FINAL DRAINAGE REPORT FOR WATERBURY FILING NO. 1 EL PASO COUNTY, COLORADO

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DESIGN ENGINEER'S STATEMENT:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

_____ _____

Quentin Armijo, P.E. 37170 Date
On behalf of Terra Nova Engineering, Inc.

OWNER/DEVELOPER'S STATEMENT:

I, the owner/developer have read and will comply with all of the requirements specified in this drainage report and plan.

_____ _____

Authorized Signature Date

Andrew R. Klein Authorized Representative
Printed Name, Title

ACM ALF VIII JV SUB II LLC
Business Name

4100 E. Mississippi Ave., Ste. 500, Denver, CO 80246
Address

EL PASO COUNTY:

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

_____ _____

Joshua J. Palmer, P.E. Date
County Engineer / ECM Administrator
Conditions:

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INTRODUCTION

PURPOSE

The purpose of this Final Drainage Report is to identify and analyze the proposed drainage patterns, determine proposed runoff quantities, size drainage structures for conveyance of developed runoff based upon the overall development of single-family homes along with all the supporting infrastructure, while following the guidelines of the 4-step process.

This site was previously submitted as Waterbury Phase 1 Preliminary Plan with 3 separate filings by Classic Consulting Engineers & Surveyors, LLC. The Final Drainage Report for Filing 1 along with the construction drawings were approved in September of 2016 by EL Paso County Development Services and the Final Drainage Report for Filing 2 along with the construction drawings were submitted for review in September of 2017 and comments given back in September of 2017. Filing 3 had been preliminary designed but nothing submitted to EL Paso County. Since this time the owner had revised the lot layout and removed the alleys shown in Filing 1. All the public roadways have remained the same with the exception of the ROW for Saybrook Road from Stapleton to Bayshore Way, where it changes from 65' to 89'. With these changes El Paso County Development Services requested that we submit a new PUD and Preliminary Plan and the associated FDR for these revisions. An Early Grading Permit was also submitted. These have been approved and this Final Drainage Report is being submitted with the Final Plat and Construction drawings. The new PUD was processed as Waterbury Filings 1 but will now be platted as Waterbury Filing 1 along with the appropriate construction drawings. The overall proposed drainage patterns do not differ much and follow the previous studies closely.

The Waterbury site lies within the Geick Ranch and the Haegler Drainage Basins, storm runoff drains southerly via 2 existing natural waterways, one bordering the site on the west (Haegler Drainage Basin) and one on the east (Geick Ranch Drainage Basin). The "Haegler Drainage Basin Planning Study" was prepared by URS and approved in June of 2009. Drexel Barrel & Co prepared the "Geick Ranch Drainage Basin Planning Study" submitted for approval February 2008 but it has yet to be

approved by El Paso County, and therefore there are no drainage fees in this basin. In the Haegler DBPS it is noted that "a portion of the Haegler Ranch as delineated by the County map was found to be part of the Geick Ranch Drainage Basin at Judge Orr Road, due to a lack of a roadway culvert at the crossing. This is excluded from the Haegler Ranch DBPS and is included as part of the Geick Ranch DBPS, per the County." These 2 channels eventually drain to Black Squirrel Creek and ultimately the Arkansas River.

PROJECT CHARACTERISTICS

Waterbury Filing 1 plat consists of 198 single family lots on 61.87 acres and is part of a larger development of 322.0 acres to be developed over time and in multiple filings. A PUD Development Plan, Zoning and Conceptual plans have all been previously processed and approved with El Paso County. The area of disturbance of 76.10 acres is larger than the platted area due to offsite drainage & street improvements, and access roads.

The site is in the SW 1/4 of Sections 28, SE ¼ 29 & NW 1/4 33, Township 12 South, Range 64 West of the 6th Principal Meridian within El Paso County, Colorado. The site is bounded to the west by natural channel and 4-Way Ranch Filing No. 1. To the south by Stapleton Drive. To the north by unplatted land consisting of future Waterbury Filings, and to the west by a natural channel unplatted land consisting of future Waterbury Filings (See vicinity map, Appendix A).

The site consists of 100% Columbine Gravelly (19) per the USDA, NRCS web soil survey. The hydrologic soil group "A" was used to represent the soil types and determine the onsite basin overland flow. (See map in appendix)

The study area consists of undeveloped land that has existing vegetation consisting of established native grasses. A ridge running north to south splits the site with the west 1/3 draining southwest with average slopes of 0% to 3% and the remaining 2/3 drains southwest with average slopes of 0% to 3%. There are no existing on-site improvements.

The site has been analyzed in several approved studies including the following "Revision to the MDDP for Meridian Ranch, EL Paso County, Colorado", approved October 2005, and prepared by PBS&J. "Final Drainage Report for 4-Way Ranch Phase 1" by JR Engineering Dated March 2006.

The “Geick Ranch Drainage Basin Planning Study” dated February 2008, and prepared by Drexel Barrel & Co. The “Preliminary/Final Drainage Report for Meridian Ranch filing No. 3” by Tech Contractors, November 2011. The “Master Development Drainage Plan, 4-Way Ranch – Phase 1” by Advanced Design Professionals, Inc. dated January 2012. The “Preliminary Drainage Report for Waterbury (Phase 1 Preliminary Plan) dated June 2013 by Classic Consulting analyzes this area in more detail and then Classic followed up with the “Final Drainage Report for Waterbury Filing No. 1” dated September 2016 which studied a portion of the area now being developed. Kiowa Engineering also prepared a 2004 LOMR (04-08-0012).

As-built field survey data is the basis for the design of the drainage basins.

FLOODPLAIN STATEMENT

A portion of this site along the western edge is within a designated F.E.M.A. floodplain, as determined by Flood Insurance Rate Map No. 08041C0552G December 7, 2018 (see appendix). The floodplain is shown on the proposed Drainage Map in the appendix along with the FEMA Firmette. Lots from Filing 1 abut the channel with rear lots lines, but are set to be outside of the FEMA floodplain. As mentioned in the previously approved “Final Drainage Report for Waterbury Filing 1” dated September 2016 prepared by Classic Consulting Engineering & Surveying the floodplain was determined by Kiowa Engineering in a 2004 LOMR (04-08-0012). Using an official FEMA Current Effective Model HEC-RAS analysis sent to us the and then editing that to get a Corrected Effective Model from the 3-42” culverts under Eastonville Road south to Stapleton Drive. This in turn was edited into the Proposed or Post Project Conditions Model to show the proposed improvements such as the proposed 48” dual culverts located at the Gilbert Road crossing and the proposed drop structure. A “No-Rise” Certification has been submitted to the El Paso County Floodplain Administrator due to a drop in elevation of 0.3’ or more from the Corrected Effective Model to the Proposed or Post Project Conditions Model due to the channel adjustments for the dual 48” RCP crossing at Gilbert Road. There is no rise of 0.50’ or more along the Haelger Ranch Tributary 2 adjacent to our site. A Floodplain Permit was issued on March 14, 2025 by the EL Paso County Floodplain Administrator.

The Base Floodplain Elevations are shown on the Final Plat and based upon the Corrected Effective Model prepared for the No Rise Certification.

HYDROLOGIC ANALYSIS

The Drainage Criteria Manual El Paso County (DCMEPC), dated January 2015 was the resource used in this analysis. Runoff was calculated using the Rational Method for developed conditions (see appendix). The DCM EPC Update includes the City of Colorado Spring's DCM Chapter 6. Runoff coefficients were calculated using weighted impervious values for each specific basin.

EXISTING CONDITIONS

In the existing condition runoff sheet flows southwest and southeast overland to the existing channels on the west and east side of the site. Below is a description of the existing condition's Design Points, Basins and site runoff.

The geotechnical report states that groundwater was encountered at a depth of 6.5' in some locations. In the proposed conditions mitigation efforts are discussed for dealing with the shallow groundwater.

There are 4 offsite basins that drain existing runoff onto the site from the north under Eastonville Road through culverts. There is also un-platted open space just north of the proposed Waterbury Filing No. 1.

At Design Point 10A 3-42" RCP that routes runoff from a temporary sediment pond south onto the property (Basin OS-5). The "Preliminary/Final Drainage Report for Meridian Ranch Filing No. 3" and shows flows of Q_5 = 28 cfs, Q_{100} = 153 cfs while the Meridian Ranch MDDP shows a 100-year flow of 185 cfs. This larger flow of 185 cfs is used in the HEC-RAS model for downstream channel analysis and culvert design. As mentioned above in the Floodplain Statement section the natural channel along the west side of the site is a recognized FEMA floodplain. This channel in the Haegler Creek Basin drains south to Stapleton Drive where dual 4' high x 8' wide concrete box culverts route the water south in its natural path.

Design Point EX1A consist of onsite Basin EXA's 9.62 acres and offsite Basin OS-5's 6.74 acres, which both consist of undeveloped open space prairie and the FEMA flood channel and the runoff from Design Point EX10A mentioned above travel in the channel south to the northern boundary of our site. The combined flow from these upstream basins and onto our site is Q_5 = 30 cfs, Q_{100} = 202

cfs.

Design Point EX1 consist of onsite Basin EXA's 9.62 acres and offsite Basin OS-5's 6.74 acres, which both consist of undeveloped open space prairie and the FEMA flood channel and the runoff from Design Point EX10A mentioned above travel in the channel south to the southern boundary of our site. The combined flow from these upstream basins and our onsite basins that contribute to the flow is Q_5 = 33 cfs, Q_{100} = 219 cfs. This report does not analyze the flow coming from the adjacent Subdivision as the culverts were previously sized and installed in the approved Classic Consulting "Final Drainage Report for Waterbury Filing No. 1" dated September 2016.

Design Point EX2 is a point at the southern boundary of Filing 1 where runoff (Q_5 = 1 cfs, Q_{100} = 9 cfs) from Basin EXB's 4.09 acres of undeveloped prairie flow into Stapleton Road.

Design Point EX3A consists of the runoff (Q_5 = 0 cfs, Q_{100} = 1 cfs) from Basin OS-4's 0.29 acres that is directed south onto the site and Basin EXC.

Design Point EX3 consists of a shallow swale that leaves the site at the southeast boundary. Runoff (Q_5 = 0 cfs, Q_{100} = 1 cfs) from Basin OS-4's 0.29 acres is directed south onto Basin EXC. The runoff (Q_5 = 7 cfs, Q_{100} = 45 cfs) form Basin EXC's 24.80 acres is combined with the Basin's OS-4. The combined runoff (Q_5 = 7 cfs, Q_{100} = 45 cfs) is directed offsite and shortly later in the existing channel in the Geick Ranch Basin.

Design Point EX4A is a point at the northern boundary of Filing 1 where runoff (Q_5 = 0 cfs, Q_{100} = 2 cfs) from Basin OS-3's 1.11 acres of undeveloped prairie flows south onto the site and Basin EXD.

Design Point EX4 is a point at the eastern boundary of Filing 1 where runoff (Q_5 = 0 cfs, Q_{100} = 2 cfs) from Basin OS-3's 1.11 acres of undeveloped prairie flows south onto Basin EXD's 15.87 acres (Q_5 = 5 cfs, Q_{100} = 31 cfs). The combined flow (Q_5 = 5 cfs, Q_{100} = 33 cfs) travels south and drains into the existing channel along the eastern boundary.

At Design Point EX10 an existing 30" CMP culvert (corresponds to DP10 in the FDR) that drains

from north to south under Eastonville Road (Basin OS-8) onto the undeveloped open space north (Basin OS-2) of the proposed Filing 2 layout. The Meridian Ranch MDDP states the runoff is Q_5 = 5 cfs, Q_{100} = 11 cfs.

Design Point EX5A consists of runoff (Q_5 = 3 cfs, Q_{100} = 22 cfs) from Basin OS-2's 11.40 acres and Design Point EX10 that is directed south onto Basin EXE at the northern boundary of the site. The combined runoff (Q_5 = 8 cfs, Q_{100} = 33 cfs) of the 2 basins is directed onto the site and routed as described below.

Design Point EX5 consists of a swale that leaves the site at the southeast boundary. Runoff (Q_5 = 3 cfs, Q_{100} = 22 cfs) from Basin OS-2's 11.40 acres and Design Point EX10 is directed south onto Basin EXE. The runoff (Q_5 = 2 cfs, Q_{100} = 14 cfs) from Basin EXE's 5.83 acres is combined with Basin's OS-2 & Design Point EX10. The combined runoff (Q_5 = 10 cfs, Q_{100} = 44 cfs) of the 3 basins is directed offsite and into the existing channel in the Geick Ranch Basin.

At Design Point EX9 (Basin OS-9) is an existing 30" culvert (corresponds to DP9 in the FDR) that routes the runoff (Q_5 = 8 cfs, Q_{100} = 19 cfs) under Eastonville Road and onto the open space in Basin OS-1. The runoff (Q_5 = 13 cfs, Q_{100} = 85 cfs) from Basin OS-1's 45.02 acres is routed south via the existing channel located in the Geick Ranch Basin. An analysis found that this drainage channel is a jurisdictional water of the U.S. with associated jurisdictional wetland habitat. Basin EXF's 1.62 acres is a small area consisting of open space prairies located at the northeast corner of the site. Runoff Q_5 = 1 cfs, Q_{100} = 4 cfs) from Basin EXF is directed onto Basin OS-1 along the eastern boundary at Design Point EX6.

Design Point EX7 is a point in the channel that corresponds to the proposed Design Point 30. The combined flow of Basin OS-1, Design Points EX5, EX6, & EX9 at DP EX7 is Q_5 = 31 cfs, Q_{100} = 151 cfs).

Design Point EX7A is a point in the eastern channel that lines up with the beginning of the Waterbury Filing 1 development. The combined flow of Basin OS-1 & EX9 at DP EX7 is Q_5 = 21 cfs, Q_{100} = 104 cfs).

Design Point 13 in this report corresponds to Design Point 13 in Classic Consulting's previously approved "Final Drainage Report for Waterbury Filing 1" dated September 2016. Design Point 13 is an existing Stormwater Quality Pond 3 (SWQ Pond 3) that was an existing stock pond south of Stapleton Drive that has been converted to an EDB and treat 40.4 acres of 4-Way Ranch Filing No. 1 from their Basins OS-5, OS-6, D, E, N 40% of L, 50% of O, Q & basins I, J & N of Waterbury Filing No. 1. The EDB was designed using a 4' x 4' outlet set at 6907.50 with an orifice plate with 1 column of 8-1/8" diameter holes spaced 4" apart. The forebay top is set at 6915.00 with the bottom at 6914.75. The required volume was calculated to be 0.66 ac-ft and the design volume shown is 1.20 ac-ft. The release out of the pond was calculated to be Q_5 = 69 cfs, Q_{100} = 396 cfs (See Classic Consulting Drainage Map in Appendix). This online EDB is no longer considered a viable solution to treating for WQCV for Waterbury Filing 1 basins I, J & N.

PROPOSED FUTURE FINAL CONDITIONS

The overall site will be developed in several Filings with each filing requiring its own final drainage report. The proposed basin descriptions below are for Waterbury Filing 1 development and the preliminary layout of the future filings to the north tributary to the storm drain system and detention ponds in Filing 1. This future area is shown as fully developed to analyze the ultimate storm drain capacity and pond volumes. In the section below labeled Hydrologic Analysis for Filing 1 FDR the interim condition will be discussed and how runoff is captured and routed safely to the proposed private EDB for Filing 1 construction. See the Proposed FDR Drainage Map in the appendix for a visual representation of the below Basin descriptions.

As mentioned above groundwater can be encountered in some places as shallow as 6.5'. To mitigate this, dewatering will be used by the contractor during construction of the utilities and storm sewer, a 8" active underdrain paralleling the sanitary sewer will collect groundwater and route it to an injection pit located in Tract I. Also, the PUD and GEC show where no basements will be allowed to be built due to high groundwater.

Design Point 1 is a proposed public 10' CDOT TYPE R sump inlet located in the west flowline of Saybrook drive just north of the roundabout. Basin A's 3.39 acres consists of roadway and single-family development. Runoff (Q_5 = 5 cfs, Q_{100} = 12 cfs) sheet flows into street sections and then is

routed south via c&g where the inlet captures all the flow.

Design Point 2 is a proposed public 5' CDOT TYPE R sump inlet located in the west flowline of Saybrook drive opposite of DP 1. Basin C's 0.86 acres is comprised of roadway and single-family development. Runoff (Q_5 = 2 cfs, Q_{100} = 4 cfs) drains overland to the street and then to the inlet where it is fully captured. Pipe run 1 an 18" RCP routes the flow to a junction at DP 1. Pipe Run 2 a public 24" RCP routes the combined flow (Q_5 = 7 cfs, Q_{100} = 15 cfs) of DP 1 & 2 down Saybrook Road and then down Bayshore Drive over to manhole junction in Sandy Neck Way.

Design Point 3 is a proposed public 5' CDOT TYPE R sump inlet located in the east flowline of Sandy Neck Way. Basin B1's 2.30 acres consists of roadway and single-family development. Runoff (Q_5 = 4 cfs, Q_{100} = 8 cfs) is directed south to Design Point 3. The 5' CDOT TYPE R sump inlet captures the entire flow. Pipe run 3 an 18" public RCP storm sewer routes the flow west to a manhole junction with Pipe run 4.

Design Point 4 is a proposed public 10' CDOT TYPE R sump inlet located in the west flowline of Sandy Neck Way opposite of DP 3. Basin B2's 3.58 acres consists of roadway and single-family development. Runoff (Q_5 = 6 cfs, Q_{100} = 13 cfs) is routed to Design Point 4. The 10' CDOT TYPE R sump inlet captures the entire flow. Pipe run 4 a 18" public RCP storm sewer routes the flow west to a manhole junction with Pipe run 3. Pipe run 5 a 24" RCP routes the combined (Q_5 = 9 cfs, Q_{100} = 21 cfs) flow of Pipe runs 3 & 4 south down Sandy Neck Way to the manhole junction with Pipe run 2. Pipe run 6 a public 36" RCP then routes the combined (Q_5 = 16 cfs, Q_{100} = 35 cfs) flow of Pipe runs 2 & 5 south down Sandy Neck Way to a junction at Design Point 5.

Design Point 5 is a proposed public 10' CDOT TYPE R sump inlet located in the flowline of Sandy Neck Way cul-de-sac. Runoff (Q_5 = 4 cfs, Q_{100} = 9 cfs) from Basin F's 2.18 acres consisting of single-family development is directed to the east flow line of Sandy Neck Way and then south to the cul-de-sac bulb low point. Runoff (Q_5 = 3 cfs, Q_{100} = 6 cfs) from Basin H's 1.46 acres consisting of single-family development is directed to the west flow line of Sandy Neck Way and then south to the cul-de-sac bulb low point. The combined flow (Q_5 = 7 cfs, Q_{100} = 16 cfs) at DP 5 is captured in the 10' CDOT TYPE R sump inlet and then is routed to the pond along with the flow from Pipe Run 6 via a

proposed 36" public RCP storm sewer (Pipe run 7, Q_5 = 22 cfs, Q_{100} = 48 cfs) to Design Point 8. If this inlet were blocked, runoff would overtop the curb and flow down the storm drain tract and into the proposed FSD Pond 1 (Design Point 8).

Design Point 6 is a proposed public 5' CDOT TYPE R sump inlet located in the west flowline of Saybrook Road. Runoff (Q_5 = 4 cfs, Q_{100} = 8 cfs) from Basin D's 2.11 acres consisting of single-family development is directed to the low point in Saybrook Road where the entire flow is captured. It is then routed via a proposed 18" public RCP storm sewer (Pipe run 8) to a manhole junction with Pipe run 9.

Design Point 7 is a proposed public 5' CDOT TYPE R sump inlet located opposite of DP 6 in Saybrook Road. Runoff (Q_5 = 4 cfs, Q_{100} = 8 cfs) from Basin E's 2.18 acres consisting of roadway and single-family lots is directed via side lot line swales and C&G to the proposed inlet. The 5' inlet captures all of the flow and Pipe run 9 a public 18" diameter RCP storm sewer routes the flow to a manhole junction at with Pipe run 8. The combined flows (Q_5 = 7 cfs, Q_{100} = 16 cfs) of Pipe runs 8 & 9 are routed south down Saybrook Road in Pipe run 10 a public 24' diameter RCP to the proposed FSD Pond 1 Design (Design Point 8).

Design Point 7A is a proposed public 5' CDOT TYPE R at-grade inlet located in the east flowline of Saybrook Road at the south boundary. Runoff (Q_5 = 1 cfs, Q_{100} = 3 cfs) from Basin G1's 0.53 acres consisting of single-family development is directed to the at-grade inlet. The flow captured is Q_5 = 1 cfs, Q_{100} = 2 cfs, while the flow by is Q_5 = 0 cfs, Q_{100} = 1 cfs. The captured flow is then routed via a proposed 18" public RCP elliptical storm sewer (Pipe run 10A) to a Design Point 7B. The flow by is routed into Stapleton Drive and the west into the channel via an asphalt rundown

Design Point 7B is a proposed public 5' CDOT TYPE R at-grade inlet located opposite of DP 7A in Saybrook Road. Runoff (Q_5 = 2 cfs, Q_{100} = 4 cfs) from Basin G2's 0.69 acres consisting of roadway and single-family lots is directed via side lot line swales and C&G to the proposed inlet. The flow captured is Q_5 = 2 cfs, Q_{100} = 2 cfs, while the flow by is Q_5 = 0 cfs, Q_{100} = 2 cfs. Pipe run 10B a public 24" diameter RCP storm sewer routes the combined flows (Q_5 = 9 cfs, Q_{100} = 20 cfs) of Pipe runs 10, 10A & Design Point 7B are routed west to the proposed FSD Pond 1 Design (Design Point 8). The

flow by is routed into Stapleton Drive and the west into the channel via an asphalt rundown.

Design Point 8 is a proposed private Full Spectrum Detention Basin called FSD Pond 1. Design Points 1-7B are routed to the pond and treated for Water Quality and Detention along with Basin K's 3.06 acres consisting mainly of the EDB area and rear yards. Runoff (Q_5 = 3 cfs, Q_{100} = 11 cfs) sheet flows into the EDB. The basins tributary to Design Point 8 are Basins A, B1, B2, C, D, E, F, G1, G2, H & K with a total area of 22.34 acres. The 100-year effective impervious area of 51.9% was calculated using UD-BMP Version 3.07 IRF spreadsheet. This information was entered into the UD-Detention_v4.06spreadsheet and the calculation yielded a required a WQCV of 0.394 ac-ft, a EURV of 0.957 ac-ft and a 100-year total required volume of 2.127 ac-ft. The top of pond is set at 6930.00, with the bottom of pond at 6923.50. The pipes and swales to the pond discharge into two concrete forebays (3% WQCV see calcs in appendix) with 18" high walls and a 3" notch to release minor flows into 2' wide concrete tickle channel. The trickle channel directs runoff to the proposed concrete micro-pool at the surcharge elevation of 6923.83. The bottom of the micro-pool is set at 6921.00 and the top set at 6923.50. A proposed 4' x 4' grate set at 6927.10 on top of a concrete outlet box, an outlet plate on the front to meet the 3-orifice requirement and an 24" outlet pipe with no restrictor will route all runoff from the pond. The metal plate will have 1 column containing 3 rows of 2" diameter orifice holes spaced 13.80" apart starting at 6923.50. The WQCV release is 0.20 cfs with a ponding elevation of 6925.29 and takes 40 hours to release. The EURV release is 0.5 cfs, with an elevation of 6926.94 and takes 73 hours to release. The 100-year detention release is 14.6 cfs, with an elevation of 6927.77 and takes 78 hours to release. A 30' long riprap emergency spillway set at 6928.00 will allow the 100-year developed peak in flow (Q_{100}= 59.9 cfs) with a depth of 0.72' (top of water = 6928.72) to be routed west into the natural channel. 1.00' freeboard is provided (see appendix for all pond calcs). The spillway and downhill slope will be armored with d50= L 9" soil riprap buried 18" deep and a concrete cutoff wall. Pipe Run 10C a private 24" RCP will route the pond release into the existing natural channel. (See Pond Calculations in appendix).

El Paso County is in coordination with 2 consultants HR Green and Stanley Consultants Inc. to widen Eastonville Road and add a Roundabout at the intersection of Londonderry. With these public improvements new storm sewer inlets and pipes will route the runoff from Eastonville and the previous culverts to the required detention and water quality ponds. The design shows 1 Full Spectrum

Detention Pond and 1 Water Quality Pond. The timing of these projects is ahead of Waterbury's schedule and therefore we are assuming these improvements will be installed prior to our development and are shown as existing in our developed condition. The 2 drainage reports "Final Drainage Report Eastonville Road Corridor – Phase 1 El Paso County" submitted November 2024, prepared by Stanley consultants and "Eastonville Road – Londonderry Drive to Rex Road Segment 1 Improvements Final Drainage Report" submitted October 2024, prepared by HR Greene for the projects are referenced for the flow entering our site.

Design Point 9 is where dual Type C inlets located behind an existing berm will capture the flow from the existing 30" RCP culvert under Eastonville Road where Offsite Basin OS-9's 11.80 acres discharges (Q_5 =8 cfs, Q_{100} =19 cfs) onto our site. Offsite Basin OS-9A's 1.07 acres is routed undeveloped flow (Q_5 = 1 cfs, Q_{100} = 4 cfs) to the this low point where the combined flow is captured in the dual Type C inlets and routed via Pipe run 43 a 24" RCP west to a junction with Pipe run 44.

Design Point 10 is an existing Full Spectrum Detention Pond Runoff (Q_5 = 5 cfs, Q_{100} = 12 cfs) to the WQ pond was taken from the Final Drainage Report Eastonville Road Corridor – Phase 1 El Paso County (Pond E). The release rate from the pond (Q_5 = 0.3 cfs, Q_{100} = 5 cfs) is routed to an existing channel via an 18" pipe. The Waterbury design will reroute this 18" RCP (Pipe run 44) to the manhole junction with Pipe run 43 in a future public ROW. The combined flow (Q_5 = 9 cfs, Q_{100} = 23 cfs) from Pipe runs 43 & 44 is routed via Pipe run 45 a public 30" RCP downstream and discharged into the same existing channel. This is shown as OS-8 on the Proposed Drainage Map.

Design Point 10A is where existing 3-42" RCP culverts from the temporary Meridian Ranch Pond cross under Eastonville Road per the "Preliminary/Final Drainage Report for Meridian Ranch Filing No. 3" and shows flows of Q_5 = 28 cfs, Q_{100} = 153 cfs while the Meridian Ranch MDDP shows a 100-year flow of 185 cfs. The pipes discharge onto Offsite Basin OS-5. Offsite Basin OS-5's 5.64 acres consists of future Waterbury rear lots, open space and the natural channel. Runoff (Q_5 = 10 cfs, Q_{100} = 23 cfs) from OS-5 sheet flows to the channel. The flow is then routed south to Design Point 11.

Design Point 13 in this report corresponds to Design Point 13 in Classic Consulting's previously

approved “Final Drainage Report for Waterbury Filing 1” dated September 2016. Design Point 13 is an existing Stormwater Quality Pond 3 (SWQ Pond 3) that was an existing stock pond south of Stapleton Drive that has been converted to an EDB and treat 40.4 acres of 4-Way Ranch Filing No. 1 from their Basins OS-5, OS-6, D, E, N 40% of L, 50% of O, Q & basins I, J & N of Waterbury Filing No. 1. The EDB was designed using a 4’ x 4’ outlet set at 6907.50 with an orifice plate with 1 column of 8-1/8” diameter holes spaced 4” apart. The forebay top is set at 6915.00 with the bottom at 6914.75. The required volume was calculated to be 0.66 ac-ft and the design volume shown is 1.20 ac-ft. The release out of the pond was calculated to be Q_5 = 69 cfs, Q_{100} = 396 cfs (See Classic Consulting Drainage Map in Appendix). This online EDB is no longer considered a viable solution to treating for WQCV for Waterbury Filing 1 basins I, J & N.

Design Point 11 is a proposed crossing under the proposed continuation of Gilbert Drive with dual 48” RCP culverts. Basin I’s 4.97 acres consists of rear lots of 131-137, & 150-162 and the natural channel. Runoff (Q_5 = 4 cfs, Q_{100} = 16 cfs) sheet flows to the channel and is directed south to Design Points 11. As mentioned above Kiowas Engineering did a HEC-RAS analysis modeling developed flows along the channel. Tera Nova Engineering has done a new HEC-RAS analysis modeling developed flows. This information can be found under the Hydraulic analysis section below. The combined flow of Design Point 10A along with Basins OS-5 and I is Q_5 = 34 cfs, Q_{100} = 216 cfs. This flow is routed south under Gilbert drive and onto Basin J. The culverts show that in the 100-year event it has supercritical flow. This would occur only in the once in life span of the culvert and we have labeled the culverts to be Type 3 Class C, which provides a thicker wall to allow for scouring. Basin I’s runoff as mentioned above was intended to be treated downstream in the existing EDB at Design Point 13. This online EDB is no longer considered a viable solution for treating for WQCV due to new regulations. Basin I’s rear 20’ of several lots consists of the rear setback where no structure can be built with this restriction the entire acreage consists of undeveloped pervious area. Therefore, this Basin is listed as excluded from Water Quality per the exclusion in ECM Appendix I.7.1.B.7 - Sites with Land Disturbance to Undeveloped Land that will Remain Undeveloped.

Design Point 12 is a proposed 18” RCP culvert under Gilbert Drive that routes the runoff (Q_5 = 2 cfs, Q_{100} = 4 cfs) from offsite Basin OS-6’s 1.06 acres that is comprised of the eastern half of Thatcher Court located in 4-Way Ranch Filing 1 to the existing natural channel.

Design Point 12A is a proposed 18" RCP culvert under an access maintenance road along the east Ditch line of Thatcher Road that routes the runoff (Q_5 = 2 cfs, Q_{100} = 4 cfs) from offsite Basin OS-6's 1.06 acres that is comprised of the eastern half of Thatcher Court located in 4-Way Ranch Filing 1 to the existing natural channel.

Basin J's 1.44 acres is comprised of the 20' of rear lots of 156-162 and the existing channel along the west boundary. Runoff (Q_5 = 3 cfs, Q_{100} = 6 cfs) sheet flows into the channel and then is routed south to Design Point 13, an on-line existing stock pond that was converted to an EDB to provide water quality for part of 4-Way Ranch Filing No. 1 and Waterbury Basins I, J & N. As mentioned above this online EDB is no longer considered a viable solution for treating for WQCV. Basin I's rear 20' of several lots consists of the rear setback where no structure can be built with this restriction the entire acreage consists of undeveloped pervious area. Therefore, this Basin is listed as excluded from Water Quality per the exclusion in ECM Appendix I.7.1.B.7 - Sites with Land Disturbance to Undeveloped Land that will Remain Undeveloped .

Design Point 11A is a point at the south end of the property used to show the total flow in the west channel. The total runoff (Q_5 = 37 cfs, Q_{100} = 222 cfs) from Basin J's area and Design Point 11 is used in modeling analysis of the stream in Hydraulic section below.

Basin N's 0.22 acres is comprised of the proposed extension of Gilbert Road form 4-Way Ranch into Waterbury. Runoff (Q_5 = 1 cfs, Q_{100} = 1 cfs) sheet flows into the channel and then is routed south to Design Point 13, an on-line existing stock pond that is being converted to an EDB to provide water quality for part of 4-Way Ranch Filing No. 1 and Waterbury Basins I, J & N. Once again, this online EDB is no longer considered a viable solution to treating for WQCV. Therefore, the UD-BMP Version 3.07 Runoff Reduction was used to show that this area can be treated using Runoff Reduction. The results show that we have a 100% WQCV reduction for Basin N. A Drainage Easement will need to be placed over these areas on the Final Plat with the note *"No lots shall have any impervious improvements constructed within the rear setback (i.e. patios, hardscape, recreational facilities, etc.) for Lots 40-42, 156, & Tract C"*. The area will be vegetated with the final GEC plan. The Preliminary Plan/PUD also places impervious restrictions on this Basin area and the O and M manual also lists

how to maintain this space. This acreage of 0.22 is within the allowable limits.

In the previously approved "Final Drainage Report for Waterbury Filing No. 1" by Classic Consulting it was stated that there were 3 Stormwater Quality Ponds that needed to be provided for the adjacent 4-Way Ranch per conditions set forth by the Board of County Commissioners at approval of the Waterbury PUD Development Plan. Because there have been no changes to the tributary areas to these 3 Ponds and they have already been designed and constructed. The original approved calculations and results can be found in the appendix of the original report by Classic Consulting (EPC Review No. SF-13-012) along with the Basin Exhibit Map.

Basin M1's 0.99 acres is comprised of the rear yards of lots 35-39 & open space tract along Stapleton Drive along. Runoff (Q_5 = 2 cfs, Q_{100} = 4 cfs) sheet flows over the 20' back yard setback and open space tract onto Stapleton Drive and then is routed east via curb & gutter to an existing storm drain system from here it is routed to the eastern channel located in the Geick Ranch Basin. Basin M1 contains the rear 20' of several lots which consists of the rear setback where no structure can be built. The entire acreage consists of undeveloped pervious area. Therefore, this Basin is listed as excluded from Water Quality per the exclusion in ECM Appendix I.7.1.B.7 - Sites with Land Disturbance to Undeveloped Land that will Remain Undeveloped.

Basin M2's 0.35 acres is comprised of the rear yards of lots 40-42 adjacent to undeveloped land east of the site. Runoff (Q_5 = 1 cfs, Q_{100} = 2 cfs) sheet flows from the back yard onto the undeveloped land. This rear lot area is not treated for water quality but is pervious area. The UD-BMP Version 3.07 Runoff Reduction was used to show that this area has 100% WQCV reduction based upon the Unconnected Impervious Area being routed over the Receiving Pervious Area. Only developed land in Basin M2 is the rear 40' which 20' of that consists of the rear setback where no structure can be built. A Drainage Easement will need to be placed over these areas on the Final Plat with the note *"No lots shall have any impervious improvements constructed within the rear setback (i.e. patios, hardscape, recreational facilities, etc.) for Lots 40-42, 156, & Tract C"*. The area will be vegetated with the final GEC plan. The Preliminary Plan/PUD also places impervious restrictions on this Basin area and the O and M manual also lists how to maintain this space. This acreage of 0.35 is within the allowable limits.

Basin P's 0.70 acres is comprised of open space Tract I adjacent to undeveloped land east of the site. Runoff (Q_5 = 0 cfs, Q_{100} = 2 cfs) sheet flows from the open space onto the undeveloped land. The entire acreage consists of undeveloped pervious area. Therefore, this Basin is listed as excluded from Water Quality per the exclusion in ECM Appendix I.7.1.B.7 - Sites with Land Disturbance to Undeveloped Land that will Remain Undeveloped.

Design Point 14 is a low point in the knuckle of Beech Creek Drive with a proposed public 10' CDOT TYPE R sump inlet. Runoff (Q_5 = 6 cfs, Q_{100} = 13 cfs) from Basin L1's 3.79 acres consisting of roadway and single-family lots is directed via side lot line swales and C&G to the proposed inlet. The 10' inlet captures all of the flow and Pipe run 11 a public 24" diameter RCP storm sewer routes the flow to a manhole junction with Pipe run 12.

Design Point 15 is a proposed public 5' CDOT TYPE R sump inlet opposite of DP 14 in Beech Creek Drive Runoff (Q_5 = 3 cfs, Q_{100} = 7 cfs) from Basin L2's 2.00 acres consisting of roadway and single-family lots is directed via side lot line swales and C&G to the proposed inlet. The 5' inlet captures all of the flow and Pipe run 12 a public 18" diameter RCP storm sewer routes the flow to a manhole junction with Pipe run 11. Pipe run 13 a 30" RCP routes the combined flow (Q_5 = 9 cfs, Q_{100} = 19 cfs) of Pipe Runs 11 & 12 north in Beech Creek Drive to a manhole junction with Pipe run 14.

Design Point 16 is a proposed public 5' CDOT TYPE R sump inlet located in the proposed western half of the public street of Beech Creek Drive. Runoff (Q_5 = 5 cfs, Q_{100} = 10 cfs) from Basin O1's 2.82 acres consisting of roadway and single-family lots is directed via side lot line swales and C&G to the proposed inlet. The 5' inlet captures all of the flow and Pipe run 14 a public 24" diameter RCP storm sewer routes the flow to a manhole junction with Pipe run 13. Pipe run 15 a 36" RCP routes the combined flow (Q_5 = 13 cfs, Q_{100} = 29 cfs) of Pipe Runs 13 & 14 west to a manhole junction with Pipe run 16.

Design Point 17 is a proposed public 5' CDOT TYPE R sump inlet located opposite of DP 16 in Beech Creek Drive. Runoff (Q_5 = 1 cfs, Q_{100} = 2 cfs) from Basin O2's 0.71 acres consisting of roadway, parking, roof and landscape area sheet flows to the east flowline of Beech Creek Drive and

to the proposed inlet. After all the flow is captured by the inlet Pipe run 16 routes the runoff to a junction with Pipe run 15. Pipe run 17 routes the combined flows (Q_5 = 15 cfs, Q_{100} = 34 cfs) of Pipe runs 15, 16, 39 & 40 and is routed west offsite via a private 36" diameter RCP to Design Point 18 a proposed private temporary EDB (FSD Pond 2) to be in place until future final design of a pond accommodates the future Waterbury development tributary to this pond. The alignment and outlet of the proposed 36" pipe along with the concrete forebay are to remain as is when the permanent FSD pond is revised and enlarged to accommodate the future development. In the future design permanent trickle channels, additional forebays, micro pools, outlet structures, berms and the emergency overflow weir will be designed built to be permanent.

Design Point 33 consists of 4-18" diameter area inlets located at the rear lot line in the downhill side yard swale. A 1' high berm along the back of Lots 46-49 in Basin O3's 0.45 acres will keep runoff (Q_5 = 1 cfs, Q_{100} = 3 cfs) from back yards and rear lot downspouts from sheet flowing into the existing wetlands untreated. Each area inlet can capture 1.40 cfs based upon a head of 0.25'. Therefore the 4 inlets can capture all of the flow. Pipe run 39 a 12" HDPE will route the captured flow to pipe run 17.

Design Point 34 consists of 3-18" diameter area inlets located at the rear lot line in the downhill side yard swale. A 1' high berm along the back of Lots 43-45 in Basin O4's 0.38 acres will keep runoff (Q_5 = 1 cfs, Q_{100} = 2 cfs) from back yards and rear lot downspouts from sheet flowing into the existing wetlands untreated. Each area inlet can capture 1.40 cfs based upon a head of 0.25'. Therefore the 3 inlets can capture all of the flow. Pipe run 40 a 12" HDPE will route the captured flow to pipe run 17.

Design Point 18 is a proposed temporary private Full Spectrum Detention Basin called FSD Pond 2. This pond will be reevaluated and resized when future filings to the east and north are final designed. There are no set time frames at this time to when the final design of the permanent pond will happen but at that time the alignment and outlet of the proposed 36" pipe (Pipe Run 17) along with the concrete forebay are to remain as is when the permanent FSD pond is revised and enlarged to accommodate the future development. In the future design permanent trickle channels, additional forebays, micro pools, outlet structures, berms and the emergency overflow weir will be redesigned and updated as permanent. In the time being Design Points 14-17 are routed to the pond and treated for Water Quality and Detention along with the Basin OS-4's 10.90 acres consisting of the EDB area

and undeveloped upstream tributary area. Runoff (Q_5 = 2 cfs, Q_{100} = 16 cfs) from Basin OS-4 sheet flows into the EDB. The basins tributary to Design Point 18 are L1, L2, O1, O2 and OS-4 with a total area of 21.05 acres. The 100-year effective impervious area of 25.76% was calculated using UD-BMP Version 3.07 IRF spreadsheet. This information was entered into the UD-Detention_v4.06spreadsheet and the calculation yielded a required a WQCV of 0.241 ac-ft, a EURV of 0.278 ac-ft and a 100-year detention total required volume of 1.026 ac-ft. The top of pond is set at 6906.00, with a bottom of pond at 6899.00. The pipes and swales to the pond discharge into a concrete forebay (3% WQCV see calcs in appendix) with 18" high walls and a 3" notch to release minor flows into 2' wide concrete tickle channel. The trickle channel directs runoff to the proposed concrete micro-pool at the surcharge elevation of 6899.33. The bottom of the micro-pool is set at 6896.50 and the top set at 6899.00. A proposed 4' x 4' grate set at 6902.10 on top of a concrete outlet box, an outlet plate on the front to meet the 3-orifice requirement and an 18" outlet pipe with no restrictor plate will route all runoff from the pond. The metal plate will have 1 column containing 3 rows of 1-1/4" diameter orifice holes spaced 12.4" apart starting at 6899.00. The WQCV release is 0.10 cfs with a ponding elevation of 6901.21 and takes 40 hours to release. The EURV release is 0.2 cfs, with an elevation of 6902.09 and takes 60 hours to release. The 100-year detention release is 14.8 cfs, with an elevation of 6902.78 and takes 60 hours to release. A 20' long riprap emergency spillway set at 6904.00 will allow the 100-year developed peak in flow (Q_{100}= 29.30 cfs) with a depth of 0.58' (top of water = 6904.58) to be routed west into the natural channel. 1.00' freeboard is provided (see appendix). The spillway and downhill slope will be armored with d50= VL 6" soil riprap buried 12" deep and a concrete cutoff wall. Pipe Run 17A a private 18" RCP will route the pond release into the existing natural channel. (See Pond Calculations in appendix). When future filings are developed this temporary Pond 2 will be replaced with a permanent Pond as shown in the "Conceptual Drainage Report for Waterbury PUD Plan" prepared by Classic Consulting and dated November 2012.

Design Point 19 is a proposed 10' CDOT TYPE R sump inlet located in the south curb of Muddy Pond Street. Runoff (Q_5 = 8 cfs, Q_{100} = 16 cfs) from Basin OS-Q1's 4.31 acres consists of future single-family development and will be directed via lot line swales and c&g onto Basin Q1. Runoff (Q_5 = 3 cfs, Q_{100} = 6 cfs) from Basin Q1's 1.46 acres is directed to the 10' inlet. The combined flow (Q_5 = 8 cfs, Q_{100} = 16 cfs) is fully captured in the inlet and Pipe run 18 a 24" RCP diameter storm routes the flows to a manhole junction with Pipe run 19.

Design Point 20 is a proposed 5' CDOT TYPE R sump inlet located opposite of DP 19. Runoff (Q_5 = 2 cfs, Q_{100} = 4 cfs) from Basin OS-Q2's 0.96 acres consists of future single-family development and will be directed via lot line swales and c&g onto Basin Q2. Runoff (Q_5 = 2 cfs, Q_{100} = 4 cfs) from Basin Q2's 0.96 acres is directed to the 5' inlet. The combined flow (Q_5 = 3 cfs, Q_{100} = 7 cfs) is fully captured in the inlet and Pipe run 19 an 18" RCP diameter storm routes the flows to a manhole junction with Pipe run 18. Pipe Run 20 a 24" RCP storm routes the combined flow (Q_5 = 10 cfs, Q_{100} = 22 cfs) of Pipe runs 19 & 20 east down Muddy Pond Street to a manhole junction with Pipe run 21.

Design Point 21 is a proposed 10' CDOT TYPE R at-grade inlet located in the north curb of Muddy Pond Street just east of Masonboro Way intersection. Runoff (Q_5 = 11 cfs, Q_{100} = 24 cfs) from Basin OS-R's 6.05 acres consists of future single-family development and will be directed via lot line swales and c&g onto Basin R. Runoff (Q_5 = 2 cfs, Q_{100} = 4 cfs) from Basin R's 1.02 acres is directed to the 10' inlet. The combined flow (Q_5 = 12 cfs, Q_{100} = 28 cfs) is routed to the inlet at Design Point 21 and Q_5 = 7 cfs, Q_{100} = 11 cfs is captured by the at-grad inlet. The bypass flow (Q_5 = 5 cfs, Q_{100} = 17 cfs) at DP 21 travels in the north flow line of Muddy Pond Street to Design Point 22. Pipe run 21 an 18" RCP diameter storm routes the captured flow to a manhole junction with Pipe run 20. Pipe run 22 routes the combined flow (Q_5 = 18 cfs, Q_{100} = 36 cfs) of Pipe runs 20 & 21 east down Muddy Pond Street to a manhole junction with Pipe run 25. The bypass flow (Q_5 = 5 cfs, Q_{100} = 17 cfs) at DP 21 travels in the north flow line of Muddy Pond Street to Design Point 22.

Design Point 22 is a proposed 15' CDOT TYPE R sump inlet located in the west curb of Megansett Way. Runoff (Q_5 = 8 cfs, Q_{100} = 18 cfs) from Basin OS-S1's 5.59 acres consists of future single-family development and will be directed via lot line swales and c&g onto Basin S1. Runoff (Q_5 = 3 cfs, Q_{100} = 7 cfs) from Basin S1's 1.55 acres is directed to the 10' inlet. The combined flow (Q_5 = 15 cfs, Q_{100} = 38 cfs) of Basins OS-S1, S1 & the bypass flow from DP 21 is routed to the low point.

Design Point 23 is a proposed 15' CDOT TYPE R sump inlet located opposite of DP 22. Runoff (Q_5 = 0 cfs, Q_{100} = 1 cfs) from Basin OS-S2's 0.17 acres consists of future single-family development and will be directed via lot line swales and c&g onto Basin S2. Runoff (Q_5 = 0 cfs, Q_{100} = 1 cfs) from Basin S2's 0.13 acres is directed to the 10' inlet. The combined flow at DP 23 is Q_5 = 1 cfs, Q_{100} = 1

cfs. It is presumed that the combined flow (Q_5 = 16 cfs, Q_{100} = 39 cfs) at DP 22 & 23 is evenly split between the 2-15' CDOT TYPE R sump inlets. Pipe run 23 a 24" RCP diameter storm routes the flow (Q_5 = 8 cfs, Q_{100} = 19 cfs) from the inlet at DP 22 to a manhole junction with Pipe run 24. Pipe Run 24 a 24" RCP storm routes the flow (Q_5 = 8 cfs, Q_{100} = 19 cfs) to the manhole junction with Pipe run 23. Pipe Run 25 a 36" RCP routes the combined flow (Q_5 = 15 cfs, Q_{100} = 39 cfs) of Pipe runs 23 & 24 south to a manhole junction with Pipe run 22 in Muddy Pond Street. Pipe run 26 a 36" RCP then routes the combined flow (Q_5 = 31 cfs, Q_{100} = 63 cfs) of Pipe runs 22 & 25 east in Muddy Pond to a manhole junction with Pipe runs 27 & 28.

Design Point 24 is a proposed 5' CDOT TYPE R sump inlet located in the south curb of Muddy Pond Street. Runoff (Q_5 = 3 cfs, Q_{100} = 6 cfs) from Basin T1's 1.42 acres consists of single-family development and will be directed via lot line swales and c&g to the 5' inlet. Pipe run 27 an 18" RCP diameter storm routes the fully captured flow from the inlet to a manhole junction with Pipe runs 26 & 28.

Design Point 25 is a proposed 5' CDOT TYPE R sump inlet located opposite of DP 24. Runoff (Q_5 = 1 cfs, Q_{100} = 3 cfs) from Basin OS-T2's 0.76 acres consists of future single-family development and will be directed via lot line swales and c&g onto Basin T2. Runoff (Q_5 = 2 cfs, Q_{100} = 5 cfs) from Basin T2's 1.23 acres is directed to the 5' inlet. The combined flow at DP 25 is Q_5 = 3 cfs, Q_{100} = 7 cfs. Pipe run 28 an 18" RCP diameter storm routes the fully captured flow from the inlet to a manhole junction with Pipe runs 26 & 27. Pipe run 29 a 42" RCP then routes the combined flow (Q_5 = 36 cfs, Q_{100} = 78 cfs) of Pipe runs 26, 27 & 28 east in Muddy Pond Street and then south down Fish Camp Circle to a manhole junction with Pipe run 30.

Design Point 26 is a proposed 10' CDOT TYPE R sump inlet located in the west curb of Fish Camp Circle near the Knuckle. Runoff (Q_5 = 7 cfs, Q_{100} = 16 cfs) from Basin U1's 4.38 acres consists of single-family development and will be directed via lot line swales and c&g to the 10' inlet. Pipe run 30 a 24" RCP diameter storm routes the fully captured flow from the inlet to a manhole junction with Pipe run 29. Pipe run 31 a 42" RCP transports the combined flow (Q_5 = 41 cfs, Q_{100} = 91 cfs) of Pipe runs 29 & 30.

Design Point 27 is a proposed 5' CDOT TYPE R sump inlet located opposite of DP 26. Runoff (Q_5 = 3 cfs, Q_{100} = 7 cfs) from Basin U2's 1.89 acres consists of future single-family development and will be directed via lot line swales to the 5' inlet. Pipe run 32 an 18" RCP diameter storm routes the fully captured flow from the inlet to a manhole junction with Pipe runs 31.

Design Point 31 consists of 3-18" diameter area inlets located at the rear lot line in the downhill side yard swale. A 1' high berm along the back of Lots 90-92 in Basin V's 0.54 acres will keep runoff (Q_5 = 1 cfs, Q_{100} = 3 cfs) from back yards and rear lot downspouts from sheet flowing into the existing wetlands untreated. Each area inlet can capture 1.40 cfs based upon a head of 0.25'. Therefore the 3 inlets can capture all of the flow. Pipe run 37 a 12" HDPE will route the captured flow to pipe run 33. Pipe run 33 a 42" RCP then routes the combined flow (Q_5 = 44 cfs, Q_{100} = 98 cfs) of Pipe runs 31, 32 & 37 east through a Drainage Tract to FSD Pond 3.

Design Point 32 consists of 2-18" diameter area inlets located at the rear lot line in the downhill side yard swale. A 1' high berm along the back of Lots 88-89 in Basin X's 0.43 acres will keep runoff (Q_5 = 1 cfs, Q_{100} = 2 cfs) from back yards and rear lot downspouts from sheet flowing into the existing wetlands untreated. Each area inlet can capture 1.40 cfs based upon a head of 0.25'. Therefore the 2 inlets can capture all of the flow. Pipe run 38 a 12" HDPE will route the fully captured flow to the north inlet at Design Point 28.

Design Point 28 are 2 proposed 10' CDOT TYPE R sump inlets located in the north and south curb of Sunken Meadow Road. These inlets are offsite in a future phase and will be built within a proposed drainage easement. The offsite curb and gutter in this area will also need to be built along with some asphalt to direct runoff to the 10' inlet. Runoff (Q_5 = 3 cfs, Q_{100} = 5 cfs) from Basin OS-W's 0.57 acres is directed onto basin w. runoff (Q_5 = 10 cfs, Q_{100} = 21 cfs) from Basin W's 5.20 acres is combined with Basin OS-W's and assumed to be evenly split between the 2-10' inlets and fully captured by them. Pipe run 34 a 24" RCP routes the captured runoff (Q_5 = 5 cfs, Q_{100} = 11 cfs) from the south inlet to the north inlet. Pipe run 34A a 30" RCP routes the combined flow (Q_5 = 11 cfs, Q_{100} = 24 cfs) from Pipe run 34 Design Points 32, described above via Pipe run 34A a 30" RCP.

Basin Y's 0.35 acres is comprised of undeveloped open space Tracts adjacent to the existing natural

channel along the east side of the site. Runoff (Q_5 = 1 cfs, Q_{100} = 2 cfs) from Basin Y sheet flows east into the channel. The entire acreage consists of undeveloped pervious area. Therefore, this Basin is listed as excluded from Water Quality per the exclusion in ECM Appendix I.7.1.B.7 - Sites with Land Disturbance to Undeveloped Land that will Remain Undeveloped and I.7.1.C.1.a – Less than 1 acres of developed roadway area.

The following Basins are for future Waterbury Filings to the north and east that will be tributary to FSD Pond 3. All the basin descriptions are the same, they are comprised of future single-family development and will be directed via lot line swales and c&g to future storm drain systems the future drain systems will be routed to FSD Pond 3. The exact routes and design have not been finalized at this time but will be with a future Final Drainage Report at the time of development. Below is the summary of the flow and acreage.

Basin OS-1: 11.81 acres, Runoff (Q_5 = 18 cfs, Q_{100} = 41 cfs)
Basin OS-2: 11.53 acres Runoff (Q_5 = 16 cfs, Q_{100} = 36 cfs)
Basin OS-3A: 0.79 acres Runoff (Q_5 = 1 cfs, Q_{100} = 3 cfs)
Basin OS-3B: 5.66 acres Runoff (Q_5 = 9 cfs, Q_{100} = 20 cfs)

Design Point 29 is a proposed private Full Spectrum Detention Basin called FSD Pond 3. basins Q1, Q2, R, S1, S2, T1, T2, U1, U2, V, 2, X, and Offsite Basins OS-1, OS-2, OS-3A, OS-3B, OS-S1, OS-S2, OS-T2, OS-R, OS-Q1, OS-Q1, and OS-W, along with Basin OS-7's 3.75 acres consisting of the EDB area. Combined runoff (Q_5=111 cfs, Q_{100}=270 cfs) sheet flows into the EDB with a total area of 72.14 acres routed to the pond and treated for Water Quality and Detention. The 100-year effective impervious area of 53.95% was calculated using UD-BMP Version 3.07 IRF spreadsheet. This information was entered into the UD-Detention_v4.06 spreadsheet and the calculation yielded a required a WQCV of 1.307 ac-ft, a EURV of 3.278 ac-ft and a 100-year total required detention volume of 7.144 ac-ft. The top of pond is set at 6930.00, with a bottom of pond at 6922.00. The pipes and swales to the pond discharge into a concrete forebay (3% WQCV see calcs in appendix) with 30" high walls and a 5" notch to release minor flows into 3' wide concrete tickle channel. The trickle channel directs runoff to the proposed concrete micro-pool at the surcharge elevation of 6922.33. The bottom of the micro-pool is set at 6919.50 and the top set at 6922.00. A proposed 12' x 6' grate set at

6927.05 on top of a concrete outlet box, an outlet plate on the front to meet the 3-orifice requirement and a 36" outlet pipe with no restrictor plate will route all runoff from the pond. The metal plate will have 1 column containing 3 rows of orifice holes spaced 20.16." apart starting at 6922.00. The first hole is 3.5" W x 2" H, the second one is 4.25" W x 2" H, and the third one is 4.5" W x 2" H. The WQCV release is 0.7 cfs with a ponding elevation of 6924.81 and takes 40 hours to release. The EURV release is 1.4 cfs, with an elevation of 6926.76 and takes 77 hours to release. The 100-year detention release is 37.7 cfs, with an elevation of 6927.80 and takes 85 hours to release. An 64' long riprap emergency spillway set at 69287.80 will allow the 100-year developed peak in flow (Q_{100}= 269.0 cfs) with a depth of 1.2' (top of water = 6929.00) to be routed west into the natural channel. 1.00' freeboard is provided (see appendix). The spillway and downhill slope will be armored with d50= L 9" soil riprap buried 18" deep and a concrete cutoff wall. Pipe Run 35 a private 36" RCP will route the pond release into the existing natural channel. (See Pond Calculations in appendix).

Design Point 30 is a triple 36" RCP culvert crossing under Sunken Meadow Road. Offsite Basin OS-10's 3.41 acres consists of open space containing the natural channel. Runoff (Q_5 = 1 cfs, Q_{100} = 8 cfs) is directed south through the wetlands to the culverts. Runoff (Q_5 = 4 cfs, Q_{100} = 30 cfs) from the Pipe run 45 that is discharged into the channel and runoff (Q_5 = 1 cfs, Q_{100} = 2 cfs) from Basin Y's 0.35 acres that sheet flow offsite on Basin OS-10 are combined for a flow of Q_5 = 6 cfs, Q_{100} = 39 cfs at DP 30 does not warrant the triple 36" RCP culverts alone but in case of failure in the Pond 3 outlet runoff from the emergency spillway (Q_{100} = 268.3 cfs) will be safely routed through the triple 36" RCP culverts (See appendix).

To protect receiving water and as part of the "four step process to minimize adverse impacts of urbanization" this site was analyzed in the following manner:

1. Reduce Runoff- The proposed impervious areas on the site are surrounded by landscaping and green space areas. Additionally, the new improvements and impervious areas on the site will be routed to a proposed private Extended Detention Basin. These items will reduce the volume of runoff using ponding and infiltration.
2. Stabilize Drainageways- There are 2 existing drainageways onsite. The westerly channel has been studied in HEC-RAS model and based upon calculations velocities are within the range for stabilized flow. The easterly channel has wetlands that allow the channel to stay stabilized.

3. Provide Water Quality Capture Volume (WQCV)- The 3 Extended Detention Basin have been sized and designed to sufficiently capture the required WQCV and slowly release it though the three-hole outlet, thereby allowing solids and contaminants to settle out.
4. Consider Need for Industrial and Commercial BMPs- The proposed development is single family site; therefore, no Industrial and Commercial BMPs have been proposed.

PROPOSED INTERIM CONDITIONS

The development of the overall Waterbury site will occur in several platting phases. With the design of Waterbury Filings 1 the site will have an interim condition where the area to the north will be unplatted natural open space with drainage patterns differing from the future full build out analysis in the **Proposed Future Final Conditions** section until such time that it is developed. Below is a description of the Design Points and the overall proposed drainage characteristics for the development of Waterbury Filing 1 in the interim condition. Design Points 1-18 do not have any changes to them from the description above in the **Proposed Future Final Conditions** section therefore these basins will not be described below. The following is a description of the Design Points 19-30 altered by the interim state of undeveloped land upstream. In all cases the design flow is less than the ultimate build-out and therefore the inlets and pipes can capture and route the flow safely

Design Point 19 is a proposed 10' CDOT TYPE R sump inlet located in the south curb of Muddy Pond Street. Runoff (Q_5 = 0 cfs, Q_{100} = 1 cfs) from Basin OS-Q1's 0.33 acres consists of undeveloped land and will sheet flow onto Basin Q1. Runoff (Q_5 = 3 cfs, Q_{100} = 6 cfs) from Basin Q1's 1.48 acres is directed to the 8' inlet. The combined flow (Q_5 = 3 cfs, Q_{100} = 6 cfs) is captured in the inlet and Pipe run 18 a 24" RCP diameter storm routes the flows to a manhole junction with Pipe run 19.

Design Point 20 is a proposed 5' CDOT TYPE R sump inlet located opposite of DP 19. Runoff (Q_5 = 0 cfs, Q_{100} = 1 cfs) from Basin OS-Q2's 0.22 acres consists of undeveloped land and will sheet flow onto Basin Q2. Runoff (Q_5 = 2 cfs, Q_{100} = 4 cfs) from Basin Q2's 0.96 acres is directed to the 5' inlet. The combined flow (Q_5 = 2 cfs, Q_{100} = 5 cfs) is fully captured in the inlet and Pipe run 19 an 18" RCP diameter storm routes the flows to a manhole junction with Pipe run 18. Pipe Run 20 a 24" RCP storm routes the combined flow (Q_5 = 4 cfs, Q_{100} = 10 cfs) of Pipe runs 19 & 20 east down Muddy Pond Street to a manhole junction with Pipe run 21.

Design Point 21 is a proposed 10' CDOT TYPE R at-grade inlet located in the north curb of Muddy Pond Street just east of Masonboro Way intersection. Runoff (Q_5 = 0 cfs, Q_{100} = 2 cfs) from Basin OS-R's 1.04 acres consists of undeveloped land and will sheet flow onto Basin R. Runoff (Q_5 = 2 cfs, Q_{100} = 4 cfs) from Basin R's 1.02 acres is directed to the 10' inlet. The combined flow (Q_5 = 2 cfs, Q_{100} = 6 cfs) is routed to the inlet and the flow is fully captured. Pipe run 21 an 18" RCP diameter storm routes the captured flow to a manhole junction with Pipe run 20. Pipe run 22 routes the combined flow (Q_5 = 6 cfs, Q_{100} = 16 cfs) of Pipe runs 20 & 21 east down Muddy Pond Street to a manhole junction with Pipe run 25. The bypass flow (Q_5 = 0 cfs, Q_{100} = 1 cfs) at DP 21 travels in the north flow line of Muddy Pond Street to Design Point 22.

Design Point 22 is a proposed 10' CDOT TYPE R sump inlet located in the west curb of Megansett Way. Runoff (Q_5 = 0 cfs, Q_{100} = 1 cfs) from Basin OS-S1's 0.31 acres consists of undeveloped land and will sheet flow onto Basin S1. Runoff (Q_5 = 3 cfs, Q_{100} = 7 cfs) from Basin S1's 1.55 acres is directed to the 10' inlet. The combined flow (Q_5 = 3 cfs, Q_{100} = 7 cfs) of Basins OS-S1 & S1 is routed via Pipe run 23 to a junction with Pipe run 24.

Design Point 23 is a proposed 10' CDOT TYPE R sump inlet located opposite of DP 22. Runoff (Q_5 = 0 cfs, Q_{100} = 0 cfs) from Basin OS-S2's 0.13 acres consists of future single-family development and will be directed via lot line swales and c&g onto Basin S2. Runoff (Q_5 = 0 cfs, Q_{100} = 1 cfs) from Basin S2's 0.13 acres is directed to the 10' inlet. The combined flow at DP 23 is Q_5 = 0 cfs, Q_{100} = 1 cfs. Pipe run 24 a 24" RCP diameter storm routes the flow (Q_5 = 0 cfs, Q_{100} = 1 cfs) from the inlet at DP 22 to a manhole junction with Pipe run 23. Pipe Run 25 a 30" RCP routes the combined flow (Q_5 = 3 cfs, Q_{100} = 7 cfs) of Pipe runs 23 & 24 south to a manhole junction with Pipe run 22 in Muddy Pond Street. Pipe run 26 a 36" RCP then routes the combined flow (Q_5 = 9 cfs, Q_{100} = 23 cfs) of Pipe runs 22 & 25 east in Muddy Pond to a manhole junction with Pipe runs 27 & 28.

Design Point 24 is a proposed 5' CDOT TYPE R sump inlet located in the south curb of Muddy Pond Street. Runoff (Q_5 = 3 cfs, Q_{100} = 6 cfs) from Basin T1's 1.42 acres consists of single-family development and will be directed via lot line swales and c&g to the 5' inlet. Pipe run 27 an 18" RCP diameter storm routes the flow from the inlet to a manhole junction with Pipe runs 26 & 28.

Design Point 25 is a proposed 5' CDOT TYPE R sump inlet located opposite of DP 24. Runoff (Q_5 = 0 cfs, Q_{100} = 1 cfs) from Basin OS-T2's 0.30 acres consists of future single-family development and will be directed via lot line swales and c&g onto Basin T2. Runoff (Q_5 = 2 cfs, Q_{100} = 5 cfs) from Basin T2's 1.23 acres is directed to the 5' inlet. The combined flow at DP 25 is Q_5 = 2 cfs, Q_{100} = 5 cfs. Pipe run 28 an 18" RCP diameter storm routes the flow from the inlet to a manhole junction with Pipe runs 27 & 28. Pipe run 29 a 36" RCP then routes the combined flow (Q_5 = 13 cfs, Q_{100} = 34 cfs) of Pipe runs 26, 27 & 28 east in Muddy Pond Street and then south down Fish Camp Circle to a manhole junction with Pipe run 30.

Design Point 26 is a proposed 10' CDOT TYPE R sump inlet located in the west curb of Fish Camp Circle near the Knuckle. Runoff (Q_5 = 7 cfs, Q_{100} = 16 cfs) from Basin U1's 4.38 acres consists of single-family development and will be directed via lot line swales and c&g to the 10' inlet. Pipe run 30 a 24" RCP diameter storm routes the flow from the inlet to a manhole junction with Pipe run 29. Pipe run 31 a 42" RCP transports the combined flow (Q_5 = 20 cfs, Q_{100} = 48 cfs) of Pipe runs 29 & 30.

Design Point 27 is a proposed 5' CDOT TYPE R sump inlet located opposite of DP 26. Runoff (Q_5 = 3 cfs, Q_{100} = 7 cfs) from Basin U2's 1.89 acres consists of future single-family development and will be directed via lot line swales to the 5' inlet. Pipe run 32 an 18" RCP diameter storm routes the flow from the inlet to a manhole junction with Pipe runs 31. Pipe run 33 a 42" RCP then routes the combined flow (Q_5 = 24 cfs, Q_{100} = 57 cfs) of Pipe runs 31 & 32 east through a Drainage Tract to FSD Pond 3.

Design Point E-E is a proposed 4' wide swale, 2' deep with 4:1 side slopes. Offsite Basin OS-2's 12.02 undeveloped acres flow (Q_5 = 3 cfs, Q_{100} = 23 cfs) south into the existing stock pond. The flow (Q_5 = 3 cfs, Q_{100} = 23 cfs) will be routed overland in a proposed Diversion Swale E-E north of the Filing 1 Boundary to the existing channel that runs along the eastern boundary, while keeping it from entering the proposed development. The swale is an 8' wide bottom 2' deep swale with 4:1 side slopes on the north side and a 4' deep swale with 3:1 side slopes on the south side. The swale is in a proposed Drainage Easement. This followed the guideline set forth in MHFD chapter 8 design criteria for

stabilized swales. The 100-Y highwater depth in the swale is 0.61' with a velocity of 3.77 fps for the LOW n value of 0.025. The 100-Y highwater depth in the swale is 0.51' with a velocity of 4.76 fps for the low n value of 0.025 (See Appendix for calcs). This is below the allowable 5 fps. Type VL d50=6" riprap pad 16' Wide x 20' long with a bury depth = 1'. It is recommended that the swale be Permanently Seeded and mulched once installed in the Initial Phase of grading to establish a dense grass bottom and side slopes. The swale will be maintained by the Waterbury Metro District #1 based upon the recommendations in the Operations and Maintenance Manual. Access to maintain the swale can be made from the access roads of the temporary turnaround at the end of Megansett Way and from Muddy Pond. The swale is located in a proposed Access and Drainage Easement (see Drainage Maps).

Design Point 29 is a proposed private Full Spectrum Detention Basin called FSD Pond 3. Basins Q1, Q2, R, S1, S2, T1, T2, U1, U2, W, V, X, and Offsite Basins OS-R, OS-Q1, OS-Q2, OS-S1, OS-S2, & OS-T2, along with Basin OS-7's 3.75 acres consisting of the EDB area. Combined runoff (Q_5=22 cfs, Q_{100}=113 cfs) sheet flows into the EDB with a total area of 26.31 acres routed to the pond and treated for Water Quality and Detention. The 100-year effective impervious area of 27% was calculated using UD-BMP Version 3.07 IRF spreadsheet. This information for the interim condition was entered into the same UD-Detention_v4.06 spreadsheet while leaving all other info the same as in the **Proposed Future Final Conditions.** The calculation yielded a required a WQCV of 0.311 ac-ft, a EURV of 0.378 ac-ft and a 100-year total required detention volume of 0.648 ac-ft. The metal plate will need to modify the bottom orifice hole in the interim condition from 3.5" W x 2" H to 1.5" W to 2" H. All other outlet items will remain the same. This orifice hole will be upsized to the original size in the **Proposed Future Final Conditions** at the time of the future development**.** The WQCV release is 0.1 cfs and takes 40 hours to release. The EURV release is 0.3 cfs, and takes 63 hours to release. The 100-year detention release is 0.6 cfs and takes 98 hours to release. See Pond Calculations for the Interim Condition in appendix.

Design Point 30 is a triple 36" RCP culvert crossing under Sunken Meadow Road. All the flow getting here is described below. The flow (Q_5 = 9 cfs, Q_{100} = 23 cfs) from Pipe run 45 is discharged into the existing channel as mentioned int the **Proposed Future Final Conditions.** Offsite Basin OS-1's 35.50 acres consists of undeveloped land and open space containing the natural channel. Runoff (Q_5

= 9 cfs, Q_{100} = 63 cfs) from Basin OS-1 is directed south through the wetlands to the culverts. Basin Y's 0.35 acres is comprised of undeveloped open space Tracts adjacent to the existing natural channel along the east side of the site. Runoff (Q_5 = 1 cfs, Q_{100} = 2 cfs) from Basin Y sheet flows east into the channel. The entire acreage consists of undeveloped pervious area. Therefore, this Basin is listed as excluded from Water Quality per the exclusion in ECM Appendix I.7.1.B.7 - Sites with Land Disturbance to Undeveloped Land that will Remain Undeveloped. Also entering the channel is the runoff from Diversion Swale E-E that routes Basin OS-2's flow mentioned above. The combined flow (Q_5 = 22 cfs, Q_{100} = 113 cfs) at DP 30 of Basins OS-1, OS-2, OS-8, OS-9, & Y will be routed through the triple 36" RCP culverts. The culvert calculations show supercritical flow (See appendix), but this is only in the interim condition as the **Proposed Future Final Condition** needs to keep the design parameters as is for the future increase in flow in case of failure in the Pond 3 outlet runoff from the emergency spillway (Q_{100} = 268.3 cfs) will be safely routed through the triple 36" RCP culverts.

The above Design point and Basin description shows that in the interim condition all runoff can be safely routed through the proposed storms drain system.

HYDRAULIC ANALYSIS

As mentioned above there are 2 major drainage ways on the east and west side of the site. In the previously approved "Final Drainage Report for Waterbury Filing 1" dated September 2016 prepared by Classic Consulting Engineering & Surveying the floodplain along the west side of the site was determined by Kiowa Engineering in a 2004 LOMR (04-08-0012) using a HEC-RAS analysis modeling developed flows along the channel from the 3-42" culverts under Eastonville Road south to the existing stock pond (Design Point 13) south of Stapleton Drive with proposed and existing improvements such as the proposed 48" dual culverts located at the Gilbert Road crossing and existing dual 4' x 8' box culverts at Stapleton Drive. Terra Nova engineering has done a new HEC-RAS study for the floodplain to establish base flood elevations (see appendix for HEC-RAS model). These channels will be contained in proposed Tracts dedicated to drainage that will allow the Waterbury Metro District No. 1 to provide maintenance.

As part of the revised Preliminary Plan submittal for the site revisions an analysis of the eastern

channel by ECO Systems found that this drainage channel is a jurisdictional water of the U.S. with associated jurisdictional wetland habitat. Therefore, to comply with Section 404 of the Clean Water Act, we must meet the 404(b)(1) project review criteria, which include impact avoidance and minimization. The option the client plan to take is to minimize Project-wide impacts to 0.5-acre or less such that the pre-approved Nationwide Permits (NWP) may be used. No channel grading or redesign is proposed for the channels; with the exception of the Sunken Meadow Crossing where 3-36" culverts are being placed and additional flow is routed into the channel further upstream (Design Point E-E on the PDR Map). The rest of the channel is to remain natural at this time as discussed below in the East Channel section. A USACE Section 404 Permit Preconstruction Notification was submitted to the Army Corp of Engineers in February of 2022 and the USACE Verification Letter (see Appendix) was returned in July of 2022 determining "that activities associated with the project are authorized by 2021 NWP 29 – Residential Developments."

For the analysis of the channels, the Manning's Roughness Coefficients were selected based upon investigation of the channels from site visits and the Natural features and Wetlands report for the site done by Ecosystems services. Both channels have a very substantial amount of vegetative cover containing cattails and Palustrine Emergent wetland vegetation (see attached exhibits & photos in appendix). Both channels show no sign of erosion but do have standing pools of water 1"to 6" deep in most areas along the reach.

The manning's n values are based upon Table 10-2 section *e. Channels not maintained, weeds and brush uncut* for *Dense weeds, high as flow depth.* The range is Minimum 0.05, Normal 0.08 Maximum 0.12

The west channel has more significant vegetation (cattails and brush) along the southern reach (RS x-sections 0 to 900) than the northern part (RS x-sections 900 to 2600) where it has more grasses and no cattails. For the existing condition in the southern part of the channel a manning's n of 0.10 was used. While in the northern part a manning's n of 0.06 was used. Channel bank armoring is proposed along sections of the channel. With this disturbance occurring to the natural cattails and grasses we are proposing planting some more cattails and other tall grasses in the disturbed areas and the northern part to help with critical RS x-sections. In the proposed condition we used a manning's n value of

0.06 for the northern part and the same 0.10 for the southern part.

The east channel has significant vegetation (cattails and brush) where it widens (RS x-sections 1801.17 to 1500). Therefore, a manning's n value of 0.10 was used in the HEC-RAS model. This is between the Normal and Maximum limit for Table 10-2 section *e.* All RS x-sections north and south of the above-mentioned sections have a little less cattails and more grasses therefore a manning's n value of 0.08 was used This is the Normal and Maximum limit for Table 10-2 section *e. Channels not maintained, weeds and brush uncut* for *Dense weeds, high as flow depth.*

For shear stress the Retardance Class ranges from Class A to Class C were used based upon the SCS Retardance Class Table 8.9 (Class A: 10.0 lb/sq ft, Class B: 7.64 lb/sq ft and Class C 5.60 lb/sq ft). Values for allowable sheer stress based upon the equation 8.29 and figures 8-23 & 8-24 in the appendix. The allowable soil stress values is 0.025 lb/sq ft. Equation 8.32 in appendix calculates the allowable Vegetal Stress and based upon this the allowable Vegetal Stress values are Class A: 7.50 lb/sq ft, Class B: 5.73 lb/sq ft and Class C 4.20 lb/sq ft.

EAST CHANNEL DEVELOPED ANALYSIS

A HEC-RAS analysis was done of the east channel using the existing topo and the proposed contours sampled from these AutoCAD files along with the 100-year flow of 151 cfs upstream of the Sunken Meadow Road crossing and 188 cfs downstream where Pond 3 outlets. These flows are taken from DP 30* (Existing Calculations DP EX7) and DP 30A* (DP 30A* & Pond 3 release). These are the largest flow the channel will see once development starts for Filing 1. This happens after development of Filing 1 and before there is development upstream in the future phases where onsite storm will route most flows in storm drain to detention/water quality ponds and not in the existing channel. The flow in the future fully developed condition is only 39 cfs (DP 30 FDR Calcs) from RS x-section 2010.09 to 1200. While from RS x-sections 1000 to 400, 97 cfs is the flow (Design Point 30A FDR Calcs). The 100-Y-MIN. FF and finished floor lot elevations shown on the HECRAS exhibit are based upon the 151 cfs and 188 cfs in case development upstream does not happen. The output information shows that the channel velocities are below the suggested velocities of 3 to 4 fps from the DCM Manual Chapter 10 and Table 8-3 located in the appendix Section H for 100-year event and are in the range of 0.47 fps to 4.00 fps, with the exception of RS x-section 400 (discussed below). The Froude

#’s vary from 0.04 to 0.74. The shear stress varies from 0.03 to 2.63 lbs/q ft, which is well under the above-mentioned limits and are compliant with DCM Manual Chapter 10 and Table 8-3 values. As mentioned above this is an existing channel that is not being altered with the exception of the road crossing with the 3-36” culverts and the diversion of flows from Basin OS-2 to a point higher in the channel. This channel shows no current erosion and contains wetlands with well-established cattails and grasses that we should avoid disturbing as the HECRAS results show that the channel is stable as is, with no needed improvements such as drop structures or channel armoring that is discussed in EPC ECM Section 3.3.3 C and H. There is a deviation request with El Paso County concerning this x-section and some others that do meet the Table 8.3 requirements. There is a proposed Type M d50=12” riprap pad with a bury depth of 24" just downstream of the RS x-section 1200 as shown on the construction drawings and this will help to stabilize the channel. It is respectfully requested that no improvements be done in these 2 areas. RS x-section 400 which is downstream of our site and on someone else’s property is also critical. RS x-section 400 is the last station in the analysis which is always critical due to no downstream RS x-section to properly run calculations in the HECRAS program. The Waterbury Metro District No. 1 will provide maintenance on the channel using access from the end of the Public ROW of Sunken Meadow Road and Muddy Pond Street and Megansett Way. There is a proposed Drainage-Maintenance Easement along the whole channel abutting Waterbury Filing 1 and to the proposed FSD Pond 2.

EAST CHANNEL WITH POND FAILURE FOR CDOT ANALYIS OF DOWNSTREAM

An analysis of the east channel was performed based upon the 100-year flow in the channel (151 cfs) and the runoff from the emergency spillway (269 cfs) and outlet release (37 cfs) of Pond 3. Downstream the runoff from the emergency spillway (29.3 cfs) and outlet release (14.8 cfs) of Pond 2 in case of failure in the ponds to check for any potential downstream impacts to Highway 24 and the CDOT drainage facilities. The flow change is downstream of the Pond 3 emergency spillway at RS x-section 11400 from 151 cfs to 420 cfs (151 + 269) and downstream of the Pond 3 outlet at RS x-section 11000 from 420 cfs to 457 cfs (420 + 37). For Pond 2 the spillway and pond outlet are at RS x-section 9600 and the flow changes to 501.1cfs (457 + 29.3 + 14.8). The RS x-sections for this analysis were taken from the original HEC RAS analysis above and added 10000 to each one to accommodate the downstream stations. The results show that the flow is maintained in the channel banks and does not have erosive velocities or critical flow. The results also show that the existing 12’

x 6’ concrete culvert can safely pass the flow under Highway 24. See appendix for results and RS x-section exhibits.

WEST CHANNEL DEVELOPED ANALYSIS

A HEC-RAS analysis was done of the West channel for the proposed conditions using the existing topo and the proposed contours. The channel was sampled from these AutoCAD files to obtain the RS x-sections data for the HECRAS analysis. The developed 100-year flow of 216 cfs was used for RS x-section 2500 to the proposed 48” dual culvert RS x-section at 1042.5. From RS x-section 900 to 100, 222 cfs was entered into the program. These flows are based upon the FDR drainage calculations for Design Points 11 & 11A respectively. As mentioned above the northern part of the channel has a manning’s n of 0.06 and the southern part 0.10 in the current condition. In the proposed analysis of the west channel the HECRAS output shows that the channel velocities are in the range of 0.60 fps to 4.00 fps for all but RS X-sections 1820, 1800 and 0 which are listed as 5.06 fps, 5.25 fps 4.46 fps respectively. RS X-sections 1820 and 1800 occur at a proposed grouted riprap drop structure with a cutoff wall and riprap bank armoring. RS X-section 0 is at a heavily grouted riprap location located at the culvert entrance under Stapleton Drive. The maximum suggested velocity is 3 to 4 fps from the DCM Manual Chapter 10 and Table 8-3 located in the appendix Section H for 100-year event;. The shear stress varies from 0.02 to 2.98 lbs/sq. These are below the above-mentioned limits. The Froude #’s vary from 0.05 to 1.01. There are 4 locations where the Froude # is above the 0.90 maximum and are shown as Critical Water Surface locations. The first two are at RS x-sections 1820 (0.91) and 1800 (1.01) the third one is at 1420 (1.01), and the fourth one is at 350 (1.01). All of these occur at a proposed drop structure with channel armoring per EPC ECM Section 3.3.3 C and H. We are adding selective riprap bank stabilization from station 2000 to 1700, 1500 to 1300, And 700 to 250. As mentioned above to help protect the channel and combat these critical flow sections, selective riprap bank stabilization has been shown on the construction drawing set for three different locations. from section 2000 to section 1700, from section 1500 to 1300 and from section 700 to 250, a grouted boulder drop structure has been added at RS x-section 1400 to shallow the channel slope downstream and planting cattails and Palustrine Emergent wetland vegetation along the bottom of the channel. These four protective measures are shown on the channel improvement plans in the Construction Drawing set and a Deviation Request has been submitted to explain and deal with these RS x-sections that may not meet Table 8.3 requirements. At RS x-section 1200 the velocity is 0.60

fps, the Froude # is 0.05 and the shear stress is 0.02 lbs/sq ft. This demonstrates that this RS x-section will be stable in the 100-Y event and no alternate stabilization is needed. It is proposed to armor with selective riprap bank stabilization from station 700 to station 250 and leave the bottom as is with the existing dense cattails and other tall grasses due to the existing lots to the west and the proposed detention pond to the east. These improvements require an easement on Lots 35 and 36 of 4-Way Ranch Filing No. 1. A Channel maintenance agreement is being put in place with an easement that will allow for the channel bank to be armored and provide a 12' access road per the final CDs and maintained. RS x-section 0 is the last station which is always critical due to no downstream RS x-section to properly run calculations in HECRAS analysis. The Waterbury Metro District No. 1 will provide maintenance on the channel using access from the Public ROW of the abutting Thatcher Court, Gilbert Drive and Stapleton Drive.

WEST CHANNEL EXISTING ANALYSIS

A HEC-RAS analysis was also done of the West channel for the existing conditions using the existing topo. Th channel was analyzed so we could compare the existing 100-Y MIN. FF to the proposed 100-Y MIN. FF. The channel was sampled from these AutoCAD files using the same reach alignment and RS x-sections. The developed 100-year flow of 216 cfs was used for RS x-section 2600 to RS x-section 900 and 222 cfs was used for RS x-section 900 to RS x-section 0. RS x sections 1400, 1300, 1200, and 900 have a lowering greater than 0.50' (1400=2.97', 1300=1.39', 1200= 0.8', and 900=1.40' see table below for comparison). The HECRAS model shows that the proposed condition reduces the encroachment as compared to the existing condition analysis. The existing lots 35-37 (RS x-sections 400 to 1300) in the adjacent subdivision to the west are affected by the change in HWL as a majority of the HWL are lowered from the existing condition to the proposed condition with the exception of few RS x-sections 100-600 where the maximum increase is 0.32'. As mentioned in the paragraph above an easement on Lots 35 and 36 of 4-Way Ranch Filing No. 1 are being added for the channel in a Channel maintenance agreement that will allow for the channel bank to be armored per the final CDs and maintained. These slight increases are still contained within the channel banks and is not detrimental to adjacent properties. El Paso County Criteria requires finished floors on adjacent lots to be set a minimum of 1' above the 100-year HWL. The minimum we have is 2.64' and most are 3' to 8' above the adjacent 100-year HWL as discussed and shown. Shown below is the comparison of the Existing HWL vs the Proposed HWL and the difference in elevation.

WEST CHANNEL 100-Y HWL EXISTING VS PROPOSED

EX RS X-SECT	100-Y HWL	PR RS X-SECT	100-Y HWL	DIFF FT.
2600	6967.84	2600	6967.85	**0.01**
2500	6965.81	2500	6965.79	**-0.02**
2400	6964.30	2400	6964.31	**0.01**
2300	6962.39	2300	6962.36	**-0.03**
2200	6959.82	2200	6959.85	**0.03**
2100	6957.62	2100	6957.55	**-0.07**
2000	6956.26	2000	6956.33	**0.07**
		1950	6955.36	
1900	6954.53	1900	6954.86	**0.33**
		1850	6953.22	
		1820	6951.94	
1800	6951.87	1800	6950.92	**-0.95**
		1780	6950.44	
1700	6949.55	1700	6949.64	**0.09**
1600	6948.29	1600	6948.23	**-0.06**
1500	6946.76	1500	6947.02	**0.26**
		1440	6945.90	
		1420	6945.02	
1400	6945.39	1400	6942.05	**-3.34**
		1380	6941.97	
		1340	6941.23	
1300	6943.51	1300	6940.97	**-2.54**
1200	6942.95	1200	6940.90	**-2.05**
1100	6942.39			
1000	6940.92			
900	6938.51	900	6936.76	**-1.75**
800	6936.27	800	6935.71	**-0.56**
700	6934.27	700	6934.20	**-0.07**
600	6932.36	600	6932.42	**0.06**
500	6929.89	500	6929.91	**0.02**
400	6927.85	400	6927.99	**0.14**
		370	6926.26	
		350	6924.88	
		330	6924.08	
300	6924.34	300	6923.73	**-0.61**
		250	6921.88	

200	6920.82	200	6921.01	**0.19**
100	6920.38	100	6920.46	**0.08**
0	6919.89	0	6919.14	**-0.75**

The 100-year high water elevations and limits for the east and west channels were checked against the adjacent proposed lots and the finished grade from the proposed channel HECRAS data. All lot grades were set above the adjacent 100-year highwater elevation and noted the minimum finished floor 1 foot on the Preliminary Plan /PUD. In this more detailed analysis, the minimum finished floors have been revised and are still a minimum 1' above the100-MIN. HWL (see Tabel Below). The proposed lots in Waterbury Filing 1 along the east and west channel are all set outside of the FEMA Floodplain and the calculated 100-year high water elevations and limits. The existing Lots 35 & 36 of the adjacent subdivision 4-Way Ranch Filing No. 1 to the west are shown to have the current FEMA floodplain study from December of 2018 encroach onto them. In the HECRAS analysis of the existing conditions flows from this FDR study the 100-Y MIN. HWL encroaches onto their property in the existing condition at RS-x-sections 600, 700, 800, & 900 (see EXISTING 100-Y FLOODPLAIN EXHIBIT in Appendix under HECRAS ANALYSIS). The encroachment of the 100-Y MIN. FF occurs across the rear yards of the lots. This encroachment is shown to be more than the current FEMA floodplain study form December of 2018. This is an existing condition, and the Waterbury Development is not initiating this concern. In the proposed condition for this FDR study the 100-Y MIN. HWL is pulled in closer to the channel at RS x-sections 800 & 900, but at RS x-sections 600 & 700 the 100-Y MIN. HWL still encroaches onto Lots 35 & 36 (see PROPOSED 100-Y FLOODPLAIN EXHIBIT in Appendix under HECRAS ANALYSIS). Per section 10.5.6 of the El Paso County Drainage Criteria Manual freeboard should be accounted for in the superelevation along bends should be looked considered. Several RS x-sections of the reach were sampled with both subcritical and supercritical flow. Results show that the increase in the height (0.01' to 0.12') along a sharp bend is negligible. All HECRAS RS-X-sections show the flow in the channel banks and the minimum finished floors of the adjacent lots are set well above the minimum 2.0' of freeboard and therefore there is no concern with the High-Water Elevations around the bends. See appendix for calculations.

MINIMUM FINISHED FLOOR ELEVATIONS BASED 100-Y MIN. FF

LOT	Min. FF	UPSTREAM 100-Y HWL	FF ABOVE 100-Y HWL
44	6919.00	6914.59	4.41
45	6919.00	6914.59	4.41
46	6924.00	6917.87	6.13
47	6926.00	6918.14	7.86
48	6928.00	6919.39	8.61
49	6928.00	6919.39	8.61
75	6929.00	6924.07	4.93
88	6930.00	6924.94	5.06
89	6930.00	6926.63	3.37
90	6935.50	6931.11	4.39
91	6939.50	6933.84	5.66
92	6943.50	6937.50	6.00
113	6944.00	6939.43	4.57
131	6965.00	6962.36	2.64
132	6963.00	6959.85	3.15
133	6961.50	6957.55	3.95
134	6960.55	6957.55	3.00
135	6960.55	6956.33	4.22
136	6957.00	6953.22	3.78
137	6956.50	6951.80	4.70
150	6953.00	6949.64	3.36
151	6951.50	6948.23	3.27
152	6949.50	6945.90	3.60
153	6949.00	6941.97	7.03
154	6948.00	6941.23	6.77
155	6947.00	6940.97	6.03
156	6944.00	6939.32	4.68
157	6943.00	6939.32	3.68
158	6943.00	6939.32	3.68
159	6943.00	6936.76	6.24
160	6943.00	6935.71	7.29
161	6942.00	6935.71	6.29
162	6940.50	6934.20	6.30
163	6940.00	6934.20	5.80
164	6939.00	6932.42	6.58
165	6937.50	6932.42	5.08

WEST CHANNEL WITH POND FAILURE FOR CDOT ANALYIS OF DOWNSTREAM

An analysis of the west channel was performed based upon the 100-year flow in the channel (216 cfs) and the runoff from the emergency spillway of Pond 1 (59.9 cfs) and outlet release (14.6 cfs) of in case of failure in the pond to check for any potential downstream impacts to Highway 24 and the CDOT drainage facilities. The flow was increased at the downstream RS x-section of the emergency spillway at 10200 from 216 cfs to 290.5 cfs (59.9 + 14.6). The RS x-sections for this analysis were taken from the original HEC RAS analysis above and added 10000 to each one to accommodate the downstream stations. The results show the flow full through the existing 2-30" culverts at the Rock Island trail just north of Highway 24 and overtops the berm of the trail. The flow also shows the existing 4' x 4' concrete culvert at Highway 24 and cannot pass all of this flow and the highway 24 is overtopped by 0.22' of runoff sheet flowing over the Highway. All this happens in the 100-year storm, with Pond 1 filling up the to the 100-year capacity, releasing the 100-year allowable historic flow and also assuming that the 100-peak in flow is not detained and is released in the emergency spillway. The only mitigation possible is closing Highway 24 during this event as there is road closure gate on Highway 24 south of this culvert crossing. This also a worst-case scenario that is not likely to occur. See appendix for results and RS x-section exhibit.

FILING 1 CONSTRUCTION COST OPINION

Private Drainage Facilities Improvements, Non-Reimbursable

	Item	Quantity	Unit Price	Cost
1.	12" HDPE	1126 LF	$ 40/LF	$ 45,040
2.	18" DIA INLET	12 EA	$ 1000/EA	$ 12,000
3.	18" RCP	465 LF	$ 111/LF	$ 51,615
4.	24" RCP	607 LF	$ 161/LF	$ 97,727
5.	30" RCP	667 LF	$ 167/LF	$ 111,389
6.	Type C Inlet	2 EA	$ 1,500/EA	$ 3,000
7.	MH Box Base	4 EA	$18,950/EA	$ 75,800
8.	FES: 30"	1 EA	$ 906/EA	$ 906
9.	SWALE 4'x2'	565 LF	$ 30/LF	$ 16,950
			Total	**$ 413,611**

Public Drainage Facilities Improvements, Non-Reimbursable

	Item	Quantity	Unit Price	Cost
1.	18" RCP	1,521 LF	$111/LF	$ 168,831
2.	24" RCP	795 LF	$161/LF	$ 127,995
3.	30" RCP	1,664 LF	$167/LF	$ 277,888
4.	36" RCP	2,619 LF	$191/LF	$ 500,229
5.	42" RCP	1,057 LF	$275/LF	$ 290,675
6.	48" RCP	256 LF	$349/LF	$ 89,344
7.	18" FES	4 EA	$624/EA	$ 2,496
8.	30" FES	1 EA	$844/EA	$ 844
9.	36" FES	1 EA	$1,028/EA	$ 1,028
10.	42" FES	2 EA	$1,426/EA	$ 2,852
11.	Headwall	4 EA	$1,500/EA	$ 6,000
12.	Wingwall	4 EA	$1,500/EA	$ 6,000
13.	5' Type R Inlet<5'	14 EA	$,8814/EA	$ 123,396
14.	5' Type R Inlet5'<X<10'	4 EA	$10,835/EA	$ 43,340
15.	10' Type R Inlet<5'	3 EA	$11,438/EA	$ 34,314
16.	10' Type R Inlet5'<X<10'	2 EA	$12,689/EA	$ 25,378
17.	15' Type R Inlet<5'	2 EA	$17,237/EA	$ 28,904
18	MH Box Base	28 EA	$18,950/EA	$ 530,600
19.	Geotextile (EC)	348 SY	$6/SY	$ 2,088
20.	Riprap, d50	1200 TONS	$136/TON	$ 1,942
			Total	**$ 2,264,144**

Private Permanent BMPs, Non-Reimbursable

	Description	Quantity	Unit Price	Cost
1.	3-Extended Detention Basins			
	- Earthwork	32,000 CY	$ 1.32	$ 42,250
	- Forebays	5 EA	$ 10,000	$ 50,000
	- Trickle Channel	1420 LF	$ 50	$ 71,000

- Outlet Structures (4'x4')	2 EA	$ 6,000		$ 12,000
- Outlet Structures (12'x6')	1 EA	$ 20,000		$ 20,000
- Armored Emergency Spillway	3 EA	$ 20,000		$ 60,000
- Toe Wall	3 EA	$ 20,000		$ 60,000
- Stabilization	3 EA	$ 5,000		$ 15,000
			Total	**$ 330,250**

Drainage Channel Improvements, Non-Reimbursable

	Description	**Quantity**	**Unit Price**	**Cost**
1.	West Channel Haegler Tributary No. 1			
	- Channel Construction	1,000 LF	$ 100	$ 100,000
	- Channel Lining Riprap	4,120 CY	$ 234	$ 964,080
	- Geotextile	348 SY	$ 6	$ 2,088
	- Grouted Riprap	1,200 TONS	$ 136	$ 163,200
	- Channel Lining Vegetation	11 AC	$ 1,911	$ 21,120
	- Drop Structures	3 EA	$ 50,000	$ 150,000
	- Toe Wall	3 EA	$ 20,000	$ 60,000
			Total	**$ 1,500,488**

DRAINAGE FEES WATERBURY FILING NO. 1

This site lies within the Haegler Ranch Drainage Basin Diversion and Geick Ranch Basin. There is no approved Drainage Basin Planning study on file done with fees for Geick Ranch Basin, therefore no fees will need to be paid for Geick Ranch Basin. Drainage and Bridge fees only need to be paid for the part of the site that lies within the Haegler Ranch Basin.

Total Site Acreage: 61.88 ac

Geick Ranch Basin Acreage: 48.11 ac

Haegler Ranch Basin Acreage: 13.77 ac

Appendix L of the Drainage Criteria Manual 1 Addendum states that for single-family 0.25-acre lots,

an impervious percentage of 40% can be used. The combined Drainage Fees (2026) are due prior to final plat recordation.

The following calculations are based upon the 2026 Drainage & Bridge fees:

13.77 ac x 40% =5.51 Impervious acres

Haegler Ranch Drainage Fees: $15,350 x 5.51 = **$84,579**

Haegler Ranch Bridge Fees: $2,265 x 5.51 = **$12,480**

SUMMARY

Site runoff and storm drain and appurtenances associated with the development of the Waterbury Filing No. 1 site will not adversely affect the surrounding and downstream developments. Runoff will be routed to the existing and proposed detention basins and reduce the runoff to be at or below historic rates mentioned above in the report via Full Spectrum Detention while slowly treating the water quality capture volume and in turn helping to stabilize the downstream channel banks. Terra Nova Engineering requests that this report satisfy the submittal requirements for the drainage analysis for Waterbury. This report and findings are in general conformance with all previously approved reports for this site.

PREPARED BY:
TERRA NOVA ENGINEERING, INC.

Quentin N. Armijo, P.E.
Vice President
Jobs/2356.00/drainage/2356.00FDR

BIBLIOGRAPHY

"City of Colorado Springs Storm Drainage Design Criteria Manual Volumes 1" Prepared by City of Colorado Springs, Revised January 2021.

"City of Colorado Springs Storm Drainage Design Criteria Manual Volumes 2" Prepared by City of Colorado Springs, Revised December 2020.

"Urban Storm Drainage Criteria Manual Volume 1" Prepared by Mile High Flood Control District, Revised August 2018.

"Urban Storm Drainage Criteria Manual Volume 2" Prepared by Mile High Flood Control District, Revised September 2017.

"Urban Storm Drainage Criteria Manual Volume 3" Prepared by Mile High Flood Control District, Revised January 2021.

USDA NRCS Web Soil Survey.

FEMA Flood Insurance Rate Map Dated December 7, 2018.

"Drainage Criteria Manual County of El Paso, Colorado Volume 1" approved October 2015 and prepared by El Paso County

"Drainage Criteria Manual County of El Paso, Colorado Volume 2" approved October 2015 and prepared by El Paso County

"Drainage Criteria Manual County of El Paso, Colorado Volume 1 update Chapter 6" approved October 2018 and prepared by El Paso County

"El Paso County Stormwater Drainage Facilities Maintenance Policy" approved October 2018 and prepared by El Paso County

"Revision to the MDDP for Meridian Ranch, EL Paso County, Colorado", approved October 2005, and prepared by PBS&J

"Final Drainage Report for 4-Way Ranch Phase 1" approved March 2006 prepared by JR Engineering

The "Geick Ranch Drainage Basin Planning Study" approved February 2008, preprepared by Drexel Barrel & Co

"Preliminary/Final Drainage Report for Meridian Ranch filing No. 3" approved November 2011 prepared by Tech Contractors

"Master Development Drainage Plan, 4-Way Ranch – Phase 1" approved January 2012 prepared by Advanced Design Professionals, Inc.

"Preliminary Drainage Report for Waterbury (Phase 1 Preliminary Plan) approved June 2013 prepared by Classic Consulting

"Final Drainage Report for Waterbury Filing No. 1" approved September 2016 prepared by Classic Consulting

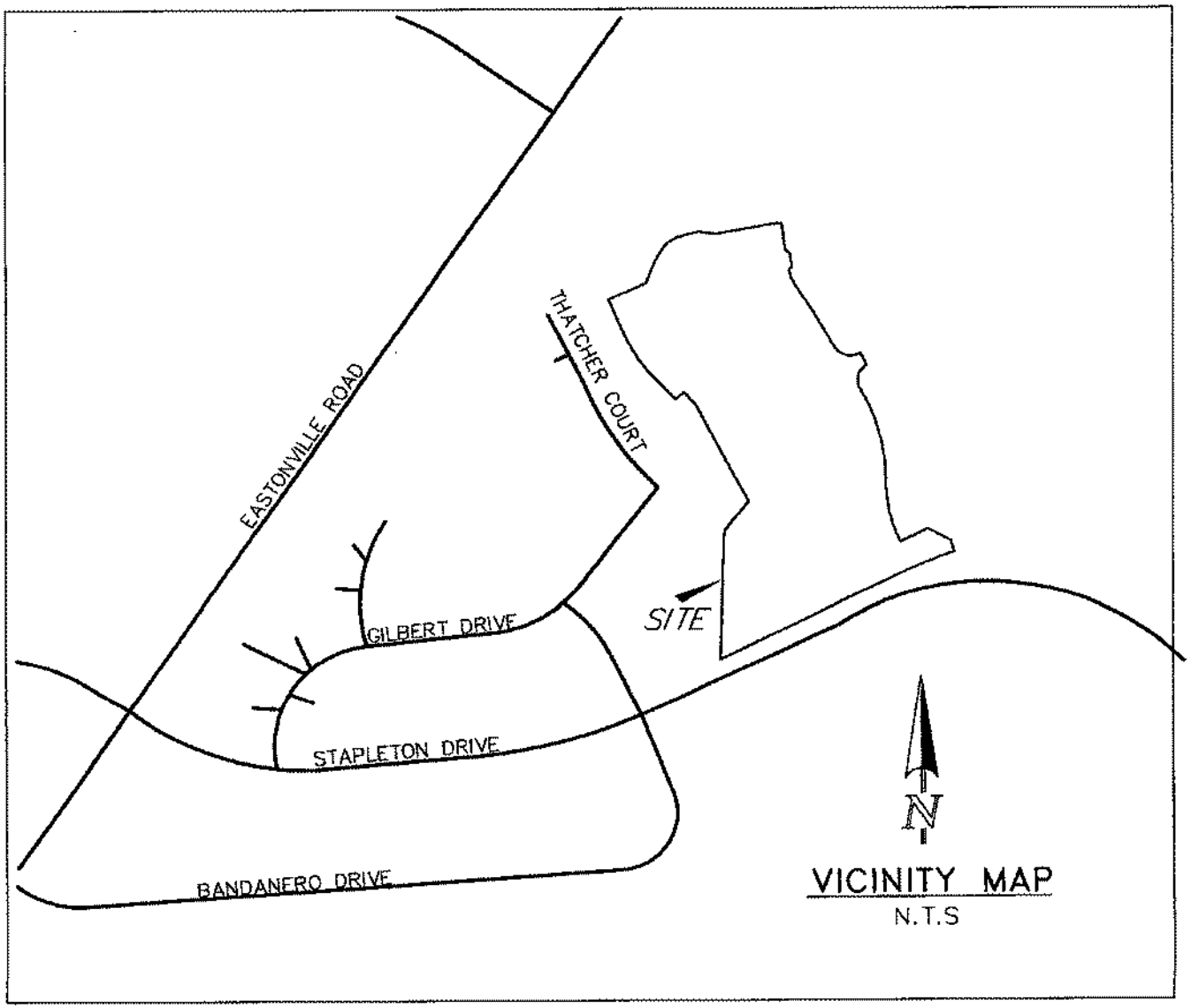
"Master Development Drainage Plan and Preliminary Drainage Report for Waterbury Filings No. 1 & 2" approved September 2024 prepared by Terra Nova Engineering

"Final Drainage Report Eastonville Road Corridor – Phase 1 El Paso County" submitted September 2024, prepared by Stanley consultants

"Eastonville Road – Londonderry Drive t Rex Road Segment 1 Improvements Final Drainage Report" submitted September 2024, prepared by HR Greene

APPENDIX

APPENDIX A
VICINTY MAP



VICINITY MAP

N.T.S

APPENDIX B
NRCS SOILS MAP

Soil Map—El Paso County Area, Colorado



Map Scale: 1:4,360 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 22, Sep 3, 2024

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 11, 2018—Oct 20, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	56.6	100.0%
Totals for Area of Interest		**56.6**	**100.0%**

El Paso County Area, Colorado

19—Columbine gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367p
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Columbine and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Columbine

Setting

Landform: Fans, fan terraces, flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 14 inches: gravelly sandy loam
C - 14 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XY214CO - Gravelly Foothill
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

Percent of map unit: 1 percent

Landform: Swales
Hydric soil rating: Yes

Other soils
Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant
Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

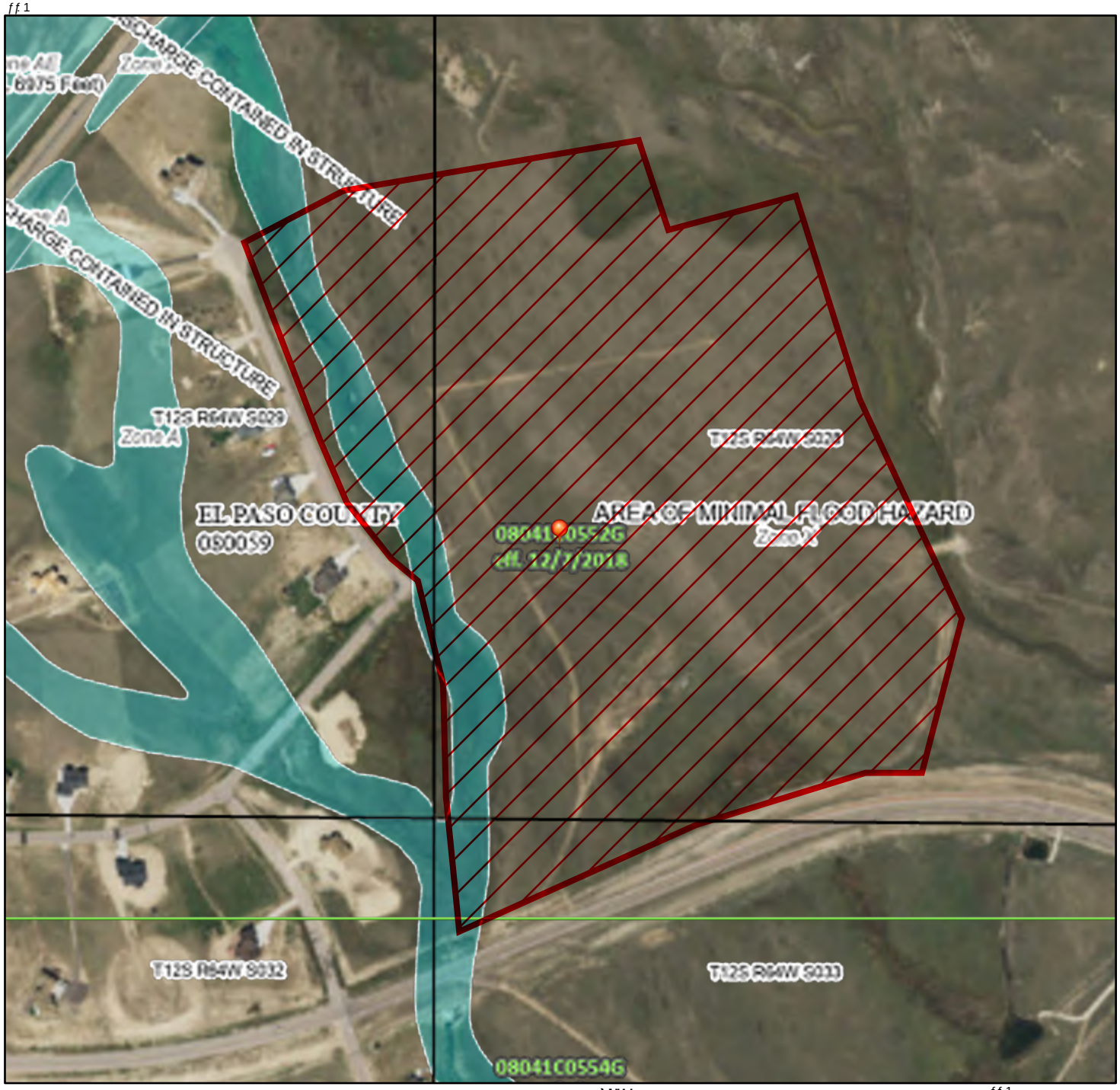
Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 22, Sep 3, 2024

APPENDIX C
FEMA FIRM MAP/
FLOODPLAIN PERMIT

1DWLRQDO)ORRG+D]DUG'DWD)6WWH

FEMA

ff 1



)HHW

ff 1

%DVHG RQ 1DWLRQDO)ORRG +D]DUG 'DWD 2UWKRJUDSKLF \DWD UHIHUHQFHG 2FWREHU

/HJHQG

6)(5 ;6(1(5(5 5(6(57

L:KRXW %DVH)ORRG(OHYDWLRQ %)(
=RQH$ 9 $
L:K%)(RUHSWK =RQH$ $9 $9 9($
5HGXFHG)ORRG5LVN'XH7R/HYHH

$QQXDO &KDQFH)ORRG+D]DUG $UHDV
R DQQXDO FKDQFHORRG ZDWHUV WKDW UHJXODU RU ZKDUDQ
GHSWKOHVV WKDQ RQH IRRW RU ZLWK GUDLQDJH
DUHDV RI OHVV WKDQ RQH VTXDUH PLOH=RQH;

)XWXUH&RQGLWLRQV $QQXDO
&KDQFH)ORRG+D]DUG =RQH;

$UHDV ZLWK 5HGXFHG)ORRG5LVN'XH WR
/HYHH 6HH1RWH= =RQH;

$UHDV ZLWK)ORRG5LVNHWRHYHH =RQH'

$UHDRI1RQLBO)ORRG+D]DUG =RQH;
(IIHFWLYH/LQH
$UHDR 8QGHWHUPLQHG)ORRG+D]DUG =RQH'

&RQQHO &XOYHUW RU 6WUXFWXUH
/HYHH'LNH RU)ORRGZDOO

&URVV6HFWLRQV ZLWK $QQXDO &KDQFH
DWHU 6XUIDFH(OHYDWLRQ
&RDVWDO 7UDQVHFW
%DVH)ORRG(OHYDWLRQ/LQH %)(
/LQH R 6WUXFW
-XULVGLFWLRQ%RXQGDU\
&RDVWDO 7UDQVHFW %DVHOLQH
3URORQJHG%DVHOLQH
+\GURORJLF)HDWXUH

L'LWDO DWD$YDLODEOH
R'LWDO DWD$YDLODEOH
8QPDSSHG

7KHSLQGLVSODFHGRQWKHPDSV DQDSSURSULDWH
SRLQW VHOHFWHGE\WKHXVHU DQGGRHV QRW UHSUH
DQDWKRULWDWLYHSURSHUW\ORFDWLRQ

7KLV PSFRROLHVZLWKJ9VWDQGDUGV/IRU WKHXVHR
GL.LWDO IORRGPS/LI LW LVQRW YRLGV/GHVFULEHGEHORZ
7KHEDVHPHSVKRZQFRROLHVZLWKJ9EDVHPHS
DFFXUDWWDQGGUG/

7KHIORRGKDUGLQRUPWLQQLV GHULYHGGLUHFWO\IURPWKH
DWKRULWDWLYH)HEVHUYLFHVSURYLGHGE\J 7KLVPS
ZVHSRUWHGRQ DW 3 DQGGRHV QRW
UHOHFW FKQQHV RU DPGPQWV VXEVHXHQW WR WKLVGDWHDQG
WLFH 7KH)HDQGHIHFWLYHLQRUPWLQQLPHRQHUHOU
EHFRPVXSUVHGHGE\QHZGDWDRYHU WLFH

7KLVPSLBHLVYRLGLI WKHIQHRU RUHR WKHIOORZLQJPS
HOHPQWV GR QRW DSSHDU EDVHPSLBH\\ IORRGJRQHODEHOV
OHHQG VFDOHEDU PSFRHDWLRQGDWH FRRL W\LGHQWLILHUV
)5$0 QXEU DQG)5$0 HIIHFWLYHGDWH DSLBHVIRU
XQPSSHGDQGXQRGHUQL}GDUHDV FDQQRW EHXVHGIRU
UHDOWRU\SUSRVHV

Pikes Peak Regional Building Department

Permit # 25023 **FLOOD PLAIN DEVELOPMENT PERMIT** **Date 14-Mar-2025**

Owner Information

Name: ACM ALF VIII JV SUB II LLC **Phone: (303) 984-9880**

Address: 4100 E. MISSISSIPPI AVE., STE 500
DENVER, CO 80246
Attention: JASON POCK

Project Location

Address: NORTH OF STAPELTON RD, EAST OF THATCHER

,

Location/Directions: NORTH OF STAPELTON RD, EAST OF THATCHER CT, SOUTH OF EASTONVILLE

Contractor/Engineer: TERRA NOVA ENGINEERING, INC. Phone: (719) 635-6422

Project Description

Single Family Residential:	[ ]	Addition/Remodel (<50%):	[ ]
Multi-Family Residential:	[ ]	Rehabilitation	[ ]
Manufactured Home:	[ ]	Subst. (>50 Appraisal) Imprv:	[ ]
Non-Residential	[ ]	Fill	[ ]
New Construction	[ ]	Bridge/Culvert	[X]
Watercourse Modification:	[X]	Levee:	[ ]

Project Cost: $0.00 Structure Market Value: $0.00

Creek: HAEGLER RANCH TRIB 2

Description of work: Waterbury Filing 1 and the future Waterbury Filing 2 are adjacent to Haegler Ranch Trib. 2 and is proposing the Gilbert Drive crossing with dual 42" RCP culverts.the channel also has some armoring along the side in areas and a drop structure shown. The anaysis is based upon the Duplicate Effective Model being adjusted to the Corrective Effective Model and editing it to the Proposed/Post Conditions Effective Model.

Flood Hazard Data

Location: Flood Fringe
Base (1%) Flood Elevation: na
Lowest Floor Elevation:
Floodproofing Level:
Source Document:

Permit Action

Permit Granted (Y/N): Yes Variance Granted (Y/N): No
Action Comments:

Compliance Section

Elevation Certificate: N Date:

LOMA: N Date: CLOMR: N Date: LOMR: N Date:

Site Inspection: **For Inspection Requests call: Keith 327-2898**
Preliminary Required: N Date:
Final Required: Y Date:

Compliance Comments:

Regional Floodplain Division: Date 14-Mar-2025

NOTE: This permit expires twelve (12) months from the date it is issued.

Federal Emergency Management Agency

Washington, D.C. 20472

FEB 19 2004

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Chuck Brown
Chairman, El Paso County
Board of Commissioners
27 East Vermijo Avenue
Colorado Springs, CO 80903-2208

IN REPLY REFER TO:
Case No.: 04-08-0012P
Community Name: El Paso County, CO
Community No.: 080059
Effective Date of This Revision: **MAR 19 2004**

Dear Mr. Brown:

The Flood Insurance Rate Map for your community has been revised by this Letter of Map Revision (LOMR). Please use the enclosed annotated map panel(s) revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals issued in your community.

Additional documents are enclosed which provide information regarding this LOMR. Please see the List of Enclosures below to determine which documents are included. Other attachments specific to this request may be included as referenced in the Determination Document. If you have any questions regarding floodplain management regulations for your community or the National Flood Insurance Program (NFIP) in general, please contact the Consultation Coordination Officer for your community. If you have any technical questions regarding this LOMR, please contact the Director, Federal Insurance and Mitigation Division of the Department of Homeland Security's Federal Emergency Management Agency (FEMA) in Denver, Colorado, at (303) 235-4830, or the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Sincerely,

Kevin C. Long

Kevin C. Long, CFM, Project Engineer
Hazard Identification Section
Mitigation Division
Emergency Preparedness
and Response Directorate

For: Doug Bellomo, P.E., CFM, Acting Chief
Hazard Identification Section
Mitigation Division
Emergency Preparedness
and Response Directorate

List of Enclosures:
Letter of Map Revision Determination Document
Annotated Flood Insurance Rate Map

cc: Mr. Kevin Stilson, P.E., CFM
Floodplain Administrator
Pikes Peak Regional Building Department

Mr. Richard N. Wray, P.E.
Principal
Kiowa Engineering Corporation

Page 1 of 4	Issue Date: FEB 19 2004	Effective Date: MAR 19 2004	Case No.: 04-08-0012P	LOMR-APP

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	El Paso County Colorado (Unincorporated Areas)	NO PROJECT	HYDROLOGIC ANALYSIS HYDRAULIC ANALYSIS NEW TOPOGRAPHIC DATA
	COMMUNITY NO.: 080059		
IDENTIFIER	Fourway Ranch Letter of Map Revision	APPROXIMATE LATITUDE & LONGITUDE: 39.974, -104.566 SOURCE: USGS QUADRANGLE DATUM: NAD 83	
FLOODING SOURCE(S) & REVISED REACH(ES)	**Haegler Ranch Tributary 1** – from approximately 1,200 feet upstream of the Cadillac and Lake City Railroad to just upstream of Eastonville Road **Haegler Ranch Tributary 1A** – from the confluence with Haegler Ranch Tributary 1 to just upstream of Eastonville Road **Haegler Ranch Tributary 2** – from the confluence with Haegler Ranch Tributary 1 to just upstream of Eastonville Road **Gelck Ranch Tributary 1** – from approximately 600 feet upstream to approximately 4,000 feet upstream of the Cadillac and Lake City Railroad **Gelck Ranch Tributary 2** – from approximately 600 feet upstream to approximately 2,600 feet upstream of the Cadillac and Lake City Railroad		

SUMMARY OF REVISIONS

Effective Flooding:	Zone A
Revised Flooding:	Zone A
Increases:	YES
Decreases:	YES

* BFEs – Base Flood Elevations

ANNOTATED MAPPING ENCLOSURES	ANNOTATED STUDY ENCLOSURES
TYPE: FIRM* NO.: 08041C0575 F Date: March 17, 1997	NO REVISION TO THE FLOOD INSURANCE STUDY REPORT

* FIRM – Flood Insurance Rate Map; ** FBFM – Flood Boundary and Floodway Map; *** FHBM – Flood Hazard Boundary Map

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2677 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Doug Bellomo, P.E., CFM, Acting Chief
Hazard Identification Section
Mitigation Division
Emergency Preparedness and Response Directorate

102061 D.A04080012 102IC

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

COMMUNITY REMINDERS

We based this determination on the 1-percent-annual-chance discharges computed in the submitted hydrologic model. Future development of projects upstream could cause increased discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on discharges and could, therefore, indicate that greater flood hazards exist in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2677 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Doug Bellomo, P.E., CFM, Acting Chief
Hazard Identification Section
Mitigation Division
Emergency Preparedness and Response Directorate

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION (CONTINUED)

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Mr. Steve L. Olsen
Director, Federal Insurance and Mitigation Division
Federal Emergency Management Agency, Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, CO 80225-0267
(303) 235-4830

STATUS OF THE COMMUNITY NFIP MAPS

We will not physically revise and republish the FIRM and FIS report for your community to reflect the modifications made by this LOMR at this time. When changes to the previously cited FIRM panel and FIS report warrant physical revision and republication in the future, we will incorporate the modifications made by this LOMR at that time.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2677 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Doug Bellomo, P.E., CFM, Acting Chief
Hazard Identification Section
Mitigation Division
Emergency Preparedness and Response Directorate

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

This revision will become effective 30 days from the date of this letter. Any requests to review or alter this determination should be made within 30 days and must be based on scientific or technical data.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2677 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Doug Bellomo, P.E., CFM, Acting Chief
Hazard Identification Section
Mitigation Division
Emergency Preparedness and Response Directorate

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APPENDIX D
WETLANDS NATIONWIDE PERMIT

ecos ecosystem services LLC

March 3, 2026

Kara Hellige
Section Chief
Southern Colorado Branch
U.S. Army Corps of Engineers
PO Box 538
1970 E 3rd Ave, #109
Durango, CO 81301

RE: Waterbury Filings 1 and 2 Nationwide Permit 29 Extension Request
(USACE Action No: SPA-2005-00801)

Dear MS. Hellige:

Acting as their Agent, Ecosystem Services, LLC (ECOS) is herein notifying the U.S. Army Corps of Engineers (USACE) that the 4-Way Ranch project (Project) was acquired by ACM ALF VIII JV SUB II LLC (managed by Westside Development Partners, Inc.) from 4 Way Ranch Joint Venture, LLC (Applicant) due to market factors and; requesting an extension of the Nationwide Permit 29 (NWP 29) Verification (Verification) issued by your office on July 14, 2022 for the Waternbury Filings 1 and 2 Residential Development project (Project) under Action Number SPA-2005-00801. A copy of the NWP Verification, set to expire on March 14, 2026, is attached for your convenience.

The Applicant has expended considerable resources planning, designing, gaining approvals from El Paso County, and acquiring wetland credits in reliance on the Verification and is ready to commence with construction of the Project as outlined in the Preconstruction Notification (PCN) approved by your office. The Applicant remains prepared to adhere to all of the conditions of PCN including all Special Conditions.

The last remaining Special Condition that had to be met prior to construction was the “purchase 0.230 emergent wetland credits from the Maria Lake Mitigation Bank in Huerfano County, Colorado… and “providing evidence of this purchase to your office prior to initiation of construction activities in waters of the U.S. authorized by the verification”. We are aware that the Maria Lake Mitigation Bank sold out all of their credits and went through a recertification/addition of credits process with the USACE. The Applicant has been waiting in line for the additional credits and now that the USACE has approved them, the Applicant has purchased 0.230 credits as promised in the PCN. A copy of a fully executed Purchase Agreement dated February 11, 2026 is provided as evidence of the purchase in compliance with Special Condition 1 of the Verification. This credit purchase should show up in your USACE mitigation bank ledgers very soon.

Project activities have commenced and are under contract to commence in reliance on an NWP, including the purchase of mitigation credits. Therefore, on behalf of the Applicant, we are herein requesting an extension of the NWP 29 Verification so that the Appicant can proceed with the Project as originally proposed.

Thank you very much for your attention to this matter. We look forward to your response.

Exhibit "B"

BILL OF SALE

Contract # 2026-01

USACE PROJECT #: **SPA-2005-0081**

In consideration of $80,500, receipt of which is hereby acknowledged, M. L. Wetlands, Inc (Bank Sponsor) does hereby bargain, sell, and transfer to ACM ALF VIII JV SUB II LLC (Permitee), 0.23 wetland credits in the Maria Lake Mitigation Bank near Walsenburg, Huerfano County, Colorado, approved by the Army Corps of Engineers.

Bank Sponsor represents and warrants that it has good title to the credits, has good right to sell the same, and that they are free and clear of all claims, liens, or encumbrances.

Bank Sponsor covenants and agrees with the buyer to warrant and defend the sale of the credits hereinbefore described against all and every person and persons whomsoever lawfully claiming or to claim the same.

DATED: 2-11 , 2026

M. L. Wetlands, Inc.

By: Donald E Sachs

Title: President

PURCHASE AGREEMENT FOR SALE OF MITIGATION CREDITS
USACE PROJECT #: TBD

This Agreement is entered into this day of Feb 11, 2026, by and between M. L. Wetlands, Inc (Bank Sponsor) and ACM ALF VIII JV SUB II LLC. (Permitee), jointly referred to as the "Parties," as follows:

RECITALS

A. The Bank Sponsor has developed the Maria Lake Mitigation Bank (Bank) located near Walsenburg, Huerfano County, Colorado;

B. The Bank was approved by the Army Corps of Engineers (USACE) on October 19, 2018 and is currently in good standing;

C. The Bank has received approval from USACE to offer wetland credits for sale as compensation for the loss of water of the U.S. ("Wetland Credits") through the Maria Lake Mitigation Bank Instrument (MBI);

D. Permitee is seeking to implement the project described on Exhibit "A" attached hereto (Project), which would unavoidably and adversely impact wetlands, and seeks to compensate for the loss of waters of the U.S. by purchasing Mitigation Credits from Bank;

E. Permitee is expecting to secure approval by the USACE to purchase from the Bank 0.23 wetland credits. upon confirmation by the Bank Sponsor of credit availability/adequate balance of credits remaining for sale; and

F. Permitee desires to purchase from Bank Sponsor and Bank Sponsor desires to sell to Permitee 0.23 wetland credits.

NOW, THEREFORE, THE PARTIES AGREE AS FOLLOWS:

1. Bank Sponsor hereby sells to Permitee and Permitee hereby purchases from Bank Sponsor 0.23 Wetland Credits for the purchase price of U.S. $80,500 (Purchase Price). The Bank Sponsor will then deliver to Permitee an executed Bill of Sale in the manner and form as attached hereto and marked Exhibit "B". The purchase price for said credits shall be paid by check or, at the option of Bank Sponsor, wire transfer of funds according to written instructions by Bank Sponsor to Permitee.

2. The sale and transfer herein are not intended as a sale or transfer to Permitee of a security, license, lease, easement, or possessory or non-possessory interest in real property, nor the granting of any interest of the foregoing.

3. Permitee shall have no obligation whatsoever by reason of the purchase of the Mitigation Credits, to support, pay for, monitor, report on, sustain, continue in perpetuity, or otherwise be obligated or liable for the success or continued expense or maintenance in perpetuity of the credits sold, or the Bank. Pursuant to the MBI and any amendments thereto, Bank Sponsor shall monitor and make reports to the appropriate agency or agencies on the status of any Mitigation Credits sold to Permitee. Bank Sponsor shall be fully and completely responsible for satisfying any and all conditions placed on the Bank or the Mitigation Credits by USACE.

4. The Mitigation Credits sold and transferred to Permitee shall be non-transferable and non-assignable, and shall not be used as compensatory mitigation for any other Project or purpose, except as set forth herein.

5 Upon purchase of the credits specified in paragraph D above, the Bank shall submit to the parties listed in the Notices section of the MBI, copies of the: a) Agreement for Sale of Mitigation Credits; b) Bill of Sale; c) Payment Receipt; and d) an updated ledger. The updated inventory / ledger must detail: i) Permitee; ii) Project Name; iii) Status (sale complete/sale not complete); iv) Credit Sale Date; v) Army Corps File Number; vi) Total Number of Credits Authorized to Sell; vii) Total Number of Credits Sold to Date (inclusive); and viii) Balance of all Credits Available. The inventory / ledger should include all sales data from bank opening/establishment to the present.

6. Permitee must send full payment of the Purchase Price within 30 days of the date of this Agreement. After the 30-day period, this Agreement will be considered null and void.

IN WITNESS WHEREOF, the parties have executed this Agreement the day and year first above written.

BANK SPONSOR:

M. L. WETLANDS, INC

By: Donald E Sacke Date: Feb 11 , 2026

Title: President

PERMITEE:

ACM ALF VIII JV SUB II LLC

By: Andrew R Klein Date: Feb 11 , 2026

Title: Andrew R. Klein
Authorized Signatory

Exhibit "A"

DESCRIPTION OF PROJECT TO BE MITIGATED

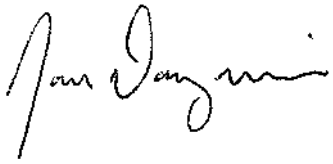
Project Description: Waterbury Planned Unit Development: The Project entails the development of the 61.9-acre Site as a single-family, planned-unit development, residential community. Tracts include residential homes, landscape easements, drainage tracts, stormwater facilities, open space tracts, streets, streetscape plantings, detention ponds, utilities, fences, parks and recreational facilities, trails, mailbox clusters, and other uses.

Army Corps File Number: SPA-2005-0081

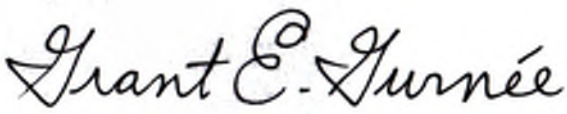
*****

Respectfully submitted,

Ecosystem Services, LLC



Jon Dauzvardis, P.W.S.
Owner - Restoration Ecologist



Grant E. Gurnée, P.W.S.
Owner - Restoration Ecologist

Cc:
Jason Pock, Westside Investment Partners, Inc

Attachments:
Copy of Nationwide Permit Verification (SPA-2005-00801)
Copy of the Purchase Agreement for the Sale of Mitigation Credits from Maria Lake Mitigation Bank

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, ALBUQUERQUE DISTRICT
SOUTHERN COLORADO REGULATORY BRANCH
201 WEST 8TH STREET, SUITE 350
PUEBLO, COLORADO 81003

July 14, 2022

Regulatory Division

SUBJECT: Nationwide Permit Verification (SPA-2005-00801)

4 Way Ranch JV, LLC
c/o Peter Martz
1271 Kelly Johnson Blvd., Suite 100
Colorado Springs, Colorado 80920
pmartzlrg@comcast.net

Dear Mr. Martz:

The U.S. Army Corps of Engineers (Corps), Albuquerque District, is responding to your pre-construction notification (PCN) submitted to us for verification of authorization under Nationwide Permit (NWP) 29 for the Waterbury Filings No. 1 & 2 Residential Development. The project site is located between Eastonville Road and State Highway 24, centered at approximately latitude 38.971834˚, longitude -104.569206˚, El Paso County, Colorado.

Based on the information provided in your PCN dated February 23, 2022, we have determined that the project involves the discharge of dredged or fill material into waters of the United States, subject to Section 404 of the Clean Water Act. The specific activities that require Corps authorization are the permanent placement of fill material in 0.225 acre of palustrine emergent wetlands to construct one road crossing (0.219 acre) and one stormwater pond outfall apron (0.006 acre). The project would also include the temporary placement of dredged and fill material into 0.103 acre of palustrine emergent wetlands for three separate utility crossings. Specific measures will be implemented to fully restore all temporary impacts to aquatic resources and all work will be conducted as described in the PCN.

The Corps has determined that activities associated with the project are authorized by 2021 NWP 29 – Residential Developments. A summary of this NWP and the 2021 Colorado Regional Conditions are available on our website at www.spa.usace.army.mil/reg/nwp. Failure to comply with all terms and conditions of this NWP may result in the suspension or revocation of this authorization. As required by General Condition 30, you shall sign the enclosed Compliance Certification (Enclosure 1) and return it to this office within 30 days after completion of the authorized work. For specific information regarding compliance with water quality certification (WQC) requirements, please refer to our website at www.spa.usace.army.mil/reg/wqc. In addition, the work must comply with the following **special condition(s):**

1. To compensate for the loss of 0.225 acre of palustrine emergent wetlands, you shall purchase 0.230 emergent wetland credits from the Maria Lake Mitigation Bank in Huerfano County, Colorado. Evidence of this purchase shall be provided to this office via email at: spa-rd-co@usace.army.mil, prior to initiation of construction activities in waters of the U.S. authorized by this verification.

2. You shall restore all temporary impacts to 0.103 acre of wetlands to their original contours and conditions within 14 days following completion of construction activities. You shall conduct all restoration of temporary impact areas in accordance with the February 23, 2022, PCN, prepared by Ecosystem Services, LLC, which is hereby incorporated by reference.

a. Within 30 days following completion of restoration activities, you shall submit a report to spa-rd-co@usace.army.mil describing the restoration activities including color photographs of the restored areas. The compass angles and positions of all photographs shall be similar to pre-construction photographs.

Our review of this project also addressed its effects on threatened and endangered species and historic properties in accordance with General Conditions 18 and 20. Based on the information provided, we have determined that the projects are not likely to adversely affect federally listed species or their critical habitat. Additionally, no historic properties will be affected by the projects. However, these determinations may be invalidated if the project is not completed as authorized or you did not provide accurate information in your PCN.

This permit verification is valid until March 14, 2026, unless the NWPs are modified, suspended, reissued, or revoked prior to that date. Continued confirmation that an activity complies with the terms and conditions, and any changes to the NWP, is the responsibility of the permittee. Activities that have commenced, or are under contract to commence, in reliance on an NWP will remain authorized provided the activity is completed within 12 months of the date of the NWP's expiration, modification, or revocation.

This letter does not constitute approval of the project design features, nor does it imply that the construction is adequate for its intended purpose. This permit does not authorize any injury to property or invasion of rights or any infringement of federal, state, local, or tribal laws or regulations. The permittee and/or any contractors acting on behalf of the permittee must possess the authority and any other approvals required by law, including property rights, to undertake the proposed work.

The landowner must allow Corps representatives to inspect the authorized activity at any time deemed necessary to ensure that it is being, or has been, accomplished in accordance with the terms and conditions of the permit.

We would appreciate your feedback on this permit action including your interaction with our staff or suggestions for improving our program. For more information about our program or to complete our Regulatory Program national customer service survey, visit our website at www.spa.usace.army.mil/reg.

Please refer to identification number SPA-2005-00801 in any correspondence concerning this project. If you have any questions, please contact me by email at kyle.d.zibung@usace.army.mil, or telephone at (651) 290-5877.

Sincerely,



Kyle Zibung
Project Manager
Southern Colorado Branch

Enclosure

cc:
Mr. Grant Gurnee, Ecosystem Services, LLC (grant@ecologicalbenefits.com)

COMPLIANCE CERTIFICATION

Action Number: SPA-2005-00801

Name of Permittee: 4 Way Ranch JV, LLC c/o Peter Martz

Permit: NWP 29 – Residential Developments

Upon completion of the activity authorized by this permit and any mitigation required by the permit, sign this certification and return it to the following address:

U.S. Army Corps of Engineers, Albuquerque District
201 West 8th Street, Suite 350
Pueblo, Colorado 81003

or via email to: spa-rd-co@usace.army.mil

Please note that your permitted activity is subject to a compliance inspection by a U.S. Army Corps of Engineers representative. If you fail to comply with this permit, you are subject to permit suspension, modification, or revocation.

I hereby certify that the work authorized by the above-referenced permit has been completed in accordance with the terms and conditions of the said permit, and required mitigation was completed in accordance with the permit conditions.

Date Work Started _____

Date Work Completed _____

_____ _____
Signature of Permittee Date

Encl 1

PURCHASE AGREEMENT FOR SALE OF MITIGATION CREDITS
USACE PROJECT #: TBD

This Agreement is entered into this day of Feb 11, 2026, by and between M. L. Wetlands, Inc (Bank Sponsor) and ACM ALF VIII JV SUB II LLC. (Permitee), jointly referred to as the "Parties," as follows:

RECITALS

A. The Bank Sponsor has developed the Maria Lake Mitigation Bank (Bank) located near Walsenburg, Huerfano County, Colorado;

B. The Bank was approved by the Army Corps of Engineers (USACE) on October 19, 2018 and is currently in good standing;

C. The Bank has received approval from USACE to offer wetland credits for sale as compensation for the loss of water of the U.S. ("Wetland Credits") through the Maria Lake Mitigation Bank Instrument (MBI);

D. Permitee is seeking to implement the project described on Exhibit "A" attached hereto (Project), which would unavoidably and adversely impact wetlands, and seeks to compensate for the loss of waters of the U.S. by purchasing Mitigation Credits from Bank;

E. Permitee is expecting to secure approval by the USACE to purchase from the Bank 0.23 wetland credits. upon confirmation by the Bank Sponsor of credit availability/adequate balance of credits remaining for sale; and

F. Permitee desires to purchase from Bank Sponsor and Bank Sponsor desires to sell to Permitee 0.23 wetland credits.

NOW, THEREFORE, THE PARTIES AGREE AS FOLLOWS:

1. Bank Sponsor hereby sells to Permitee and Permitee hereby purchases from Bank Sponsor 0.23 Wetland Credits for the purchase price of U.S. $80,500 (Purchase Price). The Bank Sponsor will then deliver to Permitee an executed Bill of Sale in the manner and form as attached hereto and marked Exhibit "B". The purchase price for said credits shall be paid by check or, at the option of Bank Sponsor, wire transfer of funds according to written instructions by Bank Sponsor to Permitee.

2. The sale and transfer herein are not intended as a sale or transfer to Permitee of a security, license, lease, easement, or possessory or non-possessory interest in real property, nor the granting of any interest of the foregoing.

3. Permitee shall have no obligation whatsoever by reason of the purchase of the Mitigation Credits, to support, pay for, monitor, report on, sustain, continue in perpetuity, or otherwise be obligated or liable for the success or continued expense or maintenance in perpetuity of the credits sold, or the Bank. Pursuant to the MBI and any amendments thereto, Bank Sponsor shall monitor and make reports to the appropriate agency or agencies on the status of any Mitigation Credits sold to Permitee. Bank Sponsor shall be fully and completely responsible for satisfying any and all conditions placed on the Bank or the Mitigation Credits by USACE.

4. The Mitigation Credits sold and transferred to Permitee shall be non-transferable and non-assignable, and shall not be used as compensatory mitigation for any other Project or purpose, except as set forth herein.

5 Upon purchase of the credits specified in paragraph D above, the Bank shall submit to the parties listed in the Notices section of the MBI, copies of the: a) Agreement for Sale of Mitigation Credits; b) Bill of Sale; c) Payment Receipt; and d) an updated ledger. The updated inventory / ledger must detail: i) Permitee; ii) Project Name; iii) Status (sale complete/sale not complete); iv) Credit Sale Date; v) Army Corps File Number; vi) Total Number of Credits Authorized to Sell; vii) Total Number of Credits Sold to Date (inclusive); and viii) Balance of all Credits Available. The inventory / ledger should include all sales data from bank opening/establishment to the present.

6. Permitee must send full payment of the Purchase Price within 30 days of the date of this Agreement. After the 30-day period, this Agreement will be considered null and void.

IN WITNESS WHEREOF, the parties have executed this Agreement the day and year first above written.

BANK SPONSOR:

M. L. WETLANDS, INC

By: Donald E Sacke Date: Feb 11 , 2026

Title: President

PERMITEE:

ACM ALF VIII JV SUB II LLC

By: Andrew R Klein Date: Feb 11 , 2026

Title: Andrew R. Klein
Authorized Signatory

Exhibit "A"

DESCRIPTION OF PROJECT TO BE MITIGATED

Project Description: Waterbury Planned Unit Development: The Project entails the development of the 61.9-acre Site as a single-family, planned-unit development, residential community. Tracts include residential homes, landscape easements, drainage tracts, stormwater facilities, open space tracts, streets, streetscape plantings, detention ponds, utilities, fences, parks and recreational facilities, trails, mailbox clusters, and other uses.

Army Corps File Number: SPA-2005-0081

*****

APPENDIX E
HYDROLOGIC CALCULATIONS

EXISTING CONDITIONS

JOB NAME: ***WATERBURY MDDP***
JOB NUMBER: ***1715.00***
DATE: ***04/16/26***
CALCULATED BY: ***QNA***

FDR ~ EXISTING BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	TOTAL AREA (AC)	IMPERVIOUS / DEVELOPED AREA			NONIMPERVIOUS / UNDEVELOPED AREA			WEIGHTED		**WEIGHTED CA**	
		AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	**CA(5)**	**CA(100)**
EXA	9.62	0.00	0.45	0.59	9.62	0.09	0.36	0.09	0.36	**0.87**	**3.46**
EXB	4.09	0.00	0.45	0.59	4.09	0.09	0.36	0.09	0.36	**0.37**	**1.47**
EXC	24.80	0.00	0.45	0.59	24.80	0.09	0.36	0.09	0.36	**2.23**	**8.93**
EXD	15.87	0.00	0.45	0.59	15.87	0.09	0.36	0.09	0.36	**1.43**	**5.71**
EXE	5.83	0.00	0.45	0.59	5.83	0.09	0.36	0.09	0.36	**0.52**	**2.10**
EXF	1.62	0.00	0.45	0.59	1.62	0.09	0.36	0.09	0.36	**0.15**	**0.58**
OS-1	45.02	0.00	0.45	0.59	45.02	0.09	0.36	0.09	0.36	**4.05**	**16.21**
OS-2	11.40	0.00	0.45	0.59	11.40	0.09	0.36	0.09	0.36	**1.03**	**4.11**
OS-3	1.11	0.00	0.45	0.59	1.11	0.09	0.36	0.09	0.36	**0.10**	**0.40**
OS-4	0.29	0.00	0.45	0.59	0.29	0.09	0.36	0.09	0.36	**0.03**	**0.11**
OS-5	6.74	0.00	0.45	0.59	6.74	0.09	0.36	0.09	0.36	**0.61**	**2.43**
OS-8	2.56	FLOW TAKEN FROM MERIDAIN RANCH MDDP									
OS-9	11.80	FLOW TAKEN FROM MERIDAIN RANCH MDDP									
OS-10A	12.80	FLOW TAKEN FROM MERIDAIN RANCH MDDP									

JOB NAME: *WATERBURY FDR FINAL CONDITIONS*
JOB NUMBER: *2356.00*
DATE: *04/16/26*
CALC'D BY: *QNA*

FDR ~ EXISTING BASIN RUNOFF SUMMARY

BASIN	WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY		TOTAL FLOWS	
	CA(5)	CA(100)	C(5)	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	TOTAL (min)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
EXA	0.87	3.46	0.25	100	3	11.1	1193	1.7%	4.5	4.4	15.4	3.43	5.81	**3**	**20**
EXB	0.37	1.47	0.25	100	2	12.6	623	2.2%	5.2	2.0	14.6	3.51	5.96	**1**	**9**
EXC	2.23	8.93	0.25	100	2.5	11.7	2420	1.7%	4.6	8.9	20.6	3.01	5.01	**7**	**45**
EXD	1.43	5.71	0.25	100	2	12.6	1615	2.6%	5.6	4.8	17.4	3.25	5.47	**5**	**31**
EXE	0.52	2.10	0.25	100	8	8.0	1063	2.1%	5.0	3.5	11.5	3.86	6.66	**2**	**14**
EXF	0.15	0.58	0.25	100	6	8.8	400	2.5%	5.5	1.2	10.0	4.06	7.07	**1**	**4**
OS-1	4.05	16.21	0.25	100	6	8.8	3219	2.3%	5.3	10.1	18.9	3.13	5.24	**13**	**85**
OS-2	1.03	4.11	0.25	100	2	12.6	1203	1.0%	3.5	5.7	18.4	3.17	5.32	**3**	**22**
OS-3	0.10	0.40	0.25	100	2	12.6	330	2.6%	5.6	1.0	13.6	3.61	6.17	**0**	**2**
OS-4	0.03	0.11	0.25	100	2	12.6	230	2.6%	5.7	0.7	13.3	3.64	6.23	**0**	**1**
OS-5	0.61	2.43	0.25	80	5	7.8	1000	2.5%	5.5	3.0	10.8	3.96	6.85	**2**	**17**
OS-8	FLOW TAKEN FROM MERIDAIN RANCH MDDP													**5**	**11**
OS-9	FLOW TAKEN FROM MERIDAIN RANCH MDDP													**8**	**19**
OS-10A	FLOW TAKEN FROM MERIDAIN RANCH MDDP													**28**	**185**

JOB NAME:	*WATERBURY FDR FINAL CONDITIONS*
JOB NUMBER:	*2356.00*
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CALCULATED BY:	*QNA*

FDR ~ EXISTING SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		
						I(5)	I(100)	Q(5)	Q(100)	Facility Size
EX1A	OS-5, & DP-EX10A	19.54	0.61	2.43	10.8	3.96	6.85	30	202	NORTH BOUNDARY
EX1	EXA, OS-5, & DP-EX10A	29.16	1.47	5.89	15.4	3.43	5.81	33	219	3-42" CULVERTS
EX2	EXB	4.09	0.37	1.47	14.6	3.51	5.96	1	9	STAPLETON ROAD
EX3A	OS-4	1.11	0.03	0.11	13.3	3.64	6.23	0	1	NORTH BOUNDARY
EX3	EXC & OS-4	25.10	2.26	9.03	20.6	3.01	5.01	7	45	EAST BOUNDARY
EX4A	OS-3	1.11	0.10	0.40	13.6	3.61	6.17	0	2	NORTH BOUNDARY
EX4	EXD & OS-3	16.98	1.53	6.11	17.4	3.25	5.47	5	33	EAST BOUNDARY
EX5A	OS-2 & OS-8	13.96	1.03	4.11	18.4	3.17	5.32	8	33	NORTH BOUNDARY
EX5	EXE, OS-2 & OS-8	17.23	1.55	6.20	18.4	3.17	5.32	10	44	EAST BOUNDARY
EX6	EXF	1.62	0.15	0.58	13.8	3.59	6.12	1	4	EAST BOUNDARY
EX7A	OS-1 & OS-9	56.82	4.05	16.21	18.9	3.13	5.24	21	104	POINT ALONG CHANNEL
EX7	EXE, EXF, OS-1, OS-2, OS-8 & OS-9	78.24	5.75	23.00	18.9	3.13	5.24	31	151	DP 30 PROP CONDITION
EX9	OS-9	11.80						8	19	EX 36" RCP Culvert
EX10	OS-8	2.56						5	11	EX 36" RCP Culvert
EX10A	MERIDIAN POND E RELEASE	Meridaian Ranch Filing 3 FDR Calculated Flows						28	185	EX 3-42" RCP Culverts
13	TOTAL OFFISITE EX. STOCK POND INFLOW	Per "Final Drainage Report for Waterbury Filing No. 1" dated September 2016, by Classic Consulting						69	396	EX STOCK POND

PROPOSED CONDITION

PROPOSED CONDITION

FINAL

JOB NAME: ***WATERBURY FDR FINAL CONDITIONS***
JOB NUMBER: ***2356.00***
DATE: ***04/16/26***
CALCULATED BY: ***QNA***

FDR FUTURE FINAL ~ PROPOSED BASIN RUNOFF COEFFICIENT SUMMARY

		IMPERVIOUS / DEVELOPED AREA			NONIMPERVIOUS / UNDEVELOPED AREA			WEIGHTED		**WEIGHTED CA**	
BASIN	TOTAL AREA (AC)	AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	**CA(5)**	**CA(100)**
A	3.39	3.39	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.52**	**2.00**
B1	2.30	2.30	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.03**	**1.36**
B2	3.58	3.58	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.61**	**2.11**
C	0.86	0.86	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.39**	**0.51**
D	2.11	2.11	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.95**	**1.24**
E	2.18	2.18	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.98**	**1.29**
F	2.18	2.18	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.98**	**1.29**
G1	0.53	0.53	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.24**	**0.31**
G2	0.69	0.69	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.31**	**0.41**
H	1.46	1.46	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.66**	**0.86**
I	4.97	1.45	0.45	0.59	3.53	0.09	0.36	0.19	0.43	**0.97**	**2.12**
J	1.44	1.44	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.65**	**0.85**
K	3.06	1.14	0.45	0.59	1.92	0.09	0.36	0.22	0.45	**0.69**	**1.37**
L1	3.79	3.79	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.71**	**2.24**
L2	2.00	2.00	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.90**	**1.18**
M1	0.99	0.99	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.44**	**0.58**
M2	0.35	0.35	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.16**	**0.21**
N	0.22	0.22	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.10**	**0.13**
O1	2.82	2.82	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.27**	**1.66**
O2	0.59	0.59	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.27**	**0.35**
O3	0.56	0.56	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.25**	**0.33**
O4	0.38	0.38	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.17**	**0.23**
P	0.70	0.00	0.45	0.59	0.70	0.09	0.36	0.09	0.36	**0.06**	**0.25**
Q1	1.48	1.48	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.66**	**0.87**
Q2	0.96	0.96	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.43**	**0.56**

JOB NAME: ***WATERBURY FDR FINAL CONDITIONS***
JOB NUMBER: ***2356.00***
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FDR FUTURE FINAL ~ PROPOSED BASIN RUNOFF COEFFICIENT SUMMARY

		IMPERVIOUS / DEVELOPED AREA			NONIMPERVIOUS / UNDEVELOPED AREA			WEIGHTED		**WEIGHTED CA**	
BASIN	TOTAL AREA (AC)	AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	**CA(5)**	**CA(100)**
R	1.02	1.02	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.46**	**0.60**
S1	1.55	1.55	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.70**	**0.91**
S2	0.13	0.13	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.06**	**0.08**
T1	1.42	1.42	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.64**	**0.84**
T2	1.23	1.23	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.55**	**0.73**
U1	4.38	4.38	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.97**	**2.58**
U2	1.89	1.89	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.85**	**1.11**
V	0.54	0.54	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.24**	**0.32**
W	5.20	5.20	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**2.34**	**3.07**
X	0.43	0.43	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.19**	**0.25**
Y	0.35	0.35	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.16**	**0.21**
OS-1	11.81	11.81	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**5.31**	**6.97**
OS-2	11.53	11.53	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**5.19**	**6.80**
0S-3A	0.79	0.79	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.35**	**0.47**
0S-3B	5.66	5.66	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**2.55**	**3.34**
OS-4	10.90	0.00	0.45	0.59	10.90	0.09	0.36	0.09	0.36	**0.98**	**3.92**
OS-5	5.64	0.00	0.45	0.59	5.64	0.09	0.36	0.09	0.36	**0.51**	**2.03**
OS-6	1.06	1.06	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.48**	**0.63**
OS-7	3.75	0.00	0.45	0.59	3.75	0.09	0.36	0.09	0.36	**0.34**	**1.35**
OS-8	8.43	INFO TAKEN FROM EASTONVILLE ROAD LONDONDERRY DR. TO REX RD. FDR									
OS-9	11.80	FLOW TAKEN FROM MERIDAIN RANCH MDDP									
OS-9A	1.07	0.40	0.45	0.59	0.67	0.09	0.36	0.22	0.45	**0.24**	**0.48**
OS-10	3.41	0.00	0.45	0.59	3.41	0.09	0.36	0.09	0.36	**0.31**	**1.23**
OS-Q1	4.31	4.31	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.94**	**2.54**
OS-Q2	0.94	0.94	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.42**	**0.55**
OS-R	6.05	6.05	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**2.72**	**3.57**
OS-S1	5.59	5.59	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**2.51**	**3.30**
OS-S2	0.17	0.17	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.08**	**0.10**
OS-T2	0.76	0.76	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.34**	**0.45**

POND TRIBUTARY AREA

POND 1 TRIB AREA (DP 8)	**22.34** AC	BASINS A, B1, B2, C, D ,E, F, H, G1, G2, & K	DCIA	5.03
			UIA	6.92
			RPA	2.46
			SPA	7.94
			Total	**22.34**
POND 2 TRIB AREA (DP 18)	**21.05** AC	BASINS L1, L2, O1, O2, O-3, O-4 & OS-4	DCIA	2.34
			UIA	3.23
			RPA	0.92
			SPA	14.55
			Total	**21.05**
POND 3 TRIB AREA (DP 29)	**72.14** AC	BASINS Q1, Q2, R, S1, S2, T1, T2, U1, U2, V, W, X, OS-1, OS-2, OS-3A, OS-3B, OS-S1, OS-S2, OS-T2, OS-R, OS-Q1, OS-Q2, OS-7, & OS-W	DCIA	19.75
			UIA	20.80
			RPA	16.16
			SPA	15.42
			Total	**72.14**

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FDR FUTURE FINAL~ PROPOSED BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(5)	WEIGHTED CA(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL FLOW Length (ft)	STREET / CHANNEL FLOW Slope (%)	STREET / CHANNEL FLOW Velocity (fps)	STREET / CHANNEL FLOW Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	TOTAL FLOWS Q(100) (cfs)
A	1.52	2.00	0.25	100	2	12.6	420	1.5%	4.3	1.6	14.3	3.54	6.03	**5**	**12**
B1	1.03	1.36	0.25	100	2	12.6	400	1.5%	4.3	1.6	14.2	3.55	6.05	**4**	**8**
B2	1.61	2.11	0.25	100	2	12.6	550	1.5%	4.3	2.1	14.8	3.49	5.93	**6**	**13**
C	0.39	0.51	0.25	20	0.5	5.3	500	2.0%	4.9	1.7	6.9	4.58	8.14	**2**	**4**
D	0.95	1.24	0.25	80	2	10.5	300	2.5%	5.5	0.9	11.4	3.87	6.69	**4**	**8**
E	0.98	1.29	0.25	100	2	12.6	400	2.5%	5.5	1.2	13.8	3.59	6.12	**4**	**8**
F	0.98	1.29	0.25	50	2	7.1	620	1.5%	4.3	2.4	9.5	4.14	7.22	**4**	**9**
G1	0.24	0.31	0.25								5.0	5.00	9.06	**1**	**3**
G2	0.31	0.41	0.25								5.0	5.00	9.06	**2**	**4**
H	0.66	0.86	0.25	50	2	7.1	525	1.5%	4.3	2.0	9.2	4.19	7.33	**3**	**6**
I	0.97	2.12	0.25	80	4	8.4	250	2.0%	4.9	0.8	9.2	4.18	7.32	**4**	**16**
J	0.65	0.85	0.25	90	6	8.1	850	2.0%	4.9	2.9	10.9	3.94	6.81	**3**	**6**
K	0.69	1.37	0.25	100	18	6.1	80	1.0%	3.5	0.4	6.5	4.67	8.33	**3**	**11**
L1	1.71	2.24	0.25	100	2	12.6	860	1.4%	4.1	3.5	16.1	3.36	5.69	**6**	**13**
L2	0.90	1.18	0.25	55	1.1	9.4	860	1.4%	4.1	3.5	12.8	3.70	6.34	**3**	**7**
M1	0.44	0.58	0.25	70	1.5	10.3	200	2.0%	4.9	0.7	11.0	3.92	6.79	**2**	**4**
M2	0.16	0.21	0.25	65	3	7.7	0	0.0%	0.0	0.0	7.7	4.43	7.83	**1**	**2**

JOB NAME: *WATERBURY FDR FINAL CONDITIONS*
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FDR FUTURE FINAL~ PROPOSED BASIN RUNOFF SUMMARY

BASIN	WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY		TOTAL FLOWS	
	CA(5)	CA(100)	C(5)	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	TOTAL (min)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
N	0.10	0.13	0.25								5.0	5.00	9.06	1	1
O1	1.27	1.66	0.25	100	2.5	11.7	460	1.5%	4.3	1.8	13.5	3.62	6.19	5	10
O2	0.27	0.35	0.25	100	2	12.6	850	2.0%	4.9	2.9	15.5	3.42	5.80	1	2
O3	0.25	0.33	0.25								5.0	5.00	9.06	1	3
O4	0.17	0.23	0.25								5.0	5.00	9.06	1	2
P	0.06	0.25	0.25								5.0	5.00	9.06	0	2
Q1	0.66	0.87	0.25	55	1.3	8.9	445	2.0%	5.0	1.5	10.4	4.01	6.97	3	6
Q2	0.43	0.56	0.25	55	1.3	8.9	445	2.0%	5.0	1.5	10.4	4.01	6.97	2	4
R	0.46	0.60	0.25	100	4	10.1	700	2.0%	4.9	2.4	12.4	3.75	6.44	2	4
S1	0.70	0.91	0.25	100	6	8.8	175	2.0%	4.9	0.6	9.4	4.16	7.26	3	7
S2	0.06	0.08	0.25								5.0	5.00	9.06	0	1
T1	0.64	0.84	0.25	55	1.1	9.4	390	2.0%	4.9	1.3	10.7	3.97	6.88	3	6
T2	0.55	0.73	0.25	100	2	12.6	245	2.0%	5.0	0.8	13.5	3.63	6.20	2	5
U1	1.97	2.58	0.25	100	2	12.6	520	2.3%	5.3	1.6	14.3	3.54	6.03	7	16
U2	0.85	1.11	0.25	100	2	12.6	385	2.3%	5.4	1.2	13.8	3.59	6.12	3	7
V	0.24	0.32	0.25								5.0	5.00	9.06	1	3
W	2.34	3.07	0.25	100	2	12.6	630	1.6%	4.4	2.4	15.0	3.47	5.89	8	18
X	0.19	0.25	0.25								5.0	5.00	9.06	1	2
Y	0.16	0.21	0.25								5.0	5.00	9.06	1	2

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FDR FUTURE FINAL~ PROPOSED BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(5)	WEIGHTED CA(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL FLOW Length (ft)	STREET / CHANNEL FLOW Slope (%)	STREET / CHANNEL FLOW Velocity (fps)	STREET / CHANNEL FLOW Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	TOTAL FLOWS Q(100) (cfs)
OS-1	5.31	6.97	0.25	100	2	12.6	690	2.0%	5.0	2.3	15.0	3.47	5.90	18	41
OS-2	5.19	6.80	0.25	100	2	12.6	1700	1.8%	4.6	6.1	18.7	3.14	5.27	16	36
0S-3A	0.35	0.47	0.25	55	1.1	9.4	480	1.3%	3.9	2.0	11.4	3.87	6.68	1	3
0S-3B	2.55	3.34	0.25	100	2	12.6	480	1.3%	3.9	2.0	14.7	3.50	5.95	9	20
OS-4	0.98	3.92	0.25	800	26	30.5					30.5	2.46	4.01	2	16
OS-5	0.51	2.03	0.25	80	5	7.8					7.8	4.42	7.82	2	16
OS-6	0.48	0.63	0.25	30	0.6	6.9	900	1.8%	4.7	3.2	10.1	4.05	7.04	2	4
OS-7	0.34	1.35									5.0	5.00	9.06	2	12
OS-8	INFO TAKEN FROM EASTONVILLE ROAD LONDONDERRY DR. TO REX RD. FDR													5	12
OS-9	FLOW TAKEN FROM MERIDAIN RANCH MDDP													8	19
OS-Q1	0.03	0.12	0.25	50	2	7.1	585	2.0%	5.0	2.0	9.1	4.21	7.36	0	1
OS-10	0.31	1.23	0.25	100	2	12.6	300	2.7%	5.7	0.9	13.5	3.62	6.19	1	8
OS-Q1	1.94	2.54	0.25	200	5	16.6	1500	1.5%	4.3	5.8	22.4	2.88	4.78	6	12
OS-Q2	0.42	0.55	0.25	50	1	8.9	900	1.5%	4.3	3.5	12.4	3.75	6.43	2	4
OS-R	2.72	3.57	0.25	50	1	8.9	850	2.7%	5.8	2.5	11.4	3.87	6.69	11	24
OS-S1	2.51	3.30	0.25	100	2	12.6	920	1.2%	3.8	4.0	16.7	3.32	5.60	8	18
OS-S2	0.08	0.10	0.25	100	2	12.6					12.6	3.72	6.39	0	1
OS-T2	0.34	0.45	0.25	100	2	12.6					12.6	3.72	6.39	1	3
OS-W	0.51	0.54	0.25	10	1	2.4					5.0	5.00	9.06	3	5

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CALCULATED BY:	*QNA*

FDR FUTURE FINAL ~ PROPOSED SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		
						I(5)	I(100)	Q(5)	Q(100)	Facility Size
1	A	3.39	1.52	2.00	14.3	3.54	6.03	5	12	10' Type R Sump Inlet
2	C	0.86	0.39	0.51	6.9	4.58	8.14	2	4	5' Type R Sump Inlet
3	B1	2.30	1.03	1.36	14.2	3.55	6.05	4	8	5' Type R Sump Inlet
4	B2	3.58	1.61	2.11	14.8	3.49	5.93	6	13	10' Type R Sump Inlet
5	F & H	3.65	1.64	2.15	9.5	4.14	7.22	7	16	10' Type R Sump Inlet
6	D	2.11	0.95	1.24	11.4	3.87	6.69	4	8	5' Type R Sump Inlets
7	E	2.18	0.98	1.29	13.8	3.59	6.12	4	8	5' Type R Sump Inlets
7A	G1	0.53	0.24	0.31	5.0	5.00	9.06	1	3	5' Type R At-grade Inlet
7B	G2	0.69	0.31	0.41	5.0	5.00	9.06	2	4	5' Type R At-grade Inlet
8	DESIGN POINTS 1-7B & K	22.34	8.13	10.66	14.8	3.49	5.93	28	63	FSD Pond 1
9	OS-9	11.80	FLOW TAKEN FROM MERIDAIN RANCH MDDP					8	19	EX 30" RCP Culvert
9A	OS-9A	12.87	2.14	3.06	9.1	4.21	7.36	9	23	DUAL TYPE C INLETS
10	OS-8	8.43	INFO TAKEN FROM EASTONVILLE ROAD LONDONDERRY DR. TO REX RD. FDR					5	12	EX FSD Pond
10-1	POND RELEASE & DP10	11.80	INFO TAKEN FROM EASTONVILLE ROAD LONDONDERRY DR. TO REX RD. FDR					0.3	5	PR 18" RCP
10A	MERIDIAN POND E RELEASE	Meridaian Ranch Filing 3 FDR Calculated Flows						28	185	EX 3-42" RCP Culverts
11	OS-5, I, DP10A (MERIDIAN POND E RELEASE)	Sum of Basins						34	216	PR 2-48" RCP Culverts
11A	DP 11 & BASIN J	Sum of Basins						37	222	EX Channel

JOB NAME:	*WATERBURY FDR FINAL CONDITIONS*
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FDR FUTURE FINAL ~ PROPOSED SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Facility Size
						I(5)	I(100)	Q(5)	Q(100)	
12	OS-6	1.06	0.48	0.63	10.1	4.05	7.04	2	4	18"' RCP Culvert
12A	OS-6	Design Point used for 18" culvert xing for Access Road. Use DP 12 Flow						2	4	18"' RCP Culvert
13	TOTAL OFFISITE EX. STOCK POND INFLOW	Per "Final Drainage Report for Waterbury Filing No. 1" dated September 2016, by Classic Consulting						69	396	EX STOCK POND
14	L1	3.79	1.71	2.24	16.1	3.36	5.69	6	13	10' Type R Sump Inlet
15	L2	2.00	0.90	1.18	12.8	3.70	6.34	3	7	5' Type R Sump Inlet
16	O1	2.82	1.27	1.66	13.5	3.62	6.19	5	10	10' Type R Sump Inlet
17	O2	0.59	0.27	0.35	15.5	3.42	5.80	1	2	5' Type R Sump Inlet
18	DESIGN POINTS 14-17 & 33-34 AND BASIN 0S-4	21.05	5.12	5.43	16.1	3.36	5.69	17	31	Interim FSD Pond 2
19	Q1 & OS-Q1	5.78	2.60	3.41	22.4	2.88	4.78	8	16	10' Type R Sump Inlet
20	Q2 & OS-Q2	1.89	0.85	1.12	12.4	3.75	6.43	3	7	5' Type R Sump Inlet
21	R & OS-R	7.06	3.18	4.17	11.4	3.87	6.69	12	28	10' Type R At-grade Inlet
22	S1 & OS-S1 & DP 21 FLOW BY	7.14	4.46	6.76	16.7	3.32	5.60	15	38	15' Type R Sump Inlet
23	S2 & OS-S2	0.31	0.14	0.18	12.6	3.72	6.39	1	1	15' Type R Sump Inlet
22 & 23 SPLIT	S1, OS-S1, S2, OS-S2, & DP 21 FLOW BY	7.44	4.59	6.95	16.7	3.32	5.60	8	19	2-10' Type R Sump Inlets
24	T1	1.42	0.64	0.84	10.7	3.97	6.88	3	6	5' Type R Sump Inlets
25	T2 & OS-T2	1.99	0.90	1.18	13.5	3.63	6.20	3	7	5' Type R Sump Inlets

JOB NAME:	*WATERBURY FDR FINAL CONDITIONS*
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FDR FUTURE FINAL ~ PROPOSED SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		
						I(5)	I(100)	Q(5)	Q(100)	Facility Size
26	U1	4.38	1.97	2.58	14.3	3.54	6.03	7	16	10' Type R Sump Inlets
27	U2	1.89	0.85	1.11	13.8	3.59	6.12	3	7	5' Type R Sump Inlets
28	W & OS-W	5.76	2.85	3.61	15.0	3.47	5.89	10	21	2-10' Type R Sump Inlets
29	BASINS Q1, Q2, R, S1, S2, T1, T2, U1, U2, V, W, X, OS-1, OS-2, OS-3A, OS-3B, OS-S1, OS-S2, OS-T2, OS-R, OS-Q1, OS-Q2	72.14	37.28	51.38	22.4	2.88	4.78	115	265	FSD POND 3
30	PR 45, Y & OS-10	3.76	3.03	5.88	13.5	3.62	6.19	11	36	Triple 36" RCP Culverts
30*	DPEX7A	UNDEVELOPED UPSTREAM CHANNEL FLOW						31	151	Triple 36" RCP Culverts
30**	FSD POND 3 EMERGENCY SPILLWAY RELEASE & ULTIMATE DP 30	MHFD DETENTION 100Y PEAK INFLOW							306	Triple 36" RCP Culverts
30A	DP 30 & FSD POND RELEASE	MHFD DETENTION 100Y PEAK INFLOW						12	94	EAST CHANNEL FULLY DEVELOPED UPSTREAM
30A*	DP 30* & FSD POND 3 RELEASE	UPSTREAM CHANNEL FLOW & POND 3 RELEASE						32	188	EAST CHANNEL FULLY DEVELOPED UPSTREAM W/ SPILLWAY RELEASE
31	V	0.54	0.24	0.32	5.0	5.00	9.06	1	3	3-18" DIA INLETS
32	X	0.43	0.19	0.25	5.0	5.00	9.06	1	2	2-18" DIA INLETS
33	O-3	0.56	0.25	0.33	5.0	5.00	9.06	1	3	4-18" DIA INLETS
34	O-4	0.38	0.17	0.23	5.0	5.00	9.06	1	2	3-18" DIA INLETS
EX5A*	OS-2 & OS-8	13.96	1.03	4.11	18.38	3.17	5.32	8	33	NORTH BOUNDARY

ULTIMATE: DP 30 IS FLOW IN CHANNEL WHEN FUTURE UPSTRREAM WATERBURY FILINGS ARE DEVELOPED

INTERIM: 30* IS FLOW IN CHANNEL PRIOR TO FUTURE UPSTRREAM WATERBURY FILINGS

ULTIMATE DP 30** IS FLOW IN CHANNEL WHEN FUTURE UPSTRREAM WATERBURY FILINGS ARE DEVELOPED AND THE EMERGENCY SPILLWAY IS BREACHED

ULTIMATE 30A EAST CHANNEL FULLY DEVELOPED UPSTREAM

ULTIMATE 30A* EAST CHANNEL FULLY DEVELOPED UPSTREAM AND THE EMERGENCY SPILLWAY IS BREACHED

EX5A* IS TAKEN FROM THE EXISTING CONDITIONS TO SHOW THE FLOW IN THE DIVERSION SWALE E-E PRIOR TO THE DEVELOPMENT OF THE FUTURE UPSTREAM FILNGS

JOB NAME: *WATERBURY FDR FINAL CONDITIONS*
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* PIPES ARE LISTED AT MAXIMUM SIZE REQUIRED TO ACCOMMODATE Q100 FLOWS AT MINIMUM GRADE.
REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

FDR FUTURE FIANL~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Design Points/Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Pipe Size*
					I(5)	I(100)	Q(5)	Q(100)	
1	DP 2	0.39	0.51	6.9	4.58	8.14	2	4	18" RCP
2	DP 1 & 2	1.91	2.51	14.3	3.54	6.03	7	15	24" RCP
3	DP 3	1.03	1.36	14.2	3.55	6.05	4	8	18" RCP
4	DP-4	1.61	2.11	14.8	3.49	5.93	6	13	18" RCP
5	DP 3 & 4	2.64	3.47	14.8	3.49	5.93	9	21	24" RCP
6	DP 1-4	4.56	5.97	14.8	3.49	5.93	16	35	36" RCP
7	DP-1-5	6.20	8.12	14.8	3.49	5.93	22	48	36" RCP
8	DP-6	0.95	1.24	11.4	3.87	6.69	4	8	18" RCP
9	DP-7	0.98	1.29	13.8	3.59	6.12	4	8	18" RCP
10	DP-6 & 7	1.97	2.58	13.8	3.59	6.12	7	16	24" RCP
10A	DP-7A	0.24	0.31	5.0	5.00	9.06	1	3	15" RCP
10B	DP-6, 7, 7A, & 7B	2.51	3.30	13.8	3.59	6.12	9	20	24" RCP
10C	POND 1 RELEASE	2.95	3.87	13.8	3.59	6.12	0.4	14.6	24" RCP

JOB NAME:	*WATERBURY FDR FINAL CONDITIONS*
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FDR FUTURE FIANL~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Design Points/Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Pipe Size*
					I(5)	I(100)	Q(5)	Q(100)	
11	DP-14	1.71	2.24	16.1	3.36	5.69	6	13	24" RCP
12	DP-15	0.90	1.18	12.8	3.70	6.34	3	7	18" RCP
13	DP 14 & 15	2.61	3.42	16.1	3.36	5.69	9	19	30" RCP
14	DP 16	1.27	1.66	13.5	3.62	6.19	5	10	24" RCP
15	DP 14, 15 & 16	3.88	5.08	16.1	3.36	5.69	13	29	36" RCP
16	DP 17	0.27	0.35	15.5	3.42	5.80	1	2	18" RCP
17	DP 14, 15, 16, 17, 33, & 34	4.57	5.99	16.1	3.36	5.69	15	34	36" RCP
17A	POND 2 RELEASE						0.2	14.8	18" RCP
18	DP 19	2.60	3.41	22.4	2.88	4.78	8	16	24" RCP
19	DP 20	0.85	1.12	12.4	3.75	6.43	3	7	18" RCP
20	DP 18 & 19	3.46	4.53	22.4	2.88	4.78	10	22	24" RCP
21	DP 21 PICK UP						8	14	18" RCP
22	DP 19, 20 & 21	6.23	7.46	22.4	2.88	4.78	18	36	30" RCP
23	DP 22	2.30	3.47	16.7	3.32	5.60	8	19	24" RCP
24	DP 23	2.30	3.47	16.7	3.32	5.60	8	19	24" RCP
25	DP 22 & 23	4.59	6.95	16.7	3.32	5.60	15	39	36" RCP
26	DP 19 -23	10.83	14.40	22.4	2.88	4.78	31	69	36" RCP
27	DP 24	0.64	0.84	10.7	3.97	6.88	3	6	18" RCP

JOB NAME:	*WATERBURY FDR FINAL CONDITIONS*
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REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

FDR FUTURE FIANL~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Design Points/Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Pipe Size*
					I(5)	I(100)	Q(5)	Q(100)	
28	DP 25	0.90	1.18	13.5	3.63	6.20	3	7	18" RCP
29	DP 19-25	12.36	16.42	22.4	2.88	4.78	36	78	42" RCP
30	DP 26	1.97	2.58	14.3	3.54	6.03	7	16	24" RCP
31	DP 19-26	14.33	19.00	22.4	2.89	4.79	41	91	42" RCP
32	DP 27	0.85	1.11	13.8	3.59	6.12	3	7	18" RCP
33	DP 19-27, & 31	15.42	20.43	22.4	2.88	4.78	44	98	42" RCP
33A	DPR 33 & PR 37	15.66	20.75	22.4	2.88	4.78	45	99	42" RCP
34	DP 28 SPLIT	1.42	1.81	15.0	3.47	5.89	5	11	24" RCP
34A	DP 28 & 32	3.04	3.86	13.84	3.59	6.12	11	24	30" RCP
35	Pond 3 Release	MHFD UD-DETENTION POND RELEASE					1.3	37.7	36" RCP
36	DP 30	FSD POND 3 EMERGCNEY SPILLWAY RELEASE						269.3	TRIPLE 36" RCP
37	DP 31	0.24	0.32	5.00	5.00	9.06	1	3	12" HDPE
38	DP 32	0.19	0.25	5.00	5.00	9.06	1	2	12" HDPE
39	DP 33	0.25	0.33	5.00	5.00	9.06	1	3	12" HDPE
40	DP 34	0.17	0.23	5.00	5.00	9.06	1	2	12" HDPE
43	DP 9 & 9A	2.14	3.06	9.06	4.21	7.36	9	23	24" RCP
44	DP 10 RELEASE	Eastonville Road – Londonderry Drive to Rex Road Segment 1 Improvements FDR					0.3	5	18' RCP
45	PR 43 & 44	Eastonville Road – Londonderry Drive to Rex Road Segment 1 Improvements FDR					9	28	30" RCP

PROPOSED CONDITION
INTERIM

JOB NAME: *WATERBURY FILING INTERIM FDR*
JOB NUMBER: *2356.00*
DATE: *04/15/26*
CALCULATED BY: *QNA*

FINAL DRAINAGE REPORT INTERIM ~ BASIN RUNOFF COEFFICIENT SUMMARY

		IMPERVIOUS / DEVELOPED AREA			NONIMPERVIOUS / UNDEVELOPED AREA			WEIGHTED		**WEIGHTED CA**	
BASIN	TOTAL AREA (AC)	AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	**CA(5)**	**CA(100)**
A	3.39	3.39	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.52**	**2.00**
B1	2.30	2.30	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.03**	**1.36**
B2	3.58	3.58	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.61**	**2.11**
C	0.86	0.86	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.39**	**0.51**
D	2.11	2.11	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.95**	**1.24**
E	2.18	2.18	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.98**	**1.29**
F	2.18	2.18	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.98**	**1.29**
G1	0.39	0.39	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.17**	**0.23**
G2	0.60	0.60	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.27**	**0.35**
H	1.46	1.46	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.66**	**0.86**
I	4.97	1.45	0.45	0.59	3.53	0.09	0.36	0.19	0.43	**0.97**	**2.12**
J	1.44	1.44	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.65**	**0.85**
K	3.06	1.14	0.45	0.59	1.92	0.09	0.36	0.22	0.45	**0.69**	**1.37**
L1	3.79	3.79	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.71**	**2.24**
L2	2.00	2.00	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.90**	**1.18**
M1	0.99	0.99	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.45**	**0.58**
M2	0.35	0.35	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.16**	**0.21**
N	0.22	0.22	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.10**	**0.13**
O1	2.82	2.82	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.27**	**1.66**
O2	0.71	0.71	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.32**	**0.42**

JOB NAME: ***WATERBURY FILING INTERIM FDR***
JOB NUMBER: ***2356.00***
DATE: ***04/15/26***
CALCULATED BY: ***QNA***

FINAL DRAINAGE REPORT INTERIM ~ BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	TOTAL AREA (AC)	IMPERVIOUS / DEVELOPED AREA			NONIMPERVIOUS / UNDEVELOPED AREA			WEIGHTED		**WEIGHTED CA**	
		AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	**CA(5)**	**CA(100)**
O3	0.45	0.45	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.20**	**0.27**
O4	0.38	0.38	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.17**	**0.23**
P	0.70	0.00	0.45	0.59	0.70	0.09	0.36	0.09	0.36	**0.06**	**0.25**
Q1	1.48	1.48	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.66**	**0.87**
Q2	0.96	0.96	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.43**	**0.56**
R	1.02	1.02	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.46**	**0.60**
S1	1.55	1.55	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.70**	**0.91**
S2	0.13	0.13	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.06**	**0.08**
T1	1.42	1.42	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.64**	**0.84**
T2	1.23	1.23	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.55**	**0.73**
U1	4.38	4.38	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.97**	**2.58**
U2	1.89	1.89	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.85**	**1.11**
V	0.54	0.54	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.24**	**0.32**
W	5.20	5.20	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**2.34**	**3.07**
X	0.43	0.43	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.19**	**0.25**
Y	0.35	0.35	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.16**	**0.21**
OS-1	**35.50**	**0.00**	**0.45**	**0.59**	**35.50**	**0.09**	**0.36**	**0.09**	**0.36**	**3.20**	**12.78**
OS-2	**12.02**	**0.00**	**0.45**	**0.59**	**12.02**	**0.09**	**0.36**	**0.09**	**0.36**	**1.08**	**4.33**
OS-4	10.90	0.00	0.45	0.59	10.90	0.09	0.36	0.09	0.36	**0.98**	**3.92**
OS-5	5.64	0.00	0.45	0.59	5.64	0.09	0.36	0.09	0.36	**0.51**	**2.03**
OS-6	1.06	1.06	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.48**	**0.63**
OS-7	3.75	0.00	0.45	0.59	3.75	0.09	0.36	0.09	0.36	**0.34**	**1.35**
OS-8	8.43	INFO TAKEN FROM EASTONVILLE ROAD LONDONDERRY DR. TO REX RD. FDR									
OS-9	11.80	FLOW TAKEN FROM MERIDAIN RANCH MDDP									
OS-9A	1.07	0.40	0.45	0.59	0.67	0.09	0.36	0.22	0.45	0.24	0.48
OS-Q1	**0.33**	**0.00**	**0.45**	**0.59**	**0.33**	**0.09**	**0.36**	**0.09**	**0.36**	**0.03**	**0.12**
OS-Q2	**0.22**	**0.00**	**0.45**	**0.59**	**0.22**	**0.09**	**0.36**	**0.09**	**0.36**	**0.02**	**0.08**
OS-R	**1.04**	**0.00**	**0.45**	**0.59**	**1.04**	**0.09**	**0.36**	**0.09**	**0.36**	**0.09**	**0.38**
OS-S1	**0.31**	**0.00**	**0.45**	**0.59**	**0.31**	**0.09**	**0.36**	**0.09**	**0.36**	**0.03**	**0.11**
OS-S2	**0.13**	**0.00**	**0.45**	**0.59**	**0.13**	**0.09**	**0.36**	**0.09**	**0.36**	**0.01**	**0.05**
OS-T2	**0.30**	**0.00**	**0.45**	**0.59**	**0.30**	**0.09**	**0.36**	**0.09**	**0.36**	**0.03**	**0.11**

JOB NAME: *WATERBURY FILING INTERIM FDR*
JOB NUMBER: *2356.00*
DATE: *04/15/26*
CALC'D BY: *QNA*

FINAL DRAINAGE REPORT INTERIM ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(5)	WEIGHTED CA(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL FLOW Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	Q(100) (cfs)
A	1.52	2.00	0.25	100	2	12.6	420	1.5%	4.3	1.6	14.3	3.54	6.03	5	12
B1	1.03	1.36	0.25	100	2	12.6	400	1.5%	4.3	1.6	14.2	3.55	6.05	4	8
B2	1.61	2.11	0.25	100	2	12.6	550	1.5%	4.3	2.1	14.8	3.49	5.93	6	13
C	0.39	0.51	0.25	20	0.5	5.3	500	2.0%	4.9	1.7	6.9	4.58	8.14	2	4
D	0.95	1.24	0.25	80	2	10.5	300	2.5%	5.5	0.9	11.4	3.87	6.69	4	8
E	0.98	1.29	0.25	100	2	12.6	400	2.5%	5.5	1.2	13.8	3.59	6.12	4	8
F	0.98	1.29	0.25	50	2	7.1	620	1.5%	4.3	2.4	9.5	4.14	7.22	4	9
G1	0.17	0.23	0.25								5.0	5.00	9.06	1	2
G2	0.27	0.35	0.25								5.0	5.00	9.06	1	3
H	0.66	0.86	0.25	50	2	7.1	525	1.5%	4.3	2.0	9.2	4.19	7.33	3	6
I	0.97	2.12	0.25	80	4	8.4	250	2.0%	4.9	0.8	9.2	4.18	7.32	4	16
J	0.65	0.85	0.25	90	6	8.1	850	2.0%	4.9	2.9	10.9	3.94	6.81	3	6
K	0.69	1.37	0.25	100	18	6.1	80	1.0%	3.5	0.4	6.5	4.67	8.33	3	11
L1	1.71	2.24	0.25	100	2	12.6	860	1.4%	4.1	3.5	16.1	3.36	5.69	6	13
L2	0.90	1.18	0.25	55	1.1	9.4	860	1.4%	4.1	3.5	12.8	3.70	6.34	3	7
M1	0.45	0.58	0.25	70	1.5	10.3	200	2.0%	4.9	0.7	11.0	3.92	6.79	2	4
M2	0.16	0.21	0.25	65	3	7.7	0	0.0%	0.0	0.0	7.7	4.43	7.83	1	2
N	0.10	0.13	0.25								5.0	5.00	9.06	1	1
O1	1.27	1.66	0.25	100	2.5	11.7	460	1.5%	4.3	1.8	13.5	3.62	6.19	5	10
O2	0.32	0.42	0.25	100	2	12.6	850	2.0%	4.9	2.9	15.5	3.42	5.80	1	2
O3	0.20	0.27	0.25								5.0	5.00	9.06	1	2
O4	0.17	0.23	0.25								5.0	5.00	9.06	1	2
P	0.06	0.25	0.25								5.0	5.00	9.06	0	2

JOB NAME: *WATERBURY FILING INTERIM FDR*
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FINAL DRAINAGE REPORT INTERIM ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY		TOTAL FLOWS	
	CA(5)	CA(100)	C(5)	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	TOTAL (min)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
Q1	0.66	0.87	0.25	55	1.3	8.9	445	2.0%	5.0	1.5	10.4	4.01	6.97	3	6
Q2	0.43	0.56	0.25	55	1.3	8.9	445	2.0%	5.0	1.5	10.4	4.01	6.97	2	4
R	0.46	0.60	0.25	100	4	10.1	700	2.0%	4.9	2.4	12.4	3.75	6.44	2	4
S1	0.70	0.91	0.25	100	6	8.8	175	2.0%	4.9	0.6	9.4	4.16	7.26	3	7
S2	0.06	0.08	0.25								5.0	5.00	9.06	0	1
T1	0.64	0.84	0.25	55	1.1	9.4	390	2.0%	4.9	1.3	10.7	3.97	6.88	3	6
T2	0.55	0.73	0.25	100	2	12.6	245	2.0%	5.0	0.8	13.5	3.63	6.20	2	5
U1	1.97	2.58	0.25	100	2	12.6	520	2.3%	5.3	1.6	14.3	3.54	6.03	7	16
U2	0.85	1.11	0.25	100	2	12.6	385	2.3%	5.4	1.2	13.8	3.59	6.12	3	7
V	0.24	0.32	0.25								5.0	5.00	9.06	1	3
W	2.34	3.07	0.25	100	2	12.6	630	1.6%	4.4	2.4	15.0	3.47	5.89	8	18
X	0.19	0.25	0.25								5.0	5.00	9.06	1	2
Y	0.16	0.21	0.25								5.0	5.00	9.06	1	2
OS-1	3.20	12.78	0.25	100	2	12.6	2700	2.3%	5.3	8.5	21.1	2.97	4.94	9	63
OS-2	1.08	4.33	0.25	100	2	12.6	1203	1.0%	3.5	5.7	18.4	3.17	5.32	3	23
OS-4	0.98	3.92	0.25	800	26	30.5					30.5	2.46	4.01	2	16
OS-5	0.51	2.03	0.25	80	5	7.8					7.8	4.42	7.82	2	16
OS-6	0.48	0.63	0.25	30	0.6	6.9	900	1.8%	4.7	3.2	10.1	4.05	7.04	2	4
OS-7	0.34	1.35	0.25								5.0	5.00	9.06	2	12
OS-8	INFO TAKEN FROM EASTONVILLE ROAD LONDONDERRY DR. TO REX RD. FDR													5	12
OS-9	FLOW TAKEN FROM MERIDAIN RANCH MDDP													8	19
OS-9A	0.24	0.48	0.25	50	2	7.1	585	2.0%	5.0	2.0	9.1	4.21	7.36	1	4
OS-Q1	0.03	0.12	0.25	100	2	12.6	135	1.5%	4.3	0.5	13.2	3.66	6.27	0	1
OS-Q2	0.02	0.08	0.25	50	1	8.9	135	1.5%	4.3	0.5	9.5	4.14	7.24	0	1
OS-R	0.09	0.38	0.25	100	2	12.6	50	2.7%	5.8	0.1	12.8	3.70	6.35	0	2
OS-S1	0.03	0.11	0.25								5.0	5.00	9.06	0	1
OS-S2	0.01	0.05	0.25								5.0	5.00	9.06	0	0
OS-T2	0.03	0.11	0.25								5.0	5.00	9.06	0	1

JOB NAME:	*WATERBURY FILING INTERIM FDR*
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FINAL DRAINAGE REPORT INTERIM~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Facility Size
						I(5)	I(100)	Q(5)	Q(100)	
1	A	3.39	1.52	2.00	14.3	3.54	6.03	5	12	10' Type R Sump Inlet
2	C	0.86	0.39	0.51	6.9	4.58	8.14	2	4	5' Type R Sump Inlet
3	B1	2.30	1.03	1.36	14.2	3.55	6.05	4	8	5' Type R Sump Inlet
4	B2	3.58	1.61	2.11	14.8	3.49	5.93	6	13	5' Type R Sump Inlet
5	F & H	3.65	1.64	2.15	9.5	4.14	7.22	7	16	10' Type R Sump Inlet
6	D	2.11	0.95	1.24	11.4	3.87	6.69	4	8	5' Type R Sump Inlets
7	E	2.18	0.98	1.29	13.8	3.59	6.12	4	8	5' Type R Sump Inlets
7A	G1	0.39	0.17	0.23	5.0	5.00	9.06	1	2	5' Type R At-grade Inlet
7B	G2	0.60	0.27	0.35	5.0	5.00	9.06	1	3	5' Type R At-grade Inlet
8	DESIGN POINTS 1-7 & K	22.11	8.13	10.66	14.8	3.49	5.93	28	63	FSD Pond 1
9	OS-9	11.80	FLOW TAKEN FROM MERIDAIN RANCH MDDP					8	19	EX 36" RCP Culvert
9A	OS-9A	12.87	2.14	3.06	9.1	4.21	7.36	9	23	DUAL TYPE C INLETS
10	OS-8	8.43	INFO TAKEN FROM EASTONVILLE ROAD LONDONDERRY DR. TO REX RD. FDR					5	11	EX 36" RCP Culvert
10-1	POND RELEASE & DP10	11.80	INFO TAKEN FROM EASTONVILLE ROAD LONDONDERRY DR. TO REX RD. FDR					0.3	5	PR 18" RCP
10A	MERIDIAN POND E RELEASE	Meridaian Ranch Filing 3 FDR Calculated Flows						28	185	EX 3-42" RCP Culverts
11	OS-5, I, OS-& MERIDIAN POND E RELEASE	Sum of Basins						34	216	PR 2-48" RCP Culverts
11A	DP 11 & BASIN J	Sum of Basins						37	222	PR 2-42" RCP Culverts
12	OS-6	1.06	0.48	0.63	10.1	4.05	7.04	2	4	18"' RCP Culvert
12A	OS-6	Design Point used for 18" culvert xing for Access Road. Use DP 12 Flow						2	4	18"' RCP Culvert
13	TOTAL OFFISITE EX. STOCK POND INFLOW	Per "Final Drainage Report for Waterbury Filing No. 1" dated September 2016, by Classic Consulting						69	396	EX STOCK POND

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FINAL DRAINAGE REPORT INTERIM~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Facility Size
						I(5)	I(100)	Q(5)	Q(100)	
14	L1	3.79	1.71	2.24	16.1	3.36	5.69	6	13	10' Type R Sump Inlet
15	L2	2.00	0.90	1.18	16.1	3.36	5.69	3	7	5' Type R Sump Inlet
16	O1	2.82	1.27	1.66	13.5	3.62	6.19	5	10	5' Type R Sump Inlet
17	O2	0.71	0.32	0.42	15.5	3.42	5.80	1	2	5' Type R Sump Inlet
18	DESIGN POINTS 14-17 & BASIN 0S-4	20.23	5.18	5.50	16.1	3.36	5.69	17	31	Interim FSD Pond 2
19	Q1 & OS-Q1	1.81	0.69	0.99	13.2	3.66	6.27	3	6	10' Type R Sump Inlet
20	Q2 & OS-Q2	1.18	0.45	0.65	9.5	4.14	7.24	2	5	5' Type R Sump Inlet
21	R & OS-R	2.06	0.55	0.98	12.4	3.75	6.44	2	6	10' Type R At-grade Inlet
22	S1 & OS-S1	1.86	0.72	1.02	12.4	3.75	6.44	3	7	10' Type R Sump Inlet
23	S2 & OS-S2	0.27	0.07	0.13	5.0	5.00	9.06	0	1	10' Type R Sump Inlet
24	T1	1.42	0.64	0.84	10.7	3.97	6.88	3	6	5' Type R Sump Inlets
25	T2 & OS-T2	1.54	0.58	0.84	13.5	3.63	6.20	2	5	5' Type R Sump Inlets
26	U1	4.38	1.97	2.58	14.3	3.54	6.03	7	16	10' Type R Sump Inlets
27	U2	1.89	0.85	1.11	13.8	3.59	6.12	3	7	5' Type R Sump Inlets
28	W	5.20	2.34	3.07	15.0	3.47	5.89	8	18	2-10' Type R Sump Inlets
32	DESIGN POINTS 19-28 & OS-7	26.31	9.21	13.55	15.0	3.47	5.89	32	80	FSD POND 3
E-E	OS-2	12.02	1.08	4.33	18.4	3.17	5.32	3	23	DIVERSION SWALE E-E
30	Y, OS-1, OS-2, PR 45	50.02	7.57	22.88	21.1	2.97	4.94	22	113	Triple 36" RCP Culverts
31	V	0.54	0.24	0.32	5.0	5.00	9.06	1	3	18" DIA INLETS
32	X	0.43	0.19	0.25	5.0	5.00	9.06	1	2	18" DIA INLETS
33	O-3	0.45	0.20	0.27	5.0	5.00	9.06	1	2	18" DIA INLETS
34	O-4	0.38	0.17	0.23	5.0	5.00	9.06	1	2	18" DIA INLETS

JOB NAME: *WATERBURY FILING INTERIM FDR*
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FINAL DRAINAGE REPORT INTERIM~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Design Points/Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Pipe Size
					I(5)	I(100)	Q(5)	Q(100)	
1	DP 2	0.39	0.51	6.9	4.58	8.14	2	4	18" RCP
2	DP 1 & 2	1.91	2.51	14.3	3.54	6.03	7	15	24" RCP
3	DP 3	1.03	1.36	14.2	3.55	6.05	4	8	18" RCP
4	DP-4	1.61	2.11	14.8	3.49	5.93	6	13	18" RCP
5	DP 3 & 4	2.64	3.47	14.8	3.49	5.93	9	21	24" RCP
6	DP 1-4	4.56	5.97	14.8	3.49	5.93	16	35	36" RCP
7	DP-1-5	6.20	8.12	14.8	3.49	5.93	22	48	36" RCP
8	DP-6	0.95	1.24	11.4	3.87	6.69	4	8	18" RCP
9	DP-7	0.98	1.29	13.8	3.59	6.12	4	8	18" RCP
10	DP-6 & 7	1.93	2.53	13.8	3.59	6.12	7	15	24" RCP
10A	DP-7A	0.17	0.23	5.0	5.00	9.06	1	2	15" RCP
10B	DP-6, 7, 7A & 7B	2.37	3.11	13.8	3.59	6.12	9	19	24" RCP
10C	Pond 1 Release						0.4	14.5	18" RCP
11	DP-14	1.71	2.24	16.1	3.36	5.69	6	13	24" RCP

JOB NAME: *WATERBURY FILING INTERIM FDR*
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FINAL DRAINAGE REPORT INTERIM~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Design Points/Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Pipe Size
					I(5)	I(100)	Q(5)	Q(100)	
12	DP-15	0.90	1.18	16.1	3.36	5.69	3	7	24" RCP
13	DP 14 & 15	2.61	3.42	16.1	3.36	5.69	9	19	30" RCP
14	DP 16	1.27	1.66	13.5	3.62	6.19	5	10	30" RCP
15	DP 14, 15 & 16	3.88	5.08	16.1	3.36	5.69	13	29	36" RCP
16	DP 17	0.32	0.42	15.5	3.42	5.80	1	2	18" RCP
17	DP 14, 15, 16, & 17	4.57	6.00	16.1	3.36	5.69	15	34	36" RCP
17A	Pond 2 Release						1.1	2.4	18" RCP
18	DP 19	0.69	0.99	13.2	3.66	6.27	3	6	24" RCP
19	DP 20	0.45	0.65	9.5	4.14	7.24	2	5	18" RCP
20	DP 19 & 20	1.15	1.64	13.2	3.66	6.27	4	10	24" RCP
21	DP 21 PICK UP						2	6	18" RCP
22	DP 19, 20 & 21	1.69	2.59	13.2	3.66	6.27	6	16	30" RCP
23	DP 22	0.72	1.02	12.4	3.75	6.44	3	7	24" RCP
24	DP 23	0.07	0.13	5.0	5.00	9.06	0	1	24" RCP

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FINAL DRAINAGE REPORT INTERIM~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Design Points/Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Pipe Size
					I(5)	I(100)	Q(5)	Q(100)	
25	DP 22 & 23	0.80	1.15	12.4	3.75	6.44	3	7	30" RCP
26	DP 19 -23	2.49	3.74	13.2	3.66	6.27	9	23	36" RCP
27	DP 24	0.64	0.84	10.7	3.97	6.88	3	6	18" RCP
28	DP 25	0.58	0.84	13.5	3.63	6.20	2	5	18" RCP
29	DP 19-25	3.71	5.42	13.5	3.63	6.20	13	34	36" RCP
30	DP 26	1.97	2.58	14.3	3.54	6.03	7	16	24" RCP
31	DP 19-26	5.68	8.00	14.3	3.54	6.03	20	48	42" RCP
32	DP 27	0.85	1.11	13.8	3.59	6.12	3	7	18" RCP
33	DP 19-27 & 31	6.77	9.43	14.3	3.54	6.03	24	57	42" RCP
34	DP 28 SPLIT FLOW	2.34	3.07	15.03	3.47	5.89	4	9	24" RCP
34A	28 & 32	2.53	3.32	15.0	3.47	5.89	9	20	24" RCP
35	Pond 3 Release	MHFD UD-DETENTION POND RELEASE					1	58	36" RCP
36	DP 30	SUM OF BASINS					22	113	TRIPLE 36" RCP
37	DP 31	0.24	0.32	5.00	5.00	9.06	1	3	15" HDPE
38	DP 32	0.19	0.25	5.00	5.00	9.06	1	2	15" HDPE
39	DP 33	0.20	0.27	5.00	5.00	9.06	1	2	15" HDPE
40	DP 34	0.17	0.23	5.00	5.00	9.06	1	2	15" HDPE

APPENDIX F
HYDRAULIC CALCULATIONS

STREET CAPACITY

Irregular Channel Manning Uniform Flow Calculator

Waterbury Filing No. 1

Modified Arterial Saybrook Rd @ 1.0%

Inputs

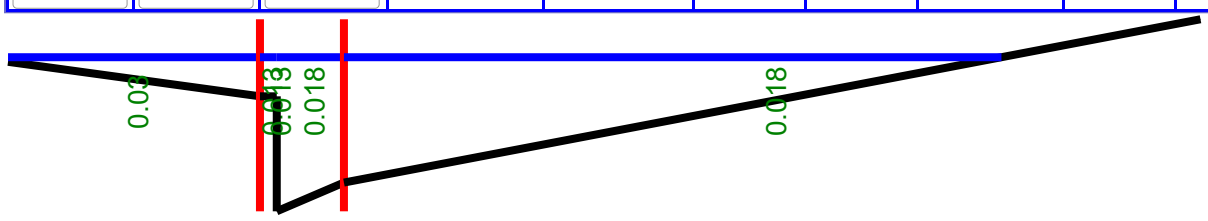
Water surface elevation	.67	ft
Channel slope, S	1	% rise/run

Results

Q	26.55	cfs

Cross section points +/- (or Copy/Paste using data area)

Point					Segment			Region					
Sta ft	Elev ft	n for seg-ment	R_h, Q region boundary (Bank)	Bot. shear τ psf	T ft	P_w ft	A ft^2	R_h ft	Comp. n	v ft/sec	H_v ft	Fr	Q cfs
0	.65			0.01									
7.5	.5	0.03	☑	0.11	7.50	7.50	0.71	0.09	0.03	1.03	0.02	0.59	0.73
8	.5	0.013	☐	0.11	0.50	0.50	0.09						
8	0	0.013	☐	0.42	0.00	0.00	0.00						
10	.125	0.018	☑	0.34	2.00	2.00	1.22	0.52	0.02	5.63	0.49	1.23	7.31
35.5	.835	0.018	☑	0.00	19.57	19.58	5.33	0.27	0.02	3.47	0.19	1.17	18.50



Notes

Composite n

This calculator follows HEC-RAS Reference Manual in calculating region composite n using Chow 1959, page 136, equation 6-17 (not 6-18).

