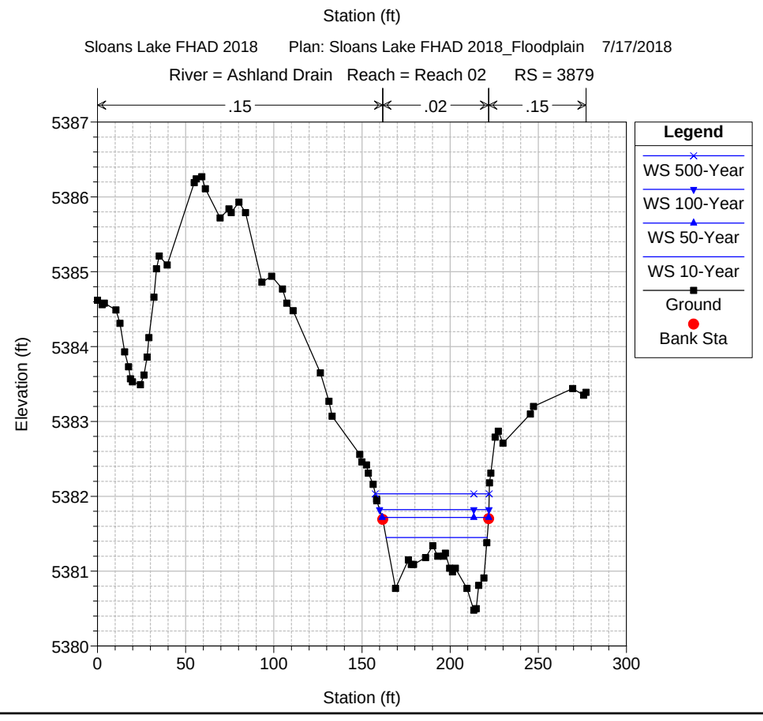
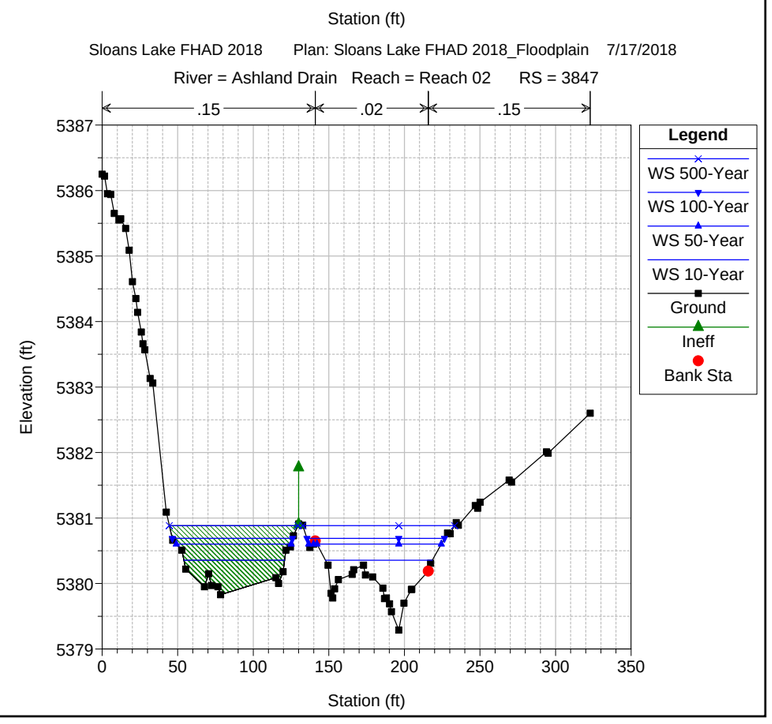
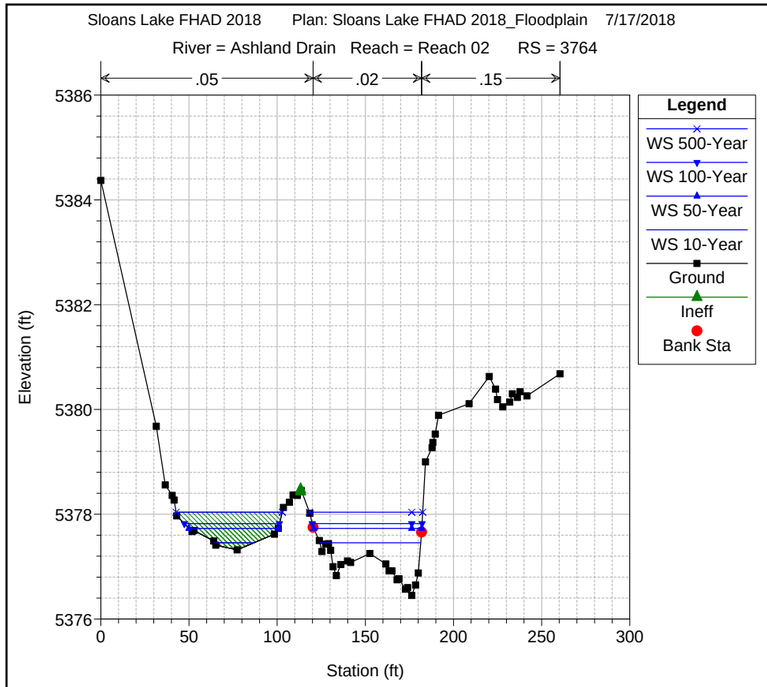
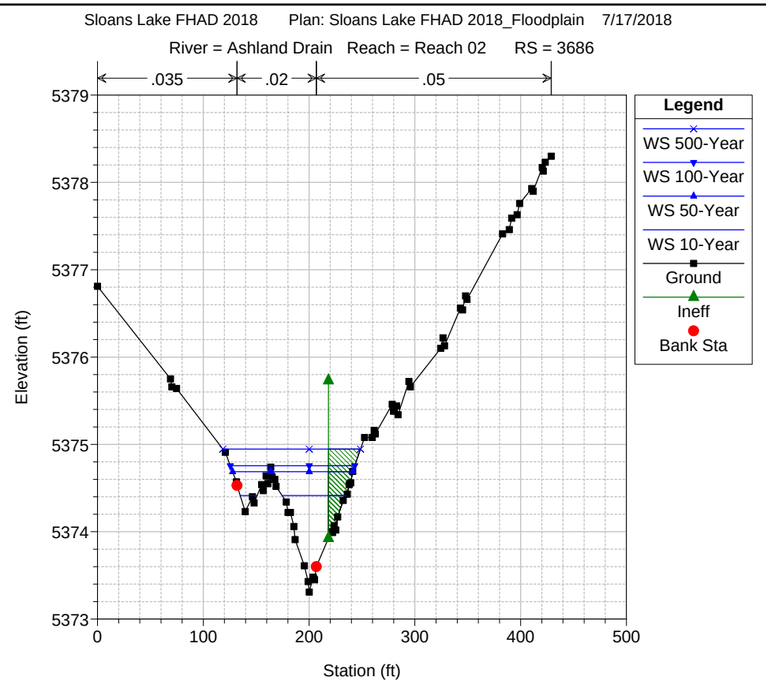
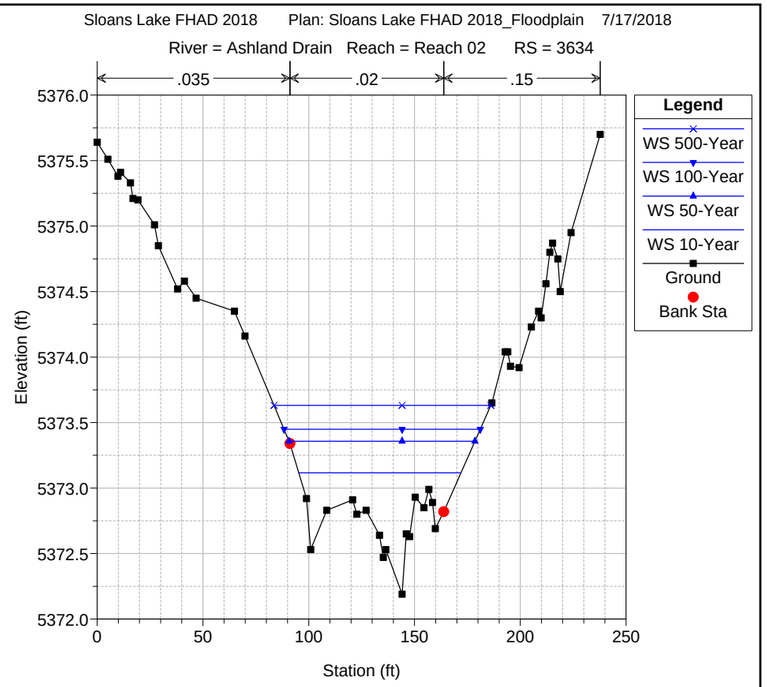
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

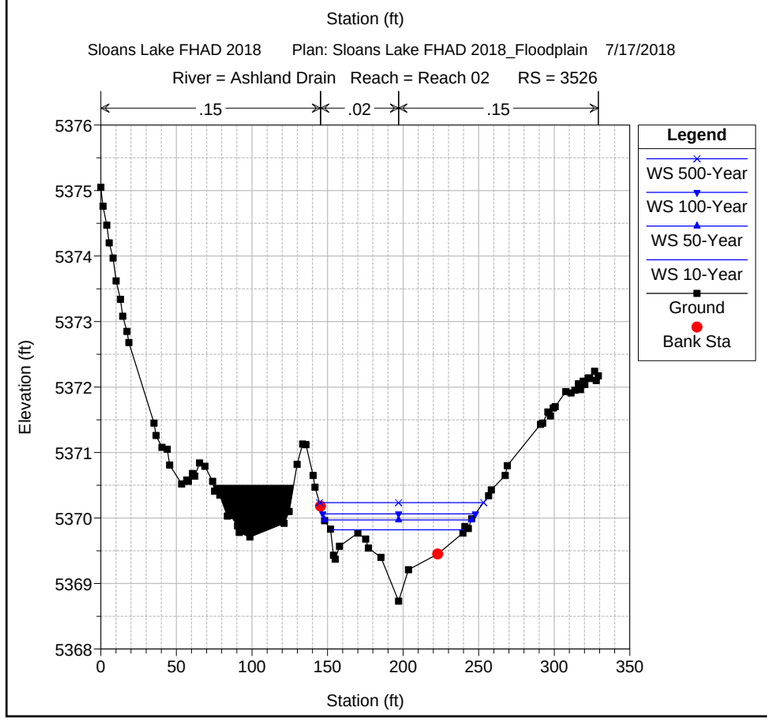

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 3879
.15
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

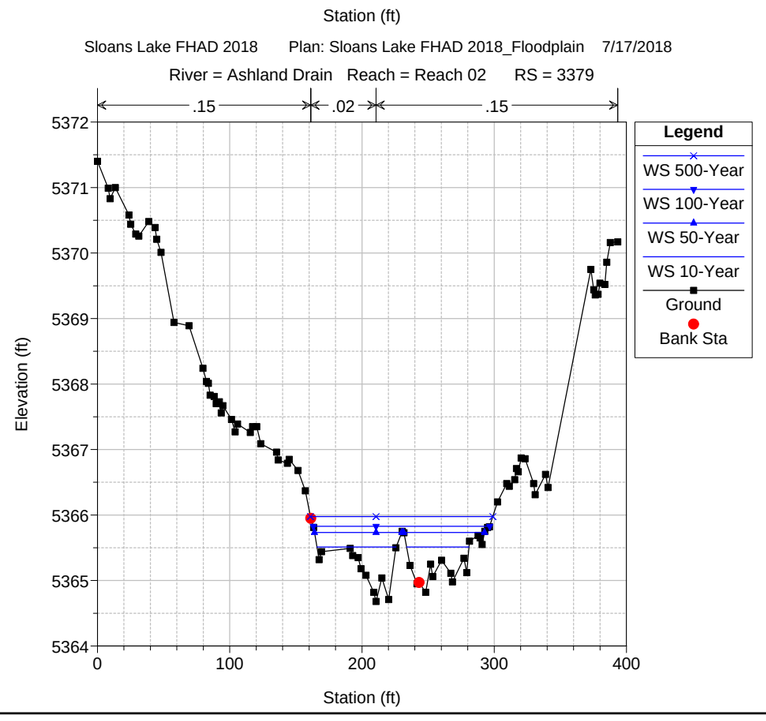

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 3847
.15
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

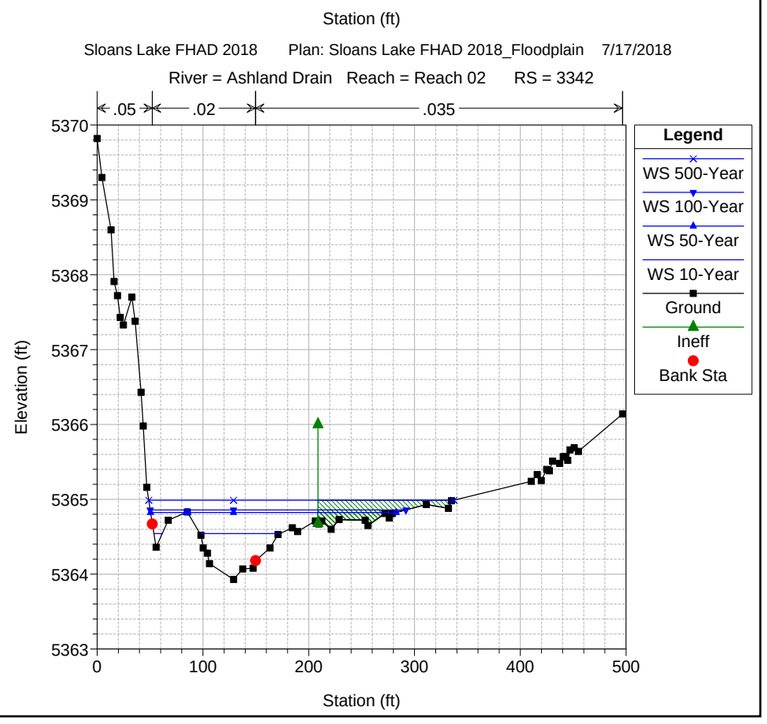

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 3764
.05
.02
.15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta

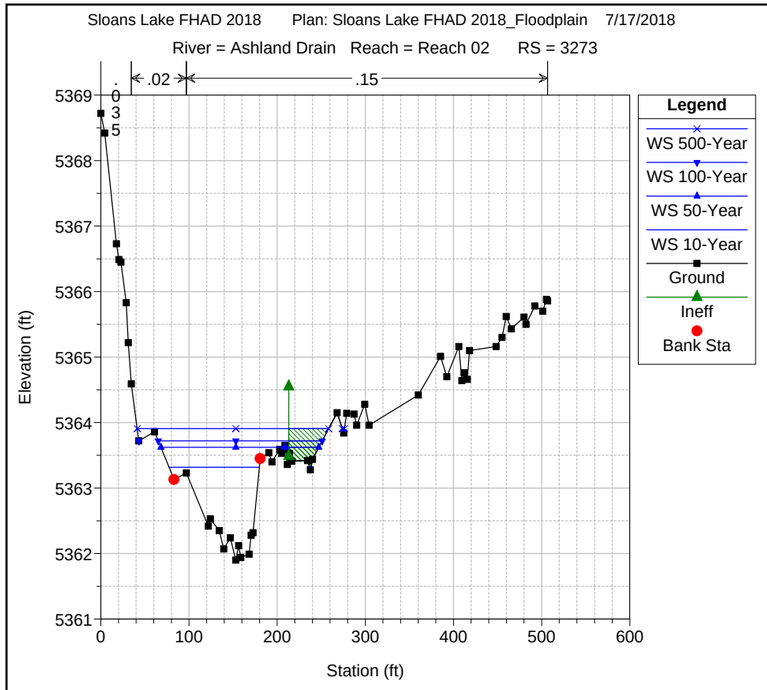

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 3686
.035
.02
.05
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta

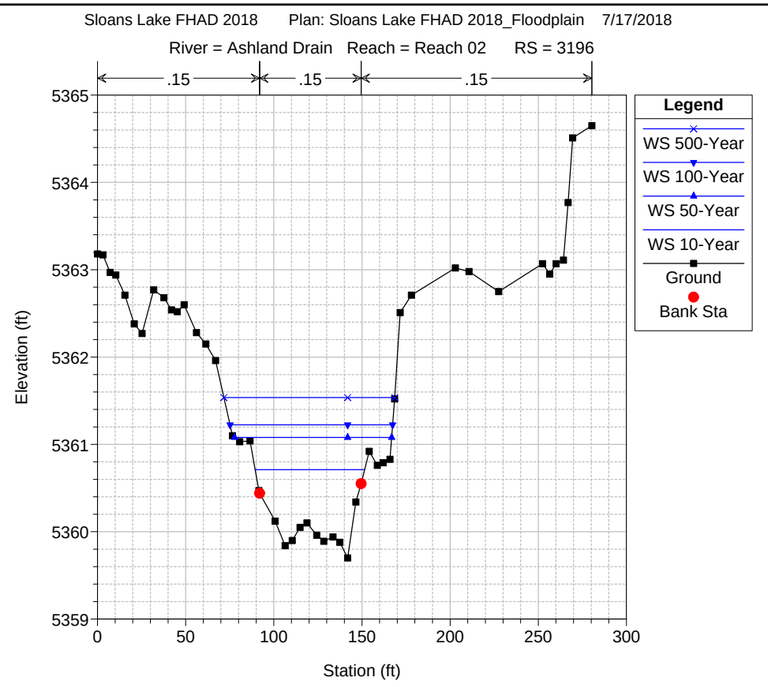

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 3634
.035
.02
.15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta

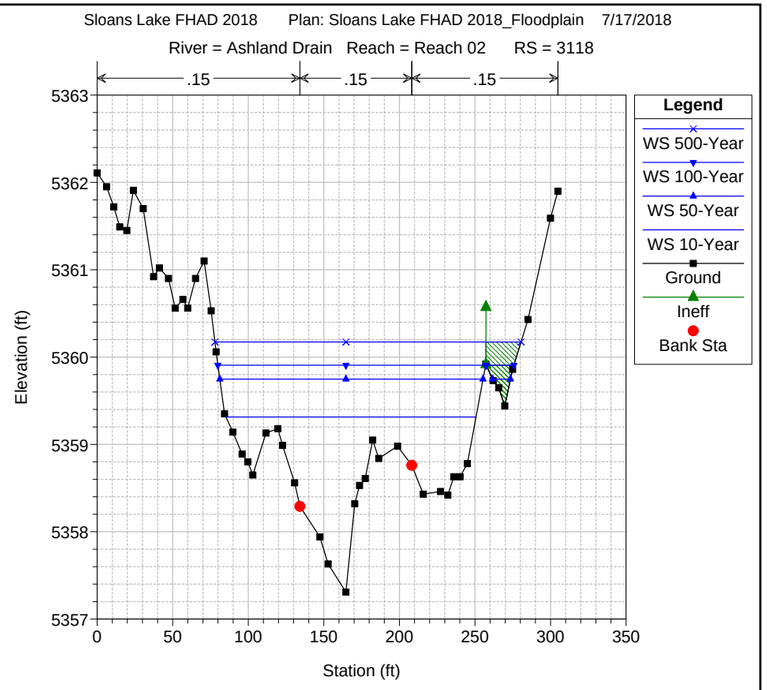

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 3526
.15
.02
.15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta

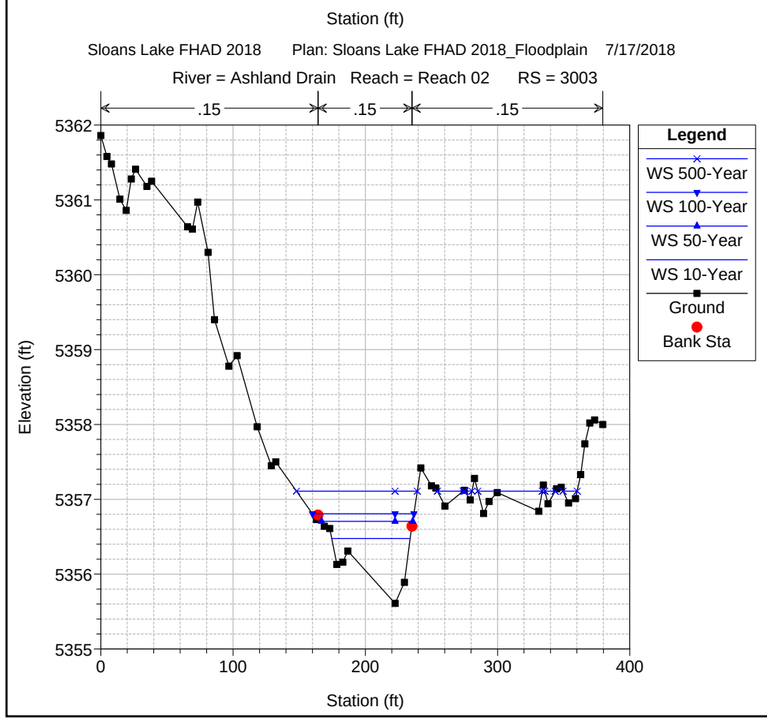

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 3379
.15
.02
.15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta

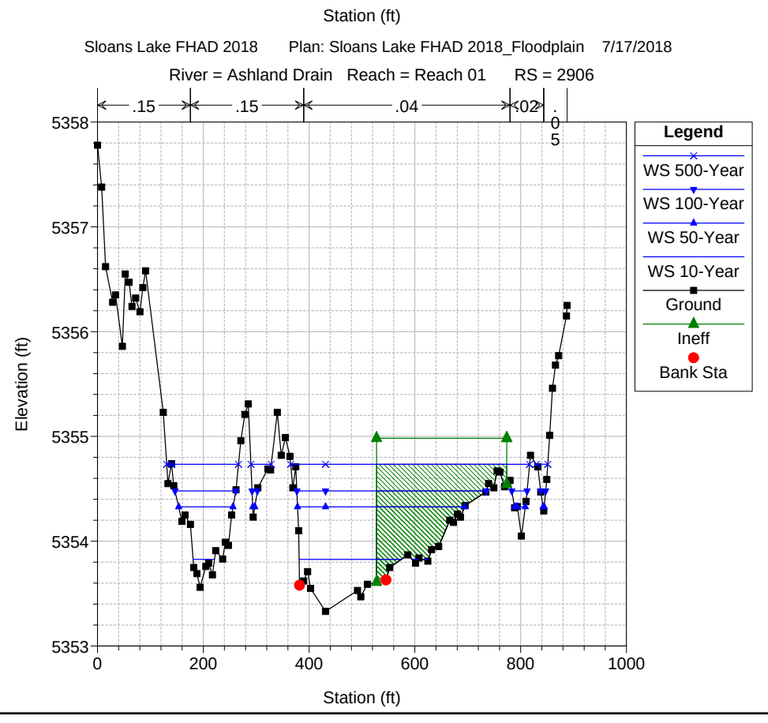

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 3342
.05
.02
.035
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta

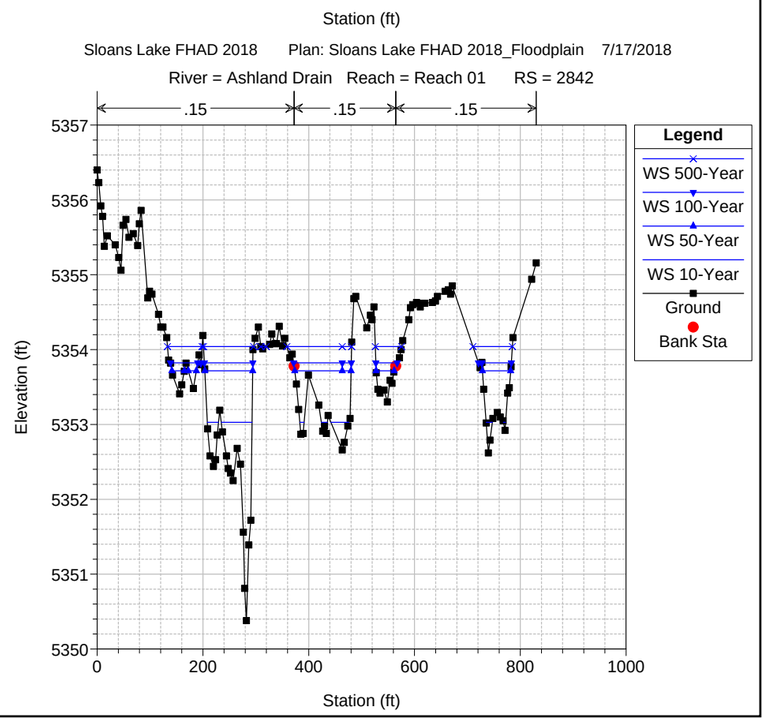

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 3273
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

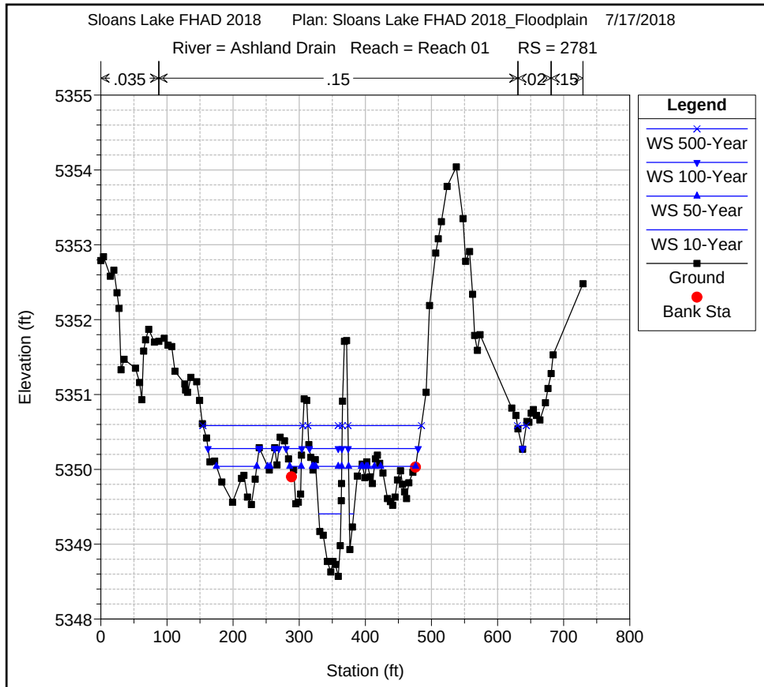

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 3196
.15
.15
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

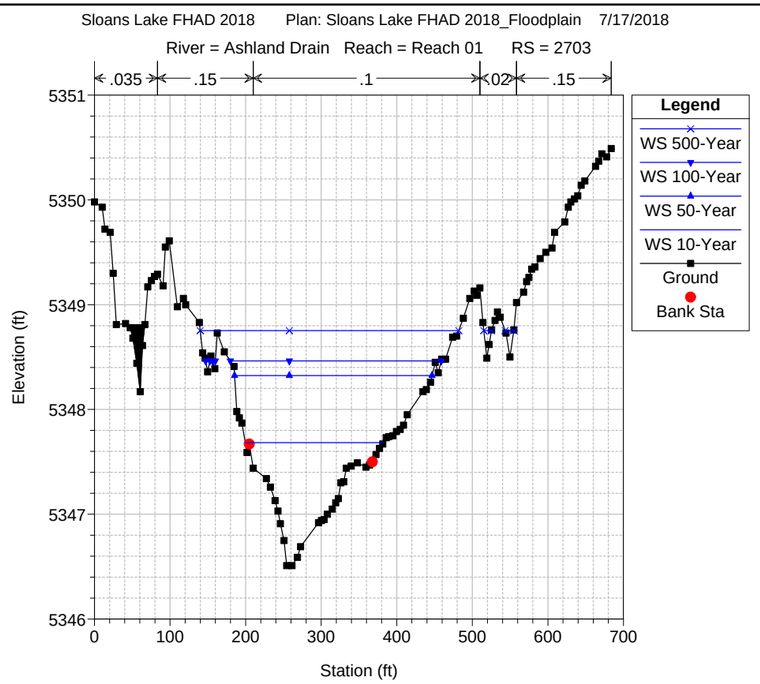

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 3118
.15
.15
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

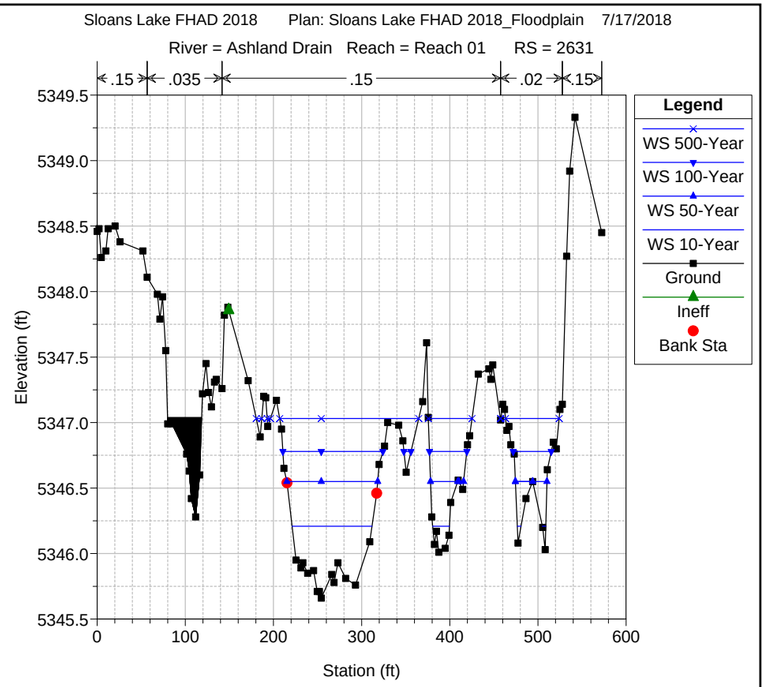

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 02 RS = 3003
.15
.15
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

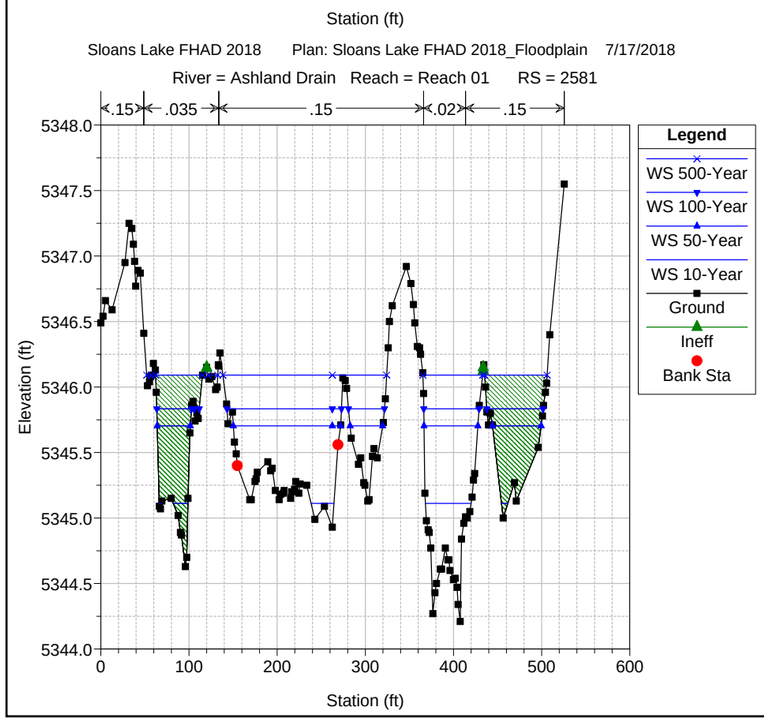

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 2906
.15
.15
.04
.02
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

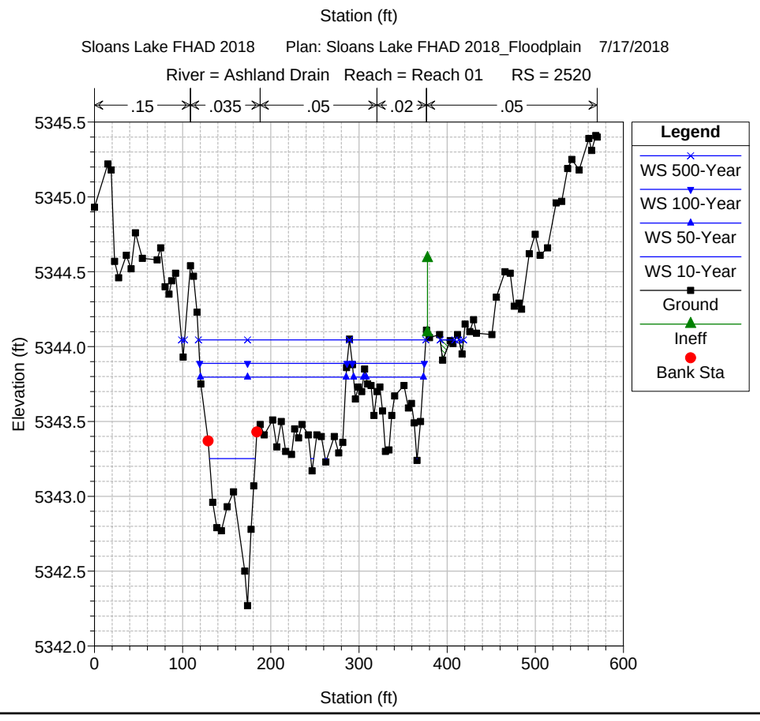

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 2842
.15
.15
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

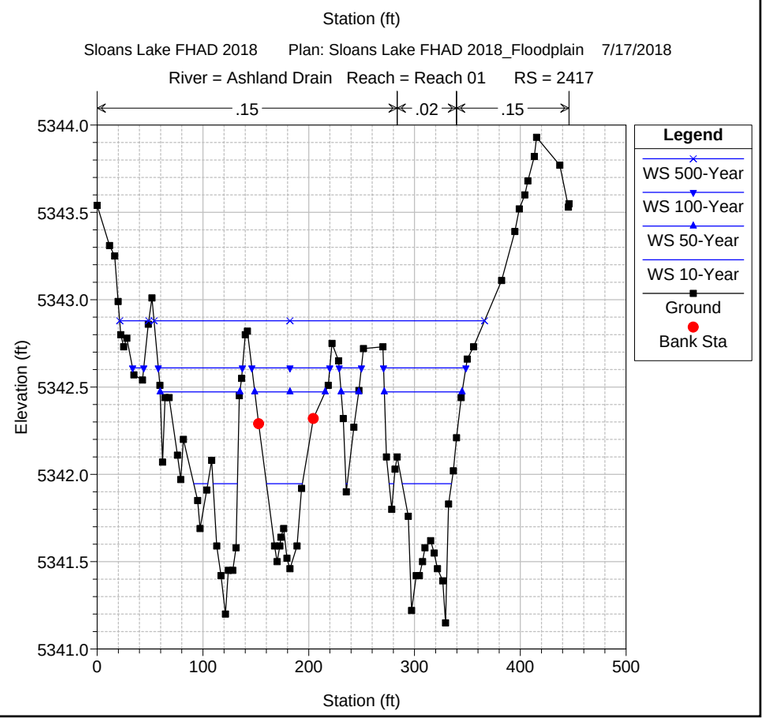

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 2781
.035
.15
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

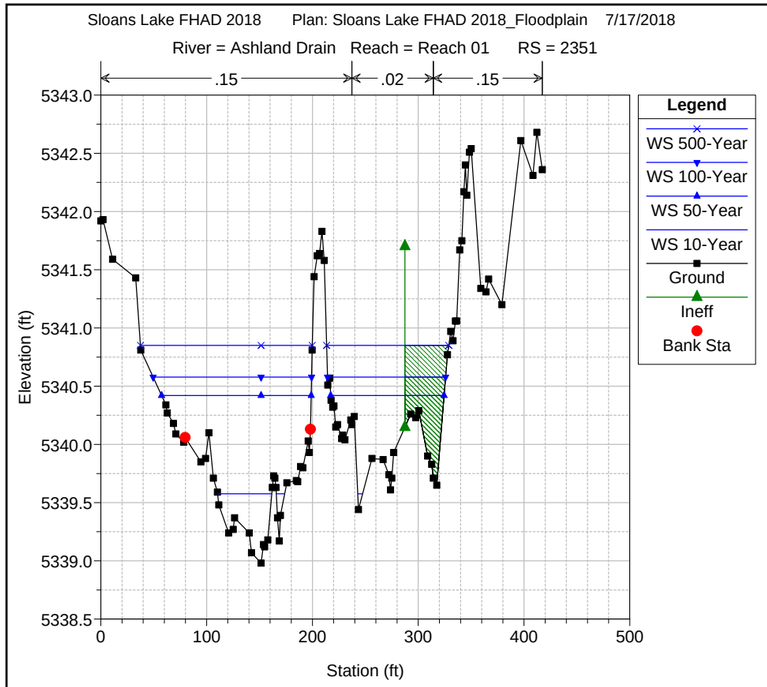

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 2703
.035
.15
.1
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

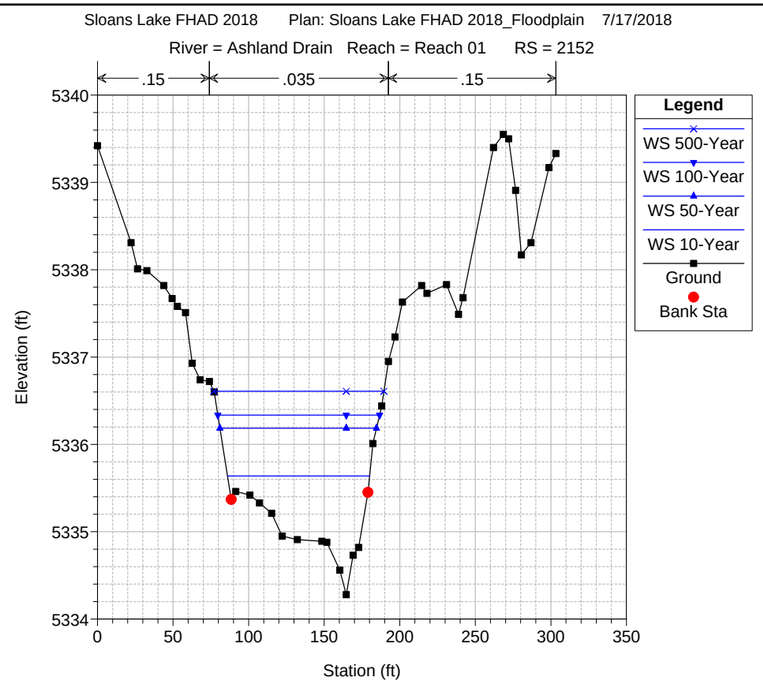

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 2631
.15
.035
.15
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

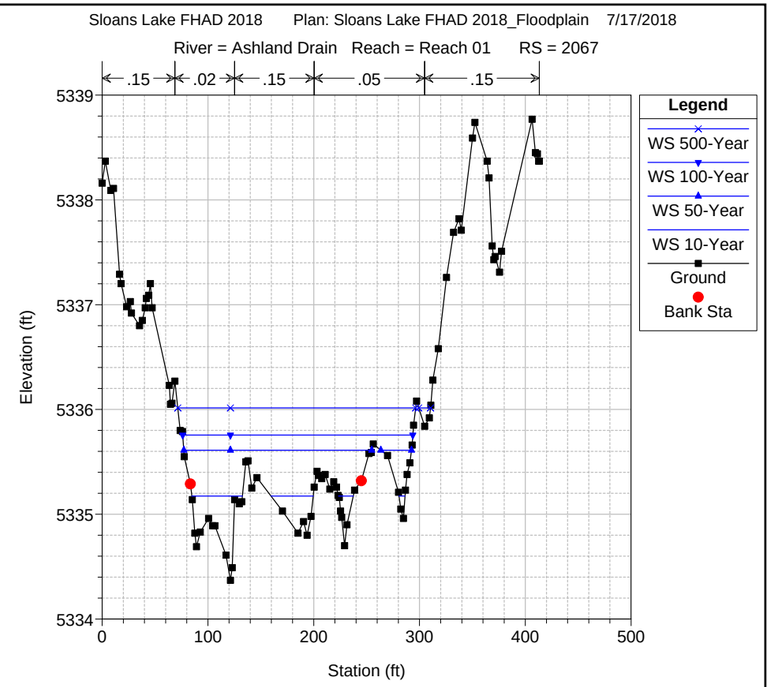

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 2581
.15
.035
.15
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

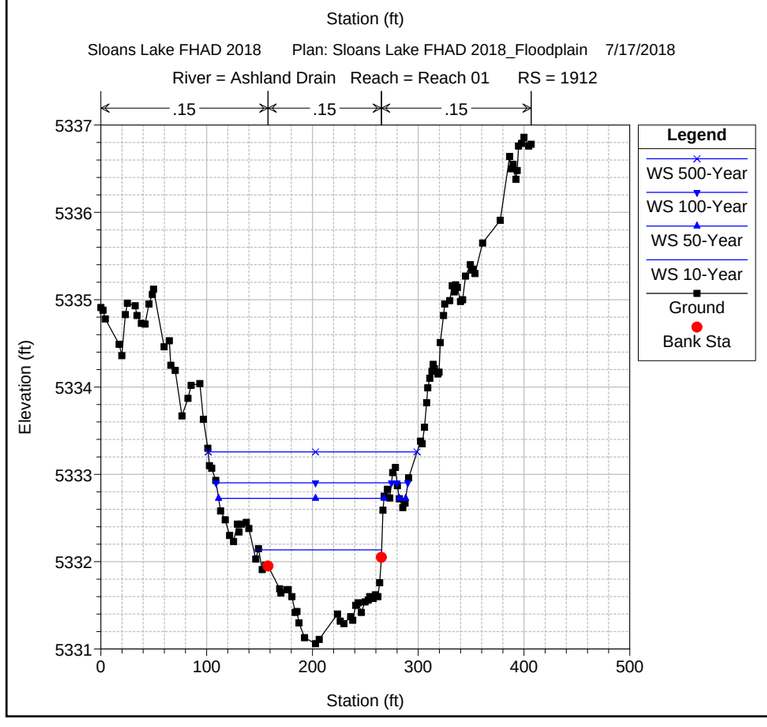

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 2520
.15
.035
.05
.02
.05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

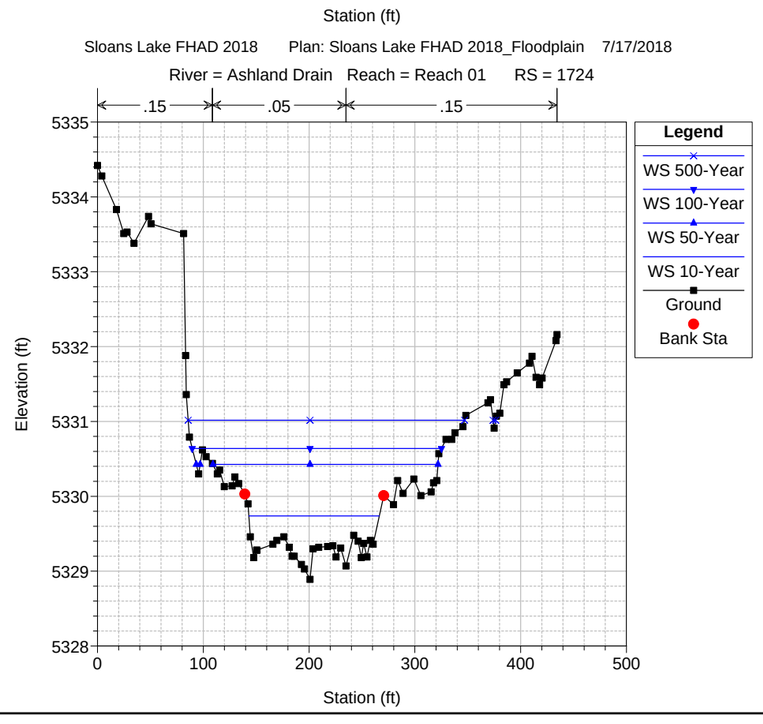

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 2417
.15
.02
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

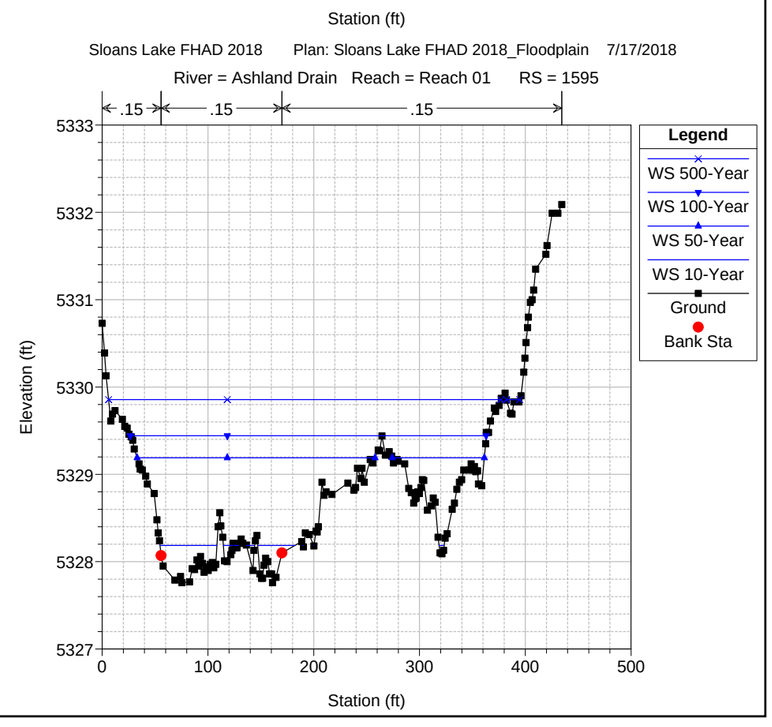

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 2351
.15 .02 .15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

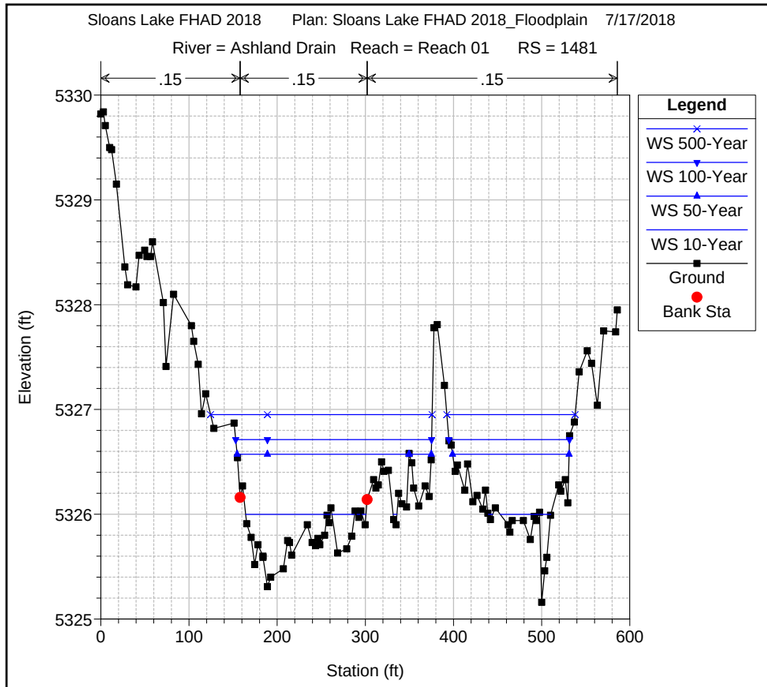

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 2152
.15 .035 .15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 2067
.15 .02 .15 .05 .15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 1912
.15 .15 .15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 1724
.15 .05 .15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 1595
.15 .15 .15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)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River = Ashland Drain Reach = Reach 01 RS = 1481
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.15
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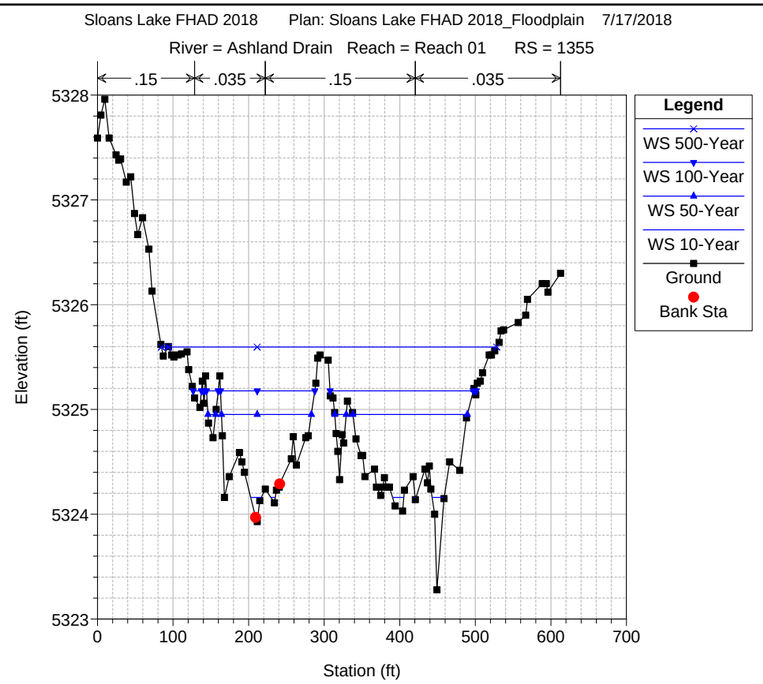
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 1355
.15
.035
.15
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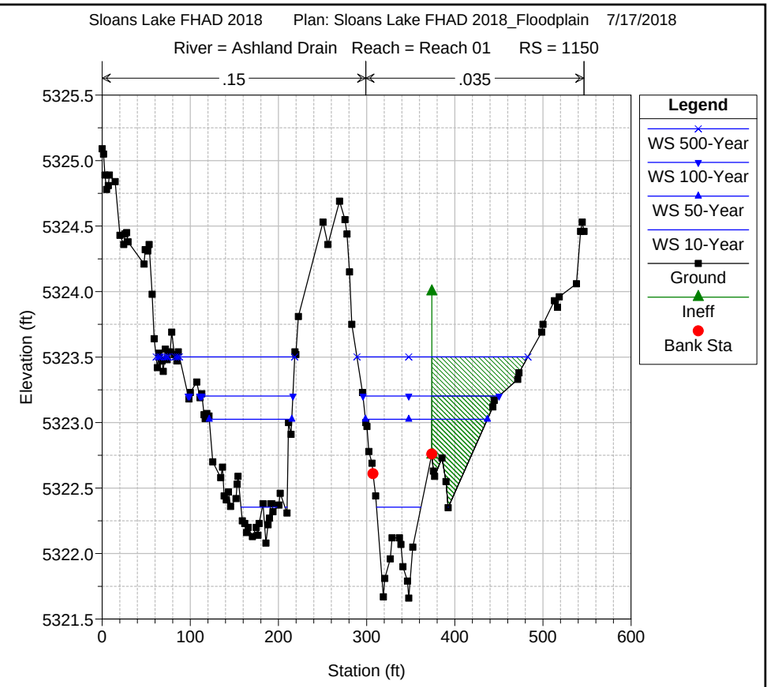
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 1150
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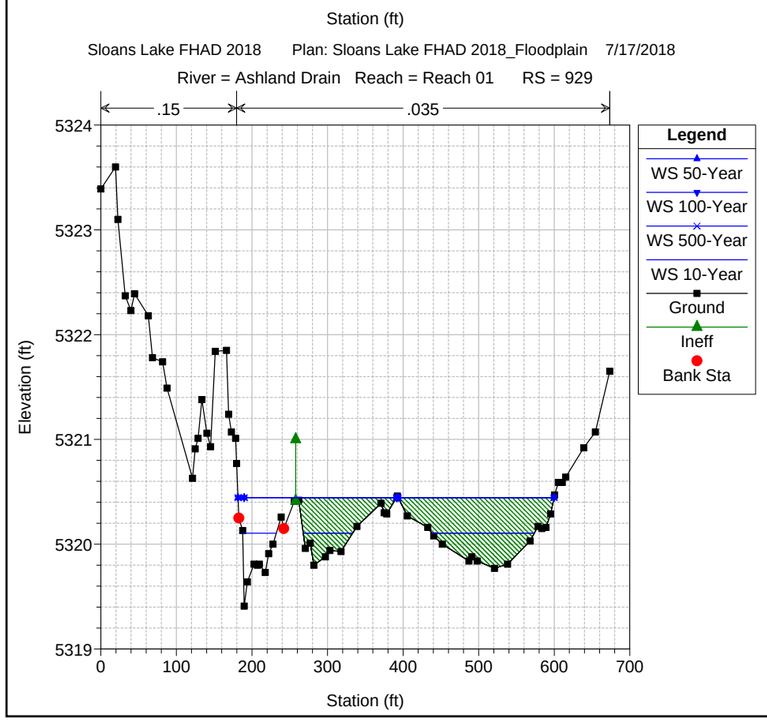
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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River = Ashland Drain Reach = Reach 01 RS = 929
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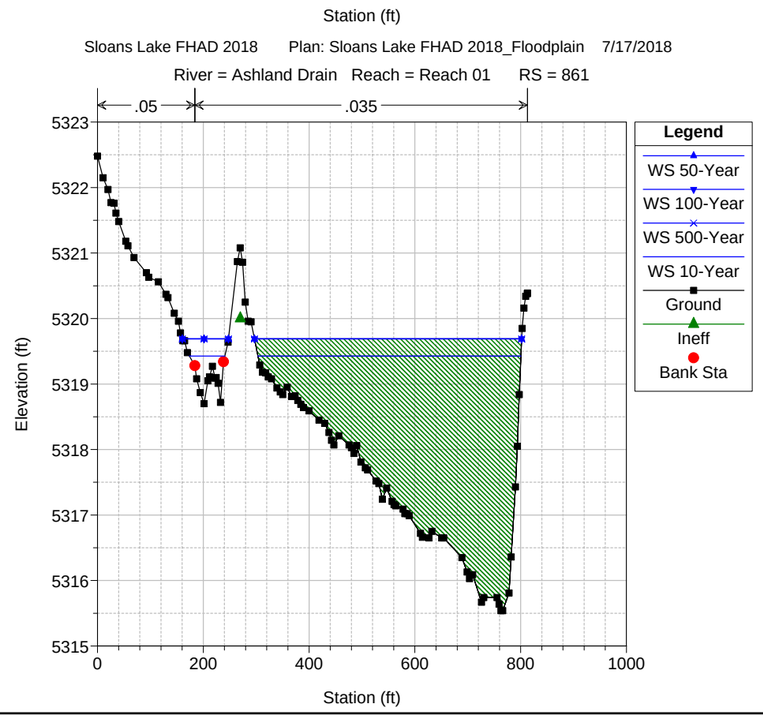
Legend
WS 50-Year
WS 100-Year
WS 500-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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River = Ashland Drain Reach = Reach 01 RS = 861
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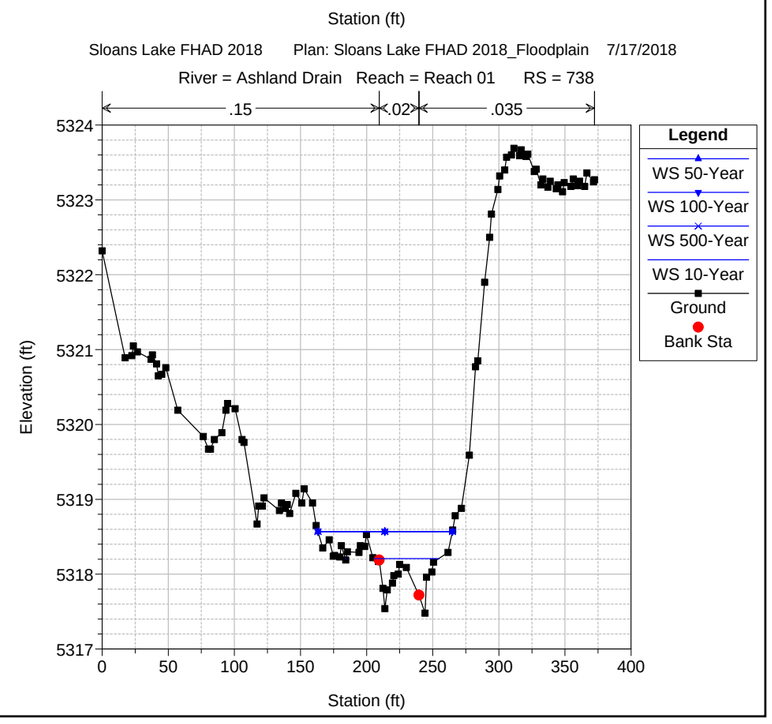
.035
Legend
WS 50-Year
WS 100-Year
WS 500-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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River = Ashland Drain Reach = Reach 01 RS = 738
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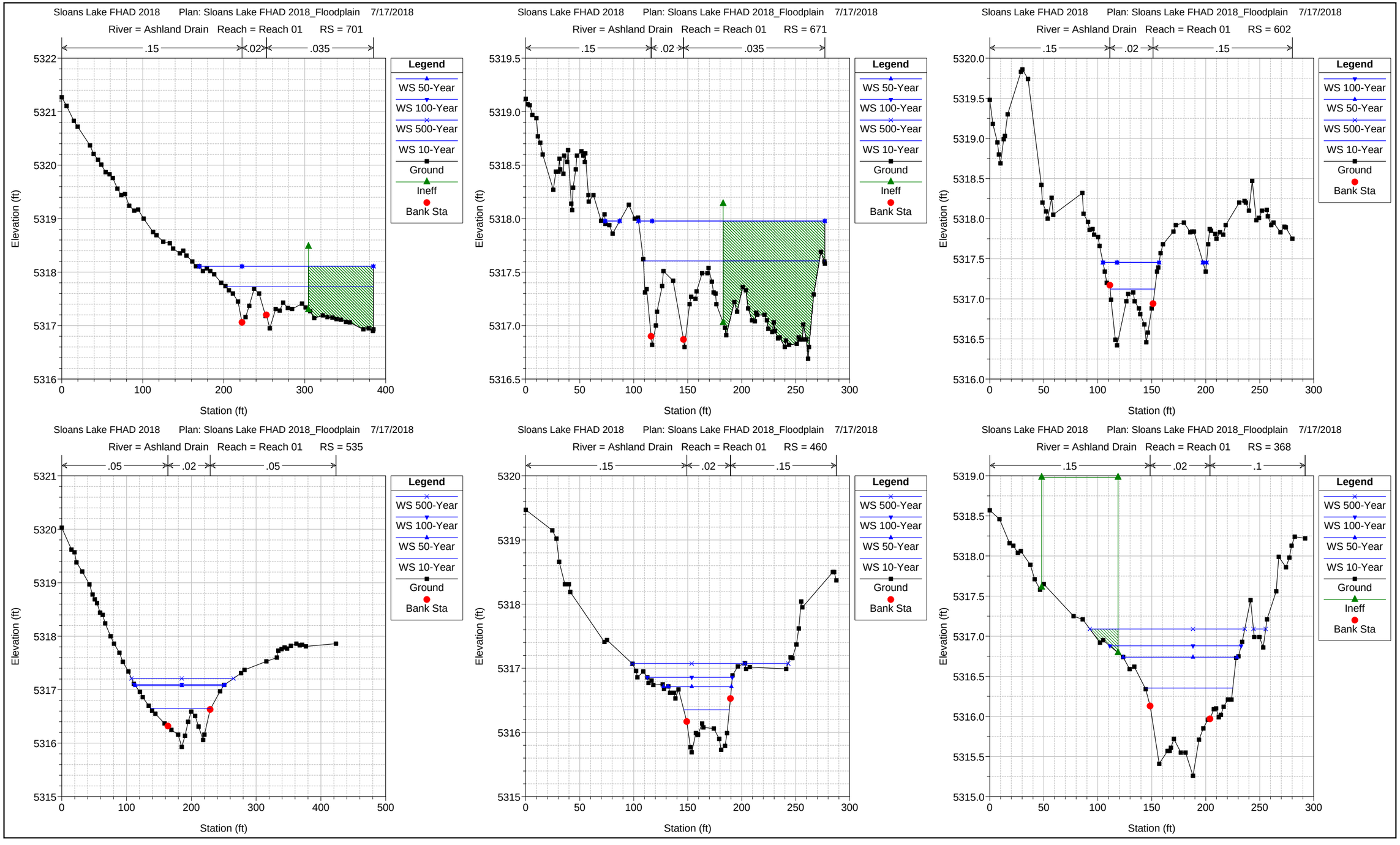
.02
.035
Legend
WS 50-Year
WS 100-Year
WS 500-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)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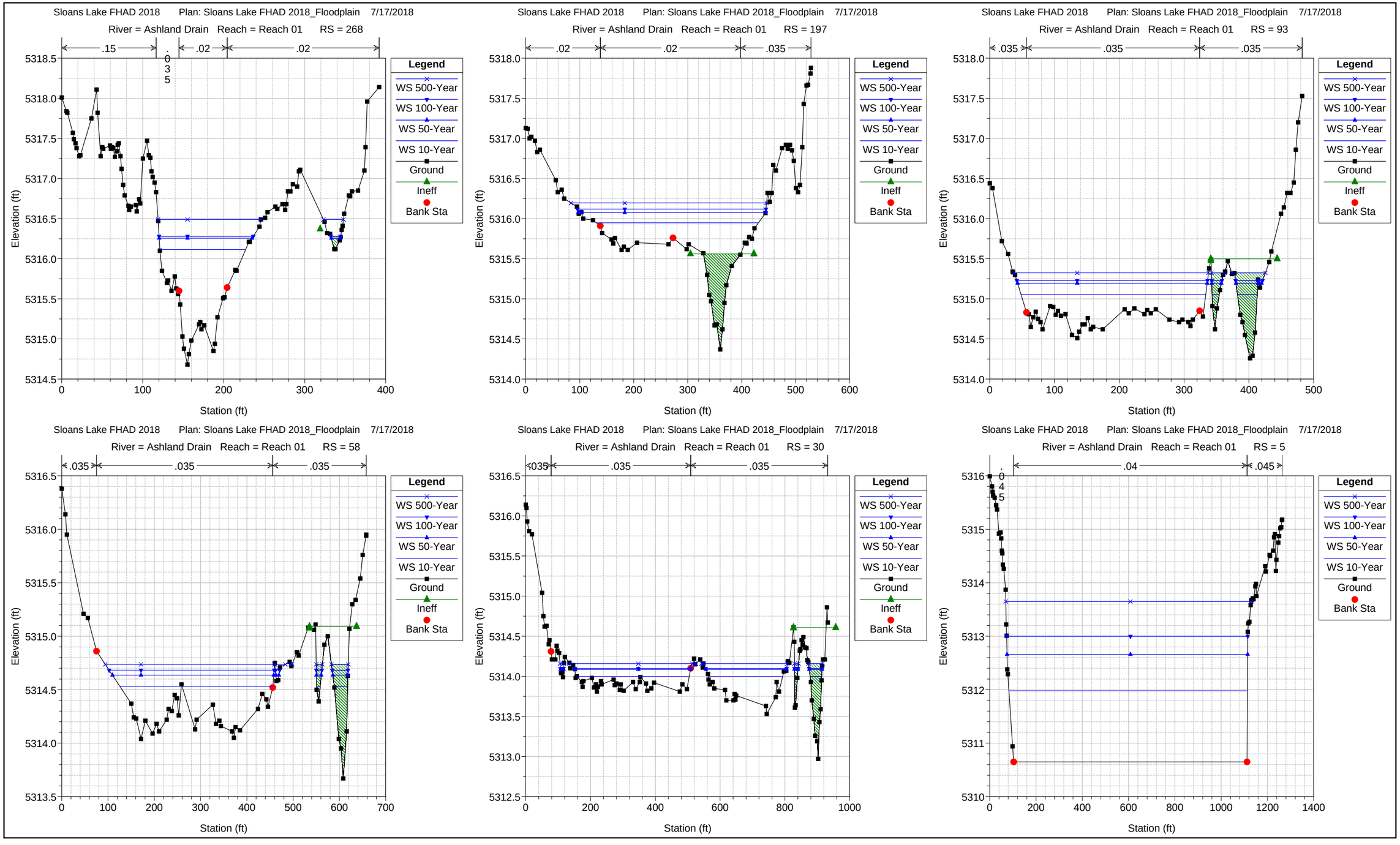
River = Ashland Drain Reach = Reach 01 RS = 701
.15 .02 .035
Legend
WS 50-Year
WS 100-Year
WS 500-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 671
.15 .02 .035
Legend
WS 50-Year
WS 100-Year
WS 500-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 602
.15 .02 .15
Legend
WS 100-Year
WS 50-Year
WS 500-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 535
.05 .02 .05
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 460
.15 .02 .15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 368
.15 .02 .1
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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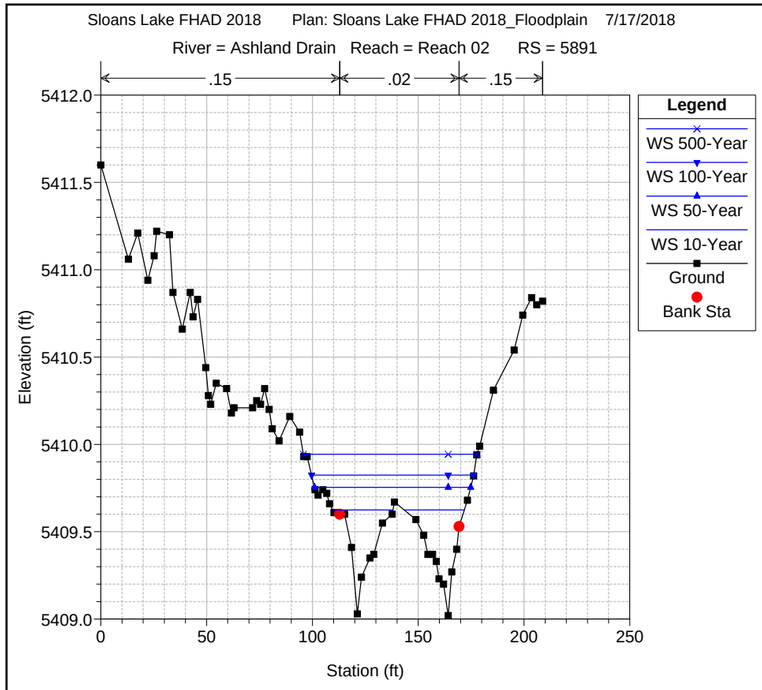
River = Ashland Drain Reach = Reach 01 RS = 268
.15
.035
.02
.02
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 197
.02
.02
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 93
.035
.035
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 58
.035
.035
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 30
.035
.035
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Ashland Drain Reach = Reach 01 RS = 5
.04
.045
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

HEC-RAS Sections

Gray Street Tributary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River = Ashland Drain Reach = Reach 02 RS = 5891
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.02
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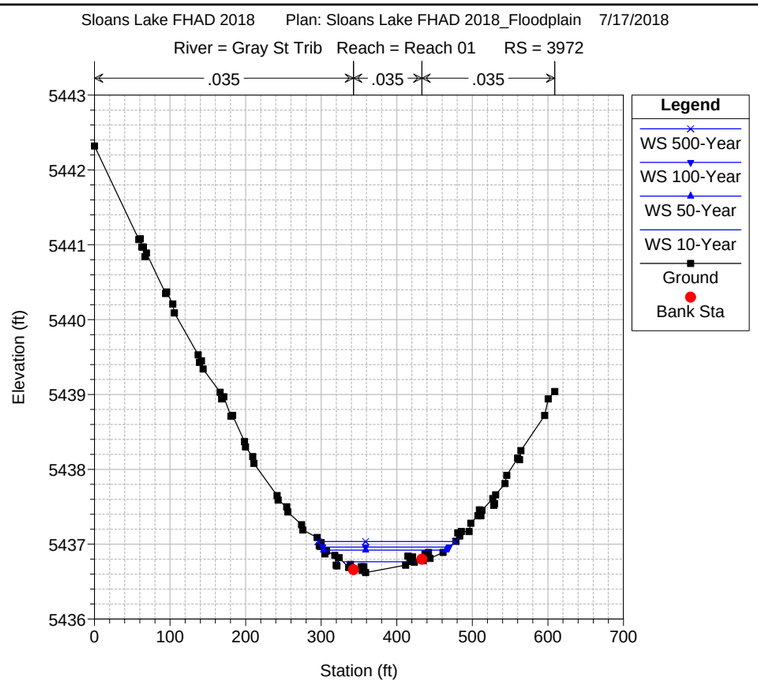
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)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River = Gray St Trib Reach = Reach 01 RS = 3972
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.035
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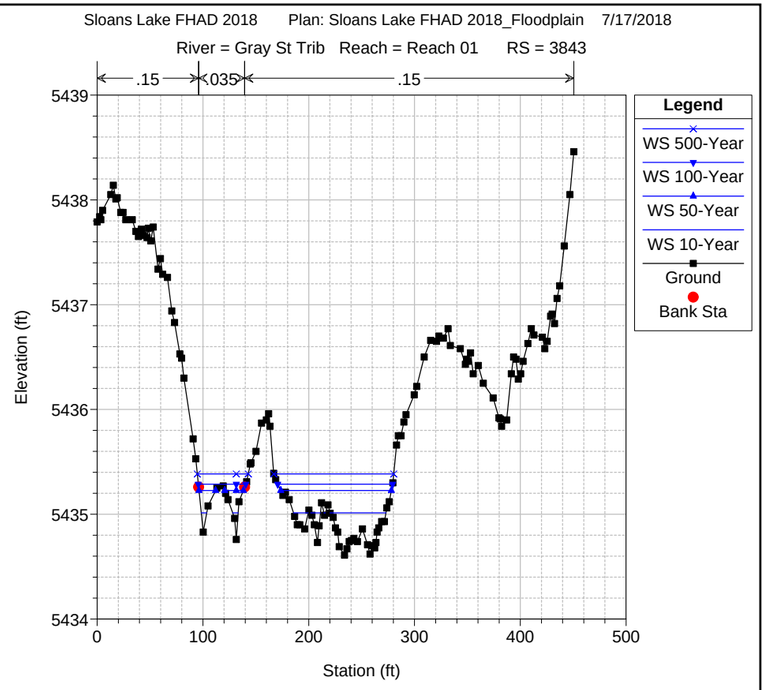
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 3843
.15
035
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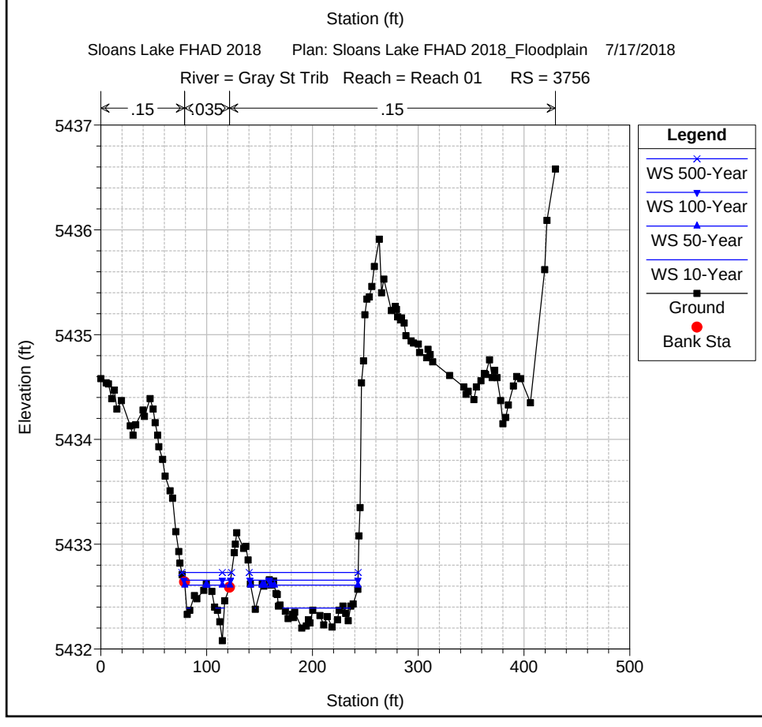
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 3756
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035
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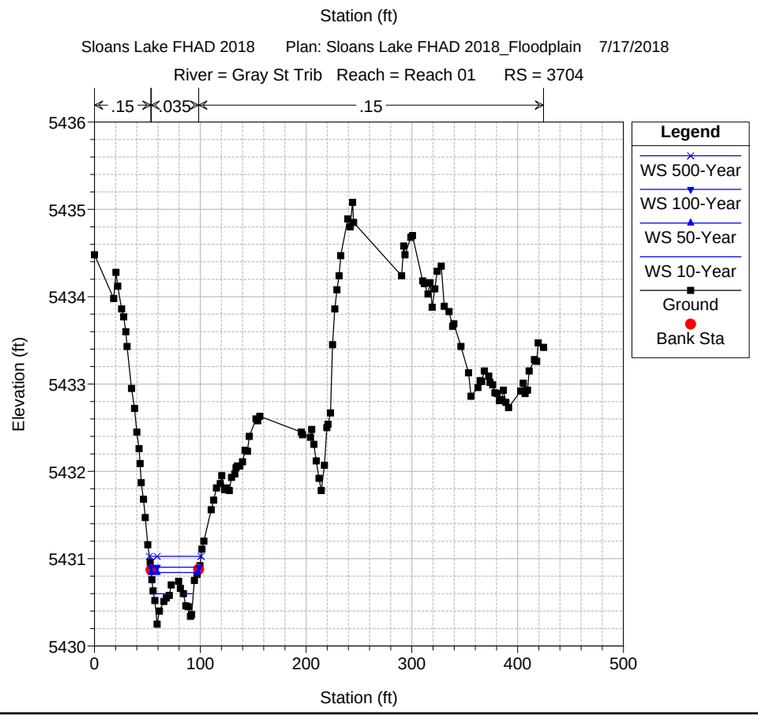
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 3704
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035
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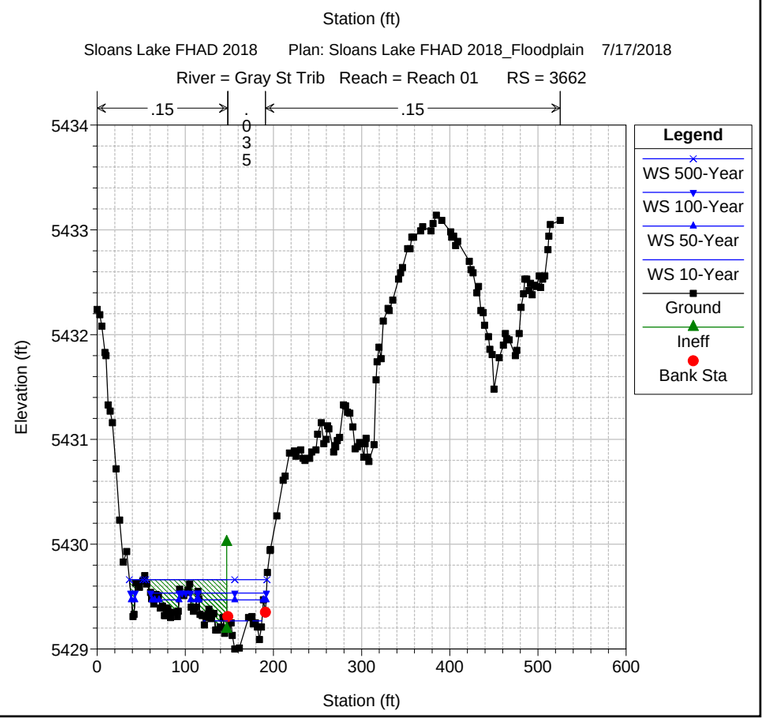
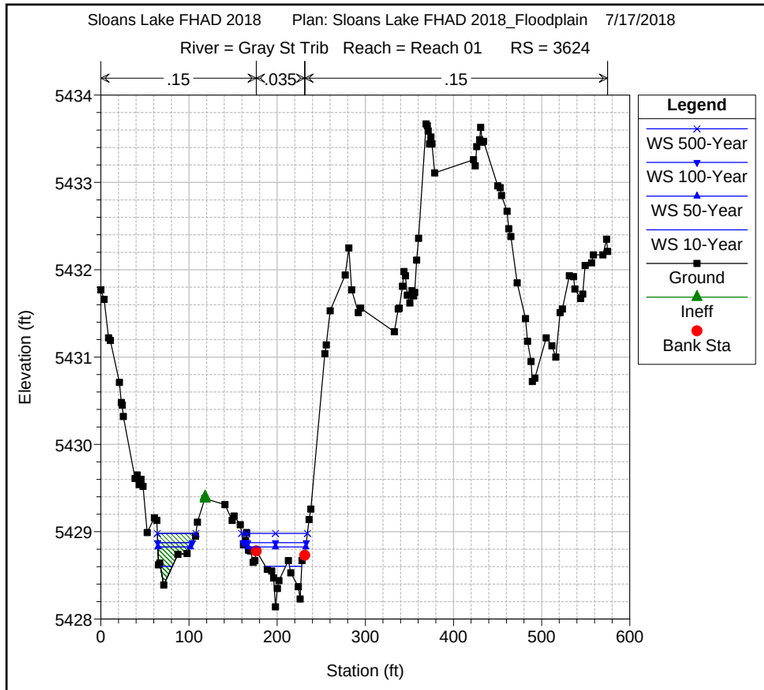
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 3662
.15
.0
35
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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River = Gray St Trib Reach = Reach 01 RS = 3624
.15
.035
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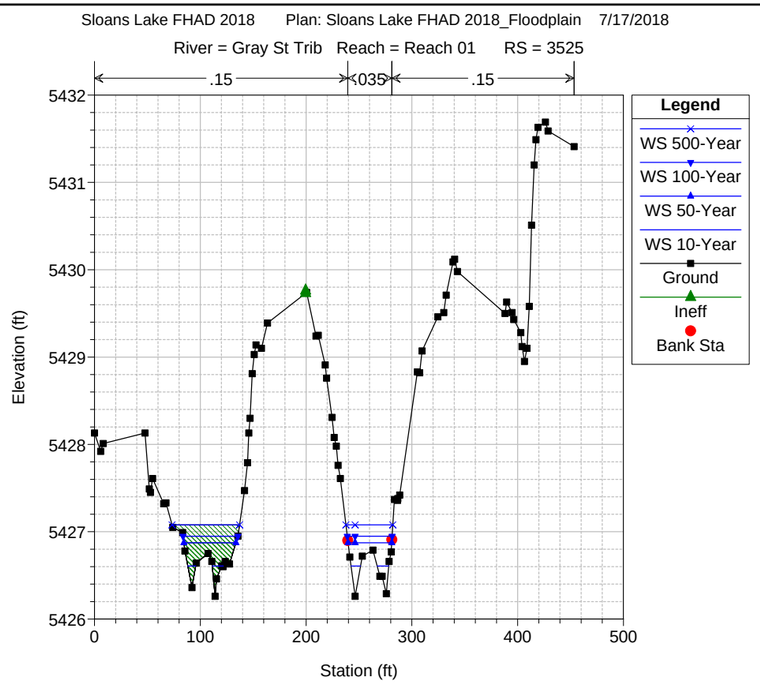
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta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River = Gray St Trib Reach = Reach 01 RS = 3525
.15
.035
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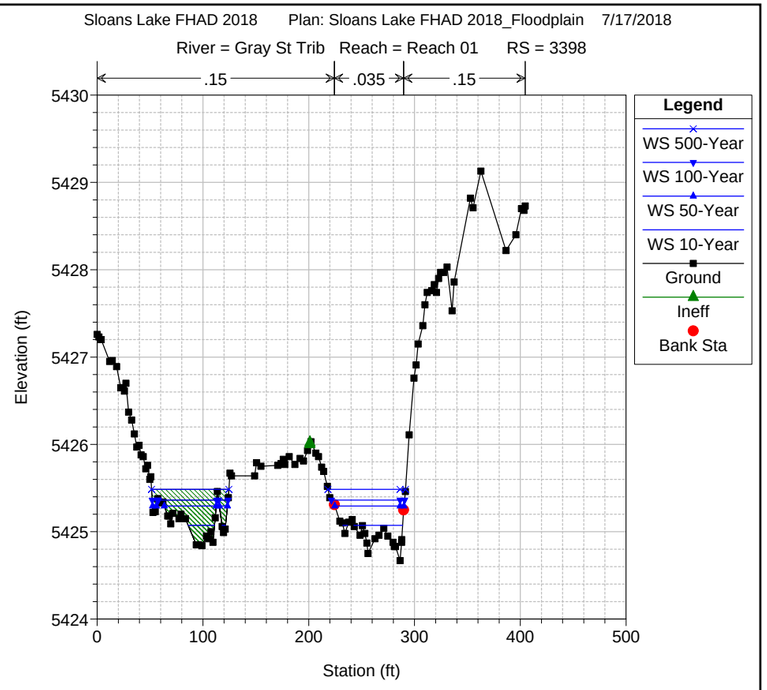
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 3398
.15
.035
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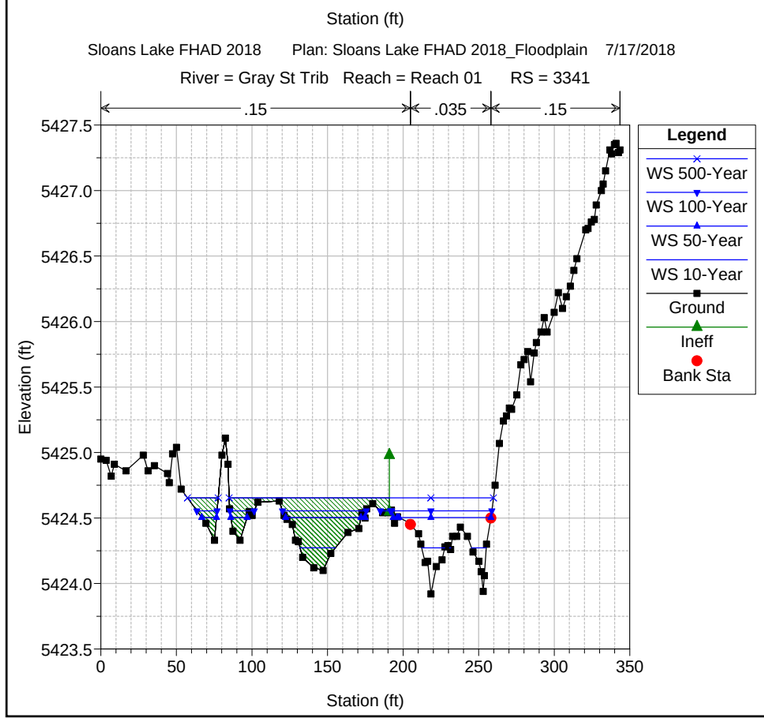
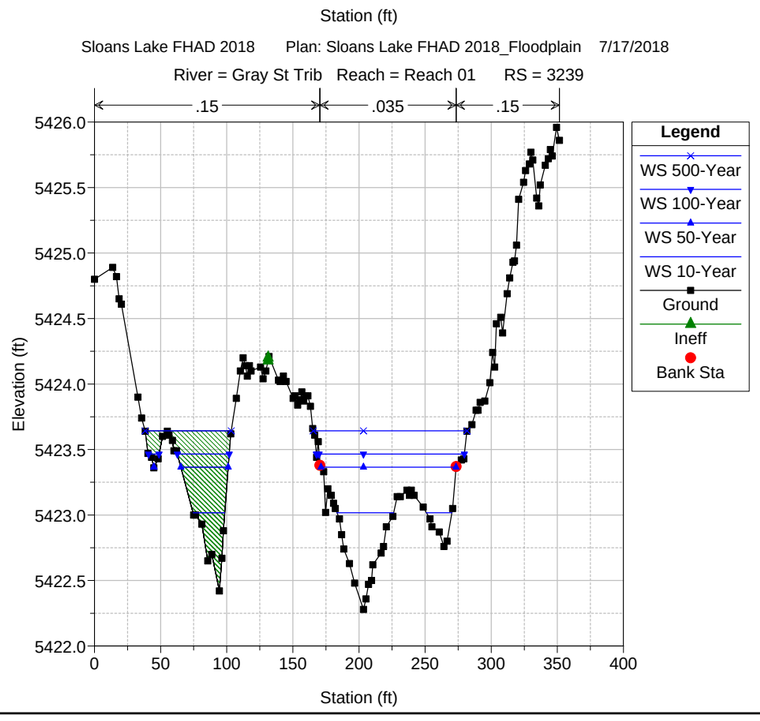
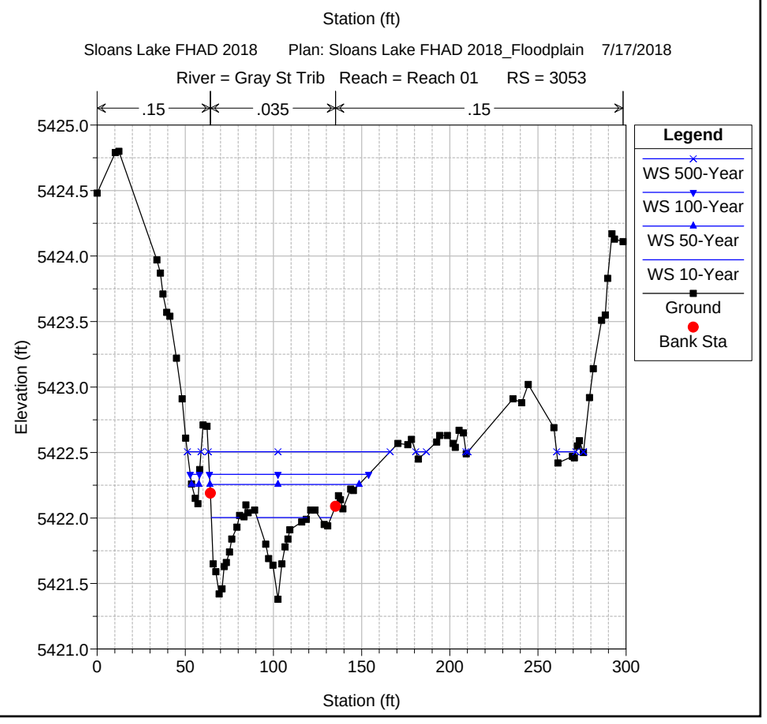
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 3341
.15
.035
.15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 3239
.15
.035
.15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 3053
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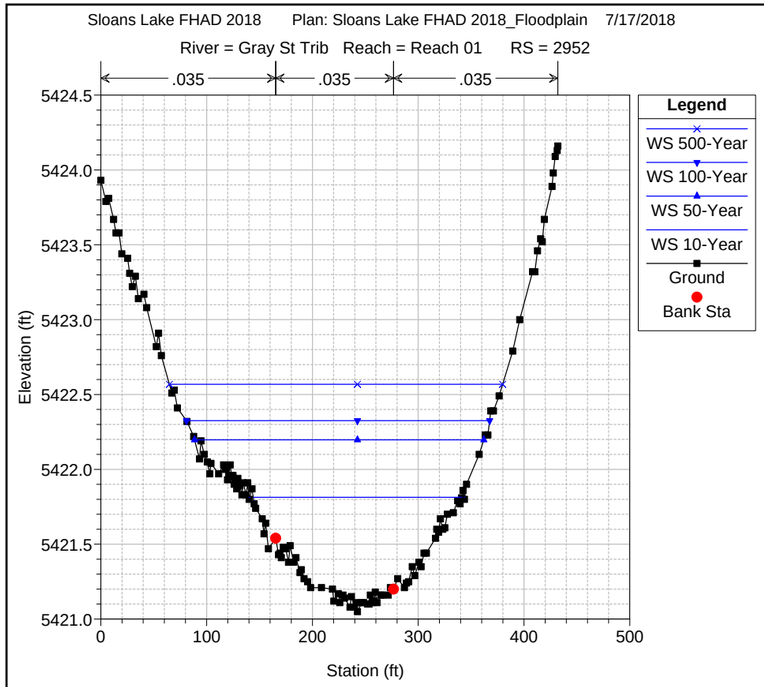
.035
.15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 2952
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.035
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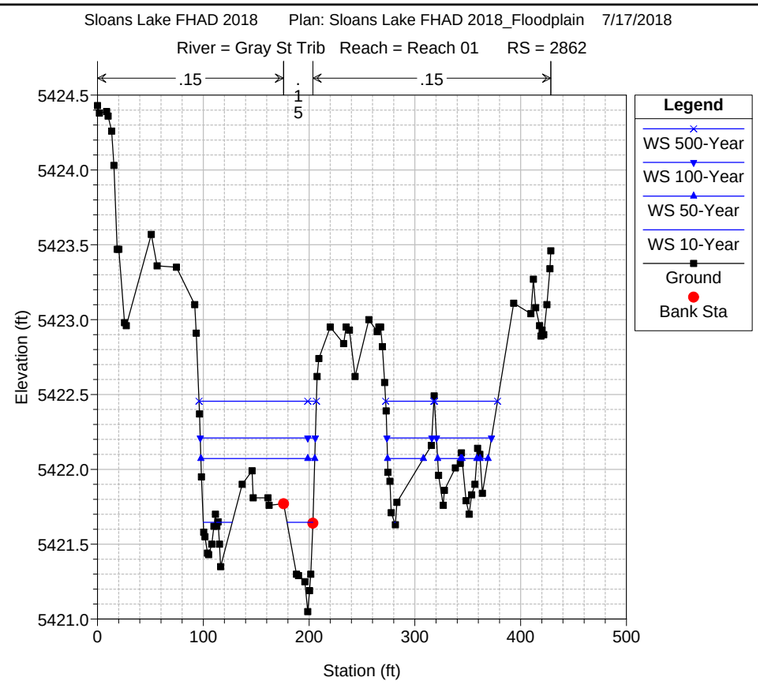
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 2862
.15
.15
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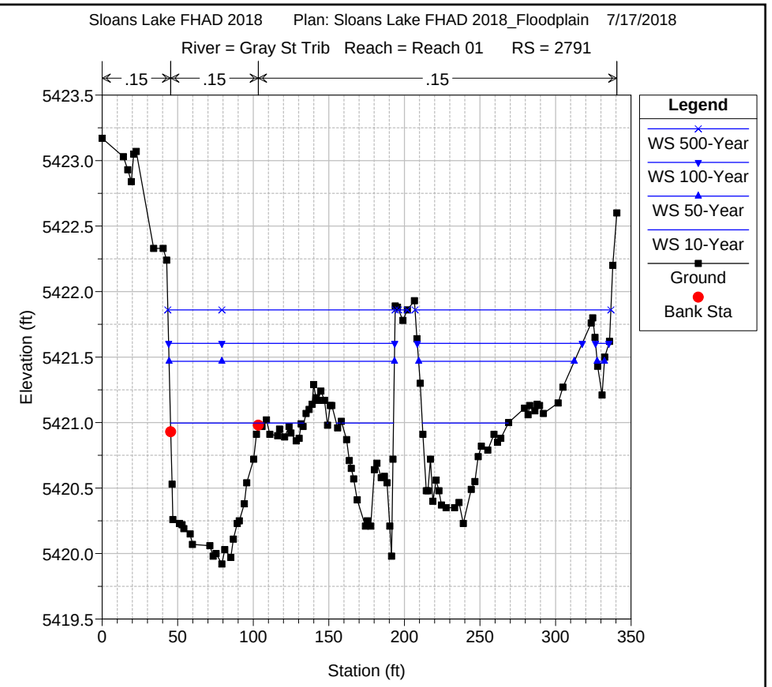
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 2791
.15
.15
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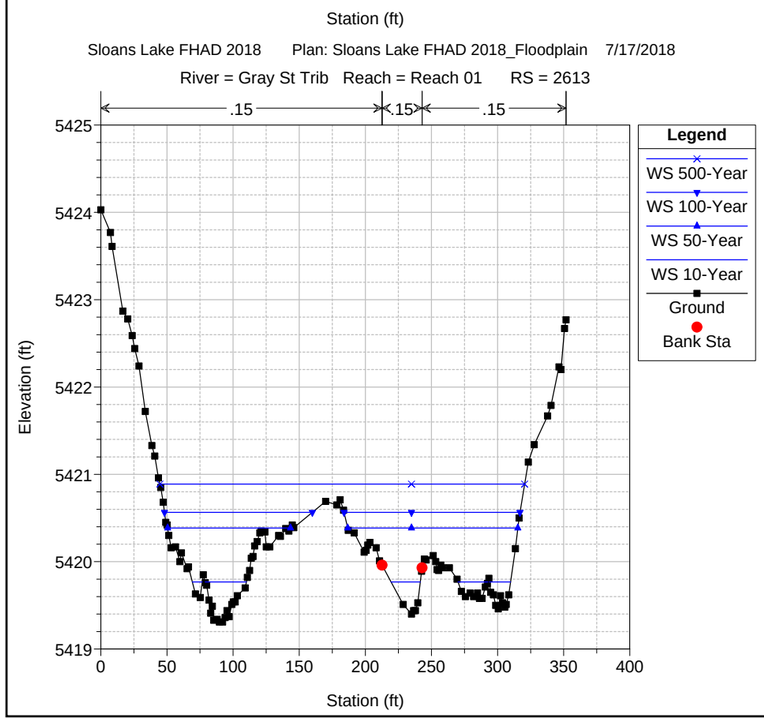
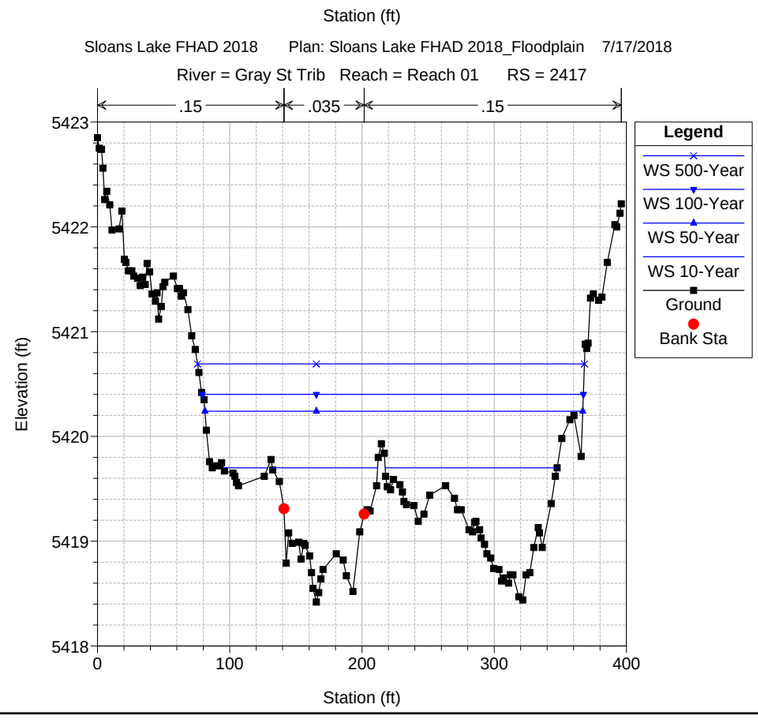
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 2613
.15
.15
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 2417
.15
.035
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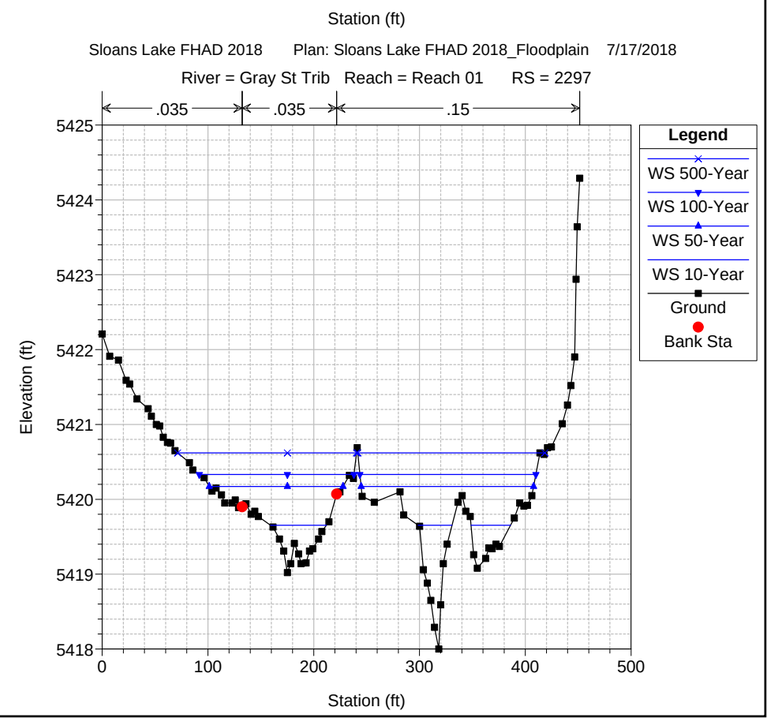
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 2297
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.035
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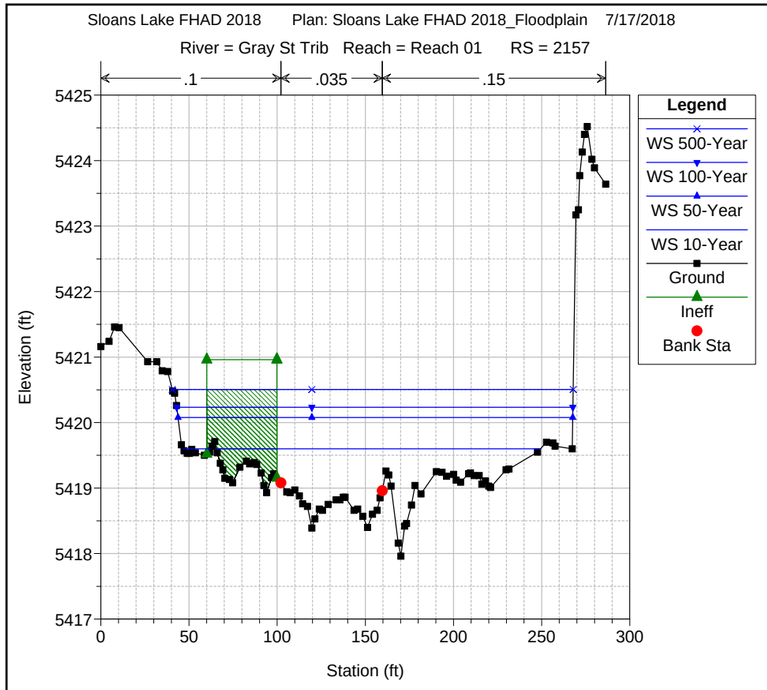
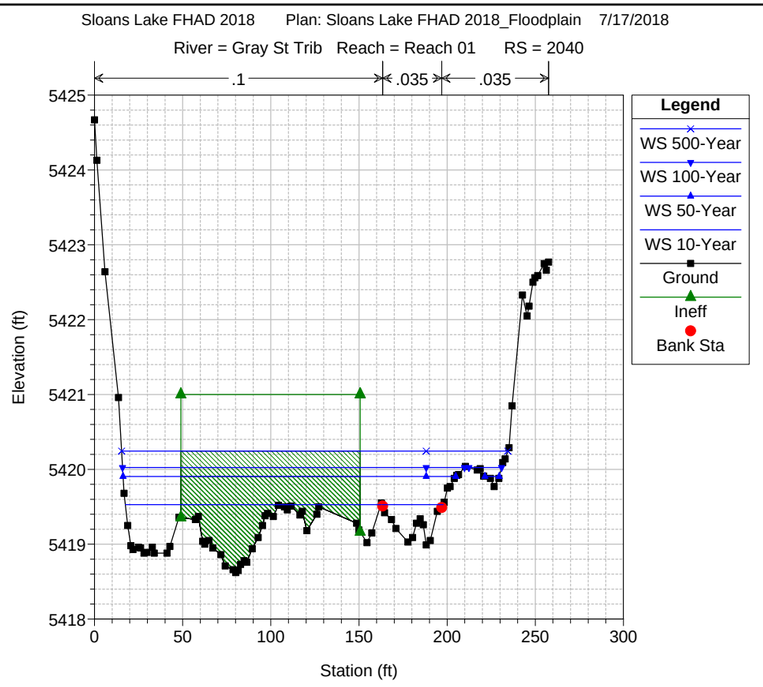
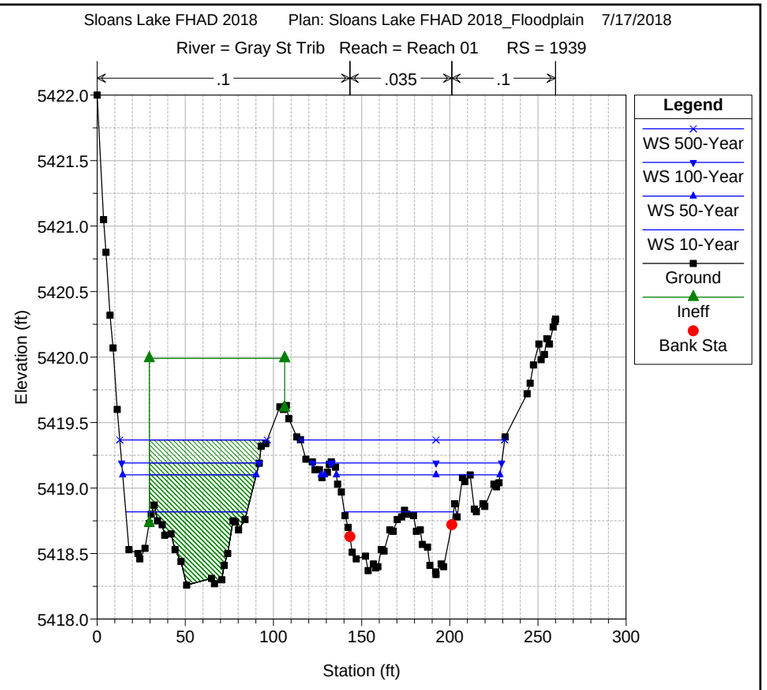
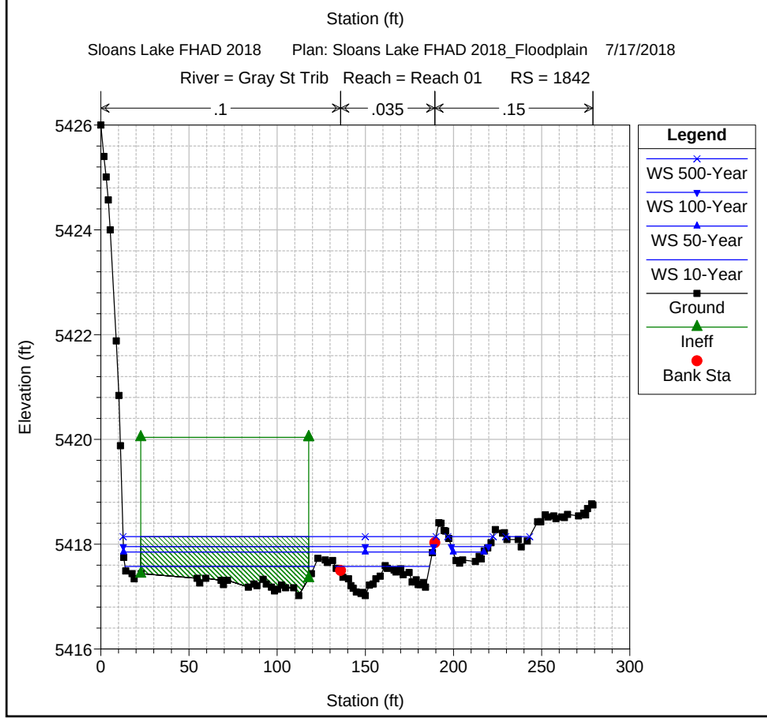
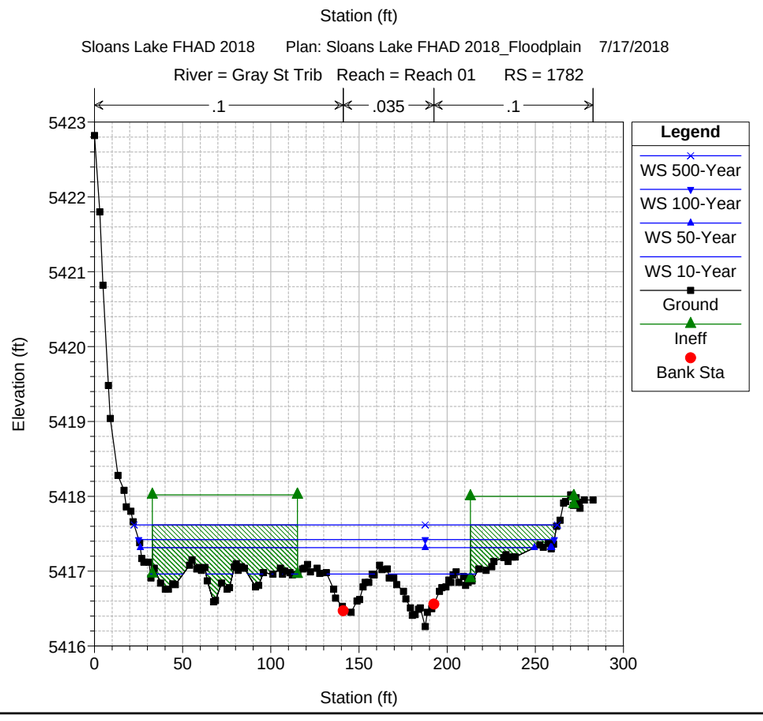
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