Rock lining

Use the Manning Trapezoidal Channel Calculator to design rock lining. This calculator is more for natural sections.

Irregular Channel Manning Uniform Flow Calculator

Waterbury Filing No. 1

Modified Arterial Saybrook Rd @ 2.25%

Inputs

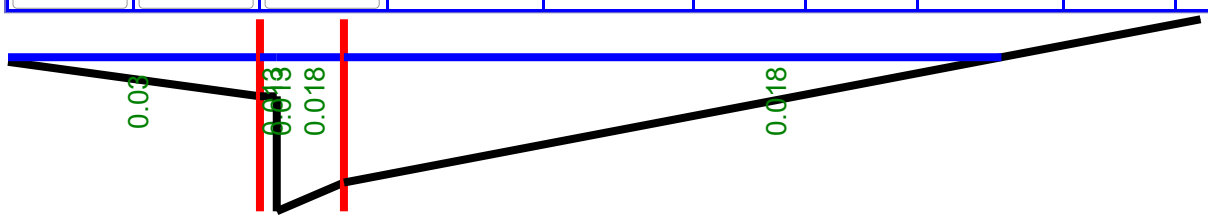
Water surface elevation	.67	ft
Channel slope, S	2.25	% rise/run

Results

Q	39.83	cfs

Cross section points +/- (or Copy/Paste using data area)

Point					Segment			Region					
Sta (ft)	Elev (ft)	n for segment	R_h, Q region boundary (Bank)	Bot. shear τ (psf)	T (ft)	P_w (ft)	A (ft^2)	R_h (ft)	Comp. n	v (ft/sec)	H_v (ft)	Fr	Q (cfs)
0	.65			0.03									
7.5	.5	0.03	☑	0.24	7.50	7.50	0.71	0.09	0.03	1.55	0.04	0.88	1.10
8	.5	0.013	☐	0.24	0.50	0.50	0.09						
8	0	0.013	☐	0.94	0.00	0.00	0.00						
10	.125	0.018	☑	0.77	2.00	2.00	1.22	0.52	0.02	8.44	1.11	1.85	10.97
35.5	.835	0.018	☑	0.00	19.57	19.58	5.33	0.27	0.02	5.20	0.42	1.76	27.75



Notes

Composite n

This calculator follows HEC-RAS Reference Manual in calculating region composite n using Chow 1959, page 136, equation 6-17 (not 6-18).

Rock lining

Use the Manning Trapezoidal Channel Calculator to design rock lining. This calculator is more for natural sections.

Irregular Channel Manning Uniform Flow Calculator

Waterbury Filing No. 1

Modified Arterial Saybrook Rd @4.42%

Inputs

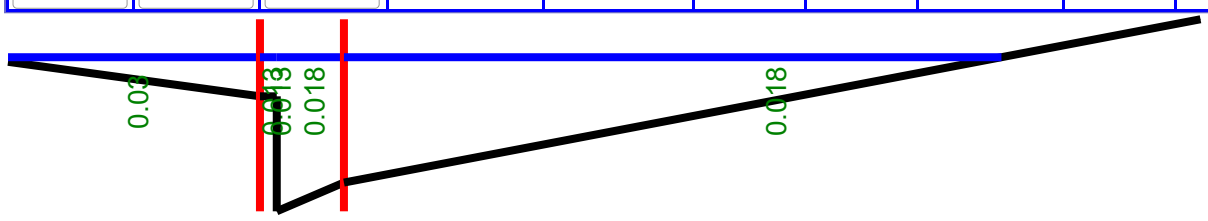
Water surface elevation	.67	ft
Channel slope, S	4.42	% rise/run

Results

Q	55.82	cfs

Cross section points +/- (or Copy/Paste using data area)

Point					Segment			Region					
Sta ft	Elev ft	n for seg-ment	R_h, Q region boundary (Bank)	Bot. shear τ psf	T ft	P_w ft	A ft^2	R_h ft	Comp. n	v ft/sec	H_v ft	Fr	Q cfs
0	.65			0.06									
7.5	.5	0.03	☑	0.47	7.50	7.50	0.71	0.09	0.03	2.17	0.07	1.24	1.54
8	.5	0.013	☐	0.47	0.50	0.50	0.09						
8	0	0.013	☐	1.85	0.00	0.00	0.00						
10	.125	0.018	☑	1.50	2.00	2.00	1.22	0.52	0.02	11.83	2.17	2.59	15.38
35.5	.835	0.018	☑	0.00	19.57	19.58	5.33	0.27	0.02	7.29	0.83	2.46	38.90



Notes

Composite n

This calculator follows HEC-RAS Reference Manual in calculating region composite n using Chow 1959, page 136, equation 6-17 (not 6-18).

Rock lining

Use the Manning Trapezoidal Channel Calculator to design rock lining. This calculator is more for natural sections.

Irregular Channel Manning Uniform Flow Calculator

Waterbury Filing No. 1

50' ROW 6" Curb Center Crown @ 0.50% - 7.5' Back Conveyance @ 2.0%

Inputs

Water surface elevation	1	ft
Channel slope, S	0.50	% rise/run

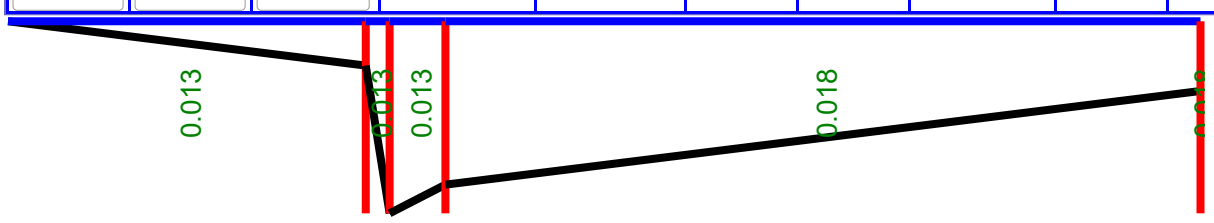
Results

Q	25.15	cfs

Fish Camp Max Q100=16.0 cfs < 25.15 cfs
Masonboro Max Q100=4.0 cfs < 25.15 cfs

Cross section points +/- (or Copy/Paste using data area)

Point					Segment			Region					
Sta ft	Elev ft	n for segment	R_h, Q region boundary (Bank)	Bot. shear τ psf	T ft	P_w ft	A ft^2	R_h ft	Comp. n	v ft/sec	H_v ft	Fr	Q cfs
0	1			0.00									
7.5	0.85	0.013	☑	0.05	7.50	7.50	0.56	0.07	0.01	1.44	0.03	0.93	0.81
8	0.35	0.013	☑	0.20	0.50	0.71	0.20	0.28	0.01	3.48	0.19	0.97	0.70
9.17	0.447	0.013	☑	0.17	1.17	1.17	0.70	0.60	0.01	5.75	0.51	1.31	4.04
25	0.764	0.018	☑	0.07	15.83	15.83	6.25	0.39	0.02	3.14	0.15	0.88	19.61
25	0.764	0.018	☑	0.07	NaN	0.00	0.00	NaN	NaN	NaN	NaN	NaN	0.00



Notes

Composite n

This calculator follows HEC-RAS Reference Manual in calculating region composite n using Chow 1959, page 136, equation 6-17 (not 6-18).

Rock lining

Use the Manning Trapezoidal Channel Calculator to design rock lining. This calculator is more for natural sections.

Irregular Channel Manning Uniform Flow Calculator

Waterbury Filing No. 1

50' ROW 6" Curb Center Crown @ 1.00% - 7.5' Back Conveyance @ 2.0%

Inputs

Water surface elevation	1	ft
Channel slope, S	1.00	% rise/run

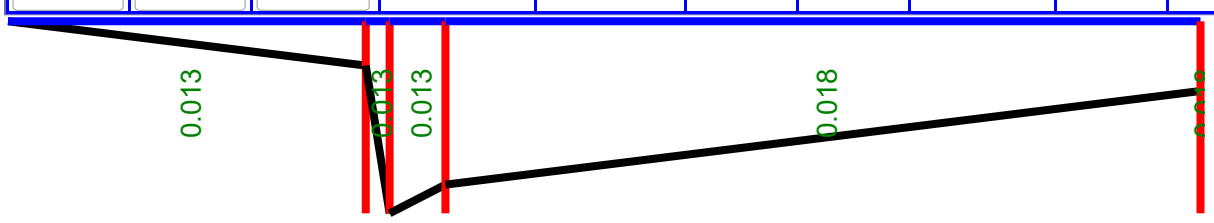
Results

Q	35.57	cfs

Sunken Meadow Max Q100=21.0 cfs < 35.57 cfs
Fish Camp Max Q100=16.0 cfs < 35.57 cfs
Manor Haven Max Q100=13.0 cfs < 35.57 cfs

Cross section points +/- (or Copy/Paste using data area)

Point					Segment			Region					
Sta ft	Elev ft	n for seg-ment	R_h, Q region boundary (Bank)	Bot. shear τ psf	T ft	P_w ft	A ft^2	R_h ft	Comp. n	v ft/sec	H_v ft	Fr	Q cfs
0	1			0.00									
7.5	0.85	0.013	☑	0.09	7.50	7.50	0.56	0.07	0.01	2.03	0.06	1.31	1.14
8	0.35	0.013	☑	0.41	0.50	0.71	0.20	0.28	0.01	4.93	0.38	1.37	0.99
9.17	0.447	0.013	☑	0.35	1.17	1.17	0.70	0.60	0.01	8.13	1.03	1.85	5.72
25	0.764	0.018	☑	0.15	15.83	15.83	6.25	0.39	0.02	4.44	0.31	1.25	27.73
25	0.764	0.018	☑	0.15	NaN	0.00	0.00	NaN	NaN	NaN	NaN	NaN	0.00



Notes

Composite n

This calculator follows HEC-RAS Reference Manual in calculating region composite n using Chow 1959, page 136, equation 6-17 (not 6-18).

Rock lining

Use the Manning Trapezoidal Channel Calculator to design rock lining. This calculator is more for natural sections.

Irregular Channel Manning Uniform Flow Calculator

Waterbury Filing No. 1

50' ROW 6" Curb Center Crown @ 1.25% - 7.5' Back Conveyance @ 2.0%

Inputs

Water surface elevation	1	ft
Channel slope, S	1.25	% rise/run

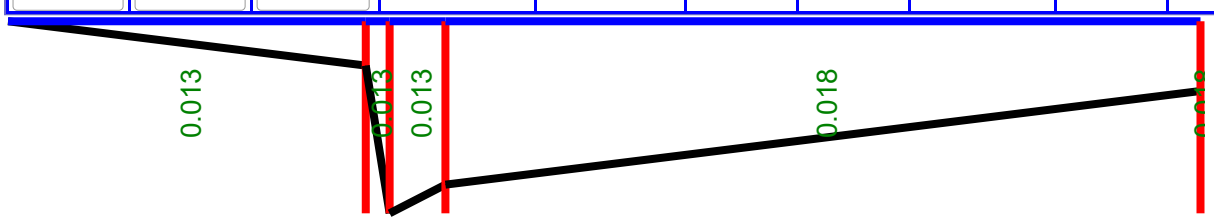
Results

Q	39.77	cfs

Fish Camp Max Q100=16.0 cfs < 39.77 cfs
Megansett Max Q100=32.0 cfs < 39.77 cfs

Cross section points +/- (or Copy/Paste using data area)

Point					Segment			Region					
Sta ft	Elev ft	n for segment	R_h, Q region boundary (Bank)	Bot. shear τ psf	T ft	P_w ft	A ft^2	R_h ft	Comp. n	v ft/sec	H_v ft	Fr	Q cfs
0	1			0.00									
7.5	0.85	0.013	☑	0.12	7.50	7.50	0.56	0.07	0.01	2.27	0.08	1.46	1.28
8	0.35	0.013	☑	0.51	0.50	0.71	0.20	0.28	0.01	5.51	0.47	1.54	1.10
9.17	0.447	0.013	☑	0.43	1.17	1.17	0.70	0.60	0.01	9.09	1.28	2.07	6.39
25	0.764	0.018	☑	0.18	15.83	15.83	6.25	0.39	0.02	4.96	0.38	1.39	31.00
25	0.764	0.018	☑	0.18	NaN	0.00	0.00	NaN	NaN	NaN	NaN	NaN	0.00



Notes

Composite n

This calculator follows HEC-RAS Reference Manual in calculating region composite n using Chow 1959, page 136, equation 6-17 (not 6-18).

Rock lining

Use the Manning Trapezoidal Channel Calculator to design rock lining. This calculator is more for natural sections.

Irregular Channel Manning Uniform Flow Calculator

Waterbury Filing No. 1

50' ROW 6" Curb Center Crown @ 1.50% - 7.5' Back Conveyance @ 2.0%

Inputs

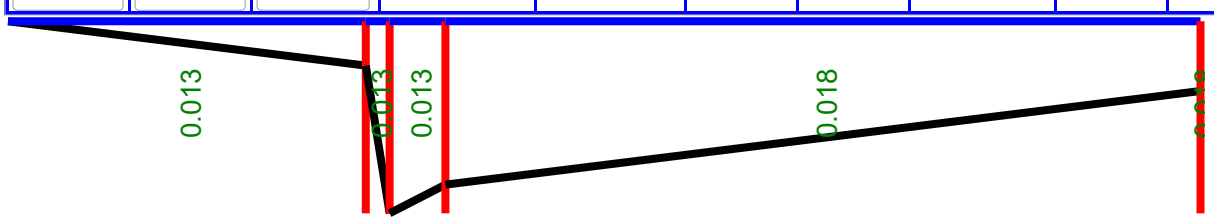
Water surface elevation	1	ft
Channel slope, S	1.50	% rise/run

Results

Q	43.57	cfs

Cross section points +/- (or Copy/Paste using data area)

Point					Segment			Region					
Sta ft	Elev ft	n for segment	R_h, Q region boundary (Bank)	Bot. shear τ psf	T ft	P_w ft	A ft^2	R_h ft	Comp. n	v ft/sec	H_v ft	Fr	Q cfs
0	1			0.00									
7.5	0.85	0.013	☑	0.14	7.50	7.50	0.56	0.07	0.01	2.49	0.10	1.60	1.40
8	0.35	0.013	☑	0.61	0.50	0.71	0.20	0.28	0.01	6.03	0.57	1.68	1.21
9.17	0.447	0.013	☑	0.52	1.17	1.17	0.70	0.60	0.01	9.95	1.54	2.26	7.00
25	0.764	0.018	☑	0.22	15.83	15.83	6.25	0.39	0.02	5.44	0.46	1.53	33.96
25	0.764	0.018	☐	0.22	NaN	0.00	0.00	NaN	NaN	NaN	NaN	NaN	0.00



Notes

Composite n

This calculator follows HEC-RAS Reference Manual in calculating region composite n using Chow 1959, page 136, equation 6-17 (not 6-18).

Rock lining

Use the Manning Trapezoidal Channel Calculator to design rock lining. This calculator is more for natural sections.

Saybrook Max Q100=12.0 cfs < 43.57 cfs
Sandy Neck Max Q100=16.0 cfs < 43.57 cfs
Fish Camp Max Q100=16.0 cfs < 43.57 cfs
Manor Haven Max Q100=13.0 cfs < 43.57 cfs
Beech Creek Max Q100=13.0 cfs < 43.57 cfs
Muddy Pond Max Q100=28.0 cfs < 43.57 cfs
Masonboro Max Q100=4.0 cfs < 43.57 cfs

Irregular Channel Manning Uniform Flow Calculator

Waterbury Filing No. 1

50' ROW 6" Curb Center Crown @ 1.75% - 7.5' Back Conveyance @ 2.0%

Inputs

Water surface elevation	1	ft
Channel slope, S	1.75	% rise/run

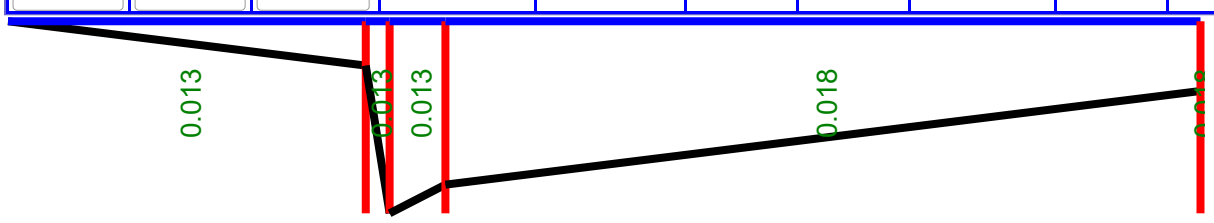
Results

Q	47.06	cfs

Muddy Pond Max Q100=28.0 cfs < 47.06 cfs

Cross section points +/- (or Copy/Paste using data area)

Point					Segment			Region					
Sta ft	Elev ft	n for segment	R_h, Q region boundary (Bank)	Bot. shear τ psf	T ft	P_w ft	A ft^2	R_h ft	Comp. n	v ft/sec	H_v ft	Fr	Q cfs
0	1			0.00									
7.5	0.85	0.013	☑	0.16	7.50	7.50	0.56	0.07	0.01	2.69	0.11	1.73	1.51
8	0.35	0.013	☑	0.71	0.50	0.71	0.20	0.28	0.01	6.52	0.66	1.82	1.30
9.17	0.447	0.013	☑	0.60	1.17	1.17	0.70	0.60	0.01	10.75	1.80	2.44	7.57
25	0.764	0.018	☑	0.26	15.83	15.83	6.25	0.39	0.02	5.87	0.54	1.65	36.68
25	0.764	0.018	☑	0.26	NaN	0.00	0.00	NaN	NaN	NaN	NaN	NaN	0.00



Notes

Composite n

This calculator follows HEC-RAS Reference Manual in calculating region composite n using Chow 1959, page 136, equation 6-17 (not 6-18).

Rock lining

Use the Manning Trapezoidal Channel Calculator to design rock lining. This calculator is more for natural sections.

Irregular Channel Manning Uniform Flow Calculator

Waterbury Filing No. 1

50' ROW 6" Curb Center Crown @ 2.00% - 7.5' Back Conveyance @ 2.0%

Inputs

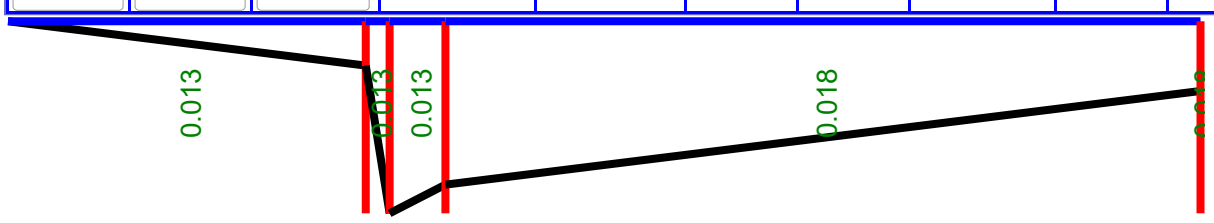
Water surface elevation	1	ft
Channel slope, S	2.0	% rise/run

Results

Q	50.31	cfs

Cross section points +/- (or Copy/Paste using data area)

Point					Segment			Region					
Sta ft	Elev ft	n for segment	R_h, Q region boundary (Bank)	Bot. shear τ psf	T ft	P_w ft	A ft^2	R_h ft	Comp. n	v ft/sec	H_v ft	Fr	Q cfs
0	1			0.00									
7.5	0.85	0.013	☑	0.19	7.50	7.50	0.56	0.07	0.01	2.87	0.13	1.85	1.62
8	0.35	0.013	☑	0.81	0.50	0.71	0.20	0.28	0.01	6.97	0.75	1.94	1.39
9.17	0.447	0.013	☑	0.69	1.17	1.17	0.70	0.60	0.01	11.49	2.05	2.61	8.09
25	0.764	0.018	☑	0.29	15.83	15.83	6.25	0.39	0.02	6.28	0.61	1.76	39.21
25	0.764	0.018	☐	0.29	NaN	0.00	0.00	NaN	NaN	NaN	NaN	NaN	0.00



Notes

Composite n

This calculator follows HEC-RAS Reference Manual in calculating region composite n using Chow 1959, page 136, equation 6-17 (not 6-18).

Rock lining

Use the Manning Trapezoidal Channel Calculator to design rock lining. This calculator is more for natural sections.

Sunken Meadow Max Q100=21.0 cfs < 50.31 cfs
Fish Camp Max Q100=16.0 cfs < 50.31 cfs
Manor Haven Max Q100=13.0 cfs < 50.31 cfs
Beech Creek Max Q100=13.0 cfs < 50.31 cfs
Muddy Pond Max Q100=28.0 cfs < 50.31 cfs
Megansett Max Q100=32.0 cfs < 50.31 cfs

Irregular Channel Manning Uniform Flow Calculator

Waterbury Filing No. 1

50' ROW 6" Curb Center Crown @ 2.25% - 7.5' Back Conveyance @ 2.0%

Inputs

Water surface elevation	1	ft
Channel slope, S	2.25	% rise/run

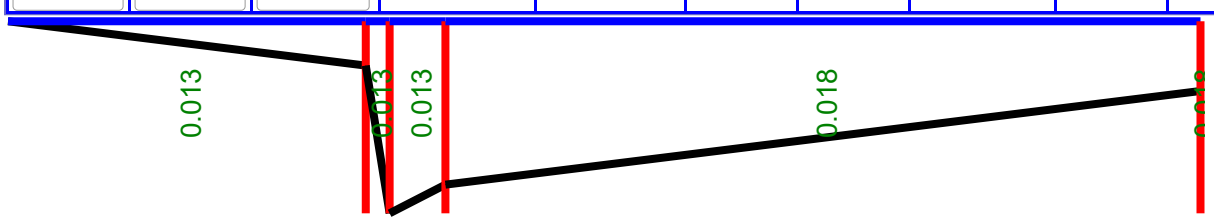
Results

Q	53.36	cfs

Sandy Neck Max Q100=16.0 cfs < 53.36 cfs
Muddy Pond Max Q100=28.0 cfs < 53.36 cfs

Cross section points +/- (or Copy/Paste using data area)

Point					Segment			Region					
Sta ft	Elev ft	n for segment	R_h, Q region boundary (Bank)	Bot. shear τ psf	T ft	P_w ft	A ft^2	R_h ft	Comp. n	v ft/sec	H_v ft	Fr	Q cfs
0	1			0.00									
7.5	0.85	0.013	☑	0.21	7.50	7.50	0.56	0.07	0.01	3.05	0.14	1.96	1.71
8	0.35	0.013	☑	0.91	0.50	0.71	0.20	0.28	0.01	7.39	0.85	2.06	1.48
9.17	0.447	0.013	☑	0.78	1.17	1.17	0.70	0.60	0.01	12.19	2.31	2.77	8.58
25	0.764	0.018	☑	0.33	15.83	15.83	6.25	0.39	0.02	6.66	0.69	1.87	41.59
25	0.764	0.018	☑	0.33	NaN	0.00	0.00	NaN	NaN	NaN	NaN	NaN	0.00



Notes

Composite n

This calculator follows HEC-RAS Reference Manual in calculating region composite n using Chow 1959, page 136, equation 6-17 (not 6-18).

Rock lining

Use the Manning Trapezoidal Channel Calculator to design rock lining. This calculator is more for natural sections.

Irregular Channel Manning Uniform Flow Calculator

Waterbury Filing No. 1

50' ROW 6" Curb Center Crown @ 2.50% - 7.5' Back Conveyance @ 2.0%

Inputs

Water surface elevation	1	ft
Channel slope, S	2.5	% rise/run

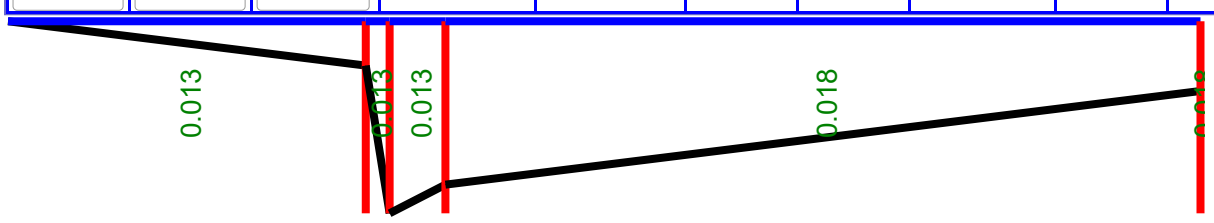
Results

Q	56.25	cfs

Sunken Meadow Max Q100=21.0 cfs < 56.25 cfs
Manor Haven Max Q100=13.0 cfs < 56.25 cfs
Sandy Neck Max Q100=16.0 cfs < 56.25 cfs

Cross section points +/- (or Copy/Paste using data area)

Point					Segment			Region					
Sta ft	Elev ft	n for seg-ment	R_h, Q region boundary (Bank)	Bot. shear τ psf	T ft	P_w ft	A ft^2	R_h ft	Comp. n	v ft/sec	H_v ft	Fr	Q cfs
0	1			0.00									
7.5	0.85	0.013	☑	0.23	7.50	7.50	0.56	0.07	0.01	3.21	0.16	2.07	1.81
8	0.35	0.013	☑	1.01	0.50	0.71	0.20	0.28	0.01	7.79	0.94	2.17	1.56
9.17	0.447	0.013	☑	0.86	1.17	1.17	0.70	0.60	0.01	12.85	2.57	2.92	9.04
25	0.764	0.018	☑	0.37	15.83	15.83	6.25	0.39	0.02	7.02	0.77	1.97	43.84
25	0.764	0.018	☑	0.37	NaN	0.00	0.00	NaN	NaN	NaN	NaN	NaN	0.00



Notes

Composite n

This calculator follows HEC-RAS Reference Manual in calculating region composite n using Chow 1959, page 136, equation 6-17 (not 6-18).

Rock lining

Use the Manning Trapezoidal Channel Calculator to design rock lining. This calculator is more for natural sections.

Irregular Channel Manning Uniform Flow Calculator

Waterbury Filing No. 1

50' ROW 6" Curb Center Crown @ 2.75% - 7.5' Back Conveyance @ 2.0%

Inputs

Water surface elevation	1	ft
Channel slope, S	2.75	% rise/run

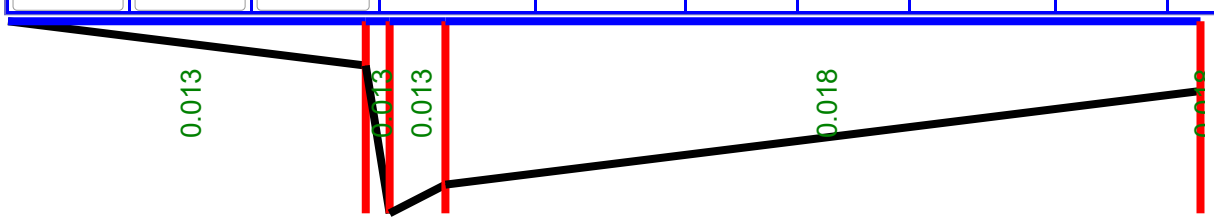
Results

Q	58.99	cfs

Beech Creek Max Q100=13.0 cfs < 58.99 cfs

Cross section points +/- (or Copy/Paste using data area)

Point					Segment			Region					
Sta ft	Elev ft	n for segment	R_h, Q region boundary (Bank)	Bot. shear τ psf	T ft	P_w ft	A ft^2	R_h ft	Comp. n	v ft/sec	H_v ft	Fr	Q cfs
0	1			0.00									
7.5	0.85	0.013	☑	0.26	7.50	7.50	0.56	0.07	0.01	3.37	0.18	2.17	1.90
8	0.35	0.013	☑	1.12	0.50	0.71	0.20	0.28	0.01	8.17	1.04	2.28	1.63
9.17	0.447	0.013	☑	0.95	1.17	1.17	0.70	0.60	0.01	13.48	2.82	3.06	9.48
25	0.764	0.018	☑	0.41	15.83	15.83	6.25	0.39	0.02	7.36	0.84	2.07	45.98
25	0.764	0.018	☑	0.41	NaN	0.00	0.00	NaN	NaN	NaN	NaN	NaN	0.00



Notes

Composite n

This calculator follows HEC-RAS Reference Manual in calculating region composite n using Chow 1959, page 136, equation 6-17 (not 6-18).

Rock lining

Use the Manning Trapezoidal Channel Calculator to design rock lining. This calculator is more for natural sections.

Irregular Channel Manning Uniform Flow Calculator

Waterbury Filing No. 1

50' ROW 6" Curb Center Crown @ 3.25% - 7.5' Back Conveyance @ 2.0%

Inputs

Water surface elevation	1	ft
Channel slope, S	3.25	% rise/run

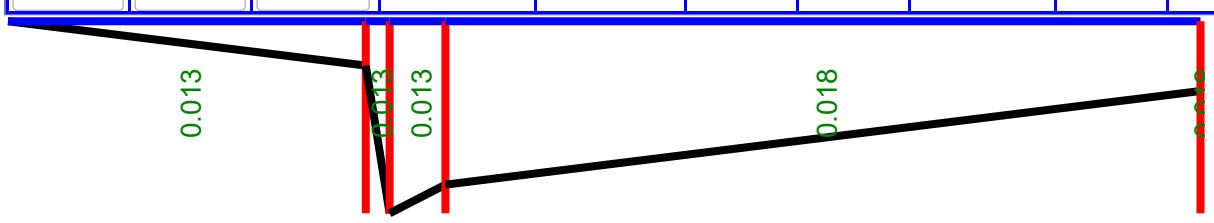
Results

Q	64.13	cfs

Sunken Meadow Max Q100=21.0 cfs < 64.13 cfs

Cross section points +/- (or Copy/Paste using data area)

Point					Segment			Region					
Sta ft	Elev ft	n for segment	R_h, Q region boundary (Bank)	Bot. shear τ psf	T ft	P_w ft	A ft^2	R_h ft	Comp. n	v ft/sec	H_v ft	Fr	Q cfs
0	1			0.00									
7.5	0.85	0.013	☑	0.30	7.50	7.50	0.56	0.07	0.01	3.66	0.21	2.36	2.06
8	0.35	0.013	☑	1.32	0.50	0.71	0.20	0.28	0.01	8.88	1.23	2.48	1.78
9.17	0.447	0.013	☑	1.12	1.17	1.17	0.70	0.60	0.01	14.65	3.34	3.33	10.31
25	0.764	0.018	☑	0.48	15.83	15.83	6.25	0.39	0.02	8.00	1.00	2.25	49.98
25	0.764	0.018	☑	0.48	NaN	0.00	0.00	NaN	NaN	NaN	NaN	NaN	0.00



Notes

Composite n

This calculator follows HEC-RAS Reference Manual in calculating region composite n using Chow 1959, page 136, equation 6-17 (not 6-18).

Rock lining

Use the Manning Trapezoidal Channel Calculator to design rock lining. This calculator is more for natural sections.

Irregular Channel Manning Uniform Flow Calculator

Waterbury Filing No. 1

50' ROW 6" Curb Center Crown @ 4.00% - 7.5' Back Conveyance @ 2.0%

Inputs

Water surface elevation	1	ft
Channel slope, S	4.00	% rise/run

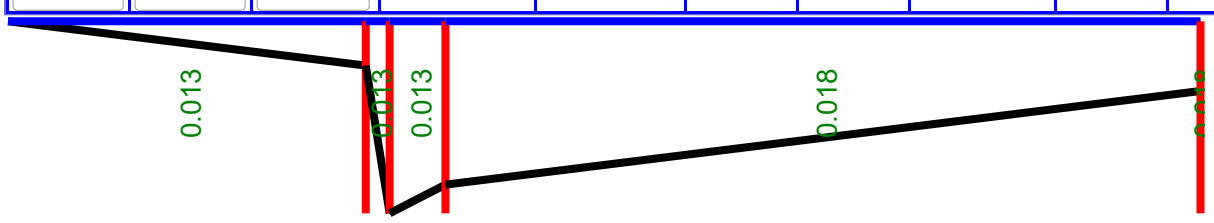
Results

Q	71.15	cfs

Sunken Meadow Max Q100=21.0 cfs < 71.15 cfs

Cross section points +/- (or Copy/Paste using data area)

Point					Segment			Region					
Sta ft	Elev ft	n for seg-ment	R_h, Q region boundary (Bank)	Bot. shear τ psf	T ft	P_w ft	A ft^2	R_h ft	Comp. n	v ft/sec	H_v ft	Fr	Q cfs
0	1			0.00									
7.5	0.85	0.013	☑	0.37	7.50	7.50	0.56	0.07	0.01	4.07	0.26	2.62	2.29
8	0.35	0.013	☑	1.62	0.50	0.71	0.20	0.28	0.01	9.85	1.51	2.75	1.97
9.17	0.447	0.013	☑	1.38	1.17	1.17	0.70	0.60	0.01	16.25	4.11	3.70	11.44
25	0.764	0.018	☑	0.59	15.83	15.83	6.25	0.39	0.02	8.88	1.23	2.49	55.45
25	0.764	0.018	☐	0.59	NaN	0.00	0.00	NaN	NaN	NaN	NaN	NaN	0.00



Notes

Composite n

This calculator follows HEC-RAS Reference Manual in calculating region composite n using Chow 1959, page 136, equation 6-17 (not 6-18).

Rock lining

Use the Manning Trapezoidal Channel Calculator to design rock lining. This calculator is more for natural sections.

Irregular Channel Manning Uniform Flow Calculator

Waterbury Filing No. 1

50' ROW 6" Curb Center Crown @ 4.50% - 7.5' Back Conveyance @ 2.0%

Inputs

Water surface elevation	1	ft
Channel slope, S	4.50	% rise/run

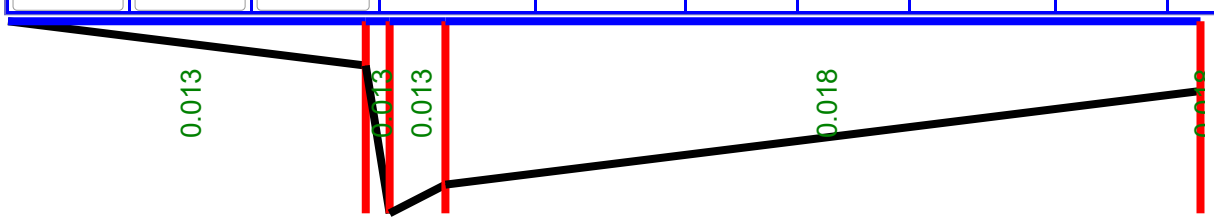
Results

Q	75.46	cfs

Fish Camp Max Q100=16.0 cfs < 75.46 cfs

Cross section points +/- (or Copy/Paste using data area)

Point					Segment			Region					
Sta ft	Elev ft	n for segment	R_h, Q region boundary (Bank)	Bot. shear τ psf	T ft	P_w ft	A ft^2	R_h ft	Comp. n	v ft/sec	H_v ft	Fr	Q cfs
0	1			0.00									
7.5	0.85	0.013	☑	0.42	7.50	7.50	0.56	0.07	0.01	4.31	0.29	2.78	2.43
8	0.35	0.013	☑	1.83	0.50	0.71	0.20	0.28	0.01	10.45	1.70	2.91	2.09
9.17	0.447	0.013	☑	1.55	1.17	1.17	0.70	0.60	0.01	17.24	4.62	3.92	12.13
25	0.764	0.018	☑	0.66	15.83	15.83	6.25	0.39	0.02	9.42	1.38	2.65	58.82
25	0.764	0.018	☐	0.66	NaN	0.00	0.00	NaN	NaN	NaN	NaN	NaN	0.00



Notes

Composite n

This calculator follows HEC-RAS Reference Manual in calculating region composite n using Chow 1959, page 136, equation 6-17 (not 6-18).

Rock lining

Use the Manning Trapezoidal Channel Calculator to design rock lining. This calculator is more for natural sections.

Irregular Channel Manning Uniform Flow Calculator

Waterbury Filing No. 1

50' ROW 6" Curb Center Crown @ 6.00% - 7.5' Back Conveyance @ 2.0%

Inputs

Water surface elevation	1	ft
Channel slope, S	6.00	% rise/run

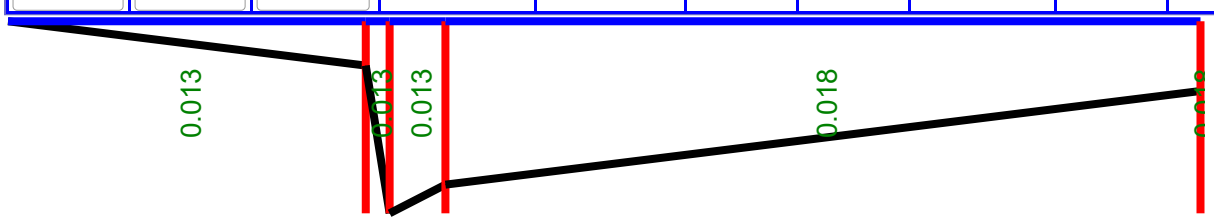
Results

Q	87.14	cfs

Fish Camp Max Q100=16.0 cfs < 87.14 cfs

Cross section points +/- (or Copy/Paste using data area)

Point					Segment			Region					
Sta ft	Elev ft	n for segment	R_h, Q region boundary (Bank)	Bot. shear τ psf	T ft	P_w ft	A ft^2	R_h ft	Comp. n	v ft/sec	H_v ft	Fr	Q cfs
0	1			0.00									
7.5	0.85	0.013	☑	0.56	7.50	7.50	0.56	0.07	0.01	4.98	0.39	3.21	2.80
8	0.35	0.013	☑	2.43	0.50	0.71	0.20	0.28	0.01	12.06	2.26	3.37	2.41
9.17	0.447	0.013	☑	2.07	1.17	1.17	0.70	0.60	0.01	19.90	6.16	4.53	14.01
25	0.764	0.018	☑	0.88	15.83	15.83	6.25	0.39	0.02	10.88	1.84	3.06	67.91
25	0.764	0.018	☑	0.88	NaN	0.00	0.00	NaN	NaN	NaN	NaN	NaN	0.00



Notes

Composite n

This calculator follows HEC-RAS Reference Manual in calculating region composite n using Chow 1959, page 136, equation 6-17 (not 6-18).

Rock lining

Use the Manning Trapezoidal Channel Calculator to design rock lining. This calculator is more for natural sections.

Irregular Channel Manning Uniform Flow Calculator

Waterbury Filing No. 1

70' ROW 6" Curb Center Crown @ 0.55% - 17.5' Back Conveyance @ 2.0%

Inputs

Water surface elevation	1	ft
Channel slope, S	0.55	% rise/run

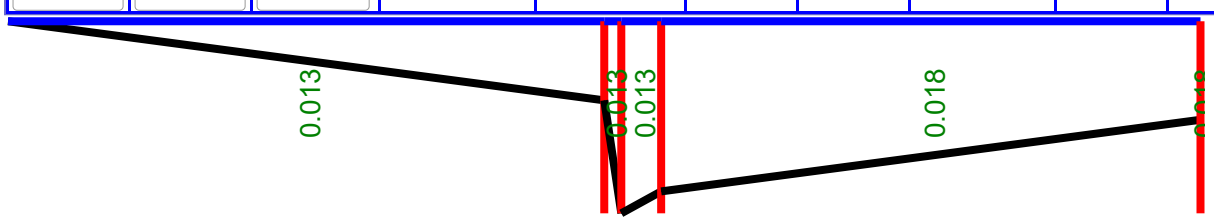
Results

Q	57.13	cfs

Gilbert Max Q100=7.0 cfs < 57.13 cfs

Cross section points +/- (or Copy/Paste using data area)

Point					Segment			Region					
Sta ft	Elev ft	n for segment	R_h, Q region boundary (Bank)	Bot. shear τ psf	T ft	P_w ft	A ft^2	R_h ft	Comp. n	v ft/sec	H_v ft	Fr	Q cfs
0	1			0.00									
17.5	0.65	0.013	☑	0.12	17.50	17.50	3.06	0.17	0.01	2.65	0.11	1.12	8.12
18	0.15	0.013	☑	0.29	0.50	0.71	0.30	0.42	0.01	4.79	0.36	1.09	1.44
19.17	0.247	0.013	☑	0.26	1.17	1.17	0.94	0.80	0.01	7.30	0.83	1.44	6.84
35	0.564	0.018	☑	0.15	15.83	15.83	9.41	0.59	0.02	4.33	0.29	0.99	40.73
35	0.564	0.018	☐	0.15	NaN	0.00	0.00	NaN	NaN	NaN	NaN	NaN	0.00



Notes

Composite n

This calculator follows HEC-RAS Reference Manual in calculating region composite n using Chow 1959, page 136, equation 6-17 (not 6-18).

Rock lining

Use the Manning Trapezoidal Channel Calculator to design rock lining. This calculator is more for natural sections.

Irregular Channel Manning Uniform Flow Calculator

Waterbury Filing No. 1

70' ROW 6" Curb Center Crown @ 0.55% - 17.5' Back Conveyance @ 2.0%

Inputs

Water surface elevation	1	ft
Channel slope, S	1.5	% rise/run

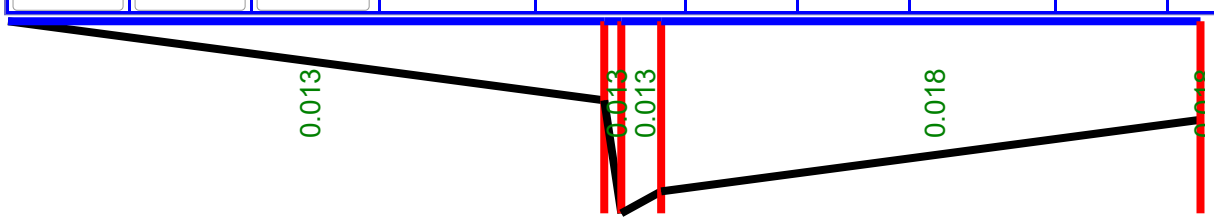
Results

Q	94.35	cfs

Gilbert Max Q100=7.0 cfs < 94.35 cfs

Cross section points +/- (or Copy/Paste using data area)

Point					Segment			Region					
Sta ft	Elev ft	n for segment	R_h, Q region boundary (Bank)	Bot. shear τ psf	T ft	P_w ft	A ft^2	R_h ft	Comp. n	v ft/sec	H_v ft	Fr	Q cfs
0	1			0.00									
17.5	0.65	0.013	☑	0.33	17.50	17.50	3.06	0.17	0.01	4.38	0.30	1.85	13.41
18	0.15	0.013	☑	0.80	0.50	0.71	0.30	0.42	0.01	7.90	0.97	1.80	2.37
19.17	0.247	0.013	☑	0.71	1.17	1.17	0.94	0.80	0.01	12.05	2.26	2.37	11.30
35	0.564	0.018	☑	0.41	15.83	15.83	9.41	0.59	0.02	7.15	0.79	1.63	67.26
35	0.564	0.018	☐	0.41	NaN	0.00	0.00	NaN	NaN	NaN	NaN	NaN	0.00



Notes

Composite n

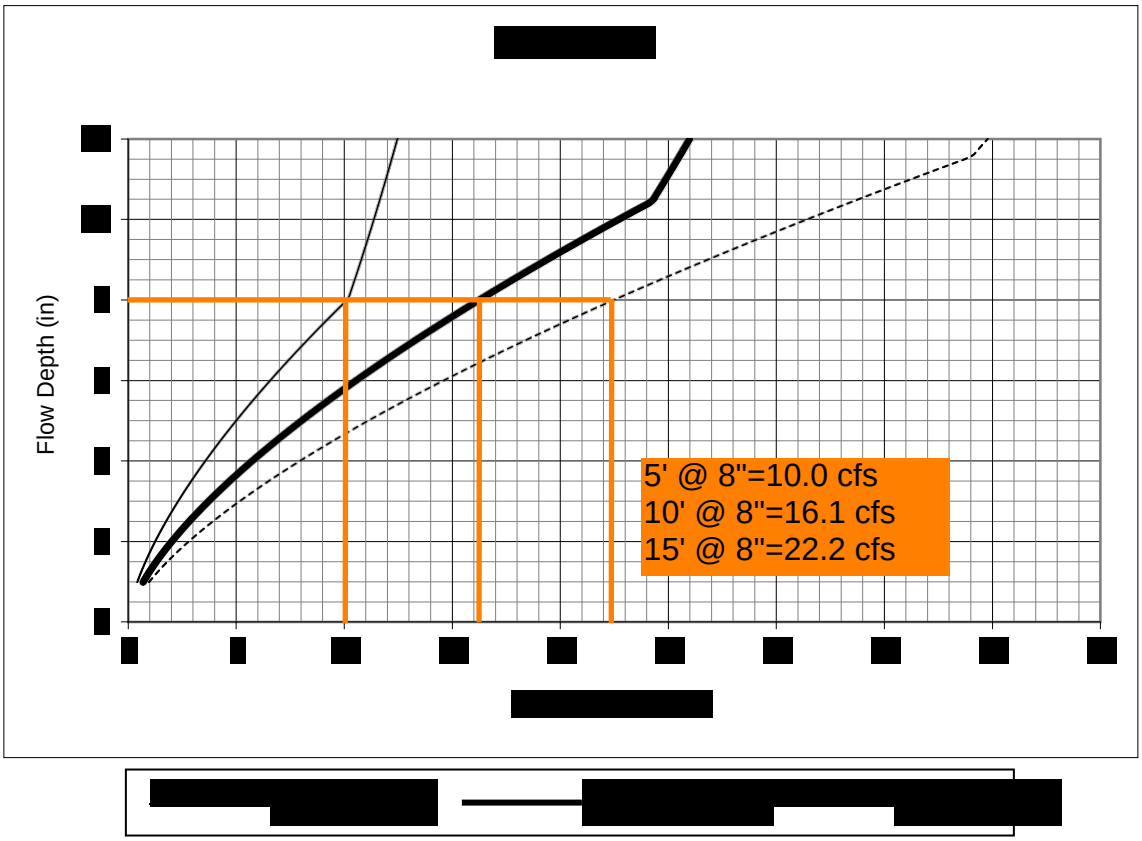
This calculator follows HEC-RAS Reference Manual in calculating region composite n using Chow 1959, page 136, equation 6-17 (not 6-18).

Rock lining

Use the Manning Trapezoidal Channel Calculator to design rock lining. This calculator is more for natural sections.

INLET CALCULATIONS

Figure 8-11. Inlet Capacity Chart Sump Conditions , Curb Opening (Type R) Inlet



DP 1 (10') Q100=12.0 cfs < 16.1 cfs
DP 2 (5') Q100=4.0 cfs < 10.0 cfs
DP 3 (5') Q100=8.0 cfs < 10.0 cfs
DP 4 (10') Q100=13.0 cfs < 16.1 cfs
DP 5 (10') Q100=16.0 cfs < 16.1 cfs
DP 6 (5') Q100=8.0 cfs < 10.0 cfs
DP 7 (5') Q100=8.0 cfs < 10.0 cfs
DP 14 (10') Q100=13.0 cfs < 16.1 cfs
DP 15 (5') Q100=7.0 cfs < 10.0 cfs
DP 16 (10') Q100=10.0 cfs < 16.1 cfs
DP 17 (5') Q100=2.0 cfs < 10.0 cfs
DP 19 (10') Q100=16.0 cfs < 16.1 cfs
DP 20 (5') Q100=7.0 cfs < 10.0 cfs
DP 22 (15') Q100=19.0 cfs < 22.2 cfs
DP 23 (15') Q100=19.0 cfs < 22.2 cfs

DP 24 (5') Q100=6.0 cfs < 10.0 cfs
DP 25 (5') Q100=7.0 cfs < 10.0 cfs
DP 26 (10') Q100=16.0 cfs < 16.1 cfs
DP 27 (5') Q100=7.0 cfs < 10.0 cfs
DP 28 ((2) 10') Q100=21.0cfs/2=10.5 cfs < 16.1 cfs

Notes:

1. The standard inlet parameters must apply to use this chart.

The inlets used have no modifications or deviations and therefore are standard per the Type R specifications

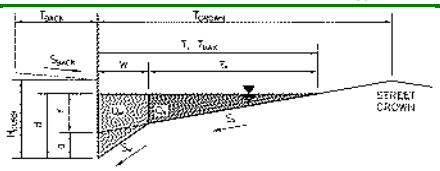
Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Gold Hill Mesa Filing No. 13

Inlet ID: Inlet DP 7A



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	13.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.041	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	23.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.013	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	23.0	23.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.4	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	5.52	5.52	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline	d =	7.03	7.03	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	21.0	21.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.256	0.256	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	24.2	24.2	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	8.3	8.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.2	0.2	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**32.7**	**32.7**	**cfs**
Flow Velocity within the Gutter Section	V =	8.3	8.3	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	4.9	4.9	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	18.7	45.4	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	16.7	43.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.318	0.125	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	13.1	167.4	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	13.1	138.7	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	6.1	24.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	22.1	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	19.3	184.8	cfs
Average Flow Velocity Within the Gutter Section	V =	7.3	12.6	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	3.7	13.1	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**19.3**	**184.9**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	6.00	12.40	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	5.37	inches

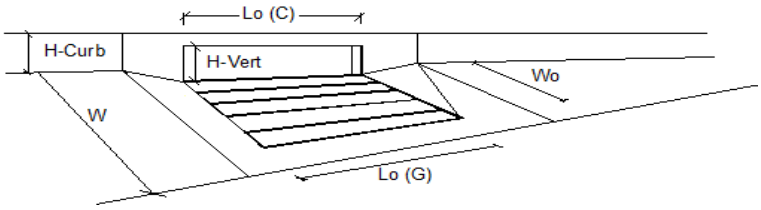
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**19.3**	**32.7**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1**	**2**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0**	**1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**98**	**72**	**%**

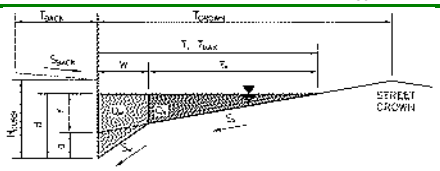
Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Gold Hill Mesa Filing No. 13

Inlet ID: Inlet DP 7B



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.9	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.100	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	43.5	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.013	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	31.5	43.5	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

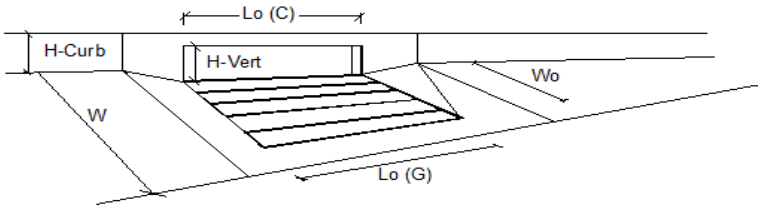
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**19.3**	**32.3**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1**	**2**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0**	**1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**91**	**63**	**%**

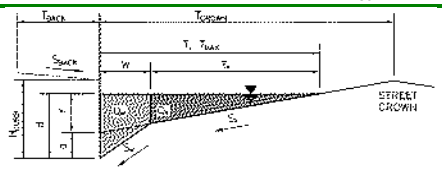
Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Gold Hill Mesa Filing No. 13

Inlet ID: Inlet DP 21



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.5	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.018	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	11.5	17.5	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

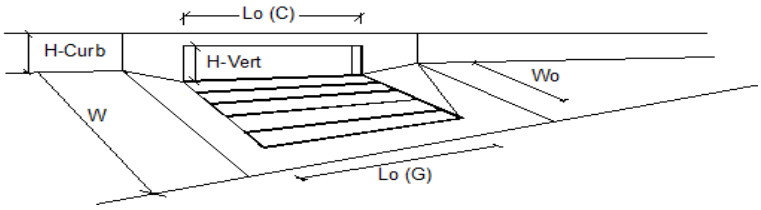
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**7.0**	**19.0**	**cfs**

WARNING: MINOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'

WARNING: MAJOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017

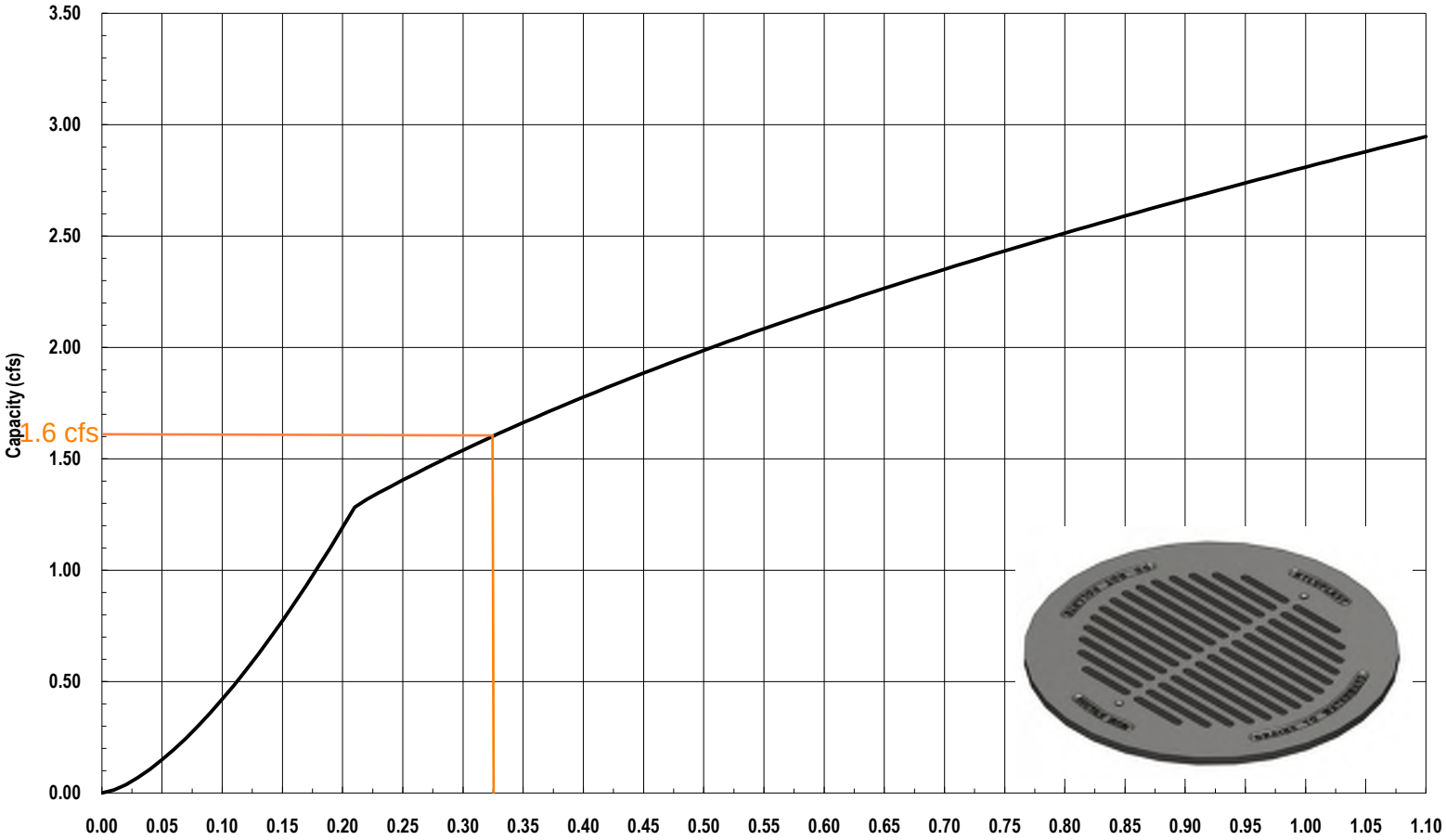


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MINOR & MAJOR STORM		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**7**	**11**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**5**	**17**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**61**	**39**	**%**

Nyloplast 18" Drop In Grate Inlet Capacity Chart

REAR YARD PRIVATE AREA INLETS

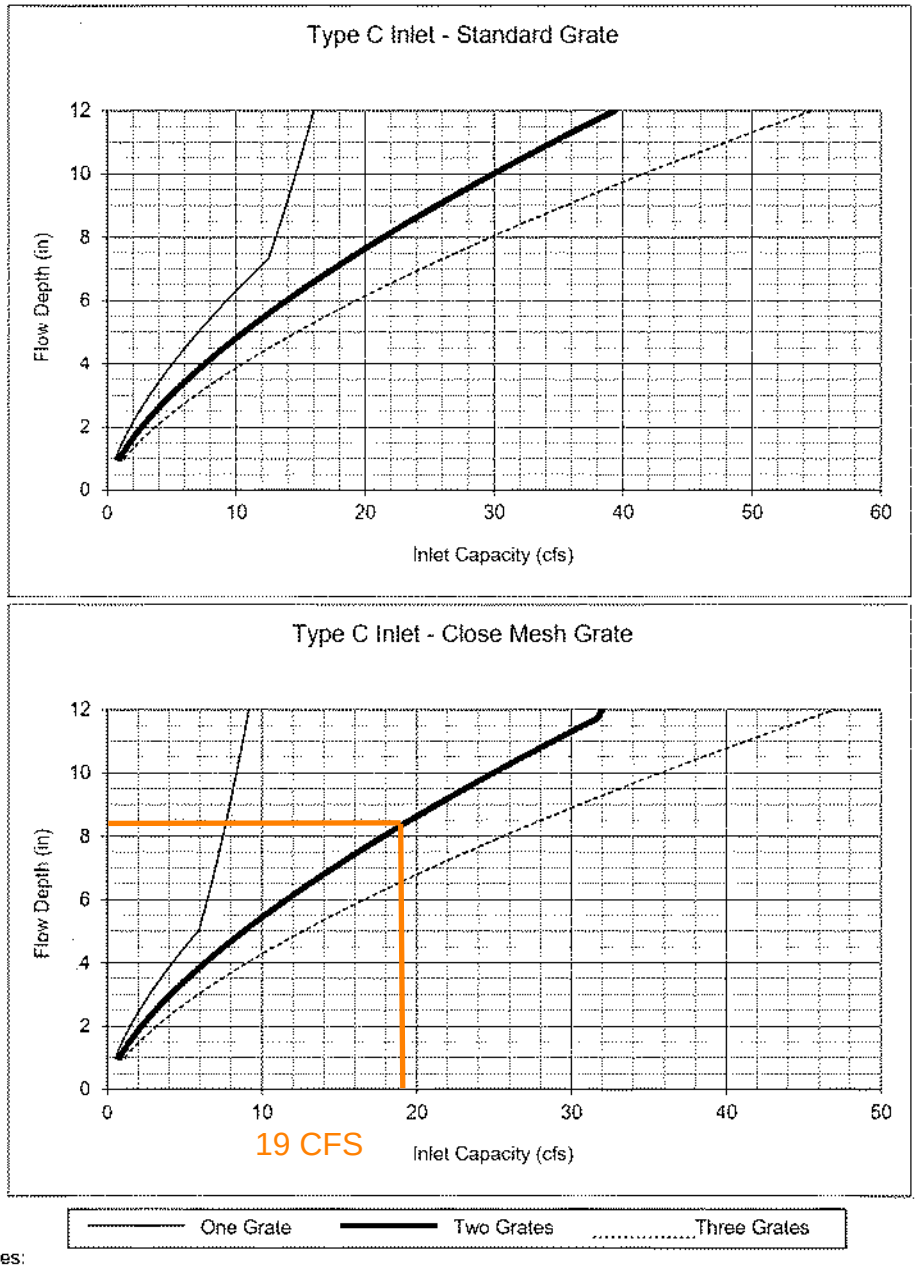


DP 31 Q100= 3 cfs / 3 Inlets = 1 cfs < 1.6 cfs
DP 32 Q100= 2 cfs / 2 Inlets = 1 cfs < 1.6 cfs
DP 33 Q100= 3 cfs / 4 Inlets = 0.75 cfs < 1.6 cfs
DP 34 Q100= 2 cfs / 3 Inlets = 0.66 cfs < 1.6 cfs

Nyloplast
3130 Verona Avenue • Buford, GA 30518
(866) 888-8479 / (770) 932-2443 • Fax: (770) 932-2490
© Nyloplast Inlet Capacity Charts June 2012

DP 9 TYPE C INLETS

Figure 8-10. Inlet Capacity Chart Sump Conditions, Area (Type C) Inlet

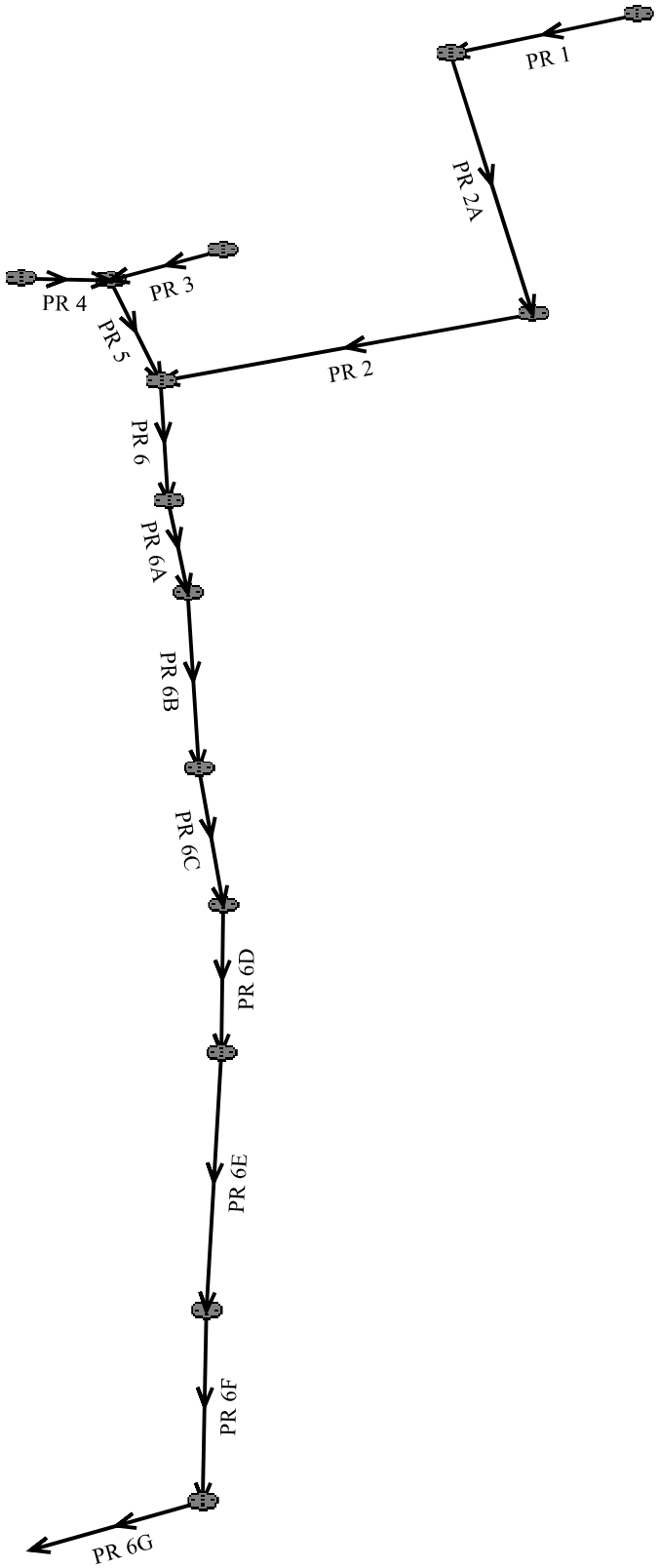


ACTUAL DEPTH =12"
(6974-6973=1')

Notes:
1. The standard inlet parameters must apply to use these charts.

HGL CALCULATIONS

PR 1-7 & ASSOCIATED LATERALS LAYOUT



Program: UDSEWER Math Model Interface 2.1.1.4
Run Date: 11/26/2024 1:58:57 PM

UDSewer Results Summary

Project Title: New UDSEWER System Module PR 1-7 AND ASSOCIATED LATERALS
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.52
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6926.76

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
FSD 1	6925.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 7	6932.90	22.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PR 6G	6933.90	16.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 6F	6936.71	16.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 6E	6938.56	16.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 6D	6939.06	16.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 6C	6939.59	16.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 6B	6940.10	16.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 6A	6941.78	16.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 6	6941.39	16.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 2	6941.19	7.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 2A	6943.36	7.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 1	6943.36	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 5	6940.83	9.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 3	6941.09	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 4	6941.09	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
FSD 1	0.00	0.00	0.00	0.00	0.00	2.00	11.03	0.85	22.00	Surface Water Present (Upstream)
PR 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.00	Surface Water Present (Downstream)
PR 6G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.00	
PR 6F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.00	
PR 6E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.00	
PR 6D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.00	
PR 6C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.00	
PR 6B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.00	
PR 6A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.00	
PR 6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.00	
PR 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.00	
PR 2A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.00	
PR 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	
PR 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.00	
PR 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00	
PR 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	

Sewer Input Summary:

	Elevation	Loss Coefficients	Given Dimensions

Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
PR 7	158.59	6925.57	0.7	6926.68	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
PR 6G	32.50	6927.18	1.0	6927.50	0.013	0.12	0.00	CIRCULAR	36.00 in	36.00 in
PR 6F	205.18	6928.06	1.2	6930.52	0.013	0.85	0.00	CIRCULAR	36.00 in	36.00 in
PR 6E	120.81	6930.55	1.2	6932.00	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 6D	30.31	6932.52	0.7	6932.73	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 6C	32.90	6932.73	0.7	6932.96	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 6B	32.35	6932.96	0.7	6933.19	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 6A	116.94	6933.19	0.7	6934.01	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 6	54.42	6934.01	0.7	6934.39	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 2	300.04	6934.96	0.6	6936.69	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
PR 2A	159.48	6937.19	0.6	6938.15	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
PR 1	38.58	6938.68	1.0	6939.07	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PR 5	52.76	6935.39	1.5	6936.18	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
PR 3	26.98	6936.68	2.0	6937.22	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PR 4	5.25	6936.68	1.9	6936.78	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PR 7	55.95	7.92	18.10	6.18	15.68	7.44	1.32	Supercritical	22.00	0.00	
PR 6G	66.88	9.46	15.32	5.58	11.99	7.77	1.60	Supercritical	16.00	0.00	
PR 6F	73.26	10.36	15.32	5.58	11.43	8.30	1.76	Supercritical	16.00	0.00	
PR 6E	73.26	10.36	15.32	5.58	11.43	8.30	1.76	Supercritical	16.00	0.00	
PR 6D	55.95	7.92	15.32	5.58	13.18	6.83	1.34	Supercritical	16.00	0.00	
PR 6C	55.95	7.92	15.32	5.58	13.18	6.83	1.34	Supercritical	16.00	0.00	
PR 6B	55.95	7.92	15.32	5.58	13.18	6.83	1.34	Supercritical	16.00	0.00	
PR 6A	55.95	7.92	15.32	5.58	13.18	6.83	1.34	Supercritical	16.00	0.00	
PR 6	55.95	7.92	15.32	5.58	13.18	6.83	1.34	Supercritical	16.00	0.00	
PR 2	31.23	6.36	10.53	4.55	9.65	5.13	1.18	Supercritical	7.00	0.00	
PR 2A	31.86	6.49	10.53	4.55	9.55	5.20	1.21	Supercritical	7.00	0.00	
PR 1	10.53	5.96	6.40	3.55	5.31	4.59	1.43	Supercritical	2.00	0.00	
PR 5	27.78	8.84	12.85	5.26	9.40	7.89	1.82	Supercritical	9.00	0.00	
PR 3	14.90	8.43	9.18	4.41	6.37	7.15	2.02	Supercritical	4.00	0.00	
PR 4	14.52	8.22	11.35	5.11	8.06	7.82	1.92	Supercritical	6.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
PR 7	22.00	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
PR 6G	16.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
PR 6F	16.00	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
PR 6E	16.00	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
PR 6D	16.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
PR 6C	16.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
PR 6B	16.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
PR 6A	16.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
PR 6	16.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
PR 2	7.00	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
PR 2A	7.00	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
PR 1	2.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 5	9.00	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
PR 3	4.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 4	6.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6926.76

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PR 7	6925.57	6926.68	0.00	0.00	6926.88	6928.19	6927.74	1.05	6928.78
PR 6G	6927.18	6927.50	0.01	0.00	6928.20	6928.78	6929.11	0.15	6929.26
PR 6F	6928.06	6930.52	0.07	0.00	6929.01	6931.80	6930.08	2.20	6932.28
PR 6E	6930.55	6932.00	0.00	0.00	6931.80	6933.28	6932.57	1.19	6933.76
PR 6D	6932.52	6932.73	0.00	0.00	6933.62	6934.01	6934.34	0.15	6934.49
PR 6C	6932.73	6932.96	0.00	0.00	6934.01	6934.24	6934.55	0.17	6934.72
PR 6B	6932.96	6933.19	0.00	0.00	6934.24	6934.47	6934.79	0.16	6934.95

PR 6A	6933.19	6934.01	0.00	0.00	6934.47	6935.29	6935.01	0.76	6935.77
PR 6	6934.01	6934.39	0.00	0.00	6935.29	6935.67	6935.83	0.32	6936.15
PR 2	6934.96	6936.69	0.04	0.00	6935.73	6937.57	6936.19	1.70	6937.89
PR 2A	6937.19	6938.15	0.04	0.00	6937.99	6939.03	6938.41	0.94	6939.35
PR 1	6938.68	6939.07	0.03	0.00	6939.13	6939.60	6939.45	0.35	6939.80
PR 5	6935.39	6936.18	0.01	0.00	6936.17	6937.25	6937.14	0.54	6937.68
PR 3	6936.68	6937.22	0.11	0.00	6937.36	6937.99	6938.00	0.28	6938.29
PR 4	6936.68	6936.78	0.24	0.00	6937.49	6938.10	6938.30	0.00	6938.30

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

TNES Note:
Downstream elevation for Pipe Run 2 was modified slightly from design values in the 5-year condition only, in order to eliminate backwater errors given by UDSewer. This change will have a negligible effect on the HGL calculations.

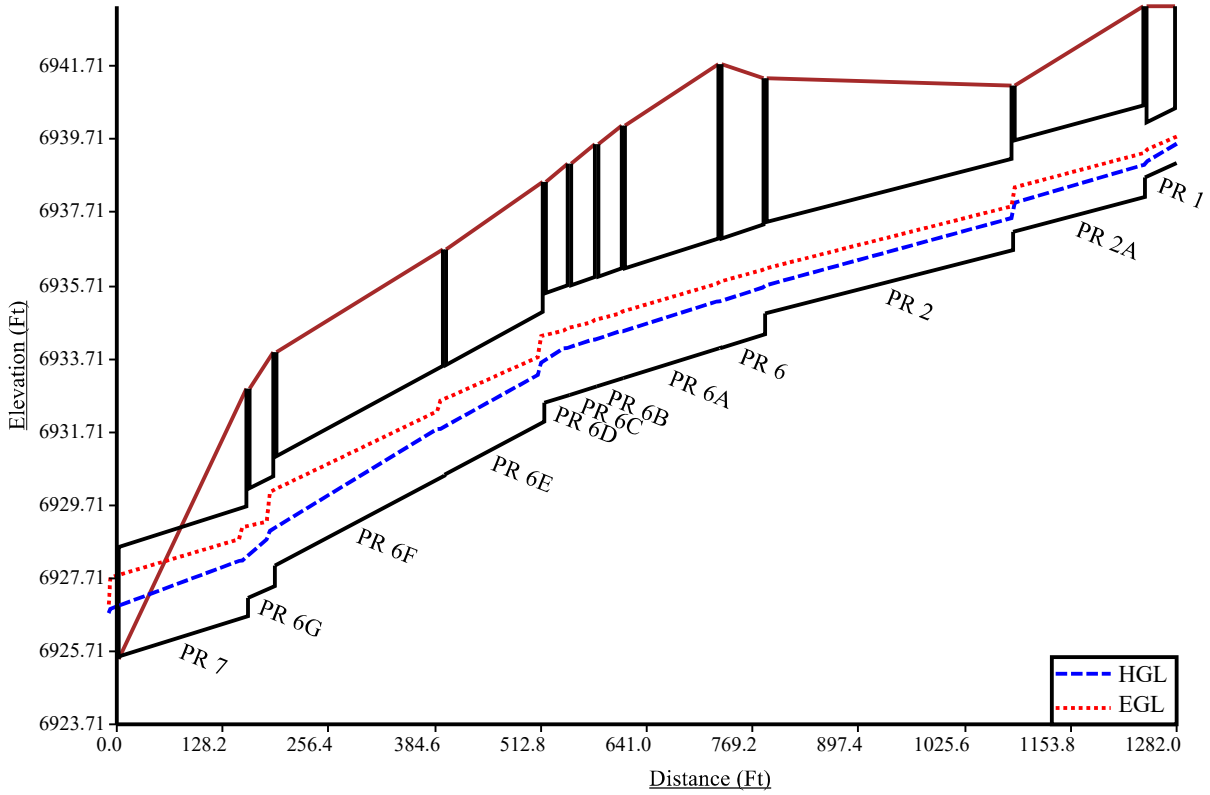
The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
PR 7	158.59	4.00	6.00	6.67	0.00	0.76	0.00	10.44	7.05	2.89	163.50	Sewer Too Shallow
PR 6G	32.50	4.00	6.00	6.67	9.45	6.56	2.39	10.80	7.23	3.07	59.07	
PR 6F	205.18	4.00	6.00	6.67	9.68	6.68	2.51	10.38	7.02	2.86	368.75	
PR 6E	120.81	4.00	6.00	6.67	10.32	6.99	2.83	11.12	7.39	3.23	233.13	
PR 6D	30.31	4.00	6.00	6.67	10.08	6.88	2.71	10.66	7.16	3.00	56.41	
PR 6C	32.90	4.00	6.00	6.67	10.66	7.16	3.00	11.26	7.46	3.30	65.05	
PR 6B	32.35	4.00	6.00	6.67	11.25	7.46	3.29	11.82	7.74	3.58	67.85	
PR 6A	116.94	4.00	6.00	6.67	11.82	7.74	3.58	13.54	8.60	4.44	275.92	
PR 6	54.42	4.00	6.00	6.67	13.54	8.60	4.44	12.00	7.83	3.67	129.51	
PR 2	300.04	3.50	6.00	6.08	11.36	7.22	3.64	7.50	5.29	1.71	464.42	Sewer Too Shallow
PR 2A	159.48	3.50	6.00	6.08	6.49	4.79	1.21	8.92	6.00	2.42	199.92	Sewer Too Shallow
PR 1	38.58	2.50	4.00	4.92	8.85	5.22	2.97	8.08	4.83	2.58	39.85	
PR 5	52.76	3.00	4.00	5.50	11.00	6.58	3.75	8.30	5.23	2.40	72.82	
PR 3	26.98	2.50	4.00	4.92	7.80	4.69	2.44	7.24	4.41	2.16	24.07	
PR 4	5.25	2.50	4.00	4.92	7.80	4.69	2.44	8.12	4.85	2.60	5.01	

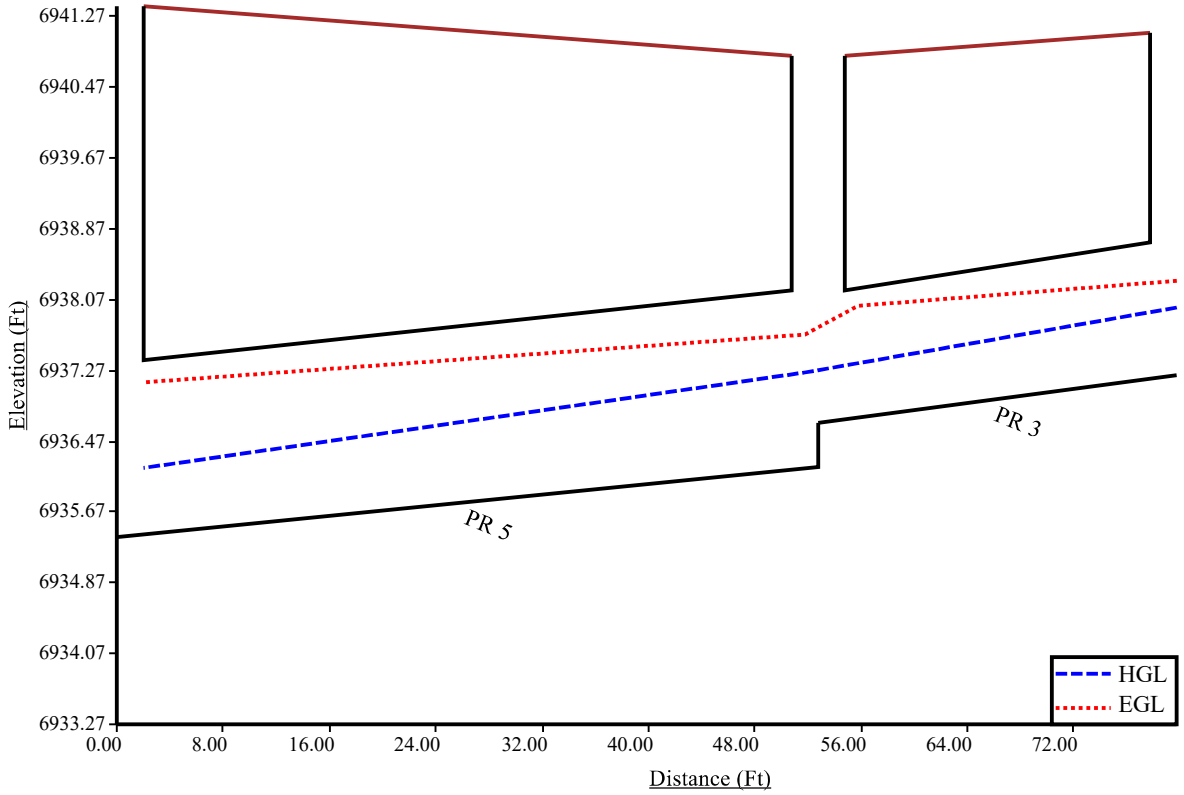
Total earth volume for sewer trenches = 2225 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:

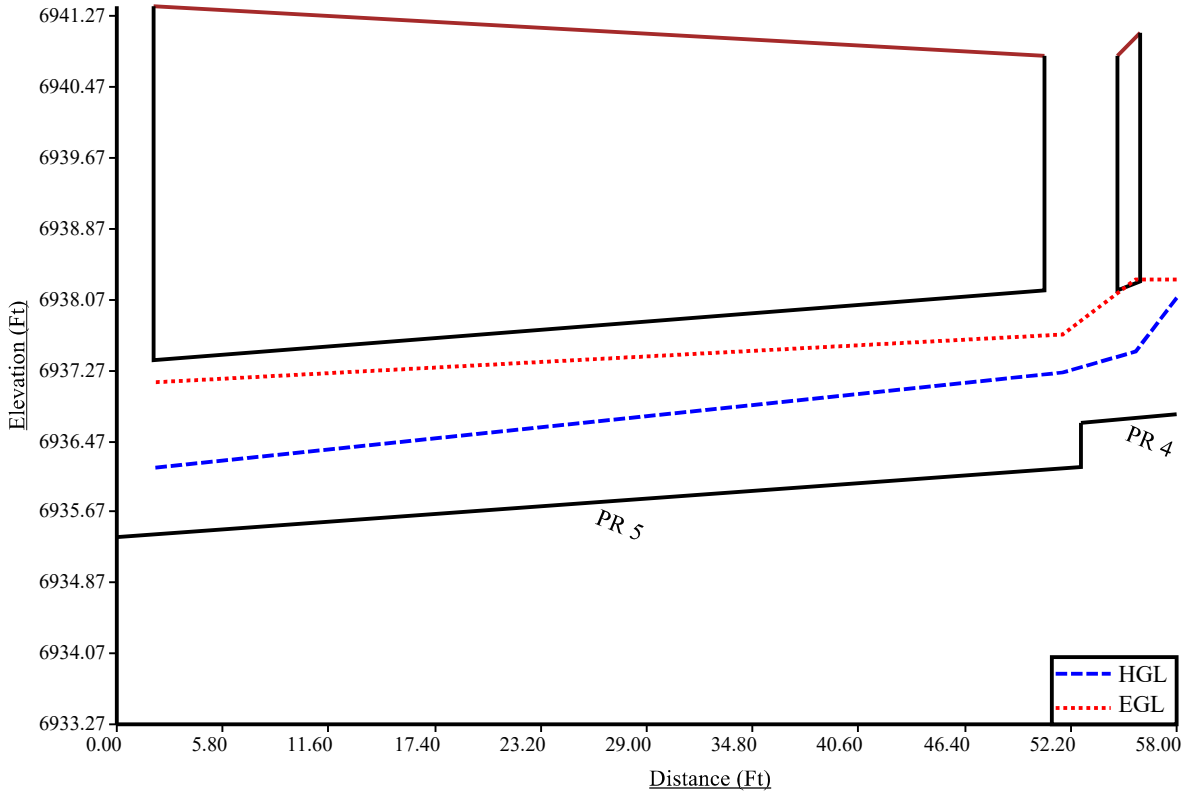
PR 1-7 5-YR HGL Profile



PR 3&5 5-YR HGL Profile



PR 4&5 5-YR HGL Profile



Program: UDSEWER Math Model Interface 2.1.1.4
Run Date: 11/26/2024 2:04:17 PM

UDSewer Results Summary

Project Title: New UDSEWER System Module
Project Description: Default system

PR 1-7 AND ASSOCIATED LATERALS

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 2.52
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6927.70

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
FSD 1	6925.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 7	6932.90	48.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PR 6G	6933.90	35.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 6F	6936.71	35.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 6E	6938.56	35.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 6D	6939.06	35.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 6C	6939.59	35.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 6B	6940.10	35.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 6A	6941.78	35.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 6	6941.39	35.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 2	6941.19	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 2A	6943.36	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 1	6943.36	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 5	6940.83	21.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 3	6941.09	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 4	6941.09	13.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
FSD 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.00	Surface Water Present (Upstream)
PR 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.00	Surface Water Present (Downstream)
PR 6G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.00	
PR 6F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.00	
PR 6E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.00	
PR 6D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.00	
PR 6C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.00	
PR 6B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.00	
PR 6A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.00	
PR 6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.00	
PR 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	
PR 2A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	
PR 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00	
PR 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.00	
PR 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	
PR 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.00	

Sewer Input Summary:

	Elevation	Loss Coefficients	Given Dimensions

Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
PR 7	158.59	6925.57	0.7	6926.68	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
PR 6G	32.50	6927.18	1.0	6927.50	0.013	0.12	0.00	CIRCULAR	36.00 in	36.00 in
PR 6F	205.18	6928.06	1.2	6930.52	0.013	0.85	0.00	CIRCULAR	36.00 in	36.00 in
PR 6E	120.81	6930.55	1.2	6932.00	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 6D	30.31	6932.52	0.7	6932.73	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 6C	32.90	6932.73	0.7	6932.96	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 6B	32.35	6932.96	0.7	6933.19	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 6A	116.94	6933.19	0.7	6934.01	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 6	54.42	6934.01	0.7	6934.39	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 2	300.04	6934.89	0.6	6936.69	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
PR 2A	159.48	6937.19	0.6	6938.15	0.013	1.32	0.00	CIRCULAR	30.00 in	30.00 in
PR 1	38.58	6938.68	1.0	6939.07	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PR 5	52.76	6935.39	1.5	6936.18	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
PR 3	26.98	6936.68	2.0	6937.22	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PR 4	5.25	6936.68	1.9	6936.78	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PR 7	55.95	7.92	27.07	8.42	25.68	8.90	1.11	Supercritical	48.00	0.00	
PR 6G	66.88	9.46	23.07	7.32	18.49	9.57	1.53	Supercritical	35.00	0.00	
PR 6F	73.26	10.36	23.07	7.32	17.53	10.25	1.69	Supercritical	35.00	0.00	
PR 6E	73.26	10.36	23.07	7.32	17.53	10.25	1.69	Supercritical	35.00	0.00	
PR 6D	55.95	7.92	23.07	7.32	20.63	8.35	1.24	Supercritical	35.00	0.00	
PR 6C	55.95	7.92	23.07	7.32	20.63	8.35	1.24	Supercritical	35.00	0.00	
PR 6B	55.95	7.92	23.07	7.32	20.63	8.35	1.24	Supercritical	35.00	0.00	
PR 6A	55.95	7.92	23.07	7.32	20.63	8.35	1.24	Supercritical	35.00	0.00	
PR 6	55.95	7.92	23.07	7.32	20.63	8.35	1.24	Supercritical	35.00	0.00	
PR 2	31.86	6.49	15.67	5.78	14.48	6.39	1.16	Supercritical	15.00	0.00	
PR 2A	31.86	6.49	15.67	5.78	14.48	6.39	1.16	Supercritical	15.00	0.00	
PR 1	10.53	5.96	9.18	4.41	7.69	5.55	1.40	Supercritical	4.00	0.00	
PR 5	27.78	8.84	19.70	7.61	15.59	9.72	1.61	Supercritical	21.00	0.00	
PR 3	14.90	8.43	13.15	5.78	9.39	8.58	1.92	Pressurized	8.00	26.98	
PR 4	14.52	8.22	16.21	7.76	13.29	9.29	1.59	Pressurized	13.00	5.25	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
PR 7	48.00	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
PR 6G	35.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
PR 6F	35.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
PR 6E	35.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
PR 6D	35.00	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
PR 6C	35.00	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
PR 6B	35.00	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
PR 6A	35.00	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
PR 6	35.00	CIRCULAR	36.00 in	36.00 in	33.00 in	33.00 in	36.00 in	36.00 in	7.07	
PR 2	15.00	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	
PR 2A	15.00	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	
PR 1	4.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 5	21.00	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
PR 3	8.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 4	13.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6927.70

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PR 7	6925.57	6926.68	0.00	0.00	6927.71	6928.94	6928.94	1.10	6930.04
PR 6G	6927.18	6927.50	0.05	0.00	6928.98	6929.42	6930.14	0.12	6930.25
PR 6F	6928.06	6930.52	0.32	0.00	6929.75	6932.44	6931.15	2.12	6933.27
PR 6E	6930.55	6932.00	0.02	0.00	6932.46	6933.92	6933.64	1.11	6934.75
PR 6D	6932.52	6932.73	0.02	0.00	6934.24	6934.65	6935.32	0.16	6935.48
PR 6C	6932.73	6932.96	0.02	0.00	6934.67	6934.88	6935.53	0.18	6935.71
PR 6B	6932.96	6933.19	0.02	0.00	6934.90	6935.11	6935.77	0.18	6935.94

PR 6A	6933.19	6934.01	0.02	0.00	6935.13	6935.93	6935.99	0.77	6936.76
PR 6	6934.01	6934.39	0.02	0.00	6935.95	6936.31	6936.81	0.33	6937.14
PR 2	6934.89	6936.69	0.19	0.00	6937.18	6938.00	6937.33	1.18	6938.52
PR 2A	6937.19	6938.15	0.19	0.00	6938.40	6939.46	6939.03	0.94	6939.98
PR 1	6938.68	6939.07	0.11	0.00	6939.99	6939.99	6940.08	0.10	6940.18
PR 5	6935.39	6936.18	0.03	0.00	6936.69	6937.82	6938.16	0.57	6938.72
PR 3	6936.68	6937.22	0.42	0.00	6938.82	6938.98	6939.14	0.16	6939.30
PR 4	6936.68	6936.78	1.11	0.00	6938.99	6939.07	6939.83	0.08	6939.91

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

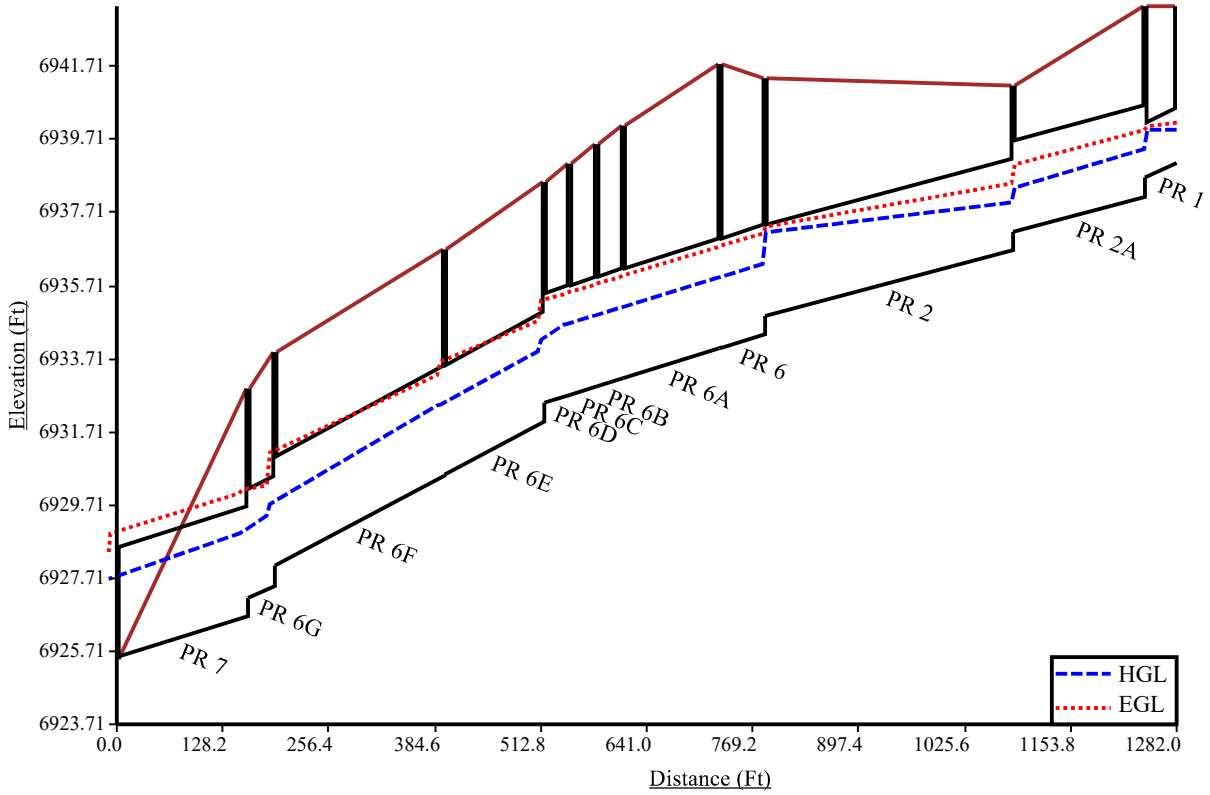
The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
PR 7	158.59	4.00	6.00	6.67	0.00	0.76	0.00	10.44	7.05	2.89	163.50	Sewer Too Shallow
PR 6G	32.50	4.00	6.00	6.67	9.45	6.56	2.39	10.80	7.23	3.07	59.07	
PR 6F	205.18	4.00	6.00	6.67	9.68	6.68	2.51	10.38	7.02	2.86	368.75	
PR 6E	120.81	4.00	6.00	6.67	10.32	6.99	2.83	11.12	7.39	3.23	233.13	
PR 6D	30.31	4.00	6.00	6.67	10.08	6.88	2.71	10.66	7.16	3.00	56.41	
PR 6C	32.90	4.00	6.00	6.67	10.66	7.16	3.00	11.26	7.46	3.30	65.05	
PR 6B	32.35	4.00	6.00	6.67	11.25	7.46	3.29	11.82	7.74	3.58	67.85	
PR 6A	116.94	4.00	6.00	6.67	11.82	7.74	3.58	13.54	8.60	4.44	275.92	
PR 6	54.42	4.00	6.00	6.67	13.54	8.60	4.44	12.00	7.83	3.67	129.51	
PR 2	300.04	3.50	6.00	6.08	11.50	7.29	3.71	7.50	5.29	1.71	468.89	Sewer Too Shallow
PR 2A	159.48	3.50	6.00	6.08	6.49	4.79	1.21	8.92	6.00	2.42	199.92	Sewer Too Shallow
PR 1	38.58	2.50	4.00	4.92	8.85	5.22	2.97	8.08	4.83	2.58	39.85	
PR 5	52.76	3.00	4.00	5.50	11.00	6.58	3.75	8.30	5.23	2.40	72.82	
PR 3	26.98	2.50	4.00	4.92	7.80	4.69	2.44	7.24	4.41	2.16	24.07	
PR 4	5.25	2.50	4.00	4.92	7.80	4.69	2.44	8.12	4.85	2.60	5.01	

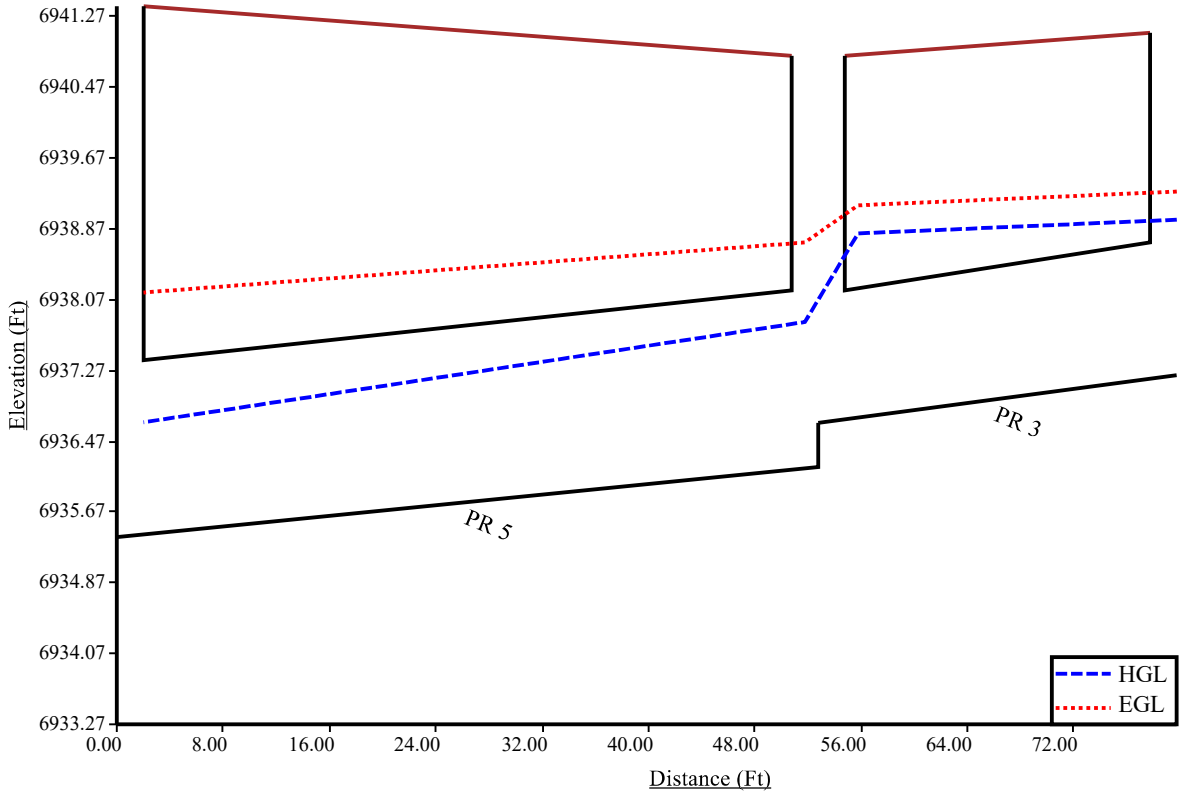
Total earth volume for sewer trenches = 2230 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:

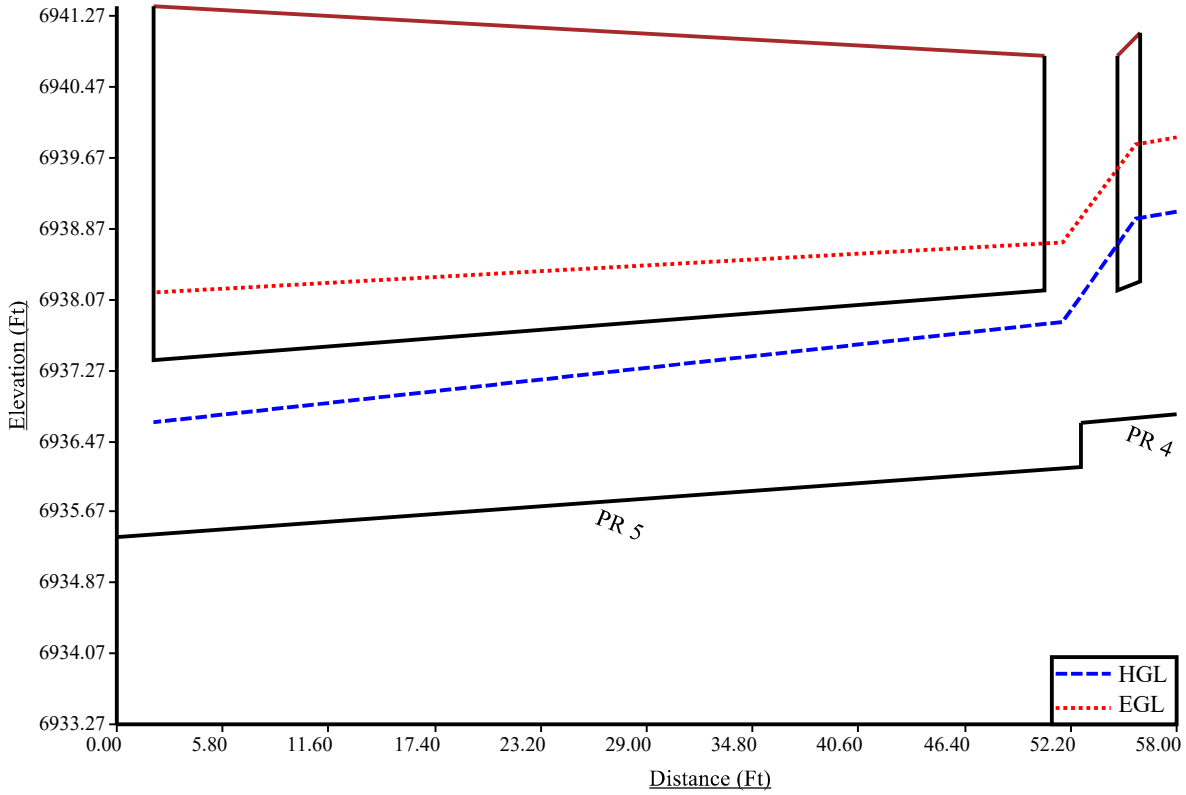
PR 1-7 100-YR HGL Profile



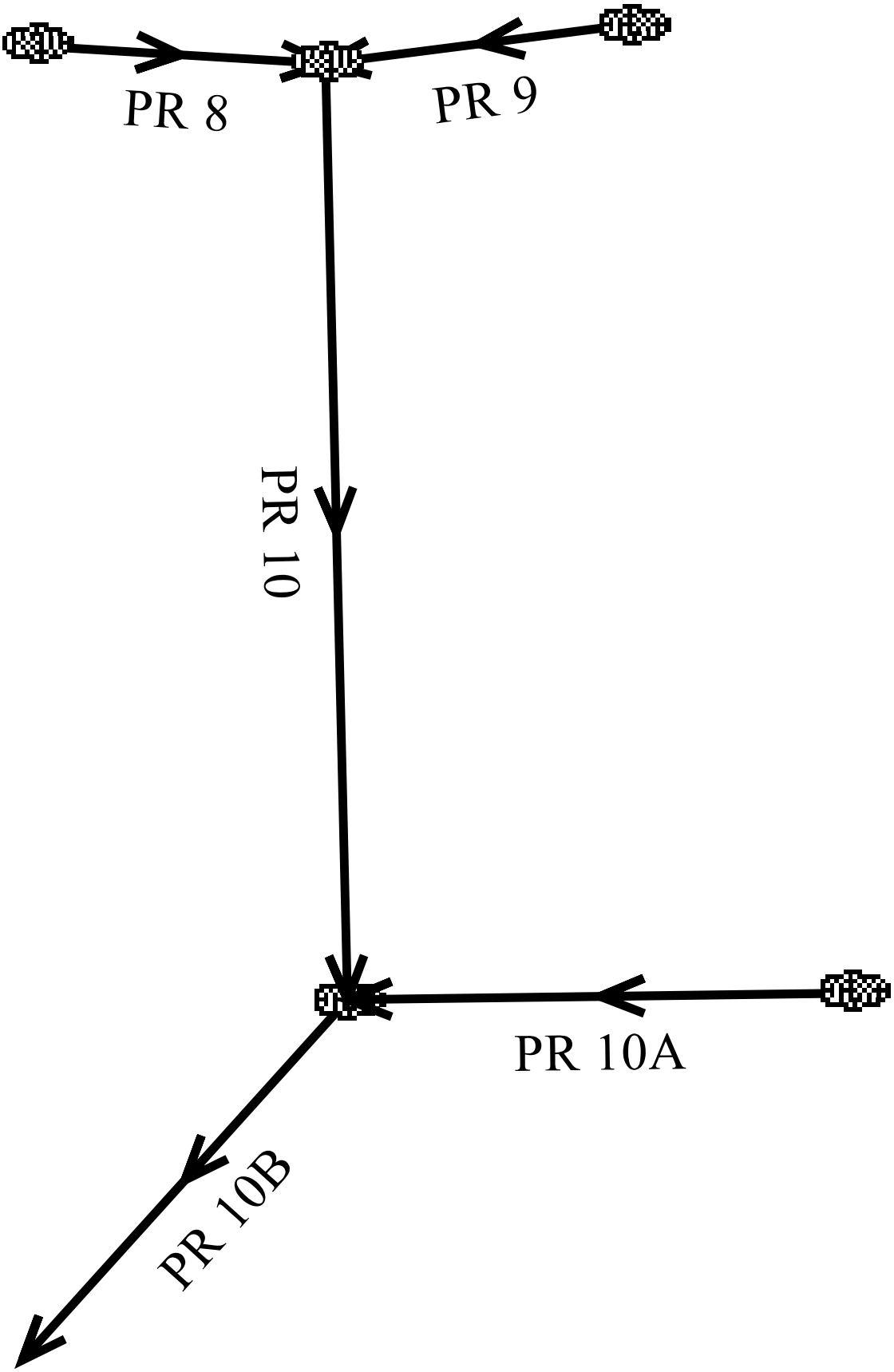
PR 3&5 100-YR HGL Profile



PR 4&5 100-YR HGL Profile



PIPE RUN 8-10 & ASSOCIATED LATERALS LAYOUT



Program: UDSEWER Math Model Interface 2.1.1.4
Run Date: 11/26/2024 2:08:21 PM

UDSewer Results Summary

Project Title: New UDSEWER System Module
Project Description: Default system

PIPE RUN 8-10 AND ASSOCIATED LATERALS

System Input Summary

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6926.71

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
FSD 1	6927.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 10B	6930.30	9.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PR-10A	6930.05	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 10	6933.86	7.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 9	6933.88	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 8	6933.98	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
FSD 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
PR 10B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.00	Surface Water Present (Downstream)
PR-10A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
PR 10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.00	
PR 9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00	
PR 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
PR 10B	50.40	6926.00	0.6	6926.30	0.013	0.03	0.00	CIRCULAR	24.00 in	24.00 in
PR-10A	66.37	6927.05	0.5	6927.38	0.013	0.38	0.00	CIRCULAR	15.00 in	15.00 in
PR 10	245.24	6926.38	1.0	6928.83	0.013	0.38	0.00	CIRCULAR	30.00 in	30.00 in
PR 9	56.54	6929.31	1.0	6929.88	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PR 8	12.46	6929.34	1.0	6929.46	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PR 10B	17.57	5.59	12.85	5.26	12.17	5.63	1.11	Supercritical	9.00	0.00	
PR-10A	4.58	3.73	4.72	3.03	4.76	2.99	0.98	Subcritical	1.00	0.00	
PR 10	41.13	8.38	10.53	4.55	8.37	6.25	1.56	Supercritical	7.00	0.00	
PR 9	10.53	5.96	9.18	4.41	7.69	5.55	1.40	Supercritical	4.00	0.00	
PR 8	10.53	5.96	9.18	4.41	7.69	5.55	1.40	Supercritical	4.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).

- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
PR 10B	9.00	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
PR-10A	1.00	CIRCULAR	15.00 in	15.00 in	18.00 in	18.00 in	15.00 in	15.00 in	1.23	Height is too small. Width is too small. Existing height is smaller than the suggested height. Existing width is smaller than the suggested width.
PR 10	7.00	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
PR 9	4.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 8	4.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6926.71

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
PR 10B	6926.00	6926.30	0.00	0.00	6927.01	6927.37	6927.50	0.30	6927.80
PR-10A	6927.05	6927.38	0.00	0.00	6927.78	6927.83	6927.80	0.12	6927.93
PR 10	6926.38	6928.83	0.01	0.00	6927.70	6929.71	6927.81	2.22	6930.03
PR 9	6929.31	6929.88	0.11	0.00	6929.96	6930.65	6930.43	0.51	6930.95
PR 8	6929.34	6929.46	0.11	0.00	6929.98	6930.23	6930.45	0.07	6930.53

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

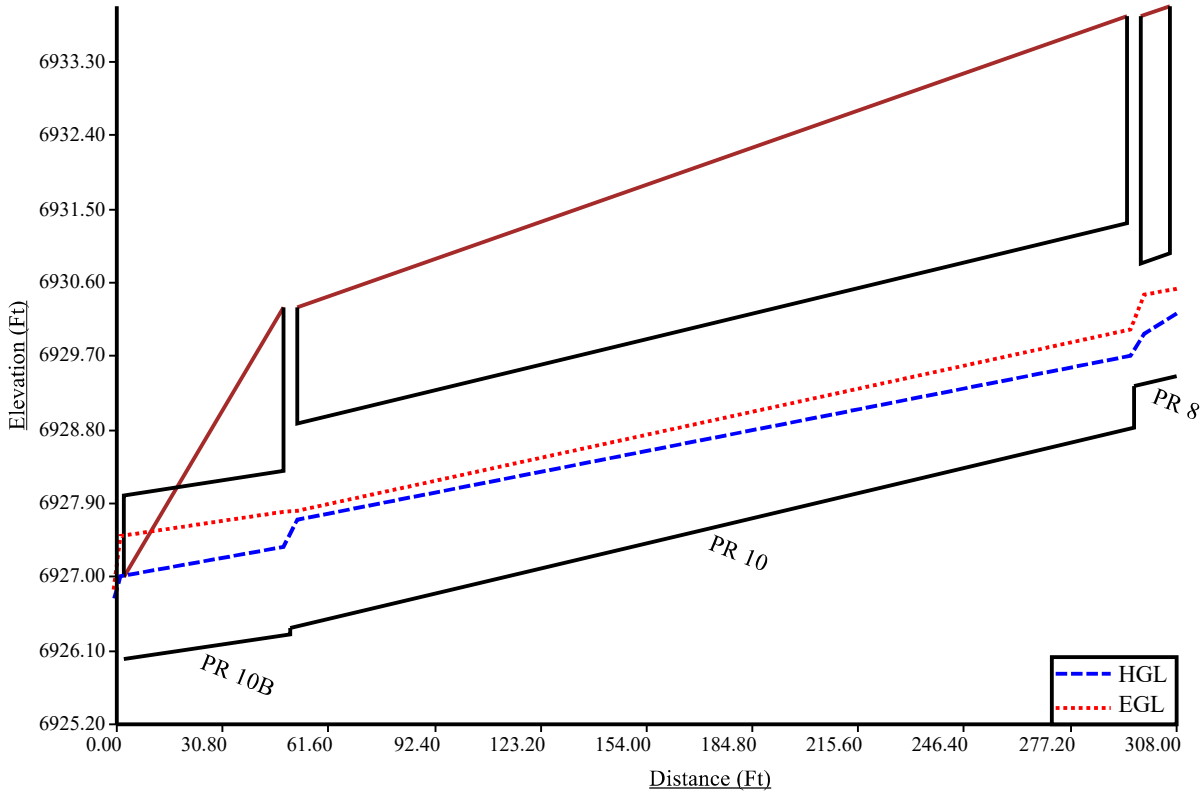
The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
PR 10B	50.40	3.00	4.00	5.50	0.00	1.59	0.00	7.00	4.58	1.75	32.19	Sewer Too Shallow
PR-10A	66.37	2.25	4.00	4.63	6.25	3.77	1.81	5.09	3.19	1.23	40.47	Sewer Too Shallow
PR 10	245.24	3.50	6.00	6.08	6.34	4.71	1.13	8.56	5.82	2.24	298.12	Sewer Too Shallow
PR 9	56.54	2.50	4.00	4.92	8.59	5.09	2.84	7.50	4.54	2.29	54.85	
PR 8	12.46	2.50	4.00	4.92	8.55	5.07	2.82	8.54	5.06	2.81	13.01	

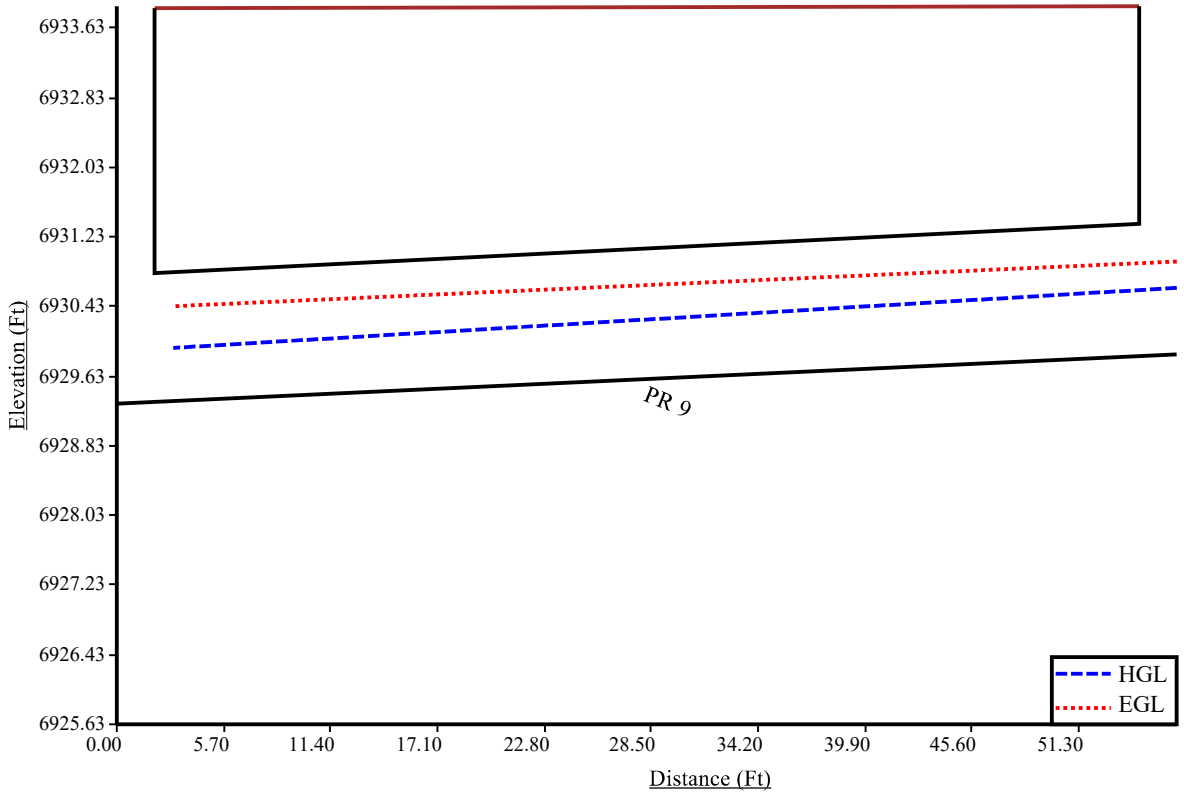
Total earth volume for sewer trenches = 439 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

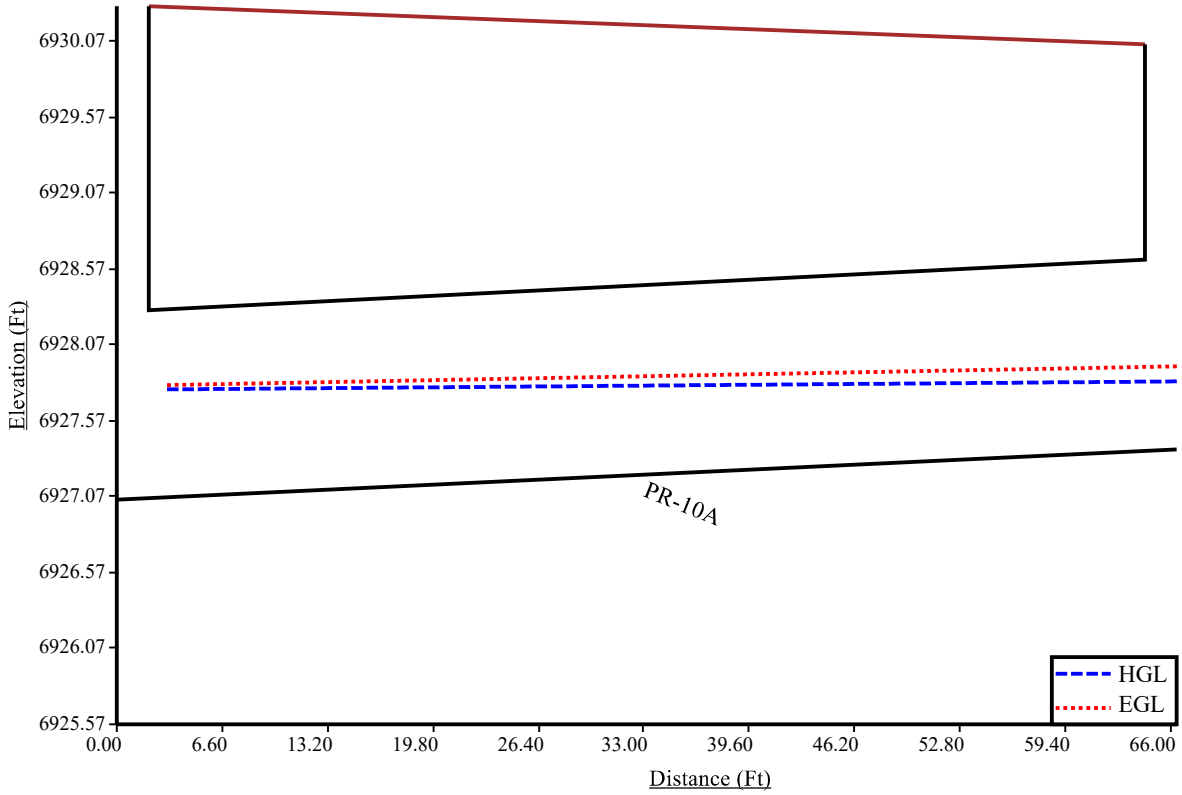
PR 8-10B 5-Year HGL Profile



PR 9 5-Year HGL Profile



PR 10A 5-Year HGL Profile



Program: UDSEWER Math Model Interface 2.1.1.4
Run Date: 11/26/2024 2:10:55 PM

UDSewer Results Summary

Project Title: New UDSEWER System Module
Project Description: Default system

PIPE RUN 8-10 AND ASSOCIATED LATERALS

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6927.70

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
FSD 1	6927.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 10B	6931.50	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PR 10A	6930.05	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 10	6933.86	16.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 9	6933.88	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 8	6933.98	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
FSD 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Surface Water Present (Upstream)
PR 10B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	Surface Water Present (Downstream)
PR 10A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	
PR 10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.00	
PR 9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	
PR 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
PR 10B	50.50	6926.00	0.6	6926.30	0.013	0.03	0.00	CIRCULAR	24.00 in	24.00 in
PR 10A	66.37	6927.05	0.5	6927.38	0.013	0.38	0.00	CIRCULAR	15.00 in	15.00 in
PR 10	245.24	6926.38	1.0	6928.83	0.013	0.38	0.00	CIRCULAR	24.00 in	24.00 in
PR 9	56.05	6929.32	1.0	6929.88	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PR 8	12.46	6929.34	1.0	6929.46	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PR 10B	17.57	5.59	24.00	6.37	24.00	6.37	0.00	Pressurized	20.00	50.50	
PR 10A	4.58	3.73	8.36	4.27	8.85	3.98	0.90	Pressurized	3.00	66.37	
PR 10	22.68	7.22	17.30	6.60	14.87	7.82	1.34	Supercritical Jump	16.00	77.94	
PR 9	10.53	5.96	13.15	5.78	11.73	6.56	1.25	Supercritical Jump	8.00	54.42	

PR 8	10.53	5.96	13.15	5.78	11.73	6.56	1.25	Pressurized	8.00	12.46	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
PR 10B	20.00	CIRCULAR	24.00 in	24.00 in	27.00 in	27.00 in	24.00 in	24.00 in	3.14	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise
PR 10A	3.00	CIRCULAR	15.00 in	15.00 in	18.00 in	18.00 in	15.00 in	15.00 in	1.23	Height is too small. Width is too small. Existing height is smaller than the suggested height. Existing width is smaller than the suggested width.
PR 10	16.00	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
PR 9	8.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 8	8.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6927.70

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
PR 10B	6926.00	6926.30	0.00	0.00	6928.00	6928.39	6928.63	0.39	6929.02
PR 10A	6927.05	6927.38	0.04	0.00	6928.96	6929.10	6929.05	0.14	6929.20
PR 10	6926.38	6928.83	0.15	0.00	6928.77	6930.27	6929.17	1.78	6930.95
PR 9	6929.32	6929.88	0.42	0.00	6931.05	6931.36	6931.37	0.31	6931.68
PR 8	6929.34	6929.46	0.42	0.00	6931.05	6931.12	6931.37	0.07	6931.44

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

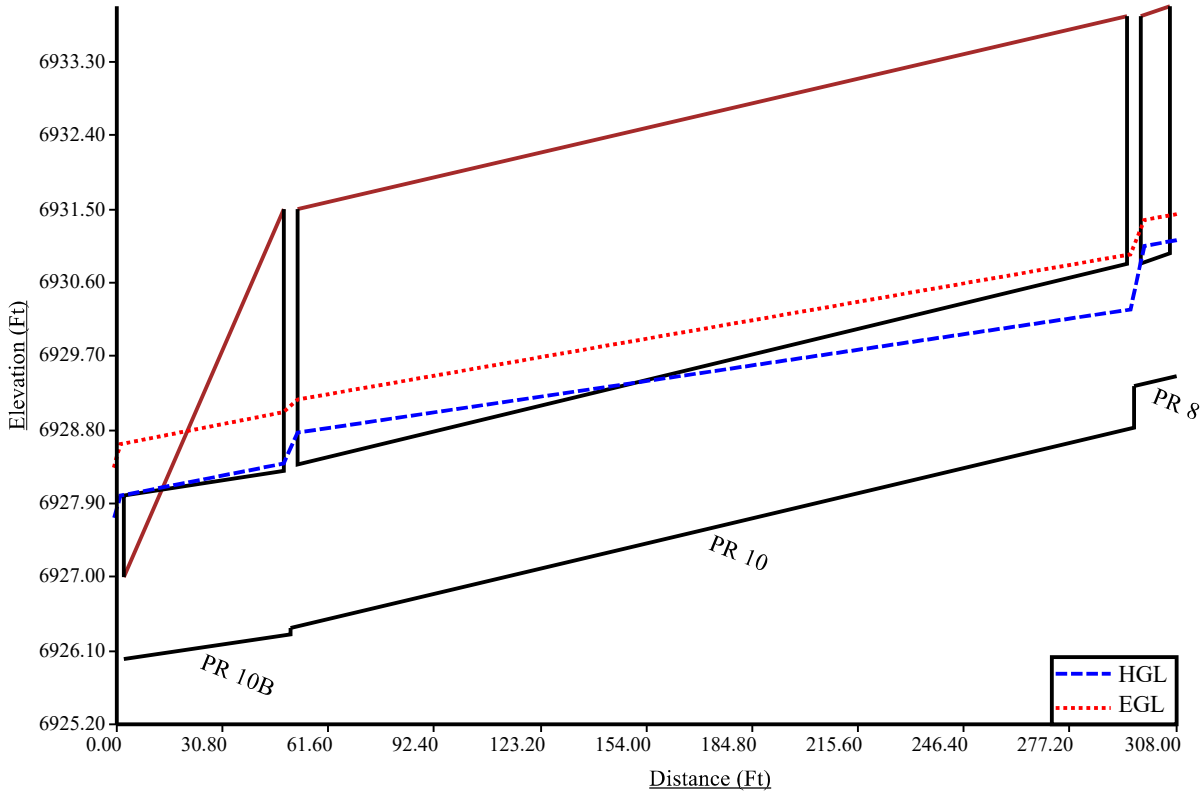
The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
PR 10B	50.50	3.00	4.00	5.50	0.00	1.59	0.00	9.40	5.78	2.95	41.46	Sewer Too Shallow
PR 10A	66.37	2.25	4.00	4.63	8.65	4.97	3.01	5.09	3.19	1.23	51.46	Sewer Too Shallow
PR 10	245.24	3.00	4.00	5.50	9.24	5.71	2.87	9.06	5.61	2.78	313.04	
PR 9	56.05	2.50	4.00	4.92	8.58	5.08	2.83	7.50	4.54	2.29	54.33	
PR 8	12.46	2.50	4.00	4.92	8.55	5.07	2.82	8.54	5.06	2.81	13.01	

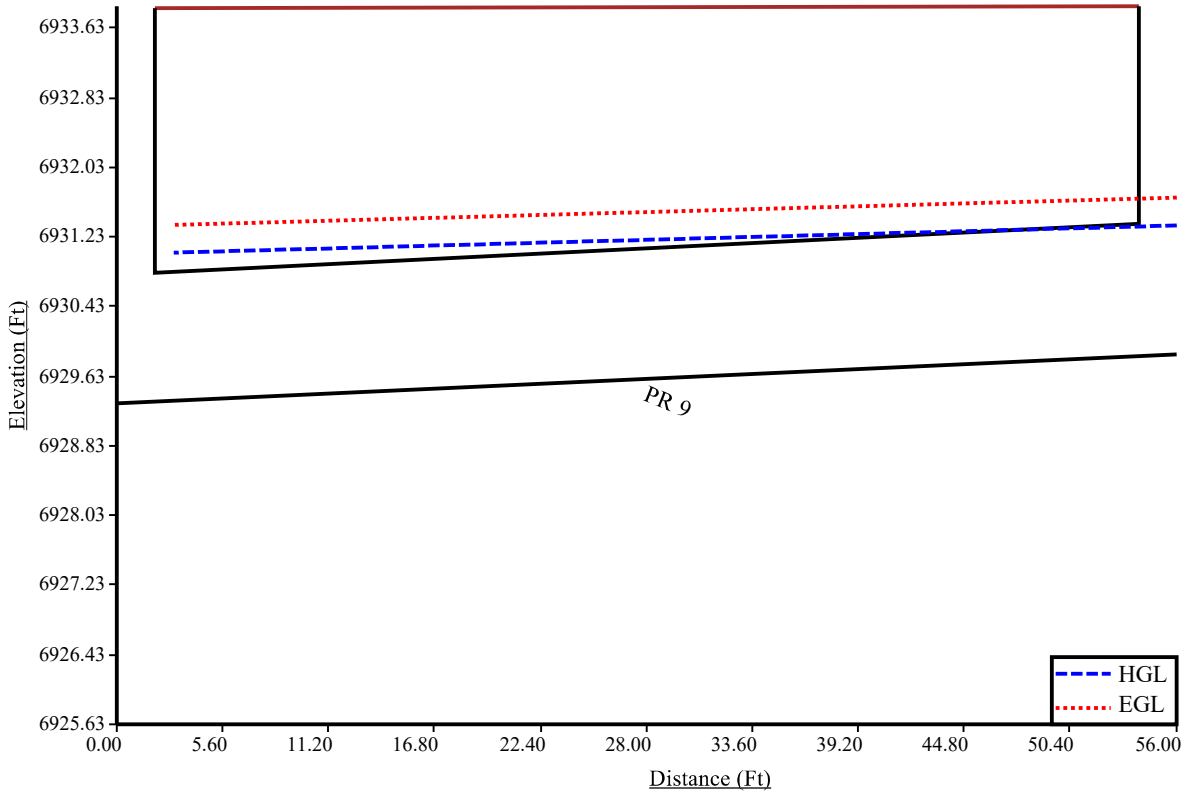
Total earth volume for sewer trenches = 473 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

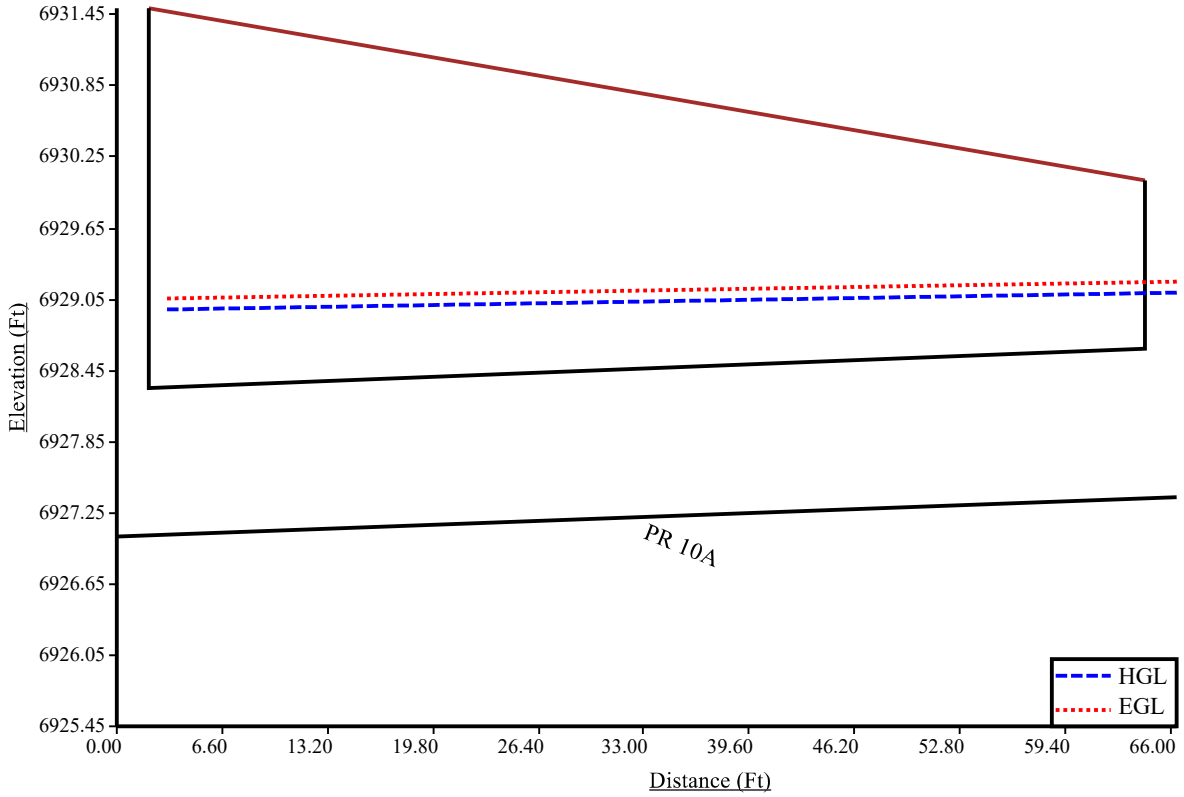
PR 8-10B 100-YR HGL Profile



PR 9 100-YR HGL Profile



PR 10A 100-YR HGL Profile



Program: UDSEWER Math Model Interface 2.1.1.4
Run Date: 11/26/2024 2:06:26 PM

UDSewer Results Summary

Project Title: Pond 1 Outfall
Project Description: 5-year

System Input Summary

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6920.47

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
10x10 Riprap	6920.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Pad										
Pond 1 Outfall	6926.54	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
10x10 Riprap Pad	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Surface Water Present (Upstream)
Pond 1 Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	Surface Water Present (Downstream)

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Pond 1 Outfall	52.48	6919.99	6.3	6923.30	0.013	0.00	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Pond 1 Outfall	56.93	18.12	2.60	2.18	1.43	5.23	3.24	Supercritical	0.40	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Pond 1 Outfall	0.40	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6920.47

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Pond 1 Outfall	6919.99	6923.30	0.00	0.00	6920.47	6923.52	6920.54	3.05	6923.59

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

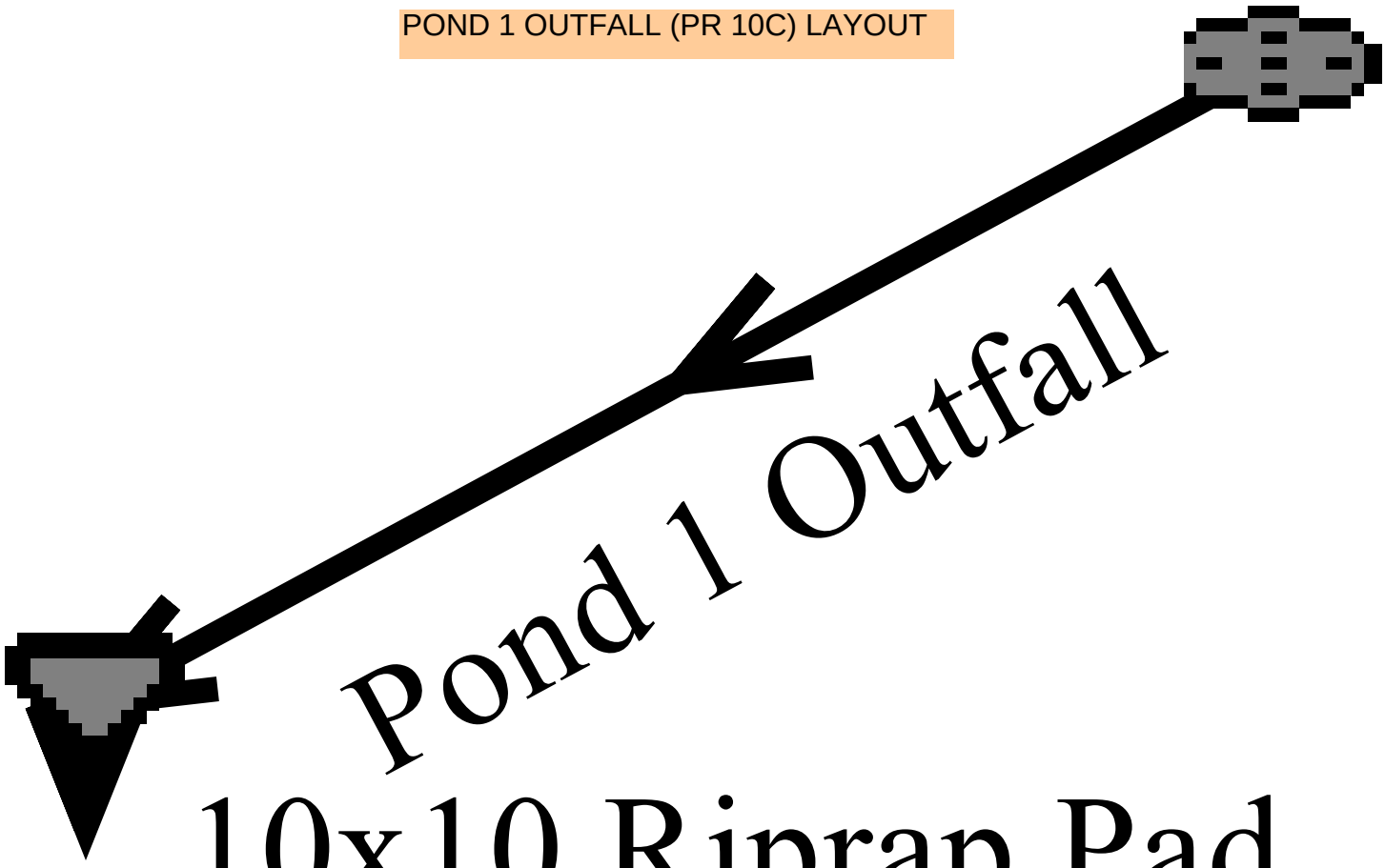
The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
Pond 1 Outfall	52.48	3.00	4.00	5.50	0.00	0.59	0.00	5.50	3.82	0.99	18.30	Sewer Too Shallow

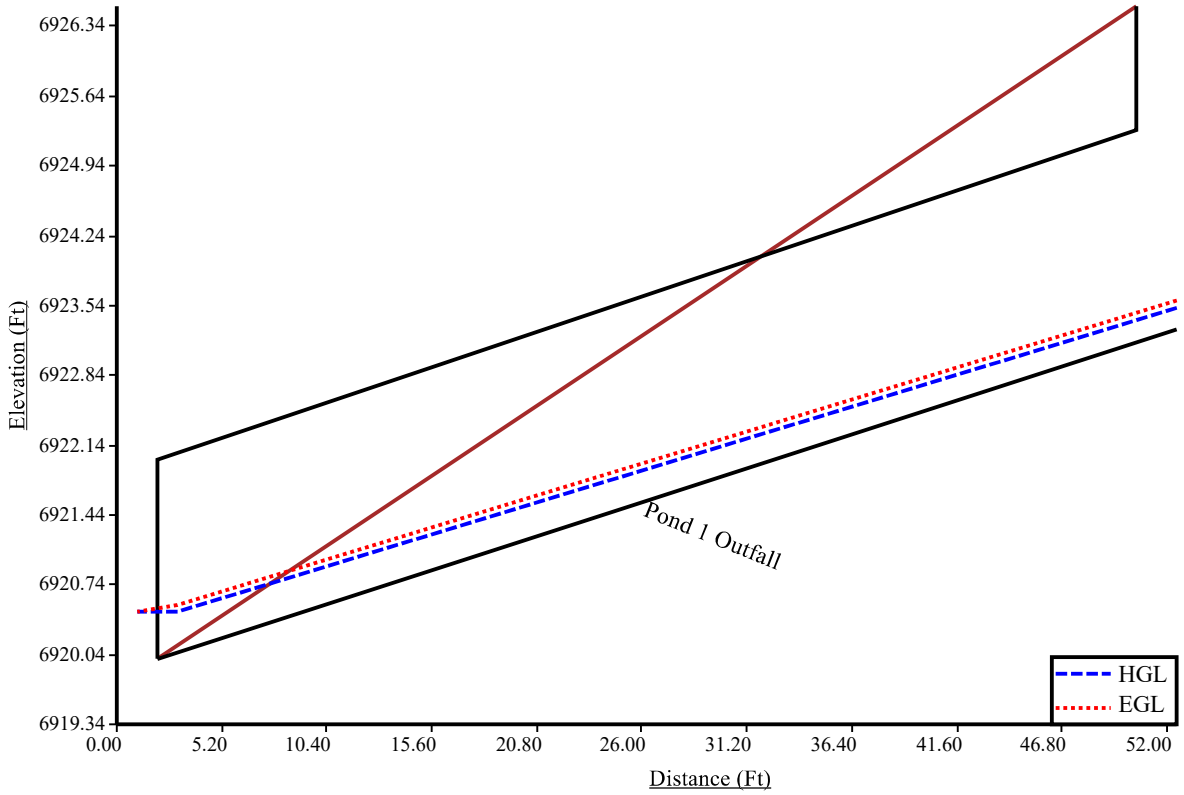
Total earth volume for sewer trenches = 18 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

POND 1 OUTFALL (PR 10C) LAYOUT



Pond 1 Outfall 5-YR HGL Profile



Program: UDSEWER Math Model Interface 2.1.1.4
Run Date: 11/26/2024 1:32:50 PM

UDSewer Results Summary

Project Title: Pond 1 Outfall
Project Description: 100-year

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6920.47

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
10x10 Riprap	6920.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Pad										
Pond 1 Outfall	6926.54	14.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
10x10 Riprap Pad	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Surface Water Present (Upstream)
Pond 1 Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.60	Surface Water Present (Downstream)

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
Pond 1 Outfall	52.48	6919.99	6.3	6923.30	0.013	0.00	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
Pond 1 Outfall	56.93	18.12	16.52	6.33	8.29	15.17	3.76	Supercritical	14.60	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
Pond 1 Outfall	14.60	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6920.47

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Pond 1 Outfall	6919.99	6923.30	0.00	0.00	6920.68	6924.68	6924.26	1.04	6925.30

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

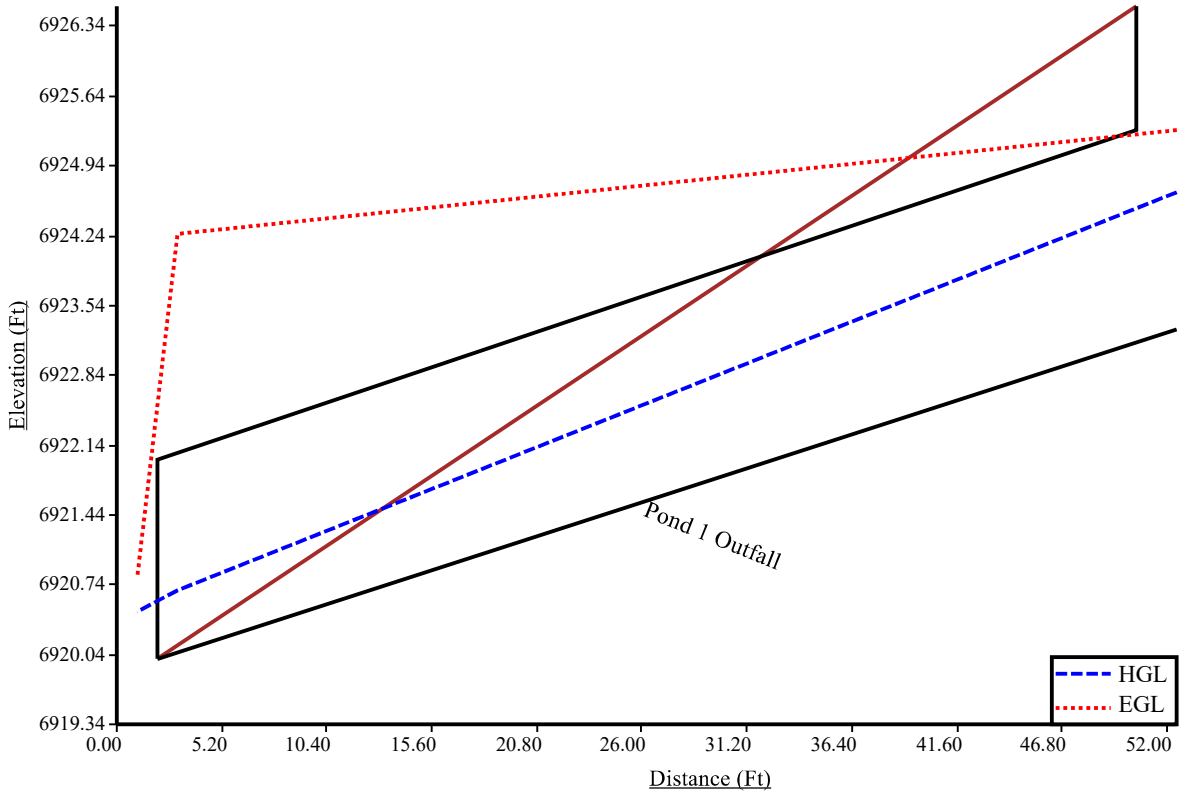
The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
Pond 1 Outfall	52.48	3.00	4.00	5.50	0.00	0.59	0.00	5.50	3.82	0.99	18.30	Sewer Too Shallow

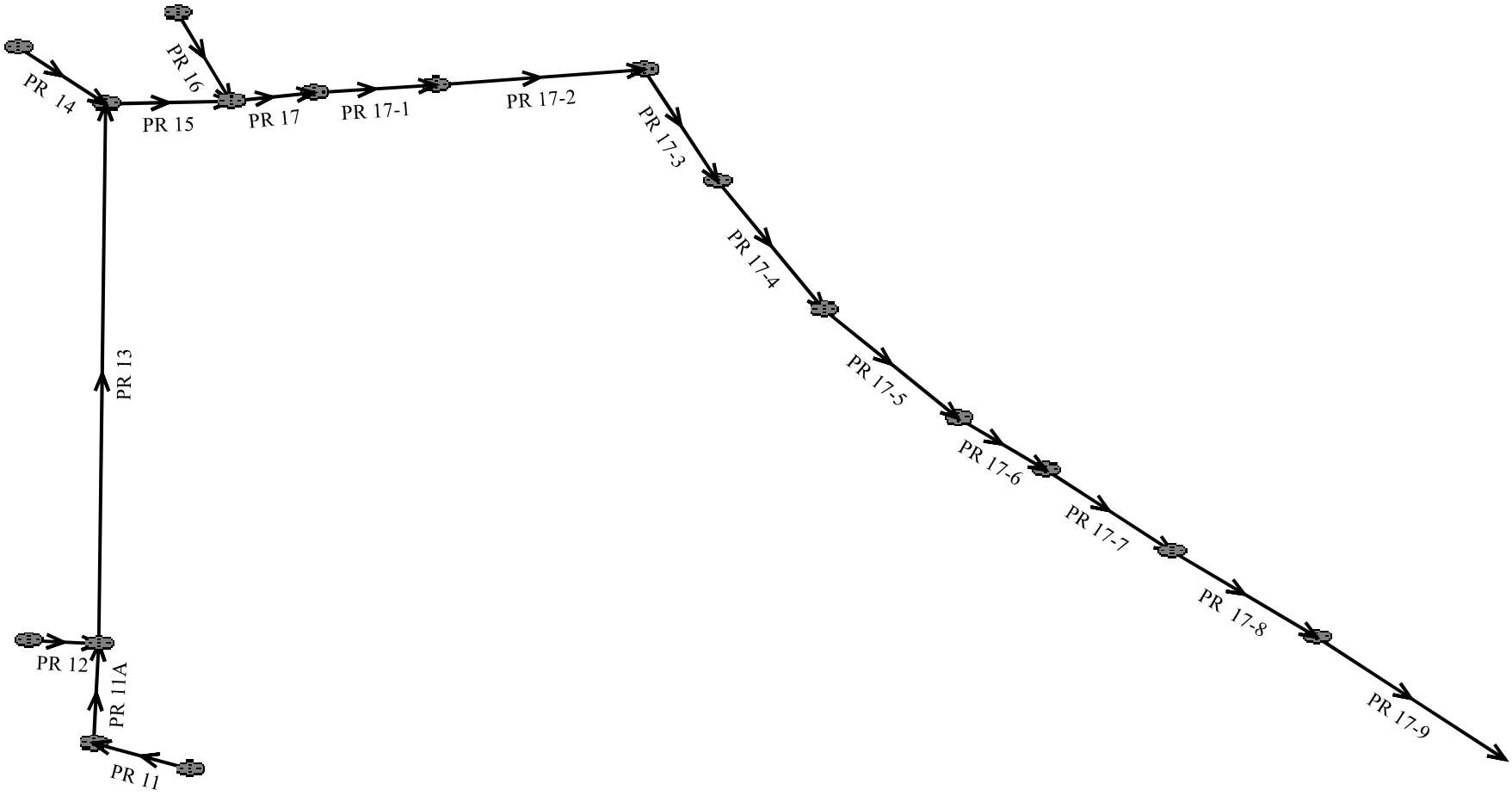
Total earth volume for sewer trenches = 18 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Pond 1 Outlet 100-YR HGL Profile



PIPE RUN 11-17 & ASSOCIATED LATERALS LAYOUT



Program: UDSEWER Math Model Interface 2.1.1.4
Run Date: 11/26/2024 2:16:56 PM

UDSewer Results Summary

Project Title: New UDSEWER System Module
Project Description: Default system

PIPE RUN 11-17 AND ASSOCIATED LATERALS

System Input Summary

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6901.86

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
FSD 2	6899.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 17-9	6907.90	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PR 17-8	6911.55	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 17-7	6912.25	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 17-6	6913.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 17-5	6914.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 17-4	6914.75	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 17-3	6916.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 17-2	6921.50	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 17-1	6923.25	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 17	6923.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 16	6922.51	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 15	6922.35	13.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 13	6922.07	9.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 12	6922.18	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 11A	6921.65	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 11	6921.81	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 14	6922.51	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
FSD 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Surface Water Present (Upstream)
PR 17-9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	Surface Water Present (Downstream)
PR 17-8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	
PR 17-7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	
PR 17-6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	
PR 17-5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	
PR 17-4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	
PR 17-3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	
PR 17-2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	
PR 17-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	
PR 17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	
PR 16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
PR 15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.00	
PR 13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.00	
PR 12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	
PR 11A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	
PR 11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	
PR 14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
PR 17-9	153.11	6901.00	0.7	6902.07	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
PR 17-8	248.15	6902.17	0.7	6903.91	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 17-7	75.41	6904.01	0.7	6904.54	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 17-6	23.28	6904.54	0.7	6904.70	0.013	0.06	0.00	CIRCULAR	36.00 in	36.00 in
PR 17-5	40.75	6904.69	0.7	6904.98	0.013	0.06	0.00	CIRCULAR	36.00 in	36.00 in
PR 17-4	40.75	6904.98	0.7	6905.27	0.013	0.06	0.00	CIRCULAR	36.00 in	36.00 in
PR 17-3	40.26	6905.27	0.7	6905.55	0.013	0.06	0.00	CIRCULAR	36.00 in	36.00 in
PR 17-2	231.50	6905.65	0.7	6907.27	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
PR 17-1	50.50	6907.26	9.7	6912.16	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 17	28.17	6912.16	1.0	6912.44	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 16	15.44	6913.19	17.8	6915.94	0.013	0.38	0.00	CIRCULAR	18.00 in	18.00 in
PR 15	31.83	6912.44	1.0	6912.76	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 13	277.53	6913.26	1.0	6916.04	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
PR 12	21.44	6917.91	1.0	6918.12	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PR 11A	29.17	6916.44	1.0	6916.73	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
PR 11	16.92	6916.90	1.0	6917.07	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
PR 14	15.96	6917.60	1.0	6917.76	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PR 17-9	55.95	7.92	14.82	5.47	12.73	6.71	1.34	Supercritical	15.00	0.00	
PR 17-8	55.95	7.92	14.82	5.47	12.73	6.71	1.34	Supercritical	15.00	0.00	
PR 17-7	55.95	7.92	14.82	5.47	12.73	6.71	1.34	Supercritical	15.00	0.00	
PR 17-6	55.95	7.92	14.82	5.47	12.73	6.71	1.34	Supercritical	15.00	0.00	
PR 17-5	55.95	7.92	14.82	5.47	12.73	6.71	1.34	Supercritical	15.00	0.00	
PR 17-4	55.95	7.92	14.82	5.47	12.73	6.71	1.34	Supercritical	15.00	0.00	
PR 17-3	55.95	7.92	14.82	5.47	12.73	6.71	1.34	Supercritical	15.00	0.00	
PR 17-2	55.95	7.92	14.82	5.47	12.73	6.71	1.34	Supercritical	15.00	0.00	
PR 17-1	208.29	29.47	14.82	5.47	6.54	17.11	4.90	Supercritical	15.00	0.00	
PR 17	66.88	9.46	14.82	5.47	11.59	7.63	1.61	Supercritical	15.00	0.00	
PR 16	44.44	25.15	4.47	2.92	1.87	10.32	5.59	Supercritical	1.00	0.00	
PR 15	66.88	9.46	13.75	5.24	10.76	7.33	1.61	Supercritical	13.00	0.00	
PR 13	66.88	9.46	11.37	4.70	8.92	6.60	1.60	Supercritical	9.00	0.00	

PR 12	10.53	5.96	7.90	4.02	6.57	5.14	1.42	Supercritical	3.00	0.00	
PR 11A	22.68	7.22	10.39	4.60	8.43	6.10	1.50	Supercritical	6.00	0.00	
PR 11	22.68	7.22	10.39	4.60	8.43	6.10	1.50	Supercritical	6.00	0.00	
PR 14	22.68	7.22	9.45	4.35	7.66	5.79	1.50	Supercritical	5.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
PR 17-9	15.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
PR 17-8	15.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
PR 17-7	15.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
PR 17-6	15.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
PR 17-5	15.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
PR 17-4	15.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
PR 17-3	15.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
PR 17-2	15.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
PR 17-1	15.00	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
PR 17	15.00	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
PR 16	1.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 15	13.00	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
PR 13	9.00	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	
PR 12	3.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 11A	6.00	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
PR 11	6.00	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
PR 14	5.00	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6901.86

	Invert Elev.	**Downstream Manhole Losses**	**HGL**	**EGL**

Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PR 17-9	6901.00	6902.07	0.00	0.00	6902.06	6903.30	6902.76	1.01	6903.77
PR 17-8	6902.17	6903.91	0.00	0.00	6903.31	6905.14	6903.93	1.68	6905.61
PR 17-7	6904.01	6904.54	0.00	0.00	6905.15	6905.77	6905.77	0.47	6906.24
PR 17-6	6904.54	6904.70	0.00	0.00	6905.78	6905.93	6906.30	0.10	6906.40
PR 17-5	6904.69	6904.98	0.00	0.00	6905.94	6906.21	6906.45	0.22	6906.68
PR 17-4	6904.98	6905.27	0.00	0.00	6906.22	6906.50	6906.74	0.22	6906.97
PR 17-3	6905.27	6905.55	0.00	0.00	6906.51	6906.78	6907.03	0.22	6907.25
PR 17-2	6905.65	6907.27	0.09	0.00	6906.88	6908.50	6907.41	1.56	6908.97
PR 17-1	6907.26	6912.16	0.00	0.00	6908.51	6913.39	6912.35	1.51	6913.86
PR 17	6912.16	6912.44	0.00	0.00	6913.40	6913.67	6914.03	0.11	6914.14
PR 16	6913.19	6915.94	0.00	0.00	6913.68	6916.31	6915.00	1.44	6916.45
PR 15	6912.44	6912.76	0.00	0.00	6913.68	6913.91	6914.17	0.16	6914.33
PR 13	6913.26	6916.04	0.03	0.00	6914.01	6916.99	6914.68	2.65	6917.33
PR 12	6917.91	6918.12	0.06	0.00	6918.45	6918.78	6918.86	0.17	6919.03
PR 11A	6916.44	6916.73	0.00	0.00	6917.14	6917.60	6917.72	0.21	6917.92
PR 11	6916.90	6917.07	0.07	0.00	6917.67	6917.94	6918.18	0.08	6918.26
PR 14	6917.60	6917.76	0.00	0.00	6918.24	6918.55	6918.76	0.08	6918.84

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

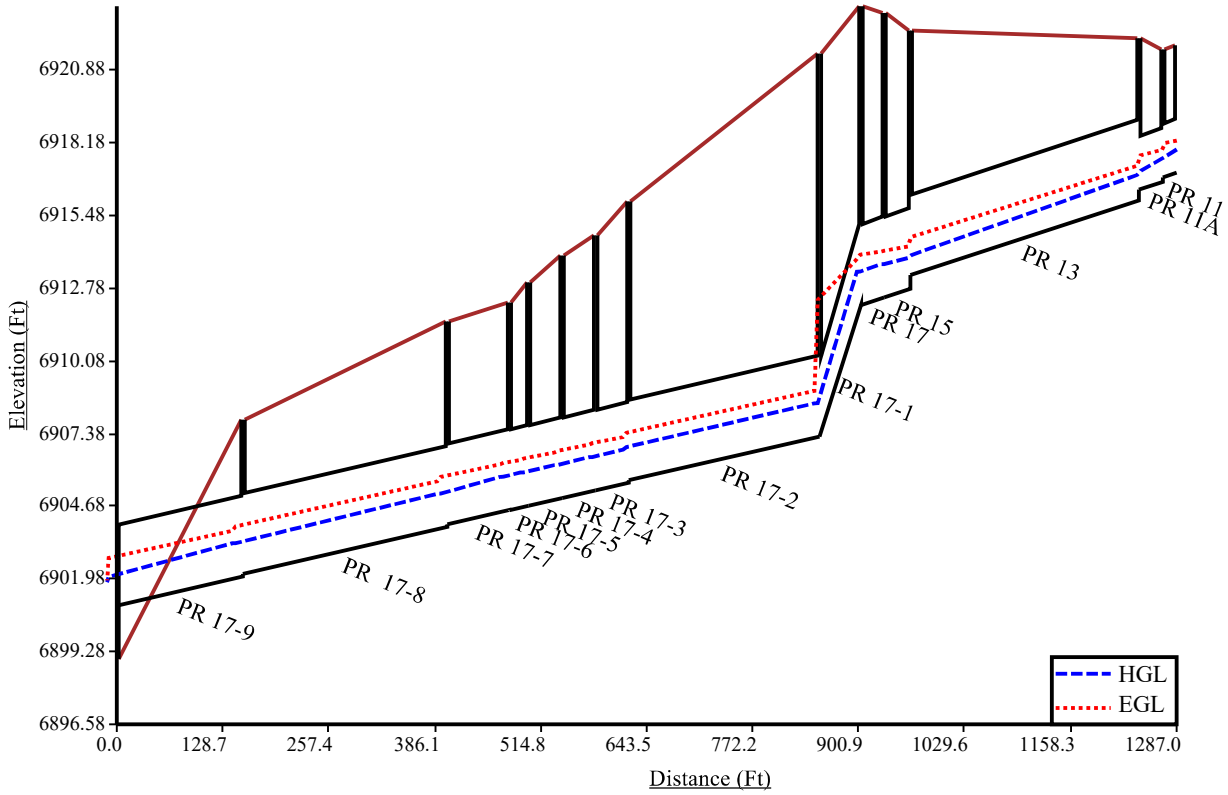
					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
PR 17-9	153.11	4.00	6.00	6.67	0.00	0.00	0.00	9.66	6.66	2.50	132.30	Sewer Too Shallow
PR 17-8	248.15	4.00	6.00	6.67	9.45	6.56	2.39	13.28	8.47	4.31	519.74	
PR 17-7	75.41	4.00	6.00	6.67	13.08	8.37	4.20	13.42	8.54	4.38	187.74	
PR 17-6	23.28	4.00	6.00	6.67	13.43	8.55	4.38	14.60	9.13	4.97	62.52	
PR 17-5	40.75	4.00	6.00	6.67	14.61	9.14	4.97	16.04	9.85	5.69	124.03	
PR 17-4	40.75	4.00	6.00	6.67	16.03	9.85	5.68	16.96	10.31	6.15	137.96	
PR 17-3	40.26	4.00	6.00	6.67	16.96	10.32	6.15	18.90	11.28	7.12	155.01	
PR 17-2	231.50	4.00	6.00	6.67	18.70	11.18	7.02	26.46	15.06	10.90	1325.26	
PR 17-1	50.50	4.00	6.00	6.67	26.48	15.07	10.91	20.18	11.92	7.76	302.75	

PR 17	28.17	4.00	6.00	6.67	20.18	11.93	7.76	19.12	11.39	7.23	125.15	
PR 16	15.44	2.50	4.00	4.92	19.12	10.35	8.10	12.64	7.11	4.86	43.22	
PR 15	31.83	4.00	6.00	6.67	19.12	11.39	7.22	17.18	10.42	6.26	124.85	
PR 13	277.53	4.00	6.00	6.67	16.17	9.92	5.75	10.06	6.86	2.70	705.85	
PR 12	21.44	2.50	4.00	4.92	7.83	4.71	2.46	7.62	4.60	2.35	19.74	
PR 11A	29.17	3.00	4.00	5.50	10.26	6.22	3.38	8.84	5.50	2.67	39.39	
PR 11	16.92	3.00	4.00	5.50	8.50	5.33	2.50	8.48	5.32	2.49	19.76	
PR 14	15.96	3.00	4.00	5.50	8.50	5.33	2.50	8.50	5.33	2.50	18.67	

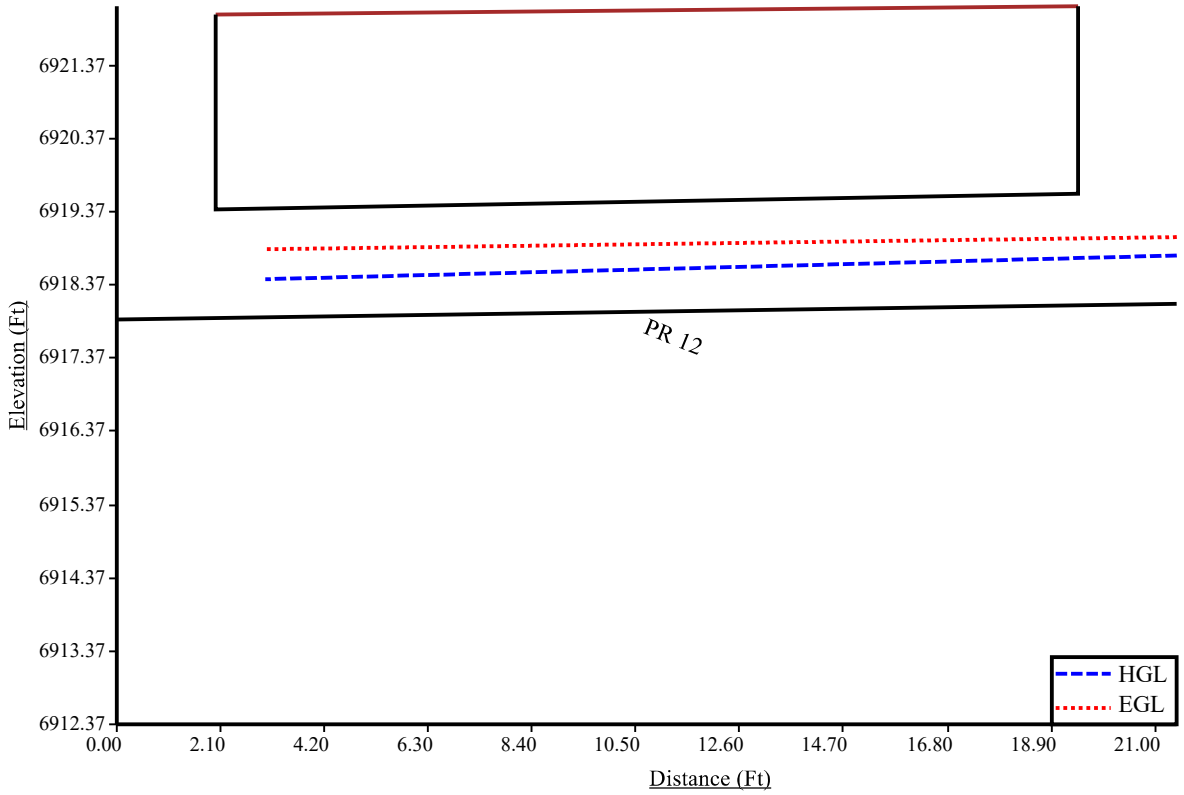
Total earth volume for sewer trenches = 4044 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
    - Four inches for pipes less than 33 inches.
    - Six inches for pipes less than 60 inches.
    - Eight inches for all larger sizes.