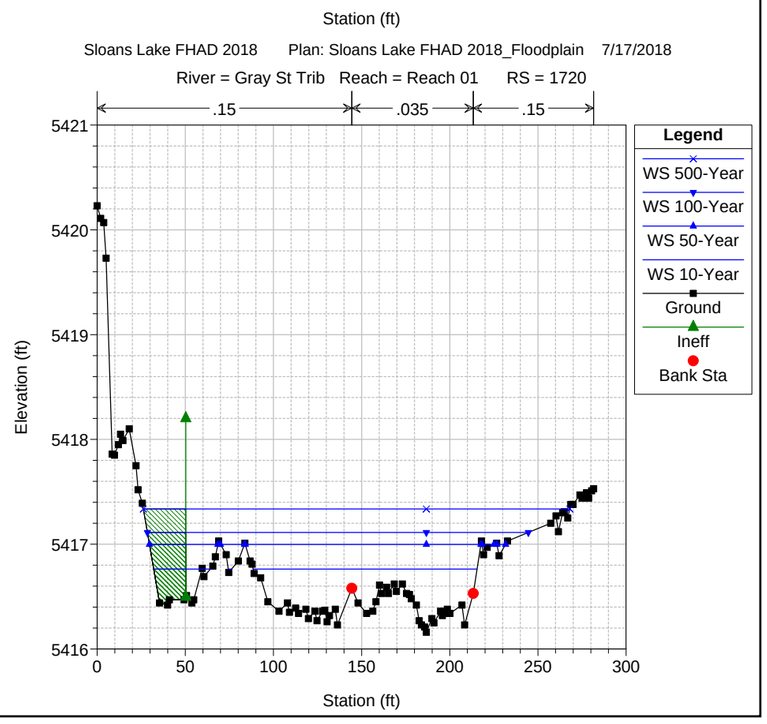

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 2157
.1
.035
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

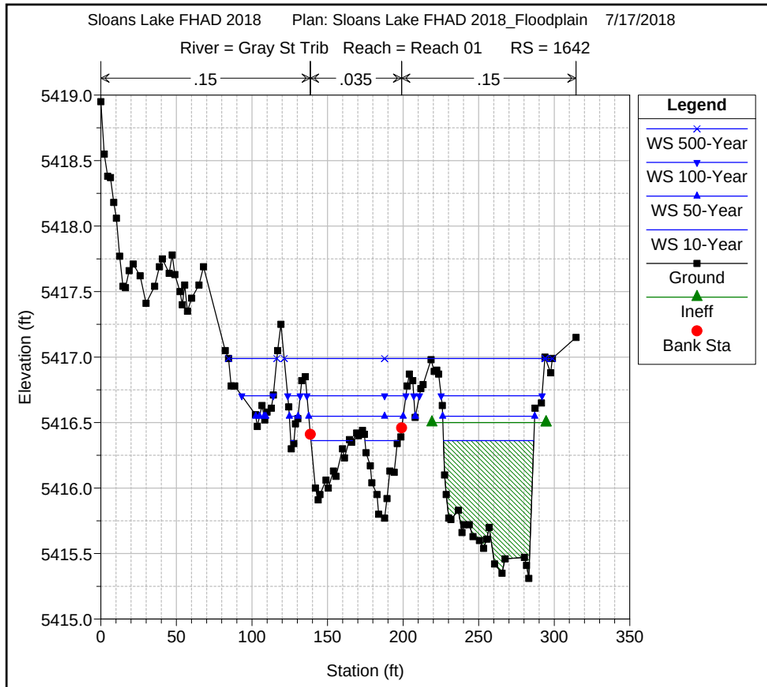

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 2040
.1
.035
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

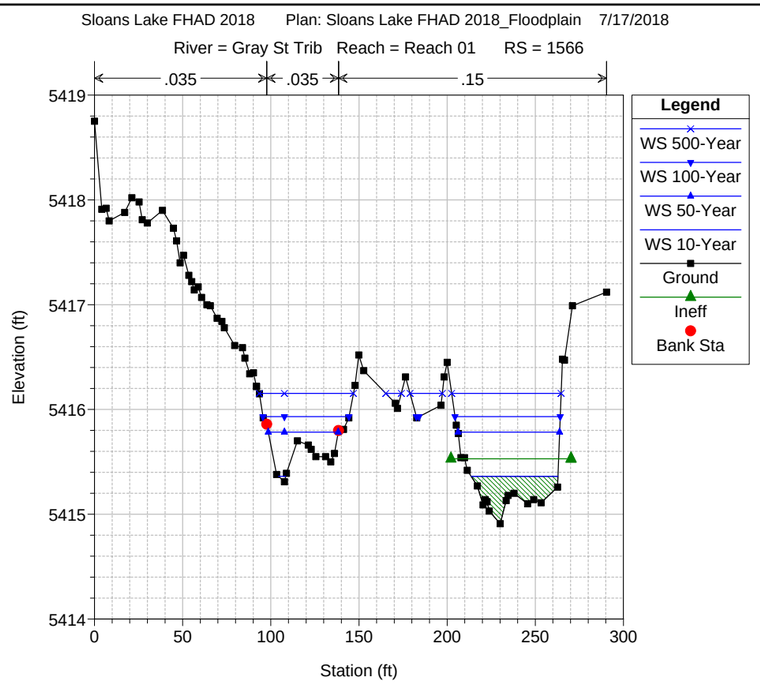

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 1939
.1
.035
.1
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

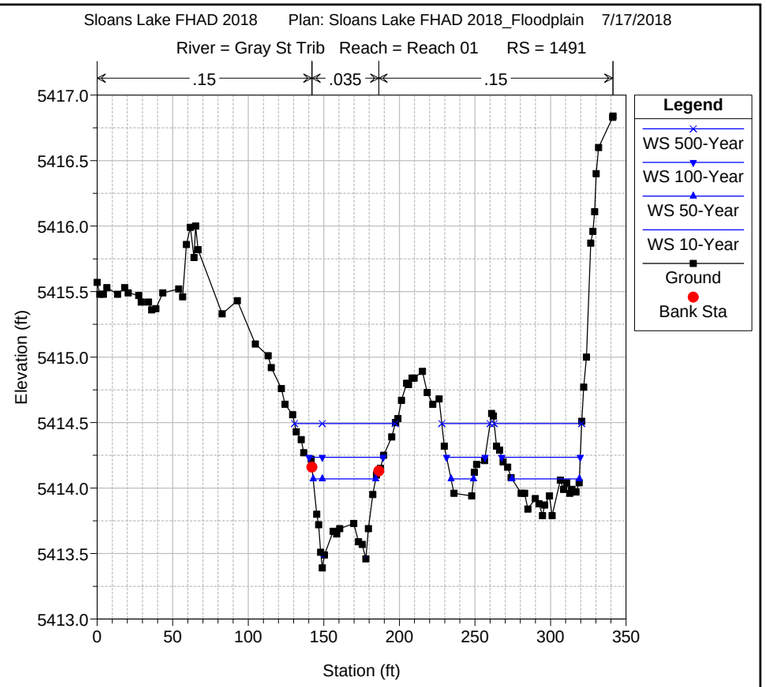

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 1842
.1
.035
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

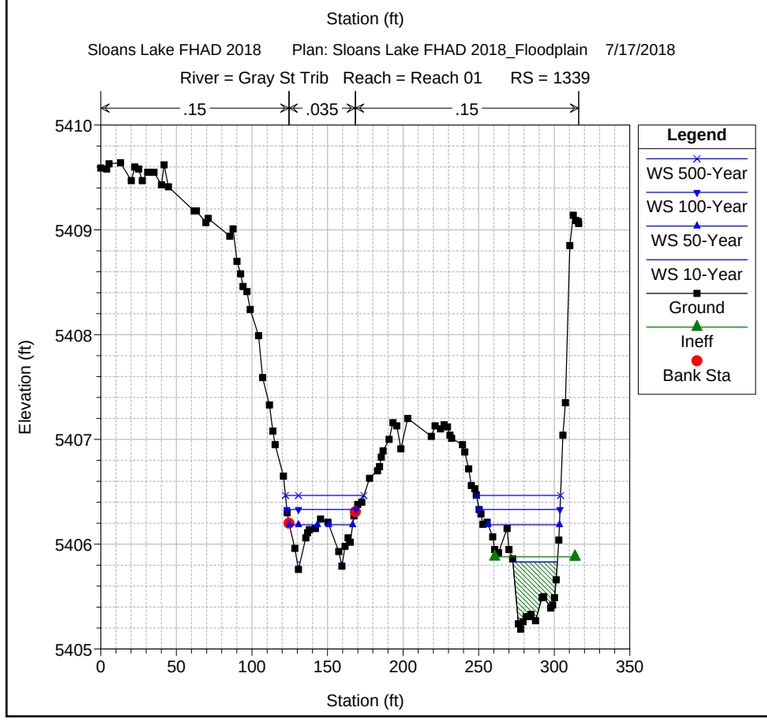

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 1782
.1
.035
.1
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

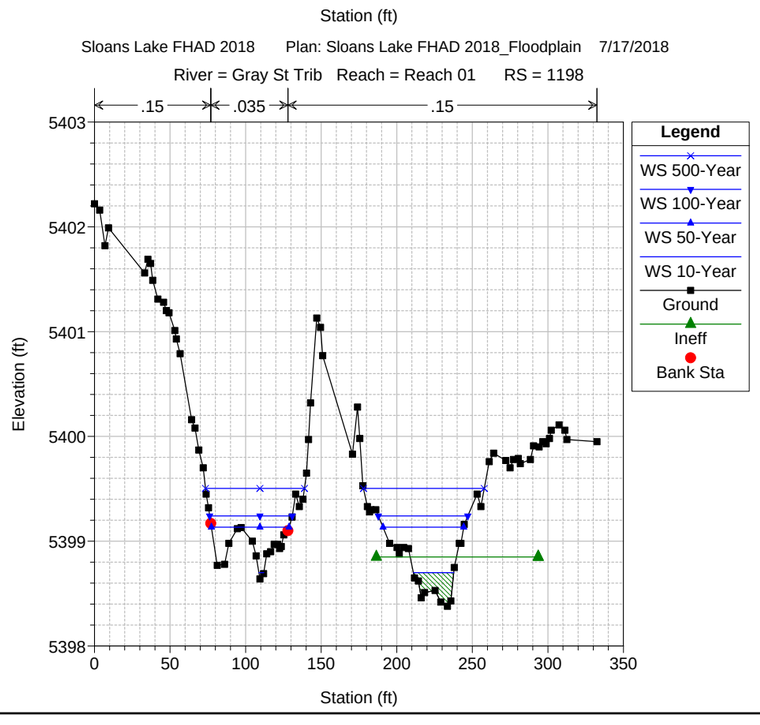

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 1720
.15
.035
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

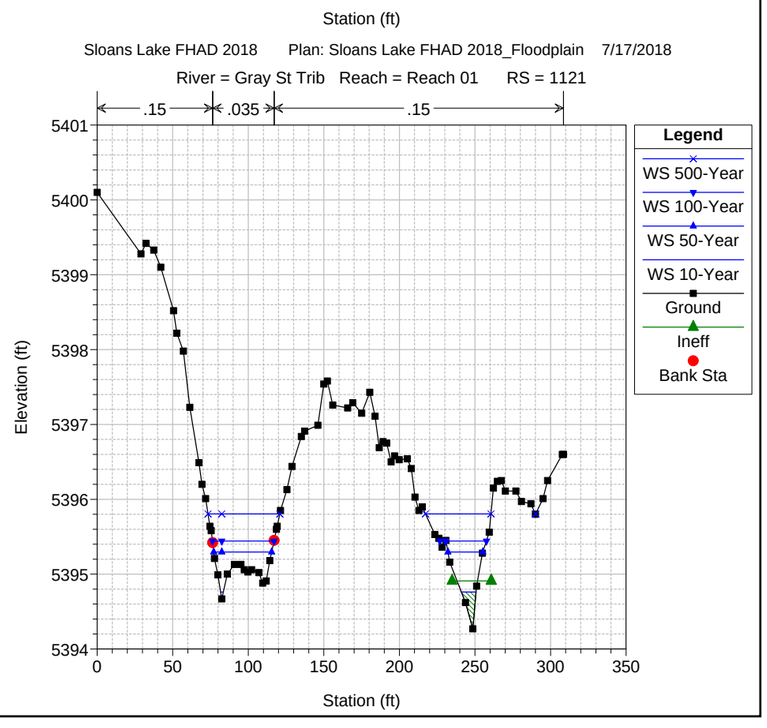

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 1642
.15 .035 .15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta

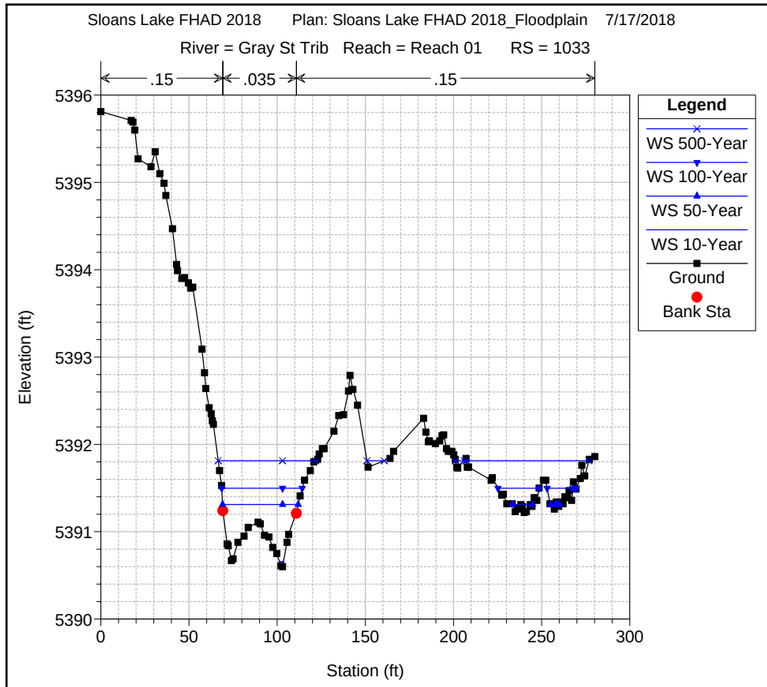

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 1566
.035 .035 .15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta

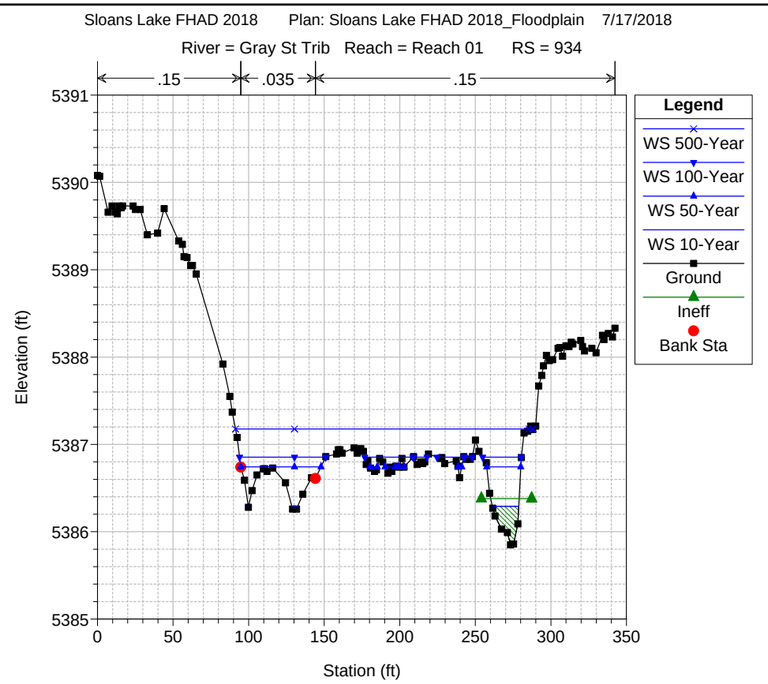

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 1491
.15 .035 .15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta

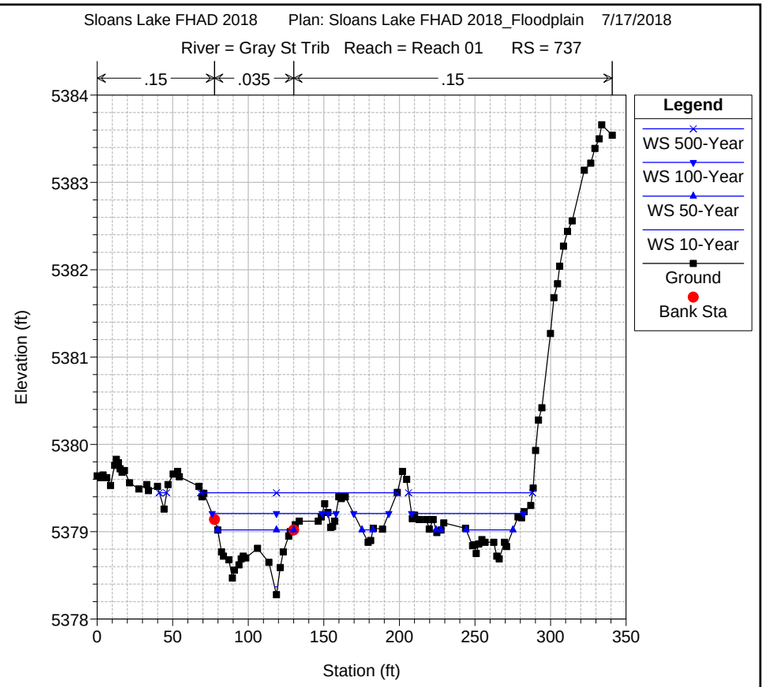

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 1339
.15 .035 .15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta

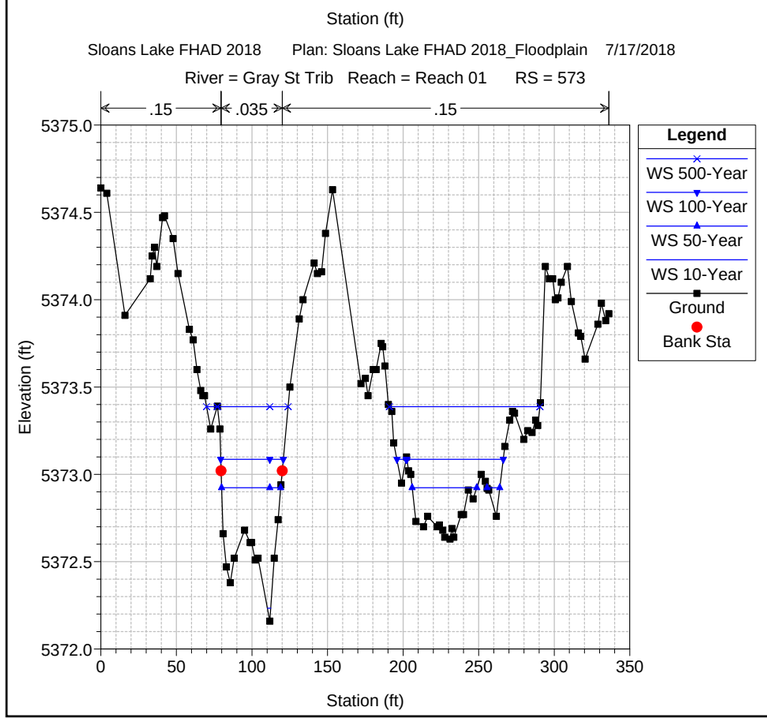

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 1198
.15 .035 .15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta

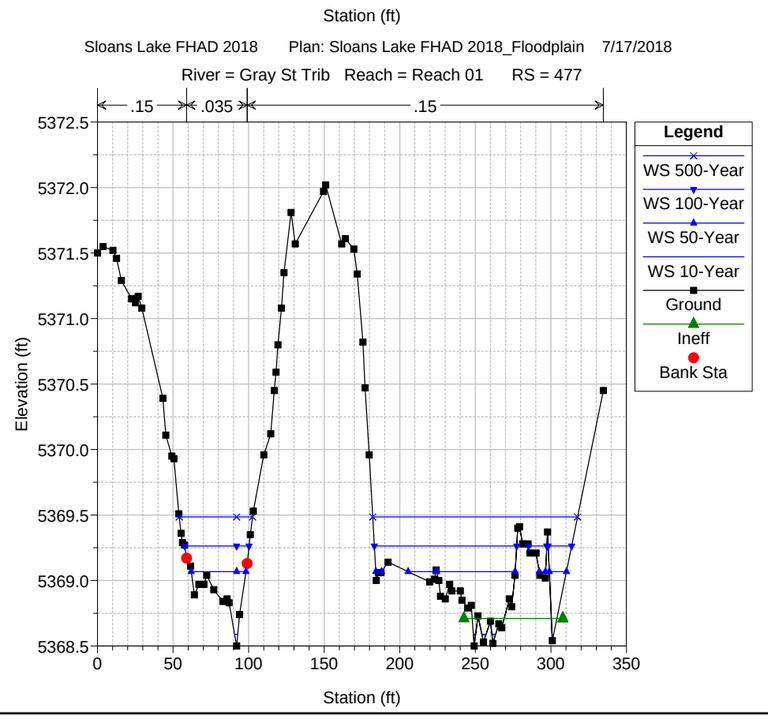

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
Station (ft)
Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 1121
.15 .035 .15
Elevation (ft)
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta

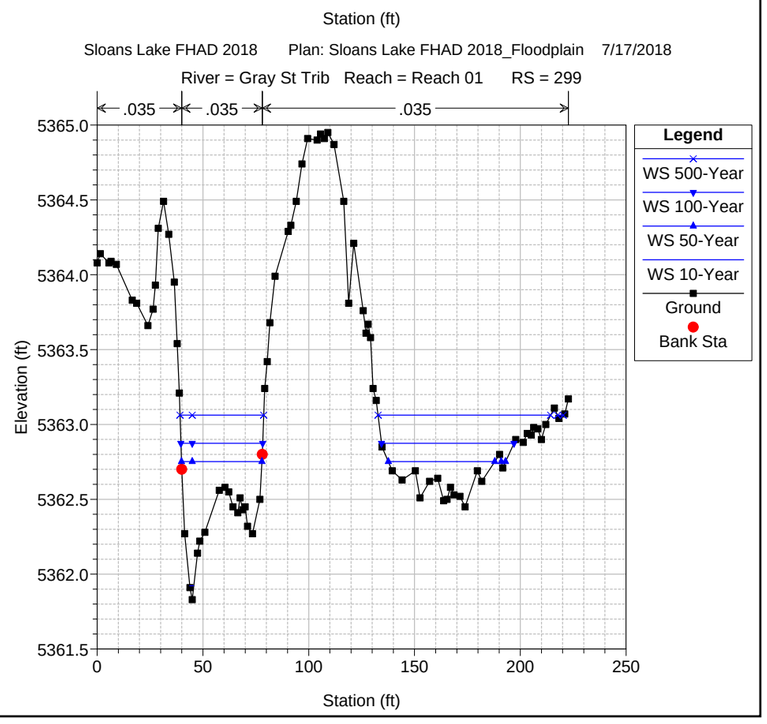

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 1033
.15
.035
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

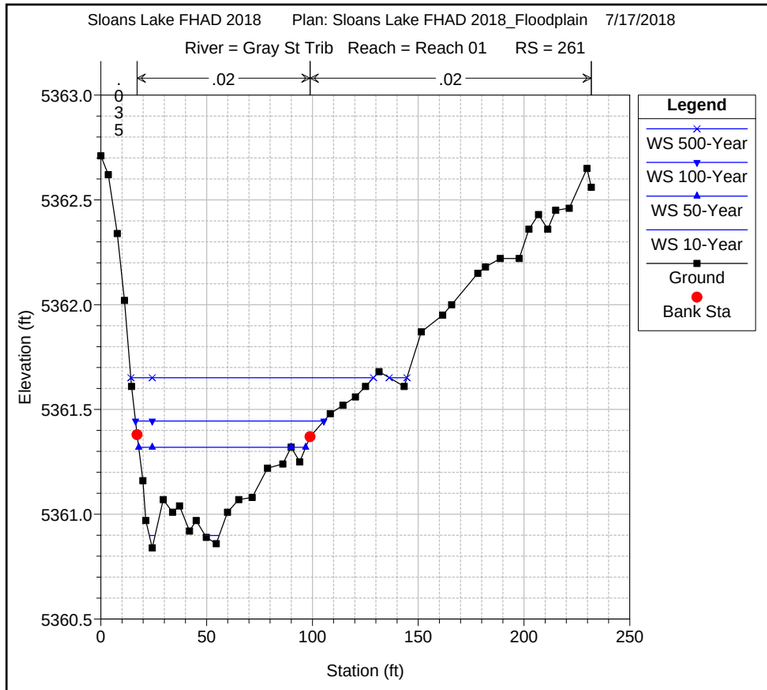

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 934
.15
.035
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 737
.15
.035
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 573
.15
.035
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

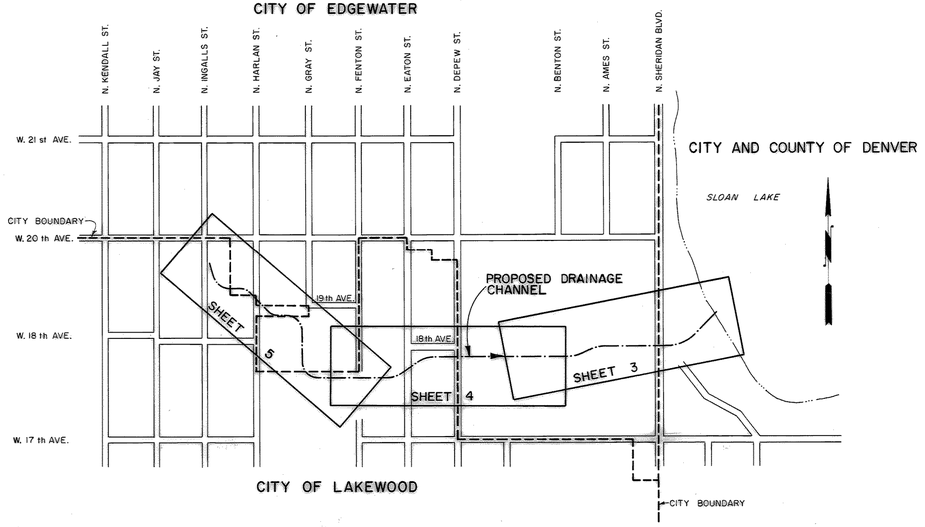

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 477
.15
.035
.15
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 299
.035
.035
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

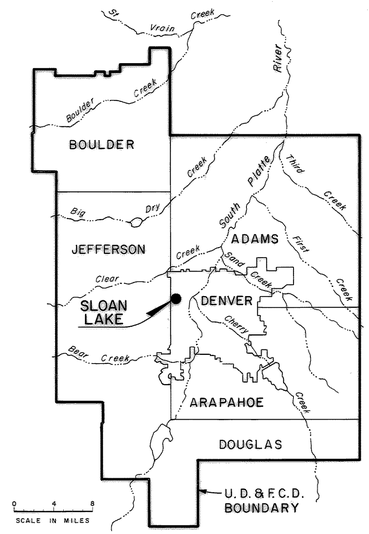

Sloans Lake FHAD 2018 Plan: Sloans Lake FHAD 2018_Floodplain 7/17/2018
River = Gray St Trib Reach = Reach 01 RS = 261
.02
.02
.035
Legend
WS 500-Year
WS 100-Year
WS 50-Year
WS 10-Year
Ground
Bank Sta
Elevation (ft)
5363.0
5362.5
5362.0
5361.5
5361.0
5360.5
0
50
100
150
200
250
Station (ft)

As-built Plans

UPPER SLOANS LAKE
STORM DRAINAGE PROJECT



LOCATION MAP
1" = 500'



DISTRICT MAP

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1	TITLE SHEET
2	GENERAL NOTES, LIMITS OF PAYMENT & LEGEND
3	PLAN-PROFILE, STA. 130+00 TO STA. 142+50
4	PLAN-PROFILE, STA. 142+50 TO STA. 156+00
5	PLAN-PROFILE, STA. 156+00 TO STA. 169+50
6	SANITARY SEWER PROFILES
7	TYPICAL SECTIONS
8	RIPRAP DROP STRUCTURES
9	16" WATERMAIN RELOCATION-SHERIDAN BLVD.
10	SHERIDAN BLVD. DETOUR CONSTRUCTION DETAILS
11	SHERIDAN BLVD. DETOUR CROSS SECTIONS
12	SHERIDAN BLVD. DETOUR PHASING, SIGNING & STRIPING
13	TEST HOLE INFORMATION; MISC. DETAILS
14	MISCELLANEOUS DETAILS
15	BOX CULVERT AT SHERIDAN BLVD.
16	BOX CULVERT AT DEPEW ST.
17	BOX CULVERT AT EATON ST.
18	BOX CULVERT AT HARLAN ST.
19	BOX CULVERT MISCELLANEOUS DETAILS
20-26	CROSS SECTIONS

AS BUILT

RECORD DRAWING

DATE APR 20 1983

48 HOURS BEFORE YOU DIG
CALL FOR THE BLUE STAKES
534-6700
Denver Inter-utility Group
Gas Electric & Telephone

CITY AND COUNTY OF DENVER
PROJECT NO. W 75-194 B

DIRECTOR OF WASTEWATER MANAGEMENT DIVISION

MANAGER OF PUBLIC WORKS

MANAGER OF PARKS AND RECREATION

CITY OF LAKEWOOD

CITY ADMINISTRATOR

CITY CLERK

DIRECTOR OF PUBLIC WORKS

CITY ENGINEER

TRAFFIC ENGINEER

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

EXECUTIVE DIRECTOR

CHIEF, DESIGN AND CONSTRUCTION

CITY OF EDGEWATER

MAYOR

CITY ENGINEER

URS 3955 E. EXPOSITION AVE. DENVER, COLO. 80209 AREA CODE 303 744-1861
ENGINEERS ARCHITECTS PLANNERS

STEPHEN CHARLES BEHRENS REGISTERED 11447 PROFESSIONAL ENGINEER STATE OF COLORADO

SCALE
500 0 500 1000
SCALE IN FEET

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
CITY OF LAKEWOOD
CITY OF EDGEWATER
CITY & COUNTY OF DENVER

UPPER SLOANS LAKE
STORM DRAINAGE FACILITIES

NO.	REVISIONS	DATE	INIT'S.

TITLE SHEET

DESIGNED E.H.W. DATE 5-16-80
DRAWN G.E.H. DATE 5-16-80
CHECKED S.C.B. DATE 5-16-80

SHEET 1 OF 26
PROJECT NO.

FOR SANITARY SEWER PROFILE, SEE SHT. NO. 6

CITY OF EDGEWATER

SEE DETOUR PLAN, SHT. NO. 10, FOR PARKING LOT PAVEMENT REPLACEMENT.

APPROXIMATE PAVEMENT CONSTRUCTION LIMITS NOT IN CONTRACT

SLOAN LAKE

NOTE: GABION IMPROVEMENTS SHOWN ARE FOR INFORMATION ONLY AND NOT "AS BUILT."

CITY & COUNTY OF DENVER
SLOAN LAKE PARK

48 HOURS BEFORE YOU DIG
CALL FOR THE BLUE STAKES
534-6700
Denver Inter-utility Group
Gas Electric & Telephone

MATCH LINE STA. 142+50 SEE SHT. NO. 4

ACCESS ROAD 8' WIDE R.O.W.

RIPRAP TRICKLE CHANNEL

R.O.W.

BURIED RIPRAP SEE SHT. NO. 7

10' PERMANENT EASEMENT

8" SANITARY SEWER

R.O.W.

FILL SLOPE

R.O.W. LINE

S 64° 34' 24" W

S 89° 34' 24" W

S 39° 34' 24" W

CONSTRUCTION LINE 131

CHANNEL BOTTOM

TOP OF CUT

WORK LIMITS

139+94; 35' RT.
RIM = 15.75
INV. IN(W) 08.00
INV. OUT(E) 07.90

138+44; 45' RT.
RIM = 14.91
INV. IN(W) = 07.26
INV. OUT(E) = 07.06

135+60; 40' RT.
RIM = 12.46
INV. IN(W-S) = 05.44
INV. IN(NW) = 01.35
INV. OUT(SE) = 01.35

P.C. 137+89.08

P.T. 138+98.16

P.C. 139+41.12

PT. 140+50.20

STA. 137+95 TO STA. 142+50
REMOVE UNDERGROUND WIRING & APPURTENANCES WITHIN THE RIGHT OF WAY.

STA. 137+95 TO STA. 142+50 LT.
CONSTRUCT CHAIN LINK FENCE 1.0' SOUTH OF RIGHT OF WAY LINE.

STA. 137+75 TO STA. 139+00 RT.
CONSTRUCT 160 L.F. 8" D.I. PIPE. RELOCATE VALVE & HYDRANT. REMOVE 210 L.F. WATER MAIN. CONSTRUCT 88 L.F. OF 6" D.I. PIPE.

STA. 136+40; 24' LT.
RELOCATE TELEPHONE POLE & UNDERGROUND CABLE. (BY OTHERS)

STA. 135+50 RT.
REMOVE DROP INLET. PLUG PIPE.

STA. 135+40 LT. & RT.
REMOVE 700 L.F. CHAIN LINK FENCE.

STA. 135+40 LT. & RT.
REMOVE 60 L.F. 43" x 29" CMP. PLUG PIPE.

QUADRUPLE 7' x 5' PRECAST BOX CULVERT WITH CAST-IN-PLACE ENDS SEE SHEET NO. 15 FOR DETAILS

LIMIT OF PAVEMENT RECONSTRUCTION

CITY LIMITS & SECTION LINE

STA. 134+50.00
102.50' SO OF 14 COR

PT. 133+91.58

STA. 134+15 TO STA. 135+40 LT.
REMOVE 125 L.F. 58" x 36" CMP. AND BACKFILL WITH FLOWABLE FILL (ASSUMED)

STA. 134+75 RT.
CONSTRUCT DRIVEWAY TO PARKING AREA. (36' CURB CUT). SEE DETAIL, SHT. NO. 13

STA. 134+32 LT. & RT.
REMOVE & REPLACE 110 L.F. OF 1¼" SPRINKLER SYSTEM.

STA. 134+15, 30' LT.
REMOVE MANHOLE.

STA. 134+10 LT. & RT.
REMOVE 80 L.F. OF SPRINKLER SYSTEM. PLUG END.

STA. 134+00, 10' RT.
REMOVE TREE.

STA. 133+95, LT. & RT.
RELOCATE 4" SPRINKLER PIPE BELOW CHANNEL. FOR DETAIL, SEE SHT. NO. 20.

STA. 133+85, 2' LT.
REMOVE DROP INLET.

STA. 130+00 TO STA. 134+15
REMOVE 390 L.F. 48" CMP.

8' MAINTENANCE RD.

CONCRETE PARKING BUMPERS

TEMPORARY PEDESTRIAN ACCESS

N 696,750

E 2,125,500

N 697,250

E 2,125,500

CONSTRUCTION LINE CURVE DATA

	①	②	③
	Δ=50°00'00"	25°00'00"	25°00'00"
	R=250'	250'	250'	
	T=116.58'	55.42'	55.42'
	L=218.17'	109.08'	109.08'

B.M.#1 ELEV. 5313.74 N. CORNER OF NE. WOOD & CONC. BENCH AT TORPEDO MONUMENT. N.E. OF 17TH AND SHERIDAN.

NOTE:
FOR DETOUR PLAN, SEE SHT. NOS. 10, 11 & 12
FOR 16" WATERMAIN RELOCATION SEE SHT. NO. 9

AS BUILT
RECORD DRAWING
DATE APR 20 1983

Q25 = 1073
DEPTH = 4.6 FT.
VAV = 7.0 F.P.S. (n=.03)
DC = 4.0
VC = 8.8 F.P.S.

STA. 141+00 SEE DETAIL, SHT. NO. 8

ACCESS ROAD PROFILE

EXIST. GROUND

S = 0.50 %

11.00
10.00

TELEPHONE CABLE RELOCATE
6" WATER REMOVE

8" WATER REMOVE

STA. 136+50 SEE DETAIL, SHT. NO. 21

STA. 135+09 (Approximate)
Culvert was expanded at upstream end.

43"x29" CMP REMOVE

12" SAN.

STA. 134+86

STA. 134+50.00 & SHERIDAN BLVD.

STA. 134+06

QUADRUPLE 7'x5' PRECAST CONC. BOXES SEE SHT. NO. 15

25 YR. WATER SURFACE

NAVD 5310.05 07.00
NAVD 5309.05 06.00
NAVD 5308.85 05.80
05.80

S = 0.00 %

4" GAS RELOCATE

16" WATER RELOCATE
WATER RELOCATED IN 1983 AS-BUILT

Normal Water Surface Revised
NAVD 5310.65 (LOMR Case No. 92-08-040P)

SLOAN LAKE
NORMAL WATER SURFACE EL. 5308.5 / NGVD 5308.5 = NAVD 5311.55

5320
5310
5300

28' WIDE CHANNEL
RIPRAP DROP
28' WIDE CHANNEL
RIPRAP TRANSITION
20' WIDE FLAT BOTTOM CHANNEL
VARIABLE WIDTH FLAT BOTTOM CHANNEL

142
140
135
130

URS 3955 E. EXPOSITION AVE. DENVER, COLO. 80209 AREA CODE 303 744-1861
ENGINEERS ARCHITECTS PLANNERS

STEPHEN CHARLES BERENS REGISTERED 11447 STATE OF COLORADO

SCALE
50 0 50 100
SCALE IN FEET
HORIZONTAL
5 0 5 10
SCALE IN FEET
VERTICAL

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

CITY OF LAKEWOOD
CITY OF EDGEWATER
CITY & COUNTY OF DENVER

UPPER SLOANS LAKE
STORM DRAINAGE FACILITIES

NO.	REVISIONS	DATE	INIT'S.

PLAN – PROFILE
STA. 130+00 TO STA. 142+50

DESIGNED E.H.W. DATE 5-16-80
DRAWN G.E.H. DATE 5-16-80
CHECKED S.C.B. DATE 5-16-80

SHEET 3 OF 26
PROJECT NO.

FOR SANITARY SEWER PROFILES, SEE SHT. NO. 6
FOR DETAILS OF SANITARY SEWER LOCATION SEE DEPEW ST. BOX CULVERT LAYOUT, SHT. NO. 16

CITY OF EDGEWATER
CITY OF LAKEWOOD
FENTON ST.
EATON ST.
DEPEW ST.
BOAT STORAGE
8' ACCESS ROAD
8' SANITARY SEWER
CONSTRUCTION LINE
DRIVE-IN THEATRE PARKING
ASPHALT PARKING
DIRT
LIMIT OF PAVEMENT RECONSTRUCTION
TYPE 13 INLET
RIPRAP TRICKLE CHANNEL
TWIN 12'x5' BOX CULV. SEE SHT. NO. 16 FOR DETAILS.
TWIN 12'x5' BOX CULVERT SEE SHT. NO. 17 FOR DETAILS
PERMANENT EASEMENT
RECONSTRUCT 205 L.F. EATON ST.
MATCH LINE STA. 156+00 SEE SHT. NO. 5
MATCH LINE STA. 142+50 SEE SHT. NO. 3
E 2,134,250
N 697,000
E 2,145,500
N 697,000

154+76; 28.7' RT.
RIM = 34.41
INV. IN(N) = 24.89
INV. IN(W) = 24.01
INV. OUT(S) = 23.91

151+62; 35' LT.
RIM = 28.67
INV. IN(SW) = 21.25
INV. IN(S) = 21.98
INV. OUT(NE) = 21.29

147+83; 92' RT.
RIM = 27.89
INV. IN(N) = 20.04
INV. IN(W) = 20.09
INV. OUT(S) = 20.05

147+40; 40' RT.
RIM = 26.56
INV. IN(SW) = 18.25
INV. OUT(E) = 18.15

144+00; 40' RT.
RIM = 19.91
INV. IN(W) = 13.61
INV. OUT(E) = 13.51

147+86; 21.5' RT.
RIM = 27.26
INV. IN(N) = 19.66
INV. OUT(E) = 19.64

147+62; 21.5' RT.
RIM =
INV. IN(W) = 19.13
INV. OUT(NE) = 19.13

147+83; 89' LT.
RIM = 26.87
INV. IN(W) = 19.60
INV. OUT(S) = 19.36

150+78; 35' LT.
RIM = 28.37
INV. IN(SW) = 20.91
INV. OUT(E) = 20.91

154+76; 45' LT.
RIM = 34.81
INV. IN(N) = 22.74
INV. IN(S) = 22.91
INV. OUT(E) = 22.53

152+42; 48' LT.
RIM = 29.39
INV. IN(W) = 21.87
INV. OUT(NE) = 21.80

RIM = 35.49
INV. IN(S) = 28.09
INV. OUT(N) = 27.99

RIM = 29.71
INV. IN(S) = 24.36
INV. OUT(W) = 24.43

S 89°34'24" W
S 51°38'42" W
S 89°34'24" W
339.9'
248.8'
93'
93.14'
P.C. 149+26.05
P.T. 150+58.44
P.T. 152+63.34
2+05
0+00
5330
5325
5320
5310

STA. 155+00 LT. CONSTRUCT 40 L.F. RIPRAP DOWNDRAIN SEE SHT. NO. 7 FOR DETAILS.
STA. 154+65 RELOCATE 8" WATER MAIN, SEE SHT. NO. 14 FOR DETAILS.
STA. 154+60 CONSTRUCT 24" L.F. 18" CONC. PIPE TO INLET; PLUG OPENING TO EXIST. PROVIDE END SECTION & 14 L.F. RIPRAP DOWNDRAIN AT OUTLET. SEE SHT. NO. 14 FOR DETAILS.
STA. 151+15 RELOCATE 8" WATER MAIN. SEE SHT. NO. 14 FOR DETAILS.
STA. 151+88 RT. RELOCATE POWER POLE
STA. 151+65 RELOCATE POWER POLE
STA. 151+50 LT. TO STA. 153+50 RT. REMOVE 220 L.F. 30" CONC. PIPE.
STA. 150+60 RT. CONSTRUCT 2 TYPE 13 INLETS, 74 L.F. 15" RCP; CONC. END SECTION. SEE SHT. NO. 23 FOR DETAILS.
STA. 151+10 TO STA. 151+40 REMOVE 2 INLETS. REMOVE 90 L.F. STORM SEWER. PLUG PIPE.
STA. 148+75 RT. CONSTRUCT TYPE 13 INLET 30 L.F. 15" RCP. CONC END SECTION. SEE SHT. NO. 23 FOR DETAILS.
STA. 149+00 TO STA. 148+75 RT. REMOVE & REPLACE 150 L.F. COMB. C & G & SIDEWALK.
STA. 147+20 TO STA. 148+10, RT. REMOVE DROP INLET & 90 L.F. 24" CMP
STA. 147+96 RELOCATE 8" WATER MAIN. SEE SHT. NO. 14 FOR DETAILS.
STA. 142+68 TO STA. 147+50 RT. RELOCATE CHAIN LINK FENCE 1.0' NORTH OF R.O.W. LINE.
STA. 142+50 TO STA. 147+50 LT. CONSTRUCT CHAIN LINK FENCE 1.0' SOUTH OF R.O.W. LINE.
STA. 142+50 TO STA. 147+50 REMOVE UNDERGROUND WIRING & APPURTENANCES WITHIN THE RIGHT OF WAY. (BY OTHERS)
STA. 145+35 REMOVE 60 L.F. 30" CONC. PIPE. INSTALL 30" CONC. END SECTION & 20 L.F. RIPRAP DOWNDRAIN. SEE SHT. NO. 14 FOR DETAILS.
STA. 142+68 RT. REMOVE 24 L.F. 36" CONC. PIPE. (3 - 8 FT. LENGTHS)

48 HOURS BEFORE YOU DIG
CALL FOR THE BLUE STAKES
534-6700
Denver Inter-utility Group
Gas Electric & Telephone

CONSTRUCTION LINE CURVE DATA

	④	⑤
	Δ = 37°55'42"	37°55'42"
	R = 200.00'	100.00'
	T = 68.73'	34.36'
	L = 132.39'	66.20'

B.M. #2 ELEV. 5338.14 N'x NE HEADBOLT ON F.H. AT NW COR. OF DEPEW & 17TH
B.M. #3 ELEV. 5329.10 R.R. SPIKE IN E. SIDE OF LIGHT POLE. STA. 150+80; 103' RT.
B.M. #4 ELEV. 5333.90 R.R. SPIKE IN S. SIDE OF POWER POLE. STA. 154+50; 62' RT.