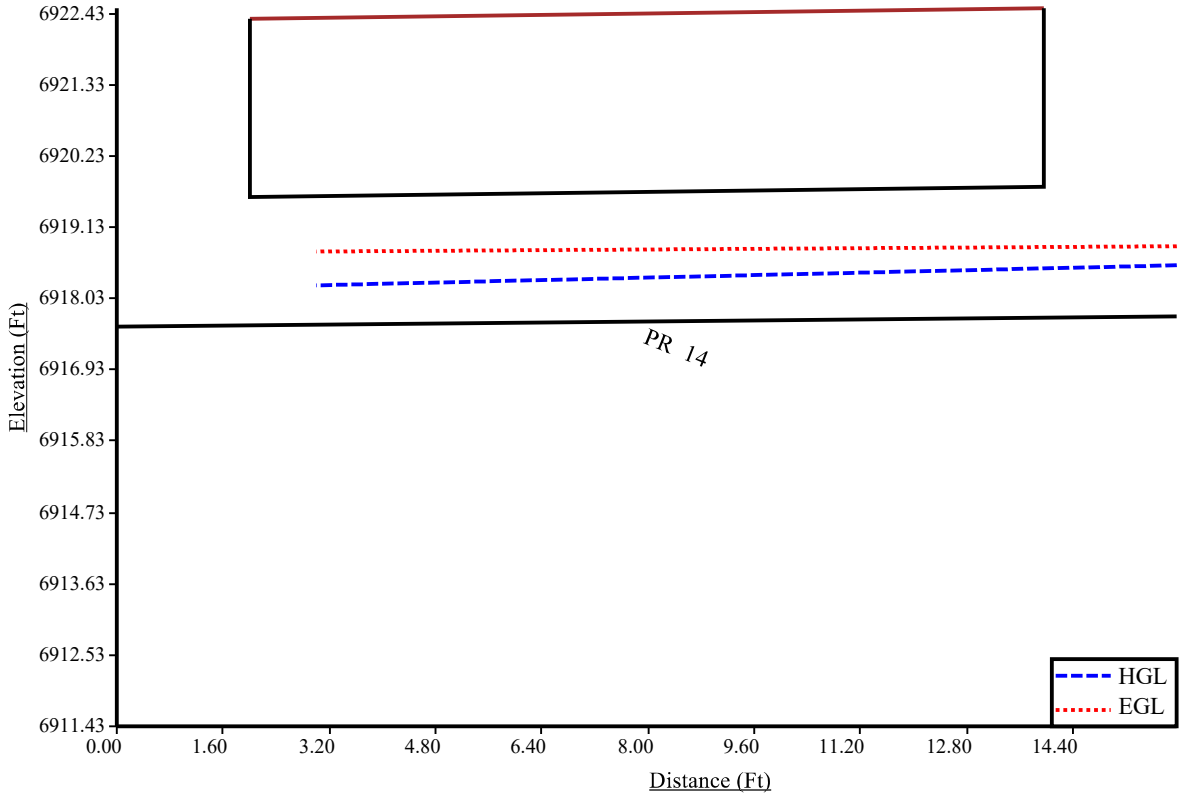
PR 11-17 5-YR HGL Profile



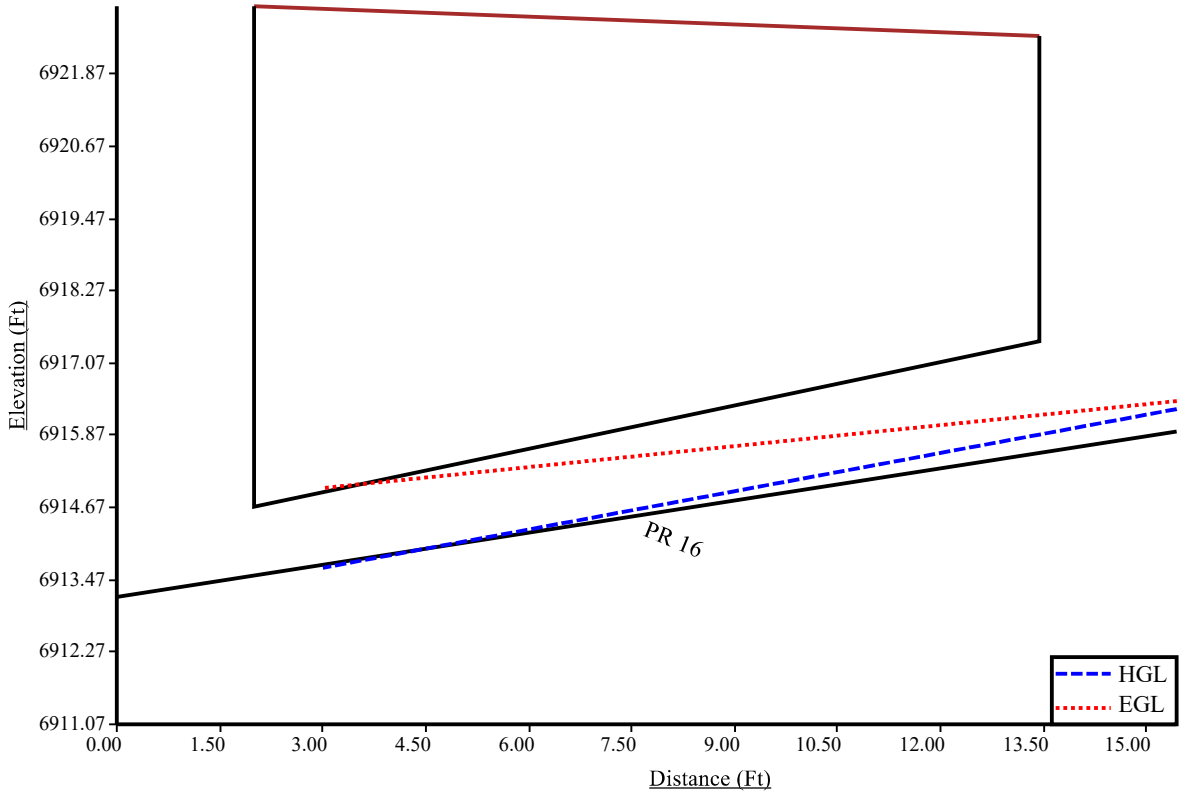
PR 12 5-YR HGL Profile



PR 14 5-YR HGL Profile



PR 16 5-YR HGL Profile



Program: UDSEWER Math Model Interface 2.1.1.4
Run Date: 11/26/2024 2:20:08 PM

UDSewer Results Summary

Project Title: New UDSEWER System Module
Project Description: Default system

PIPE RUN 11-17 AND ASSOCIATED LATERALS

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6902.71

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
FSD 2	6899.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 17-9	6907.90	34.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PR 17-8	6911.55	34.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 17-7	6912.25	34.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 17-6	6913.00	34.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 17-5	6914.00	34.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 17-4	6914.75	34.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 17-3	6916.00	34.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 17-2	6921.50	34.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 17-1	6923.25	34.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 17	6923.00	34.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 16	6922.51	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 15	6922.35	29.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 13	6922.07	19.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 12	6922.18	7.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 11A	6921.65	13.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 11	6921.81	13.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 14	6922.51	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
FSD 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Surface Water Present (Upstream)
PR 17-9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.00	Surface Water Present (Downstream)
PR 17-8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.00	
PR 17-7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.00	
PR 17-6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.00	
PR 17-5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.00	
PR 17-4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.00	
PR 17-3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.00	
PR 17-2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.00	
PR 17-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.00	
PR 17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.00	
PR 16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	
PR 15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.00	
PR 13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.00	
PR 12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.00	
PR 11A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.00	
PR 11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.00	
PR 14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
PR 17-9	153.11	6901.00	0.7	6902.07	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in
PR 17-8	248.15	6902.17	0.7	6903.91	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 17-7	75.41	6904.01	0.7	6904.54	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 17-6	23.28	6904.54	0.7	6904.70	0.013	0.06	0.00	CIRCULAR	36.00 in	36.00 in
PR 17-5	40.75	6904.69	0.7	6904.98	0.013	0.06	0.00	CIRCULAR	36.00 in	36.00 in
PR 17-4	40.75	6904.98	0.7	6905.27	0.013	0.06	0.00	CIRCULAR	36.00 in	36.00 in
PR 17-3	40.26	6905.27	0.7	6905.55	0.013	0.06	0.00	CIRCULAR	36.00 in	36.00 in
PR 17-2	231.50	6905.65	0.7	6907.27	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
PR 17-1	50.50	6907.26	9.7	6912.16	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 17	28.17	6912.16	1.0	6912.44	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 16	15.44	6913.19	17.8	6915.94	0.013	0.38	0.00	CIRCULAR	18.00 in	18.00 in
PR 15	31.83	6912.44	1.0	6912.76	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 13	277.53	6913.26	1.0	6916.04	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
PR 12	21.44	6917.91	1.0	6918.12	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PR 11A	29.17	6916.44	1.0	6916.73	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
PR 11	16.92	6916.90	1.0	6917.07	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
PR 14	15.96	6917.60	1.0	6917.76	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

A DEVIATION REQUEST HAS SUBMITTED FOR VELOCITY ABOVE 18 FPS

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PR 17-9	55.95	7.92	22.72	7.23	20.26	8.30	1.25	Supercritical	34.00	0.00	
PR 17-8	55.95	7.92	22.72	7.23	20.26	8.30	1.25	Supercritical	34.00	0.00	
PR 17-7	55.95	7.92	22.72	7.23	20.26	8.30	1.25	Supercritical	34.00	0.00	
PR 17-6	55.95	7.92	22.72	7.23	20.26	8.30	1.25	Supercritical	34.00	0.00	
PR 17-5	55.95	7.92	22.72	7.23	20.26	8.30	1.25	Supercritical	34.00	0.00	
PR 17-4	55.95	7.92	22.72	7.23	20.26	8.30	1.25	Supercritical	34.00	0.00	
PR 17-3	55.95	7.92	22.72	7.23	20.26	8.30	1.25	Supercritical	34.00	0.00	
PR 17-2	55.95	7.92	22.72	7.23	20.26	8.30	1.25	Supercritical	34.00	0.00	
PR 17-1	208.29	29.47	22.72	7.23	9.84	21.71	5.00	Supercritical	34.00	0.00	Velocity is Too High
PR 17	66.88	9.46	22.72	7.23	18.18	9.50	1.53	Supercritical	34.00	0.00	
PR 16	44.44	25.15	6.40	3.55	2.60	12.70	5.79	Supercritical Jump	2.00	4.33	

PR 15	66.88	9.46	20.92	6.81	16.57	9.12	1.56	Supercritical	29.00	0.00	
PR 13	66.88	9.46	16.76	5.89	13.13	8.15	1.60	Supercritical	19.00	0.00	
PR 12	10.53	5.96	12.29	5.45	10.72	6.38	1.30	Supercritical	7.00	0.00	
PR 11A	22.68	7.22	15.56	6.03	13.02	7.47	1.41	Supercritical	13.00	0.00	
PR 11	22.68	7.22	15.56	6.03	13.02	7.47	1.41	Supercritical	13.00	0.00	
PR 14	22.68	7.22	13.58	5.46	11.15	6.99	1.46	Supercritical	10.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
PR 17-9	34.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
PR 17-8	34.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
PR 17-7	34.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
PR 17-6	34.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
PR 17-5	34.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
PR 17-4	34.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
PR 17-3	34.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
PR 17-2	34.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
PR 17-1	34.00	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
PR 17	34.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
PR 16	2.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 15	29.00	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
PR 13	19.00	CIRCULAR	36.00 in	36.00 in	24.00 in	24.00 in	36.00 in	36.00 in	7.07	
PR 12	7.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 11A	13.00	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
PR 11	13.00	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
PR 14	10.00	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6902.71

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PR 17-9	6901.00	6902.07	0.00	0.00	6902.71	6903.96	6903.76	1.02	6904.78
PR 17-8	6902.17	6903.91	0.02	0.00	6903.98	6905.80	6904.93	1.69	6906.62
PR 17-7	6904.01	6904.54	0.02	0.00	6905.82	6906.43	6906.77	0.48	6907.25
PR 17-6	6904.54	6904.70	0.02	0.00	6906.46	6906.59	6907.29	0.11	6907.41
PR 17-5	6904.69	6904.98	0.02	0.00	6906.62	6906.87	6907.45	0.23	6907.69
PR 17-4	6904.98	6905.27	0.02	0.00	6906.90	6907.16	6907.74	0.23	6907.98
PR 17-3	6905.27	6905.55	0.02	0.00	6907.19	6907.44	6908.03	0.23	6908.26
PR 17-2	6905.65	6907.27	0.47	0.00	6908.32	6909.16	6908.73	1.25	6909.98
PR 17-1	6907.26	6912.16	0.02	0.00	6909.18	6915.03	6915.40	0.00	6915.40
PR 17	6912.16	6912.44	0.02	0.00	6915.05	6915.05	6915.42	0.05	6915.47
PR 16	6913.19	6915.94	0.01	0.00	6915.46	6916.47	6915.48	1.19	6916.67
PR 15	6912.44	6912.76	0.01	0.00	6915.21	6915.21	6915.49	0.06	6915.55
PR 13	6913.26	6916.04	0.15	0.00	6915.52	6917.44	6915.70	2.28	6917.98
PR 12	6917.91	6918.12	0.32	0.00	6918.80	6919.14	6919.43	0.17	6919.60
PR 11A	6916.44	6916.73	0.01	0.00	6917.52	6918.03	6918.39	0.20	6918.59
PR 11	6916.90	6917.07	0.35	0.00	6918.63	6918.63	6918.94	0.07	6919.01
PR 14	6917.60	6917.76	0.01	0.00	6918.53	6918.89	6919.29	0.06	6919.35

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

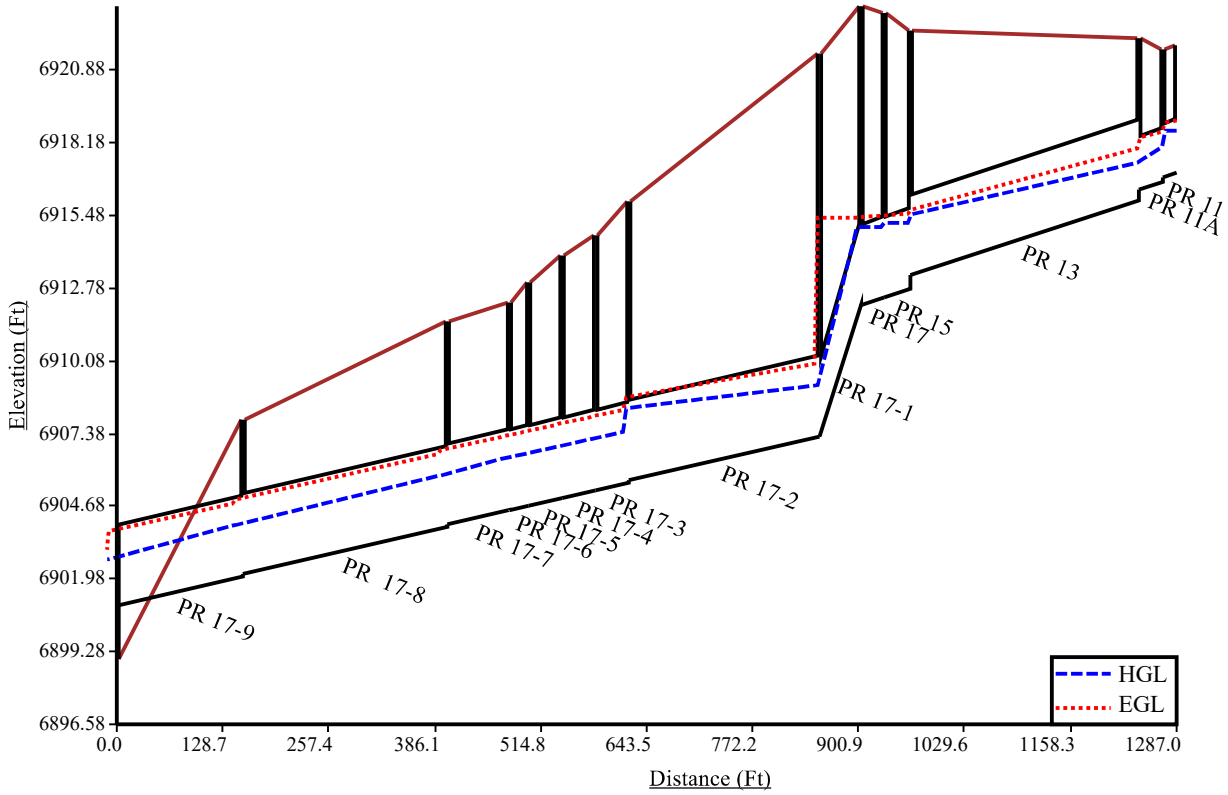
					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
PR 17-9	153.11	4.00	6.00	6.67	0.00	0.00	0.00	9.66	6.66	2.50	132.30	Sewer Too Shallow
PR 17-8	248.15	4.00	6.00	6.67	9.45	6.56	2.39	13.28	8.47	4.31	519.74	
PR 17-7	75.41	4.00	6.00	6.67	13.08	8.37	4.20	13.42	8.54	4.38	187.74	
PR 17-6	23.28	4.00	6.00	6.67	13.43	8.55	4.38	14.60	9.13	4.97	62.52	
PR 17-5	40.75	4.00	6.00	6.67	14.61	9.14	4.97	16.04	9.85	5.69	124.03	
PR 17-4	40.75	4.00	6.00	6.67	16.03	9.85	5.68	16.96	10.31	6.15	137.96	
PR 17-3	40.26	4.00	6.00	6.67	16.96	10.32	6.15	18.90	11.28	7.12	155.01	

PR 17-2	231.50	4.00	6.00	6.67	18.70	11.18	7.02	26.46	15.06	10.90	1325.26	
PR 17-1	50.50	4.00	6.00	6.67	26.48	15.07	10.91	20.18	11.92	7.76	302.75	
PR 17	28.17	4.00	6.00	6.67	20.18	11.93	7.76	19.12	11.39	7.23	125.15	
PR 16	15.44	2.50	4.00	4.92	19.12	10.35	8.10	12.64	7.11	4.86	43.22	
PR 15	31.83	4.00	6.00	6.67	19.12	11.39	7.22	17.18	10.42	6.26	124.85	
PR 13	277.53	4.00	6.00	6.67	16.17	9.92	5.75	10.06	6.86	2.70	705.85	
PR 12	21.44	2.50	4.00	4.92	7.83	4.71	2.46	7.62	4.60	2.35	19.74	
PR 11A	29.17	3.00	4.00	5.50	10.26	6.22	3.38	8.84	5.50	2.67	39.39	
PR 11	16.92	3.00	4.00	5.50	8.50	5.33	2.50	8.48	5.32	2.49	19.76	
PR 14	15.96	3.00	4.00	5.50	8.50	5.33	2.50	8.50	5.33	2.50	18.67	

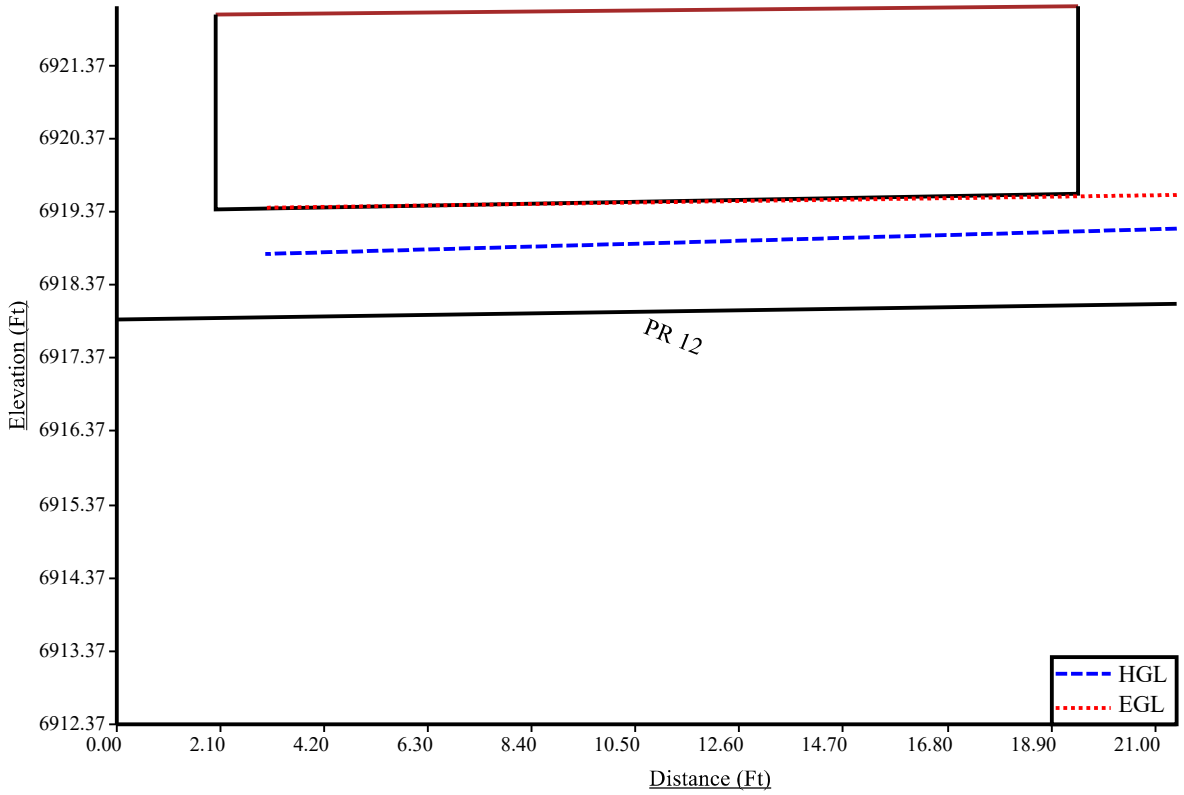
Total earth volume for sewer trenches = 4044 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
    - Four inches for pipes less than 33 inches.
    - Six inches for pipes less than 60 inches.
    - Eight inches for all larger sizes.

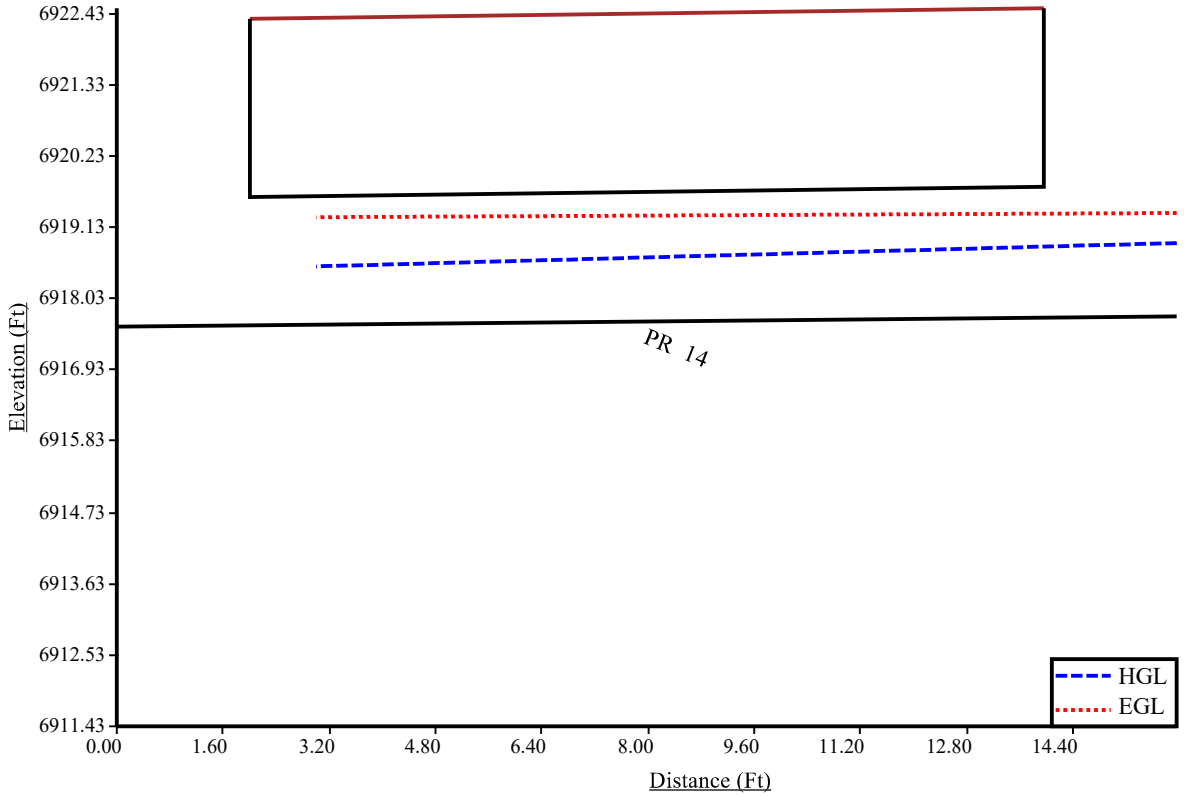
PR 11-17 100-YR HGL Profile



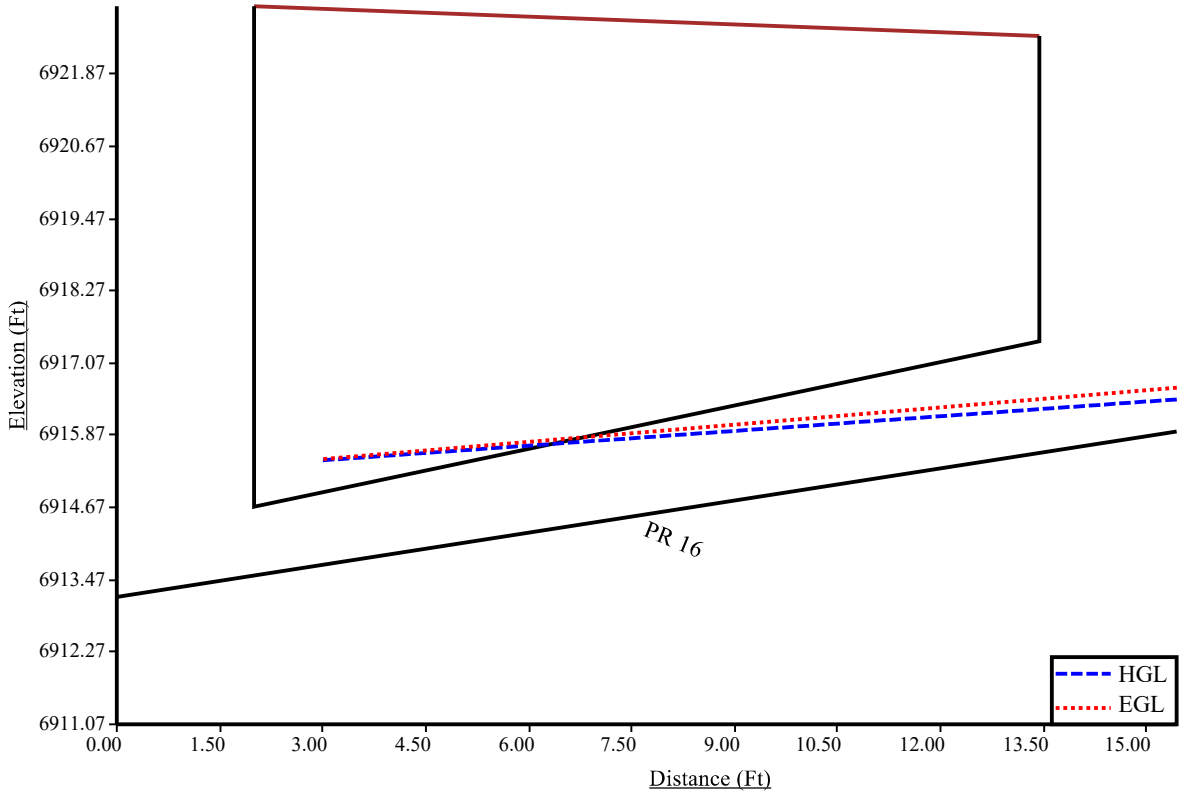
PR 12 100-YR HGL Profile



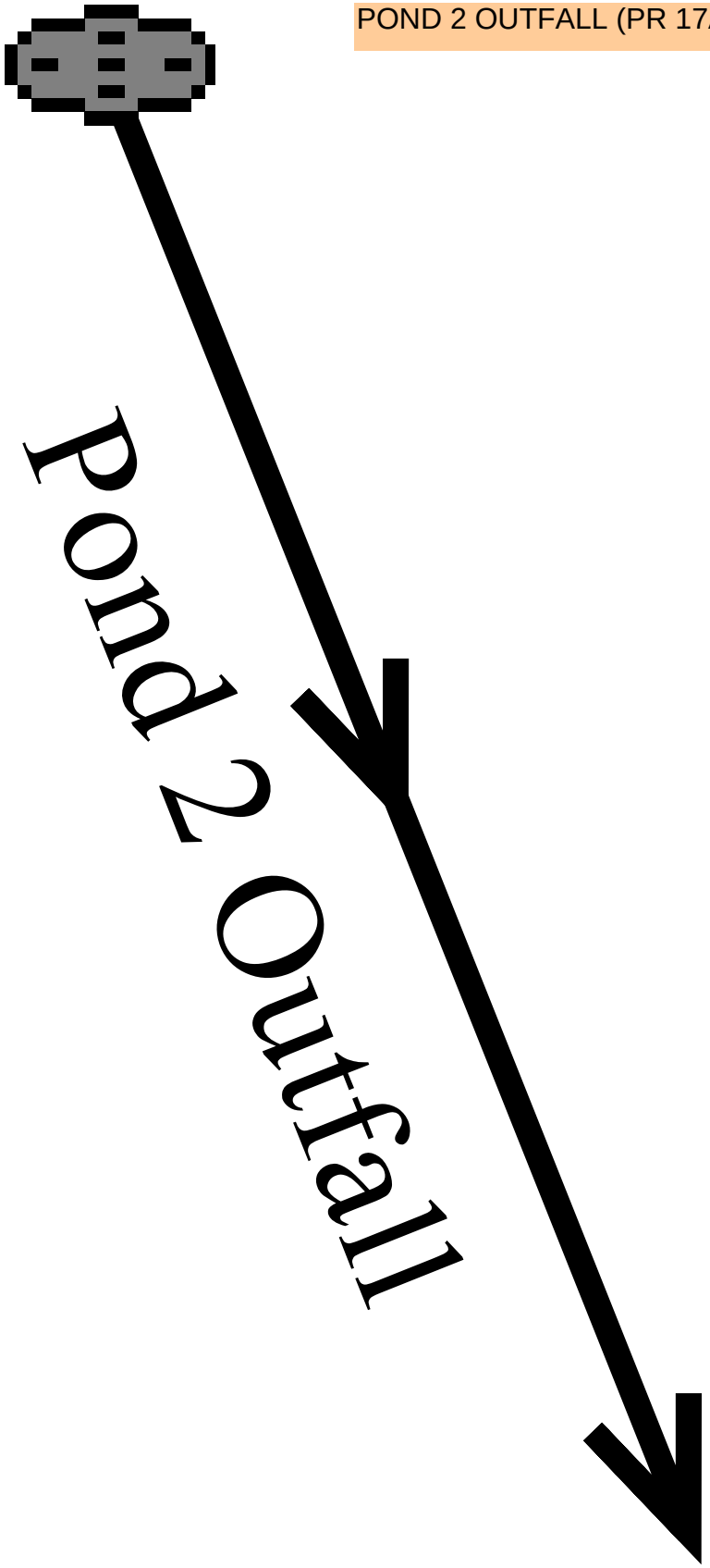
PR 14 100-YR HGL Profile



PR 16 100-YR HGL Profile



POND 2 OUTFALL (PR 17A) LAYOUT



Program: UDSEWER Math Model Interface 2.1.1.4
Run Date: 11/26/2024 2:07:08 PM

UDSewer Results Summary

Project Title: Pond 2 Outfall
Project Description: 5-year

System Input Summary

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6898.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Riprap Spillway	6897.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Pond 2 Outfall	6902.10	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Riprap Spillway	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Surface Water Present (Upstream)
Pond 2 Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	Surface Water Present (Downstream)

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Pond 2 Outfall	70.50	6897.02	2.1	6898.50	0.013	0.00	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Pond 2 Outfall	15.26	8.64	1.97	1.90	1.44	3.01	1.86	Supercritical	0.20	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Pond 2 Outfall	0.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.

- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6898.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Pond 2 Outfall	6897.02	6898.50	0.00	0.00	6898.00	6898.66	6898.00	0.72	6898.72

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

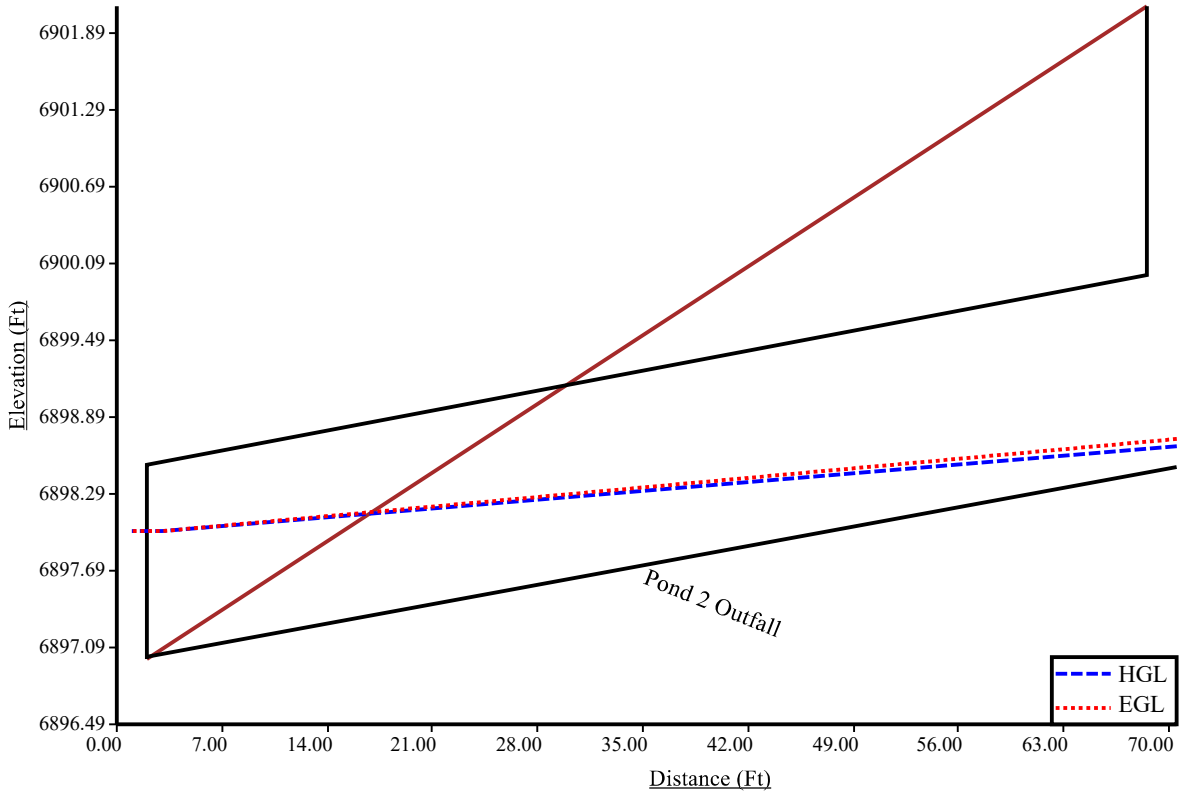
The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
Pond 2 Outfall	70.50	2.50	4.00	4.92	0.00	0.52	0.00	6.70	4.14	1.89	30.98	Sewer Too Shallow

Total earth volume for sewer trenches = 31 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Pond 2 Outfall 5-YR HGL Profile



Program: UDSEWER Math Model Interface 2.1.1.4
Run Date: 11/26/2024 1:39:23 PM

UDSewer Results Summary

Project Title: Pond 2 Outfall
Project Description: 100-year

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6898.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
Riprap Spillway	6897.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Pond 2 Outfall	6902.10	14.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
Riprap Spillway	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Surface Water Present (Upstream)
Pond 2 Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.80	Surface Water Present (Downstream)

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Pond 2 Outfall	70.50	6897.02	2.1	6898.50	0.013	0.00	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Pond 2 Outfall	15.26	8.64	16.81	8.62	14.28	9.84	1.56	Supercritical	14.80	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Pond 2 Outfall	14.80	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.

- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6898.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
Pond 2 Outfall	6897.02	6898.50	0.00	0.00	6898.21	6899.90	6899.71	1.34	6901.05

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

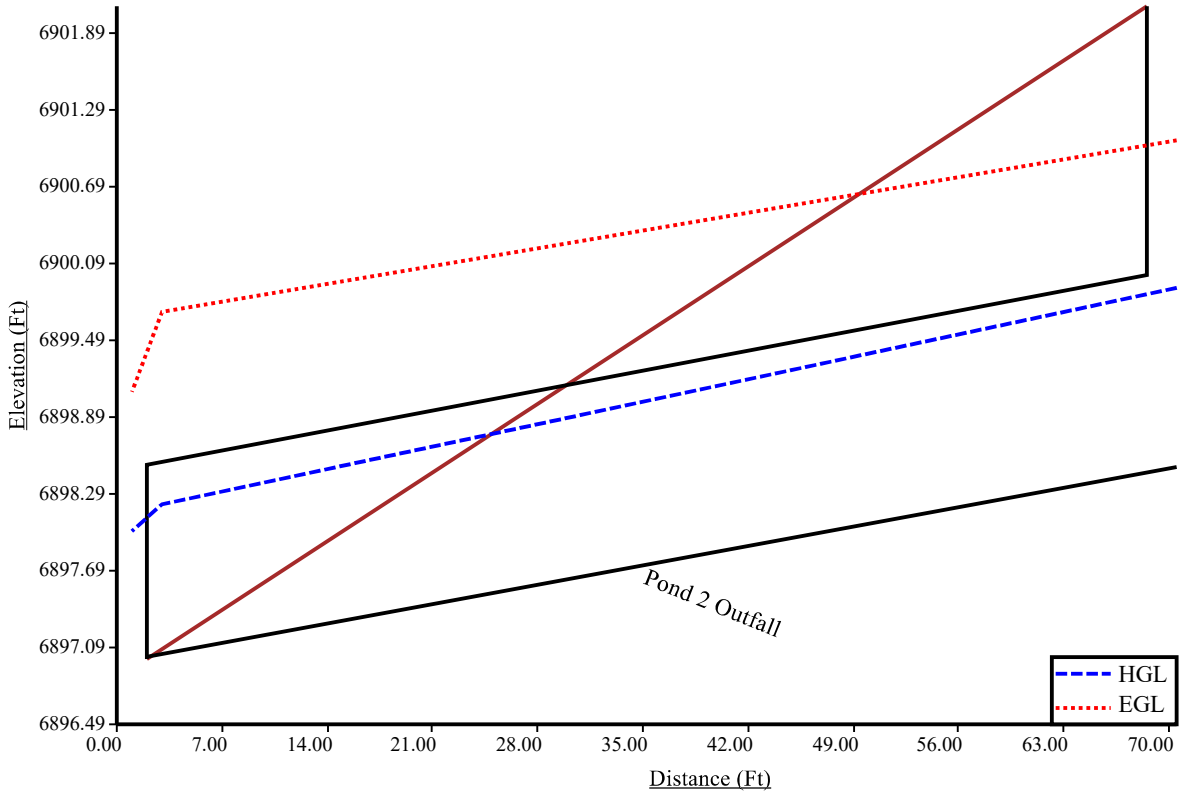
The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
Pond 2 Outfall	70.50	2.50	4.00	4.92	0.00	0.52	0.00	6.70	4.14	1.89	30.98	Sewer Too Shallow

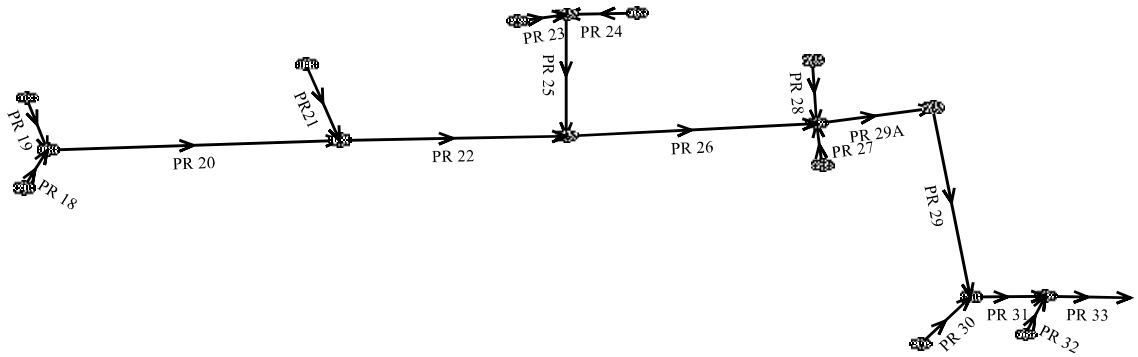
Total earth volume for sewer trenches = 31 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Pond 2 Outfall 100-YR HGL Profile



PIPE RUN 18-33 & ASSOCIATED LATERALS LAYOUT



Program: UDSEWER Math Model Interface 2.1.1.4
Run Date: 11/26/2024 2:27:27 PM

UDSewer Results Summary

Project Title: New UDSEWER System Module
Project Description: Default system

PIPE RUN 18-33 AND ASSOCIATED LATERALS

System Input Summary

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6927.75

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
FSD 3	6924.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 33A	6931.20	45.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PR 37	6931.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 33	6935.00	44.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 32	6935.06	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 31	6934.70	41.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 29	6941.90	36.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 29A	6941.40	36.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 28	6941.66	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 26	6947.10	31.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 25	6945.70	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 24	6945.98	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 23	6945.98	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 22	6952.18	18.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
PR 20	6952.70	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 18	6953.15	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 19	6953.14	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR21	6952.61	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 27	6941.66	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 30	6935.06	7.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
FSD 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Surface Water Present (Upstream)
PR 33A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	45.00	Surface Water Present (Downstream)
PR 37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
PR 33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44.00	
PR 32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	
PR 31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.00	
PR 29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.00	
PR 29A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.00	
PR 28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	
PR 26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.00	
PR 25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	
PR 24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	
PR 23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	
PR 22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.00	
PR 20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	
PR 18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	

PR 19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	
PR21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	
PR 27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	
PR 30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.00	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
PR 33A	163.90	6924.25	1.0	6925.89	0.013	0.03	0.00	CIRCULAR	42.00 in	42.00 in
PR 37	7.57	6927.89	1.1	6927.97	0.013	1.00	0.00	CIRCULAR	12.00 in	12.00 in
PR 33	126.20	6925.89	1.0	6927.15	0.013	0.05	0.00	CIRCULAR	42.00 in	42.00 in
PR 32	11.86	6928.15	11.7	6929.54	0.013	0.38	0.00	CIRCULAR	18.00 in	18.00 in
PR 31	35.39	6927.15	1.0	6927.50	0.013	0.05	0.00	CIRCULAR	42.00 in	42.00 in
PR 29	274.51	6927.71	1.8	6932.65	0.013	1.32	0.00	CIRCULAR	42.00 in	42.00 in
PR 29A	83.18	6932.97	1.6	6934.30	0.013	1.32	0.00	CIRCULAR	42.00 in	42.00 in
PR 28	25.17	6935.79	3.0	6936.55	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PR 26	345.95	6934.75	1.3	6939.25	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 25	105.89	6939.54	1.2	6940.81	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
PR 24	25.67	6941.31	1.0	6941.57	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
PR 23	5.99	6941.31	1.0	6941.37	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
PR 22	289.84	6939.89	1.8	6945.11	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
PR 20	174.56	6946.11	1.0	6947.86	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
PR 18	7.33	6948.16	1.0	6948.23	0.013	0.38	0.00	CIRCULAR	24.00 in	24.00 in
PR 19	26.19	6948.36	1.0	6948.62	0.013	0.83	0.00	CIRCULAR	18.00 in	18.00 in
PR21	26.19	6946.62	2.0	6947.14	0.013	0.38	0.00	CIRCULAR	18.00 in	18.00 in
PR 27	5.17	6935.93	0.4	6935.95	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PR 30	12.69	6928.99	4.3	6929.54	0.013	0.38	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PR 33A	100.88	10.49	25.10	7.50	19.65	10.19	1.60	Supercritical	45.00	0.00	
PR 37	3.75	4.77	5.04	3.20	4.23	4.04	1.40	Supercritical	1.00	0.00	
PR 33	100.88	10.49	24.81	7.44	19.40	10.13	1.60	Supercritical	44.00	0.00	
PR 32	36.03	20.39	7.90	4.02	3.51	12.36	4.82	Supercritical	3.00	0.00	
PR 31	100.88	10.49	23.91	7.25	18.64	9.94	1.61	Supercritical	41.00	0.00	
PR 29	135.35	14.07	22.34	6.92	14.79	11.90	2.20	Supercritical	36.00	0.00	

PR 29A	127.60	13.26	22.34	6.92	15.26	11.40	2.07	Supercritical	36.00	0.00	
PR 28	18.24	10.32	7.90	4.02	4.94	7.62	2.48	Supercritical	3.00	0.00	
PR 26	76.25	10.79	21.66	6.98	15.98	10.23	1.79	Supercritical	31.00	0.00	
PR 25	73.26	10.36	14.82	5.47	11.05	8.15	1.76	Supercritical	15.00	0.00	
PR 24	22.68	7.22	12.08	5.05	9.84	6.59	1.48	Supercritical	8.00	0.00	
PR 23	22.68	7.22	12.08	5.05	9.84	6.59	1.48	Supercritical	8.00	0.00	
PR 22	55.18	11.24	17.24	6.17	11.79	10.05	2.07	Supercritical	18.00	0.00	
PR 20	22.68	7.22	13.58	5.46	11.15	6.99	1.46	Supercritical	10.00	0.00	
PR 18	22.68	7.22	12.08	5.05	9.84	6.59	1.48	Supercritical	8.00	0.00	
PR 19	10.53	5.96	7.90	4.02	6.57	5.14	1.42	Supercritical	3.00	0.00	
PR21	14.90	8.43	13.15	5.78	9.39	8.58	1.92	Supercritical	8.00	0.00	
PR 27	6.66	3.77	7.90	4.02	8.47	3.67	0.88	Subcritical	3.00	0.00	
PR 30	47.04	14.97	11.26	4.83	6.26	10.74	3.11	Supercritical	7.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
PR 33A	45.00	CIRCULAR	42.00 in	42.00 in	33.00 in	33.00 in	42.00 in	42.00 in	9.62	
PR 37	1.00	CIRCULAR	12.00 in	12.00 in	18.00 in	18.00 in	12.00 in	12.00 in	0.79	Height is too small. Width is too small. Existing height is smaller than the suggested height. Existing width is smaller than the suggested width.
PR 33	44.00	CIRCULAR	42.00 in	42.00 in	33.00 in	33.00 in	42.00 in	42.00 in	9.62	
PR 32	3.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 31	41.00	CIRCULAR	42.00 in	42.00 in	33.00 in	33.00 in	42.00 in	42.00 in	9.62	
PR 29	36.00	CIRCULAR	42.00 in	42.00 in	27.00 in	27.00 in	42.00 in	42.00 in	9.62	
PR 29A	36.00	CIRCULAR	42.00 in	42.00 in	27.00 in	27.00 in	42.00 in	42.00 in	9.62	
PR 28	3.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 26	31.00	CIRCULAR	36.00 in	36.00 in	27.00 in	27.00 in	36.00 in	36.00 in	7.07	
PR 25	15.00	CIRCULAR	36.00 in	36.00 in	21.00 in	21.00 in	36.00 in	36.00 in	7.07	
PR 24	8.00	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
PR 23	8.00	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
PR 22	18.00	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	
PR 20	10.00	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
PR 18	8.00	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
PR 19	3.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

PR21	8.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 27	3.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 30	7.00	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6927.75

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PR 33A	6924.25	6925.89	0.00	0.00	6927.75	6927.98	6928.09	0.77	6928.86
PR 37	6927.89	6927.97	0.03	0.00	6928.25	6928.39	6928.48	0.07	6928.55
PR 33	6925.89	6927.15	0.02	0.00	6928.00	6929.22	6929.10	0.98	6930.08
PR 32	6928.15	6929.54	0.02	0.00	6929.23	6930.76	6930.82	0.00	6930.82
PR 31	6927.15	6927.50	0.01	0.00	6929.23	6929.49	6930.23	0.07	6930.31
PR 29	6927.71	6932.65	0.29	0.00	6929.78	6934.51	6931.14	4.12	6935.26
PR 29A	6932.97	6934.30	0.29	0.00	6934.80	6936.16	6936.26	0.65	6936.91
PR 28	6935.79	6936.55	0.06	0.00	6936.22	6937.21	6937.11	0.35	6937.46
PR 26	6934.75	6939.25	0.01	0.00	6936.18	6941.05	6937.71	4.10	6941.81
PR 25	6939.54	6940.81	0.09	0.00	6941.80	6942.04	6941.90	0.61	6942.51
PR 24	6941.31	6941.57	0.13	0.00	6942.18	6942.58	6942.81	0.16	6942.97
PR 23	6941.31	6941.37	0.13	0.00	6942.18	6942.52	6942.81	0.00	6942.81
PR 22	6939.89	6945.11	0.01	0.00	6941.07	6946.55	6942.44	4.69	6947.14
PR 20	6946.11	6947.86	0.01	0.00	6947.04	6948.99	6947.80	1.65	6949.45
PR 18	6948.16	6948.23	0.04	0.00	6949.03	6949.35	6949.65	0.00	6949.65
PR 19	6948.36	6948.62	0.04	0.00	6949.41	6949.41	6949.49	0.08	6949.57
PR21	6946.62	6947.14	0.12	0.00	6947.40	6948.24	6948.54	0.21	6948.76
PR 27	6935.93	6935.95	0.06	0.00	6936.86	6936.86	6936.96	0.01	6936.97
PR 30	6928.99	6929.54	0.03	0.00	6929.52	6931.21	6931.31	0.00	6931.31

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

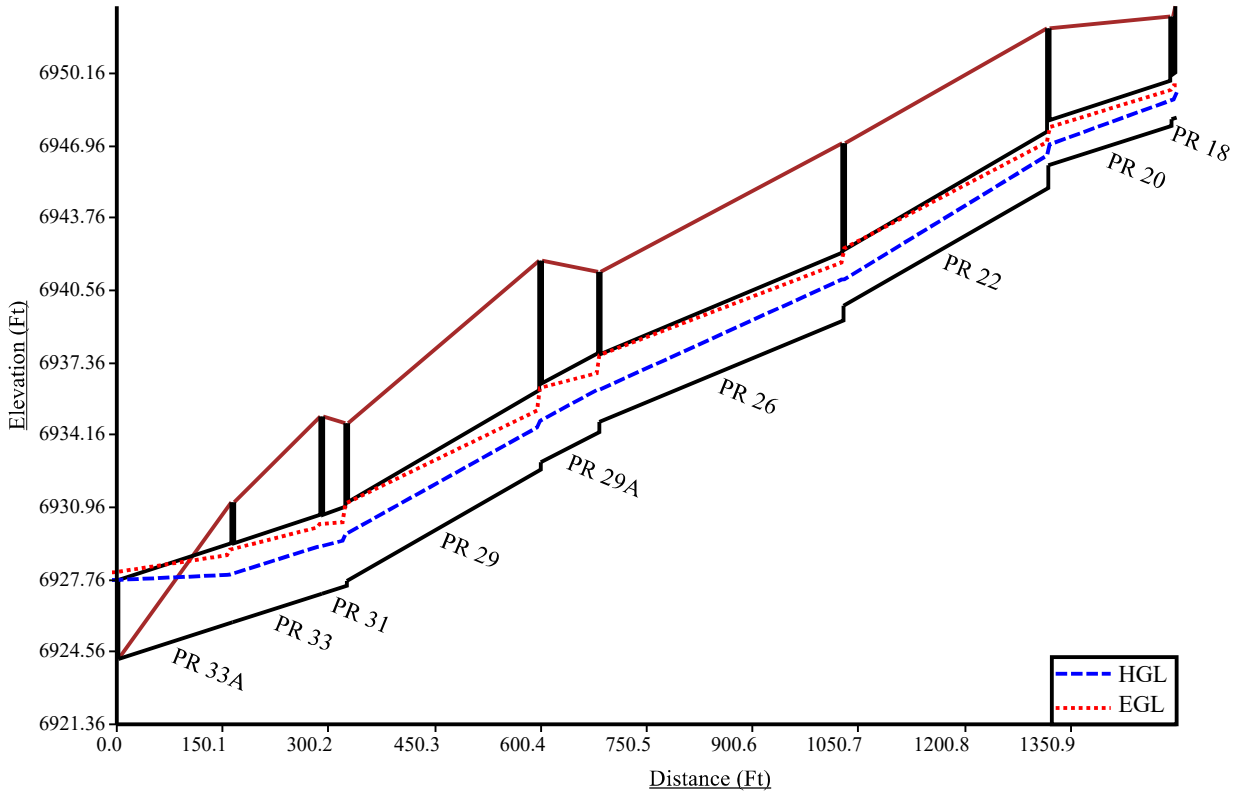
The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
PR 33A	163.90	4.50	6.00	7.25	0.00	0.87	0.00	8.12	6.19	1.44	155.91	Sewer Too Shallow
PR 37	7.57	2.00	4.00	4.33	6.63	3.81	2.15	6.06	3.53	1.86	4.75	Sewer Too Shallow
PR 33	126.20	4.50	6.00	7.25	8.12	6.19	1.44	13.20	8.73	3.98	273.79	Sewer Too Shallow
PR 32	11.86	2.50	4.00	4.92	13.20	7.39	5.14	10.54	6.06	3.81	20.02	
PR 31	35.39	4.50	6.00	7.25	13.21	8.73	3.98	11.90	8.08	3.33	89.20	
PR 29	274.51	4.50	6.00	7.25	11.48	7.87	3.12	16.00	10.13	5.38	783.14	
PR 29A	83.18	4.50	6.00	7.25	15.36	9.81	5.06	11.70	7.98	3.23	231.54	
PR 28	25.17	2.50	4.00	4.92	10.71	6.15	3.90	9.72	5.65	3.40	33.64	
PR 26	345.95	4.00	6.00	6.67	11.29	7.48	3.31	13.70	8.68	4.52	803.90	
PR 25	105.89	4.00	6.00	6.67	13.12	8.39	4.23	7.78	5.72	1.56	205.59	Sewer Too Shallow
PR 24	25.67	3.00	4.00	5.50	7.77	4.97	2.14	7.82	4.99	2.16	27.30	
PR 23	5.99	3.00	4.00	5.50	7.78	4.97	2.14	8.22	5.19	2.36	6.55	
PR 22	289.84	3.50	6.00	6.08	12.91	8.00	4.42	12.64	7.86	4.28	638.17	
PR 20	174.56	3.00	4.00	5.50	11.13	6.65	3.82	8.68	5.42	2.59	248.43	
PR 18	7.33	3.00	4.00	5.50	8.09	5.13	2.29	8.84	5.50	2.67	8.54	
PR 19	26.19	2.50	4.00	4.92	8.18	4.88	2.63	8.54	5.06	2.81	26.60	
PR21	26.19	2.50	4.00	4.92	10.63	6.11	3.86	10.44	6.01	3.76	36.55	
PR 27	5.17	2.50	4.00	4.92	10.44	6.01	3.76	10.92	6.25	4.00	7.37	
PR 30	12.69	3.00	4.00	5.50	10.41	6.29	3.46	10.04	6.10	3.27	18.65	

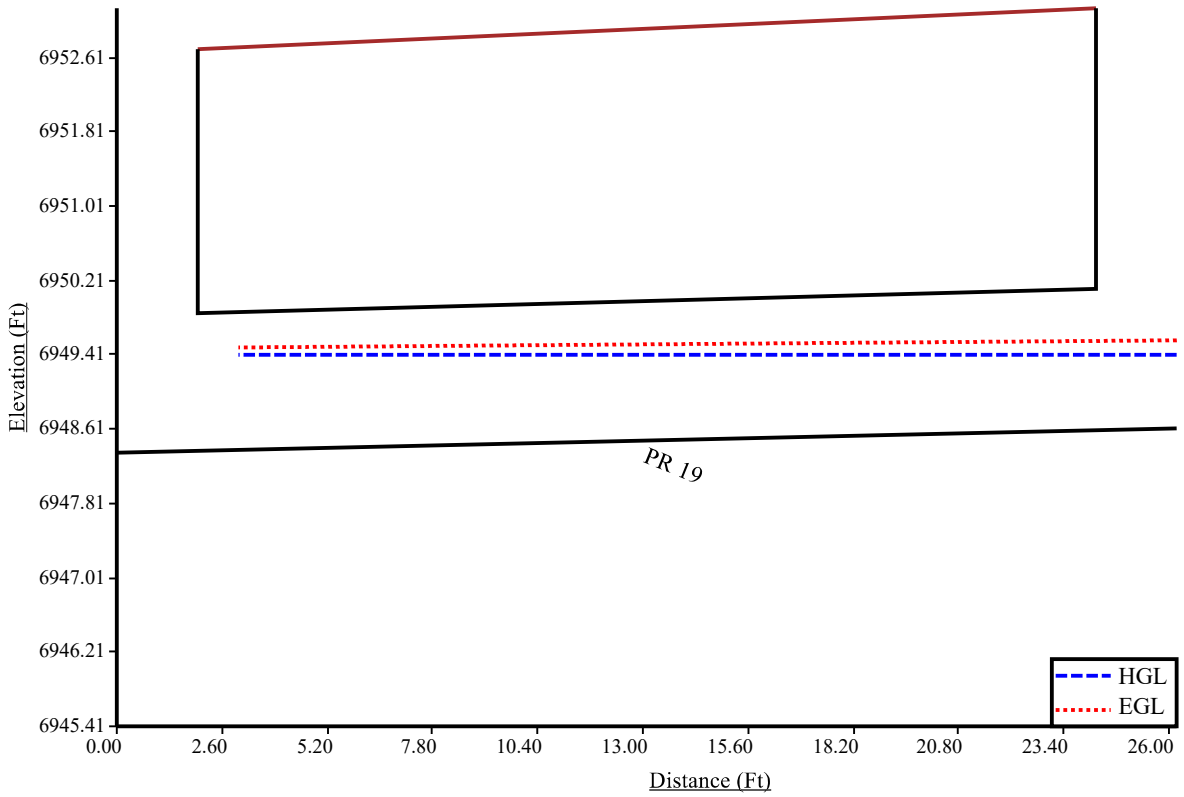
Total earth volume for sewer trenches = 3620 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

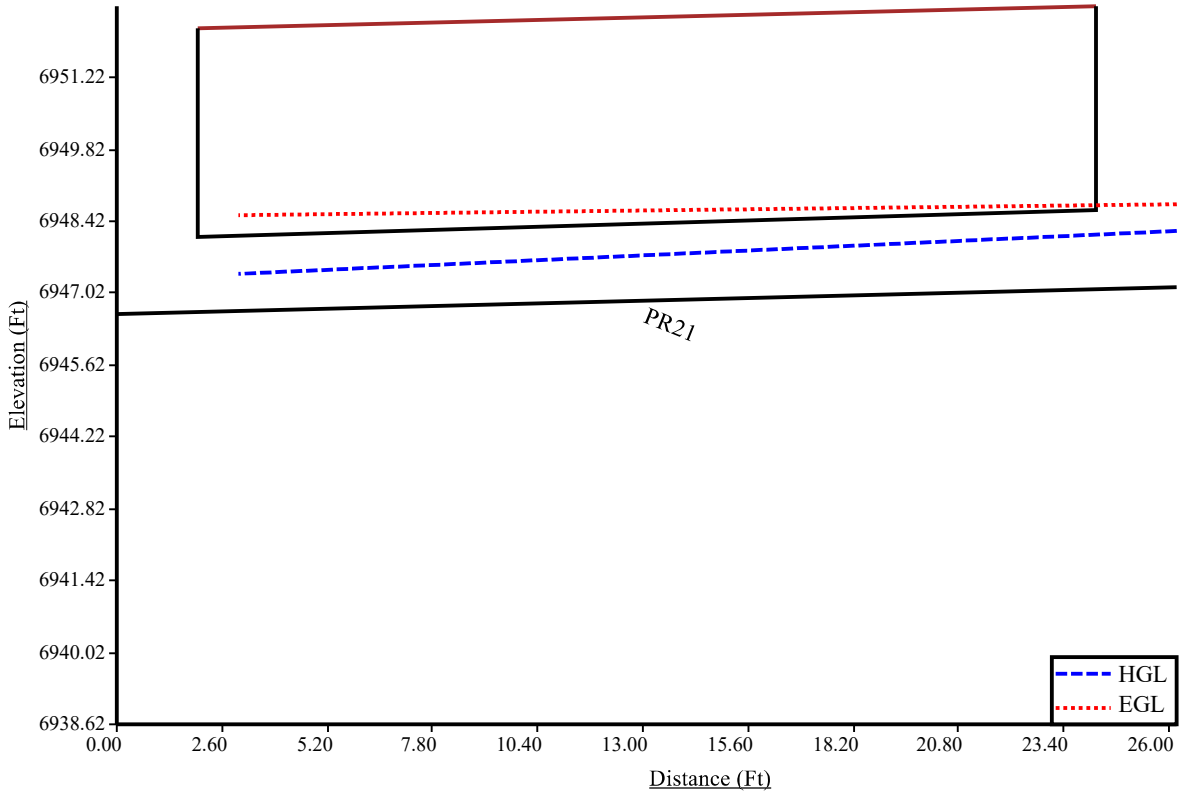
PR 18-33 5-YR HGL Profile



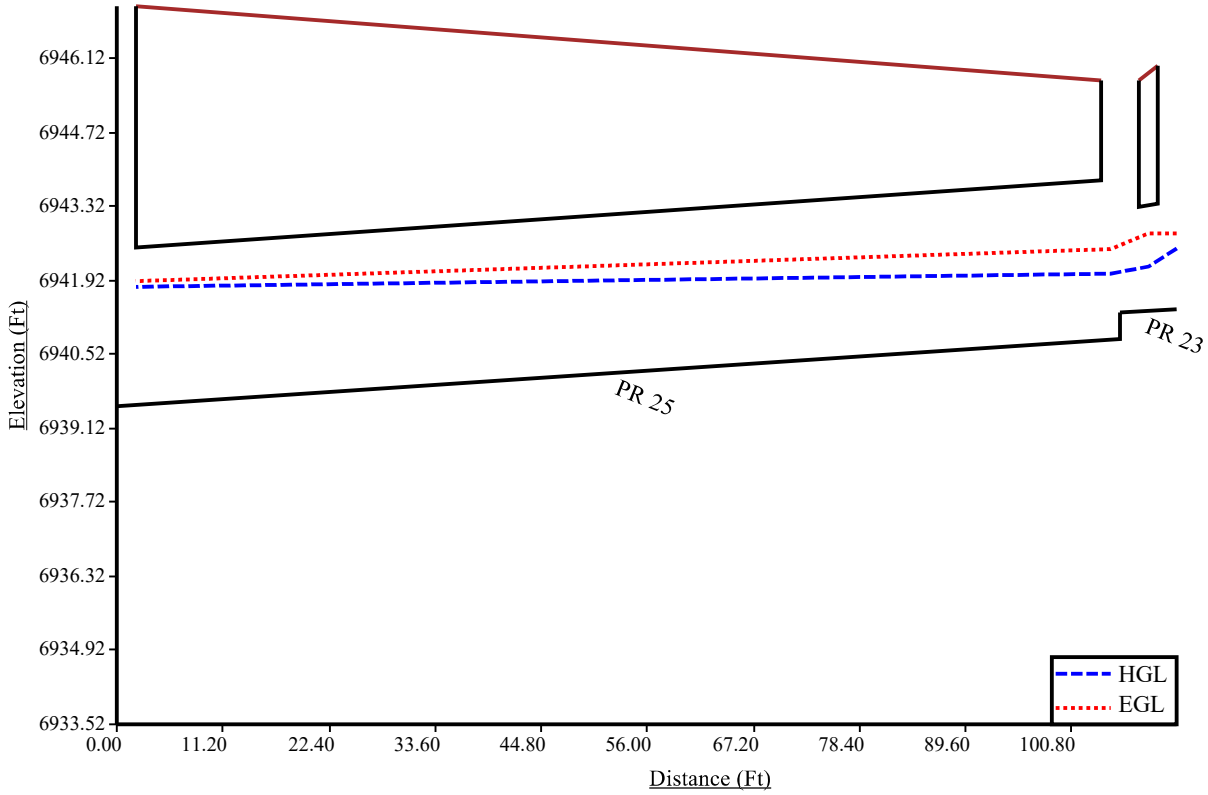
PR 19 5-YR HGL Profile



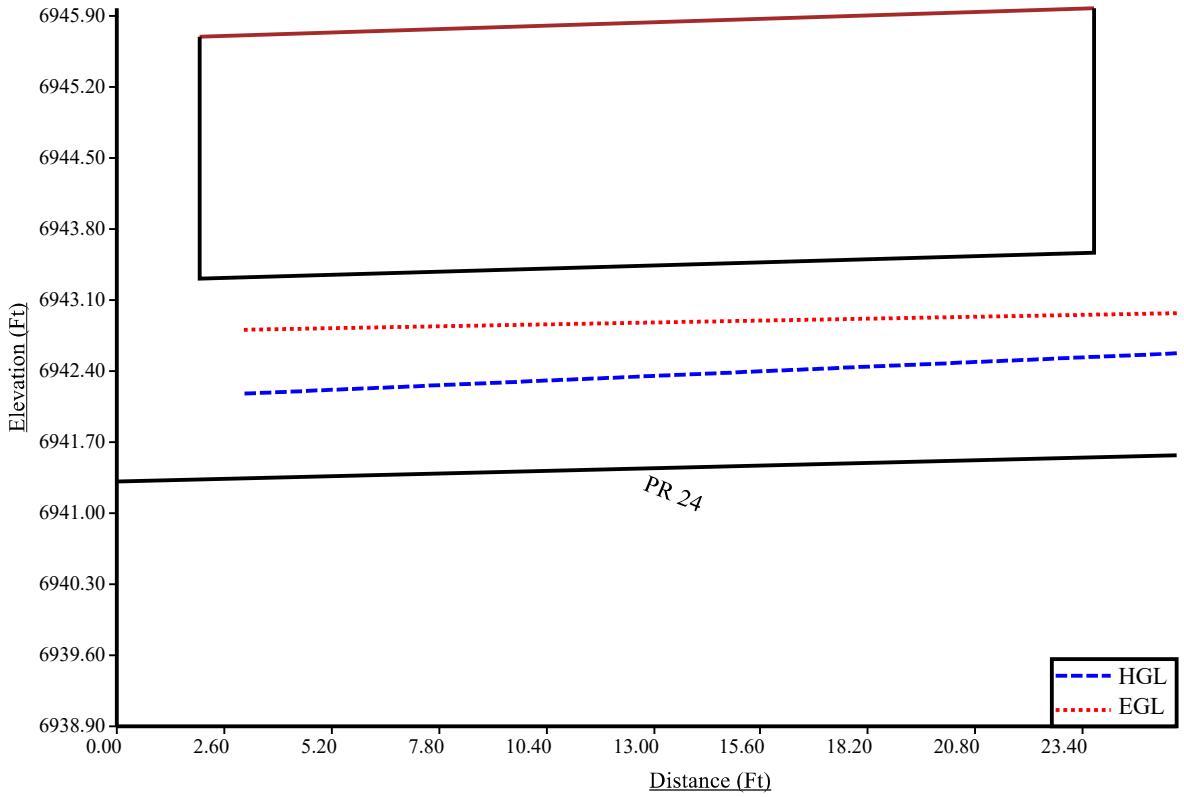
PR 21 5-YR HGL Profile



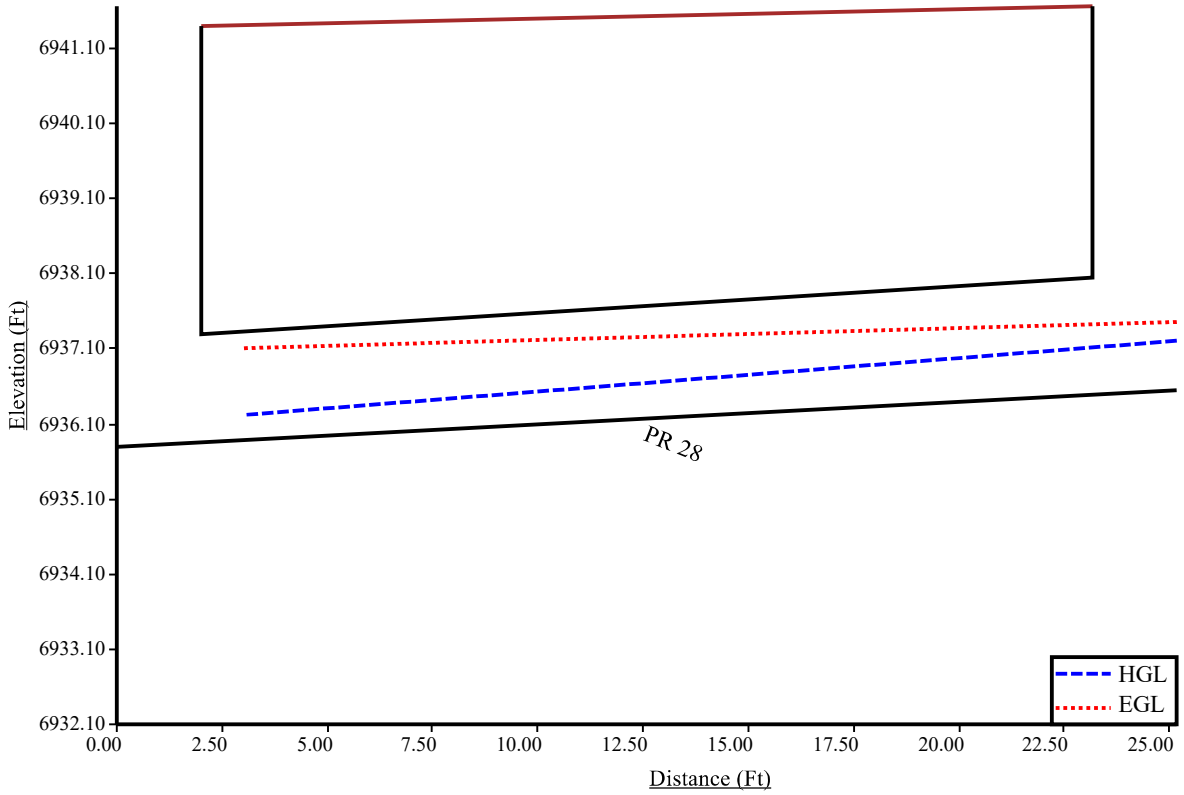
PR 23&25 5-YR HGL Profile



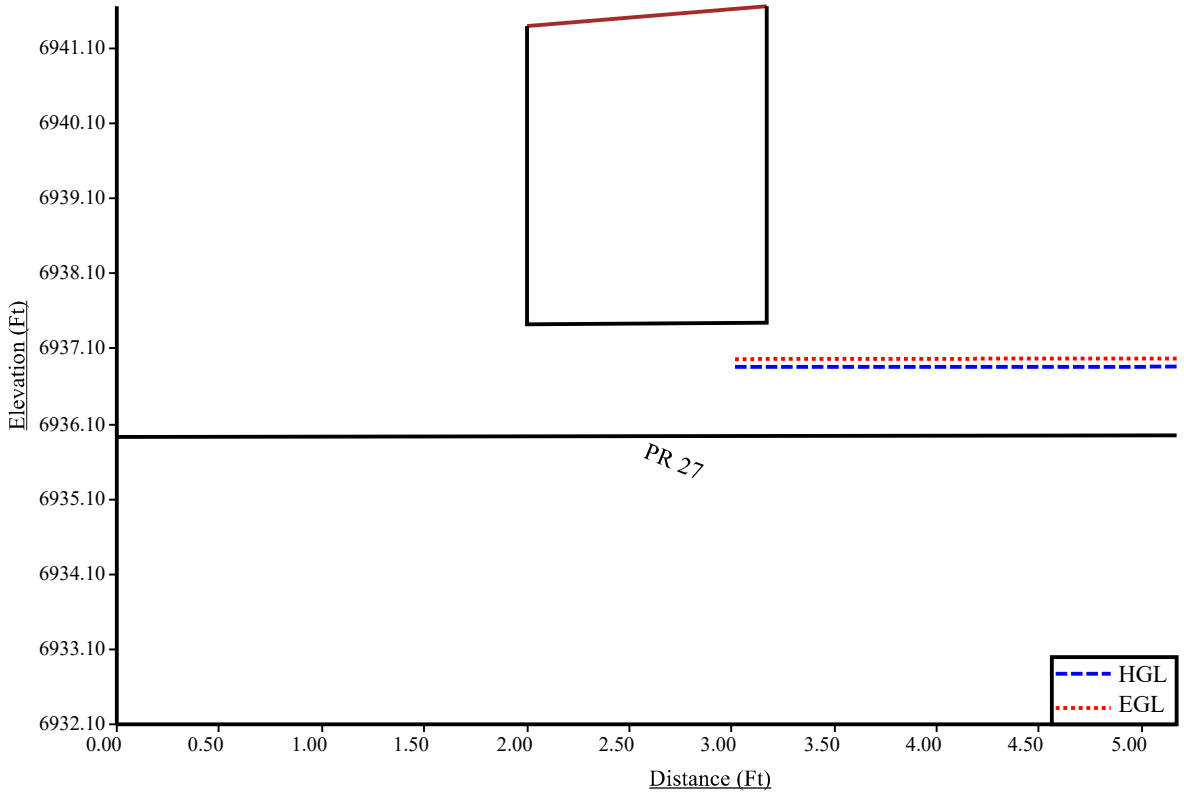
PR 24 5-YR HGL Profile



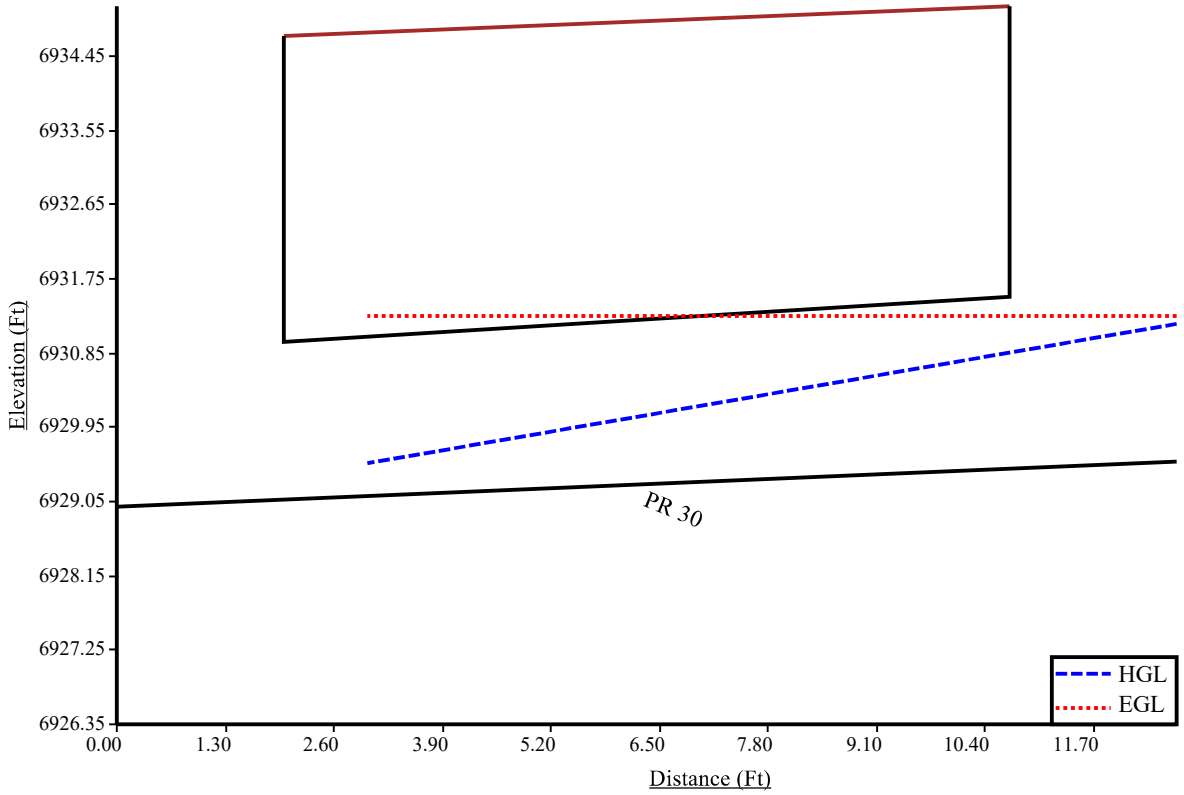
PR 28 5-YR HGL Profile



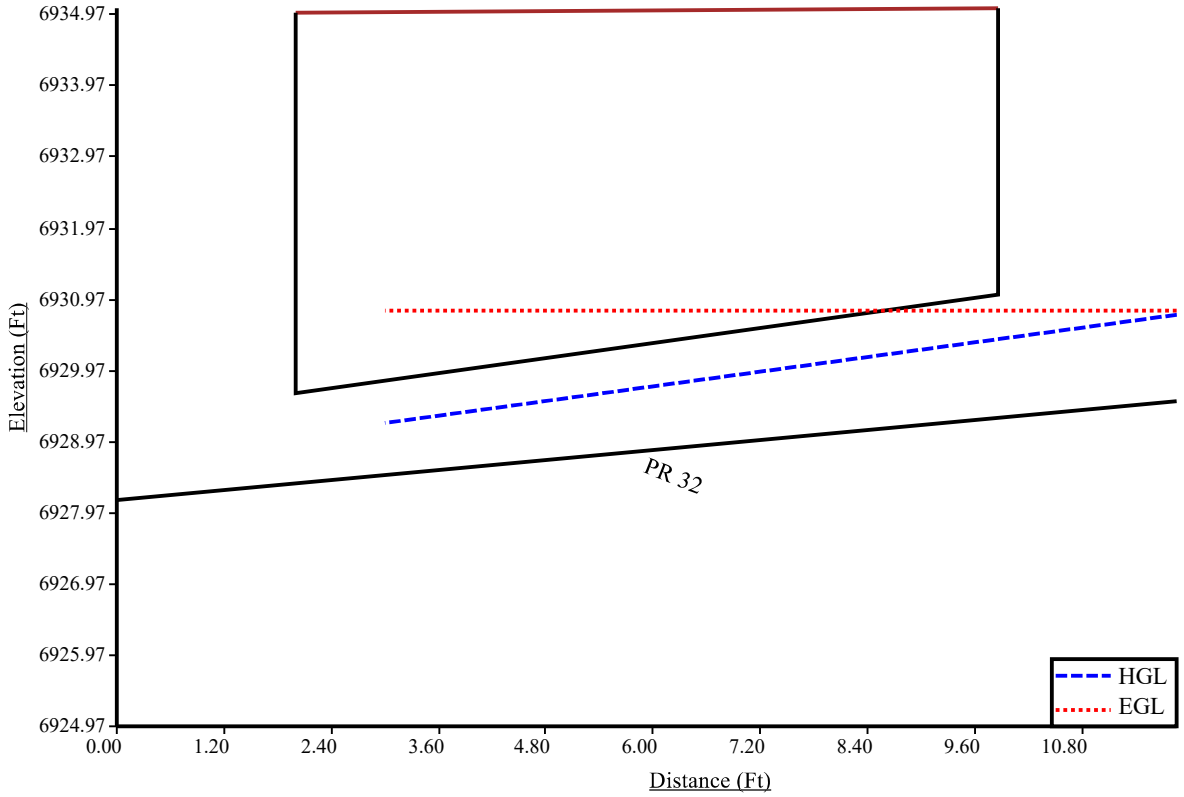
PR 27 5-YR HGL Profile



PR 30 5-YR HGL Profile



PR 32 5-YR HGL Profile



Program: UDSEWER Math Model Interface 2.1.1.4
Run Date: 11/26/2024 2:30:17 PM

UDSewer Results Summary

Project Title: New UDSEWER System Module
Project Description: Default system

PIPE RUN 18-33 AND ASSOCIATED LATERALS

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6927.75

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
FSD 3	6924.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 33A	6931.20	99.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PR 37	6931.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 33	6935.00	98.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 32	6935.06	7.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 31	6934.70	91.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 29	6941.90	78.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 29A	6941.40	78.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 27	6941.66	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 28	6941.66	7.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 26	6947.10	69.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 25	6945.70	39.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 24	6945.98	19.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 23	6945.98	19.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 22	6952.18	36.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
PR 20	6952.70	22.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 18	6953.15	16.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 19	6953.14	7.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR21	6952.61	14.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 30	6935.06	16.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
FSD 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Surface Water Present (Upstream)
PR 33A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	99.00	Surface Water Present (Downstream)
PR 37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	
PR 33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	98.00	
PR 32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.00	
PR 31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	91.00	
PR 29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	78.00	
PR 29A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	78.00	
PR 27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	
PR 28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.00	
PR 26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.00	
PR 25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39.00	
PR 24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.00	
PR 23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.00	
PR 22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.00	
PR 20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.00	

PR 18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.00	
PR 19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.00	
PR21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.00	
PR 30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.00	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
PR 33A	163.90	6924.25	1.0	6925.89	0.013	0.03	0.00	CIRCULAR	42.00 in	42.00 in
PR 37	7.57	6927.89	1.1	6927.97	0.013	1.00	0.00	CIRCULAR	12.00 in	12.00 in
PR 33	126.20	6925.89	1.0	6927.15	0.013	0.05	0.00	CIRCULAR	42.00 in	42.00 in
PR 32	11.86	6928.15	11.7	6929.54	0.013	0.38	0.00	CIRCULAR	18.00 in	18.00 in
PR 31	35.39	6927.15	1.0	6927.50	0.013	0.05	0.00	CIRCULAR	42.00 in	42.00 in
PR 29	274.51	6927.80	1.7	6932.47	0.013	1.32	0.00	CIRCULAR	42.00 in	42.00 in
PR 29A	83.18	6932.97	1.6	6934.30	0.013	1.32	0.00	CIRCULAR	42.00 in	42.00 in
PR 27	5.17	6935.80	2.9	6935.95	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PR 28	25.17	6935.79	3.0	6936.55	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PR 26	345.95	6934.75	1.3	6939.25	0.013	0.05	0.00	CIRCULAR	36.00 in	36.00 in
PR 25	105.89	6939.54	1.2	6940.81	0.013	1.32	0.00	CIRCULAR	36.00 in	36.00 in
PR 24	25.67	6941.31	1.0	6941.57	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
PR 23	5.99	6941.31	1.0	6941.37	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
PR 22	289.84	6939.89	1.8	6945.11	0.013	0.05	0.00	CIRCULAR	30.00 in	30.00 in
PR 20	174.56	6945.59	1.3	6947.86	0.013	0.05	0.00	CIRCULAR	24.00 in	24.00 in
PR 18	7.33	6948.16	1.0	6948.23	0.013	0.38	0.00	CIRCULAR	24.00 in	24.00 in
PR 19	26.19	6948.36	1.0	6948.62	0.013	0.83	0.00	CIRCULAR	18.00 in	18.00 in
PR21	26.19	6946.62	2.0	6947.14	0.013	0.38	0.00	CIRCULAR	18.00 in	18.00 in
PR 30	12.69	6928.99	4.3	6929.54	0.013	0.38	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PR 33A	100.88	10.49	36.68	11.11	33.74	11.95	1.22	Supercritical	99.00	0.00	
PR 37	3.75	4.77	8.91	4.80	8.12	5.30	1.20	Pressurized	3.00	7.57	
PR 33	100.88	10.49	36.54	11.03	33.39	11.95	1.24	Supercritical	98.00	0.00	
PR 32	36.03	20.39	12.29	5.45	5.38	15.79	4.90	Pressurized	7.00	11.86	
PR 31	100.88	10.49	35.48	10.50	31.21	11.87	1.32	Pressurized	91.00	35.39	

PR 29	131.53	13.67	33.14	9.58	23.28	14.25	2.00	Supercritical Jump	78.00	132.86	
PR 29A	127.60	13.26	33.14	9.58	23.72	13.92	1.93	Supercritical Jump	78.00	51.28	
PR 27	17.94	10.15	11.35	5.11	7.17	9.14	2.41	Pressurized	6.00	5.17	
PR 28	18.24	10.32	12.29	5.45	7.74	9.64	2.43	Pressurized	7.00	25.17	
PR 26	76.25	10.79	31.73	10.46	26.82	12.22	1.46	Supercritical	69.00	0.00	
PR 25	73.26	10.36	24.39	7.65	18.68	10.53	1.67	Pressurized	39.00	105.89	
PR 24	22.68	7.22	18.82	7.19	16.81	8.09	1.26	Pressurized	19.00	25.67	
PR 23	22.68	7.22	18.82	7.19	16.81	8.09	1.26	Pressurized	19.00	5.99	
PR 22	55.18	11.24	24.42	8.41	17.66	11.98	1.91	Supercritical Jump	36.00	39.37	
PR 20	25.86	8.23	20.10	7.83	17.01	9.24	1.42	Supercritical	22.00	0.00	
PR 18	22.68	7.22	17.30	6.60	14.87	7.82	1.34	Pressurized	16.00	7.33	
PR 19	10.53	5.96	12.29	5.45	10.72	6.38	1.30	Pressurized	7.00	26.19	
PR21	14.90	8.43	16.58	8.23	13.87	9.58	1.57	Supercritical	14.00	0.00	
PR 30	47.04	14.97	17.30	6.60	9.65	13.54	3.07	Pressurized	16.00	12.69	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
PR 33A	99.00	CIRCULAR	42.00 in	42.00 in	42.00 in	42.00 in	42.00 in	42.00 in	9.62	
PR 37	3.00	CIRCULAR	12.00 in	12.00 in	18.00 in	18.00 in	12.00 in	12.00 in	0.79	Height is too small. Width is too small. Existing height is smaller than the suggested height. Existing width is smaller than the suggested width.
PR 33	98.00	CIRCULAR	42.00 in	42.00 in	42.00 in	42.00 in	42.00 in	42.00 in	9.62	
PR 32	7.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 31	91.00	CIRCULAR	42.00 in	42.00 in	42.00 in	42.00 in	42.00 in	42.00 in	9.62	
PR 29	78.00	CIRCULAR	42.00 in	42.00 in	36.00 in	36.00 in	42.00 in	42.00 in	9.62	
PR 29A	78.00	CIRCULAR	42.00 in	42.00 in	36.00 in	36.00 in	42.00 in	42.00 in	9.62	
PR 27	6.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 28	7.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 26	69.00	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	
PR 25	39.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	
PR 24	19.00	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	

PR 23	19.00	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
PR 22	36.00	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
PR 20	22.00	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
PR 18	16.00	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
PR 19	7.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR21	14.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 30	16.00	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6927.75

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PR 33A	6924.25	6925.89	0.00	0.00	6927.75	6928.95	6929.39	1.47	6930.86
PR 37	6927.89	6927.97	0.23	0.00	6930.86	6930.92	6931.09	0.05	6931.14
PR 33	6925.89	6927.15	0.08	0.00	6929.32	6930.20	6930.94	1.14	6932.08
PR 32	6928.15	6929.54	0.09	0.00	6931.93	6931.98	6932.18	0.05	6932.23
PR 31	6927.15	6927.50	0.07	0.00	6930.76	6931.05	6932.15	0.29	6932.44
PR 29	6927.80	6932.47	1.35	0.00	6932.77	6935.23	6933.79	2.87	6936.66
PR 29A	6932.97	6934.30	1.35	0.00	6936.98	6937.06	6938.00	0.48	6938.49
PR 27	6935.80	6935.95	0.24	0.00	6938.54	6938.56	6938.72	0.02	6938.74
PR 28	6935.79	6936.55	0.32	0.00	6938.56	6938.68	6938.81	0.11	6938.92
PR 26	6934.75	6939.25	0.07	0.00	6937.14	6941.89	6939.31	4.29	6943.59
PR 25	6939.54	6940.81	0.62	0.00	6943.74	6944.10	6944.22	0.36	6944.58
PR 24	6941.31	6941.57	0.75	0.00	6944.85	6945.03	6945.42	0.18	6945.60
PR 23	6941.31	6941.37	0.75	0.00	6944.85	6944.90	6945.42	0.04	6945.46
PR 22	6939.89	6945.11	0.04	0.00	6942.80	6947.14	6943.64	4.61	6948.24
PR 20	6945.59	6947.86	0.04	0.00	6947.18	6949.53	6948.33	2.15	6950.49
PR 18	6948.16	6948.23	0.15	0.00	6950.24	6950.27	6950.64	0.04	6950.68
PR 19	6948.36	6948.62	0.20	0.00	6950.45	6950.56	6950.69	0.12	6950.80
PR21	6946.62	6947.14	0.37	0.00	6947.77	6948.52	6949.20	0.37	6949.57
PR 30	6928.99	6929.54	0.15	0.00	6932.19	6932.25	6932.59	0.06	6932.66

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)

- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

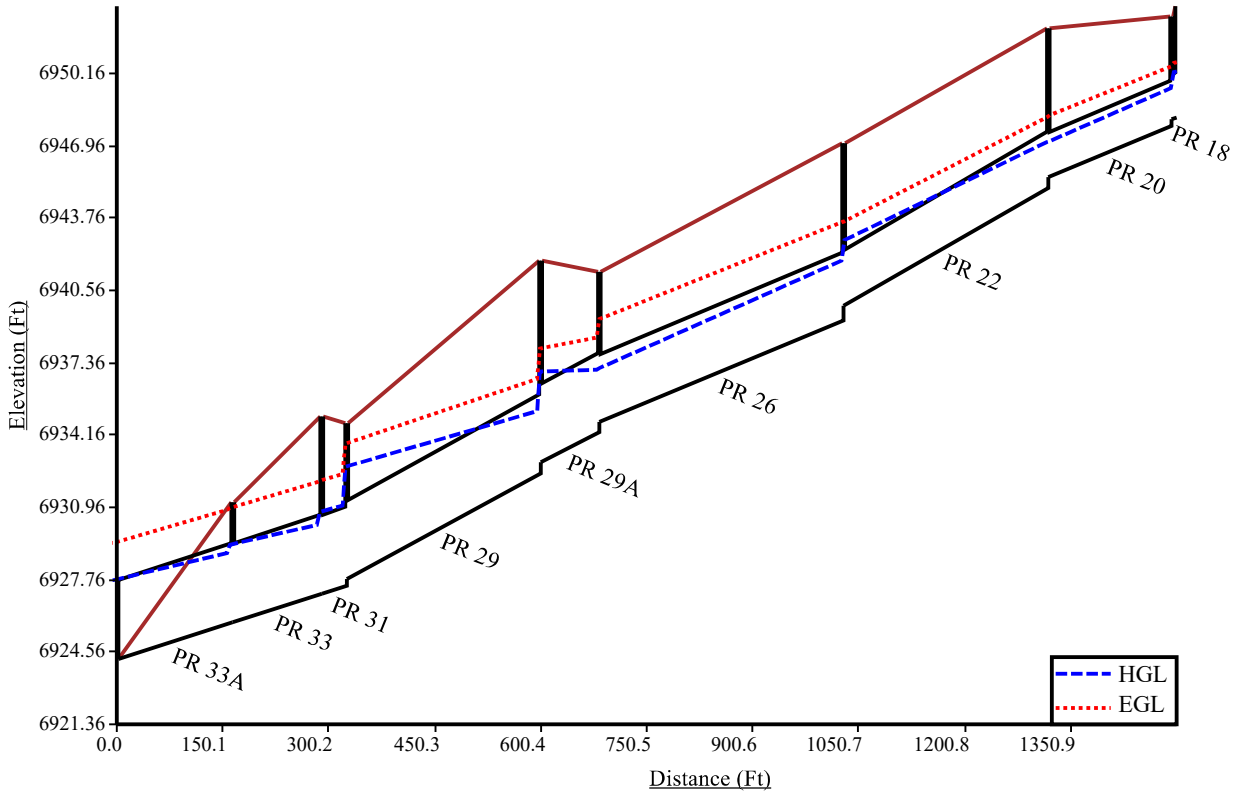
The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
PR 33A	163.90	4.50	6.00	7.25	0.00	0.87	0.00	8.12	6.19	1.44	155.91	Sewer Too Shallow
PR 37	7.57	2.00	4.00	4.33	6.63	3.81	2.15	6.06	3.53	1.86	4.75	Sewer Too Shallow
PR 33	126.20	4.50	6.00	7.25	8.12	6.19	1.44	13.20	8.73	3.98	273.79	Sewer Too Shallow
PR 32	11.86	2.50	4.00	4.92	13.20	7.39	5.14	10.54	6.06	3.81	20.02	
PR 31	35.39	4.50	6.00	7.25	13.21	8.73	3.98	11.90	8.08	3.33	89.20	
PR 29	274.51	4.50	6.00	7.25	11.29	7.77	3.02	16.36	10.31	5.56	792.47	
PR 29A	83.18	4.50	6.00	7.25	15.36	9.81	5.06	11.70	7.98	3.23	231.54	
PR 27	5.17	2.50	4.00	4.92	10.70	6.14	3.89	10.92	6.25	4.00	7.50	
PR 28	25.17	2.50	4.00	4.92	10.71	6.15	3.90	9.72	5.65	3.40	33.64	
PR 26	345.95	4.00	6.00	6.67	11.29	7.48	3.31	13.70	8.68	4.52	803.90	
PR 25	105.89	4.00	6.00	6.67	13.12	8.39	4.23	7.78	5.72	1.56	205.59	Sewer Too Shallow
PR 24	25.67	3.00	4.00	5.50	7.77	4.97	2.14	7.82	4.99	2.16	27.30	
PR 23	5.99	3.00	4.00	5.50	7.78	4.97	2.14	8.22	5.19	2.36	6.55	
PR 22	289.84	3.50	6.00	6.08	12.91	8.00	4.42	12.64	7.86	4.28	638.17	
PR 20	174.56	3.00	4.00	5.50	12.18	7.17	4.34	8.68	5.42	2.59	268.16	
PR 18	7.33	3.00	4.00	5.50	8.09	5.13	2.29	8.84	5.50	2.67	8.54	
PR 19	26.19	2.50	4.00	4.92	8.18	4.88	2.63	8.54	5.06	2.81	26.60	
PR21	26.19	2.50	4.00	4.92	10.63	6.11	3.86	10.44	6.01	3.76	36.55	
PR 30	12.69	3.00	4.00	5.50	10.41	6.29	3.46	10.04	6.10	3.27	18.65	

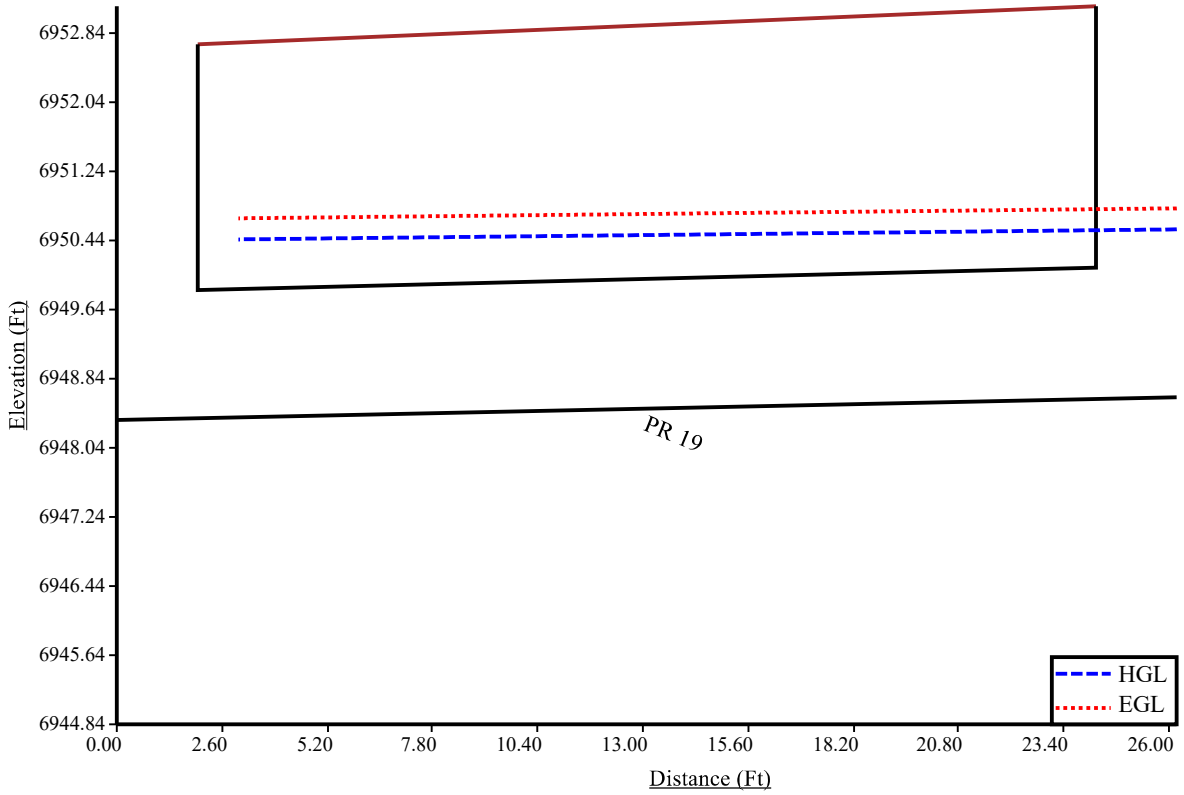
Total earth volume for sewer trenches = 3649 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

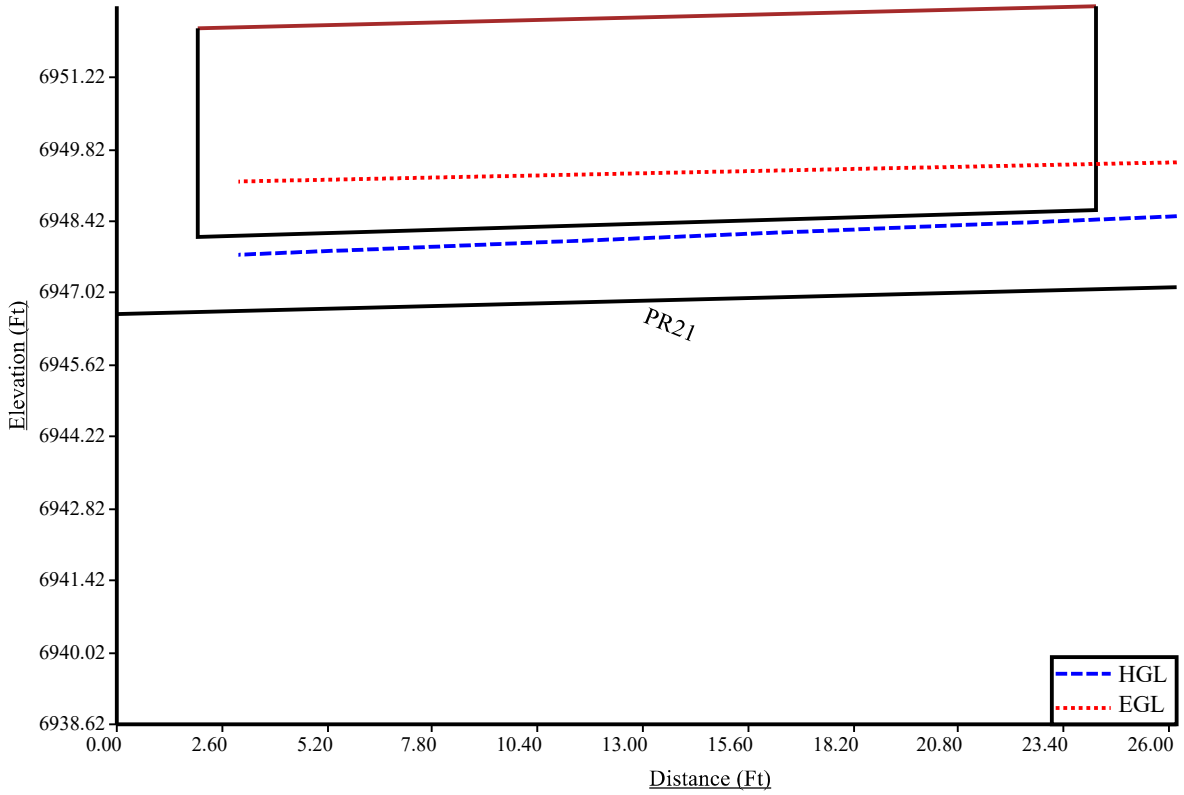
PR 18-33 100-YR HGL Profile



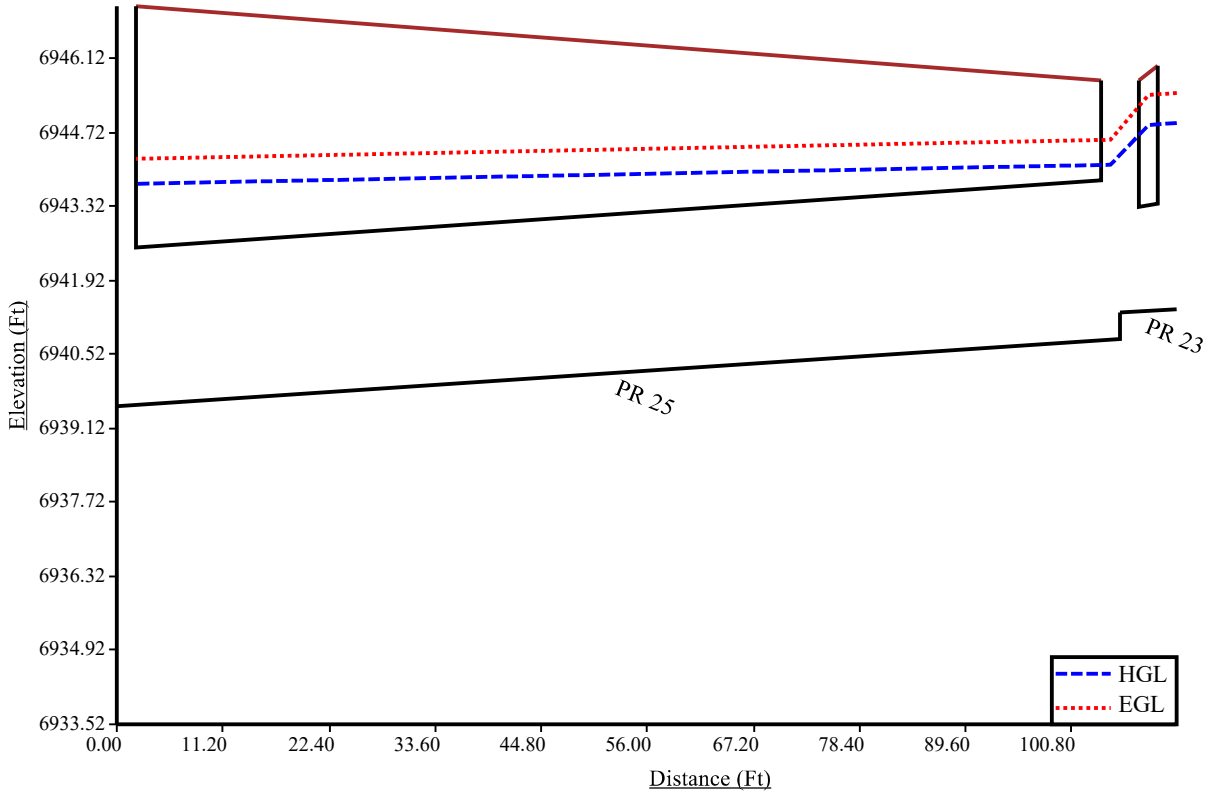
PR 19 100-YR HGL Profile



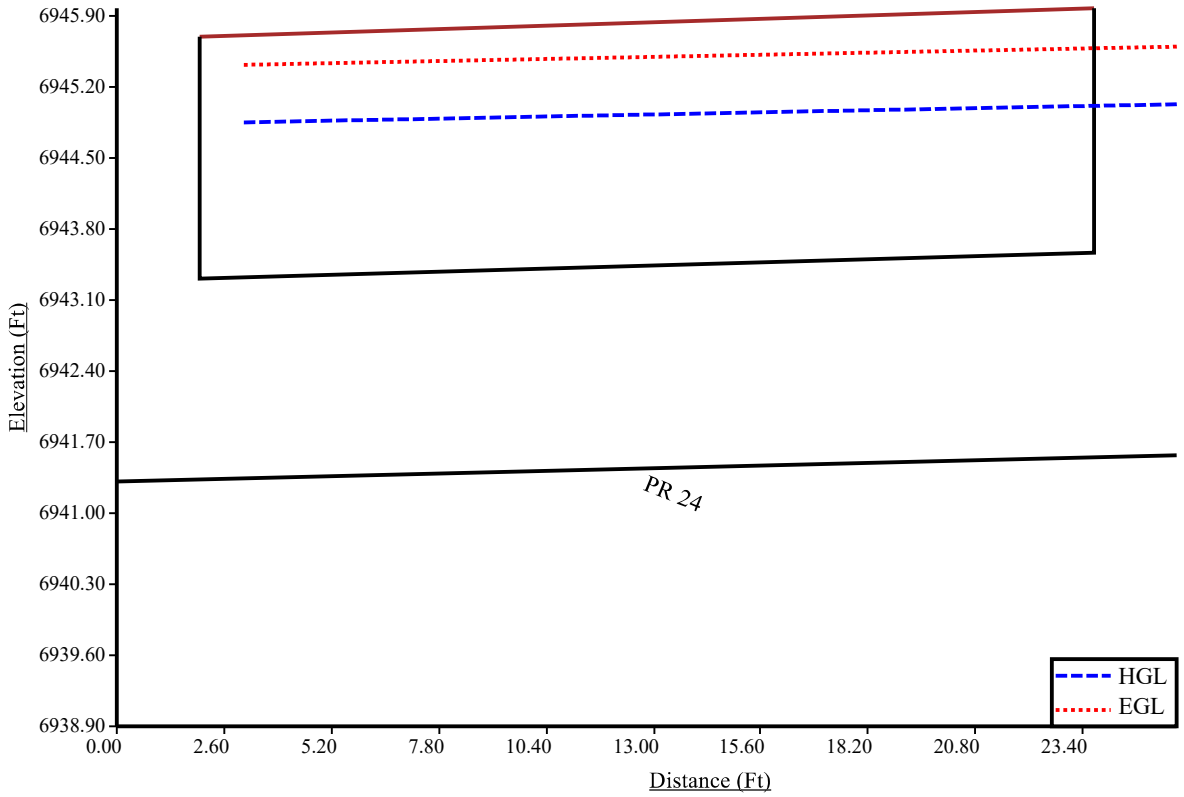
PR 21 100-YR HGL Profile



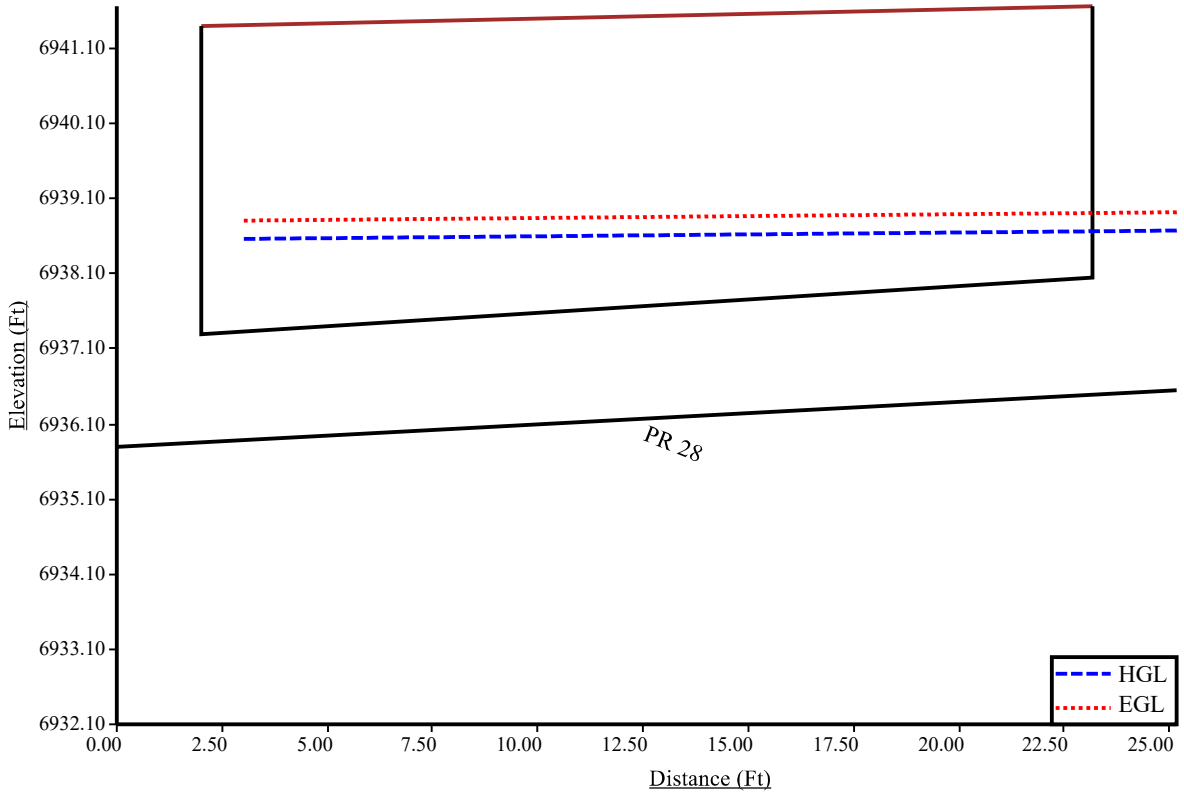
PR 23&25 100-YR HGL Profile



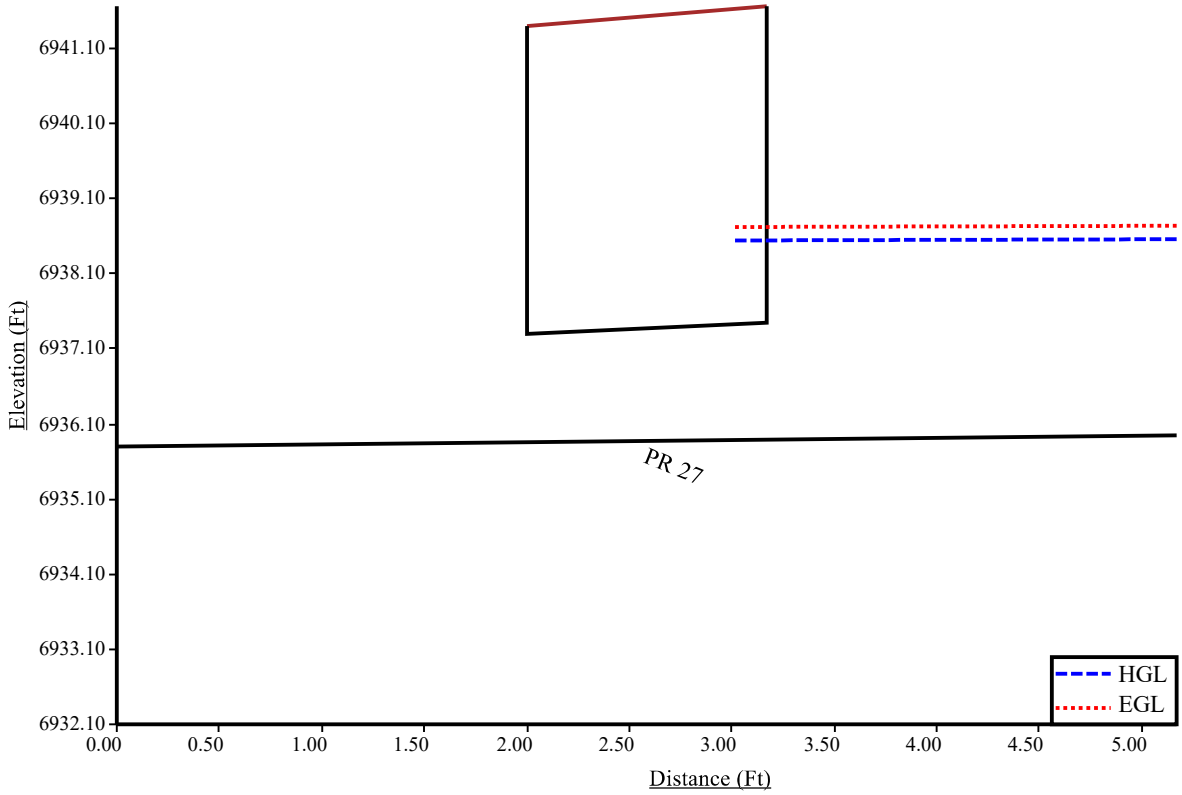
PR 24 100-YR HGL Profile



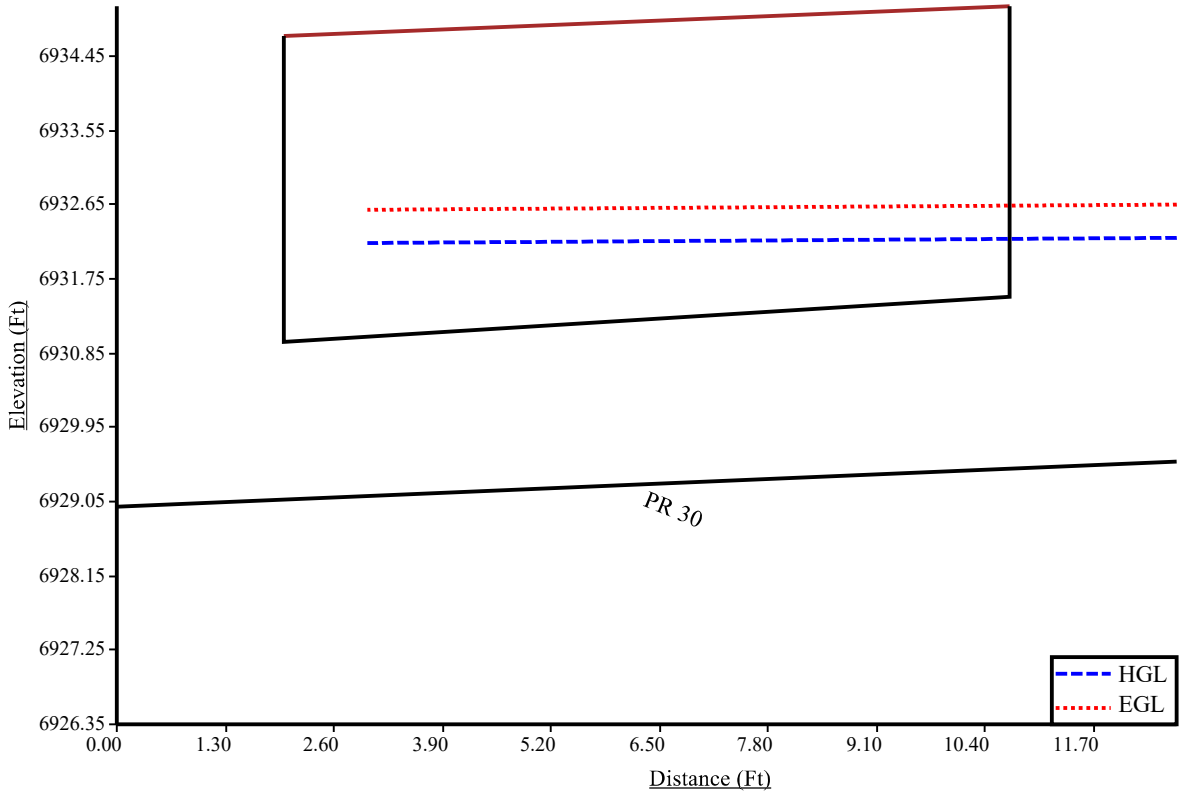
PR 28 100-YR HGL Profile



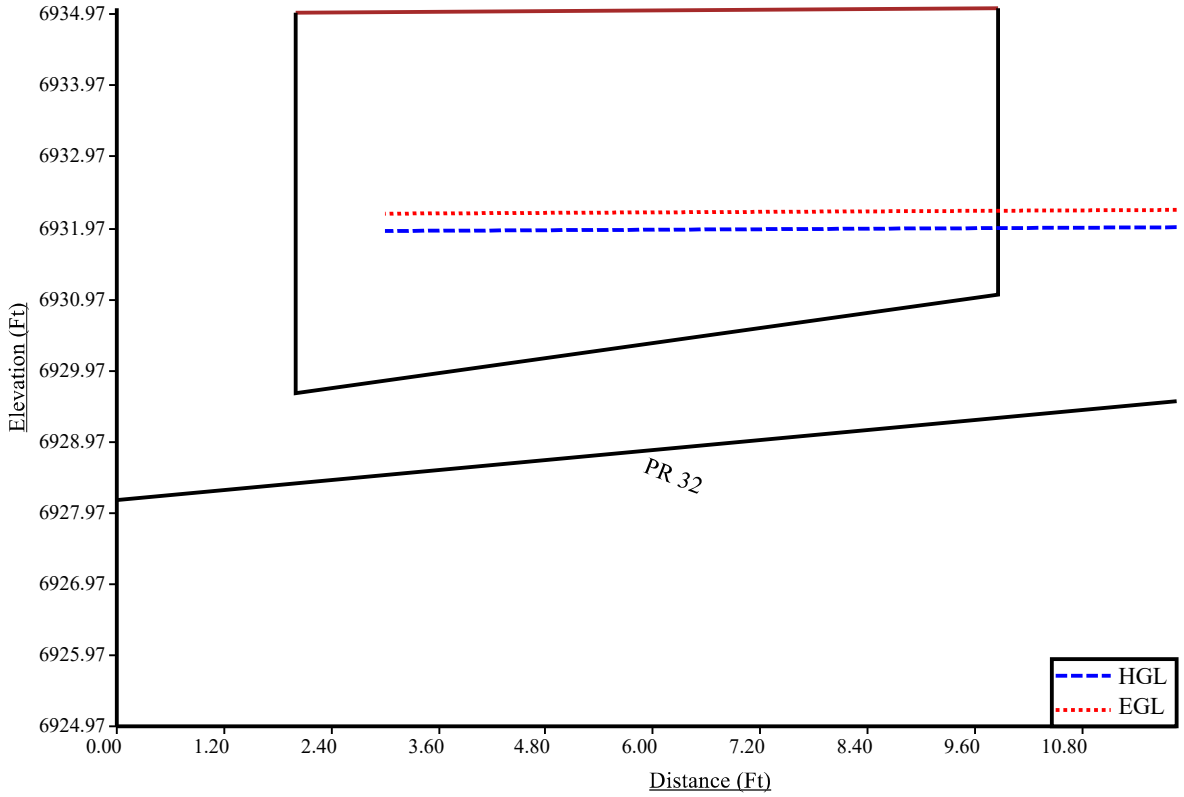
PR 27 100-YR HGL Profile



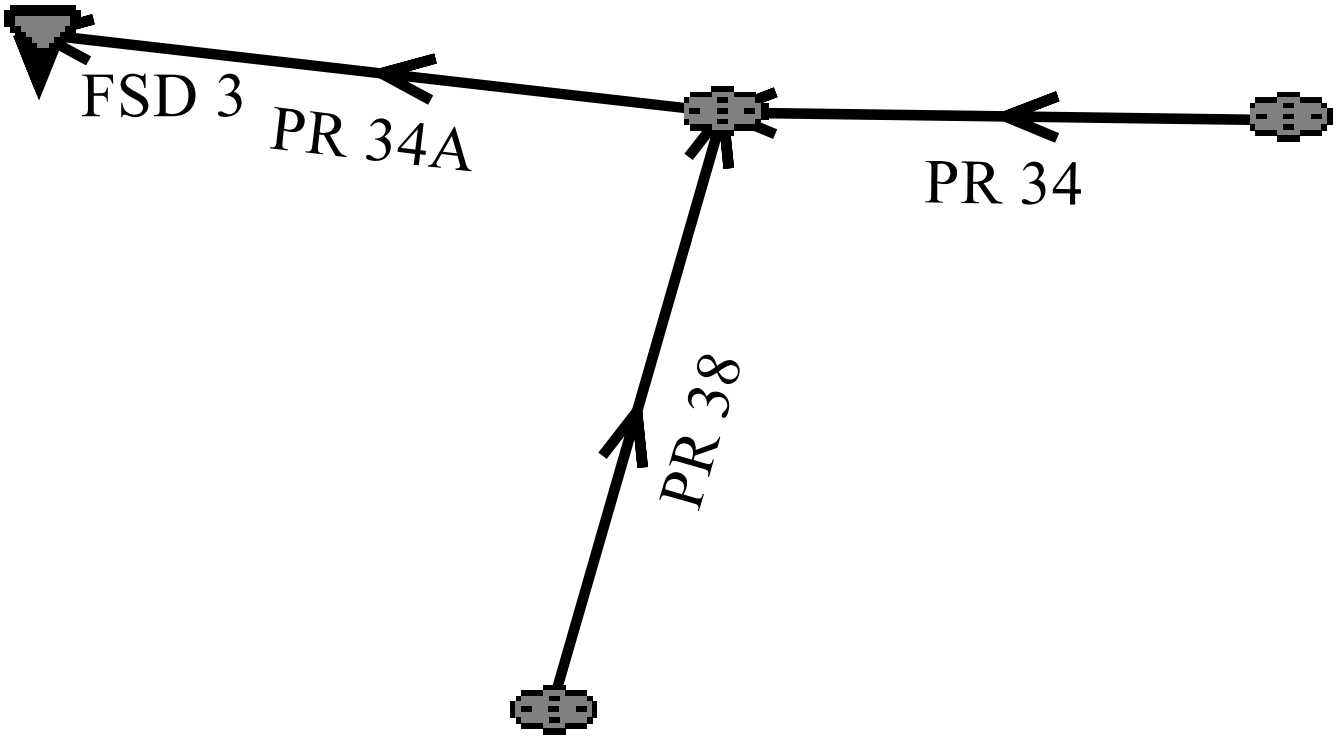
PR 30 100-YR HGL Profile



PR 32 100-YR HGL Profile



PIPE RUN 34 & ASSOCIATED LATERALS LAYOUT



Program: UDSEWER Math Model Interface 2.1.1.4
Run Date: 11/26/2024 2:58:47 PM

UDSewer Results Summary

Project Title: New UDSEWER System Module
Project Description: Default system

PIPE RUN 34 AND ASSOCIATED LATERALS

System Input Summary

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6926.71

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
FSD 3	6922.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 34A	6927.31	11.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PR 34	6927.31	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
FSD 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Surface Water Present (Upstream)
PR 34A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.00	Surface Water Present (Downstream)
PR 34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
PR 34A	135.58	6922.20	0.6	6923.01	0.013	0.03	0.00	CIRCULAR	30.00 in	30.00 in
PR 34	35.34	6923.50	0.8	6923.78	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PR 34A	31.86	6.49	13.32	5.22	12.16	5.89	1.19	Pressurized	11.00	135.58	
PR 34	9.42	5.33	10.32	4.77	9.32	5.41	1.21	Pressurized	5.00	35.34	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
PR 34A	11.00	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	
PR 34	5.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6926.71

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PR 34A	6922.20	6923.01	0.00	0.00	6926.71	6926.81	6926.79	0.10	6926.88
PR 34	6923.50	6923.78	0.01	0.00	6926.81	6926.89	6926.94	0.08	6927.02

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

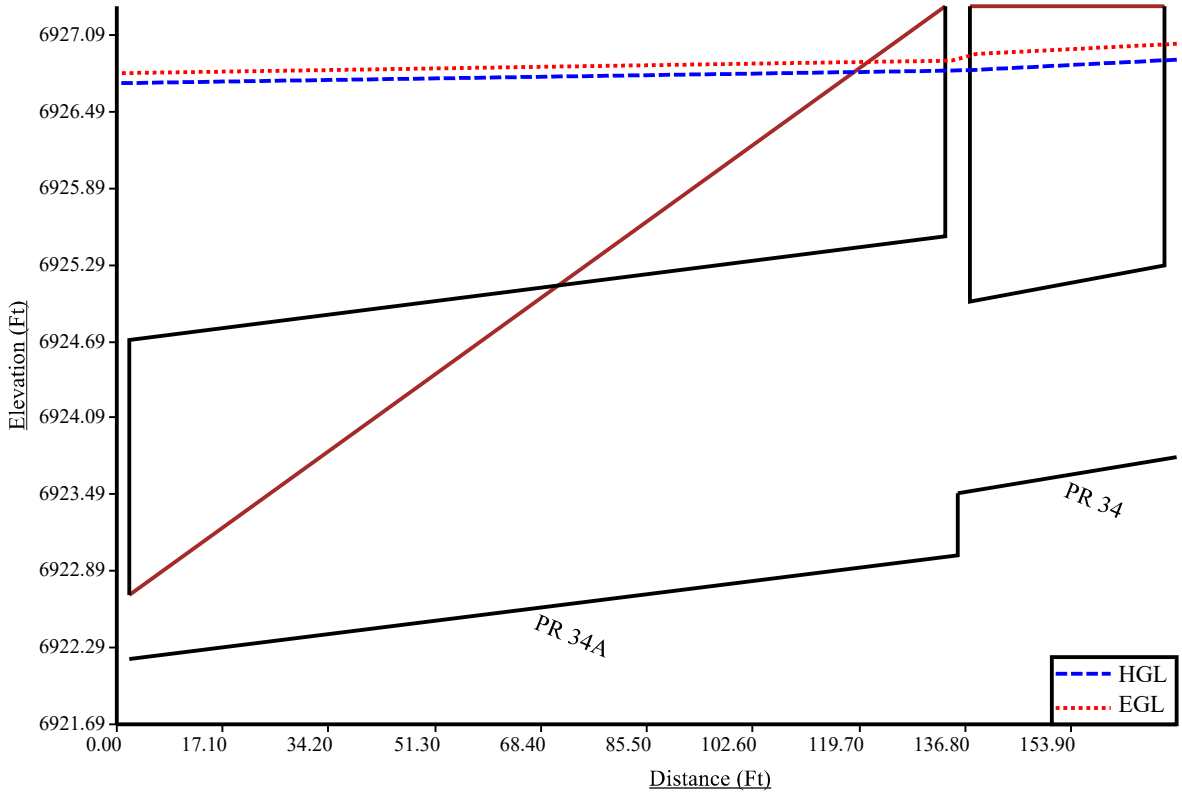
The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
PR 34A	135.58	3.50	6.00	6.08	0.00	1.30	0.00	7.10	5.09	1.51	98.20	Sewer Too Shallow
PR 34	35.34	2.50	4.00	4.92	7.13	4.35	2.10	6.56	4.07	1.82	28.35	Sewer Too Shallow

Total earth volume for sewer trenches = 127 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

PR 34-34A 5-YR HGL Profile



Program: UDSEWER Math Model Interface 2.1.1.4
Run Date: 11/26/2024 2:59:05 PM

UDSewer Results Summary

Project Title: New UDSEWER System Module
Project Description: Default system

PIPE RUN 34 AND ASSOCIATED LATERALS

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6926.71

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
FSD 3	6922.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 34A	6927.31	24.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PR 34	6927.31	11.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
FSD 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Surface Water Present (Upstream)
PR 34A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.00	Surface Water Present (Downstream)
PR 34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.00	Surface Water Present (Upstream)

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
PR 34A	135.58	6922.20	0.6	6923.01	0.013	0.03	0.00	CIRCULAR	30.00 in	30.00 in
PR 34	35.34	6923.50	0.8	6923.78	0.013	0.05	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PR 34A	31.86	6.49	20.02	6.90	19.45	7.13	1.06	Pressurized	24.00	135.58	
PR 34	9.42	5.33	18.00	6.22	18.00	6.22	0.00	Pressurized	11.00	35.34	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
PR 34A	24.00	CIRCULAR	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	30.00 in	4.91	

PR 34	11.00	CIRCULAR	18.00 in	18.00 in	21.00 in	21.00 in	18.00 in	18.00 in	1.77	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6926.71

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PR 34A	6922.20	6923.01	0.00	0.00	6926.71	6927.17	6927.08	0.46	6927.54
PR 34	6923.50	6923.78	0.03	0.00	6927.20	6927.59	6927.80	0.39	6928.19

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

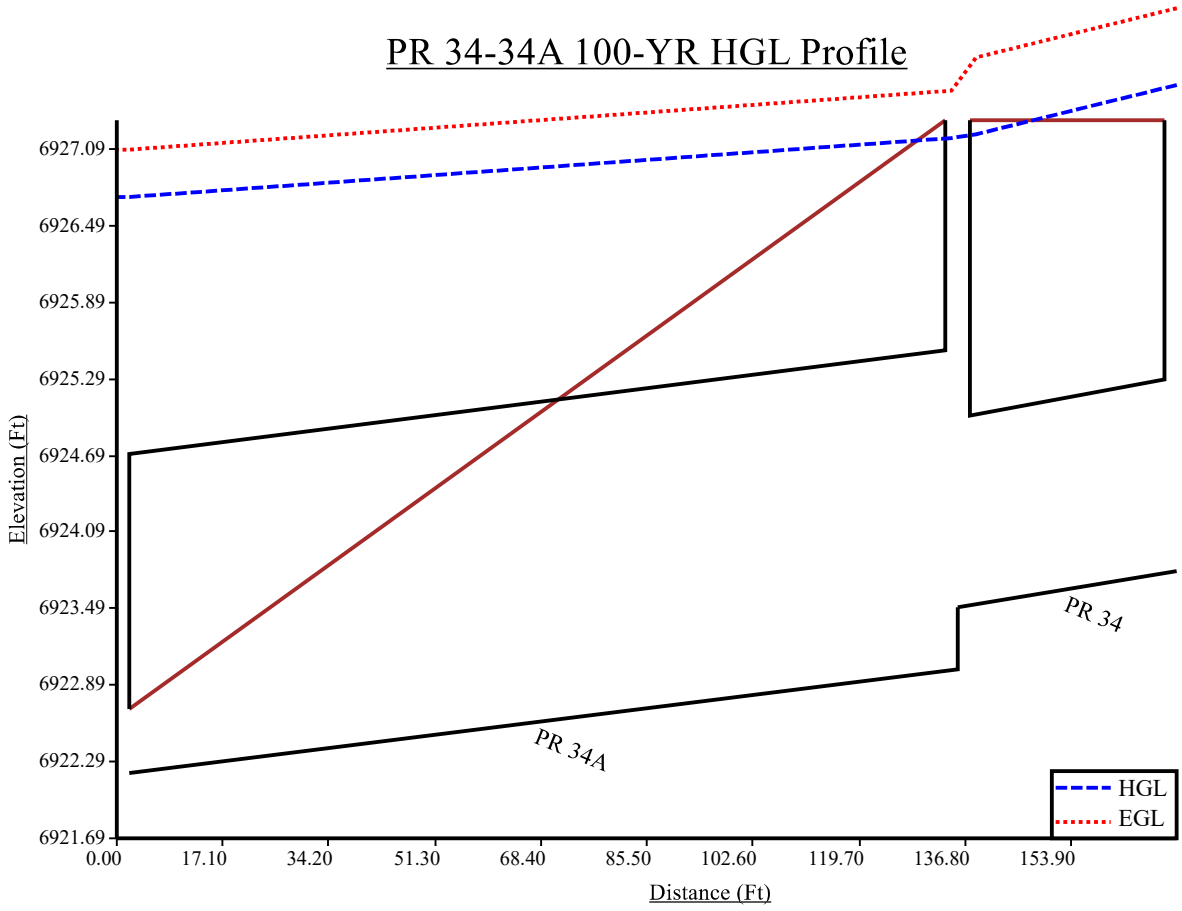
Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

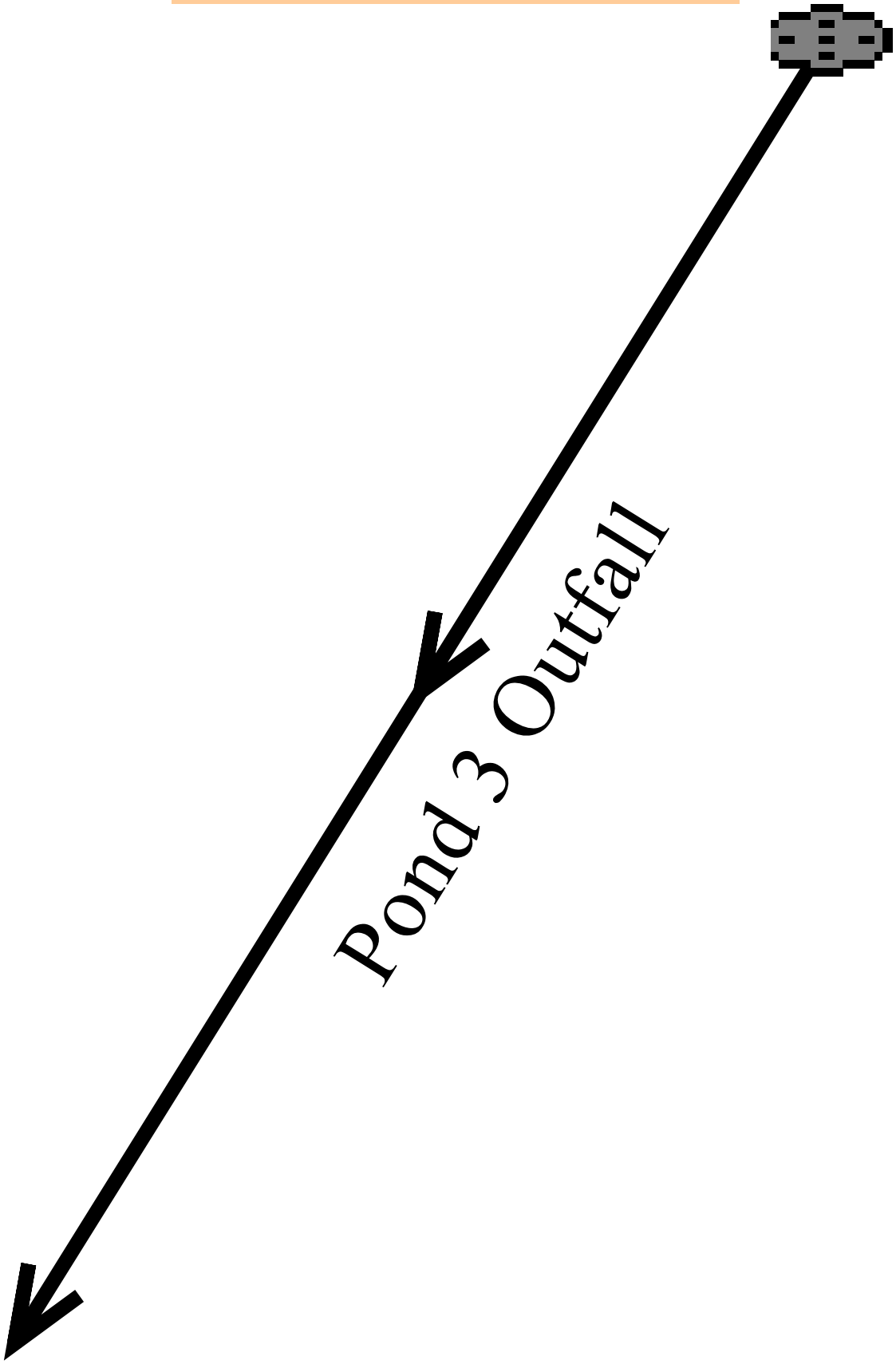
					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
PR 34A	135.58	3.50	6.00	6.08	0.00	1.30	0.00	7.10	5.09	1.51	98.20	Sewer Too Shallow
PR 34	35.34	2.50	4.00	4.92	7.13	4.35	2.10	6.56	4.07	1.82	28.35	Sewer Too Shallow

Total earth volume for sewer trenches = 127 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.


PR 34-34A 100-YR HGL Profile
6927.09
6926.49
6925.89
6925.29
6924.69
6924.09
6923.49
6922.89
6922.29
6921.69
Elevation (Ft)
0.00
17.10
34.20
51.30
68.40
85.50
102.60
119.70
136.80
153.90
Distance (Ft)
PR 34
PR 34A
HGL
EGL

POND 3 OUTFALL (PR 35) LAYOUT



Program: UDSEWER Math Model Interface 2.1.1.4
Run Date: 11/26/2024 1:30:50 PM

UDSewer Results Summary

Project Title: Pond 3 Outfall
Project Description: 5-year

System Input Summary

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6918.62

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
10x10 Riprap	6919.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Pad										
Pond 3 Outfall	6927.05	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
10x10 Riprap Pad	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Pond 3 Outfall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30	Surface Water Present (Downstream)

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
Pond 3 Outfall	216.23	6918.99	1.3	6921.80	0.013	0.00	0.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
Pond 3 Outfall	76.25	10.79	4.23	2.79	3.27	4.07	1.67	Supercritical	1.30	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
Pond 3 Outfall	1.30	CIRCULAR	36.00 in	36.00 in	18.00 in	18.00 in	36.00 in	36.00 in	7.07	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6918.62

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
Pond 3 Outfall	6918.99	6921.80	0.00	0.00	6919.26	6922.15	6919.52	2.75	6922.27

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

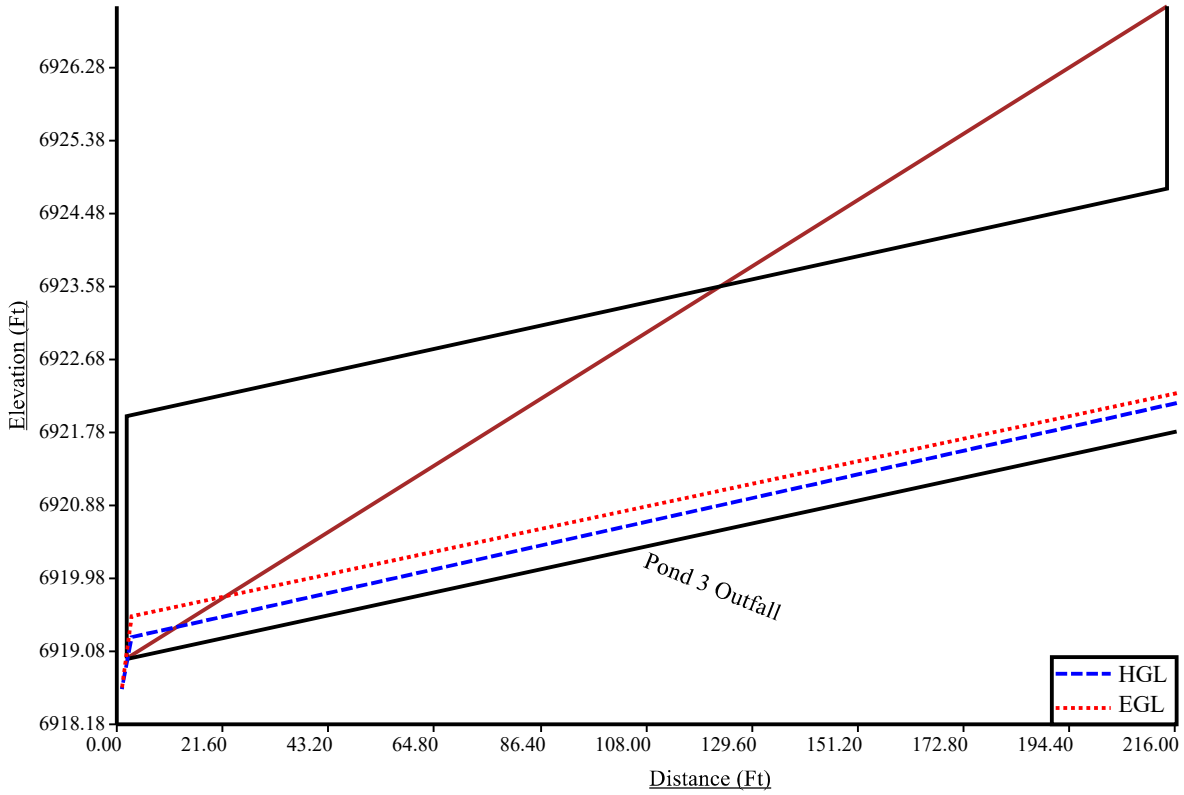
The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
Pond 3 Outfall	216.23	4.00	6.00	6.67	0.00	0.84	0.00	8.50	6.08	1.92	188.30	Sewer Too Shallow

Total earth volume for sewer trenches = 188 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Pond 3 Outfall 5-YR HGL Profile



Program: UDSEWER Math Model Interface 2.1.1.4
Run Date: 11/26/2024 2:43:21 PM

UDSewer Results Summary

Project Title: New UDSEWER System Module POND 3 OUTFALL (PR 35)
Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6922.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
OUTFALL 1	6921.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 35	6926.54	50.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Surface Water Present (Upstream)
PR 35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.50	Surface Water Present (Downstream)

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
PR 35	216.23	6918.01	1.8	6921.90	0.013	0.03	0.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PR 35	89.73	12.69	27.75	8.64	19.32	13.07	2.03	Supercritical Jump	50.50	80.68	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
PR 35	50.50	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6922.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PR 35	6918.01	6921.90	0.00	0.00	6922.00	6924.21	6922.79	2.58	6925.37

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

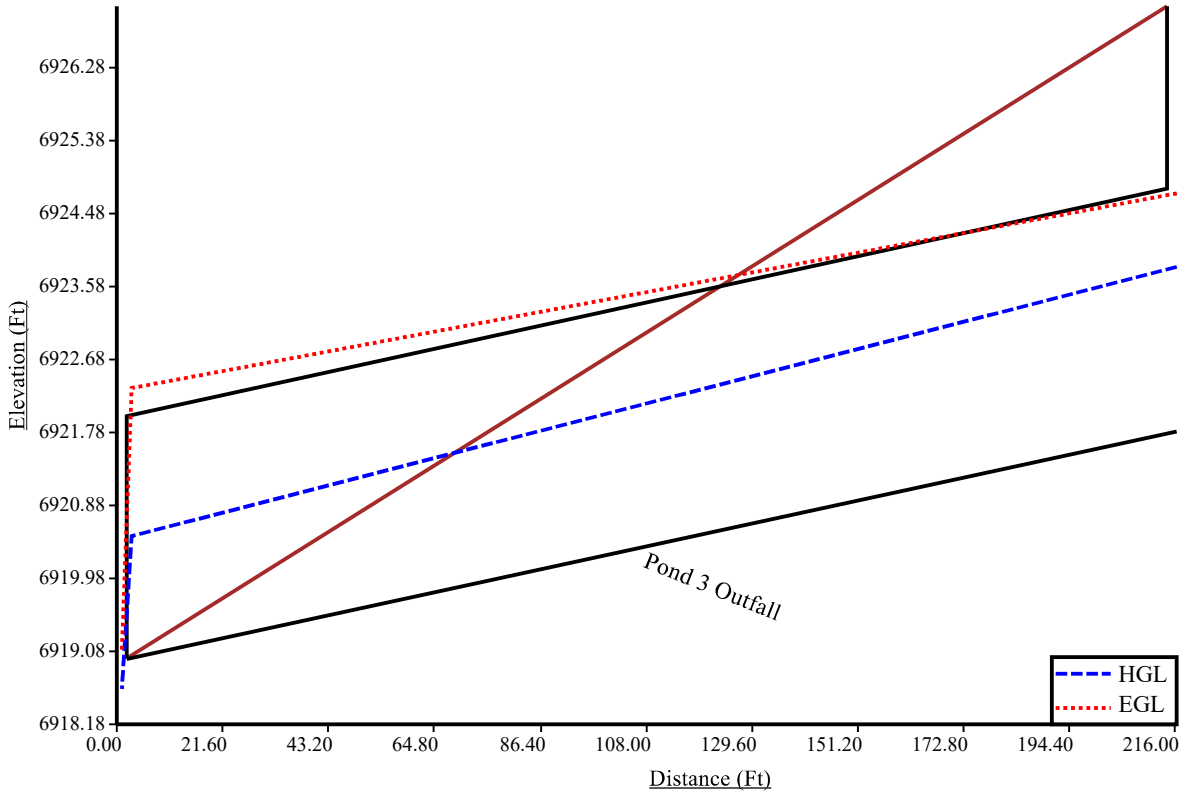
The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	Length (ft)	Wall (in)	Bedding (in)	Bottom Width (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Top Width (ft)	Trench Depth (ft)	Cover (ft)	Volume (cu. yd)	Comment
PR 35	216.23	4.00	6.00	6.67	0.00	3.83	0.00	7.28	5.47	1.31	248.61	Sewer Too Shallow

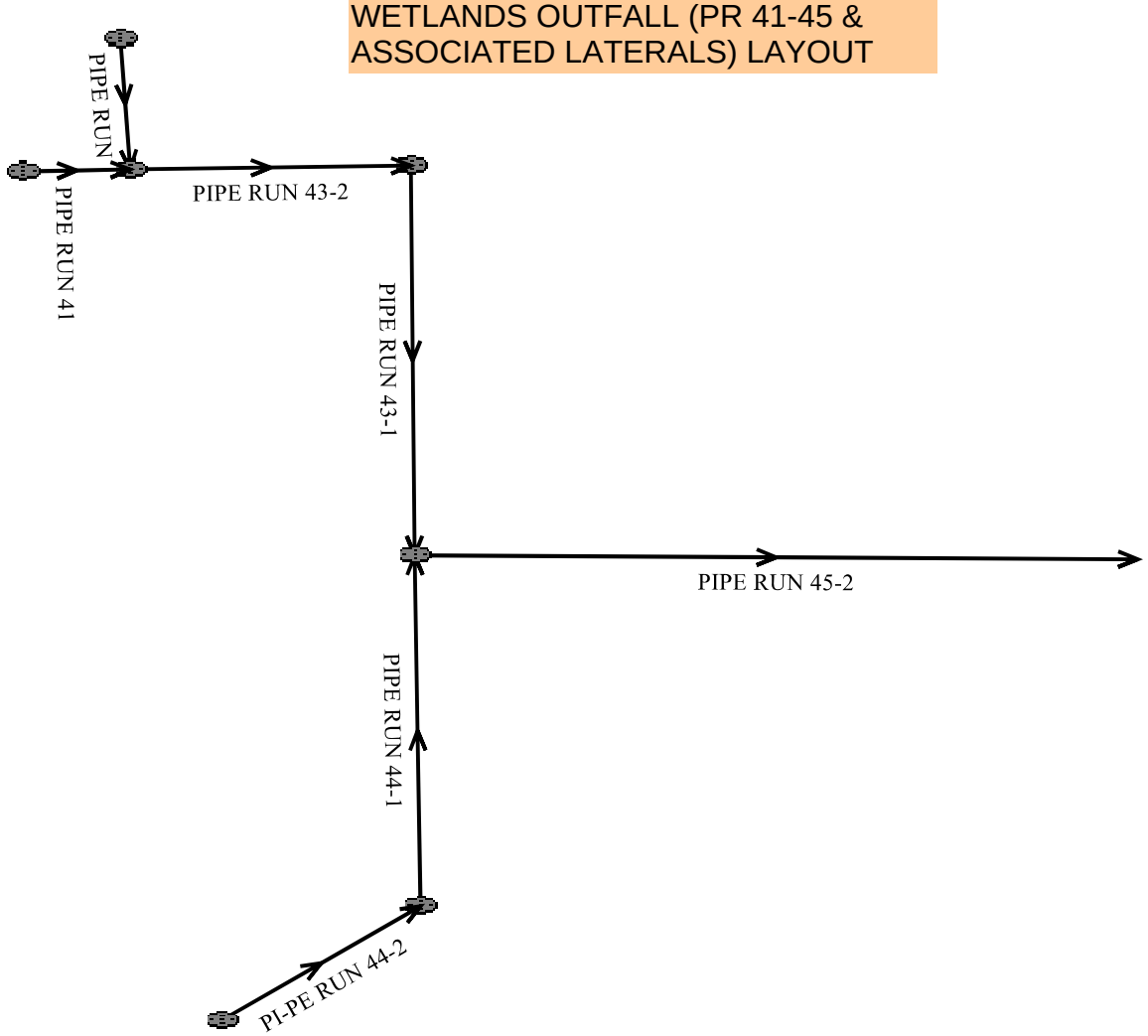
Total earth volume for sewer trenches = 249 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

Pond 3 Outfall 100-YR HGL Profile



WETLANDS OUTFALL (PR 41-45 & ASSOCIATED LATERALS) LAYOUT



Program: UDSEWER Math Model Interface 2.1.1.4
Run Date: 4/1/2026 4:30:33 PM

UDSewer Results Summary

Project Title: New UDSEWER System Module
Project Description: Default system

PIPE RUNS 43-45 5Y

System Input Summary

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6951.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
OUTFALL 1	6950.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 45-1	6954.81	9.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PR 45-2	6975.35	9.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 44-1	6970.75	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 44-2	6964.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 43-1	6972.00	9.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 43-2	6973.00	9.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Surface Water Present (Upstream)
PR 45-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.00	Surface Water Present (Downstream)
PR 45-2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.00	
PR 44-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	
PR 44-2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	
PR 43-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.00	
PR 43-2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.00	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
PR 45-1	66.50	6950.01	1.0	6950.67	0.013	0.03	0.00	CIRCULAR	30.00 in	30.00 in
PR 45-2	600.00	6951.15	1.0	6957.15	0.013	0.38	0.00	CIRCULAR	30.00 in	30.00 in
PR 44-1	478.00	6958.15	0.6	6961.02	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PR 44-2	129.30	6961.22	0.6	6962.00	0.013	0.38	0.00	CIRCULAR	18.00 in	18.00 in
PR 43-1	430.52	6957.61	2.2	6967.08	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
PR 43-2	154.50	6967.47	1.4	6969.63	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
PR 45-1	41.13	8.38	12.00	4.91	9.53	6.71	1.56	Supercritical	9.00	0.00	
PR 45-2	41.13	8.38	12.00	4.91	9.53	6.71	1.56	Supercritical	9.00	0.00	
PR 44-1	8.16	4.62	2.42	2.11	2.36	2.20	1.05	Supercritical	0.30	0.00	

PR 44-2	8.16	4.62	2.42	2.11	2.36	2.20	1.05	Supercritical	0.30	0.00	
PR 43-1	33.64	10.71	12.85	5.26	8.48	9.07	2.22	Supercritical	9.00	0.00	
PR 43-2	26.84	8.54	12.85	5.26	9.57	7.70	1.76	Supercritical	9.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
PR 45-1	9.00	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
PR 45-2	9.00	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
PR 44-1	0.30	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 44-2	0.30	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 43-1	9.00	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
PR 43-2	9.00	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6951.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
PR 45-1	6950.01	6950.67	0.00	0.00	6951.00	6951.67	6951.50	0.55	6952.04
PR 45-2	6951.15	6957.15	0.02	0.00	6951.94	6958.15	6952.64	5.88	6958.52
PR 44-1	6958.15	6961.02	0.00	0.00	6958.28	6961.22	6958.52	2.77	6961.29
PR 44-2	6961.22	6962.00	0.00	0.00	6961.42	6962.20	6961.50	0.78	6962.27
PR 43-1	6957.61	6967.08	0.17	0.00	6958.32	6968.15	6959.59	8.99	6968.58
PR 43-2	6967.47	6969.63	0.17	0.00	6968.32	6970.70	6969.18	1.94	6971.13

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

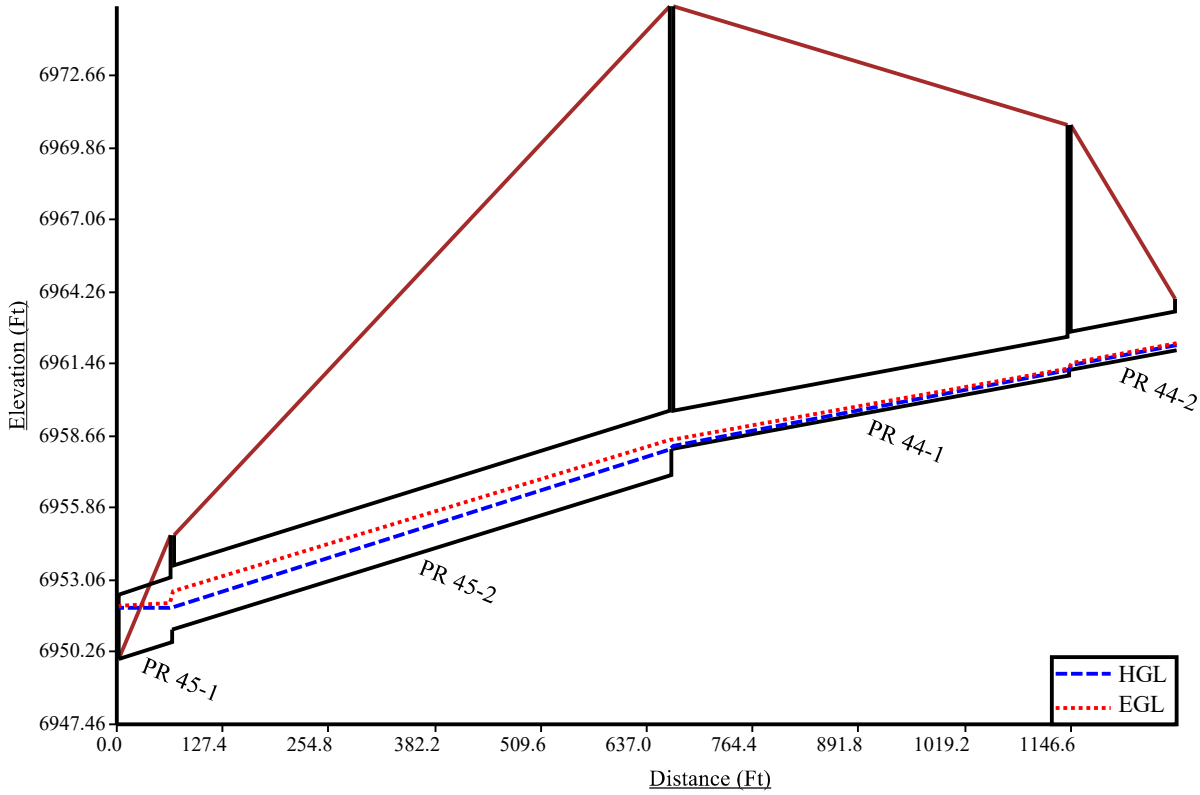
The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
PR 45-1	66.50	3.50	6.00	6.08	0.00	0.79	0.00	6.78	4.93	1.35	42.99	Sewer Too Shallow
PR 45-2	600.00	3.50	6.00	6.08	0.00	4.45	0.87	34.90	18.99	15.41	3832.57	Sewer Too Shallow
PR 44-1	478.00	2.50	4.00	4.92	33.90	17.74	15.49	18.96	10.27	8.02	3513.98	
PR 44-2	129.30	2.50	4.00	4.92	18.55	10.07	7.82	4.92	2.54	0.29	256.30	Sewer Too Shallow
PR 43-1	430.52	3.00	4.00	5.50	34.48	18.32	15.49	8.84	5.50	2.67	2741.34	
PR 43-2	154.50	3.00	4.00	5.50	8.07	5.12	2.28	5.74	3.95	1.12	147.47	Sewer Too Shallow

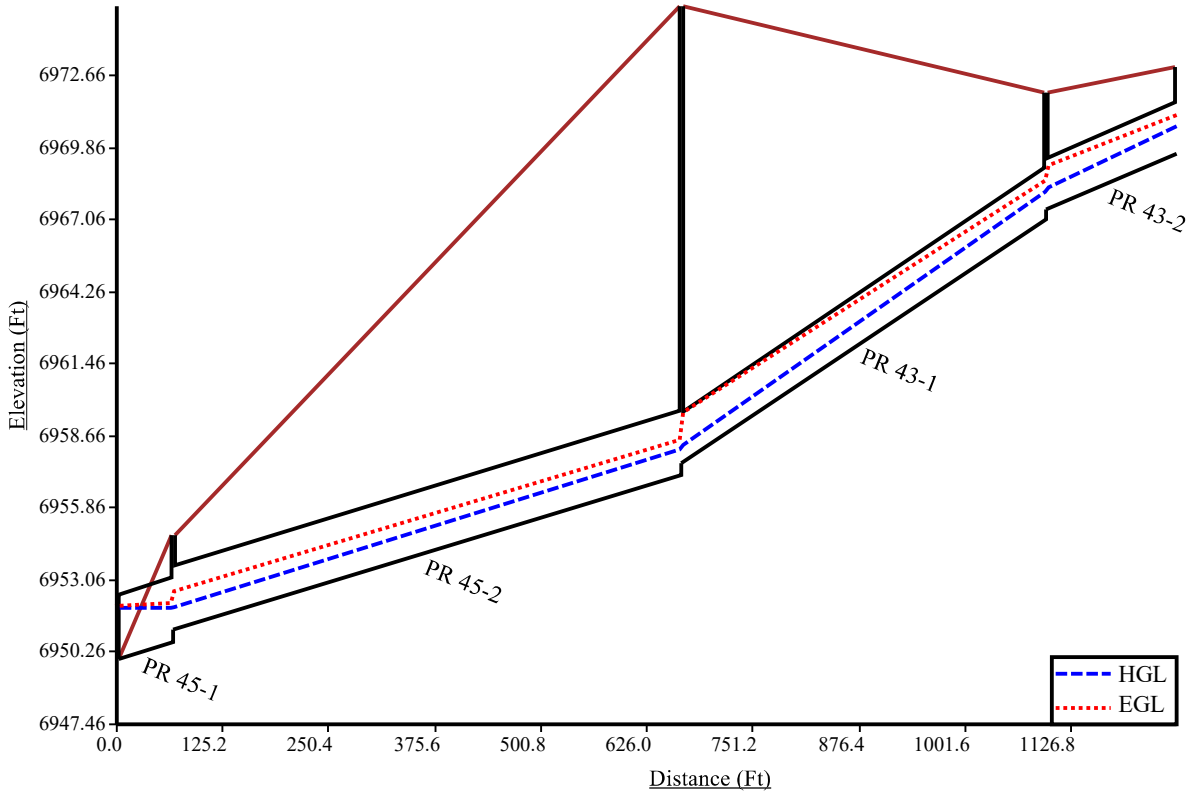
Total earth volume for sewer trenches = 10535 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

PR 43-44 5-Y


6972.66
6969.86
6967.06
6964.26
6961.46
6958.66
6955.86
6953.06
6950.26
6947.46
Elevation (Ft)
0.0
127.4
254.8
382.2
509.6
637.0
764.4
891.8
1019.2
1146.6
Distance (Ft)
PR 45-1
PR 45-2
PR 44-1
PR 44-2
HGL
EGL

PR 43-45 5-Y


6972.66
6969.86
6967.06
6964.26
6961.46
6958.66
6955.86
6953.06
6950.26
6947.46
Elevation (Ft)
0.0
125.2
250.4
375.6
500.8
626.0
751.2
876.4
1001.6
1126.8
Distance (Ft)
PR 45-1
PR 45-2
PR 43-1
PR 43-2
HGL
EGL

Program: UDSEWER Math Model Interface 2.1.1.4
Run Date: 4/1/2026 4:17:18 PM

UDSewer Results Summary

Project Title: New UDSEWER System Module
Project Description: Default system

PIPE RUNS 43-45 100Y

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6952.00

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
OUTFALL 1	6950.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 45-1	6954.81	28.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PR 45-2	6975.35	28.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 44-1	6970.75	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 44-2	6964.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 43-1	6972.00	23.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR 43-2	6973.00	23.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Surface Water Present (Upstream)
PR 45-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.00	Surface Water Present (Downstream)
PR 45-2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.00	
PR 44-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	
PR 44-2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	
PR 43-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.00	
PR 43-2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.00	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
PR 45-1	66.50	6950.01	1.0	6950.67	0.013	0.03	0.00	CIRCULAR	30.00 in	30.00 in
PR 45-2	600.00	6951.15	1.0	6957.15	0.013	0.38	0.00	CIRCULAR	30.00 in	30.00 in
PR 44-1	478.00	6958.15	0.6	6961.02	0.013	1.32	0.00	CIRCULAR	18.00 in	18.00 in
PR 44-2	129.30	6961.22	0.6	6962.00	0.013	0.38	0.00	CIRCULAR	18.00 in	18.00 in
PR 43-1	430.52	6957.61	2.2	6967.08	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in
PR 43-2	154.50	6967.47	1.4	6969.63	0.013	1.32	0.00	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
PR 45-1	41.13	8.38	21.65	7.38	18.16	9.01	1.41	Supercritical	28.00	0.00	
PR 45-2	41.13	8.38	21.65	7.38	18.16	9.01	1.41	Supercritical	28.00	0.00	

PR 44-1	8.16	4.62	10.32	4.77	10.18	4.85	1.03	Supercritical Jump	5.00	50.22	
PR 44-2	8.16	4.62	10.32	4.77	10.18	4.85	1.03	Supercritical	5.00	0.00	
PR 43-1	33.64	10.71	20.47	8.06	14.57	11.53	2.01	Supercritical Jump	23.00	39.10	
PR 43-2	26.84	8.54	20.47	8.06	17.11	9.60	1.47	Pressurized	23.00	154.50	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
PR 45-1	28.00	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
PR 45-2	28.00	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
PR 44-1	5.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 44-2	5.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
PR 43-1	23.00	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
PR 43-2	23.00	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6952.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
PR 45-1	6950.01	6950.67	0.00	0.00	6952.00	6952.47	6952.78	0.54	6953.32
PR 45-2	6951.15	6957.15	0.19	0.00	6952.67	6958.95	6953.92	5.88	6959.80
PR 44-1	6958.15	6961.02	0.16	0.00	6959.84	6961.88	6959.96	2.27	6962.23
PR 44-2	6961.22	6962.00	0.05	0.00	6962.07	6962.86	6962.44	0.78	6963.21
PR 43-1	6957.61	6967.08	1.10	0.00	6960.07	6968.79	6960.90	8.90	6969.79
PR 43-2	6967.47	6969.63	1.10	0.00	6970.06	6971.65	6970.89	1.59	6972.48

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)

- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

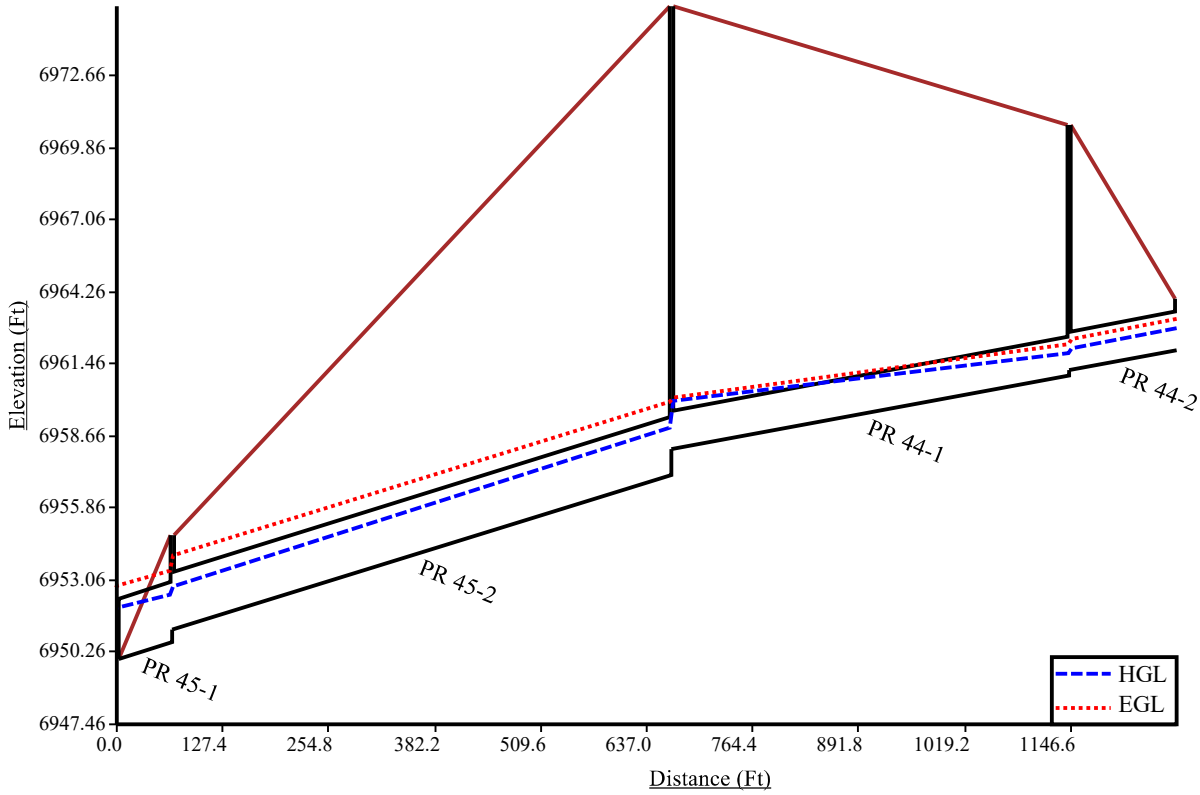
The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
PR 45-1	66.50	3.50	6.00	6.08	0.00	0.79	0.00	6.78	4.93	1.35	42.99	Sewer Too Shallow
PR 45-2	600.00	3.50	6.00	6.08	0.00	4.45	0.87	34.90	18.99	15.41	3832.57	Sewer Too Shallow
PR 44-1	478.00	2.50	4.00	4.92	33.90	17.74	15.49	18.96	10.27	8.02	3513.98	
PR 44-2	129.30	2.50	4.00	4.92	18.55	10.07	7.82	4.92	2.54	0.29	256.30	Sewer Too Shallow
PR 43-1	430.52	3.00	4.00	5.50	34.48	18.32	15.49	8.84	5.50	2.67	2741.34	
PR 43-2	154.50	3.00	4.00	5.50	8.07	5.12	2.28	5.74	3.95	1.12	147.47	Sewer Too Shallow

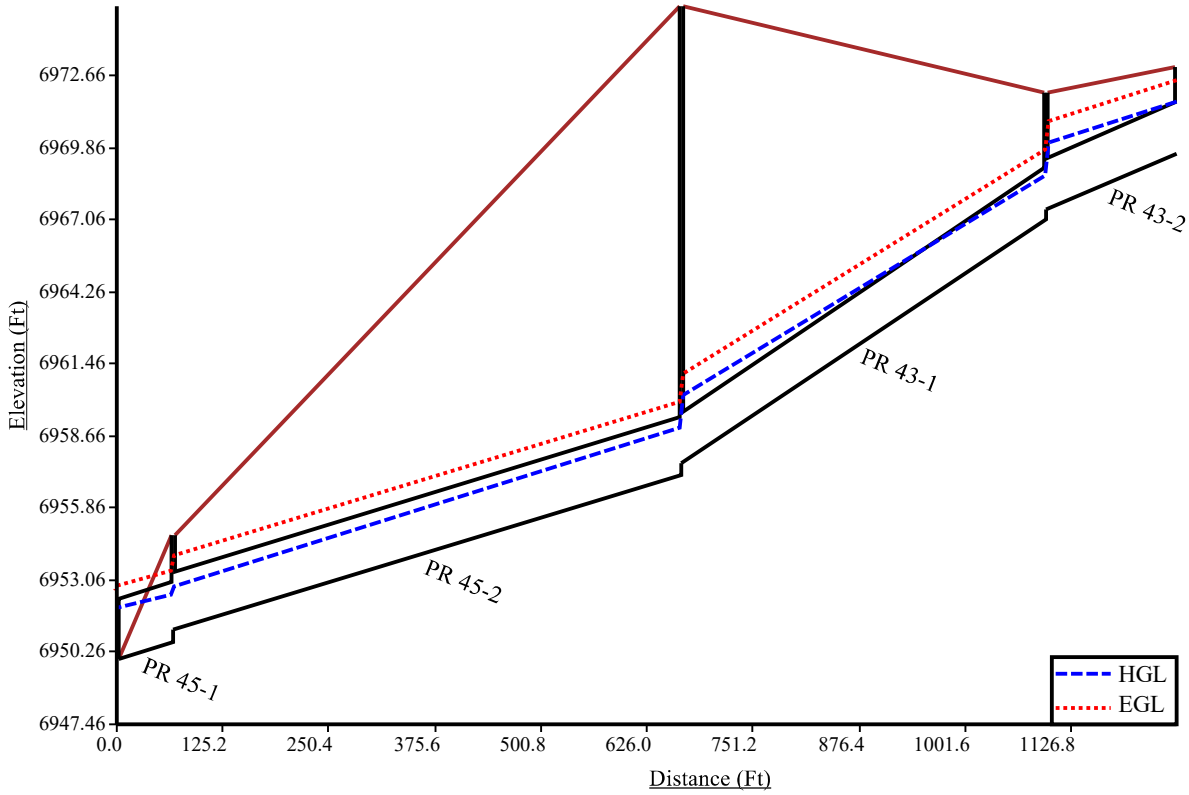
Total earth volume for sewer trenches = 10535 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

PR 43-44 100-Y


6972.66
6969.86
6967.06
6964.26
6961.46
6958.66
6955.86
6953.06
6950.26
6947.46
Elevation (Ft)
0.0
127.4
254.8
382.2
509.6
637.0
764.4
891.8
1019.2
1146.6
Distance (Ft)
PR 45-1
PR 45-2
PR 44-1
PR 44-2
HGL
EGL

PR 43-45 100-Y


6972.66
6969.86
6967.06
6964.26
6961.46
6958.66
6955.86
6953.06
6950.26
6947.46
Elevation (Ft)
0.0
125.2
250.4
375.6
500.8
626.0
751.2
876.4
1001.6
1126.8
Distance (Ft)
PR 45-1
PR 45-2
PR 43-1
PR 43-2
HGL
EGL

Manning Formula Uniform Pipe Flow at Given Slope and Depth

PIPE RUN 37

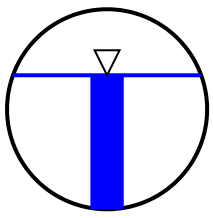
12" HDPE @ 1.00%

Inputs

Pipe diameter, d_0	12	in
Manning roughness, n	0.012	
Pressure slope (possibly ? equal to pipe slope), S_0	1	% rise/run
Relative flow depth, y/d_0	67	%

Results

Flow depth, y	0.6700	ft
Flow area, a	0.5594	ft^2
Pipe area, a0	0.7854	ft^2
Relative area, a/a0	0.7122	fraction
Wetted perimeter, P_w	1.9177	ft
Hydraulic radius, R_h	0.2917	ft
Top width, T	0.9404	ft
Velocity, v	5.4461	ft/sec
Velocity head, h_v	0.4610	ft H2O
Froude number, F	1.25	
Average shear stress (tractive force), tau	0.1821	psf
Flow, Q (See notes)	3.0462	cfs
Full flow, Q0	3.8593	cfs
Ratio to full flow, Q/Q0	0.7893	fraction



Notes:

This is the flow and depth inside an *infinitely long* pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

PIPE RUN 38

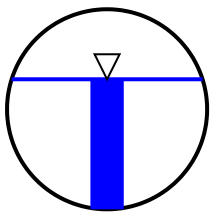
12" HDPE @ 0.50%

Inputs

Pipe diameter, d_0	12	in
Manning roughness, n	0.012	
Pressure slope (possibly ? equal to pipe slope), S_0	0.5	% rise/run
Relative flow depth, y/d_0	65	%

Results

Flow depth, y	0.6500	ft
Flow area, a	0.5404	ft^2
Pipe area, a0	0.7854	ft^2
Relative area, a/a0	0.6881	fraction
Wetted perimeter, P_w	1.8755	ft
Hydraulic radius, R_h	0.2881	ft
Top width, T	0.9539	ft
Velocity, v	3.8198	ft/sec
Velocity head, h_v	0.2268	ft H2O
Froude number, F	0.89	
Average shear stress (tractive force), tau	0.0899	psf
Flow, Q (See notes)	2.0642	cfs
Full flow, Q0	2.7290	cfs
Ratio to full flow, Q/Q0	0.7564	fraction



Notes:

This is the flow and depth inside an *infinitely long* pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

PIPE RUN 39

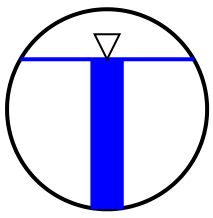
12" HDPE @ 0.77%

Inputs

Pipe diameter, d_0	12	in
Manning roughness, n	0.012	
Pressure slope (possibly ? equal to pipe slope), S_0	0.77	% rise/run
Relative flow depth, y/d_0	75	%

Results

Flow depth, y	0.7500	ft
Flow area, a	0.6319	ft^2
Pipe area, a0	0.7854	ft^2
Relative area, a/a0	0.8045	fraction
Wetted perimeter, P_w	2.0944	ft
Hydraulic radius, R_h	0.3017	ft
Top width, T	0.8660	ft
Velocity, v	4.8876	ft/sec
Velocity head, h_v	0.3713	ft H2O
Froude number, F	1.01	
Average shear stress (tractive force), tau	0.1450	psf
Flow, Q (See notes)	3.0881	cfs
Full flow, Q0	3.3866	cfs
Ratio to full flow, Q/Q0	0.9119	fraction



Notes:

This is the flow and depth inside an *infinitely long* pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

PIPE RUN 40

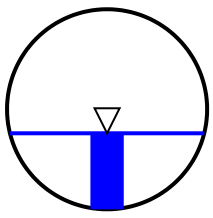
12" HDPE @ 3.12%

Inputs

Pipe diameter, d_0	12	in
Manning roughness, n	0.012	
Pressure slope (possibly ? equal to pipe slope), S_0	3.12	% rise/run
Relative flow depth, y/d_0	38	%

Results

Flow depth, y	0.3800	ft
Flow area, a	0.2739	ft^2
Pipe area, a0	0.7854	ft^2
Relative area, a/a0	0.3487	fraction
Wetted perimeter, P_w	1.3284	ft
Hydraulic radius, R_h	0.2062	ft
Top width, T	0.9708	ft
Velocity, v	7.6327	ft/sec
Velocity head, h_v	0.9054	ft H2O
Froude number, F	2.53	
Average shear stress (tractive force), tau	0.4015	psf
Flow, Q (See notes)	2.0902	cfs
Full flow, Q0	6.8169	cfs
Ratio to full flow, Q/Q0	0.3066	fraction



Notes:

This is the flow and depth inside an *infinitely long* pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

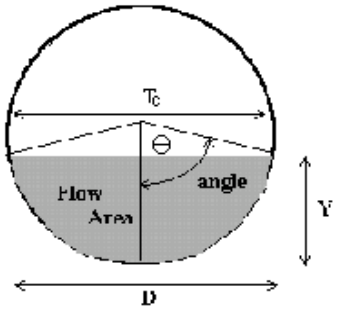
CULVERT CALCULATIONS

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Waterbury Fil #1

Pipe ID: Gilbert Double Culvert for Design Point 11



Design Information (Input)			
Pipe Invert Slope	So =	0.0100	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	48.00	inches
Design discharge	Q =	144.00	cfs

Full-Flow Capacity (Calculated)			
Full-flow area	Af =	12.57	sq ft
Full-flow wetted perimeter	Pf =	12.57	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	144.03	cfs

Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	2.26	radians
Flow area	An =	11.02	sq ft
Top width	Tn =	3.08	ft
Wetted perimeter	Pn =	9.06	ft
Flow depth	Yn =	3.28	ft
Flow velocity	Vn =	13.07	fps
Discharge	Qn =	144.00	cfs
Percent of Full Flow	Flow =	100.0%	of full flow
Normal Depth Froude Number	Fr_n =	1.22	supercritical

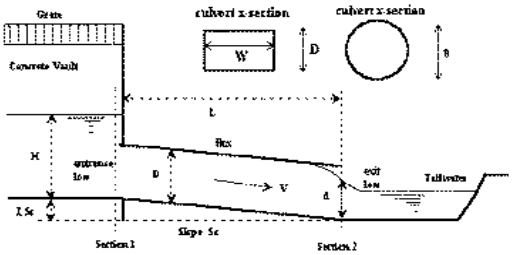
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.45	radians
Critical flow area	Ac =	11.78	sq ft
Critical top width	Tc =	2.54	ft
Critical flow depth	Yc =	3.55	ft
Critical flow velocity	Vc =	12.22	fps
Critical Depth Froude Number	Fr_c =	1.00	

CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Waterbury Fil #1

ID: Gilbert Double Culvert for Design Point 11



Design Information (Input):

Circular Culvert:

Barrel Diameter in Inches	D =	48	inches
Inlet Edge Type (Choose from pull-down list)		Square Edge with Headwall	

OR:

Box Culvert:

Barrel Height (Rise) in Feet	H (Rise) =		ft
Barrel Width (Span) in Feet	W (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			

Number of Barrels	# Barrels =	2	
Inlet Elevation at Culvert Invert	Elev IN =	6935.82	ft
Outlet Elevation **OR** Slope	Elev OUT =	6934.54	ft
Culvert Length	L =	128	ft
Manning's Roughness	n =	0.013	
Bend Loss Coefficient	K_b =	0	
Exit Loss Coefficient	K_x =	1	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	0.50
Friction Loss Coefficient	K_f =	0.63
Sum of All Loss Coefficients	K_s =	2.13
Minimum Energy Condition Coefficient	KE_{low} =	0.0133
Orifice Inlet Condition Coefficient	C_d =	0.60

Calculations of Culvert Capacity (output):

Backwater calculations required to obtain Outlet Control Flowrate when HWo < 0.75 * Culvert Rise

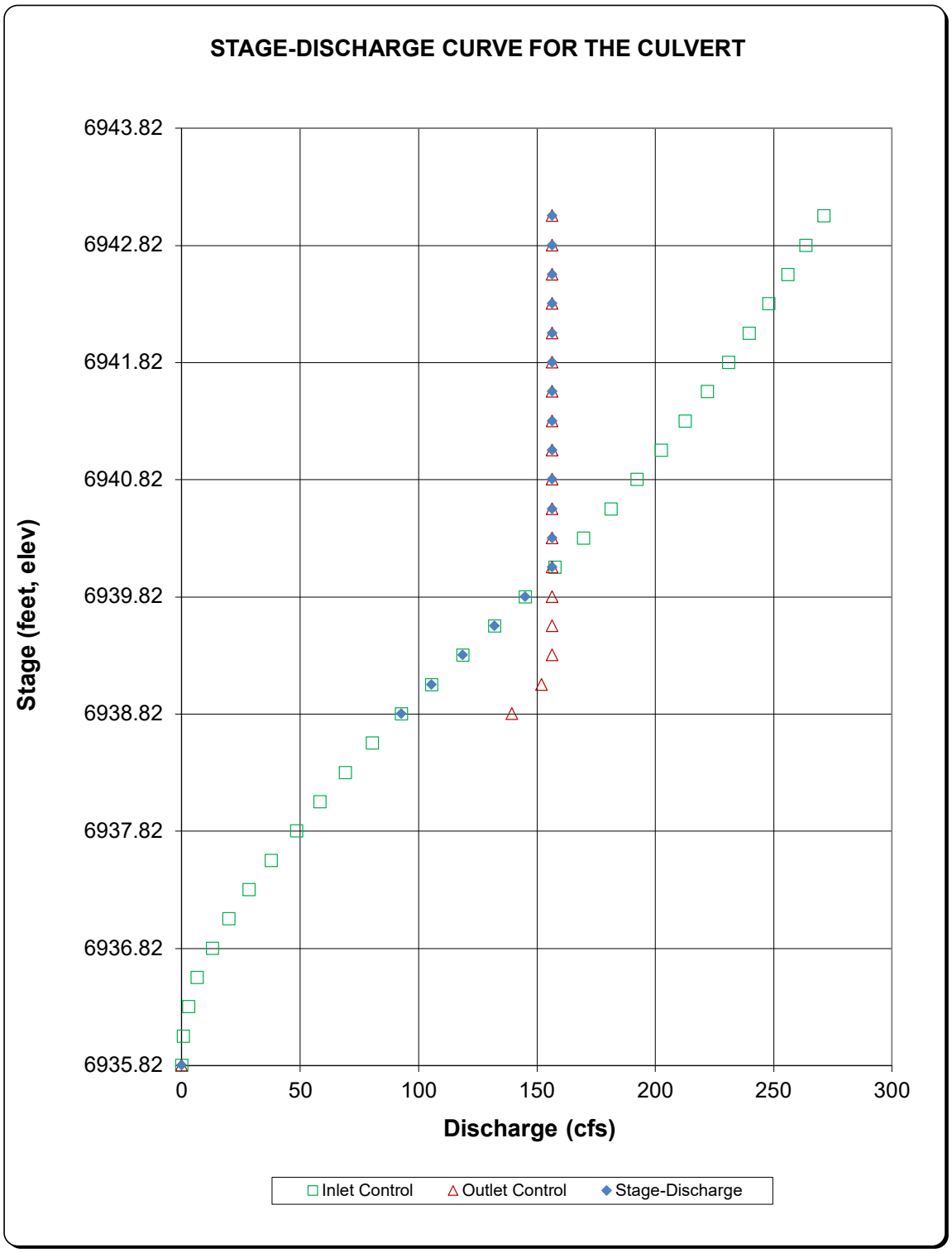
Headwater Surface Elevation (ft)	Tailwater Surface Elevation (ft)	Inlet Control Equation Used	Inlet Control Flowrate (cfs)	Outlet Control Flowrate (cfs)	Controlling Culvert Flowrate (cfs)	Flow Control Used
6935.82	6934.54	No Flow (WS < inlet)	0.00	0.00	**0.00**	N/A
6936.07	6934.79	Min. Energy. Eqn.	0.66	#N/A	#N/A	#N/A
6936.32	6935.04	Min. Energy. Eqn.	2.82	#N/A	#N/A	#N/A
6936.57	6935.29	Min. Energy. Eqn.	6.42	#N/A	#N/A	#N/A
6936.82	6935.54	Min. Energy. Eqn.	13.02	#N/A	#N/A	#N/A
6937.07	6935.79	Min. Energy. Eqn.	20.02	#N/A	#N/A	#N/A
6937.32	6936.04	Min. Energy. Eqn.	28.34	#N/A	#N/A	#N/A
6937.57	6936.29	Min. Energy. Eqn.	37.90	#N/A	#N/A	#N/A
6937.82	6936.54	Min. Energy. Eqn.	48.64	#N/A	#N/A	#N/A
6938.07	6936.79	Regression Eqn.	58.42	#N/A	#N/A	#N/A
6938.32	6937.04	Regression Eqn.	69.04	#N/A	#N/A	#N/A
6938.57	6937.29	Regression Eqn.	80.52	#N/A	#N/A	#N/A
6938.82	6937.54	Regression Eqn.	92.82	139.51	**92.82**	INLET
6939.07	6937.79	Regression Eqn.	105.64	152.12	**105.64**	INLET
6939.32	6938.04	Regression Eqn.	118.84	156.46	**118.84**	INLET
6939.57	6938.29	Regression Eqn.	132.08	156.46	**132.08**	INLET
6939.82	6938.54	Regression Eqn.	145.12	156.46	**145.12**	INLET
6940.07	6938.79	Regression Eqn.	157.74	156.46	**156.46**	OUTLET
6940.32	6939.04	Regression Eqn.	169.82	156.46	**156.46**	OUTLET
6940.57	6939.29	Regression Eqn.	181.34	156.46	**156.46**	OUTLET
6940.82	6939.54	Regression Eqn.	192.28	156.46	**156.46**	OUTLET
6941.07	6939.79	Regression Eqn.	202.68	156.46	**156.46**	OUTLET
6941.32	6940.04	Regression Eqn.	212.62	156.46	**156.46**	OUTLET
6941.57	6940.29	Regression Eqn.	222.02	156.46	**156.46**	OUTLET
6941.82	6940.54	Regression Eqn.	231.02	156.46	**156.46**	OUTLET
6942.07	6940.79	Regression Eqn.	239.68	156.46	**156.46**	OUTLET
6942.32	6941.04	Regression Eqn.	248.02	156.46	**156.46**	OUTLET
6942.57	6941.29	Regression Eqn.	256.02	156.46	**156.46**	OUTLET
6942.82	6941.54	Regression Eqn.	263.72	156.46	**156.46**	OUTLET
6943.07	6941.79	Regression Eqn.	271.22	156.46	**156.46**	OUTLET
				Processing Time:	**00.26 Seconds**	

CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Waterbury Fil #1

ID: Gilbert Double Culvert for Design Point 11

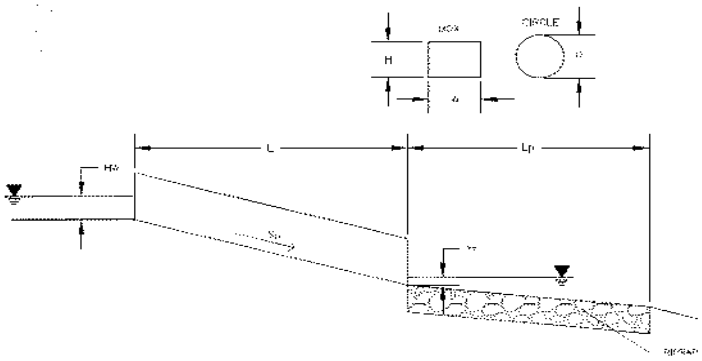


DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: **Waterbury Fil #1**

ID: **Gilbert Double Culvert for Design Point 11**



Soil Type:
Choose One:
(●) Sandy
( ) Non-Sandy

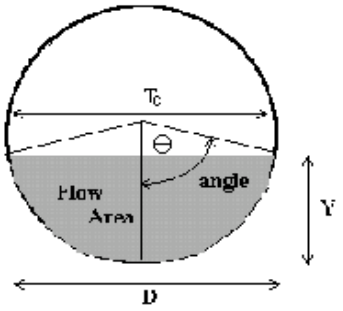
Design Information:				
	Design Discharge	Q =	216	cfs
Circular Culvert:				
	Barrel Diameter in Inches	D =	48	inches
	Inlet Edge Type (Choose from pull-down list)		Beveled Edge (1:1)	
OR:				
Box Culvert:			**OR**	
	Barrel Height (Rise) in Feet	H (Rise) =		ft
	Barrel Width (Span) in Feet	W (Span) =		ft
	Inlet Edge Type (Choose from pull-down list)			
	Number of Barrels	# Barrels =	2	
	Inlet Elevation	Elev IN =	6935.82	ft
	Outlet Elevation **OR** Slope	Elev OUT =	6935.18	ft
	Culvert Length	L =	128	ft
	Manning's Roughness	n =	0.013	
	Bend Loss Coefficient	k_b =	0	
	Exit Loss Coefficient	k_x =	1	
	Tailwater Surface Elevation	$Y_{t,\ Elevation}$ =	6938.04	ft
	Max Allowable Channel Velocity	V =	5	ft/s
Calculated Results:				
	Culvert Cross Sectional Area Available	A =	12.57	ft^2
	Culvert Normal Depth	Y_n =	3.56	ft
	Culvert Critical Depth	Y_c =	3.14	ft
	Froude Number	Fr =	0.74	
	Entrance Loss Coefficient	k_e =	0.20	
	Friction Loss Coefficient	k_f =	0.63	
	Sum of All Loss Coefficients	k_s =	1.83	ft
Headwater:				
	Inlet Control Headwater	HW_I =	5.30	ft
	Outlet Control Headwater	HW_O =	5.03	ft
	Design Headwater Elevation	**HW =**	**6941.12**	**ft**
	Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**1.32**	
Outlet Protection:				
	Flow/(Diameter^2.5)	Q/D^2.5 =	3.38	$ft^{0.5}/s$
	Tailwater Surface Height	Y_t =	2.86	ft
	Tailwater/Diameter	Yt/D =	0.71	
	Expansion Factor	1/(2*tan(Θ)) =	6.68	
	Flow Area at Max Channel Velocity	A_t =	43.20	ft^2
	Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	8.00	ft
	Length of Riprap Protection	**L_p =**	**40**	**ft**
	Width of Riprap Protection at Downstream End	**T =**	**14**	**ft**
	Adjusted Diameter for Supercritical Flow	Da =	-	ft
	Minimum Theoretical Riprap Size	d_{50} min=	6	in
	Nominal Riprap Size	d_{50} nominal=	6	in
	MHFD Riprap Type	**Type =**	**VL**	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Waterbury Fil #1

Pipe ID: Pipe Run #12 - Gilbert Road Side Ditch Culvert for Design Point 12



Design Information (Input)			
Pipe Invert Slope	So =	0.0575	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	18.00	inches
Design discharge	Q =	4.00	cfs

Full-Flow Capacity (Calculated)			
Full-flow area	Af =	1.77	sq ft
Full-flow wetted perimeter	Pf =	4.71	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	25.26	cfs

Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.09	radians
Flow area	An =	0.38	sq ft
Top width	Tn =	1.33	ft
Wetted perimeter	Pn =	1.64	ft
Flow depth	Yn =	0.40	ft
Flow velocity	Vn =	10.44	fps
Discharge	Qn =	4.00	cfs
Percent of Full Flow	Flow =	15.8%	of full flow
Normal Depth Froude Number	Fr_n =	3.43	supercritical

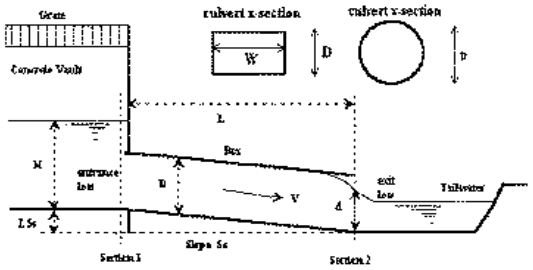
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.59	radians
Critical flow area	Ac =	0.91	sq ft
Critical top width	Tc =	1.50	ft
Critical flow depth	Yc =	0.77	ft
Critical flow velocity	Vc =	4.41	fps
Critical Depth Froude Number	Fr_c =	1.00	

CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Waterbury Fil #1

ID: Pipe Run #12 - Gilbert Road Side Ditch Culvert for Design Point 12



Design Information (Input):

Circular Culvert:	Barrel Diameter in Inches	D =	18	inches
	Inlet Edge Type (Choose from pull-down list)		Beveled Edge (1:1)	
OR:				
Box Culvert:	Barrel Height (Rise) in Feet	H (Rise) =		ft
	Barrel Width (Span) in Feet	W (Span) =		ft
	Inlet Edge Type (Choose from pull-down list)			
	Number of Barrels	# Barrels =	1	
	Inlet Elevation at Culvert Invert	Elev IN =	6940.17	ft
	Outlet Elevation **OR** Slope	Elev OUT =	6934.42	ft
	Culvert Length	L =	100	ft
	Manning's Roughness	n =	0.013	
	Bend Loss Coefficient	K_b =	0	
	Exit Loss Coefficient	K_x =	1	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	0.20
Friction Loss Coefficient	K_f =	1.81
Sum of All Loss Coefficients	K_s =	3.01
Minimum Energy Condition Coefficient	KE_{low} =	-0.1813
Orifice Inlet Condition Coefficient	C_d =	0.65

Calculations of Culvert Capacity (output):

Backwater calculations required to obtain Outlet Control Flowrate when HWo < 0.75 * Culvert Ris

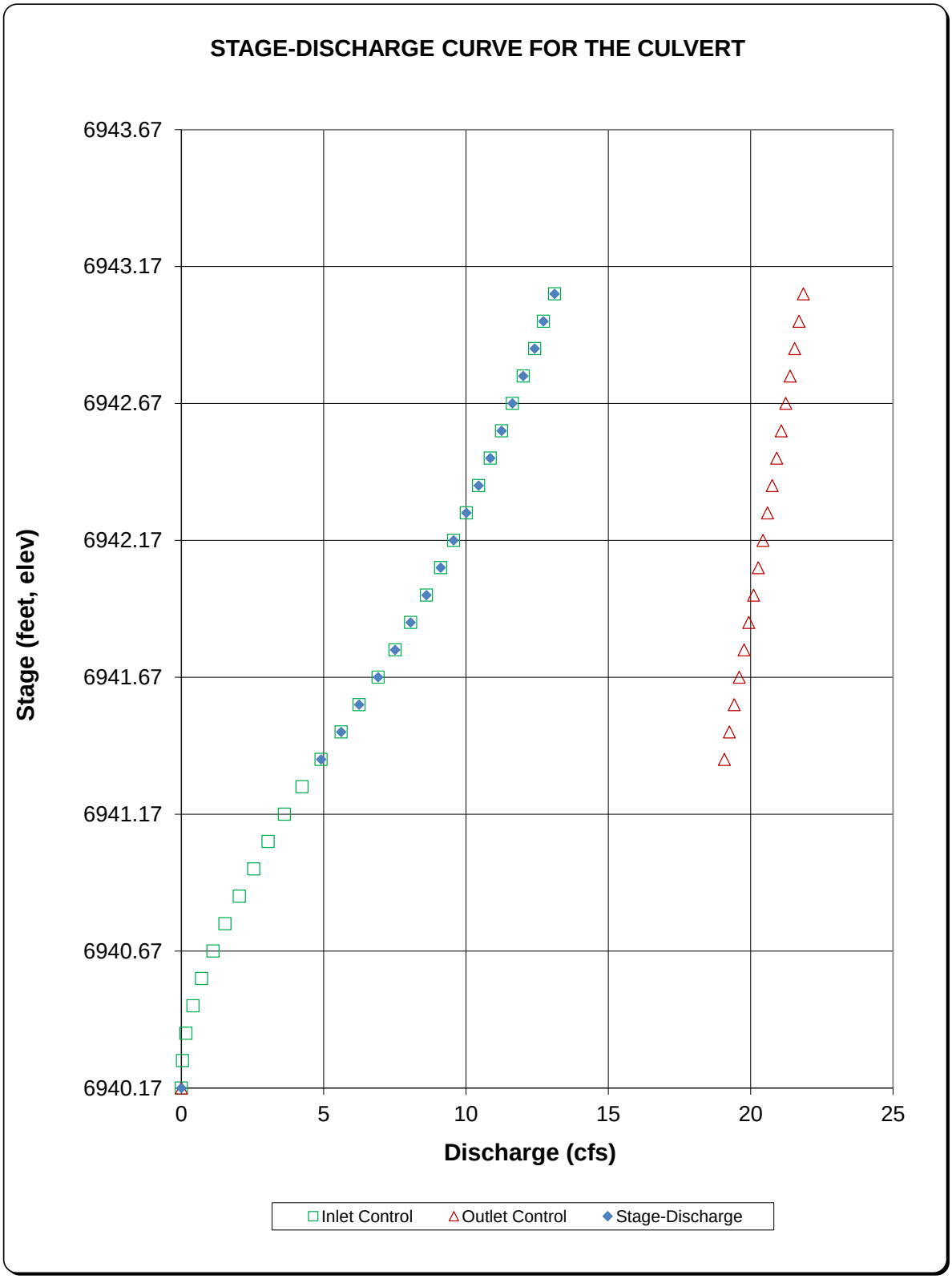
Headwater Surface Elevation (ft)	Tailwater Surface Elevation (ft)	Inlet Control Equation Used	Inlet Control Flowrate (cfs)	Outlet Control Flowrate (cfs)	Controlling Culvert Flowrate (cfs)	Flow Control Used
6940.17		No Flow (WS < inlet)	0.00	0.00	**0.00**	N/A
6940.27		Min. Energy. Eqn.	0.04	#N/A	#N/A	#N/A
6940.37		Min. Energy. Eqn.	0.16	#N/A	#N/A	#N/A
6940.47		Min. Energy. Eqn.	0.41	#N/A	#N/A	#N/A
6940.57		Min. Energy. Eqn.	0.71	#N/A	#N/A	#N/A
6940.67		Min. Energy. Eqn.	1.11	#N/A	#N/A	#N/A
6940.77		Min. Energy. Eqn.	1.53	#N/A	#N/A	#N/A
6940.87		Min. Energy. Eqn.	2.04	#N/A	#N/A	#N/A
6940.97		Regression Eqn.	2.54	#N/A	#N/A	#N/A
6941.07		Regression Eqn.	3.05	#N/A	#N/A	#N/A
6941.17		Regression Eqn.	3.62	#N/A	#N/A	#N/A
6941.27		Regression Eqn.	4.24	#N/A	#N/A	#N/A
6941.37		Regression Eqn.	4.91	19.08	**4.91**	INLET
6941.47		Regression Eqn.	5.61	19.25	**5.61**	INLET
6941.57		Regression Eqn.	6.24	19.42	**6.24**	INLET
6941.67		Regression Eqn.	6.91	19.59	**6.91**	INLET
6941.77		Regression Eqn.	7.51	19.76	**7.51**	INLET
6941.87		Regression Eqn.	8.05	19.93	**8.05**	INLET
6941.97		Regression Eqn.	8.61	20.10	**8.61**	INLET
6942.07		Regression Eqn.	9.11	20.26	**9.11**	INLET
6942.17		Regression Eqn.	9.56	20.43	**9.56**	INLET
6942.27		Regression Eqn.	10.01	20.59	**10.01**	INLET
6942.37		Regression Eqn.	10.44	20.75	**10.44**	INLET
6942.47		Regression Eqn.	10.85	20.91	**10.85**	INLET
6942.57		Regression Eqn.	11.25	21.07	**11.25**	INLET
6942.67		Regression Eqn.	11.63	21.23	**11.63**	INLET
6942.77		Regression Eqn.	12.01	21.39	**12.01**	INLET
6942.87		Regression Eqn.	12.41	21.54	**12.41**	INLET
6942.97		Regression Eqn.	12.72	21.69	**12.72**	INLET
6943.07		Regression Eqn.	13.11	21.85	**13.11**	INLET
				Processing Time:	**00.20 Seconds**	

CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

MHFD-Culvert, Version 4.00 (May 2020)

Project: **Waterbury Fil #1**

ID: **Pipe Run #12 - Gilbert Road Side Ditch Culvert for Design Point 12**

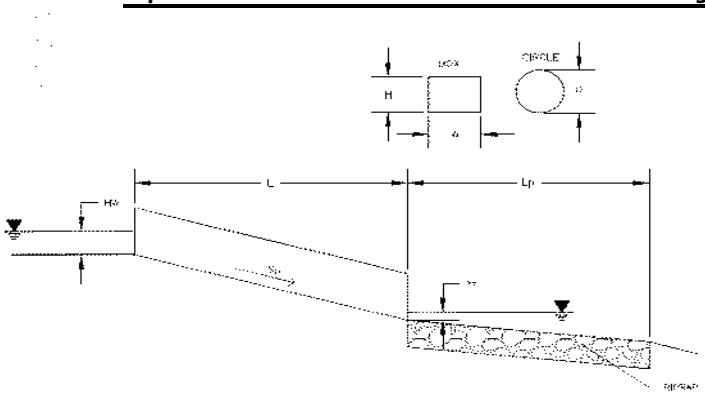


DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: **Waterbury Fil #1**

ID: **Pipe Run #12 - Gilbert Road Side Ditch Culvert for Design Point 12**



Soil Type:
Choose One:
(●) Sandy
( ) Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

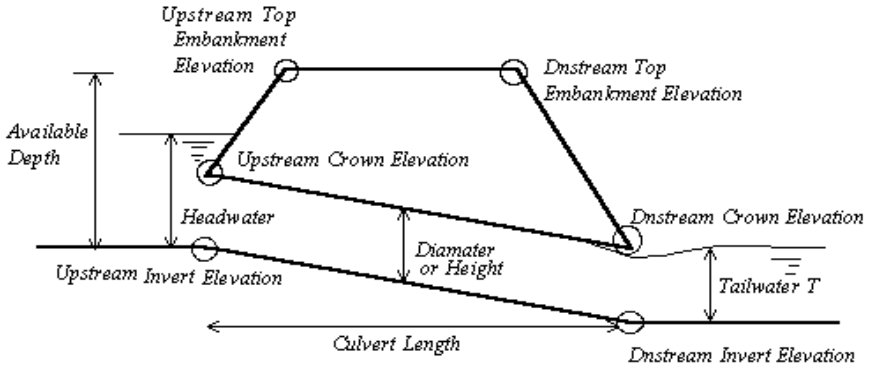
Design Information:				
	Design Discharge	Q =	4	cfs
Circular Culvert:				
	Barrel Diameter in Inches	D =	18	inches
	Inlet Edge Type (Choose from pull-down list)		Beveled Edge (1:1)	
OR:				
Box Culvert:			**OR**	
	Barrel Height (Rise) in Feet	H (Rise) =		ft
	Barrel Width (Span) in Feet	W (Span) =		ft
	Inlet Edge Type (Choose from pull-down list)			
	Number of Barrels	# Barrels =	1	
	Inlet Elevation	Elev IN =	6940.17	ft
	Outlet Elevation **OR** Slope	Elev OUT =	6934.42	ft
	Culvert Length	L =	100	ft
	Manning's Roughness	n =	0.013	
	Bend Loss Coefficient	k_b =	0	
	Exit Loss Coefficient	k_x =	1	
	Tailwater Surface Elevation	$Y_{t,\ Elevation}$ =	6935.02	ft
	Max Allowable Channel Velocity	V =	5	ft/s
Calculated Results:				
	Culvert Cross Sectional Area Available	A =	1.77	ft^2
	Culvert Normal Depth	Y_n =	0.40	ft
	Culvert Critical Depth	Y_c =	0.77	ft
	Froude Number	Fr =	3.43	**Supercritical!**
	Entrance Loss Coefficient	k_e =	0.20	
	Friction Loss Coefficient	k_f =	1.81	
	Sum of All Loss Coefficients	k_s =	3.01	ft
Headwater:				
	Inlet Control Headwater	HW_I =	1.06	ft
	Outlet Control Headwater	HW_O =	N/A	ft
	Design Headwater Elevation	**HW =**	**N/A**	**ft**
	Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**N/A**	
	Outlet Control Headwater Approximation Method Inaccurate for Low Flow - Backwater Calculations Required			
Outlet Protection:				
	Flow/(Diameter^2.5)	Q/D^2.5 =	1.45	$ft^{0.5}/s$
	Tailwater Surface Height	Y_t =	0.60	ft
	Tailwater/Diameter	Yt/D =	0.40	
	Expansion Factor	1/(2*tan(Θ)) =	6.27	
	Flow Area at Max Channel Velocity	A_t =	0.80	ft^2
	Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	-	ft
	Length of Riprap Protection	**L_p =**	**5**	**ft**
	Width of Riprap Protection at Downstream End	**T =**	**3**	**ft**
	Adjusted Diameter for Supercritical Flow	Da =	0.95	ft
	Minimum Theoretical Riprap Size	d_{50} min=	2	in
	Nominal Riprap Size	d_{50} nominal=	6	in
	MHFD Riprap Type	**Type =**	**VL**	

VERTICAL PROFILE FOR THE CULVERT

MHFD-Culvert, Version 4.00 (May 2020)

Project = Waterbury Fil #1

ID = Pipe Run #12 - Gilbert Road Side Ditch Culvert for Design Point 12



Culvert Information (Input)			
Barrel Diameter or Height	D or H =	18.00	inches
Barrel Length	L =	100.00	ft
Barrel Invert Slope	So =	0.0575	ft/ft
Downstream Invert Elevation	EDI =	6934.42	ft
Downstream Top Embankment Elevation	EDT =	6942.00	ft
Upstream Top Embankment Elevation	EUT =	6942.70	ft
Design Headwater Depth (not elev.)	Hw =	1.06	ft
Tailwater Depth (not elev.)	Yt =	0.60	ft

Culvert Hydraulics (Calculated)			
Available Headwater Depth	HW-a =	2.53	ft
Design Hw/D ratio	Hw/D =	0.71	

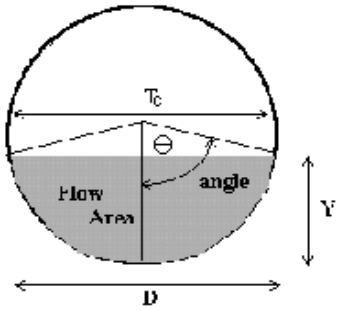
Culvert Vertical Profile			
Upstream Invert Elevation	EUI =	6940.17	ft
Upstream Crown Elevation	EUC =	6941.67	ft
Upstream Soil Cover Depth	Upsoil =	1.03	ft
Downstream Crown Elevation	EDC =	6935.92	ft
Downstream Soil Cover Depth	Dnsoil =	6.08	ft

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Waterbury Fil #1

Pipe ID: Pipe Run #12A - Thathcer Road Ditch Acess Xing Culvert for Design Point 12A



Design Information (Input)			
Pipe Invert Slope	So =	0.0100	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	18.00	inches
Design discharge	Q =	4.00	cfs

Full-Flow Capacity (Calculated)			
Full-flow area	Af =	1.77	sq ft
Full-flow wetted perimeter	Pf =	4.71	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	10.53	cfs

Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.42	radians
Flow area	An =	0.72	sq ft
Top width	Tn =	1.48	ft
Wetted perimeter	Pn =	2.14	ft
Flow depth	Yn =	0.64	ft
Flow velocity	Vn =	5.55	fps
Discharge	Qn =	4.00	cfs
Percent of Full Flow	Flow =	38.0%	of full flow
Normal Depth Froude Number	Fr_n =	1.40	supercritical

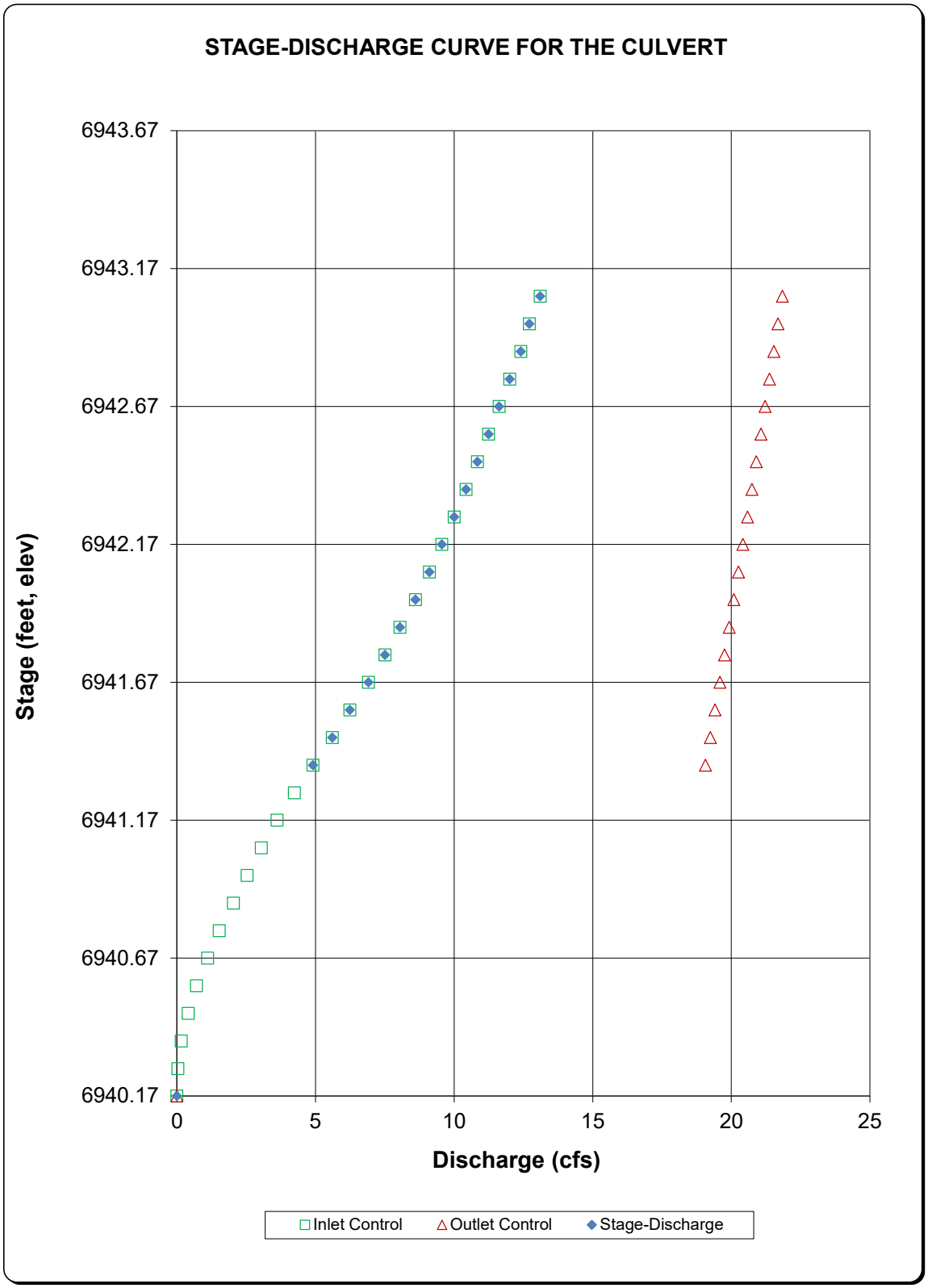
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.59	radians
Critical flow area	Ac =	0.91	sq ft
Critical top width	Tc =	1.50	ft
Critical flow depth	Yc =	0.77	ft
Critical flow velocity	Vc =	4.41	fps
Critical Depth Froude Number	Fr_c =	1.00	

CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Waterbury Fil #1

ID: Pipe Run #12A - Thathcer Road Ditch Acess Xing Culvert for Design Point 12A

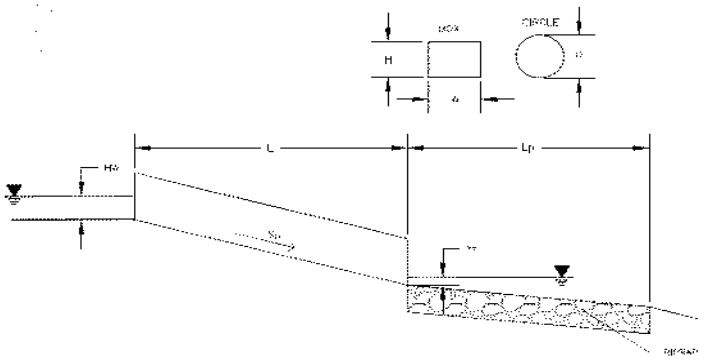


DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: **Waterbury Fil #1**

ID: **Pipe Run #12A - Thathcer Road Ditch Acess Xing Culvert for Design Point 12A**



Soil Type:
Choose One:
(●) Sandy
( ) Non-Sandy

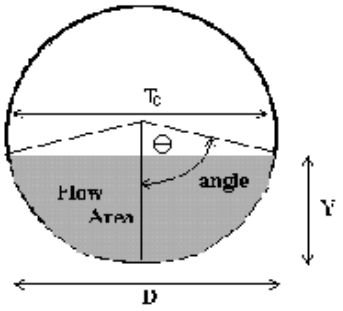
Design Information:				
	Design Discharge	Q =	4	cfs
Circular Culvert:				
	Barrel Diameter in Inches	D =	18	inches
	Inlet Edge Type (Choose from pull-down list)		Grooved Edge in Headwall	
OR:				
Box Culvert:			**OR**	
	Barrel Height (Rise) in Feet	H (Rise) =		ft
	Barrel Width (Span) in Feet	W (Span) =		ft
	Inlet Edge Type (Choose from pull-down list)			
	Number of Barrels	# Barrels =	1	
	Inlet Elevation	Elev IN =	6943.51	ft
	Outlet Elevation **OR** Slope	Elev OUT =	6943.32	ft
	Culvert Length	L =	42	ft
	Manning's Roughness	n =	0.012	
	Bend Loss Coefficient	k_b =	0	
	Exit Loss Coefficient	k_x =	1	
	Tailwater Surface Elevation	$Y_{t,\ Elevation}$ =	6944.57	ft
	Max Allowable Channel Velocity	V =	5	ft/s
Calculated Results:				
	Culvert Cross Sectional Area Available	A =	1.77	ft^2
	Culvert Normal Depth	Y_n =	0.77	ft
	Culvert Critical Depth	Y_c =	0.77	ft
	Froude Number	Fr =	0.99	
	Entrance Loss Coefficient	k_e =	0.20	
	Friction Loss Coefficient	k_f =	0.65	
	Sum of All Loss Coefficients	k_s =	1.85	ft
Headwater:				
	Inlet Control Headwater	HW_I =	1.09	ft
	Outlet Control Headwater	HW_O =	1.21	ft
	Design Headwater Elevation	**HW =**	**6944.72**	**ft**
	Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**0.80**	
Outlet Protection:				
	Flow/(Diameter^2.5)	Q/D^2.5 =	1.45	$ft^{0.5}/s$
	Tailwater Surface Height	Y_t =	1.25	ft
	Tailwater/Diameter	Yt/D =	0.83	
	Expansion Factor	1/(2*tan(Θ)) =	6.70	
	Flow Area at Max Channel Velocity	A_t =	0.80	ft^2
	Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	-	ft
	Length of Riprap Protection	**L_p =**	**5**	**ft**
	Width of Riprap Protection at Downstream End	**T =**	**3**	**ft**
	Adjusted Diameter for Supercritical Flow	Da =	-	ft
	Minimum Theoretical Riprap Size	d_{50} min=	1	in
	Nominal Riprap Size	d_{50} nominal=	6	in
	MHFD Riprap Type	**Type =**	**VL**	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Waterbury Fil #1

Pipe ID: Pipe Run #36 - Sunken Meadow Triple Culvert for Design Point 30



Design Information (Input)			
Pipe Invert Slope	So =	0.0225	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	36.00	inches
Design discharge	Q =	39.00	cfs

Full-Flow Capacity (Calculated)			
Full-flow area	Af =	7.07	sq ft
Full-flow wetted perimeter	Pf =	9.42	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	100.32	cfs

Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.44	radians
Flow area	An =	2.93	sq ft
Top width	Tn =	2.97	ft
Wetted perimeter	Pn =	4.31	ft
Flow depth	Yn =	1.30	ft
Flow velocity	Vn =	13.30	fps
Discharge	Qn =	39.00	cfs
Percent of Full Flow	Flow =	38.9%	of full flow
Normal Depth Froude Number	Fr_n =	2.36	supercritical

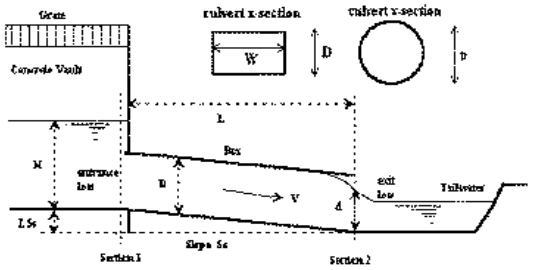
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.93	radians
Critical flow area	Ac =	5.10	sq ft
Critical top width	Tc =	2.80	ft
Critical flow depth	Yc =	2.03	ft
Critical flow velocity	Vc =	7.65	fps
Critical Depth Froude Number	Fr_c =	1.00	

CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Waterbury Fil #1

ID: Pipe Run #36 - Sunken Meadow Triple Culvert for Design Point 30



Design Information (Input):

Circular Culvert:	Barrel Diameter in Inches	D =	36	inches
	Inlet Edge Type (Choose from pull-down list)		Beveled Edge (1:1)	
OR:				
Box Culvert:	Barrel Height (Rise) in Feet	H (Rise) =		ft
	Barrel Width (Span) in Feet	W (Span) =		ft
	Inlet Edge Type (Choose from pull-down list)			
	Number of Barrels	# Barrels =	3	
	Inlet Elevation at Culvert Invert	Elev IN =	6920	ft
	Outlet Elevation **OR** Slope	Elev OUT =	6917	ft
	Culvert Length	L =	133.53	ft
	Manning's Roughness	n =	0.013	
	Bend Loss Coefficient	K_b =	0	
	Exit Loss Coefficient	K_x =	1	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	0.20
Friction Loss Coefficient	K_f =	0.96
Sum of All Loss Coefficients	K_s =	2.16
Minimum Energy Condition Coefficient	KE_{low} =	-0.0654
Orifice Inlet Condition Coefficient	C_d =	0.65

Calculations of Culvert Capacity (output):

Backwater calculations required to obtain Outlet Control Flowrate when HWo < 0.75 * Culvert Ris

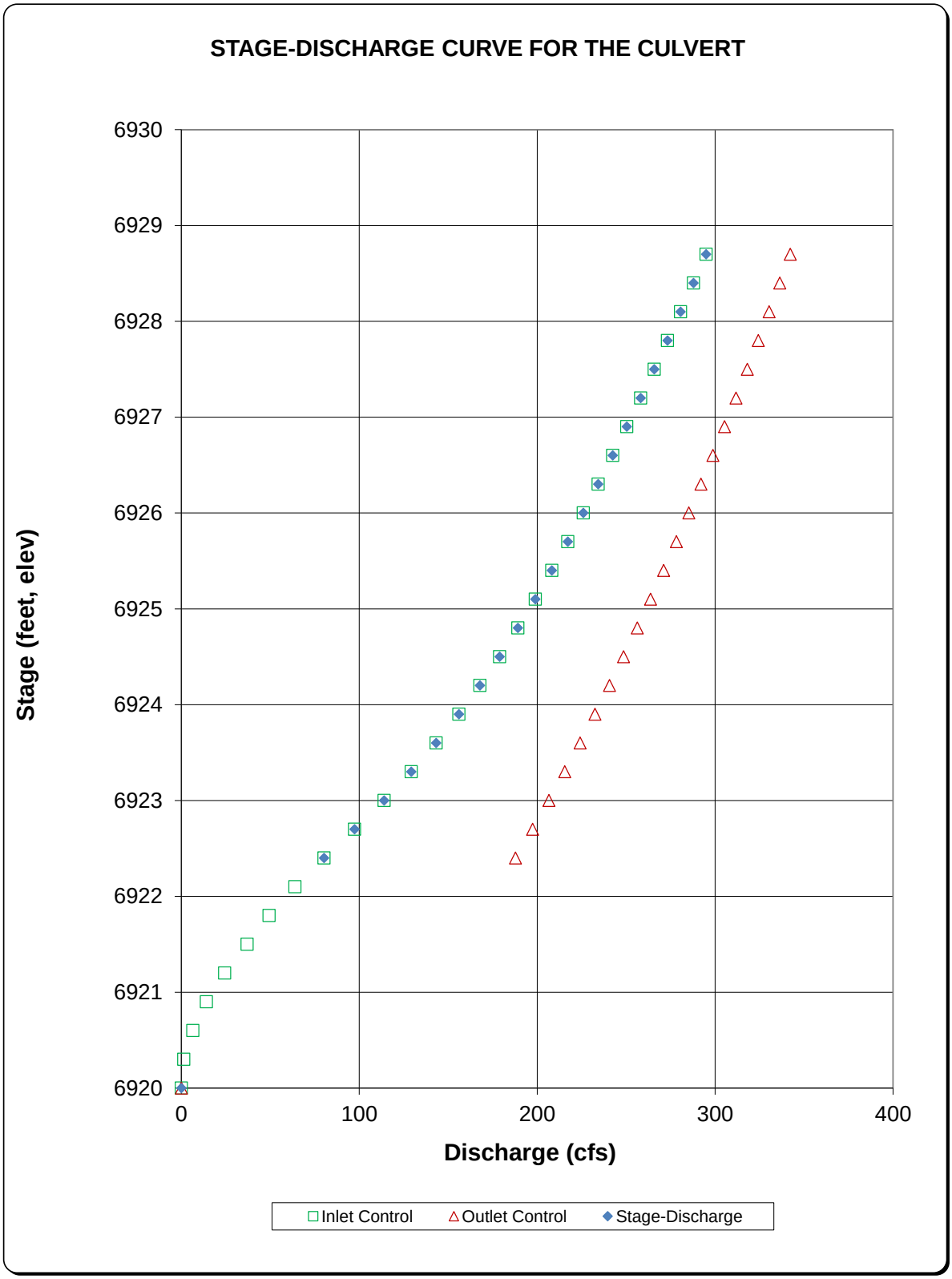
Headwater Surface Elevation (ft)	Tailwater Surface Elevation (ft)	Inlet Control Equation Used	Inlet Control Flowrate (cfs)	Outlet Control Flowrate (cfs)	Controlling Culvert Flowrate (cfs)	Flow Control Used
6920.00		No Flow (WS < inlet)	0.00	0.00	**0.00**	N/A
6920.30		Min. Energy. Eqn.	1.32	#N/A	#N/A	#N/A
6920.60		Min. Energy. Eqn.	6.42	#N/A	#N/A	#N/A
6920.90		Min. Energy. Eqn.	14.07	#N/A	#N/A	#N/A
6921.20		Min. Energy. Eqn.	24.33	#N/A	#N/A	#N/A
6921.50		Min. Energy. Eqn.	36.96	#N/A	#N/A	#N/A
6921.80		Regression Eqn.	49.32	#N/A	#N/A	#N/A
6922.10		Regression Eqn.	63.81	#N/A	#N/A	#N/A
6922.40		Regression Eqn.	80.16	187.80	**80.16**	INLET
6922.70		Regression Eqn.	97.29	197.36	**97.29**	INLET
6923.00		Regression Eqn.	113.91	206.57	**113.91**	INLET
6923.30		Regression Eqn.	129.24	215.47	**129.24**	INLET
6923.60		Regression Eqn.	143.22	224.07	**143.22**	INLET
6923.90		Regression Eqn.	156.03	232.45	**156.03**	INLET
6924.20		Regression Eqn.	167.79	240.61	**167.79**	INLET
6924.50		Regression Eqn.	178.83	248.50	**178.83**	INLET
6924.80		Regression Eqn.	189.09	256.19	**189.09**	INLET
6925.10		Regression Eqn.	198.93	263.69	**198.93**	INLET
6925.40		Regression Eqn.	208.23	271.03	**208.23**	INLET
6925.70		Regression Eqn.	217.23	278.20	**217.23**	INLET
6926.00		Regression Eqn.	225.93	285.20	**225.93**	INLET
6926.30		Regression Eqn.	234.24	292.02	**234.24**	INLET
6926.60		Regression Eqn.	242.40	298.73	**242.40**	INLET
6926.90		Regression Eqn.	250.35	305.29	**250.35**	INLET
6927.20		Regression Eqn.	258.15	311.74	**258.15**	INLET
6927.50		Regression Eqn.	265.77	318.03	**265.77**	INLET
6927.80		Regression Eqn.	273.24	324.23	**273.24**	INLET
6928.10		Regression Eqn.	280.56	330.34	**280.56**	INLET
6928.40		Regression Eqn.	287.79	336.31	**287.79**	INLET
6928.70		Regression Eqn.	294.87	342.21	**294.87**	INLET
				Processing Time:	**00.27 Seconds**	

CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

MHFD-Culvert, Version 4.00 (May 2020)

Project: **Waterbury Fil #1**

ID: **Pipe Run #36 - Sunken Meadow Triple Culvert for Design Point 30**

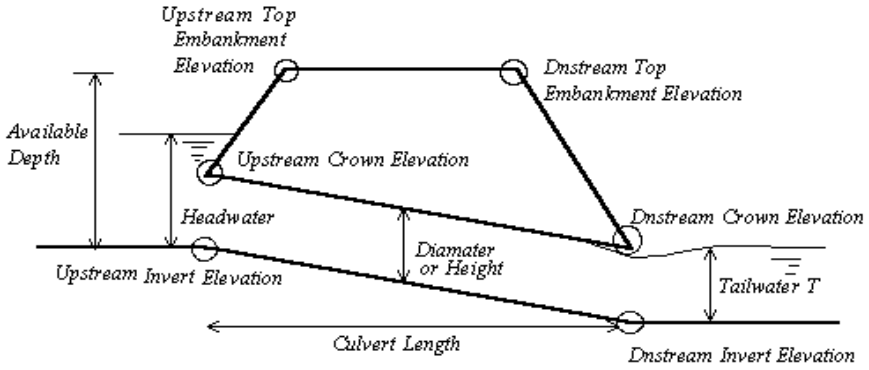


VERTICAL PROFILE FOR THE CULVERT

MHFD-Culvert, Version 4.00 (May 2020)

Project = Waterbury Fil #1

ID = Pipe Run #36 - Sunken Meadow Triple Culvert for Design Point 30



Culvert Information (Input)			
Barrel Diameter or Height	D or H =	36.00	inches
Barrel Length	L =	133.53	ft
Barrel Invert Slope	So =	0.0225	ft/ft
Downstream Invert Elevation	EDI =	6917.00	ft
Downstream Top Embankment Elevation	EDT =	6921.67	ft
Upstream Top Embankment Elevation	EUT =	6924.67	ft
Design Headwater Depth (not elev.)	Hw =	1.55	ft
Tailwater Depth (not elev.)	Yt =	1.20	ft

Culvert Hydraulics (Calculated)			
Available Headwater Depth	HW-a =	4.67	ft
Design Hw/D ratio	Hw/D =	0.52	

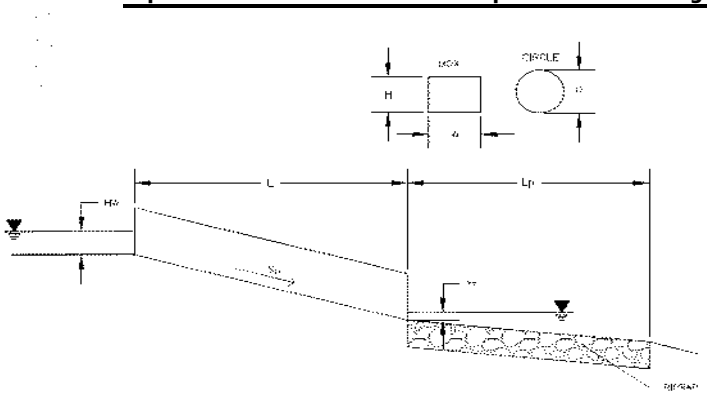
Culvert Vertical Profile			
Upstream Invert Elevation	EUI =	6920.00	ft
Upstream Crown Elevation	EUC =	6923.00	ft
Upstream Soil Cover Depth	Upsoil =	1.67	ft
Downstream Crown Elevation	EDC =	6920.00	ft
Downstream Soil Cover Depth	Dnsoil =	1.67	ft

DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: **Waterbury Fil #1**

ID: **Pipe Run #36 - Sunken Meadow Triple Culvert for Design Point 30**



Soil Type:
Choose One:
(●) Sandy
( ) Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

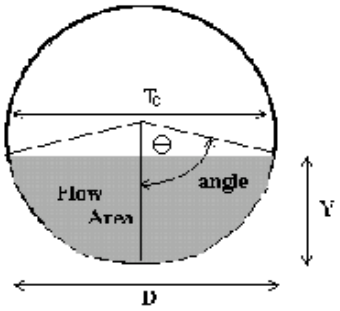
Design Information:				
	Design Discharge	Q =	151	cfs
Circular Culvert:				
	Barrel Diameter in Inches	D =	36	inches
	Inlet Edge Type (Choose from pull-down list)		Square Edge with Headwall	
OR:				
Box Culvert:			**OR**	
	Barrel Height (Rise) in Feet	H (Rise) =		ft
	Barrel Width (Span) in Feet	W (Span) =		ft
	Inlet Edge Type (Choose from pull-down list)			
	Number of Barrels	# Barrels =	3	
	Inlet Elevation	Elev IN =	6920	ft
	Outlet Elevation **OR** Slope	Elev OUT =	6917	ft
	Culvert Length	L =	133.53	ft
	Manning's Roughness	n =	0.013	
	Bend Loss Coefficient	k_b =	0	
	Exit Loss Coefficient	k_x =	1	
	Tailwater Surface Elevation	$Y_{t,\ Elevation}$ =	6920	ft
	Max Allowable Channel Velocity	V =	5	ft/s
Calculated Results:				
	Culvert Cross Sectional Area Available	A =	7.07	ft^2
	Culvert Normal Depth	Y_n =	1.50	ft
	Culvert Critical Depth	Y_c =	2.31	ft
	Froude Number	Fr =	2.30	**Supercritical!**
	Entrance Loss Coefficient	k_e =	0.50	
	Friction Loss Coefficient	k_f =	0.96	
	Sum of All Loss Coefficients	k_s =	2.46	ft
Headwater:				
	Inlet Control Headwater	HW_I =	3.99	ft
	Outlet Control Headwater	HW_O =	N/A	ft
	Design Headwater Elevation	**HW =**	**6923.99**	**ft**
	Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**1.33**	
	Outlet Control Headwater Approximation Method Inaccurate for Low Flow - Backwater Calculations Required			
Outlet Protection:				
	Flow/(Diameter^2.5)	Q/D^2.5 =	3.23	$ft^{0.5}/s$
	Tailwater Surface Height	Y_t =	3.00	ft
	Tailwater/Diameter	Yt/D =	1.00	
	Expansion Factor	1/(2*tan(Θ)) =	6.70	
	Flow Area at Max Channel Velocity	A_t =	30.20	ft^2
	Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	9.00	ft
	Length of Riprap Protection	**L_p =**	**9**	**ft**
	Width of Riprap Protection at Downstream End	**T =**	**11**	**ft**
	Adjusted Diameter for Supercritical Flow	Da =	2.25	ft
	Minimum Theoretical Riprap Size	d_{50} min=	3	in
	Nominal Riprap Size	d_{50} nominal=	6	in
	MHFD Riprap Type	**Type =**	**VL**	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Waterbury Fil #1

Pipe ID: Pipe Run #36 - Sunken Meadow Triple Culvert for Design Point 30 Interim Condition



Design Information (Input)			
Pipe Invert Slope	So =	0.0225	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	36.00	inches
Design discharge	Q =	100.00	cfs

Full-Flow Capacity (Calculated)			
Full-flow area	Af =	7.07	sq ft
Full-flow wetted perimeter	Pf =	9.42	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	100.32	cfs

Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	2.26	radians
Flow area	An =	6.18	sq ft
Top width	Tn =	2.32	ft
Wetted perimeter	Pn =	6.77	ft
Flow depth	Yn =	2.45	ft
Flow velocity	Vn =	16.18	fps
Discharge	Qn =	100.00	cfs
Percent of Full Flow	Flow =	99.7%	of full flow
Normal Depth Froude Number	Fr_n =	1.75	supercritical

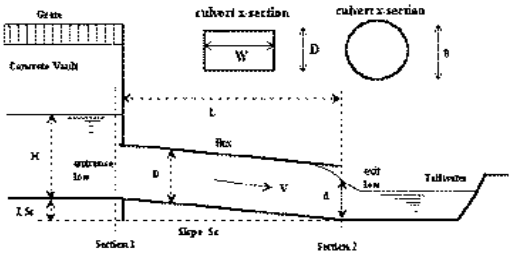
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.77	radians
Critical flow area	Ac =	6.99	sq ft
Critical top width	Tc =	1.10	ft
Critical flow depth	Yc =	2.90	ft
Critical flow velocity	Vc =	14.30	fps
Critical Depth Froude Number	Fr_c =	1.00	

CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Waterbury Fil #1

ID: Pipe Run #36 - Sunken Meadow Triple Culvert for Design Point 30 Interim Condition



Design Information (Input):

Circular Culvert:	Barrel Diameter in Inches	D =	36	inches
	Inlet Edge Type (Choose from pull-down list)		Beveled Edge (1:1)	
	OR:			
Box Culvert:	Barrel Height (Rise) in Feet	H (Rise) =		ft
	Barrel Width (Span) in Feet	W (Span) =		ft
	Inlet Edge Type (Choose from pull-down list)			
	Number of Barrels	# Barrels =	3	
	Inlet Elevation at Culvert Invert	Elev IN =	6920	ft
	Outlet Elevation **OR** Slope	Elev OUT =	6917	ft
	Culvert Length	L =	133.53	ft
	Manning's Roughness	n =	0.013	
	Bend Loss Coefficient	K_b =	0	
	Exit Loss Coefficient	K_x =	1	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	0.20
Friction Loss Coefficient	K_f =	0.96
Sum of All Loss Coefficients	K_s =	2.16
Minimum Energy Condition Coefficient	KE_{low} =	-0.0654
Orifice Inlet Condition Coefficient	C_d =	0.65

Calculations of Culvert Capacity (output):

Backwater calculations required to obtain Outlet Control Flowrate when HWo < 0.75 * Culvert Rise

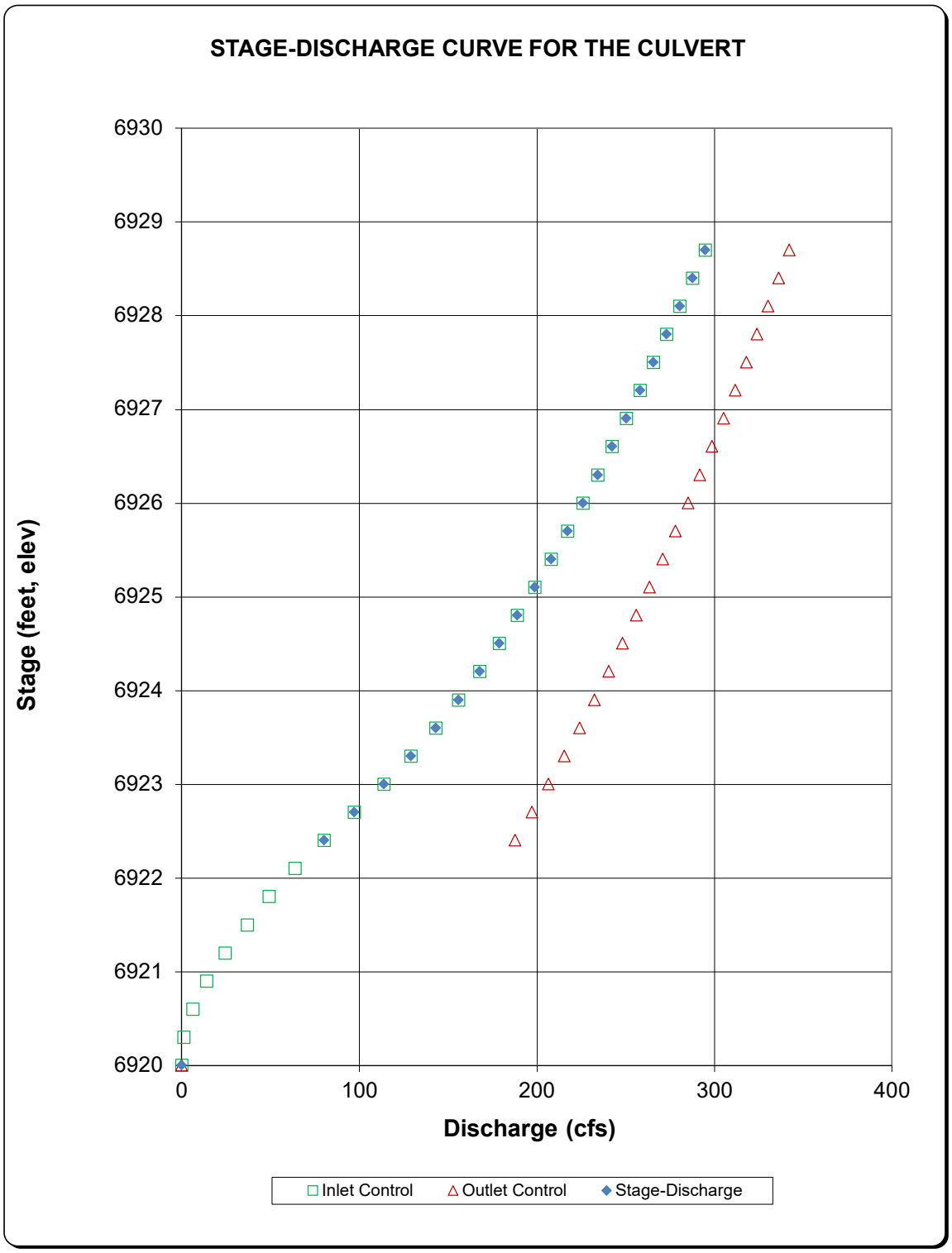
Headwater Surface Elevation (ft)	Tailwater Surface Elevation (ft)	Inlet Control Equation Used	Inlet Control Flowrate (cfs)	Outlet Control Flowrate (cfs)	Controlling Culvert Flowrate (cfs)	Flow Control Used
6920.00		No Flow (WS < inlet)	0.00	0.00	**0.00**	N/A
6920.30		Min. Energy. Eqn.	1.32	#N/A	#N/A	#N/A
6920.60		Min. Energy. Eqn.	6.42	#N/A	#N/A	#N/A
6920.90		Min. Energy. Eqn.	14.07	#N/A	#N/A	#N/A
6921.20		Min. Energy. Eqn.	24.33	#N/A	#N/A	#N/A
6921.50		Min. Energy. Eqn.	36.96	#N/A	#N/A	#N/A
6921.80		Regression Eqn.	49.32	#N/A	#N/A	#N/A
6922.10		Regression Eqn.	63.81	#N/A	#N/A	#N/A
6922.40		Regression Eqn.	80.16	187.80	**80.16**	INLET
6922.70		Regression Eqn.	97.29	197.36	**97.29**	INLET
6923.00		Regression Eqn.	113.91	206.57	**113.91**	INLET
6923.30		Regression Eqn.	129.24	215.47	**129.24**	INLET
6923.60		Regression Eqn.	143.22	224.07	**143.22**	INLET
6923.90		Regression Eqn.	156.03	232.45	**156.03**	INLET
6924.20		Regression Eqn.	167.79	240.61	**167.79**	INLET
6924.50		Regression Eqn.	178.83	248.50	**178.83**	INLET
6924.80		Regression Eqn.	189.09	256.19	**189.09**	INLET
6925.10		Regression Eqn.	198.93	263.69	**198.93**	INLET
6925.40		Regression Eqn.	208.23	271.03	**208.23**	INLET
6925.70		Regression Eqn.	217.23	278.20	**217.23**	INLET
6926.00		Regression Eqn.	225.93	285.20	**225.93**	INLET
6926.30		Regression Eqn.	234.24	292.02	**234.24**	INLET
6926.60		Regression Eqn.	242.40	298.73	**242.40**	INLET
6926.90		Regression Eqn.	250.35	305.29	**250.35**	INLET
6927.20		Regression Eqn.	258.15	311.74	**258.15**	INLET
6927.50		Regression Eqn.	265.77	318.03	**265.77**	INLET
6927.80		Regression Eqn.	273.24	324.23	**273.24**	INLET
6928.10		Regression Eqn.	280.56	330.34	**280.56**	INLET
6928.40		Regression Eqn.	287.79	336.31	**287.79**	INLET
6928.70		Regression Eqn.	294.87	342.21	**294.87**	INLET
				Processing Time:	**00.27 Seconds**	

CULVERT SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Waterbury Fil #1

ID: Pipe Run #36 - Sunken Meadow Triple Culvert for Design Point 30 Interim Condition

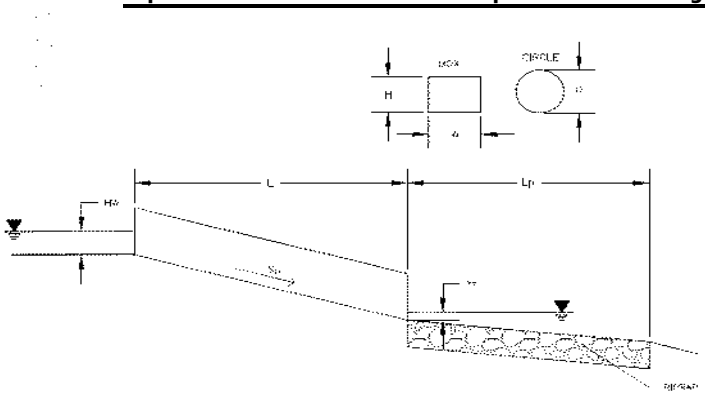


DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: **Waterbury Fil #1**

ID: **Pipe Run #36 - Sunken Meadow Triple Culvert for Design Point 30 Interim Condition**



Soil Type:
Choose One:
(●) Sandy
( ) Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

Design Information:

Design Discharge	Q =	113	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	36	inches
Inlet Edge Type (Choose from pull-down list)		Square Edge with Headwall	
OR:		**OR**	
Box Culvert:			
Barrel Height (Rise) in Feet	H (Rise) =		ft
Barrel Width (Span) in Feet	W (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	# Barrels =	3	
Inlet Elevation	Elev IN =	6920	ft
Outlet Elevation **OR** Slope	Elev OUT =	6917	ft
Culvert Length	L =	133.53	ft
Manning's Roughness	n =	0.013	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	$Y_{t,\ Elevation}$ =	6920	ft
Max Allowable Channel Velocity	V =	5	ft/s

FLOW IS SUPERCRITCAL BECAUSE THIS IS AN INTERIM CONDTION. PIPE NEED TO STAT AT DESIGN FOR PASSING POND 3 EMERGENCY SPILLWAY

Calculated Results:

Culvert Cross Sectional Area Available	A =	7.07	ft^2
Culvert Normal Depth	Y_n =	1.27	ft
Culvert Critical Depth	Y_c =	2.00	ft
Froude Number	Fr =	2.36	**Supercritical!**
Entrance Loss Coefficient	k_e =	0.50	
Friction Loss Coefficient	k_f =	0.96	
Sum of All Loss Coefficients	k_s =	2.46	ft
Headwater:			
Inlet Control Headwater	HW_I =	3.12	ft
Outlet Control Headwater	HW_O =	N/A	ft
Design Headwater Elevation	**HW =**	**6923.12**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**1.04**	

Outlet Control Headwater Approximation Method Inaccurate for Low Flow - Backwater Calculations Required

Outlet Protection:			
Flow/(Diameter^2.5)	Q/D^2.5 =	2.42	$ft^{0.5}/s$
Tailwater Surface Height	Y_t =	3.00	ft
Tailwater/Diameter	Yt/D =	1.00	
Expansion Factor	1/(2*tan(Θ)) =	6.70	
Flow Area at Max Channel Velocity	A_t =	22.60	ft^2
Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	9.00	ft
Length of Riprap Protection	**L_p =**	**9**	**ft**
Width of Riprap Protection at Downstream End	**T =**	**11**	**ft**
Adjusted Diameter for Supercritical Flow	Da =	2.14	ft
Minimum Theoretical Riprap Size	d_{50} min=	2	in
Nominal Riprap Size	d_{50} nominal=	6	in
MHFD Riprap Type	**Type =**	**VL**	

FDR SWALE CALCULATIONS

SWALE E-E LOW n VALUE

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: **WATERBURY 1 FDR** Location: DP-EX5A DIVERSIONS SWALE E-E FDR

By: QNA Date: 12/21/2024

Chk By: Date: version 12-2004

Mannings Formula

$Q = (1.486/n)AR_h^{2/3}S^{1/2}$

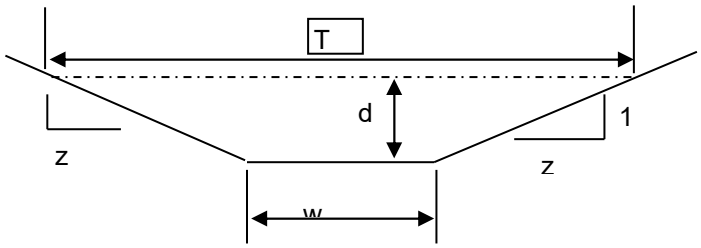
R = A/P

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$V = (1.49/n)R_h^{2/3}S^{1/2}$

Q = V x A

INPUT	
z (sideslope)=	4
z (sideslope)=	3
b (btm width, ft)=	8
d (depth, ft)=	0.51
S (slope, ft/ft)	0.02
n_{low} =	0.025
n_{high} =	0.035

Clear Data Entry Cells

				Low N		High N			
Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs		
0.51	4.99	11.72	0.43	4.75875967	23.7479	3.399114	16.9628	T =	11.57
								Dm =	0.431
				Sc low =	0.0122	Sc high =	0.0240		
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc		
				0.0086	0.0159	0.0168	0.0312		

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

Created by: Mike O'Shea

SWALE E-E HIGH n VALUE

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: **WATERBURY 1 FDR** Location: DP-EX5A DIVERSIONS SWALE E-E FDR

By: QNA Date: 12/21/2024

Chk By: Date: version 12-2004

Mannings Formula

$Q = (1.486/n)AR_h^{2/3}S^{1/2}$

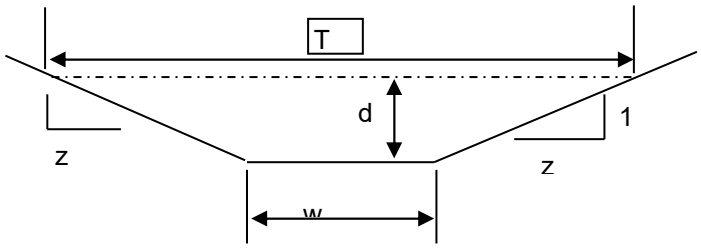
R = A/P

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$V = (1.49/n)R_h^{2/3}S^{1/2}$

Q = V x A

INPUT	
z (sideslope)=	4
z (sideslope)=	3
b (btm width, ft)=	8
d (depth, ft)=	0.61
S (slope, ft/ft)	0.02
n_{low} =	0.025
n_{high} =	0.035

Clear Data Entry Cells

				Low N		High N			
Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs		
0.61	6.18	12.44	0.50	5.27283416	32.5985	3.76631	23.2846	T =	12.27
								Dm =	0.504
				Sc low =	0.0117	Sc high =	0.0228		
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc		
				0.0082	0.0151	0.0160	0.0297		

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

Created by: Mike O'Shea

APPENDIX G
FULL SPECTRUM DETENTION & WATER QUALITY CALCULATIONS

FUTURE FINAL DESIGN

POND TRIBUTARY AREA				
POND 1 TRIB AREA (DP 8)	**22.34** AC	BASINS A, B1, B2, C, D ,E, F, H, G1, G2, & K	DCIA	5.03
			UIA	6.92
			RPA	2.46
			SPA	7.94
			Total	**22.34**
POND 2 TRIB AREA (DP 18)	**21.05** AC	BASINS L1, L2, O1, O2, O-3, O-4 & OS-4	DCIA	2.34
			UIA	3.23
			RPA	0.92
			SPA	14.55
			Total	**21.05**
POND 3 TRIB AREA (DP 29)	**72.14** AC	BASINS Q1, Q2, R, S1, S2, T1, T2, U1, U2, V, W, X, OS-1, OS-2, OS-3A, OS-3B, OS-S1, OS-S2, OS-T2, OS-R, OS-Q1, OS-Q2, OS-7, & OS-W	DCIA	19.75
			UIA	20.80
			RPA	16.16
			SPA	15.42
			Total	**72.14**

POND 1

Worksheet Protected

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	0.43	inches	**Designer:**	**QNA**
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches	**Company:**	**Terra Nova Engineering**
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches	**Date:**	**September 17, 2024**
Optional User Defined Storm	CUHP			**Project:**	**WATERBURY FILING 1 POND 1**
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event			**Location:**	**POND 1 Design Point 8 Full Spectrum Detention**
Max Intensity for Optional User Defined Storm	0				

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	**DP 8 FSD**														
Receiving Pervious Area Soil Type	Loamy Sand														
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	22.34														
Directly Connected Impervious Area (DCIA, acres)	5.03														
Unconnected Impervious Area (UIA, acres)	6.92														
Receiving Pervious Area (RPA, acres)	2.46														
Separate Pervious Area (SPA, acres)	7.94														
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C														

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	22.343														
Directly Connected Impervious Area (DCIA, %)	22.5%														
Unconnected Impervious Area (UIA, %)	31.0%														
Receiving Pervious Area (RPA, %)	11.0%														
Separate Pervious Area (SPA, %)	35.5%														
A_R (RPA / UIA)	0.355														
I_a Check	0.740														
f / I for WQCV Event:	4.5														
f / I for 5-Year Event:	0.5														
f / I for 100-Year Event:	0.4														
f / I for Optional User Defined Storm CUHP:															
IRF for WQCV Event:	0.74														
IRF for 5-Year Event:	0.93														
IRF for 100-Year Event:	0.95														
IRF for Optional User Defined Storm CUHP:															
Total Site Imperviousness: I_{total}	53.5%														
Effective Imperviousness for WQCV Event:	45.5%														
Effective Imperviousness for 5-Year Event:	51.3%														
Effective Imperviousness for 100-Year Event:	51.9%														
Effective Imperviousness for Optional User Defined Storm CUHP:															

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	10.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	2.9%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:															

Total Site Imperviousness:	**53.5%**
Total Site Effective Imperviousness for WQCV Event:	**45.5%**
Total Site Effective Imperviousness for 5-Year Event:	**51.3%**
Total Site Effective Imperviousness for 100-Year Event:	**51.9%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.

** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.

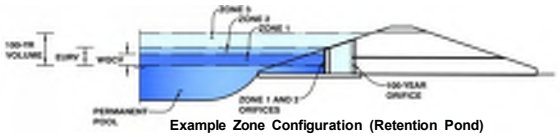
*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **WATERBURY FILING NO. 1**

Basin ID: **POND 1 DP 8**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	22.34	acres
Watershed Length =	1,250	ft
Watershed Length to Centroid =	325	ft
Watershed Slope =	0.019	ft/ft
Watershed Imperviousness =	51.90%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.394	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.351	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.974	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.292	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.546	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.938	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.321	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.805	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3 in.) =	3.607	acre-feet	3.00	inches
Approximate 2-yr Detention Volume =	0.870	acre-feet		
Approximate 5-yr Detention Volume =	1.145	acre-feet		
Approximate 10-yr Detention Volume =	1.394	acre-feet		
Approximate 25-yr Detention Volume =	1.702	acre-feet		
Approximate 50-yr Detention Volume =	1.896	acre-feet		
Approximate 100-yr Detention Volume =	2.127	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.394	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.957	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.775	acre-feet
Total Detention Basin Volume =	2.127	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

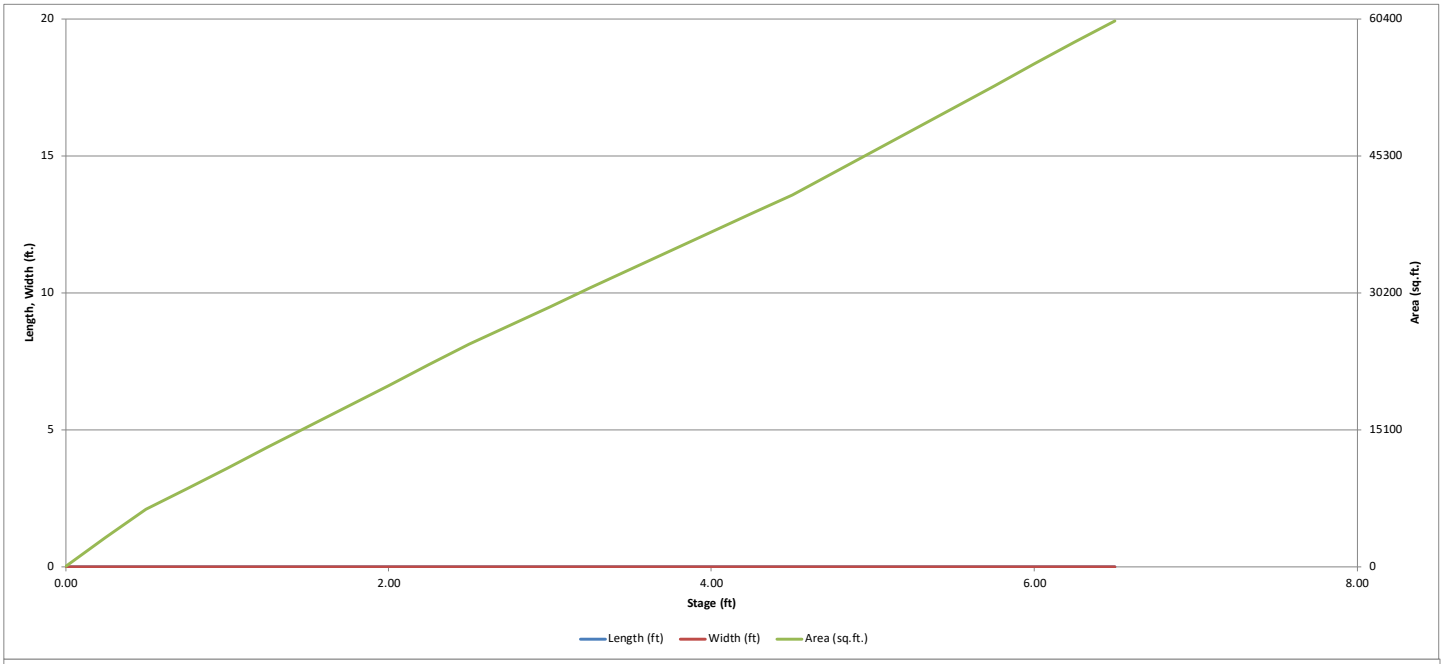
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

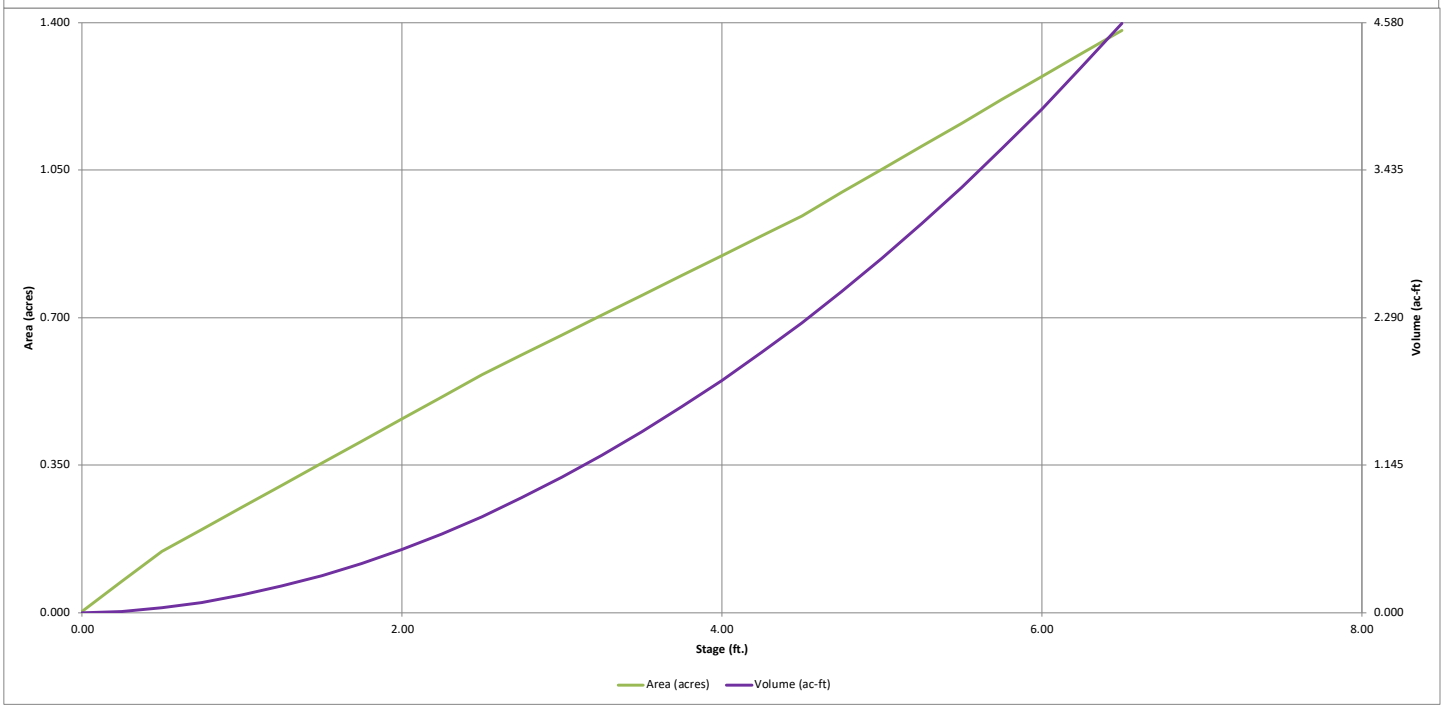
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	100	0.002		
6923.75	--	0.25	--	--	--	3,201	0.073	412	0.009
6924.00	--	0.50	--	--	--	6,302	0.145	1,600	0.037
6924.25	--	0.75	--	--	--	8,582	0.197	3,461	0.079
6924.50	--	1.00	--	--	--	10,862	0.249	5,891	0.135
6924.75	--	1.25	--	--	--	13,142	0.302	8,891	0.204
6925.00	--	1.50	--	--	--	15,422	0.354	12,462	0.286
6925.25	--	1.75	--	--	--	17,702	0.406	16,602	0.381
6925.50	--	2.00	--	--	--	19,982	0.459	21,313	0.489
6925.75	--	2.25	--	--	--	22,262	0.511	26,593	0.610
6926.00	--	2.50	--	--	--	24,542	0.563	32,444	0.745
6926.25	--	2.75	--	--	--	26,599	0.611	38,836	0.892
6926.50	--	3.00	--	--	--	28,656	0.658	45,743	1.050
6926.75	--	3.25	--	--	--	30,713	0.705	53,164	1.220
6927.00	--	3.50	--	--	--	32,770	0.752	61,099	1.403
6927.25	--	3.75	--	--	--	34,826	0.800	69,549	1.597
6927.50	--	4.00	--	--	--	36,883	0.847	78,513	1.802
6927.75	--	4.25	--	--	--	38,940	0.894	87,991	2.020
6928.00	--	4.50	--	--	--	40,997	0.941	97,983	2.249
6928.25	--	4.75	--	--	--	43,397	0.996	108,532	2.492
6928.50	--	5.00	--	--	--	45,797	1.051	119,681	2.748
6928.75	--	5.25	--	--	--	48,198	1.106	131,431	3.017
6929.00	--	5.50	--	--	--	50,598	1.162	143,780	3.301
6929.25	--	5.75	--	--	--	52,998	1.217	156,730	3.598
6929.50	--	6.00	--	--	--	55,398	1.272	170,279	3.909
6929.75	--	6.25	--	--	--	57,798	1.327	184,428	4.234
6930.00	--	6.50	--	--	--	60,198	1.382	199,178	4.572

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



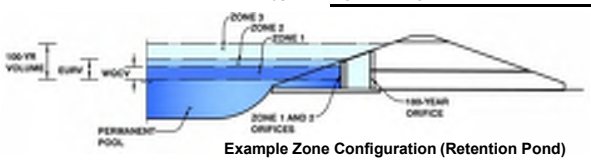


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: WATERBURY FILING NO. 1

Basin ID: POND 1 DP 8



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.79	0.394	Orifice Plate
Zone 2 (EURV)	3.44	0.957	Orifice Plate
Zone 3 (100-year)	4.37	0.775	Weir&Pipe (Restrict)
Total (all zones)		2.127	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	2.146E-02	ft^2
Depth at top of Zone using Orifice Plate =	3.60	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	13.80	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	3.09	sq. inches (diameter = 2 inches)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.20	2.40					
Orifice Area (sq. inches)	3.09	3.09	3.09					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.60	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.60	N/A	feet
Overflow Weir Front Edge Length =	4.00	N/A	feet	Overflow Weir Slope Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	3.54	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	11.14	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	5.57	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.20	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.14	N/A	ft^2
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	1.00	N/A	feet
Restrictor Plate Height Above Pipe Invert =	24.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.50	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.72	feet
Spillway Crest Length =	30.00	feet	Stage at Top of Freeboard =	6.22	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.32	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	4.19	acre-ft

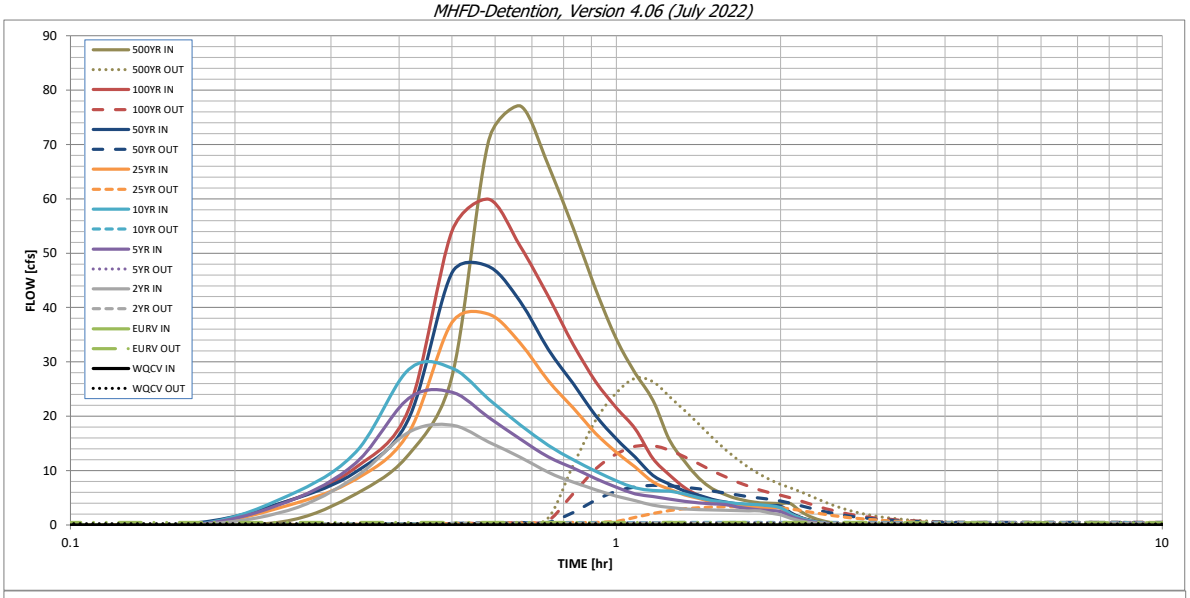
Calculated Parameters for Spillway

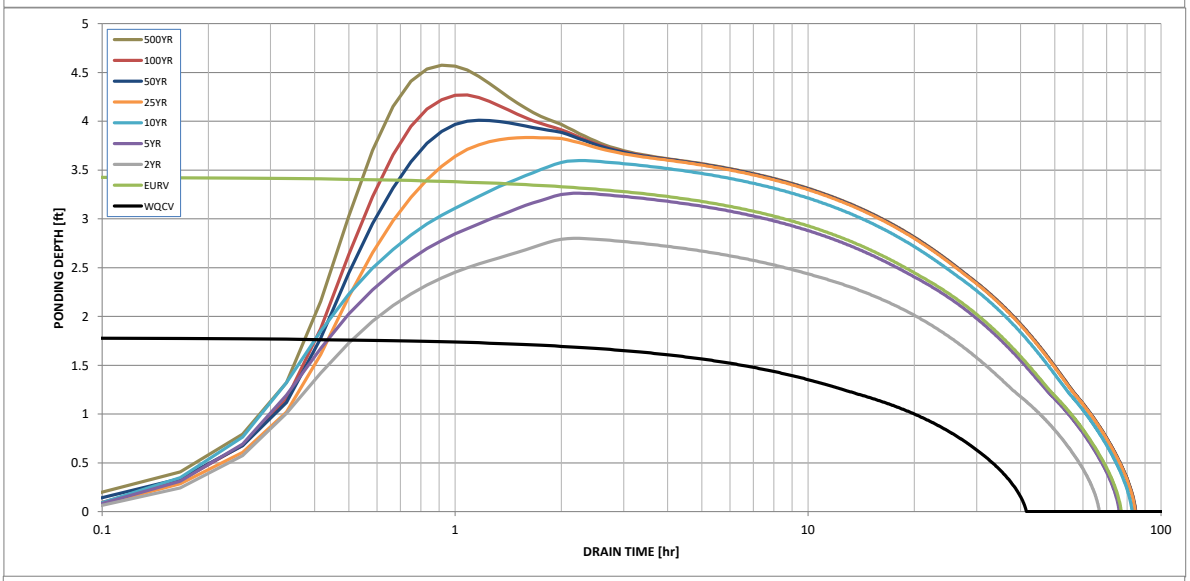
Routed Hydrograph Results *The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

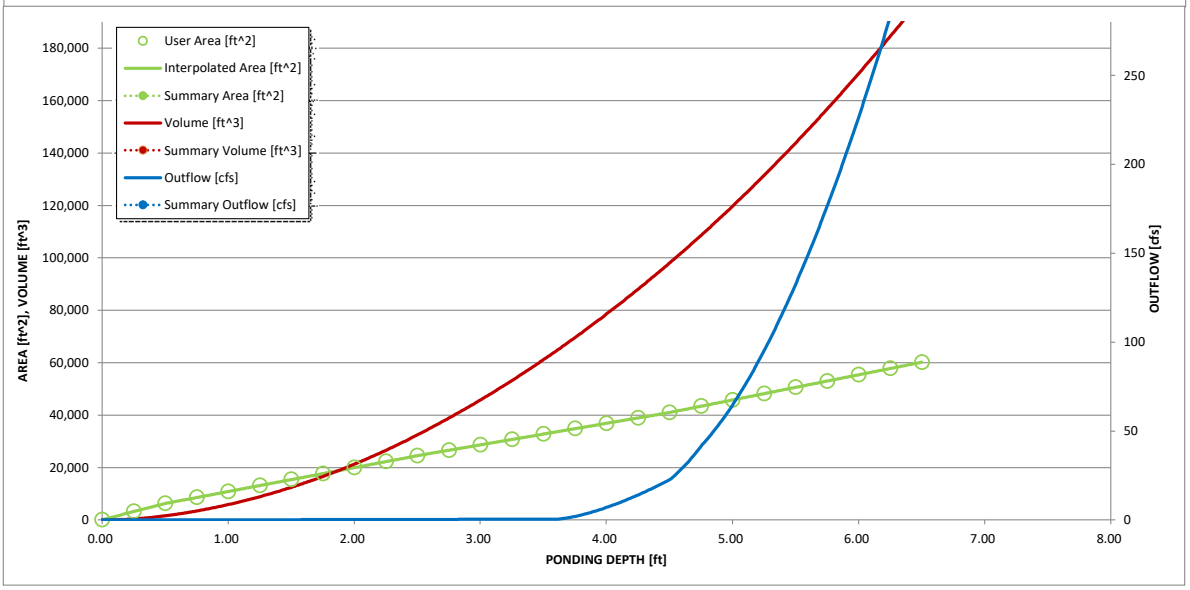
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.00
CUHP Runoff Volume (acre-ft) =	0.394	1.351	0.974	1.292	1.546	1.938	2.321	2.805	3.607
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.974	1.292	1.546	1.938	2.321	2.805	3.607
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.2	0.5	0.7	5.8	11.2	18.4	29.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.26	0.50	0.82	1.31
Peak Inflow Q (cfs) =	N/A	N/A	18.4	24.4	28.8	38.8	47.6	59.9	77.1
Peak Outflow Q (cfs) =	0.2	0.5	0.4	0.4	0.5	3.3	7.3	14.6	27.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.9	0.7	0.6	0.6	0.8	0.9
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.3	0.6	1.3	2.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	68	60	68	73	73	72	70	67
Time to Drain 99% of Inflow Volume (hours) =	**40**	73	64	72	79	79	79	78	77
Maximum Ponding Depth (ft) =	1.79	3.44	2.80	3.26	3.60	3.83	4.01	4.27	4.57
Area at Maximum Ponding Depth (acres) =	0.41	0.74	0.62	0.71	0.77	0.81	0.85	0.90	0.96
Maximum Volume Stored (acre-ft) =	0.398	1.358	0.916	1.228	1.471	1.661	1.802	2.029	2.316

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.03	0.76
	0:15:00	0.00	0.00	2.64	4.29	5.33	3.59	4.43	4.38	5.73
	0:20:00	0.00	0.00	8.85	11.43	13.42	8.44	9.77	10.57	12.96
	0:25:00	0.00	0.00	17.06	23.32	28.60	16.96	19.54	21.29	27.22
	0:30:00	0.00	0.00	18.39	24.42	28.84	37.28	46.40	54.02	70.77
	0:35:00	0.00	0.00	15.26	19.78	23.13	38.77	47.57	59.90	77.10
	0:40:00	0.00	0.00	12.50	15.81	18.41	33.49	41.13	51.33	66.22
	0:45:00	0.00	0.00	9.68	12.53	14.67	26.54	32.34	42.09	54.60
	0:50:00	0.00	0.00	7.85	10.46	11.99	21.56	26.00	33.21	43.39
	0:55:00	0.00	0.00	6.49	8.54	9.90	16.82	20.10	26.37	34.22
	1:00:00	0.00	0.00	5.31	6.93	8.13	13.36	15.81	21.57	27.92
	1:05:00	0.00	0.00	4.47	5.73	6.80	10.62	12.46	17.67	22.98
	1:10:00	0.00	0.00	3.64	5.21	6.33	7.91	9.11	12.21	15.68
	1:15:00	0.00	0.00	3.21	4.77	6.20	6.61	7.54	9.23	11.71
	1:20:00	0.00	0.00	2.96	4.34	5.69	5.51	6.24	6.87	8.60
	1:25:00	0.00	0.00	2.82	4.07	4.97	4.86	5.49	5.41	6.67
	1:30:00	0.00	0.00	2.74	3.88	4.50	4.17	4.70	4.56	5.56
	1:35:00	0.00	0.00	2.67	3.78	4.17	3.74	4.21	3.99	4.82
	1:40:00	0.00	0.00	2.63	3.32	3.96	3.46	3.89	3.63	4.34
	1:45:00	0.00	0.00	2.61	3.00	3.82	3.27	3.68	3.42	4.07
	1:50:00	0.00	0.00	2.61	2.79	3.72	3.17	3.57	3.35	3.99
	1:55:00	0.00	0.00	2.17	2.65	3.53	3.11	3.50	3.32	3.95
	2:00:00	0.00	0.00	1.86	2.47	3.16	3.08	3.47	3.32	3.95
	2:05:00	0.00	0.00	1.22	1.61	2.08	2.02	2.27	2.18	2.59
	2:10:00	0.00	0.00	0.78	1.03	1.33	1.31	1.46	1.40	1.66
	2:15:00	0.00	0.00	0.49	0.64	0.84	0.82	0.92	0.88	1.04
	2:20:00	0.00	0.00	0.28	0.38	0.50	0.49	0.55	0.53	0.62
	2:25:00	0.00	0.00	0.15	0.23	0.29	0.29	0.33	0.31	0.37
	2:30:00	0.00	0.00	0.07	0.11	0.13	0.15	0.16	0.15	0.18
	2:35:00	0.00	0.00	0.02	0.04	0.04	0.05	0.05	0.05	0.06
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FSD POND 1
FORBAY VOLUMES

Required Forbay Volume = 3% of WQCV

WQCV =	0.394	ac-ft
WQCV =	17,155	cu-ft
3% of WQCV =	0.01	ac-ft
3% of WQCV =	514.65	cu-ft

FORBAY PR 7

ELEV	*AREA*	*AREA AVG.*	*DELTA ELEV.*	*VOLUME*	*VOLUME TOTAL*
6925.50	198				
		198	1.5	297	
6927.00	198				297

End Area Method: 297 C.F.
0.007 A.F.

FORBAY PR 10

ELEV	*AREA*	*AREA AVG.*	*DELTA ELEV.*	*VOLUME*	*VOLUME TOTAL*
6927.00	198				
		198	1.5	297	
6928.50	198				297

End Area Method: 297 C.F.
0.007 A.F.
TOTAL 594.000 A.F.
TOTAL 0.014 A.F.

WATEBURY FILING NO. 1 POND 1
FORBAY WALL NOTCH CALCS

Middle Wall Notch

Notch to releae 2% of the undetained 100-year peak discharge.
Assume split between east and west forebays

100-y peak discharge	=	59.9	cfs
2.0%	=	1.20	

The general form of the equation for horizontal crested weirs is Q = CLH3/2 where:

Q = Weir flow discharge (cfs)	**1.20**	
C = Weir flow coefficient	3.4	
H = Depth of flow over the weir (ft)	1.50	Opening Height
L = Length of the weir (ft)	**0.19**	Length
L = Length of the weir (in)	**2**	

Notch to releae 2% of the undetained 100-year peak discharge is 3" wide by 18" high

West Wall Notch

Notch to releae 2% of the undetained 100-year peak discharge.
Assume split between east and west forebays

100-y peak discharge	=	59.9	cfs
2.0%	=	1.20	

The general form of the equation for horizontal crested weirs is Q = CLH3/2 where:

Q = Weir flow discharge (cfs)	**1.20**	
C = Weir flow coefficient	3.4	
H = Depth of flow over the weir (ft)	1.50	Opening Height
L = Length of the weir (ft)	**0.19**	Length
L = Length of the weir (in)	**2**	

Notch to releae 2% of the undetained 100-year peak discharge is 3" wide by 18" high

POND 1 TRICKLE CHANNEL EAST

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: **WATERBURY FILIN NO. 1** Location: POND 1 DP 8 EAST MIN SLOPE 0.6%

By: QNA Date: 9/16/2024

Chk By: Date: version 12-2004

Mannings Formula

$Q = (1.486/n)AR_h^{2/3}S^{1/2}$

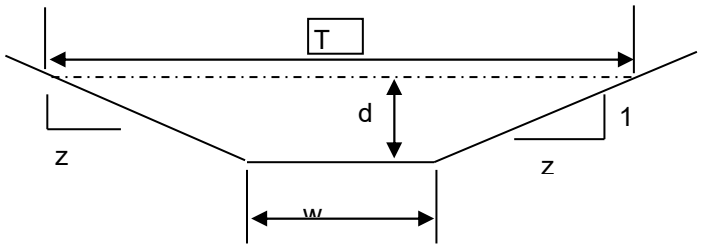
R = A/P

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$V = (1.49/n)R_h^{2/3}S^{1/2}$

Q = V x A

INPUT	
z (sideslope)=	0
z (sideslope)=	0
b (btm width, ft)=	2
d (depth, ft)=	0.5
S (slope, ft/ft)	0.006
n_{low} =	0.012
n_{high} =	0.015

Clear Data Entry Cells

				Low N		High N			
Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs		
0.5	1.00	3.00	0.33	4.61122643	4.61123	3.688981	3.68898	T =	2
								Dm =	0.500
				Sc low =	0.0045	Sc high =	0.0071		
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc		
				0.0032	0.0059	0.0050	0.0092		

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

3.69 CFS > 2% OF 59.9 CFS = 1.2 CFS

Created by: Mike O'Shea

POND 1 TRICKLE CHANNEL MIDDLE

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: **WATERBURY FILIN NO. 1** Location: POND 1 DP 8 MIDDLE MIN SLOPE 1.0%

By: QNA Date: 9/16/2024

Chk By: Date: version 12-2004

Mannings Formula

$Q = (1.486/n)AR_h^{2/3}S^{1/2}$

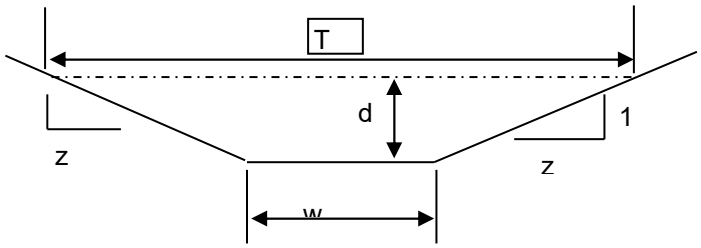
R = A/P

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$V = (1.49/n)R_h^{2/3}S^{1/2}$

Q = V x A

INPUT	
z (sideslope)=	0
z (sideslope)=	0
b (btm width, ft)=	2
d (depth, ft)=	0.5
S (slope, ft/ft)	0.01
n_{low} =	0.012
n_{high} =	0.015

Clear Data Entry Cells

				Low N		High N			
Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs		
0.5	1.00	3.00	0.33	5.95306772	5.95307	4.762454	4.76245	T =	2
								Dm =	0.500
				Sc low =	0.0045	Sc high =	0.0071		
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc		
				0.0032	0.0059	0.0050	0.0092		

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

4.76 CFS > 2% OF 59.9 CFS = 1.2 CFS

Created by: Mike O'Shea

POND 1 EMERGENCY WEIR

Figure 13-12c. Emergency Spillway Protection

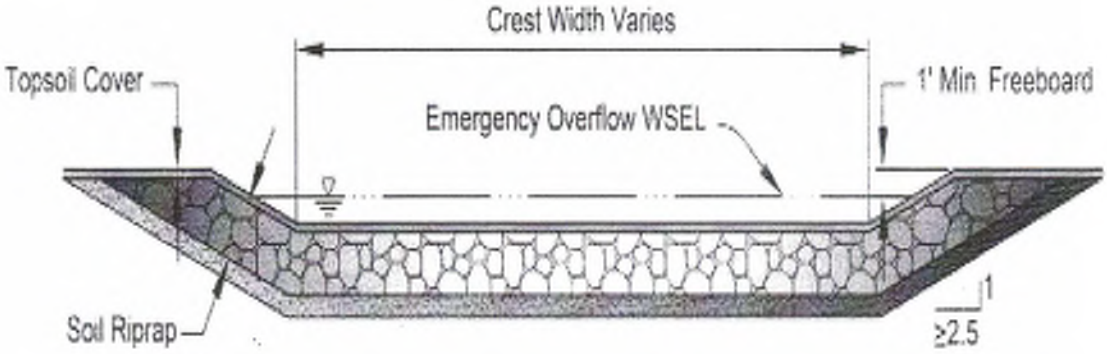
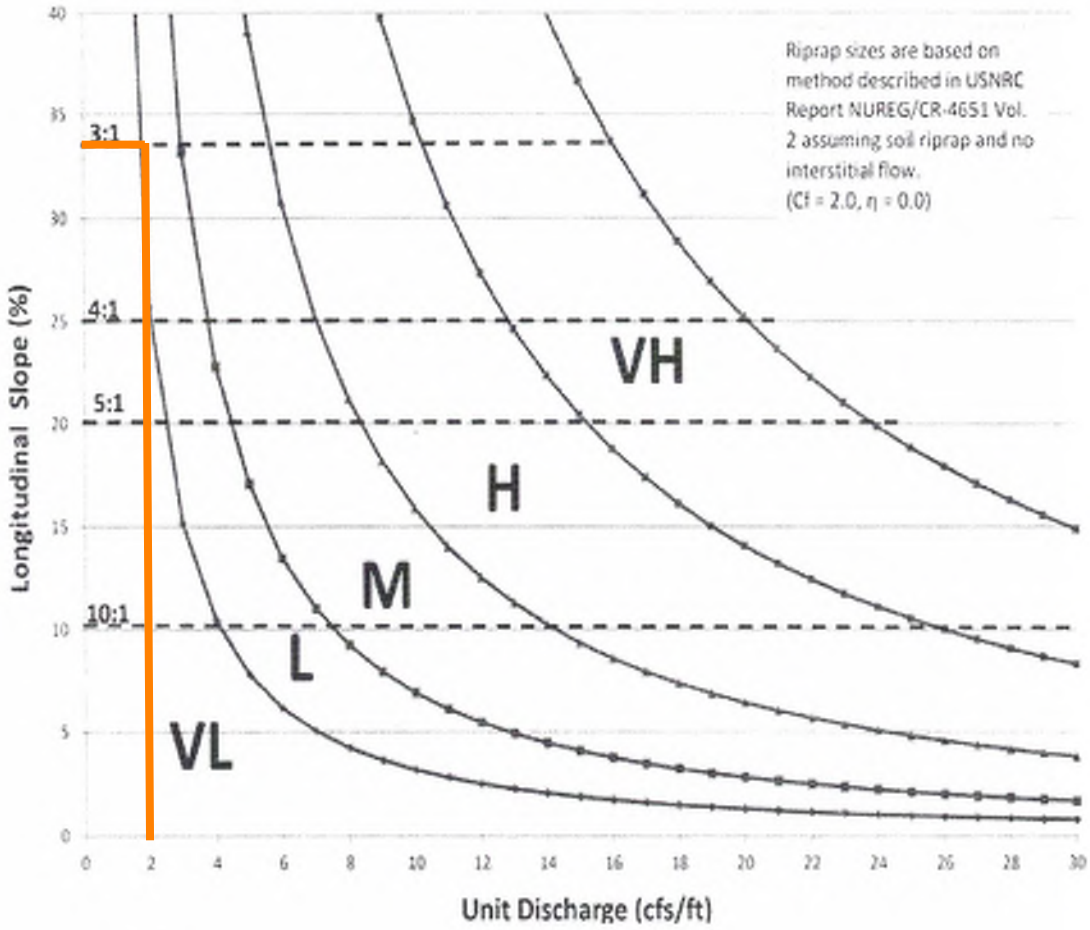


Figure 13-12d. Riprap Types for Emergency Spillway Protection



QPEAK INFLOW = 59.9 CFS
WEIR LENGTH = 30 FT
59.9/30=2.0

POND 2

Worksheet Protected

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	0.43	inches	
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches	
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches	
Optional User Defined Storm	CUHP			
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event			
Max Intensity for Optional User Defined Storm	0			

Designer: QNA
Company: Terra Nova Engineering
Date: September 17, 2024
Project: WATERBURY FILING 1 POND 2
Location: POND 2 Design Point 18 Full Spectrum Detention

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	**DP 18 FSD**
Receiving Pervious Area Soil Type	Loamy Sand
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	21.06
Directly Connected Impervious Area (DCIA, acres)	2.34
Unconnected Impervious Area (UIA, acres)	3.23
Receiving Pervious Area (RPA, acres)	0.94
Separate Pervious Area (SPA, acres)	14.55
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	21.061
Directly Connected Impervious Area (DCIA, %)	11.1%
Unconnected Impervious Area (UIA, %)	15.3%
Receiving Pervious Area (RPA, %)	4.5%
Separate Pervious Area (SPA, %)	69.1%
A_R (RPA / UIA)	0.290
I_a Check	0.770
f / I for WQCV Event:	4.5
f / I for 5-Year Event:	0.5
f / I for 100-Year Event:	0.4
f / I for Optional User Defined Storm CUHP:	
IRF for WQCV Event:	0.76
IRF for 5-Year Event:	0.94
IRF for 100-Year Event:	0.95
IRF for Optional User Defined Storm CUHP:	
Total Site Imperviousness: I_{total}	26.5%
Effective Imperviousness for WQCV Event:	22.8%
Effective Imperviousness for 5-Year Event:	25.5%
Effective Imperviousness for 100-Year Event:	25.8%
Effective Imperviousness for Optional User Defined Storm CUHP:	

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	9.5%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	2.8%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:														

Total Site Imperviousness:	**26.5%**
Total Site Effective Imperviousness for WQCV Event:	**22.8%**
Total Site Effective Imperviousness for 5-Year Event:	**25.5%**
Total Site Effective Imperviousness for 100-Year Event:	**25.8%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	

Notes:

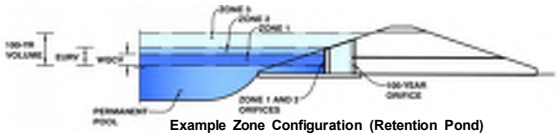
* Use Green-Ampt average infiltration rate values from Table 3-3.
** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.
*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **WATERBURY FILING NO. 1**

Basin ID: **POND 2 DP 18**



Example Zone Configuration (Retention Pond)

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft²)	Optional Override Area (ft²)	Area (acre)	Volume (ft³)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	100	0.002		
6899.25	--	0.25	--	--	--	942	0.022	130	0.003
6899.50	--	0.50	--	--	--	1,784	0.041	471	0.011
6899.75	--	0.75	--	--	--	2,626	0.060	1,022	0.023
6900.00	--	1.00	--	--	--	3,468	0.080	1,784	0.041
6900.25	--	1.25	--	--	--	5,034	0.116	2,847	0.065
6900.50	--	1.50	--	--	--	6,600	0.152	4,301	0.099
6900.75	--	1.75	--	--	--	8,166	0.187	6,147	0.141
6901.00	--	2.00	--	--	--	9,732	0.223	8,384	0.192
6901.25	--	2.25	--	--	--	11,297	0.259	11,012	0.253
6901.50	--	2.50	--	--	--	12,863	0.295	14,032	0.322
6901.75	--	2.75	--	--	--	14,429	0.331	17,444	0.400
6902.00	--	3.00	--	--	--	15,995	0.367	21,247	0.488
6902.25	--	3.25	--	--	--	19,602	0.450	25,697	0.590
6902.50	--	3.50	--	--	--	23,209	0.533	31,048	0.713
6902.75	--	3.75	--	--	--	26,815	0.616	37,301	0.856
6903.00	--	4.00	--	--	--	30,422	0.698	44,456	1.021
6903.25	--	4.25	--	--	--	34,029	0.781	52,512	1.206
6903.50	--	4.50	--	--	--	37,636	0.864	61,470	1.411
6903.75	--	4.75	--	--	--	41,243	0.947	71,330	1.638
6904.00	--	5.00	--	--	--	44,850	1.030	82,092	1.885
6904.25	--	5.25	--	--	--	48,650	1.117	93,779	2.153
6904.50	--	5.50	--	--	--	52,450	1.204	106,416	2.443
6904.75	--	5.75	--	--	--	56,251	1.291	120,004	2.755
6905.00	--	6.00	--	--	--	60,051	1.379	134,542	3.089
6905.25	--	6.25	--	--	--	63,851	1.466	150,029	3.444
6905.50	--	6.50	--	--	--	67,652	1.553	166,467	3.822
6905.75	--	6.75	--	--	--	71,452	1.640	183,855	4.221
6906.00	--	7.00	--	--	--	75,252	1.728	202,193	4.642

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	21.05	acres
Watershed Length =	1,050	ft
Watershed Length to Centroid =	350	ft
Watershed Slope =	0.019	ft/ft
Watershed Imperviousness =	25.76%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.241	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.519	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.343	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.481	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.601	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.938	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.254	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.679	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3 in.) =	2.376	acre-feet	3.00	inches
Approximate 2-yr Detention Volume =	0.324	acre-feet		
Approximate 5-yr Detention Volume =	0.434	acre-feet		
Approximate 10-yr Detention Volume =	0.547	acre-feet		
Approximate 25-yr Detention Volume =	0.697	acre-feet		
Approximate 50-yr Detention Volume =	0.817	acre-feet		
Approximate 100-yr Detention Volume =	1.026	acre-feet		

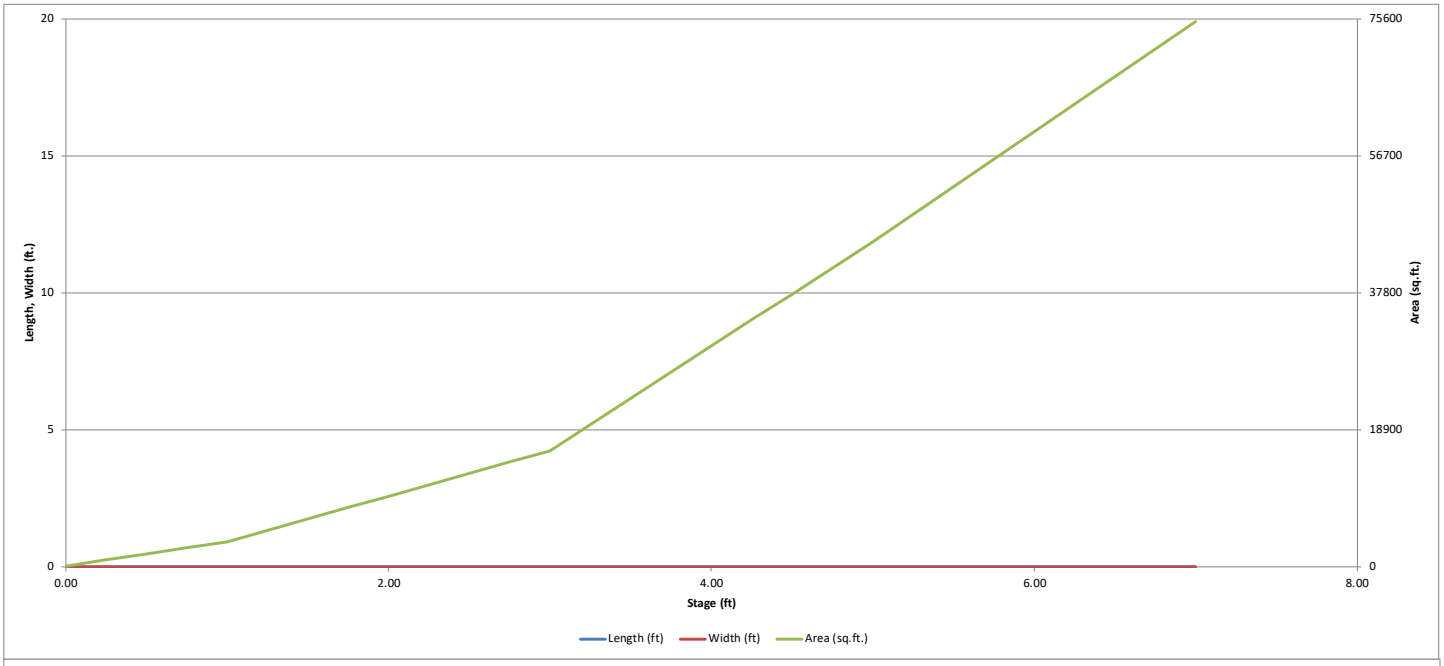
Define Zones and Basin Geometry

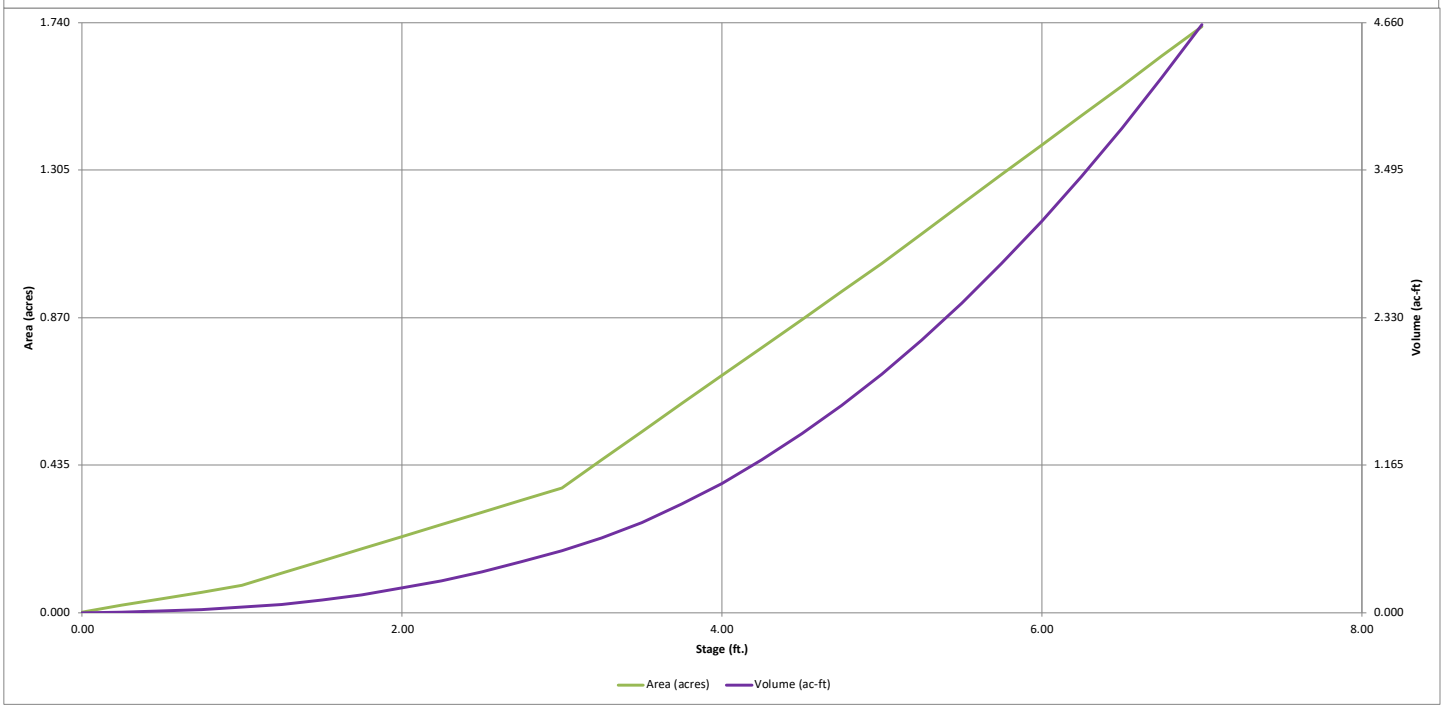
Zone 1 Volume (WQCV) =	0.241	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.278	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.507	acre-feet
Total Detention Basin Volume =	1.026	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



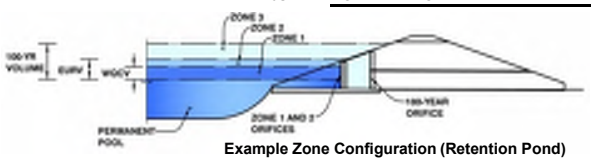


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **WATERBURY FILING NO. 1**

Basin ID: **POND 2 DP 18**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.21	0.241	Orifice Plate
Zone 2 (EURV)	3.09	0.278	Orifice Plate
Zone 3 (100-year)	4.01	0.507	Weir&Pipe (Restrict)
Total (all zones)		1.026	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	3.10	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	12.40	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.03	2.07					
Orifice Area (sq. inches)	1.32	1.32	1.32					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.10	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.10	N/A	feet
Overflow Weir Front Edge Length =	4.00	N/A	feet	Overflow Weir Slope Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	6.30	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	11.14	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	5.57	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.77	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.75	N/A	feet
Restrictor Plate Height Above Pipe Invert =	18.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.58	feet
Spillway Crest Length =	20.00	feet	Stage at Top of Freeboard =	6.58	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.58	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	3.95	acre-ft

Calculated Parameters for Spillway

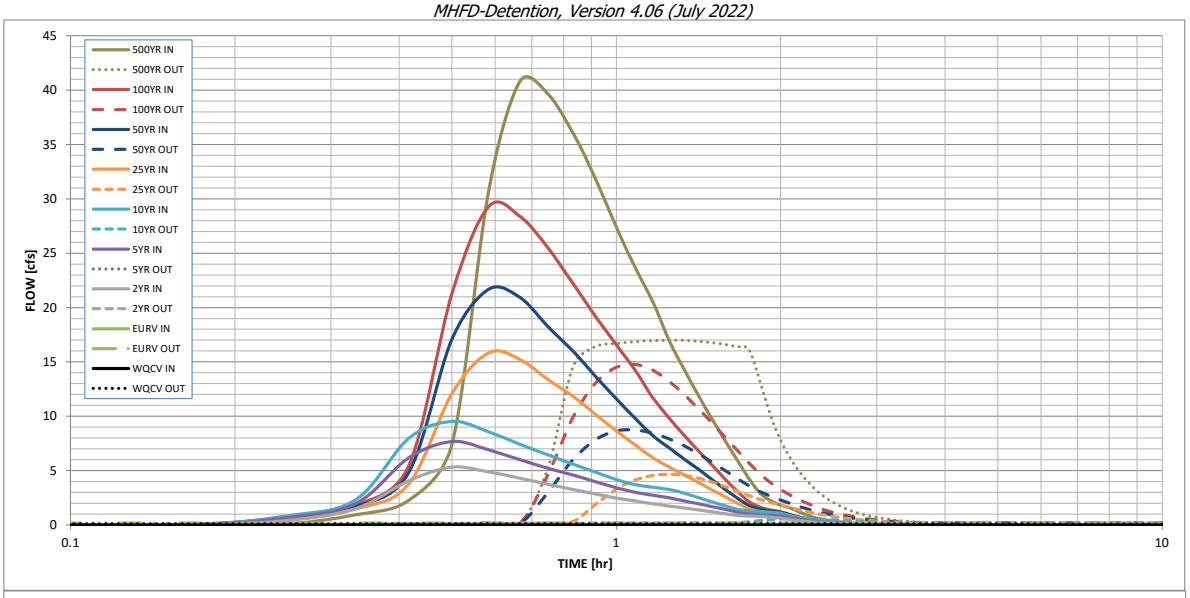
Routed Hydrograph Results

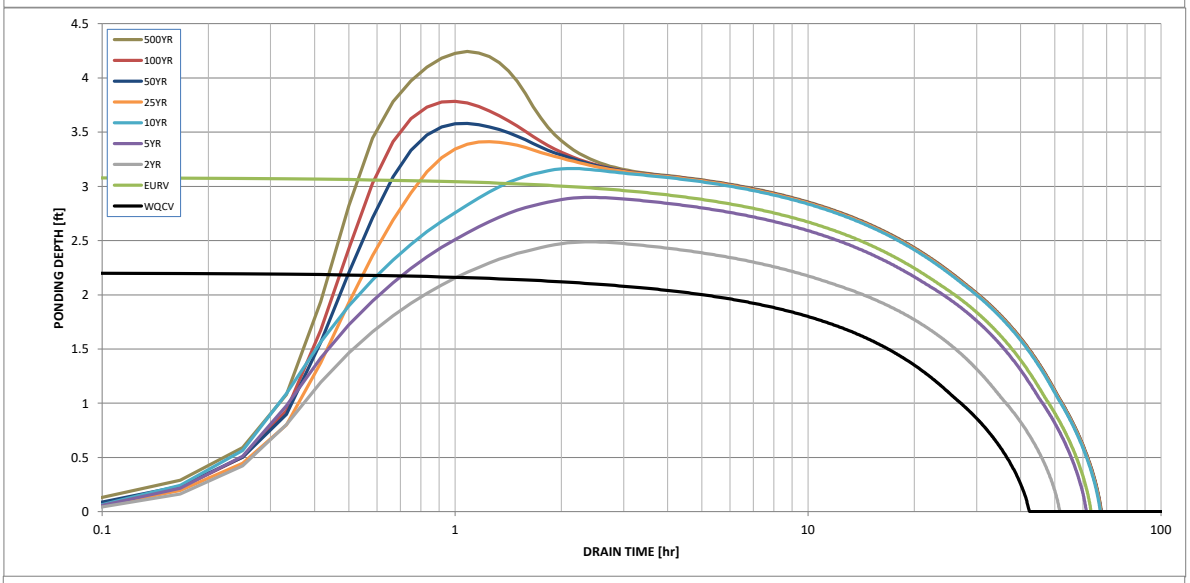
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

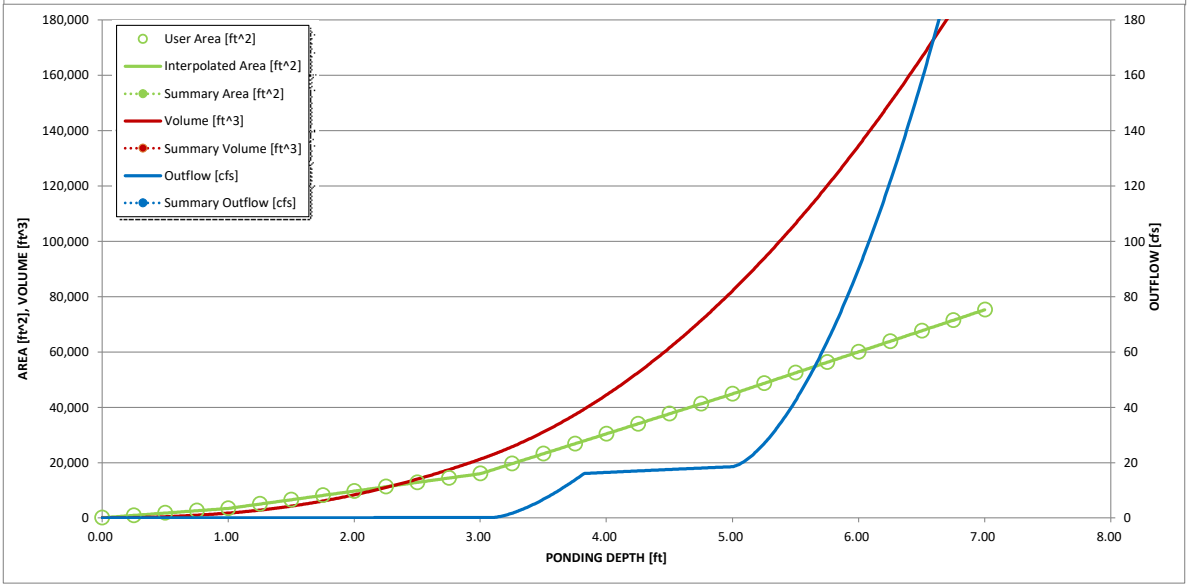
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.00
CUHP Runoff Volume (acre-ft) =	0.241	0.519	0.343	0.481	0.601	0.938	1.254	1.679	2.376
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.343	0.481	0.601	0.938	1.254	1.679	2.376
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.2	0.5	0.6	5.5	10.8	17.5	27.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.26	0.51	0.83	1.32
Peak Inflow Q (cfs) =	N/A	N/A	5.3	7.7	9.5	15.8	21.7	29.3	40.8
Peak Outflow Q (cfs) =	0.1	0.2	0.2	0.2	0.6	4.7	8.7	14.8	17.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	1.0	0.8	0.8	0.8	0.6
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.4	0.8	1.3	1.5
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	56	46	54	59	56	53	50	47
Time to Drain 99% of Inflow Volume (hours) =	**40**	60	49	58	64	62	61	60	58
Maximum Ponding Depth (ft) =	2.21	3.09	2.49	2.90	3.16	3.41	3.58	3.78	4.24
Area at Maximum Ponding Depth (acres) =	0.25	0.40	0.29	0.35	0.42	0.50	0.56	0.63	0.78
Maximum Volume Stored (acre-ft) =	0.243	0.522	0.316	0.448	0.551	0.666	0.751	0.875	1.198

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.12
	0:15:00	0.00	0.00	0.42	0.68	0.85	0.57	0.71	0.70	0.94
	0:20:00	0.00	0.00	1.50	1.97	2.32	1.47	1.71	1.83	2.27
	0:25:00	0.00	0.00	4.07	6.18	7.97	3.75	4.83	5.44	7.40
	0:30:00	0.00	0.00	5.33	7.68	9.53	12.08	17.09	21.28	30.73
	0:35:00	0.00	0.00	4.87	6.91	8.58	15.84	21.68	29.30	40.83
	0:40:00	0.00	0.00	4.31	6.00	7.42	15.23	20.92	28.38	39.60
	0:45:00	0.00	0.00	3.73	5.21	6.44	13.35	18.21	25.47	36.01
	0:50:00	0.00	0.00	3.26	4.59	5.60	11.85	15.99	22.18	31.83
	0:55:00	0.00	0.00	2.85	3.98	4.85	10.15	13.67	19.17	27.39
	1:00:00	0.00	0.00	2.48	3.42	4.17	8.65	11.60	16.57	23.66
	1:05:00	0.00	0.00	2.20	3.01	3.72	7.35	9.79	14.23	20.51
	1:10:00	0.00	0.00	1.95	2.75	3.47	6.17	8.21	11.70	16.95
	1:15:00	0.00	0.00	1.75	2.49	3.28	5.33	7.09	9.83	14.26
	1:20:00	0.00	0.00	1.56	2.22	2.92	4.58	6.05	8.21	11.83
	1:25:00	0.00	0.00	1.38	1.95	2.51	3.90	5.09	6.78	9.68
	1:30:00	0.00	0.00	1.20	1.69	2.11	3.22	4.16	5.46	7.75
	1:35:00	0.00	0.00	1.03	1.45	1.76	2.58	3.28	4.22	5.94
	1:40:00	0.00	0.00	0.89	1.18	1.45	1.99	2.46	3.08	4.26
	1:45:00	0.00	0.00	0.82	1.03	1.31	1.49	1.80	2.15	2.94
	1:50:00	0.00	0.00	0.79	0.95	1.24	1.23	1.46	1.64	2.23
	1:55:00	0.00	0.00	0.71	0.89	1.17	1.10	1.28	1.38	1.83
	2:00:00	0.00	0.00	0.63	0.83	1.08	1.03	1.19	1.22	1.57
	2:05:00	0.00	0.00	0.51	0.66	0.86	0.81	0.93	0.93	1.18
	2:10:00	0.00	0.00	0.40	0.52	0.67	0.62	0.71	0.70	0.87
	2:15:00	0.00	0.00	0.31	0.41	0.52	0.48	0.55	0.52	0.63
	2:20:00	0.00	0.00	0.24	0.31	0.40	0.37	0.42	0.38	0.46
	2:25:00	0.00	0.00	0.19	0.24	0.30	0.28	0.32	0.29	0.35
	2:30:00	0.00	0.00	0.14	0.18	0.23	0.21	0.24	0.22	0.26
	2:35:00	0.00	0.00	0.11	0.14	0.17	0.16	0.18	0.17	0.20
	2:40:00	0.00	0.00	0.08	0.10	0.13	0.12	0.13	0.13	0.15
	2:45:00	0.00	0.00	0.06	0.07	0.10	0.09	0.10	0.10	0.11
	2:50:00	0.00	0.00	0.04	0.05	0.07	0.06	0.07	0.07	0.08
	2:55:00	0.00	0.00	0.02	0.03	0.04	0.04	0.05	0.04	0.05
	3:00:00	0.00	0.00	0.01	0.02	0.02	0.03	0.03	0.03	0.03
	3:05:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FSD POND 2
FORBAY VOLUMES

Required Forbay Volume = 3% of WQCV

WQCV =	0.241	ac-ft
WQCV =	10,513	cu-ft
3% of WQCV =	0.01	ac-ft
3% of WQCV =	315.38	cu-ft

FORBAY PR 17

ELEV	*AREA*	*AREA AVG.*	*DELTA ELEV.*	*VOLUME*	*VOLUME TOTAL*
6900.25	382				
		382	1.5	573	
6901.75	382				573

End Area Method: 573 C.F.
0.013 A.F.

WATEBURY FILING NO. 1 POND 2
FORBAY WALL NOTCH CALCS

Wall Notch

Notch to releae 2% of the undetained 100-year peak discharge.
Assume split between east and west forebays

100-y peak discharge	=	29.3	cfs
2.0%	=	0.59	

The general form of the equation for horizontal crested weirs is Q = CLH3/2 where:

Q = Weir flow discharge (cfs)	**0.59**	
C = Weir flow coefficient	3.4	
H = Depth of flow over the weir (ft)	1.50	Opening Height
L = Length of the weir (ft)	**0.09**	Length
L = Length of the weir (in)	**1**	

Notch to releae 2% of the undetained 100-year peak discharge is 3" wide by 18" high

POND 2 EMERGENCY WEIR

Figure 13-12c. Emergency Spillway Protection

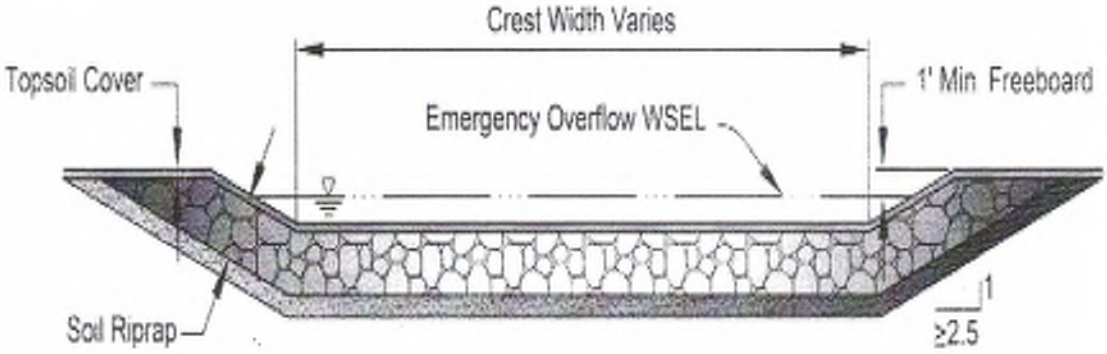
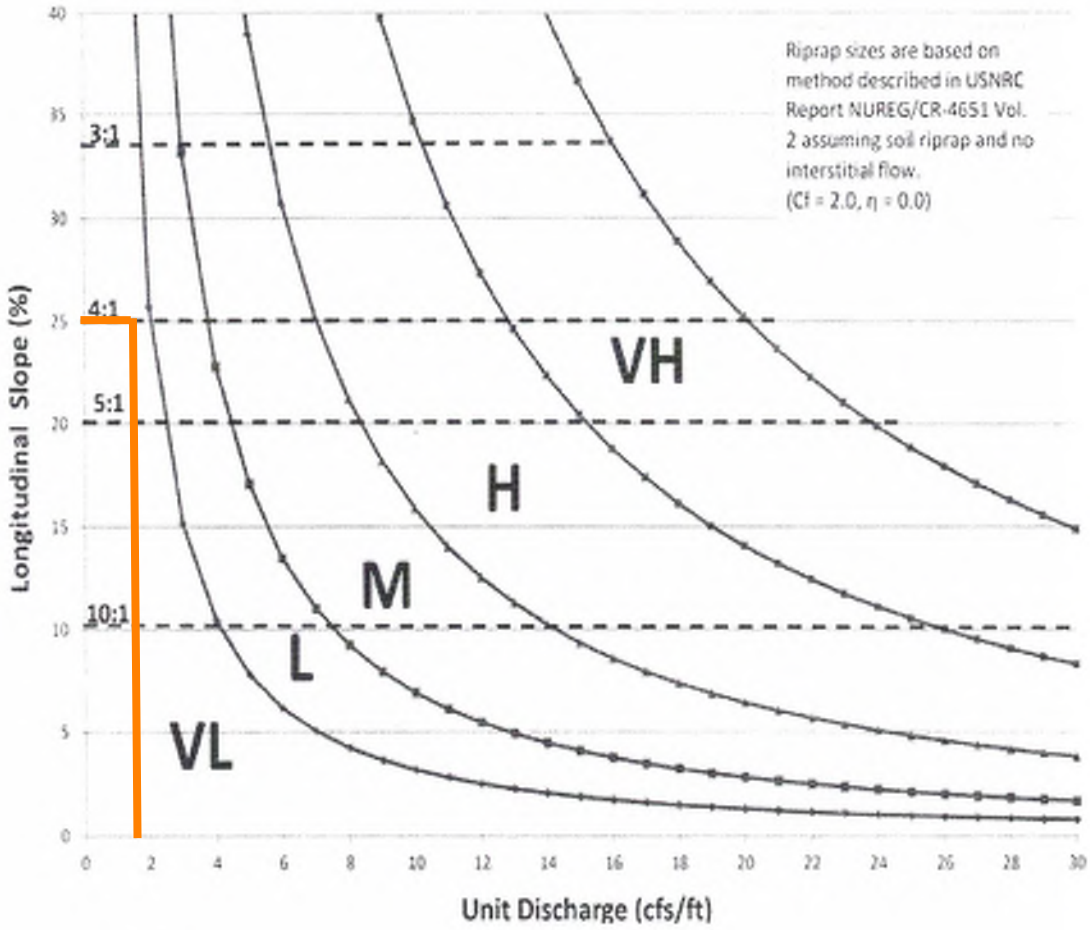


Figure 13-12d. Riprap Types for Emergency Spillway Protection



QPEAK INFLOW = 29.3 CFS
WEIR LENGTH = 20 FT
29.3/20=1.47

POND 3

Worksheet Protected

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	0.43	inches	
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches	
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches	
Optional User Defined Storm	CUHP			
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event			
Max Intensity for Optional User Defined Storm	0			

Designer: QNA
Company: Terra Nova Engineering
Date: December 21, 2024
Project: WATERBURY FILING 1 POND 3
Location: POND 3 Design Point 29 Full Spectrum Detention

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	**DP 29 FSD**
Receiving Pervious Area Soil Type	Loamy Sand
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	72.14
Directly Connected Impervious Area (DCIA, acres)	19.75
Unconnected Impervious Area (UIA, acres)	20.80
Receiving Pervious Area (RPA, acres)	16.16
Separate Pervious Area (SPA, acres)	15.42
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	72.137
Directly Connected Impervious Area (DCIA, %)	27.4%
Unconnected Impervious Area (UIA, %)	28.8%
Receiving Pervious Area (RPA, %)	22.4%
Separate Pervious Area (SPA, %)	21.4%
A_R (RPA / UIA)	0.777
I_a Check	0.560
f / I for WQCV Event:	4.5
f / I for 5-Year Event:	0.5
f / I for 100-Year Event:	0.4
f / I for Optional User Defined Storm CUHP:	
IRF for WQCV Event:	0.64
IRF for 5-Year Event:	0.90
IRF for 100-Year Event:	0.92
IRF for Optional User Defined Storm CUHP:	
Total Site Imperviousness: I_{total}	56.2%
Effective Imperviousness for WQCV Event:	45.8%
Effective Imperviousness for 5-Year Event:	53.3%
Effective Imperviousness for 100-Year Event:	54.0%
Effective Imperviousness for Optional User Defined Storm CUHP:	

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	12.9%
This line only for 10-Year Event	N/A
100-Year Event CREDIT**: Reduce Detention By:	3.9%
User Defined CUHP CREDIT: Reduce Detention By:	

Total Site Imperviousness:	**56.21%**
Total Site Effective Imperviousness for WQCV Event:	**45.84%**
Total Site Effective Imperviousness for 5-Year Event:	**53.33%**
Total Site Effective Imperviousness for 100-Year Event:	**53.95%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.

** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.

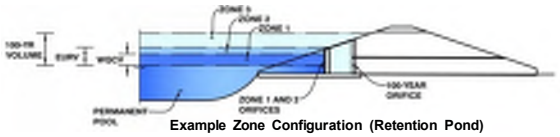
*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **WATERBURY FILING NO. 1**

Basin ID: **POND 3 DP 29**



Example Zone Configuration (Retention Pond)

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft²)	Optional Override Area (ft²)	Area (acre)	Volume (ft³)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	100	0.002		
6922.25	--	0.25	--	--	--	3,412	0.078	439	0.010
6922.50	--	0.50	--	--	--	6,282	0.144	1,650	0.038
6922.75	--	0.75	--	--	--	9,372	0.215	3,607	0.083
6923.00	--	1.00	--	--	--	13,347	0.306	6,447	0.148
6923.25	--	1.25	--	--	--	16,659	0.382	10,198	0.234
6923.50	--	1.50	--	--	--	19,971	0.458	14,777	0.339
6923.75	--	1.75	--	--	--	23,283	0.534	20,183	0.463
6924.00	--	2.00	--	--	--	26,595	0.611	26,418	0.606
6924.25	--	2.25	--	--	--	33,544	0.770	33,935	0.779
6924.50	--	2.50	--	--	--	40,493	0.930	43,190	0.992
6924.75	--	2.75	--	--	--	47,442	1.089	54,182	1.244
6925.00	--	3.00	--	--	--	54,392	1.249	66,911	1.536
6925.25	--	3.25	--	--	--	61,341	1.408	81,378	1.868
6925.50	--	3.50	--	--	--	68,290	1.568	97,582	2.240
6925.75	--	3.75	--	--	--	75,240	1.727	115,523	2.652
6926.00	--	4.00	--	--	--	82,189	1.887	135,201	3.104
6926.25	--	4.25	--	--	--	87,136	2.000	156,367	3.590
6926.50	--	4.50	--	--	--	92,083	2.114	178,769	4.104
6926.75	--	4.75	--	--	--	97,030	2.228	202,409	4.647
6927.00	--	5.00	--	--	--	101,977	2.341	227,285	5.218
6927.25	--	5.25	--	--	--	106,924	2.455	253,397	5.817
6927.50	--	5.50	--	--	--	111,871	2.568	280,747	6.445
6927.75	--	5.75	--	--	--	116,819	2.682	309,333	7.101
6928.00	--	6.00	--	--	--	121,766	2.795	339,156	7.786
6928.25	--	6.25	--	--	--	124,516	2.858	369,941	8.493
6928.50	--	6.50	--	--	--	127,266	2.922	401,414	9.215
6928.75	--	6.75	--	--	--	130,017	2.985	433,574	9.953
6929.00	--	7.00	--	--	--	132,767	3.048	466,422	10.708
6929.25	--	7.25	--	--	--	135,518	3.111	499,958	11.477
6929.50	--	7.50	--	--	--	138,268	3.174	534,181	12.263
6929.75	--	7.75	--	--	--	141,019	3.237	569,092	13.065
6930.00	--	8.00	--	--	--	143,769	3.300	604,691	13.882

Watershed Information

Selected BMP Type =	**EDB**		**Note: L / W Ratio < 1**
Watershed Area =	72.14	acres	**L / W Ratio = 0.72**
Watershed Length =	1,500	ft	
Watershed Length to Centroid =	300	ft	
Watershed Slope =	0.026	ft/ft	
Watershed Imperviousness =	53.95%	percent	
Percentage Hydrologic Soil Group A =	100.0%	percent	
Percentage Hydrologic Soil Group B =	0.0%	percent	
Percentage Hydrologic Soil Groups C/D =	0.0%	percent	
Target WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

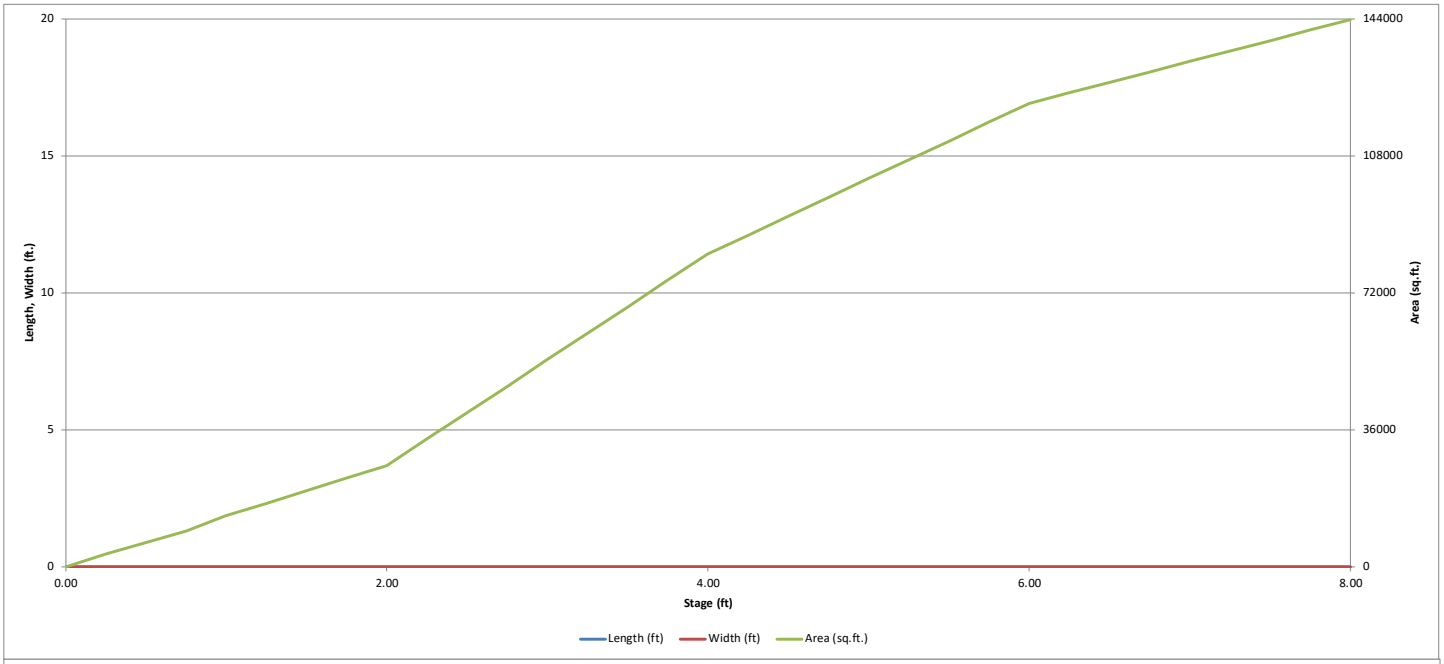
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.307	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	4.584	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	3.326	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	4.403	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	5.271	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	6.568	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	7.836	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	9.430	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3 in.) =	12.081	acre-feet	3.00	inches
Approximate 2-yr Detention Volume =	2.958	acre-feet		
Approximate 5-yr Detention Volume =	3.886	acre-feet		
Approximate 10-yr Detention Volume =	4.725	acre-feet		
Approximate 25-yr Detention Volume =	5.753	acre-feet		
Approximate 50-yr Detention Volume =	6.395	acre-feet		
Approximate 100-yr Detention Volume =	7.144	acre-feet		

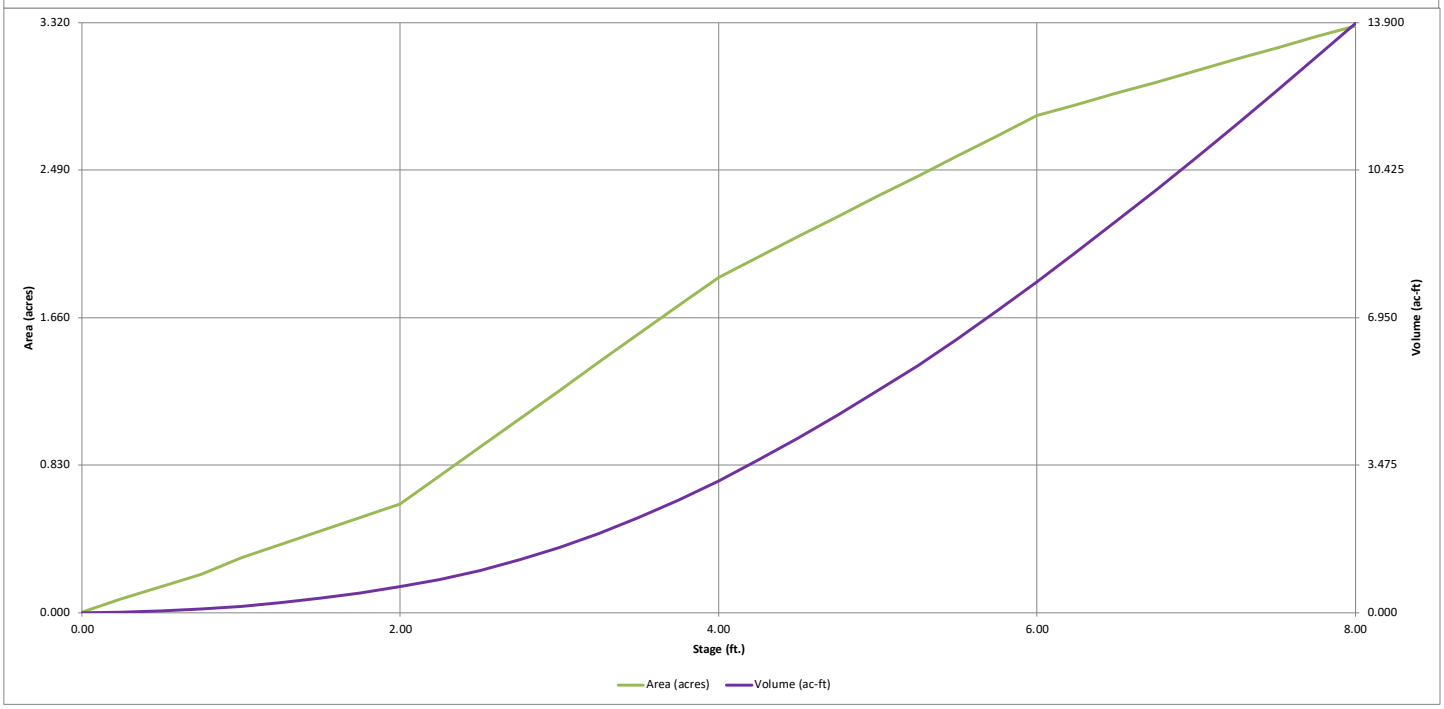
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.307	acre-feet
Zone 2 Volume (EURV - Zone 1) =	3.278	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.559	acre-feet
Total Detention Basin Volume =	7.144	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



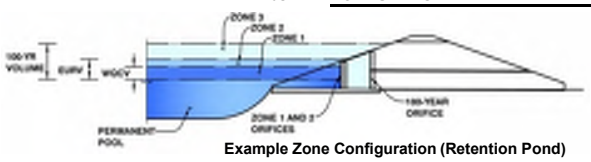


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **WATERBURY FILING NO. 1**

Basin ID: **POND 3 DP 29**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.81	1.307	Orifice Plate
Zone 2 (EURV)	4.73	3.278	Orifice Plate
Zone 3 (100-year)	5.77	2.559	Weir&Pipe (Restrict)
Total (all zones)		7.144	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth = [ ] ft (distance below the filtration media surface)

Underdrain Orifice Diameter = [ ] inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = [ ] ft^2

Underdrain Orifice Centroid = [ ] feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)

Depth at top of Zone using Orifice Plate = 4.76 ft (relative to basin bottom at Stage = 0 ft)

Orifice Plate: Orifice Vertical Spacing = N/A inches

Orifice Plate: Orifice Area per Row = N/A sq. inches

Calculated Parameters for Plate

WQ Orifice Area per Row = N/A ft^2

Elliptical Half-Width = N/A feet

Elliptical Slot Centroid = N/A feet

Elliptical Slot Area = N/A ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.68	3.37					
Orifice Area (sq. inches)	7.00	8.50	9.00					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.05	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	12.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	6.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.05	N/A	feet
Overflow Weir Slope Length =	6.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	7.09	N/A	
Overflow Grate Open Area w/o Debris =	50.11	N/A	ft^2
Overflow Grate Open Area w/ Debris =	25.06	N/A	ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.20	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	36.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	36.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	7.07	N/A	ft^2
Outlet Orifice Centroid =	1.50	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage= 5.80 ft (relative to basin bottom at Stage = 0 ft)

Spillway Crest Length = 64.00 feet

Spillway End Slopes = 4.00 H:V

Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway

Spillway Design Flow Depth= 1.20 feet

Stage at Top of Freeboard = 8.00 feet

Basin Area at Top of Freeboard = 3.30 acres

Basin Volume at Top of Freeboard = 13.88 acre-ft

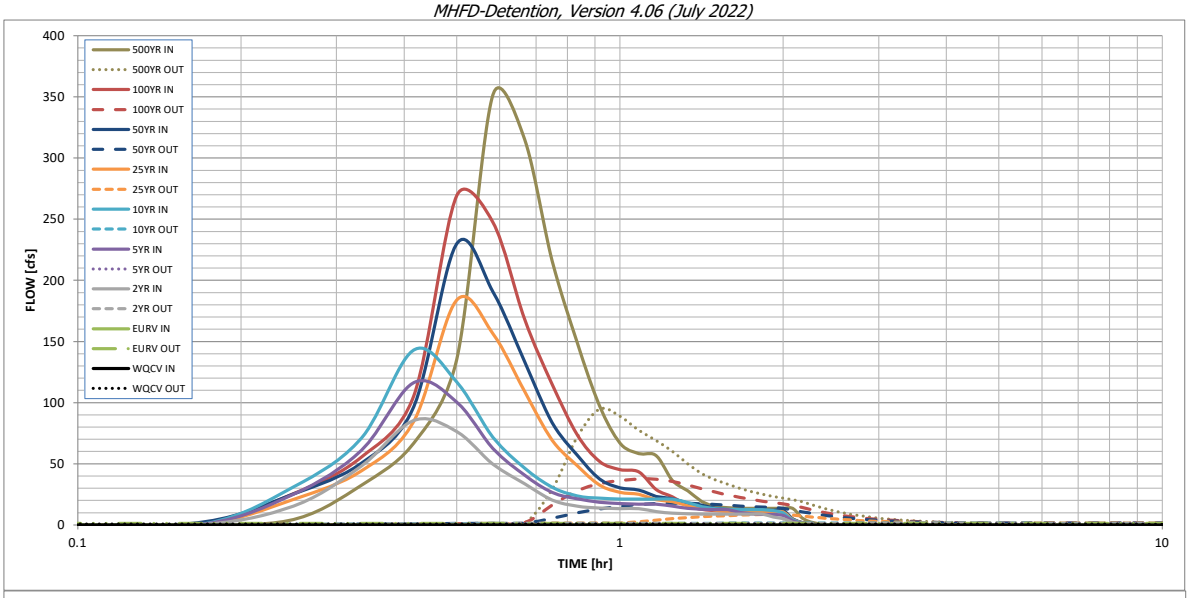
Routed Hydrograph Results

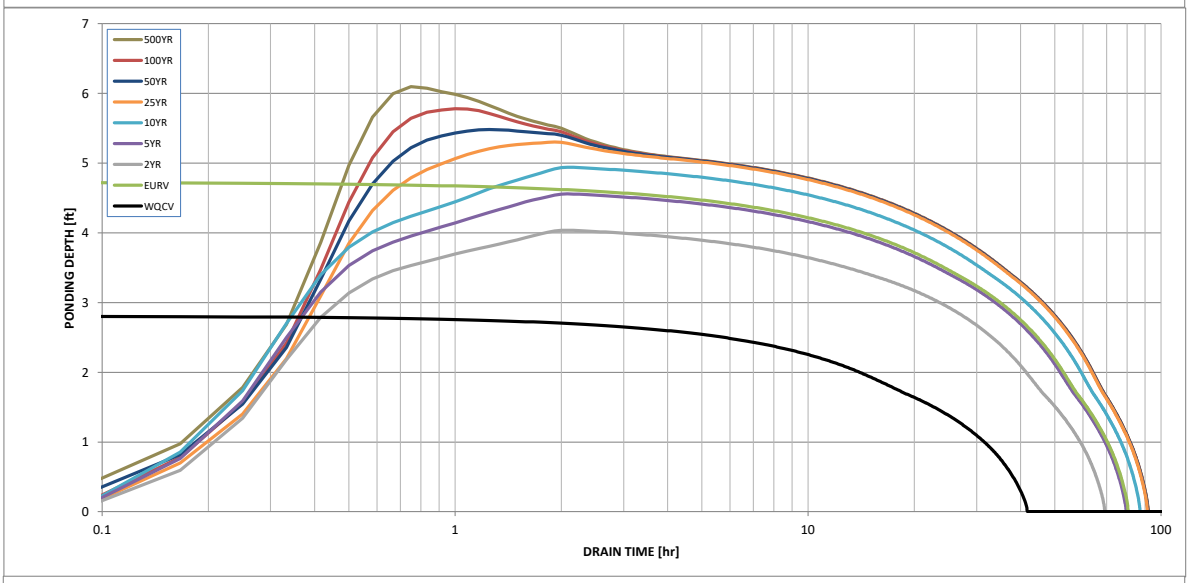
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

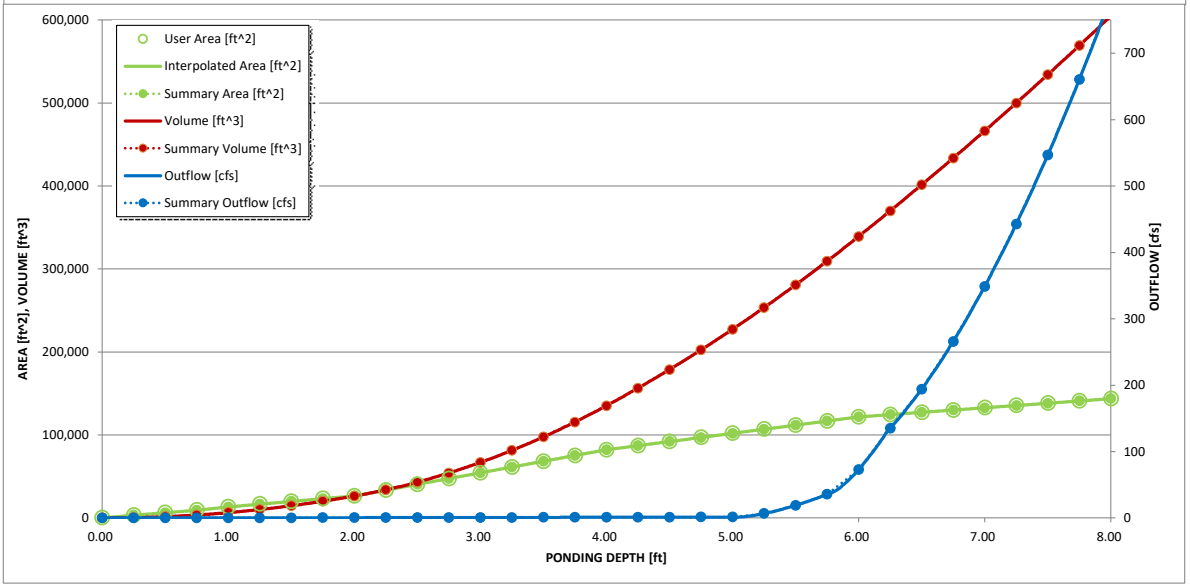
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.00
CUHP Runoff Volume (acre-ft) =	1.307	4.584	3.326	4.403	5.271	6.568	7.836	9.430	12.081
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	3.326	4.403	5.271	6.568	7.836	9.430	12.081
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	1.2	2.4	3.2	29.9	56.5	92.4	144.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.02	0.03	0.04	0.41	0.78	1.28	2.01
Peak Inflow Q (cfs) =	N/A	N/A	85.6	116.4	143.1	183.9	230.0	269.3	351.7
Peak Outflow Q (cfs) =	0.7	1.4	1.2	1.3	1.4	8.7	17.8	37.7	94.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.6	0.4	0.3	0.3	0.4	0.7
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.1	0.3	0.7	1.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	71	62	70	76	79	77	75	72
Time to Drain 99% of Inflow Volume (hours) =	**40**	77	66	76	83	86	85	85	83
Maximum Ponding Depth (ft) =	2.81	4.73	4.04	4.55	4.94	5.30	5.48	5.78	6.09
Area at Maximum Ponding Depth (acres) =	1.13	2.22	1.90	2.14	2.31	2.47	2.55	2.69	2.82
Maximum Volume Stored (acre-ft) =	1.310	4.602	3.161	4.210	5.055	5.916	6.368	7.155	8.039

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	1.75	0.18	4.40
	0:15:00	0.00	0.00	15.44	25.11	31.16	20.96	25.41	25.53	32.31
	0:20:00	0.00	0.00	48.04	60.77	70.81	44.14	50.54	55.41	66.92
	0:25:00	0.00	0.00	85.57	116.37	143.08	84.82	96.82	105.70	135.12
	0:30:00	0.00	0.00	76.34	100.43	116.83	183.95	230.01	269.26	351.71
	0:35:00	0.00	0.00	49.60	62.47	71.71	156.30	190.69	247.51	315.63
	0:40:00	0.00	0.00	33.73	40.73	46.60	109.19	133.55	168.46	216.19
	0:45:00	0.00	0.00	20.36	26.49	30.82	69.37	83.74	115.14	149.60
	0:50:00	0.00	0.00	15.24	21.50	23.69	48.58	57.22	74.05	97.62
	0:55:00	0.00	0.00	13.90	18.56	21.85	32.52	37.56	51.94	67.02
	1:00:00	0.00	0.00	13.39	17.44	21.23	26.70	30.38	45.26	58.31
	1:05:00	0.00	0.00	13.39	17.06	21.02	24.95	28.58	43.33	56.62
	1:10:00	0.00	0.00	10.81	16.88	21.02	20.57	23.33	28.88	36.37
	1:15:00	0.00	0.00	9.67	15.25	21.02	19.03	21.51	22.86	28.05
	1:20:00	0.00	0.00	9.18	13.56	18.35	15.75	17.76	15.83	19.13
	1:25:00	0.00	0.00	8.93	12.82	14.90	14.27	16.07	12.63	15.04
	1:30:00	0.00	0.00	8.92	12.47	13.38	12.03	13.54	11.79	14.05
	1:35:00	0.00	0.00	8.92	12.37	12.70	11.02	12.41	11.39	13.58
	1:40:00	0.00	0.00	8.92	10.10	12.48	10.69	12.04	11.39	13.58
	1:45:00	0.00	0.00	8.92	9.10	12.48	10.53	11.85	11.39	13.58
	1:50:00	0.00	0.00	8.92	8.66	12.48	10.53	11.85	11.39	13.58
	1:55:00	0.00	0.00	6.35	8.44	11.72	10.53	11.85	11.39	13.58
	2:00:00	0.00	0.00	5.21	7.79	9.86	10.53	11.85	11.39	13.58
	2:05:00	0.00	0.00	2.14	3.28	4.10	4.41	4.96	4.75	5.65
	2:10:00	0.00	0.00	0.75	1.29	1.56	1.73	1.94	1.85	2.19
	2:15:00	0.00	0.00	0.25	0.42	0.47	0.57	0.63	0.60	0.71
	2:20:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
	2:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FSD POND 3
FORBAY VOLUMES

Required Forbay Volume = 3% of WQCV

WQCV =	1.307	ac-ft
WQCV =	56,917	cu-ft
3% of WQCV =	0.04	ac-ft
3% of WQCV =	1707.51	cu-ft

FORBAY PR 33A

ELEV	*AREA*	*AREA AVG.*	*DELTA ELEV.*	*VOLUME*	*VOLUME TOTAL*
6900.25	900				
		900	1.5	1350	
6901.75	900				1350

End Area Method: 1350 C.F.
0.031 A.F.

FORBAY PR 34A

ELEV	*AREA*	*AREA AVG.*	*DELTA ELEV.*	*VOLUME*	*VOLUME TOTAL*
6900.25	425				
		425	1.5	638	
6901.75	425				638

End Area Method: 638 C.F.
0.015 A.F.

TOTAL 1987.500 A.F.
TOTAL 0.046 A.F.

WATEBURY FILING NO. 1 POND 3
FORBAY WALL NOTCH CALCS

North Wall Notch

Notch to releae 2% of the undetained 100-year peak discharge.