Qes = 1073
DEPTH = 3.5 FT.
VAV = 10.9 FPS (n=.04)

Qes = 1073
DEPTH = 4.6 FT.
VAV = 7.0 FPS (n=.03)
Dc = 4.0 FT.
Vc = 8.8 FPS

-0.45 %
28.9
28.0
0
1
2
℄ BOX STA. 1+10
REVISED PROFILE EATON ST.
ACCESS ROAD PROFILE
EXIST. GROUND
S=0.50 %
28.50
S=3.1 %
25 YR. WATER SURFACE
TWIN 12'x5' RCB
20.00 BEGIN LOW FLOW CHANNEL STA. 150+61
NAVD 5330.55 27.50
NAVD 5324.35 21.30
NAVD 5324.25 21.20
NAVD 5324.05 21.00
NAVD 5321.65 18.60
NAVD 5321.35 18.30
17.30
17.00
16.00
NAVD 5320.05
15.00
14.00
13.00
12.00
S=0.50 %
1.0 %
BEGIN LOW FLOW CHANNEL STA. 147+45
STA. 154+25
STA. 154+00
STA. 152+00
STA. 151+86
STA. 151+35 ℄ EATON ST.
STA. 150+91
STA. 148+10.5
STA. 147+83 ℄ DEPEW ST.
STA. 147+65
STA. 147+50 MEET EXIST. EL. 5327.00
STA. 147+35.5
STA. 147+00 RIPRAP DROP SEE DETAIL, SHT. NO. 8
STA. 145+00 RIPRAP DROP SEE DETAIL, SHT. NO. 8
STA. 143+00 RIPRAP DROP SEE DETAIL, SHT. NO. 8
2" GAS (REMOVE) 6" SAN. (NEW) 12" SAN. (NEW) RELOCATE
6" WATER RELOCATE
30" CONC. REMOVE
2" GAS RELOCATE 8" SAN. REMOVE 6" WATER RELOCATE
2" GAS (REMOVE) 12" SAN. REMOVE 6" WATER RELOCATE PROTECT
28' WIDE CHANNEL
28' WIDE RIPRAP CHANNEL
28' WIDE CHANNEL
28' WIDE CHANNEL WITH 1' RIPRAP DROP STRUCTURES
155
150
145

AS BUILT
RECORD DRAWING
DATE APR 20 1983

NO.	REVISIONS	DATE	INIT'S.

URS 3955 E. EXPOSITION AVE. DENVER, COLO. 80209 AREA CODE 303 744-1861
ENGINEERS ARCHITECTS PLANNERS

STEPHEN CHARLES BEHRENS REGISTERED 11447 STATE OF COLORADO

SCALE
50 0 50 100
SCALE IN FEET HORIZONTAL
5 0 5 10
SCALE IN FEET VERTICAL

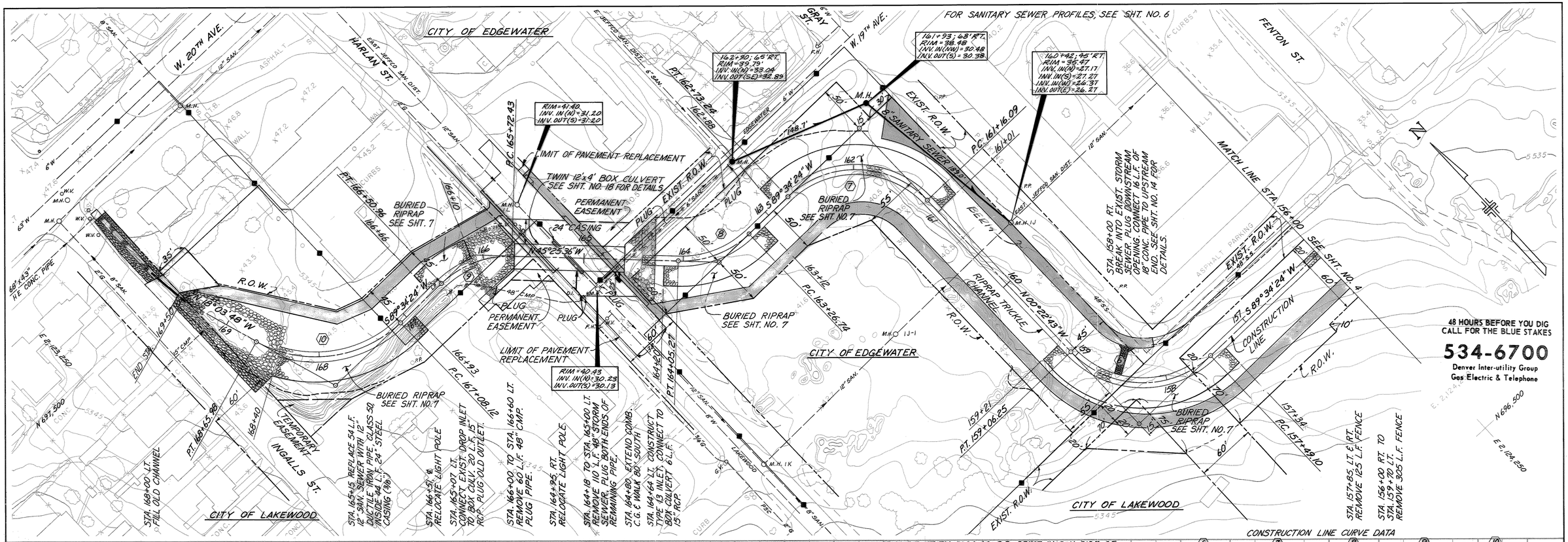
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
CITY OF LAKEWOOD
CITY OF EDGEWATER
CITY & COUNTY OF DENVER

UPPER SLOANS LAKE
STORM DRAINAGE FACILITIES

PLAN - PROFILE
STA. 142+50 TO STA. 156+00

DESIGNED E.H.W. DATE 5-16-80
DRAWN G.E.H. DATE 5-16-80
CHECKED S.C.B. DATE 5-16-80

SHEET 4 OF 26
PROJECT NO.



URS 3955 E. EXPOSITION AVE. DENVER, COLO. 80209 AREA CODE 303 744-1861 ENGINEERS ARCHITECTS PLANNERS	STEPHEN CHARLES BEHRENS REGISTERED 11447 STATE OF COLORADO	SCALE 50 0 50 100 SCALE IN FEET HORIZONTAL; 5 0 5 10 SCALE IN FEET VERTICAL	URBAN DRAINAGE AND FLOOD CONTROL DISTRICT CITY OF LAKEWOOD CITY OF EDGEWATER CITY & COUNTY OF DENVER

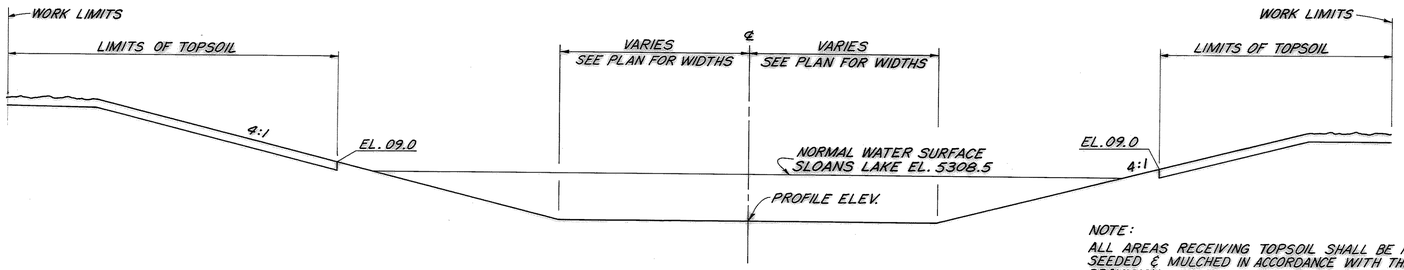
UPPER SLOANS LAKE
STORM DRAINAGE FACILITIES

NO.	REVISIONS	DATE	INIT'S.

PLAN – PROFILE
STA. 156+00 TO STA. 169+50

DESIGNED E.H.W. DATE 5-16-80
DRAWN G.E.H. DATE 5-16-80
CHECKED S.C.B. DATE 5-16-80

SHEET 5 OF 26
PROJECT NO.

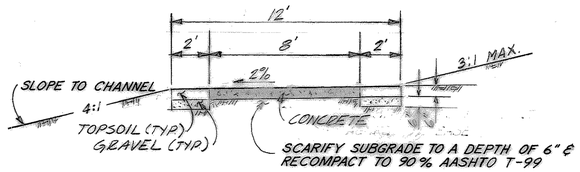


TYPICAL CHANNEL SECTION

NO SCALE

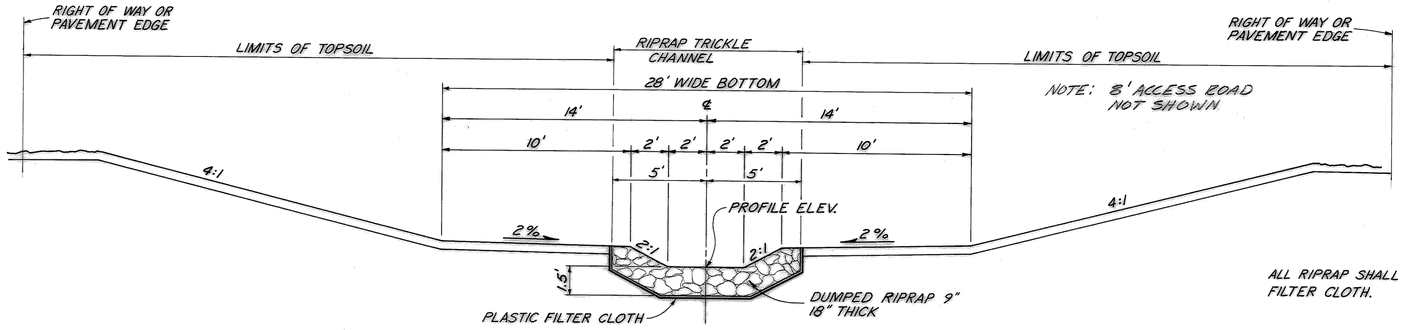
STA. 130+00 TO STA. 137+00

NOTE:
ALL AREAS RECEIVING TOPSOIL SHALL BE FERTILIZED, SEEDED & MULCHED IN ACCORDANCE WITH THE TECHNICAL PROVISIONS UNDER SECTION 7, SURFACE RESTORATION.



MAINTENANCE ROAD (8' ACCESS ROAD)

NO SCALE



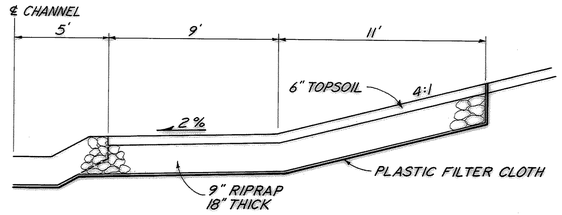
NOTE: 8' ACCESS ROAD NOT SHOWN.

TYPICAL CHANNEL SECTION
28' WIDE BOTTOM

NO SCALE

STA. 137+00 TO STA. 169+50

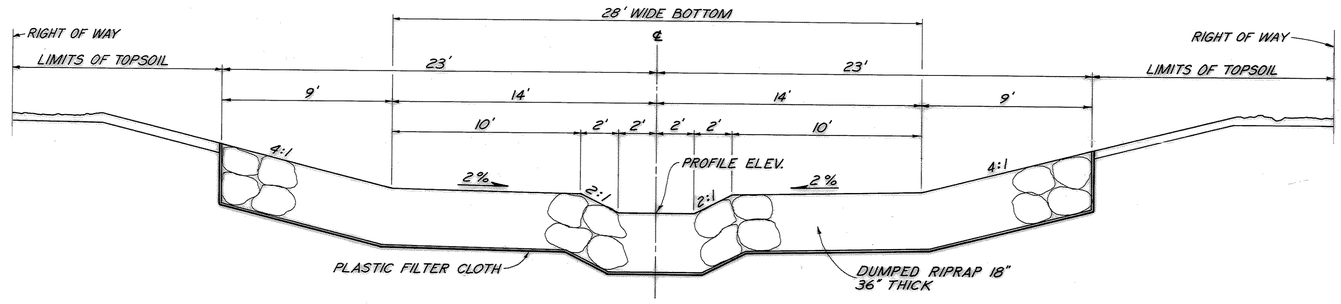
ALL RIPRAP SHALL BE PLACED ON PLASTIC FILTER CLOTH.



RIPRAP PROTECTION ON OUTSIDE OF CURVES

NO SCALE

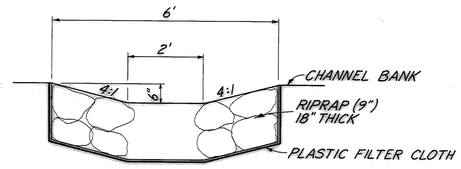
STA. 137+74 TO STA. 139+13 RT.
STA. 139+26 TO STA. 140+65 LT.
STA. 157+34 TO STA. 159+21 LT.
STA. 161+01 TO STA. 162+88 RT.
STA. 163+12 TO STA. 164+20 LT.
STA. 166+10 TO STA. 166+66 RT.
STA. 166+93 TO STA. 168+40 LT.



RIPRAP CHANNEL SECTION
28' WIDE BOTTOM

NO SCALE

STA. 151+85 TO STA. 154+25



6' WIDE RIPRAP DOWNDRAIN

NO SCALE

STA. 143+47 LT.
STA. 144+25 LT.
STA. 145+35 LT.
STA. 148+75 RT.
STA. 150+60 RT.
STA. 154+60 RT.
STA. 155+00 LT.

AS BUILT

RECORD DRAWING

DATE APR 20 1983

URS 3955 E. EXPOSITION AVE. DENVER, COLO. 80209 AREA CODE 303 744-1861
ENGINEERS ARCHITECTS PLANNERS

STEPHEN CHARLES BERNERT REGISTERED 11447 PROFESSIONAL ENGINEER STATE OF COLORADO

SCALE

AS SHOWN

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

CITY OF LAKEWOOD
CITY OF EDGEWATER
CITY & COUNTY OF DENVER

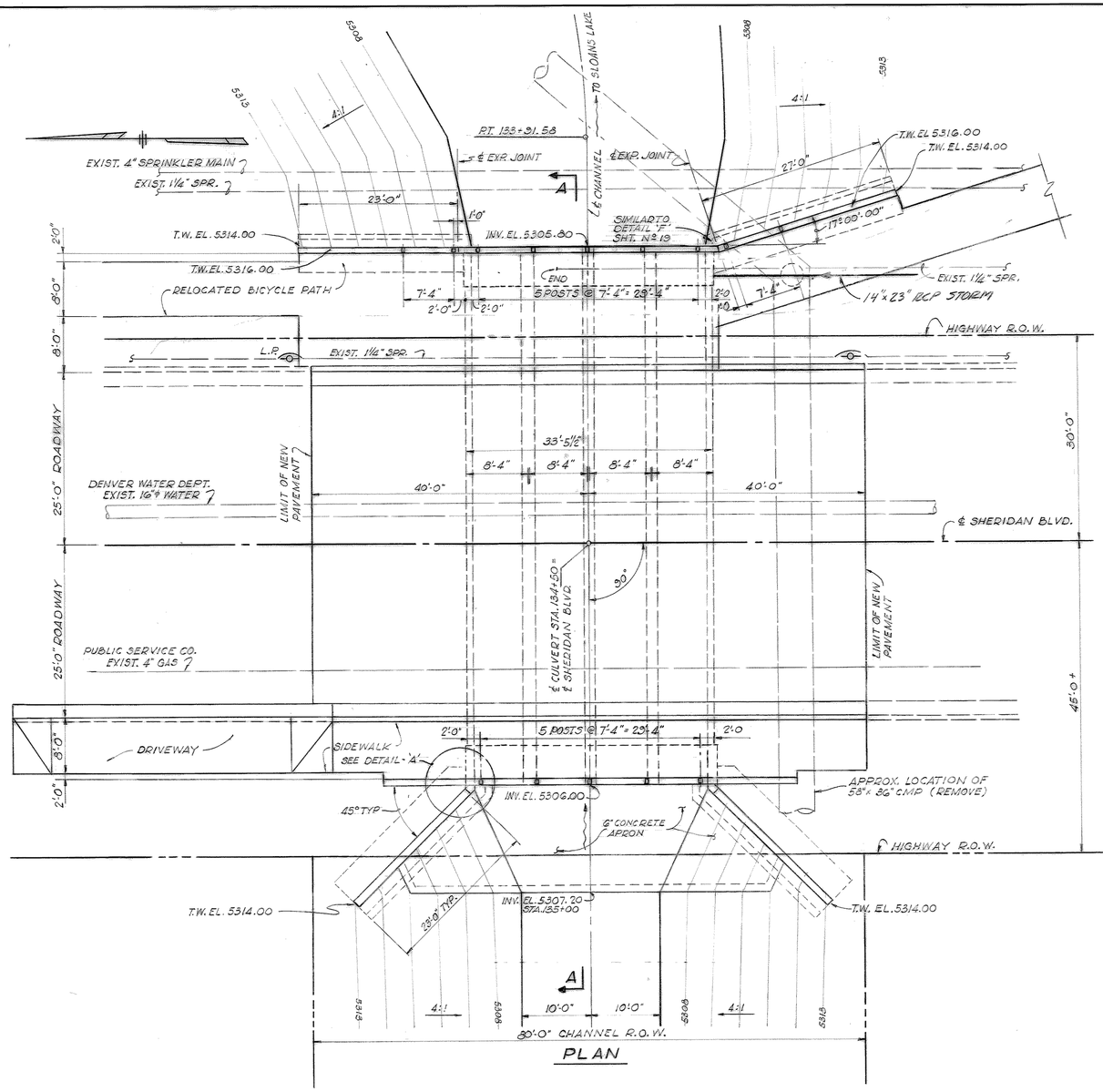
UPPER SLOANS LAKE
STORM DRAINAGE FACILITIES

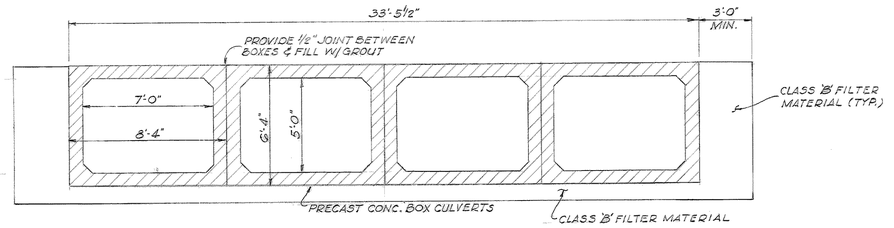
NO.	REVISIONS	DATE	INIT'S.

TYPICAL SECTIONS

DESIGNED E.H.W. DATE 5-16-80
DRAWN G.E.H. DATE 5-16-80
CHECKED S.C.B. DATE 5-16-80

SHEET 7 OF 26
PROJECT NO.





TYPICAL SECTION - SHERIDAN BOULEVARD

SCALE: ¼"=1'0"

NOTE: 16" WATER MAIN & 4" GAS MAIN WILL BE LOWERED AT THE TIME THE EXCAVATION IS MADE FOR CULVERT CONSTRUCTION.

FOR DETAILS OF 16" WATER MAIN RELOCATION, SEE SHT. Nº 3.

4" GAS MAIN WILL BE RELOCATED BY THE PUBLIC SERVICE COMPANY.

FOR DETAILS OF 4" SPRINKLER MAIN RELOCATION SEE SHT. Nº 20.

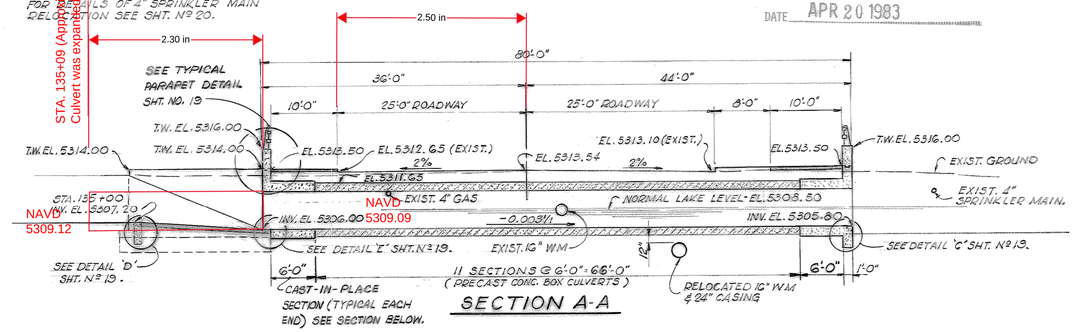
NOTE: PRECAST BOXES SHALL CONFORM TO ASTM C850-76. ALLOWABLE SOIL BEARING PRESSURE = 3000 PSF. LOADING DATA:
LIVE LOAD = AASHTO, HS 20-44.
DEAD LOAD = EARTH LOAD 84 LBS/C.F.
EQUIV. FLUID PRESSURE 30 LBS/C.F.

ALL HORIZONTAL REINFORCEMENT IN PRECAST BOXES TO BE EXTENDED INTO CAST-IN-PLACE END SECTIONS.

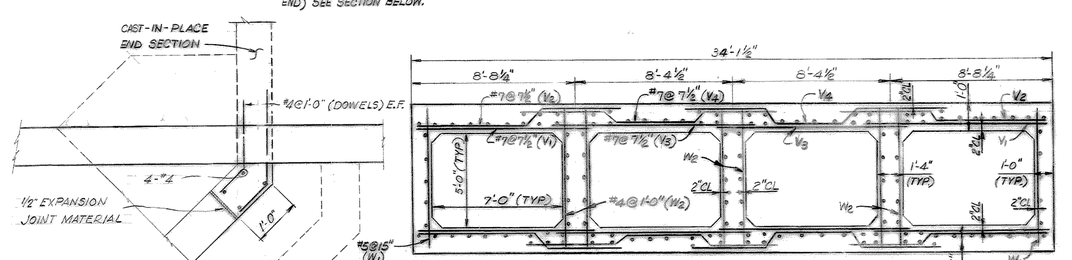
AS BUILT

RECORD DRAWING

DATE APR 20 1983



SECTION A-A



NOTES:
ALL LONGITUDINAL BARS (U1) ARE #4@1'-0" (CONT.) AS SHOWN.

BAR SIZE, LENGTH & PLACEMENT FOLLOWS STANDARD M-601-803.

TYPICAL CAST-IN-PLACE END SECTION SHERIDAN BOULEVARD

NOTE: FOR TYPICAL WINGWALL SECTION SEE SHT. Nº 16.

48 HOURS BEFORE YOU DIG CALL FOR THE BLUE STAKES
534-6700
Denver Inter-utility Group
Gas Electric & Telephone

URS 3955 E. EXPOSITION AVE. DENVER, COLO. 80209 AREA CODE 303 744-1861
ENGINEERS ARCHITECTS PLANNERS

GERNOT D. APPELT REGISTERED 7002 PROFESSIONAL ENGINEER STATE OF COLORADO

SCALE
NO SCALE

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
CITY OF LAKEWOOD
CITY OF EDGEWATER
CITY & COUNTY OF DENVER

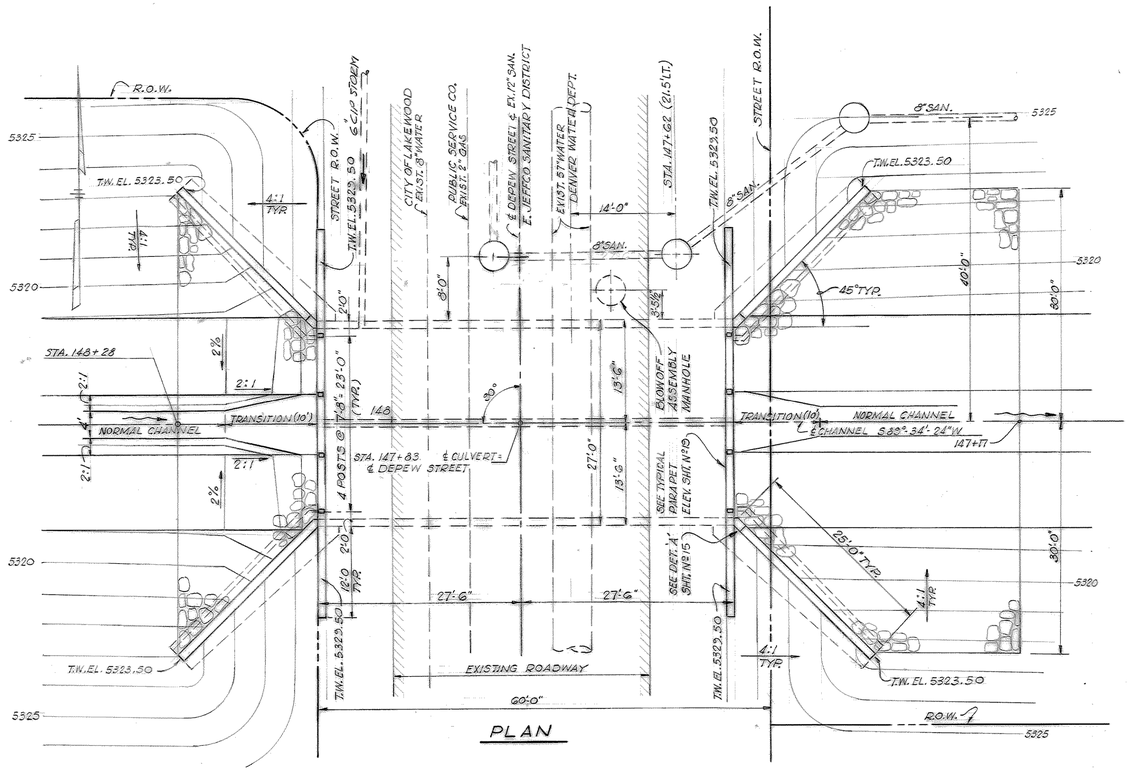
UPPER SLOANS LAKE
STORM DRAINAGE FACILITIES

NO.	REVISIONS	DATE	INIT'S.

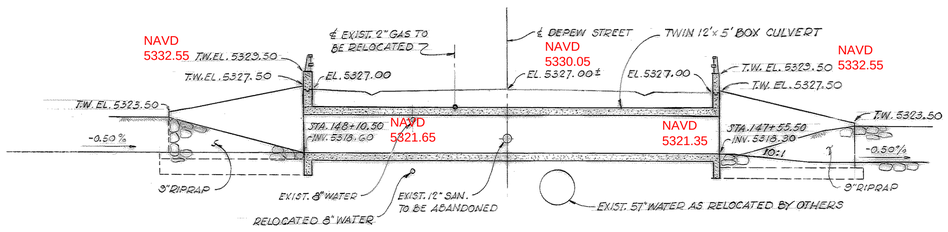
BOX CULVERT AT SHERIDAN BOULEVARD

DESIGNED L.L.F. DATE 5-16-80
DRAWN J.M.O. DATE 5-16-80
CHECKED G.D.A. DATE 5-16-80

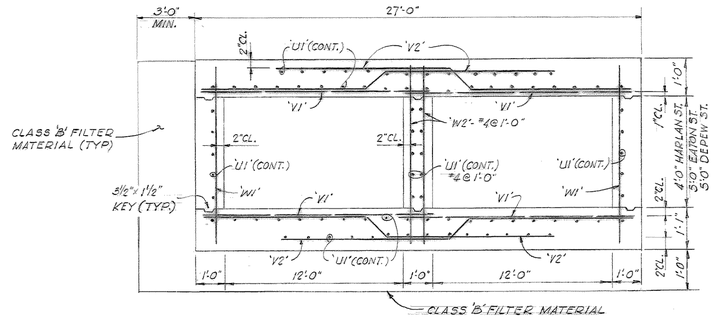
SHEET 15 OF 26
PROJECT NO.



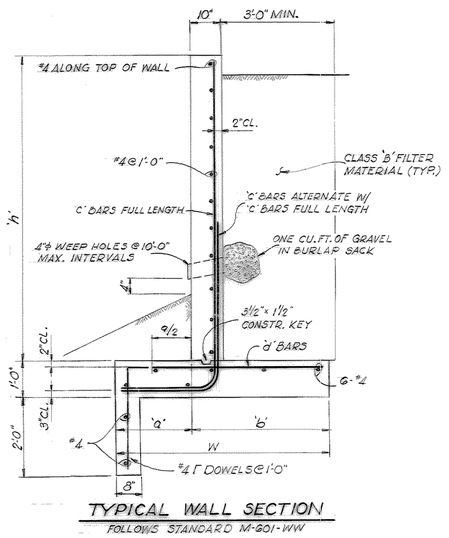
PLAN



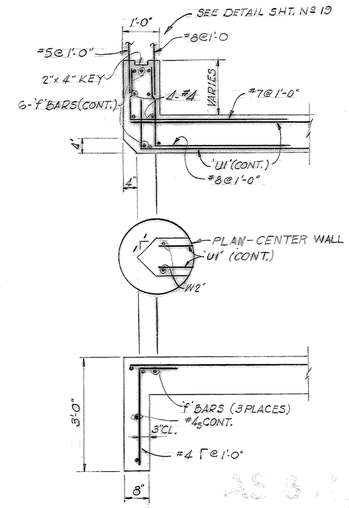
ELEVATION



TYPICAL SECTION
(EATON, HARLAN & DEPEW STS.)
FOLLOWS STANDARD M-601-BC-2, TYPE 12-12-A



TYPICAL WALL SECTION
FOLLOWS STANDARD M-601-WW



TYPICAL INLET-OUTLET SECTION
FOLLOWS STANDARD M-601-BC-2

NOTES:
ALL RELOCATIONS OF E. JEFFCO SANITARY SEWERS LYING BETWEEN FENTON ST. & SHERIDAN BLVD. SHALL BE COMPLETED PRIOR TO CONSTRUCTION OF THE BOX CULVERT AT DEPEW ST. FOR ADDITIONAL DETAILS SEE SHT. NOS. 3, 4 & 6.

FOR DETAILS OF 8" WATERMAIN RELOCATION SEE SHT. N° 14.

2" GAS MAIN WILL BE RELOCATED BY THE PUBLIC SERVICE CO.

AS BUILT

RECORD DRAWING

DATE APR 20 1983

NOTES:
ALLOWABLE SOIL BEARING PRESSURES:

HARLAN ST.	2,000 PSF.
EATON ST.	2,500 PSF.
DEPEW ST.	2,500 PSF.

48 HOURS BEFORE YOU DIG
CALL FOR THE BLUE STAKES
534-6700
Denver Inter-utility Group
Gas Electric & Telephone

URS 3955 E. EXPOSITION AVE. DENVER, COLO. 80209 AREA CODE 303 744-1861
ENGINEERS ARCHITECTS PLANNERS

GERNOT D. APPELT REGISTERED 7002 PROFESSIONAL ENGINEER STATE OF COLORADO

SCALE
NO SCALE

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
CITY OF LAKEWOOD
CITY OF EDGEWATER
CITY & COUNTY OF DENVER

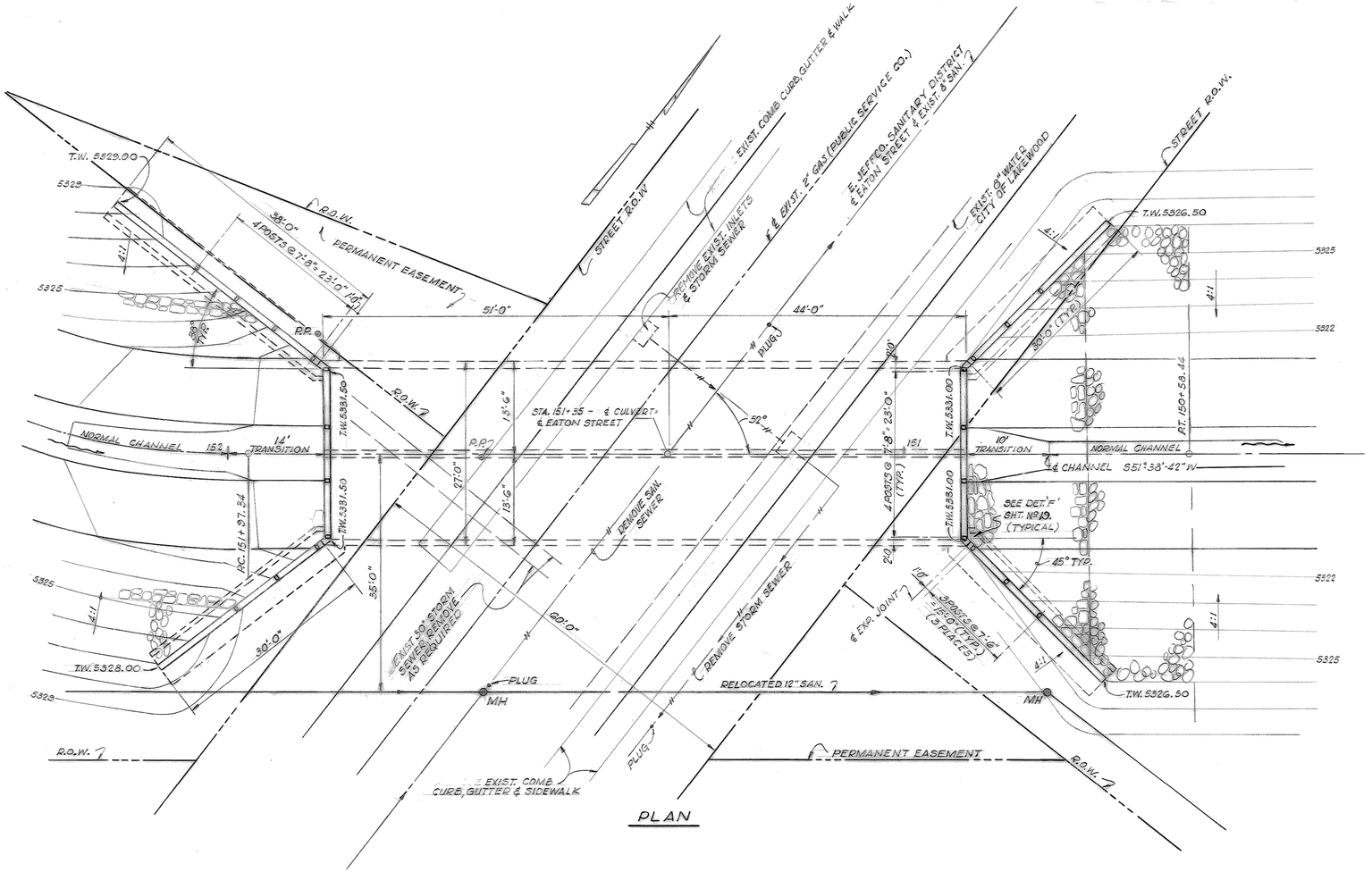
UPPER SLOANS LAKE
STORM DRAINAGE FACILITIES

NO.	REVISIONS	DATE	INIT'S.

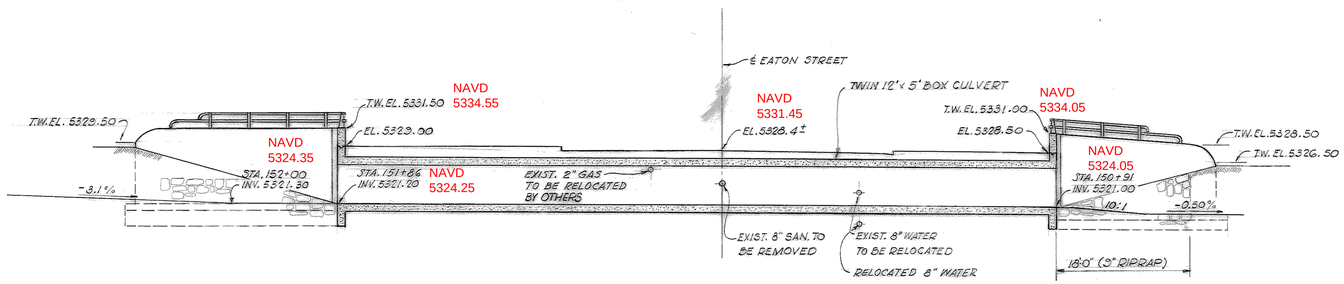
BOX CULVERT AT DEPEW STREET

DESIGNED L.L.F. DATE 5-16-80
DRAWN J.M.D. DATE 5-16-80
CHECKED G.D.A. DATE 5-16-80

SHEET 16 OF 26
PROJECT NO.



PLAN



ELEVATION

NOTES:

1. RELOCATION OF THE E. JEFFCO SANITARY SEWER BETWEEN EATON ST. & DEPEW ST. SHALL BE COMPLETED PRIOR TO CONSTRUCTION OF THIS BOX CULVERT.
2. FOR DETAILS OF 8" WATERMAIN RELOCATION SEE SHT. No 14.
3. 2" GAS MAIN WILL BE RELOCATED BY THE PUBLIC SERVICE CO.

AS BUILT

RECORD DRAWING

DATE APR 20 1983

NOTE: FOR TYPICAL WINGWALL & BOX CULVERT SECTIONS AND DETAILS SEE SHT. No 16 & SHT. No 19.

48 HOURS BEFORE YOU DIG
CALL FOR THE BLUE STAKES
534-6700
Denver Inter-utility Group
Gas Electric & Telephone

URS 3955 E. EXPOSITION AVE. DENVER, COLO. 80209 AREA CODE 303 744-1881
ENGINEERS ARCHITECTS PLANNERS

BERNOT D. ARCELL REGISTERED 7002 PROFESSIONAL ENGINEER STATE OF COLORADO

SCALE
NO SCALE

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
CITY OF LAKEWOOD
CITY OF EDGEWATER
CITY & COUNTY OF DENVER

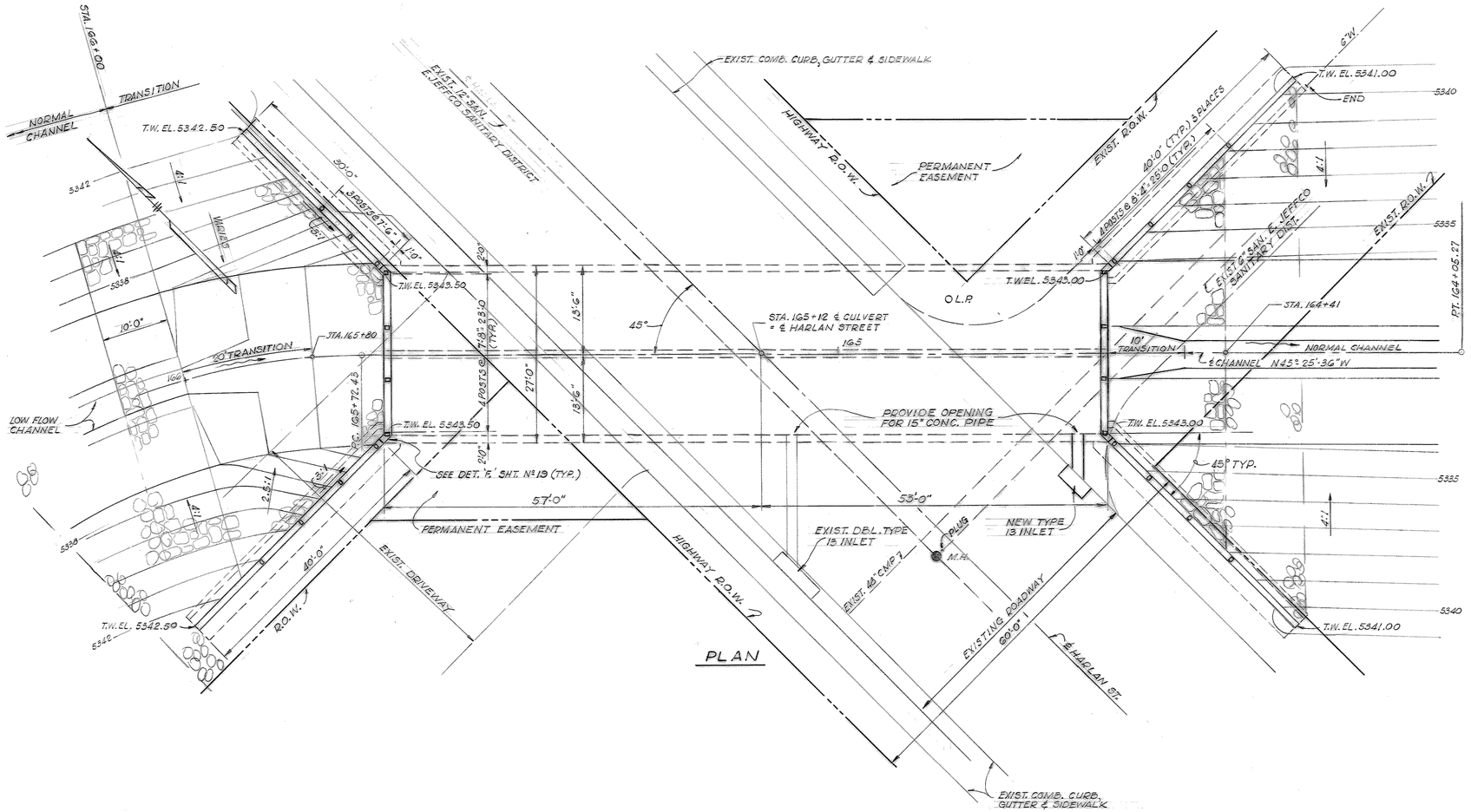
UPPER SLOANS LAKE
STORM DRAINAGE FACILITIES

NO.	REVISIONS	DATE	INIT'S.

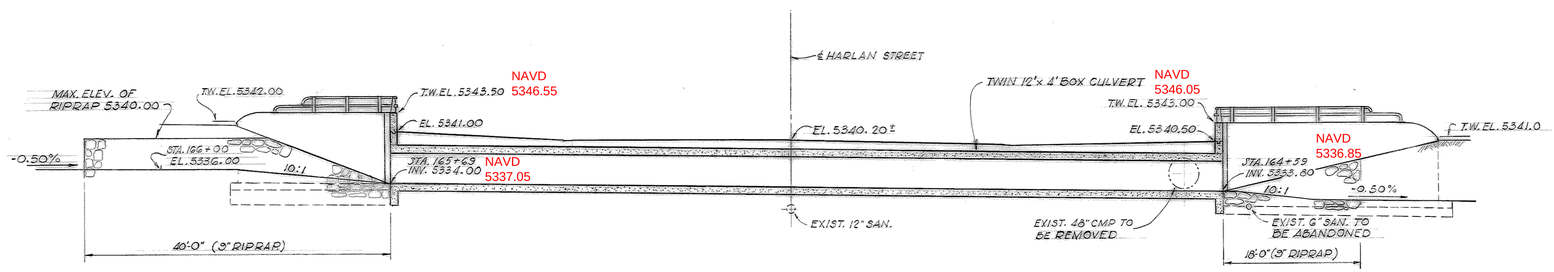
BOX CULVERT AT EATON STREET

DESIGNED L.L.F. DATE 5-16-80
DRAWN J.M.O. DATE 5-16-80
CHECKED G.D.A. DATE 5-16-80

SHEET 17 OF 26
PROJECT NO.



PLAN



ELEVATION

NOTE:
RELOCATION OF THE E. JEFFCO SANITARY DISTRICT 8" SANITARY SEWER SHALL BE COMPLETED PRIOR TO CONSTRUCTION OF THE BOX CULVERT. FOR DETAILS SEE SHT. NOS 5 & 6.

AS BUILT

RECORD DRAWING

DATE APR 20 1983

NOTE: FOR TYPICAL WINGWALL & BOX CULVERT SECTIONS AND DETAILS SEE SHT. Nº 16 & SHT. Nº 19.

48 HOURS BEFORE YOU DIG
CALL FOR THE BLUE STAKES
534-6700
Denver Inter-utility Group
Gas Electric & Telephone

URS 3955 E. EXPOSITION AVE. DENVER, COLO. 80209 AREA CODE 303 744-1861
ENGINEERS ARCHITECTS PLANNERS

BERNOT D. APPELT REGISTERED 7002 PROFESSIONAL ENGINEER STATE OF COLORADO

SCALE
NO SCALE

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
CITY OF LAKEWOOD
CITY OF EDGEWATER
CITY & COUNTY OF DENVER

UPPER SLOANS LAKE
STORM DRAINAGE FACILITIES

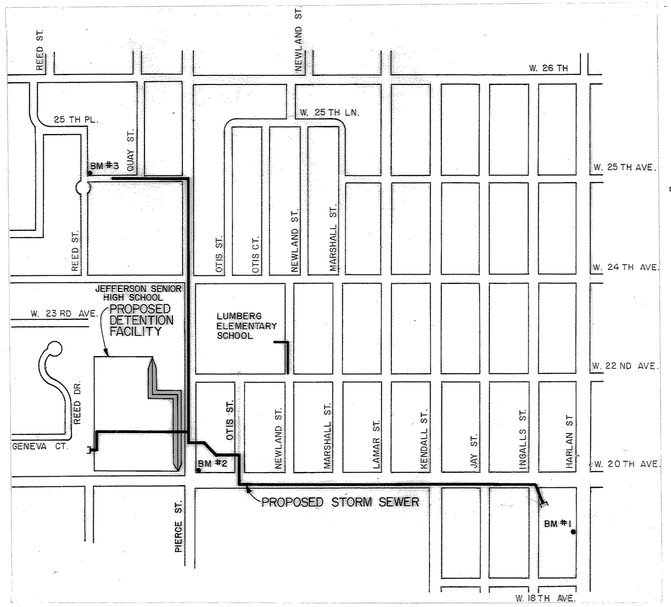
NO.	REVISIONS	DATE	INIT'S.

BOX CULVERT AT HARLAN STREET

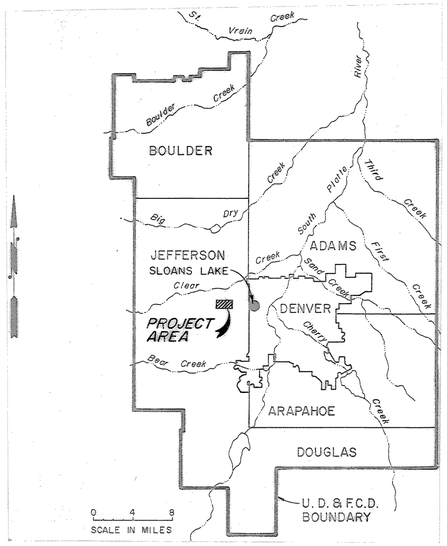
DESIGNED L.L.F. DATE 5-16-80
DRAWN J.M.D. DATE 5-16-80
CHECKED G.D.A. DATE 5-16-80

SHEET 18 OF 26
PROJECT NO.