100-y peak discharge	=	269	cfs
2.0%	=	5.39	

The general form of the equation for horizontal crested weirs is Q = CLH3/2 where:

Q = Weir flow discharge (cfs)	**5.39**	
C = Weir flow coefficient	3.4	
H = Depth of flow over the weir (ft)	2.50	Opening Height
L = Length of the weir (ft)	**0.40**	Length
L = Length of the weir (in)	**5**	

Notch to releae 2% of the undetained 100-year peak discharge is 5" wide by 30" high

South Wall Notch

Notch to releae 2% of the undetained 100-year peak discharge.

100-y peak discharge	=	269	cfs
2.0%	=	5.39	

The general form of the equation for horizontal crested weirs is Q = CLH3/2 where:

Q = Weir flow discharge (cfs)	**5.39**	
C = Weir flow coefficient	3.4	
H = Depth of flow over the weir (ft)	2.50	Opening Height
L = Length of the weir (ft)	**0.40**	Length
L = Length of the weir (in)	**5**	

Notch to releae 2% of the undetained 100-year peak discharge is 5" wide by 30" high

POND 3 TRICKLE CHANNEL NORTH

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project:	**WATERBURY FILIN NO. 1**	Location:	POND 3 DP 29 NORTH	MIN SLOPE 0.5%	
By:	QNA	Date:	9/16/2024		
Chk By:		Date:		version 12-2004	

Mannings Formula

$Q = (1.486/n)AR_h^{2/3}S^{1/2}$

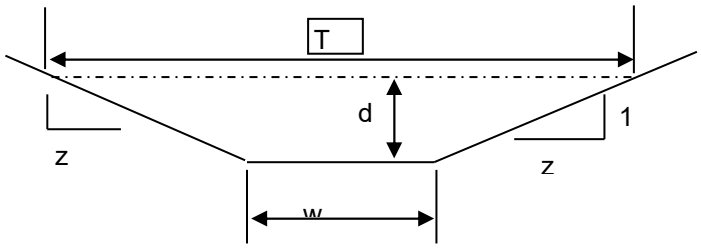
R = A/P

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$V = (1.49/n)R_h^{2/3}S^{1/2}$

Q = V x A

INPUT	
z (sideslope)=	0
z (sideslope)=	0
b (btm width, ft)=	3
d (depth, ft)=	0.5
S (slope, ft/ft)	0.005
n_{low} =	0.012
n_{high} =	0.015

Clear Data Entry Cells

				Low N		High N			
Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs		
0.5	1.50	4.00	0.38	4.55333089	6.83	3.642665	5.464	T =	3
								Dm =	0.500
				Sc low =	0.0039	Sc high =	0.0061		
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc		
				0.0027	0.0050	0.0042	0.0079		

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

5.46 CFS > 2% OF 269 CFS = 5.38 CFS

Created by: Mike O'Shea

POND 3 TRICKLE CHANNEL SOUTH

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: **WATERBURY FILIN NO. 1** Location: POND 3 DP 29 SOUTH MIN SLOPE 0.88%

By: QNA Date: 9/16/2024

Chk By: Date: version 12-2004

Mannings Formula

$Q = (1.486/n)AR_h^{2/3}S^{1/2}$

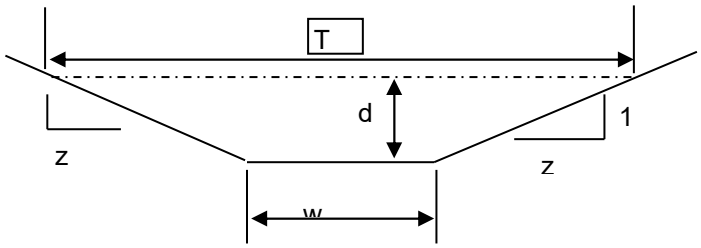
R = A/P

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$V = (1.49/n)R_h^{2/3}S^{1/2}$

Q = V x A

INPUT	
z (sideslope)=	0
z (sideslope)=	0
b (btm width, ft)=	3
d (depth, ft)=	0.5
S (slope, ft/ft)	0.0088
n_{low} =	0.012
n_{high} =	0.015

Clear Data Entry Cells

				Low N		High N			
Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs		
0.5	1.50	4.00	0.38	6.04067605	9.06101	4.832541	7.24881	T =	3
								Dm =	0.500
				Sc low =	0.0039	Sc high =	0.0061		
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc		
				0.0027	0.0050	0.0042	0.0079		

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

7.25 CFS > 2% OF 269 CFS = 5.38 CFS

Created by: Mike O'Shea

Figure 13-12c. Emergency Spillway Protection

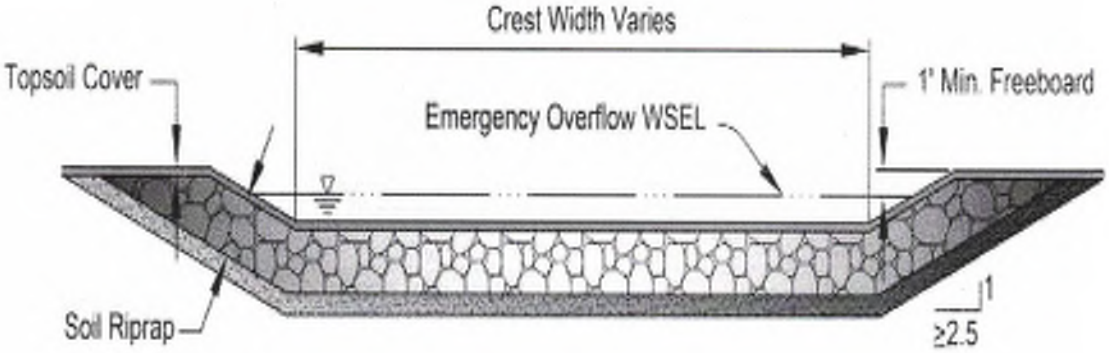
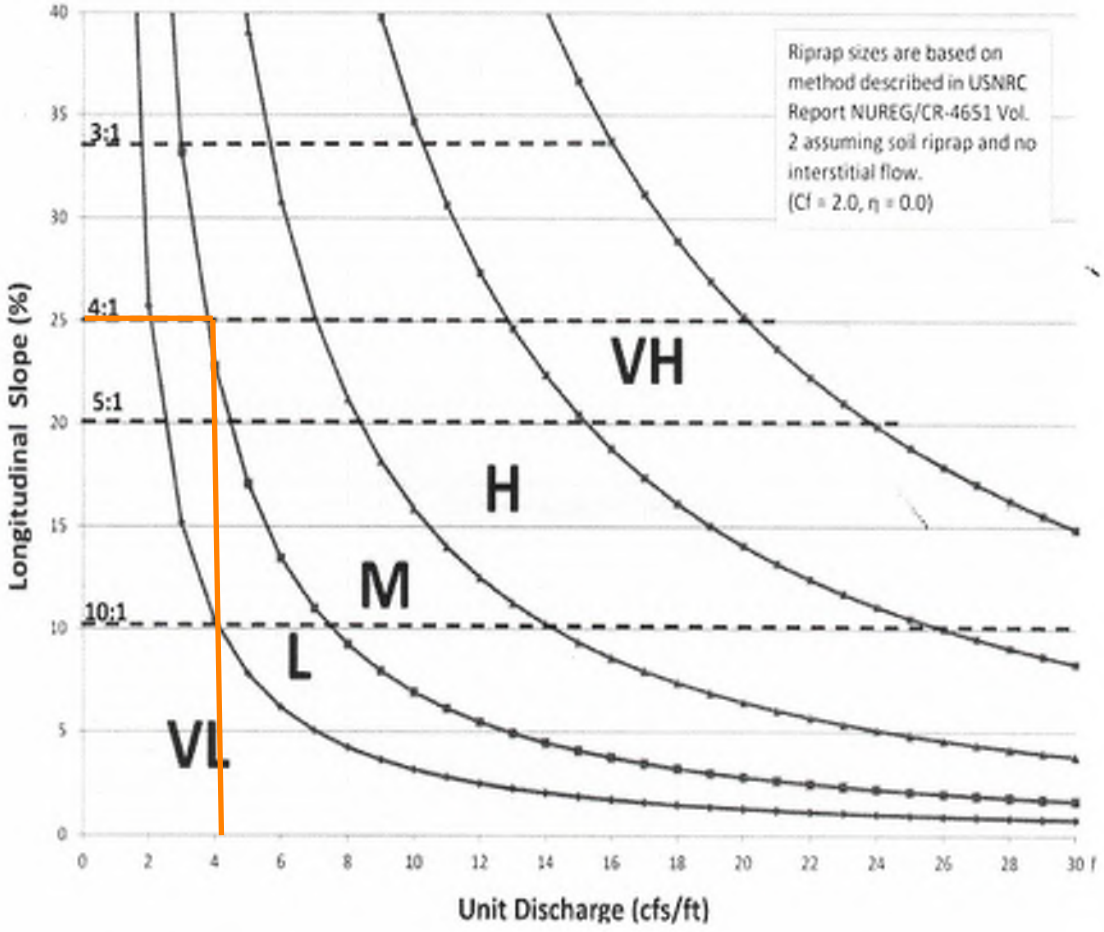


Figure 13-12d. Riprap Types for Emergency Spillway Protection



Q PEAK INFLOW = 269 CFS
WIER LENGTH = 64 FT
269/64=4.2
TYPE M

POND CALCULATIONS INTERIM CONDITION

POND 3

POND TRIBUTARY AREA

POND 3 TRIB AREA (DP 29)	26.31 AC	BASINS Q1, Q2, R, S1, S2, T1, T2, U1, U2, W, V, X, OS-Q1, OS-Q2, OS-R, OS-SI, OS-S2, OS-T2, & OS-7	DCIA	3.20
			UIA	4.49
			RPA	16.41
			SPA	2.21

Worksheet Protected

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	0.43	inches	
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches	
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches	
Optional User Defined Storm	CUHP			
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event			
Max Intensity for Optional User Defined Storm	0			

Designer: QNA
Company: Terra Nova Engineering
Date: March 26, 2026
Project: WATERBURY FILING 1 POND 3 INTERIM CONDITION
Location: POND 3 Design Point 29 Full Spectrum Detention

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	DP 29 FSD
Receiving Pervious Area Soil Type	Loamy Sand
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	26.31
Directly Connected Impervious Area (DCIA, acres)	3.20
Unconnected Impervious Area (UIA, acres)	4.49
Receiving Pervious Area (RPA, acres)	16.41
Separate Pervious Area (SPA, acres)	2.21
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	26.310
Directly Connected Impervious Area (DCIA, %)	12.2%
Unconnected Impervious Area (UIA, %)	17.1%
Receiving Pervious Area (RPA, %)	62.4%
Separate Pervious Area (SPA, %)	8.4%
A_R (RPA / UIA)	3.658
I_a Check	0.210
f / I for WQCV Event:	4.5
f / I for 5-Year Event:	0.5
f / I for 100-Year Event:	0.4
f / I for Optional User Defined Storm CUHP:	
IRF for WQCV Event:	0.44
IRF for 5-Year Event:	0.84
IRF for 100-Year Event:	0.87
IRF for Optional User Defined Storm CUHP:	
Total Site Imperviousness: I_{total}	29.2%
Effective Imperviousness for WQCV Event:	19.7%
Effective Imperviousness for 5-Year Event:	26.5%
Effective Imperviousness for 100-Year Event:	27.0%
Effective Imperviousness for Optional User Defined Storm CUHP:	

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	23.2%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	8.1%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:														

Total Site Imperviousness:	**29.2%**
Total Site Effective Imperviousness for WQCV Event:	**19.7%**
Total Site Effective Imperviousness for 5-Year Event:	**26.5%**
Total Site Effective Imperviousness for 100-Year Event:	**27.0%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	

Notes:

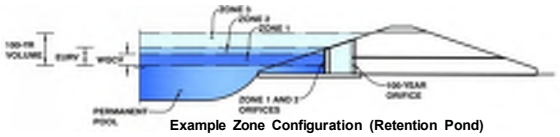
* Use Green-Ampt average infiltration rate values from Table 3-3.
** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.
*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **WATERBURY FILING NO. 1**

Basin ID: **POND 3 DP 29 INTERIM CONDITION**



Example Zone Configuration (Retention Pond)

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft²)	Optional Override Area (ft²)	Area (acre)	Volume (ft³)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	100	0.002		
6922.25	--	0.25	--	--	--	3,412	0.078	439	0.010
6922.50	--	0.50	--	--	--	6,282	0.144	1,650	0.038
6922.75	--	0.75	--	--	--	9,372	0.215	3,607	0.083
6923.00	--	1.00	--	--	--	13,347	0.306	6,447	0.148
6923.25	--	1.25	--	--	--	16,659	0.382	10,198	0.234
6923.50	--	1.50	--	--	--	19,971	0.458	14,777	0.339
6923.75	--	1.75	--	--	--	23,283	0.534	20,183	0.463
6924.00	--	2.00	--	--	--	26,595	0.611	26,418	0.606
6924.25	--	2.25	--	--	--	33,544	0.770	33,935	0.779
6924.50	--	2.50	--	--	--	40,493	0.930	43,190	0.992
6924.75	--	2.75	--	--	--	47,442	1.089	54,182	1.244
6925.00	--	3.00	--	--	--	54,392	1.249	66,911	1.536
6925.25	--	3.25	--	--	--	61,341	1.408	81,378	1.868
6925.50	--	3.50	--	--	--	68,290	1.568	97,582	2.240
6925.75	--	3.75	--	--	--	75,240	1.727	115,523	2.652
6926.00	--	4.00	--	--	--	82,189	1.887	135,201	3.104
6926.25	--	4.25	--	--	--	87,136	2.000	156,367	3.590
6926.50	--	4.50	--	--	--	92,083	2.114	178,769	4.104
6926.75	--	4.75	--	--	--	97,030	2.228	202,409	4.647
6927.00	--	5.00	--	--	--	101,977	2.341	227,285	5.218
6927.25	--	5.25	--	--	--	106,924	2.455	253,397	5.817
6927.50	--	5.50	--	--	--	111,871	2.568	280,747	6.445
6927.75	--	5.75	--	--	--	116,819	2.682	309,333	7.101
6928.00	--	6.00	--	--	--	121,766	2.795	339,156	7.786
6928.25	--	6.25	--	--	--	124,516	2.858	369,941	8.493
6928.50	--	6.50	--	--	--	127,266	2.922	401,414	9.215
6928.75	--	6.75	--	--	--	130,017	2.985	433,574	9.953
6929.00	--	7.00	--	--	--	132,767	3.048	466,422	10.708
6929.25	--	7.25	--	--	--	135,518	3.111	499,958	11.477
6929.50	--	7.50	--	--	--	138,268	3.174	534,181	12.263
6929.75	--	7.75	--	--	--	141,019	3.237	569,092	13.065
6930.00	--	8.00	--	--	--	143,769	3.300	604,691	13.882

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	26.31	acres
Watershed Length =	1,500	ft
Watershed Length to Centroid =	300	ft
Watershed Slope =	0.026	ft/ft
Watershed Imperviousness =	26.97%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

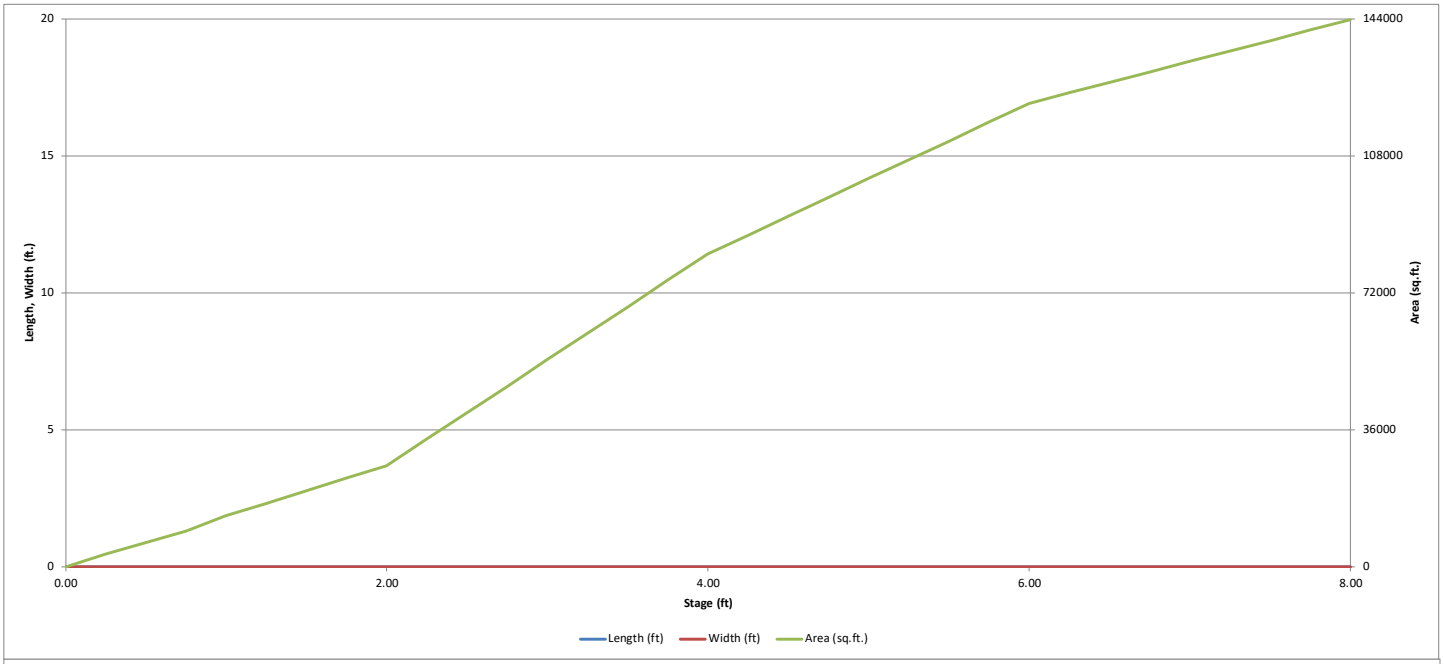
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.311	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.688	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.460	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.641	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.797	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.223	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.620	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.155	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3 in.) =	3.028	acre-feet	3.00	inches
Approximate 2-yr Detention Volume =	0.431	acre-feet		
Approximate 5-yr Detention Volume =	0.576	acre-feet		
Approximate 10-yr Detention Volume =	0.724	acre-feet		
Approximate 25-yr Detention Volume =	0.921	acre-feet		
Approximate 50-yr Detention Volume =	1.074	acre-feet		
Approximate 100-yr Detention Volume =	1.336	acre-feet		

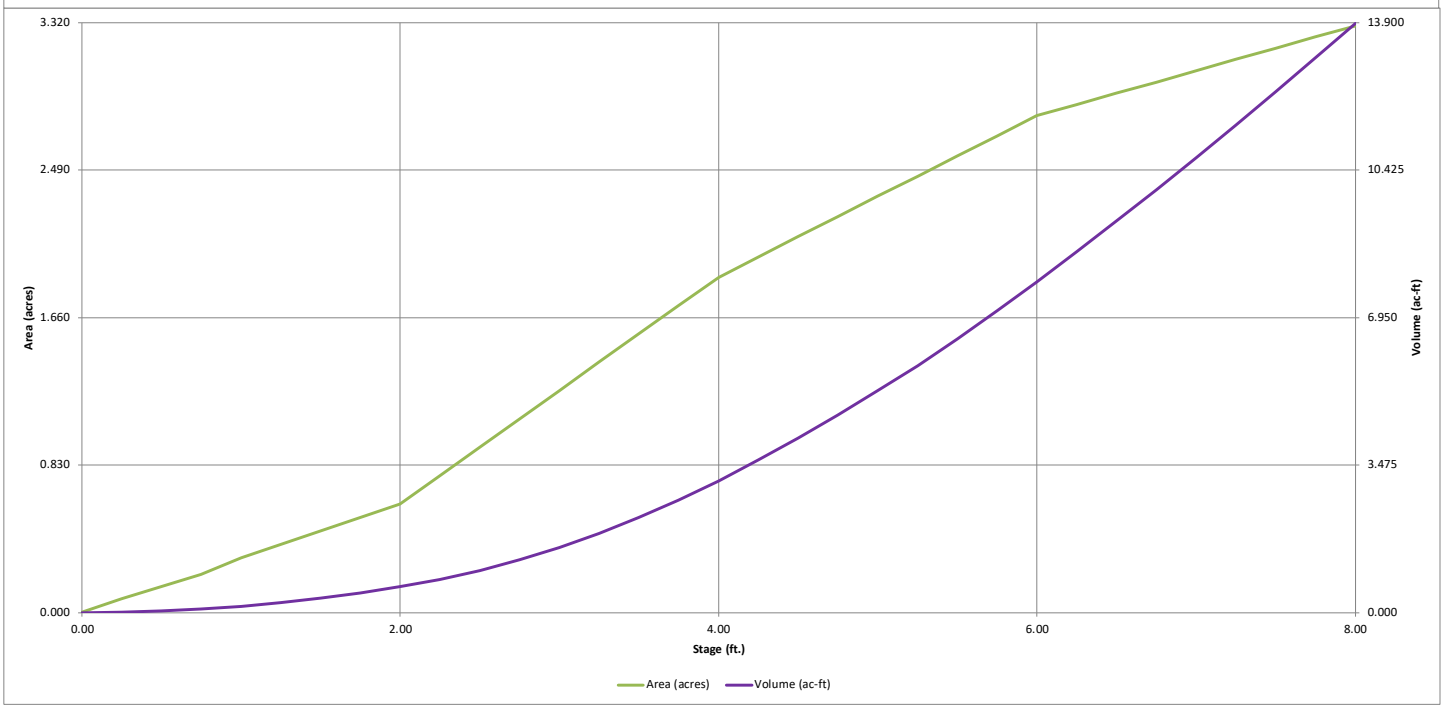
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.311	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.378	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.648	acre-feet
Total Detention Basin Volume =	1.336	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



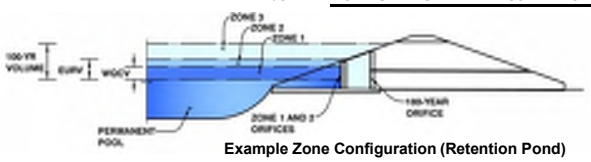


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: WATERBURY FILING NO. 1

Basin ID: POND 3 DP 29 INTERIM CONDITION



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.44	0.311	Orifice Plate
Zone 2 (EURV)	2.13	0.378	Orifice Plate
Zone 3 (100-year)	2.84	0.648	Weir&Pipe (Restrict)
Total (all zones)		1.336	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)

Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = ft^2

Underdrain Orifice Centroid = feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)

Depth at top of Zone using Orifice Plate = 4.76 ft (relative to basin bottom at Stage = 0 ft)

Orifice Plate: Orifice Vertical Spacing = N/A inches

Orifice Plate: Orifice Area per Row = N/A sq. inches

Calculated Parameters for Plate

WQ Orifice Area per Row = N/A ft^2

Elliptical Half-Width = N/A feet

Elliptical Slot Centroid = N/A feet

Elliptical Slot Area = N/A ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.68	3.37					
Orifice Area (sq. inches)	3.00	8.50	9.00					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.05	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	12.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	6.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.05	N/A	feet
Overflow Weir Slope Length =	6.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	7.09	N/A	
Overflow Grate Open Area w/o Debris =	50.11	N/A	ft^2
Overflow Grate Open Area w/ Debris =	25.06	N/A	ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.20	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	36.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	36.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	7.07	N/A	ft^2
Outlet Orifice Centroid =	1.50	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage= 5.80 ft (relative to basin bottom at Stage = 0 ft)

Spillway Crest Length = 64.00 feet

Spillway End Slopes = 4.00 H:V

Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway

Spillway Design Flow Depth= 1.20 feet

Stage at Top of Freeboard = 8.00 feet

Basin Area at Top of Freeboard = 3.30 acres

Basin Volume at Top of Freeboard = 13.88 acre-ft

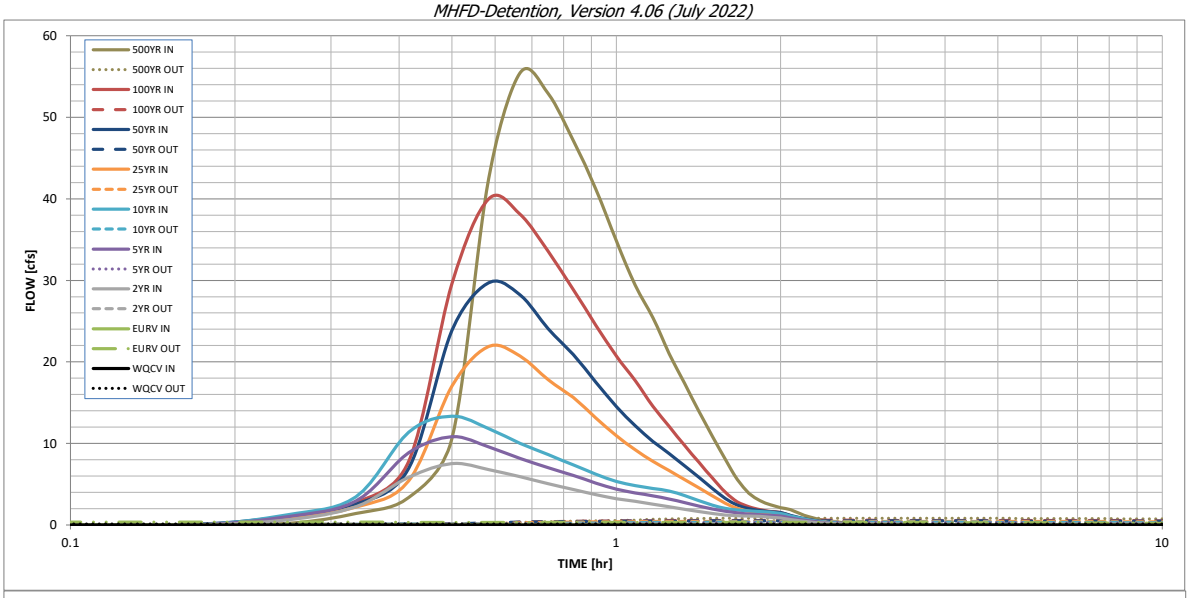
Routed Hydrograph Results

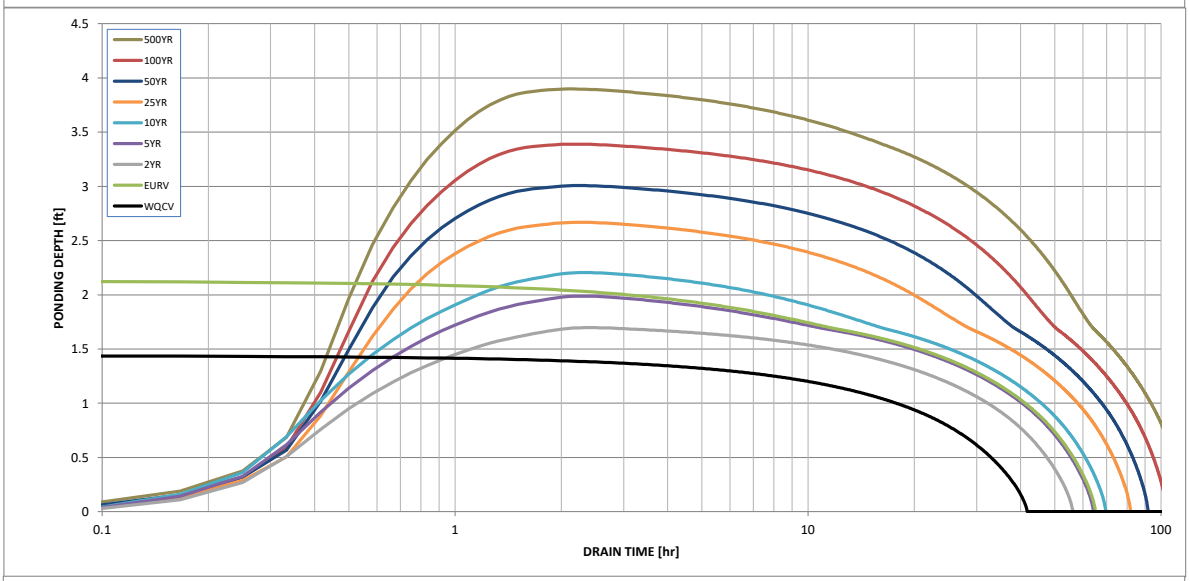
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

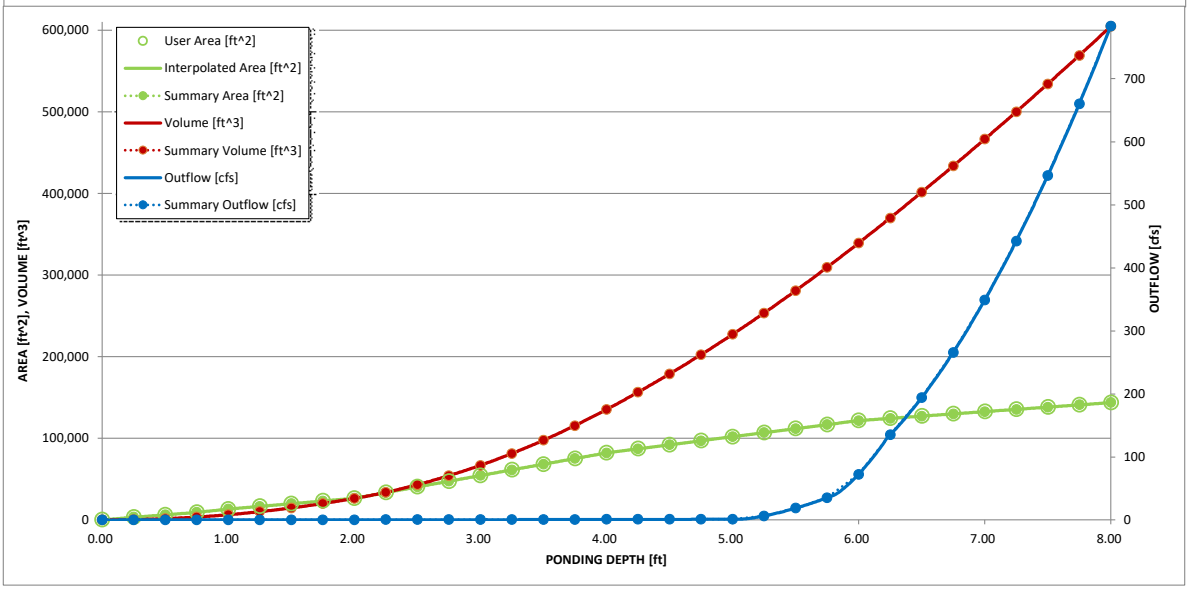
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.00
CUHP Runoff Volume (acre-ft) =	0.311	0.688	0.460	0.641	0.797	1.223	1.620	2.155	3.028
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.460	0.641	0.797	1.223	1.620	2.155	3.028
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.3	0.6	0.8	7.5	14.4	23.5	37.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.28	0.55	0.89	1.41
Peak Inflow Q (cfs) =	N/A	N/A	7.5	10.8	13.4	21.9	29.7	40.0	55.5
Peak Outflow Q (cfs) =	0.1	0.3	0.2	0.3	0.4	0.4	0.5	0.6	0.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.4	0.1	0.0	0.0	0.0
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Plate
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	60	52	59	64	74	81	91	101
Time to Drain 99% of Inflow Volume (hours) =	**40**	63	54	62	67	78	87	98	110
Maximum Ponding Depth (ft) =	1.44	2.13	1.70	1.99	2.20	2.67	3.01	3.39	3.90
Area at Maximum Ponding Depth (acres) =	0.44	0.69	0.52	0.60	0.74	1.03	1.25	1.49	1.82
Maximum Volume Stored (acre-ft) =	0.312	0.691	0.432	0.594	0.741	1.148	1.536	2.057	2.900

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.01	0.18
	0:15:00	0.00	0.00	0.63	1.02	1.27	0.85	1.07	1.05	1.40
	0:20:00	0.00	0.00	2.24	2.93	3.45	2.18	2.55	2.73	3.38
	0:25:00	0.00	0.00	5.86	8.85	11.36	5.43	6.94	7.82	10.59
	0:30:00	0.00	0.00	7.55	10.81	13.36	17.04	23.87	29.60	42.49
	0:35:00	0.00	0.00	6.80	9.56	11.82	21.89	29.71	40.00	55.45
	0:40:00	0.00	0.00	5.92	8.15	10.02	20.71	28.21	38.10	52.90
	0:45:00	0.00	0.00	5.06	7.02	8.62	17.80	24.06	33.55	47.17
	0:50:00	0.00	0.00	4.35	6.08	7.37	15.64	20.93	28.89	41.26
	0:55:00	0.00	0.00	3.72	5.16	6.24	13.14	17.53	24.54	34.84
	1:00:00	0.00	0.00	3.22	4.40	5.34	10.94	14.52	20.71	29.38
	1:05:00	0.00	0.00	2.90	3.94	4.84	9.22	12.18	17.71	25.44
	1:10:00	0.00	0.00	2.56	3.59	4.49	7.79	10.26	14.57	21.00
	1:15:00	0.00	0.00	2.24	3.19	4.17	6.66	8.76	12.08	17.38
	1:20:00	0.00	0.00	1.94	2.75	3.61	5.57	7.25	9.76	13.94
	1:25:00	0.00	0.00	1.65	2.33	2.98	4.56	5.85	7.68	10.88
	1:30:00	0.00	0.00	1.40	1.96	2.42	3.56	4.49	5.76	8.07
	1:35:00	0.00	0.00	1.21	1.69	2.02	2.67	3.26	4.03	5.56
	1:40:00	0.00	0.00	1.12	1.48	1.83	2.03	2.42	2.84	3.88
	1:45:00	0.00	0.00	1.09	1.35	1.72	1.69	1.99	2.22	2.99
	1:50:00	0.00	0.00	1.07	1.26	1.64	1.52	1.76	1.88	2.46
	1:55:00	0.00	0.00	0.95	1.18	1.56	1.41	1.62	1.66	2.12
	2:00:00	0.00	0.00	0.84	1.10	1.43	1.33	1.53	1.51	1.89
	2:05:00	0.00	0.00	0.66	0.86	1.11	1.04	1.18	1.14	1.40
	2:10:00	0.00	0.00	0.50	0.66	0.85	0.78	0.88	0.83	1.00
	2:15:00	0.00	0.00	0.38	0.50	0.64	0.59	0.66	0.62	0.74
	2:20:00	0.00	0.00	0.29	0.38	0.48	0.45	0.50	0.47	0.56
	2:25:00	0.00	0.00	0.22	0.28	0.35	0.33	0.37	0.35	0.41
	2:30:00	0.00	0.00	0.16	0.21	0.26	0.24	0.27	0.26	0.30
	2:35:00	0.00	0.00	0.12	0.15	0.19	0.18	0.20	0.19	0.22
	2:40:00	0.00	0.00	0.08	0.11	0.14	0.13	0.15	0.14	0.16
	2:45:00	0.00	0.00	0.06	0.07	0.09	0.09	0.10	0.10	0.11
	2:50:00	0.00	0.00	0.03	0.05	0.06	0.06	0.06	0.06	0.07
	2:55:00	0.00	0.00	0.02	0.03	0.03	0.03	0.04	0.03	0.04
	3:00:00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.02
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

RUNOFF REDUCTION
& EXCLUDED UNDEVELOPED PERVIOUS AREA

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018) **Sheet 1 of 1**

Designer:	QUENTIN ARMIJO
Company:	TERRA NOVA ENGINEERING, INC.
Date:	November 19, 2022
Project:	WATERBURY FILING 1 & 2
Location:	BASIN M2 EASTERN CHANNEL DIRECT RELEASE

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches

Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA											
Area ID	M2											
Downstream Design Point ID	EAST CH											
Downstream BMP Type	None											
DCIA (ft^2)	--											
UIA (ft^2)	5,300											
RPA (ft^2)	7,000											
SPA (ft^2)	--											
HSG A (%)	100%											
HSG B (%)	0%											
HSG C/D (%)	0%											
Average Slope of RPA (ft/ft)	0.020											
UIA:RPA Interface Width (ft)	60.00											

CALCULATED RUNOFF RESULTS

Area ID	M2											
UIA:RPA Area (ft^2)	12,300											
L / W Ratio	3.42											
UIA / Area	0.4309											
Runoff (in)	0.00											
Runoff (ft^3)	0											
Runoff Reduction (ft^3)	221											

CALCULATED WQCV RESULTS

Area ID	M2											
WQCV (ft^3)	221											
WQCV Reduction (ft^3)	221											
WQCV Reduction (%)	100%											
Untreated WQCV (ft^3)	0											

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	EAST CH											
DCIA (ft^2)	0											
UIA (ft^2)	5,300											
RPA (ft^2)	7,000											
SPA (ft^2)	0											
Total Area (ft^2)	12,300											
Total Impervious Area (ft^2)	5,300											
WQCV (ft^3)	221											
WQCV Reduction (ft^3)	221											
WQCV Reduction (%)	100%											
Untreated WQCV (ft^3)	0											

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	12,300
Total Impervious Area (ft^2)	5,300
WQCV (ft^3)	221
WQCV Reduction (ft^3)	221
WQCV Reduction (%)	100%
Untreated WQCV (ft^3)	0

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018) **Sheet 1 of 1**

Designer:	**Quentin Armijo**
Company:	**Terra Nova Engineering, Inc.**
Date:	**November 19, 2022**
Project:	**Waterbury Filings 1 & 2**
Location:	*BASIN N WESTERN CHANNEL DIRECT RELEASE.

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches

Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA											
Area ID	N											
Downstream Design Point ID	WEST CH											
Downstream BMP Type	None											
DCIA (ft^2)	--											
UIA (ft^2)	1,105											
RPA (ft^2)	1,895											
SPA (ft^2)	--											
HSG A (%)	100%											
HSG B (%)	0%											
HSG C/D (%)	0%											
Average Slope of RPA (ft/ft)	0.020											
UIA:RPA Interface Width (ft)	60.00											

CALCULATED RUNOFF RESULTS

Area ID	N											
UIA:RPA Area (ft^2)	3,000											
L / W Ratio	0.83											
UIA / Area	0.3683											
Runoff (in)	0.00											
Runoff (ft^3)	0											
Runoff Reduction (ft^3)	46											

CALCULATED WQCV RESULTS

Area ID	N											
WQCV (ft^3)	46											
WQCV Reduction (ft^3)	46											
WQCV Reduction (%)	100%											
Untreated WQCV (ft^3)	0											

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	WEST CH											
DCIA (ft^2)	0											
UIA (ft^2)	1,105											
RPA (ft^2)	1,895											
SPA (ft^2)	0											
Total Area (ft^2)	3,000											
Total Impervious Area (ft^2)	1,105											
WQCV (ft^3)	46											
WQCV Reduction (ft^3)	46											
WQCV Reduction (%)	100%											
Untreated WQCV (ft^3)	0											

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	3,000
Total Impervious Area (ft^2)	1,105
WQCV (ft^3)	46
WQCV Reduction (ft^3)	46
WQCV Reduction (%)	100%
Untreated WQCV (ft^3)	0

APPENDIX H
HEC-RAS ANALYSIS

Table 3. Adjustment values for factors that affect roughness of flood plains

[Modified from Aldridge and Garrett, 1973, table 2]

Flood-plain conditions		*n* value adjustment	Example
Degree of irregularity (n_1)	Smooth	0.000	Compares to the smoothest, flattest flood plain attainable in a given bed material.
	Minor	0.001–0.005	Is a flood plain slightly irregular in shape. A few rises and dips or sloughs may be visible on the flood plain.
	Moderate	0.006–0.010	Has more rises and dips. Sloughs and hummocks may occur.
	Severe	0.011–0.020	Flood plain very irregular in shape. Many rises and dips or sloughs are visible. Irregular ground surfaces in pastureland and furrows perpendicular to the flow are also included.
Variation of flood-plain cross section (n_2)		0.0	Not applicable.
Effect of obstructions (n_3)	Negligible	0.000–0.004	Few scattered obstructions, which include debris deposits, stumps, exposed roots, logs, or isolated boulders, occupy less than 5 percent of the cross-sectional area.
	Minor	0.005–0.019	Obstructions occupy less than 15 percent of the cross-sectional area.
	Appreciable	0.020–0.030	Obstructions occupy from 15 to 50 percent of the cross-sectional area.
Amount of vegetation (n_4)	Small	0.001–0.010	Dense growth of flexible turf grass, such as Bermuda, or weeds growing where the average depth of flow is at least two times the height of the vegetation, or supple tree seedlings such as willow, cottonwood, arrowweed, or saltcedar growing where the average depth of flow is at least three times the height of the vegetation.
	Medium	0.011–0.025	Turf grass growing where the average depth of flow is from one to two times the height of the vegetation, or moderately dense stemmy grass, weeds, or tree seedlings growing where the average depth of flow is from two to three times the height of the vegetation; brushy, moderately dense vegetation, similar to 1- to 2-year-old willow trees in the dormant season.
	Large	0.025–0.050	Turf grass growing [illegible] of the vegetation, or 8- to 10-year-old willow or cottonwood trees intergrown with some weeds and brush (none of the vegetation in foliage) where the hydraulic radius exceeds 2 ft, or mature row crops such as small vegetables, or mature field crops where depth of flow is at least twice the height of the vegetation.
	Very large	0.050–0.100	Turf grass growing where the average depth of flow is less than half the height of the vegetation, or moderate to dense brush, or heavy stand of timber with few down trees and little undergrowth where depth of flow is below branches, or mature field crops where depth of flow is less than the height of the vegetation.
	Extreme	0.100–0.200	Dense bushy willow, mesquite, and saltcedar (all vegetation in full foliage), or heavy stand of timber, few down trees, depth of flow reaching branches.
Degree of meander (m)		1.0	Not applicable.

Chow (1959) presents a table showing minimum, normal, and maximum values of *n* for flood plains covered by pasture and crops. These values are helpful for comparing the roughness values of flood plains having similar vegetation.

Vegetation-Density Method

For a wooded flood plain, the vegetation-density method can be used as an alternative to the previous method for determining *n* values for flood plains. In a wooded flood plain, where the tree diameters can be measured, the vegetation density of the flood plain can be determined.

Determining the vegetation density is an effective way of relating plant height and density characteristics, as a function of depth of flow, to the flow resistance of vegetation. Application of the flow-resistance model presented below requires an estimate of the vegetation density as a function of depth of flow. The procedure requires a direct or indirect determination of vegetation density at a given depth. If the change in *n* value through a range in depth is required, then an estimation of vegetation density through that range is necessary.

Techniques for Determining Vegetation Density

Petryk and Bosmajian (1975) developed a method of analysis of the vegetation density to determine the rough-

Classification of Vegetal Covers

Retardance Class	Cover	Condition
A	Weeping lovegrass	Excellent stand, tall, average 30 in.
	Yellow bluestem Ischaemum	Excellent stand, tall, average 36 in.
	Bermuda grass	Good stand, tall, average 12 in.
	Native grass mixture (little bluestem, bluestem, blue gamma, and other long and short Midwest grasses	Good stand, unmowed
	Weeping lovegrass	Good stand, tall, average 24 in.
B	Lespedeza serica	Good stand, not woody, tall, average 19 in.
	Alfalfa	Good stand uncut, average 11 in.
	Weeping lovegrass	Good stand, unmowed, average 13 in.
	Kudzu	Dense growth, uncut
	Blue gamma	Good stand, uncut, average 13 in.
C	Crabgrass	Fair stand, uncut, avg. 10 in.
	Bermuda grass	Good stand, mowed, average 6 in.
	Common lespedeza	Good stand, uncut, average 11 in.
	Grass-legume mixture - summer (orchard grass, redtop Italian ryegrass, and common lespedeza)	Good stand, uncut, average 6 to 8 in.
	Centipedegrass	Very dense cover, average 6 in.
	Kentucky Bluegrass	Good stand, headed, 6 to 12 in.
D	Bermuda grass	Good stand, cut to 2.5 in. height
	Common lespedeza	Excellent stand, uncut, average 4.5 in.
	Buffalo Grass	Good stand, uncut, 3 t 6 in.
	Grass-legume mixture - tall (orchard grass, redtop Italian ryegrass, and common lespedeza)	Good stand, uncut, 3 to 5 in.
	Lespedeza serica	After cutting to 2 in. height, good stand before cutting
E	Bermuda grass	Good stand, cut to average 1.5 in. height
	Bermuda grass	Burned stubble

Note: Covers classified have been tested in experimental channels. Covers were green and generally uniform.

Source: HEC-15

Coefficients for Roughness of Grass-Lined Channels

SCS Retardance Class	C_n
A	0.605
B	0.418
C	0.220
D	0.147
E	0.093

Source: HEC-15

Composite Roughness

Culverts using different materials for portions of the perimeter such as embedded culverts or culverts with an invert liner should use a composite Manning's n value. A weighted n value based on the materials can be derived using the following equation:

$$n_c = \left[\frac{\Sigma(p_i n_i^{1.5})}{p}\right]^{0.67}$$

Where:
n_c = Composite/weighted Manning's n.
p_i = Wetted perimeter for the material, ft.
n_i = Manning's n value for the material.
p = Total wetted perimeter, ft.

750.1.4.1.2 Hydraulic Radius

The hydraulic radius is a characteristic depth of flow and is defined as the cross-sectional area of flow divided by the wetted perimeter of the channel. The hydraulic radius is computed as follows:

$$R = \frac{A}{P}$$

where:

R = hydraulic radius, ft
A = cross-sectional area of flow, ft^2
P = wetted perimeter of the channel cross section, ft

750.1.4.1.3 Slope

Table 8–8 Characteristics of selected grass species for use in channels and waterways

Grass species	Height at maturity (ft)	Height at maturity (m)
Cool-season grasses		
Creeping foxtail	3–4	0.9–1.2
Crested wheatgrass	2–3	0.6–0.9
Green needlegrass	3–4	0.9–1.2
Russian wild rye	3–4	0.9–1.2
Smooth bromegrass	3–4	0.9–1.2
Tall fescue	3–4	0.9–1.2
Tall wheatgrass		1.2–1.5
Western wheatgrass	2–3	0.6–0.9
Warm-season grasses		
Bermudagrass	3/4–2	0.2–0.6
Big bluestem	4–6	1.2–1.8
Blue grama	1–2	0.3–0.6
Buffalograss	1/3–1	0.1–0.3
Green spangletop	3–4	0.9–1.2
Indiangrass	5–6	1.5–1.8
Klein grass	3–4	0.9–1.2
Little bluestem	3–4	0.9–1.2
Plains bristlegrass	1–2	0.3–0.6
Sand bluestem	5–6	1.5–1.8
Sideoats grama	2–3	0.6–0.9
Switchgrass	4–5	1.2–1.5
Vine mesquitegrass	1–2	0.3–0.6
Weeping lovegrass	3–4	0.9–1.2
Old World bluestems		
Caucasian bluestem	4–5	1.2–1.5
Ganada yellow bluestem	3–4	0.9–1.2

this table were obtained from a review of the available qualitative descriptions and stem counts reported by researchers studying channel resistance and stability.

Since cover conditions vary from year to year and season to season, it is recommended that an upper and lower bound be determined for C_f. The lower bound should be used in stability computations, and the upper bound should be used to determine channel capacity. Some practitioners find that the use of SCS retardance class (table 8–9) is a preferable approach.

The vegetal cover index, C_f, depends primarily on the density and uniformity of density in the immediate vicinity of the soil boundary. Because this parameter is associated with the prevention of local erosion damage which may lead to channel unraveling, the cover factor should represent the weakest area in a reach, rather than the average for the cover species. Recommended values for the cover factor are presented in table 8–10. Values in this table do not account for such considerations as maintenance practices or uniformity of soil fertility or moisture. Therefore, appropriate engineering judgment should be used in its application.

Table 8–9 Retardance curve index by SCS retardance class

SCS retardance class	Retardance curve index
A	10.0
B	7.64
C	5.60
D	4.44
E	2.88

Table 8–10 Properties of grass channel linings values (apply to good uniform stands of each cover)

Cover factor (C_F)	Covers tested	Reference stem density (stems/ft²)	Reference stem density (stems/m²)
0.90	Bermudagrass	500	5,380
	Centipede grass	500	5,380
0.87	Buffalograss	400	4,300
	Kentucky bluegrass	350	3,770
	Blue grama	350	3,770
0.75	Grass mixture	200	2,150
0.50	Weeping lovegrass	350	3,770
	Yellow bluestem	250	2,690
0.50	Alfalfa	500	5,380
	Lespedeza sericea	300	3,280
0.50	Common lespedeza	150	1,610
	Sudangrass	50	538

Multiply the stem densities given by 1/3, 2/3, 1, 4/3, and 5/3 for poor, fair, good, very good, and excellent covers, respectively. Reduce the C_F by 20% for fair stands and 50% for poor stands.

Two soil parameters are required for application of effective stress concepts to the stability design of lined or unlined channels having an erodible soil boundary: soil grain roughness, n_s, and allowable effective stress, τ_a. When the effective stress approach is used, the soil parameters are the same for both lined and unlined channels with negligible bed-material sediment transport.

Soil grain roughness is defined as the roughness associated with particles or aggregates of a size that can be independently moved by the flow at incipient channel failure. For noncohesive soils, the soil grain roughness and effective shear stress are both a function of the D_{75} grain size. When D_{75} is greater than 1.3 millimeter, the soil is considered coarse grained. When D_{75} is less than 1.3 millimeter, the soil is considered fine grained. Fine-grained roughness is considered to have a constant value of 0.0156. Fine-grained effective shear stress is taken to have a constant value of 0.02 pound per square foot. Coarse-grained shear stress and roughness are given in figures 8–21 and 8–22.

A soil grain roughness of 0.0156 is assigned to all cohesive soils. The allowable effective stresses are a function of the unified soil classification system soil type, the plasticity index, and the void ratio. The basic allowable shear stress, τ_{ab}, is determined from the plasticity index and soil classification, and then adjusted by the void ratio correction factor, C_e, using the following equation:

$$\tau_a = \tau_{ab} C_e^2 \qquad \text{(eq. 8–29)}$$

The basic allowable effective stress can be determined from figure 8–23 and the void ratio correction factor from figure 8–24. These two figures were developed directly from the allowable velocity curves in AH 667. Stress partitioning (slope partitioning) is essential to application of figures 8–21 to 8–24, with or without vegetation (Temple et al. 1987).

(e) General design procedure

Use the basic shear stress equation to determine effective shear stress on the soil beneath the vegetation. Use any consistent units of measurement.

$$\tau_e = \gamma d S (1 - C_F) \left(\frac{n_s}{n} \right)^2 \qquad \text{(eq. 8–30)}$$

where:

τ_e = effective shear stress exerted on the soil beneath vegetation (lb/ft^2 or N/m^2)
γ = specific weight of water (lb/ft^3 or N/m^3)
d = maximum depth of flow in the cross section (ft or m)
S = energy slope, dimensionless
C_F = vegetation cover factor (0 for unlined channel), dimensionless
n_s = grain roughness of underlying soil, typically taken as dimensionless
n = roughness coefficient of vegetation, typically taken as dimensionless

The flow depth is used instead of the hydraulic radius because this will result in the maximum local shear stress, rather than the average shear stress. The cover factor is a function of the grass and stem density. Roughness coefficients are standard Manning's roughness values; n_s can be determined from figure 8–22, n can be determined from the old SCS curves (fig. 8–20) or from the following equation.

$$n_R = \exp\left\{ C_1 \left[0.0133 (\ln R_v)^2 - 0.0954 \ln R_v + 0.297 \right] - 4.16 \right\} \qquad \text{(eq. 8–31)}$$

where:

R_v = (VR/v) x 10^{-5} (this dimensionless term reduces to VR for practical application in English units)
V = channel velocity (ft/s or m/s)
R = hydraulic radius (ft or m)

Limited to $0.0025 C_1^{2.5} < R_v < 36$

A reference value of Manning's resistance coefficient, n_R is applicable to vegetation established on relatively smoothly graded fine-grained soil.

If vegetated channel liner mats are used, manufacturer-supplied roughness coefficients for particular mats may be used in the equation.

Maximum allowable shear stress, τ_{va}, in pound per square foot is determined as a function of the retardance curve index, C_I. Very little information is available for vegetal performance under very high stresses and this relation is believed to be conservative.

$$\tau_{va} = 0.75 C_I \qquad \text{(eq. 8–32)}$$

Figure 8–21 Allowable shear stress for noncohesive soils

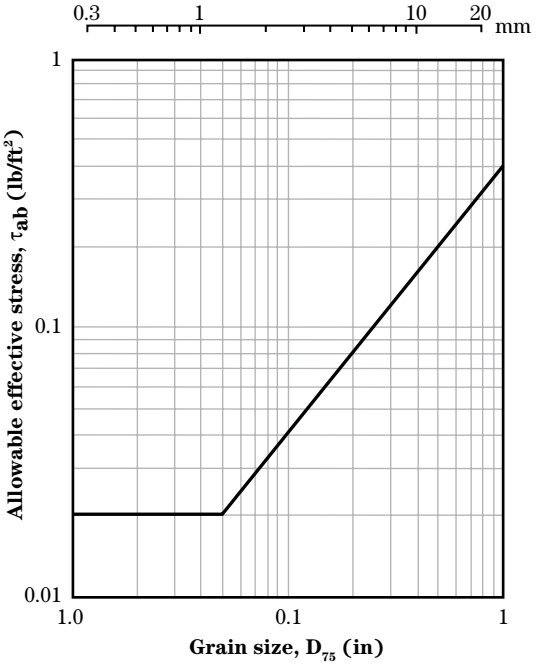


Figure 8–22 Soil grain roughness for noncohesive soils

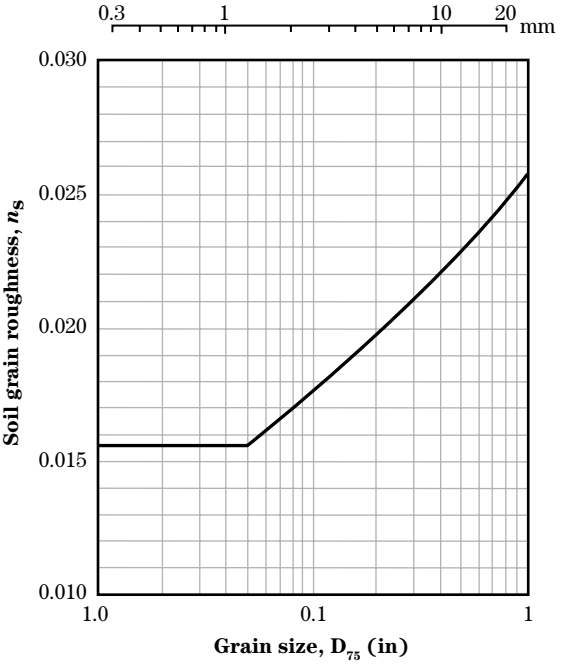


Figure 8–23 Basic allowable shear stress for cohesive soils

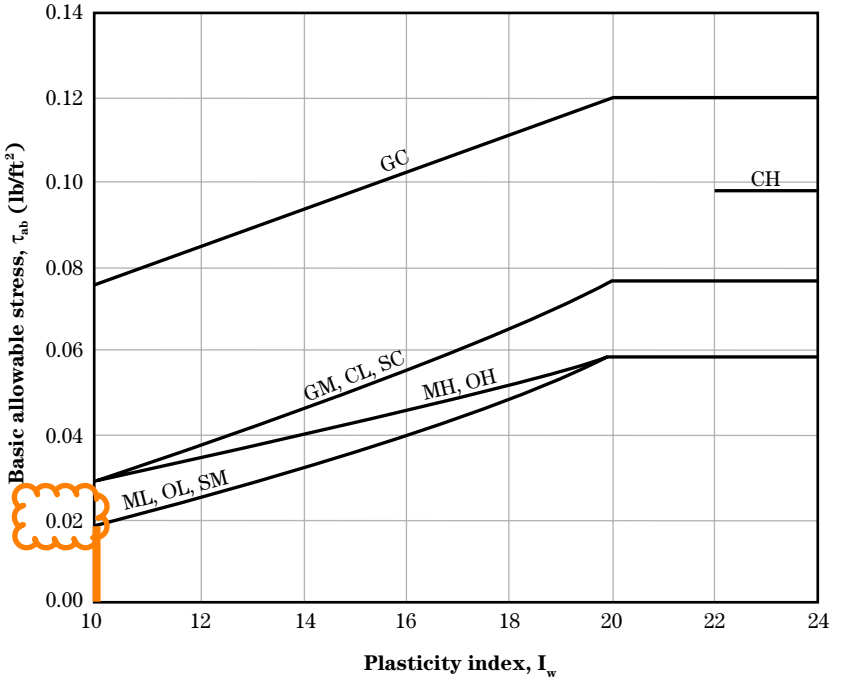
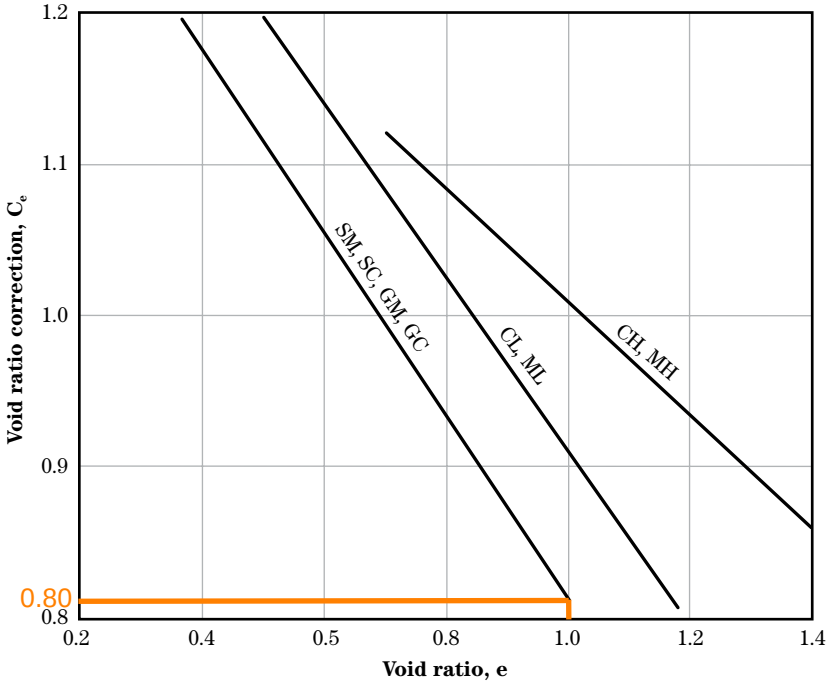


Figure 8–24 Void ratio correction factor for cohesive soils



Channel Slope	Lining	Permissible Mean Channel Velocity* (ft/sec)
0 - 5%	Sodded grass	7
	Bermudagrass	6
	Reed canarygrass	5
	Tall fescue	5
	Kentucky bluegrass	5
	Grass-legume mixture	4
	Red fescue	2.5
	Redtop	2.5
	Sericea lespedeza	2.5
	Annual lespedeza	2.5
	Small grains (temporary)	2.5
5 - 10%	Sodded grass	6
	Bermudagrass	5
	Reed canarygrass	4
	Tall fescue	4
	Kentucky bluegrass	4

Channel Slope	Lining	Permissible Mean Channel Velocity* (ft/sec)
	Grass-legume mixture	3
Greater than 10%	Sodded grass	5
	Bermudagrass	4
	Reed canarygrass	3
	Tall fescue	3
	Kentucky bluegrass	3
*For highly erodible soils, decrease permissible velocities by 25%.		
*Grass lined channels are dependent upon assurances of continuous growth and maintenance of grass.		

Table 8-3. Design parameters for naturalized channels

Design Parameter	Design Value	Results East Channel	Results West Channel
Maximum 100-year depth outside of bankfull channel per MHFD Criteria Manual Volume 1 Table 8.3	5 ft	< than 5 ft	< than 5 ft
Roughness values per EPC Table 10-2 section e. (Channels not maintained, weeds and brush uncut for Dense weeds, high as flow depth)	0.05 to 0.12	0.06 to 0.10	0.06 to 0.10
Maximum 5-year velocity, main channel (within bankfull channel width) (ft/s) per EPC Table 10-4.	3-4 ft/s	3.79 ft/s	3.32 ft/s
Maximum 100-year velocity, main channel (within bankfull channel width) (ft/s) per EPC Table 10-4.	3-4 ft/s	4.00 ft/s	5.25 ft/s****
Froude No., 5-year, main channel (within bankfull channel width low Manning's n) per MHFD Criteria Manual Volume 1 Table 8.3	0.7	1.00*	1.02*
Froude No., 100-year, main channel (within bankfull channel width) per MHFD Criteria Manual Volume 1 Table 8.3	0.8	0.74	1.01**
Maximum Vegetal shear stress, 100-year, main channel (within bankfull channel width) *using shear retardance* per Open Channels- Engineering Policy Guide Table 8.9	Class A:3.7lb/sq ft Class B: 2.1 lb/sq ft Class C: 1.0 lb/sq ft	2.63 lb/sq ft	2.98 lb/sq ft
Minimum bankfull capacity of bankfull channel (based on future development conditions) per MHFD Criteria Manual Volume 1 Table 8.3	70% of 2-year discharge or 10% of 100-yr discharge, whichever is greater	100% of 100-year	100% of 100-year
Maximum longitudinal slope of low flow channel (assuming lined, vegetated low flow channel) per MHFD Criteria Manual Volume 1 Table 8.3	0.20%	3.84%**	3.43%**
Maximum Overbank Side Slopes per MHFD Criteria Manual Volume 1 Table 8.3	4:1	4:1	4:1
Maximum Bankful Side Slopes per MHFD Criteria Manual Volume 1 Table 8.3	2.5:1	2.5:1	2.5:1
Minimum radius of curvature (2 times the top width of a trapezoidal channel) per ECM 3.3.3.E	East Max Top W=144', Min R=360' West Max Top W=279', Min R=648'	R=200'***	Min R=200'***

Note: For the East channel RS x-section 400 and for the West Channel RS-x-section 0 are the last stations which are always critical, have a higher velocity and Froude # due to no downstream RS x-section to properly run calculations in the HECRAS analysis. For this table these 2 sections are not addressed in this table

* Froude No. not in compliance in the 100 -Y occur at areas with proposed stabilzation measures. A deviation is being requested for the Froude No's. East Channel RS-section 5-Y: 2010.45, 1300, & 600 West Channel 5-Y: 1850, 1800, 1420, 1340, 1200, 350, 300, & 200. 100-Y: 1820, 1800, 1420, & 350.

**Slope are the Existing Condition of the channels. We are not adding a low flow channel. A deviation is being requested for the longitudal slopes.

***Radii are the Existing Condition of the channels. No channel re-aligning is proposed for the centerline. A deviation is being requested for the minimum radius. Bank Stabaliation is being provided along sections that have concerns where radii do not meet minimum values.

****Velocites occur at a proposed grouted riprap drop structure with a cutoff wall

10.5.6. Superelevation

To meet the minimum freeboard requirement of a channel along a sharp bend, additional design flow depth at the outside bank or wall, or height of additional embankment height protection, must be provided. This amount can be determined by the following relationship:

$$H = C \frac{v^2 W}{gR} \qquad (10\text{-}4)$$

where:

C = coefficient;

= 0.5, subcritical flow, simple curve

= 1.0, supercritical flow, simple curve

v = average velocity of flow in channel, in fps;

W = channel width at level water surface

g = acceleration of gravity constant, 32.2 ft/sec ^{2};

R = channel centerline radius of curvature, in ft; and

H = additional height of freeboard on outside edge of channel, in ft.

The minimum length of transition from superelevated freeboard to normal freeboard shall be equal to twice the top width of the channel. The minimum radius of curvature to the channel centerline shall be equal to three times the top width of the design flow but not less than 100 feet.

For supercritical flows with the possibility of cross waves generated downstream of the simple curve, channel heights should be increased as for superelevation not only in the curve but a considerable distance downstream.

RS X-SECT 2400, C=0.5, V=2.03, W=153.8', R=461.4'. THEREFORE H=0.02'

RS X-SECT 1900, C=1.0, V=2.16, W=113.9', R=341.7'. THEREFORE H=0.05'

RS X-SECT 1440, C=1.0, V=3.36, W=83.31', R=250.0'. THEREFOE H=0.12'

RS X-SECT 1200, C=1.0, V=0.60, W=110.12', R=330.4'. THEREFORE H=0.01'

RS X-SECT 700, C=0.5, V=1.95, W=143.24', R=430.0'. THEREFORE H=0.02'

RS X-SECT 300, C=0.5, V=2.76, W=61.39', R=184.2'. THEREFORE H=0.04'

Several RS x-sections of the reach were sampled with both sub-critical and supercritical flow. Results show that the increase in the height (0.01’ to 0.12’) along a bend is negligible. All HECRAS RS-X-sections show the flow in the channel banks and the minimum finished floors of the adjacent lots are set well above the minimum 1.0' of freeboard and therefore there is no concern with the High-Water Elevations around the bends.



Figure 3 VEGETATION COMMUNITY MAP

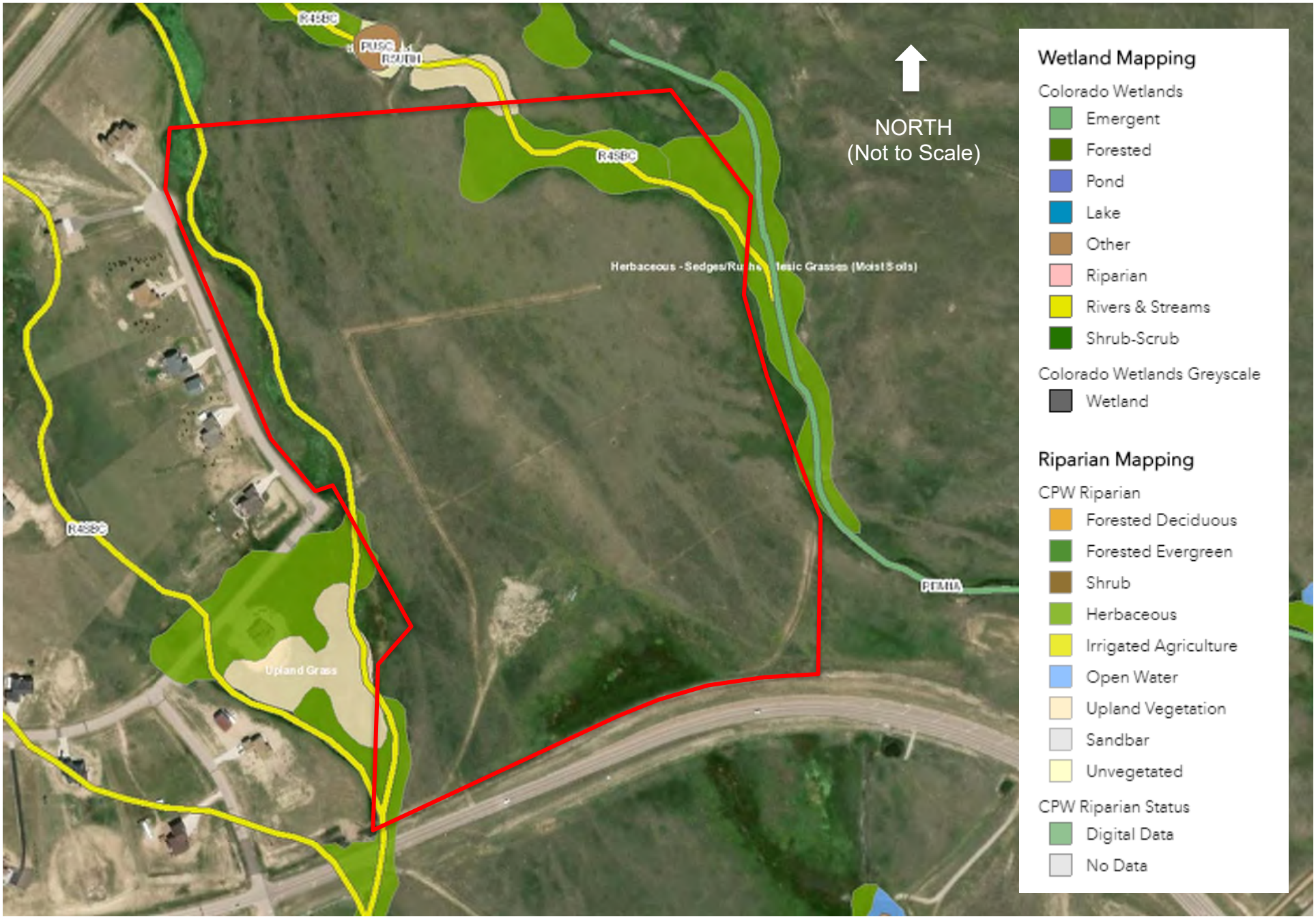


Figure 4

NWI & CNHP WETLAND AND RIPARIAN AREAS MAP



PHOTO LOCATION MAP



PP3 – WETLAND/CHANNEL B (FROM UPSTREAM END LOOKING SOUTH)



PP4 – WETLAND/CHANNEL B (LOOKING UPSTREAM)



PP4 – WETLAND/CHANNEL B (LOOKING DOWNSTREAM)



PP5– WETLAND/CHANNEL B (LOOKING UPSTREAM)



PP5– WETLAND/CHANNEL B (LOOKING DOWNSTREAM)



PP6– WETLAND/CHANNEL B (LOOKING UPSTREAM)



PP6– WETLAND/CHANNEL B (LOOKING DOWNSTREAM)



PP7– WETLAND/CHANNEL B (LOOKING UPSTREAM)



PP7 – WETLAND/CHANNEL B (LOOKING DOWNSTREAM)



PP8 – WETLAND/CHANNEL B (LOOKING UPSTREAM)



PP8 – WETLAND/CHANNEL B (LOOKING DOWNSTREAM)



PP9 – SITE OVERVIEW FROM SOUTHEAST CORNER (LOOKING WEST)



PP9 – SITE OVERVIEW FROM SOUTHEAST CORNER (LOOKING NORTH)



PP10 – SITE OVERVIEW FROM SOUTHWEST CORNER (LOOKING NORTH)



PP10 – SITE OVERVIEW FROM SOUTHWEST CORNER (LOOKING WEST)



PP11 – SITE OVERVIEW FROM NORTHWEST CORNER (LOOKING EAST)



PP11 – SITE OVERVIEW FROM NORTHWEST CORNER (LOOKING SOUTH)



PP12 – SITE OVERVIEW FROM NORTHEASTCORNER (LOOKING WEST)



PP12 – SITE OVERVIEW FROM NORTHEASTCORNER CORNER (LOOKING SOUTH)



SAMPLE POINT B1 – WETLAND PHOTO (LOOKING UPSTREAM)



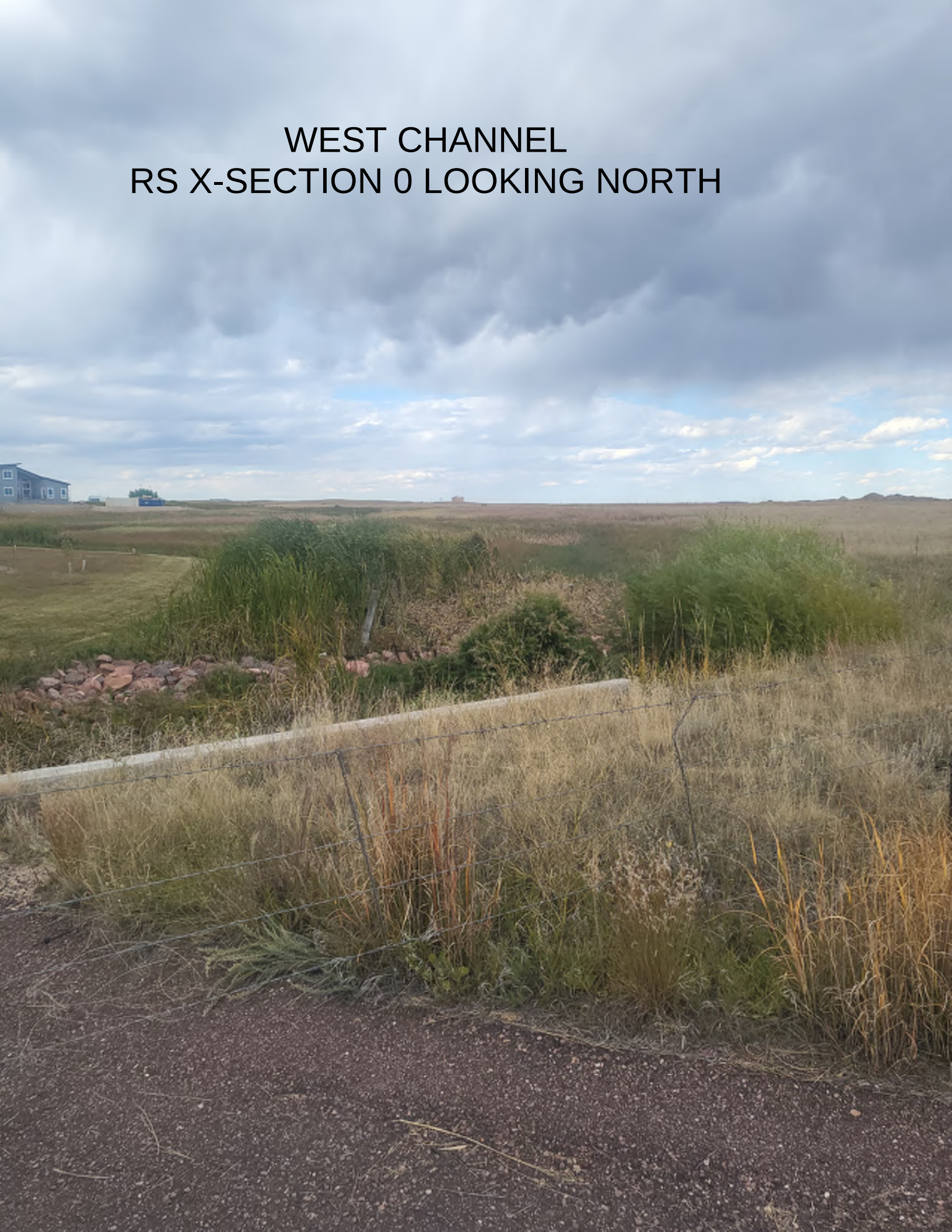
SAMPLE POINT B1 – WETLAND PHOTO (LOOKING DOWNSTREAM)

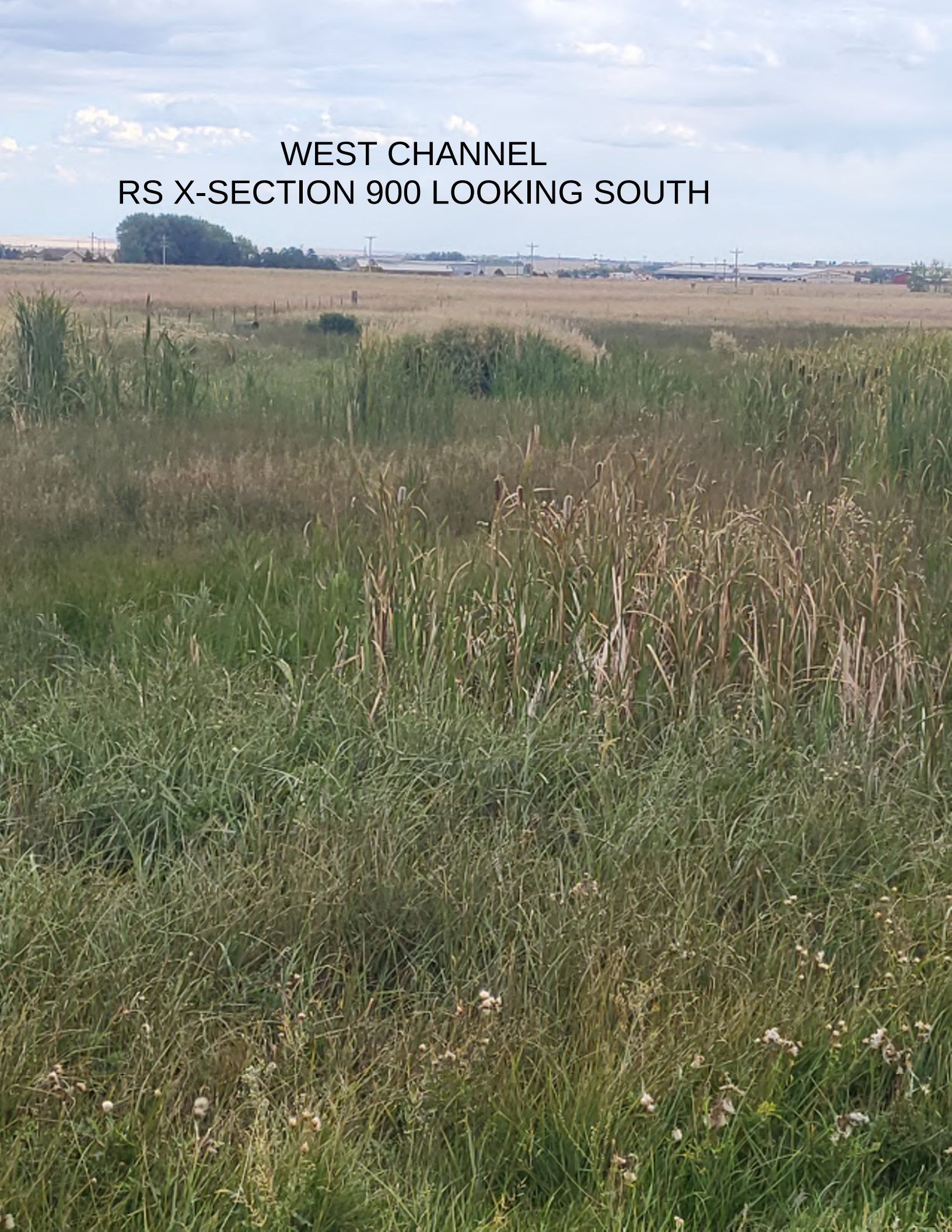


SAMPLE POINT B2 – WETLAND PHOTO (LOOKING UPSTREAM)



SAMPLE POINT B2 – WETLAND PHOTO (LOOKING DOWNSTREAM)

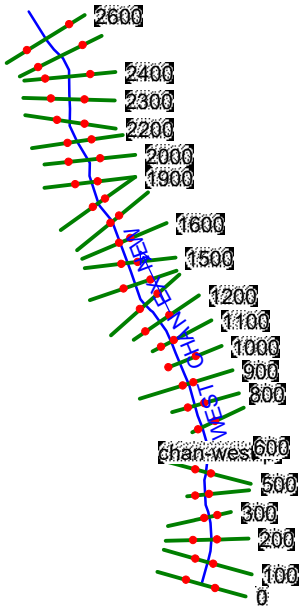

WEST CHANNEL
RS X-SECTION 0 LOOKING NORTH


WEST CHANNEL
RS X-SECTION 900 LOOKING SOUTH


WEST CHANNEL
RS X-SECTION 900 LOOKING EAST


WEST CHANNEL
RS X-SECTION 1500 LOOKING NORTH

WEST CHANNEL EXISTING CONDITIONS



EXISTING WEST CHANNEL 100-Y

HEC-RAS Plan: Plan 02 River: WEST CHAN EX NEW Reach: chan-west-pr Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
chan-west-pr	2600	PF 1	219.00	6966.83	6967.84		6967.93	0.019536	2.37	92.25	162.38	0.56
chan-west-pr	2500	PF 1	219.00	6964.90	6965.81		6965.91	0.020926	2.59	84.70	138.14	0.58
chan-west-pr	2400	PF 1	219.00	6963.25	6964.30		6964.37	0.011755	2.09	104.95	153.17	0.44
chan-west-pr	2300	PF 1	219.00	6961.27	6962.39		6962.53	0.032804	2.97	73.77	137.42	0.71
chan-west-pr	2200	PF 1	219.00	6958.46	6959.82		6959.94	0.020694	2.71	80.96	127.03	0.59
chan-west-pr	2100	PF 1	219.00	6955.98	6957.62		6957.79	0.022265	3.35	65.40	75.74	0.64
chan-west-pr	2000	PF 1	219.00	6954.57	6956.26		6956.35	0.009751	2.37	92.24	96.35	0.43
chan-west-pr	1900	PF 1	219.00	6952.76	6954.54	6954.40	6954.71	0.032488	3.39	64.75	100.15	0.73
chan-west-pr	1800	PF 1	219.00	6949.31	6951.86		6952.07	0.021810	3.67	59.71	59.03	0.64
chan-west-pr	1700	PF 1	219.00	6947.11	6949.56		6949.84	0.022659	4.23	51.75	42.27	0.67
chan-west-pr	1600	PF 1	219.00	6945.84	6948.27		6948.40	0.009453	2.98	74.76	64.69	0.45
chan-west-pr	1500	PF 1	219.00	6944.91	6946.80		6946.99	0.023587	3.45	63.94	80.32	0.65
chan-west-pr	1400	PF 1	219.00	6943.78	6945.34		6945.42	0.010717	2.27	96.66	116.26	0.44
chan-west-pr	1300	PF 1	219.00	6942.19	6943.61		6943.79	0.027384	3.35	65.41	88.53	0.69
chan-west-pr	1200	PF 1	219.00	6940.78	6943.00		6943.03	0.003204	1.37	164.44	152.72	0.22
chan-west-pr	1100	PF 1	219.00	6940.72	6942.47		6942.54	0.008194	2.39	111.15	165.41	0.40
chan-west-pr	1000	PF 1	219.00	6939.66	6941.18		6941.25	0.022125	2.15	101.76	105.80	0.39
chan-west-pr	900	PF 1	219.00	6937.05	6938.51		6938.58	0.032181	2.55	119.86	247.82	0.46
chan-west-pr	800	PF 1	219.00	6934.82	6936.27		6936.32	0.016822	2.05	129.79	189.89	0.35
chan-west-pr	700	PF 1	219.00	6932.96	6934.27		6934.34	0.023433	2.23	111.48	157.10	0.40
chan-west-pr	600	PF 1	219.00	6930.96	6932.36		6932.40	0.015395	1.88	150.73	251.93	0.33
chan-west-pr	500	PF 1	219.00	6928.39	6929.89		6930.03	0.041420	3.02	75.24	90.48	0.53
chan-west-pr	400	PF 1	219.00	6924.96	6927.85	6926.99	6927.93	0.012549	2.22	106.06	92.44	0.31
chan-west-pr	300	PF 1	219.00	6923.02	6924.34	6924.34	6924.79	0.153741	5.37	40.78	45.95	1.01
chan-west-pr	200	PF 1	219.00	6919.08	6920.93		6920.98	0.009384	1.74	125.54	93.95	0.27
chan-west-pr	100	PF 1	219.00	6918.00	6920.46		6920.49	0.002988	1.31	171.12	102.93	0.16
chan-west-pr	0	PF 1	219.00	6918.00	6919.89	6919.12	6919.94	0.013006	1.71	127.72	125.43	0.30

EXISTING WEST CHANNEL 100-Y

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 2600 Profile: PF 1

E.G. Elev (ft)	6967.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.		0.060	
W.S. Elev (ft)	6967.84	Reach Len. (ft)	108.00	100.00	88.00
Crit W.S. (ft)		Flow Area (sq ft)		92.25	
E.G. Slope (ft/ft)	0.019536	Area (sq ft)		92.25	
Q Total (cfs)	219.00	Flow (cfs)		219.00	
Top Width (ft)	162.38	Top Width (ft)		162.38	
Vel Total (ft/s)	2.37	Avg. Vel. (ft/s)		2.37	
Max Chl Dpth (ft)	1.01	Hydr. Depth (ft)		0.57	
Conv. Total (cfs)	1566.9	Conv. (cfs)		1566.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		162.40	
Min Ch El (ft)	6966.83	Shear (lb/sq ft)		0.69	
Alpha	1.00	Stream Power (lb/ft s)		1.64	
Frctn Loss (ft)	2.02	Cum Volume (acre-ft)	0.37	5.02	0.38
C & E Loss (ft)	0.00	Cum SA (acres)	0.91	5.32	1.02

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 2500 Profile: PF 1

E.G. Elev (ft)	6965.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.		0.060	
W.S. Elev (ft)	6965.81	Reach Len. (ft)	132.00	100.00	59.00
Crit W.S. (ft)		Flow Area (sq ft)		84.70	
E.G. Slope (ft/ft)	0.020926	Area (sq ft)		84.70	
Q Total (cfs)	219.00	Flow (cfs)		219.00	
Top Width (ft)	138.14	Top Width (ft)		138.14	
Vel Total (ft/s)	2.59	Avg. Vel. (ft/s)		2.59	
Max Chl Dpth (ft)	0.91	Hydr. Depth (ft)		0.61	
Conv. Total (cfs)	1513.9	Conv. (cfs)		1513.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		138.16	
Min Ch El (ft)	6964.90	Shear (lb/sq ft)		0.80	
Alpha	1.00	Stream Power (lb/ft s)		2.07	
Frctn Loss (ft)	1.54	Cum Volume (acre-ft)	0.37	4.82	0.38
C & E Loss (ft)	0.01	Cum SA (acres)	0.91	4.98	1.02

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 2400 Profile: PF 1

E.G. Elev (ft)	6964.37	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.		0.060	
W.S. Elev (ft)	6964.30	Reach Len. (ft)	113.00	100.00	91.00
Crit W.S. (ft)		Flow Area (sq ft)		104.95	
E.G. Slope (ft/ft)	0.011755	Area (sq ft)		104.95	
Q Total (cfs)	219.00	Flow (cfs)		219.00	
Top Width (ft)	153.17	Top Width (ft)		153.17	
Vel Total (ft/s)	2.09	Avg. Vel. (ft/s)		2.09	
Max Chl Dpth (ft)	1.05	Hydr. Depth (ft)		0.69	
Conv. Total (cfs)	2019.9	Conv. (cfs)		2019.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		153.19	
Min Ch El (ft)	6963.25	Shear (lb/sq ft)		0.50	
Alpha	1.00	Stream Power (lb/ft s)		1.05	
Frctn Loss (ft)	1.84	Cum Volume (acre-ft)	0.37	4.60	0.38
C & E Loss (ft)	0.01	Cum SA (acres)	0.91	4.64	1.02

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 2300 Profile: PF 1

E.G. Elev (ft)	6962.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.060	0.000
W.S. Elev (ft)	6962.39	Reach Len. (ft)	107.00	100.00	97.00
Crit W.S. (ft)		Flow Area (sq ft)		73.76	0.00
E.G. Slope (ft/ft)	0.032804	Area (sq ft)		73.76	0.00
Q Total (cfs)	219.00	Flow (cfs)		219.00	0.00

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 2300 Profile: PF 1 (Continued)

Top Width (ft)	137.42	Top Width (ft)		136.89	0.53
Vel Total (ft/s)	2.97	Avg. Vel. (ft/s)		2.97	0.18
Max Chl Dpth (ft)	1.12	Hydr. Depth (ft)		0.54	0.01
Conv. Total (cfs)	1209.1	Conv. (cfs)		1209.1	0.0
Length Wtd. (ft)	100.00	Wetted Per. (ft)		136.98	0.53
Min Ch El (ft)	6961.27	Shear (lb/sq ft)		1.10	
Alpha	1.00	Stream Power (lb/ft s)		3.27	
Frctn Loss (ft)	2.57	Cum Volume (acre-ft)	0.37	4.40	0.38
C & E Loss (ft)	0.01	Cum SA (acres)	0.91	4.31	1.02

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 2200 Profile: PF 1

E.G. Elev (ft)	6959.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.060	0.060	0.060
W.S. Elev (ft)	6959.82	Reach Len. (ft)	74.00	100.00	110.00
Crit W.S. (ft)		Flow Area (sq ft)	0.12	80.80	0.04
E.G. Slope (ft/ft)	0.020694	Area (sq ft)	0.12	80.80	0.04
Q Total (cfs)	219.00	Flow (cfs)	0.05	218.94	0.01
Top Width (ft)	127.03	Top Width (ft)	3.52	121.67	1.84
Vel Total (ft/s)	2.70	Avg. Vel. (ft/s)	0.38	2.71	0.28
Max Chl Dpth (ft)	1.36	Hydr. Depth (ft)	0.03	0.66	0.02
Conv. Total (cfs)	1522.4	Conv. (cfs)	0.3	1522.0	0.1
Length Wtd. (ft)	100.00	Wetted Per. (ft)	3.52	121.81	1.85
Min Ch El (ft)	6958.46	Shear (lb/sq ft)	0.04	0.86	0.03
Alpha	1.00	Stream Power (lb/ft s)	0.02	2.32	0.01
Frctn Loss (ft)	2.15	Cum Volume (acre-ft)	0.37	4.22	0.38
C & E Loss (ft)	0.01	Cum SA (acres)	0.90	4.01	1.01

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 2100 Profile: PF 1

E.G. Elev (ft)	6957.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.		0.060	
W.S. Elev (ft)	6957.62	Reach Len. (ft)	92.00	100.00	83.00
Crit W.S. (ft)		Flow Area (sq ft)		65.40	
E.G. Slope (ft/ft)	0.022265	Area (sq ft)		65.40	
Q Total (cfs)	219.00	Flow (cfs)		219.00	
Top Width (ft)	75.74	Top Width (ft)		75.74	
Vel Total (ft/s)	3.35	Avg. Vel. (ft/s)		3.35	
Max Chl Dpth (ft)	1.64	Hydr. Depth (ft)		0.86	
Conv. Total (cfs)	1467.7	Conv. (cfs)		1467.7	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		75.82	
Min Ch El (ft)	6955.98	Shear (lb/sq ft)		1.20	
Alpha	1.00	Stream Power (lb/ft s)		4.02	
Frctn Loss (ft)	1.41	Cum Volume (acre-ft)	0.36	4.05	0.38
C & E Loss (ft)	0.03	Cum SA (acres)	0.90	3.79	1.01

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 2000 Profile: PF 1

E.G. Elev (ft)	6956.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.		0.060	
W.S. Elev (ft)	6956.26	Reach Len. (ft)	101.00	100.00	102.00
Crit W.S. (ft)		Flow Area (sq ft)		92.24	
E.G. Slope (ft/ft)	0.009751	Area (sq ft)		92.24	
Q Total (cfs)	219.00	Flow (cfs)		219.00	
Top Width (ft)	96.35	Top Width (ft)		96.35	
Vel Total (ft/s)	2.37	Avg. Vel. (ft/s)		2.37	
Max Chl Dpth (ft)	1.69	Hydr. Depth (ft)		0.96	
Conv. Total (cfs)	2217.7	Conv. (cfs)		2217.7	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		96.43	
Min Ch El (ft)	6954.57	Shear (lb/sq ft)		0.58	

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 2000 Profile: PF 1 (Continued)

Alpha	1.00	Stream Power (lb/ft s)		1.38	
Frctn Loss (ft)	1.63	Cum Volume (acre-ft)	0.36	3.87	0.38
C & E Loss (ft)	0.01	Cum SA (acres)	0.90	3.59	1.01

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 1900 Profile: PF 1

E.G. Elev (ft)	6954.71	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.18	Wt. n-Val.		0.060	0.060
W.S. Elev (ft)	6954.54	Reach Len. (ft)	81.00	100.00	134.00
Crit W.S. (ft)	6954.40	Flow Area (sq ft)		64.40	0.35
E.G. Slope (ft/ft)	0.032488	Area (sq ft)		64.40	0.35
Q Total (cfs)	219.00	Flow (cfs)		218.65	0.35
Top Width (ft)	100.15	Top Width (ft)		96.95	3.20
Vel Total (ft/s)	3.38	Avg. Vel. (ft/s)		3.39	1.01
Max Chl Dpth (ft)	1.78	Hydr. Depth (ft)		0.66	0.11
Conv. Total (cfs)	1215.0	Conv. (cfs)		1213.1	1.9
Length Wtd. (ft)	100.03	Wetted Per. (ft)		97.10	3.21
Min Ch El (ft)	6952.76	Shear (lb/sq ft)		1.35	0.22
Alpha	1.01	Stream Power (lb/ft s)		4.57	0.22
Frctn Loss (ft)	2.64	Cum Volume (acre-ft)	0.36	3.69	0.38
C & E Loss (ft)	0.00	Cum SA (acres)	0.90	3.37	1.01

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 1800 Profile: PF 1

E.G. Elev (ft)	6952.07	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.		0.060	
W.S. Elev (ft)	6951.86	Reach Len. (ft)	97.00	100.00	124.00
Crit W.S. (ft)		Flow Area (sq ft)		59.71	
E.G. Slope (ft/ft)	0.021810	Area (sq ft)		59.71	
Q Total (cfs)	219.00	Flow (cfs)		219.00	
Top Width (ft)	59.03	Top Width (ft)		59.03	
Vel Total (ft/s)	3.67	Avg. Vel. (ft/s)		3.67	
Max Chl Dpth (ft)	2.55	Hydr. Depth (ft)		1.01	
Conv. Total (cfs)	1482.9	Conv. (cfs)		1482.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		59.46	
Min Ch El (ft)	6949.31	Shear (lb/sq ft)		1.37	
Alpha	1.00	Stream Power (lb/ft s)		5.01	
Frctn Loss (ft)	2.22	Cum Volume (acre-ft)	0.36	3.55	0.37
C & E Loss (ft)	0.01	Cum SA (acres)	0.90	3.19	1.00

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 1700 Profile: PF 1

E.G. Elev (ft)	6949.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.		0.060	
W.S. Elev (ft)	6949.56	Reach Len. (ft)	110.00	100.00	96.00
Crit W.S. (ft)		Flow Area (sq ft)		51.75	
E.G. Slope (ft/ft)	0.022659	Area (sq ft)		51.75	
Q Total (cfs)	219.00	Flow (cfs)		219.00	
Top Width (ft)	42.27	Top Width (ft)		42.27	
Vel Total (ft/s)	4.23	Avg. Vel. (ft/s)		4.23	
Max Chl Dpth (ft)	2.45	Hydr. Depth (ft)		1.22	
Conv. Total (cfs)	1454.9	Conv. (cfs)		1454.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		42.79	
Min Ch El (ft)	6947.11	Shear (lb/sq ft)		1.71	
Alpha	1.00	Stream Power (lb/ft s)		7.24	
Frctn Loss (ft)	1.40	Cum Volume (acre-ft)	0.36	3.42	0.37
C & E Loss (ft)	0.04	Cum SA (acres)	0.90	3.07	1.00

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 1600 Profile: PF 1

E.G. Elev (ft)	6948.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.060	0.060	0.060
W.S. Elev (ft)	6948.27	Reach Len. (ft)	109.00	100.00	92.00
Crit W.S. (ft)		Flow Area (sq ft)	0.27	73.21	1.28
E.G. Slope (ft/ft)	0.009453	Area (sq ft)	0.27	73.21	1.28
Q Total (cfs)	219.00	Flow (cfs)	0.14	218.02	0.84
Top Width (ft)	64.69	Top Width (ft)	2.67	53.00	9.02
Vel Total (ft/s)	2.93	Avg. Vel. (ft/s)	0.53	2.98	0.65
Max Chl Dpth (ft)	2.43	Hydr. Depth (ft)	0.10	1.38	0.14
Conv. Total (cfs)	2252.4	Conv. (cfs)	1.5	2242.4	8.6
Length Wtd. (ft)	99.99	Wetted Per. (ft)	2.68	53.22	9.03
Min Ch El (ft)	6945.84	Shear (lb/sq ft)	0.06	0.81	0.08
Alpha	1.03	Stream Power (lb/ft s)	0.03	2.42	0.05
Frctn Loss (ft)	1.42	Cum Volume (acre-ft)	0.36	3.28	0.37
C & E Loss (ft)	0.00	Cum SA (acres)	0.89	2.96	0.99

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 1500 Profile: PF 1

E.G. Elev (ft)	6946.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.18	Wt. n-Val.	0.060	0.060	0.060
W.S. Elev (ft)	6946.80	Reach Len. (ft)	95.00	100.00	109.00
Crit W.S. (ft)		Flow Area (sq ft)	0.26	63.27	0.41
E.G. Slope (ft/ft)	0.023587	Area (sq ft)	0.26	63.27	0.41
Q Total (cfs)	219.00	Flow (cfs)	0.19	218.48	0.33
Top Width (ft)	80.32	Top Width (ft)	3.09	73.00	4.22
Vel Total (ft/s)	3.42	Avg. Vel. (ft/s)	0.74	3.45	0.80
Max Chl Dpth (ft)	1.89	Hydr. Depth (ft)	0.09	0.87	0.10
Conv. Total (cfs)	1426.0	Conv. (cfs)	1.3	1422.5	2.1
Length Wtd. (ft)	100.00	Wetted Per. (ft)	3.10	73.14	4.23
Min Ch El (ft)	6944.91	Shear (lb/sq ft)	0.13	1.27	0.14
Alpha	1.01	Stream Power (lb/ft s)	0.09	4.40	0.11
Frctn Loss (ft)	1.53	Cum Volume (acre-ft)	0.36	3.12	0.37
C & E Loss (ft)	0.03	Cum SA (acres)	0.89	2.82	0.98

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 1400 Profile: PF 1

E.G. Elev (ft)	6945.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.		0.060	
W.S. Elev (ft)	6945.34	Reach Len. (ft)	69.00	100.00	114.80
Crit W.S. (ft)		Flow Area (sq ft)		96.66	
E.G. Slope (ft/ft)	0.010717	Area (sq ft)		96.66	
Q Total (cfs)	219.00	Flow (cfs)		219.00	
Top Width (ft)	116.26	Top Width (ft)		116.26	
Vel Total (ft/s)	2.27	Avg. Vel. (ft/s)		2.27	
Max Chl Dpth (ft)	1.56	Hydr. Depth (ft)		0.83	
Conv. Total (cfs)	2115.5	Conv. (cfs)		2115.5	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		116.35	
Min Ch El (ft)	6943.78	Shear (lb/sq ft)		0.56	
Alpha	1.00	Stream Power (lb/ft s)		1.26	
Frctn Loss (ft)	1.62	Cum Volume (acre-ft)	0.36	2.94	0.37
C & E Loss (ft)	0.01	Cum SA (acres)	0.88	2.60	0.97

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 1300 Profile: PF 1

E.G. Elev (ft)	6943.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.		0.060	
W.S. Elev (ft)	6943.61	Reach Len. (ft)	108.00	100.00	101.00
Crit W.S. (ft)		Flow Area (sq ft)		65.41	
E.G. Slope (ft/ft)	0.027384	Area (sq ft)		65.41	
Q Total (cfs)	219.00	Flow (cfs)		219.00	

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 1300 Profile: PF 1 (Continued)

Top Width (ft)	88.53	Top Width (ft)		88.53	
Vel Total (ft/s)	3.35	Avg. Vel. (ft/s)		3.35	
Max Chl Dpth (ft)	1.42	Hydr. Depth (ft)		0.74	
Conv. Total (cfs)	1323.4	Conv. (cfs)		1323.4	
Length Wtd. (ft)	100.06	Wetted Per. (ft)		88.60	
Min Ch El (ft)	6942.19	Shear (lb/sq ft)		1.26	
Alpha	1.00	Stream Power (lb/ft s)		4.23	
Frctn Loss (ft)	0.71	Cum Volume (acre-ft)	0.36	2.75	0.37
C & E Loss (ft)	0.04	Cum SA (acres)	0.88	2.37	0.97

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 1200 Profile: PF 1

E.G. Elev (ft)	6943.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.060	0.070	0.060
W.S. Elev (ft)	6943.00	Reach Len. (ft)	110.00	100.00	95.00
Crit W.S. (ft)		Flow Area (sq ft)	3.97	154.69	5.78
E.G. Slope (ft/ft)	0.003204	Area (sq ft)	3.97	154.69	5.78
Q Total (cfs)	219.00	Flow (cfs)	2.68	211.81	4.51
Top Width (ft)	152.72	Top Width (ft)	11.86	127.00	13.86
Vel Total (ft/s)	1.33	Avg. Vel. (ft/s)	0.68	1.37	0.78
Max Chl Dpth (ft)	2.22	Hydr. Depth (ft)	0.33	1.22	0.42
Conv. Total (cfs)	3868.7	Conv. (cfs)	47.4	3741.6	79.7
Length Wtd. (ft)	100.85	Wetted Per. (ft)	11.88	127.18	13.88
Min Ch El (ft)	6940.78	Shear (lb/sq ft)	0.07	0.24	0.08
Alpha	1.03	Stream Power (lb/ft s)	0.05	0.33	0.07
Frctn Loss (ft)	0.49	Cum Volume (acre-ft)	0.36	2.50	0.36
C & E Loss (ft)	0.00	Cum SA (acres)	0.87	2.12	0.96

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 1100 Profile: PF 1

E.G. Elev (ft)	6942.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.	0.060	0.060	0.060
W.S. Elev (ft)	6942.47	Reach Len. (ft)	119.00	100.00	95.00
Crit W.S. (ft)		Flow Area (sq ft)	31.32	70.48	9.35
E.G. Slope (ft/ft)	0.008194	Area (sq ft)	31.32	70.48	9.35
Q Total (cfs)	219.00	Flow (cfs)	41.51	168.36	9.13
Top Width (ft)	165.41	Top Width (ft)	68.91	64.00	32.49
Vel Total (ft/s)	1.97	Avg. Vel. (ft/s)	1.33	2.39	0.98
Max Chl Dpth (ft)	1.74	Hydr. Depth (ft)	0.45	1.10	0.29
Conv. Total (cfs)	2419.3	Conv. (cfs)	458.5	1859.9	100.9
Length Wtd. (ft)	101.70	Wetted Per. (ft)	68.93	64.07	32.50
Min Ch El (ft)	6940.72	Shear (lb/sq ft)	0.23	0.56	0.15
Alpha	1.23	Stream Power (lb/ft s)	0.31	1.34	0.14
Frctn Loss (ft)	1.29	Cum Volume (acre-ft)	0.31	2.24	0.35
C & E Loss (ft)	0.00	Cum SA (acres)	0.77	1.90	0.91

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 1000 Profile: PF 1

E.G. Elev (ft)	6941.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.		0.100	
W.S. Elev (ft)	6941.18	Reach Len. (ft)	114.00	100.00	102.00
Crit W.S. (ft)		Flow Area (sq ft)		101.76	
E.G. Slope (ft/ft)	0.022125	Area (sq ft)		101.76	
Q Total (cfs)	219.00	Flow (cfs)		219.00	
Top Width (ft)	105.80	Top Width (ft)		105.80	
Vel Total (ft/s)	2.15	Avg. Vel. (ft/s)		2.15	
Max Chl Dpth (ft)	1.52	Hydr. Depth (ft)		0.96	
Conv. Total (cfs)	1472.3	Conv. (cfs)		1472.3	
Length Wtd. (ft)	100.62	Wetted Per. (ft)		105.92	
Min Ch El (ft)	6939.66	Shear (lb/sq ft)		1.33	

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 1000 Profile: PF 1 (Continued)

Alpha	1.00	Stream Power (lb/ft s)		2.86	
Frctn Loss (ft)	2.66	Cum Volume (acre-ft)	0.27	2.04	0.34
C & E Loss (ft)	0.00	Cum SA (acres)	0.67	1.70	0.87

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 900 Profile: PF 1

E.G. Elev (ft)	6938.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.	0.100	0.100	0.100
W.S. Elev (ft)	6938.51	Reach Len. (ft)	102.00	100.00	99.00
Crit W.S. (ft)		Flow Area (sq ft)	5.00	45.00	69.86
E.G. Slope (ft/ft)	0.032181	Area (sq ft)	5.00	45.00	69.86
Q Total (cfs)	219.00	Flow (cfs)	5.35	114.64	99.02
Top Width (ft)	247.82	Top Width (ft)	19.70	48.00	180.12
Vel Total (ft/s)	1.83	Avg. Vel. (ft/s)	1.07	2.55	1.42
Max Chl Dpth (ft)	1.46	Hydr. Depth (ft)	0.25	0.94	0.39
Conv. Total (cfs)	1220.8	Conv. (cfs)	29.8	639.0	552.0
Length Wtd. (ft)	99.82	Wetted Per. (ft)	19.71	48.17	180.16
Min Ch El (ft)	6937.05	Shear (lb/sq ft)	0.51	1.88	0.78
Alpha	1.30	Stream Power (lb/ft s)	0.55	4.78	1.10
Frctn Loss (ft)	2.26	Cum Volume (acre-ft)	0.26	1.88	0.26
C & E Loss (ft)	0.00	Cum SA (acres)	0.65	1.53	0.66

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 800 Profile: PF 1

E.G. Elev (ft)	6936.32	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.	0.100	0.100	0.100
W.S. Elev (ft)	6936.27	Reach Len. (ft)	92.00	100.00	105.00
Crit W.S. (ft)		Flow Area (sq ft)	17.86	81.23	30.70
E.G. Slope (ft/ft)	0.016822	Area (sq ft)	17.86	81.23	30.70
Q Total (cfs)	219.00	Flow (cfs)	20.07	166.58	32.35
Top Width (ft)	189.89	Top Width (ft)	40.10	74.00	75.79
Vel Total (ft/s)	1.69	Avg. Vel. (ft/s)	1.12	2.05	1.05
Max Chl Dpth (ft)	1.44	Hydr. Depth (ft)	0.45	1.10	0.41
Conv. Total (cfs)	1688.5	Conv. (cfs)	154.7	1284.4	249.5
Length Wtd. (ft)	99.78	Wetted Per. (ft)	40.11	74.01	75.92
Min Ch El (ft)	6934.82	Shear (lb/sq ft)	0.47	1.15	0.42
Alpha	1.22	Stream Power (lb/ft s)	0.53	2.36	0.45
Frctn Loss (ft)	1.97	Cum Volume (acre-ft)	0.24	1.73	0.14
C & E Loss (ft)	0.00	Cum SA (acres)	0.58	1.39	0.37

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 700 Profile: PF 1

E.G. Elev (ft)	6934.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.	0.100	0.100	0.100
W.S. Elev (ft)	6934.27	Reach Len. (ft)	123.00	100.00	93.00
Crit W.S. (ft)		Flow Area (sq ft)	16.55	79.73	15.20
E.G. Slope (ft/ft)	0.023433	Area (sq ft)	16.55	79.73	15.20
Q Total (cfs)	219.00	Flow (cfs)	23.21	177.99	17.81
Top Width (ft)	157.10	Top Width (ft)	34.17	82.00	40.93
Vel Total (ft/s)	1.96	Avg. Vel. (ft/s)	1.40	2.23	1.17
Max Chl Dpth (ft)	1.31	Hydr. Depth (ft)	0.48	0.97	0.37
Conv. Total (cfs)	1430.7	Conv. (cfs)	151.6	1162.7	116.3
Length Wtd. (ft)	103.16	Wetted Per. (ft)	34.19	82.01	41.11
Min Ch El (ft)	6932.96	Shear (lb/sq ft)	0.71	1.42	0.54
Alpha	1.13	Stream Power (lb/ft s)	0.99	3.17	0.63
Frctn Loss (ft)	1.94	Cum Volume (acre-ft)	0.20	1.55	0.09
C & E Loss (ft)	0.01	Cum SA (acres)	0.50	1.21	0.23

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 600 Profile: PF 1

E.G. Elev (ft)	6932.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.100	0.100	0.100
W.S. Elev (ft)	6932.36	Reach Len. (ft)	106.00	100.00	82.00
Crit W.S. (ft)		Flow Area (sq ft)	51.16	73.05	26.53
E.G. Slope (ft/ft)	0.015395	Area (sq ft)	51.16	73.05	26.53
Q Total (cfs)	219.00	Flow (cfs)	51.63	137.23	30.14
Top Width (ft)	251.93	Top Width (ft)	126.26	71.00	54.67
Vel Total (ft/s)	1.45	Avg. Vel. (ft/s)	1.01	1.88	1.14
Max Chl Dpth (ft)	1.40	Hydr. Depth (ft)	0.41	1.03	0.49
Conv. Total (cfs)	1765.1	Conv. (cfs)	416.2	1106.0	242.9
Length Wtd. (ft)	99.43	Wetted Per. (ft)	126.30	71.02	54.84
Min Ch El (ft)	6930.96	Shear (lb/sq ft)	0.39	0.99	0.46
Alpha	1.25	Stream Power (lb/ft s)	0.39	1.86	0.53
Frctn Loss (ft)	2.36	Cum Volume (acre-ft)	0.11	1.37	0.04
C & E Loss (ft)	0.01	Cum SA (acres)	0.27	1.03	0.13

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 500 Profile: PF 1

E.G. Elev (ft)	6930.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.100	0.100	0.100
W.S. Elev (ft)	6929.89	Reach Len. (ft)	91.00	100.00	115.00
Crit W.S. (ft)		Flow Area (sq ft)	2.45	70.91	1.88
E.G. Slope (ft/ft)	0.041420	Area (sq ft)	2.45	70.91	1.88
Q Total (cfs)	219.00	Flow (cfs)	2.83	214.18	1.98
Top Width (ft)	90.48	Top Width (ft)	10.32	71.00	9.16
Vel Total (ft/s)	2.91	Avg. Vel. (ft/s)	1.16	3.02	1.05
Max Chl Dpth (ft)	1.50	Hydr. Depth (ft)	0.24	1.00	0.21
Conv. Total (cfs)	1076.1	Conv. (cfs)	13.9	1052.4	9.7
Length Wtd. (ft)	99.82	Wetted Per. (ft)	10.33	71.04	9.17
Min Ch El (ft)	6928.39	Shear (lb/sq ft)	0.61	2.58	0.53
Alpha	1.06	Stream Power (lb/ft s)	0.71	7.80	0.56
Frctn Loss (ft)	2.08	Cum Volume (acre-ft)	0.04	1.20	0.02
C & E Loss (ft)	0.02	Cum SA (acres)	0.11	0.87	0.07

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 400 Profile: PF 1

E.G. Elev (ft)	6927.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.	0.100	0.100	0.100
W.S. Elev (ft)	6927.85	Reach Len. (ft)	172.00	100.00	180.00
Crit W.S. (ft)	6926.99	Flow Area (sq ft)	11.20	93.39	1.48
E.G. Slope (ft/ft)	0.012549	Area (sq ft)	11.20	93.39	1.48
Q Total (cfs)	219.00	Flow (cfs)	10.71	207.39	0.90
Top Width (ft)	92.44	Top Width (ft)	25.67	60.00	6.76
Vel Total (ft/s)	2.06	Avg. Vel. (ft/s)	0.96	2.22	0.60
Max Chl Dpth (ft)	2.89	Hydr. Depth (ft)	0.44	1.56	0.22
Conv. Total (cfs)	1955.0	Conv. (cfs)	95.6	1851.4	8.0
Length Wtd. (ft)	101.92	Wetted Per. (ft)	25.69	60.60	6.78
Min Ch El (ft)	6924.96	Shear (lb/sq ft)	0.34	1.21	0.17
Alpha	1.11	Stream Power (lb/ft s)	0.33	2.68	0.10
Frctn Loss (ft)	3.10	Cum Volume (acre-ft)	0.03	1.02	0.01
C & E Loss (ft)	0.04	Cum SA (acres)	0.07	0.72	0.05

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 300 Profile: PF 1

E.G. Elev (ft)	6924.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.45	Wt. n-Val.		0.100	
W.S. Elev (ft)	6924.34	Reach Len. (ft)	106.00	100.00	108.00
Crit W.S. (ft)	6924.34	Flow Area (sq ft)		40.78	
E.G. Slope (ft/ft)	0.153741	Area (sq ft)		40.78	
Q Total (cfs)	219.00	Flow (cfs)		219.00	

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 300 Profile: PF 1 (Continued)

Top Width (ft)	45.95	Top Width (ft)		45.95	
Vel Total (ft/s)	5.37	Avg. Vel. (ft/s)		5.37	
Max Chl Dpth (ft)	1.32	Hydr. Depth (ft)		0.89	
Conv. Total (cfs)	558.5	Conv. (cfs)		558.5	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		46.07	
Min Ch El (ft)	6923.02	Shear (lb/sq ft)		8.49	
Alpha	1.00	Stream Power (lb/ft s)		45.62	
Frctn Loss (ft)	2.41	Cum Volume (acre-ft)	0.00	0.86	0.01
C & E Loss (ft)	0.12	Cum SA (acres)	0.02	0.60	0.03

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 200 Profile: PF 1

E.G. Elev (ft)	6920.98	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.		0.100	
W.S. Elev (ft)	6920.93	Reach Len. (ft)	81.00	100.00	107.00
Crit W.S. (ft)		Flow Area (sq ft)		125.54	
E.G. Slope (ft/ft)	0.009384	Area (sq ft)		125.54	
Q Total (cfs)	219.00	Flow (cfs)		219.00	
Top Width (ft)	93.95	Top Width (ft)		93.95	
Vel Total (ft/s)	1.74	Avg. Vel. (ft/s)		1.74	
Max Chl Dpth (ft)	1.85	Hydr. Depth (ft)		1.34	
Conv. Total (cfs)	2260.7	Conv. (cfs)		2260.7	
Length Wtd. (ft)	99.99	Wetted Per. (ft)		94.10	
Min Ch El (ft)	6919.08	Shear (lb/sq ft)		0.78	
Alpha	1.00	Stream Power (lb/ft s)		1.36	
Frctn Loss (ft)	0.49	Cum Volume (acre-ft)	0.00	0.67	0.01
C & E Loss (ft)	0.01	Cum SA (acres)	0.02	0.44	0.03

Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 100 Profile: PF 1

E.G. Elev (ft)	6920.49	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.100	0.100	0.100
W.S. Elev (ft)	6920.46	Reach Len. (ft)	101.00	100.00	107.00
Crit W.S. (ft)		Flow Area (sq ft)	2.16	165.86	3.09
E.G. Slope (ft/ft)	0.002988	Area (sq ft)	2.16	165.86	3.09
Q Total (cfs)	219.00	Flow (cfs)	0.69	217.37	0.94
Top Width (ft)	102.93	Top Width (ft)	8.80	80.70	13.44
Vel Total (ft/s)	1.28	Avg. Vel. (ft/s)	0.32	1.31	0.30
Max Chl Dpth (ft)	2.46	Hydr. Depth (ft)	0.25	2.06	0.23
Conv. Total (cfs)	4006.3	Conv. (cfs)	12.6	3976.4	17.3
Length Wtd. (ft)	100.02	Wetted Per. (ft)	8.81	80.93	13.44
Min Ch El (ft)	6918.00	Shear (lb/sq ft)	0.05	0.38	0.04
Alpha	1.04	Stream Power (lb/ft s)	0.01	0.50	0.01
Frctn Loss (ft)	0.55	Cum Volume (acre-ft)	0.00	0.34	0.00
C & E Loss (ft)	0.00	Cum SA (acres)	0.01	0.24	0.02

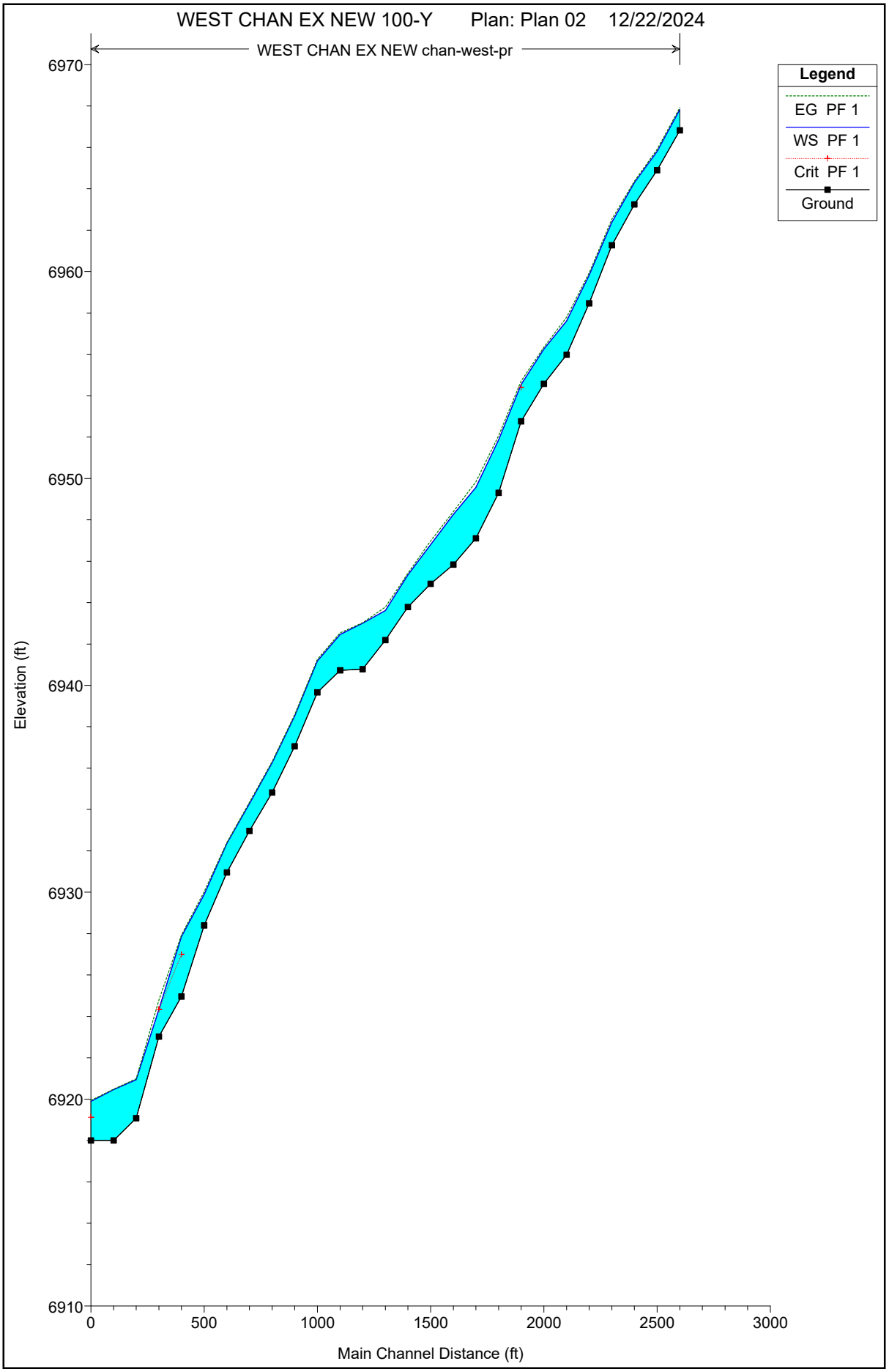
Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 0 Profile: PF 1

E.G. Elev (ft)	6919.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.		0.100	
W.S. Elev (ft)	6919.89	Reach Len. (ft)			
Crit W.S. (ft)	6919.12	Flow Area (sq ft)		127.72	
E.G. Slope (ft/ft)	0.013006	Area (sq ft)		127.72	
Q Total (cfs)	219.00	Flow (cfs)		219.00	
Top Width (ft)	125.43	Top Width (ft)		125.43	
Vel Total (ft/s)	1.71	Avg. Vel. (ft/s)		1.71	
Max Chl Dpth (ft)	1.89	Hydr. Depth (ft)		1.02	
Conv. Total (cfs)	1920.3	Conv. (cfs)		1920.3	
Length Wtd. (ft)		Wetted Per. (ft)		125.49	
Min Ch El (ft)	6918.00	Shear (lb/sq ft)		0.83	

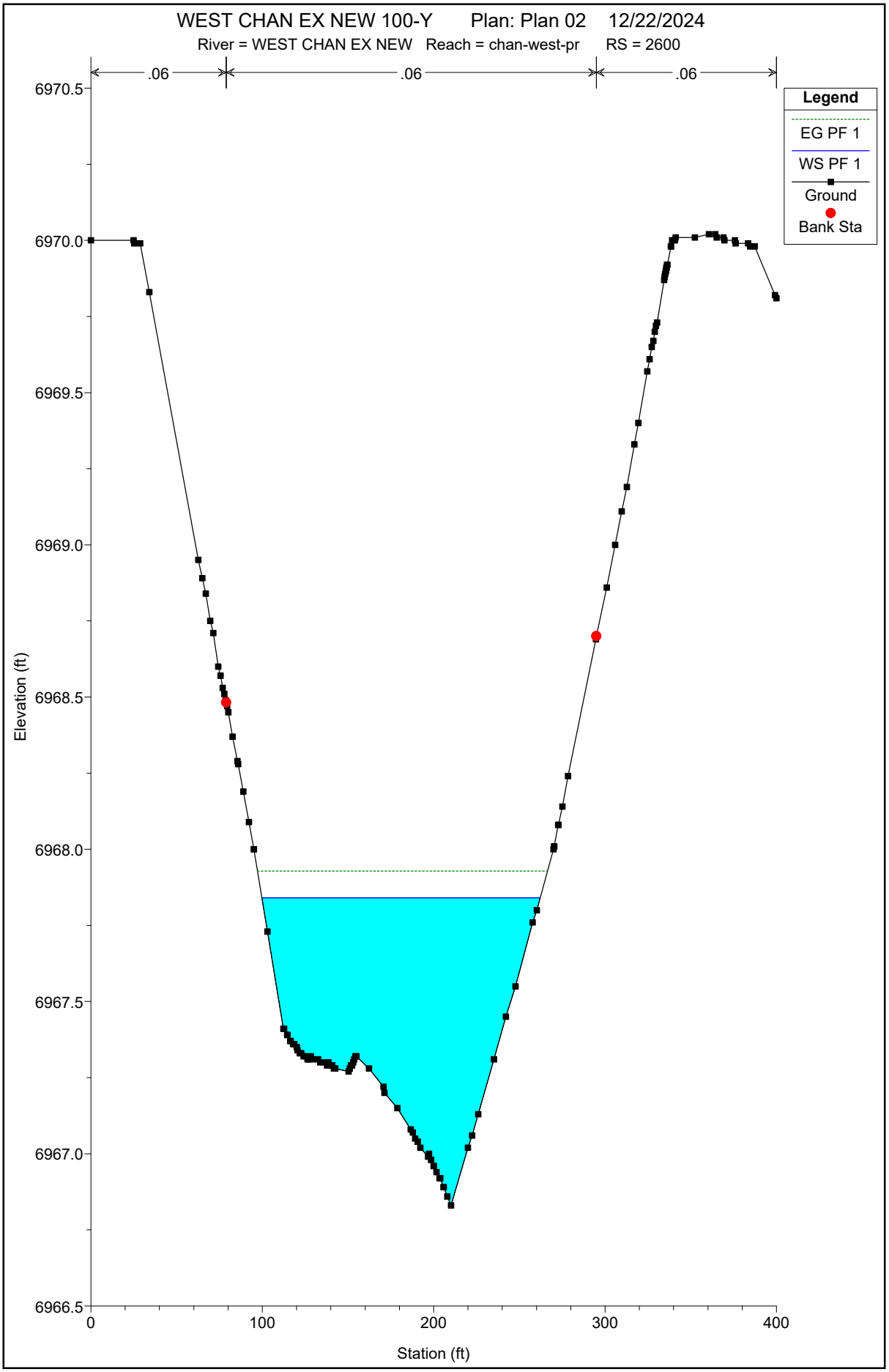
Plan: Plan 02 WEST CHAN EX NEW chan-west-pr RS: 0 Profile: PF 1 (Continued)

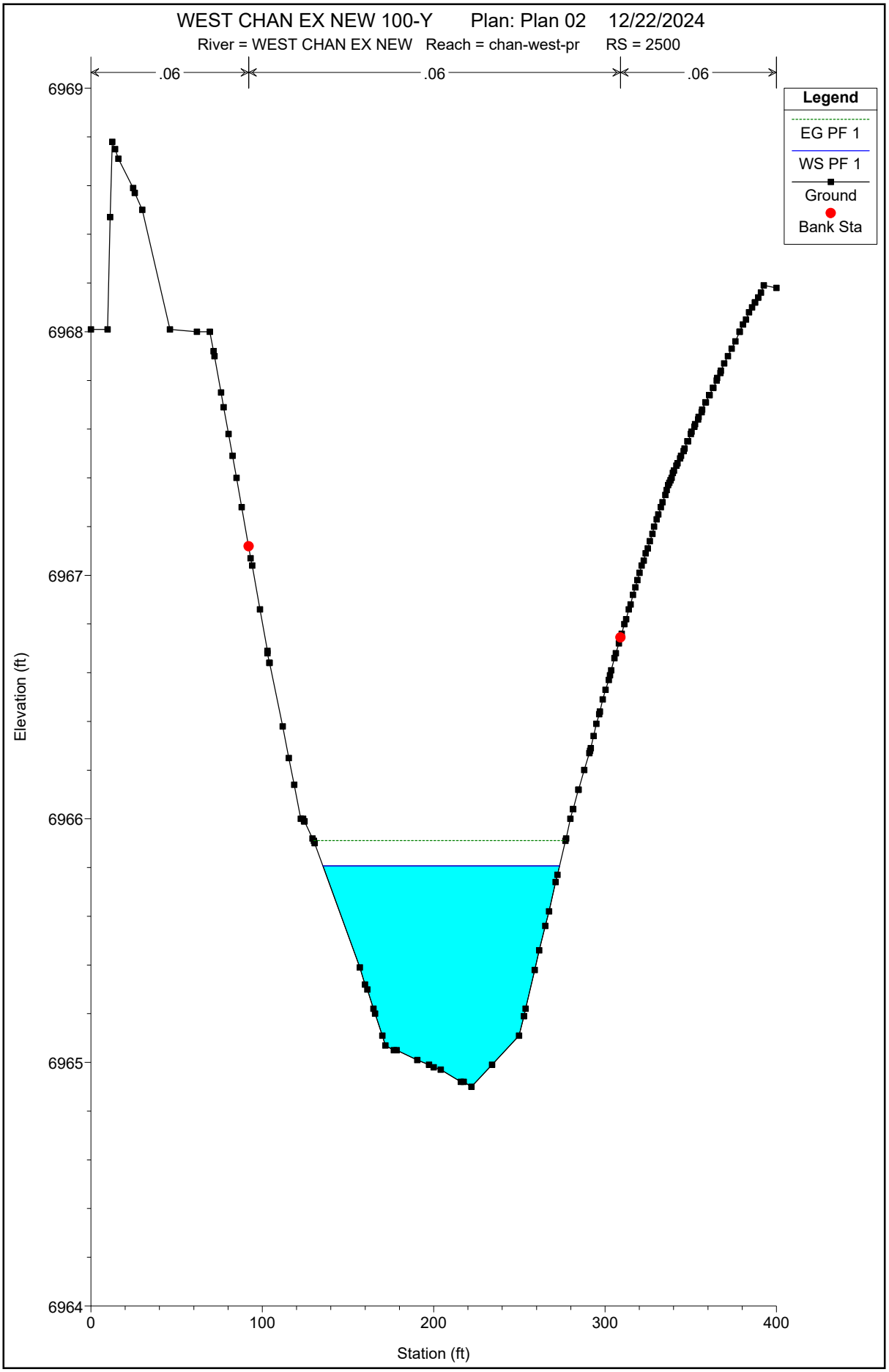
Alpha	1.00	Stream Power (lb/ft s)		1.42	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

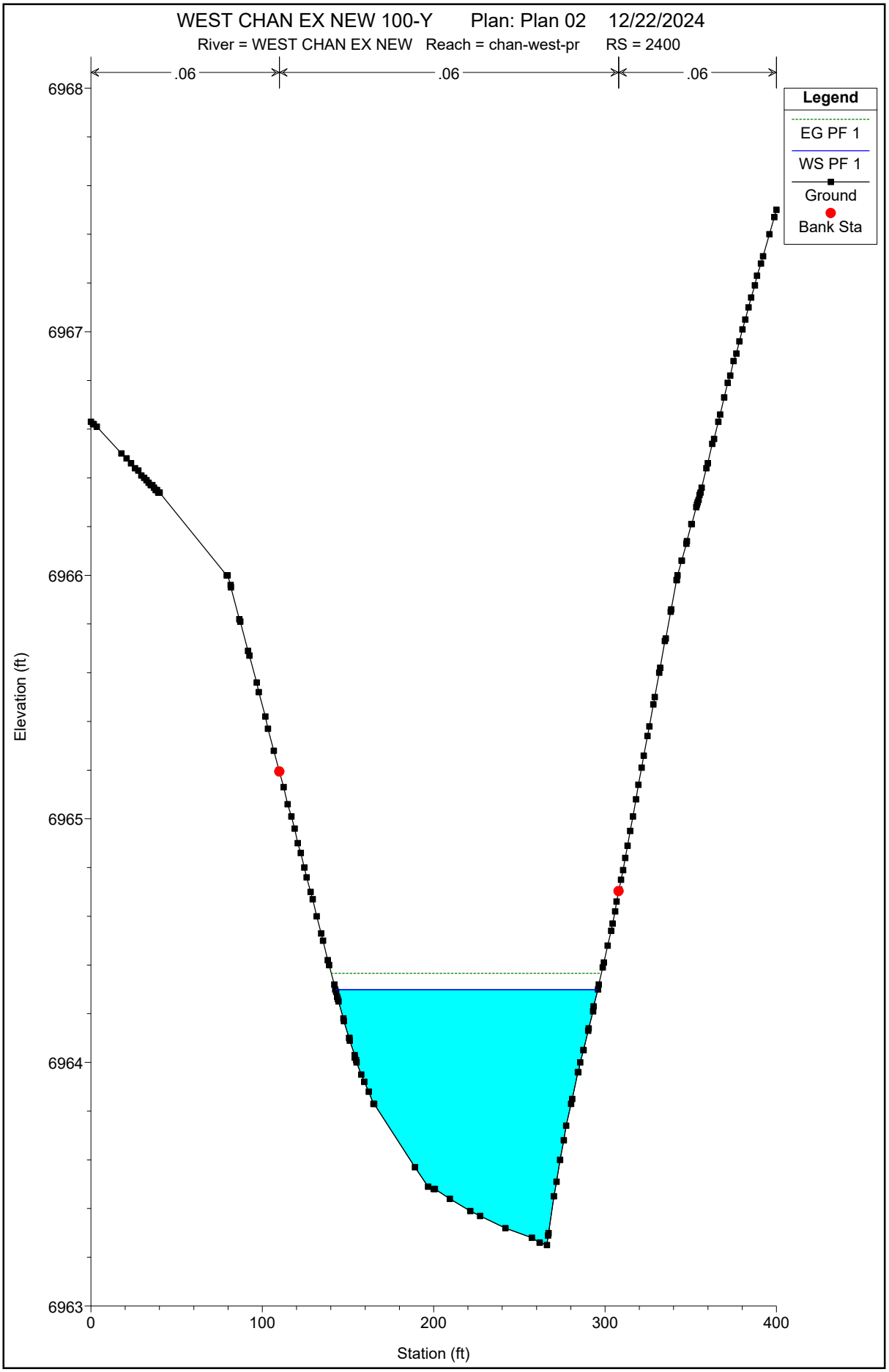
EXISTING WEST CHANNEL 100-Y

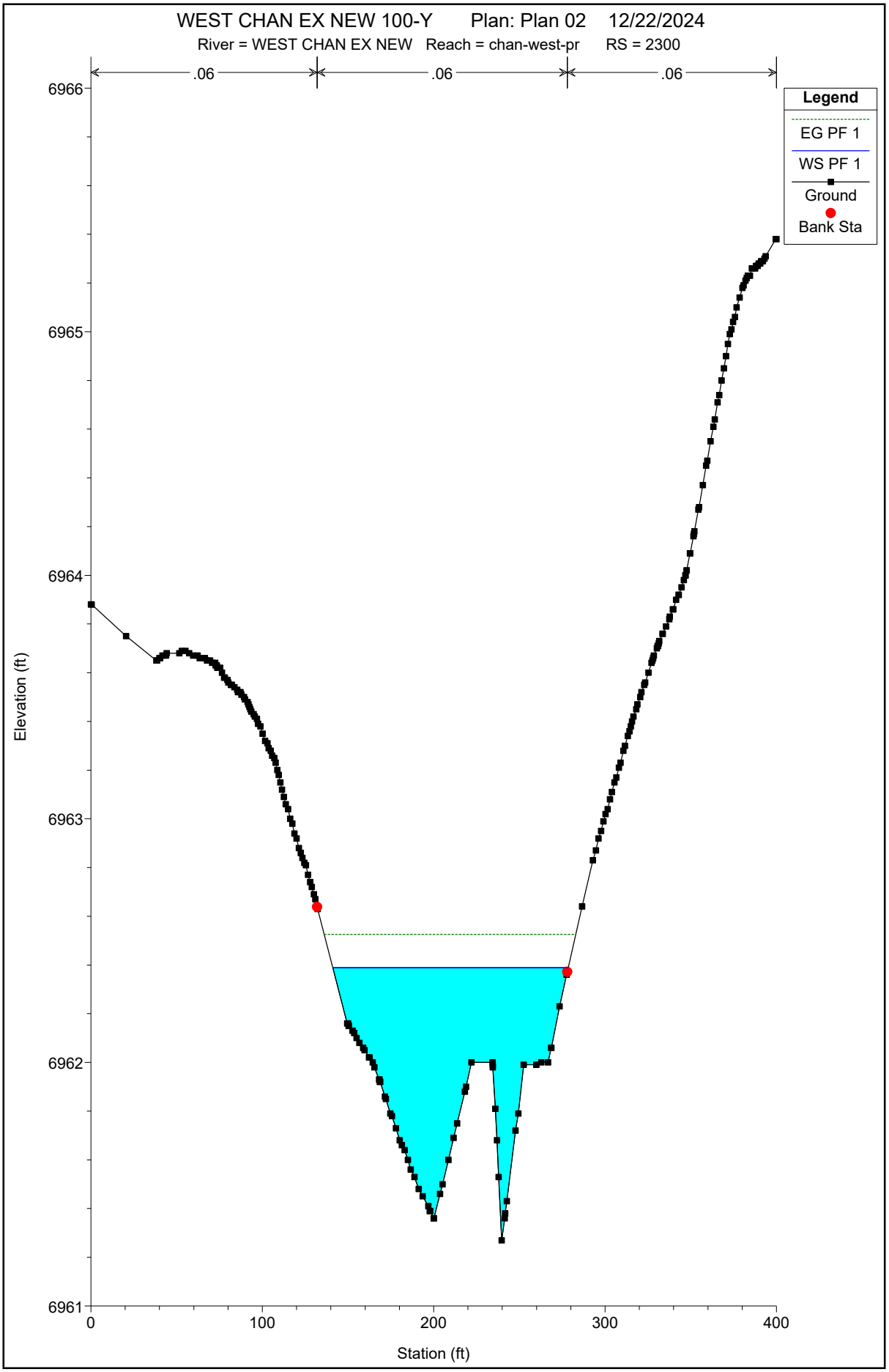


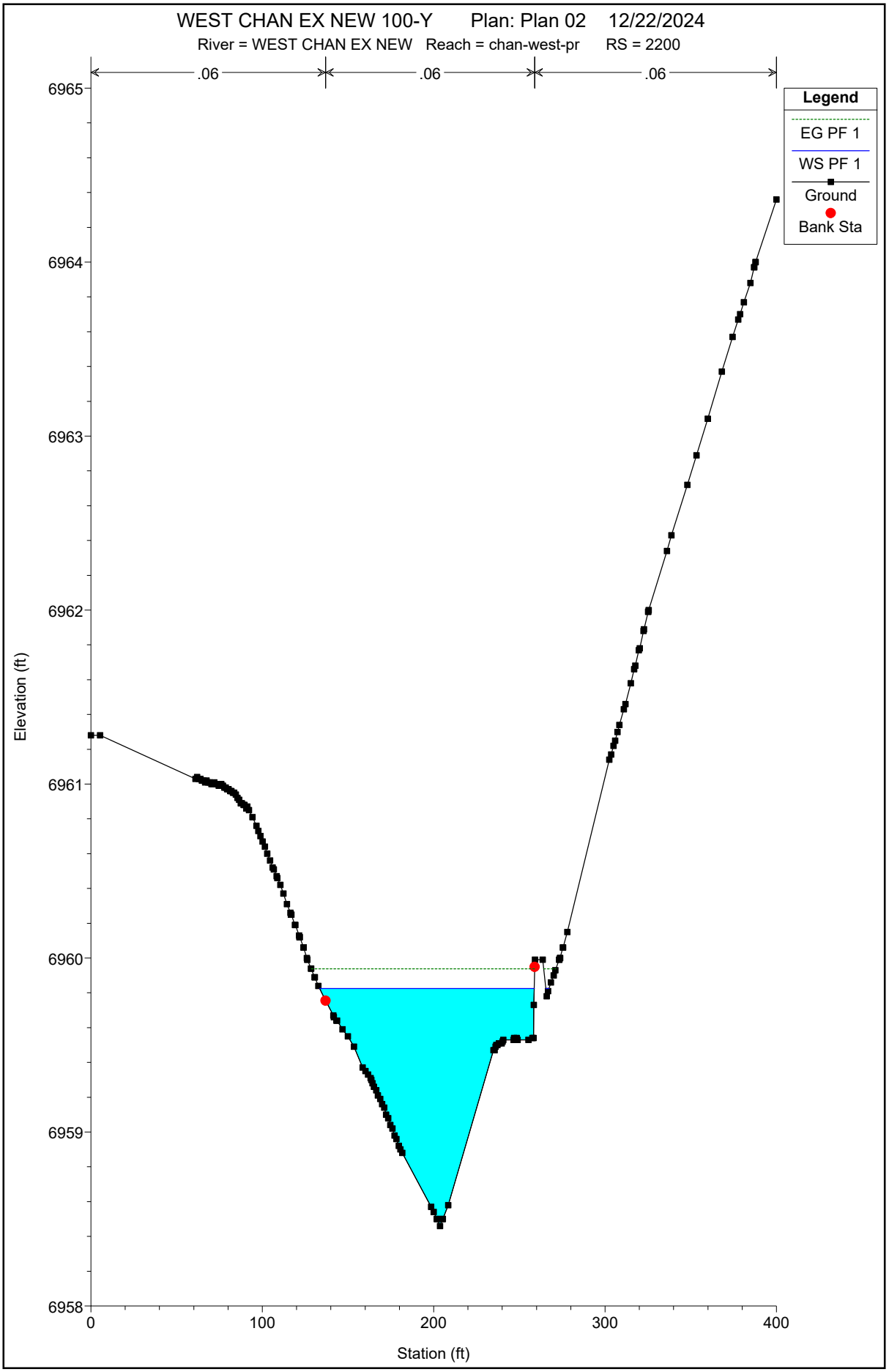
EXISTING WEST CHANNEL 100-Y

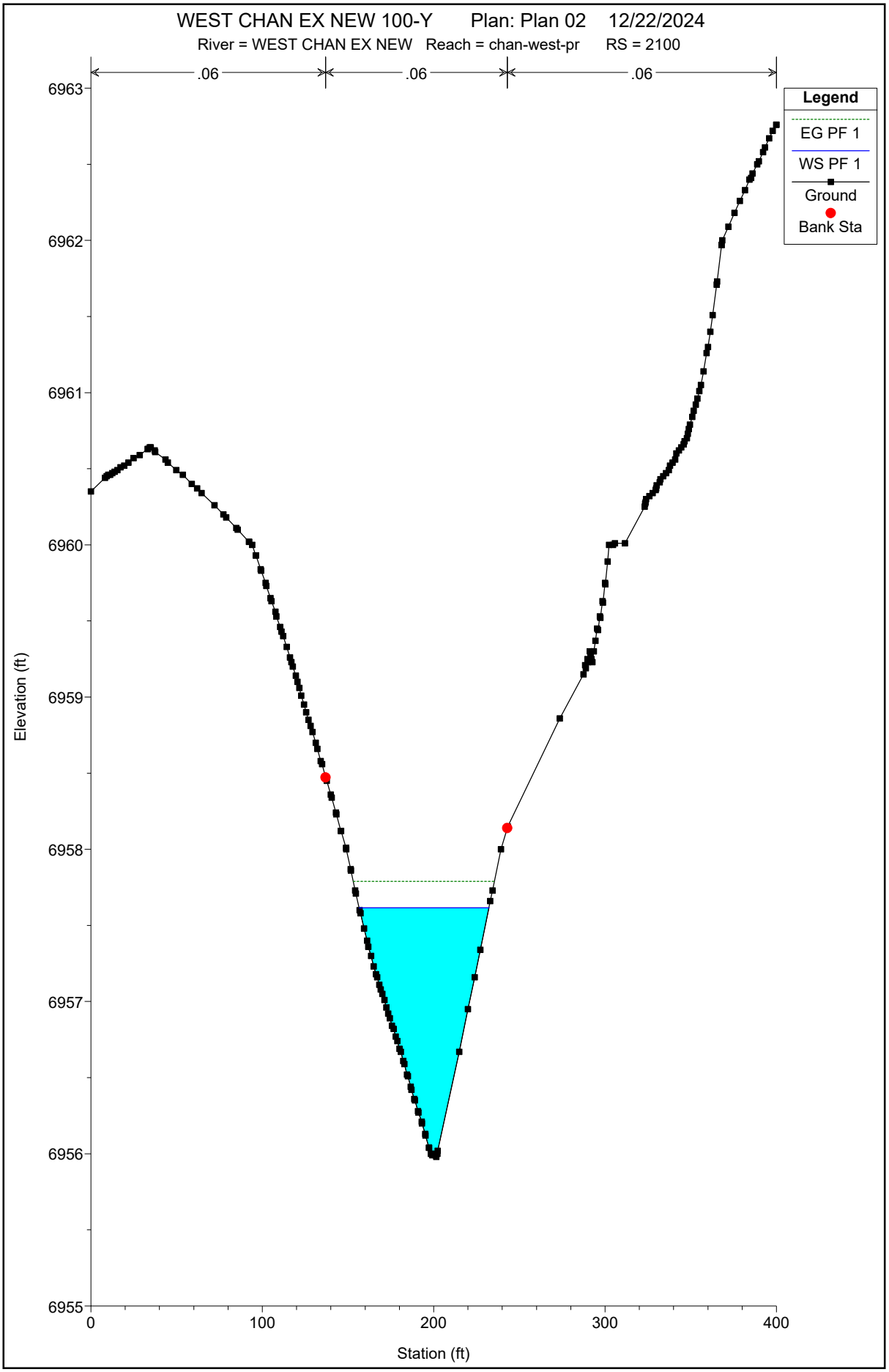


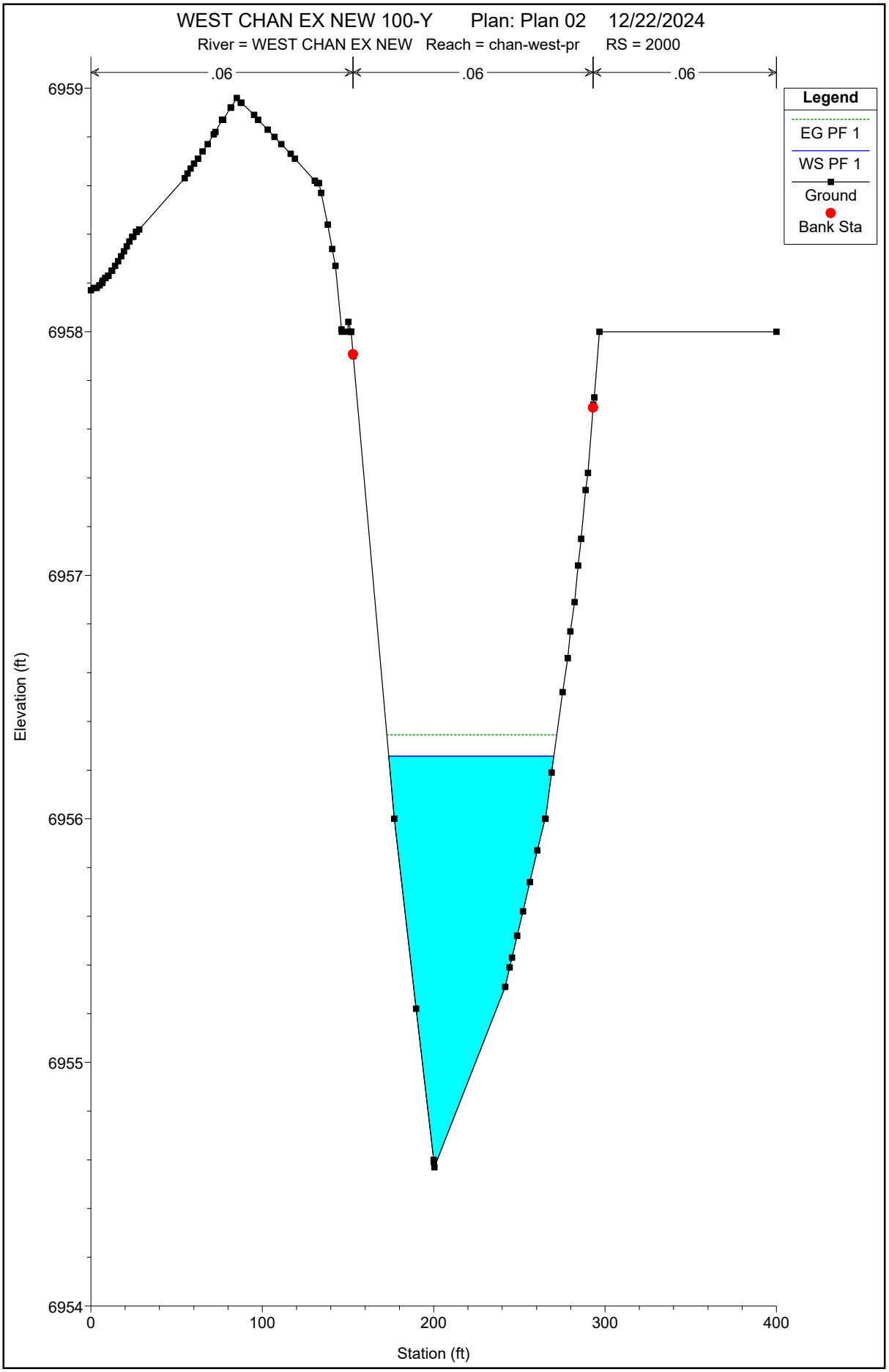

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 2500
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6969
6968
6967
6966
6965
6964
Elevation (ft)
0
100
200
300
400
Station (ft)

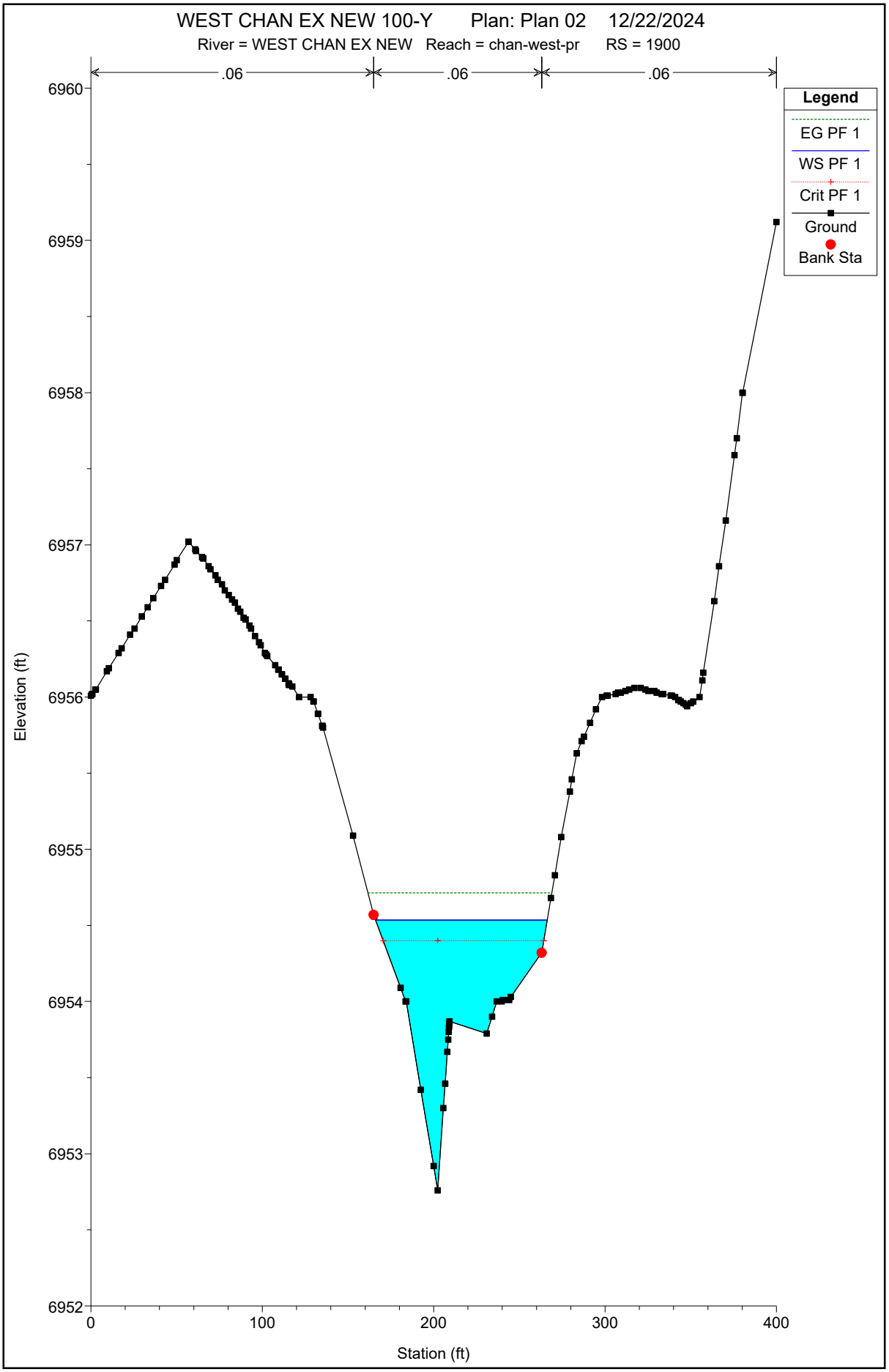

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 2400
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6968
6967
6966
6965
6964
6963
Elevation (ft)
0
100
200
300
400
Station (ft)

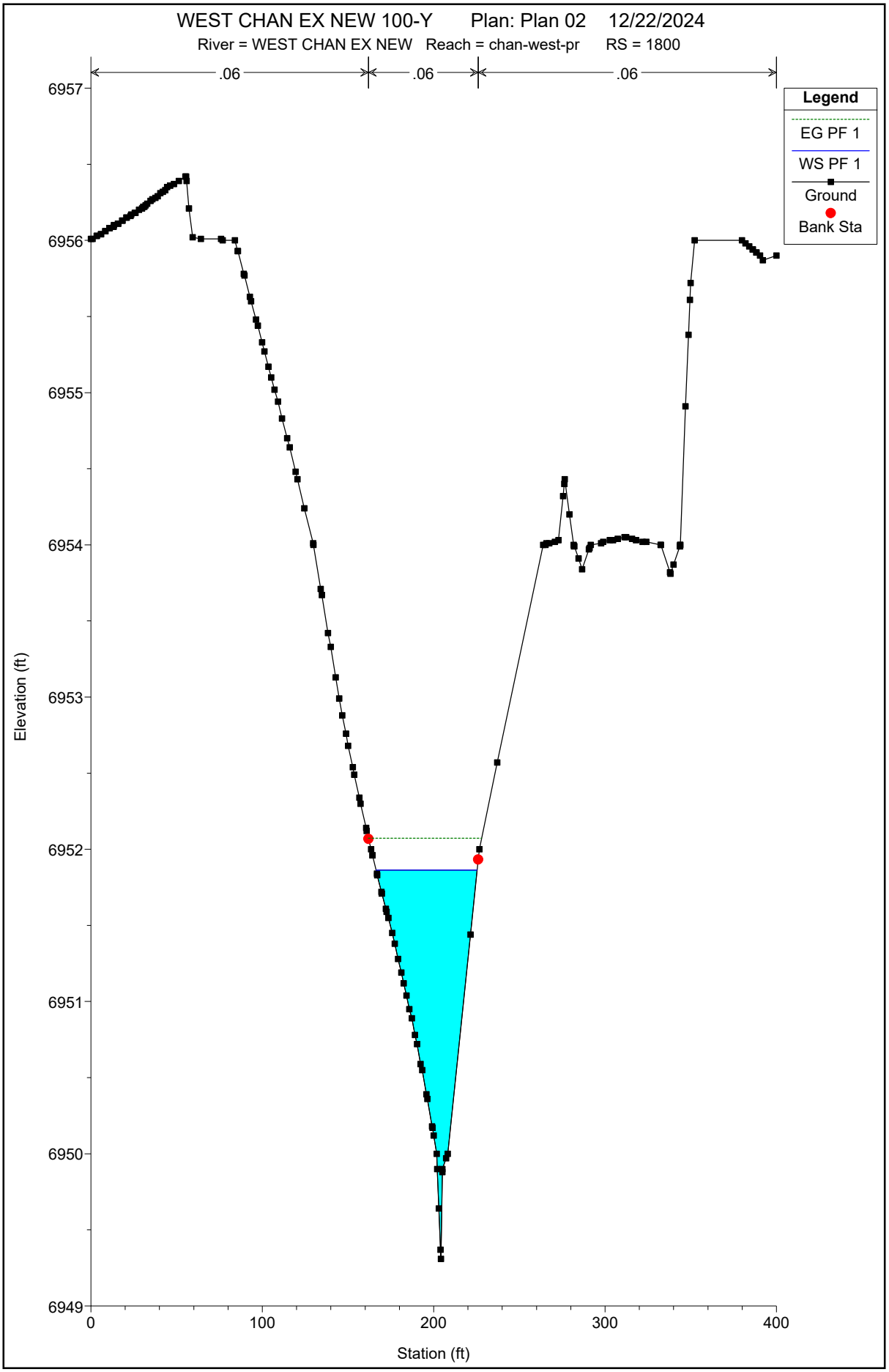

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 2300
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6966
6965
6964
6963
6962
6961
Elevation (ft)
0
100
200
300
400
Station (ft)

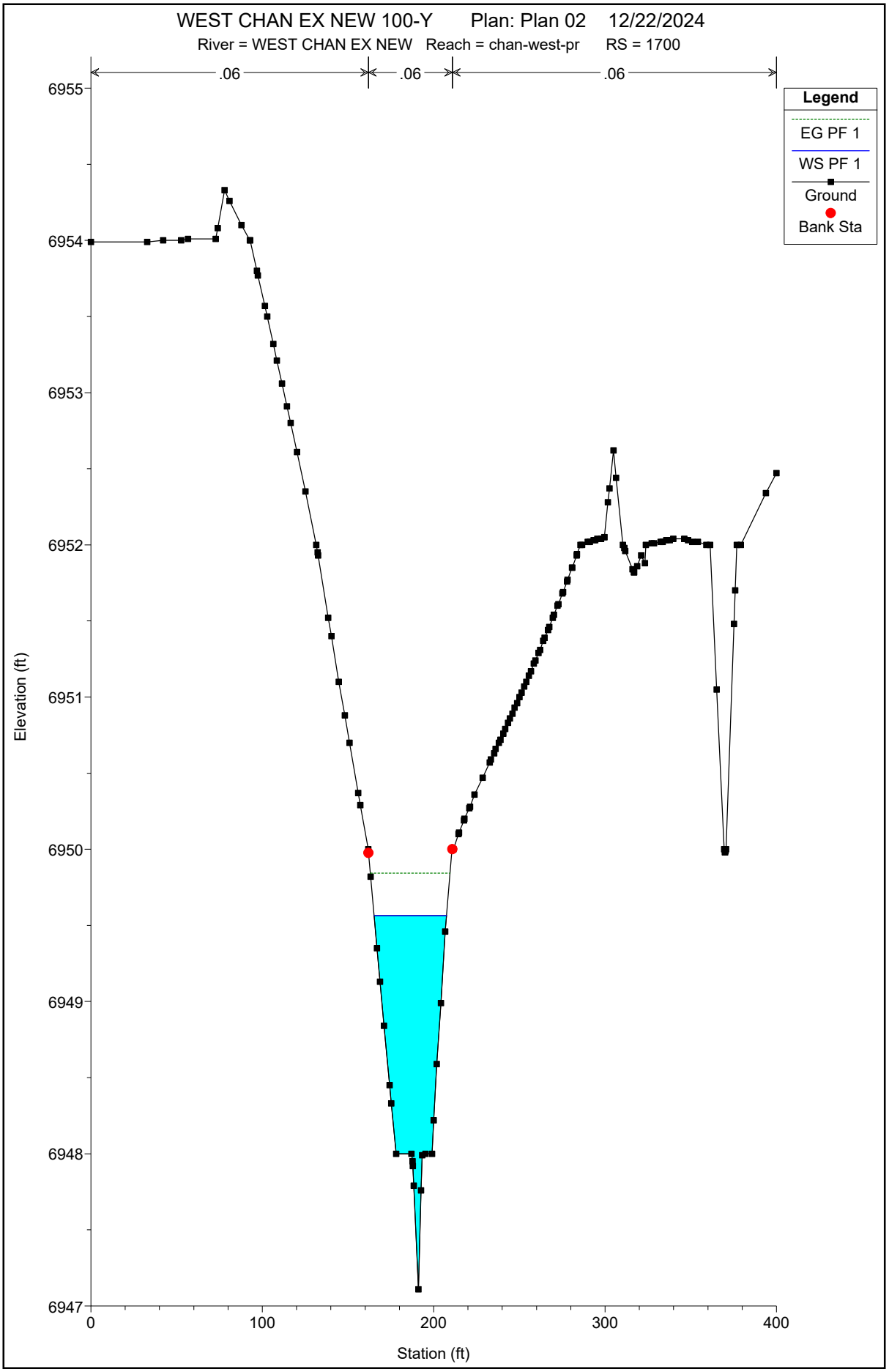

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 2200
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6965
6964
6963
6962
6961
6960
6959
6958
0
100
200
300
400
Station (ft)

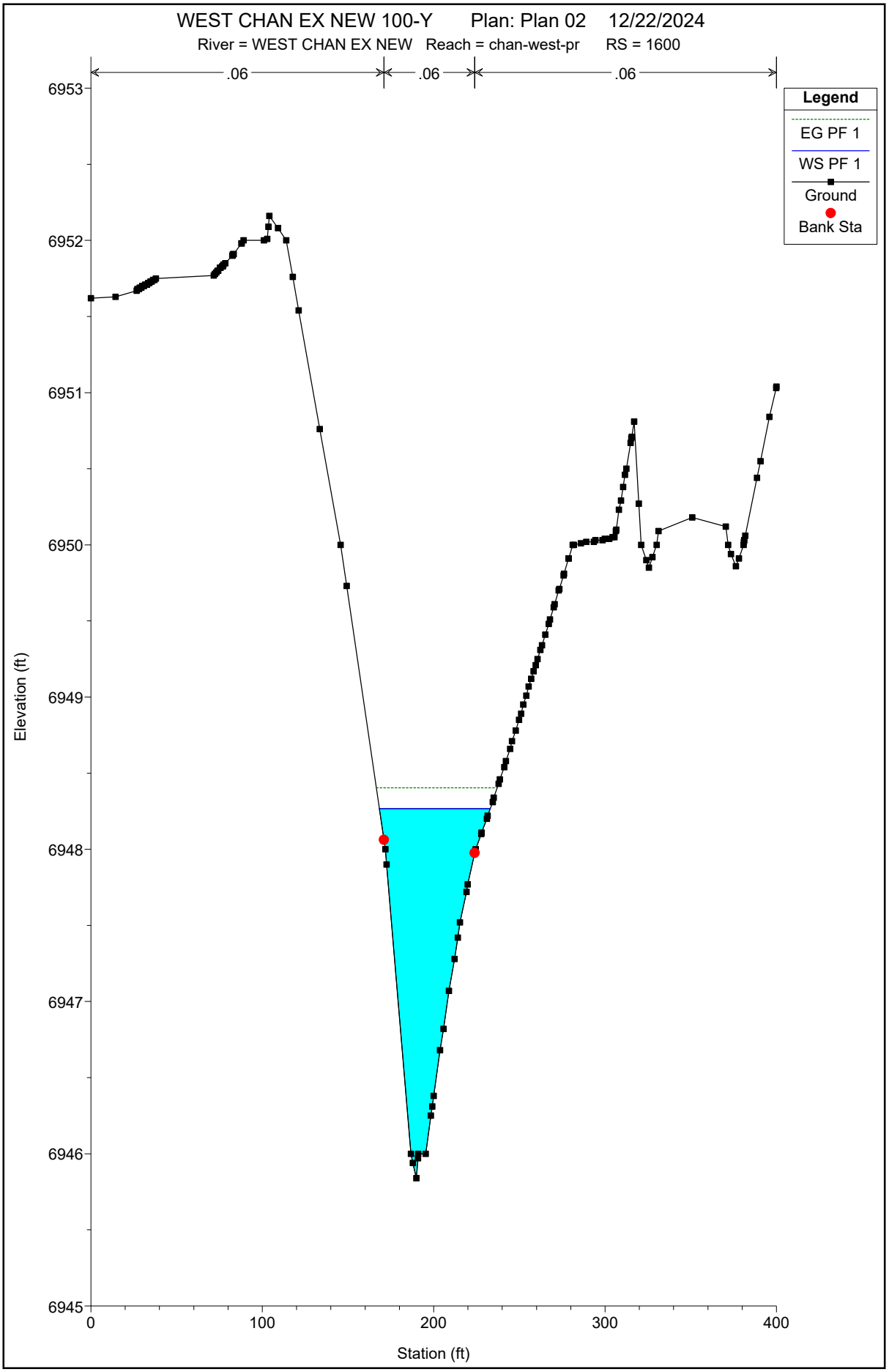

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 2100
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6963
6962
6961
6960
6959
6958
6957
6956
6955
0
100
200
300
400
Station (ft)

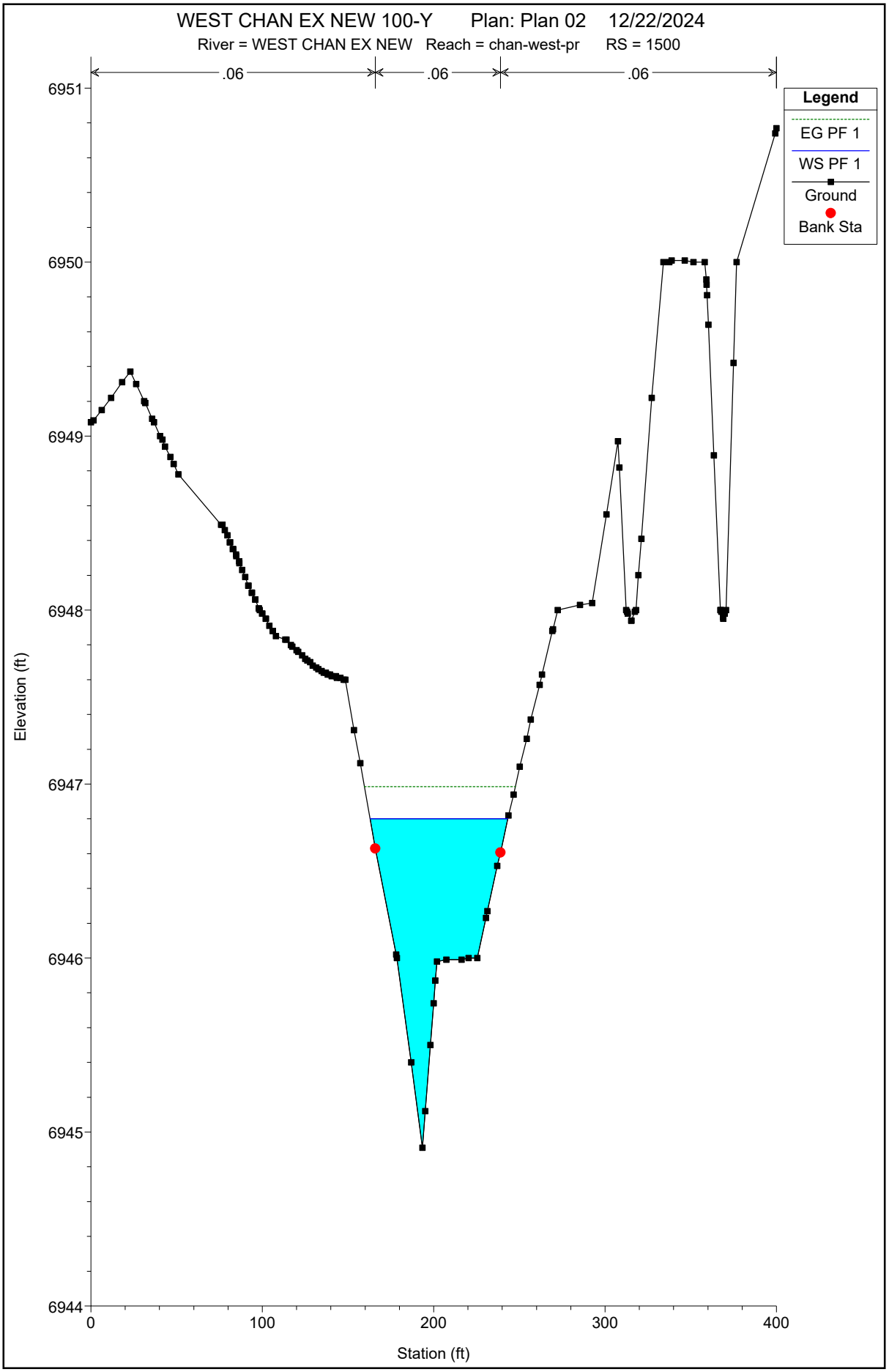

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 2000
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6959
6958
6957
6956
6955
6954
Elevation (ft)
0
100
200
300
400
Station (ft)

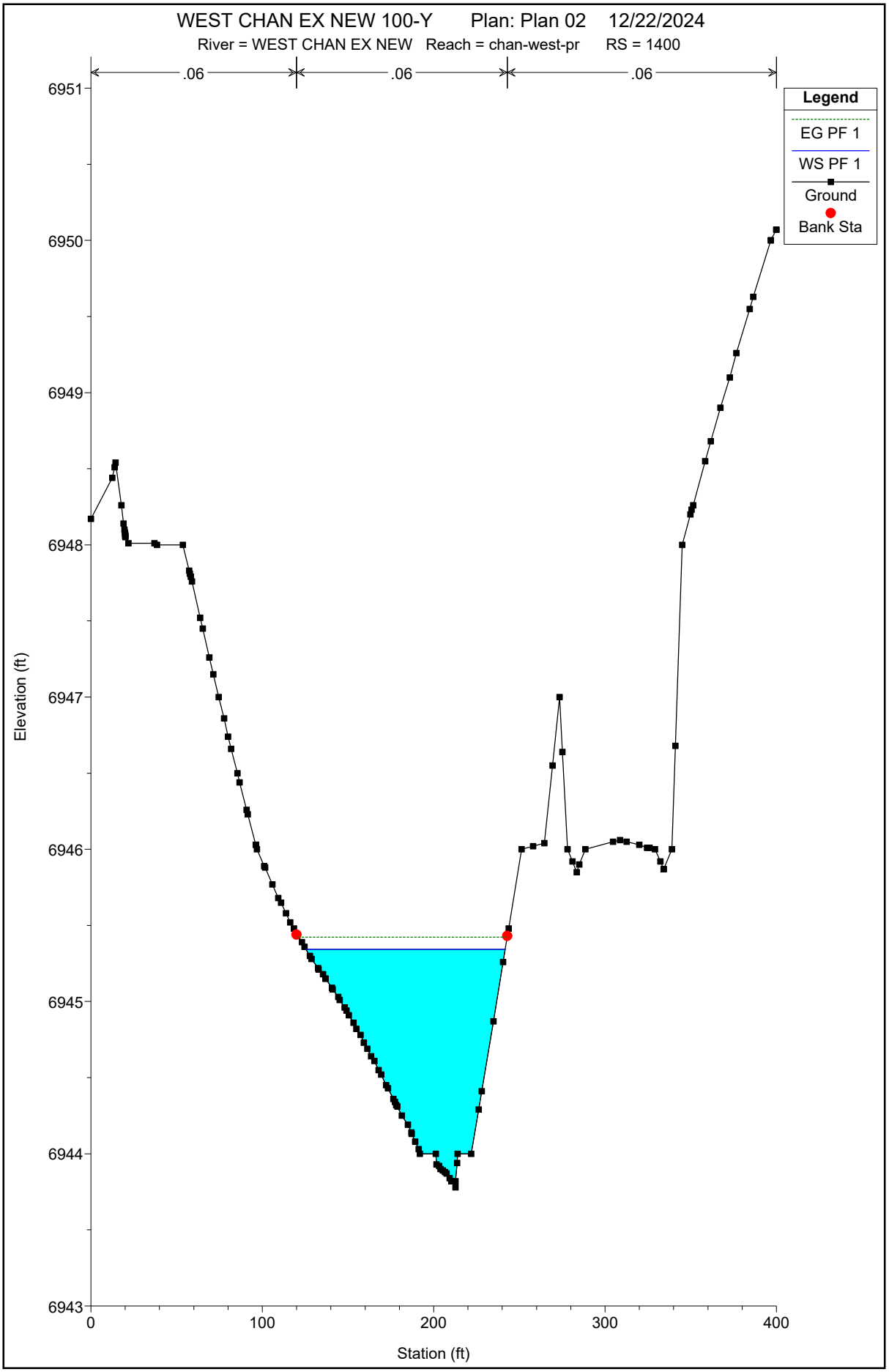

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 1900
.06
.06
.06
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6960
6959
6958
6957
6956
6955
6954
6953
6952
0
100
200
300
400
Station (ft)

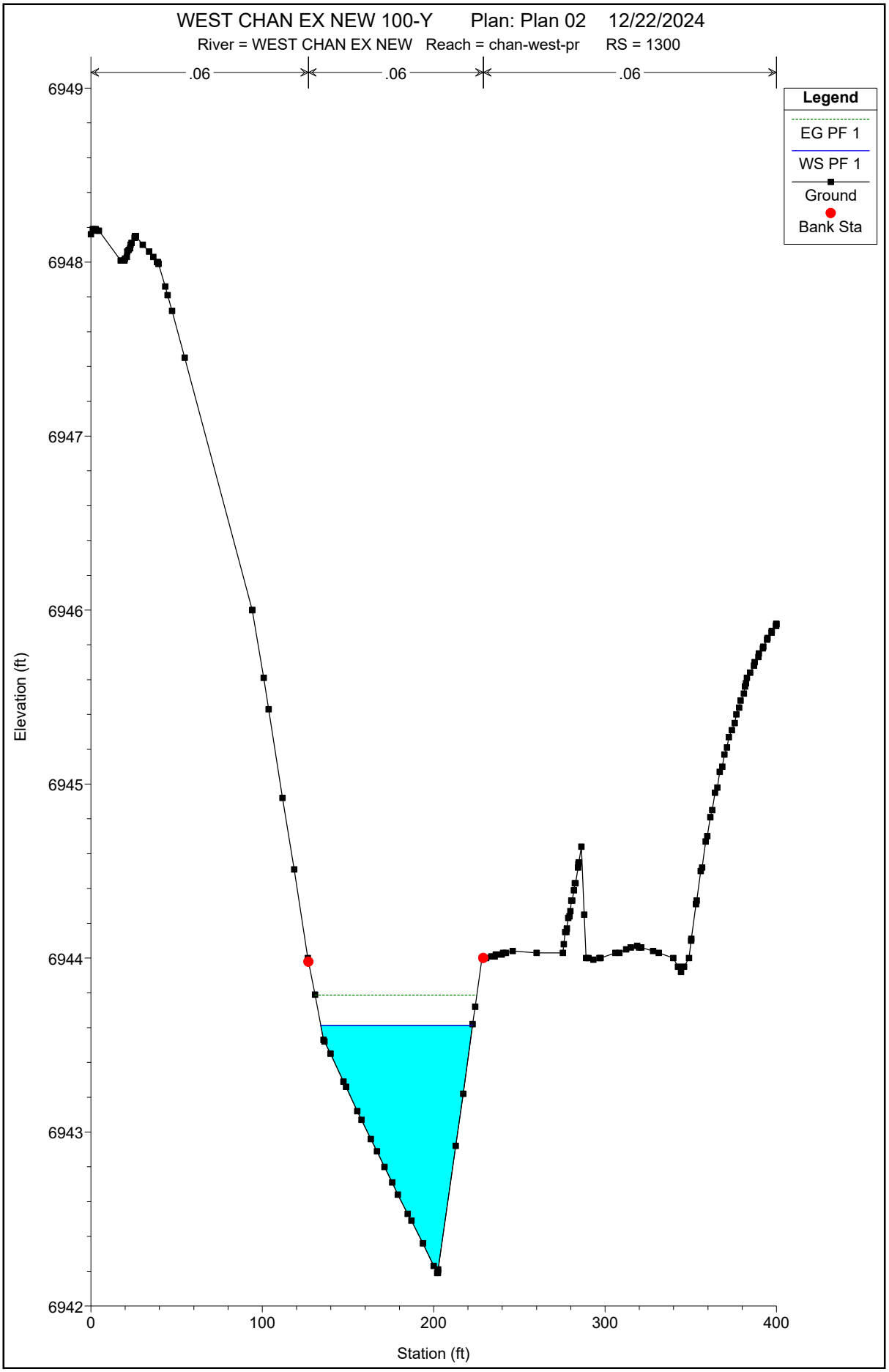

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 1800
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6957
6956
6955
6954
6953
6952
6951
6950
6949
0
100
200
300
400
Station (ft)