UPPER SLOANS LAKE
STORM DRAINAGE PROJECT
SCHEDULE II



VICINITY MAP
SCALE 1" = 200'



DISTRICT MAP

INDEX OF SHEETS

DRAWING NO.	TITLE
1	TITLE SHEET
2	GENERAL NOTES AND TYPICAL SECTIONS
3	GENERAL PLAN AND SOILS INFORMATION
4	HORIZONTAL AND VERTICAL CONTROL
5	PLAN AND PROFILE - STORM SEWER - SHT. 1 OF 6
6	PLAN AND PROFILE - STORM SEWER - SHT. 2 OF 6
7	PLAN AND PROFILE - STORM SEWER - SHT. 3 OF 6
8	PLAN AND PROFILE - STORM SEWER - SHT. 4 OF 6
9	PLAN AND PROFILE - STORM SEWER - SHT. 5 OF 6
10	PLAN AND PROFILE - STORM SEWER - SHT. 6 OF 6
11	PLAN AND PROFILE - UTILITY RELOCATION - SHT. 1 OF 4
12	PLAN AND PROFILE - UTILITY RELOCATION - SHT. 2 OF 4
13	PLAN AND PROFILE - UTILITY RELOCATION - SHT. 3 OF 4
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15	CHANNEL GRADING AND OUTFALL STRUCTURE
16	JEFFERSON HIGH SCHOOL DETENTION POND
17	DETENTION POND - STORM SEWER PROFILE
18	DETENTION POND - EMBANKMENT SECTIONS
19	DETENTION POND - INLET STRUCTURE DETAILS
20	MANHOLE AND JUNCTION STRUCTURE DETAILS
21	JUNCTION STRUCTURE, MISC. DETAILS
22	UTILITY RELOCATION DETAILS
23	LUMBERG SEWER & MISC. DETAILS
24	TYPE 13 INLETS
25	TYPE R INLETS - SHT. 1 OF 2
26	TYPE R INLETS - SHT. 2 OF 2
27	INLET PROFILES - SHT. 1 OF 2
28	INLET PROFILES - SHT. 2 OF 2
29	R.O.W. MAP - SHT. 1 OF 3
30	R.O.W. MAP - SHT. 2 OF 3
31	R.O.W. MAP - SHT. 3 OF 3
32	PIERCE STREET PAVING PLAN

CITY OF EDGEWATER

MAYOR

CITY ENGINEER 4/6/87

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

EXECUTIVE DIRECTOR 4/6/87

CHIEF, DESIGN AND CONSTRUCTION

CITY OF LAKEWOOD

CITY ENGINEER 4-1-87

URS 3955 E. EXPOSITION AVE. DENVER, COLO. 80209 AREA CODE 303 744-1861
ENGINEERS ARCHITECTS PLANNERS

COLORADO REGISTERED PROFESSIONAL ENGINEER 22117

SCALE

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
CITY OF LAKEWOOD
CITY OF EDGEWATER

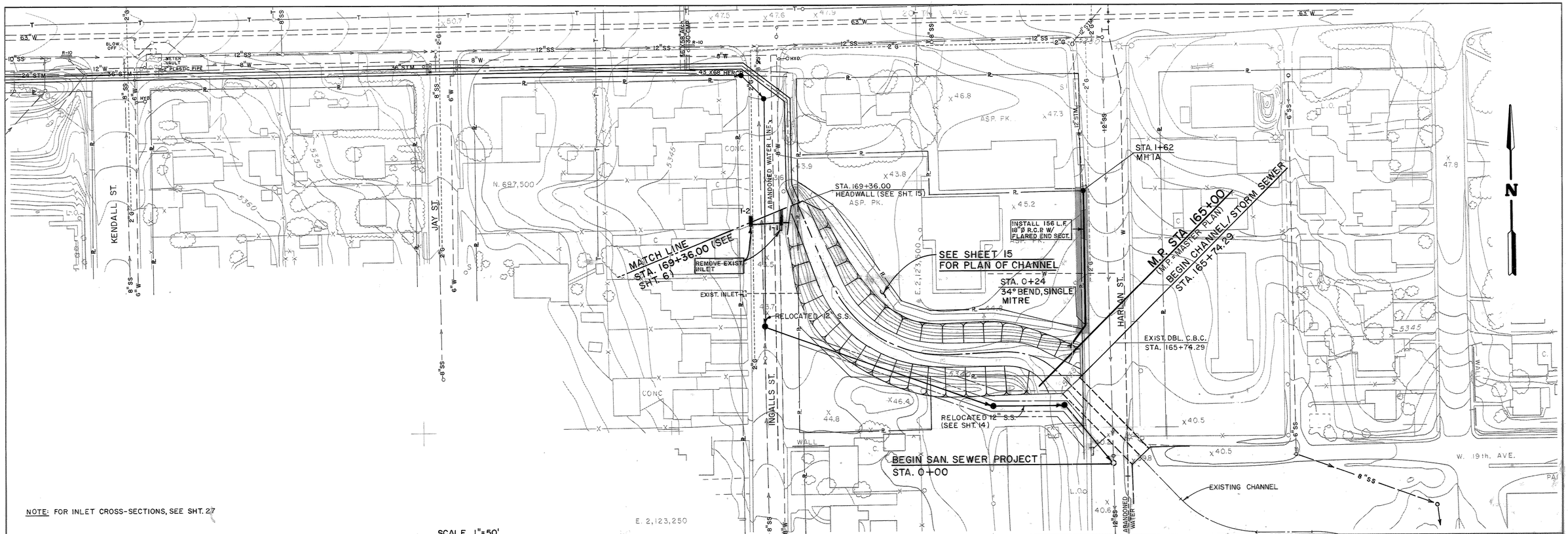
UPPER SLOANS LAKE
STORM DRAINAGE FACILITIES
SCHEDULE II

NO.	REVISIONS	DATE	INIT'S.

TITLE SHEET

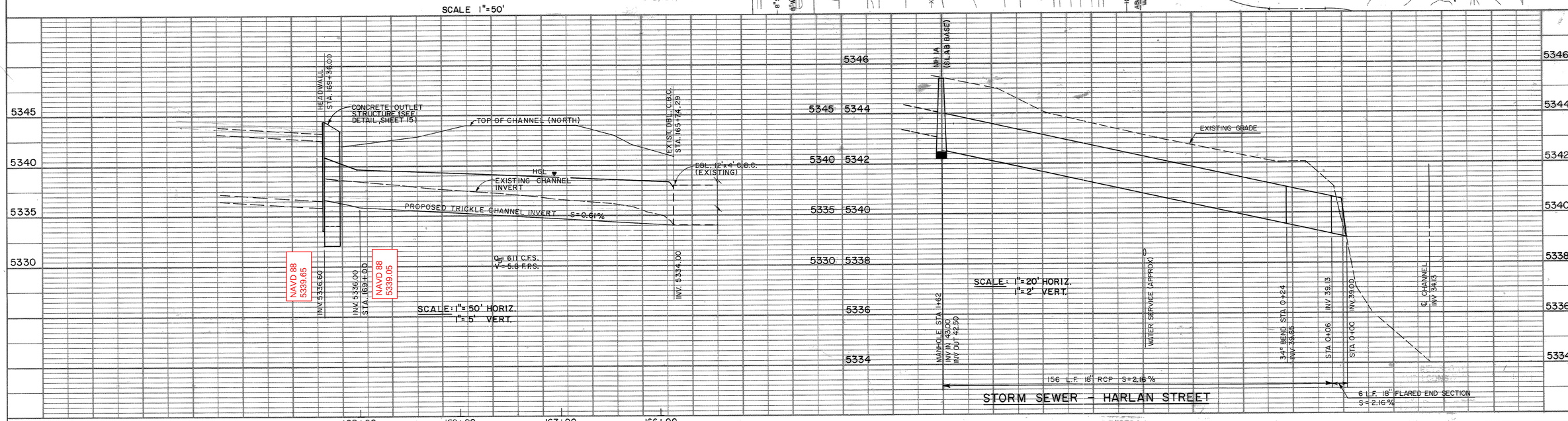
DESIGNED K.A.D. DATE 6/86
DRAWN D.S.K. DATE 6/86
CHECKED C.R.B. DATE 6/86

SHEET 1 OF 32
PROJECT NO. 3136



NOTE: FOR INLET CROSS-SECTIONS, SEE SHT. 27

SCALE 1"=50'



URS 3955 E. EXPOSITION AVE. DENVER, COLO. 80209 AREA CODE 303 744-1861
ENGINEERS ARCHITECTS PLANNERS

COLORADO REGISTERED PROFESSIONAL ENGINEER — CLIFFORD R. BRUNSWICK — 22117

SCALE
AS NOTED

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
CITY OF LAKEWOOD
CITY OF EDGEWATER

UPPER SLOANS LAKE
STORM DRAINAGE FACILITIES
SCHEDULE 11

NO.	REVISIONS	DATE	INIT'S.
	REVISED TO CONFORM WITH CONSTRUCTION RECORDS By: H. Foerster Ck'd: W. Wemmet Date: 3/88		

UPPER SLOANS LAKE
PLAN AND PROFILE
STORM SEWER - SHT. 1 OF 6

DESIGNED	K.A.D.	DATE	6/86
DRAWN	D.S.K.	DATE	6/86
CHECKED	C.R.B.	DATE	6/86

SHEET 5 OF 32
PROJECT NO. 3136

NOTES

1. Construct 6" vertical curb and gutter, Sta. 170+54, 34' Rt to Sta. 170+54, 120' Lt. Match existing grade. Provide 15' radius curb returns at Am Legion driveway.
2. Remove sanitary sewer, plug ends Sta. 170+79
3. Relocate water valve Sta. 177+10 TO BE FIELD RELOCATED
4. Remove sanitary sewer, plug ends
5. Remove existing storm sewer manhole, connect existing 21" and 24" diameter storm sewers to proposed storm sewer, Sta. 177+60
6. Remove sanitary sewer, plug ends, Sta. 178+02

GENERAL NOTES

1. Remove existing storm sewer and manholes, Sta. 170+80 to Sta. 182+36
2. Shading indicates curb and gutter and/or sidewalk to be replaced
3. Contractor shall restore all landscaped areas, including fences, irrigation systems, and plantings to pre-construction conditions, unless otherwise directed by Engineer. This shall be incidental to the work.

(SEE SHT. 7)

MATCH LINE STA. 182+36.00

STA 182+32.00 MH-4

REMOVE EXIST. INLET

REMOVE EXIST. INLET

EXIST. R-5 INLET

REMOVE EXIST. INLET, CONSTRUCT NEW COMB. CURB, GUTTER & WALK. MATCH EXIST. GRADE TO DRAIN.

REMOVE EXIST. STORM MH

ABANDONED WATER

REMOVE EXIST. INLETS

REMOVE EXIST. STORM SEWER (TYP.)

WARNING GAS CROSSING TO BE RELOCATED

WARNING GAS CROSSING TO BE RELOCATED

RELOCATE EXIST. WATER SERVICE & METER AS REQ'D.

REMOVE PIPE PLUG ENDS

IRRIGATION CONTROL BOX

CONNECT EXIST. 18" STM. TO PROPOSED STM. SEWER

STA 177+84.00 MH-3

WARNING GAS CROSSING TO BE RELOCATED

STA 174+40.00 MH-2

EXIST. POLES TO BE RELOCATED BY OTHERS

UNDERGROUND ELECTRIC SERVICE TO METER VAULT TO BE MAINTAINED

CONSTRUCT 80 L.F. COMB. CURB, GUTTER & WALK TO MATCH EXIST.

RELOCATED SANITARY SEWER (SEE SHTS. 13 & 14)

STA 171+58.00 MH-1, REMOVE EXISTING STRUCTURE, CONSTRUCT JUNCTION BOX, SEE SHT. 20

STA 171+00.00 38° BEND, SINGLE MITRE

REMOVE EXISTING CULVERT

RELOCATED 12" SS (SEE SHEET 14)

STA. 169+36.00 HEADWALL

AS-BUILT NOTE: ARCH PIPE & 52° WERE REPLACED W/ 6'x3' BOX CULVERT ALSO INSTALLED NEW INLET STRUCTURE AT NORTH CURB

STA 170+44.00 52° BEND, DOUBLE MITRE

FILL EXIST. DITCH

ABANDONED WATER LINE, PROTECT EXISTING 8" WATER LINE

CONCRETE DRIVEWAY SLAB W/ CROSS PAN TO BE CONSTRUCTED

STA 169+56.00 22°30' BEND, SINGLE MITRE

MATCH LINE (SEE SHT. 5) STA. 169+36.00

NOTE: FOR INLET CROSS-SECTIONS SEE SHEET 27

KENDALL

JAY ST.

LAMAR

INSTALL

ASP. PK.

N. 697,500

EXISTING GRADE

HGL

MH-4 PRECAST TEE STA 182+32.00

MATCH LINE STA 182+36.00 (SEE SHT 7)

INV. 5353.72

456 L.F. 72" RCP
S = 1.36 %
Q_5 = 474 cfs
V = 18 fps

6"W (LOWER)

18" STORM SEWER (CONNECT TO 72")

12" WATER (LOWER)

8" SANITARY SEWER (REMOVE & PLUG)

INV. 5347.62

NAVD 88 5350.47

INV. 5344.57 STA. 177+80.00

MH-3 PRECAST TEE STA. 177+84

REMOVE EXIST. INLET, CONSTRUCT 10' INLET OVER 72" R.C.P.

21" STM. CONN. EXIST. 21" & 24" STM SEWERS TO PROPOSED 72" STM

8" SANITARY SEWER

2"G

6"W (LOWER)

344 L.F. 72" RCP
S = 1.89%
Q_5 = 494 cfs
V = 17.5 fps

MH-2 PRECAST TEE STA. 174+40.00

78"x72" TRANSITION STA. 174+28.00

REMOVE EXISTING INLETS CONSTRUCT 13 L.F. 4'R IO INLETS OVER 72" R.C.P., SEE DETAIL SHEET 21

INV. 5342.65

INV. 5341.07 STA. 174+36.00

INV. 5340.92

8 L.F. 72"x78" ECCENTRIC TRANSITION

270 L.F. 78" RCP
S = 0.98 %
Q_5 = 494 cfs
V = 14.9 fps

6" (REMOVE & PLUG)

6"W (LOWER)

TELEPHONE

EXIST. 36"x56" STORM MH-1 STA. 171+58.00

EXIST. 36" STORM

38° BEND STA. 171+00.00

6" G.A.S. (TO BE LOWERED BY OTHERS) & SANITARY (REMOVE & PLUG)

8" WATER (LOWER)

52° BEND STA. 170+44.00

22°30' BEND STA. 169+36.00 HEADWALL STA. 169+36

6" CONC. SLAB

SAN. SEWER (TYP.) (RELOCATED)

INV. 5339.08

INV. 5337.72

INV. 5337.34

INV. 5336.74

INV. 5336.60

NAVD 88 5339.65

222 L.F. 8' x 6' CBC
S = 0.667%
Q_5 = 611 cfs
V = 14 fps

182+00 181+00 180+00 179+00 178+00 177+00 176+00 175+00 174+00 173+00 172+00 171+00 170+00 169+00

5360 5355 5350 5345 5340 5335 5330

URS 3955 E. EXPOSITION AVE. DENVER, COLO. 80209 AREA CODE 303 744-1861
ENGINEERS ARCHITECTS PLANNERS

COLORADO REGISTERED CLIFFORD L. CROCKETT 22117 PROFESSIONAL ENGINEER

SCALE
50 0 50 100
SCALE: 1"= 50'
HORIZONTAL
5 0 5 10
SCALE: 1"= 5'
VERTICAL

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

CITY OF LAKEWOOD
CITY OF EDGEWATER

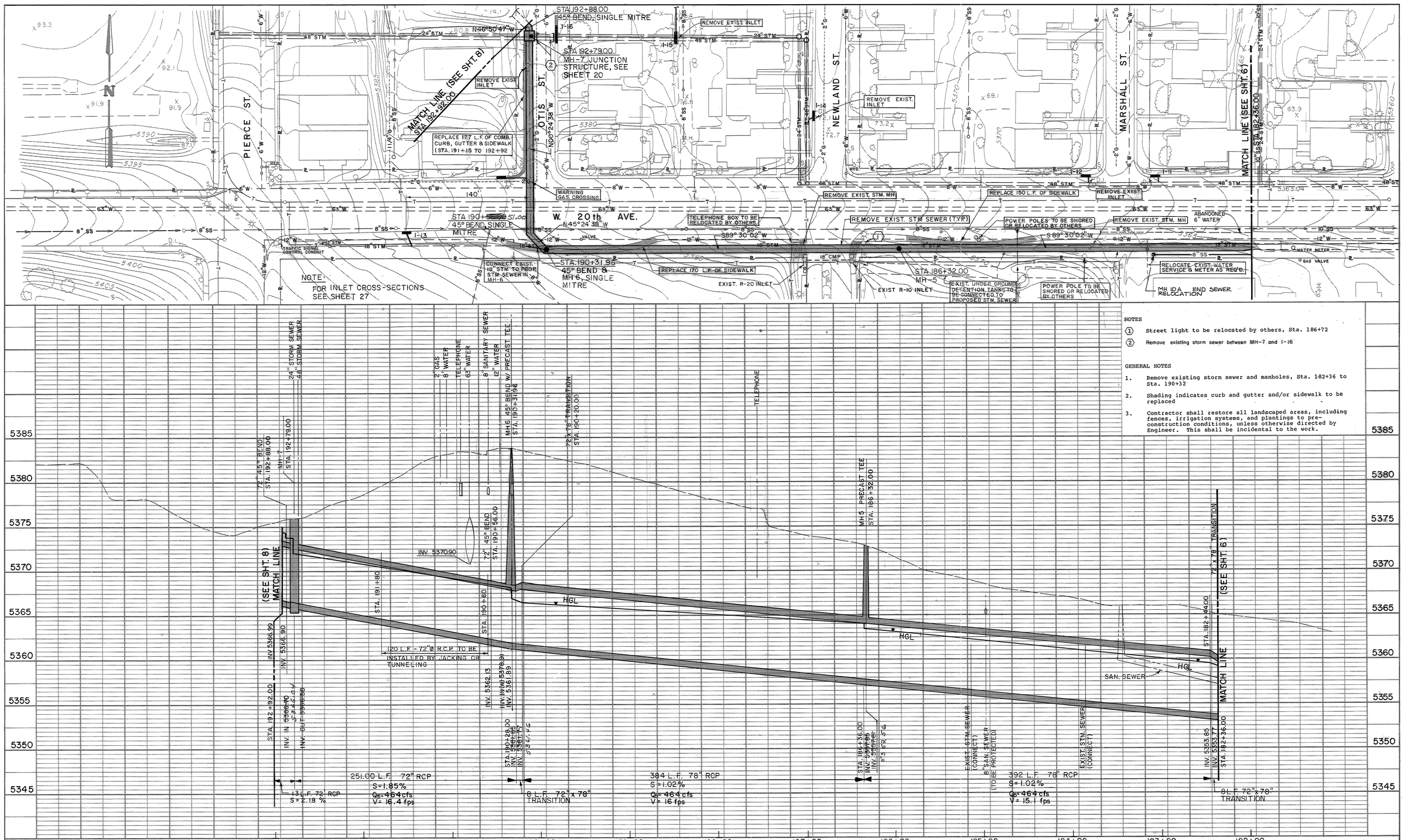
UPPER SLOANS LAKE
STORM DRAINAGE FACILITIES
SCHEDULE II

NO.	REVISIONS	DATE	INIT'S.
	REVISED TO CONFORM WITH CONSTRUCTION RECORDS By: H. Foerster Ck'd: W. Wemmert Date: 3/88		

UPPER SLOANS LAKE
PLAN AND PROFILE
STORM SEWER-SHT. 2 OF 6

DESIGNED	K.A.D.	DATE	6/86
DRAWN	D.S.K.	DATE	6/86
CHECKED	C.R.B.	DATE	6/86

SHEET 6 OF 32
PROJECT NO. 3136



NOTES

1. Street light to be relocated by others, Sta. 186+72
2. Remove existing storm sewer between MH-7 and I-16

GENERAL NOTES

1. Remove existing storm sewer and manholes, Sta. 182+36 to Sta. 190+32
2. Shading indicates curb and gutter and/or sidewalk to be replaced
3. Contractor shall restore all landscaped areas, including fences, irrigation systems, and plantings to pre-construction conditions, unless otherwise directed by Engineer. This shall be incidental to the work.

URS 3955 E. EXPOSITION AVE. DENVER, COLO. 80209 AREA CODE 303 744-1861
ENGINEERS ARCHITECTS PLANNERS

COLORADO REGISTERED PROFESSIONAL ENGINEER 22117

SCALE
SCALE: 1"=50'
HORIZONTAL
SCALE: 1"= 5'
VERTICAL

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
CITY OF LAKEWOOD
CITY OF EDGEWATER

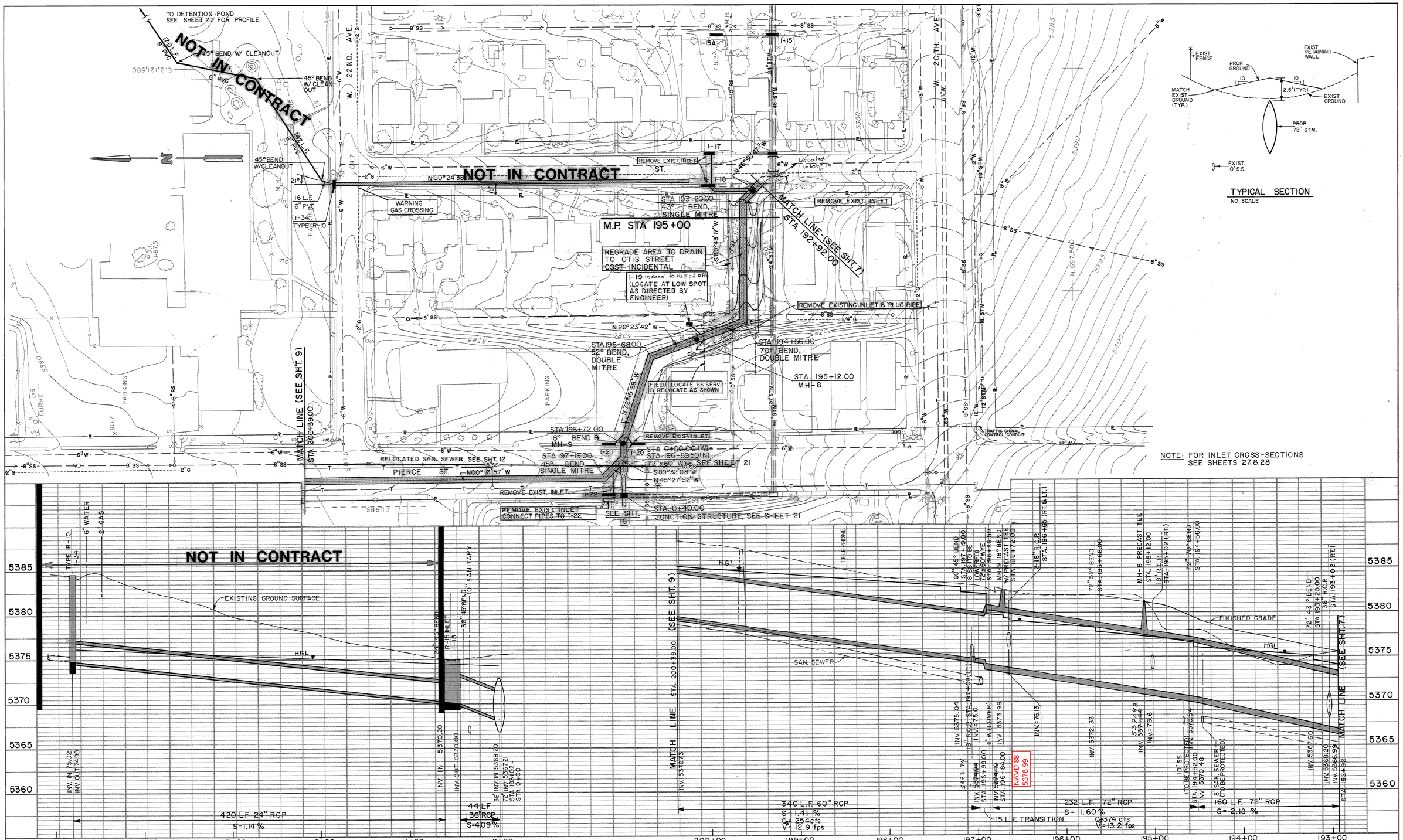
UPPER SLOANS LAKE
STORM DRAINAGE FACILITIES
SCHEDULE 11

NO.	REVISIONS	DATE	INIT'S.
	REVISED TO CONFORM WITH CONSTRUCTION RECORDS By: H. Foerster Ck'd: W. Wemmert Date: 3/88		

UPPER SLOANS LAKE
PLAN AND PROFILE
STORM SEWER - SHT. 3 OF 6

DESIGNED	K.A.D.	DATE	6/86
DRAWN	D.S.K.	DATE	6/86
CHECKED	C.R.B.	DATE	6/86

SHEET 7 OF 32
PROJECT NO. 3136



URS 3955 E. EXPOSITION AVE. DENVER, COLO. 80209 AREA CODE 303 744-1861
ENGINEERS ARCHITECTS PLANNERS

COLORADO REGISTERED PROFESSIONAL ENGINEER 22117

SCALE
SCALE: 1"=50'
HORIZONTAL
SCALE: 1"=5'
VERTICAL

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

CITY OF LAKEWOOD
CITY OF EDGEWATER

UPPER SLOANS LAKE
STORM DRAINAGE FACILITIES
SCHEDULE 11

NO.	REVISIONS	DATE	INIT'S.

REVISED TO CONFORM WITH CONSTRUCTION RECORDS
By: H. Foerster
Ck'd: W. Wemmert
Date: 3/88

UPPER SLOANS LAKE
PLAN AND PROFILE
STORM SEWER-SHT. 4 OF 6

DESIGNED	K.A.D.	DATE	6/86
DRAWN	D.S.K.	DATE	6/86
CHECKED	C.R.B.	DATE	6/86

SHEET 8 OF 32
PROJECT NO. 3136



URS 3955 E. EXPOSITION AVE. DENVER, COLO. 80209 AREA CODE 303 744-1861
ENGINEERS ARCHITECTS PLANNERS

COLORADO REGISTERED CLIFFORD R. BROWN 22117 PROFESSIONAL ENGINEER

SCALE
50 0 50 100
SCALE 1"=50'
HORIZONTAL
5 0 5 10
SCALE 1"=5'
VERTICAL

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

CITY OF LAKEWOOD
CITY OF EDGEWATER

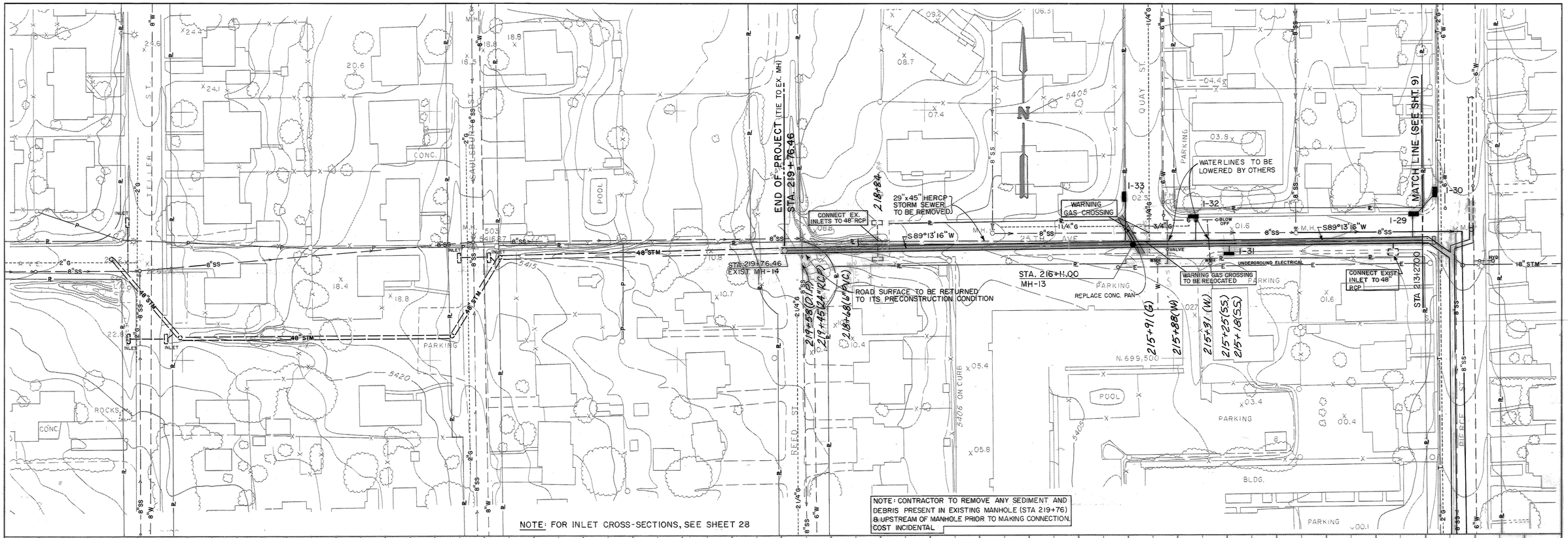
UPPER SLOANS LAKE
STORM DRAINAGE FACILITIES
SCHEDULE 11

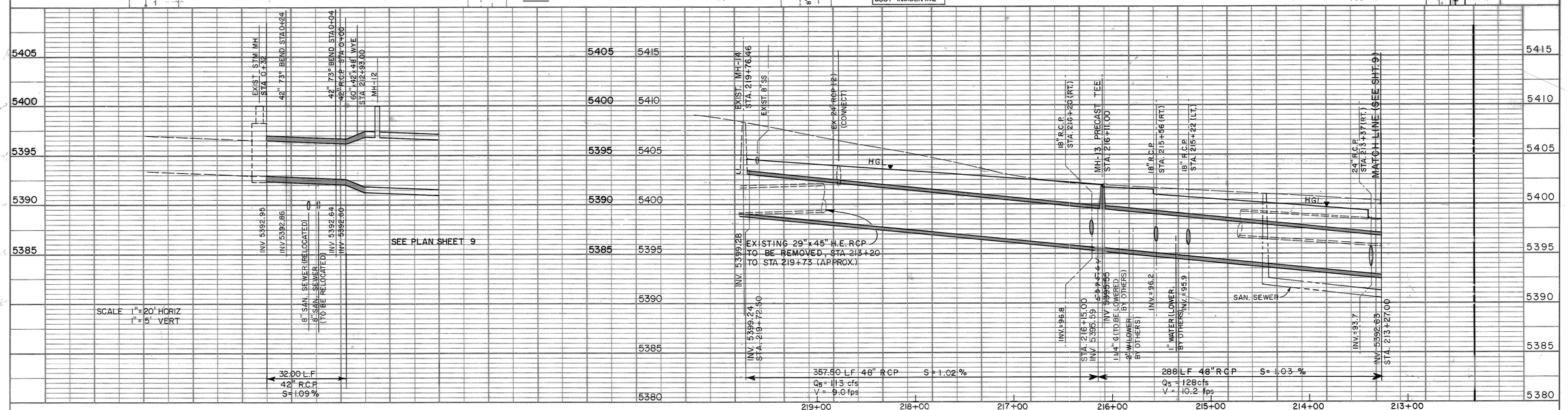
NO.	REVISIONS	DATE	INIT'S.
	PLOT ASBUILTS	1-26-88	DSN
	REVISED TO CONFORM WITH CONSTRUCTION RECORDS By: H. Foerster Ck'd: W. Wemmer Date: 5/88		

UPPER SLOANS LAKE
PLAN AND PROFILE
STORM SEWER - SHT. 5 OF 6

DESIGNED K.A.D. DATE 6/86
DRAWN D.S.K. DATE 6/86
CHECKED C.R.B. DATE 6/86

SHEET 9 OF 32
PROJECT NO. 3136





URS 3955 E. EXPOSITION AVE. DENVER, COLO. 80209 AREA CODE 303 744-1861
ENGINEERS ARCHITECTS PLANNERS

COLORADO REGISTERED 22117 PROFESSIONAL ENGINEER

SCALE
50 0 50 100
SCALE: 1"=50'
HORIZONTAL
5 0 5 10
SCALE: 1"=5'
VERTICAL

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

CITY OF LAKEWOOD
CITY OF EDGEWATER

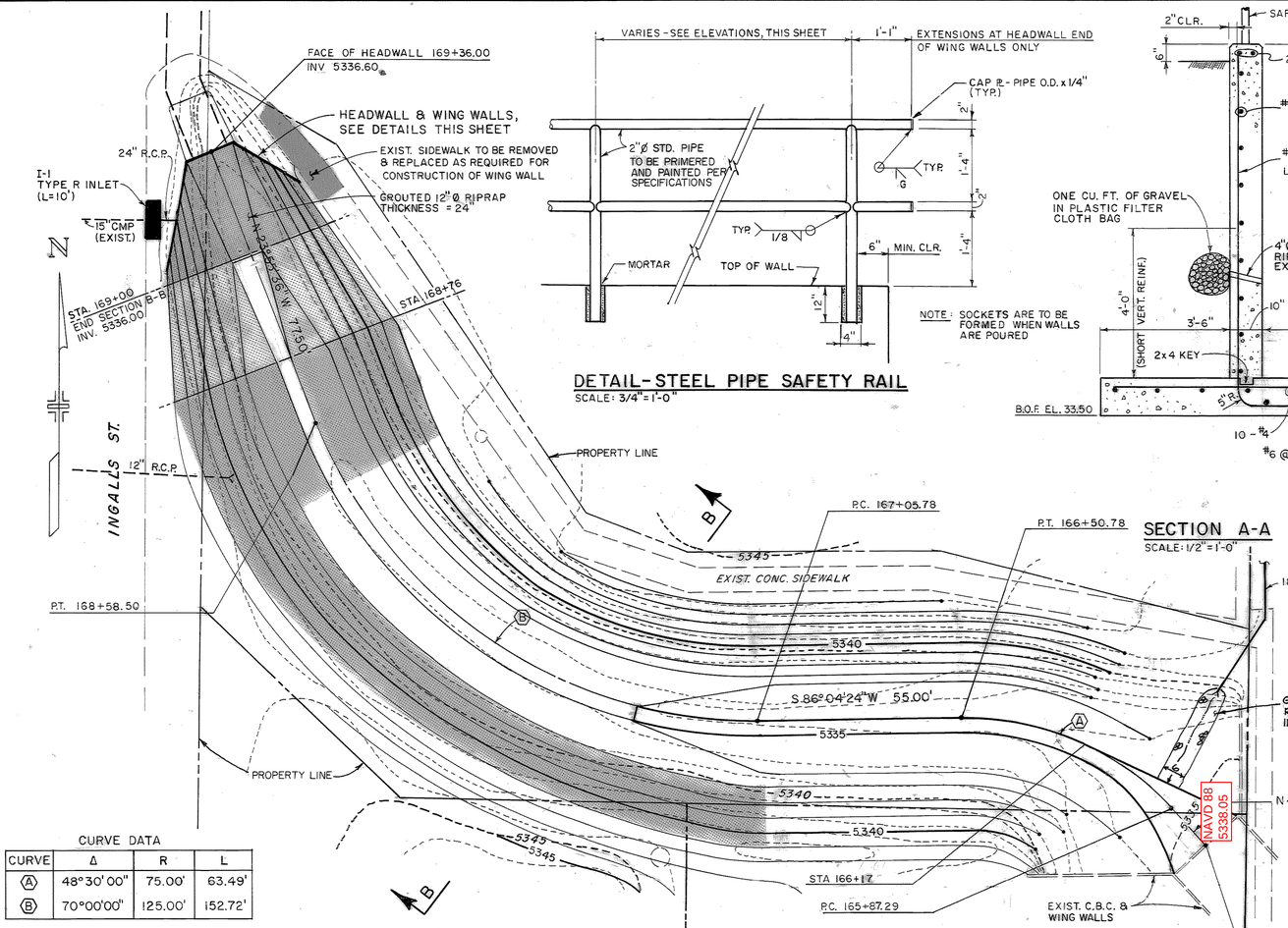
UPPER SLOANS LAKE
STORM DRAINAGE FACILITIES
SCHEDULE II

NO.	REVISIONS	DATE	INIT'S.
	PLOT ASBUILTS	1-26-88	DSN
	REVISED TO CONFORM WITH CONSTRUCTION RECORDS By: H. Forster Ck'd: W. Wrampt Date: 3/88		

UPPER SLOANS LAKE
PLAN AND PROFILE
STORM SEWER-SHT. 6 OF 6

DESIGNED K.A.D. DATE 6/86
DRAWN D.S.K. DATE 6/86
CHECKED C.R.B. DATE 6/86

SHEET 10 OF 32
PROJECT NO. 3136



CURVE DATA

CURVE	Δ	R	L
Ⓐ	48°30'00"	75.00'	63.49'
Ⓑ	70°00'00"	125.00'	152.72'

CHANNEL REGRADING PLAN - STA. 165+74 TO STA. 169+36

SCALE: 1"=20'

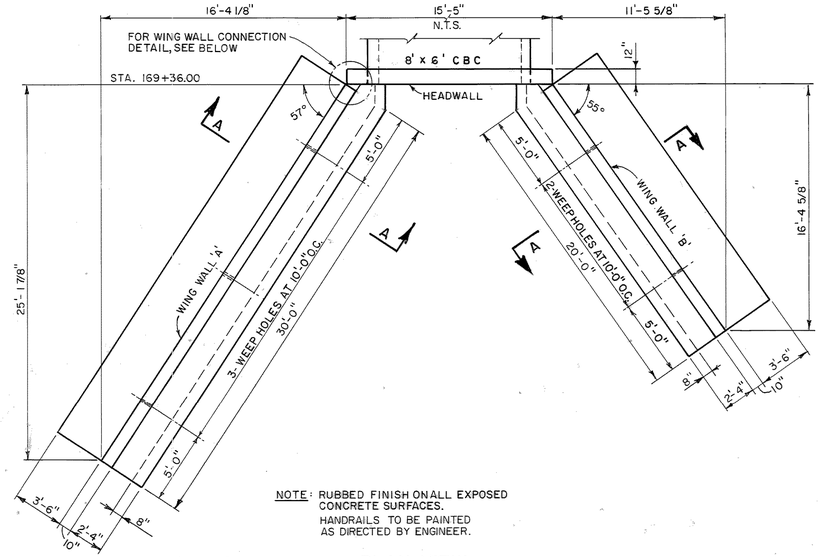
NOTE: SOCKETS ARE TO BE FORMED WHEN WALLS ARE POURED

DETAIL - STEEL PIPE SAFETY RAIL

SCALE: 3/4"=1'-0"

SECTION A-A

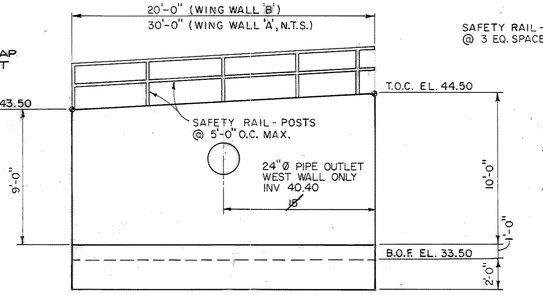
SCALE: 1/2"=1'-0"



NOTE: RUBBED FINISH ON ALL EXPOSED CONCRETE SURFACES. HANDRAILS TO BE PAINTED AS DIRECTED BY ENGINEER.

PLAN VIEW

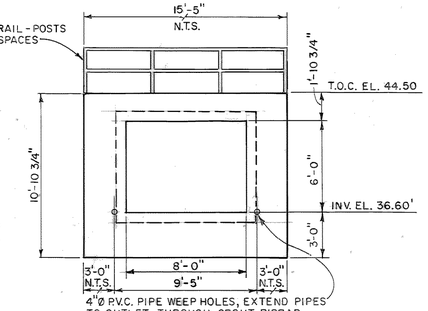
SCALE: 1"=5'



EAST ELEVATION - WING WALL 'A' (AS SHOWN)

WEST ELEVATION - WING WALL 'B' (OPP. HAND)

SCALE: 1"=5'

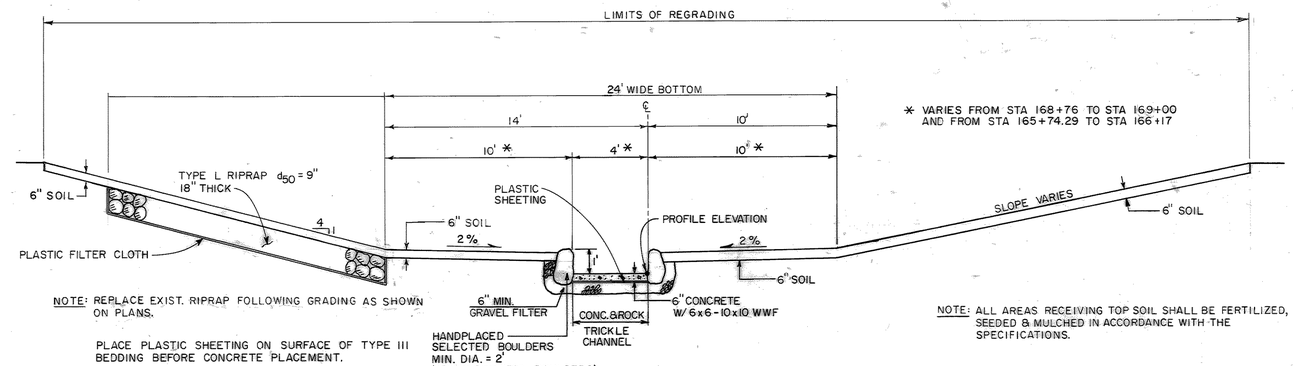


4"Ø P.V.C. PIPE WEEP HOLES, EXTEND PIPES TO OUTLET THROUGH GROUT RIPRAP

NOTE: FOR HEADWALL REINF. SEE DETAIL 'B', SHEET 22

HEADWALL ELEVATION

SCALE: 1"=5'



* VARIES FROM STA 168+76 TO STA 169+00 AND FROM STA 165+74.29 TO STA 166+17

NOTE: REPLACE EXIST. RIPRAP FOLLOWING GRADING AS SHOWN ON PLANS.

PLACE PLASTIC SHEETING ON SURFACE OF TYPE III BEDDING BEFORE CONCRETE PLACEMENT.

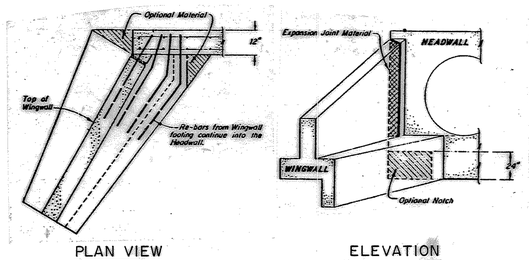
CONTRACTION JOINTS TO BE AT 10' SPACING.

CONTRACTOR TO SUPPLY ADEQUATE ASSISTANCE TO HELP ENGINEER MAKE FIELD MEASUREMENTS.

NOTE: ALL AREAS RECEIVING TOP SOIL SHALL BE FERTILIZED, SEEDED & MULCHED IN ACCORDANCE WITH THE SPECIFICATIONS.

SECTION B-B

NO SCALE



PLAN VIEW ELEVATION

WING WALL CONNECTION DETAILS

NO SCALE

URS 3955 E. EXPOSITION AVE. DENVER, COLO. 80209 AREA CODE 303 744-1861
ENGINEERS ARCHITECTS PLANNERS

COLORADO REGISTERED PROFESSIONAL ENGINEER 22117

SCALE AS NOTED

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

CITY OF LAKEWOOD
CITY OF EDGEWATER

UPPER SLOANS LAKE
STORM DRAINAGE FACILITIES
SCHEDULE II

NO.	REVISIONS	DATE	INIT'S.
	REVISED TO CONFORM WITH CONSTRUCTION RECORDS By: W. Weyandt Ckd: Date: 3/89		

UPPER SLOANS LAKE
CHANNEL GRADING AND OUTFALL STRUCTURE

DESIGNED	K.A.D.	DATE	6/86
DRAWN	J.N.M.	DATE	6/86
CHECKED	C.R.B.	DATE	6/86

SHEET 15 OF 32
PROJECT NO. 3136

SPILLWAY WALL
COORDINATES AT NORTH AND EAST FACE

NO.	NORTH	EAST
100	697,997.8510	2,120,990.8403
101	697,747.8559	2,120,992.4083
102	697,997.6503	2,120,958.8409

DETENTION WALL
COORDINATES AT NORTH AND EAST FACE

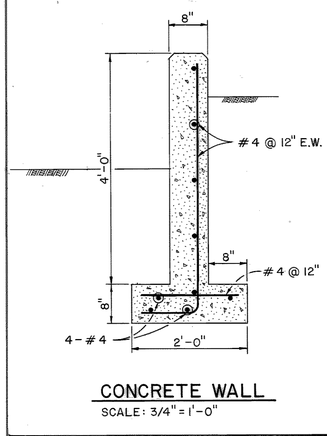
NO.	NORTH	EAST
103	698,418.7725	2,120,821.9026
104	698,407.5063	2,120,542.1293
105	698,353.7738	2,120,822.3103
106	698,354.9004	2,120,850.2876

COORDINATES AT TOP OF BERM

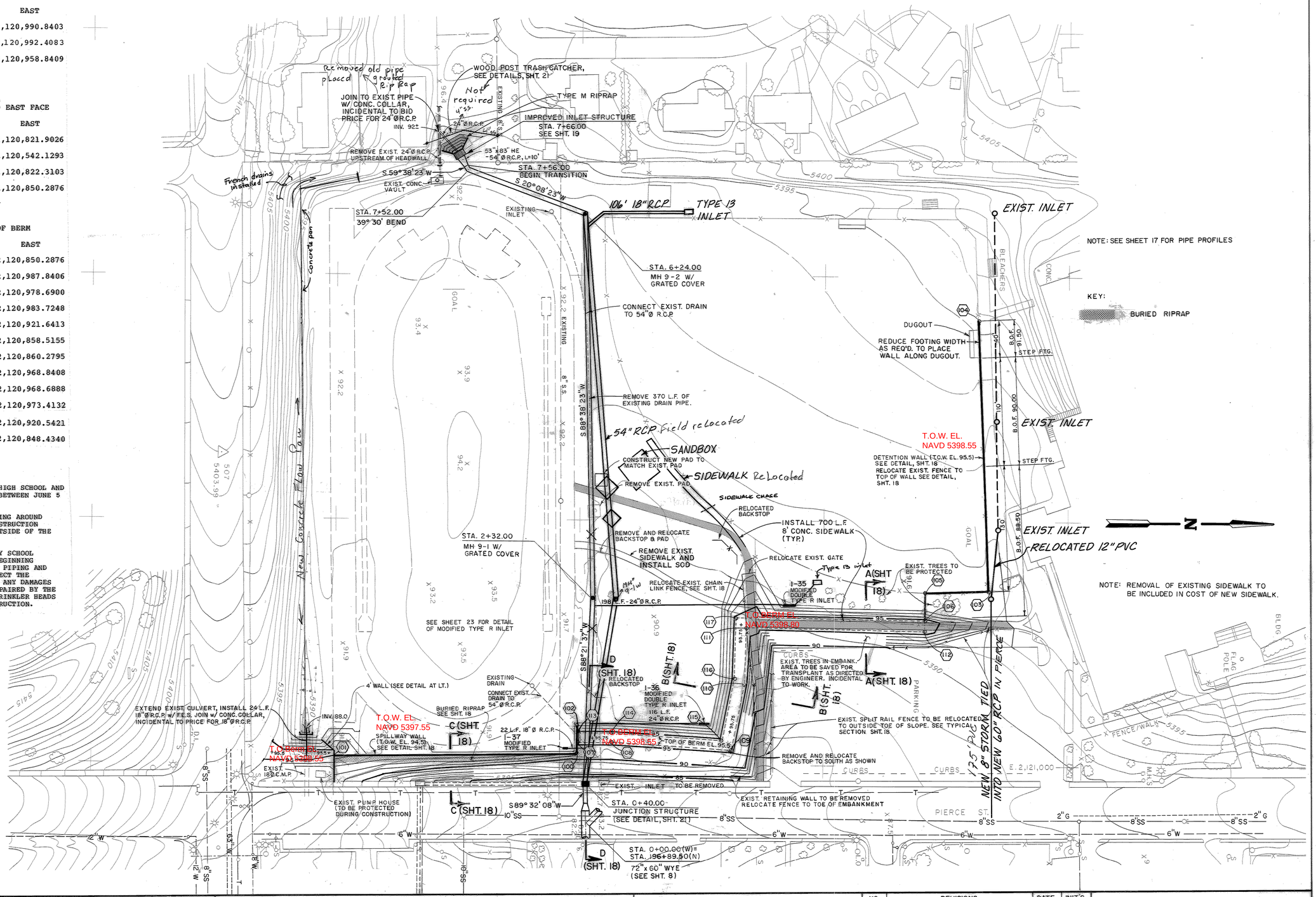
NO.	NORTH	EAST
106	698,354.9004	2,120,850.2876
107	697,997.7757	2,120,987.8406
108	698,021.7753	2,120,978.6900
109	698,154.8234	2,120,983.7248
110	698,167.9343	2,120,921.6413
111	698,168.6344	2,120,858.5155
112	698,355.3028	2,120,860.2795
113	697,997.7130	2,120,968.8408
114	698,021.9330	2,120,968.6888
115	698,146.7805	2,120,973.4132
116	698,157.9458	2,120,920.5421
117	698,158.7456	2,120,848.4340

NOTES:

1. ALL WORK ON SCHOOL PROPERTY (JEFFERSON HIGH SCHOOL AND LUMBERG ELEMENTARY) SHALL BE COMPLETED BETWEEN JUNE 5 AND AUGUST 23.
2. CONTRACTOR SHALL INSTALL TEMPORARY FENCING AROUND TRACK PRIOR TO BEGINNING WORK. ALL CONSTRUCTION EQUIPMENT AND MATERIALS SHALL REMAIN OUTSIDE OF THE FENCED AREA THROUGHOUT CONSTRUCTION.
3. CONTRACTOR SHALL NOTIFY JEFFERSON COUNTY SCHOOL DISTRICT (231-2376) 48 HOURS PRIOR TO BEGINNING CONSTRUCTION FOR LOCATION OF IRRIGATION PIPING AND SPRINKLER HEADS. CONTRACTOR SHALL PROTECT THE IRRIGATION SYSTEM DURING CONSTRUCTION. ANY DAMAGES RESULTING FROM CONSTRUCTION SHALL BE REPAIRED BY THE CONTRACTOR AT NO COST. RESETTING OF SPRINKLER HEADS SHALL BE INCIDENTAL TO EMBANKMENT CONSTRUCTION.