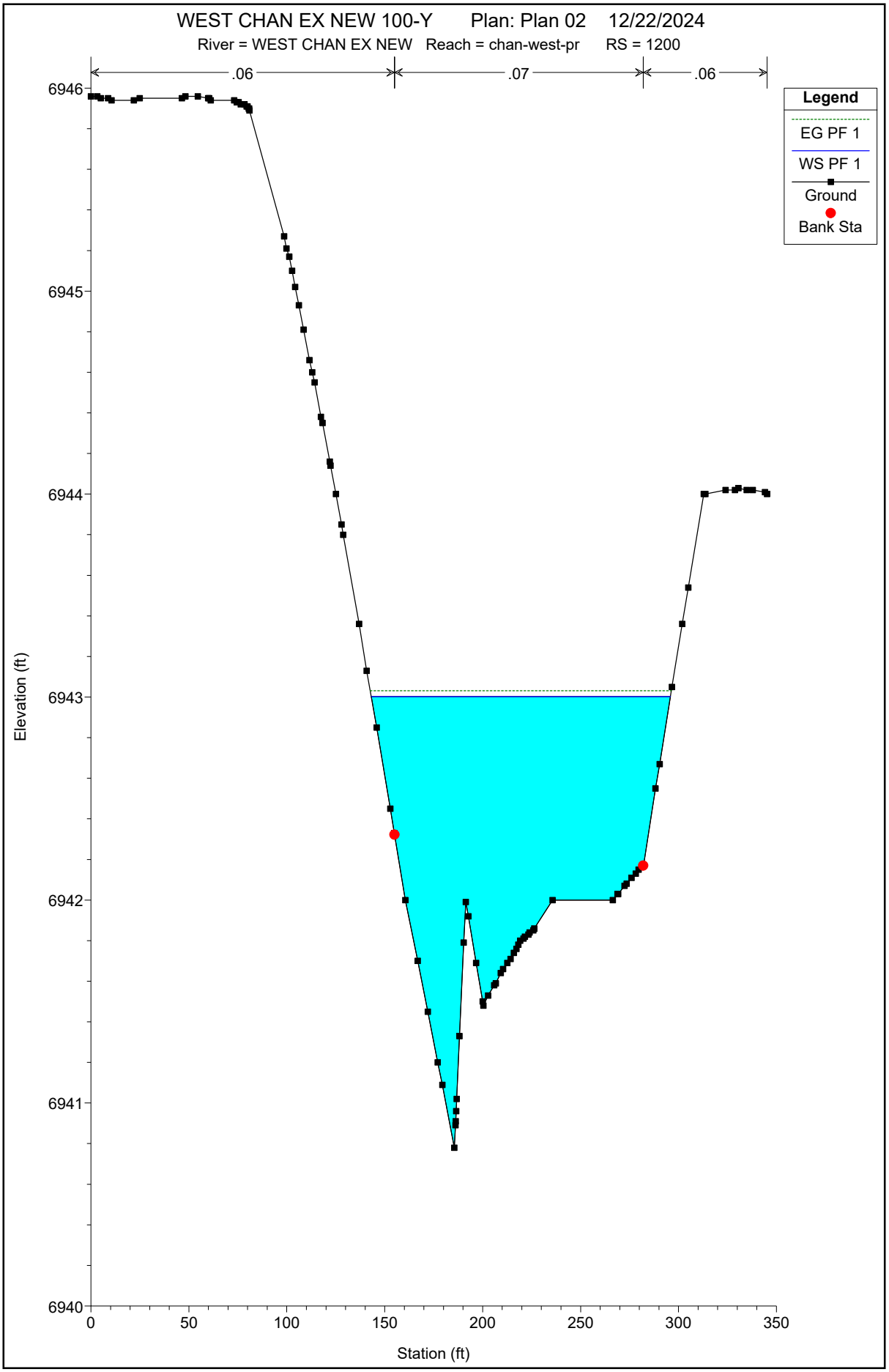

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 1700
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6955
6954
6953
6952
6951
6950
6949
6948
6947
0
100
200
300
400
Station (ft)

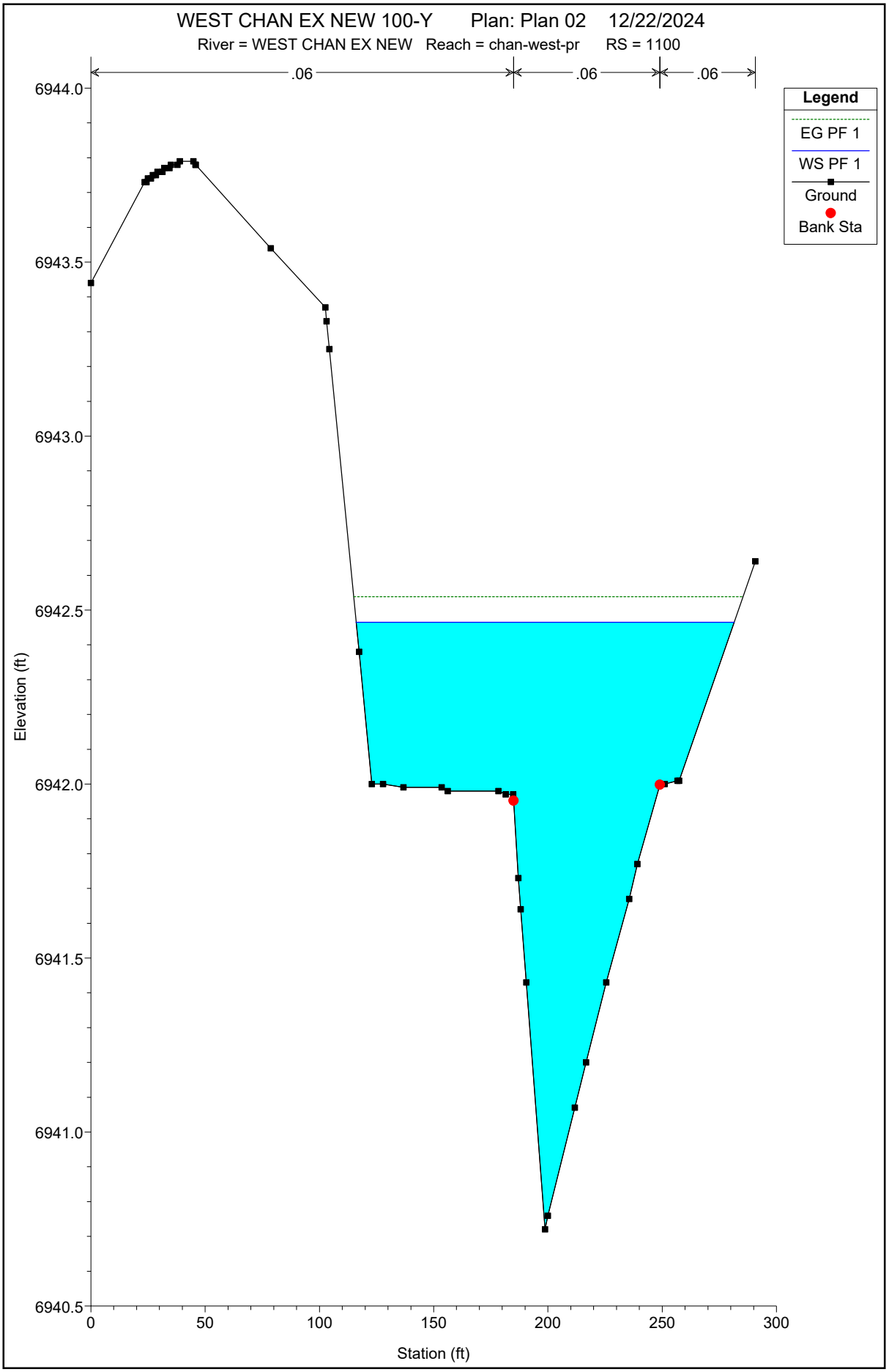

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 1600
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6953
6952
6951
6950
6949
6948
6947
6946
6945
0
100
200
300
400
Station (ft)

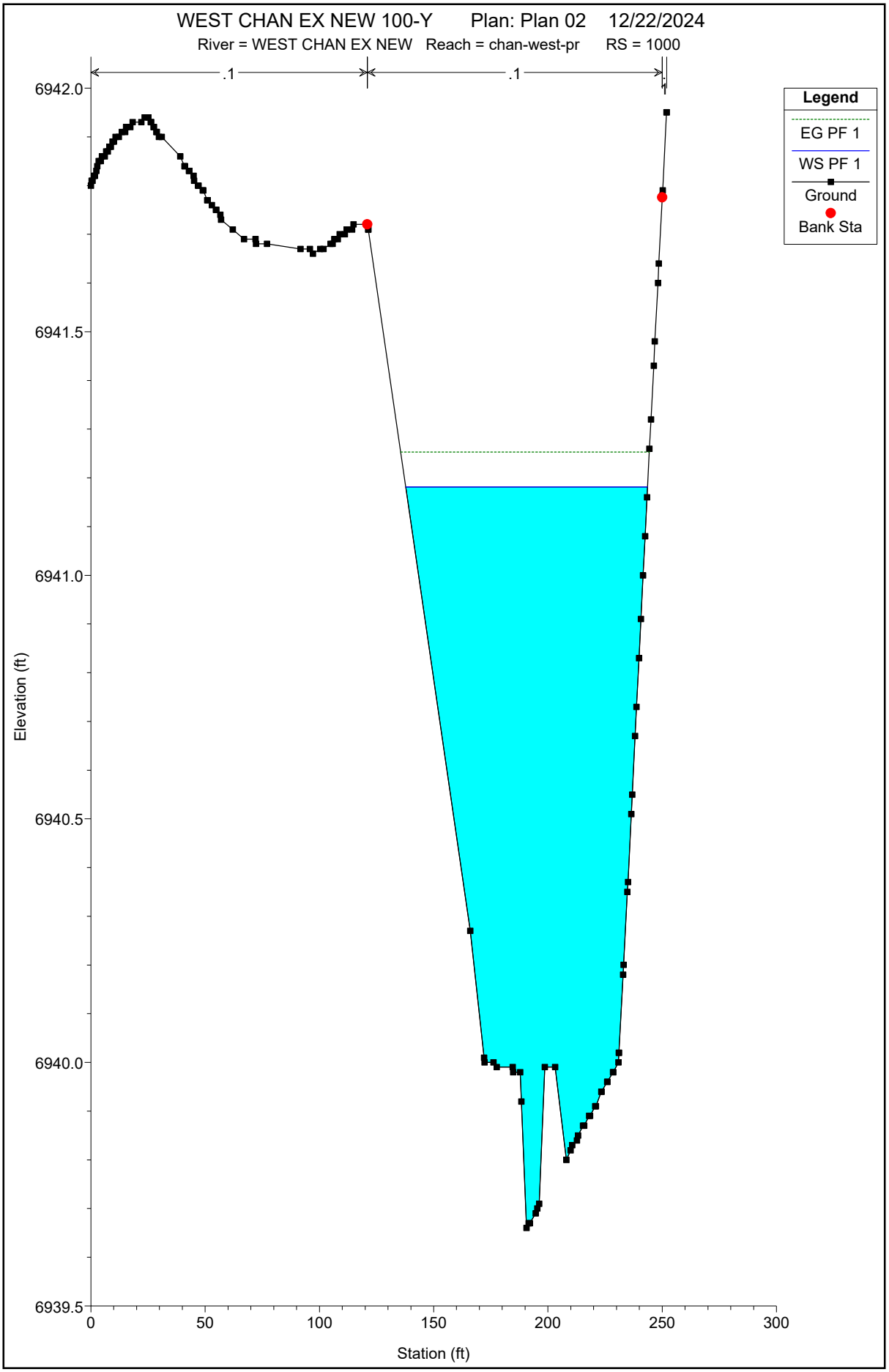

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 1500
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6951
6950
6949
6948
6947
6946
6945
6944
0
100
200
300
400
Station (ft)

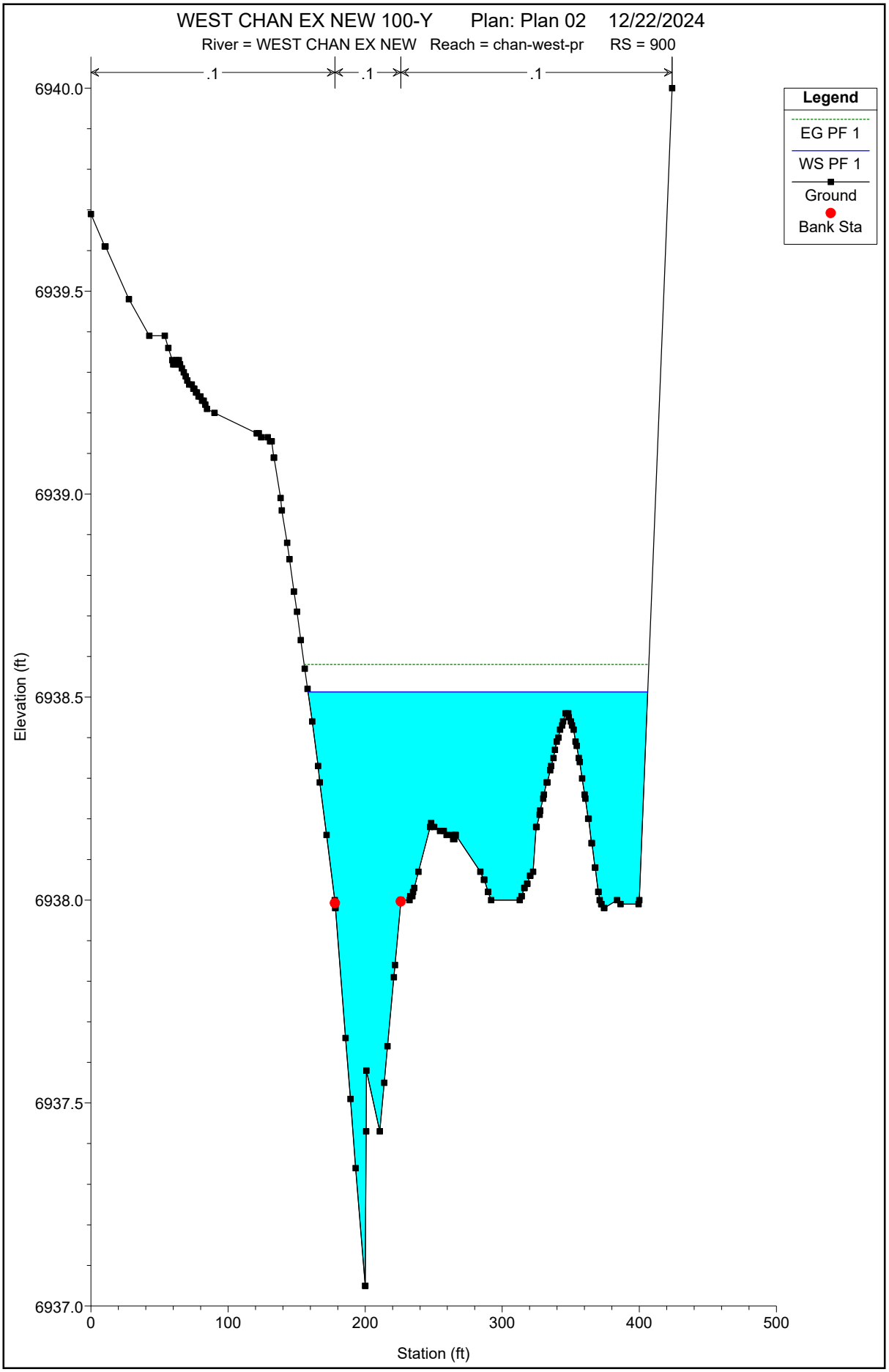

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 1400
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6951
6950
6949
6948
6947
6946
6945
6944
6943
0
100
200
300
400
Station (ft)

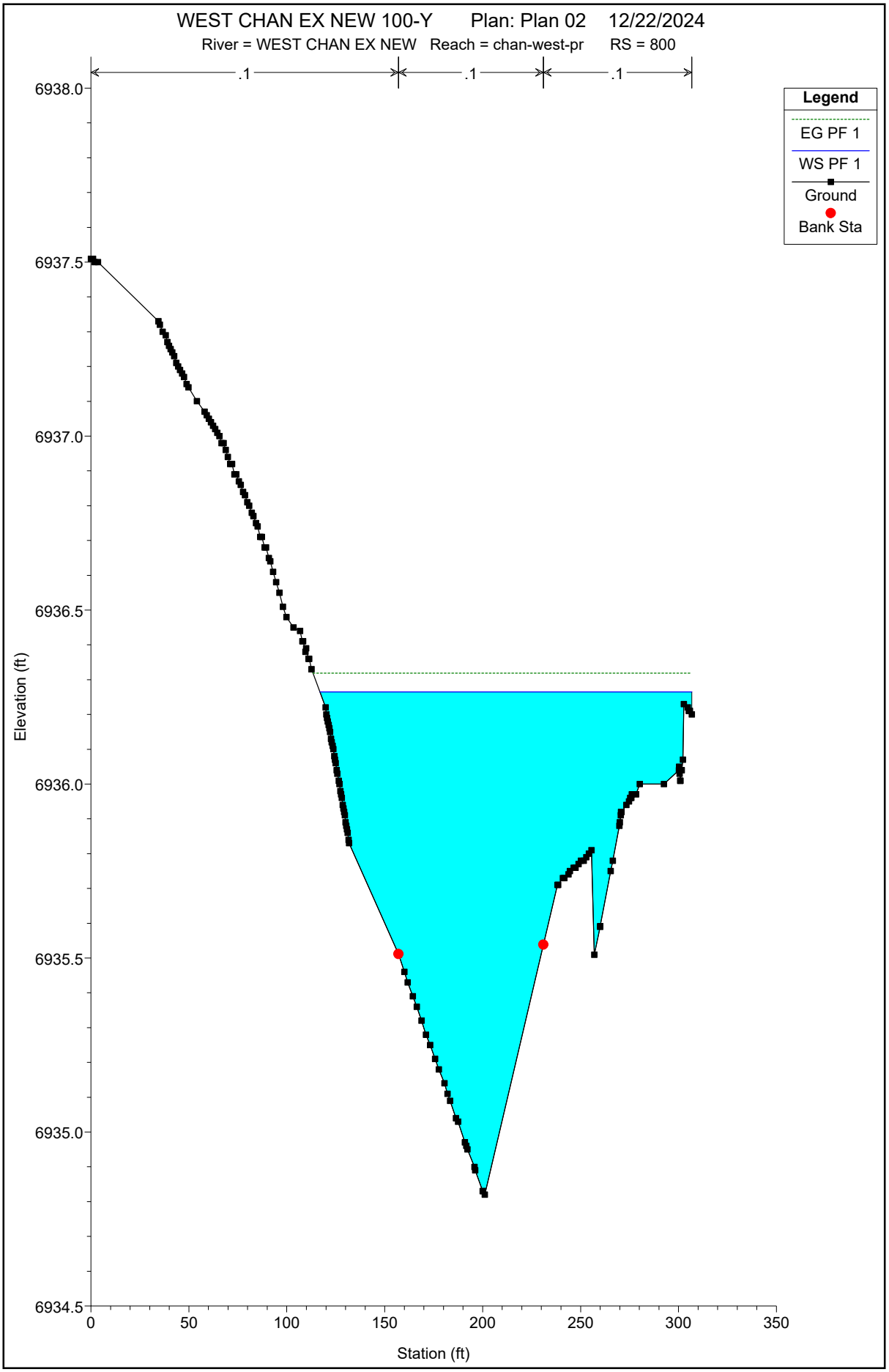

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 1300
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6949
6948
6947
6946
6945
6944
6943
6942
0
100
200
300
400
Station (ft)

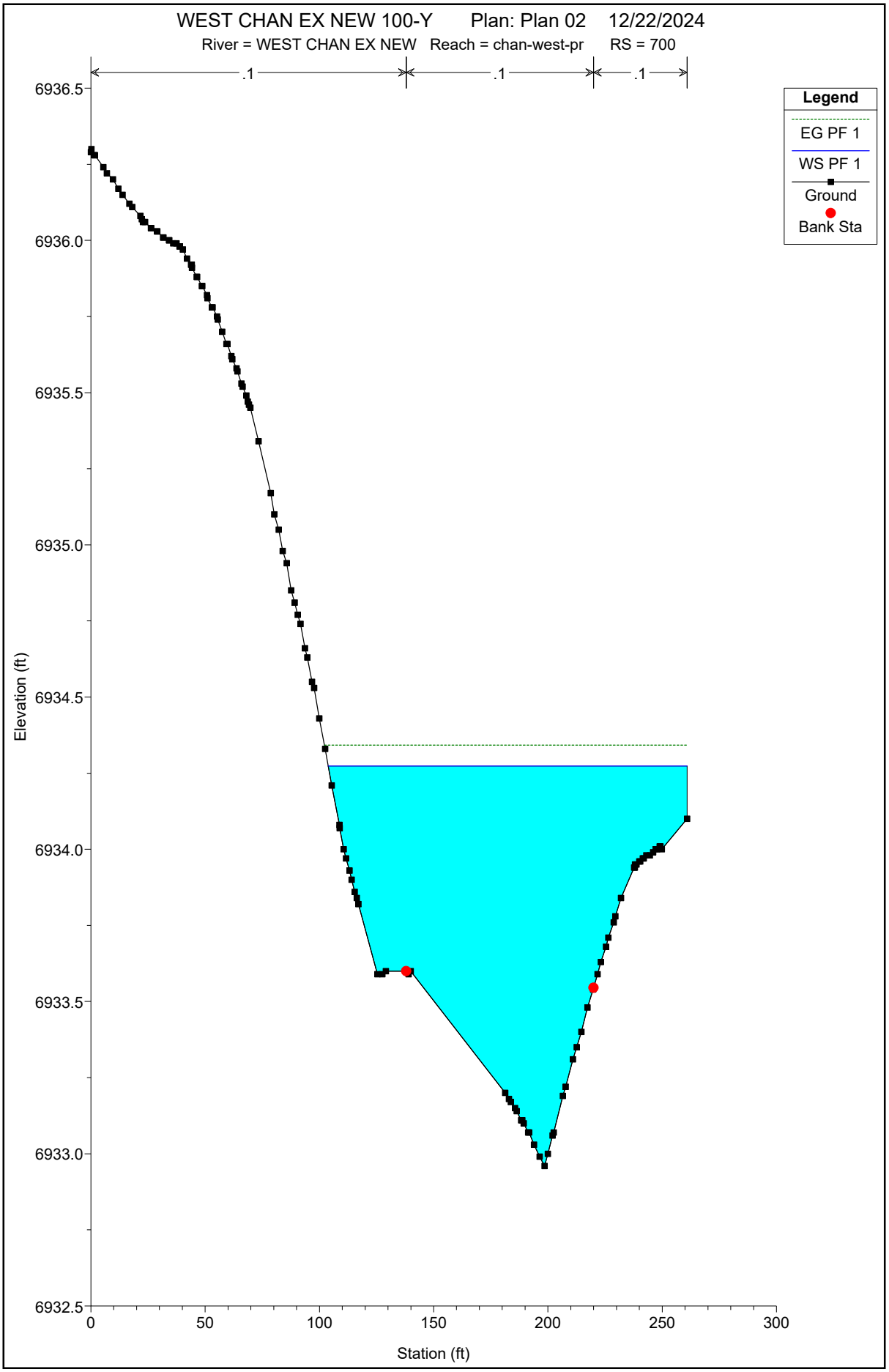

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 1200
.06
.07
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6946
6945
6944
6943
6942
6941
6940
0
50
100
150
200
250
300
350
Station (ft)

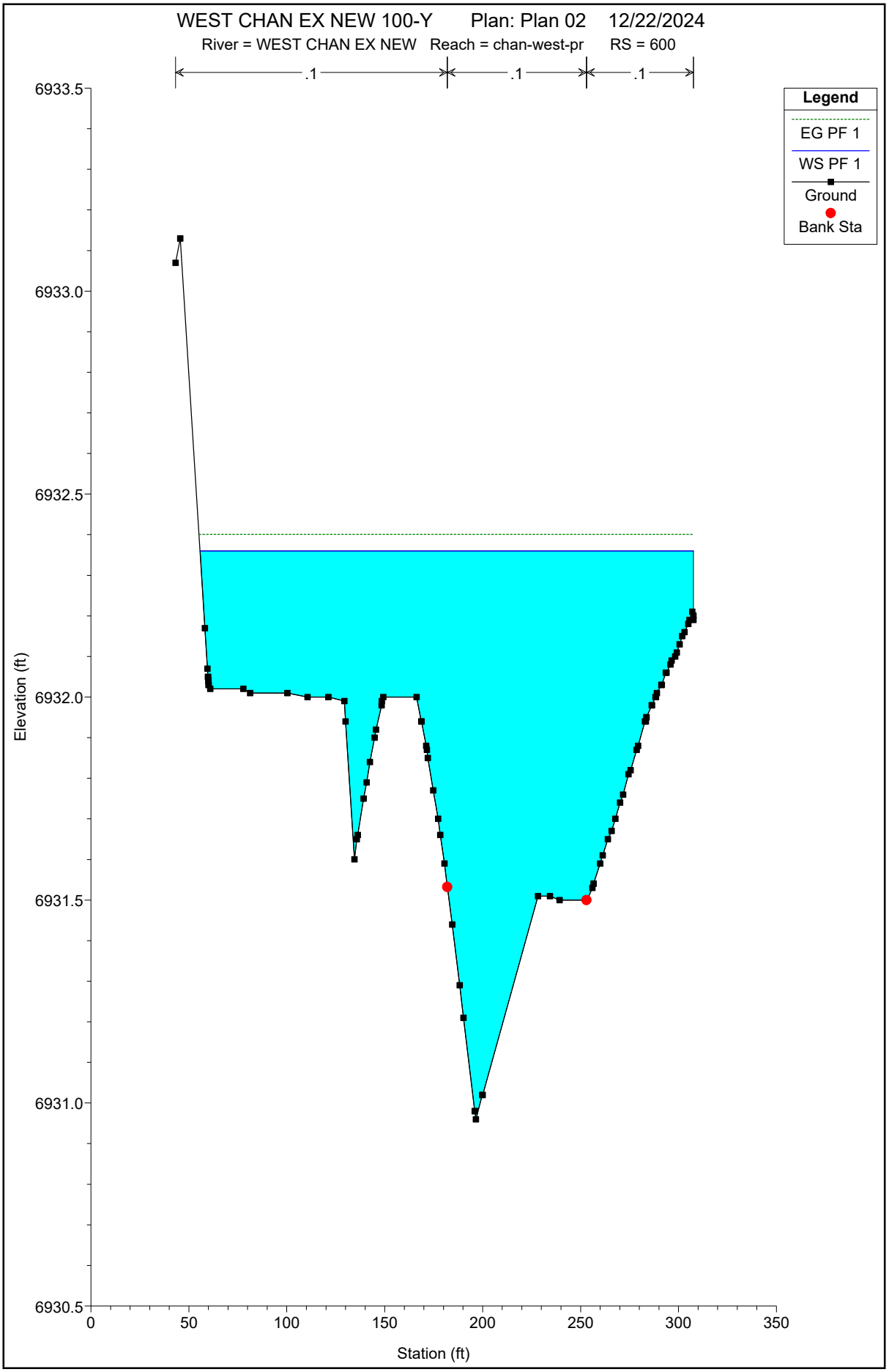

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 1100
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6944.0
6943.5
6943.0
6942.5
6942.0
6941.5
6941.0
6940.5
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

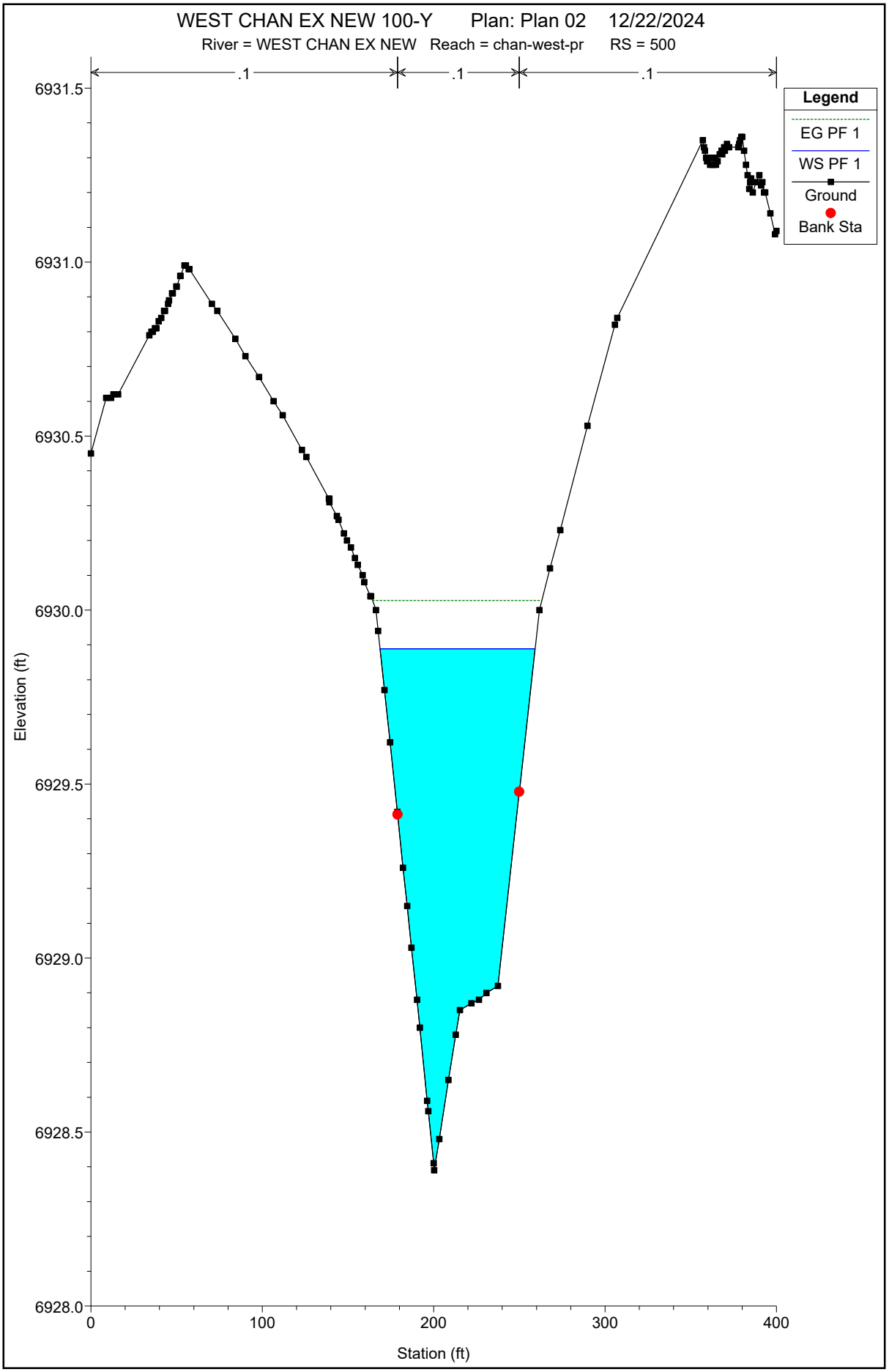

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 1000
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6942.0
6941.5
6941.0
6940.5
6940.0
6939.5
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

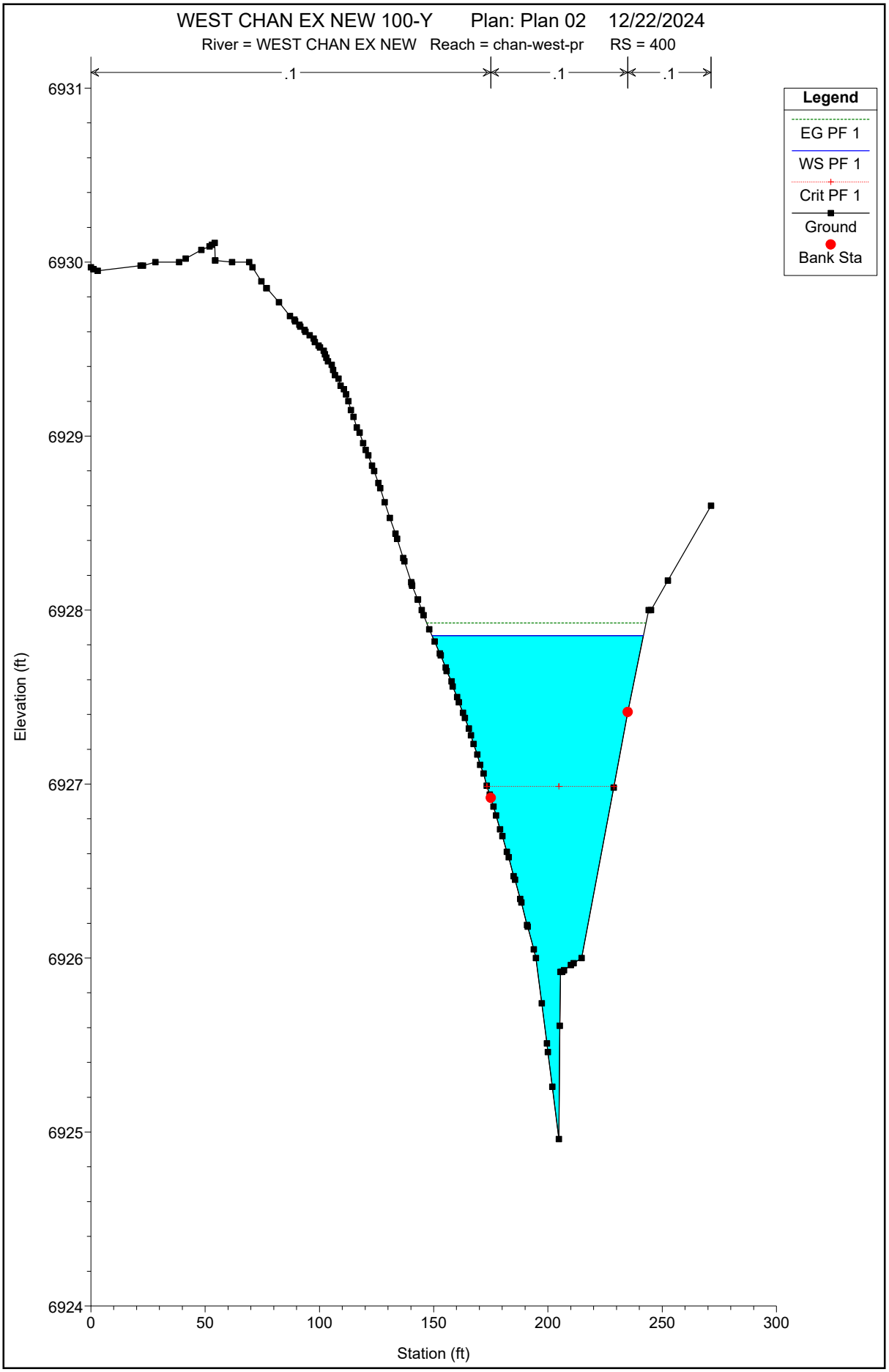

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 900
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6940.0
6939.5
6939.0
6938.5
6938.0
6937.5
6937.0
Elevation (ft)
0
100
200
300
400
500
Station (ft)

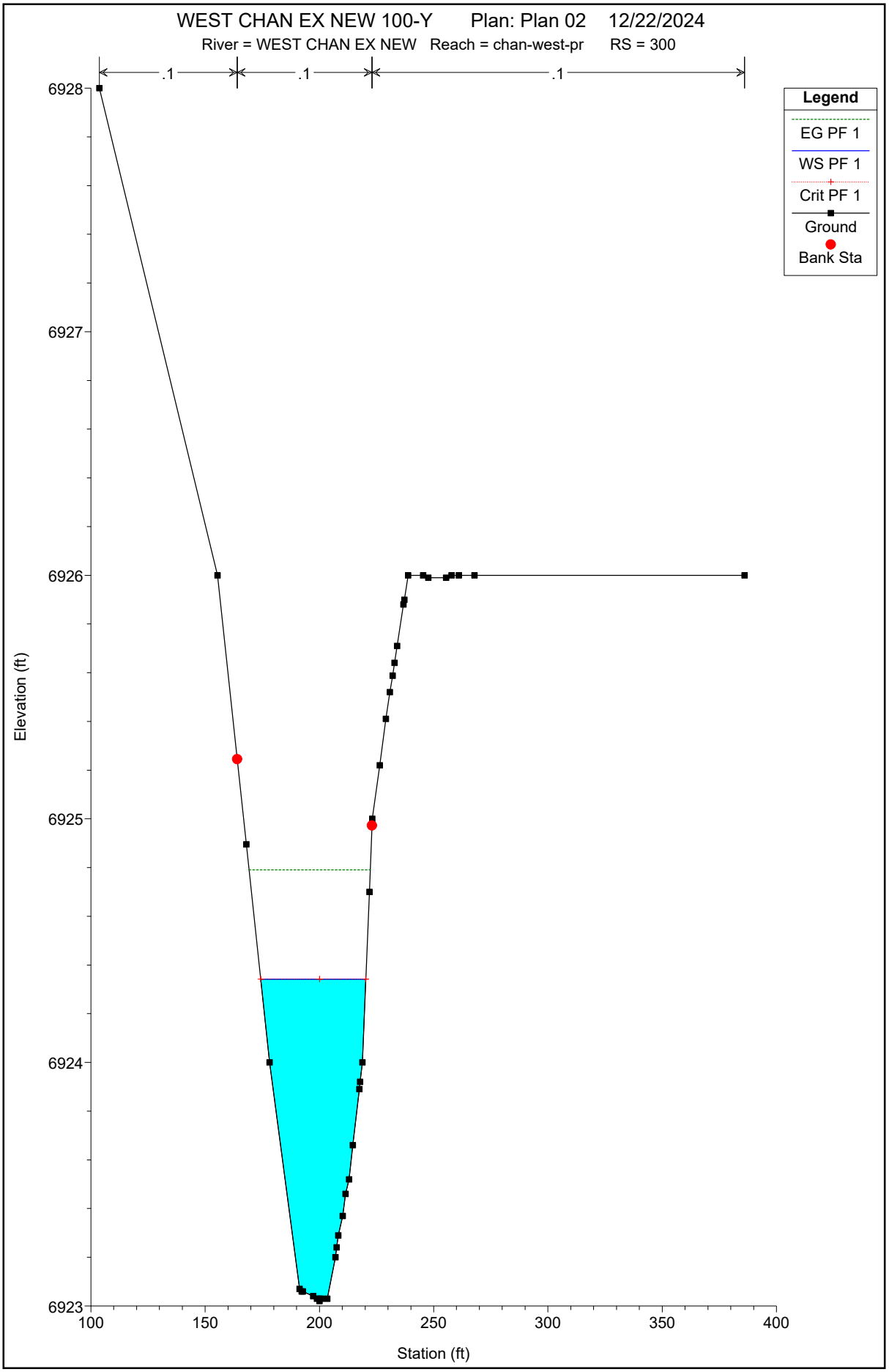

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 800
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6938.0
6937.5
6937.0
6936.5
6936.0
6935.5
6935.0
6934.5
Elevation (ft)
0
50
100
150
200
250
300
350
Station (ft)

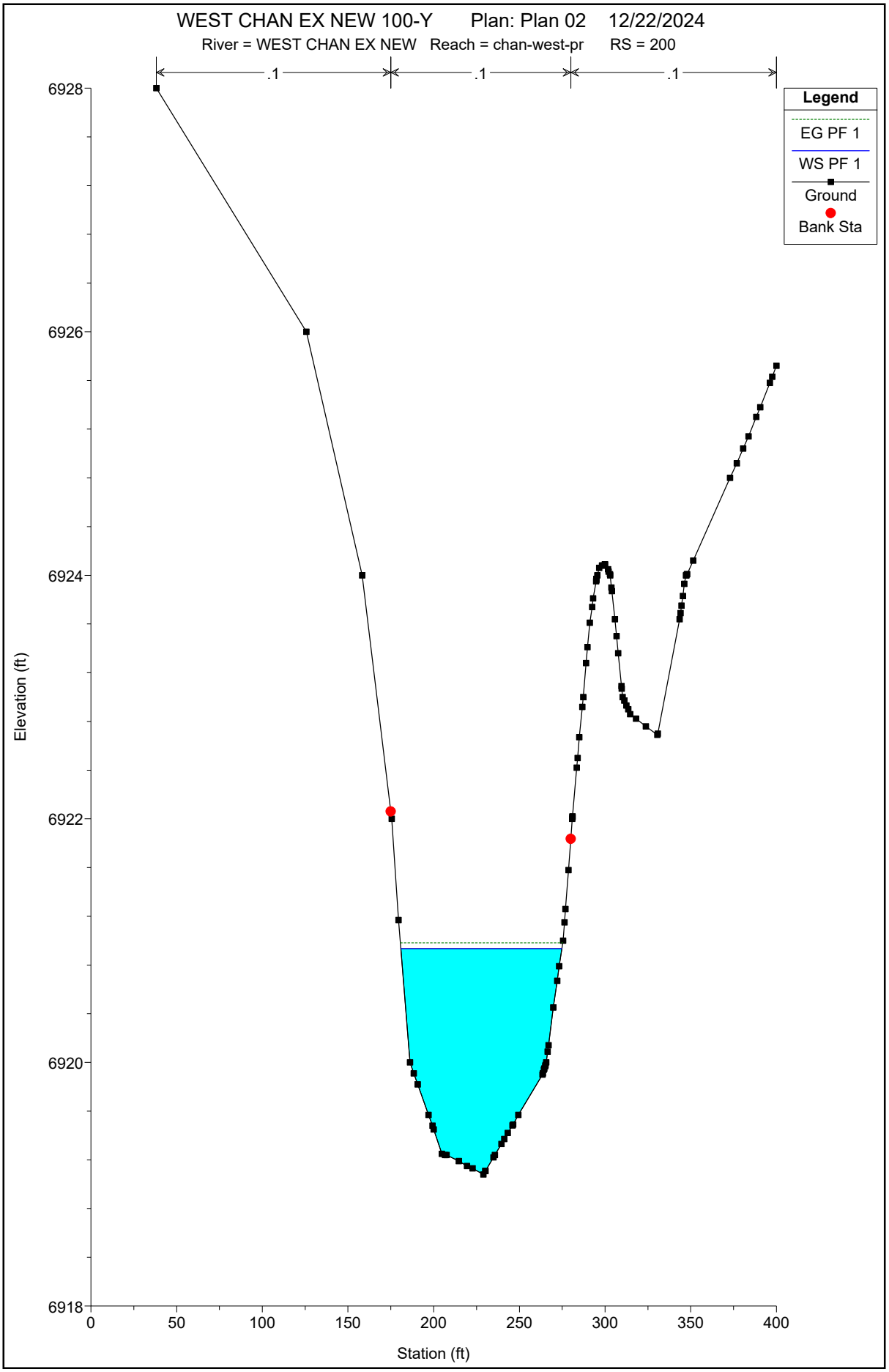

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 700
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6936.5
6936.0
6935.5
6935.0
6934.5
6934.0
6933.5
6933.0
6932.5
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

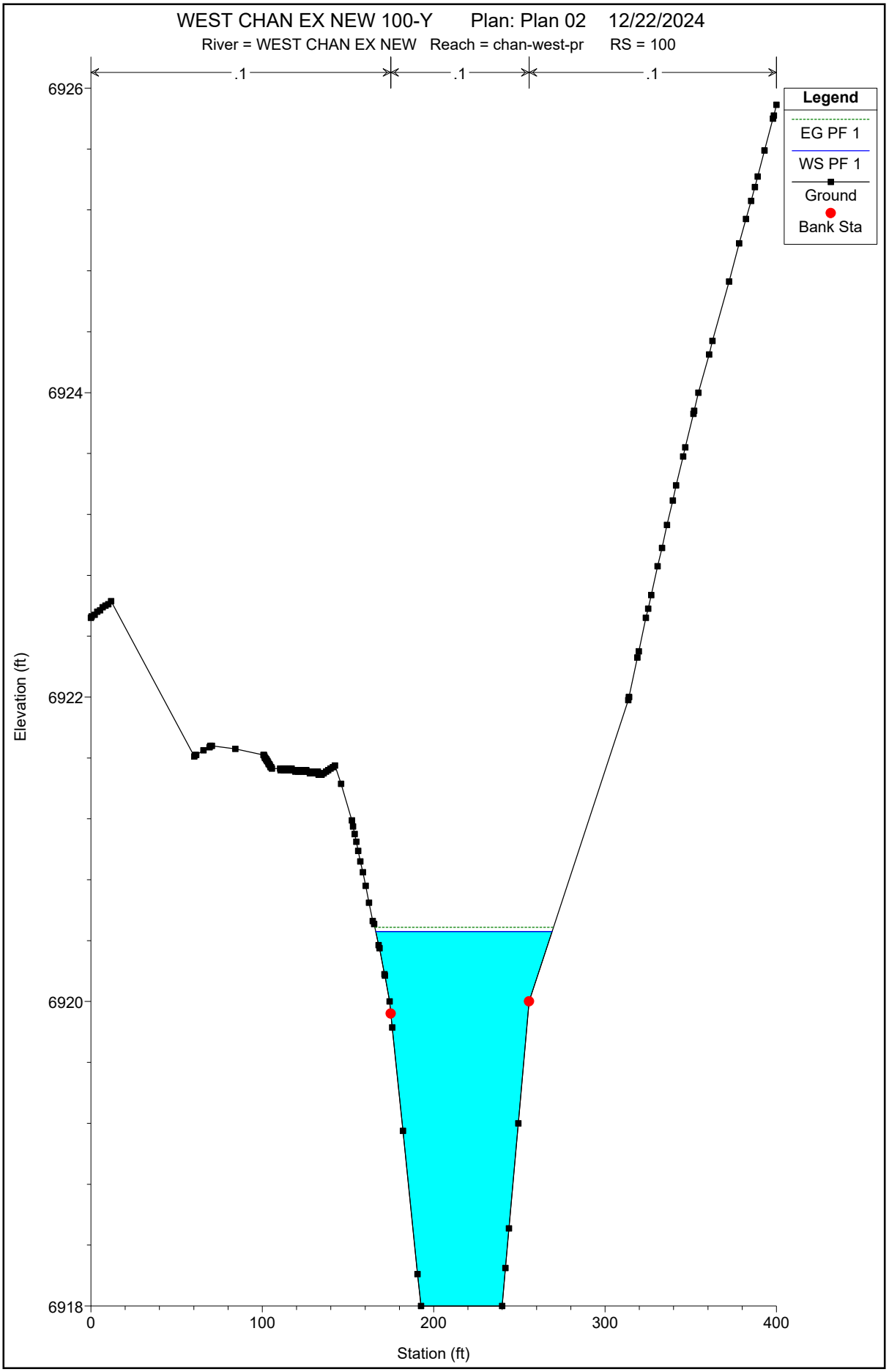

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 600
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6933.5
6933.0
6932.5
6932.0
6931.5
6931.0
6930.5
Elevation (ft)
0
50
100
150
200
250
300
350
Station (ft)

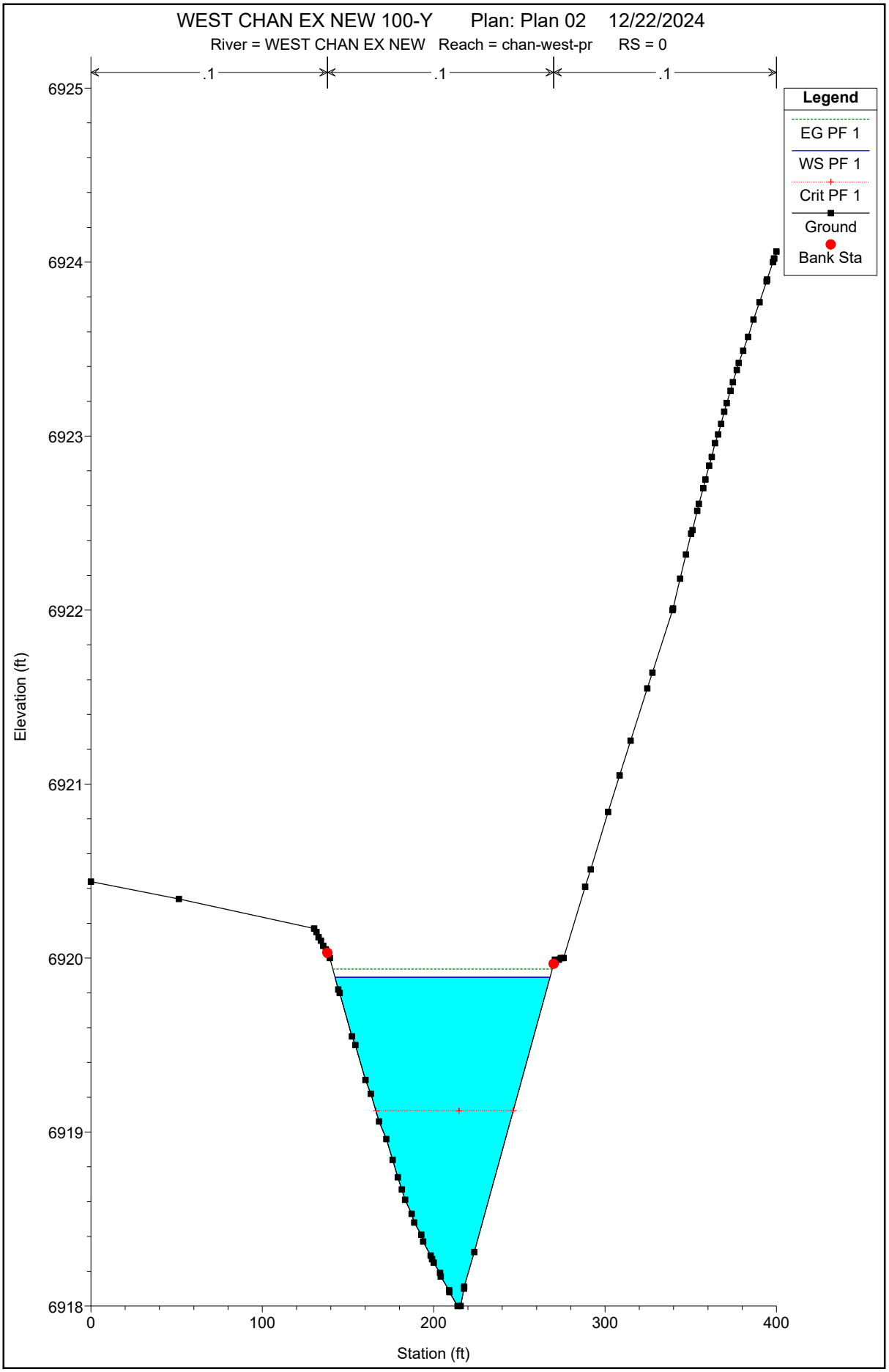

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 500
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6931.5
6931.0
6930.5
6930.0
6929.5
6929.0
6928.5
6928.0
Elevation (ft)
0
100
200
300
400
Station (ft)

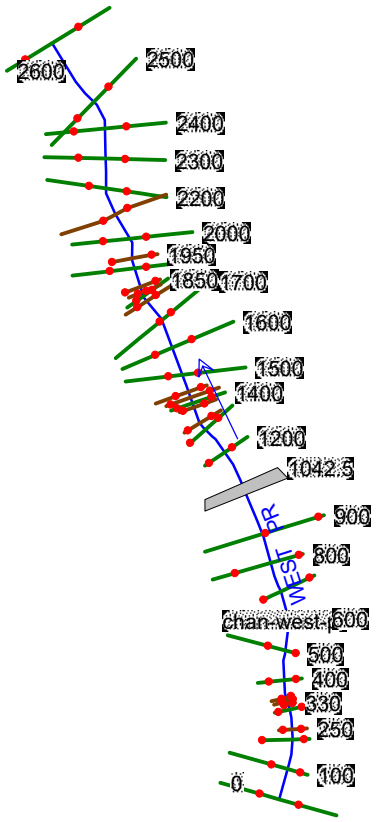

WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 400
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6931
6930
6929
6928
6927
6926
6925
6924
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)


WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 300
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6928
6927
6926
6925
6924
6923
Elevation (ft)
100
150
200
250
300
350
400
Station (ft)


WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 200
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6928
6926
6924
6922
6920
6918
Elevation (ft)
0
50
100
150
200
250
300
350
400
Station (ft)


WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 100
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6926
6924
6922
6920
6918
Elevation (ft)
0
100
200
300
400
Station (ft)


WEST CHAN EX NEW 100-Y Plan: Plan 02 12/22/2024
River = WEST CHAN EX NEW Reach = chan-west-pr RS = 0
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6925
6924
6923
6922
6921
6920
6919
6918
Elevation (ft)
0
100
200
300
400
Station (ft)



Some schematic data outside default extents (see View/Set Schematic Plot Extents...)

PROPOSED WEST CHANNEL 100-Y

HEC-RAS Plan: Plan p02 River: WEST PR Reach: chan-west-pr Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
chan-west-pr	2600	PF 1	216.00	6966.83	6967.85		6967.93	0.018480	2.32	93.12	162.80	0.54
chan-west-pr	2500	PF 1	216.00	6964.90	6965.79		6965.90	0.022300	2.63	82.02	136.48	0.60
chan-west-pr	2400	PF 1	216.00	6963.25	6964.31		6964.37	0.010916	2.03	106.60	153.80	0.43
chan-west-pr	2300	PF 1	216.00	6961.27	6962.36		6962.51	0.038187	3.10	69.57	135.31	0.76
chan-west-pr	2200	PF 1	216.00	6958.46	6959.85		6959.95	0.018192	2.56	84.60	129.59	0.55
chan-west-pr	2100	PF 1	216.00	6955.98	6957.55		6957.75	0.026921	3.58	60.39	73.05	0.69
chan-west-pr	2000	PF 1	216.00	6954.57	6956.33		6956.40	0.007738	2.18	98.95	98.57	0.38
chan-west-pr	1950	PF 1	216.00	6953.44	6955.36		6955.46	0.011771	2.46	87.72	99.89	0.46
chan-west-pr	1900	PF 1	216.00	6952.76	6954.86		6954.94	0.009029	2.16	99.81	113.00	0.41
chan-west-pr	1850	PF 1	216.00	6951.60	6953.22		6953.42	0.029464	3.66	59.03	73.85	0.72
chan-west-pr	1820	PF 1	216.00	6950.65	6951.94	6951.86	6952.34	0.043656	5.06	42.71	44.04	0.9
chan-west-pr	1800	PF 1	216.00	6950.00	6950.92	6950.92	6951.35	0.057149	5.25	41.18	49.12	1.0
chan-west-pr	1780	PF 1	216.00	6948.00	6950.44		6950.53	0.004383	2.43	89.00	48.83	0.32
chan-west-pr	1700	PF 1	216.00	6947.11	6949.64		6949.88	0.018693	3.93	54.95	43.40	0.62
chan-west-pr	1600	PF 1	216.00	6945.84	6948.23		6948.37	0.012010	2.97	72.67	63.17	0.49
chan-west-pr	1500	PF 1	216.00	6944.87	6947.02	6946.57	6947.13	0.012690	2.66	81.10	86.75	0.49
chan-west-pr	1440	PF 1	216.00	6944.35	6945.90	6945.66	6946.07	0.025967	3.36	64.33	83.31	0.67
chan-west-pr	1420	PF 1	216.00	6944.50	6945.02	6945.02	6945.27	0.068516	4.00	54.01	111.39	1.01
chan-west-pr	1400	PF 1	216.00	6941.00	6942.05		6942.11	0.006974	2.06	104.70	104.87	0.36
chan-west-pr	1380	PF 1	216.00	6940.70	6941.97		6942.01	0.003173	1.61	133.78	106.25	0.25
chan-west-pr	1340	PF 1	216.00	6940.60	6941.23		6941.40	0.034542	3.32	65.03	105.95	0.75
chan-west-pr	1300	PF 1	216.00	6939.80	6940.97		6941.01	0.003931	1.67	129.32	115.65	0.28
chan-west-pr	1200	PF 1	216.00	6938.25	6940.90	6938.86	6940.91	0.000412	0.93	235.54	99.66	0.10
chan-west-pr	1042.5		Culvert									
chan-west-pr	900	PF 1	222.00	6935.37	6936.76		6936.81	0.010333	1.68	132.40	112.98	0.27
chan-west-pr	800	PF 1	222.00	6934.21	6935.71		6935.74	0.010932	1.52	146.24	151.34	0.27
chan-west-pr	700	PF 1	222.00	6932.80	6934.20		6934.26	0.021238	1.81	122.92	161.31	0.36
chan-west-pr	600	PF 1	222.00	6930.86	6932.42		6932.45	0.015472	1.52	154.43	246.36	0.31
chan-west-pr	500	PF 1	222.00	6928.40	6929.91		6930.04	0.043154	2.80	79.17	91.39	0.53
chan-west-pr	400	PF 1	222.00	6924.97	6927.99		6928.05	0.011259	1.88	117.99	90.52	0.29
chan-west-pr	370	PF 1	222.00	6924.50	6926.26	6925.64	6926.40	0.026430	2.94	76.46	64.47	0.45
chan-west-pr	350	PF 1	222.00	6924.00	6924.88	6924.88	6925.30	0.159086	5.17	42.94	52.49	1.01
chan-west-pr	330	PF 1	222.00	6922.00	6924.08		6924.18	0.013338	2.52	88.17	49.72	0.33
chan-west-pr	300	PF 1	222.00	6921.60	6923.73		6923.81	0.011412	2.33	95.12	52.82	0.31
chan-west-pr	250	PF 1	222.00	6920.20	6921.88		6922.03	0.031497	3.04	73.10	58.98	0.48
chan-west-pr	200	PF 1	222.00	6919.30	6921.01		6921.07	0.012198	1.85	119.81	99.73	0.30
chan-west-pr	100	PF 1	222.00	6918.00	6920.46		6920.49	0.003285	1.33	169.27	98.32	0.17
chan-west-pr	0	PF 1	222.00	6918.00	6919.14	6919.14	6919.45	0.172225	4.46	49.81	81.02	1.00

DROP STRUCTURE

DROP STRUCTURE

DROP STRUCTURE

PROPOSED WEST CHANNEL 100-Y
W/ 0.05 MANNING'S M

HEC-RAS Plan: Plan p02 River: WEST PR Reach: chan-west-pr Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
chan-west-pr	2600	PF 1	216.00	6966.83	6967.79	6967.63	6967.89	0.017175	2.56	84.41	158.48	0.62
chan-west-pr	2500	PF 1	216.00	6964.90	6965.69		6965.84	0.024719	3.11	69.55	128.33	0.74
chan-west-pr	2400	PF 1	216.00	6963.25	6964.24		6964.32	0.010095	2.24	96.61	149.08	0.49
chan-west-pr	2300	PF 1	216.00	6961.27	6962.28	6962.26	6962.49	0.042212	3.62	59.59	130.19	0.94
chan-west-pr	2200	PF 1	216.00	6958.46	6959.79		6959.91	0.017125	2.83	76.43	123.60	0.63
chan-west-pr	2100	PF 1	216.00	6955.98	6957.42	6957.32	6957.70	0.029179	4.21	51.36	68.04	0.85
chan-west-pr	2000	PF 1	216.00	6954.57	6956.21		6956.30	0.007638	2.46	87.67	94.80	0.45
chan-west-pr	1950	PF 1	216.00	6953.44	6955.25		6955.37	0.011597	2.81	76.87	93.35	0.55
chan-west-pr	1900	PF 1	216.00	6952.76	6954.78		6954.87	0.008538	2.40	89.86	109.56	0.47
chan-west-pr	1850	PF 1	216.00	6951.60	6953.10	6953.01	6953.38	0.030534	4.25	50.80	68.49	0.87
chan-west-pr	1820	PF 1	216.00	6950.65	6951.86	6951.86	6952.33	0.038735	5.51	39.17	42.65	1.01
chan-west-pr	1800	PF 1	216.00	6950.00	6950.92	6950.92	6951.35	0.039687	5.25	41.18	49.12	1.01
chan-west-pr	1780	PF 1	216.00	6948.00	6950.28		6950.39	0.003813	2.65	81.49	46.38	0.35
chan-west-pr	1700	PF 1	216.00	6947.11	6949.45		6949.78	0.019800	4.58	47.14	40.59	0.75
chan-west-pr	1600	PF 1	216.00	6945.84	6948.06		6948.24	0.011761	3.48	62.11	55.19	0.58
chan-west-pr	1500	PF 1	216.00	6944.87	6946.94	6946.57	6947.07	0.011405	2.92	73.87	83.35	0.55
chan-west-pr	1440	PF 1	216.00	6944.35	6945.76	6945.66	6946.01	0.029893	4.06	53.23	75.78	0.85
chan-west-pr	1420	PF 1	216.00	6944.50	6945.02	6945.02	6945.27	0.047580	4.00	54.01	111.39	1.01
chan-west-pr	1400	PF 1	216.00	6941.00	6941.96		6942.04	0.006457	2.26	95.77	104.14	0.41
chan-west-pr	1380	PF 1	216.00	6940.70	6941.90		6941.95	0.002644	1.71	126.57	106.14	0.28
chan-west-pr	1340	PF 1	216.00	6940.60	6941.12	6941.12	6941.38	0.045644	4.05	53.40	104.89	1.00
chan-west-pr	1300	PF 1	216.00	6939.80	6940.94		6940.99	0.002969	1.71	125.99	115.40	0.29
chan-west-pr	1200	PF 1	216.00	6938.25	6940.90	6938.86	6940.91	0.000286	0.93	235.54	99.66	0.10
chan-west-pr	1042.5		Culvert									
chan-west-pr	900	PF 1	222.00	6935.37	6936.35		6936.45	0.010430	2.58	86.11	109.86	0.51
chan-west-pr	800	PF 1	222.00	6934.21	6935.34		6935.42	0.010042	2.36	94.03	133.17	0.50
chan-west-pr	700	PF 1	222.00	6932.80	6933.90	6933.74	6934.03	0.020670	2.90	76.49	136.60	0.68
chan-west-pr	600	PF 1	222.00	6930.86	6932.18	6932.00	6932.27	0.014913	2.33	97.78	236.96	0.57
chan-west-pr	500	PF 1	222.00	6928.40	6929.55	6929.55	6929.87	0.043325	4.59	48.38	75.67	1.01
chan-west-pr	400	PF 1	222.00	6924.97	6927.55		6927.67	0.008434	2.77	80.19	78.03	0.48
chan-west-pr	370	PF 1	222.00	6924.50	6925.64	6925.64	6926.08	0.038443	5.28	42.05	48.61	1.00
chan-west-pr	350	PF 1	222.00	6924.00	6924.89	6924.89	6925.30	0.039105	5.14	43.17	52.52	1.00
chan-west-pr	330	PF 1	222.00	6922.00	6923.39		6923.64	0.013917	4.02	55.29	44.71	0.64
chan-west-pr	300	PF 1	222.00	6921.60	6923.04		6923.25	0.011246	3.66	60.66	48.14	0.57
chan-west-pr	250	PF 1	222.00	6920.20	6921.53	6921.30	6921.80	0.019310	4.16	53.37	52.66	0.73
chan-west-pr	200	PF 1	222.00	6919.30	6920.34		6920.58	0.031158	3.93	56.53	87.22	0.86
chan-west-pr	100	PF 1	222.00	6918.00	6919.96		6920.01	0.001986	1.78	124.92	80.15	0.25
chan-west-pr	0	PF 1	222.00	6918.00	6919.14	6919.14	6919.45	0.043056	4.46	49.81	81.02	1.00

DROP STRUCTURE

DROP STRUCTURE

DROP STRUCTURE

HEC-RAS Plan: Plan p02 River: WEST PR Reach: chan-west-pr Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
chan-west-pr	2600	PF 1	34.00	6966.83	6967.39	6967.26	6967.42	0.019407	1.25	27.18	124.51	0.47
chan-west-pr	2500	PF 1	34.00	6964.90	6965.27	6965.18	6965.31	0.023072	1.48	22.93	92.66	0.53
chan-west-pr	2400	PF 1	34.00	6963.25	6963.72		6963.74	0.011246	1.15	29.48	101.26	0.38
chan-west-pr	2300	PF 1	34.00	6961.27	6961.88		6961.94	0.032970	1.93	17.64	62.76	0.64
chan-west-pr	2200	PF 1	34.00	6958.46	6959.12		6959.17	0.023467	1.87	18.22	52.79	0.56
chan-west-pr	2100	PF 1	34.00	6955.98	6956.76		6956.83	0.023358	2.11	16.09	38.55	0.58
chan-west-pr	2000	PF 1	34.00	6954.57	6955.41		6955.44	0.009227	1.36	25.06	58.15	0.36
chan-west-pr	1950	PF 1	34.00	6953.44	6954.52		6954.55	0.008387	1.39	24.48	51.04	0.35
chan-west-pr	1900	PF 1	34.00	6952.76	6954.13		6954.15	0.007665	1.18	28.83	71.72	0.33
chan-west-pr	1850	PF 1	34.00	6951.60	6952.31	6952.28	6952.45	0.062217	3.06	11.11	31.80	0.9
chan-west-pr	1820	PF 1	34.00	6950.65	6951.19	6951.05	6951.27	0.026685	2.39	14.20	31.11	0.6
chan-west-pr	1800	PF 1	34.00	6950.00	6950.28	6950.28	6950.41	0.078517	2.91	11.70	43.06	0.9
chan-west-pr	1780	PF 1	34.00	6948.00	6949.00		6949.02	0.002320	1.10	30.87	34.53	0.2
chan-west-pr	1700	PF 1	34.00	6947.11	6948.36		6948.51	0.050128	3.11	10.92	25.61	0.84
chan-west-pr	1600	PF 1	34.00	6945.84	6947.11		6947.14	0.006056	1.53	22.16	31.07	0.32
chan-west-pr	1500	PF 1	34.00	6944.87	6946.12		6946.17	0.018127	1.74	19.50	51.44	0.50
chan-west-pr	1440	PF 1	34.00	6944.35	6945.24		6945.28	0.012228	1.59	21.32	47.96	0.4
chan-west-pr	1420	PF 1	34.00	6944.50	6944.65	6944.65	6944.73	0.099195	2.21	15.36	101.65	1.0
chan-west-pr	1400	PF 1	34.00	6941.00	6941.28		6941.30	0.014911	1.27	26.74	97.99	0.4
chan-west-pr	1380	PF 1	34.00	6940.70	6941.22		6941.22	0.001572	0.63	54.06	104.98	0.1
chan-west-pr	1340	PF 1	34.00	6940.60	6940.75	6940.75	6940.83	0.098507	2.21	15.38	101.36	1.00
chan-west-pr	1300	PF 1	34.00	6939.80	6940.14		6940.15	0.006408	0.95	35.90	108.65	0.29
chan-west-pr	1200	PF 1	34.00	6938.25	6938.43	6938.43	6938.52	0.096858	2.42	14.04	79.74	1.02
chan-west-pr	1042.5		Culvert									
chan-west-pr	900	PF 1	37.00	6935.37	6936.14		6936.15	0.002971	0.59	63.01	102.01	0.13
chan-west-pr	800	PF 1	37.00	6934.42	6935.49		6935.51	0.020998	1.22	30.30	70.91	0.33
chan-west-pr	700	PF 1	37.00	6932.80	6933.46		6933.47	0.019920	1.03	35.82	103.56	0.31
chan-west-pr	600	PF 1	37.00	6930.86	6931.79		6931.81	0.014124	1.15	36.27	110.54	0.28
chan-west-pr	500	PF 1	37.00	6928.40	6929.08		6929.15	0.069105	1.98	18.67	51.62	0.58
chan-west-pr	400	PF 1	37.00	6924.97	6926.75		6926.77	0.011861	1.21	30.47	46.47	0.26
chan-west-pr	370	PF 1	37.00	6924.50	6925.27	6924.89	6925.30	0.018263	1.46	25.38	40.91	0.3
chan-west-pr	350	PF 1	37.00	6924.00	6924.28	6924.28	6924.41	0.223040	2.92	12.69	47.34	0.9
chan-west-pr	330	PF 1	37.00	6922.00	6923.51		6923.52	0.001154	0.61	60.84	45.57	0.0
chan-west-pr	300	PF 1	37.00	6922.38	6923.24		6923.39	0.137106	3.12	11.87	27.76	0.8
chan-west-pr	250	PF 1	37.00	6920.20	6921.11		6921.13	0.008662	1.12	33.03	45.23	0.23
chan-west-pr	200	PF 1	37.00	6919.30	6919.78	6919.78	6919.90	0.234212	2.78	13.33	55.53	1.00
chan-west-pr	100	PF 1	37.00	6918.00	6919.17		6919.17	0.001401	0.55	66.69	66.81	0.10
chan-west-pr	0	PF 1	37.00	6918.00	6918.53	6918.53	6918.68	0.231293	3.07	12.05	42.77	1.02

DROP STRUCTURE

DROP STRUCTURE

DROP STRUCTURE

PROPOSED WEST CHANNEL 2-Y

HEC-RAS Plan: Plan p02 River: WEST PR Reach: chan-west-pr Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
chan-west-pr	2600	PF 1	22.00	6966.83	6967.33	6967.19	6967.35	0.020117	1.10	19.95	113.38	0.46
chan-west-pr	2500	PF 1	22.00	6964.90	6965.21		6965.24	0.022153	1.26	17.51	87.97	0.50
chan-west-pr	2400	PF 1	22.00	6963.25	6963.63		6963.65	0.011997	1.03	21.38	91.49	0.38
chan-west-pr	2300	PF 1	22.00	6961.27	6961.81		6961.85	0.029694	1.65	13.30	55.03	0.59
chan-west-pr	2200	PF 1	22.00	6958.46	6959.01		6959.05	0.026173	1.73	12.73	44.90	0.57
chan-west-pr	2100	PF 1	22.00	6955.98	6956.65		6956.70	0.021236	1.83	12.01	33.18	0.54
chan-west-pr	2000	PF 1	22.00	6954.57	6955.28		6955.30	0.009888	1.23	17.92	50.86	0.36
chan-west-pr	1950	PF 1	22.00	6953.44	6954.38		6954.40	0.008119	1.24	17.71	42.62	0.34
chan-west-pr	1900	PF 1	22.00	6952.76	6954.00		6954.02	0.007271	1.07	20.48	56.29	0.31
chan-west-pr	1850	PF 1	22.00	6951.60	6952.18	6952.18	6952.32	0.073639	2.93	7.51	26.03	0.96
chan-west-pr	1820	PF 1	22.00	6950.65	6951.08	6950.95	6951.14	0.023784	1.99	11.05	29.34	0.57
chan-west-pr	1800	PF 1	22.00	6950.00	6950.21	6950.21	6950.31	0.087239	2.54	8.67	42.39	0.99
chan-west-pr	1780	PF 1	22.00	6948.00	6948.81		6948.83	0.001995	0.90	24.45	33.10	0.13
chan-west-pr	1700	PF 1	22.00	6947.11	6948.24	6948.19	6948.36	0.055947	2.77	7.94	24.06	0.85
chan-west-pr	1600	PF 1	22.00	6945.84	6946.89		6946.92	0.006288	1.39	15.85	26.57	0.32
chan-west-pr	1500	PF 1	22.00	6944.87	6945.89		6945.96	0.016715	2.03	10.82	21.28	0.50
chan-west-pr	1440	PF 1	22.00	6944.35	6945.13		6945.15	0.010590	1.35	16.24	41.85	0.38
chan-west-pr	1420	PF 1	22.00	6944.50	6944.62	6944.62	6944.67	0.098664	1.86	11.81	100.70	0.96
chan-west-pr	1400	PF 1	22.00	6941.00	6941.17		6941.20	0.029371	1.31	16.74	97.06	0.56
chan-west-pr	1380	PF 1	22.00	6940.70	6941.12		6941.12	0.001353	0.51	43.50	104.80	0.14
chan-west-pr	1340	PF 1	22.00	6940.60	6940.72	6940.72	6940.77	0.093407	1.83	12.02	101.05	0.94
chan-west-pr	1300	PF 1	22.00	6939.80	6940.06		6940.07	0.006238	0.79	27.80	108.02	0.27
chan-west-pr	1200	PF 1	22.00	6938.25	6938.38	6938.38	6938.45	0.104661	2.09	10.55	79.38	1.01
chan-west-pr	1042.5		Culvert									
chan-west-pr	900	PF 1	24.00	6935.37	6935.98		6935.99	0.003232	0.51	46.94	99.66	0.13
chan-west-pr	800	PF 1	24.00	6934.42	6935.32		6935.34	0.018529	1.18	20.31	45.43	0.31
chan-west-pr	700	PF 1	24.00	6932.80	6933.35		6933.36	0.020851	0.94	25.54	88.08	0.31
chan-west-pr	600	PF 1	24.00	6930.86	6931.67		6931.69	0.013873	1.01	24.99	78.37	0.27
chan-west-pr	500	PF 1	24.00	6928.40	6928.98		6929.03	0.071038	1.78	13.49	44.80	0.57
chan-west-pr	400	PF 1	24.00	6924.97	6926.54		6926.56	0.012280	1.11	21.66	38.81	0.26
chan-west-pr	370	PF 1	24.00	6924.50	6925.12	6924.79	6925.15	0.016339	1.22	19.62	37.90	0.30
chan-west-pr	350	PF 1	24.00	6924.00	6924.21	6924.21	6924.31	0.250286	2.55	9.41	46.74	1.00
chan-west-pr	330	PF 1	24.00	6922.00	6923.32		6923.32	0.000782	0.46	52.07	44.20	0.07
chan-west-pr	300	PF 1	24.00	6922.38	6923.05	6923.05	6923.22	0.215184	3.31	7.24	21.69	1.01
chan-west-pr	250	PF 1	24.00	6920.20	6920.94		6920.95	0.007874	0.94	25.48	42.14	0.21
chan-west-pr	200	PF 1	24.00	6919.30	6919.70	6919.70	6919.80	0.246084	2.54	9.45	46.77	1.00
chan-west-pr	100	PF 1	24.00	6918.00	6918.97		6918.98	0.001118	0.44	53.93	63.53	0.09
chan-west-pr	0	PF 1	24.00	6918.00	6918.45	6918.45	6918.57	0.237386	2.76	8.70	36.96	1.00

DROP STRUCTURE

DROP STRUCTURE

DROP STRUCTURE

PROPOSED WEST CHANNEL 100-Y

Plan: Plan p02 WEST PR chan-west-pr RS: 2600 Profile: PF 1

E.G. Elev (ft)	6967.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.		0.060	
W.S. Elev (ft)	6967.85	Reach Len. (ft)	92.00	100.00	105.00
Crit W.S. (ft)		Flow Area (sq ft)		93.12	
E.G. Slope (ft/ft)	0.018480	Area (sq ft)		93.12	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	162.80	Top Width (ft)		162.80	
Vel Total (ft/s)	2.32	Avg. Vel. (ft/s)		2.32	
Max Chl Dpth (ft)	1.02	Hydr. Depth (ft)		0.57	
Conv. Total (cfs)	1588.9	Conv. (cfs)		1588.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		162.82	
Min Ch El (ft)	6966.83	Shear (lb/sq ft)		0.66	
Alpha	1.00	Stream Power (lb/ft s)		1.53	
Frctn Loss (ft)	2.03	Cum Volume (acre-ft)	0.00	6.01	0.04
C & E Loss (ft)	0.00	Cum SA (acres)	0.02	6.72	0.19

Plan: Plan p02 WEST PR chan-west-pr RS: 2500 Profile: PF 1

E.G. Elev (ft)	6965.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.		0.060	
W.S. Elev (ft)	6965.79	Reach Len. (ft)	148.70	100.00	20.00
Crit W.S. (ft)		Flow Area (sq ft)		82.02	
E.G. Slope (ft/ft)	0.022300	Area (sq ft)		82.02	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	136.48	Top Width (ft)		136.48	
Vel Total (ft/s)	2.63	Avg. Vel. (ft/s)		2.63	
Max Chl Dpth (ft)	0.89	Hydr. Depth (ft)		0.60	
Conv. Total (cfs)	1446.5	Conv. (cfs)		1446.5	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		136.50	
Min Ch El (ft)	6964.90	Shear (lb/sq ft)		0.84	
Alpha	1.00	Stream Power (lb/ft s)		2.20	
Frctn Loss (ft)	1.51	Cum Volume (acre-ft)	0.00	5.81	0.04
C & E Loss (ft)	0.01	Cum SA (acres)	0.02	6.38	0.19

Plan: Plan p02 WEST PR chan-west-pr RS: 2400 Profile: PF 1

E.G. Elev (ft)	6964.37	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.		0.060	
W.S. Elev (ft)	6964.31	Reach Len. (ft)	119.30	100.00	96.70
Crit W.S. (ft)		Flow Area (sq ft)		106.60	
E.G. Slope (ft/ft)	0.010916	Area (sq ft)		106.60	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	153.80	Top Width (ft)		153.80	
Vel Total (ft/s)	2.03	Avg. Vel. (ft/s)		2.03	
Max Chl Dpth (ft)	1.06	Hydr. Depth (ft)		0.69	
Conv. Total (cfs)	2067.4	Conv. (cfs)		2067.4	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		153.82	
Min Ch El (ft)	6963.25	Shear (lb/sq ft)		0.47	
Alpha	1.00	Stream Power (lb/ft s)		0.96	
Frctn Loss (ft)	1.85	Cum Volume (acre-ft)	0.00	5.59	0.04
C & E Loss (ft)	0.01	Cum SA (acres)	0.02	6.04	0.19

Plan: Plan p02 WEST PR chan-west-pr RS: 2300 Profile: PF 1

E.G. Elev (ft)	6962.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.		0.060	
W.S. Elev (ft)	6962.36	Reach Len. (ft)	113.10	100.00	97.60
Crit W.S. (ft)		Flow Area (sq ft)		69.57	
E.G. Slope (ft/ft)	0.038187	Area (sq ft)		69.57	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	135.31	Top Width (ft)		135.31	
Vel Total (ft/s)	3.10	Avg. Vel. (ft/s)		3.10	
Max Chl Dpth (ft)	1.09	Hydr. Depth (ft)		0.51	
Conv. Total (cfs)	1105.3	Conv. (cfs)		1105.3	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		135.41	
Min Ch El (ft)	6961.27	Shear (lb/sq ft)		1.22	
Alpha	1.00	Stream Power (lb/ft s)		3.80	
Frctn Loss (ft)	2.55	Cum Volume (acre-ft)	0.00	5.39	0.04
C & E Loss (ft)	0.01	Cum SA (acres)	0.02	5.71	0.19

Plan: Plan p02 WEST PR chan-west-pr RS: 2200 Profile: PF 1

E.G. Elev (ft)	6959.95	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.	0.000	0.060	0.060
W.S. Elev (ft)	6959.85	Reach Len. (ft)	115.00	100.00	72.00
Crit W.S. (ft)		Flow Area (sq ft)	0.00	84.48	0.11
E.G. Slope (ft/ft)	0.018192	Area (sq ft)	0.00	84.48	0.11
Q Total (cfs)	216.00	Flow (cfs)	0.00	215.96	0.04
Top Width (ft)	129.59	Top Width (ft)	0.51	126.05	3.03
Vel Total (ft/s)	2.55	Avg. Vel. (ft/s)	0.11	2.56	0.37
Max Chl Dpth (ft)	1.39	Hydr. Depth (ft)	0.01	0.67	0.04
Conv. Total (cfs)	1601.4	Conv. (cfs)	0.0	1601.1	0.3
Length Wtd. (ft)	100.00	Wetted Per. (ft)	0.51	126.20	3.03
Min Ch El (ft)	6958.46	Shear (lb/sq ft)		0.76	0.04
Alpha	1.00	Stream Power (lb/ft s)		1.94	0.02
Frctn Loss (ft)	2.19	Cum Volume (acre-ft)	0.00	5.21	0.04
C & E Loss (ft)	0.01	Cum SA (acres)	0.02	5.41	0.19

Plan: Plan p02 WEST PR chan-west-pr RS: 2100 Profile: PF 1

E.G. Elev (ft)	6957.75	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	Wt. n-Val.		0.060	
W.S. Elev (ft)	6957.55	Reach Len. (ft)	71.61	100.00	83.53
Crit W.S. (ft)		Flow Area (sq ft)		60.39	
E.G. Slope (ft/ft)	0.026921	Area (sq ft)		60.39	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	73.05	Top Width (ft)		73.05	
Vel Total (ft/s)	3.58	Avg. Vel. (ft/s)		3.58	
Max Chl Dpth (ft)	1.57	Hydr. Depth (ft)		0.83	
Conv. Total (cfs)	1316.5	Conv. (cfs)		1316.5	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		73.12	
Min Ch El (ft)	6955.98	Shear (lb/sq ft)		1.39	
Alpha	1.00	Stream Power (lb/ft s)		4.96	
Frctn Loss (ft)	1.31	Cum Volume (acre-ft)	0.00	5.05	0.04
C & E Loss (ft)	0.04	Cum SA (acres)	0.02	5.18	0.18

Plan: Plan p02 WEST PR chan-west-pr RS: 2000 Profile: PF 1

E.G. Elev (ft)	6956.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.		0.060	
W.S. Elev (ft)	6956.33	Reach Len. (ft)	91.80	100.00	81.50
Crit W.S. (ft)		Flow Area (sq ft)		98.95	
E.G. Slope (ft/ft)	0.007738	Area (sq ft)		98.95	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	98.57	Top Width (ft)		98.57	
Vel Total (ft/s)	2.18	Avg. Vel. (ft/s)		2.18	
Max Chl Dpth (ft)	1.76	Hydr. Depth (ft)		1.00	
Conv. Total (cfs)	2455.5	Conv. (cfs)		2455.5	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		98.65	
Min Ch El (ft)	6954.57	Shear (lb/sq ft)		0.48	
Alpha	1.00	Stream Power (lb/ft s)		1.06	
Frctn Loss (ft)	0.94	Cum Volume (acre-ft)	0.00	4.86	0.04
C & E Loss (ft)	0.00	Cum SA (acres)	0.02	4.99	0.18

Plan: Plan p02 WEST PR chan-west-pr RS: 1950 Profile: PF 1

E.G. Elev (ft)	6955.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.		0.060	
W.S. Elev (ft)	6955.36	Reach Len. (ft)	45.30	50.00	59.50
Crit W.S. (ft)		Flow Area (sq ft)		87.72	
E.G. Slope (ft/ft)	0.011771	Area (sq ft)		87.72	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	99.89	Top Width (ft)		99.89	
Vel Total (ft/s)	2.46	Avg. Vel. (ft/s)		2.46	
Max Chl Dpth (ft)	1.92	Hydr. Depth (ft)		0.88	
Conv. Total (cfs)	1990.9	Conv. (cfs)		1990.9	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		99.98	
Min Ch El (ft)	6953.44	Shear (lb/sq ft)		0.64	
Alpha	1.00	Stream Power (lb/ft s)		1.59	
Frctn Loss (ft)	0.51	Cum Volume (acre-ft)	0.00	4.65	0.04
C & E Loss (ft)	0.01	Cum SA (acres)	0.02	4.76	0.18

Plan: Plan p02 WEST PR chan-west-pr RS: 1900 Profile: PF 1

E.G. Elev (ft)	6954.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.		0.060	
W.S. Elev (ft)	6954.86	Reach Len. (ft)	674.00	100.00	141.40
Crit W.S. (ft)		Flow Area (sq ft)		99.81	
E.G. Slope (ft/ft)	0.009029	Area (sq ft)		99.81	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	113.00	Top Width (ft)		113.00	
Vel Total (ft/s)	2.16	Avg. Vel. (ft/s)		2.16	
Max Chl Dpth (ft)	2.10	Hydr. Depth (ft)		0.88	
Conv. Total (cfs)	2273.1	Conv. (cfs)		2273.1	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		113.17	
Min Ch El (ft)	6952.76	Shear (lb/sq ft)		0.50	
Alpha	1.00	Stream Power (lb/ft s)		1.08	
Frctn Loss (ft)	1.50	Cum Volume (acre-ft)	0.00	4.54	0.04
C & E Loss (ft)	0.01	Cum SA (acres)	0.02	4.64	0.18

Plan: Plan p02 WEST PR chan-west-pr RS: 1850 Profile: PF 1

E.G. Elev (ft)	6953.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.		0.060	
W.S. Elev (ft)	6953.22	Reach Len. (ft)	24.00	30.00	35.00
Crit W.S. (ft)		Flow Area (sq ft)		59.03	
E.G. Slope (ft/ft)	0.029464	Area (sq ft)		59.03	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	73.85	Top Width (ft)		73.85	
Vel Total (ft/s)	3.66	Avg. Vel. (ft/s)		3.66	
Max Chl Dpth (ft)	1.62	Hydr. Depth (ft)		0.80	
Conv. Total (cfs)	1258.4	Conv. (cfs)		1258.4	
Length Wtd. (ft)	30.00	Wetted Per. (ft)		73.93	
Min Ch El (ft)	6951.60	Shear (lb/sq ft)		1.47	
Alpha	1.00	Stream Power (lb/ft s)		5.37	
Frctn Loss (ft)	1.07	Cum Volume (acre-ft)	0.00	4.36	0.04
C & E Loss (ft)	0.02	Cum SA (acres)	0.02	4.42	0.18

Plan: Plan p02 WEST PR chan-west-pr RS: 1820 Profile: PF 1

E.G. Elev (ft)	6952.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.40	Wt. n-Val.		0.060	
W.S. Elev (ft)	6951.94	Reach Len. (ft)	19.00	20.00	24.00
Crit W.S. (ft)	6951.86	Flow Area (sq ft)		42.71	
E.G. Slope (ft/ft)	0.043656	Area (sq ft)		42.71	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	44.04	Top Width (ft)		44.04	
Vel Total (ft/s)	5.06	Avg. Vel. (ft/s)		5.06	
Max Chl Dpth (ft)	1.29	Hydr. Depth (ft)		0.97	
Conv. Total (cfs)	1033.8	Conv. (cfs)		1033.8	
Length Wtd. (ft)	20.00	Wetted Per. (ft)		44.19	
Min Ch El (ft)	6950.65	Shear (lb/sq ft)		2.63	
Alpha	1.00	Stream Power (lb/ft s)		13.32	
Frctn Loss (ft)	0.99	Cum Volume (acre-ft)	0.00	4.32	0.04
C & E Loss (ft)	0.00	Cum SA (acres)	0.02	4.38	0.18

Plan: Plan p02 WEST PR chan-west-pr RS: 1800 Profile: PF 1

E.G. Elev (ft)	6951.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.43	Wt. n-Val.		0.060	
W.S. Elev (ft)	6950.92	Reach Len. (ft)	23.00	20.00	18.00
Crit W.S. (ft)	6950.92	Flow Area (sq ft)		41.18	
E.G. Slope (ft/ft)	0.057149	Area (sq ft)		41.18	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	49.12	Top Width (ft)		49.12	
Vel Total (ft/s)	5.25	Avg. Vel. (ft/s)		5.25	
Max Chl Dpth (ft)	0.92	Hydr. Depth (ft)		0.84	
Conv. Total (cfs)	903.5	Conv. (cfs)		903.5	
Length Wtd. (ft)	20.00	Wetted Per. (ft)		49.37	
Min Ch El (ft)	6950.00	Shear (lb/sq ft)		2.98	
Alpha	1.00	Stream Power (lb/ft s)		15.61	
Frctn Loss (ft)	0.22	Cum Volume (acre-ft)	0.00	4.30	0.04
C & E Loss (ft)	0.10	Cum SA (acres)	0.02	4.36	0.18

Plan: Plan p02 WEST PR chan-west-pr RS: 1780 Profile: PF 1

E.G. Elev (ft)	6950.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.		0.060	
W.S. Elev (ft)	6950.44	Reach Len. (ft)	82.00	80.00	78.00
Crit W.S. (ft)		Flow Area (sq ft)		89.00	
E.G. Slope (ft/ft)	0.004383	Area (sq ft)		89.00	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	48.83	Top Width (ft)		48.83	
Vel Total (ft/s)	2.43	Avg. Vel. (ft/s)		2.43	
Max Chl Dpth (ft)	2.44	Hydr. Depth (ft)		1.82	
Conv. Total (cfs)	3262.6	Conv. (cfs)		3262.6	
Length Wtd. (ft)	80.00	Wetted Per. (ft)		49.42	
Min Ch El (ft)	6948.00	Shear (lb/sq ft)		0.49	
Alpha	1.00	Stream Power (lb/ft s)		1.20	
Frctn Loss (ft)	0.64	Cum Volume (acre-ft)	0.00	4.27	0.04
C & E Loss (ft)	0.01	Cum SA (acres)	0.02	4.34	0.18

Plan: Plan p02 WEST PR chan-west-pr RS: 1700 Profile: PF 1

E.G. Elev (ft)	6949.88	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.		0.060	
W.S. Elev (ft)	6949.64	Reach Len. (ft)	113.00	100.00	112.30
Crit W.S. (ft)		Flow Area (sq ft)		54.95	
E.G. Slope (ft/ft)	0.018693	Area (sq ft)		54.95	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	43.40	Top Width (ft)		43.40	
Vel Total (ft/s)	3.93	Avg. Vel. (ft/s)		3.93	
Max Chl Dpth (ft)	2.53	Hydr. Depth (ft)		1.27	
Conv. Total (cfs)	1579.8	Conv. (cfs)		1579.8	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		43.93	
Min Ch El (ft)	6947.11	Shear (lb/sq ft)		1.46	
Alpha	1.00	Stream Power (lb/ft s)		5.74	
Frctn Loss (ft)	1.48	Cum Volume (acre-ft)	0.00	4.14	0.04
C & E Loss (ft)	0.03	Cum SA (acres)	0.02	4.25	0.18

Plan: Plan p02 WEST PR chan-west-pr RS: 1600 Profile: PF 1

E.G. Elev (ft)	6948.37	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.060	
W.S. Elev (ft)	6948.23	Reach Len. (ft)	113.20	100.00	83.60
Crit W.S. (ft)		Flow Area (sq ft)		72.67	
E.G. Slope (ft/ft)	0.012010	Area (sq ft)		72.67	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	63.17	Top Width (ft)		63.17	
Vel Total (ft/s)	2.97	Avg. Vel. (ft/s)		2.97	
Max Chl Dpth (ft)	2.39	Hydr. Depth (ft)		1.15	
Conv. Total (cfs)	1971.0	Conv. (cfs)		1971.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		63.41	
Min Ch El (ft)	6945.84	Shear (lb/sq ft)		0.86	
Alpha	1.00	Stream Power (lb/ft s)		2.55	
Frctn Loss (ft)	1.23	Cum Volume (acre-ft)	0.00	4.00	0.04
C & E Loss (ft)	0.01	Cum SA (acres)	0.02	4.13	0.18

Plan: Plan p02 WEST PR chan-west-pr RS: 1500 Profile: PF 1

E.G. Elev (ft)	6947.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.		0.060	
W.S. Elev (ft)	6947.02	Reach Len. (ft)	67.00	60.00	52.00
Crit W.S. (ft)	6946.57	Flow Area (sq ft)		81.10	
E.G. Slope (ft/ft)	0.012690	Area (sq ft)		81.10	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	86.75	Top Width (ft)		86.75	
Vel Total (ft/s)	2.66	Avg. Vel. (ft/s)		2.66	
Max Chl Dpth (ft)	2.15	Hydr. Depth (ft)		0.93	
Conv. Total (cfs)	1917.4	Conv. (cfs)		1917.4	
Length Wtd. (ft)	60.00	Wetted Per. (ft)		86.94	
Min Ch El (ft)	6944.87	Shear (lb/sq ft)		0.74	
Alpha	1.00	Stream Power (lb/ft s)		1.97	
Frctn Loss (ft)	1.06	Cum Volume (acre-ft)	0.00	3.82	0.04
C & E Loss (ft)	0.01	Cum SA (acres)	0.02	3.96	0.18

Plan: Plan p02 WEST PR chan-west-pr RS: 1440 Profile: PF 1

E.G. Elev (ft)	6946.07	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.18	Wt. n-Val.		0.060	
W.S. Elev (ft)	6945.90	Reach Len. (ft)	21.00	20.00	21.00
Crit W.S. (ft)	6945.66	Flow Area (sq ft)		64.33	
E.G. Slope (ft/ft)	0.025967	Area (sq ft)		64.33	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	83.31	Top Width (ft)		83.31	
Vel Total (ft/s)	3.36	Avg. Vel. (ft/s)		3.36	
Max Chl Dpth (ft)	1.54	Hydr. Depth (ft)		0.77	
Conv. Total (cfs)	1340.4	Conv. (cfs)		1340.4	
Length Wtd. (ft)	20.00	Wetted Per. (ft)		83.37	
Min Ch El (ft)	6944.35	Shear (lb/sq ft)		1.25	
Alpha	1.00	Stream Power (lb/ft s)		4.20	
Frctn Loss (ft)	0.80	Cum Volume (acre-ft)	0.00	3.72	0.04
C & E Loss (ft)	0.01	Cum SA (acres)	0.02	3.84	0.18

Plan: Plan p02 WEST PR chan-west-pr RS: 1420 Profile: PF 1

E.G. Elev (ft)	6945.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.		0.060	
W.S. Elev (ft)	6945.02	Reach Len. (ft)	19.90	20.00	20.20
Crit W.S. (ft)	6945.02	Flow Area (sq ft)		54.01	
E.G. Slope (ft/ft)	0.068516	Area (sq ft)		54.01	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	111.39	Top Width (ft)		111.39	
Vel Total (ft/s)	4.00	Avg. Vel. (ft/s)		4.00	
Max Chl Dpth (ft)	0.52	Hydr. Depth (ft)		0.48	
Conv. Total (cfs)	825.2	Conv. (cfs)		825.2	
Length Wtd. (ft)	20.00	Wetted Per. (ft)		111.45	
Min Ch El (ft)	6944.50	Shear (lb/sq ft)		2.07	
Alpha	1.00	Stream Power (lb/ft s)		8.29	
Frctn Loss (ft)	0.32	Cum Volume (acre-ft)	0.00	3.69	0.04
C & E Loss (ft)	0.05	Cum SA (acres)	0.02	3.80	0.18

Plan: Plan p02 WEST PR chan-west-pr RS: 1400 Profile: PF 1

E.G. Elev (ft)	6942.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.		0.060	
W.S. Elev (ft)	6942.05	Reach Len. (ft)	19.90	20.00	21.00
Crit W.S. (ft)		Flow Area (sq ft)		104.70	
E.G. Slope (ft/ft)	0.006974	Area (sq ft)		104.70	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	104.87	Top Width (ft)		104.87	
Vel Total (ft/s)	2.06	Avg. Vel. (ft/s)		2.06	
Max Chl Dpth (ft)	1.04	Hydr. Depth (ft)		1.00	
Conv. Total (cfs)	2586.5	Conv. (cfs)		2586.5	
Length Wtd. (ft)	20.00	Wetted Per. (ft)		105.10	
Min Ch El (ft)	6941.00	Shear (lb/sq ft)		0.43	
Alpha	1.00	Stream Power (lb/ft s)		0.89	
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	0.00	3.66	0.04
C & E Loss (ft)	0.01	Cum SA (acres)	0.02	3.75	0.18

Plan: Plan p02 WEST PR chan-west-pr RS: 1380 Profile: PF 1

E.G. Elev (ft)	6942.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.		0.060	
W.S. Elev (ft)	6941.97	Reach Len. (ft)	53.20	80.00	101.00
Crit W.S. (ft)		Flow Area (sq ft)		133.78	
E.G. Slope (ft/ft)	0.003173	Area (sq ft)		133.78	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	106.25	Top Width (ft)		106.25	
Vel Total (ft/s)	1.61	Avg. Vel. (ft/s)		1.61	
Max Chl Dpth (ft)	1.27	Hydr. Depth (ft)		1.26	
Conv. Total (cfs)	3834.8	Conv. (cfs)		3834.8	
Length Wtd. (ft)	80.00	Wetted Per. (ft)		107.43	
Min Ch El (ft)	6940.70	Shear (lb/sq ft)		0.25	
Alpha	1.00	Stream Power (lb/ft s)		0.40	
Frctn Loss (ft)	0.60	Cum Volume (acre-ft)	0.00	3.60	0.04
C & E Loss (ft)	0.01	Cum SA (acres)	0.02	3.70	0.18

Plan: Plan p02 WEST PR chan-west-pr RS: 1340 Profile: PF 1

E.G. Elev (ft)	6941.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.		0.060	
W.S. Elev (ft)	6941.23	Reach Len. (ft)	29.00	40.00	51.00
Crit W.S. (ft)		Flow Area (sq ft)		65.03	
E.G. Slope (ft/ft)	0.034542	Area (sq ft)		65.03	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	105.95	Top Width (ft)		105.95	
Vel Total (ft/s)	3.32	Avg. Vel. (ft/s)		3.32	
Max Chl Dpth (ft)	0.63	Hydr. Depth (ft)		0.61	
Conv. Total (cfs)	1162.2	Conv. (cfs)		1162.2	
Length Wtd. (ft)	40.00	Wetted Per. (ft)		106.08	
Min Ch El (ft)	6940.60	Shear (lb/sq ft)		1.32	
Alpha	1.00	Stream Power (lb/ft s)		4.39	
Frctn Loss (ft)	0.35	Cum Volume (acre-ft)	0.00	3.42	0.04
C & E Loss (ft)	0.04	Cum SA (acres)	0.02	3.50	0.18

Plan: Plan p02 WEST PR chan-west-pr RS: 1300 Profile: PF 1

E.G. Elev (ft)	6941.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.		0.060	
W.S. Elev (ft)	6940.97	Reach Len. (ft)	107.40	100.00	88.80
Crit W.S. (ft)		Flow Area (sq ft)		129.32	
E.G. Slope (ft/ft)	0.003931	Area (sq ft)		129.32	
Q Total (cfs)	216.00	Flow (cfs)		216.00	
Top Width (ft)	115.65	Top Width (ft)		115.65	
Vel Total (ft/s)	1.67	Avg. Vel. (ft/s)		1.67	
Max Chl Dpth (ft)	1.17	Hydr. Depth (ft)		1.12	
Conv. Total (cfs)	3445.3	Conv. (cfs)		3445.3	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		115.89	
Min Ch El (ft)	6939.80	Shear (lb/sq ft)		0.27	
Alpha	1.00	Stream Power (lb/ft s)		0.46	
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	0.00	3.33	0.04
C & E Loss (ft)	0.01	Cum SA (acres)	0.02	3.40	0.18

Plan: Plan p02 WEST PR chan-west-pr RS: 1200 Profile: PF 1

E.G. Elev (ft)	6940.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.060	0.060	0.060
W.S. Elev (ft)	6940.90	Reach Len. (ft)	313.70	300.00	276.40
Crit W.S. (ft)	6938.86	Flow Area (sq ft)	1.62	232.30	1.63
E.G. Slope (ft/ft)	0.000412	Area (sq ft)	1.62	232.30	1.63
Q Total (cfs)	216.00	Flow (cfs)	0.47	215.06	0.47
Top Width (ft)	99.66	Top Width (ft)	3.60	92.43	3.63
Vel Total (ft/s)	0.92	Avg. Vel. (ft/s)	0.29	0.93	0.29
Max Chl Dpth (ft)	2.65	Hydr. Depth (ft)	0.45	2.51	0.45
Conv. Total (cfs)	10647.7	Conv. (cfs)	23.0	10601.6	23.1
Length Wtd. (ft)	300.00	Wetted Per. (ft)	3.71	92.86	3.74
Min Ch El (ft)	6938.25	Shear (lb/sq ft)	0.01	0.06	0.01
Alpha	1.02	Stream Power (lb/ft s)	0.00	0.06	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	0.00	2.91	0.04
C & E Loss (ft)		Cum SA (acres)	0.02	3.16	0.18

Plan: Plan p02 WEST PR chan-west-pr RS: 900 Profile: PF 1

E.G. Elev (ft)	6936.81	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.		0.100	
W.S. Elev (ft)	6936.76	Reach Len. (ft)	104.20	100.00	101.80
Crit W.S. (ft)		Flow Area (sq ft)		132.40	
E.G. Slope (ft/ft)	0.010333	Area (sq ft)		132.40	
Q Total (cfs)	222.00	Flow (cfs)		222.00	
Top Width (ft)	112.98	Top Width (ft)		112.98	
Vel Total (ft/s)	1.68	Avg. Vel. (ft/s)		1.68	
Max Chl Dpth (ft)	1.39	Hydr. Depth (ft)		1.17	
Conv. Total (cfs)	2184.0	Conv. (cfs)		2184.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		113.21	
Min Ch El (ft)	6935.37	Shear (lb/sq ft)		0.75	
Alpha	1.00	Stream Power (lb/ft s)		1.26	
Frctn Loss (ft)	1.06	Cum Volume (acre-ft)	0.00	2.63	0.04
C & E Loss (ft)	0.00	Cum SA (acres)	0.00	2.46	0.17

Plan: Plan p02 WEST PR chan-west-pr RS: 800 Profile: PF 1

E.G. Elev (ft)	6935.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.		0.100	
W.S. Elev (ft)	6935.71	Reach Len. (ft)	96.40	100.00	114.30
Crit W.S. (ft)		Flow Area (sq ft)		146.24	
E.G. Slope (ft/ft)	0.010932	Area (sq ft)		146.24	
Q Total (cfs)	222.00	Flow (cfs)		222.00	
Top Width (ft)	151.34	Top Width (ft)		151.34	
Vel Total (ft/s)	1.52	Avg. Vel. (ft/s)		1.52	
Max Chl Dpth (ft)	1.49	Hydr. Depth (ft)		0.97	
Conv. Total (cfs)	2123.3	Conv. (cfs)		2123.3	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		151.42	
Min Ch El (ft)	6934.21	Shear (lb/sq ft)		0.66	
Alpha	1.00	Stream Power (lb/ft s)		1.00	
Frctn Loss (ft)	1.48	Cum Volume (acre-ft)	0.00	2.31	0.04
C & E Loss (ft)	0.00	Cum SA (acres)	0.00	2.15	0.17

Plan: Plan p02 WEST PR chan-west-pr RS: 700 Profile: PF 1

E.G. Elev (ft)	6934.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.		0.100	
W.S. Elev (ft)	6934.20	Reach Len. (ft)	114.30	100.00	85.80
Crit W.S. (ft)		Flow Area (sq ft)		122.92	
E.G. Slope (ft/ft)	0.021238	Area (sq ft)		122.92	
Q Total (cfs)	222.00	Flow (cfs)		222.00	
Top Width (ft)	161.31	Top Width (ft)		161.31	
Vel Total (ft/s)	1.81	Avg. Vel. (ft/s)		1.81	
Max Chl Dpth (ft)	1.40	Hydr. Depth (ft)		0.76	
Conv. Total (cfs)	1523.3	Conv. (cfs)		1523.3	
Length Wtd. (ft)	99.58	Wetted Per. (ft)		161.37	
Min Ch El (ft)	6932.80	Shear (lb/sq ft)		1.01	
Alpha	1.00	Stream Power (lb/ft s)		1.82	
Frctn Loss (ft)	1.79	Cum Volume (acre-ft)	0.00	2.00	0.04
C & E Loss (ft)	0.00	Cum SA (acres)	0.00	1.79	0.17

Plan: Plan p02 WEST PR chan-west-pr RS: 600 Profile: PF 1

E.G. Elev (ft)	6932.45	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.		0.100	0.100
W.S. Elev (ft)	6932.42	Reach Len. (ft)	110.80	100.00	88.00
Crit W.S. (ft)		Flow Area (sq ft)		137.63	16.81
E.G. Slope (ft/ft)	0.015472	Area (sq ft)		137.63	16.81
Q Total (cfs)	222.00	Flow (cfs)		208.94	13.06
Top Width (ft)	246.36	Top Width (ft)		184.69	61.67
Vel Total (ft/s)	1.44	Avg. Vel. (ft/s)		1.52	0.78
Max Chl Dpth (ft)	1.56	Hydr. Depth (ft)		0.75	0.27
Conv. Total (cfs)	1784.8	Conv. (cfs)		1679.8	105.0
Length Wtd. (ft)	99.65	Wetted Per. (ft)		184.86	61.68
Min Ch El (ft)	6930.86	Shear (lb/sq ft)		0.72	0.26
Alpha	1.07	Stream Power (lb/ft s)		1.09	0.20
Frctn Loss (ft)	2.41	Cum Volume (acre-ft)	0.00	1.70	0.03
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	1.40	0.11

Plan: Plan p02 WEST PR chan-west-pr RS: 500 Profile: PF 1

E.G. Elev (ft)	6930.04	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.		0.100	
W.S. Elev (ft)	6929.91	Reach Len. (ft)	85.20	100.00	105.50
Crit W.S. (ft)		Flow Area (sq ft)		79.17	
E.G. Slope (ft/ft)	0.043154	Area (sq ft)		79.17	
Q Total (cfs)	222.00	Flow (cfs)		222.00	
Top Width (ft)	91.39	Top Width (ft)		91.39	
Vel Total (ft/s)	2.80	Avg. Vel. (ft/s)		2.80	
Max Chl Dpth (ft)	1.51	Hydr. Depth (ft)		0.87	
Conv. Total (cfs)	1068.7	Conv. (cfs)		1068.7	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		91.45	
Min Ch El (ft)	6928.40	Shear (lb/sq ft)		2.33	
Alpha	1.00	Stream Power (lb/ft s)		6.54	
Frctn Loss (ft)	1.97	Cum Volume (acre-ft)	0.00	1.45	0.01
C & E Loss (ft)	0.02	Cum SA (acres)	0.00	1.08	0.04

Plan: Plan p02 WEST PR chan-west-pr RS: 400 Profile: PF 1

E.G. Elev (ft)	6928.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.	0.100	0.100	
W.S. Elev (ft)	6927.99	Reach Len. (ft)	95.20	100.00	105.50
Crit W.S. (ft)		Flow Area (sq ft)	0.06	117.93	
E.G. Slope (ft/ft)	0.011259	Area (sq ft)	0.06	117.93	
Q Total (cfs)	222.00	Flow (cfs)	0.02	221.98	
Top Width (ft)	90.52	Top Width (ft)	0.61	89.91	
Vel Total (ft/s)	1.88	Avg. Vel. (ft/s)	0.34	1.88	
Max Chl Dpth (ft)	3.02	Hydr. Depth (ft)	0.10	1.31	
Conv. Total (cfs)	2092.2	Conv. (cfs)	0.2	2092.0	
Length Wtd. (ft)	100.01	Wetted Per. (ft)	0.65	90.40	
Min Ch El (ft)	6924.97	Shear (lb/sq ft)	0.07	0.92	
Alpha	1.00	Stream Power (lb/ft s)	0.02	1.73	
Frctn Loss (ft)	1.65	Cum Volume (acre-ft)	0.00	1.22	0.01
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.87	0.04

Plan: Plan p02 WEST PR chan-west-pr RS: 370 Profile: PF 1

E.G. Elev (ft)	6926.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	Wt. n-Val.	0.100	0.100	0.100
W.S. Elev (ft)	6926.26	Reach Len. (ft)	18.00	20.00	22.00
Crit W.S. (ft)	6925.64	Flow Area (sq ft)	0.10	75.35	1.00
E.G. Slope (ft/ft)	0.026430	Area (sq ft)	0.10	75.35	1.00
Q Total (cfs)	222.00	Flow (cfs)	0.06	221.32	0.62
Top Width (ft)	64.47	Top Width (ft)	0.78	56.00	7.69
Vel Total (ft/s)	2.90	Avg. Vel. (ft/s)	0.60	2.94	0.62
Max Chl Dpth (ft)	1.76	Hydr. Depth (ft)	0.13	1.35	0.13
Conv. Total (cfs)	1365.5	Conv. (cfs)	0.4	1361.3	3.8
Length Wtd. (ft)	20.00	Wetted Per. (ft)	0.82	56.21	7.70
Min Ch El (ft)	6924.50	Shear (lb/sq ft)	0.20	2.21	0.21
Alpha	1.02	Stream Power (lb/ft s)	0.12	6.50	0.13
Frctn Loss (ft)	1.07	Cum Volume (acre-ft)	0.00	1.00	0.01
C & E Loss (ft)	0.03	Cum SA (acres)	0.00	0.70	0.04

Plan: Plan p02 WEST PR chan-west-pr RS: 350 Profile: PF 1

E.G. Elev (ft)	6925.30	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.42	Wt. n-Val.		0.100	
W.S. Elev (ft)	6924.88	Reach Len. (ft)	20.00	20.00	22.00
Crit W.S. (ft)	6924.88	Flow Area (sq ft)		42.94	
E.G. Slope (ft/ft)	0.159086	Area (sq ft)		42.94	
Q Total (cfs)	222.00	Flow (cfs)		222.00	
Top Width (ft)	52.49	Top Width (ft)		52.49	
Vel Total (ft/s)	5.17	Avg. Vel. (ft/s)		5.17	
Max Chl Dpth (ft)	0.88	Hydr. Depth (ft)		0.82	
Conv. Total (cfs)	556.6	Conv. (cfs)		556.6	
Length Wtd. (ft)	20.00	Wetted Per. (ft)		52.69	
Min Ch El (ft)	6924.00	Shear (lb/sq ft)		8.09	
Alpha	1.00	Stream Power (lb/ft s)		41.84	
Frctn Loss (ft)	0.64	Cum Volume (acre-ft)	0.00	0.97	0.01
C & E Loss (ft)	0.10	Cum SA (acres)	0.00	0.68	0.03

Plan: Plan p02 WEST PR chan-west-pr RS: 330 Profile: PF 1

E.G. Elev (ft)	6924.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.	0.100	0.100	0.100
W.S. Elev (ft)	6924.08	Reach Len. (ft)	36.00	30.00	22.00
Crit W.S. (ft)		Flow Area (sq ft)	0.01	88.14	0.02
E.G. Slope (ft/ft)	0.013338	Area (sq ft)	0.01	88.14	0.02
Q Total (cfs)	222.00	Flow (cfs)	0.00	221.99	0.00
Top Width (ft)	49.72	Top Width (ft)	0.25	49.00	0.46
Vel Total (ft/s)	2.52	Avg. Vel. (ft/s)	0.20	2.52	0.21
Max Chl Dpth (ft)	2.08	Hydr. Depth (ft)	0.04	1.80	0.04
Conv. Total (cfs)	1922.2	Conv. (cfs)	0.0	1922.2	0.0
Length Wtd. (ft)	30.00	Wetted Per. (ft)	0.27	49.57	0.47
Min Ch El (ft)	6922.00	Shear (lb/sq ft)	0.03	1.48	0.03
Alpha	1.00	Stream Power (lb/ft s)	0.01	3.73	0.01
Frctn Loss (ft)	0.37	Cum Volume (acre-ft)	0.00	0.94	0.01
C & E Loss (ft)	0.00	Cum SA (acres)	0.00	0.66	0.03

Plan: Plan p02 WEST PR chan-west-pr RS: 300 Profile: PF 1

E.G. Elev (ft)	6923.81	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.		0.100	
W.S. Elev (ft)	6923.73	Reach Len. (ft)	113.50	100.00	139.70
Crit W.S. (ft)		Flow Area (sq ft)		95.12	
E.G. Slope (ft/ft)	0.011412	Area (sq ft)		95.12	
Q Total (cfs)	222.00	Flow (cfs)		222.00	
Top Width (ft)	52.82	Top Width (ft)		52.82	
Vel Total (ft/s)	2.33	Avg. Vel. (ft/s)		2.33	
Max Chl Dpth (ft)	2.13	Hydr. Depth (ft)		1.80	
Conv. Total (cfs)	2078.1	Conv. (cfs)		2078.1	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		53.35	
Min Ch El (ft)	6921.60	Shear (lb/sq ft)		1.27	
Alpha	1.00	Stream Power (lb/ft s)		2.96	
Frctn Loss (ft)	1.78	Cum Volume (acre-ft)		0.88	0.01
C & E Loss (ft)	0.01	Cum SA (acres)		0.62	0.03

Plan: Plan p02 WEST PR chan-west-pr RS: 250 Profile: PF 1

E.G. Elev (ft)	6922.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.100	
W.S. Elev (ft)	6921.88	Reach Len. (ft)	53.00	50.00	52.00
Crit W.S. (ft)		Flow Area (sq ft)		73.10	
E.G. Slope (ft/ft)	0.031497	Area (sq ft)		73.10	
Q Total (cfs)	222.00	Flow (cfs)		222.00	
Top Width (ft)	58.98	Top Width (ft)		58.98	
Vel Total (ft/s)	3.04	Avg. Vel. (ft/s)		3.04	
Max Chl Dpth (ft)	1.68	Hydr. Depth (ft)		1.24	
Conv. Total (cfs)	1250.9	Conv. (cfs)		1250.9	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		59.16	
Min Ch El (ft)	6920.20	Shear (lb/sq ft)		2.43	
Alpha	1.00	Stream Power (lb/ft s)		7.38	
Frctn Loss (ft)	0.93	Cum Volume (acre-ft)		0.69	0.01
C & E Loss (ft)	0.03	Cum SA (acres)		0.49	0.03

Plan: Plan p02 WEST PR chan-west-pr RS: 200 Profile: PF 1

E.G. Elev (ft)	6921.07	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.		0.100	
W.S. Elev (ft)	6921.01	Reach Len. (ft)	109.50	100.00	110.20
Crit W.S. (ft)		Flow Area (sq ft)		119.81	
E.G. Slope (ft/ft)	0.012198	Area (sq ft)		119.81	
Q Total (cfs)	222.00	Flow (cfs)		222.00	
Top Width (ft)	99.73	Top Width (ft)		99.73	
Vel Total (ft/s)	1.85	Avg. Vel. (ft/s)		1.85	
Max Chl Dpth (ft)	1.71	Hydr. Depth (ft)		1.20	
Conv. Total (cfs)	2010.1	Conv. (cfs)		2010.1	
Length Wtd. (ft)	100.02	Wetted Per. (ft)		99.86	
Min Ch El (ft)	6919.30	Shear (lb/sq ft)		0.91	
Alpha	1.00	Stream Power (lb/ft s)		1.69	
Frctn Loss (ft)	0.57	Cum Volume (acre-ft)		0.58	0.01
C & E Loss (ft)	0.01	Cum SA (acres)		0.40	0.03

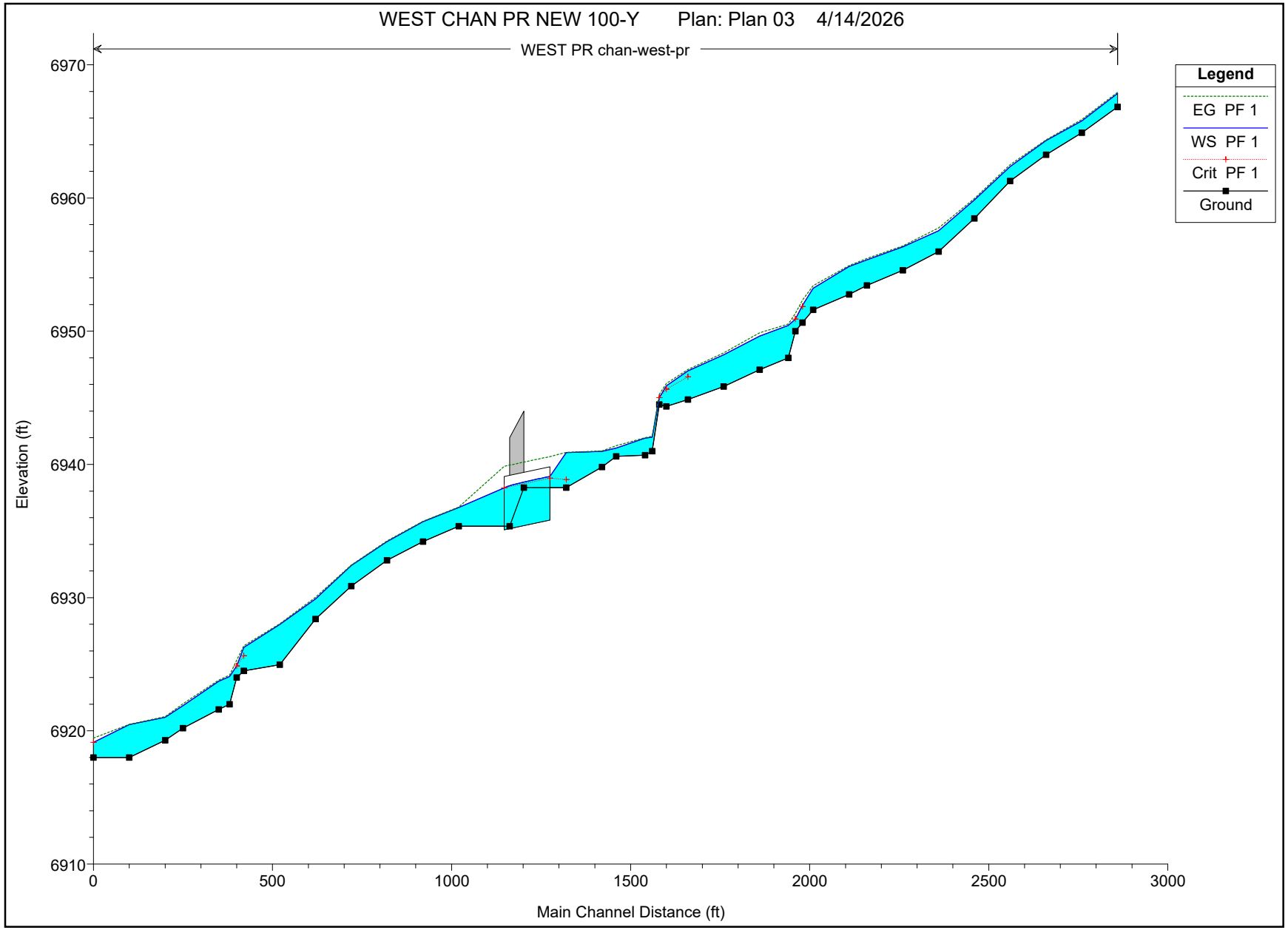
Plan: Plan p02 WEST PR chan-west-pr RS: 100 Profile: PF 1

E.G. Elev (ft)	6920.49	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.		0.100	0.100
W.S. Elev (ft)	6920.46	Reach Len. (ft)	97.00	100.00	105.00
Crit W.S. (ft)		Flow Area (sq ft)		166.17	3.10
E.G. Slope (ft/ft)	0.003285	Area (sq ft)		166.17	3.10
Q Total (cfs)	222.00	Flow (cfs)		221.01	0.99
Top Width (ft)	98.32	Top Width (ft)		84.87	13.45
Vel Total (ft/s)	1.31	Avg. Vel. (ft/s)		1.33	0.32
Max Chl Dpth (ft)	2.46	Hydr. Depth (ft)		1.96	0.23
Conv. Total (cfs)	3873.6	Conv. (cfs)		3856.3	17.3
Length Wtd. (ft)	100.01	Wetted Per. (ft)		85.14	13.46
Min Ch El (ft)	6918.00	Shear (lb/sq ft)		0.40	0.05
Alpha	1.02	Stream Power (lb/ft s)		0.53	0.02
Frctn Loss (ft)	1.01	Cum Volume (acre-ft)		0.25	0.00
C & E Loss (ft)	0.03	Cum SA (acres)		0.19	0.02

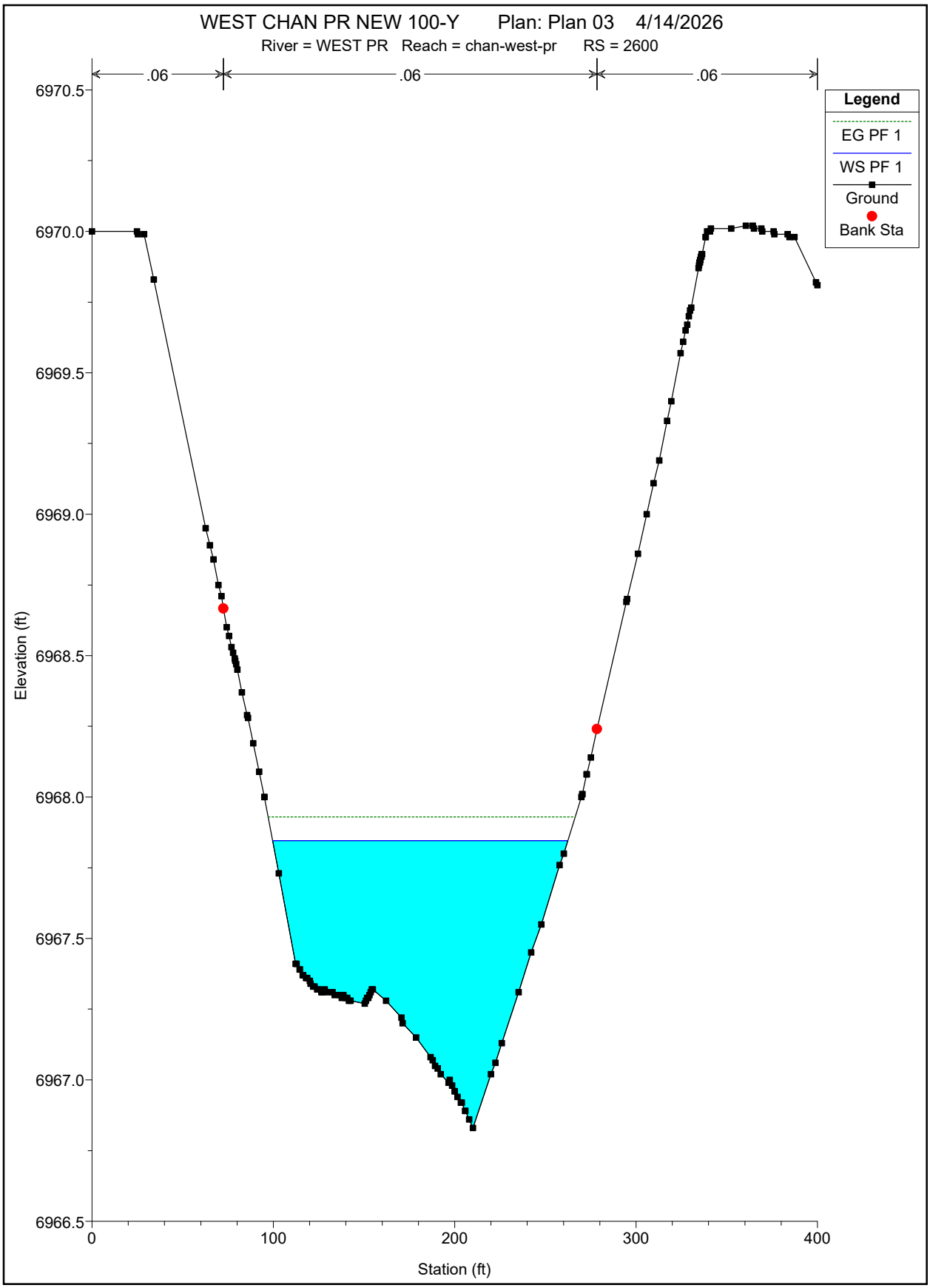
Plan: Plan p02 WEST PR chan-west-pr RS: 0 Profile: PF 1

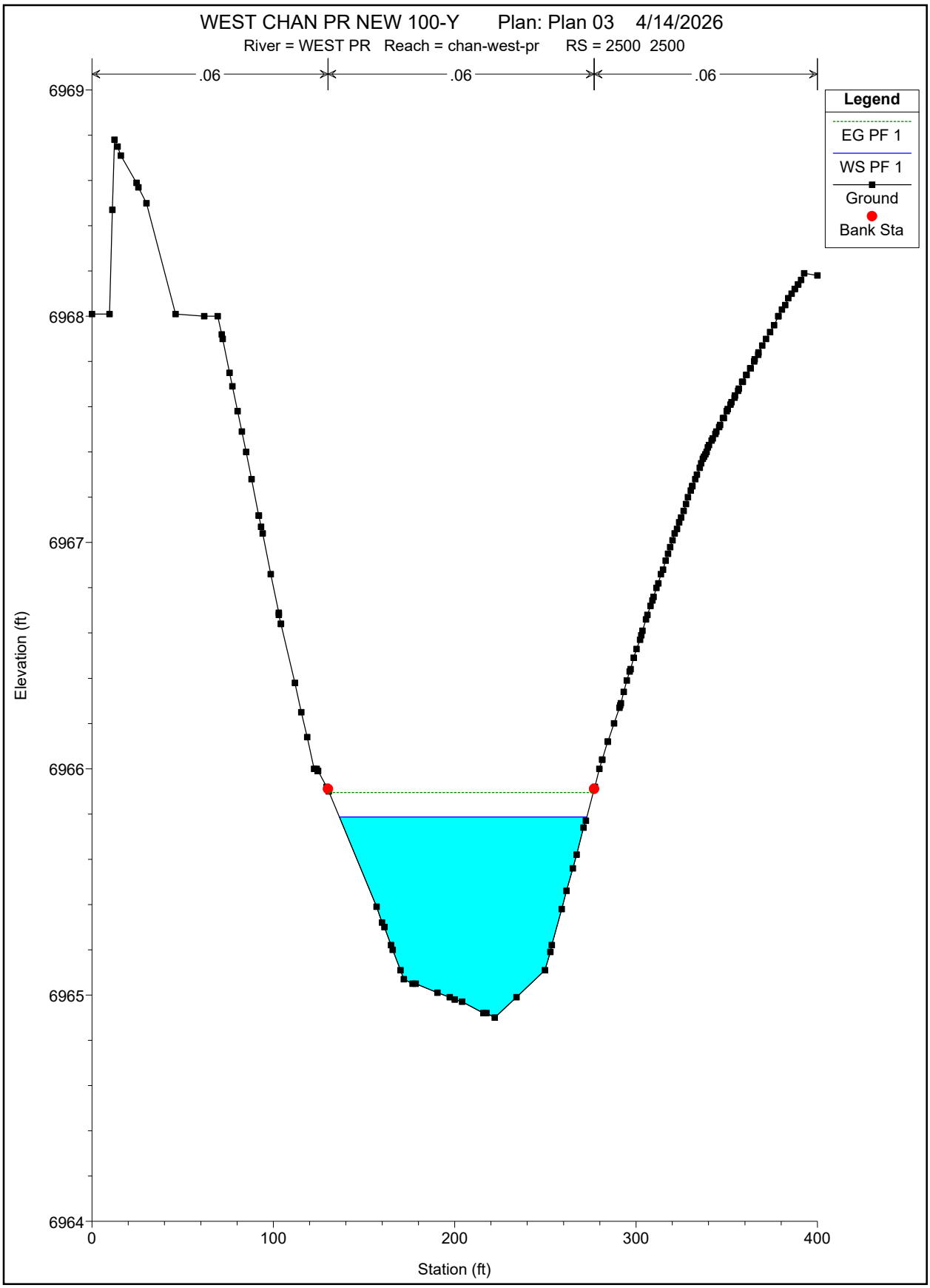
E.G. Elev (ft)	6919.45	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.		0.100	
W.S. Elev (ft)	6919.14	Reach Len. (ft)			
Crit W.S. (ft)	6919.14	Flow Area (sq ft)		49.81	
E.G. Slope (ft/ft)	0.172225	Area (sq ft)		49.81	
Q Total (cfs)	222.00	Flow (cfs)		222.00	
Top Width (ft)	81.02	Top Width (ft)		81.02	
Vel Total (ft/s)	4.46	Avg. Vel. (ft/s)		4.46	
Max Chl Dpth (ft)	1.14	Hydr. Depth (ft)		0.61	
Conv. Total (cfs)	534.9	Conv. (cfs)		534.9	
Length Wtd. (ft)		Wetted Per. (ft)		81.06	
Min Ch El (ft)	6918.00	Shear (lb/sq ft)		6.61	
Alpha	1.00	Stream Power (lb/ft s)		29.45	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

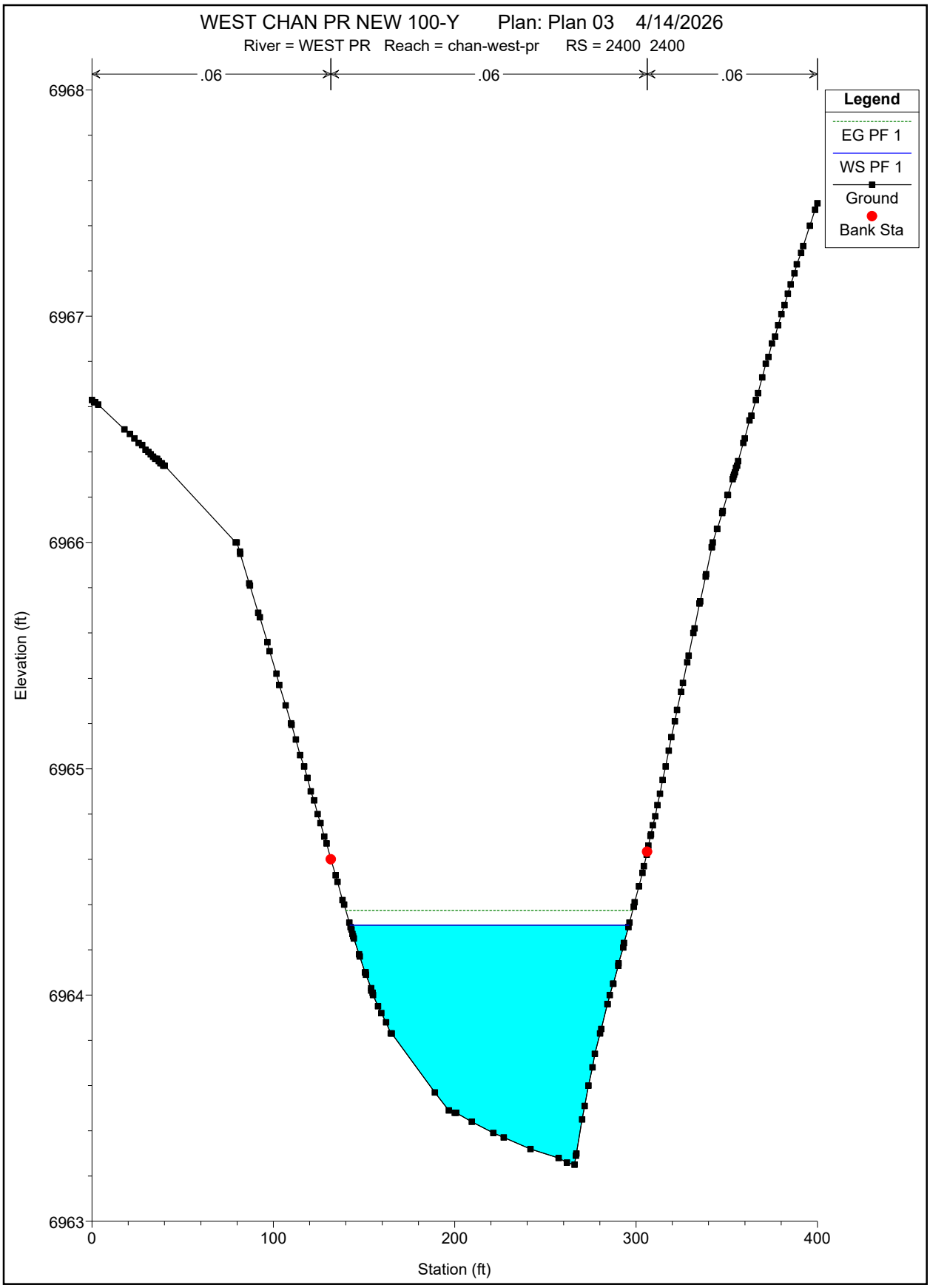
PROPOSED WEST CHANNEL 100-Y

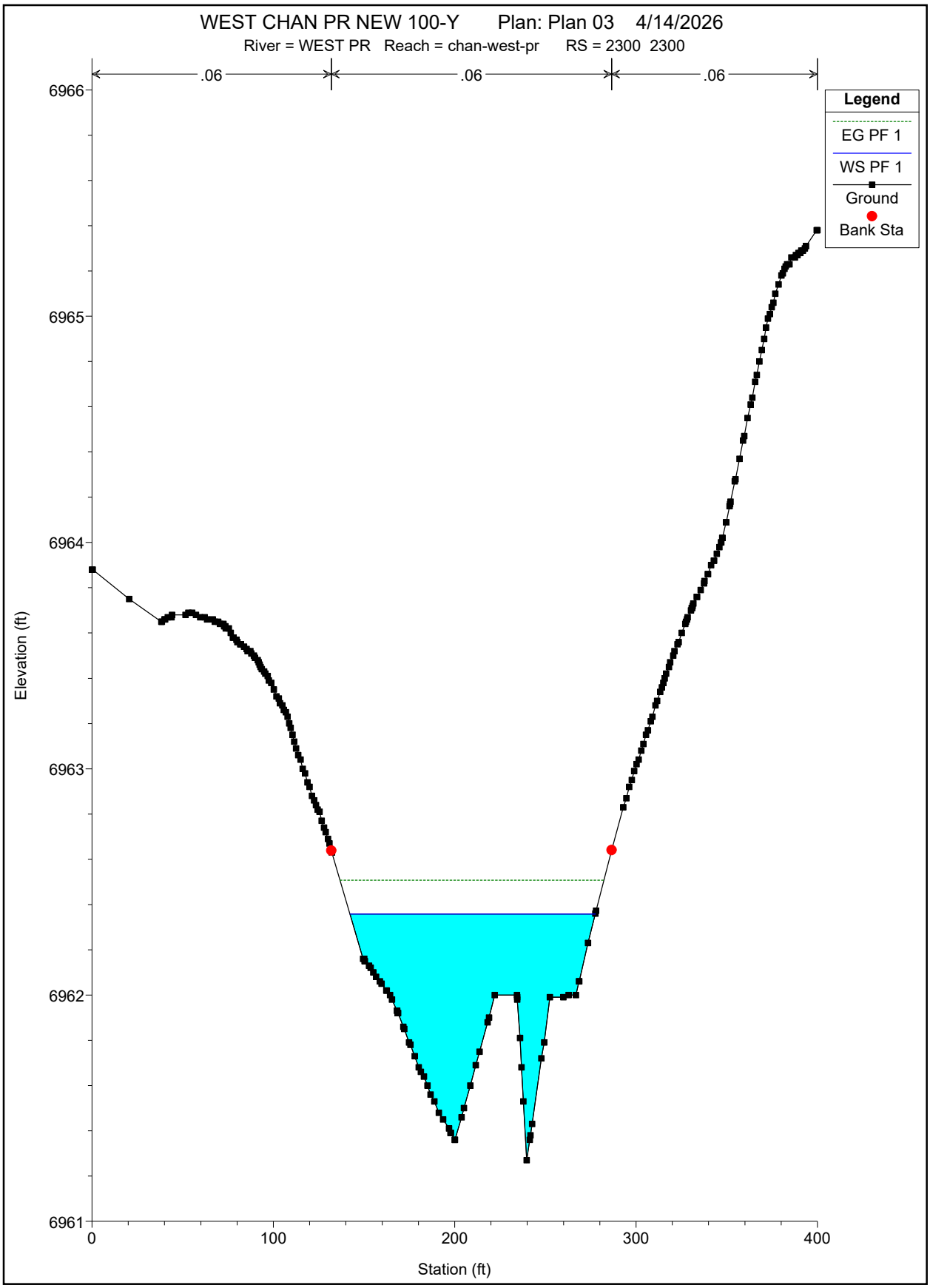


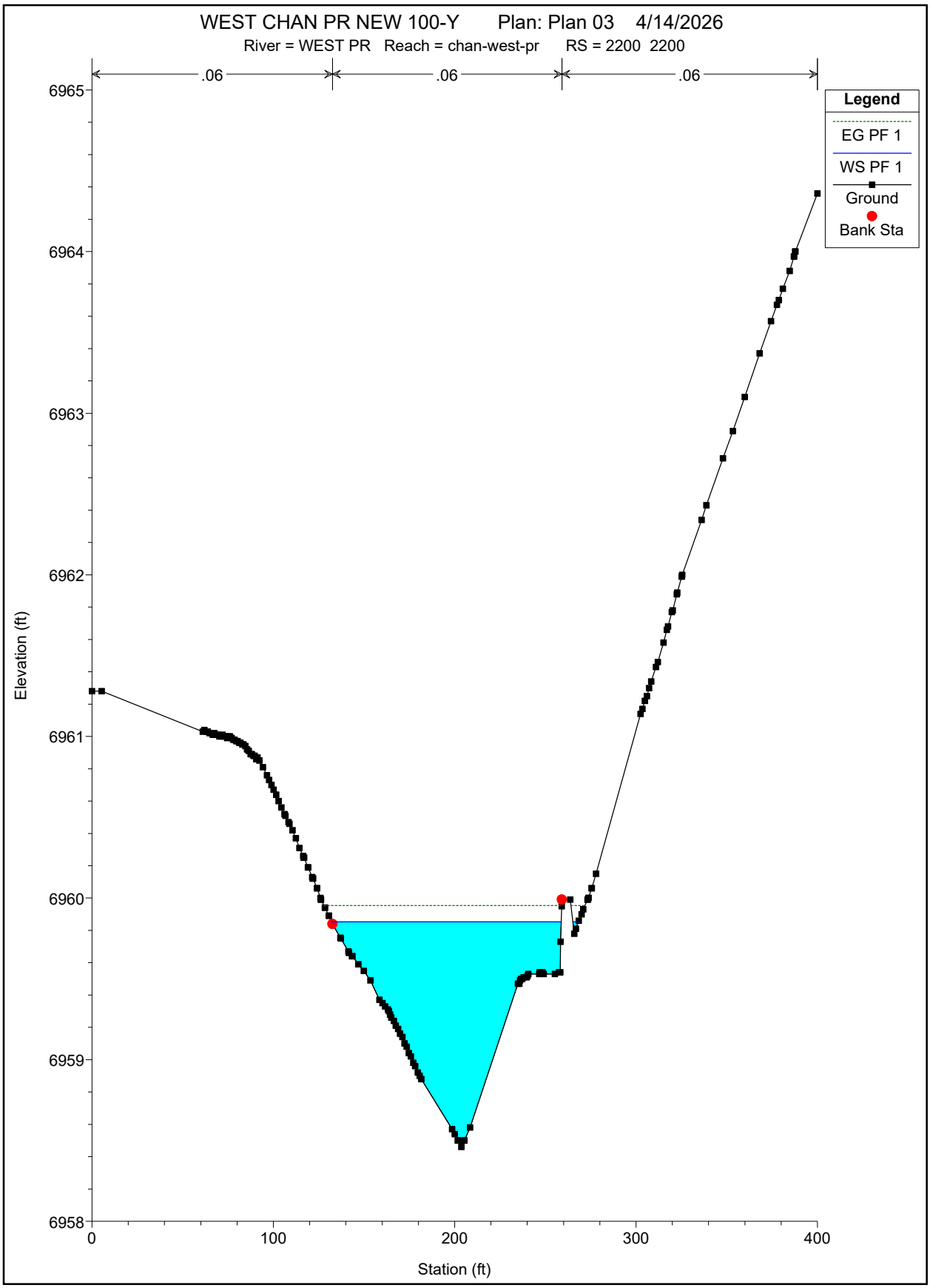
PROPOSED WEST CHANNEL 100-Y

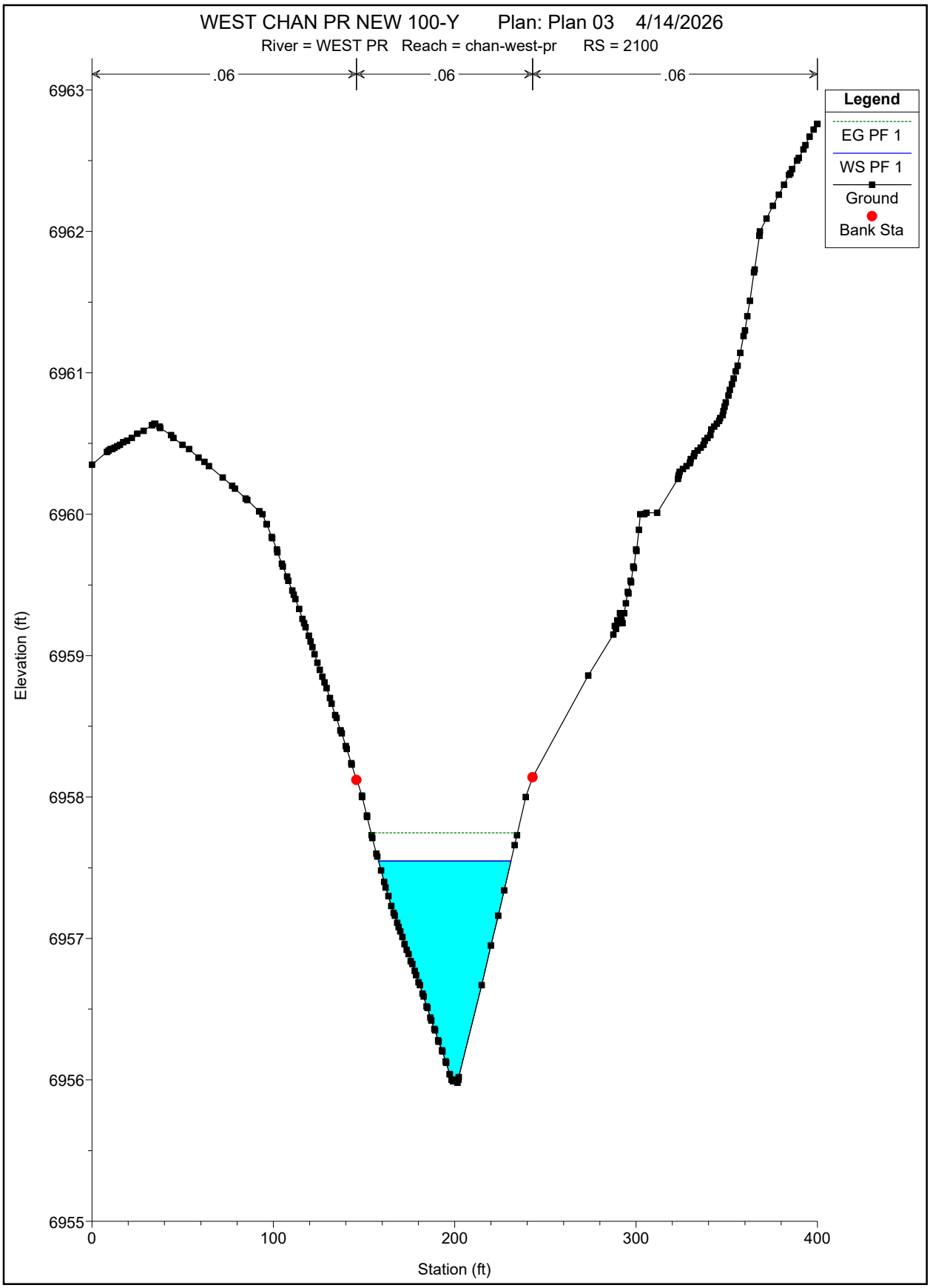


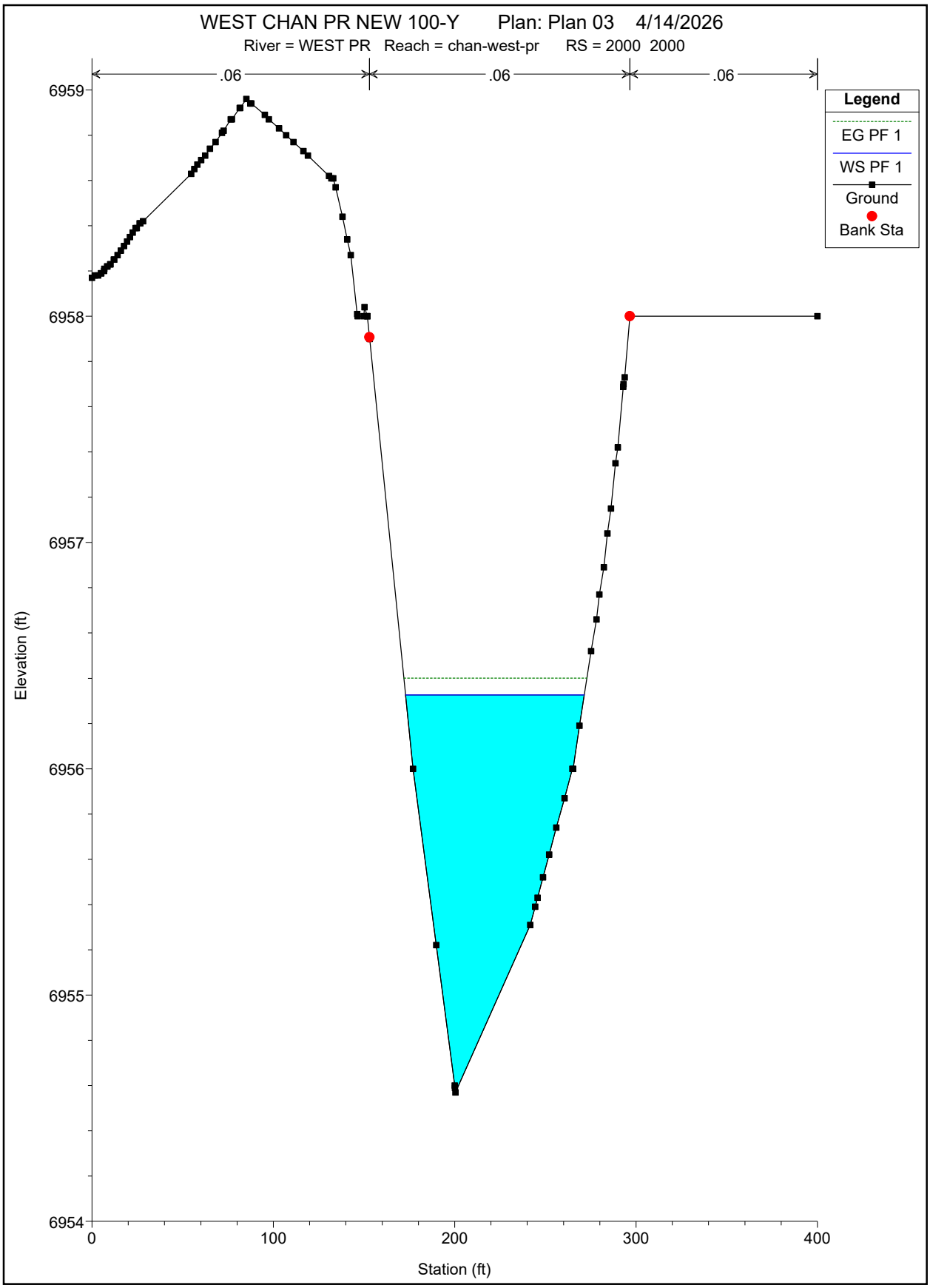

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 2500 2500
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6969
6968
6967
6966
6965
6964
Elevation (ft)
0
100
200
300
400
Station (ft)

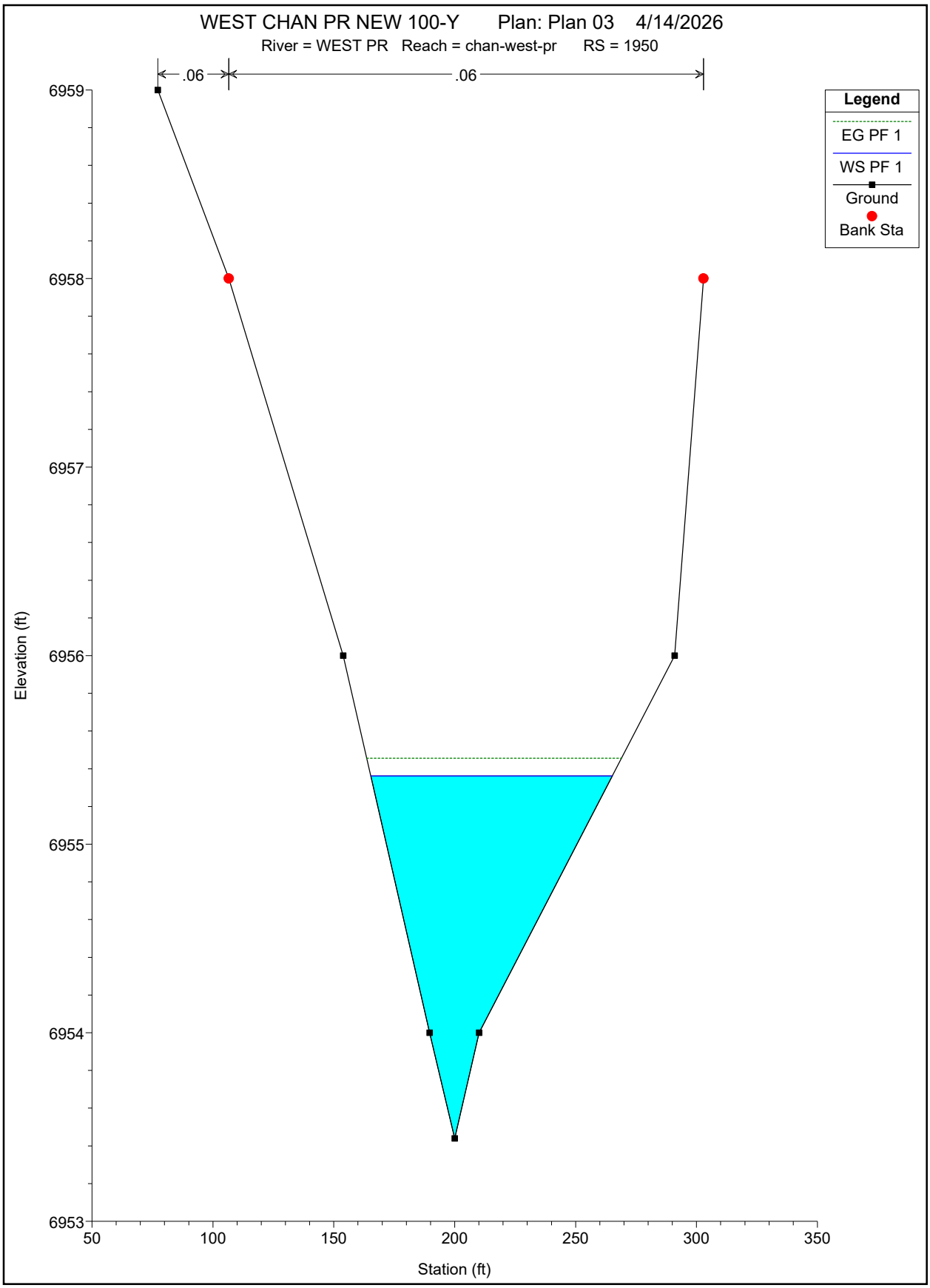

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 2400 2400
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6968
6967
6966
6965
6964
6963
Elevation (ft)
0
100
200
300
400
Station (ft)

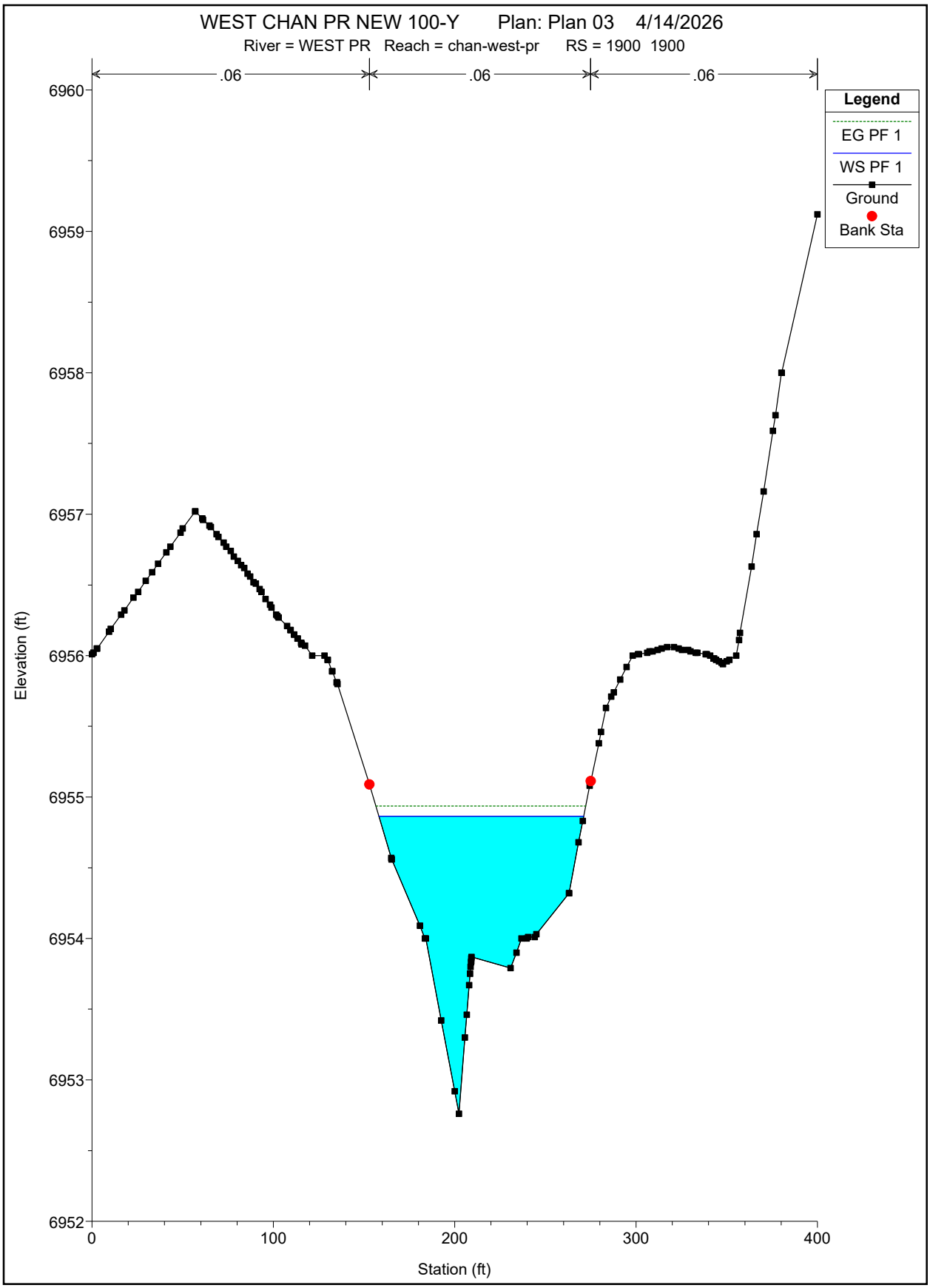

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 2300 2300
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6966
6965
6964
6963
6962
6961
Elevation (ft)
0
100
200
300
400
Station (ft)

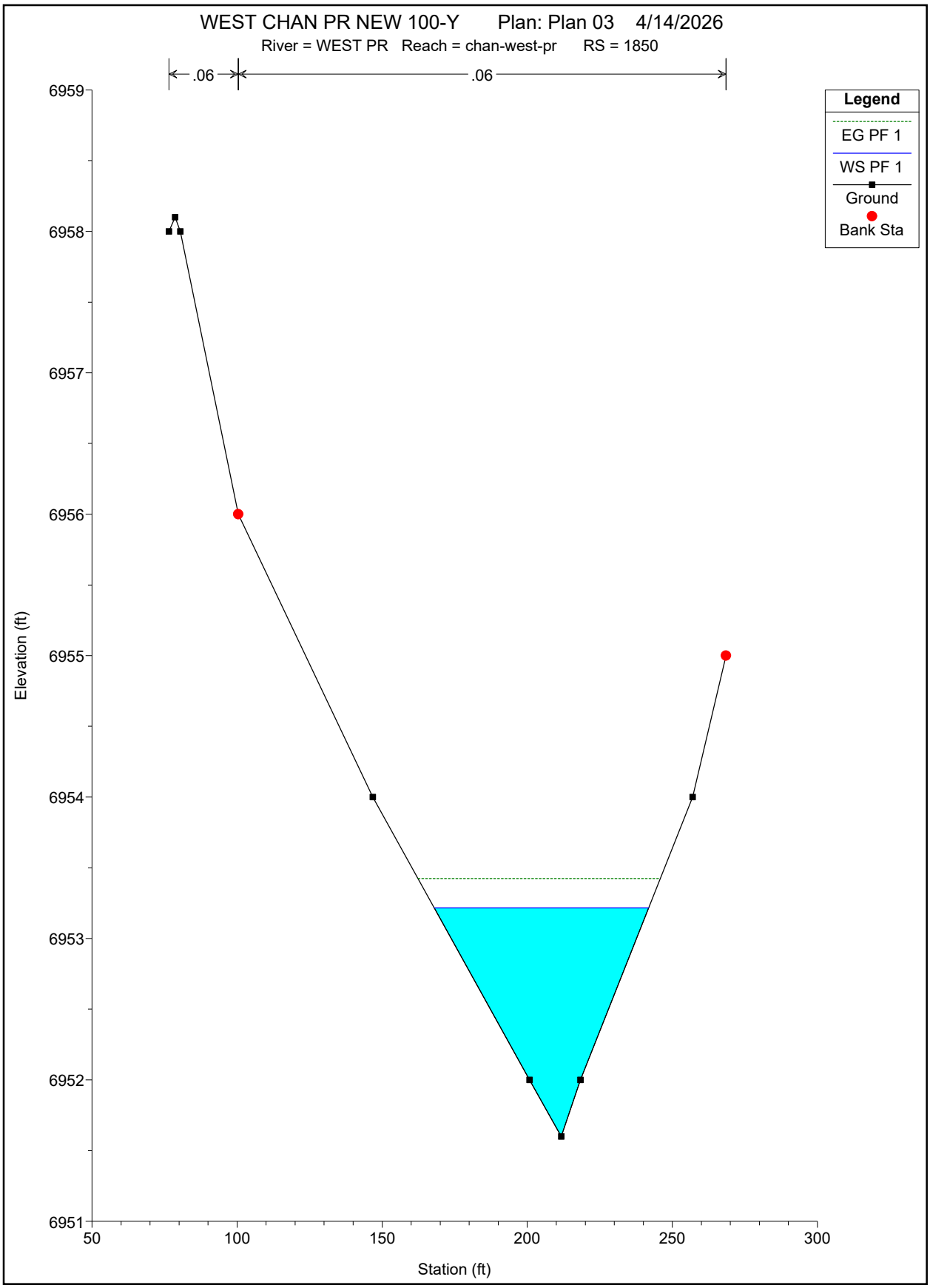

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 2200 2200
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6965
6964
6963
6962
6961
6960
6959
6958
0
100
200
300
400
Station (ft)

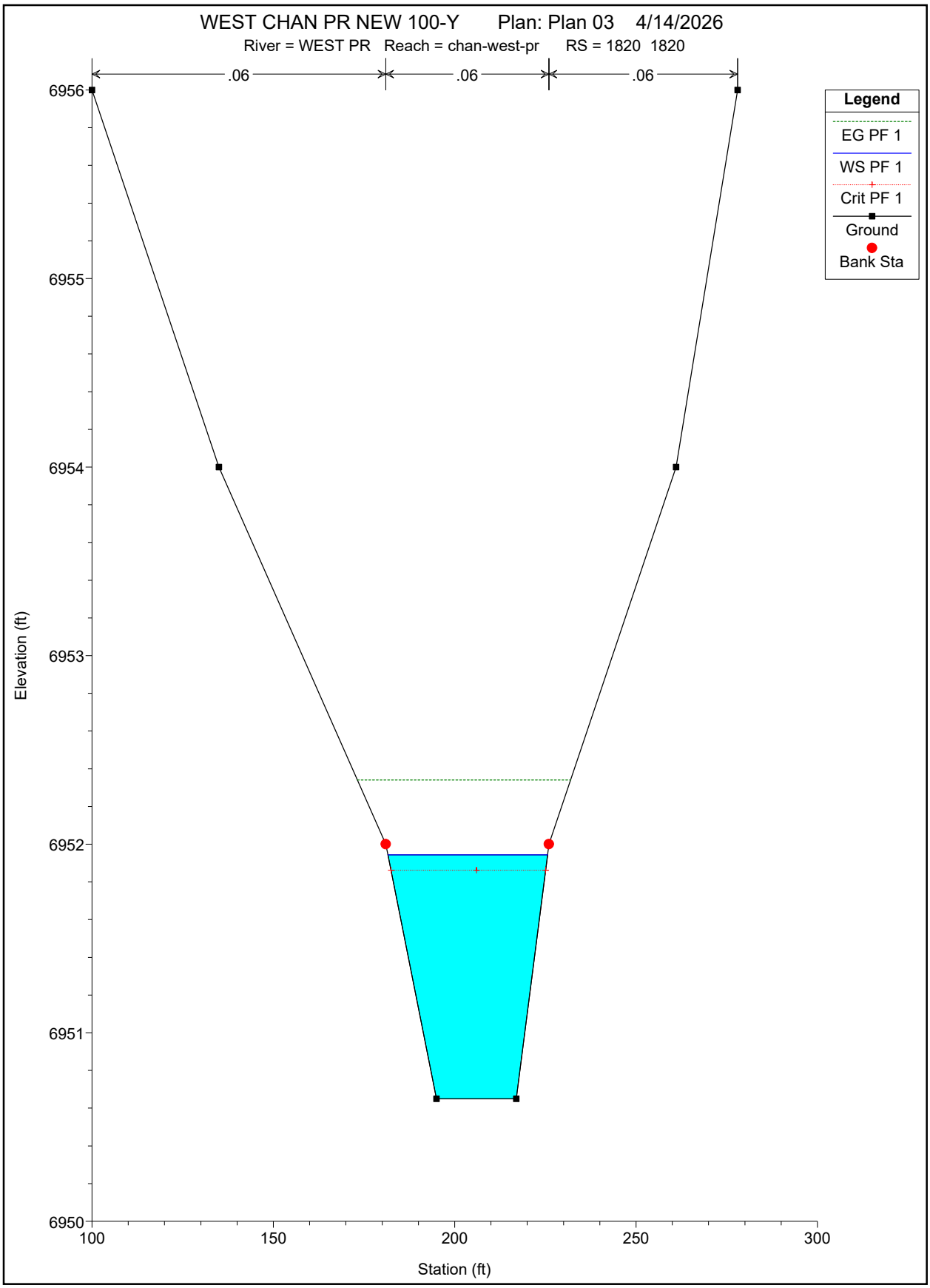

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 2100
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6963
6962
6961
6960
6959
6958
6957
6956
6955
0
100
200
300
400
Station (ft)

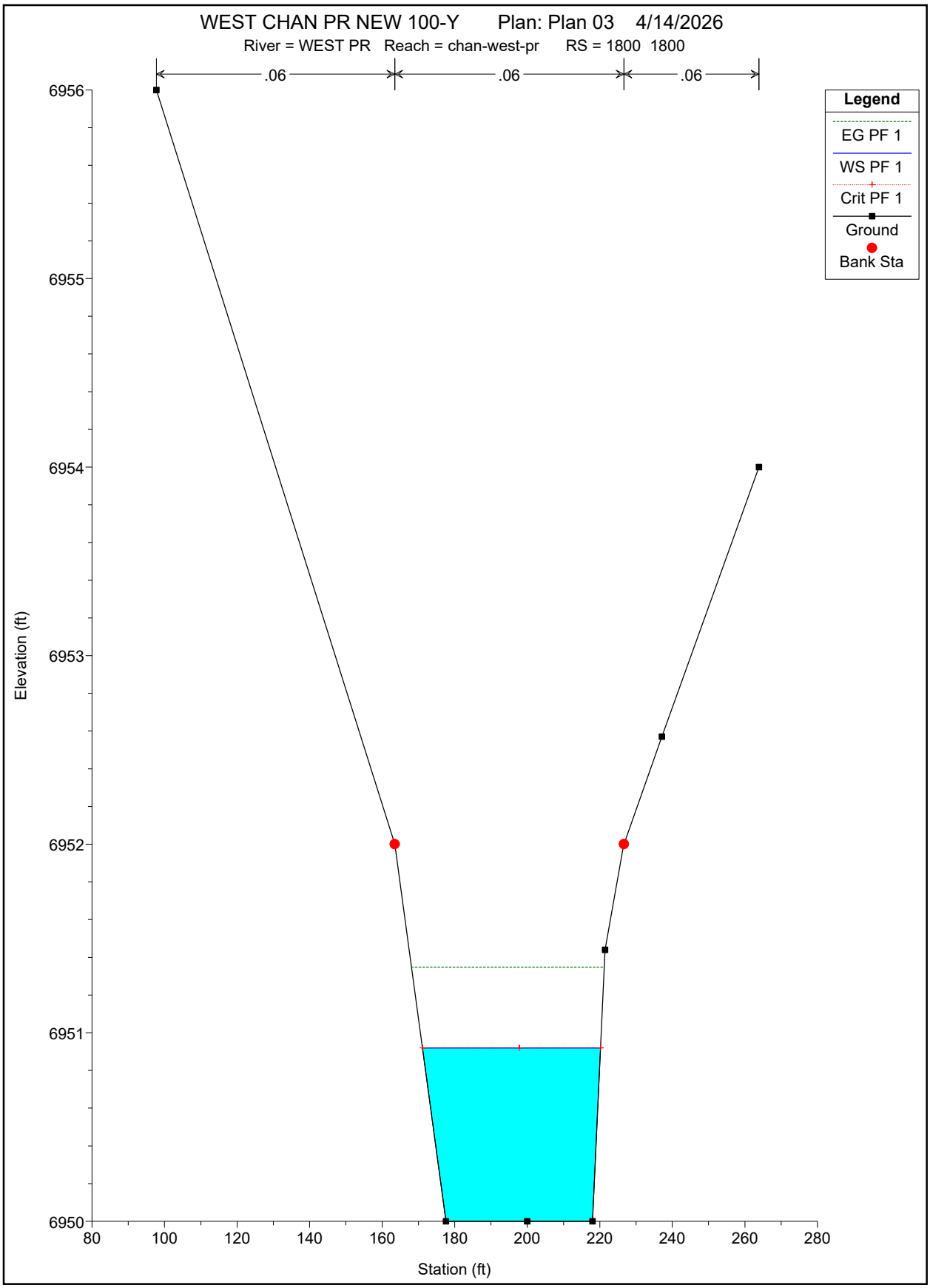

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 2000 2000
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6959
6958
6957
6956
6955
6954
Elevation (ft)
0
100
200
300
400
Station (ft)

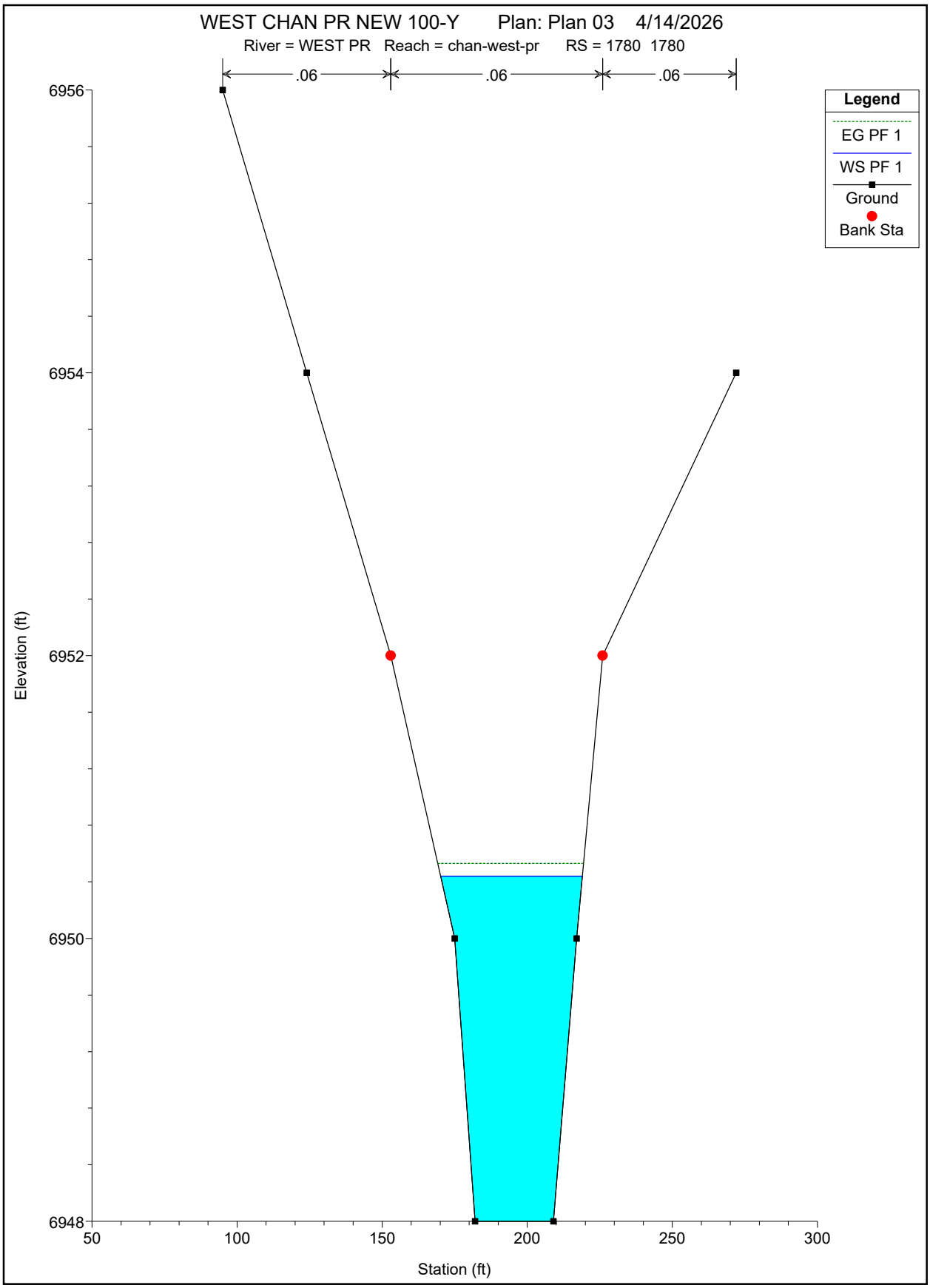

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 1950
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6959
6958
6957
6956
6955
6954
6953
50
100
150
200
250
300
350
Station (ft)