CONCRETE WALL
SCALE: 3/4" = 1'-0"



URS 3955 E. EXPOSITION AVE. DENVER, COLO. 80209 AREA CODE 303 744-1861
ENGINEERS ARCHITECTS PLANNERS

COLORADO REGISTERED RICHARD R. BROCKETT No. 22117 PROFESSIONAL ENGINEER

SCALE
50 0 50 100
SCALE: 1" = 50'

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

CITY OF LAKEWOOD
CITY OF EDGEWATER

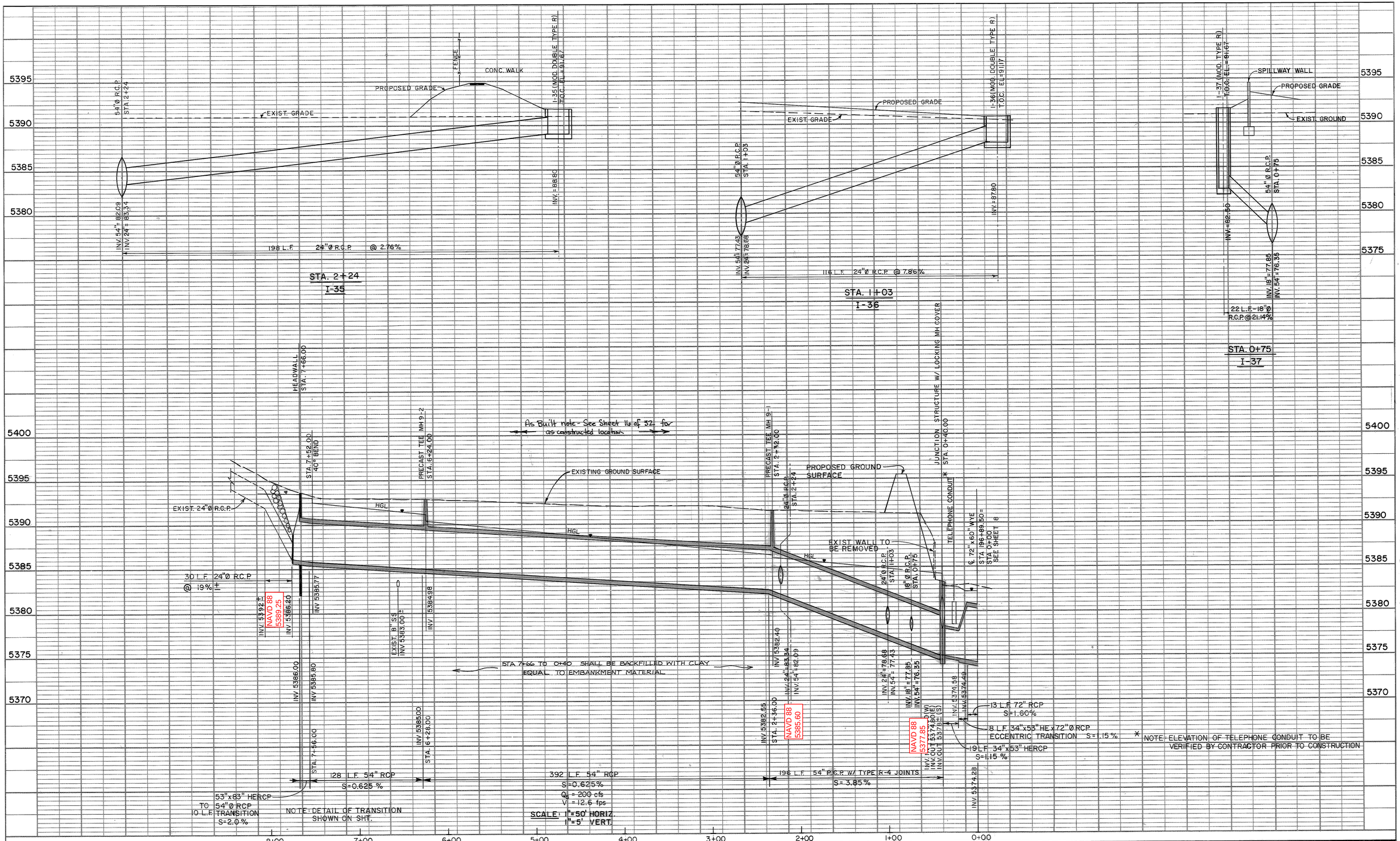
UPPER SLOANS LAKE
STORM DRAINAGE FACILITIES
SCHEDULE II

NO.	REVISIONS	DATE	INIT'S.
	PLOT ASBUILTS	1-26-87	DSN
	REVISED TO CONFORM WITH CONSTRUCTION RECORDS By: H. Foerster Ck'd: W Hummert Date: 3/00		

JEFFERSON HIGH SCHOOL DETENTION POND

DESIGNED	K.A.D.	DATE	6/86
DRAWN	J.N.M.	DATE	6/86
CHECKED	C.R.B.	DATE	6/86

SHEET 16 OF 32
PROJECT NO. 3136



URS
3955 E. EXPOSITION AVE.
DENVER, COLO. 80209
AREA CODE 303 744-1861
ENGINEERS ARCHITECTS PLANNERS

COLORADO REGISTERED P.E. 21121 PROFESSIONAL ENGINEER

SCALE
SCALE: 1"=20' HORIZONTAL
SCALE: 1"=5' VERTICAL
EXCEPT AS OTHERWISE NOTED

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

CITY OF LAKEWOOD
CITY OF EDGEWATER

UPPER SLOANS LAKE
STORM DRAINAGE FACILITIES
SCHEDULE 11

NO.	REVISIONS	DATE	INIT'S.
	REVISED TO CONFORM WITH CONSTRUCTION RECORDS By: W. Wemmert Date: 3/88		

DETENTION POND STORM SEWER PROFILE

DESIGNED	K.A.D.	DATE	6/86
DRAWN	D.S.K.	DATE	6/86
CHECKED	C.R.B.	DATE	6/86

SHEET 17 OF 32
PROJECT NO. 3136

Appendix D – Floodplain/Floodway Data Table and Agreement Table

TABLE D-1 Sloan's Lake Drainageway
Floodplain and Floodway Data Table

REFERENCE LOCATION	RIVER STATION	CROSS SECTION	THALWEG ELEVATION (FT)	PEAK DISCHARGES				WATER SURFACE ELEVATION				100-YEAR FLOODPLAIN		100-YEAR FLOODWAY (0.5' HGL/ EGL)						NOTE	COMMENTS
				10-YR	50-YR	100-YR	500-YR	10-YR	50-YR	100-YR	500-YR										
				FLOW (CFS)	FLOW (CFS)	FLOW (CFS)	FLOW (CFS)	WSEL (FT)	WSEL (FT)	WSEL (FT)	WSEL (FT)	WIDTH (FT)	EGL (FT)	WSEL (FT)	WIDTH (FT)	AREA (SQ FT)	VELOCITY (FT/S)	HGL SURCHARGE (FT)	EGL SURCHARGE (FT)		
Sloan's Lake Drainageway _ Sloan's Lake to Pierce Street																					
Sloan's Lake Outlet	70+63	7063	5310.7	26	32	34	360	5311.6	5312.4	5312.8	5313.4	59	5312.8	5312.8	59	85	0.4	0.00	0.00		Blocked obstruction was used to model the top of bikepath at elevation of 5313.05 per LOMR Case No. 92-08-040P
Pedestrian Bridge	70+79	7079	5309.2	26	32	34	360	5311.6	5312.4	5312.8	5313.5	431	5312.8	5312.8	431	334	0.2	0.00	0.00	1	Bikepath at elevation of 5313.05.
	106+68	10668	5309.2	1,634	3,053	3,703	5,491	5312.0	5312.7	5313.0	5313.8	2608	5313.1	5313.0	2608	9962	0.6	0.00	0.00	1	
	115+97	11597	5309.2	672	1,299	1,646	2,380	5312.0	5312.6	5312.9	5313.8	661	5313.5	5312.9	132	403	5.8	0.00	0.00	1, 4	
Pedestrian Bridge	116+05	11605	Bridge																		
	116+18	11618	5309.1	672	1,299	1,646	2,380	5312.2	5312.8	5313.1	5313.9	638	5313.6	5313.1	131	466	5.6	0.00	0.00	1, 4	
	117+19	11719	5308.9	672	1,299	1,646	2,380	5312.5	5313.2	5313.5	5313.9	539	5313.9	5313.5	130	534	4.8	0.00	0.00	1, 4	
	118+18	11818	5308.9	672	1,299	1,646	2,380	5312.6	5313.4	5313.7	5314.0	206	5314.2	5313.7	104	416	5.9	0.00	0.00	1, 4	
	119+16	11916	5308.7	672	1,299	1,646	2,380	5312.8	5313.9	5314.4	5315.6	73	5316.4	5314.4	73	316	11.2	0.00	0.00	2	
Sheridan Blvd.	119+90	11990	Culvert																		
	120+53	12053	5310.1	672	1,299	1,646	2,380	5313.8	5315.9	5317.0	5317.9	549	5317.3	5317.4	62	417	4.1	0.44	0.40	2	
	120+98	12098	5310.6	672	1,299	1,646	2,380	5313.9	5316.0	5317.1	5318.0	539	5317.4	5317.5	79	446	3.7	0.43	0.39	2	
	121+54	12154	5310.8	608	1,195	1,494	2,160	5314.0	5316.0	5317.1	5318.0	332	5317.5	5317.6	78	444	3.7	0.48	0.32	2	The floodplain top width was manually adjusted to include shallow flooding from the upstream left overbank.
Access Road 1	121+80	12180	Culvert																		
	122+33	12233	5311.2	608	1,195	1,494	2,160	5313.9	5316.2	5317.5	5318.3	347	5317.8	5318.0	62	336	4.5	0.50	0.49	2	
	122+80	12280	5311.8	608	1,195	1,494	2,160	5314.6	5316.2	5317.4	5318.0	93	5318.0	5317.9	55	262	5.7	0.50	0.46		
	125+08	12508	5313.2	608	1,195	1,494	2,160	5317.2	5317.8	5318.3	5319.0	58	5319.7	5318.3	52	156	9.6	0.00	0.01		
	125+88	12588	5313.3	608	1,195	1,494	2,160	5317.9	5319.3	5319.8	5320.9	62	5320.4	5319.8	58	256	5.8	0.01	0.01	3	
Access Road 2 (Benton Rd)	126+50	12650	Culvert																		
	127+18	12718	5313.9	608	1,195	1,494	2,160	5318.1	5319.8	5320.6	5322.5	79	5321.0	5320.6	79	326	4.6	0.01	0.01		
	127+56	12756	5314.2	608	1,195	1,494	2,160	5318.0	5319.7	5320.5	5322.4	64	5321.1	5320.5	64	241	6.2	0.01	0.01		
	128+84	12884	5315.0	608	1,195	1,494	2,160	5319.2	5320.4	5321.0	5322.7	65	5321.7	5321.0	64	227	6.6	0.00	0.00		
	129+29	12929	5317.2	608	1,195	1,494	2,160	5319.6	5320.7	5321.3	5323.1	93	5322.3	5321.3	65	190	7.9	0.00	0.01		
	129+60	12960	5318.6	608	1,195	1,494	2,160	5320.6	5321.3	5321.6	5323.1	137	5322.6	5321.8	62	168	8.9	0.20	0.50	3	
	130+01	13001	5316.4	608	1,195	1,494	2,160	5320.8	5322.0	5322.4	5323.1	89	5323.6	5322.5	57	167	9.0	0.08	0.32	3	
	131+14	13114	5320.0	608	1,195	1,494	2,160	5322.8	5323.8	5324.2	5325.1	64	5325.6	5324.2	60	163	9.2	0.00	0.00		
	131+75	13175	5320.2	608	1,195	1,494	2,160	5323.8	5324.8	5325.3	5326.1	70	5326.1	5325.3	54	197	7.6	0.00	0.02		
	132+53	13253	5320.4	608	1,195	1,494	2,160	5324.2	5325.2	5325.7	5326.4	59	5326.8	5325.7	55	180	8.3	0.04	0.02	3	
Depew Street	133+00	13300	Culvert																		
	133+50	13350	5321.7	608	1,195	1,494	2,160	5325.2	5328.4	5330.0	5330.5	285	5330.3	5330.1	60	356	4.2	0.09	0.11	2	
	133+95	13395	5322.1	608	1,195	1,494	2,160	5326.0	5328.4	5330.1	5330.7	359	5330.4	5330.1	62	336	4.5	0.04	0.13	2	
	135+14	13514	5322.7	608	1,195	1,494	2,160	5327.3	5328.7	5330.2	5330.7	122	5330.5	5330.3	62	304	4.9	0.09	0.14	2	
	135+82	13582	5323.1	608	1,195	1,494	2,160	5327.7	5328.9	5330.3	5330.9	143	5330.7	5330.4	62	295	5.1	0.11	0.12	4	
Eaton Street	136+50	13650	Culvert																		
	137+22	13722	5324.4	608	1,195	1,494	2,160	5328.0	5330.6	5333.1	5334.3	106	5333.3	5333.6	60	403	3.7	0.49	0.46		
	138+19	13819	5327.0	608	1,195	1,494	2,160	5330.9	5332.1	5333.1	5334.3	61	5334.3	5333.6	60	214	7.0	0.50	0.22		
	139+34	13934	5331.4	608	1,195	1,494	2,160	5334.7	5335.8	5336.4	5337.2	82	5337.8	5336.4	81	179	8.3	0.01	0.00		
	139+86	13986	5332.1	608	1,195	1,494	2,160	5335.6	5336.7	5337.3	5338.6	215	5338.2	5337.3	88	211	7.1	0.00	0.00	3	
	140+31	14031	5333.0	608	1,195	1,494	2,160	5336.3	5337.4	5337.8	5338.9	117	5338.5	5337.8	91	237	6.3	0.00	0.00	3	
	141+32	14132	5332.9	608	1,195	1,494	2,160	5336.8	5337.8	5338.2	5338.9	77	5339.2	5338.2	77	192	7.8	0.00	0.00		
	143+33	14333	5334.7	608	1,195	1,494	2,160	5338.1	5339.2	5339.7	5340.5	156	5340.4	5339.7	71	220	6.8	0.00	0.01	2	
	145+52	14552	5335.5	608	1,195	1,494	2,160	5339.1	5340.3	5340.8	5341.6	232	5340.9	5340.8	73	286	5.2	0.02	0.27	3	
	146+76	14676	5336.5	608	1,195	1,494	2,160	5339.3	5340.2	5340.6	5341.7	80	5341.8	5341.0	58	189	7.9	0.41	0.19	5	
	147+50	14750	5337.2	608	1,195	1,494	2,160	5340.0	5341.1	5341.5	5342.0	86	5342.4	5341.5	67	190	7.9	0.00	0.09	5	
	148+73	14873	5338.8	608	1,195	1,494	2,160	5341.3	5342.2	5342.6	5343.4	100	5343.3	5342.6	82	211	7.1	0.06	0.13		
	149+45	14945	5338.4	608	1,195	1,494	2,160	5341.9	5342.6	5343.3	5344.0	95	5343.7	5343.5	92	313	4.8	0.18	0.14		
Harlan Street	150+30	15030	Culvert																		
	151+11	15111	5339.0	608	1,195	1,494	2,160	5342.6	5345.7	5346.7	5347.5	285	5346.9	5347.2	107	546	2.7	0.47	0.45	2	
	151+86	15186	5339.9	587	1,134	1,421	2,065	5343.1	5345.6	5346.6	5347.4	135	5347.1	5347.1	67	296	4.8	0.48	0.40	2	
	152+59	15259	5340.4	587	1,134	1,421	2,065	5344.2	5345.7	5346.6	5347.2	58	5347.4	5347.1	58	232	6.1	0.50	0.30		
	154+41	15441	5341.7	587	1,134	1,421	2,065	5346.9	5347.7	5348.1	5349.1	357	5348.3	5348.2	120	272	5.2	0.05	0.28	3	
	154+52	15452	5346.4	39	549	818	1,410	5347.4	5347.9	5348.3	5349.2	346	5348.4	5348.4	124	196	4.2	0.16	0.33	3	
Ingalls Street	154+91	15491	5347.1	39	549	818	1,410	5347.4	5348.0	5348.3	5349.1	310	5348.6	5348.5	123	160	5.1	0.25	0.35	3	

TABLE D-1 Sloan's Lake Drainageway
Floodplain and Floodway Data Table

REFERENCE LOCATION	RIVER STATION	CROSS SECTION	THALWEG ELEVATION (FT)	PEAK DISCHARGES				WATER SURFACE ELEVATION				100-YEAR FLOODPLAIN		100-YEAR FLOODWAY (0.5' HGL/ EGL)						NOTE	COMMENTS
				10-YR	50-YR	100-YR	500-YR	10-YR	50-YR	100-YR	500-YR										
				FLOW (CFS)	FLOW (CFS)	FLOW (CFS)	FLOW (CFS)	WSEL (FT)	WSEL (FT)	WSEL (FT)	WSEL (FT)	WIDTH (FT)	EGL (FT)	WSEL (FT)	WIDTH (FT)	AREA (SQ FT)	VELOCITY (FT/S)	HGL SURCHARGE (FT)	EGL SURCHARGE (FT)		
	155+04	15504	5346.6	39	549	818	1,410	5347.4	5348.3	5348.6	5349.3	247	5348.7	5348.8	123	254	3.2	0.27	0.35		
	155+63	15563	5346.9	39	549	818	1,410	5347.6	5348.6	5349.0	5349.6	170	5349.4	5349.5	110	191	4.3	0.50	0.33		
	156+25	15625	5348.5	39	549	818	1,410	5349.6	5351.0	5351.3	5351.6	265	5351.3	5351.8	126	332	2.5	0.50	0.50		
	157+42	15742	5351.8	39	549	818	1,410	5352.6	5353.3	5353.5	5354.1	217	5354.1	5353.9	114	172	4.8	0.34	0.11		
Jay Street	158+62	15862	5353.7	39	549	818	1,410	5354.1	5354.8	5355.0	5355.5	256	5355.5	5355.1	124	138	5.9	0.03	0.10	3	
	159+41	15941	5354.2	39	549	818	1,410	5355.0	5355.9	5356.2	5356.8	170	5356.8	5356.2	101	127	6.5	0.00	0.02		
	160+27	16027	5355.6	39	549	818	1,410	5356.3	5357.2	5357.5	5358.0	348	5358.1	5357.5	100	132	6.2	0.00	0.02	3	
	161+31	16131	5357.7	39	549	818	1,410	5358.3	5359.3	5359.7	5360.2	323	5360.3	5359.7	108	134	6.1	0.00	0.00	2	
Kendall Street	161+92	16192	5358.5	39	549	818	1,410	5358.8	5360.0	5360.4	5361.0	438	5360.5	5360.4	113	146	5.6	0.00	0.49	3	
	162+87	16287	5359.7	39	549	818	1,410	5360.4	5361.4	5361.8	5362.4	419	5362.4	5361.8	123	127	6.4	0.00	0.08	5	
	163+48	16348	5360.2	0	339	544	993	5360.8	5362.1	5362.5	5363.2	478	5362.6	5362.5	98	171	3.2	0.01	0.11	5	
	164+55	16455	5361.9	0	339	544	993	5361.9	5363.1	5363.5	5364.0	180	5364.0	5363.4	96	93	5.9	-0.04	0.01		
Lamar Street	165+20	16520	5362.6	0	339	544	993	5362.6	5363.8	5364.1	5364.7	264	5364.3	5364.2	95	107	5.1	0.13	0.50		
	166+11	16611	5364.5	0	339	544	993	5364.6	5365.8	5366.0	5366.6	269	5366.6	5366.2	85	91	6.0	0.18	0.22	4	
	166+81	16681	5366.1	0	339	544	993	5366.1	5367.3	5367.6	5368.0	235	5368.0	5367.6	83	94	5.8	0.06	0.16		
	167+34	16734	5367.0	0	339	544	993	5367.0	5368.2	5368.5	5369.1	84	5369.1	5368.5	84	92	5.9	0.01	0.00		
Marshall Street	168+36	16836	5368.5	0	339	544	993	5368.6	5369.7	5370.0	5370.5	153	5370.5	5370.0	86	93	5.9	0.00	0.02	3	
	169+04	16904	5369.3	0	339	544	993	5369.3	5370.7	5371.1	5371.6	85	5371.6	5371.1	84	92	5.9	0.01	0.00		
	170+12	17012	5371.0	0	339	544	993	5371.1	5372.5	5372.8	5373.4	195	5373.4	5372.9	69	86	6.3	0.03	0.08	3	
	171+15	17115	5373.9	0	339	544	993	5374.0	5375.3	5375.6	5376.2	83	5376.2	5375.6	77	89	6.1	0.00	0.00		
Newland Street	171+94	17194	5375.7	0	339	544	993	5375.7	5376.5	5376.8	5377.4	251	5377.0	5376.8	181	135	4.0	0.00	0.03		
	173+24	17324	5379.7	0	339	544	993	5379.7	5380.7	5380.9	5381.2	362	5381.3	5381.3	165	183	3.0	0.45	0.22	2	
	174+31	17431	5378.7	0	339	544	993	5379.7	5381.4	5381.9	5382.6	401	5381.9	5382.3	160	501	1.1	0.40	0.40	2	
	175+44	17544	5378.9	0	339	544	993	5379.7	5381.8	5382.3	5383.1	196	5382.3	5382.7	149	394	1.4	0.36	0.35		
Otis Street	176+08	17608	5378.4	0	339	544	993	5379.7	5381.9	5382.4	5383.3	366	5382.4	5382.8	147	578	0.9	0.35	0.35	3	
	177+01	17701	5380.3	0	339	544	993	5380.4	5381.9	5382.4	5383.4	135	5382.7	5382.9	134	188	2.9	0.50	0.29		
	177+65	17765	5380.2	0	339	544	993	5380.6	5383.2	5383.8	5384.5	348	5383.8	5383.9	129	364	1.5	0.11	0.12	3	
	178+13	17813	5381.8	0	339	544	993	5381.9	5383.5	5384.0	5384.7	304	5384.1	5384.2	98	205	2.7	0.18	0.23	3	
	178+99	17899	5386.3	0	339	544	993	5386.3	5387.5	5387.8	5388.4	107	5388.3	5387.8	106	103	5.3	0.02	0.00		
	179+67	17967	5385.6	0	339	544	993	5386.3	5388.1	5388.5	5389.3	275	5388.5	5388.5	206	468	1.2	-0.01	-0.01		
Pierce Street	179+96	17996	5386.1	0	339	544	993	5386.3	5388.1	5388.5	5389.3	302	5388.6	5388.5	292	492	1.1	-0.01	-0.01		
Sloan's Lake Drainageway _ Pierce Street to Yarrow Street																					
	180+24	18024	5385.9	0	168	257	464	5386.3	5388.1	5388.6	5389.3	359	5388.6	5388.5	358	404	0.6	-0.01	-0.01		Floodplain delineation was manually extended at right overbank to provide a more realistic flood boundary transition.
Weir Structure	180+53	18053	5397.6	0	168	257	464	5397.6	5397.8	5397.9	5398.0	248	5398.0	5397.9	248	80	3.2	0.00	0.00		
	180+95	18095	5394.5	0	168	257	464	5397.6	5397.9	5398.1	5398.3	466	5398.1	5398.1	466	1585	0.5	0.00	0.00	3	
Jerfferson High School	181+89	18189	5394.1	0	168	257	464	5397.6	5398.0	5398.1	5398.3	464	5398.1	5398.1	463	1290	0.5	0.00	0.00	3	
Detention	184+50	18450	5394.6	0	50	127	290	5397.6	5398.0	5398.1	5398.4	624	5398.1	5398.1	624	1369	0.2	0.00	0.00	3	
	186+48	18648	5394.9	0	50	127	290	5397.6	5398.0	5398.1	5398.4	281	5398.1	5398.1	257	696	0.6	0.00	0.00	3	
	187+06	18706	5397.0	101	212	289	454	5397.6	5398.0	5398.1	5398.5	231	5398.2	5398.1	184	228	2.0	0.00	0.01	3	Inlet structure of 54-inch storm pipe at west end of Jefferson High School Detention was blocked with obstruction for only modeling surface flow.
	187+71	18771	5397.1	101	212	289	454	5399.3	5400.7	5401.0	5401.3	163	5401.3	5401.0	53	59	4.9	0.00	0.19		
	188+51	18851	5399.2	101	212	289	454	5400.8	5401.4	5401.6	5402.0	157	5401.7	5402.0	39	87	3.3	0.36	0.49		
	190+04	19004	5402.7	101	212	289	454	5403.9	5404.2	5404.4	5404.6	118	5404.7	5404.5	39	46	6.2	0.15	0.46		
	191+93	19193	5407.9	101	212	289	454	5408.7	5409.0	5409.1	5409.4	119	5409.3	5409.5	63	76	3.8	0.41	0.50		
	192+95	19295	5408.0	101	212	289	454	5411.1	5411.5	5411.7	5411.9	129	5411.9	5411.9	65	56	5.2	0.29	0.50		
	193+24	19324	5408.1	101	212	289	454	5411.8	5412.8	5413.2	5413.5	133	5413.6	5413.4	65	79	3.9	0.13	0.20	3	
Teller Street	193+50	19350	Culvert																		
	193+78	19378	5409.8	101	212	289	454	5414.6	5415.2	5415.5	5415.9	97	5415.6	5415.6	65	153	2.3	0.17	0.15	3	
	194+41	19441	5413.5	101	212	289	454	5415.5	5416.2	5416.5	5417.1	69	5416.7	5416.6	43	93	3.1	0.09	0.11		
	195+62	19562	5415.2	101	212	289	454	5418.0	5418.5	5418.8	5419.4	74	5419.0	5419.2	32	74	3.9	0.39	0.50		
	196+79	19679	5417.5	101	212	289	454	5420.6	5421.3	5421.7	5422.3	47	5422.0	5422.2	20	65	4.5	0.50	0.44	2	
	197+36	19736	5418.7	101	212	289	454	5421.7	5422.6	5423.1	5423.8	33	5423.3	5423.4	24	80	3.6	0.31	0.29		
	198+12	19812	5420.0	101	212	289	454	5423.2	5424.1	5424.6	5425.3	44	5425.2	5424.8	19	55	5.3	0.16	0.10	2	
	199+82	19982	5423.1	101	212	289	454	5426.5	5427.8	5428.5	5429.1	100	5428.8	5428.5	17	67	4.3	0.00	0.03		The floodplain top width was manually adjusted to include shallow flooding from the upstream left overbank.

TABLE D-1 Sloan's Lake Drainageway
Floodplain and Floodway Data Table

REFERENCE LOCATION	RIVER STATION	CROSS SECTION	THALWEG ELEVATION (FT)	PEAK DISCHARGES				WATER SURFACE ELEVATION				100-YEAR FLOODPLAIN		100-YEAR FLOODWAY (0.5' HGL/ EGL)						NOTE	COMMENTS
				10-YR	50-YR	100-YR	500-YR	10-YR	50-YR	100-YR	500-YR										
				FLOW (CFS)	FLOW (CFS)	FLOW (CFS)	FLOW (CFS)	WSEL (FT)	WSEL (FT)	WSEL (FT)	WSEL (FT)	WIDTH (FT)	EGL (FT)	WSEL (FT)	WIDTH (FT)	AREA (SQ FT)	VELOCITY (FT/S)	HGL SURCHARGE (FT)	EGL SURCHARGE (FT)		
Vance Street	200+44	20044	5435.5	101	212	289	454	5436.4	5436.6	5436.9	5437.2	268	5437.3	5437.2	48	52	5.5	0.35	0.49	2	
	201+12	20112	5437.0	101	212	289	454	5438.0	5438.5	5438.7	5439.2	298	5439.4	5438.7	35	48	6.0	0.01	0.01	3	
Office Hallway Bridge	202+00	20200	Inl Struct																		Office hallway bridge above drainageway was modeled as inline structure with gate 15' Wx1.5' H.
	202+04	20204	5437.7	101	212	289	454	5439.2	5441.1	5442.2	5443.1	418	5442.5	5442.7	141	358	3.6	0.50	0.42	3	
	202+59	20259	5438.6	101	212	289	454	5439.9	5441.5	5442.6	5443.5	351	5442.6	5443.0	139	237	1.8	0.41	0.40	2	
	204+19	20419	5442.5	101	212	289	454	5443.5	5443.7	5443.8	5444.0	336	5444.0	5443.9	168	141	4.6	0.16	0.26	2	
	204+47	20447	5443.8	101	212	289	454	5444.2	5444.3	5444.4	5444.6	313	5444.6	5444.6	172	115	4.4	0.18	0.23	2	
	205+54	20554	5445.8	101	212	289	454	5446.1	5446.3	5446.4	5446.5	323	5446.6	5446.6	156	82	4.4	0.23	0.38	2	
	206+44	20644	5447.3	101	212	289	454	5448.0	5448.2	5448.3	5448.4	276	5448.5	5448.6	164	96	5.1	0.31	0.50	2	
	206+89	20689	5448.0	101	212	289	454	5448.8	5449.1	5449.3	5449.4	265	5449.4	5449.3	119	71	4.1	0.02	0.13		
	207+09	20709	5448.1	101	212	289	454	5449.2	5449.5	5449.6	5449.7	257	5449.7	5449.6	117	71	4.1	0.06	0.19		
	207+40	20740	5448.0	101	212	289	454	5449.4	5449.6	5449.7	5449.9	291	5449.8	5449.9	99	165	1.8	0.18	0.21		
Wadsworth Blvd	208+31	20831	5450.7	101	212	289	454	5451.2	5451.3	5451.4	5451.6	216	5451.6	5451.5	96	63	4.6	0.10	0.23		
	208+73	20873	5449.0	101	212	289	454	5451.3	5451.6	5451.7	5451.9	359	5451.7	5451.9	81	210	1.4	0.24	0.27		
	209+04	20904	5444.9	101	212	289	454	5451.3	5451.5	5451.7	5451.9	183	5451.7	5451.9	90	376	1.5	0.26	0.26	2	
	210+68	21068	5448.8	101	212	289	454	5451.4	5451.6	5451.8	5452.1	77	5452.1	5452.0	30	64	4.5	0.19	0.24		
	211+27	21127	5448.7	101	212	289	454	5451.5	5451.9	5452.1	5452.5	25	5452.6	5452.3	25	66	4.9	0.19	0.14	3	
Yukon St (Acess Road)	211+70	21170	Culvert																		
	212+10	21210	5450.1	101	212	289	454	5452.3	5453.9	5454.9	5456.2	28	5455.1	5454.9	28	97	3.1	0.00	0.00	3	
	212+54	21254	5453.0	101	212	289	454	5454.6	5455.3	5455.7	5456.4	22	5456.6	5455.7	22	39	7.5	0.00	0.00		
	213+40	21340	5454.7	101	212	289	454	5457.2	5458.0	5458.3	5458.9	59	5458.5	5458.4	29	74	3.9	0.07	0.10		The right overbank ponding area was removed from 100-year floodplain delineation and included in the FLO-2D floodplain. The right overbank ponding is a potential 100-year floodplain with an average flood depth less than one foot.
	214+21	21421	5458.1	101	212	289	454	5459.6	5460.1	5460.3	5460.6	69	5460.7	5460.5	37	58	5.0	0.15	0.19		
	215+14	21514	5459.3	101	212	289	454	5460.6	5461.0	5461.2	5461.6	212	5461.3	5461.5	82	137	2.1	0.25	0.28	3	
Yarrow Street	215+33	21533	5460.3	101	212	289	454	5460.8	5461.0	5461.2	5461.6	192	5461.4	5461.5	69	72	4.0	0.24	0.30	3	
	215+49	21549	5460.2	101	212	289	454	5461.1	5461.4	5461.5	5461.8	232	5461.7	5461.7	61	85	3.4	0.23	0.27	3	
Pierce Street Tributary _ Reach 01: W 20th Avenue to W 25th Avenue/Quay Street																					
	1+56	156	5387.3	16	233	338	713	5387.8	5388.5	5388.7	5389.3	85	5389.1	5388.7	65	61	5.6	0.00	0.01		
	1+99	199	5388.2	16	233	338	713	5388.6	5389.2	5389.4	5390.1	88	5389.9	5389.4	65	61	5.6	0.00	0.01		
	2+44	244	5389.1	16	233	338	713	5389.5	5390.1	5390.3	5390.9	111	5390.8	5390.3	73	64	5.3	0.00	0.01		
	2+79	279	5389.6	16	233	338	713	5390.1	5390.8	5391.0	5391.6	125	5391.4	5391.0	69	62	5.4	0.00	0.03		
W 22nd Avenue	3+51	351	5390.4	16	233	338	713	5391.0	5391.7	5391.9	5392.5	121	5392.4	5391.9	64	61	5.6	0.01	0.03		
	4+13	413	5391.0	16	233	338	713	5391.7	5392.4	5392.6	5393.2	120	5393.1	5392.6	64	61	5.6	0.00	0.03		
	6+63	663	5393.8	16	233	338	713	5394.3	5395.0	5395.2	5395.7	86	5395.6	5395.2	70	63	5.4	0.00	0.01		
	7+50	750	Lat Struct																		Lateral Structure between Station 7+53 to 1+99
	7+53	753	5394.8	16	233	338	713	5395.2	5395.9	5396.1	5396.7	92	5396.5	5396.1	66	62	5.5	0.00	0.02		
	8+27	827	5395.5	16	233	338	713	5396.0	5396.6	5396.9	5397.5	89	5397.3	5396.9	61	59	5.7	0.01	0.03		
	8+90	890	5396.2	16	233	338	713	5396.6	5397.3	5397.5	5398.1	91	5398.0	5397.5	64	61	5.6	0.01	0.02		
W 24th Avenue	9+75	975	5397.0	16	233	338	713	5397.5	5398.1	5398.4	5398.9	106	5398.8	5398.4	64	61	5.6	0.06	0.08		
	10+32	1032	5397.0	16	233	338	713	5397.9	5398.5	5398.7	5399.3	74	5399.2	5398.8	64	63	5.4	0.04	0.02		
	10+95	1095	Lat Struct																		Lateral Structure between Station 10+96 to 7+53
	10+96	1096	5397.9	16	214	311	704	5398.3	5399.0	5399.2	5399.8	128	5399.6	5399.2	62	56	5.5	0.03	0.08		
	12+67	1267	5399.3	16	214	311	704	5399.8	5400.5	5400.7	5401.3	125	5401.1	5400.7	58	56	5.6	0.01	0.06		
	13+88	1388	5400.3	16	214	311	704	5400.9	5401.5	5401.7	5402.3	100	5402.1	5401.7	58	56	5.6	0.01	0.04		
	14+52	1452	5400.8	16	214	311	704	5401.4	5402.1	5402.3	5402.9	107	5402.7	5402.3	58	57	5.5	0.04	0.06		
	15+35	1535	Lat Struct																		Lateral Structure between Station 15+39 to 10+96
	15+39	1539	5401.8	16	214	311	704	5402.3	5403.0	5403.2	5403.8	229	5403.6	5403.2	58	56	5.5	0.02	0.05	2	
Pierce St/W 25th Ave	16+11	1611	5402.7	16	214	311	704	5403.1	5403.8	5403.9	5404.5	302	5404.3	5404.0	78	62	5.0	0.06	0.08	2	
	17+06	1706	5402.9	16	214	311	704	5403.6	5404.3	5404.5	5405.2	405	5404.8	5404.5	67	70	4.5	0.00	0.14	2	
	17+70	1770	Lat Struct																		Lateral Structure between Station 17+80 to 15+39
	17+80	17+80	5403.1	16	214	311	704	5403.9	5404.6	5404.8	5405.4	458	5405.2	5404.9	129	85	3.7	0.08	0.14	2	
Pierce Street Tributary _ Reach 02: W 25th Avenue/Quay Street to W 24th Avenue/Yarrow Street																					
	19+73	1973	5405.2	0	0	34	384	5405.4	5406.0	5406.2	5407.0	54	5406.2	5406.3	46	25	1.3	0.06	0.05		
	22+00	2200	5409.2	0	0	34	384	5409.3	5409.3	5409.9	5411.2	31	5410.0	5409.9	31	10	3.3	0.00	0.00		
Reed Street	22+71	2271	5411.3	0	0	34	384	5411.4	5411.4	5412.1	5413.0	57	5412.2	5412.1	34	12	2.8	0.01	0.01		

TABLE D-1 Sloan's Lake Drainageway
Floodplain and Floodway Data Table

REFERENCE LOCATION	RIVER STATION	CROSS SECTION	THALWEG ELEVATION (FT)	PEAK DISCHARGES				WATER SURFACE ELEVATION				100-YEAR FLOODPLAIN		100-YEAR FLOODWAY (0.5' HGL/ EGL)						NOTE	COMMENTS
				10-YR	50-YR	100-YR	500-YR	10-YR	50-YR	100-YR	500-YR										
				FLOW (CFS)	FLOW (CFS)	FLOW (CFS)	FLOW (CFS)	WSEL (FT)	WSEL (FT)	WSEL (FT)	WSEL (FT)	WIDTH (FT)	EGL (FT)	WSEL (FT)	WIDTH (FT)	AREA (SQ FT)	VELOCITY (FT/S)	HGL SURCHARGE (FT)	EGL SURCHARGE (FT)		
	23+13	2313	5411.4	0	0	34	384	5411.5	5411.5	5412.7	5413.8	18	5412.8	5412.7	18	16	2.2	0.00	0.00		
	24+68	2468	5415.7	0	0	34	384	5415.8	5415.8	5416.8	5418.4	114	5417.0	5416.8	14	8	4.2	-0.02	0.09	4	
	25+35	2535	5417.6	0	0	34	384	5417.7	5417.7	5419.0	5420.3	172	5419.1	5419.4	19	25	1.4	0.39	0.40	4	
	25+61	2561	5417.8	0	0	34	384	5418.0	5418.0	5419.4	5420.7	125	5419.4	5419.8	20	27	1.3	0.35	0.35	4	
Saulsbury Street	25+88	2588	5419.9	0	0	34	384	5420.0	5420.0	5420.2	5420.9	121	5420.3	5420.3	36	11	3.1	0.09	0.14	3	
	26+06	2606	5419.2	0	0	34	384	5420.0	5420.0	5420.3	5421.2	186	5420.3	5420.5	34	39	0.9	0.16	0.17	3	
	26+91	2691	5420.5	0	0	34	384	5420.5	5420.5	5421.1	5421.9	60	5421.2	5421.1	29	10	3.3	0.00	0.00	2	
	27+77	2777	5421.6	0	0	34	384	5421.7	5421.7	5423.0	5424.7	93	5423.0	5423.1	29	37	0.9	0.15	0.15	3	
	28+45	2845	5423.8	0	0	34	384	5423.9	5423.9	5424.5	5426.3	96	5424.8	5424.5	18	8	4.1	0.00	0.00		The floodplain top width was manually adjusted to include intercept shallow flooding (< 1 ft) from the upstream left overbank of cross-section 2884.
	28+84	2884	5424.3	0	0	34	384	5424.5	5424.5	5425.9	5427.6	112	5425.9	5426.0	38	36	0.9	0.03	0.03	3	
Teller Street	29+30	2930	5425.1	0	0	34	384	5425.2	5425.2	5426.0	5427.6	131	5426.0	5426.0	72	54	0.6	0.03	0.03		
	30+16	3016	5425.1	0	0	34	384	5425.2	5425.2	5426.1	5427.6	69	5426.1	5426.1	64	26	1.3	0.03	0.03	4	
	31+05	3105	5426.3	0	0	34	384	5426.4	5426.4	5427.0	5428.1	52	5427.1	5427.0	52	11	3.2	0.00	0.00	4	
Teller Court	31+63	3163	5427.2	0	0	34	384	5427.3	5427.3	5428.2	5429.1	73	5428.2	5428.2	51	14	2.4	0.00	0.01	4	
	32+20	3220	5428.3	0	0	34	384	5428.4	5428.4	5429.2	5430.3	46	5429.4	5429.2	46	13	3.5	0.00	0.00	2	
	33+01	3301	5429.5	0	0	34	384	5430.2	5430.2	5430.8	5431.6	66	5431.0	5430.8	57	22	3.5	0.02	0.01	2	
	34+03	3403	5431.8	0	0	34	384	5432.5	5432.5	5433.1	5433.8	62	5433.3	5433.1	61	22	3.2	0.00	0.00	2	
Upham Street	34+49	3449	5434.1	0	0	34	384	5434.1	5434.1	5434.5	5435.1	143	5434.6	5434.6	38	11	3.2	0.06	0.09	3	
	35+01	3501	5435.1	0	0	34	384	5435.1	5435.1	5435.6	5436.7	77	5435.7	5435.6	39	14	2.4	-0.01	0.00	2	
	35+74	3574	5437.0	0	0	34	384	5437.1	5437.1	5437.7	5438.5	113	5437.9	5437.7	41	13	2.7	0.00	0.00	4	
	36+29	3629	5436.0	0	0	34	384	5437.1	5437.1	5437.9	5439.1	72	5437.9	5437.9	43	67	0.5	0.01	0.01		
Toe of Spillway	36+59	3659	5437.2	0	0	34	384	5437.2	5437.2	5437.9	5439.1	60	5437.9	5437.9	60	40	0.9	0.02	0.01		
	37+02	3702	5447.8	0	0	34	384	5447.8	5447.8	5448.0	5448.9	59	5448.1	5448.0	59	13	2.6	0.00	0.00		
Crest of Spillway	37+21	3721	5448.1	0	0	34	384	5448.1	5448.1	5448.3	5449.1	63	5448.4	5448.3	63	13	2.6	0.01	0.00		
26th Ave/Wadsworth Blvd Detention	37+89	3789	5434.0	162	398	511	761	5440.7	5446.5	5448.8	5450.1	231	5449.0	5448.8	231	1889	2.9	0.00	0.00		Detention at Wadsworth Blvd/26th Ave, IEFA was used below crest of spillway.
	41+33	4133	5438.7	162	398	511	761	5440.9	5446.5	5449.0	5450.1	327	5449.0	5449.0	327	2304	0.2	0.00	0.00		
	42+30	4230	5450.9	0	0	101	351	5451.0	5451.0	5451.5	5451.9	140	5451.6	5451.5	140	33	3.1	0.00	0.00	4	
	42+98	4298	5461.1	0	0	101	351	5461.1	5461.1	5461.4	5462.0	163	5461.6	5461.5	97	31	3.3	0.05	0.10		
	43+05	4305	5461.3	0	0	101	351	5461.3	5461.3	5461.9	5462.2	126	5462.0	5461.9	68	28	3.6	0.00	0.06		
	43+23	4323	5460.7	0	0	101	351	5461.3	5461.3	5462.0	5462.5	308	5462.0	5462.1	73	76	1.3	0.06	0.08		
Wadsworth Blvd	43+66	4366	5462.5	0	0	101	351	5462.5	5462.5	5462.9	5463.2	190	5463.0	5462.9	80	29	3.5	0.06	0.12		The floodplain top width was manually adjusted to include shallow flooding from the upstream left overbank.
	44+01	4401	5460.7	0	0	101	351	5462.5	5462.5	5463.0	5463.4	469	5463.0	5463.1	79	176	0.6	0.12	0.12		
	44+81	4481	5462.4	0	0	13	110	5462.5	5462.5	5463.0	5463.3	52	5463.0	5463.1	48	16	0.8	0.13	0.12	4	
	45+86	4586	5464.6	0	0	13	110	5464.6	5464.6	5465.1	5465.8	74	5465.3	5465.1	15	4	3.1	0.00	0.03		The floodplain top width was manually adjusted to include shallow flooding (< 1 ft) from the upstream left overbank.
	48+36	4836	5471.3	0	0	13	110	5471.4	5471.4	5471.8	5472.6	64	5471.9	5471.8	16	4	3.0	0.00	0.00		The floodplain top width was manually adjusted to include shallow flooding (< 1 ft) from the upstream left overbank.
Yarrow Street	50+24	5024	5477.9	0	0	13	110	5478.0	5478.0	5478.2	5478.7	53	5478.2	5478.2	25	5	2.5	0.02	0.04		
	50+82	5082	5477.4	87	179	223	320	5479.2	5479.6	5479.8	5480.2	85	5479.8	5480.1	39	78	2.8	0.37	0.43		
	51+28	5128	5479.6	87	179	223	320	5480.8	5481.2	5481.4	5481.7	107	5481.5	5481.8	49	84	2.6	0.43	0.46		
	51+69	5169	5481.9	87	179	223	320	5483.0	5483.3	5483.5	5483.7	235	5483.6	5483.8	46	66	3.4	0.32	0.40	2	Rocky Mountain Ditch was modeled with blocked obstruction.
	52+20	5220	5483.0	87	179	223	320	5484.5	5485.0	5485.2	5485.5	116	5485.2	5485.4	74	127	1.8	0.24	0.24		Rocky Mountain Ditch was modeled with blocked obstruction.
	52+82	5282	5484.9	87	179	223	320	5486.6	5487.1	5487.2	5487.5	107	5487.3	5487.4	81	77	2.9	0.13	0.17	4	Rocky Mountain Ditch was modeled with blocked obstruction.
	53+18	5318	5484.8	87	179	223	320	5486.9	5487.5	5487.7	5488.1	101	5487.7	5488.0	57	159	1.4	0.30	0.31		
Pierce Street Tributary _ Reach 03: W 25th Avenue/Quay Street to W 28th Avenue/Upham Street																					
W 25th Ave/Quay Street	0+76	76	5404.6	110	227	292	435	5405.7	5406.0	5406.1	5406.5	458	5406.3	5406.2	217	71	4.1	0.06	0.22	4	
	1+37	137	5405.5	110	227	292	435	5406.5	5406.7	5406.8	5407.0	459	5406.9	5407.1	184	107	2.7	0.24	0.50	4	
	2+28	228	5406.8	110	227	292	435	5407.5	5407.8	5407.9	5408.1	441	5408.0	5408.3	214	180	1.6	0.42	0.50	4	
	2+82	282	5407.6	110	227	292	435	5408.4	5408.6	5408.7	5408.8	459	5408.7	5408.9	217	130	2.2	0.25	0.43	4	
	3+43	343	5408.6	110	227	292	435	5409.2	5409.4	5409.5	5409.7	438	5409.6	5409.9	232	139	2.1	0.38	0.50	4	
	4+70	470	Lat Struct																		Lateral Structure between Station 4+75 to 3+43
	4+75	475	5410.8	110	227	292	435	5411.3	5411.5	5411.5	5411.7	529	5411.6	5411.9	239	138	2.1	0.39	0.50	4	
	6+15	615	5413.5	110	227	292	435	5414.1	5414.3	5414.3	5414.4	434	5414.4	5414.7	146	98	3.0	0.34	0.50	4	
W 26th Ave/Quay St	6+87	687	5414.8	110	227	292	435	5415.6	5415.8	5415.9	5416.0	410	5416.1	5416.1	77	59	4.9	0.18	0.36	4	
	7+55	755	5415.6	110	227	292	435	5416.7	5416.9	5417.0	5417.2	441	5417.2	-	-	-	-	-	-	4	