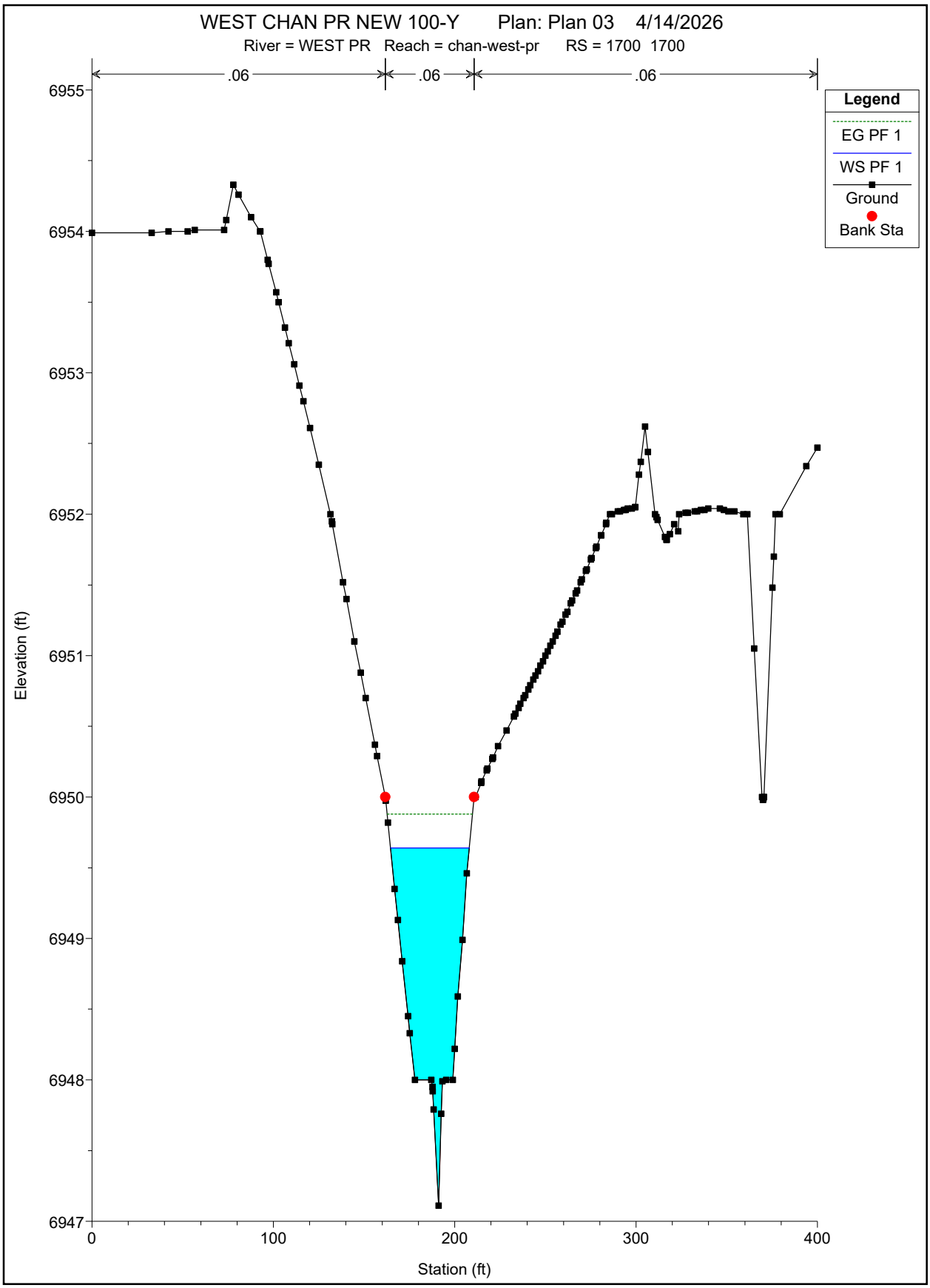

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 1900 1900
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6960
6959
6958
6957
6956
6955
6954
6953
6952
0
100
200
300
400
Station (ft)

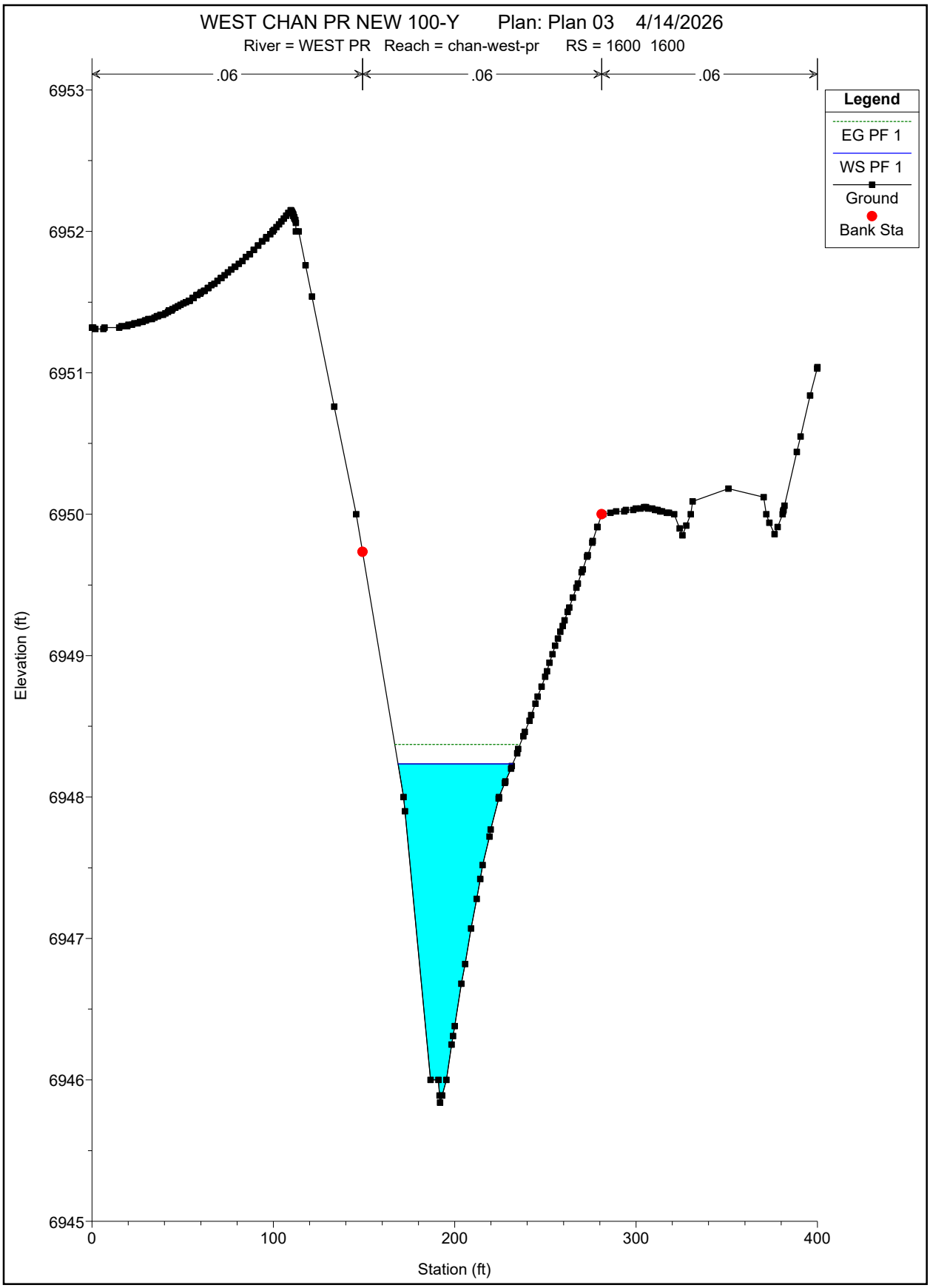

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 1850
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6959
6958
6957
6956
6955
6954
6953
6952
6951
50
100
150
200
250
300
Station (ft)

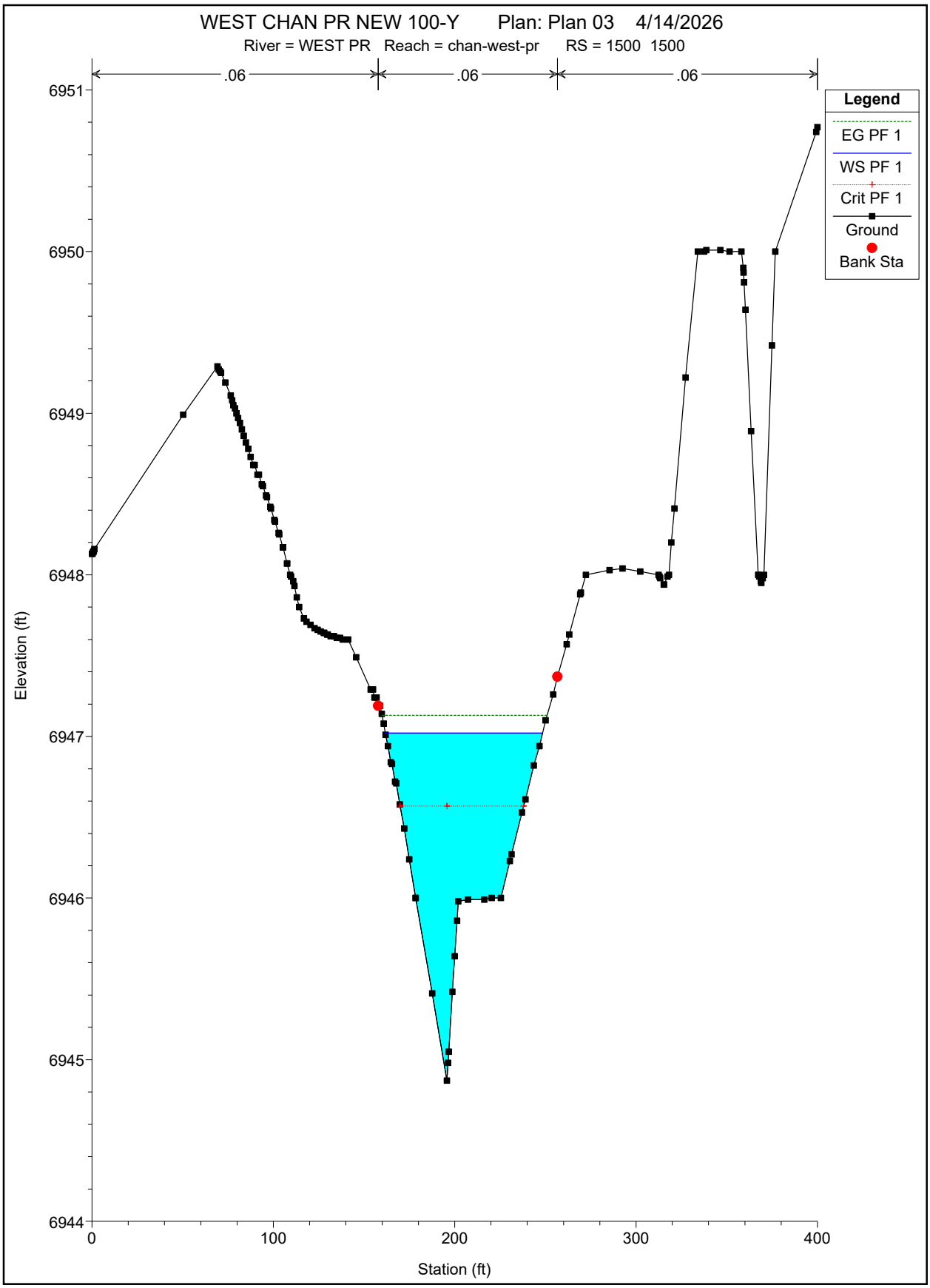

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 1820 1820
.06
.06
.06
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6956
6955
6954
6953
6952
6951
6950
100
150
200
250
300
Station (ft)

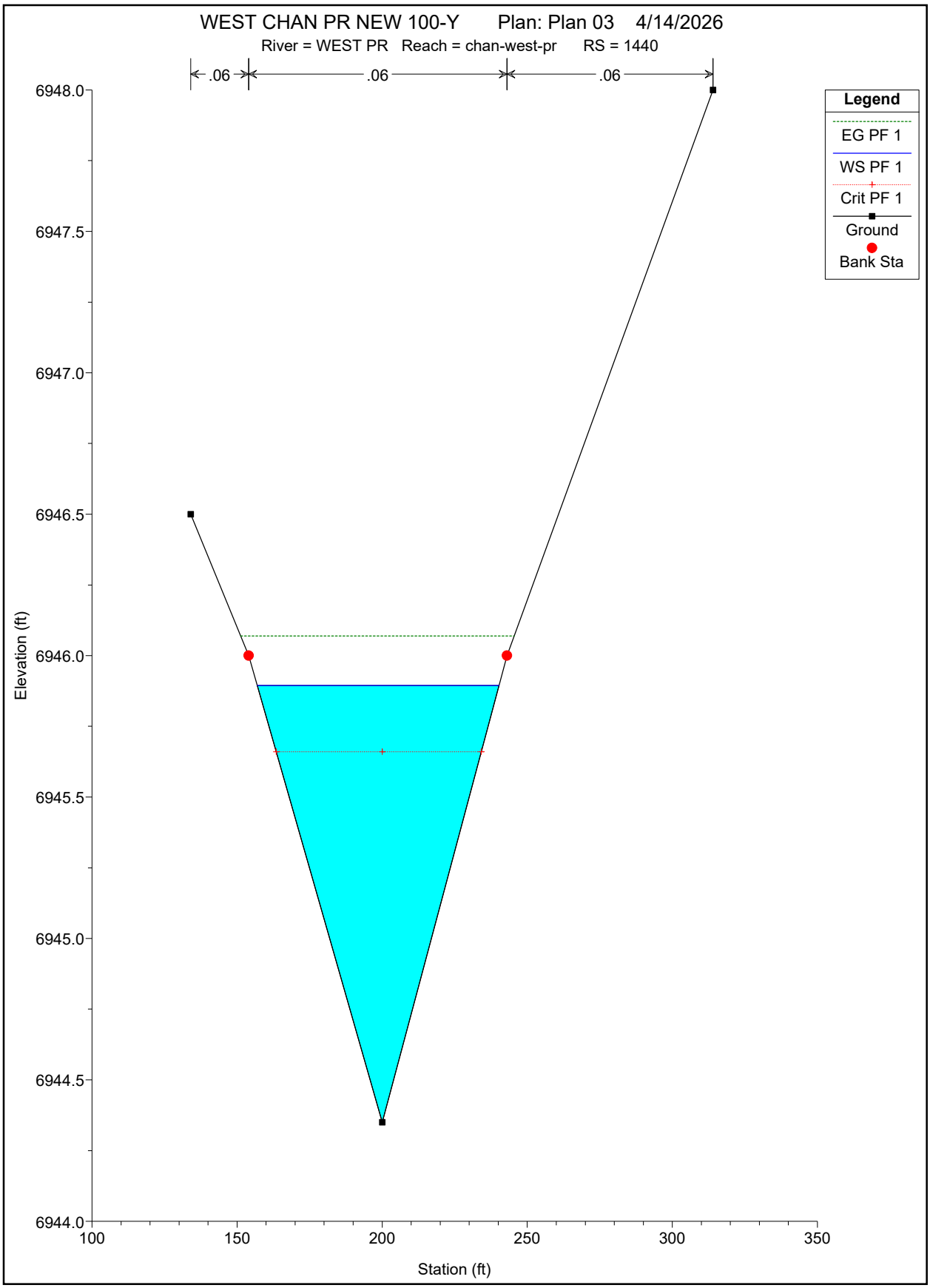

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 1800 1800
.06
.06
.06
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6956
6955
6954
6953
6952
6951
6950
80
100
120
140
160
180
200
220
240
260
280
Station (ft)

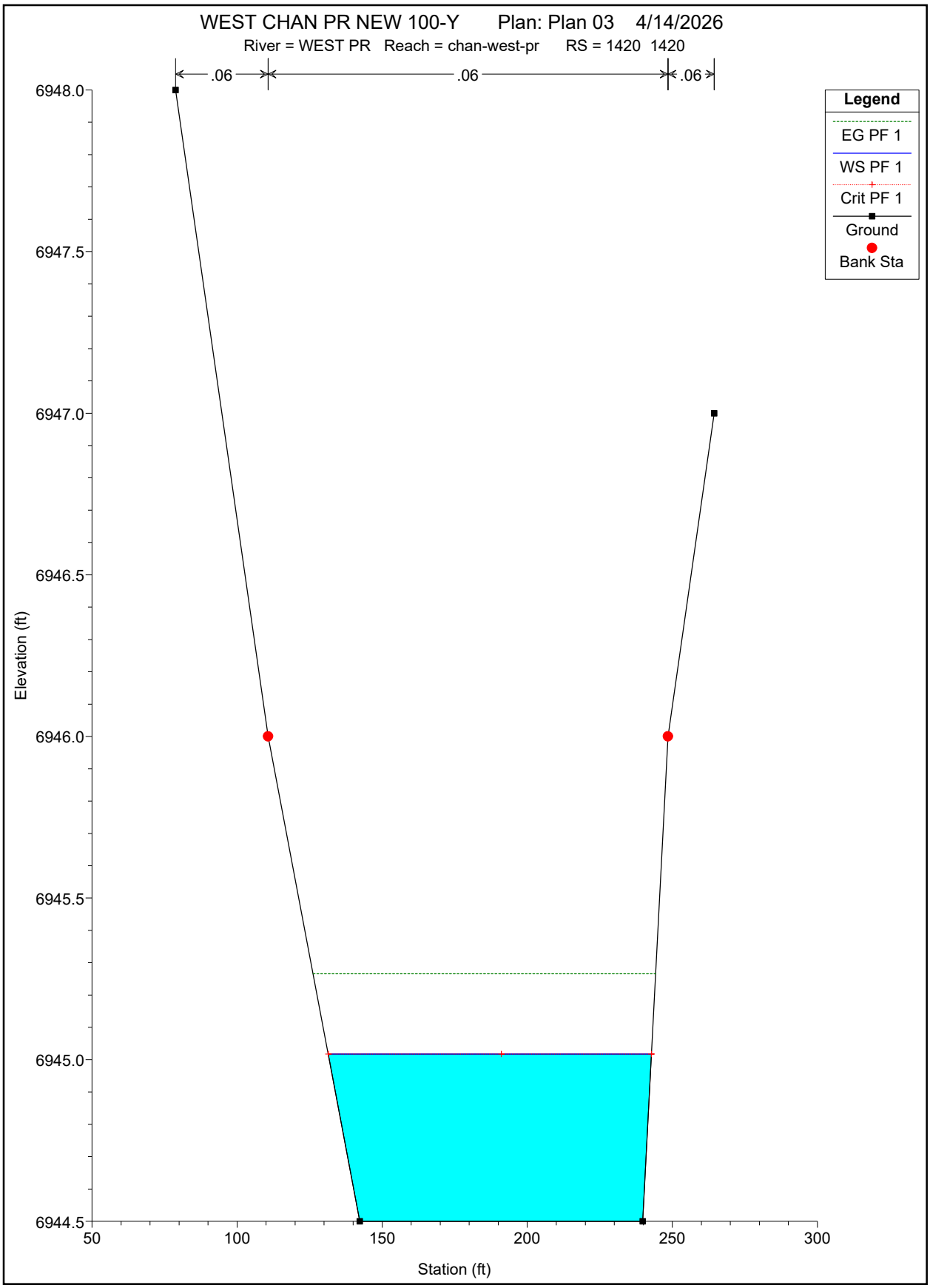

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 1780 1780
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6956
6954
6952
6950
6948
Elevation (ft)
50
100
150
200
250
300
Station (ft)

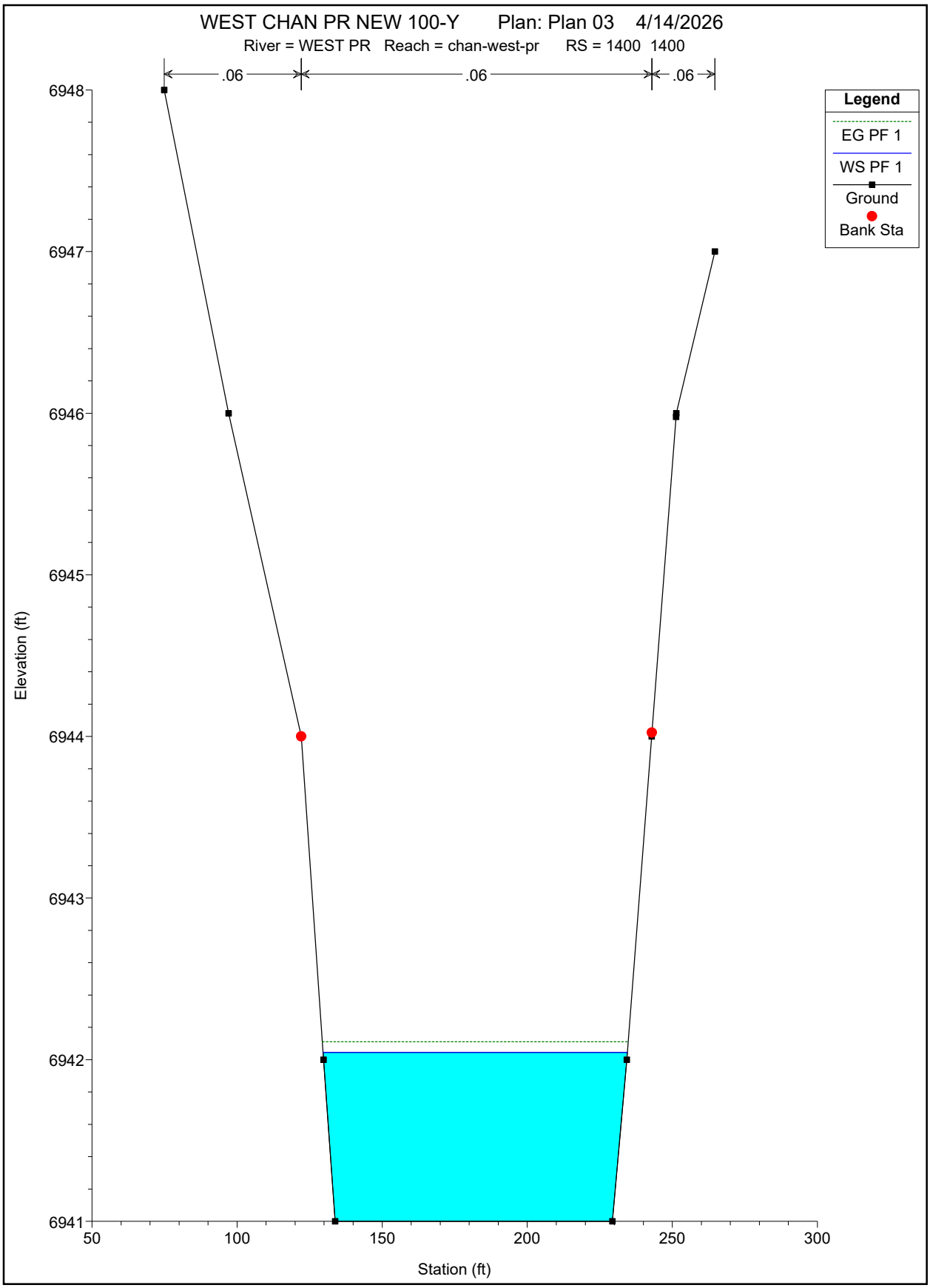

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 1700 1700
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6955
6954
6953
6952
6951
6950
6949
6948
6947
0
100
200
300
400
Station (ft)

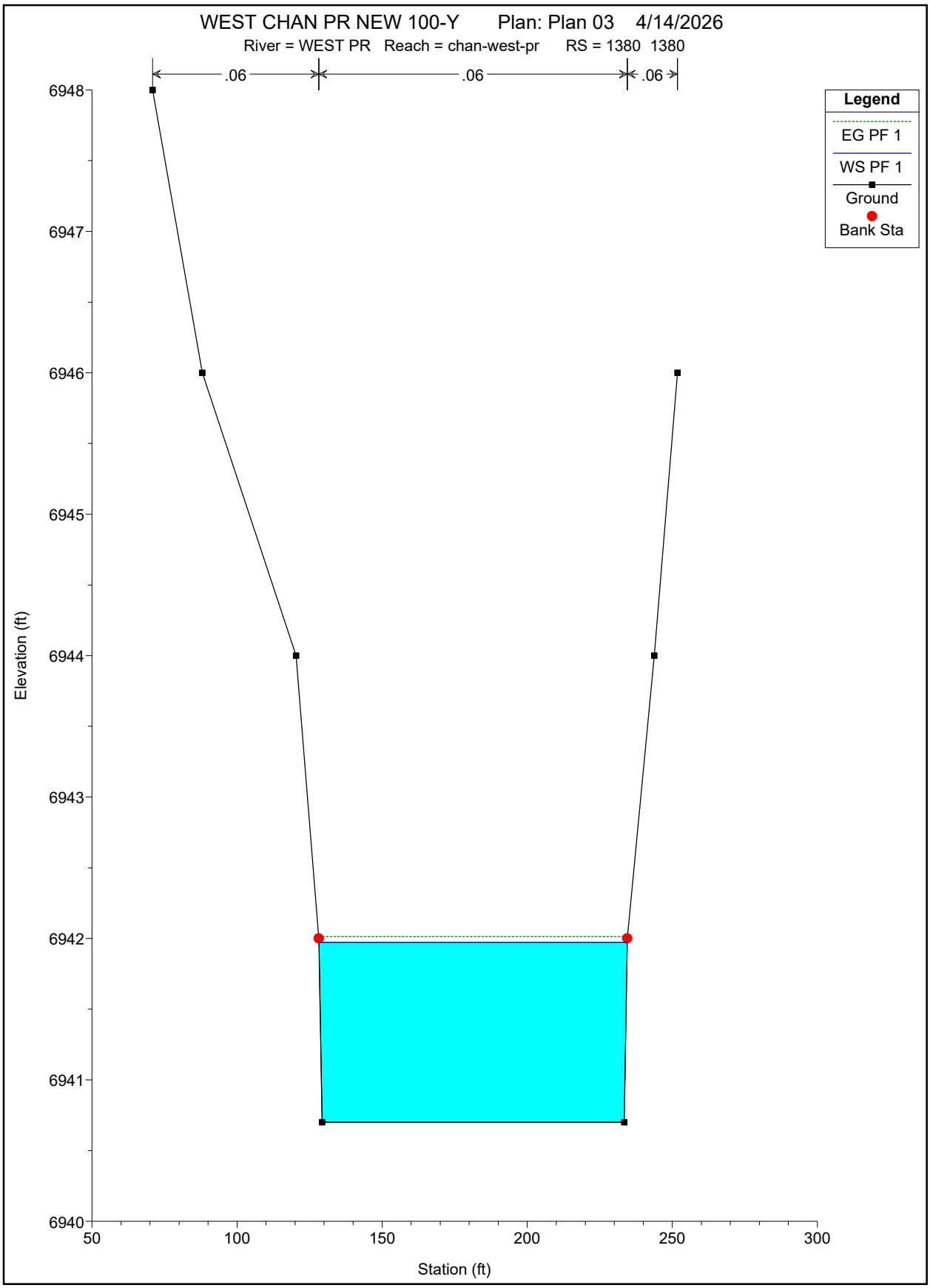

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 1600 1600
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6953
6952
6951
6950
6949
6948
6947
6946
6945
0
100
200
300
400
Station (ft)

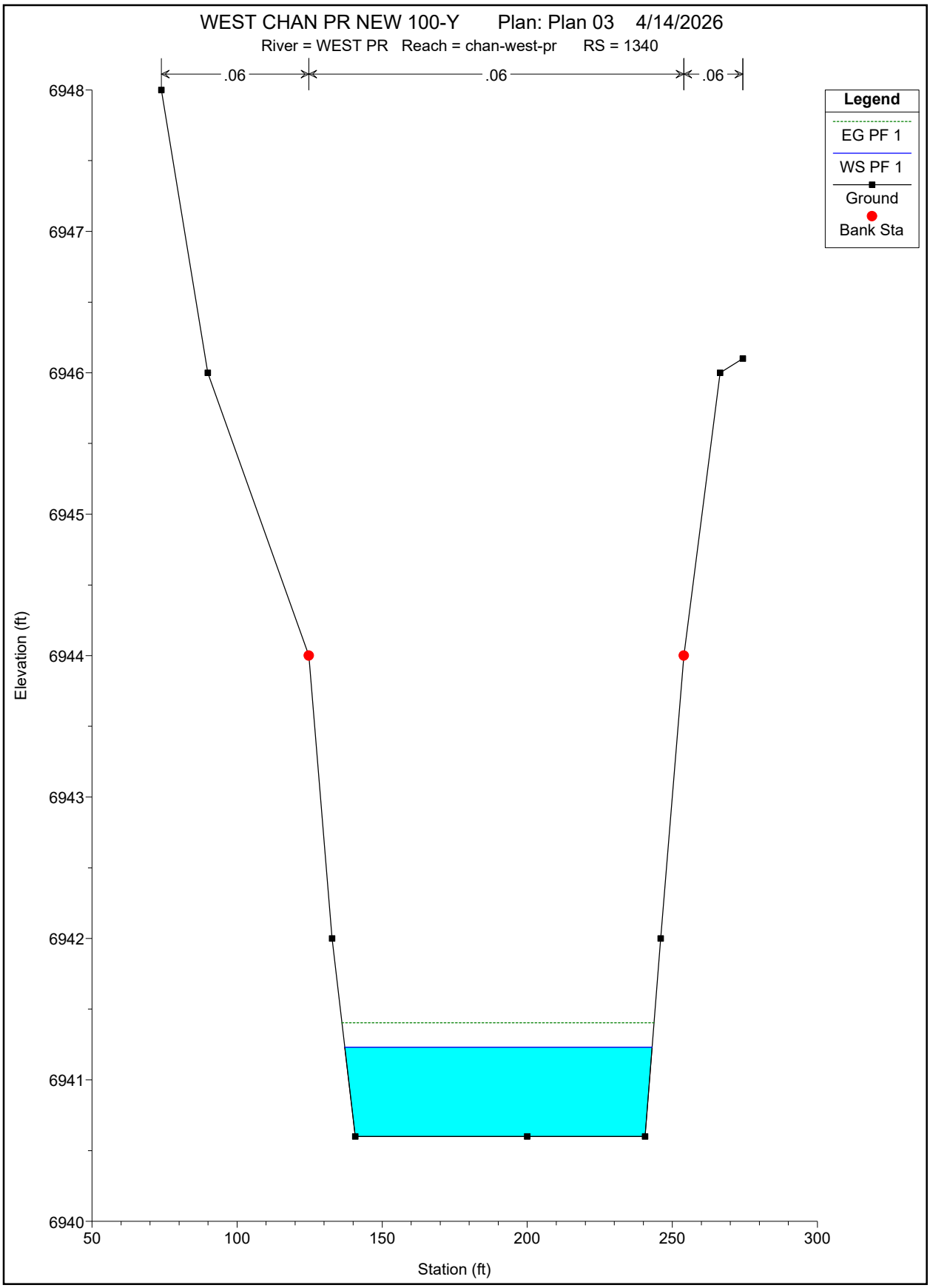

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 1500 1500
.06
.06
.06
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
6951
6950
6949
6948
6947
6946
6945
6944
0
100
200
300
400

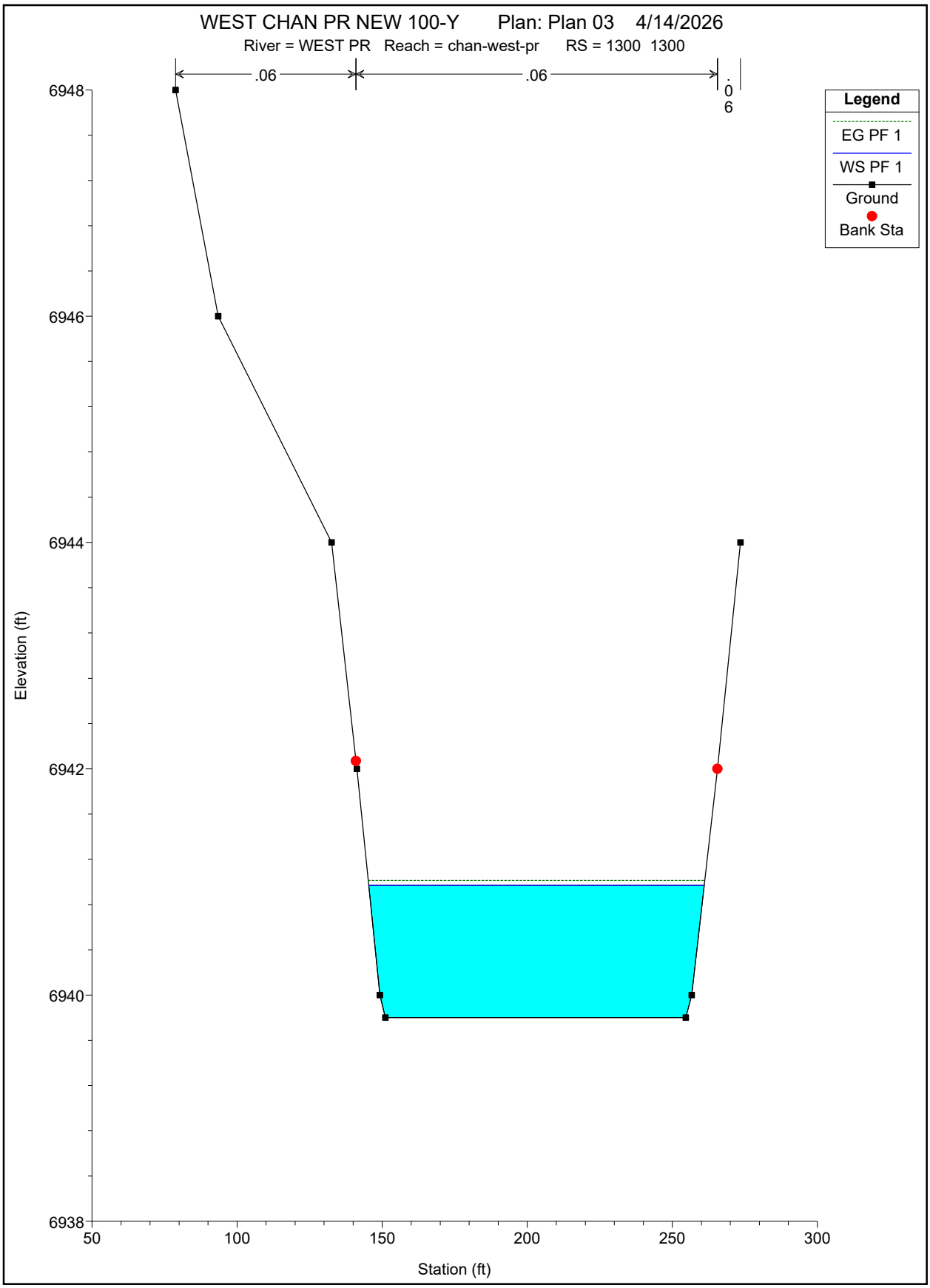

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 1440
.06
.06
.06
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6948.0
6947.5
6947.0
6946.5
6946.0
6945.5
6945.0
6944.5
6944.0
Elevation (ft)
100
150
200
250
300
350
Station (ft)

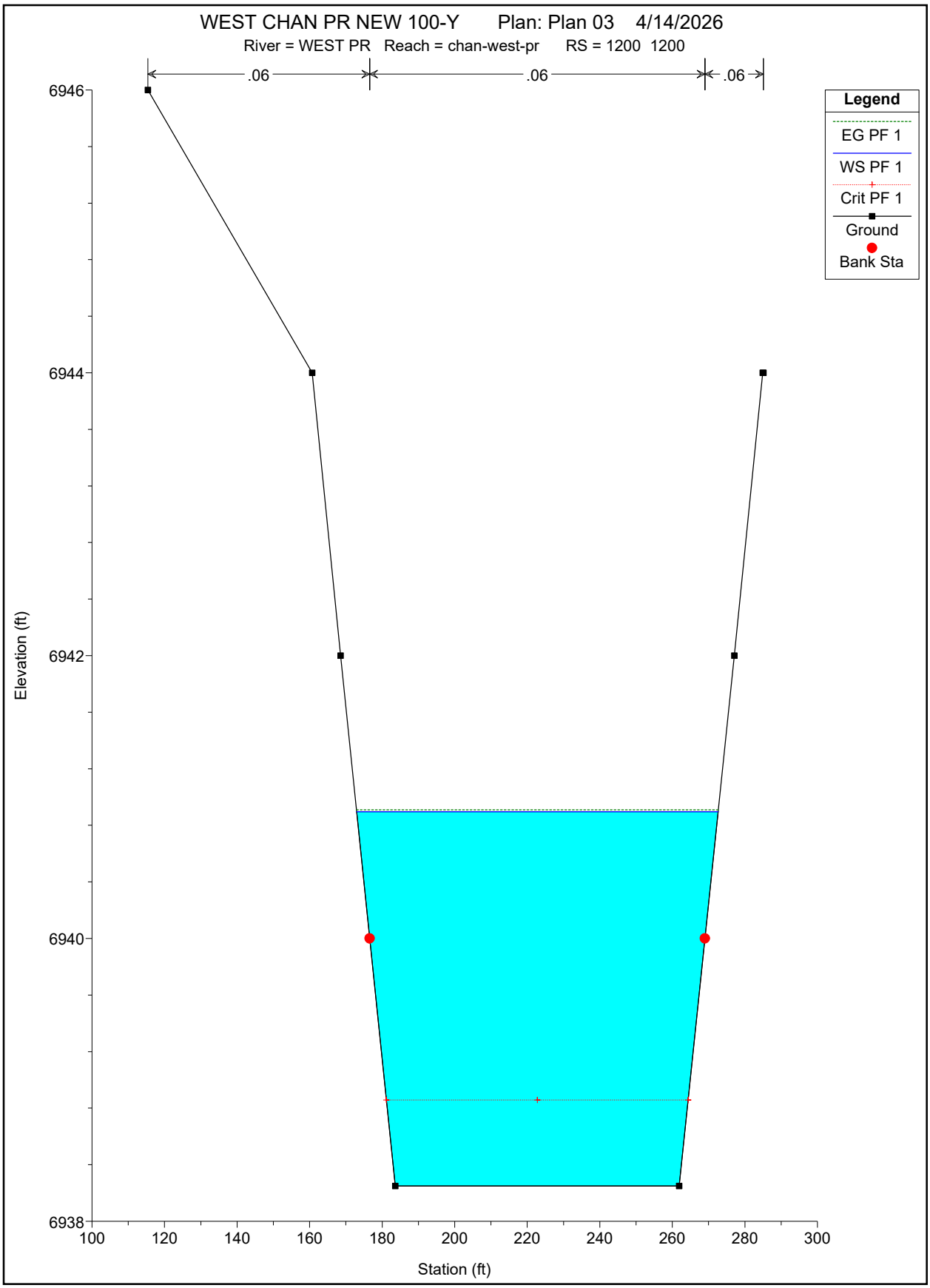

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 1420 1420
.06
.06
.06
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6948.0
6947.5
6947.0
6946.5
6946.0
6945.5
6945.0
6944.5
Elevation (ft)
50
100
150
200
250
300
Station (ft)

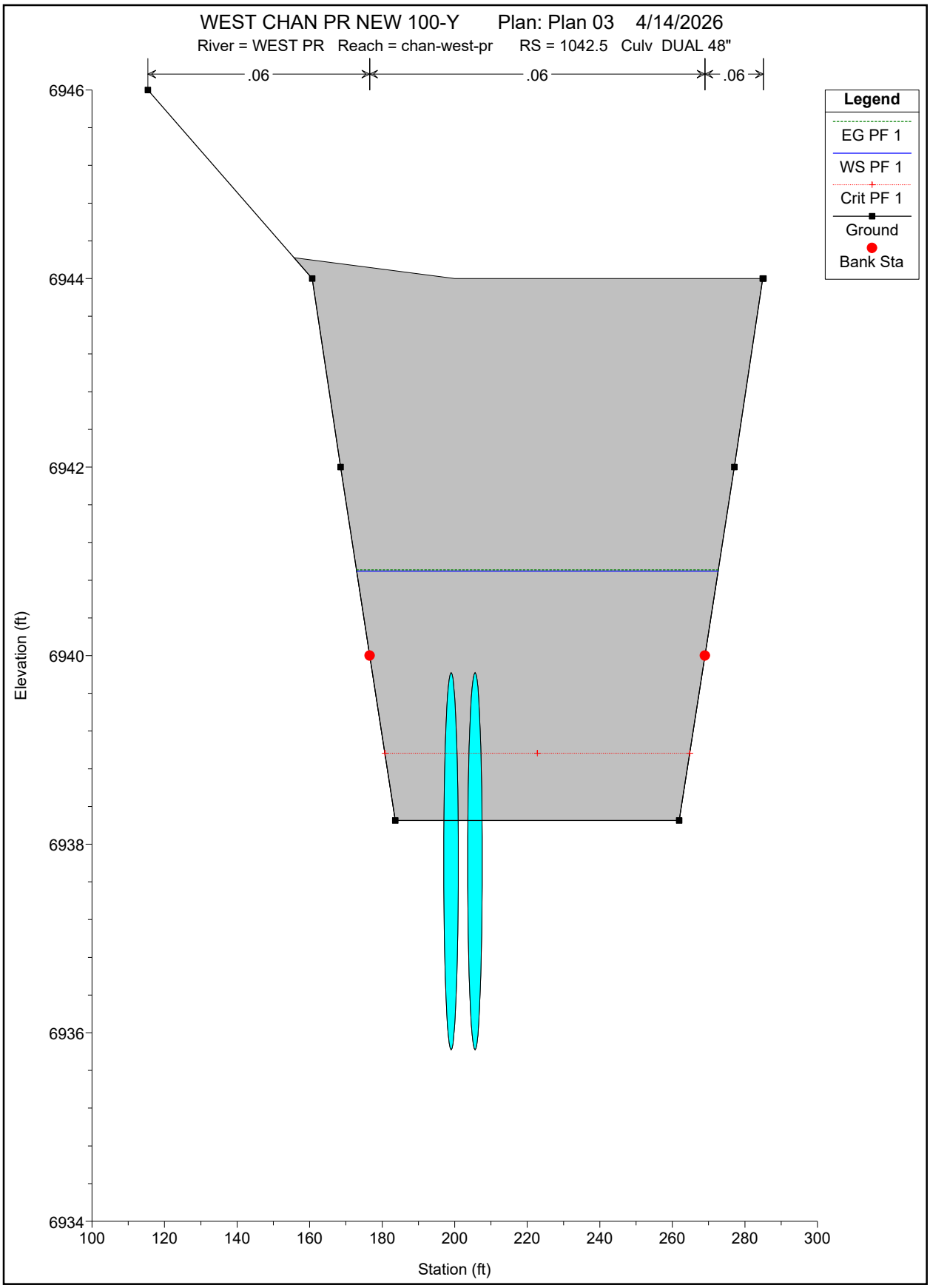

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 1400 1400
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6948
6947
6946
6945
6944
6943
6942
6941
Elevation (ft)
50
100
150
200
250
300
Station (ft)

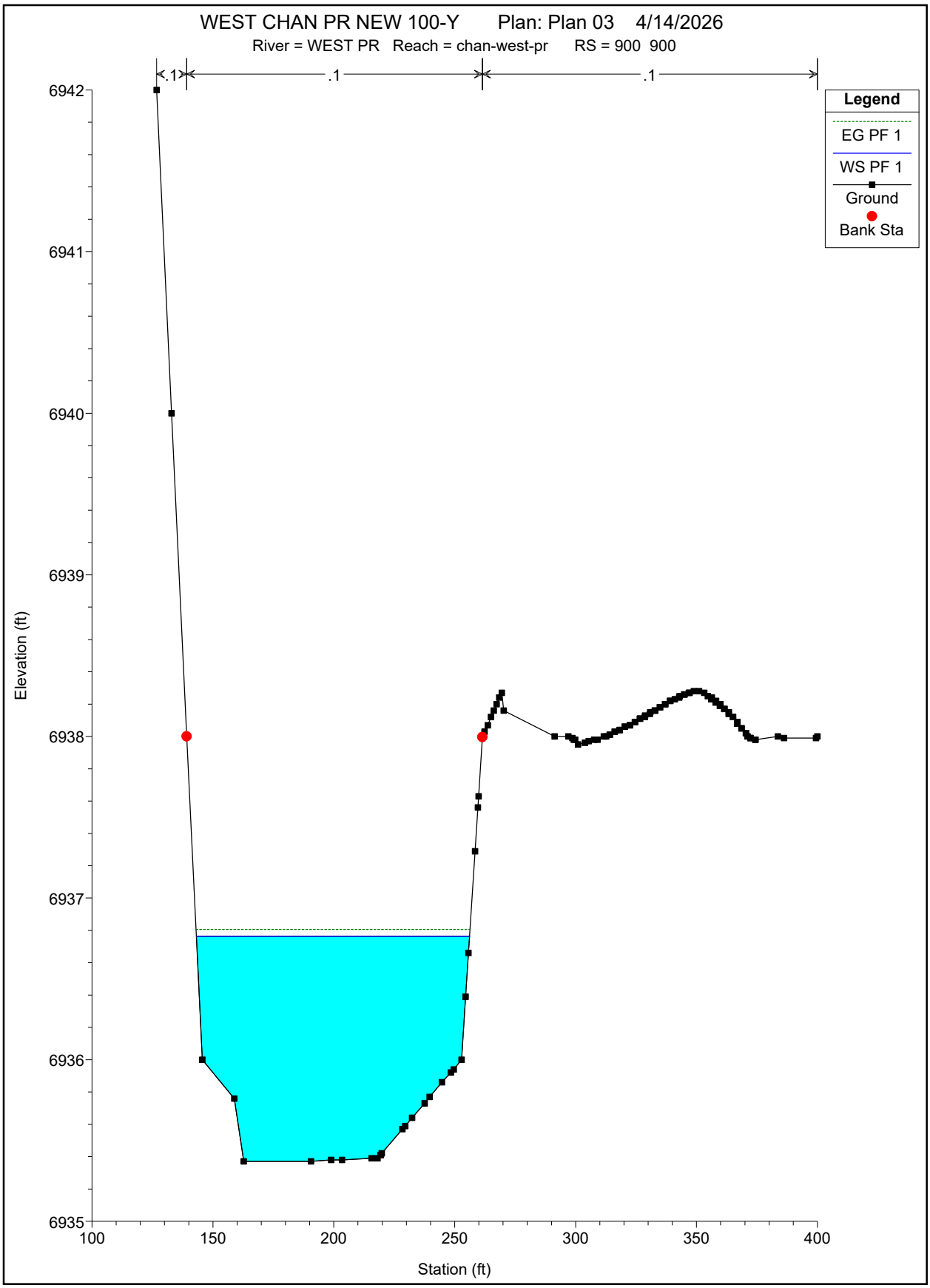

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 1380 1380
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6948
6947
6946
6945
6944
6943
6942
6941
6940
Elevation (ft)
50
100
150
200
250
300
Station (ft)

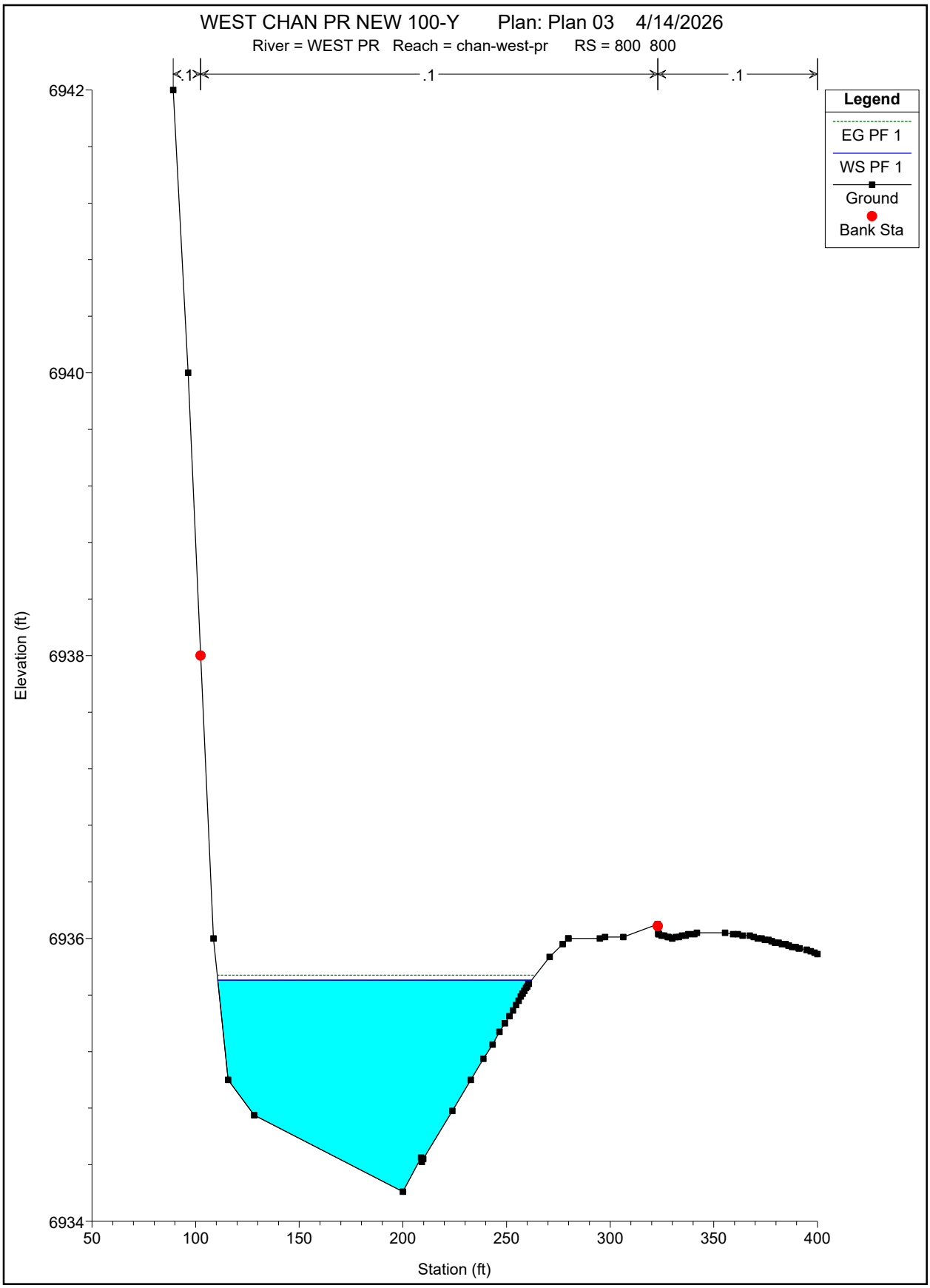

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 1340
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6948
6947
6946
6945
6944
6943
6942
6941
6940
50
100
150
200
250
300
Station (ft)

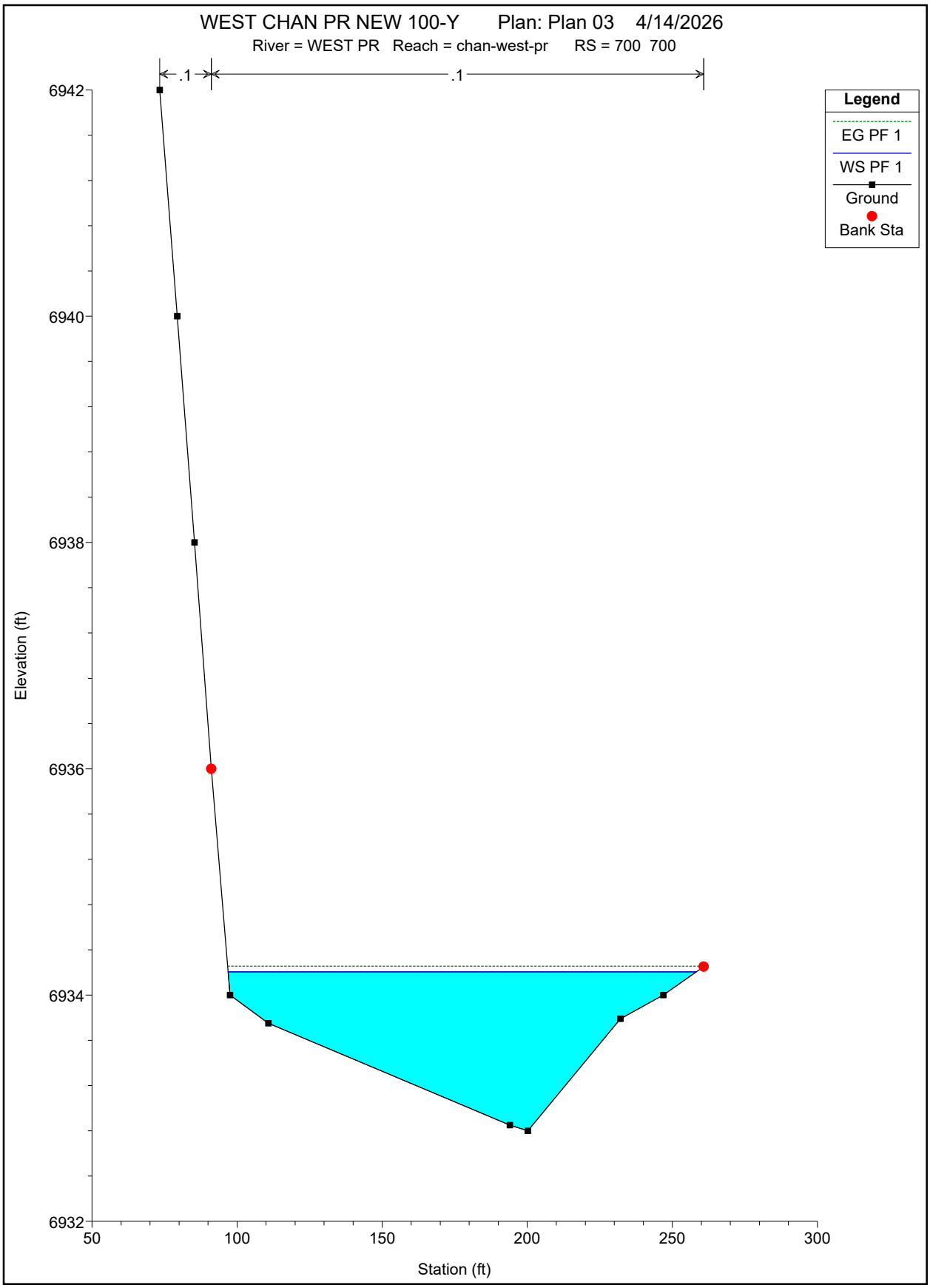

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 1300 1300
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6948
6946
6944
6942
6940
6938
Elevation (ft)
50
100
150
200
250
300
Station (ft)

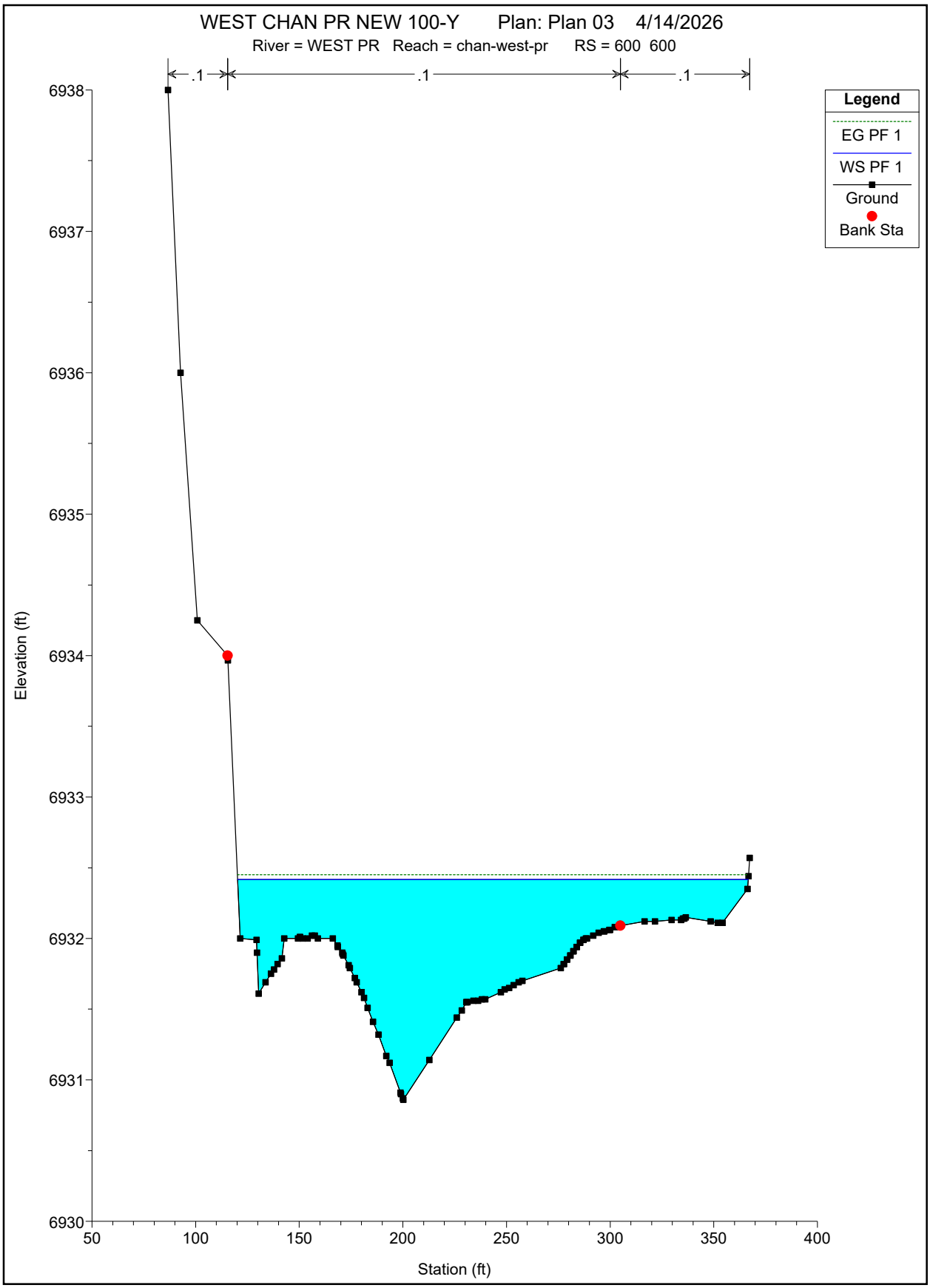

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 1200 1200
.06
.06
.06
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6946
6944
6942
6940
6938
100
120
140
160
180
200
220
240
260
280
300
Station (ft)

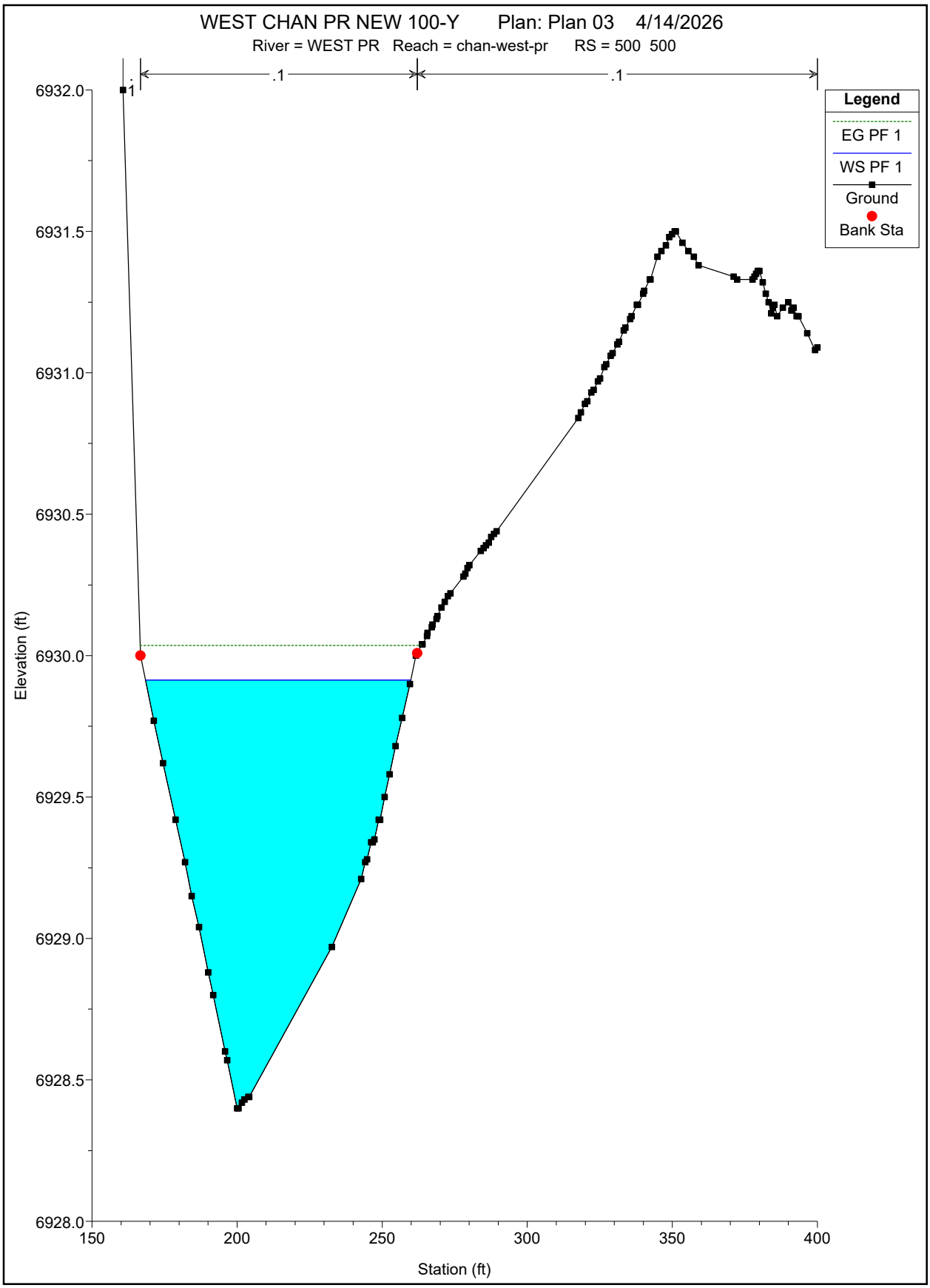

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 1042.5 Culv DUAL 48"
.06
.06
.06
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6946
6944
6942
6940
6938
6936
6934
100
120
140
160
180
200
220
240
260
280
300
Station (ft)

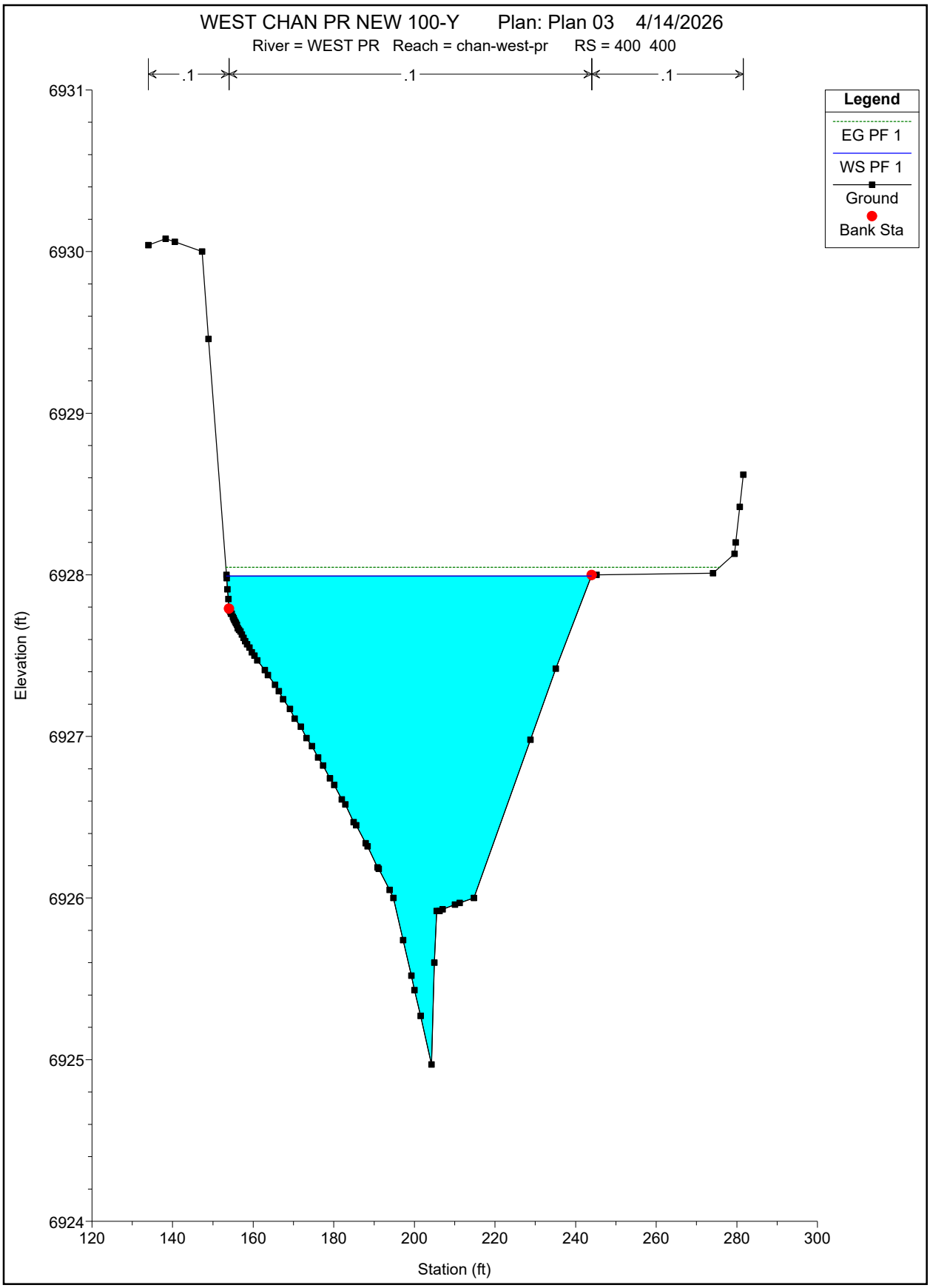

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 900 900
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6942
6941
6940
6939
6938
6937
6936
6935
100
150
200
250
300
350
400
Station (ft)

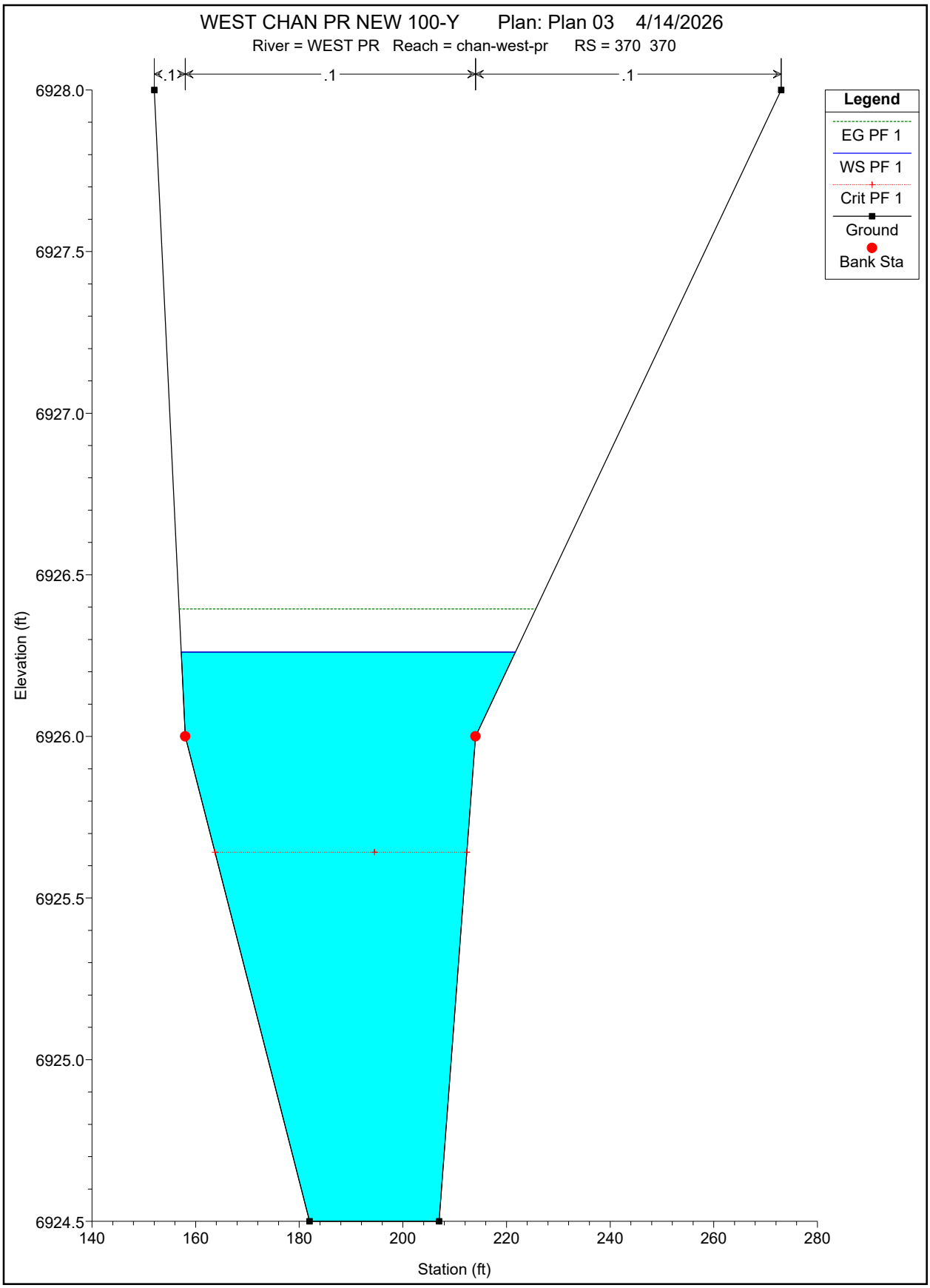

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 800 800
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6942
6940
6938
6936
6934
50
100
150
200
250
300
350
400
Station (ft)

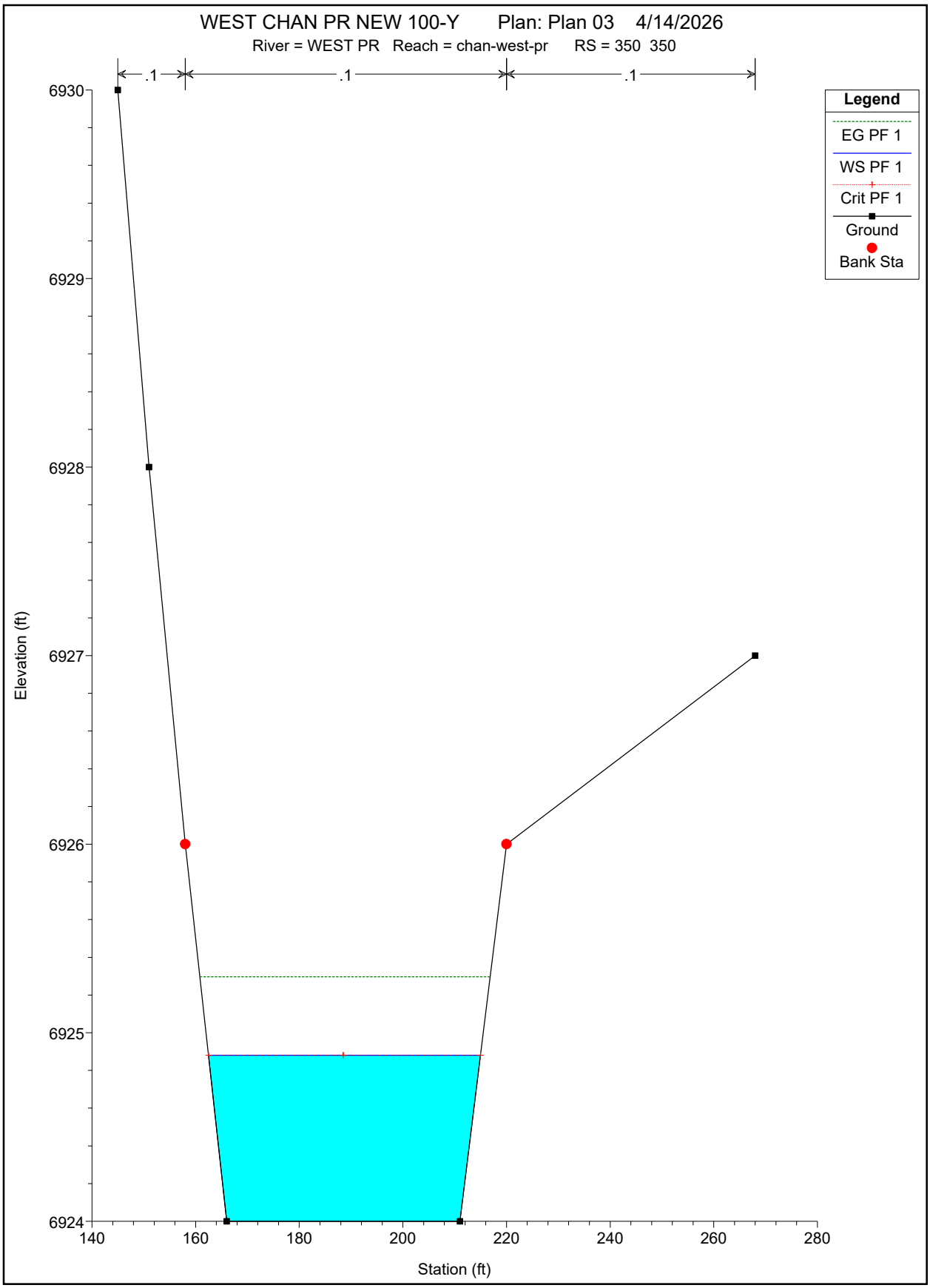

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 700 700
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6942
6940
6938
6936
6934
6932
Elevation (ft)
50
100
150
200
250
300
Station (ft)

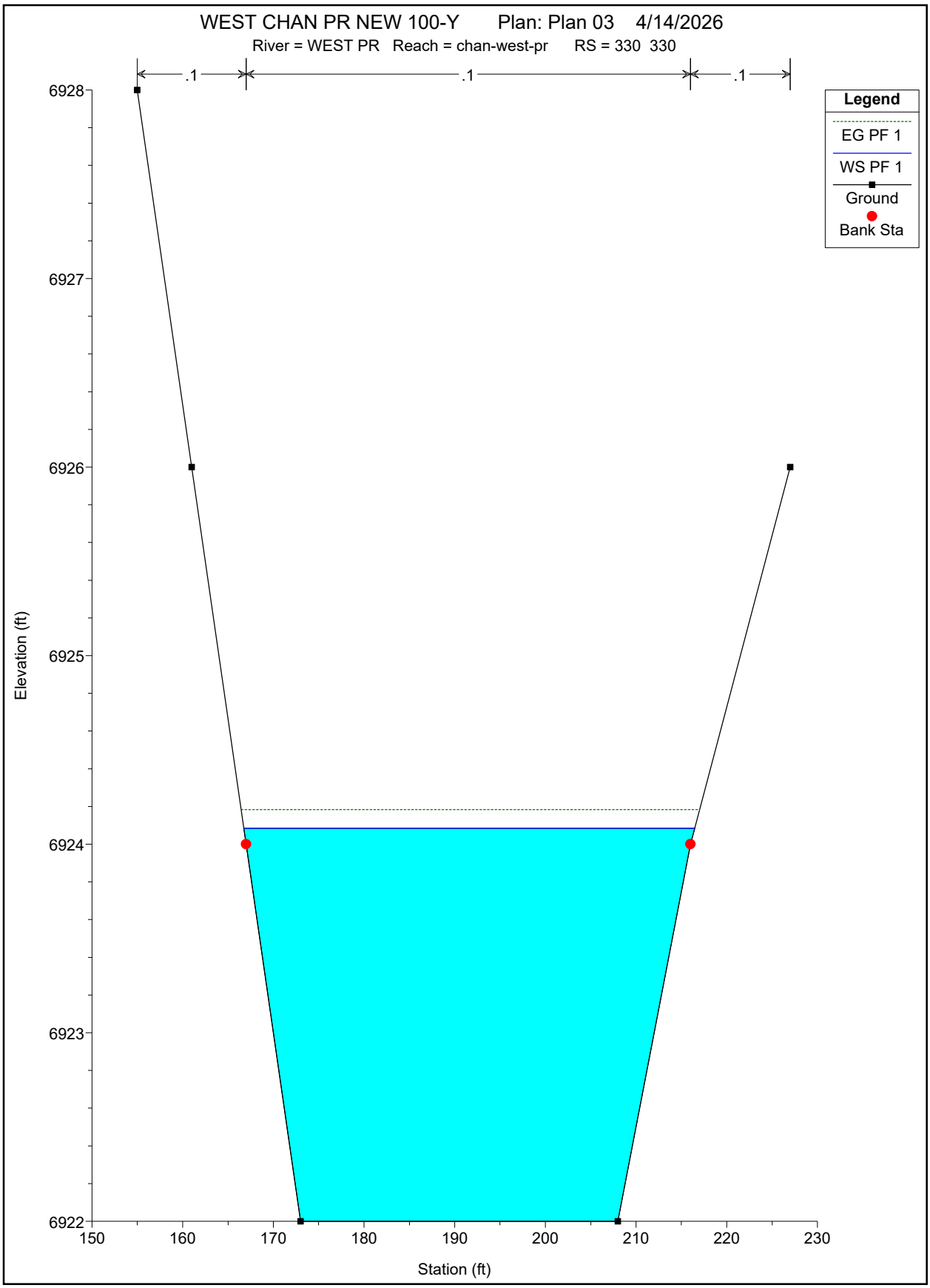

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 600 600
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6938
6937
6936
6935
6934
6933
6932
6931
6930
50
100
150
200
250
300
350
400
Station (ft)

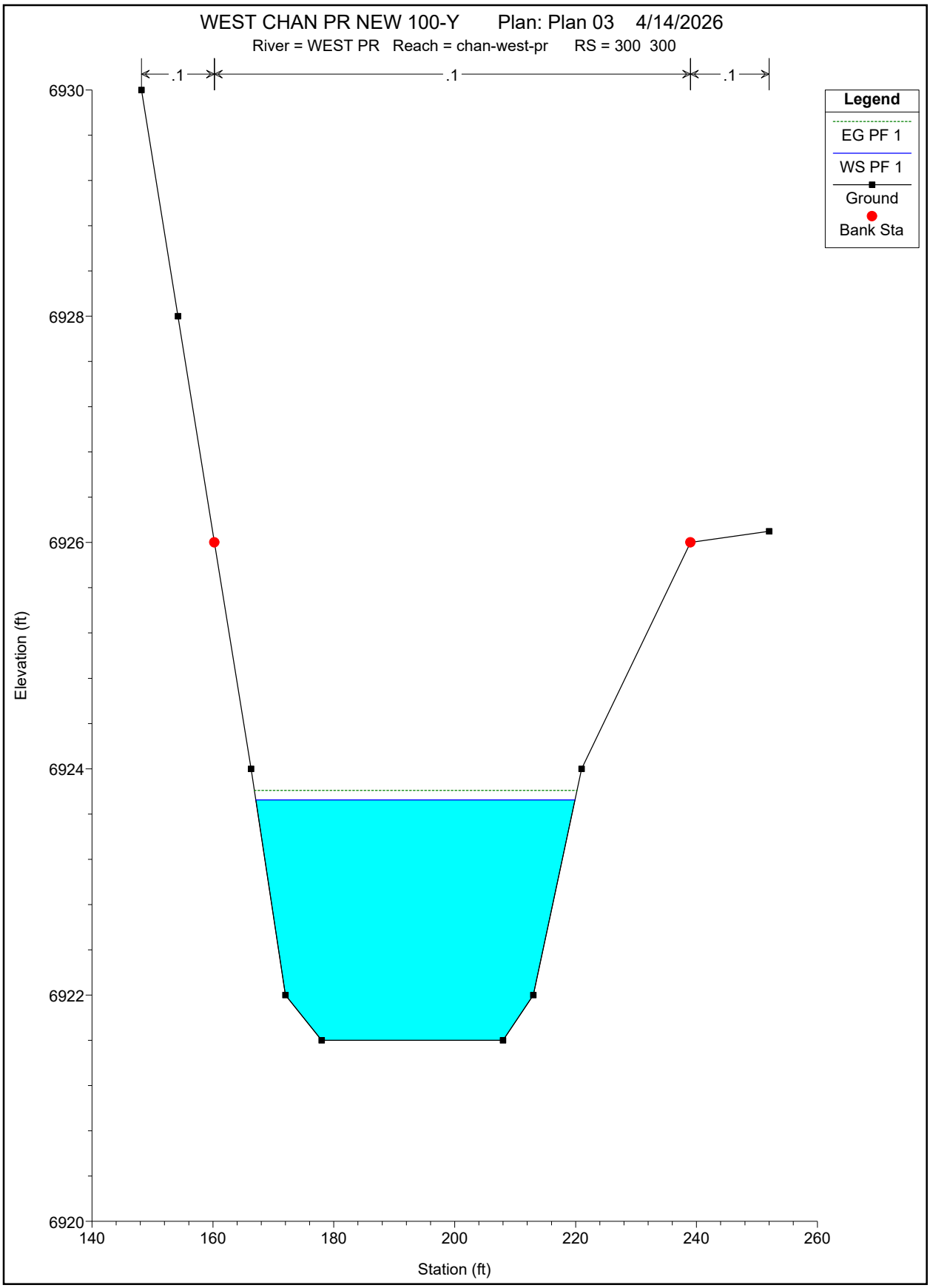

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 500 500
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6932.0
6931.5
6931.0
6930.5
6930.0
6929.5
6929.0
6928.5
6928.0
Elevation (ft)
150
200
250
300
350
400
Station (ft)

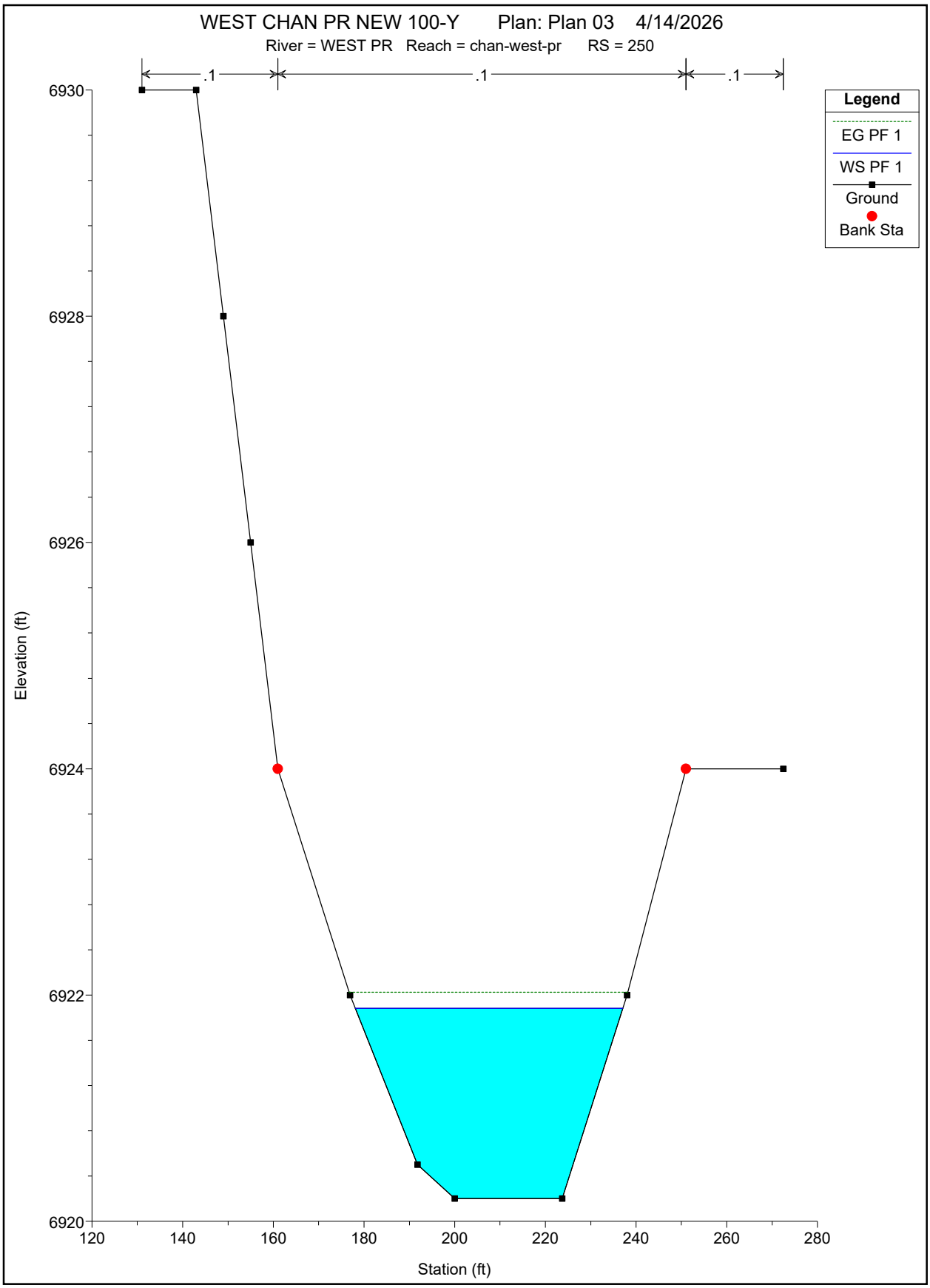

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 400 400
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
6931
6930
6929
6928
6927
6926
6925
6924
120
140
160
180
200
220
240
260
280
300

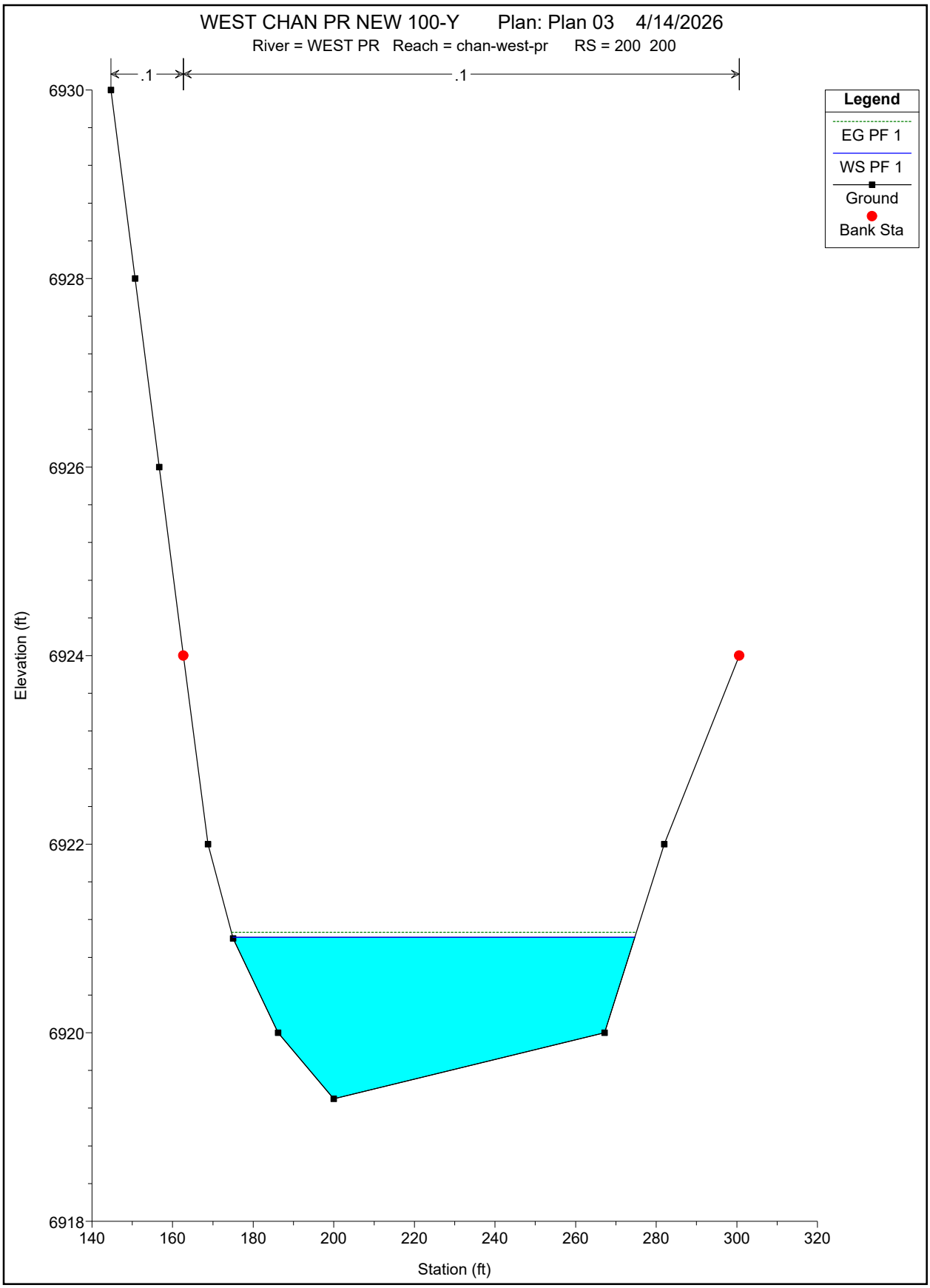

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 370 370
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6928.0
6927.5
6927.0
6926.5
6926.0
6925.5
6925.0
6924.5
Elevation (ft)
140
160
180
200
220
240
260
280
Station (ft)

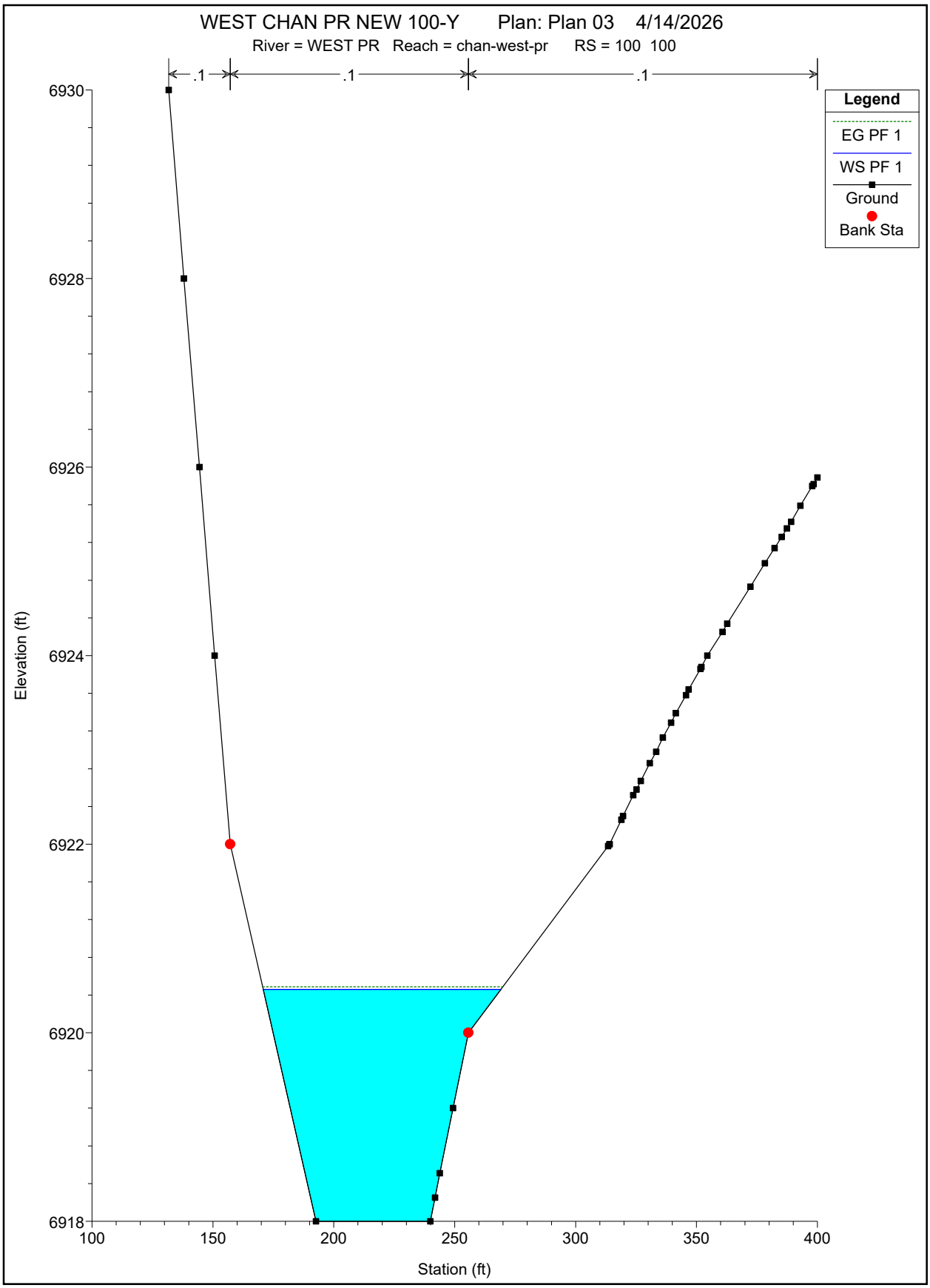

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 350 350
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6930
6929
6928
6927
6926
6925
6924
140
160
180
200
220
240
260
280
Station (ft)

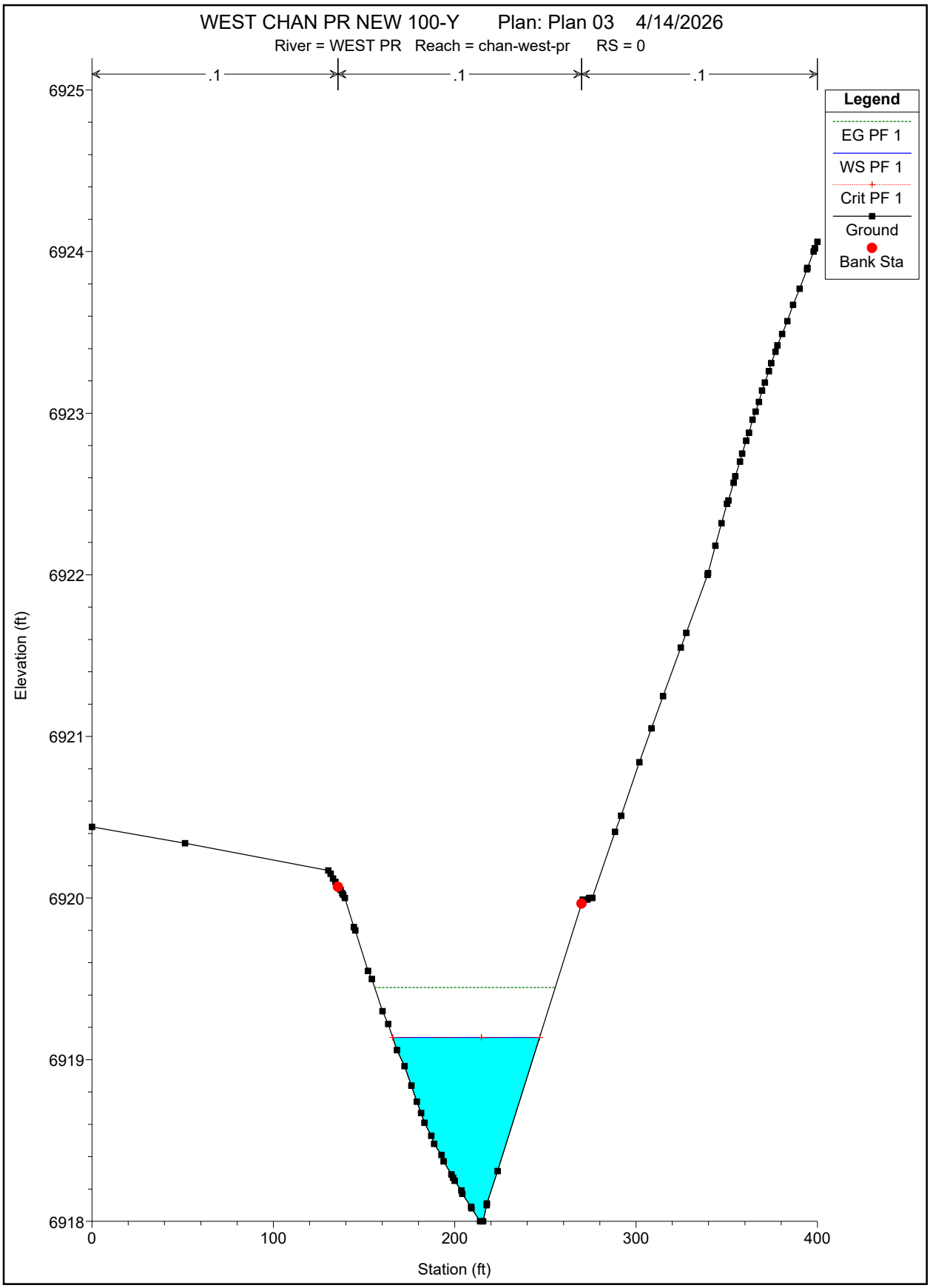

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 330 330
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6928
6927
6926
6925
6924
6923
6922
150
160
170
180
190
200
210
220
230
Station (ft)


WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 300 300
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6930
6928
6926
6924
6922
6920
Elevation (ft)
140
160
180
200
220
240
260
Station (ft)

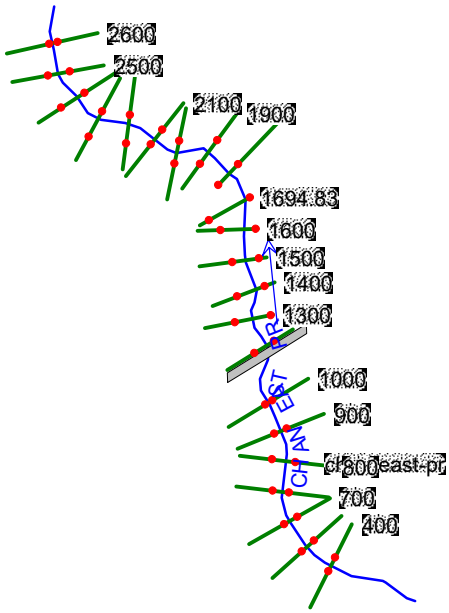

WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 250
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6930
6928
6926
6924
6922
6920
Elevation (ft)
120
140
160
180
200
220
240
260
280
Station (ft)


WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 200 200
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6930
6928
6926
6924
6922
6920
6918
140
160
180
200
220
240
260
280
300
320
Station (ft)


WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 100 100
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6930
6928
6926
6924
6922
6920
6918
Elevation (ft)
100
150
200
250
300
350
400
Station (ft)


WEST CHAN PR NEW 100-Y Plan: Plan 03 4/14/2026
River = WEST PR Reach = chan-west-pr RS = 0
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6925
6924
6923
6922
6921
6920
6919
6918
0
100
200
300
400
Station (ft)

EAST CHANNEL PROPOSED CONDITIONS



PROPOSED EAST CHANNEL 100-Y

HEC-RAS Plan: Plan 01 River: CHAN EAST PR Reach: chan-east-pr Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
chan-east-pr	2600	PF 1	151.00	6942.53	6944.49		6944.60	0.020083	3.02	66.20	108.74	0.48
chan-east-pr	2500	PF 1	151.00	6941.18	6943.07		6943.13	0.010904	1.96	84.33	124.93	0.34
chan-east-pr	2400	PF 1	151.00	6939.95	6941.64		6941.73	0.018619	2.32	65.19	74.51	0.44
chan-east-pr	2300	PF 1	151.00	6938.19	6939.43		6939.53	0.026082	2.57	58.82	74.24	0.51
chan-east-pr	2200	PF 1	151.00	6936.58	6938.37		6938.40	0.006135	1.52	100.52	103.51	0.26
chan-east-pr	2100	PF 1	151.00	6935.13	6937.50		6937.58	0.011365	2.31	65.48	51.30	0.36
chan-east-pr	2010.45	PF 1	151.00	6933.88	6935.43		6935.63	0.056212	3.63	42.30	65.96	0.74
chan-east-pr	1900	PF 1	151.00	6931.88	6933.84		6933.88	0.007048	1.62	93.32	88.19	0.28
chan-east-pr	1801.17	PF 1	151.00	6931.01	6932.59		6932.66	0.027173	2.09	72.33	92.03	0.41
chan-east-pr	1694.83	PF 1	151.00	6929.94	6931.11		6931.13	0.008773	1.24	121.34	143.39	0.24
chan-east-pr	1600	PF 1	151.00	6928.36	6929.63		6929.71	0.030740	2.19	69.00	89.57	0.44
chan-east-pr	1500	PF 1	151.00	6924.52	6926.65		6926.76	0.028222	2.70	55.97	49.57	0.45
chan-east-pr	1400	PF 1	151.00	6922.11	6924.73		6924.81	0.014150	2.23	67.68	66.38	0.39
chan-east-pr	1300	PF 1	151.00	6921.11	6924.05		6924.08	0.004293	1.49	101.14	73.88	0.22
chan-east-pr	1200	PF 1	151.00	6919.19	6924.04	6920.52	6924.04	0.000109	0.47	355.73	125.84	0.04
chan-east-pr	1111.15		Culvert									
chan-east-pr	1000	PF 1	188.00	6916.11	6919.03		6919.16	0.011207	3.06	73.33	65.85	0.38
chan-east-pr	900	PF 1	188.00	6915.02	6917.87		6917.99	0.012344	2.79	67.32	42.09	0.39
chan-east-pr	800	PF 1	188.00	6913.85	6916.89		6916.97	0.008358	2.34	80.17	48.98	0.32
chan-east-pr	700	PF 1	188.00	6913.13	6916.11		6916.19	0.007279	2.18	86.53	55.48	0.30
chan-east-pr	600	PF 1	188.00	6912.13	6914.59		6914.84	0.031340	4.00	46.99	34.58	0.61
chan-east-pr	500	PF 1	188.00	6909.89	6913.37		6913.46	0.007372	2.36	79.71	43.67	0.31
chan-east-pr	400	PF 1	188.00	6908.81	6911.02	6911.02	6911.60	0.094950	6.11	30.76	27.24	1.01

PROPOSED EAST CHANNEL 100-Y
W/ 0.05 MANNING'S M

HEC-RAS Plan: Plan 01 River: CHAN EAST PR Reach: chan-east-pr Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
chan-east-pr	2600	PF 1	151.00	6942.53	6944.27	6944.27	6944.52	0.021288	4.37	44.51	90.76	0.76
chan-east-pr	2500	PF 1	151.00	6941.18	6942.83	6942.56	6942.94	0.011541	2.68	58.03	91.34	0.54
chan-east-pr	2400	PF 1	151.00	6939.95	6941.38	6941.15	6941.54	0.017390	3.21	46.98	63.16	0.66
chan-east-pr	2300	PF 1	151.00	6938.19	6939.19		6939.39	0.027034	3.62	41.76	65.53	0.80
chan-east-pr	2200	PF 1	151.00	6936.58	6938.07		6938.14	0.006824	2.10	71.82	91.84	0.42
chan-east-pr	2100	PF 1	151.00	6935.13	6937.14	6936.70	6937.29	0.010480	3.14	48.12	45.21	0.54
chan-east-pr	2010.45	PF 1	151.00	6933.88	6935.25	6935.25	6935.59	0.042851	4.69	32.18	48.66	1.01
chan-east-pr	1900	PF 1	151.00	6931.88	6933.57		6933.64	0.005686	2.12	71.17	77.16	0.39
chan-east-pr	1801.17	PF 1	151.00	6931.01	6932.23	6932.22	6932.44	0.040694	3.71	40.76	83.82	0.94
chan-east-pr	1694.83	PF 1	151.00	6929.94	6930.85		6930.90	0.007081	1.79	84.22	138.65	0.41
chan-east-pr	1600	PF 1	151.00	6928.36	6929.22	6929.22	6929.49	0.046505	4.16	36.28	69.30	1.01
chan-east-pr	1500	PF 1	151.00	6924.52	6926.23		6926.48	0.018898	4.00	37.71	38.64	0.71
chan-east-pr	1400	PF 1	151.00	6922.11	6924.34		6924.53	0.019741	3.49	43.32	56.50	0.70
chan-east-pr	1300	PF 1	151.00	6921.11	6924.03		6924.06	0.001745	1.52	99.63	73.31	0.23
chan-east-pr	1200	PF 1	151.00	6919.19	6924.04	6920.53	6924.04	0.000043	0.47	355.73	125.84	0.04
chan-east-pr	1111.15		Culvert									
chan-east-pr	1000	PF 1	188.00	6916.11	6918.61		6918.88	0.011828	4.27	48.70	49.94	0.61
chan-east-pr	900	PF 1	188.00	6915.02	6917.34		6917.59	0.013804	4.04	46.56	36.87	0.63
chan-east-pr	800	PF 1	188.00	6913.85	6916.39		6916.56	0.007704	3.25	57.93	41.39	0.48
chan-east-pr	700	PF 1	188.00	6913.13	6915.77		6915.89	0.005606	2.74	68.62	49.60	0.41
chan-east-pr	600	PF 1	188.00	6912.13	6914.13	6914.13	6914.67	0.037631	5.88	31.97	30.75	1.02
chan-east-pr	500	PF 1	188.00	6909.89	6912.81		6912.97	0.006783	3.29	57.14	36.09	0.46
chan-east-pr	400	PF 1	188.00	6908.81	6911.02	6911.02	6911.60	0.037090	6.11	30.76	27.24	1.01

PROPOSED EAST CHANNEL 5-Y

HEC-RAS Plan: Plan 01 River: CHAN EAST PR Reach: chan-east-pr Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
chan-east-pr	2600	PF 1	31.00	6942.53	6943.83		6943.89	0.019615	1.94	15.94	24.40	0.42
chan-east-pr	2500	PF 1	31.00	6941.18	6942.43		6942.45	0.010793	1.12	27.62	62.13	0.30
chan-east-pr	2400	PF 1	31.00	6939.95	6940.80		6940.85	0.025978	1.77	17.49	38.34	0.46
chan-east-pr	2300	PF 1	31.00	6938.19	6938.88		6938.90	0.014891	1.32	23.46	52.68	0.35
chan-east-pr	2200	PF 1	31.00	6936.58	6937.54		6937.56	0.012323	1.14	27.31	66.80	0.31
chan-east-pr	2100	PF 1	31.00	6935.13	6936.57	6936.11	6936.60	0.007728	1.24	24.90	36.77	0.27
chan-east-pr	2010.45	PF 1	31.00	6933.88	6934.63	6934.62	6934.80	0.125209	3.34	9.29	25.65	0.98
chan-east-pr	1900	PF 1	31.00	6931.88	6932.93		6932.95	0.006112	1.03	30.23	50.91	0.23
chan-east-pr	1801.17	PF 1	31.00	6931.01	6931.95		6931.99	0.018414	1.54	20.08	41.86	0.39
chan-east-pr	1694.83	PF 1	31.00	6929.94	6930.55		6930.55	0.010212	0.71	43.53	133.24	0.22
chan-east-pr	1600	PF 1	31.00	6928.36	6929.02		6929.05	0.028146	1.33	23.29	59.69	0.38
chan-east-pr	1500	PF 1	31.00	6924.52	6925.46		6925.54	0.044684	2.20	14.08	23.87	0.51
chan-east-pr	1400	PF 1	31.00	6922.11	6924.18		6924.19	0.006255	0.89	34.87	52.71	0.19
chan-east-pr	1300	PF 1	31.00	6921.11	6922.19	6922.19	6922.36	0.200434	3.34	9.28	25.68	0.98
chan-east-pr	1200	PF 1	31.00	6919.19	6921.57	6920.03	6921.58	0.000290	0.31	99.20	71.76	0.05
chan-east-pr	1111.15		Culvert									
chan-east-pr	1000	PF 1	32.00	6916.11	6917.92		6917.95	0.010581	1.38	23.12	26.69	0.26
chan-east-pr	900	PF 1	32.00	6915.02	6916.54		6916.58	0.018490	1.58	20.27	28.93	0.33
chan-east-pr	800	PF 1	32.00	6913.85	6915.51		6915.53	0.006648	1.17	27.31	28.48	0.21
chan-east-pr	700	PF 1	32.00	6913.13	6914.93		6914.94	0.005243	0.99	32.44	36.42	0.18
chan-east-pr	600	PF 1	32.00	6912.13	6913.12	6913.12	6913.38	0.189670	4.04	7.92	15.92	1.01
chan-east-pr	500	PF 1	32.00	6909.89	6911.81		6911.83	0.004944	1.15	27.75	23.54	0.19
chan-east-pr	400	PF 1	32.00	6908.81	6910.10	6910.10	6910.32	0.207973	3.71	8.63	20.97	1.02

PROPOSED EAST CHANNEL 2-Y

HEC-RAS Plan: Plan 01 River: CHAN EAST PR Reach: chan-east-pr Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
chan-east-pr	2600	PF 1	21.00	6942.53	6943.67		6943.72	0.018097	1.71	12.27	21.41	0.40
chan-east-pr	2500	PF 1	21.00	6941.18	6942.31		6942.33	0.010976	1.03	20.48	53.39	0.29
chan-east-pr	2400	PF 1	21.00	6939.95	6940.68		6940.72	0.025717	1.60	13.12	33.26	0.45
chan-east-pr	2300	PF 1	21.00	6938.19	6938.77		6938.79	0.014820	1.17	17.90	47.90	0.34
chan-east-pr	2200	PF 1	21.00	6936.58	6937.39		6937.41	0.012863	1.11	18.89	49.25	0.32
chan-east-pr	2100	PF 1	21.00	6935.13	6936.42	6936.03	6936.43	0.007648	1.09	19.31	34.63	0.26
chan-east-pr	2010.45	PF 1	21.00	6933.88	6934.53	6934.51	6934.67	0.121395	3.00	7.01	22.18	0.94
chan-east-pr	1900	PF 1	21.00	6931.88	6932.77		6932.78	0.006323	0.94	22.37	44.10	0.23
chan-east-pr	1801.17	PF 1	21.00	6931.01	6931.87	6931.56	6931.89	0.013535	1.24	16.88	38.60	0.33
chan-east-pr	1694.83	PF 1	21.00	6929.94	6930.45		6930.46	0.013196	0.67	31.11	125.07	0.24
chan-east-pr	1600	PF 1	21.00	6928.36	6928.97		6928.99	0.018681	1.02	20.55	57.53	0.30
chan-east-pr	1500	PF 1	21.00	6924.52	6925.16		6925.28	0.105830	2.70	7.77	18.48	0.74
chan-east-pr	1400	PF 1	21.00	6922.11	6923.84		6923.85	0.005242	0.97	21.73	25.27	0.18
chan-east-pr	1300	PF 1	21.00	6921.11	6922.08	6922.08	6922.23	0.249263	3.19	6.58	22.91	1.05
chan-east-pr	1200	PF 1	21.00	6919.19	6921.28	6919.87	6921.28	0.000248	0.27	79.17	65.08	0.04
chan-east-pr	1111.15		Culvert									
chan-east-pr	1000	PF 1	22.00	6916.11	6917.74		6917.77	0.009297	1.19	18.51	24.19	0.24
chan-east-pr	900	PF 1	22.00	6915.02	6916.35		6916.38	0.022502	1.48	14.84	27.01	0.35
chan-east-pr	800	PF 1	22.00	6913.85	6915.28		6915.30	0.006315	1.04	21.10	25.25	0.20
chan-east-pr	700	PF 1	22.00	6913.13	6914.72		6914.74	0.005064	0.87	25.26	33.29	0.18
chan-east-pr	600	PF 1	22.00	6912.13	6912.98	6912.98	6913.20	0.198497	3.74	5.88	13.72	1.01
chan-east-pr	500	PF 1	22.00	6909.89	6911.55		6911.56	0.004425	1.00	21.96	21.17	0.17
chan-east-pr	400	PF 1	22.00	6908.81	6910.00	6910.00	6910.18	0.238618	3.40	6.47	19.84	1.05

PROPOSED EAST CHANNEL 100-Y

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 2600 Profile: PF 1

E.G. Elev (ft)	6944.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.080	0.080	0.080
W.S. Elev (ft)	6944.49	Reach Len. (ft)	103.00	100.00	103.00
Crit W.S. (ft)		Flow Area (sq ft)	2.13	33.58	30.49
E.G. Slope (ft/ft)	0.020083	Area (sq ft)	2.13	33.58	30.49
Q Total (cfs)	151.00	Flow (cfs)	1.95	101.52	47.53
Top Width (ft)	108.74	Top Width (ft)	14.87	27.00	66.87
Vel Total (ft/s)	2.28	Avg. Vel. (ft/s)	0.91	3.02	1.56
Max Chl Dpth (ft)	1.96	Hydr. Depth (ft)	0.14	1.24	0.46
Conv. Total (cfs)	1065.5	Conv. (cfs)	13.8	716.4	335.4
Length Wtd. (ft)	100.57	Wetted Per. (ft)	14.99	27.28	66.88
Min Ch El (ft)	6942.53	Shear (lb/sq ft)	0.18	1.54	0.57
Alpha	1.33	Stream Power (lb/ft s)	0.16	4.67	0.89
Frctn Loss (ft)	1.45	Cum Volume (acre-ft)	0.05	3.69	0.14
C & E Loss (ft)	0.02	Cum SA (acres)	0.23	3.27	0.34

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 2500 Profile: PF 1

E.G. Elev (ft)	6943.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.	0.080	0.080	0.080
W.S. Elev (ft)	6943.07	Reach Len. (ft)	83.00	100.00	112.00
Crit W.S. (ft)		Flow Area (sq ft)	6.97	73.09	4.26
E.G. Slope (ft/ft)	0.010904	Area (sq ft)	6.97	73.09	4.26
Q Total (cfs)	151.00	Flow (cfs)	4.66	143.00	3.34
Top Width (ft)	124.93	Top Width (ft)	36.36	72.00	16.56
Vel Total (ft/s)	1.79	Avg. Vel. (ft/s)	0.67	1.96	0.78
Max Chl Dpth (ft)	1.89	Hydr. Depth (ft)	0.19	1.02	0.26
Conv. Total (cfs)	1446.0	Conv. (cfs)	44.7	1369.4	32.0
Length Wtd. (ft)	99.87	Wetted Per. (ft)	36.61	72.15	16.57
Min Ch El (ft)	6941.18	Shear (lb/sq ft)	0.13	0.69	0.17
Alpha	1.14	Stream Power (lb/ft s)	0.09	1.35	0.14
Frctn Loss (ft)	1.40	Cum Volume (acre-ft)	0.04	3.56	0.10
C & E Loss (ft)	0.00	Cum SA (acres)	0.17	3.16	0.24

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 2400 Profile: PF 1

E.G. Elev (ft)	6941.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.		0.080	
W.S. Elev (ft)	6941.64	Reach Len. (ft)	83.00	100.00	128.00
Crit W.S. (ft)		Flow Area (sq ft)		65.19	
E.G. Slope (ft/ft)	0.018619	Area (sq ft)		65.19	
Q Total (cfs)	151.00	Flow (cfs)		151.00	
Top Width (ft)	74.51	Top Width (ft)		74.51	
Vel Total (ft/s)	2.32	Avg. Vel. (ft/s)		2.32	
Max Chl Dpth (ft)	1.69	Hydr. Depth (ft)		0.87	
Conv. Total (cfs)	1106.6	Conv. (cfs)		1106.6	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		74.61	
Min Ch El (ft)	6939.95	Shear (lb/sq ft)		1.02	
Alpha	1.00	Stream Power (lb/ft s)		2.35	
Frctn Loss (ft)	2.19	Cum Volume (acre-ft)	0.03	3.40	0.09
C & E Loss (ft)	0.00	Cum SA (acres)	0.13	2.99	0.22

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 2300 Profile: PF 1

E.G. Elev (ft)	6939.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.		0.080	
W.S. Elev (ft)	6939.43	Reach Len. (ft)	90.00	100.00	123.00
Crit W.S. (ft)		Flow Area (sq ft)		58.82	
E.G. Slope (ft/ft)	0.026082	Area (sq ft)		58.82	
Q Total (cfs)	151.00	Flow (cfs)		151.00	

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 2300 Profile: PF 1 (Continued)

Top Width (ft)	74.24	Top Width (ft)		74.24	
Vel Total (ft/s)	2.57	Avg. Vel. (ft/s)		2.57	
Max Chl Dpth (ft)	1.24	Hydr. Depth (ft)		0.79	
Conv. Total (cfs)	935.0	Conv. (cfs)		935.0	
Length Wtd. (ft)	99.97	Wetted Per. (ft)		74.31	
Min Ch El (ft)	6938.19	Shear (lb/sq ft)		1.29	
Alpha	1.00	Stream Power (lb/ft s)		3.31	
Frctn Loss (ft)	1.11	Cum Volume (acre-ft)	0.03	3.26	0.09
C & E Loss (ft)	0.02	Cum SA (acres)	0.13	2.82	0.22

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 2200 Profile: PF 1

E.G. Elev (ft)	6938.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.080	0.080	
W.S. Elev (ft)	6938.37	Reach Len. (ft)	115.00	100.00	80.00
Crit W.S. (ft)		Flow Area (sq ft)	1.97	98.55	
E.G. Slope (ft/ft)	0.006135	Area (sq ft)	1.97	98.55	
Q Total (cfs)	151.00	Flow (cfs)	0.87	150.13	
Top Width (ft)	103.51	Top Width (ft)	11.72	91.79	
Vel Total (ft/s)	1.50	Avg. Vel. (ft/s)	0.44	1.52	
Max Chl Dpth (ft)	1.79	Hydr. Depth (ft)	0.17	1.07	
Conv. Total (cfs)	1927.9	Conv. (cfs)	11.1	1916.7	
Length Wtd. (ft)	100.04	Wetted Per. (ft)	11.73	91.98	
Min Ch El (ft)	6936.58	Shear (lb/sq ft)	0.06	0.41	
Alpha	1.02	Stream Power (lb/ft s)	0.03	0.63	
Frctn Loss (ft)	0.82	Cum Volume (acre-ft)	0.03	3.08	0.09
C & E Loss (ft)	0.00	Cum SA (acres)	0.12	2.63	0.22

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 2100 Profile: PF 1

E.G. Elev (ft)	6937.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.		0.080	
W.S. Elev (ft)	6937.50	Reach Len. (ft)	65.00	89.55	98.00
Crit W.S. (ft)		Flow Area (sq ft)		65.48	
E.G. Slope (ft/ft)	0.011365	Area (sq ft)		65.48	
Q Total (cfs)	151.00	Flow (cfs)		151.00	
Top Width (ft)	51.30	Top Width (ft)		51.30	
Vel Total (ft/s)	2.31	Avg. Vel. (ft/s)		2.31	
Max Chl Dpth (ft)	2.37	Hydr. Depth (ft)		1.28	
Conv. Total (cfs)	1416.4	Conv. (cfs)		1416.4	
Length Wtd. (ft)	89.57	Wetted Per. (ft)		52.10	
Min Ch El (ft)	6935.13	Shear (lb/sq ft)		0.89	
Alpha	1.00	Stream Power (lb/ft s)		2.06	
Frctn Loss (ft)	1.94	Cum Volume (acre-ft)	0.03	2.89	0.09
C & E Loss (ft)	0.01	Cum SA (acres)	0.10	2.46	0.22

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 2010.45 Profile: PF 1

E.G. Elev (ft)	6935.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	Wt. n-Val.		0.080	0.080
W.S. Elev (ft)	6935.43	Reach Len. (ft)	123.00	110.45	82.00
Crit W.S. (ft)		Flow Area (sq ft)		41.30	1.00
E.G. Slope (ft/ft)	0.056212	Area (sq ft)		41.30	1.00
Q Total (cfs)	151.00	Flow (cfs)		150.11	0.89
Top Width (ft)	65.96	Top Width (ft)		54.97	10.99
Vel Total (ft/s)	3.57	Avg. Vel. (ft/s)		3.63	0.89
Max Chl Dpth (ft)	1.55	Hydr. Depth (ft)		0.75	0.09
Conv. Total (cfs)	636.9	Conv. (cfs)		633.1	3.8
Length Wtd. (ft)	110.37	Wetted Per. (ft)		55.07	11.00
Min Ch El (ft)	6933.88	Shear (lb/sq ft)		2.63	0.32

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 2010.45 Profile: PF 1 (Continued)

Alpha	1.03	Stream Power (lb/ft s)		9.57	0.28
Frctn Loss (ft)	1.70	Cum Volume (acre-ft)	0.03	2.78	0.09
C & E Loss (ft)	0.05	Cum SA (acres)	0.10	2.35	0.20

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 1900 Profile: PF 1

E.G. Elev (ft)	6933.88	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.		0.080	
W.S. Elev (ft)	6933.84	Reach Len. (ft)	102.00	98.83	89.00
Crit W.S. (ft)		Flow Area (sq ft)		93.32	
E.G. Slope (ft/ft)	0.007048	Area (sq ft)		93.32	
Q Total (cfs)	151.00	Flow (cfs)		151.00	
Top Width (ft)	88.19	Top Width (ft)		88.19	
Vel Total (ft/s)	1.62	Avg. Vel. (ft/s)		1.62	
Max Chl Dpth (ft)	1.96	Hydr. Depth (ft)		1.06	
Conv. Total (cfs)	1798.6	Conv. (cfs)		1798.6	
Length Wtd. (ft)	98.83	Wetted Per. (ft)		88.28	
Min Ch El (ft)	6931.88	Shear (lb/sq ft)		0.47	
Alpha	1.00	Stream Power (lb/ft s)		0.75	
Frctn Loss (ft)	1.22	Cum Volume (acre-ft)	0.03	2.61	0.09
C & E Loss (ft)	0.00	Cum SA (acres)	0.10	2.17	0.19

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 1801.17 Profile: PF 1

E.G. Elev (ft)	6932.66	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.	0.000	0.100	
W.S. Elev (ft)	6932.59	Reach Len. (ft)	114.00	106.34	118.00
Crit W.S. (ft)		Flow Area (sq ft)	0.00	72.33	
E.G. Slope (ft/ft)	0.027173	Area (sq ft)	0.00	72.33	
Q Total (cfs)	151.00	Flow (cfs)	0.00	151.00	
Top Width (ft)	92.03	Top Width (ft)	0.21	91.82	
Vel Total (ft/s)	2.09	Avg. Vel. (ft/s)	0.09	2.09	
Max Chl Dpth (ft)	1.58	Hydr. Depth (ft)	0.01	0.79	
Conv. Total (cfs)	916.0	Conv. (cfs)	0.0	916.0	
Length Wtd. (ft)	106.34	Wetted Per. (ft)	0.21	91.92	
Min Ch El (ft)	6931.01	Shear (lb/sq ft)		1.33	
Alpha	1.00	Stream Power (lb/ft s)		2.79	
Frctn Loss (ft)	1.52	Cum Volume (acre-ft)	0.03	2.42	0.09
C & E Loss (ft)	0.01	Cum SA (acres)	0.10	1.97	0.19

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 1694.83 Profile: PF 1

E.G. Elev (ft)	6931.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.		0.100	
W.S. Elev (ft)	6931.11	Reach Len. (ft)	103.00	94.83	49.00
Crit W.S. (ft)		Flow Area (sq ft)		121.34	
E.G. Slope (ft/ft)	0.008773	Area (sq ft)		121.34	
Q Total (cfs)	151.00	Flow (cfs)		151.00	
Top Width (ft)	143.39	Top Width (ft)		143.39	
Vel Total (ft/s)	1.24	Avg. Vel. (ft/s)		1.24	
Max Chl Dpth (ft)	1.17	Hydr. Depth (ft)		0.85	
Conv. Total (cfs)	1612.2	Conv. (cfs)		1612.2	
Length Wtd. (ft)	94.83	Wetted Per. (ft)		143.51	
Min Ch El (ft)	6929.94	Shear (lb/sq ft)		0.46	
Alpha	1.00	Stream Power (lb/ft s)		0.58	
Frctn Loss (ft)	1.41	Cum Volume (acre-ft)	0.03	2.19	0.09
C & E Loss (ft)	0.01	Cum SA (acres)	0.10	1.68	0.19

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 1600 Profile: PF 1

E.G. Elev (ft)	6929.71	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.		0.100	
W.S. Elev (ft)	6929.63	Reach Len. (ft)	96.00	100.00	108.00
Crit W.S. (ft)		Flow Area (sq ft)		69.00	
E.G. Slope (ft/ft)	0.030740	Area (sq ft)		69.00	
Q Total (cfs)	151.00	Flow (cfs)		151.00	
Top Width (ft)	89.57	Top Width (ft)		89.57	
Vel Total (ft/s)	2.19	Avg. Vel. (ft/s)		2.19	
Max Chl Dpth (ft)	1.27	Hydr. Depth (ft)		0.77	
Conv. Total (cfs)	861.2	Conv. (cfs)		861.2	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		89.62	
Min Ch El (ft)	6928.36	Shear (lb/sq ft)		1.48	
Alpha	1.00	Stream Power (lb/ft s)		3.23	
Frctn Loss (ft)	2.94	Cum Volume (acre-ft)	0.03	1.98	0.09
C & E Loss (ft)	0.00	Cum SA (acres)	0.10	1.43	0.19

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 1500 Profile: PF 1

E.G. Elev (ft)	6926.76	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.		0.100	
W.S. Elev (ft)	6926.65	Reach Len. (ft)	91.00	100.00	112.00
Crit W.S. (ft)		Flow Area (sq ft)		55.97	
E.G. Slope (ft/ft)	0.028222	Area (sq ft)		55.97	
Q Total (cfs)	151.00	Flow (cfs)		151.00	
Top Width (ft)	49.57	Top Width (ft)		49.57	
Vel Total (ft/s)	2.70	Avg. Vel. (ft/s)		2.70	
Max Chl Dpth (ft)	2.13	Hydr. Depth (ft)		1.13	
Conv. Total (cfs)	898.8	Conv. (cfs)		898.8	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		49.82	
Min Ch El (ft)	6924.52	Shear (lb/sq ft)		1.98	
Alpha	1.00	Stream Power (lb/ft s)		5.34	
Frctn Loss (ft)	1.94	Cum Volume (acre-ft)	0.03	1.84	0.09
C & E Loss (ft)	0.01	Cum SA (acres)	0.10	1.27	0.19

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 1400 Profile: PF 1

E.G. Elev (ft)	6924.81	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.		0.080	
W.S. Elev (ft)	6924.73	Reach Len. (ft)	96.00	100.00	83.00
Crit W.S. (ft)		Flow Area (sq ft)		67.68	
E.G. Slope (ft/ft)	0.014150	Area (sq ft)		67.68	
Q Total (cfs)	151.00	Flow (cfs)		151.00	
Top Width (ft)	66.38	Top Width (ft)		66.38	
Vel Total (ft/s)	2.23	Avg. Vel. (ft/s)		2.23	
Max Chl Dpth (ft)	2.62	Hydr. Depth (ft)		1.02	
Conv. Total (cfs)	1269.4	Conv. (cfs)		1269.4	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		66.71	
Min Ch El (ft)	6922.11	Shear (lb/sq ft)		0.90	
Alpha	1.00	Stream Power (lb/ft s)		2.00	
Frctn Loss (ft)	0.71	Cum Volume (acre-ft)	0.03	1.70	0.09
C & E Loss (ft)	0.01	Cum SA (acres)	0.10	1.14	0.19

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 1300 Profile: PF 1

E.G. Elev (ft)	6924.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.		0.080	
W.S. Elev (ft)	6924.05	Reach Len. (ft)	83.00	100.00	118.00
Crit W.S. (ft)		Flow Area (sq ft)		101.14	
E.G. Slope (ft/ft)	0.004293	Area (sq ft)		101.14	
Q Total (cfs)	151.00	Flow (cfs)		151.00	

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 1300 Profile: PF 1 (Continued)

Top Width (ft)	73.88	Top Width (ft)		73.88	
Vel Total (ft/s)	1.49	Avg. Vel. (ft/s)		1.49	
Max Chl Dpth (ft)	2.94	Hydr. Depth (ft)		1.37	
Conv. Total (cfs)	2304.7	Conv. (cfs)		2304.7	
Length Wtd. (ft)	100.66	Wetted Per. (ft)		74.43	
Min Ch El (ft)	6921.11	Shear (lb/sq ft)		0.36	
Alpha	1.00	Stream Power (lb/ft s)		0.54	
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	0.03	1.50	0.09
C & E Loss (ft)	0.01	Cum SA (acres)	0.10	0.97	0.19

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 1200 Profile: PF 1

E.G. Elev (ft)	6924.04	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.080	0.080	0.080
W.S. Elev (ft)	6924.04	Reach Len. (ft)	191.00	200.00	169.00
Crit W.S. (ft)	6920.52	Flow Area (sq ft)	20.32	281.35	54.07
E.G. Slope (ft/ft)	0.000109	Area (sq ft)	20.32	281.35	54.07
Q Total (cfs)	151.00	Flow (cfs)	3.99	132.19	14.82
Top Width (ft)	125.84	Top Width (ft)	19.84	74.00	32.00
Vel Total (ft/s)	0.42	Avg. Vel. (ft/s)	0.20	0.47	0.27
Max Chl Dpth (ft)	4.85	Hydr. Depth (ft)	1.02	3.80	1.69
Conv. Total (cfs)	14460.9	Conv. (cfs)	381.9	12659.9	1419.1
Length Wtd. (ft)	200.00	Wetted Per. (ft)	19.96	74.61	32.18
Min Ch El (ft)	6919.19	Shear (lb/sq ft)	0.01	0.03	0.01
Alpha	1.12	Stream Power (lb/ft s)	0.00	0.01	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	0.01	1.06	0.02
C & E Loss (ft)		Cum SA (acres)	0.08	0.80	0.15

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 1000 Profile: PF 1

E.G. Elev (ft)	6919.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	Wt. n-Val.	0.080	0.080	0.080
W.S. Elev (ft)	6919.03	Reach Len. (ft)	103.00	100.00	98.00
Crit W.S. (ft)		Flow Area (sq ft)	5.65	53.03	14.65
E.G. Slope (ft/ft)	0.011207	Area (sq ft)	5.65	53.03	14.65
Q Total (cfs)	188.00	Flow (cfs)	7.13	162.15	18.73
Top Width (ft)	65.85	Top Width (ft)	10.94	27.00	27.92
Vel Total (ft/s)	2.56	Avg. Vel. (ft/s)	1.26	3.06	1.28
Max Chl Dpth (ft)	2.92	Hydr. Depth (ft)	0.52	1.96	0.52
Conv. Total (cfs)	1775.8	Conv. (cfs)	67.3	1531.6	176.9
Length Wtd. (ft)	99.96	Wetted Per. (ft)	10.99	27.35	27.95
Min Ch El (ft)	6916.11	Shear (lb/sq ft)	0.36	1.36	0.37
Alpha	1.26	Stream Power (lb/ft s)	0.45	4.15	0.47
Frctn Loss (ft)	1.18	Cum Volume (acre-ft)	0.01	0.92	0.02
C & E Loss (ft)	0.00	Cum SA (acres)	0.02	0.57	0.03

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 900 Profile: PF 1

E.G. Elev (ft)	6917.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.		0.080	
W.S. Elev (ft)	6917.87	Reach Len. (ft)	111.00	100.00	84.00
Crit W.S. (ft)		Flow Area (sq ft)		67.32	
E.G. Slope (ft/ft)	0.012344	Area (sq ft)		67.32	
Q Total (cfs)	188.00	Flow (cfs)		188.00	
Top Width (ft)	42.09	Top Width (ft)		42.09	
Vel Total (ft/s)	2.79	Avg. Vel. (ft/s)		2.79	
Max Chl Dpth (ft)	2.84	Hydr. Depth (ft)		1.60	
Conv. Total (cfs)	1692.1	Conv. (cfs)		1692.1	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		42.77	
Min Ch El (ft)	6915.02	Shear (lb/sq ft)		1.21	

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 900 Profile: PF 1 (Continued)

Alpha	1.00	Stream Power (lb/ft s)		3.39	
Frctn Loss (ft)	1.01	Cum Volume (acre-ft)	0.00	0.79	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.49	0.00

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 800 Profile: PF 1

E.G. Elev (ft)	6916.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.		0.080	
W.S. Elev (ft)	6916.89	Reach Len. (ft)	100.50	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		80.17	
E.G. Slope (ft/ft)	0.008358	Area (sq ft)		80.17	
Q Total (cfs)	188.00	Flow (cfs)		188.00	
Top Width (ft)	48.98	Top Width (ft)		48.98	
Vel Total (ft/s)	2.34	Avg. Vel. (ft/s)		2.34	
Max Chl Dpth (ft)	3.03	Hydr. Depth (ft)		1.64	
Conv. Total (cfs)	2056.3	Conv. (cfs)		2056.3	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		49.40	
Min Ch El (ft)	6913.85	Shear (lb/sq ft)		0.85	
Alpha	1.00	Stream Power (lb/ft s)		1.99	
Frctn Loss (ft)	0.78	Cum Volume (acre-ft)	0.00	0.62	0.00
C & E Loss (ft)	0.00	Cum SA (acres)	0.00	0.39	0.00

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 700 Profile: PF 1

E.G. Elev (ft)	6916.19	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.	0.080	0.080	0.080
W.S. Elev (ft)	6916.11	Reach Len. (ft)	82.00	100.00	114.00
Crit W.S. (ft)		Flow Area (sq ft)	0.06	86.37	0.10
E.G. Slope (ft/ft)	0.007279	Area (sq ft)	0.06	86.37	0.10
Q Total (cfs)	188.00	Flow (cfs)	0.01	187.95	0.04
Top Width (ft)	55.48	Top Width (ft)	1.42	53.00	1.06
Vel Total (ft/s)	2.17	Avg. Vel. (ft/s)	0.20	2.18	0.34
Max Chl Dpth (ft)	2.98	Hydr. Depth (ft)	0.04	1.63	0.10
Conv. Total (cfs)	2203.6	Conv. (cfs)	0.1	2203.0	0.4
Length Wtd. (ft)	100.00	Wetted Per. (ft)	1.43	53.67	1.07
Min Ch El (ft)	6913.13	Shear (lb/sq ft)	0.02	0.73	0.04
Alpha	1.00	Stream Power (lb/ft s)	0.00	1.59	0.01
Frctn Loss (ft)	1.33	Cum Volume (acre-ft)	0.00	0.43	0.00
C & E Loss (ft)	0.02	Cum SA (acres)	0.00	0.27	0.00

Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 600 Profile: PF 1

E.G. Elev (ft)	6914.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.		0.080	
W.S. Elev (ft)	6914.59	Reach Len. (ft)	94.00	100.00	104.00
Crit W.S. (ft)		Flow Area (sq ft)		46.99	
E.G. Slope (ft/ft)	0.031340	Area (sq ft)		46.99	
Q Total (cfs)	188.00	Flow (cfs)		188.00	
Top Width (ft)	34.58	Top Width (ft)		34.58	
Vel Total (ft/s)	4.00	Avg. Vel. (ft/s)		4.00	
Max Chl Dpth (ft)	2.46	Hydr. Depth (ft)		1.36	
Conv. Total (cfs)	1062.0	Conv. (cfs)		1062.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		35.02	
Min Ch El (ft)	6912.13	Shear (lb/sq ft)		2.63	
Alpha	1.00	Stream Power (lb/ft s)		10.50	
Frctn Loss (ft)	1.34	Cum Volume (acre-ft)		0.27	
C & E Loss (ft)	0.05	Cum SA (acres)		0.17	

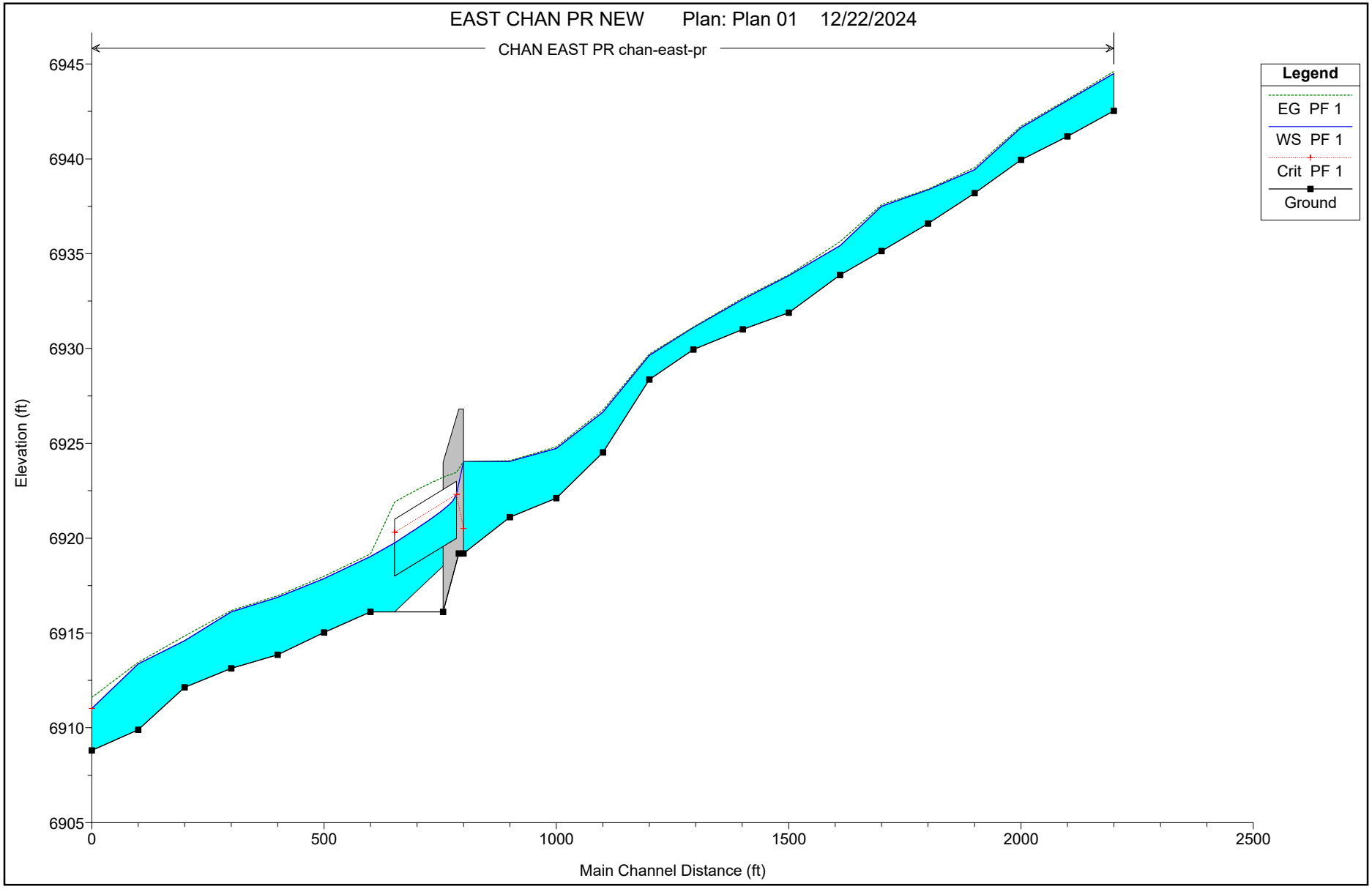
Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 500 Profile: PF 1

E.G. Elev (ft)	6913.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.		0.080	
W.S. Elev (ft)	6913.37	Reach Len. (ft)	87.00	100.00	107.00
Crit W.S. (ft)		Flow Area (sq ft)		79.71	
E.G. Slope (ft/ft)	0.007372	Area (sq ft)		79.71	
Q Total (cfs)	188.00	Flow (cfs)		188.00	
Top Width (ft)	43.67	Top Width (ft)		43.67	
Vel Total (ft/s)	2.36	Avg. Vel. (ft/s)		2.36	
Max Chl Dpth (ft)	3.48	Hydr. Depth (ft)		1.83	
Conv. Total (cfs)	2189.6	Conv. (cfs)		2189.6	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		44.32	
Min Ch El (ft)	6909.89	Shear (lb/sq ft)		0.83	
Alpha	1.00	Stream Power (lb/ft s)		1.95	
Frctn Loss (ft)	1.80	Cum Volume (acre-ft)		0.13	
C & E Loss (ft)	0.05	Cum SA (acres)		0.08	

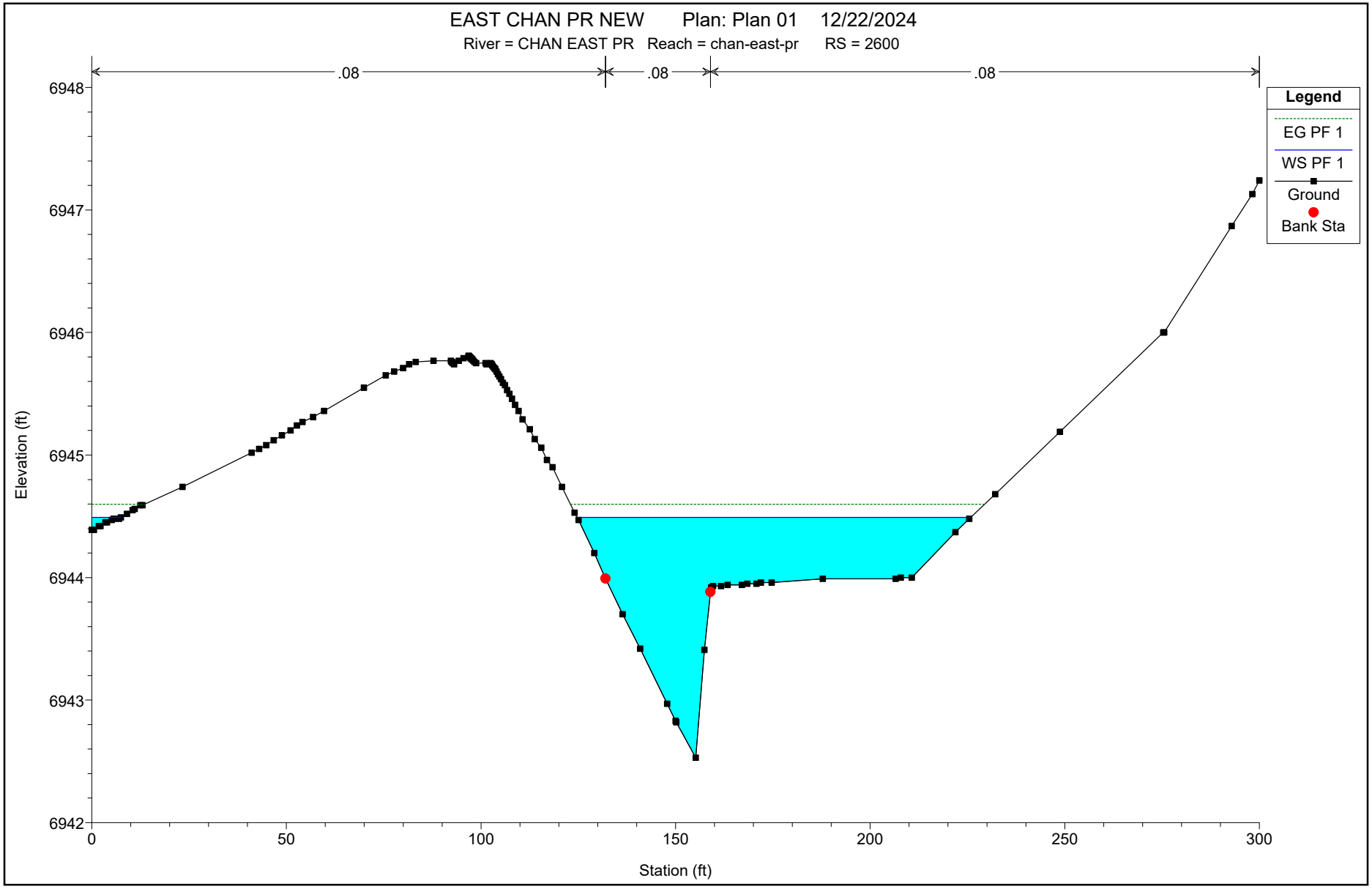
Plan: Plan 01 CHAN EAST PR chan-east-pr RS: 400 Profile: PF 1

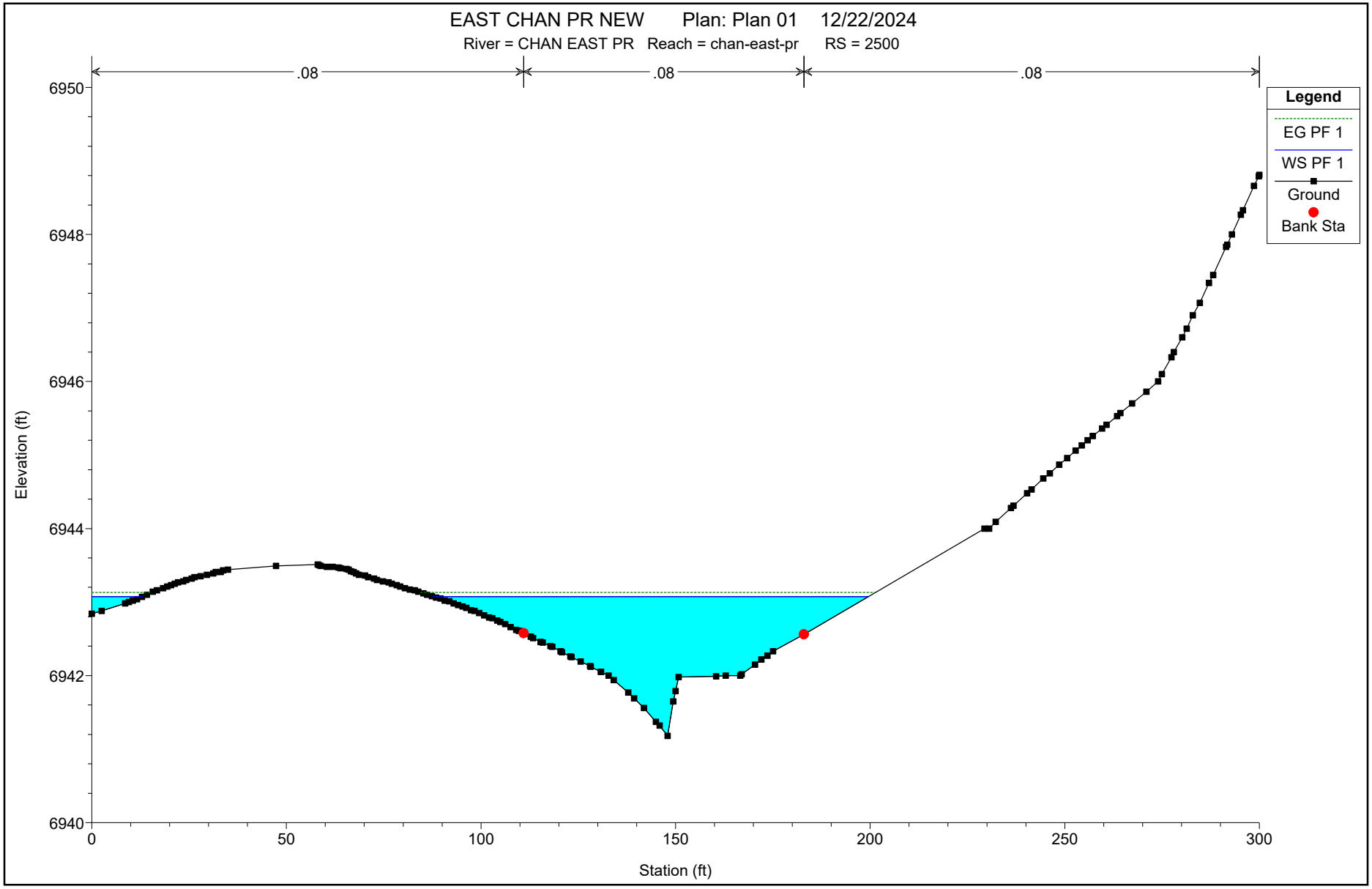
E.G. Elev (ft)	6911.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.58	Wt. n-Val.		0.080	
W.S. Elev (ft)	6911.02	Reach Len. (ft)			
Crit W.S. (ft)	6911.02	Flow Area (sq ft)		30.76	
E.G. Slope (ft/ft)	0.094950	Area (sq ft)		30.76	
Q Total (cfs)	188.00	Flow (cfs)		188.00	
Top Width (ft)	27.24	Top Width (ft)		27.24	
Vel Total (ft/s)	6.11	Avg. Vel. (ft/s)		6.11	
Max Chl Dpth (ft)	2.21	Hydr. Depth (ft)		1.13	
Conv. Total (cfs)	610.1	Conv. (cfs)		610.1	
Length Wtd. (ft)		Wetted Per. (ft)		27.87	
Min Ch El (ft)	6908.81	Shear (lb/sq ft)		6.54	
Alpha	1.00	Stream Power (lb/ft s)		39.99	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

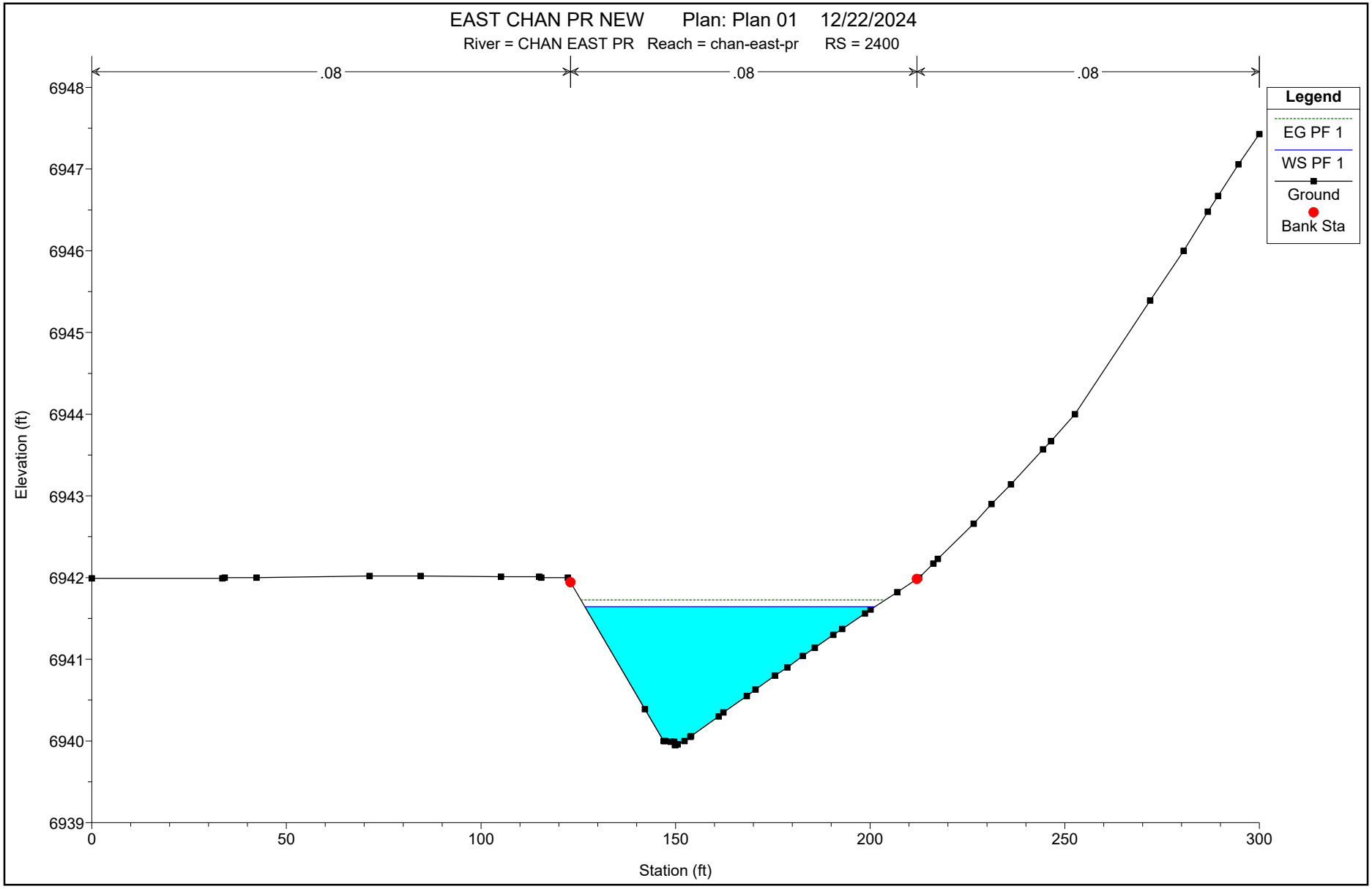
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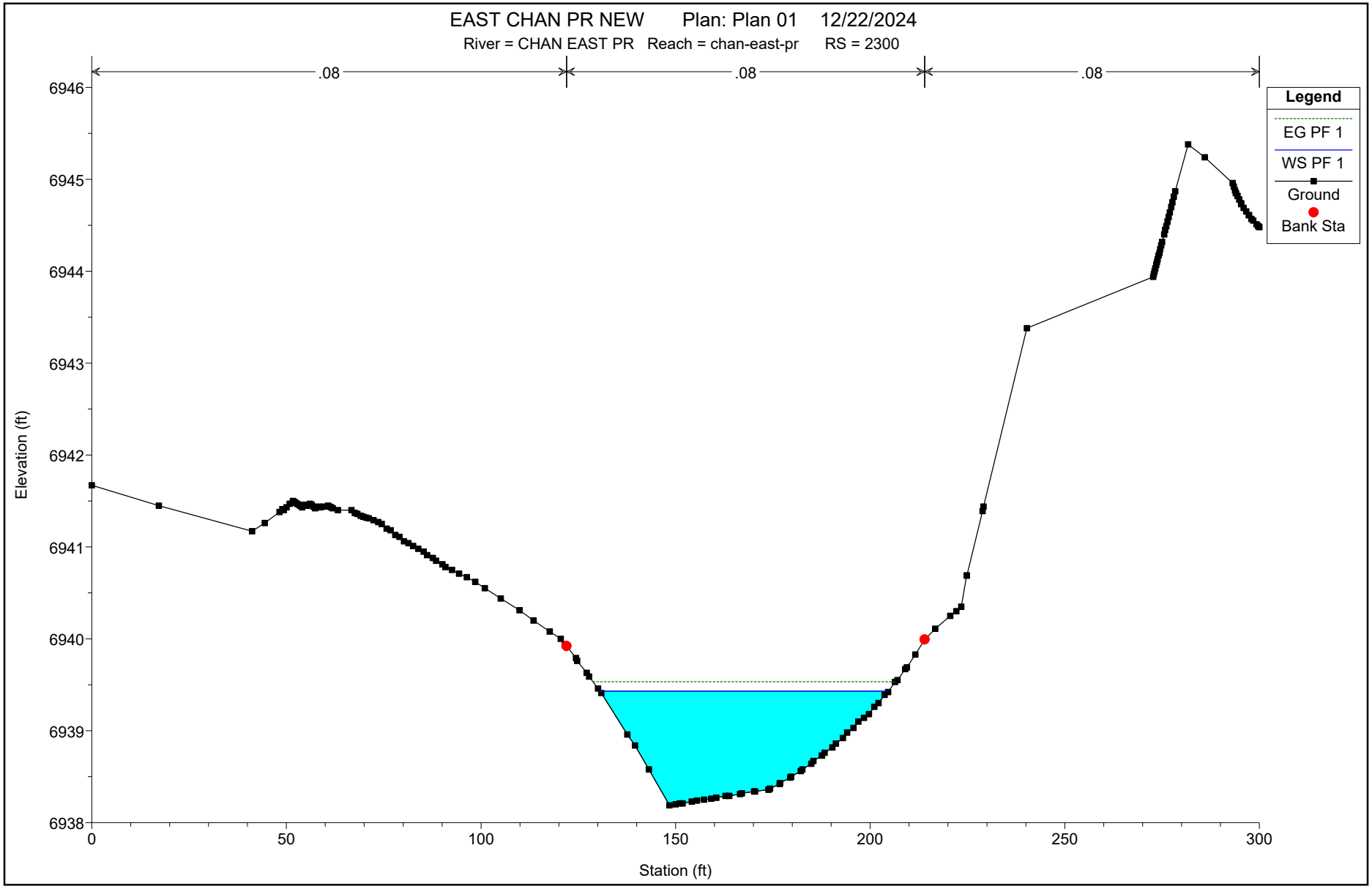


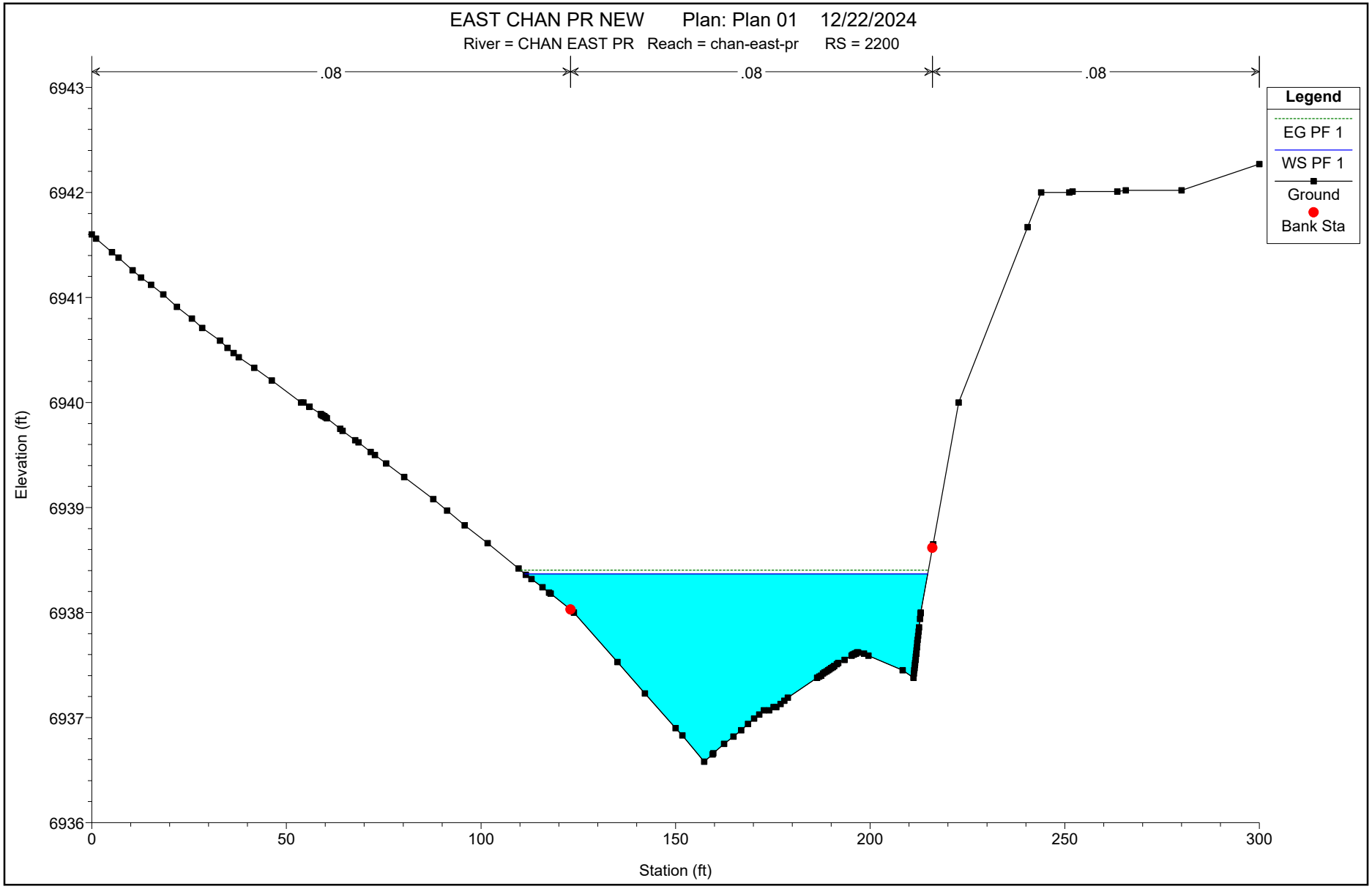
PROPOSED EAST CHANNEL 100-Y

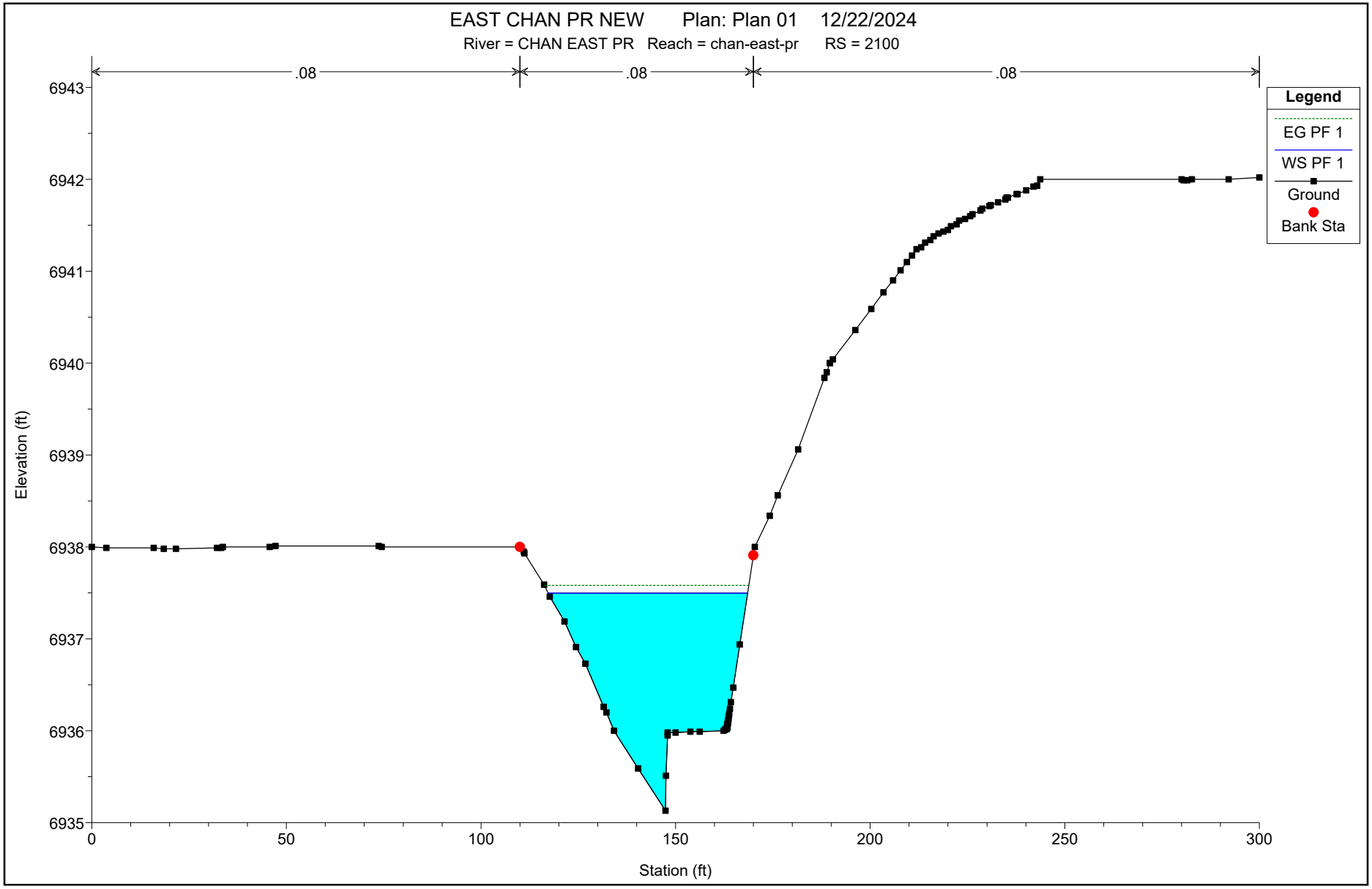


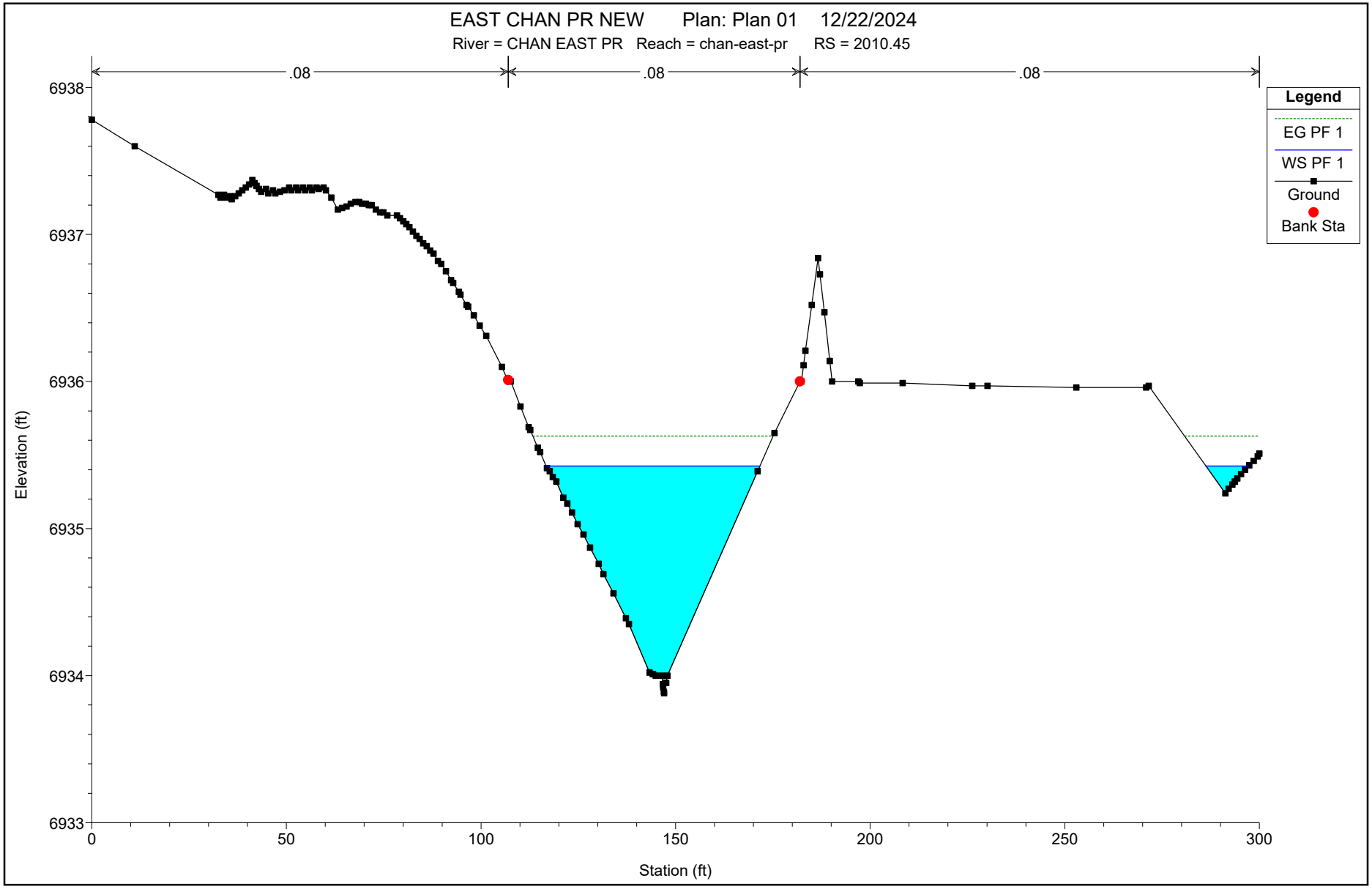

EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 2500
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6950
6948
6946
6944
6942
6940
0
50
100
150
200
250
300
Station (ft)

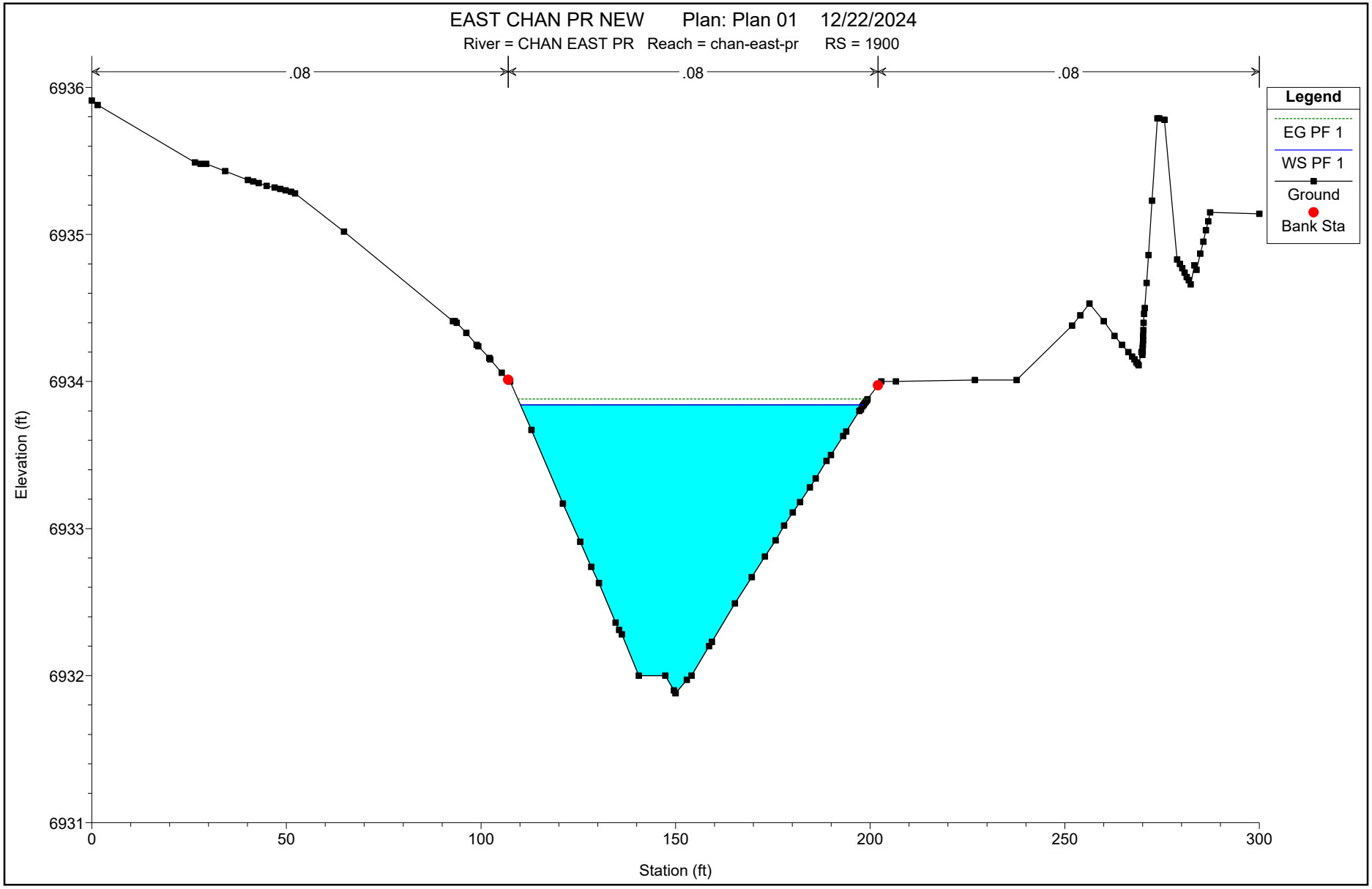

EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 2400
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6948
6947
6946
6945
6944
6943
6942
6941
6940
6939
0
50
100
150
200
250
300
Station (ft)