TABLE D-1 Sloan's Lake Drainageway
Floodplain and Floodway Data Table

REFERENCE LOCATION	RIVER STATION	CROSS SECTION	THALWEG ELEVATION (FT)	PEAK DISCHARGES				WATER SURFACE ELEVATION				100-YEAR FLOODPLAIN		100-YEAR FLOODWAY (0.5' HGL/ EGL)						NOTE	COMMENTS
				10-YR	50-YR	100-YR	500-YR	10-YR	50-YR	100-YR	500-YR										
				FLOW (CFS)	FLOW (CFS)	FLOW (CFS)	FLOW (CFS)	WSEL (FT)	WSEL (FT)	WSEL (FT)	WSEL (FT)	WIDTH (FT)	EGL (FT)	WSEL (FT)	WIDTH (FT)	AREA (SQ FT)	VELOCITY (FT/S)	HGL SURCHARGE (FT)	EGL SURCHARGE (FT)		
	9+26	926	5419.1	110	227	292	435	5420.0	5420.2	5420.4	5420.5	327	5420.6	-	-	-	-	-	-	4	
	10+75	1075	5422.4	110	227	292	435	5423.5	5423.7	5423.9	5424.1	414	5424.3	-	-	-	-	-	-	3	
W 27th Ave/Quay St	11+73	1173	5424.3	110	227	292	435	5425.5	5425.8	5425.9	5426.2	265	5426.3	-	-	-	-	-	-	3	
	12+69	1269	5426.2	110	227	292	435	5427.3	5427.7	5427.8	5428.1	233	5428.2	-	-	-	-	-	-	3	
	13+56	1356	5428.1	110	227	292	435	5429.2	5429.5	5429.7	5430.0	190	5430.2	-	-	-	-	-	-	2	
	14+19	1419	5429.7	110	227	292	435	5430.6	5430.9	5431.1	5431.4	80	5431.5	-	-	-	-	-	-		
W 27th Ave/Reed St	15+00	1500	5431.8	110	227	292	435	5432.7	5432.9	5433.1	5433.3	147	5433.4	-	-	-	-	-	-		
	15+65	1565	5433.5	110	227	292	435	5434.2	5434.4	5434.5	5434.7	210	5434.7	-	-	-	-	-	-	4	
	16+43	1643	5435.7	24	70	92	141	5436.4	5436.5	5436.6	5436.8	217	5436.8	-	-	-	-	-	-	2	
	16+88	1688	5436.6	24	70	92	141	5437.5	5437.9	5438.0	5438.3	255	5438.1	-	-	-	-	-	-	2	
	17+54	1754	5438.3	24	70	92	141	5438.9	5439.2	5439.3	5439.6	212	5439.4	-	-	-	-	-	-	2	
	18+32	1832	5440.1	24	70	92	141	5440.9	5441.2	5441.3	5441.6	299	5441.4	-	-	-	-	-	-	2	
	19+13	1913	5442.7	24	70	92	141	5443.2	5443.4	5443.5	5443.7	175	5443.6	-	-	-	-	-	-	2	
	19+99	1999	5444.3	24	70	92	141	5445.1	5445.4	5445.5	5445.7	162	5445.5	-	-	-	-	-	-		
	21+08	2108	5446.6	24	70	92	141	5447.3	5447.6	5447.7	5447.8	153	5447.7	-	-	-	-	-	-		
	21+89	2189	5449.3	24	70	92	141	5449.9	5450.2	5450.3	5450.4	188	5450.3	-	-	-	-	-	-	4	
Teller Street	22+46	2246	5452.2	24	70	92	141	5452.4	5452.5	5452.6	5452.7	207	5452.7	-	-	-	-	-	-	4	
	23+48	2348	5452.6	24	70	92	141	5453.4	5453.7	5453.7	5453.9	166	5453.8	-	-	-	-	-	-	2	
W 28th Ave/Teller St	24+13	2413	5454.0	24	70	92	141	5454.5	5454.8	5454.9	5455.1	212	5455.1	-	-	-	-	-	-	2	
	24+87	2487	5455.4	24	70	92	141	5456.0	5456.2	5456.3	5456.5	109	5456.6	-	-	-	-	-	-	3	
	26+05	2605	5456.9	24	70	92	141	5457.4	5457.7	5457.8	5458.0	50	5458.0	-	-	-	-	-	-		
Ashland Drainageway _ Reach 01: Sloan's Lake/Sheridan Blvd to Gray Street																					
Sloan's Lake	0+05	5	5310.7	195	362	423	559	5312.0	5312.7	5313.0	5313.7	1056	5313.0	-	-	-	-	-	-		
	0+30	30	5313.8	195	362	423	559	5314.0	5314.1	5314.1	5314.2	842	5314.2	-	-	-	-	-	-	2	The floodplain top width was manually adjusted to include shallow flooding from the upstream right overbank.
	0+58	58	5314.0	195	362	423	559	5314.5	5314.6	5314.7	5314.7	554	5314.8	-	-	-	-	-	-		
	0+93	93	5314.5	195	362	423	559	5315.1	5315.2	5315.2	5315.3	380	5315.4	-	-	-	-	-	-	2	
Sheridan Blvd.	1+97	197	5315.6	195	362	423	559	5316.0	5316.1	5316.1	5316.2	349	5316.3	-	-	-	-	-	-		Permanent IEFA was used to model road crown of Sheridan Blvd.
	2+68	268	5314.7	195	362	423	559	5316.1	5316.3	5316.3	5316.5	225	5316.7	-	-	-	-	-	-	4	
	3+68	368	5315.3	42	122	122	122	5316.4	5316.7	5316.9	5317.1	115	5316.9	-	-	-	-	-	-	2	
	4+60	460	5315.7	42	122	122	122	5316.4	5316.7	5316.9	5317.1	79	5317.0	-	-	-	-	-	-		
Ames Street	5+35	535	5315.9	42	122	122	122	5316.7	5317.1	5317.1	5317.2	156	5317.2	-	-	-	-	-	-		
	6+02	602	5316.4	42	122	122	122	5317.1	5317.5	5317.5	5317.5	95	5317.8	-	-	-	-	-	-	4	
	6+71	671	5316.8	42	122	122	122	5317.6	5318.0	5318.0	5318.0	205	5318.1	-	-	-	-	-	-	3	
	7+01	701	5317.1	42	122	122	122	5317.7	5318.1	5318.1	5318.1	215	5318.2	-	-	-	-	-	-	3	
	7+35	735	Lat Struct																		Lateral Structure between Station 7+38 to 6+02
	7+38	738	5317.5	42	122	122	122	5318.2	5318.6	5318.6	5318.6	101	5318.8	-	-	-	-	-	-		
Benton Street	8+61	861	5318.7	42	122	122	122	5319.4	5319.7	5319.7	5319.7	640	5319.8	-	-	-	-	-	-	3	IEFA was used at Citizen Park Detention.
	9+29	929	5319.4	42	122	122	122	5320.1	5320.5	5320.5	5320.5	417	5320.7	-	-	-	-	-	-	3	Same as above
W 24th Ave/Chase St	11+50	1150	5321.7	21	281	419	719	5322.4	5323.0	5323.2	5323.5	357	5323.5	-	-	-	-	-	-	2	
	13+55	1355	5323.9	21	281	419	719	5324.2	5325.0	5325.2	5325.6	370	5325.2	-	-	-	-	-	-	4	
	14+81	1481	5325.3	21	281	419	719	5326.0	5326.6	5326.7	5327.0	380	5326.8	-	-	-	-	-	-	4	
	15+95	1595	5327.8	21	281	419	719	5328.2	5329.2	5329.4	5329.9	335	5329.5	-	-	-	-	-	-	4	
Depew Street	17+24	1724	5328.9	80	317	428	674	5329.7	5330.4	5330.6	5331.0	234	5330.7	-	-	-	-	-	-		
	19+12	1912	5331.1	80	317	428	674	5332.1	5332.7	5332.9	5333.3	182	5333.0	-	-	-	-	-	-		
	20+67	2067	5334.4	80	317	428	674	5335.2	5335.6	5335.8	5336.0	217	5335.9	-	-	-	-	-	-		
W 25th Ave/Eaton St	21+52	2152	5334.3	80	317	428	674	5335.6	5336.2	5336.3	5336.6	107	5336.5	-	-	-	-	-	-		
	23+51	2351	5339.0	80	317	428	674	5339.6	5340.4	5340.6	5340.9	276	5341.0	-	-	-	-	-	-	2	
Fenton Street	24+17	2417	5341.5	80	317	428	674	5342.0	5342.5	5342.6	5342.9	315	5342.9	-	-	-	-	-	-	4	
	25+20	2520	5342.3	80	317	428	674	5343.3	5343.8	5343.9	5344.0	335	5344.1	-	-	-	-	-	-	4	The floodplain top width was manually adjusted to include shallow flooding from the upstream right overbank and includes high ground.
	25+81	2581	5344.9	80	317	428	674	5345.1	5345.7	5345.8	5346.1	435	5346.2	-	-	-	-	-	-	4	
Gray Street	26+31	2631	5345.7	80	317	428	674	5346.2	5346.6	5346.8	5347.0	301	5347.1	-	-	-	-	-	-	4	Blocked obstruction was used at area of non-realistic flow area.
	27+03	2703	5346.5	80	317	428	674	5347.7	5348.3	5348.5	5348.8	409	5348.5	-	-	-	-	-	-	4	The floodplain top width was manually adjusted to include shallow flooding from the upstream right overbank. Blocked obstruction was used at area of non-realistic flow area.

TABLE D-1 Sloan's Lake Drainageway
Floodplain and Floodway Data Table

REFERENCE LOCATION	RIVER STATION	CROSS SECTION	THALWEG ELEVATION (FT)	PEAK DISCHARGES				WATER SURFACE ELEVATION				100-YEAR FLOODPLAIN		100-YEAR FLOODWAY (0.5' HGL/ EGL)						NOTE	COMMENTS
				10-YR	50-YR	100-YR	500-YR	10-YR	50-YR	100-YR	500-YR										
				FLOW (CFS)	FLOW (CFS)	FLOW (CFS)	FLOW (CFS)	WSEL (FT)	WSEL (FT)	WSEL (FT)	WSEL (FT)	WIDTH (FT)	EGL (FT)	WSEL (FT)	WIDTH (FT)	AREA (SQ FT)	VELOCITY (FT/S)	HGL SURCHARGE (FT)	EGL SURCHARGE (FT)		
	27+81	2781	5348.6	80	317	428	674	5349.4	5350.0	5350.3	5350.6	514	5350.4	-	-	-	-	-	-	4	The floodplain top width was manually adjusted to include shallow flooding from the upstream right overbank.
	28+42	2842	5352.7	80	317	428	674	5353.0	5353.7	5353.8	5354.0	645	5353.9	-	-	-	-	-	-	4	
	29+06	2906	5353.3	80	317	428	674	5353.8	5354.3	5354.5	5354.7	701	5354.6	-	-	-	-	-	-	2	
Ashland Drainageway _ Reach 02: Gray Street to Pierce Street/W 26th Avenue																					
	30+03	3003	5355.6	93	190	235	337	5356.5	5356.7	5356.8	5357.1	76	5357.2	-	-	-	-	-	-		
	31+18	3118	5357.3	93	190	235	337	5359.3	5359.8	5359.9	5360.2	276	5359.9	-	-	-	-	-	-		The floodplain top width was manually adjusted to include shallow flooding (< 1 ft) from the upstream left overbank.
	31+96	3196	5359.7	93	190	235	337	5360.7	5361.1	5361.2	5361.5	168	5361.4	-	-	-	-	-	-		The floodplain top width was manually adjusted to include shallow flooding (< 1 ft) from the upstream left overbank.
	32+73	3273	5361.9	93	190	235	337	5363.3	5363.6	5363.7	5363.9	207	5363.8	-	-	-	-	-	-	3	
Harlan Street	33+42	3342	5363.9	93	190	235	337	5364.5	5364.8	5364.9	5365.0	242	5365.1	-	-	-	-	-	-	3	
	33+79	3379	5364.7	93	190	235	337	5365.5	5365.7	5365.8	5366.0	133	5366.1	-	-	-	-	-	-		
	35+26	3526	5368.7	93	190	235	337	5369.8	5370.0	5370.1	5370.2	109	5370.4	-	-	-	-	-	-		Blocked obstruction was used at area of non-realistic flow area.
	36+34	3634	5372.2	93	190	235	337	5373.1	5373.4	5373.5	5373.6	92	5373.8	-	-	-	-	-	-		
Ingalls Street	36+86	3686	5373.3	93	190	235	337	5374.4	5374.7	5374.8	5375.0	114	5375.1	-	-	-	-	-	-	3	
	37+64	3764	5376.5	93	190	235	337	5377.5	5377.7	5377.8	5378.0	133	5378.2	-	-	-	-	-	-	4	
	38+47	3847	5379.3	93	190	235	337	5380.4	5380.6	5380.7	5380.9	180	5381.0	-	-	-	-	-	-	2	
	38+79	3879	5380.5	93	190	235	337	5381.5	5381.7	5381.8	5382.0	63	5382.2	-	-	-	-	-	-		
	39+52	3952	5383.1	93	190	235	337	5384.1	5384.4	5384.5	5384.7	58	5384.9	-	-	-	-	-	-		
Jay Street	40+00	4000	5384.5	93	190	235	337	5385.4	5385.7	5385.8	5385.9	132	5386.1	-	-	-	-	-	-		
	40+58	4058	5386.9	93	190	235	337	5387.8	5388.0	5388.1	5388.3	80	5388.5	-	-	-	-	-	-		
	40+97	4097	5388.1	93	190	235	337	5389.1	5389.4	5389.5	5389.7	79	5389.9	-	-	-	-	-	-		The left overbank shallow flooding at cross sections 4235 and 4097 on Ashland Drainageway was removed from the mapping due to the area is hydraulically
	42+35	4235	5392.4	93	190	235	337	5393.2	5393.5	5393.6	5393.8	100	5394.0	-	-	-	-	-	-		
	42+79	4279	5393.4	93	190	235	337	5394.2	5394.4	5394.5	5394.7	146	5394.9	-	-	-	-	-	-		
Kendall Street	43+41	4341	5394.4	26	56	73	111	5394.8	5395.1	5395.2	5395.4	381	5395.2	-	-	-	-	-	-		
	43+80	4380	Lat Struct																		Lateral Structure between Station 43+82 to 42+35
	43+82	4382	5395.0	26	56	73	111	5395.5	5395.7	5395.7	5395.8	361	5395.9	-	-	-	-	-	-	2	
	45+91	4591	5397.4	26	56	73	111	5398.0	5398.2	5398.2	5398.3	59	5398.4	-	-	-	-	-	-		
	47+91	4791	5399.0	26	56	73	111	5399.6	5399.7	5399.8	5399.9	81	5399.9	-	-	-	-	-	-	4	
	49+80	4980	Lat Struct																		Lateral Structure between Station 49+90 to 45+91
	49+90	4990	5400.2	26	56	73	111	5400.8	5400.9	5401.0	5401.1	68	5401.1	-	-	-	-	-	-		
	51+92	5192	5401.7	26	56	73	111	5402.2	5402.3	5402.4	5402.5	77	5402.6	-	-	-	-	-	-		
	54+75	5475	Lat Struct																		Lateral Structure between Station 54+79 to 51+92
	54+79	5479	5403.7	26	56	73	111	5404.4	5404.5	5404.6	5404.7	61	5404.7	-	-	-	-	-	-		
	58+41	5841	5408.3	26	56	73	111	5408.9	5409.0	5409.1	5409.2	66	5409.3	-	-	-	-	-	-		
W 26th Ave/Pierce St	58+90	5890	5409.0	26	56	73	111	5409.6	5409.7	5409.8	5409.9	76	5410.0	-	-	-	-	-	-		
Gray Street Tributary _ Reach 01: W 26th Avenue to W 32nd Avenue/Kendall Street																					
W 26th Avenue	2+61	261	5360.8	0	57	102	203	5360.9	5361.3	5361.5	5361.7	215	5361.6	-	-	-	-	-	-	4	The floodplain top width was manually adjusted to include shallow flooding (< 1 ft) from the upstream right overbank.
	2+99	299	5361.8	0	57	102	203	5361.9	5362.8	5362.9	5363.1	183	5363.0	-	-	-	-	-	-	4	The floodplain top width was manually adjusted to include shallow flooding (< 1 ft) from the upstream right overbank.
	4+77	477	5368.5	0	57	102	203	5368.6	5369.1	5369.3	5369.5	252	5369.4	-	-	-	-	-	-	4	
	5+73	573	5372.2	0	57	102	203	5372.2	5372.9	5373.1	5373.4	189	5373.3	-	-	-	-	-	-	4	
	7+37	737	5378.3	0	57	102	203	5378.4	5379.0	5379.2	5379.5	206	5379.4	-	-	-	-	-	-	4	
	9+34	934	5386.3	0	57	102	203	5386.3	5386.7	5386.9	5387.2	185	5387.1	-	-	-	-	-	-	4	
	10+33	1033	5390.6	0	57	102	203	5390.7	5391.3	5391.5	5391.8	201	5391.8	-	-	-	-	-	-	4	
	11+21	1121	5394.7	0	57	102	203	5394.8	5395.3	5395.4	5395.8	182	5395.8	-	-	-	-	-	-	4	
	11+98	1198	5398.6	0	57	102	203	5398.7	5399.1	5399.2	5399.5	170	5399.4	-	-	-	-	-	-	4	
	13+39	1339	5405.8	0	57	102	203	5405.8	5406.2	5406.3	5406.5	181	5406.5	-	-	-	-	-	-	4	
	14+91	1491	5413.4	0	57	102	203	5413.5	5414.1	5414.2	5414.5	180	5414.5	-	-	-	-	-	-	4	
W 29th Avenue	15+66	1566	5415.3	0	57	102	203	5415.4	5415.8	5415.9	5416.2	169	5416.0	-	-	-	-	-	-	4	
	16+42	1642	5415.8	28	98	131	205	5416.4	5416.6	5416.7	5417.0	198	5416.8	-	-	-	-	-	-	4	
	17+20	1720	5416.2	28	98	131	205	5416.8	5417.0	5417.1	5417.3	224	5417.2	-	-	-	-	-	-	3	
	17+82	1782	5416.3	28	98	131	205	5417.0	5417.3	5417.4	5417.6	235	5417.5	-	-	-	-	-	-	3	
	18+42	1842	5417.0	28	98	131	205	5417.6	5417.9	5418.0	5418.2	200	5418.2	-	-	-	-	-	-	2	

TABLE D-1 Sloan's Lake Drainageway
Floodplain and Floodway Data Table

REFERENCE LOCATION	RIVER STATION	CROSS SECTION	THALWEG ELEVATION (FT)	PEAK DISCHARGES				WATER SURFACE ELEVATION				100-YEAR FLOODPLAIN		100-YEAR FLOODWAY (0.5' HGL/ EGL)						NOTE	COMMENTS
				10-YR	50-YR	100-YR	500-YR	10-YR	50-YR	100-YR	500-YR										
				FLOW (CFS)	FLOW (CFS)	FLOW (CFS)	FLOW (CFS)	WSEL (FT)	WSEL (FT)	WSEL (FT)	WSEL (FT)	WIDTH (FT)	EGL (FT)	WSEL (FT)	WIDTH (FT)	AREA (SQ FT)	VELOCITY (FT/S)	HGL SURCHARGE (FT)	EGL SURCHARGE (FT)		
	19+39	1939	5418.3	28	98	131	205	5418.8	5419.1	5419.2	5419.4	217	5419.3	-	-	-	-	-	-	2	
W 29th Ave/Ingalls St	20+40	2040	5419.0	28	98	131	205	5419.5	5419.9	5420.0	5420.2	215	5420.1	-	-	-	-	-	-	2	
	21+57	2157	5418.4	28	98	131	205	5419.6	5420.1	5420.2	5420.5	229	5420.3	-	-	-	-	-	-	3	
W 29th Pl/Ingalls St	22+97	2297	5419.0	28	98	131	205	5419.7	5420.2	5420.3	5420.6	318	5420.4	-	-	-	-	-	-	4	
	24+17	2417	5341.5	80	317	428	674	5342.0	5342.5	5342.6	5342.9	315	5342.9	-	-	-	-	-	-	4	
	26+13	2613	5419.4	28	98	131	205	5419.8	5420.4	5420.6	5420.9	269	5420.6	-	-	-	-	-	-	4	
	27+91	2791	5419.9	28	98	131	205	5421.0	5421.5	5421.6	5421.9	293	5421.6	-	-	-	-	-	-	4	
	28+62	2862	5421.1	28	98	131	205	5421.7	5422.1	5422.2	5422.5	275	5422.3	-	-	-	-	-	-	4	
Jay Street	29+52	2952	5421.1	28	98	131	205	5421.8	5422.2	5422.3	5422.6	287	5422.3	-	-	-	-	-	-		
	30+53	3053	5421.4	28	98	131	205	5422.0	5422.3	5422.3	5422.5	101	5422.6	-	-	-	-	-	-	4	
W 30th Ave/Kendall St	32+39	3239	5422.3	7	35	48	77	5423.0	5423.4	5423.5	5423.6	240	5423.5	-	-	-	-	-	-	2	
	33+41	3341	5423.9	7	35	48	77	5424.3	5424.5	5424.6	5424.7	194	5424.7	-	-	-	-	-	-	2	
	33+98	3398	5424.7	7	35	48	77	5425.1	5425.3	5425.4	5425.5	239	5425.4	-	-	-	-	-	-	2	
	35+25	3525	5426.3	7	35	48	77	5426.6	5426.9	5427.0	5427.1	200	5427.1	-	-	-	-	-	-	2	
	36+24	3624	5428.1	7	35	48	77	5428.6	5428.8	5428.9	5429.0	168	5429.0	-	-	-	-	-	-	2	
	36+62	3662	5429.0	7	35	48	77	5429.3	5429.5	5429.5	5429.7	154	5429.7	-	-	-	-	-	-	2	
	37+04	3704	5430.3	7	35	48	77	5430.6	5430.8	5430.9	5431.0	46	5431.1	-	-	-	-	-	-		
	37+56	3756	5432.1	7	35	48	77	5432.4	5432.6	5432.7	5432.7	167	5432.7	-	-	-	-	-	-	4	
	38+43	3843	5434.8	7	35	48	77	5435.0	5435.2	5435.3	5435.4	184	5435.3	-	-	-	-	-	-	4	
W 32nd Ave/Kendall St	39+72	3972	5436.6	7	35	48	77	5436.8	5436.9	5437.0	5437.0	167	5437.0	-	-	-	-	-	-		

Notes:

1. Permanent IFEA was used for wet pond.
2. Floodplain top width includes high ground and IEFA.
3. Floodplain top width includes IEFA.
4. Floodplain top width includes high ground.
5. Floodplain top width include high ground and IEFA, but exclude water quality detention at right overbank from floodplain top width.

Table D-2 AGREEMENT TABLE: MODEL - PROFILE - MAP

PROJECT NAME: Sloan's Lake Drainageway (16.155.026.005)

Community(ies): City and County of Denver, City of Edgewater, City of Weat Ridge & City of Lakewood
Flooding Source: Sloan's Lake Drainageway - 0.5' ΔEGL
Reach: South Platte River to Wadsworth Boulevard

Engineer: Robert Krehbiel / Hung-Teng Ho
Page: 1 of 2
Date: 7/20/2018

Reference Location	Cross Section	River Station	Distance b/a RS, ft			Cumulative Distance, ft			FP Width, ft		FW Width, ft		BFE, ft		BFE Loc.	Comments and/ or Explanations
			Model	Profile	Map	Model	Profile	Map	Model	Map	Model	Map	Model	Profile		
Sloan's Lake Drainageway _ Sloan's Lake to Pierce Street																
Sloan's Lake Outlet	7063	70+63	7063	7063	7063	7,063	7,063	7,063	57	59	57	59	5312.8	5312.8		Blocked obstruction was used to model the top of bikepath at elevation of 5313.05 per LOMR Case No. 92-08-040P
Pedestrian Bridge	7079	70+79	15	15	15	7,079	7,079	7,079	432	431	432	431	5312.8	5312.8	OK	Bikepath at elevation of 5313.05.
	10668	106+68	3589	3589	3589	10,668	10,668	10,668	2606	2608	2606	2608	5313.0	5313.0		
	11597	115+97	929	929	929	11,597	11,597	11,597	665	661	132	132	5312.9	5312.9		
Pedestrian Bridge	11605	116+05														
	11618	116+18	21	21	21	11,618	11,618	11,618	646	638	131	131	5313.1	5313.1	OK	
	11719	117+19	101	101	101	11,719	11,719	11,719	541	539	130	130	5313.5	5313.5		
	11818	118+18	99	99	99	11,818	11,818	11,818	206	206	104	104	5313.7	5313.7	OK	
	11916	119+16	98	98	98	11,916	11,916	11,916	77	73	77	73	5314.4	5314.4		
Sheridan Blvd.	11990	119+90														
	12053	120+53	137	137	137	12,053	12,053	12,053	551	549	62	62	5317.0	5317.0	OK	
	12098	120+98	46	46	46	12,098	12,098	12,098	539	539	79	79	5317.1	5317.1		
	12154	121+54	55	55	55	12,154	12,154	12,154	239	332	78	78	5317.1	5317.1	OK	The floodplain top width was manually adjusted to include shallow flooding from the upstream left overbank.
Access Road 1	12180	121+80														
	12233	122+33	79	79	79	12,233	12,233	12,233	345	347	62	62	5317.5	5317.5		
	12280	122+80	48	48	48	12,280	12,280	12,280	93	93	54	55	5317.4	5317.4	OK	
	12508	125+08	227	227	227	12,508	12,508	12,508	57	58	52	52	5318.3	5318.3	OK	
	12588	125+88	81	81	81	12,588	12,588	12,588	63	62	58	58	5319.8	5319.8	OK	
Access Road 2 (Benton Rd)	12650	126+50														
	12718	127+18	130	130	130	12,718	12,718	12,718	79	79	79	79	5320.6	5320.6		
	12756	127+56	37	37	37	12,756	12,756	12,756	65	64	65	64	5320.5	5320.5		
	12884	128+84	128	128	128	12,884	12,884	12,884	64	65	64	64	5321.0	5321.0	OK	
	12929	129+29	45	45	45	12,929	12,929	12,929	93	93	65	65	5321.3	5321.3		
	12960	129+60	31	31	31	12,960	12,960	12,960	137	137	62	62	5321.6	5321.6	OK	
	13001	130+01	41	41	41	13,001	13,001	13,001	88	89	57	57	5322.4	5322.4		
	13114	131+14	113	113	113	13,114	13,114	13,114	64	64	60	60	5324.2	5324.2	OK	
	13175	131+75	61	61	61	13,175	13,175	13,175	70	70	54	54	5325.3	5325.3		
	13253	132+53	78	78	78	13,253	13,253	13,253	60	59	55	55	5325.7	5325.7	OK	
Depew Street	13300	133+00														
	13350	133+50	97	97	97	13,350	13,350	13,350	286	285	59	60	5330.0	5330.0		
	13395	133+95	45	45	45	13,395	13,395	13,395	356	359	62	62	5330.1	5330.1		
	13514	135+14	119	119	119	13,514	13,514	13,514	118	122	62	62	5330.2	5330.2		
	13582	135+82	69	69	69	13,582	13,582	13,582	141	143	62	62	5330.3	5330.3	OK	
Eaton Street	13650	136+50														
	13722	137+22	140	140	140	13,722	13,722	13,722	103	106	60	60	5333.1	5333.1		
	13819	138+19	97	97	97	13,819	13,819	13,819	60	61	60	60	5333.1	5333.1	OK	
	13934	139+34	115	115	115	13,934	13,934	13,934	82	82	82	81	5336.4	5336.4	OK	
	13986	139+86	52	52	52	13,986	13,986	13,986	215	215	88	88	5337.3	5337.3		
	14031	140+31	45	45	45	14,031	14,031	14,031	117	117	90	91	5337.8	5337.8	OK	

Table D-2 AGREEMENT TABLE: MODEL - PROFILE - MAP

PROJECT NAME: Sloan's Lake Drainageway (16.155.026.005)

Community(ies): City and County of Denver, City of Edgewater, City of Weat Ridge & City of Lakewood
Flooding Source: Sloan's Lake Drainageway - 0.5' ΔEGL
Reach: South Platte River to Wadsworth Boulevard

Engineer: Robert Krehbiel / Hung-Teng Ho
Page: 1 of 2
Date: 7/20/2018

Reference Location	Cross Section	River Station	Distance b/a RS, ft			Cumulative Distance, ft			FP Width, ft		FW Width, ft		BFE, ft		BFE Loc.	Comments and/ or Explanations
			Model	Profile	Map	Model	Profile	Map	Model	Map	Model	Map	Model	Profile		
	14132	141+32	101	101	101	14,132	14,132	14,132	77	77	77	77	5338.2	5338.2	OK	
	14333	143+33	201	201	201	14,333	14,333	14,333	156	156	71	71	5339.7	5339.7	OK	
	14552	145+52	219	219	219	14,552	14,552	14,552	238	232	71	73	5340.8	5340.8		
	14676	146+76	124	124	124	14,676	14,676	14,676	79	80	55	58	5340.6	5340.6	OK	
	14750	147+50	74	74	74	14,750	14,750	14,750	85	86	67	67	5341.5	5341.5		
	14873	148+73	123	123	123	14,873	14,873	14,873	99	100	82	82	5342.6	5342.6	OK	
	14945	149+45	72	72	72	14,945	14,945	14,945	92	95	92	92	5343.3	5343.3	OK	
Harlan Street	15030	150+30														
	15111	151+11	167	167	167	15,111	15,111	15,111	285	285	107	107	5346.7	5346.7		
	15186	151+86	74	74	74	15,186	15,186	15,186	135	135	68	67	5346.6	5346.6		
	15259	152+59	74	74	74	15,259	15,259	15,259	58	58	58	58	5346.6	5346.6	OK	
	15441	154+41	182	182	182	15,441	15,441	15,441	356	357	120	120	5348.1	5348.1		
	15452	154+52	11	11	11	15,452	15,452	15,452	346	346	124	124	5348.3	5348.3		
Ingalls Street	15491	154+91	40	40	40	15,491	15,491	15,491	310	310	123	123	5348.3	5348.3		
	15504	155+04	13	13	13	15,504	15,504	15,504	247	247	123	123	5348.6	5348.6		
	15563	155+63	59	59	59	15,563	15,563	15,563	176	170	110	110	5349.0	5349.0	OK	
	15625	156+25	62	62	62	15,625	15,625	15,625	264	265	126	126	5351.3	5351.3	OK	
	15742	157+42	117	117	117	15,742	15,742	15,742	217	217	114	114	5353.5	5353.5	OK	
Jay Street	15862	158+62	120	120	120	15,862	15,862	15,862	247	256	124	124	5355.0	5355.0		
	15941	159+41	79	79	79	15,941	15,941	15,941	169	170	101	101	5356.2	5356.2	OK	
	16027	160+27	86	86	86	16,027	16,027	16,027	348	348	100	100	5357.5	5357.5	OK	
	16131	161+31	104	104	104	16,131	16,131	16,131	323	323	109	108	5359.7	5359.7	OK	
Kendall Street	16192	161+92	61	61	61	16,192	16,192	16,192	437	438	113	113	5360.4	5360.4		
	16287	162+87	95	95	95	16,287	16,287	16,287	419	419	124	123	5361.8	5361.8	OK	
	16348	163+48	61	61	61	16,348	16,348	16,348	488	478	98	98	5362.5	5362.5		
	16455	164+55	107	107	107	16,455	16,455	16,455	180	180	96	96	5363.5	5363.5	OK	
Lamar Street	16520	165+20	64	64	64	16,520	16,520	16,520	255	264	95	95	5364.1	5364.1	OK	
	16611	166+11	91	91	91	16,611	16,611	16,611	270	269	85	85	5366.0	5366.0		
	16681	166+81	70	70	70	16,681	16,681	16,681	235	235	83	83	5367.6	5367.6	OK	
	16734	167+34	54	54	54	16,734	16,734	16,734	84	84	84	84	5368.5	5368.5		
Marshall Street	16836	168+36	102	102	102	16,836	16,836	16,836	145	153	86	86	5370.0	5370.0		
	16904	169+04	67	67	67	16,904	16,904	16,904	84	85	84	84	5371.1	5371.1	OK	
	17012	170+12	109	109	109	17,012	17,012	17,012	195	195	69	69	5372.8	5372.8	OK	
	17115	171+15	102	102	102	17,115	17,115	17,115	83	83	77	77	5375.6	5375.6	OK	
Newland Street	17194	171+94	79	79	79	17,194	17,194	17,194	251	251	181	181	5376.8	5376.8	OK	
	17324	173+24	130	130	130	17,324	17,324	17,324	362	362	165	165	5380.9	5380.9	OK	
	17431	174+31	106	106	106	17,431	17,431	17,431	402	401	160	160	5381.9	5381.9	OK	
	17544	175+44	114	114	114	17,544	17,544	17,544	197	196	149	149	5382.3	5382.3		
Otis Street	17608	176+08	64	64	64	17,608	17,608	17,608	366	366	147	147	5382.4	5382.4		
	17701	177+01	93	93	93	17,701	17,701	17,701	134	135	134	134	5382.4	5382.4	OK	
	17765	177+65	65	65	65	17,765	17,765	17,765	348	348	129	129	5383.8	5383.8	OK	
	17813	178+13	48	48	48	17,813	17,813	17,813	302	304	98	98	5384.0	5384.0	OK	

Table D-2 AGREEMENT TABLE: MODEL - PROFILE - MAP

PROJECT NAME: Sloan's Lake Drainageway (16.155.026.005)

Community(ies): City and County of Denver, City of Edgewater, City of Weat Ridge & City of Lakewood
Flooding Source: Sloan's Lake Drainageway - 0.5' ΔEGL
Reach: South Platte River to Wadsworth Boulevard

Engineer: Robert Krehbiel / Hung-Teng Ho
Page: 1 of 2
Date: 7/20/2018

Reference Location	Cross Section	River Station	Distance b/a RS, ft			Cumulative Distance, ft			FP Width, ft		FW Width, ft		BFE, ft		BFE Loc.	Comments and/ or Explanations
			Model	Profile	Map	Model	Profile	Map	Model	Map	Model	Map	Model	Profile		
	17899	178+99	86	86	86	17,899	17,899	17,899	107	107	107	106	5387.8	5387.8	OK	
	17967	179+67	69	69	69	17,967	17,967	17,967	275	275	207	206	5388.5	5388.5		
Pierce Street	17996	179+96	28	28	28	17,996	17,996	17,996	302	302	292	292	5388.5	5388.5		
Sloan's Lake Drainageway _ Pierce Street to Yarrow Street																
	18024	180+24	28	28	28	18,024	18,024	18,024	253	359	253	358	5388.6	5388.6	OK	Floodplain delineation was manually extended at right overbank to provide a more realistic flood boundary transition.
Weir Structure	18053	180+53	30	30	30	18,053	18,053	18,053	248	248	248	248	5397.9	5397.9	OK	
Jerfferson High School Detention	18095	180+95	41	41	41	18,095	18,095	18,095	465	466	464	466	5398.1	5398.1		
	18189	181+89	94	94	94	18,189	18,189	18,189	463	464	463	463	5398.1	5398.1		
	18450	184+50	260	260	260	18,450	18,450	18,450	641	624	623	624	5398.1	5398.1		
	18648	186+48	199	199	199	18,648	18,648	18,648	280	281	257	257	5398.1	5398.1	OK	
	18706	187+06	57	57	57	18,706	18,706	18,706	243	231	183	184	5398.1	5398.1	OK	Inlet structure of 54-inch storm pipe at west end of Jefferson High School Detention was blocked with obstruction for only modeling surface flow.
	18771	187+71	65	65	65	18,771	18,771	18,771	162	163	53	53	5401.0	5401.0	OK	
	18851	188+51	80	80	80	18,851	18,851	18,851	157	157	39	39	5401.6	5401.6	OK	
	19004	190+04	154	154	154	19,004	19,004	19,004	118	118	39	39	5404.4	5404.4	OK	
	19193	191+93	189	189	189	19,193	19,193	19,193	118	119	63	63	5409.1	5409.1	OK	
	19295	192+95	102	102	102	19,295	19,295	19,295	129	129	65	65	5411.7	5411.7	OK	
	19324	193+24	30	30	30	19,324	19,324	19,324	134	133	65	65	5413.2	5413.2	OK	
Teller Street	19350	193+50														
	19378	193+78	54	54	54	19,378	19,378	19,378	97	97	65	65	5415.5	5415.5	OK	
	19441	194+41	62	62	62	19,441	19,441	19,441	70	69	43	43	5416.5	5416.5	OK	
	19562	195+62	121	121	121	19,562	19,562	19,562	74	74	32	32	5418.8	5418.8		
	19679	196+79	117	117	117	19,679	19,679	19,679	46	47	20	20	5421.7	5421.7	OK	
	19736	197+36	57	57	57	19,736	19,736	19,736	33	33	24	24	5423.1	5423.1		
	19812	198+12	76	76	76	19,812	19,812	19,812	46	44	19	19	5424.6	5424.6	OK	
	19982	199+82	171	171	171	19,982	19,982	19,982	23	100	18	17	5428.5	5428.5	OK	The floodplain top width was manually adjusted to include shallow flooding from the upstream left overbank.
Vance Street	20044	200+44	62	62	62	20,044	20,044	20,044	268	268	48	48	5436.9	5436.9	OK	
	20112	201+12	68	68	68	20,112	20,112	20,112	297	298	35	35	5438.7	5438.7	OK	
Office Hallway Bridge	20200	202+00														Office hallway bridge above drainageway was modeled as inline structure with gate 15' Wx1.5' H.
	20204	202+04	92	92	92	20,204	20,204	20,204	422	418	141	141	5442.2	5442.2		
	20259	202+59	55	55	55	20,259	20,259	20,259	353	351	140	139	5442.6	5442.6	OK	
	20419	204+19	160	160	160	20,419	20,419	20,419	336	336	168	168	5443.8	5443.8	OK	
	20447	204+47	27	27	27	20,447	20,447	20,447	313	313	171	172	5444.4	5444.4		
	20554	205+54	107	107	107	20,554	20,554	20,554	322	323	156	156	5446.4	5446.4	OK	
	20644	206+44	90	90	90	20,644	20,644	20,644	276	276	164	164	5448.3	5448.3	OK	
	20689	206+89	45	45	45	20,689	20,689	20,689	261	265	119	119	5449.3	5449.3		
	20709	207+09	20	20	20	20,709	20,709	20,709	257	257	117	117	5449.6	5449.6		
	20740	207+40	31	31	31	20,740	20,740	20,740	285	291	99	99	5449.7	5449.7	OK	
Wadsworth Blvd	20831	208+31	90	90	90	20,831	20,831	20,831	217	216	96	96	5451.4	5451.4		

Table D-2 AGREEMENT TABLE: MODEL - PROFILE - MAP

PROJECT NAME: Sloan's Lake Drainageway (16.155.026.005)

Community(ies): City and County of Denver, City of Edgewater, City of Weat Ridge & City of Lakewood
Flooding Source: Sloan's Lake Drainageway - 0.5' ΔEGL
Reach: South Platte River to Wadsworth Boulevard

Engineer: Robert Krehbiel / Hung-Teng Ho
Page: 1 of 2
Date: 7/20/2018

Reference Location	Cross Section	River Station	Distance b/a RS, ft			Cumulative Distance, ft			FP Width, ft		FW Width, ft		BFE, ft		BFE Loc.	Comments and/ or Explanations
			Model	Profile	Map	Model	Profile	Map	Model	Map	Model	Map	Model	Profile		
	20873	208+73	42	42	42	20,873	20,873	20,873	360	359	81	81	5451.7	5451.7		
	20904	209+04	31	31	31	20,904	20,904	20,904	183	183	90	90	5451.7	5451.7		
	21068	210+68	164	164	164	21,068	21,068	21,068	78	77	30	30	5451.8	5451.8	OK	
	21127	211+27	58	58	58	21,127	21,127	21,127	24	25	24	25	5452.1	5452.1		
Yukon St (Acess Road)	21170	211+70														
	21210	212+10	83	83	83	21,210	21,210	21,210	29	28	29	28	5454.9	5454.9	OK	
	21254	212+54	44	44	44	21,254	21,254	21,254	22	22	22	22	5455.7	5455.7	OK	
	21340	213+40	85	85	85	21,340	21,340	21,340	174	59	29	29	5458.3	5458.3	OK	The right overbank ponding area was removed from 100-year floodplain delineation and included in the FLO-2D floodplain. The right overbank ponding is a potential 100-year floodplain with an average flood depth less than one foot.
	21421	214+21	81	81	81	21,421	21,421	21,421	128	69	37	37	5460.3	5460.3	OK	
	21514	215+14	93	93	93	21,514	21,514	21,514	293	212	82	82	5461.2	5461.2		
Yarrow Street	21533	215+33	19	19	19	21,533	21,533	21,533	192	192	69	69	5461.2	5461.2		
	21549	215+49	16	16	16	21,549	21,549	21,549	233	232	61	61	5461.5	5461.5		
Pierce Street Tributary _ Reach 01: W 20th Avenue to W 25th Avenue/Quay Street																
	156	1+56	156	156	156	156	156	156	85	85	65	65	5388.7	5388.7	OK	
	199	1+99	43	43	43	199	199	199	87	88	65	65	5389.4	5389.4		
	244	2+44	45	45	45	244	244	244	111	111	73	73	5390.3	5390.3		
	279	2+79	35	35	35	279	279	279	128	125	69	69	5391.0	5391.0	OK	
W 22nd Avenue	351	3+51	71	71	71	351	351	351	122	121	64	64	5391.9	5391.9	OK	
	413	4+13	63	63	63	413	413	413	120	120	64	64	5392.6	5392.6	OK	
	663	6+63	250	250	250	663	663	663	84	86	70	70	5395.2	5395.2		
	750	7+50														Lateral Structure between Station 7+53 to 1+99
	753	7+53	89	89	89	753	753	753	92	92	66	66	5396.1	5396.1		
	827	8+27	74	74	74	827	827	827	88	89	61	61	5396.9	5396.9		
	890	8+90	63	63	63	890	890	890	92	91	64	64	5397.5	5397.5	OK	
W 24th Avenue	975	9+75	85	85	85	975	975	975	107	106	64	64	5398.4	5398.4		
	1032	10+32	57	57	57	1,032	1,032	1,032	74	74	64	64	5398.7	5398.7		
	1095	10+95														Lateral Structure between Station 10+96 to 7+53
	1096	10+96	65	65	65	1,096	1,096	1,096	128	128	62	62	5399.2	5399.2		
	1267	12+67	171	171	171	1,267	1,267	1,267	125	125	58	58	5400.7	5400.7	OK	
	1388	13+88	121	121	121	1,388	1,388	1,388	100	100	58	58	5401.7	5401.7		
	1452	14+52	64	64	64	1,452	1,452	1,452	107	107	58	58	5402.3	5402.3	OK	
	1535	15+35														Lateral Structure between Station 15+39 to 10+96
	1539	15+39	87	87	87	1,539	1,539	1,539	229	229	58	58	5403.2	5403.2		
Pierce St/W 25th Ave	1611	16+11	72	72	72	1,611	1,611	1,611	302	302	78	78	5403.9	5403.9	OK	
	1706	17+06	94	94	94	1,706	1,706	1,706	405	405	67	67	5404.5	5404.5		
	1770	17+70														Lateral Structure between Station 17+80 to 15+39
	1780	17+80	74	74	74	1,780	1,780	1,780	458	458	129	129	5404.8	5404.8	OK	
Pierce Street Tributary _ Reach 02: W 25th Avenue/Quay Street to W 24th Avenue/Yarrow Street																
	1973	19+73	193	193	193	1,973	1,973	1,973	54	54	46	46	5406.2	5406.2	OK	
	2200	22+00	226	226	226	2,200	2,200	2,200	33	31	33	31	5409.9	5409.9	OK	
Reed Street	2271	22+71	71	71	71	2,271	2,271	2,271	57	57	34	34	5412.1	5412.1		

Table D-2 AGREEMENT TABLE: MODEL - PROFILE - MAP

PROJECT NAME: Sloan's Lake Drainageway (16.155.026.005)

Community(ies): City and County of Denver, City of Edgewater, City of Weat Ridge & City of Lakewood
Flooding Source: Sloan's Lake Drainageway - 0.5' ΔEGL
Reach: South Platte River to Wadsworth Boulevard

Engineer: Robert Krehbiel / Hung-Teng Ho
Page: 1 of 2
Date: 7/20/2018

Reference Location	Cross Section	River Station	Distance b/a RS, ft			Cumulative Distance, ft			FP Width, ft		FW Width, ft		BFE, ft		BFE Loc.	Comments and/ or Explanations
			Model	Profile	Map	Model	Profile	Map	Model	Map	Model	Map	Model	Profile		
	2313	23+13	42	42	42	2,313	2,313	2,313	18	18	18	18	5412.7	5412.7	OK	
	2468	24+68	155	155	155	2,468	2,468	2,468	115	114	14	14	5416.8	5416.8	OK	
	2535	25+35	66	66	66	2,535	2,535	2,535	171	172	19	19	5419.0	5419.0		
	2561	25+61	27	27	27	2,561	2,561	2,561	125	125	20	20	5419.4	5419.4	OK	
Saulsbury Street	2588	25+88	26	26	26	2,588	2,588	2,588	128	121	36	36	5420.2	5420.2		
	2606	26+06	18	18	18	2,606	2,606	2,606	185	186	34	34	5420.3	5420.3	OK	
	2691	26+91	85	85	85	2,691	2,691	2,691	59	60	29	29	5421.1	5421.1	OK	
	2777	27+77	86	86	86	2,777	2,777	2,777	93	93	29	29	5423.0	5423.0	OK	
	2845	28+45	68	68	68	2,845	2,845	2,845	17	96	17	18	5424.5	5424.5	OK	The floodplain top width was manually adjusted to include intercept shallow flooding (< 1 ft) from the upstream left overbank of cross-section 2884.
	2884	28+84	38	38	38	2,884	2,884	2,884	111	112	38	38	5425.9	5425.9	OK	
Teller Street	2930	29+30	46	46	46	2,930	2,930	2,930	119	131	72	72	5426.0	5426.0		
	3016	30+16	86	86	86	3,016	3,016	3,016	68	69	64	64	5426.1	5426.1	OK	
	3105	31+05	89	89	89	3,105	3,105	3,105	49	52	49	52	5427.0	5427.0	OK	
Teller Court	3163	31+63	58	58	58	3,163	3,163	3,163	68	73	51	51	5428.2	5428.2		
	3220	32+20	58	58	58	3,220	3,220	3,220	44	46	44	46	5429.2	5429.2	OK	
	3301	33+01	81	81	81	3,301	3,301	3,301	66	66	57	57	5430.8	5430.8	OK	
	3403	34+03	102	102	102	3,403	3,403	3,403	62	62	61	61	5433.1	5433.1	OK	
Upham Street	3449	34+49	46	46	46	3,449	3,449	3,449	147	143	38	38	5434.5	5434.5	OK	
	3501	35+01	52	52	52	3,501	3,501	3,501	79	77	39	39	5435.6	5435.6	OK	
	3574	35+74	73	73	73	3,574	3,574	3,574	115	113	43	41	5437.7	5437.7		
	3629	36+29	55	55	55	3,629	3,629	3,629	76	72	43	43	5437.9	5437.9		
Toe of Spillway	3659	36+59	30	30	30	3,659	3,659	3,659	61	60	61	60	5437.9	5437.9	OK	
Crest of Spillway	3702	37+02	43	43	43	3,702	3,702	3,702	61	59	61	59	5448.0	5448.0	OK	
	3721	37+21	19	19	19	3,721	3,721	3,721	62	63	62	63	5448.3	5448.3	OK	
26th Ave/Wadsworth Blvd Detention	3789	37+89	68	68	68	3,789	3,789	3,789	231	231	231	231	5448.8	5448.8		Detention at Wadsworth Blvd/26th Ave, IEFA was used below crest of spillway.
	4133	41+33	344	344	344	4,133	4,133	4,133	329	327	329	327	5449.0	5449.0	OK	
	4230	42+30	97	97	97	4,230	4,230	4,230	140	140	140	140	5451.5	5451.5	OK	
	4298	42+98	68	68	68	4,298	4,298	4,298	162	163	96	97	5461.4	5461.4		
	4305	43+05	6	6	6	4,305	4,305	4,305	126	126	68	68	5461.9	5461.9	OK	
	4323	43+23	19	19	19	4,323	4,323	4,323	304	308	73	73	5462.0	5462.0		
Wadsworth Blvd	4366	43+66	43	43	43	4,366	4,366	4,366	155	190	80	80	5462.9	5462.9	OK	The floodplain top width was manually adjusted to include shallow flooding from the upstream left overbank.
	4401	44+01	35	35	35	4,401	4,401	4,401	477	469	79	79	5463.0	5463.0		
	4481	44+81	80	80	80	4,481	4,481	4,481	49	52	48	48	5463.0	5463.0	OK	
	4586	45+86	105	105	105	4,586	4,586	4,586	48	74	15	15	5465.1	5465.1	OK	The floodplain top width was manually adjusted to include shallow flooding (< 1 ft) from the upstream left overbank.
	4836	48+36	250	250	250	4,836	4,836	4,836	33	64	16	16	5471.8	5471.8	OK	The floodplain top width was manually adjusted to include shallow flooding (< 1 ft) from the upstream left overbank.
Yarrow Street	5024	50+24	188	188	188	5,024	5,024	5,024	64	53	25	25	5478.2	5478.2		
	5082	50+82	58	58	58	5,082	5,082	5,082	85	85	39	39	5479.8	5479.8	OK	
	5128	51+28	47	47	47	5,128	5,128	5,128	106	107	49	49	5481.4	5481.4	OK	

Table D-2 AGREEMENT TABLE: MODEL - PROFILE - MAP

PROJECT NAME: Sloan's Lake Drainageway (16.155.026.005)

Community(ies): City and County of Denver, City of Edgewater, City of Weat Ridge & City of Lakewood
Flooding Source: Sloan's Lake Drainageway - 0.5' ΔEGL
Reach: South Platte River to Wadsworth Boulevard

Engineer: Robert Krehbiel / Hung-Teng Ho
Page: 1 of 2
Date: 7/20/2018

Reference Location	Cross Section	River Station	Distance b/a RS, ft			Cumulative Distance, ft			FP Width, ft		FW Width, ft		BFE, ft		BFE Loc.	Comments and/ or Explanations
			Model	Profile	Map	Model	Profile	Map	Model	Map	Model	Map	Model	Profile		
	5169	51+69	41	41	41	5,169	5,169	5,169	234	235	46	46	5483.5	5483.5		Rocky Mountain Ditch was modeled with blocked obstruction.
	5220	52+20	51	51	51	5,220	5,220	5,220	116	116	74	74	5485.2	5485.2	OK	Rocky Mountain Ditch was modeled with blocked obstruction.
	5282	52+82	62	62	62	5,282	5,282	5,282	106	107	81	81	5487.2	5487.2		Rocky Mountain Ditch was modeled with blocked obstruction.
	5318	53+18	36	36	36	5,318	5,318	5,318	101	101	57	57	5487.7	5487.7		
Pierce Street Tributary _ Reach 03: W 25th Avenue/Quay Street to W 28th Avenue/Upham Street																
W 25th Ave/Quay Street	76	0+76	76	76	76	76	76	76	458	458	217	217	5406.1	5406.1		
	137	1+37	61	61	61	137	137	137	459	459	184	184	5406.8	5406.8		
	228	2+28	91	91	91	228	228	228	441	441	214	214	5407.9	5407.9	OK	
	282	2+82	54	54	54	282	282	282	459	459	217	217	5408.7	5408.7		
	343	3+43	62	62	62	343	343	343	438	438	232	232	5409.5	5409.5	OK	
	470	4+70														Lateral Structure between Station 4+75 to 3+43
	475	4+75	132	132	132	475	475	475	529	529	239	239	5411.5	5411.5	OK	
	615	6+15	140	140	140	615	615	615	430	434	146	146	5414.3	5414.3	OK	
W 26th Ave/Quay St	687	6+87	71	71	71	687	687	687	409	410	77	77	5415.9	5415.9		
	755	7+55	68	68	68	755	755	755	439	441	-	-	5417.0	5417.0	OK	
	926	9+26	171	171	171	926	926	926	327	327	-	-	5420.4	5420.4	OK	
	1075	10+75	149	149	149	1,075	1,075	1,075	414	414	-	-	5423.9	5423.9		
W 27th Ave/Quay St	1173	11+73	98	98	98	1,173	1,173	1,173	266	265	-	-	5425.9	5425.9	OK	
	1269	12+69	96	96	96	1,269	1,269	1,269	234	233	-	-	5427.8	5427.8		
	1356	13+56	87	87	87	1,356	1,356	1,356	188	190	-	-	5429.7	5429.7	OK	
	1419	14+19	63	63	63	1,419	1,419	1,419	79	80	-	-	5431.1	5431.1	OK	
W 27th Ave/Reed St	1500	15+00	81	81	81	1,500	1,500	1,500	144	147	-	-	5433.1	5433.1	OK	
	1565	15+65	65	65	65	1,565	1,565	1,565	210	210	-	-	5434.5	5434.5	OK	
	1643	16+43	79	79	79	1,643	1,643	1,643	217	217	-	-	5436.6	5436.6	OK	
	1688	16+88	45	45	45	1,688	1,688	1,688	255	255	-	-	5438.0	5438.0	OK	
	1754	17+54	66	66	66	1,754	1,754	1,754	212	212	-	-	5439.3	5439.3	OK	
	1832	18+32	78	78	78	1,832	1,832	1,832	298	299	-	-	5441.3	5441.3	OK	
	1913	19+13	81	81	81	1,913	1,913	1,913	169	175	-	-	5443.5	5443.5	OK	
	1999	19+99	87	87	87	1,999	1,999	1,999	159	162	-	-	5445.5	5445.5	OK	
	2108	21+08	109	109	109	2,108	2,108	2,108	153	153	-	-	5447.7	5447.7	OK	
	2189	21+89	80	80	80	2,189	2,189	2,189	187	188	-	-	5450.3	5450.3	OK	
Teller Street	2246	22+46	58	58	58	2,246	2,246	2,246	208	207	-	-	5452.6	5452.6	OK	
	2348	23+48	102	102	102	2,348	2,348	2,348	165	166	-	-	5453.7	5453.7	OK	
W 28th Ave/Teller St	2413	24+13	64	64	64	2,413	2,413	2,413	211	212	-	-	5454.9	5454.9	OK	
	2487	24+87	74	74	74	2,487	2,487	2,487	110	109	-	-	5456.3	5456.3	OK	
	2605	26+05	118	118	118	2,605	2,605	2,605	51	50	-	-	5457.8	5457.8		
Ashland Drainageway _ Reach 01: Sloan's Lake/Sheridan Blvd to Gray Street																
Sloan's Lake	5	0+05	5	5	5	5	5	5	1042	1056	-	-	5313.0	5313.0	OK	
	30	0+30	25	25	25	30	30	30	807	842	-	-	5314.1	5314.1		The floodplain top width was manually adjusted to include shallow flooding from the upstream right overbank.
	58	0+58	29	29	29	58	58	58	516	554	-	-	5314.7	5314.7	OK	
	93	0+93	34	34	34	93	93	93	379	380	-	-	5315.2	5315.2	OK	
Sheridan Blvd.	197	1+97	104	104	104	197	197	197	349	349	-	-	5316.1	5316.1		Permanent IEFA was used to model road crown of Sheridan Blvd.

Table D-2 AGREEMENT TABLE: MODEL - PROFILE - MAP

PROJECT NAME: Sloan's Lake Drainageway (16.155.026.005)

Community(ies): City and County of Denver, City of Edgewater, City of Weat Ridge & City of Lakewood
Flooding Source: Sloan's Lake Drainageway - 0.5' ΔEGL
Reach: South Platte River to Wadsworth Boulevard

Engineer: Robert Krehbiel / Hung-Teng Ho
Page: 1 of 2
Date: 7/20/2018

Reference Location	Cross Section	River Station	Distance b/a RS, ft			Cumulative Distance, ft			FP Width, ft		FW Width, ft		BFE, ft		BFE Loc.	Comments and/ or Explanations
			Model	Profile	Map	Model	Profile	Map	Model	Map	Model	Map	Model	Profile		
	268	2+68	72	72	72	268	268	268	224	225	-	-	5316.3	5316.3		
	368	3+68	100	100	100	368	368	368	122	115	-	-	5316.9	5316.9		
	460	4+60	92	92	92	460	460	460	79	79	-	-	5316.9	5316.9	OK	
Ames Street	535	5+35	75	75	75	535	535	535	140	156	-	-	5317.1	5317.1		
	602	6+02	68	68	68	602	602	602	96	95	-	-	5317.5	5317.5		
	671	6+71	69	69	69	671	671	671	203	205	-	-	5318.0	5318.0	OK	
	701	7+01	30	30	30	701	701	701	215	215	-	-	5318.1	5318.1		
	735	7+35														Lateral Structure between Station 7+38 to 6+02
	738	7+38	38	38	38	738	738	738	102	101	-	-	5318.6	5318.6	OK	
Benton Street	861	8+61	122	122	122	861	861	861	642	640	-	-	5319.7	5319.7	OK	IEFA was used at Citizen Park Detention.
	929	9+29	68	68	68	929	929	929	418	417	-	-	5320.5	5320.5	OK	Same as above
W 24th Ave/Chase St	1150	11+50	221	221	221	1,150	1,150	1,150	352	357	-	-	5323.2	5323.2	OK	
	1355	13+55	205	205	205	1,355	1,355	1,355	375	370	-	-	5325.2	5325.2	OK	
	1481	14+81	126	126	126	1,481	1,481	1,481	379	380	-	-	5326.7	5326.7	OK	
	1595	15+95	114	114	114	1,595	1,595	1,595	336	335	-	-	5329.4	5329.4	OK	
Depew Street	1724	17+24	130	130	130	1,724	1,724	1,724	236	234	-	-	5330.6	5330.6	OK	
	1912	19+12	187	187	187	1,912	1,912	1,912	181	182	-	-	5332.9	5332.9	OK	
	2067	20+67	155	155	155	2,067	2,067	2,067	218	217	-	-	5335.8	5335.8	OK	
W 25th Ave/Eaton St	2152	21+52	85	85	85	2,152	2,152	2,152	107	107	-	-	5336.3	5336.3	OK	
	2351	23+51	199	199	199	2,351	2,351	2,351	276	276	-	-	5340.6	5340.6	OK	
Fenton Street	2417	24+17	66	66	66	2,417	2,417	2,417	315	315	-	-	5342.6	5342.6	OK	
	2520	25+20	103	103	103	2,520	2,520	2,520	255	335	-	-	5343.9	5343.9	OK	The floodplain top width was manually adjusted to include shallow flooding from the upstream right overbank and includes high ground.
	2581	25+81	61	61	61	2,581	2,581	2,581	438	435	-	-	5345.8	5345.8	OK	
Gray Street	2631	26+31	50	50	50	2,631	2,631	2,631	304	301	-	-	5346.8	5346.8		Blocked obstruction was used at area of non-realistic flow area.
	2703	27+03	72	72	72	2,703	2,703	2,703	312	409	-	-	5348.5	5348.5	OK	The floodplain top width was manually adjusted to include shallow flooding from the upstream right overbank. Blocked obstruction was used at area of non-realistic flow area.
	2781	27+81	79	79	79	2,781	2,781	2,781	476	514	-	-	5350.3	5350.3	OK	The floodplain top width was manually adjusted to include shallow flooding from the upstream right overbank.
	2842	28+42	61	61	61	2,842	2,842	2,842	644	645	-	-	5353.8	5353.8	OK	
	2906	29+06	64	64	64	2,906	2,906	2,906	701	701	-	-	5354.5	5354.5	OK	
Ashland Drainageway _ Reach 02: Gray Street to Pierce Street/W 26th Avenue																
	3003	30+03	97	97	97	3,003	3,003	3,003	77	76	-	-	5356.8	5356.8	OK	
	3118	31+18	115	115	115	3,118	3,118	3,118	196	276	-	-	5359.9	5359.9	OK	The floodplain top width was manually adjusted to include shallow flooding (< 1 ft) from the upstream left overbank.
	3196	31+96	78	78	78	3,196	3,196	3,196	92	168	-	-	5361.2	5361.2	OK	The floodplain top width was manually adjusted to include shallow flooding (< 1 ft) from the upstream left overbank.
	3273	32+73	77	77	77	3,273	3,273	3,273	208	207	-	-	5363.7	5363.7	OK	
Harlan Street	3342	33+42	69	69	69	3,342	3,342	3,342	242	242	-	-	5364.9	5364.9	OK	
	3379	33+79	37	37	37	3,379	3,379	3,379	133	133	-	-	5365.8	5365.8	OK	
	3526	35+26	147	147	147	3,526	3,526	3,526	101	109	-	-	5370.1	5370.1	OK	Blocked obstruction was used at area of non-realistic flow area.
	3634	36+34	108	108	108	3,634	3,634	3,634	93	92	-	-	5373.5	5373.5	OK	

Table D-2 AGREEMENT TABLE: MODEL - PROFILE - MAP

PROJECT NAME: Sloan's Lake Drainageway (16.155.026.005)

Community(ies): City and County of Denver, City of Edgewater, City of Weat Ridge & City of Lakewood
Flooding Source: Sloan's Lake Drainageway - 0.5' ΔEGL
Reach: South Platte River to Wadsworth Boulevard

Engineer: Robert Krehbiel / Hung-Teng Ho
Page: 1 of 2
Date: 7/20/2018

Reference Location	Cross Section	River Station	Distance b/a RS, ft			Cumulative Distance, ft			FP Width, ft		FW Width, ft		BFE, ft		BFE Loc.	Comments and/ or Explanations
			Model	Profile	Map	Model	Profile	Map	Model	Map	Model	Map	Model	Profile		
Ingalls Street	3686	36+86	53	53	53	3,686	3,686	3,686	118	114	-	-	5374.8	5374.8	OK	
	3764	37+64	78	78	78	3,764	3,764	3,764	135	133	-	-	5377.8	5377.8	OK	
	3847	38+47	84	84	84	3,847	3,847	3,847	180	180	-	-	5380.7	5380.7		
	3879	38+79	32	32	32	3,879	3,879	3,879	62	63	-	-	5381.8	5381.8	OK	
	3952	39+52	73	73	73	3,952	3,952	3,952	58	58	-	-	5384.5	5384.5	OK	
Jay Street	4000	40+00	48	48	48	4,000	4,000	4,000	129	132	-	-	5385.8	5385.8	OK	
	4058	40+58	58	58	58	4,058	4,058	4,058	84	80	-	-	5388.1	5388.1		
	4097	40+97	39	39	39	4,097	4,097	4,097	73	79	-	-	5389.5	5389.5	OK	The left overbank shallow flooding at cross sections 4235 and 4097 on Ashland Drainageway was removed from the mapping due to the area is hydraulically disconnected to the main cahnnel.
	4235	42+35	137	137	137	4,235	4,235	4,235	101	100	-	-	5393.6	5393.6	OK	
	4279	42+79	44	44	44	4,279	4,279	4,279	144	146	-	-	5394.5	5394.5		
Kendall Street	4341	43+41	62	62	62	4,341	4,341	4,341	381	381	-	-	5395.2	5395.2		
	4380	43+80														Lateral Structure between Station 43+82 to 42+35
	4382	43+82	41	41	41	4,382	4,382	4,382	362	361	-	-	5395.7	5395.7	OK	
	4591	45+91	209	209	209	4,591	4,591	4,591	59	59	-	-	5398.2	5398.2		
	4791	47+91	199	199	199	4,791	4,791	4,791	80	81	-	-	5399.8	5399.8		
	4980	49+80														Lateral Structure between Station 49+90 to 45+91
	4990	49+90	200	200	200	4,990	4,990	4,990	69	68	-	-	5401.0	5401.0	OK	
	5192	51+92	202	202	202	5,192	5,192	5,192	77	77	-	-	5402.4	5402.4	OK	
	5475	54+75									-					Lateral Structure between Station 54+79 to 51+92
	5479	54+79	286	286	286	5,479	5,479	5,479	61	61	-	-	5404.6	5404.6	OK	
	5841	58+41	362	362	362	5,841	5,841	5,841	66	66	-	-	5409.1	5409.1		
W 26th Ave/Pierce St	5890	58+90	49	49	49	5,890	5,890	5,890	75	76	-	-	5409.8	5409.8		
Gray Street Tributary _ Reach 01: W 26th Avenue to W 32nd Avenue/Kendall Street																
W 26th Avenue	261	2+61	261	261	261	261	261	261	89	215	-	-	5361.5	5361.5		The floodplain top width was manually adjusted to include shallow flooding (< 1 ft) from the upstream right overbank.
	299	2+99	38	38	38	299	299	299	157	183	-	-	5362.9	5362.9	OK	The floodplain top width was manually adjusted to include shallow flooding (< 1 ft) from the upstream right overbank.
	477	4+77	178	178	178	477	477	477	256	252	-	-	5369.3	5369.3	OK	
	573	5+73	96	96	96	573	573	573	187	189	-	-	5373.1	5373.1	OK	
	737	7+37	164	164	164	737	737	737	206	206	-	-	5379.2	5379.2	OK	
	934	9+34	197	197	197	934	934	934	186	185	-	-	5386.9	5386.9	OK	
	1033	10+33	99	99	99	1,033	1,033	1,033	201	201	-	-	5391.5	5391.5	OK	
	1121	11+21	88	88	88	1,121	1,121	1,121	181	182	-	-	5395.4	5395.4	OK	
	1198	11+98	77	77	77	1,198	1,198	1,198	171	170	-	-	5399.2	5399.2	OK	
	1339	13+39	141	141	141	1,339	1,339	1,339	181	181	-	-	5406.3	5406.3	OK	
	1491	14+91	151	151	151	1,491	1,491	1,491	179	180	-	-	5414.2	5414.2	OK	
W 29th Avenue	1566	15+66	75	75	75	1,566	1,566	1,566	169	169	-	-	5415.9	5415.9	OK	
	1642	16+42	76	76	76	1,642	1,642	1,642	199	198	-	-	5416.7	5416.7	OK	
	1720	17+20	78	78	78	1,720	1,720	1,720	216	224	-	-	5417.1	5417.1		
	1782	17+82	62	62	62	1,782	1,782	1,782	236	235	-	-	5417.4	5417.4		
	1842	18+42	60	60	60	1,842	1,842	1,842	207	200	-	-	5418.0	5418.0	OK	

Table D-2 AGREEMENT TABLE: MODEL - PROFILE - MAP

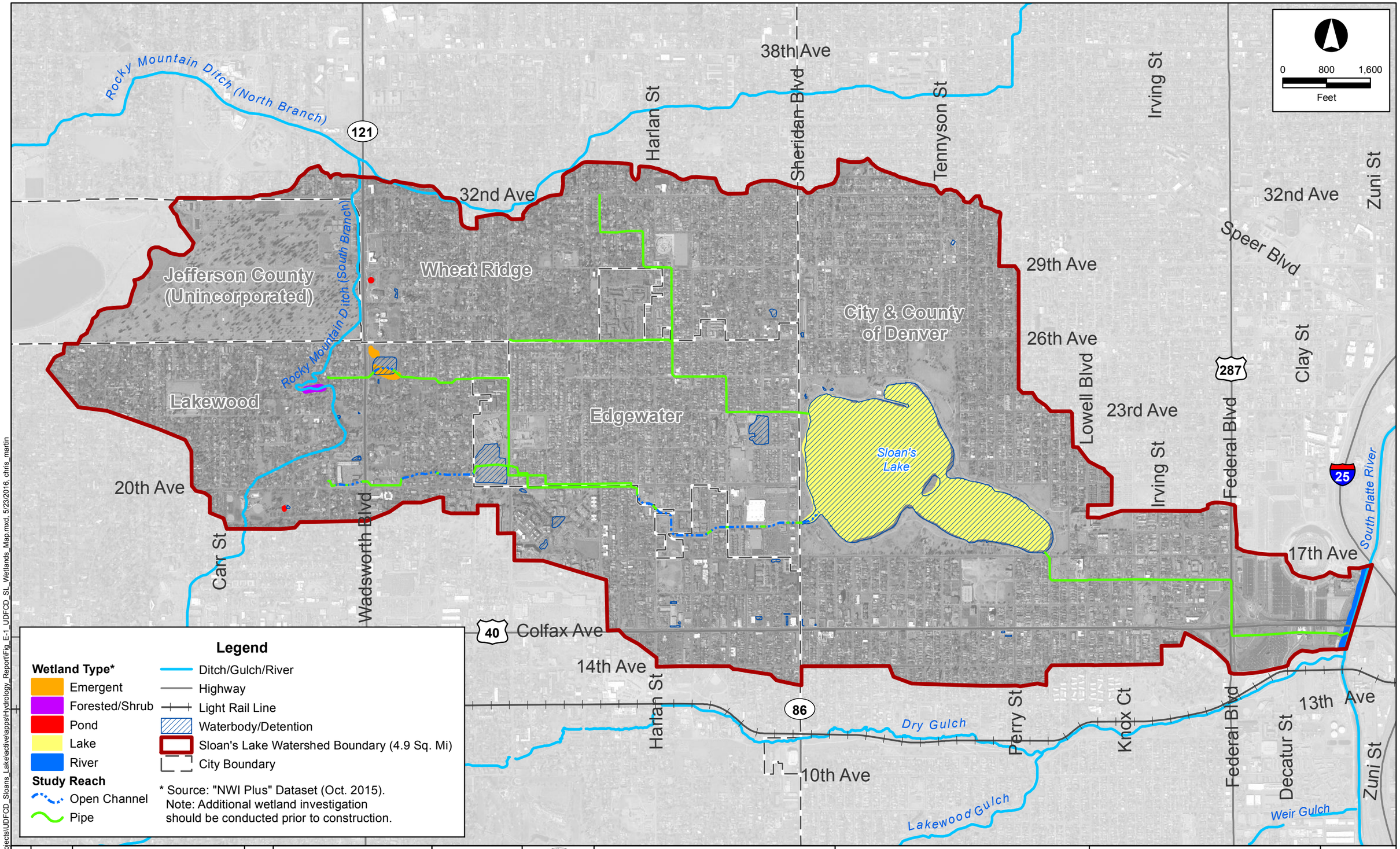
PROJECT NAME: Sloan's Lake Drainageway (16.155.026.005)

Community(ies): City and County of Denver, City of Edgewater, City of Weat Ridge & City of Lakewood
Flooding Source: Sloan's Lake Drainageway - 0.5' ΔEGL
Reach: South Platte River to Wadsworth Boulevard

Engineer: Robert Krehbiel / Hung-Teng Ho
Page: 1 of 2
Date: 7/20/2018

Reference Location	Cross Section	River Station	Distance b/a RS, ft			Cumulative Distance, ft			FP Width, ft		FW Width, ft		BFE, ft		BFE Loc.	Comments and/ or Explanations
			Model	Profile	Map	Model	Profile	Map	Model	Map	Model	Map	Model	Profile		
	1939	19+39	97	97	97	1,939	1,939	1,939	215	217	-	-	5419.2	5419.2	OK	
W 29th Ave/Ingalls St	2040	20+40	101	101	101	2,040	2,040	2,040	215	215	-	-	5420.0	5420.0		
	2157	21+57	117	117	117	2,157	2,157	2,157	225	229	-	-	5420.2	5420.2		
W 29th Pl/Ingalls St	2297	22+97	140	140	140	2,297	2,297	2,297	318	318	-	-	5420.3	5420.3		
	2417	24+17	66	66	66	2,417	2,417	2,417	315	315	-	-	5342.6	5342.6	OK	
	2613	26+13	195	195	195	2,613	2,613	2,613	269	269	-	-	5420.6	5420.6	OK	
	2791	27+91	178	178	178	2,791	2,791	2,791	291	293	-	-	5421.6	5421.6	OK	
	2862	28+62	71	71	71	2,862	2,862	2,862	275	275	-	-	5422.2	5422.2		
Jay Street	2952	29+52	90	90	90	2,952	2,952	2,952	287	287	-	-	5422.3	5422.3		
	3053	30+53	101	101	101	3,053	3,053	3,053	101	101	-	-	5422.3	5422.3	OK	
W 30th Ave/Kendall St	3239	32+39	185	185	185	3,239	3,239	3,239	239	240	-	-	5423.5	5423.5	OK	
	3341	33+41	102	102	102	3,341	3,341	3,341	195	194	-	-	5424.6	5424.6	OK	
	3398	33+98	57	57	57	3,398	3,398	3,398	239	239	-	-	5425.4	5425.4		
	3525	35+25	127	127	127	3,525	3,525	3,525	198	200	-	-	5427.0	5427.0	OK	
	3624	36+24	100	100	100	3,624	3,624	3,624	169	168	-	-	5428.9	5428.9	OK	
	3662	36+62	37	37	37	3,662	3,662	3,662	154	154	-	-	5429.5	5429.5	OK	
	3704	37+04	42	42	42	3,704	3,704	3,704	46	46	-	-	5430.9	5430.9	OK	
	3756	37+56	52	52	52	3,756	3,756	3,756	164	167	-	-	5432.7	5432.7	OK	
	3843	38+43	88	88	88	3,843	3,843	3,843	184	184	-	-	5435.3	5435.3		
W 32nd Ave/Kendall St	3972	39+72	128	128	128	3,972	3,972	3,972	167	167	-	-	5437.0	5437.0		

Appendix E – Wetland and Riparian Inventory



Legend

Wetland Type*
- Emergent
- Forested/Shrub
- Pond
- Lake
- River

Study Reach
- Open Channel
- Pipe

- Ditch/Gulch/River
- Highway
- Light Rail Line
- Waterbody/Detention
- Sloan's Lake Watershed Boundary (4.9 Sq. Mi)
- City Boundary

* Source: "NWI Plus" Dataset (Oct. 2015).
Note: Additional wetland investigation should be conducted prior to construction.

FILE: G:\gis_projects\UDFCD_Sloans_Lake\activeapps\Hydrology_Report\Fig_E-1_UDFCD_SL_Wetlands_Map.mxd, 5/23/2016, chris_martin

No.	DATE	DESCRIPTION	APPR.

Matrix DESIGN GROUP
AN EMPLOYEE-OWNED COMPANY

designed by:
drawn by: CM
checked by: RK
project no.: 16.155.026
date: 05/23/2016

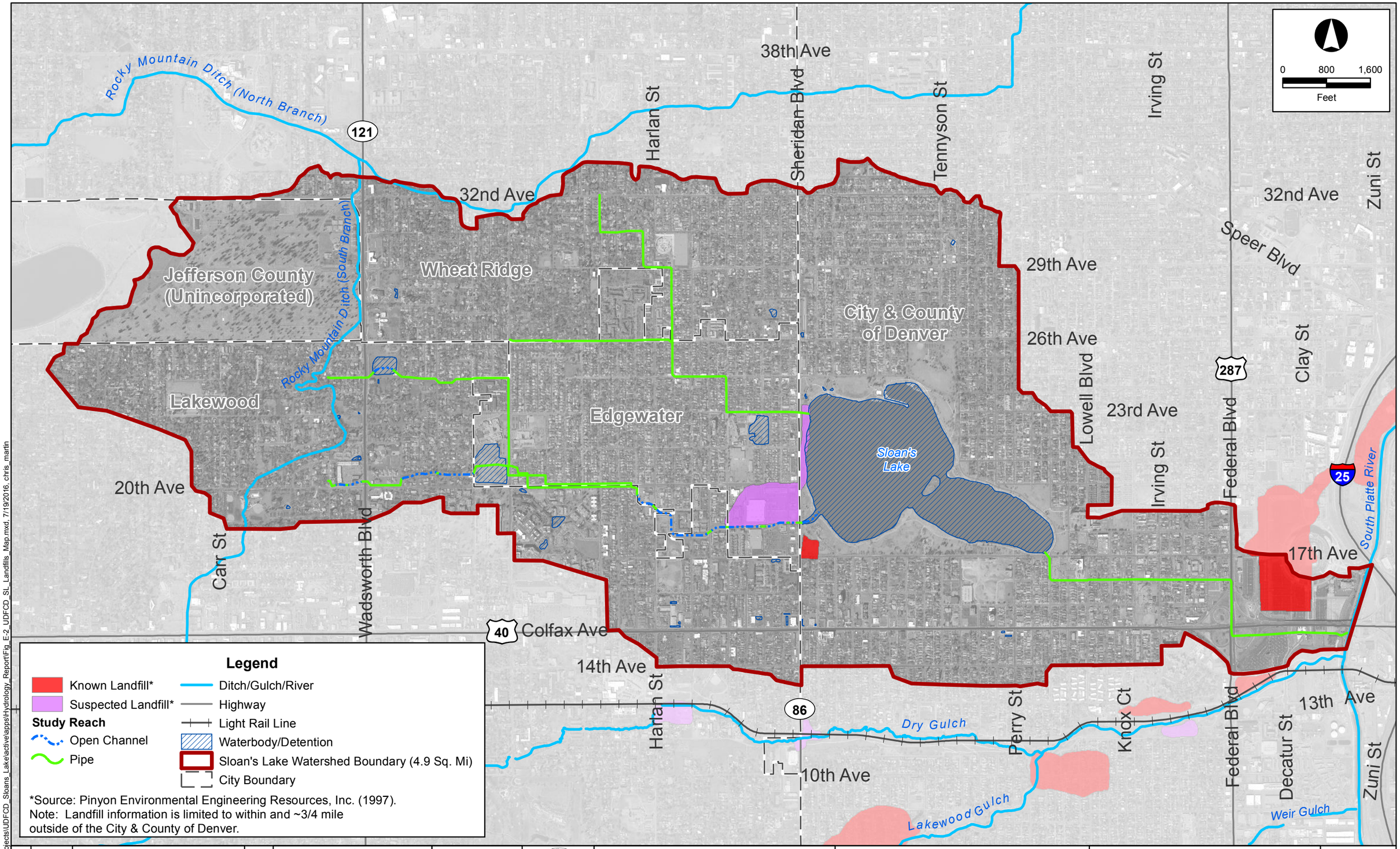
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT, CITY AND COUNTY OF DENVER

FLOOD HAZARD AREA DELINEATION
SLOAN'S LAKE DRAINAGEWAY AND TRIBUTARIES

POTENTIAL WETLANDS AND RIPARIAN ZONES MAP

FIGURE E-1

X



Legend

- Known Landfill*
- Suspected Landfill*
- **Study Reach**
- Open Channel
- Pipe
- Ditch/Gulch/River
- Highway
- Light Rail Line
- Waterbody/Detention
- Sloan's Lake Watershed Boundary (4.9 Sq. Mi)
- City Boundary

*Source: Pinyon Environmental Engineering Resources, Inc. (1997).
Note: Landfill information is limited to within and ~3/4 mile outside of the City & County of Denver.

No.	DATE	DESCRIPTION	APPR.

Matrix DESIGN GROUP
AN EMPLOYEE-OWNED COMPANY

designed by:
drawn by: CM
checked by: RK
project no.: 16.155.026
date: 07/19/2016

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT, CITY AND COUNTY OF DENVER

FLOOD HAZARD AREA DELINEATION
SLOAN'S LAKE DRAINAGEWAY AND TRIBUTARIES

HISTORICAL LANDFILLS MAP

FIGURE
E-2

FILE: G:\gis_projects\UDFCD_Sloans_Lake\activeIapps\Hydrology_Report\Fig_E-2_UDFCD_SL_Landfills_Map.mxd, 7/19/2016, chris_martin

Appendix G – Flood Maps

Flow Diverted Southward between
Station 738 to 602 (Approximately)
Flows Overland in Alley and Ames Street
toward W 22nd Avenue and Sheridan Boulevard
Q_{500} = 56 cfs
Q_{100} = 54 cfs
Q_{50} = 54 cfs
Q_{10} = 25 cfs

Potential Shallow Flooding
Average Depth Less Than 1 Foot

Potential Shallow Flooding
Average Depth Less Than 3 Feet

Flow Overtops and Continues in Sheridan
Boulevard toward North (Approximately)
Q_{500} = 897 cfs
Q_{100} = 22 cfs
Q_{50} = 0 cfs
Q_{10} = 0 cfs

Potential Shallow Flooding
Average Depth Less Than 3 Feet

Sheet 2
Sheet 1

Sloan's Lake Drainageway

LIMIT OF STUDY

The shallow flooding shown downstream of Sloan's Lake is due to localized flooding from the tributary drainage area south of 17th Avenue. 100-year flow from upstream areas are captured by the lake. While there is a potential inundation area subject to flood risk shown downstream of Sloan's Lake, there is not a mapped regulatory 100-year floodplain associated with Sloan's Lake Drainageway in this area. The potential inundation area due to local flooding is not limited to the extents shown. Please contact the City and County of Denver Floodplain Administrator for detailed information on this potential inundation area.

Legend

- Municipal Boundary
- Parcel
- HEC-RAS Cross Section with Labeled Base Flood Elevation
- Base Flood Elevation
- Regulatory 100-Year Floodplain Tie-In
- Floodway (0.5 ft rise)
- 100-Year Floodplain (1% Annual Chance Flood)
- 500-Year Floodplain (0.2% Annual Chance Flood)
- FHAD Inundated Habitable Structure
- Highway
- Index Contour (10 ft)
- Intermediate Contour (2 ft)

- 100-Year FLO-2D Shallow Flooding (Click HERE to activate)

Overland Flow Depth at Cell (Click HERE to activate)*

- 3" - 6"
- 6" - 12"
- 1' - 1.5'
- 1.5' - 3'
- 3' - 4.5'
- 4.5' - 6'
- > 6'

Notes:

*20-foot FLO-2D computational grid

Vertical Datum: NAVD 88
Horizontal Datum: NAD83
Contour Interval: 2 Feet

Topographic information provided by the USGS, 2014

Instructions to print an area smaller than the full page to scale:
1. Using the "Snapshot" tool, select the desired area to print.
2. Click File --> Print
3. Select your printer from the printer dropdown menu.
4. Select the desired paper size using the printer "Properties" menu.
5. Choose the "Selected Graphic" option under "Print Range"
6. Select "None" from the "Page Scaling" dropdown menu.
7. Unselect "Choose Paper Source by PDF Page Size".
8. Click "OK" to print selection.

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0 200 400 800 Feet

Sheet 1 of 2

Flood Hazard Area Delineation - July 2018

Sloan's Lake Drainageway and Tributaries Flood Hazard Area Delineation

Instructions to print an area smaller than the full page to scale:
1. Using the "Snapshot" tool, select the desired area to print.
2. Click File –> Print
3. Select your printer from the printer dropdown menu.
4. Select the desired paper size using the printer "Properties" menu.
5. Choose the "Selected Graphic" option under "Print Range"
6. Select "None" from the "Page Scaling" dropdown menu.
7. Unselect "Choose Paper Source by PDF Page Size".
8. Click "OK" to print selection.

Legend

- Municipal Boundary
- Parcel
- HEC-RAS Cross Section with Labeled Base Flood Elevation
- Base Flood Elevation
- Floodway (0.5 ft rise)
- 100-Year Floodplain (1% Annual Chance Flood)
- 100-Year Overland Flow Average Depth < 1 Foot (1% Annual Chance Flood)
- 100-Year Overland Flow Average Depth < 3 Feet (1% Annual Chance Flood)
- 500-Year Floodplain (0.2% Annual Chance Flood)
- FHAD Inundated Habitable Structure
- Rocky Mountain Ditch
- Highway
- Index Contour (10 ft)
- Intermediate Contour (2 ft)

Shallow Flooding (Based on FLO-2D)

Average Flow Depth (Click HERE to activate)
- 100-year Average Depth <= 1 ft
- 500-year Average Depth <= 1 ft

100-Year Overland Flow Depth at Cell (Click HERE to activate)*
500-Year Overland Flow Depth at Cell (Click HERE to activate)*
- 3" - 6"
- 6" - 12"
- 1' - 1.5'
- 1.5' - 3'
- 3' - 4.5'
- 4.5' - 6'
- > 6'

Notes:
*10-foot FLO-2D computational grid in Edgewater and 20-foot FLO-2D computational grid in Lakewood

Vertical Datum: NAVD 88
Horizontal Datum: NAD83
Contour Interval: 2 Feet

Topographic information provided by the USGS, 2014

Flow Diverted Eastward on W 26th Avenue between Station 475 to 343 (Approximately)
Q_{500} = 111 cfs
Q_{100} = 73 cfs
Q_{50} = 56 cfs
Q_{10} = 26 cfs

Flow Diverted Southward between Station 5479 to 5192 (Approximately)
Q_{500} = 44 cfs
Q_{100} = 23 cfs
Q_{50} = 13 cfs
Q_{10} = 0 cfs (No Inflow)

Flow Diverted Southward between Station 5479 to 5193 (Approximately)
Q_{500} = 64 cfs
Q_{100} = 50 cfs
Q_{50} = 44 cfs
Q_{10} = 25 cfs

Flow Diverted Eastward between Station 1780 to 1539 (Approximately)
Q_{500} = 37 cfs
Q_{100} = 12 cfs
Q_{50} = 8 cfs
Q_{10} = 0 cfs

Flow Diverted Eastward between Station 1539 to 1096 (Approximately)
Q_{500} = 88 cfs
Q_{100} = 23 cfs
Q_{50} = 10 cfs
Q_{10} = 0 cfs

Flow Diverted Eastward between Station 1096 to 753 (Approximately)
Q_{500} = 332 cfs
Q_{100} = 169 cfs
Q_{50} = 121 cfs
Q_{10} = 15 cfs

Flow Diverted Eastward between Station 753 to 199 (Approximately)
Q_{500} = 128 cfs
Q_{100} = 67 cfs
Q_{50} = 48 cfs
Q_{10} = 0 cfs (No Inflow)

Flow Continues Eastward in W 20th Avenue (Approximately)
Q_{500} = 76 cfs
Q_{100} = 30 cfs
Q_{50} = 17 cfs
Q_{10} = 3 cfs

Flow Diverted Southward between Station 738 to 602 (Approximately)
Flows Overland in Alley and Ames Street toward W 22nd Avenue and Sheridan Boulevard
Q_{500} = 56 cfs
Q_{100} = 54 cfs
Q_{50} = 54 cfs
Q_{10} = 25 cfs

Flow Overtops and Continues in Sheridan Boulevard toward North (Approximately)
Q_{500} = 897 cfs
Q_{100} = 22 cfs
Q_{50} = 0 cfs
Q_{10} = 0 cfs

Shallow Flooding from Upstream Average Depth Less Than 1 Foot

Potential Shallow Flooding Average Depth Less Than 1 Foot

Potential Shallow Flooding Average Depth Less Than 3 Feet

Wheat Ridge Unincorporated Jefferson County

Unincorporated Jefferson County Lakewood

Wheat Ridge Lakewood

Edgewater Lakewood

Wheat Ridge Edgewater

Edgewater

City & County of Denver

Pierce Street Tributary

Sloan's Lake Drainageway

Rocky Mountain Ditch - South Fork

Ashland Drainageway

Sheet 2
Sheet 1

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0 200 400 800 Feet

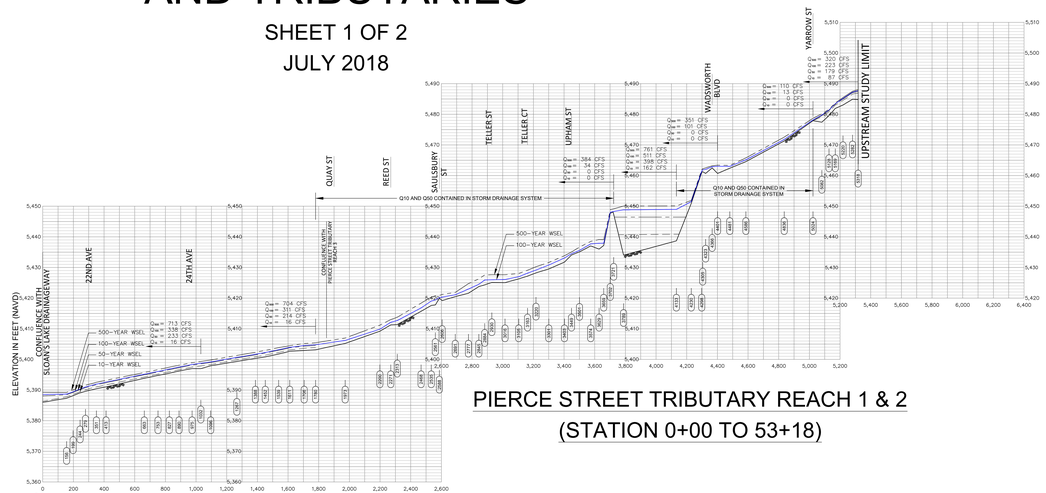
Sheet 2 of 2
Flood Hazard Area Delineation - July 2018
Sloan's Lake Drainageway and Tributaries Flood Hazard Area Delineation

Appendix H – Flood Profiles

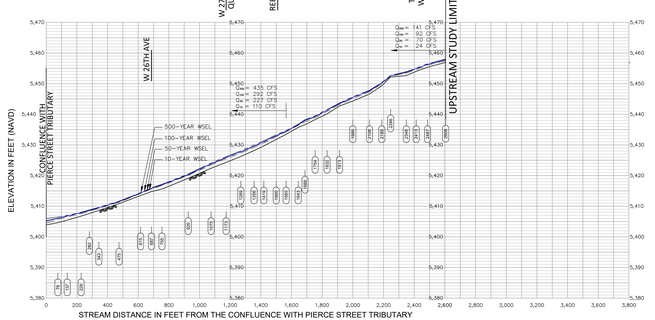
FLOOD HAZARD AREA DELINEATION
SLOAN'S LAKE DRAINAGEWAY AND TRIBUTARIES

SHEET 1 OF 2

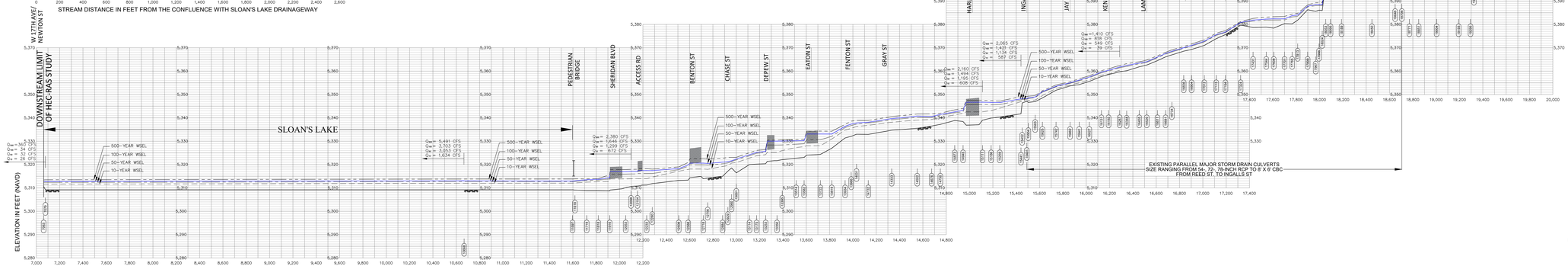
JULY 2018



PIERCE STREET TRIBUTARY REACH 1 & 2
(STATION 0+00 TO 53+18)



PIERCE STREET TRIBUTARY REACH 3
(STATION 0+00 TO 26+06)



SLOAN'S LAKE DRAINAGEWAY (STATION 70+63 TO 215+49)

LEGEND

- 0.2% ANNUAL CHANCE FLOOD (500-YEAR)
- 1% ANNUAL CHANCE FLOOD (100-YEAR)
- 2% ANNUAL CHANCE FLOOD (50-YEAR)
- 10% ANNUAL CHANCE FLOOD (10-YEAR)
- STREAM BED
- CROSS SECTION (HEC-RAS)
- EXISTING CULVERT
- EXISTING ROADWAY/PEDESTRIAN BRIDGE

INSTRUCTION TO PRINT AN AREA SMALLER THAN THE FULL PAGE TO SCALE:

1. USING THE "SNAPSHOT" TOOL, SELECT THE DESIRED AREA TO PRINT.
2. CLICK FILE>PRINT...
3. SELECT YOUR PRINTER FROM THE PRINTER DROPDOWN MENU.
4. SET THE DESIRED PAPER SIZE USING THE PRINTER "PROPERTIES" MENU.
5. CHOOSE THE "SELECTED GRAPHIC" OPTION UNDER "PRINT RANGE".
6. SELECT "NONE" FROM THE "PAGE SCALING" DROPDOWN MENU.
7. UNSELECT "CHOOSE PAPER SOURCE BY PDF SIZE".
8. CLICK "OK" TO PRINT SELECTION.

SCALE

0 100 200 400

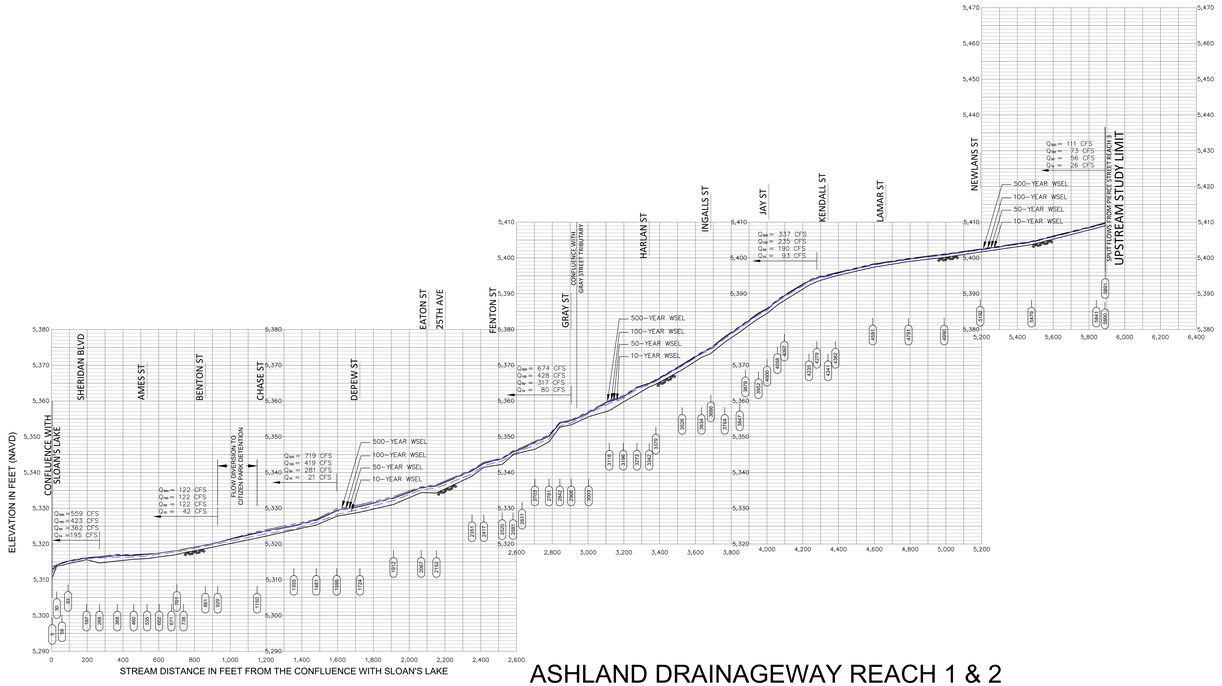
ORIGINAL HORIZ. SCALE: 1" = 100'
ORIGINAL VERT. SCALE: 1" = 10'

Matrix DESIGN GROUP

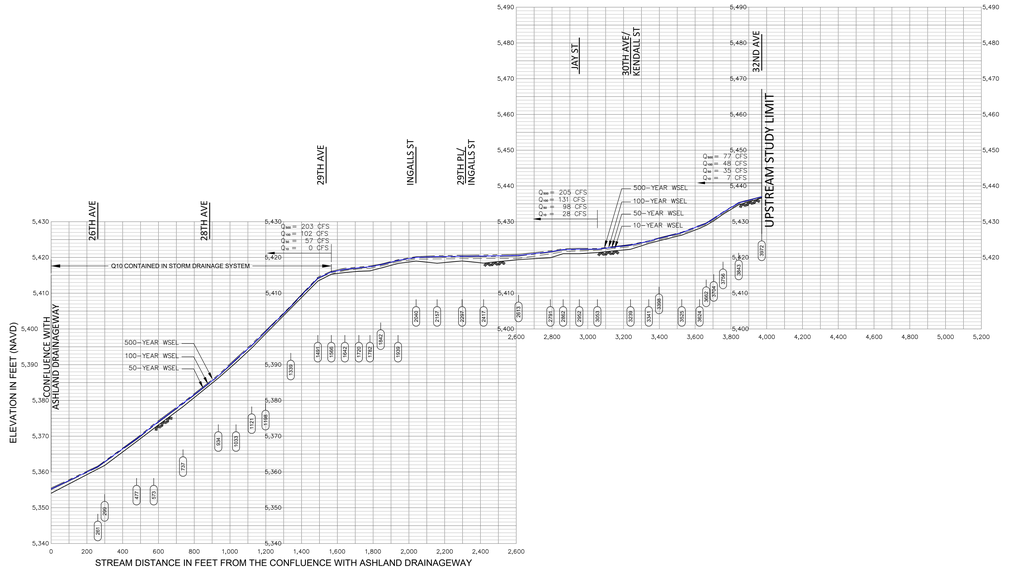
FLOOD HAZARD AREA DELINEATION
SLOAN'S LAKE DRAINAGEWAY AND TRIBUTARIES

SHEET 2 OF 2

JULY 2018



ASHLAND DRAINAGEWAY REACH 1 & 2
(STATION 0+00 TO 58+91)



GRAY STREET TRIBUTARY
STATION 0+00 TO 39+72

LEGEND

- 0.2% ANNUAL CHANCE FLOOD (500-YEAR)
- 1% ANNUAL CHANCE FLOOD (100-YEAR)
- 2% ANNUAL CHANCE FLOOD (50-YEAR)
- 10% ANNUAL CHANCE FLOOD (10-YEAR)
- STREAM BED
- CROSS SECTION (HEC-RAS)
- EXISTING CULVERT
- EXISTING ROADWAY/PEDESTRIAN BRIDGE

INSTRUCTION TO PRINT AN AREA SMALLER THAN THE FULL PAGE TO SCALE:

1. USING THE "SNAPSHOT" TOOL, SELECT THE DESIRED AREA TO PRINT.
2. CLICK FILE>PRINT...
3. SELECT YOUR PRINTER FROM THE PRINTER DROPDOWN MENU.
4. SET THE DESIRED PAPER SIZE USING THE PRINTER "PROPERTIES" MENU.
5. CHOOSE THE "SELECTED GRAPHIC" OPTION UNDER "PRINT RANGE".
6. SELECT 'NONE' FROM THE "PAGE SCALING" DROPDOWN MENU.
7. UNSELECT "CHOOSE PAPER SOURCE BY PDF SIZE".
8. CLICK "OK" TO PRINT SELECTION.

SCALE

200 0 100 200 400

ORIGINAL HORIZ. SCALE: 1" = 200'
ORIGINAL VERT. SCALE: 1" = 10'

Matrix DESIGN GROUP