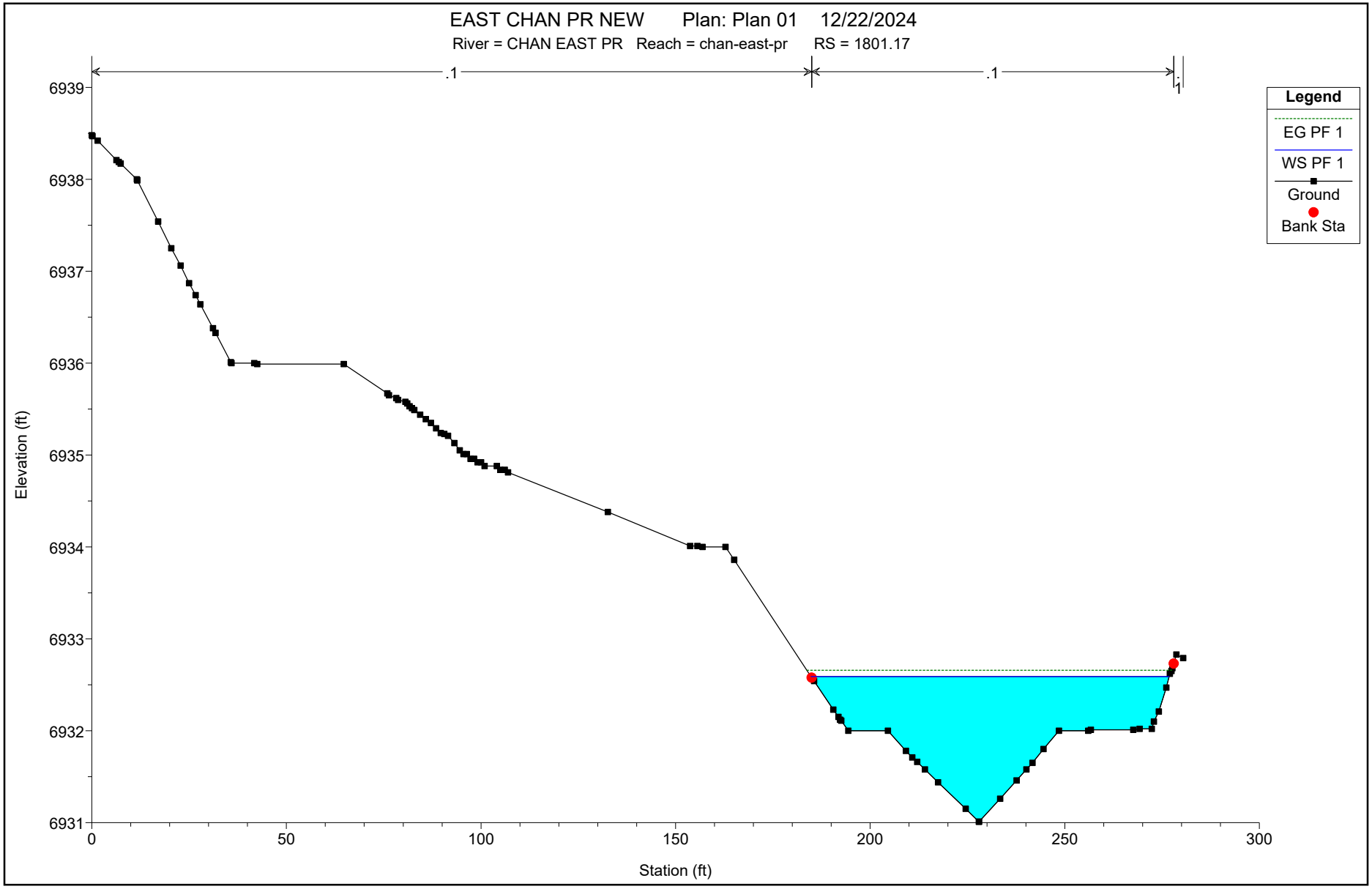

EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 2300
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6946
6945
6944
6943
6942
6941
6940
6939
6938
0
50
100
150
200
250
300
Station (ft)

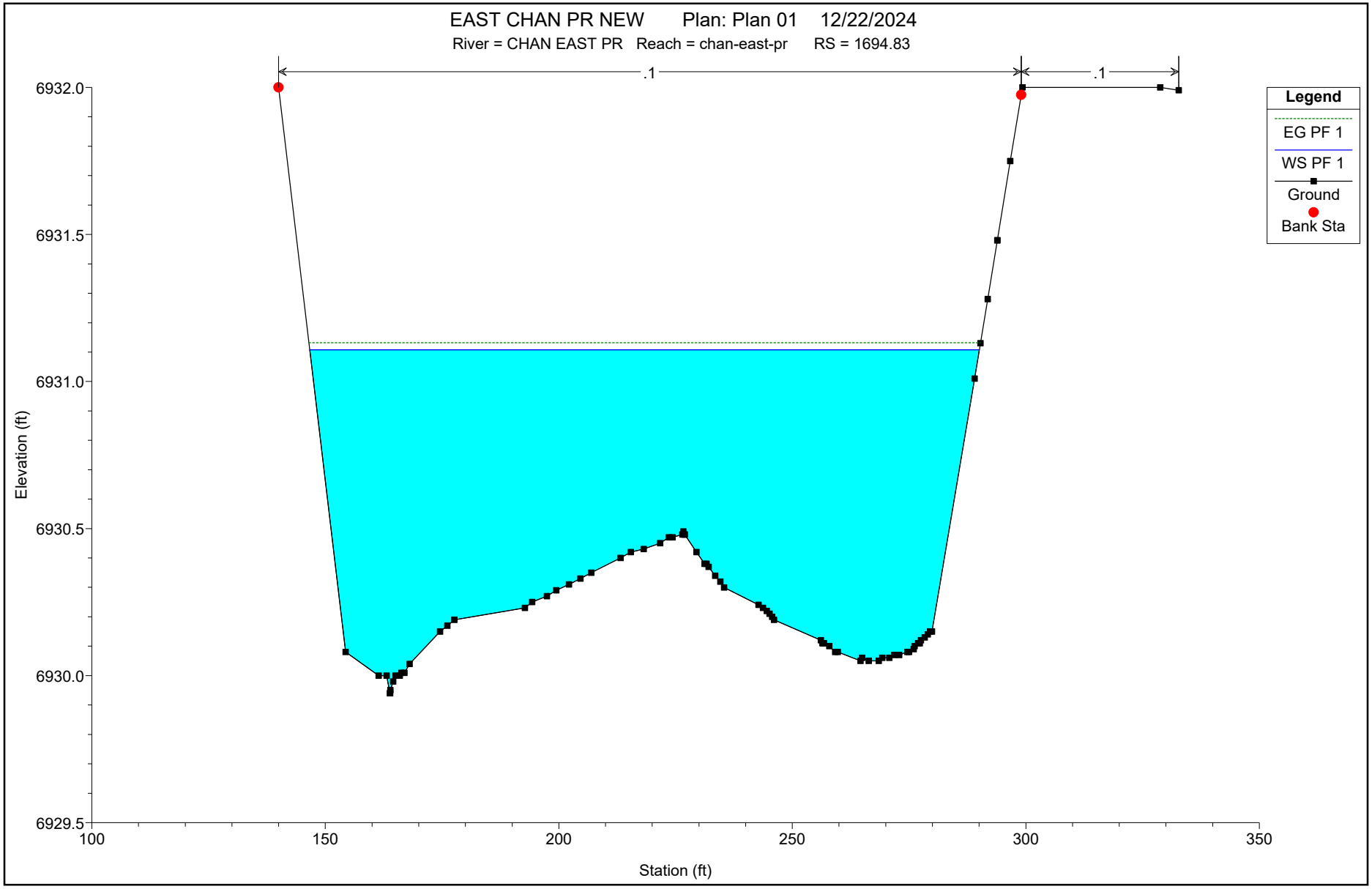

EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 2200
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6943
6942
6941
6940
6939
6938
6937
6936
0
50
100
150
200
250
300
Station (ft)

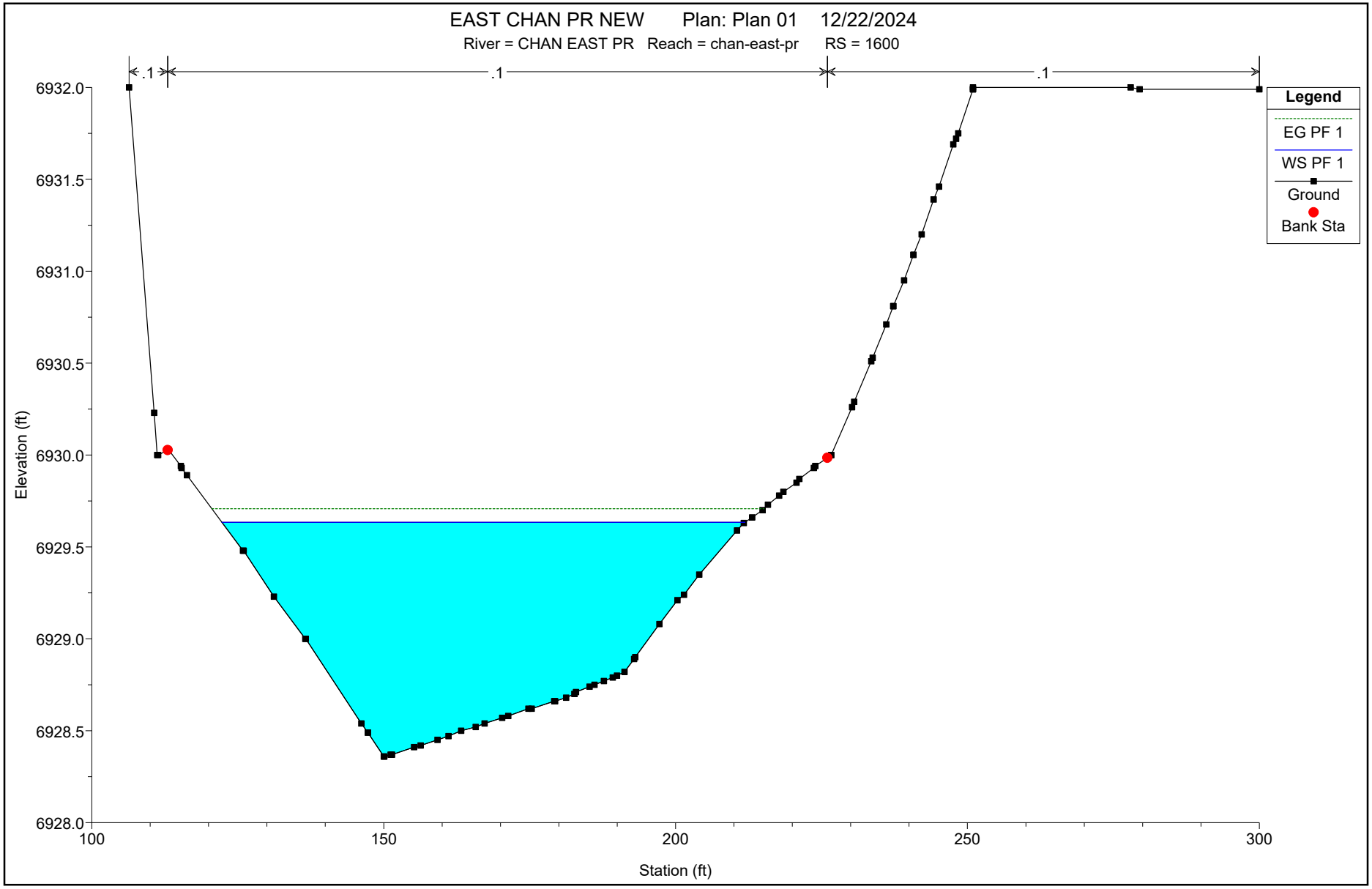

EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 2100
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6943
6942
6941
6940
6939
6938
6937
6936
6935
0
50
100
150
200
250
300
Station (ft)

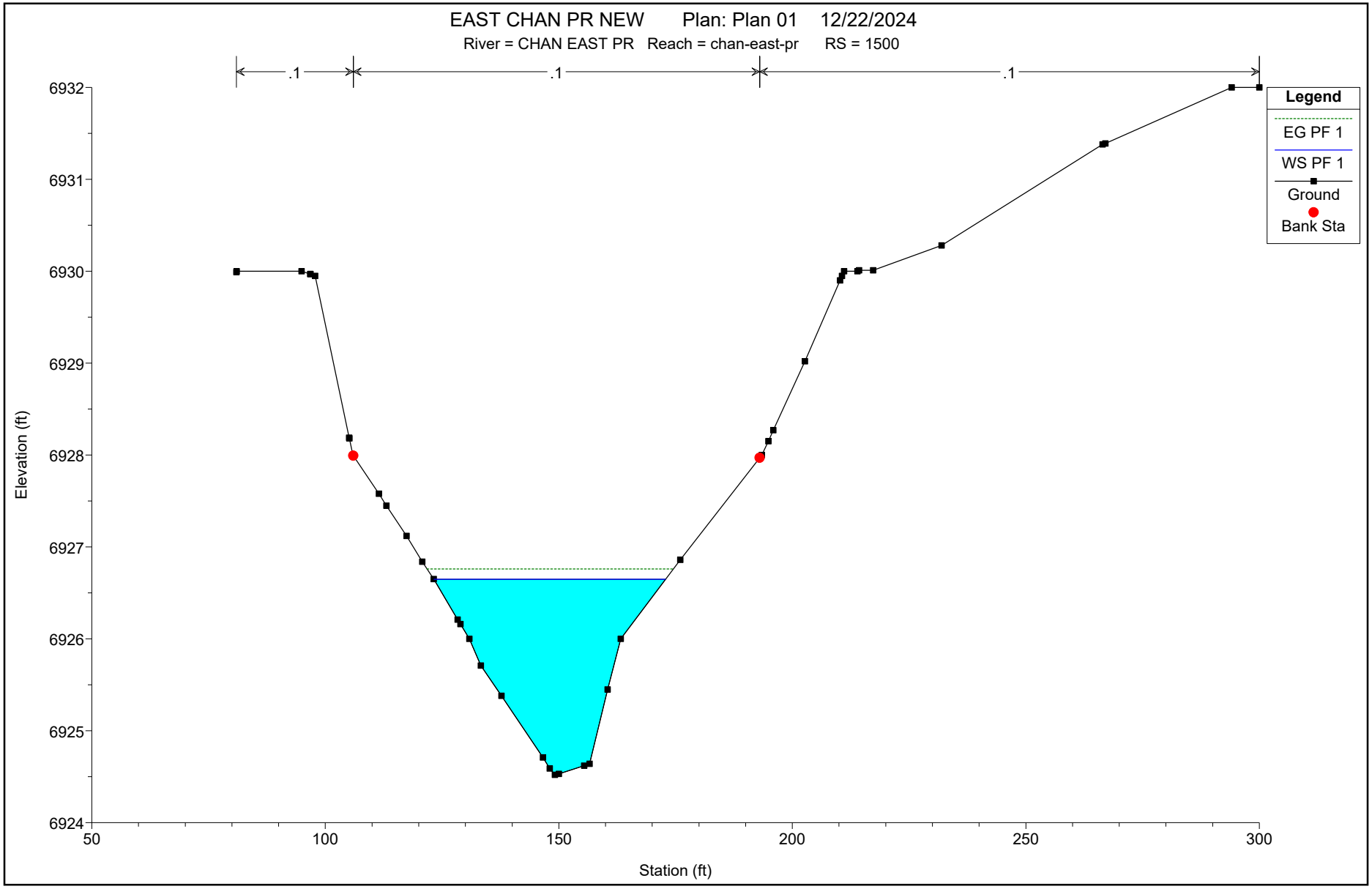

EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 2010.45
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6938
6937
6936
6935
6934
6933
0
50
100
150
200
250
300
Station (ft)

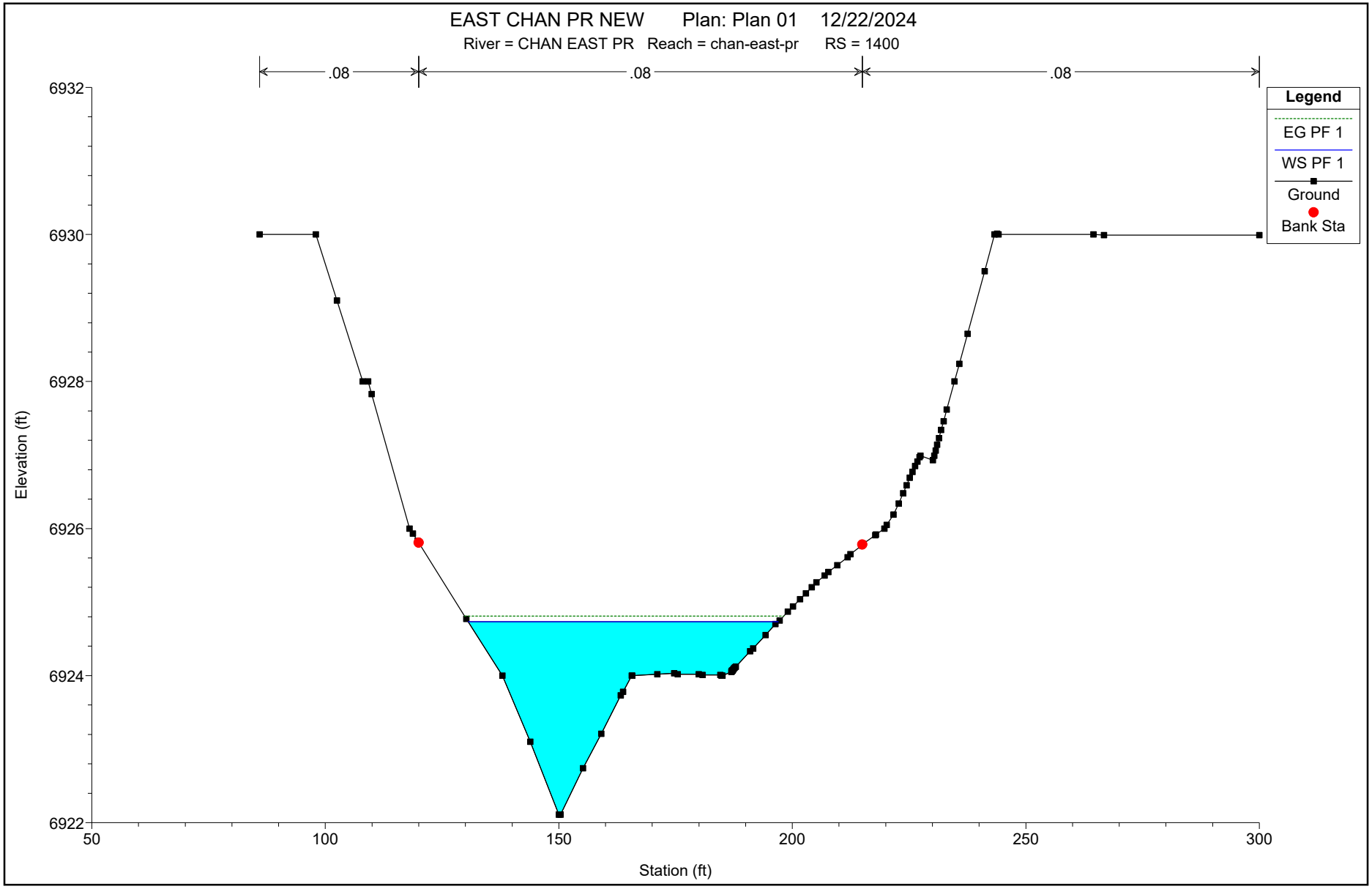

EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 1900
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6936
6935
6934
6933
6932
6931
0
50
100
150
200
250
300
Station (ft)

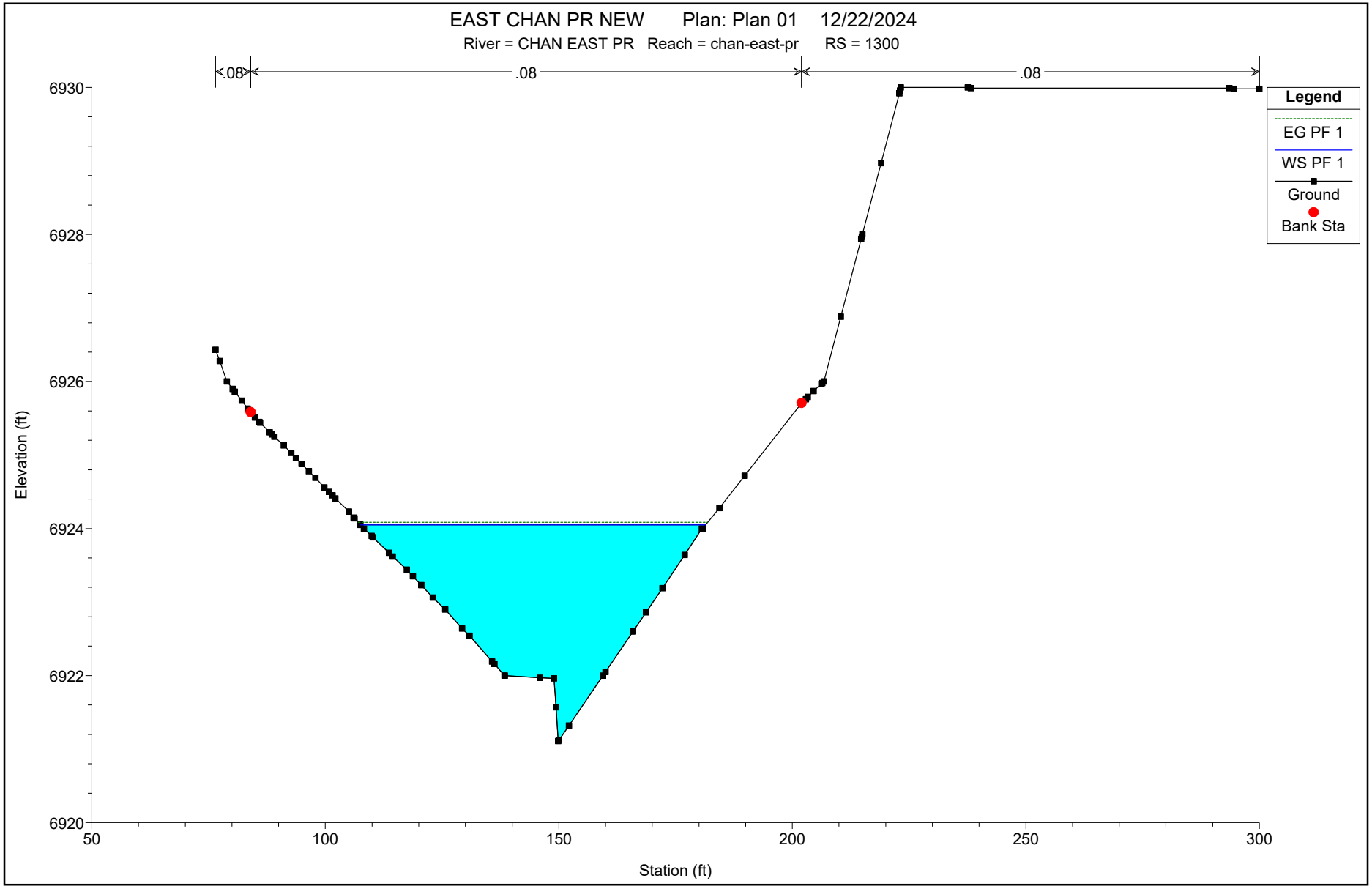

EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 1801.17
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6939
6938
6937
6936
6935
6934
6933
6932
6931
0
50
100
150
200
250
300
Station (ft)

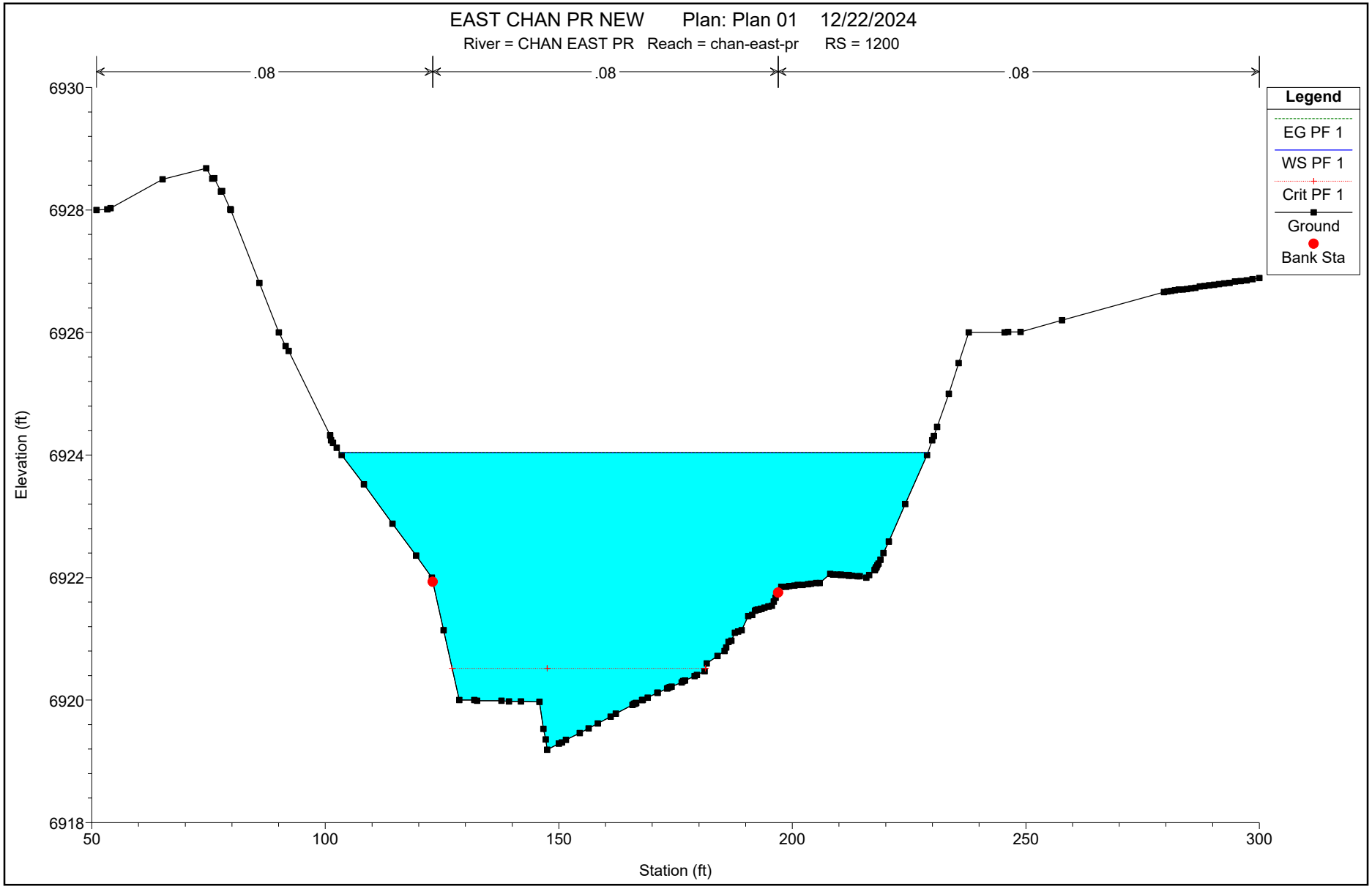

EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 1694.83
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6932.0
6931.5
6931.0
6930.5
6930.0
6929.5
Elevation (ft)
100
150
200
250
300
350
Station (ft)

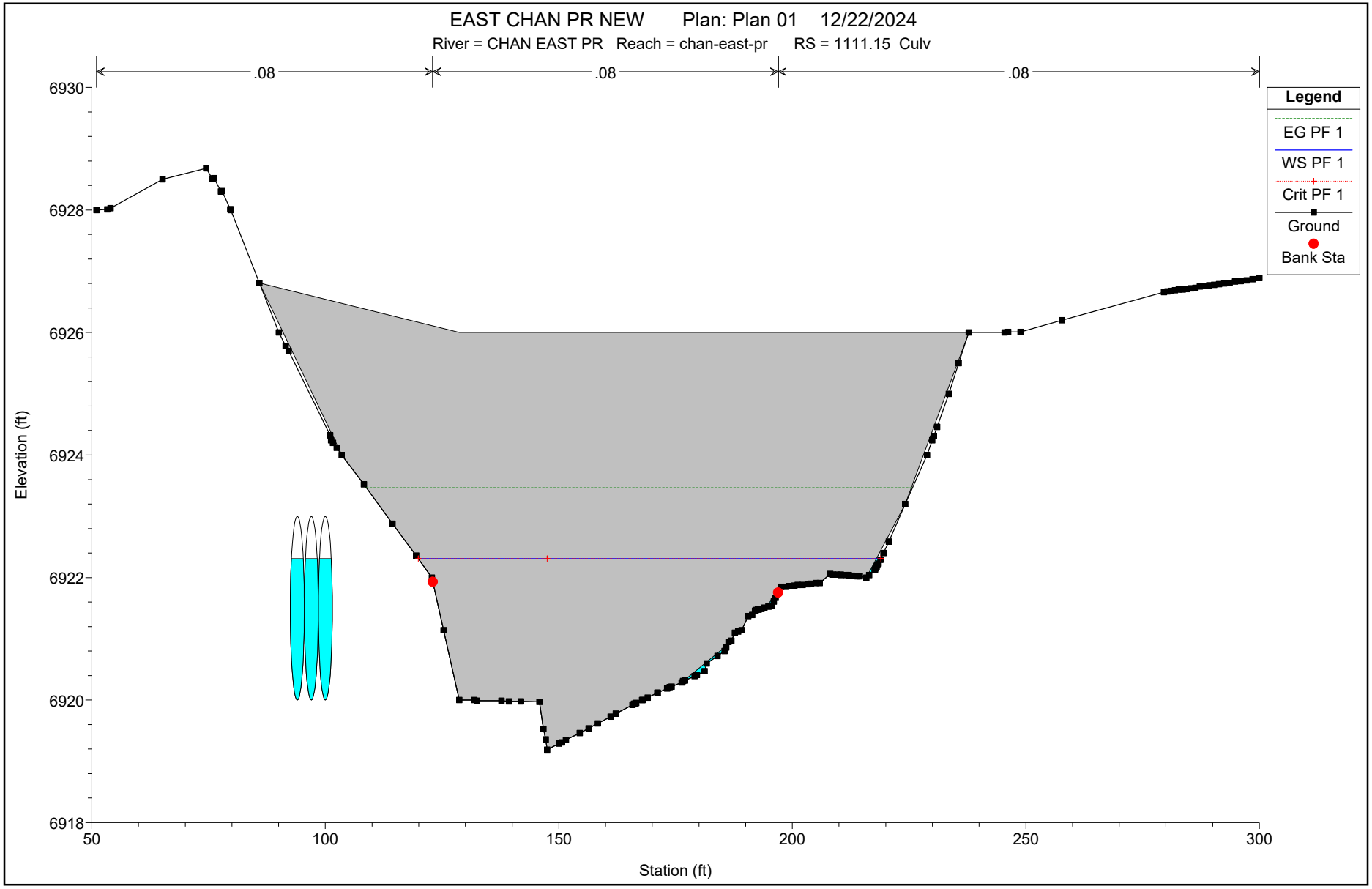

EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 1600
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6932.0
6931.5
6931.0
6930.5
6930.0
6929.5
6929.0
6928.5
6928.0
Elevation (ft)
100
150
200
250
300
Station (ft)

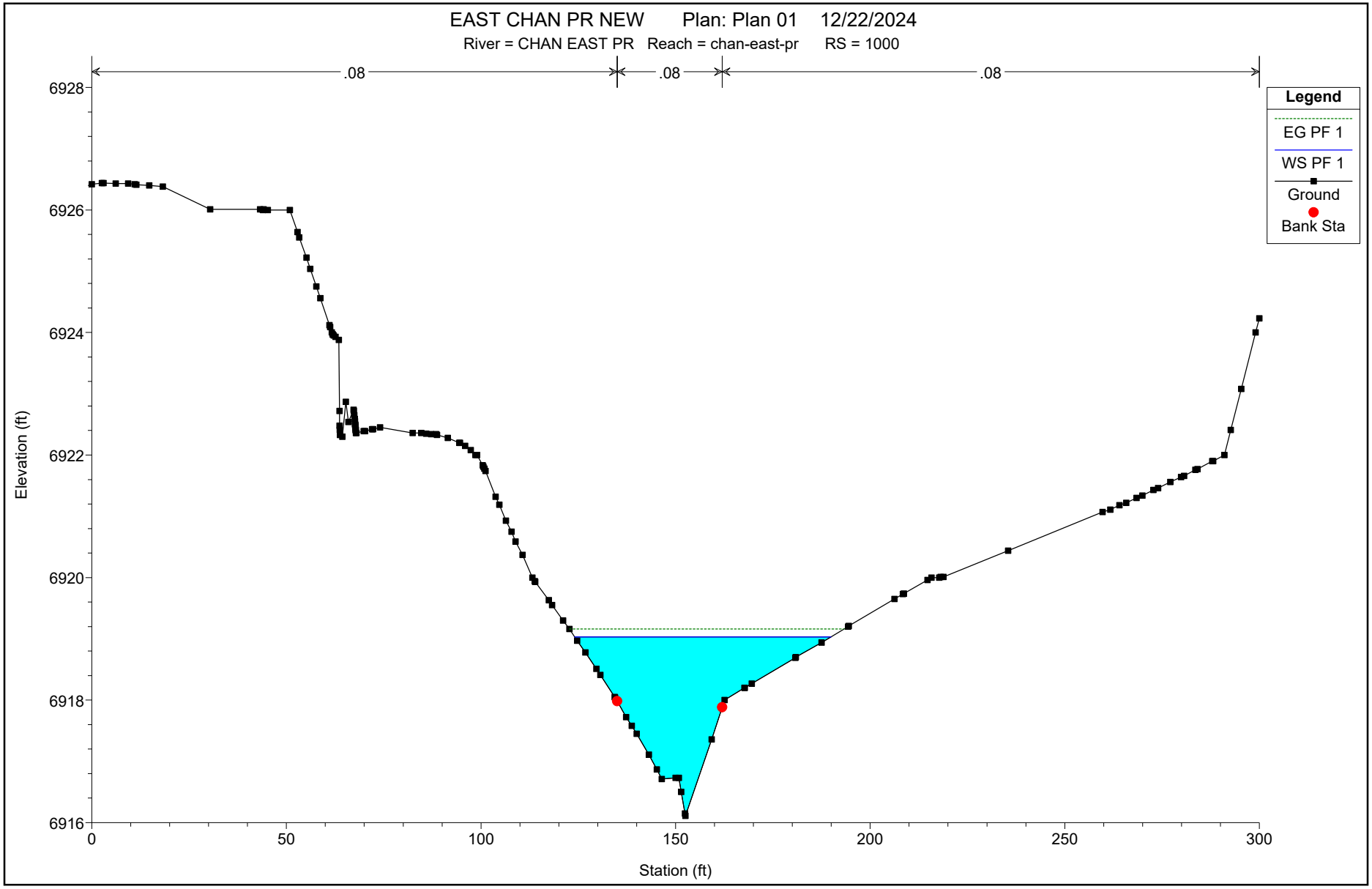

EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 1500
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6932
6931
6930
6929
6928
6927
6926
6925
6924
50
100
150
200
250
300
Station (ft)

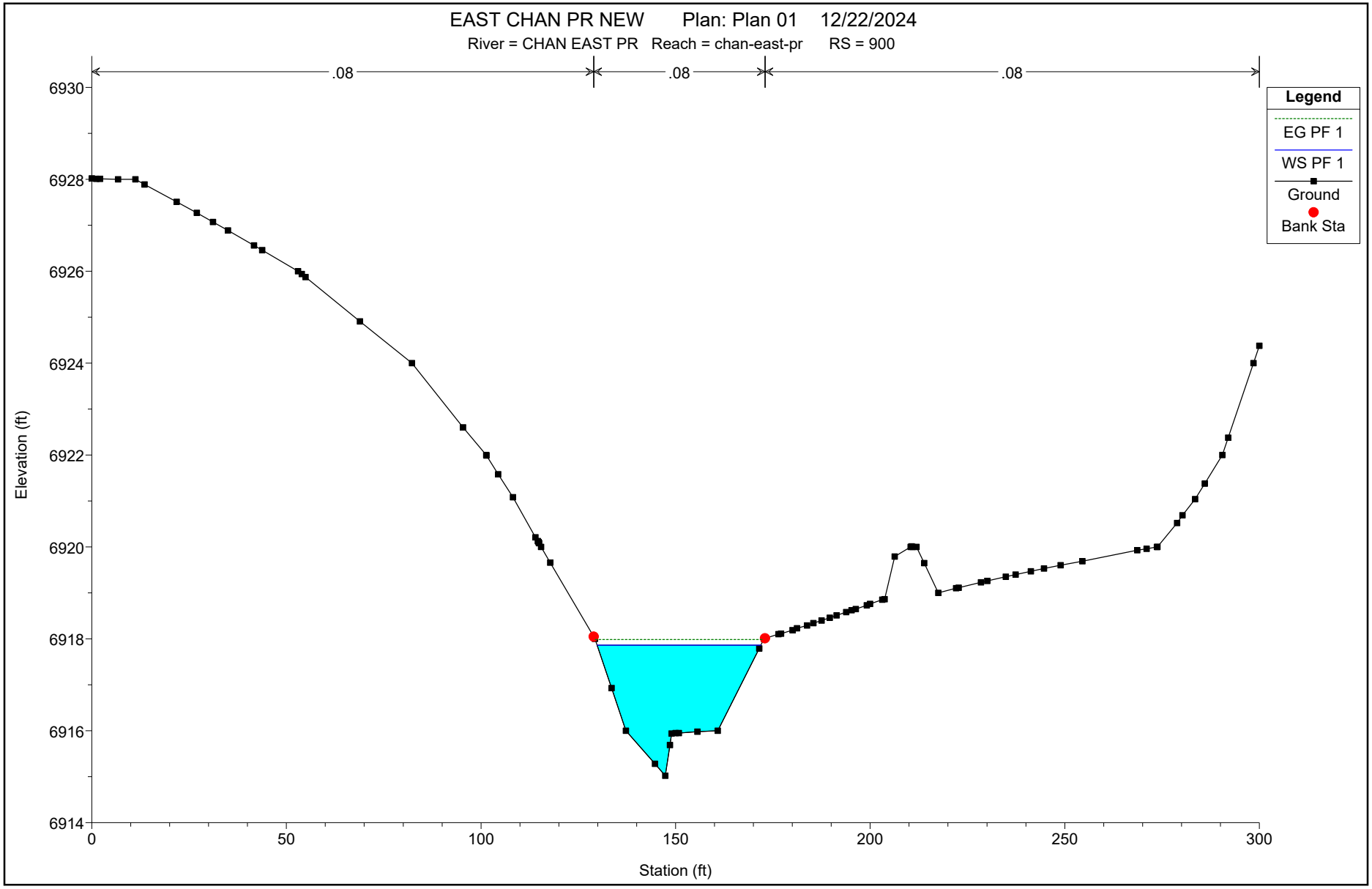

EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 1400
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6932
6930
6928
6926
6924
6922
50
100
150
200
250
300
Station (ft)

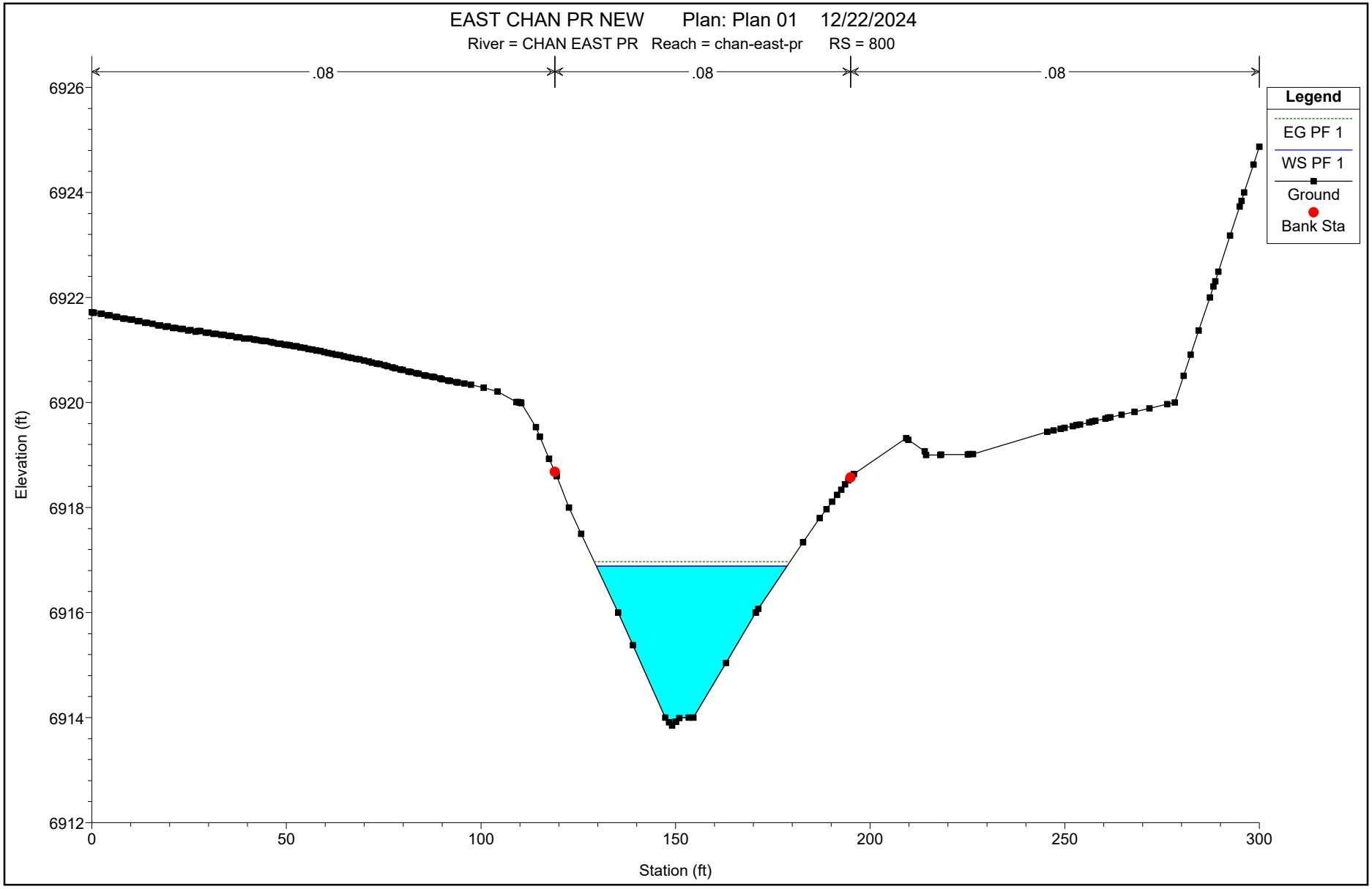

EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 1300
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6930
6928
6926
6924
6922
6920
50
100
150
200
250
300
Station (ft)

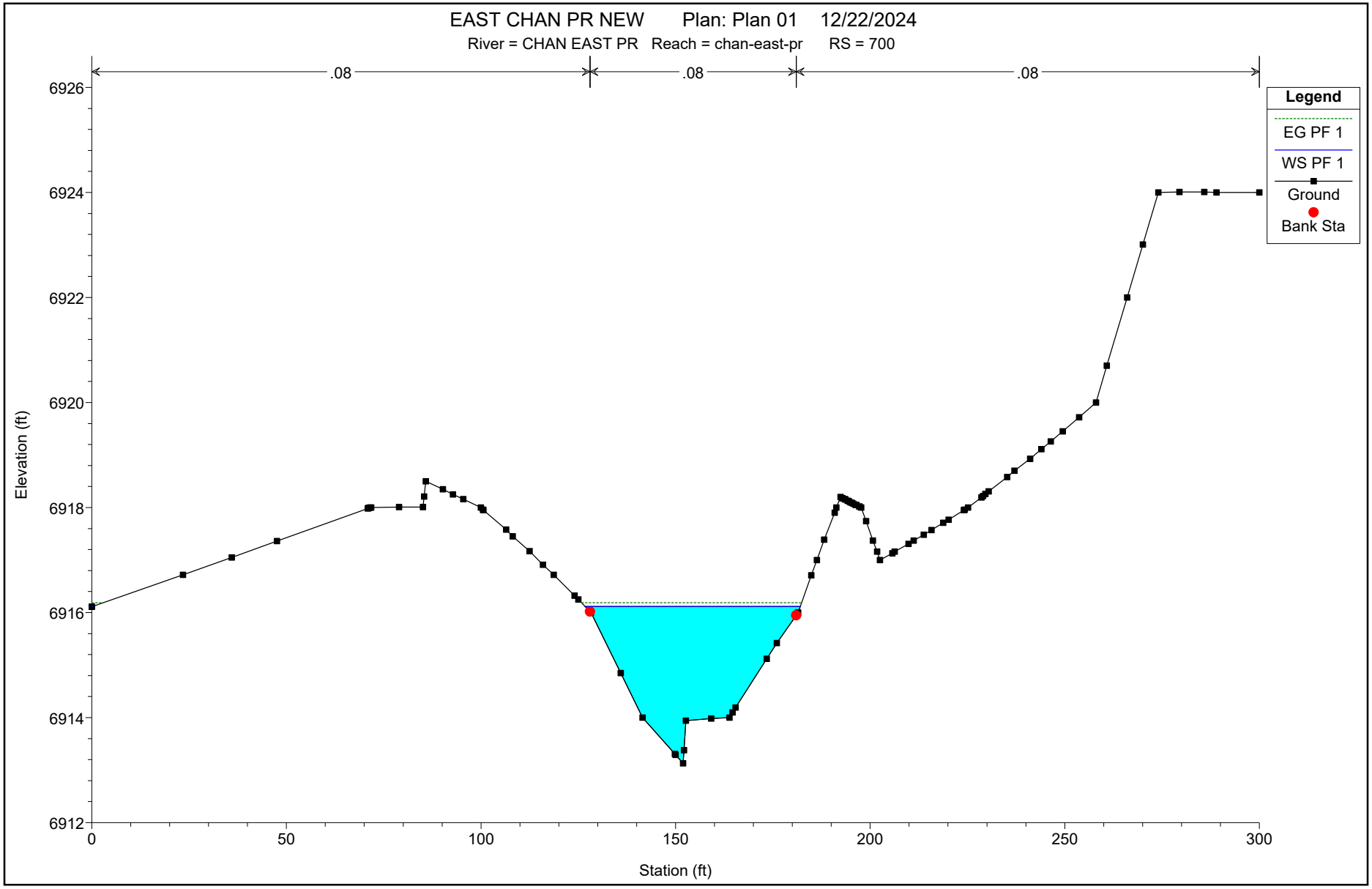

EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 1200
.08
.08
.08
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6930
6928
6926
6924
6922
6920
6918
50
100
150
200
250
300
Station (ft)

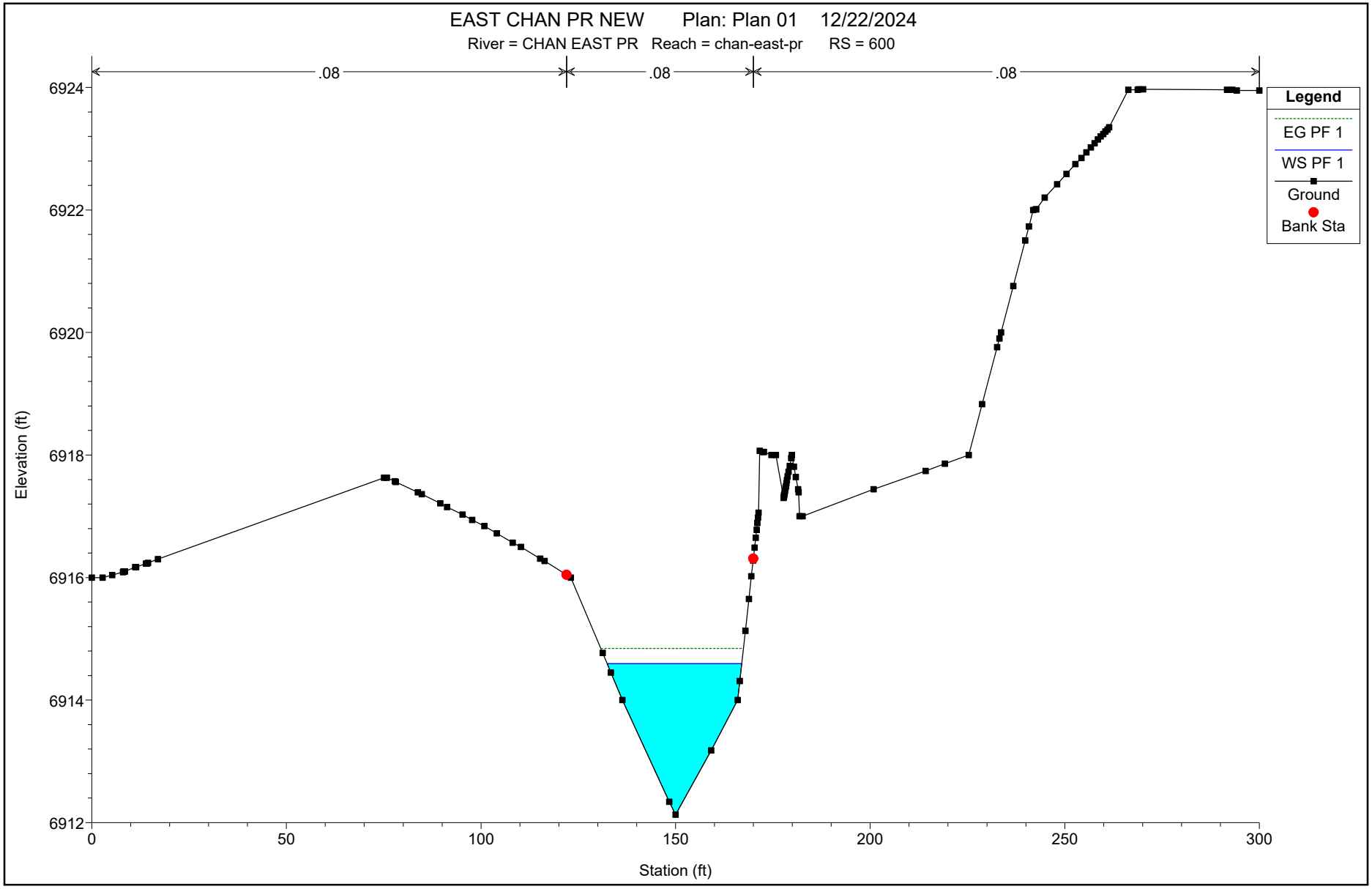

EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 1111.15 Culv
.08
.08
.08
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6930
6928
6926
6924
6922
6920
6918
50
100
150
200
250
300
Station (ft)

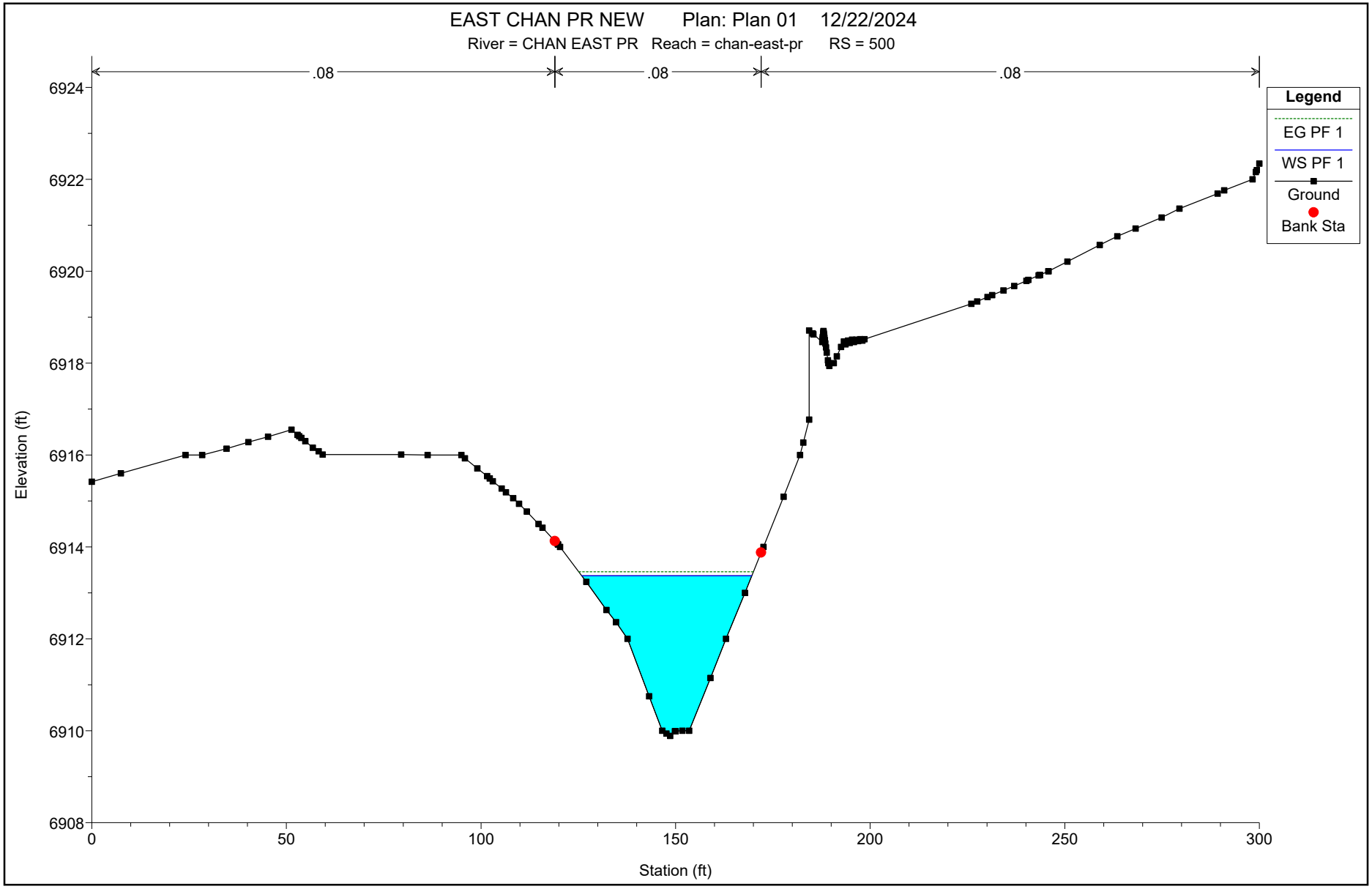

EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 1000
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6928
6926
6924
6922
6920
6918
6916
0
50
100
150
200
250
300
Station (ft)

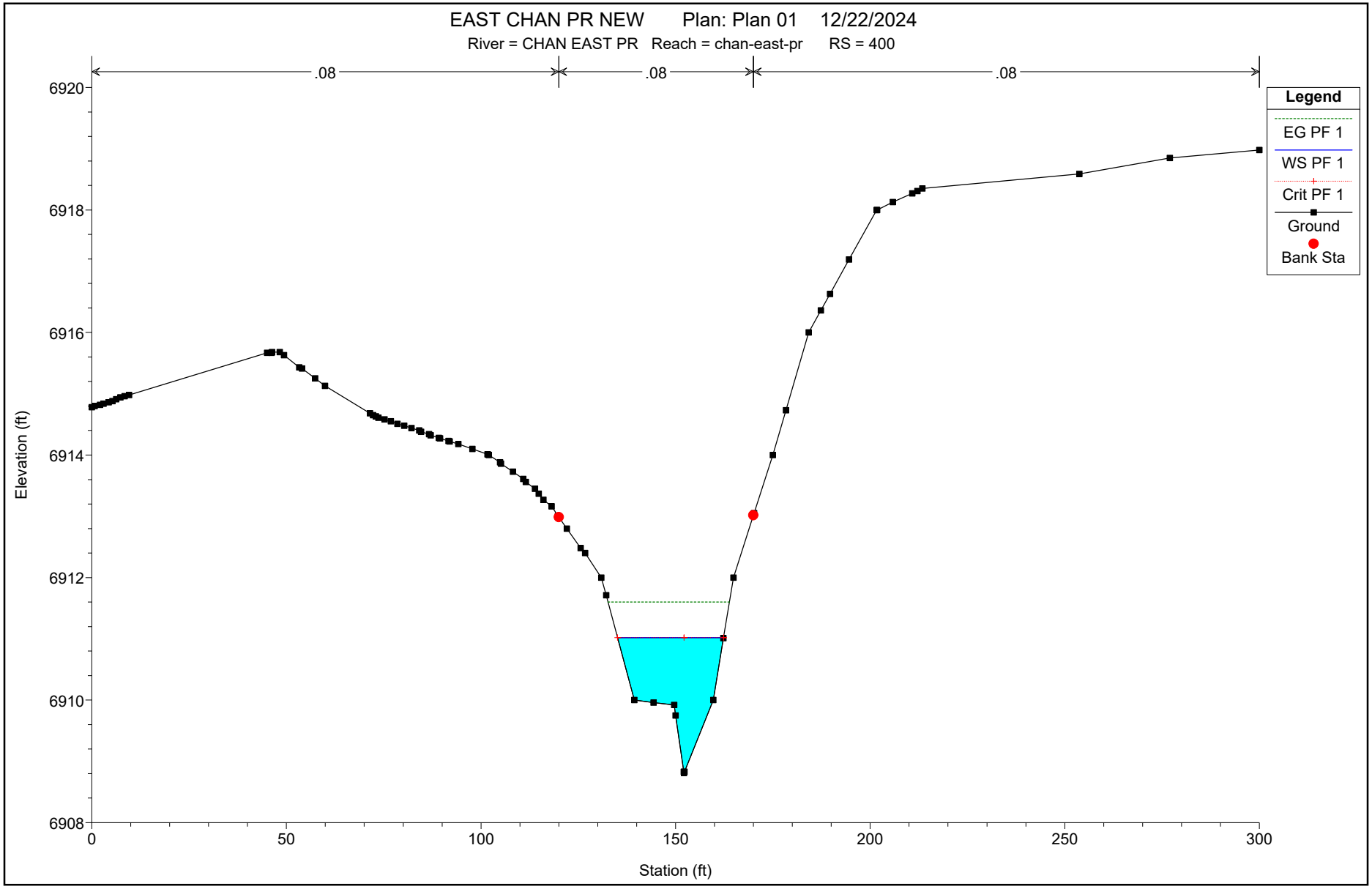

EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 900
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6930
6928
6926
6924
6922
6920
6918
6916
6914
0
50
100
150
200
250
300
Station (ft)


EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 800
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6926
6924
6922
6920
6918
6916
6914
6912
0
50
100
150
200
250
300
Station (ft)


EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 700
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6926
6924
6922
6920
6918
6916
6914
6912
0
50
100
150
200
250
300
Station (ft)


EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 600
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6924
6922
6920
6918
6916
6914
6912
0
50
100
150
200
250
300
Station (ft)


EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 500
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6924
6922
6920
6918
6916
6914
6912
6910
6908
0
50
100
150
200
250
300
Station (ft)


EAST CHAN PR NEW Plan: Plan 01 12/22/2024
River = CHAN EAST PR Reach = chan-east-pr RS = 400
.08
.08
.08
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6920
6918
6916
6914
6912
6910
6908
0
50
100
150
200
250
300
Station (ft)

EASTONVILLE ROAD

ACM ACM ALF VIII JV SUB II LLC
4100 E. MISSISSIPPI AVE., STE 500
DENVER, CO 80246

ACM ALF VIII JV SUB II LLC
4100 E. MISSISSIPPI AVE., STE 500
DENVER, CO 80246

ACM ALF VIII JV SUB II LLC
4100 E. MISSISSIPPI AVE., STE 500
DENVER, CO 80246

KO1515 LLC
PO BOX 1385
COLORADO SPRINGS CO, 80901-1385

935 DEVELOPMENT INC.
4100 E. MISSISSIPPI AVE., STE 500
DENVER, CO 80246

WATERBURY FIL NO 1

4 WAY RANCH FIL NO 1

LOT 42
LOT 41
LOT 40
LOT 39
LOT 38
LOT 37
LOT 36
LOT 35
LOT 15

GILBERT DRIVE

BANDANERO DRIVE

STAPLETON ROAD

RS X-SECT 2600 100-Y W.S. EL=6961.75
RS X-SECT 2500 100-Y W.S. EL=6865.71
RS X-SECT 2400 100-Y W.S. EL = 6984.24
RS X-SECT 2300 100-Y W.S. EL = 6962.31
RS X-SECT 2200 100-Y W.S. EL = 6959.7
RS X-SECT 2100 100-Y W.S. EL = 6957.46
RS X-SECT 2000 100-Y W.S. EL = 6956.19
RS X-SECT 1900 100-Y W.S. EL = 6954.43
100-YEAR H/W, HEC-RAS ANALYSIS
RS X-SECT 1800 100-Y W.S. EL = 6951.19
RS X-SECT 1700 100-Y W.S. EL = 6948.05
RS X-SECT 1600 100-Y W.S. EL = 6946.16
100-YEAR H/W, HEC-RAS ANALYSIS
RS X-SECT 1500 100-Y W.S. EL = 6946.68
RS X-SECT 1400 100-Y W.S. EL = 6945.45
RS X-SECT 1300 100-Y W.S. EL = 6943.58
RS X-SECT 1200 100-Y W.S. EL = 6943.03
RS X-SECT 1100 100-Y W.S. EL = 6942.45
RS X-SECT 1000 100-Y W.S. EL = 6940.99
RS X-SECT 900 100-Y W.S. EL = 6938.39
RS X-SECT 800 100-Y W.S. EL = 6936.19
LIMITS OF DISTURBANCE/ CONSTRUCTION BOUNDARY
RS X-SECT 700 100-Y W.S. EL = 6934.13
RS X-SECT 600 100-Y W.S. EL = 6932.22
RS X-SECT 500 100-Y W.S. EL = 6929.7
100-YEAR H/W, HEC-RAS ANALYSIS
RS X-SECT 400 100-Y W.S. EL = 6927.52
RS X-SECT 300 100-Y W.S. EL = 6924.34
RS X-SECT 200 100-Y W.S. EL = 6920.46
RS X-SECT 100 100-Y W.S. EL = 6920.09
RS X-SECT 0 100-Y W.S. EL = 6919.85

LEGEND
10' EXISTING CONTOUR
2' EXISTING CONTOUR
EXISTING 100-Y HIGH WATER LINE
CHANNEL ALIGNMENT
SUBDIVISION BOUNDARY
EXISTING ADJACENT LOTS/ROW
WETLANDS

N

120' 0 120' 240'
SCALE: 1"=120'

REVISIONS

NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, TERRA NOVA ENGINEERING, INC. APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR:
4-WAY RANCH JOINT VENTURE
ATTN: PETER MARTZ
4100 E. MISSISSIPPI AVE., STE 500
DENVER, CO 80246
719-491-3150

Terra Nova Engineering, Inc.
Creative Civil Engineering
721 S. 23RD STREET
COLORADO SPRINGS, CO 80904
OFFICE: 719-635-6422
FAX: 719-635-6426
www.tnesinc.com

WATERBURY FILING NO. 1

EXISTING 100-Y FLOODPLAIN EXHIBIT
WEST CHANNEL

DESIGNED BY DLF
DRAWN BY QNA
CHECKED BY QNA
H-SCALE 1" = 120'
V-SCALE N/A
JOB NO. 2356.00
DATE ISSUED 2/11/26
SHEET NO. 1 OF 2

EASTONVILLE ROAD

THATCHER COURT

GILBERT DRIVE

STAPLETON ROAD

BANDANERO DRIVE

PR CHANNEL MAINTENANCE ESMT

LOT 42

LOT 41

LOT 40

LOT 39

LOT 38

LOT 37

LOT 36

LOT 35

LOT 15

4 WAY RANCH FIL NO 1

WATERBURY FIL NO 1

TRACT C

TRACT D

TRACT E

TRACT F

TRACT G

TRACT H

TRACT J

TRACT A

TRACT B

ACM ACM ALF VIII JV SUB II LLC
4100 E. MISSISSIPPI AVE., STE 500
DENVER, CO 80246

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DENVER, CO 80246

ACM ALF VIII JV SUB II LLC
4100 E. MISSISSIPPI AVE., STE 500
DENVER, CO 80246

KO1515 LLC
PO BOX 1385
COLORADO SPRINGS CO, 80901-1385

935 DEVELOPMENT INC.
4100 E. MISSISSIPPI AVE., STE 500
DENVER, CO 80246

X-SECT A-A

100-YEAR HWL HEC-RAS ANALYSIS

STA 1700 TO STA 2000 300 LF OF SELECTIVE RIPRAP BANK STABILIZATION

STA 1300 TO STA 1500 200 LF OF SELECTIVE RIPRAP BANK STABILIZATION

STA 144+00.00 DROP 2' GROUTED BOULDER DROP STRUCTURE W/ TOP=6944.00 BOT=6942.00

STA 250 TO STA 700 WEST 450 LF OF SELECTIVE

STA 150 TO STA 700 EAST 550 LF OF SELECTIVE RIPRAP BANK STABILIZATION

STA 10+00.00± (FIELD FIT TO LOCATION NEEDED IN FIELD) PR 2' GROUTED BOULDER DROP STRUCTURE W/ TOP=6950.00 BOT=6948.00

STA 3+50.00± (FIELD FIT TO LOCATION NEEDED IN FIELD) PR 2' GROUTED BOULDER DROP STRUCTURE W/ TOP=6914.00 BOT=6922.00

EX RIPRAP TO BE USED AS BANK STABILIZATION

LIMITS OF DISTURBANCE/ CONSTRUCTION BOUNDARY

LEGEND
10' EXISTING CONTOUR
2' EXISTING CONTOUR
10' PROPOSED CONTOUR
2' PROPOSED CONTOUR
LIMITS OF DISTURBANCE
SUBDIVISION BOUNDARY
100-Y HIGH WATER LINE
CHANNEL ALIGNMENT
MINIMUM FINISHED FLOOR
W.S.
WETLANDS
WSE FF WATER SURFACE

N

120' 0 120' 240'

SCALE: 1"=120'

REVISIONS

NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, TERRA NOVA ENGINEERING, INC. APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

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719-491-3150

Terra Nova Engineering, Inc.
Excellence in Civil Engineering and Surveying
721 S. 23RD STREET
COLORADO SPRINGS, CO 80904
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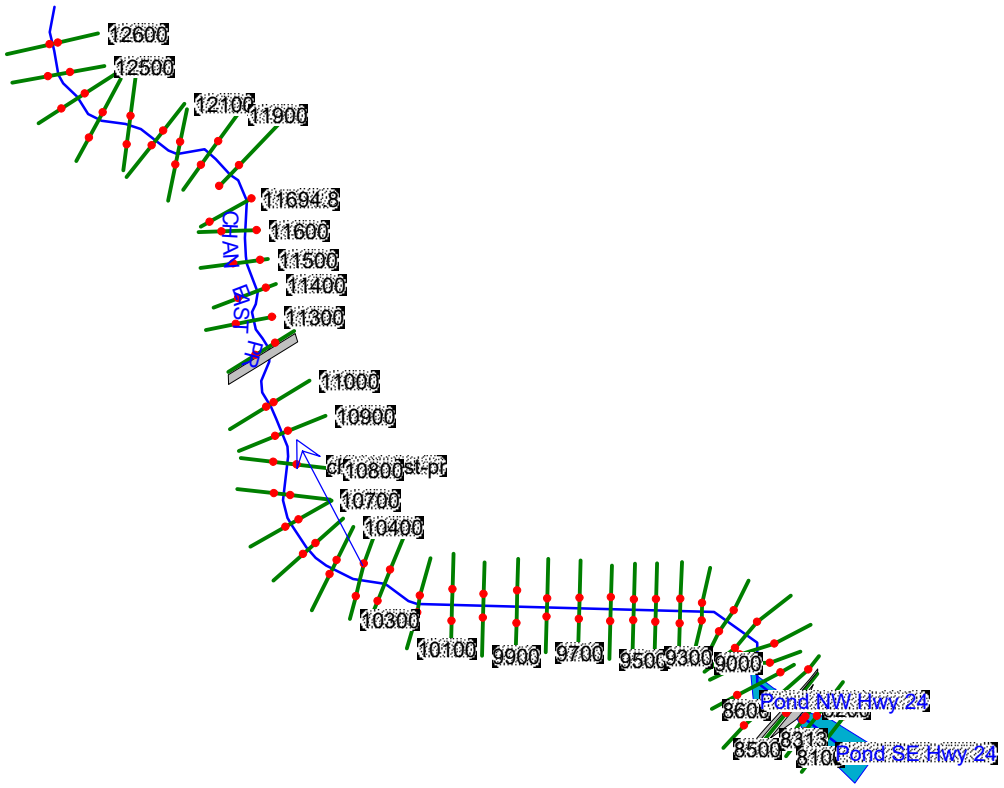
WATERBURY FILING NO. 1

PROPOSED 100-Y FLOODPLAIN EXHIBIT

DESIGNED BY DLF
DRAWN BY QNA
CHECKED BY QNA
H-SCALE 1" = 100'
V-SCALE N/A
JOB NO. 2356.00
DATE ISSUED 2/11/26
SHEET NO. 2 OF 2

HEC-RAS ANALYSIS
POND FAILURE

PROPOSED EAST CHANNEL 100-Y
W/ POND FAILURES



PROPOSED EAST CHANNEL 100-Y
W/ POND FAILURES

HEC-RAS Plan: Plan 01 River: CHAN EAST PR Reach: chan-east-pr Profile: PF 1

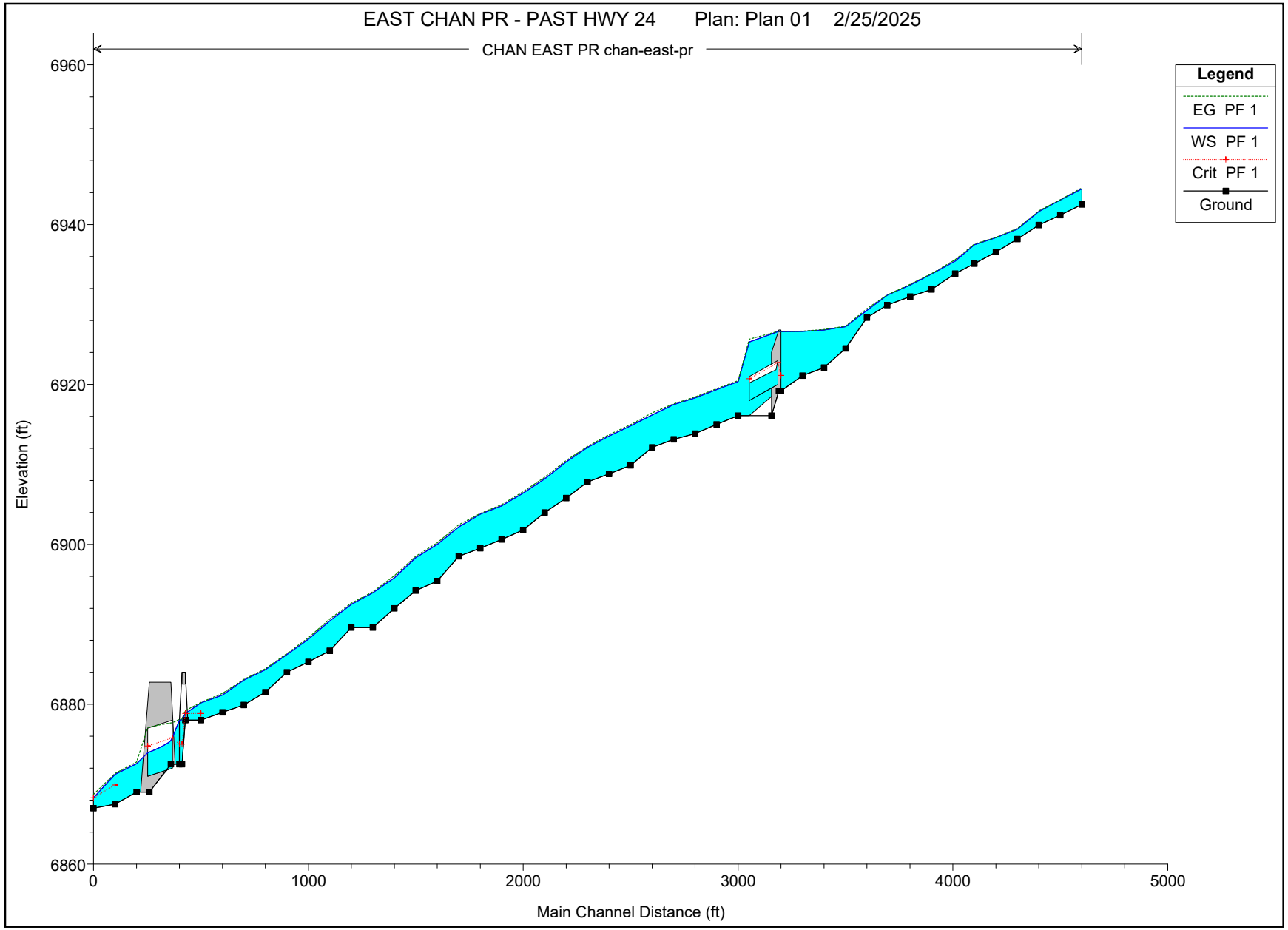
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
chan-east-pr	12600	PF 1	151.00	6942.53	6944.49		6944.60	0.020083	3.02	66.20	108.74	0.48
chan-east-pr	12500	PF 1	151.00	6941.18	6943.07		6943.13	0.010904	1.96	84.33	124.93	0.34
chan-east-pr	12400	PF 1	151.00	6939.95	6941.64		6941.73	0.018619	2.32	65.19	74.51	0.44
chan-east-pr	12300	PF 1	151.00	6938.19	6939.43		6939.53	0.026036	2.57	58.86	74.26	0.51
chan-east-pr	12200	PF 1	151.00	6936.58	6938.37		6938.40	0.006144	1.52	100.47	103.49	0.26
chan-east-pr	12100	PF 1	151.00	6935.13	6937.49		6937.58	0.011540	2.32	65.13	51.20	0.36
chan-east-pr	12010.4	PF 1	151.00	6933.88	6935.44		6935.64	0.053677	3.57	43.11	67.15	0.72
chan-east-pr	11900	PF 1	151.00	6931.88	6933.83		6933.87	0.007284	1.64	92.16	87.61	0.28
chan-east-pr	11801.1	PF 1	151.00	6931.01	6932.45		6932.55	0.031250	2.52	59.91	88.99	0.54
chan-east-pr	11694.8	PF 1	151.00	6929.94	6931.19		6931.21	0.006635	1.14	132.45	144.76	0.21
chan-east-pr	11600	PF 1	151.00	6928.36	6929.28		6929.50	0.139298	3.76	40.19	72.02	0.89
chan-east-pr	11500	PF 1	151.00	6924.52	6927.24		6927.29	0.008344	1.67	90.50	66.11	0.25
chan-east-pr	11400	PF 1	420.00	6922.11	6926.83		6926.88	0.003350	1.64	262.39	111.83	0.18
chan-east-pr	11300	PF 1	420.00	6921.11	6926.66		6926.68	0.001210	1.11	384.42	132.95	0.11
chan-east-pr	11200	PF 1	420.00	6919.19	6926.63	6921.13	6926.64	0.000187	0.70	734.78	191.41	0.05
chan-east-pr	11111.15		Culvert									
chan-east-pr	11000	PF 1	457.00	6916.11	6920.37		6920.48	0.009741	3.22	196.10	121.87	0.31
chan-east-pr	10900	PF 1	457.00	6915.02	6919.36		6919.49	0.010019	3.07	171.30	105.04	0.31
chan-east-pr	10800	PF 1	457.00	6913.85	6918.32		6918.44	0.011122	2.74	166.74	71.47	0.32
chan-east-pr	10700	PF 1	457.00	6913.13	6917.50		6917.59	0.006619	2.50	221.32	148.22	0.25
chan-east-pr	10600	PF 1	457.00	6912.13	6916.19		6916.45	0.023936	4.03	115.00	63.97	0.46
chan-east-pr	10500	PF 1	457.00	6909.89	6914.83		6914.96	0.009682	2.95	158.71	65.47	0.30
chan-east-pr	10400	PF 1	457.00	6908.81	6913.55		6913.74	0.015814	3.49	133.20	61.05	0.38
chan-east-pr	10300	PF 1	457.00	6907.80	6912.12		6912.26	0.013729	2.97	153.95	68.54	0.35
chan-east-pr	10200	PF 1	457.00	6905.80	6910.31		6910.52	0.022763	3.63	125.98	60.49	0.44
chan-east-pr	10100	PF 1	457.00	6904.00	6908.18		6908.39	0.019974	3.64	126.05	60.03	0.42
chan-east-pr	10000	PF 1	457.00	6901.80	6906.43		6906.59	0.016047	3.23	141.35	61.91	0.38
chan-east-pr	9900	PF 1	457.00	6900.60	6904.80		6904.97	0.016323	3.30	138.58	59.84	0.38
chan-east-pr	9800	PF 1	457.00	6899.50	6903.78		6903.86	0.007720	2.23	212.09	105.20	0.26
chan-east-pr	9700	PF 1	457.00	6898.50	6902.17		6902.44	0.033416	4.15	110.36	60.05	0.53
chan-east-pr	9600	PF 1	501.10	6895.40	6899.99		6900.19	0.016360	3.64	137.81	51.11	0.39
chan-east-pr	9500	PF 1	501.10	6894.20	6898.33		6898.51	0.017155	3.46	144.68	60.13	0.39
chan-east-pr	9400	PF 1	501.10	6892.00	6895.81		6896.09	0.036497	4.22	118.82	66.06	0.55
chan-east-pr	9300	PF 1	501.10	6889.60	6893.94		6894.07	0.012381	2.93	171.25	72.14	0.33
chan-east-pr	9200	PF 1	501.10	6889.60	6892.49		6892.64	0.016625	3.08	164.19	88.27	0.38
chan-east-pr	9100	PF 1	501.10	6886.70	6890.44		6890.67	0.023374	3.89	130.11	64.44	0.46
chan-east-pr	9000	PF 1	501.10	6885.30	6888.13		6888.31	0.023479	3.37	148.66	85.04	0.44
chan-east-pr	8900	PF 1	501.10	6884.00	6886.22		6886.33	0.016514	2.69	193.23	180.26	0.37
chan-east-pr	8800	PF 1	501.10	6881.50	6884.32		6884.44	0.021637	2.86	178.45	143.61	0.41
chan-east-pr	8700	PF 1	501.10	6879.90	6883.01		6883.11	0.009035	2.51	212.60	120.55	0.29

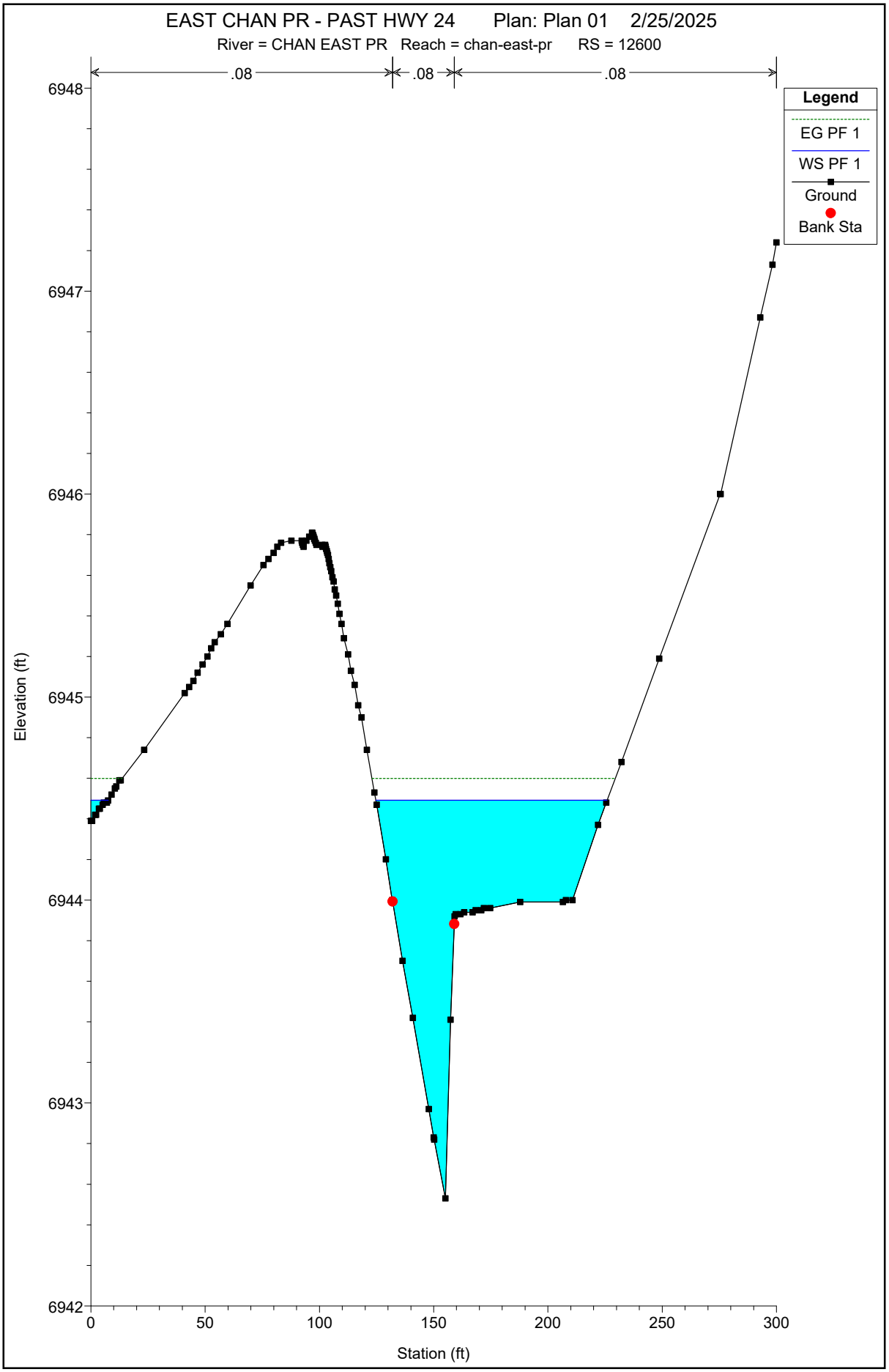
PROPOSED EAST CHANNEL 100-Y
W/ POND FAILURES

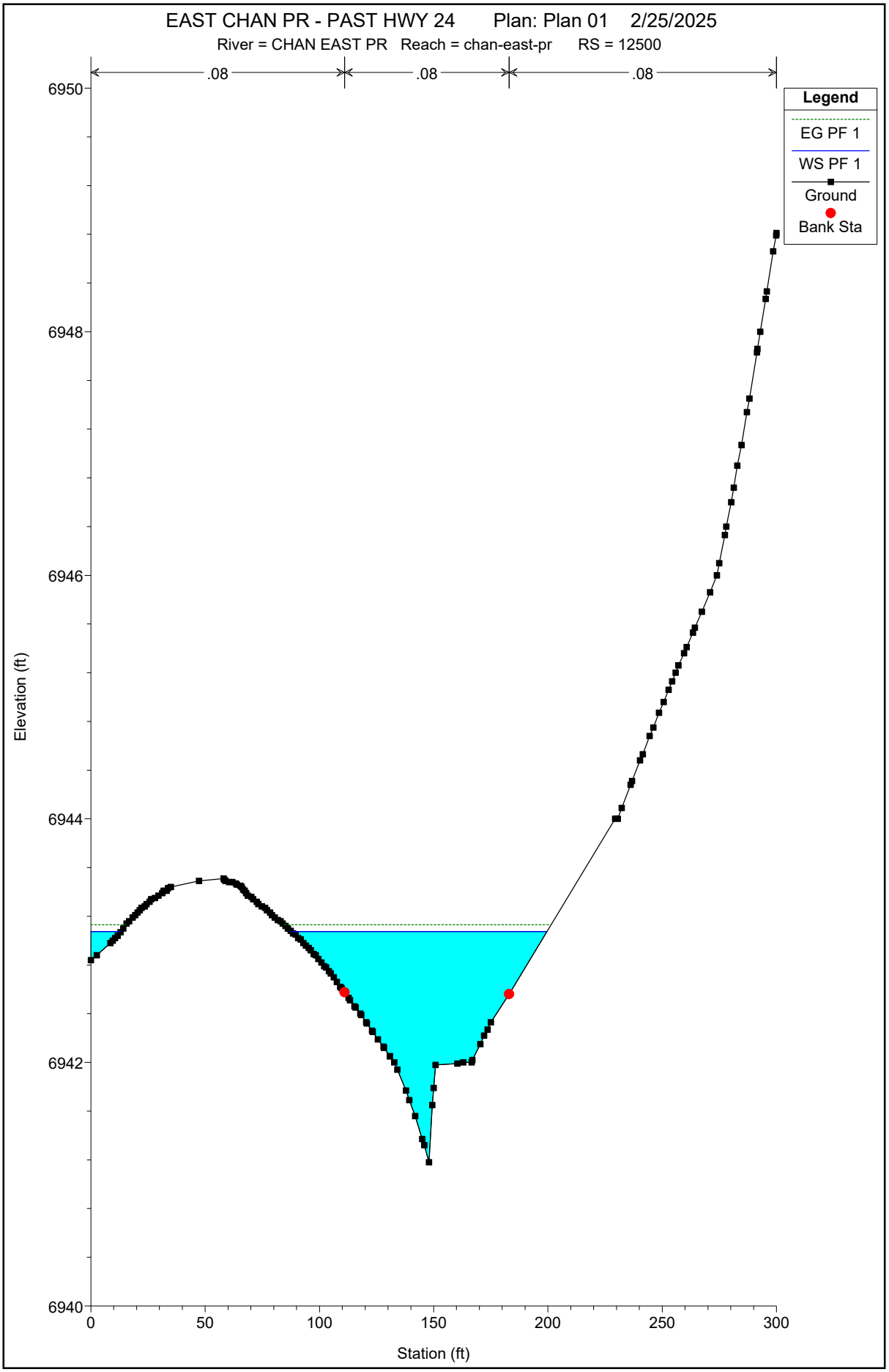
HEC-RAS Plan: Plan 01 River: CHAN EAST PR Reach: chan-east-pr Profile: PF 1 (Continued)

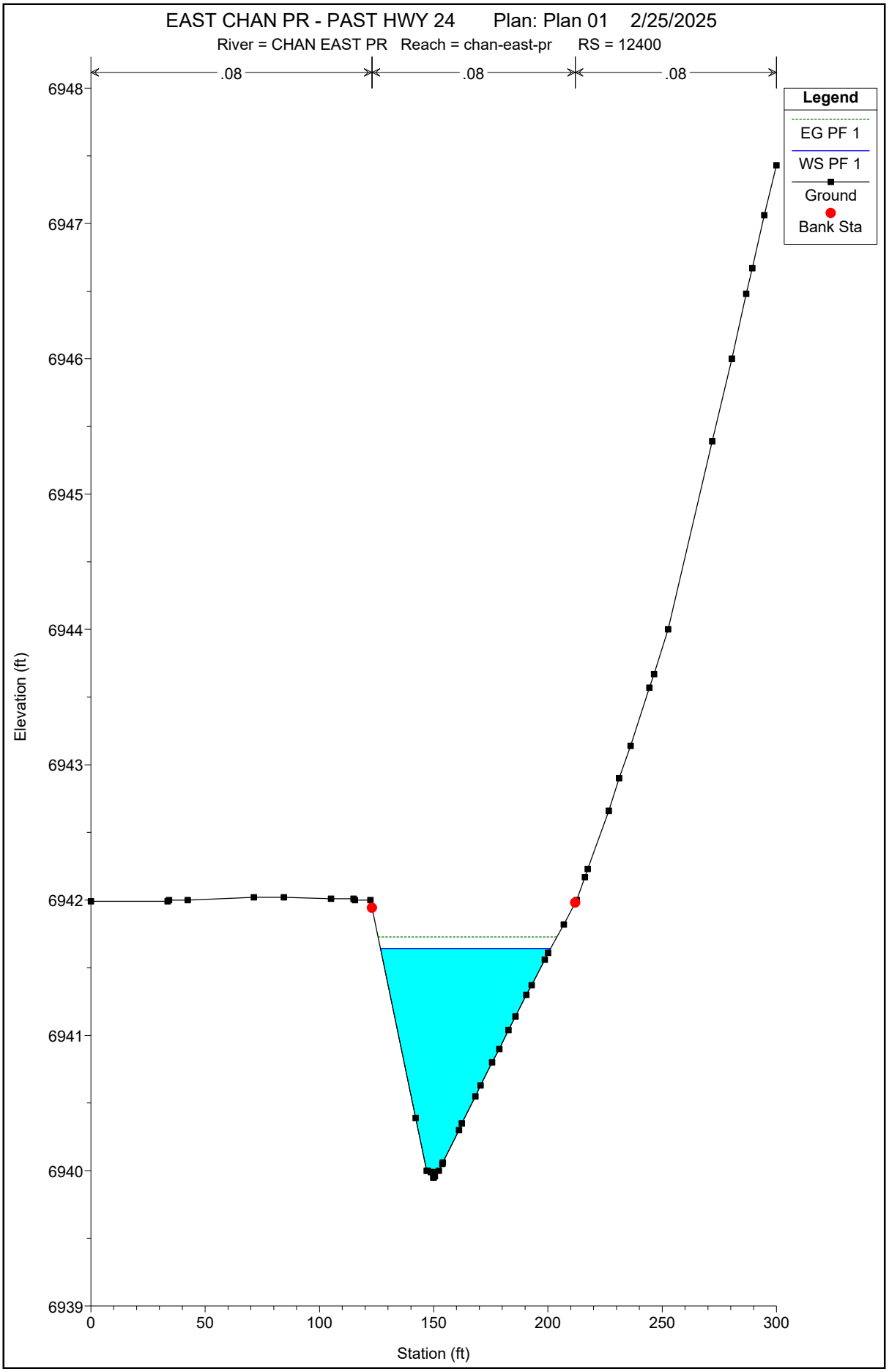
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
chan-east-pr	8600	PF 1	501.10	6879.00	6881.15		6881.35	0.046890	3.59	139.66	118.50	0.58
chan-east-pr	8500	PF 1	501.10	6878.00	6880.19	6878.84	6880.22	0.004658	1.45	345.95	202.35	0.20
chan-east-pr	8415		Bridge									
chan-east-pr	8400	PF 1	501.10	6872.50	6878.02	6875.02	6878.09	0.003149	2.36	238.88	66.78	0.19
chan-east-pr	8313		Culvert									
chan-east-pr	8200	PF 1	501.10	6869.00	6872.55		6872.78	0.020621	3.89	135.67	83.24	0.43
chan-east-pr	8100	PF 1	501.10	6867.50	6871.23	6869.88	6871.35	0.010142	2.79	203.74	128.14	0.31
chan-east-pr	8000	PF 1	501.10	6867.00	6868.31	6868.31	6868.71	0.164745	5.07	98.81	128.08	1.02

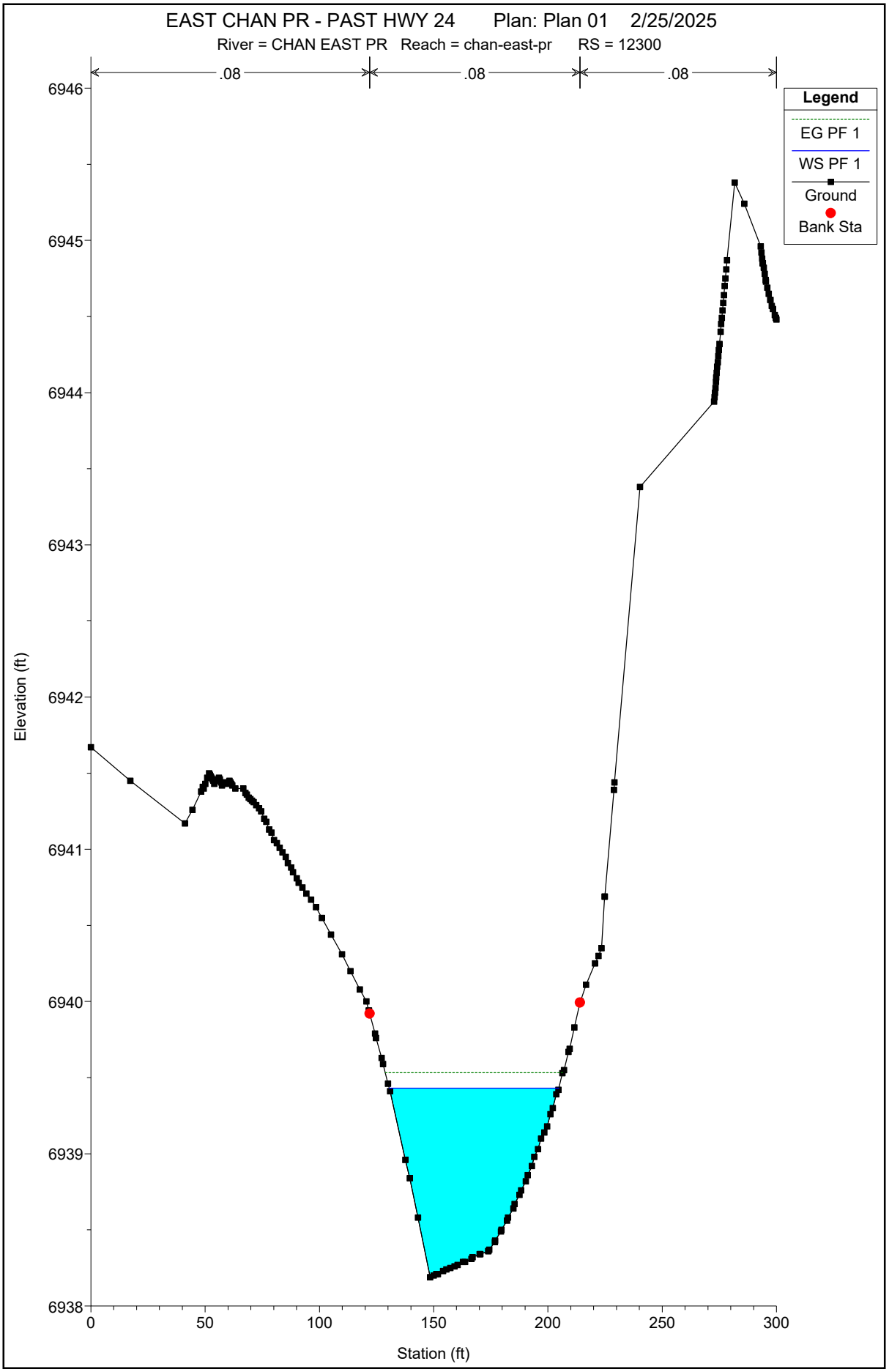
PROPOSED EAST CHANNEL 100-Y
W/ POND FAILURES

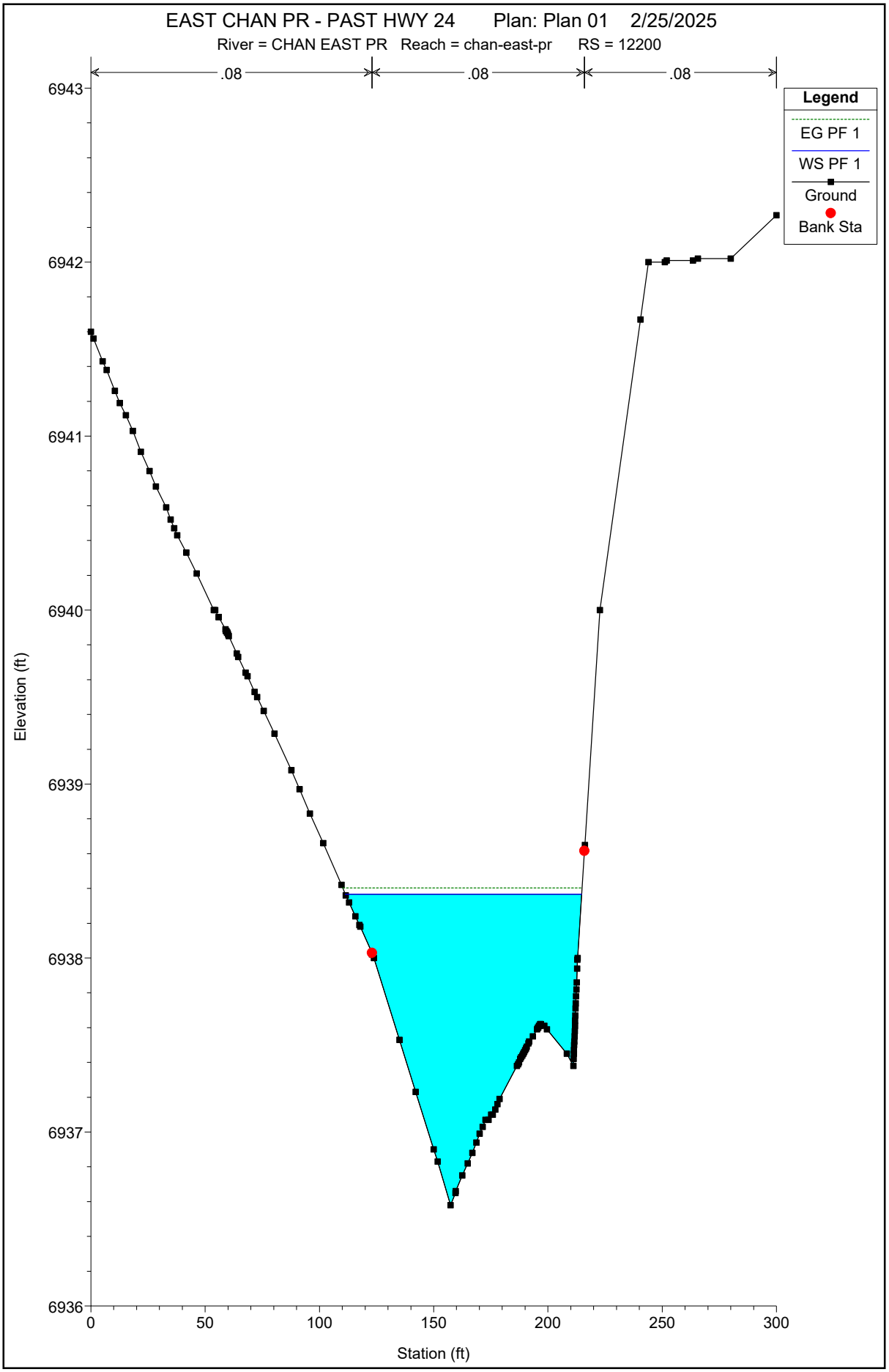


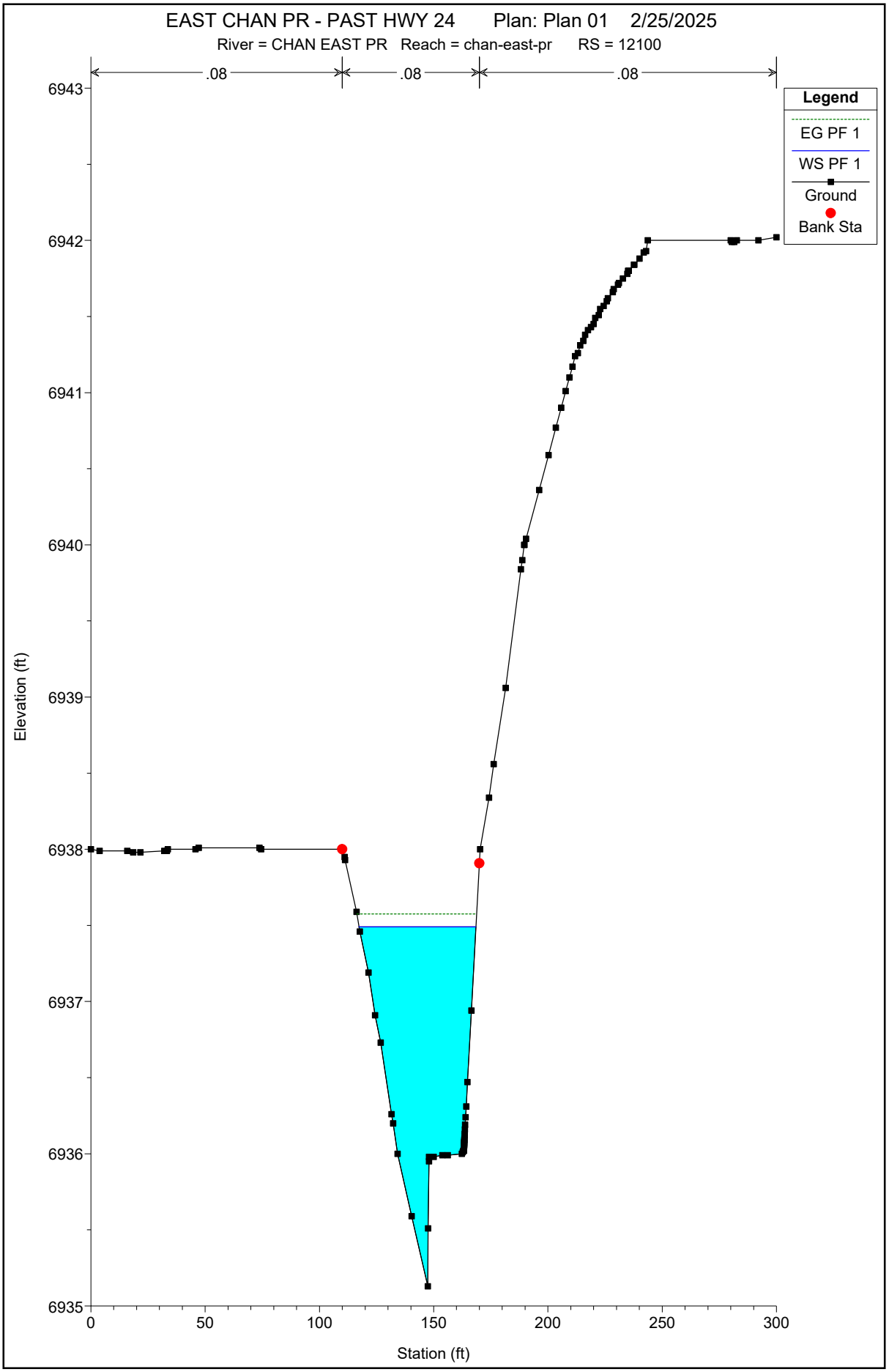

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 12600
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6948
6947
6946
6945
6944
6943
6942
0
50
100
150
200
250
300
Station (ft)

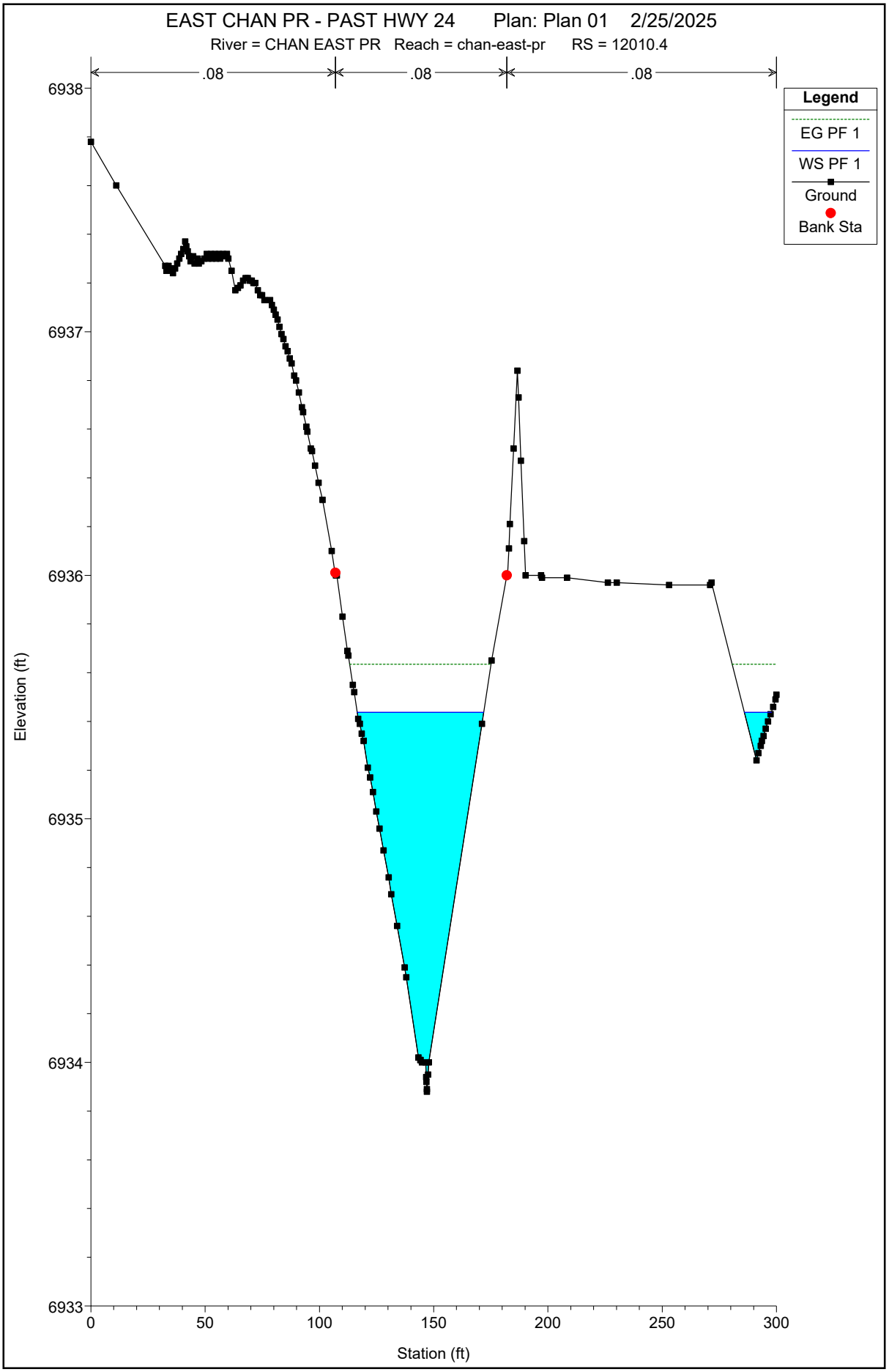

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 12500
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6950
6948
6946
6944
6942
6940
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

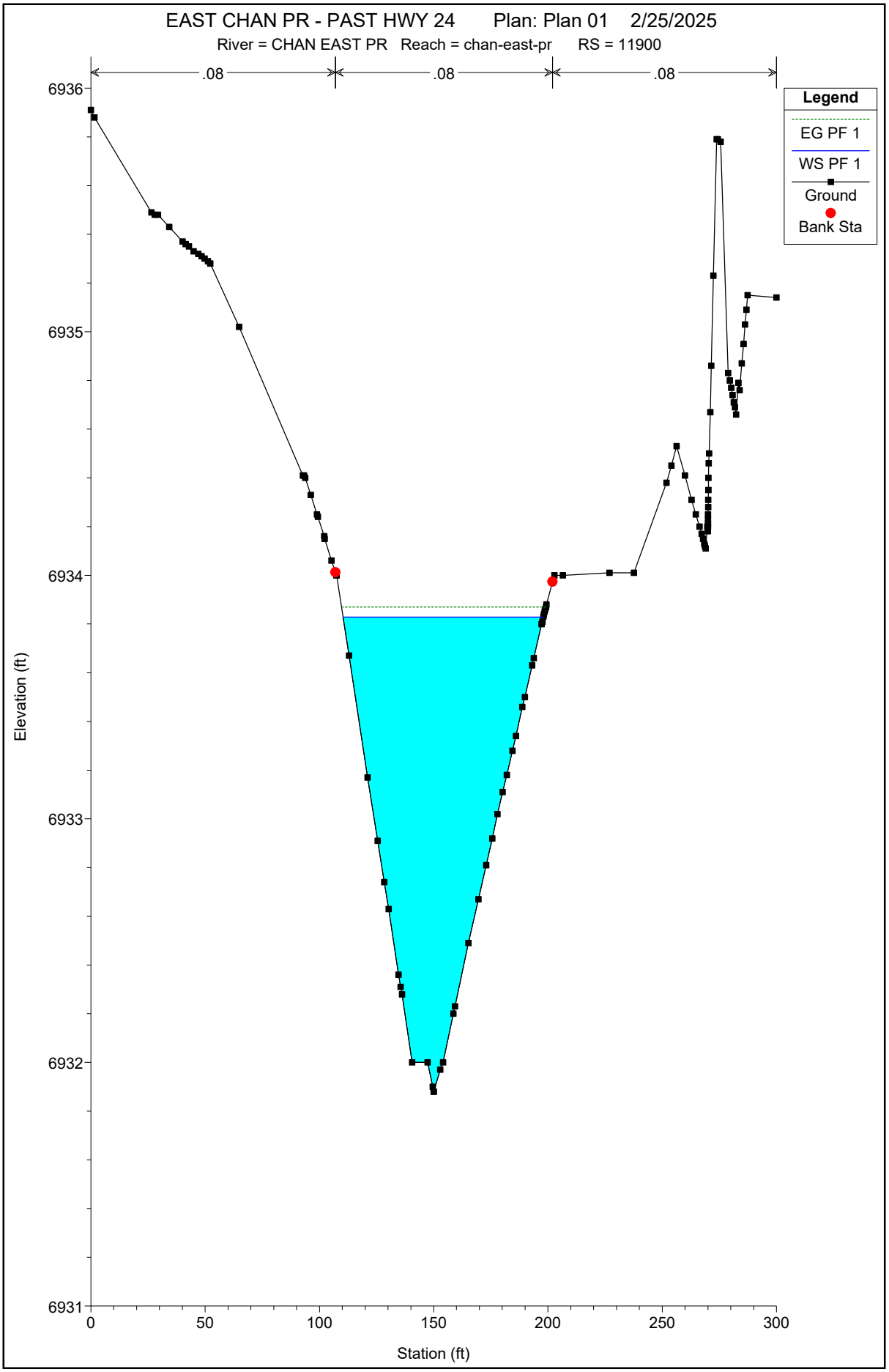

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 12400
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6948
6947
6946
6945
6944
6943
6942
6941
6940
6939
0
50
100
150
200
250
300
Station (ft)

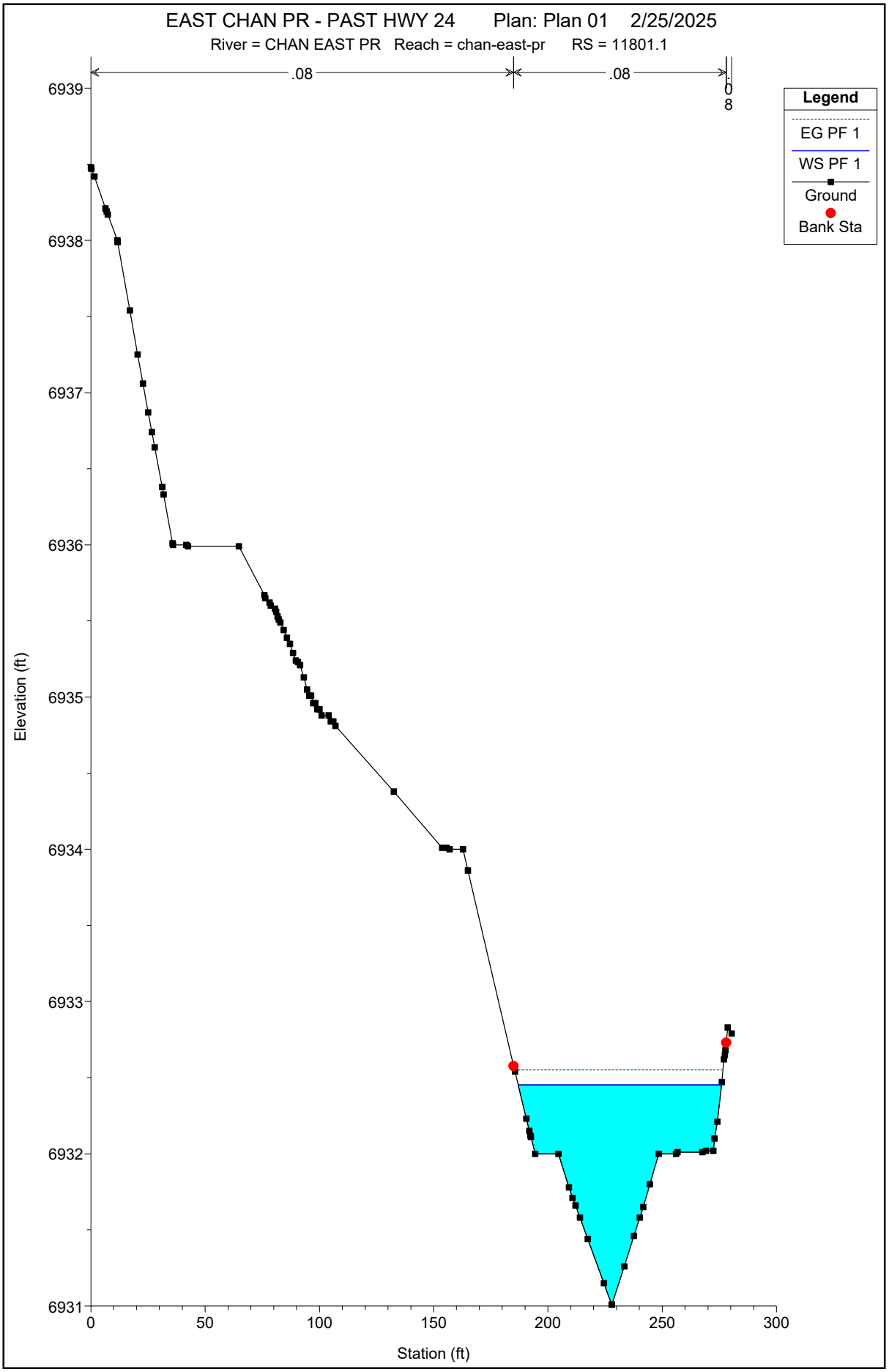

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 12300
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6946
6945
6944
6943
6942
6941
6940
6939
6938
0
50
100
150
200
250
300
Station (ft)

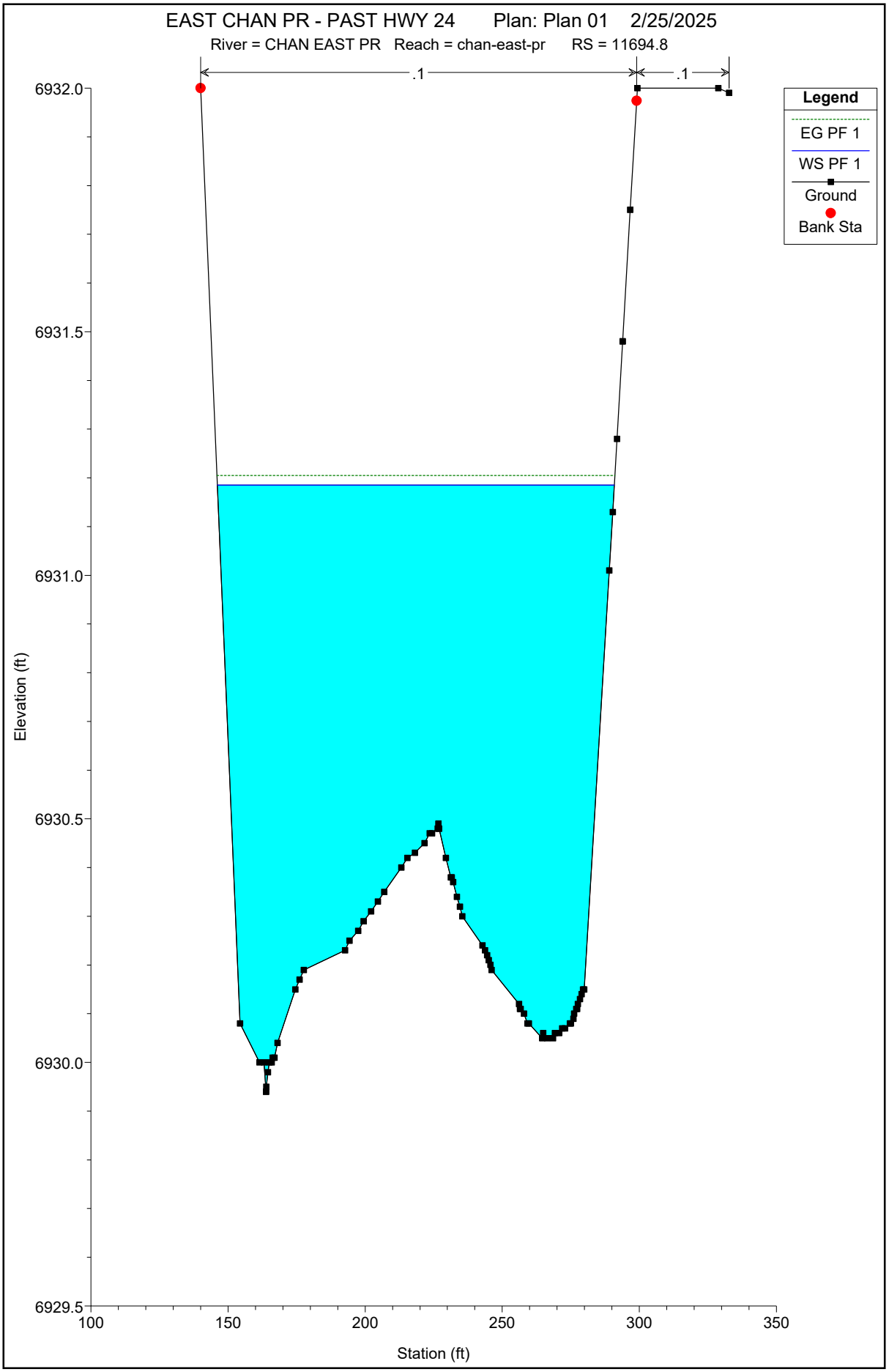

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 12200
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6943
6942
6941
6940
6939
6938
6937
6936
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

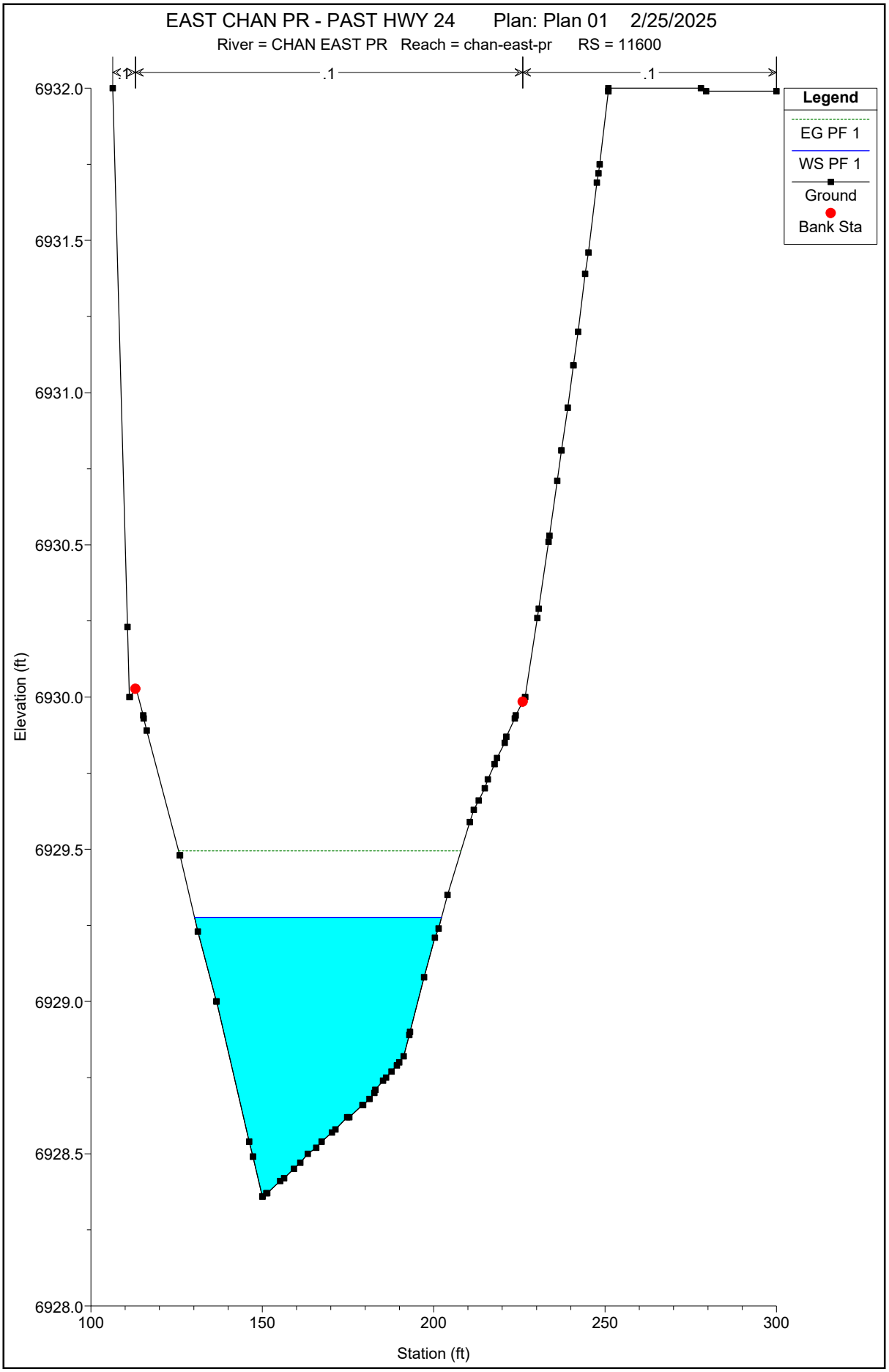

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 12100
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6943
6942
6941
6940
6939
6938
6937
6936
6935
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

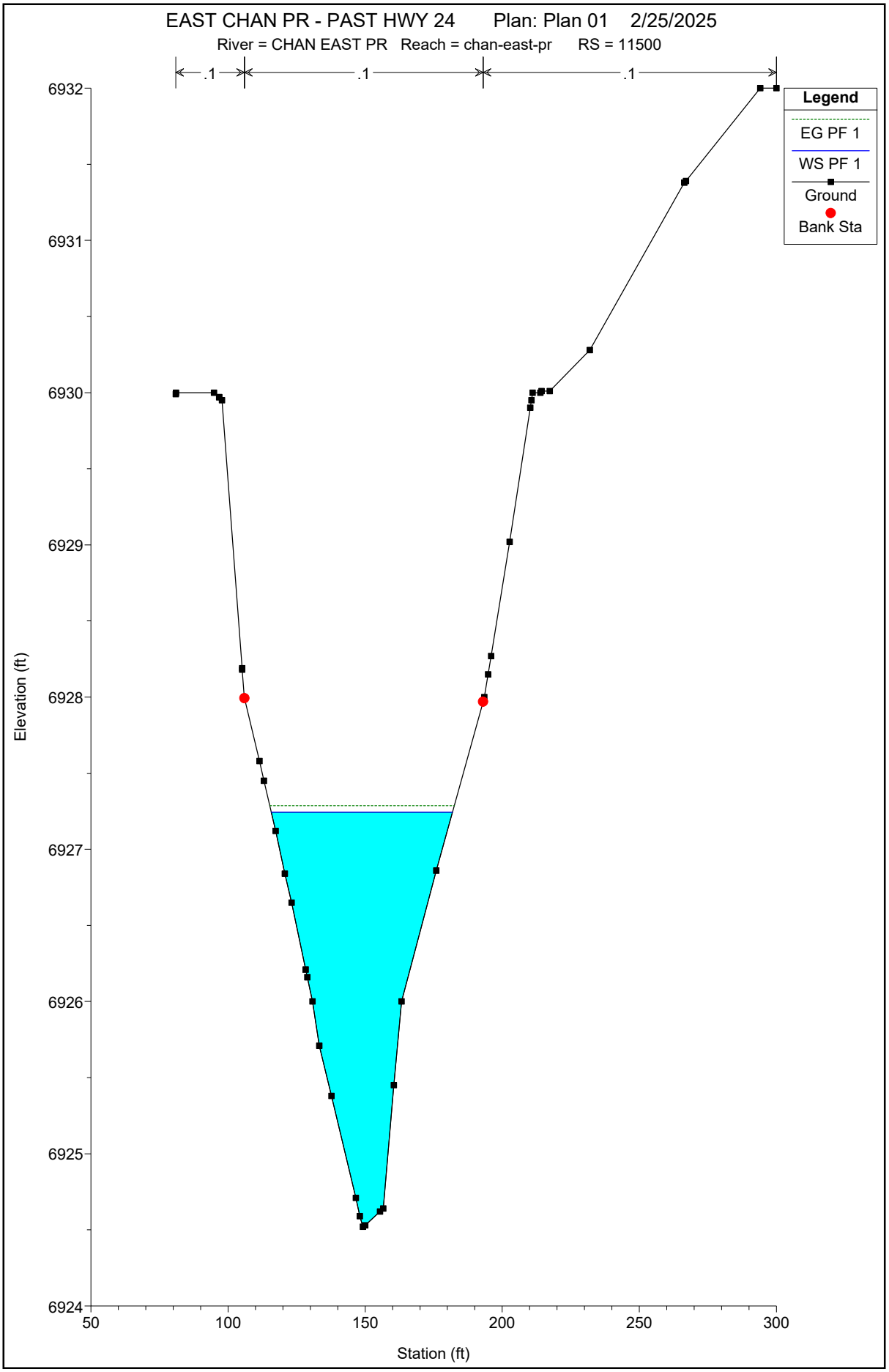

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 12010.4
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6938
6937
6936
6935
6934
6933
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

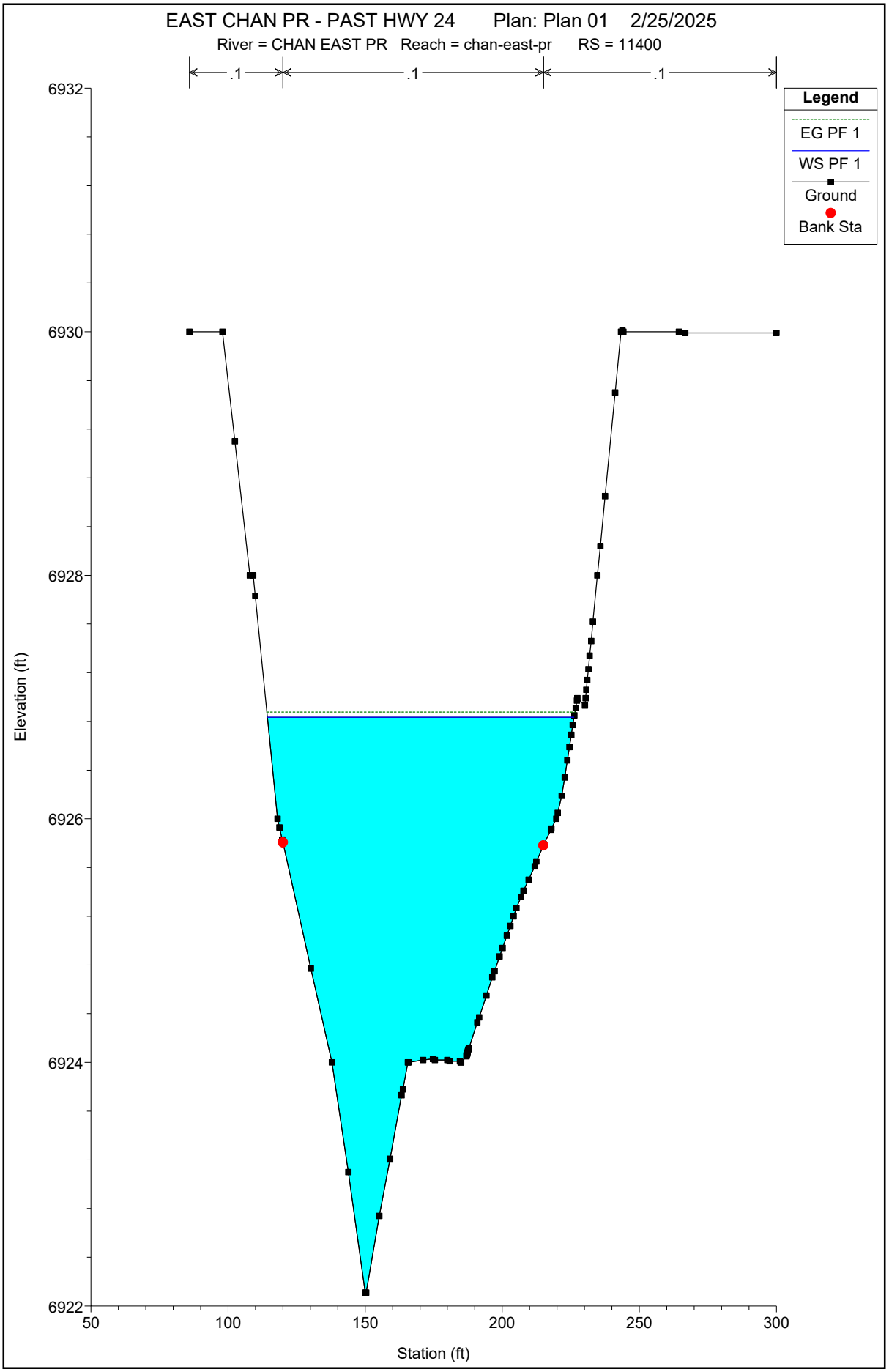

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 11900
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6936
6935
6934
6933
6932
6931
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

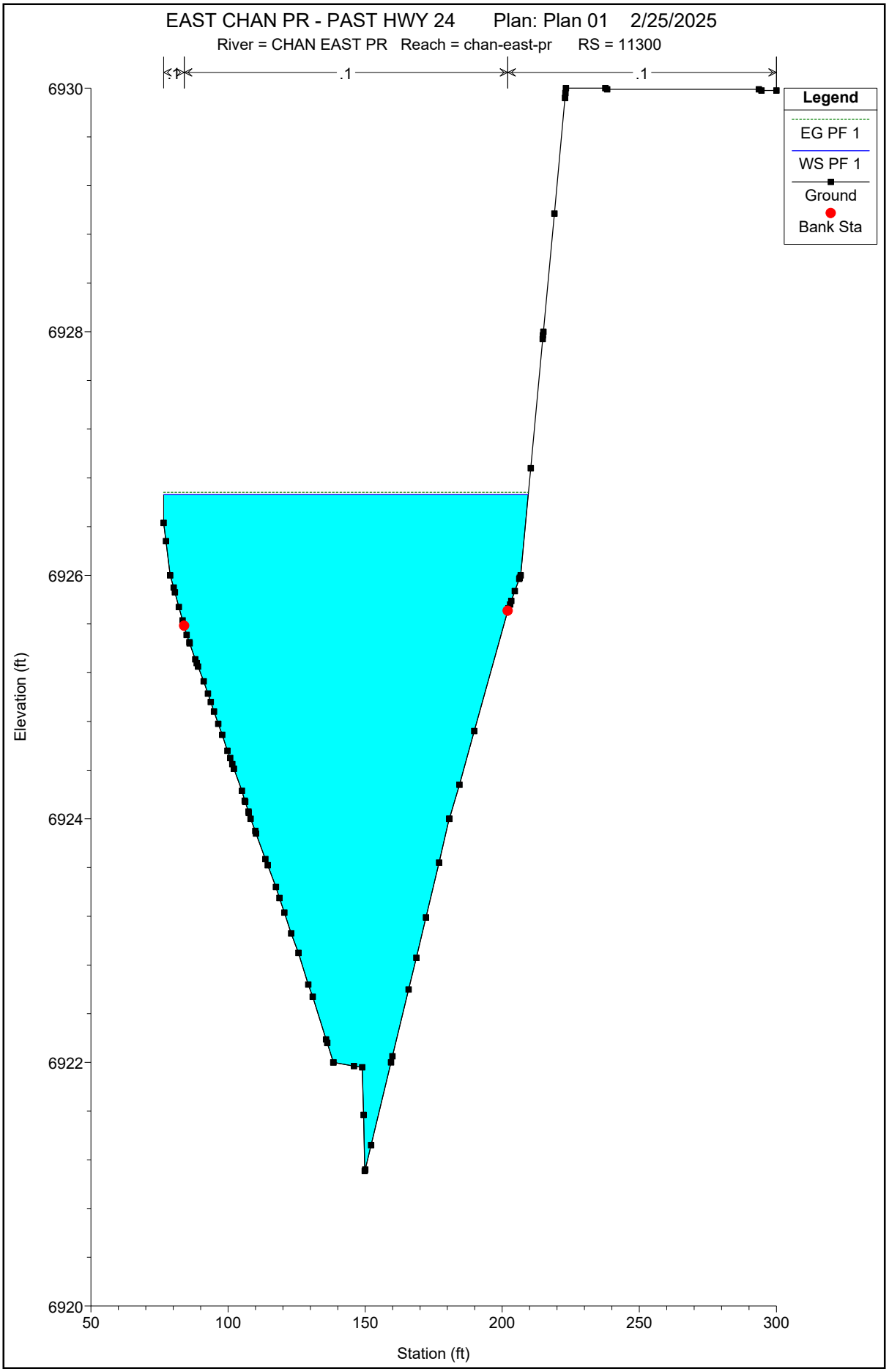

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 11801.1
.08
.08
.0
8
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6939
6938
6937
6936
6935
6934
6933
6932
6931
0
50
100
150
200
250
300
Station (ft)

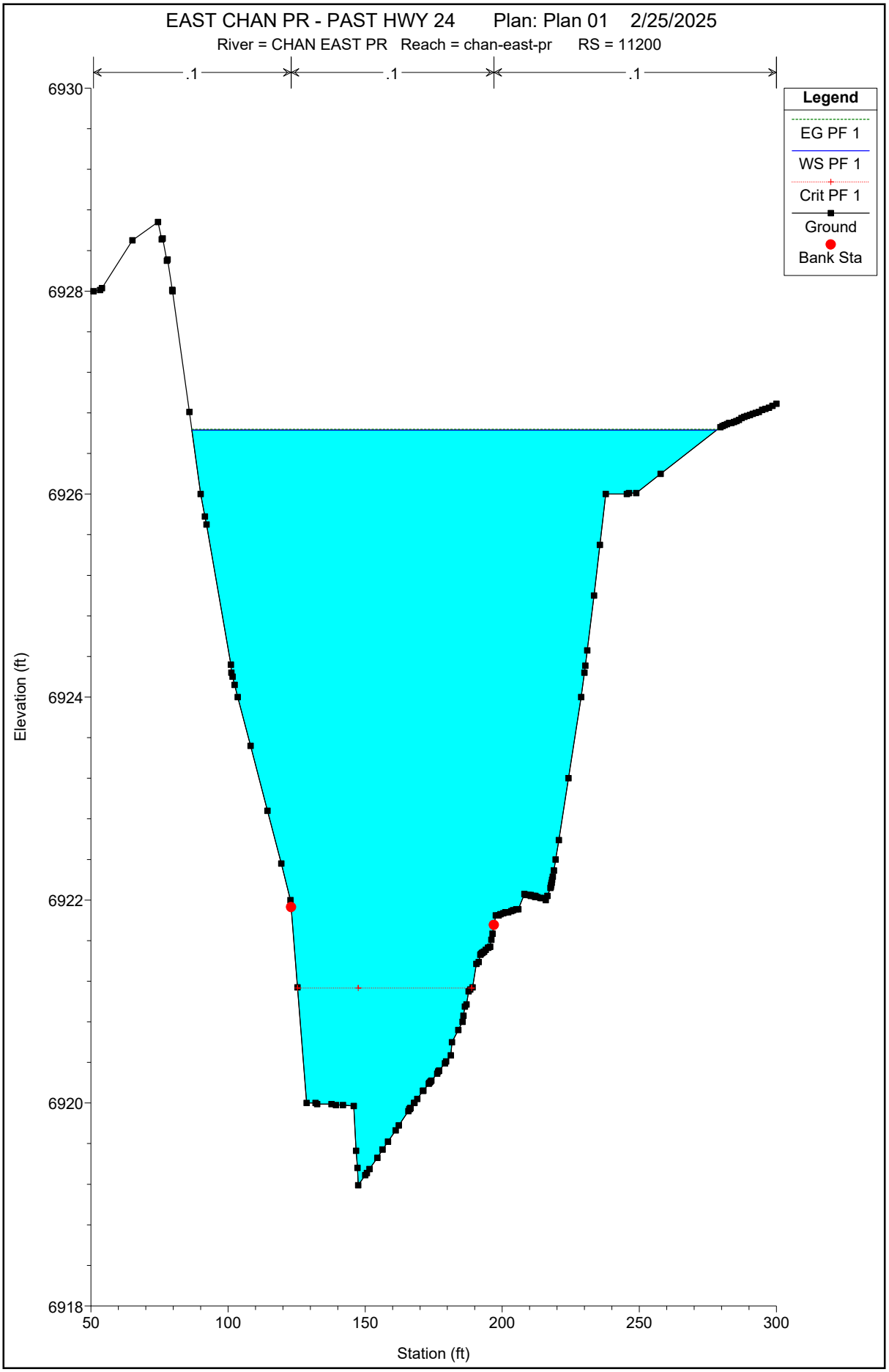

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 11694.8
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6932.0
6931.5
6931.0
6930.5
6930.0
6929.5
Elevation (ft)
100
150
200
250
300
350
Station (ft)

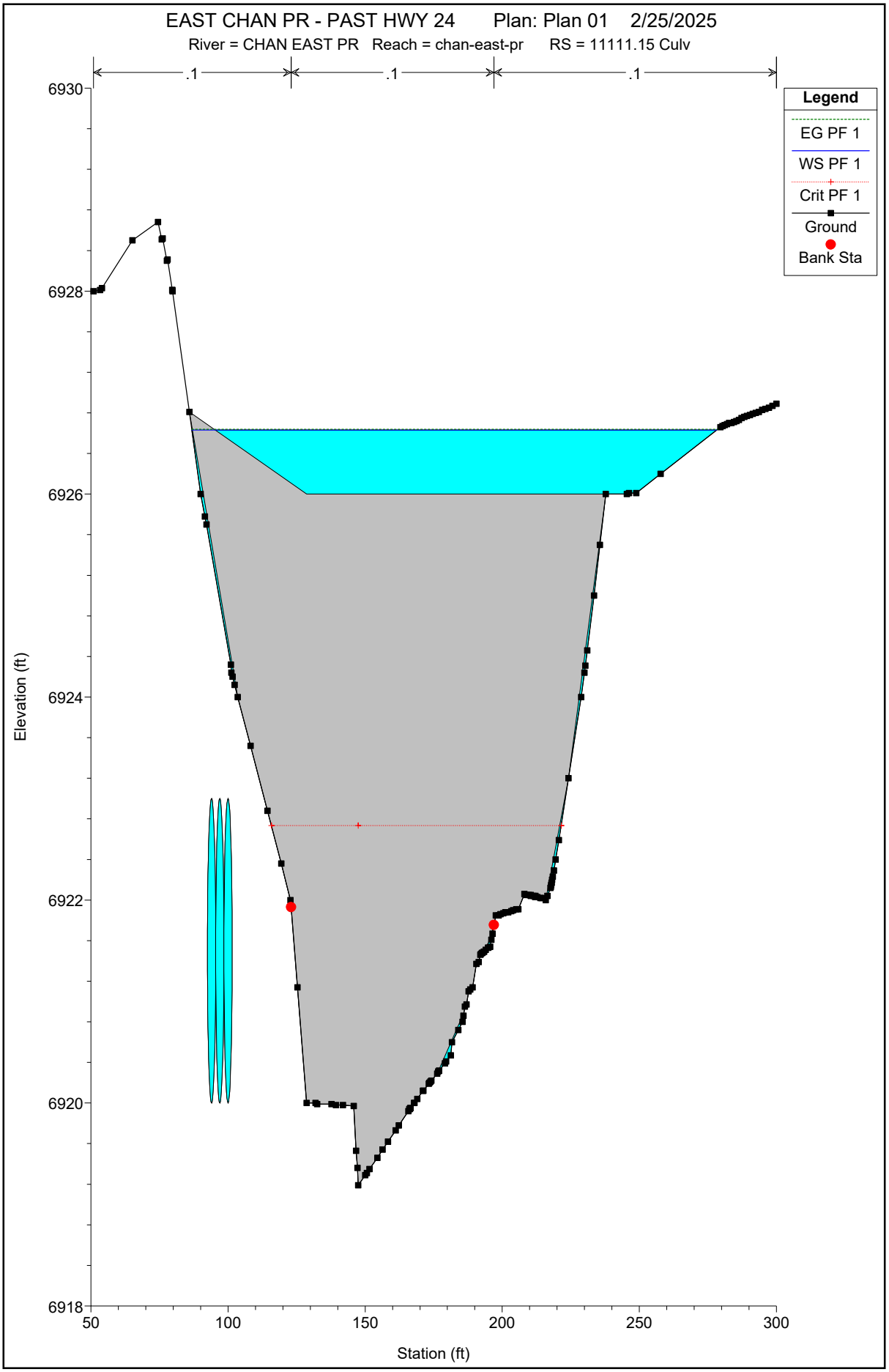

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 11600
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6932.0
6931.5
6931.0
6930.5
6930.0
6929.5
6929.0
6928.5
6928.0
100
150
200
250
300
Station (ft)

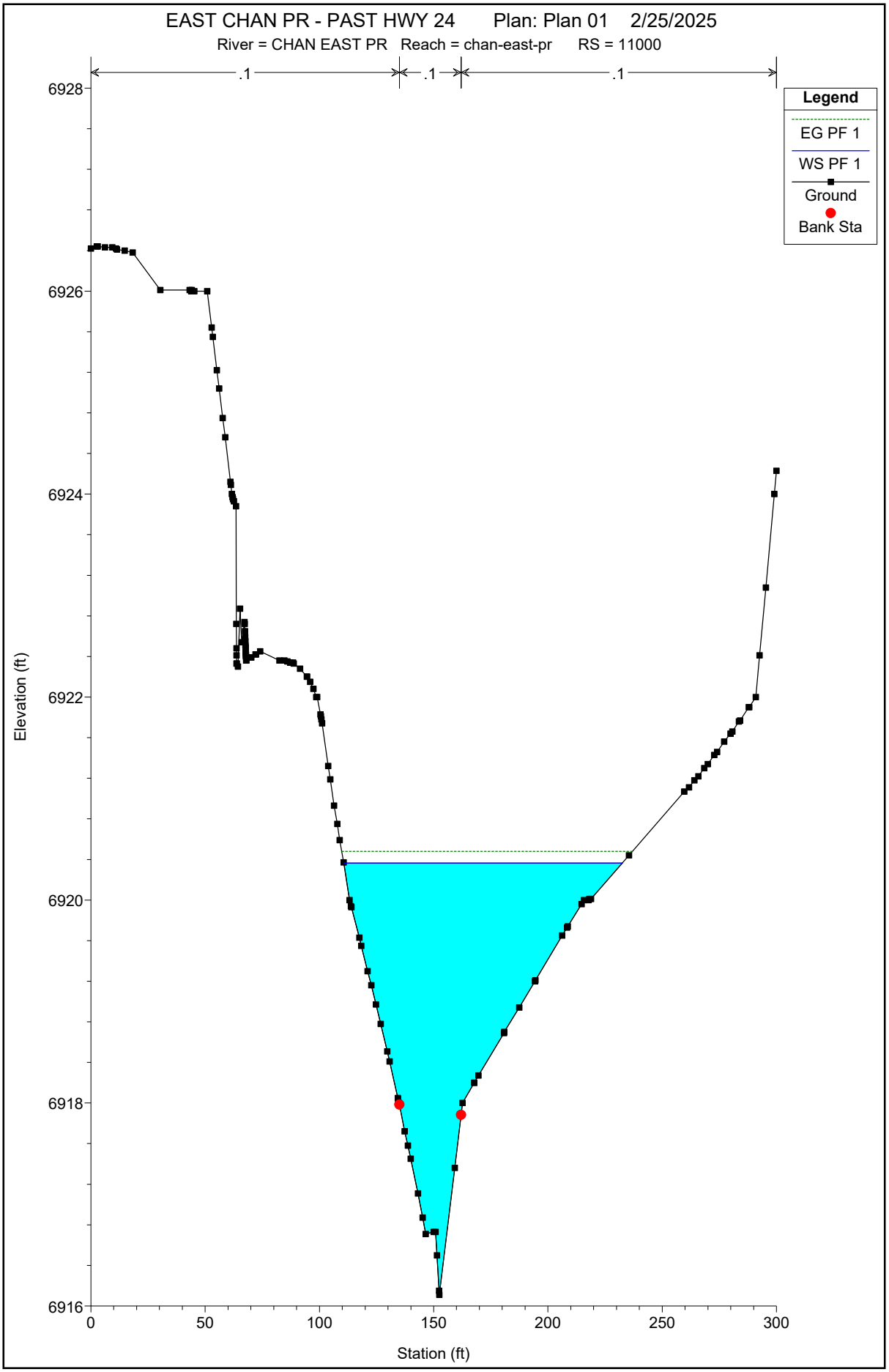

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 11500
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6932
6931
6930
6929
6928
6927
6926
6925
6924
50
100
150
200
250
300
Station (ft)

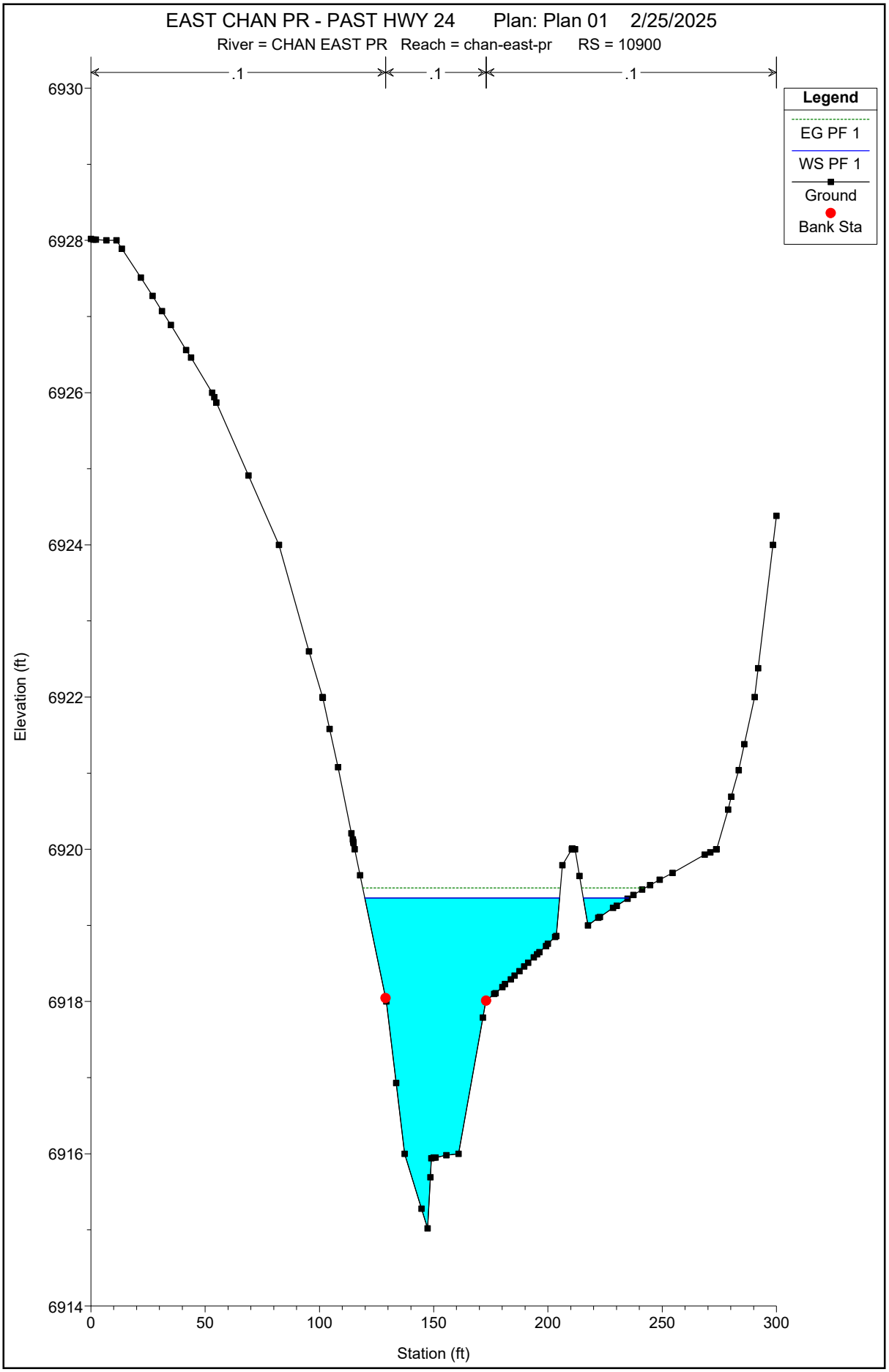

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 11400
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6932
6930
6928
6926
6924
6922
Elevation (ft)
50
100
150
200
250
300
Station (ft)

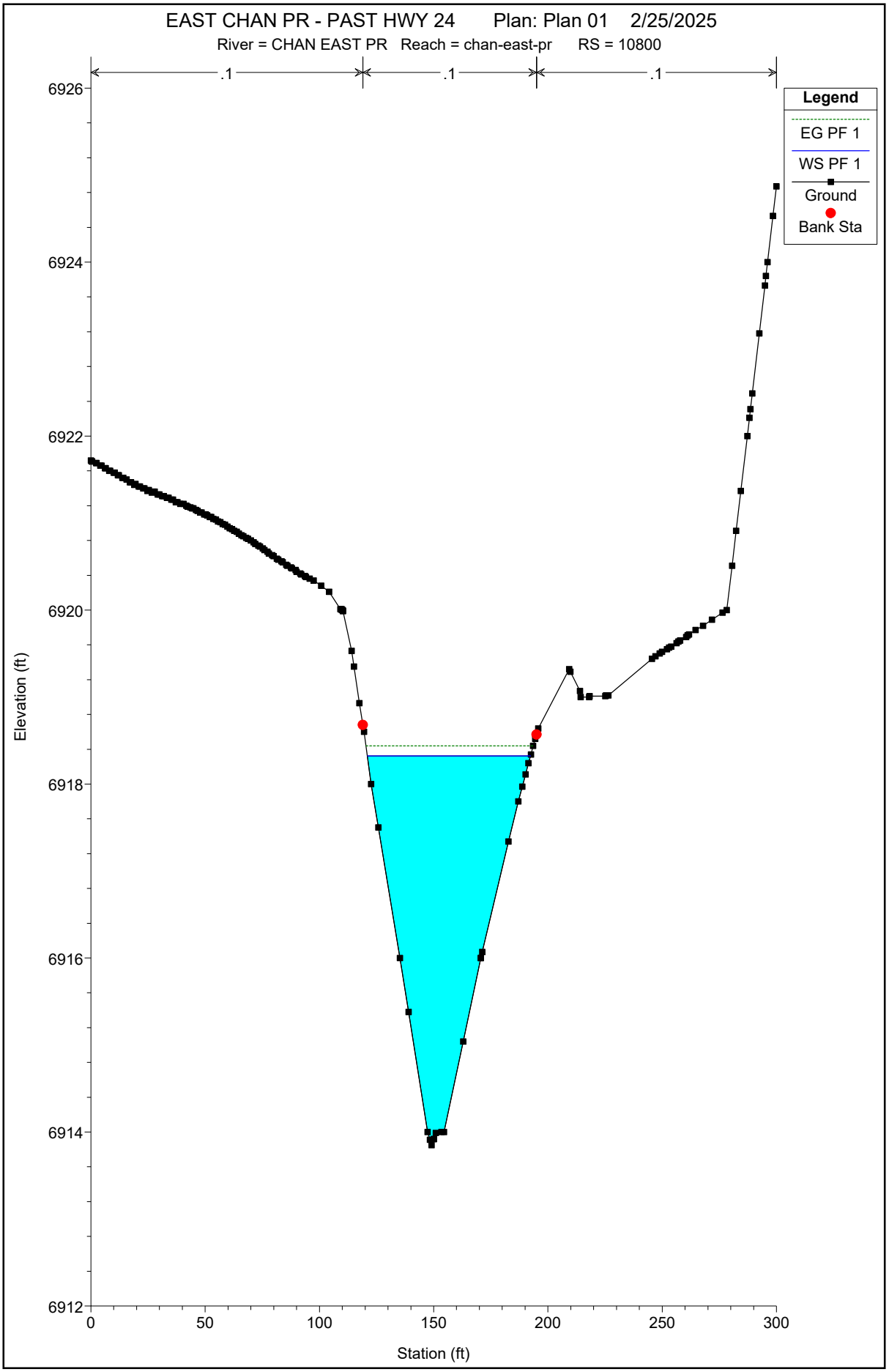

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 11300
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6930
6928
6926
6924
6922
6920
Elevation (ft)
50
100
150
200
250
300
Station (ft)

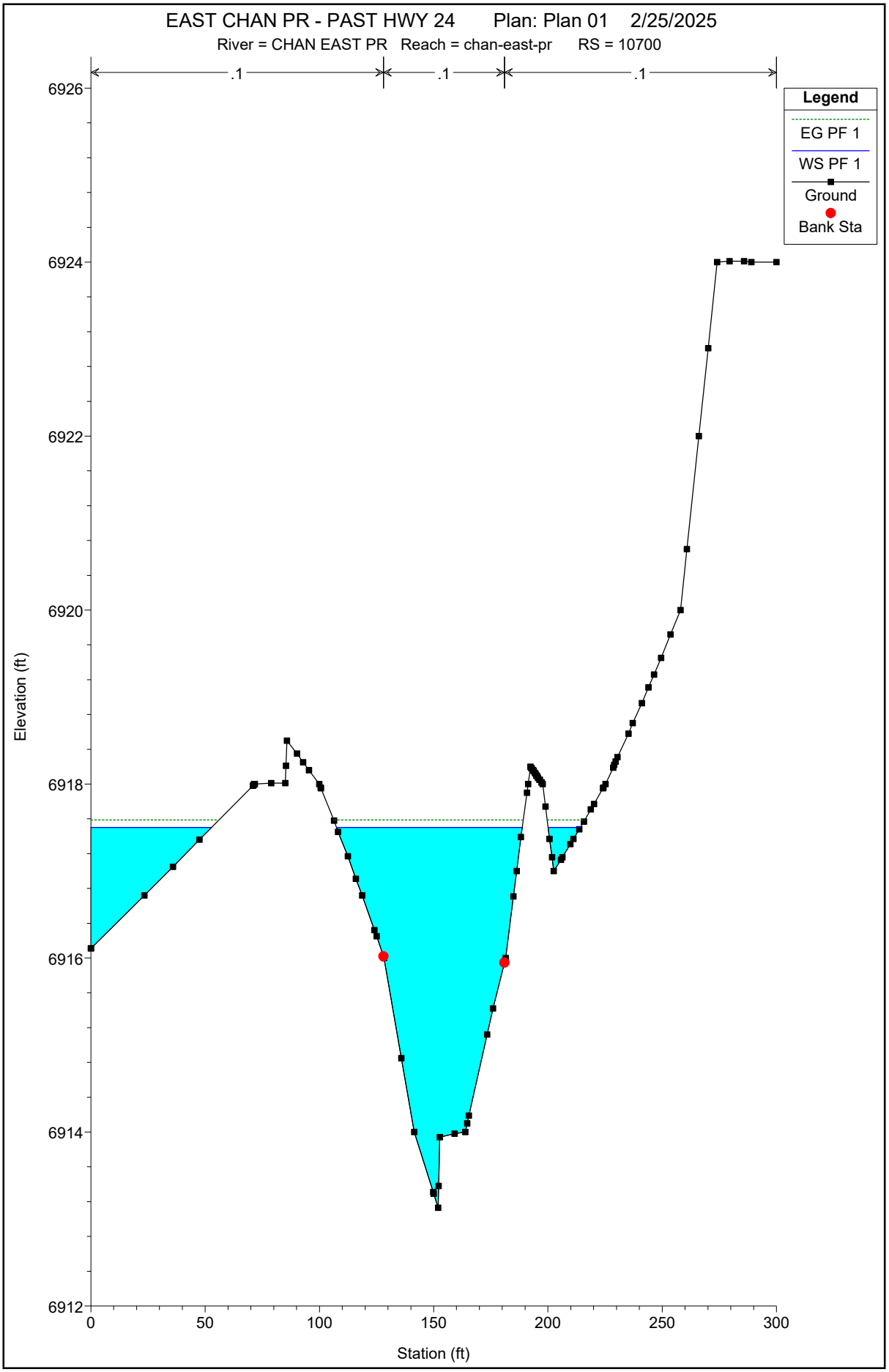

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 11200
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6930
6928
6926
6924
6922
6920
6918
Elevation (ft)
50
100
150
200
250
300
Station (ft)

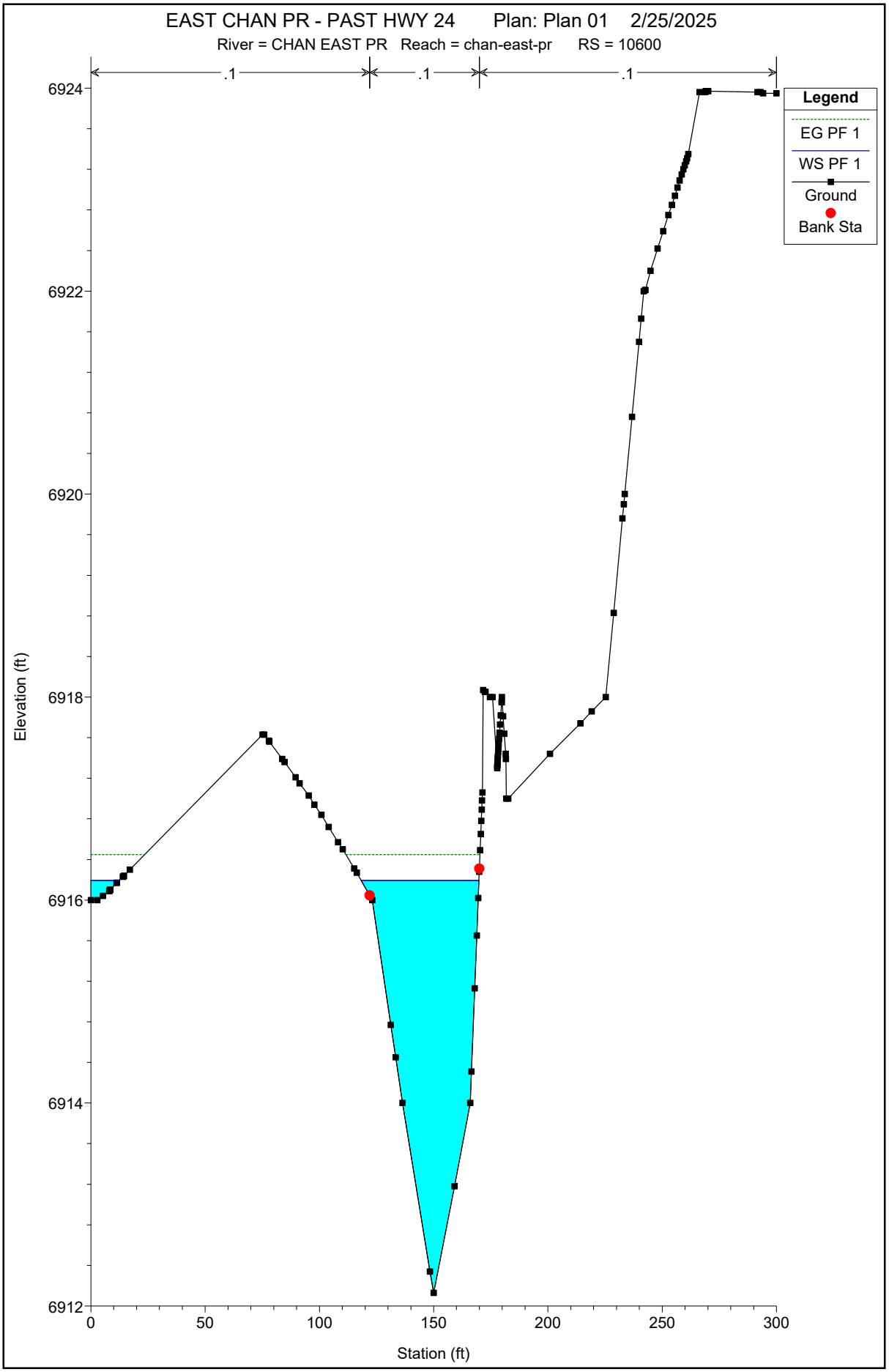

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 11111.15 Culv
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6930
6928
6926
6924
6922
6920
6918
Elevation (ft)
50
100
150
200
250
300
Station (ft)

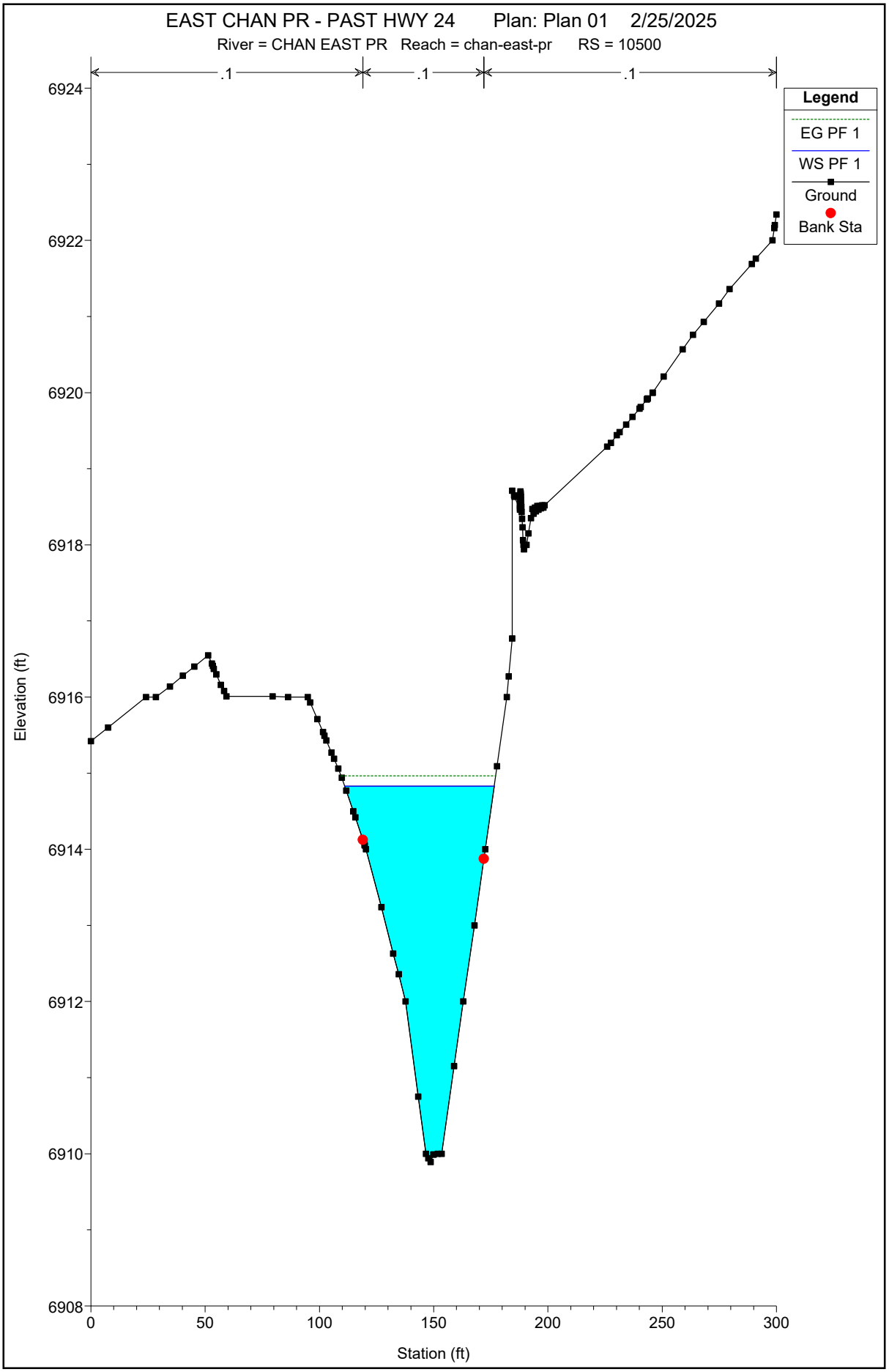

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 11000
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6928
6926
6924
6922
6920
6918
6916
0
50
100
150
200
250
300
Station (ft)

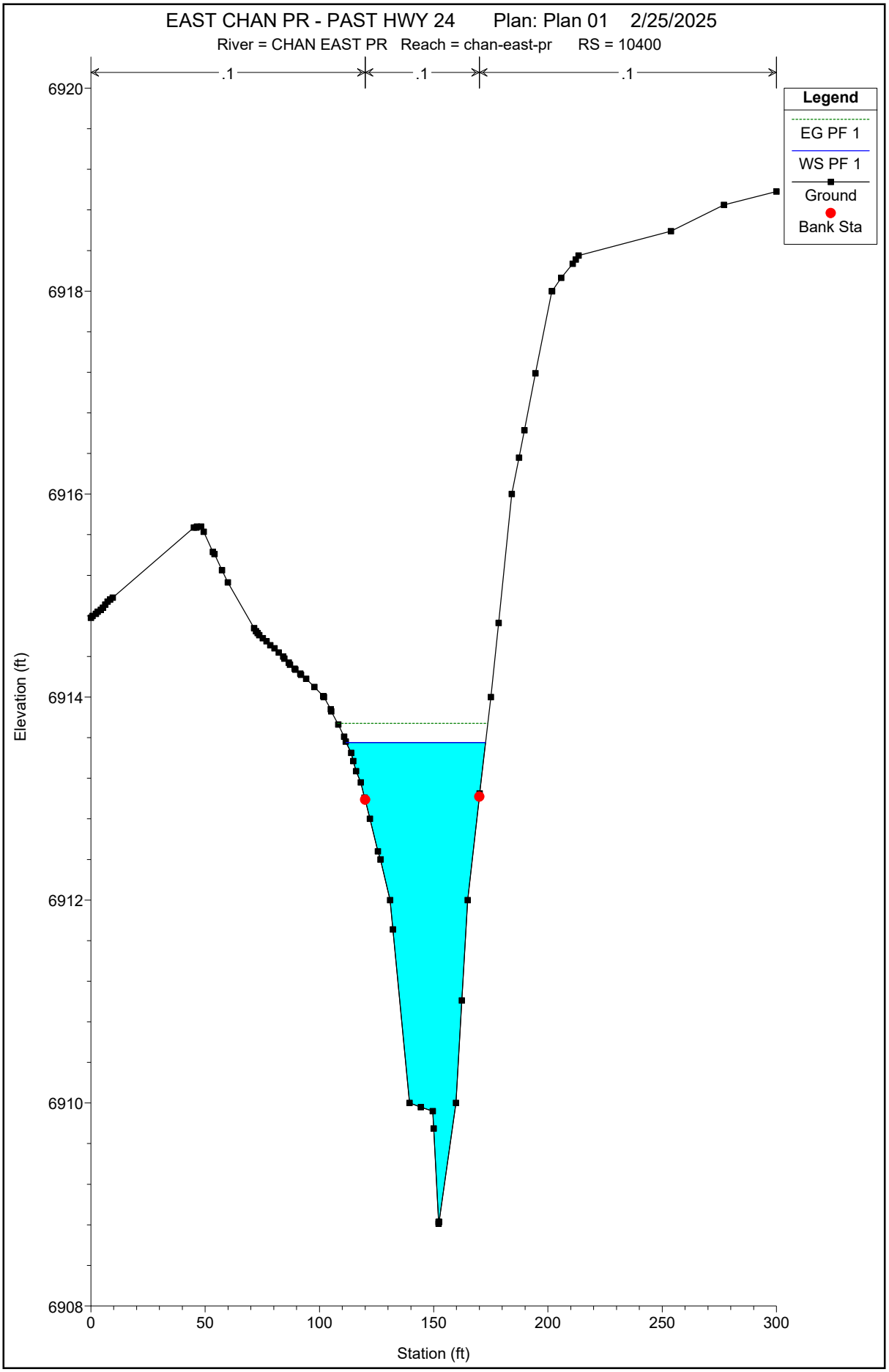

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 10900
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6930
6928
6926
6924
6922
6920
6918
6916
6914
0
50
100
150
200
250
300
Station (ft)

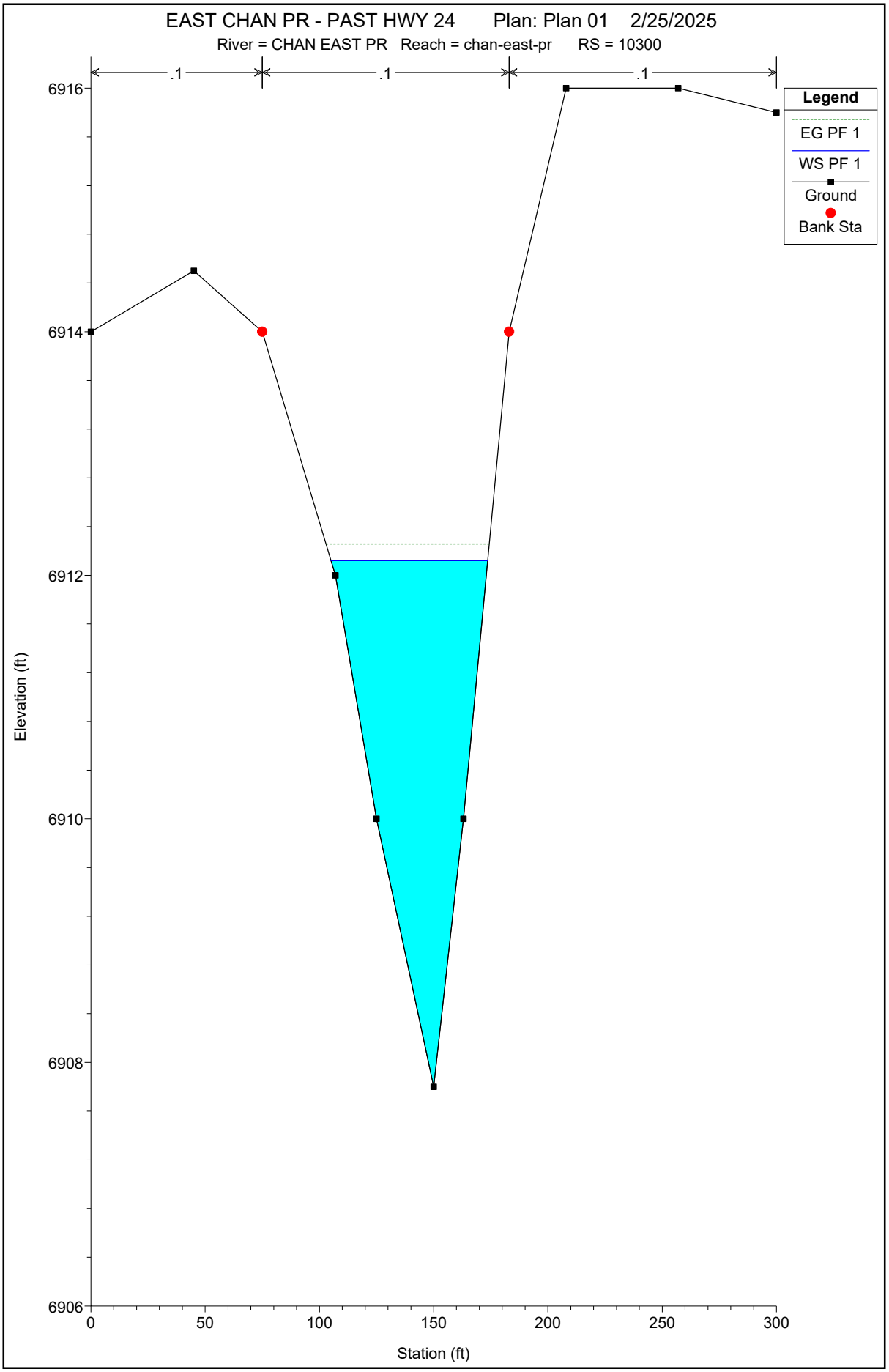

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 10800
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6926
6924
6922
6920
6918
6916
6914
6912
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

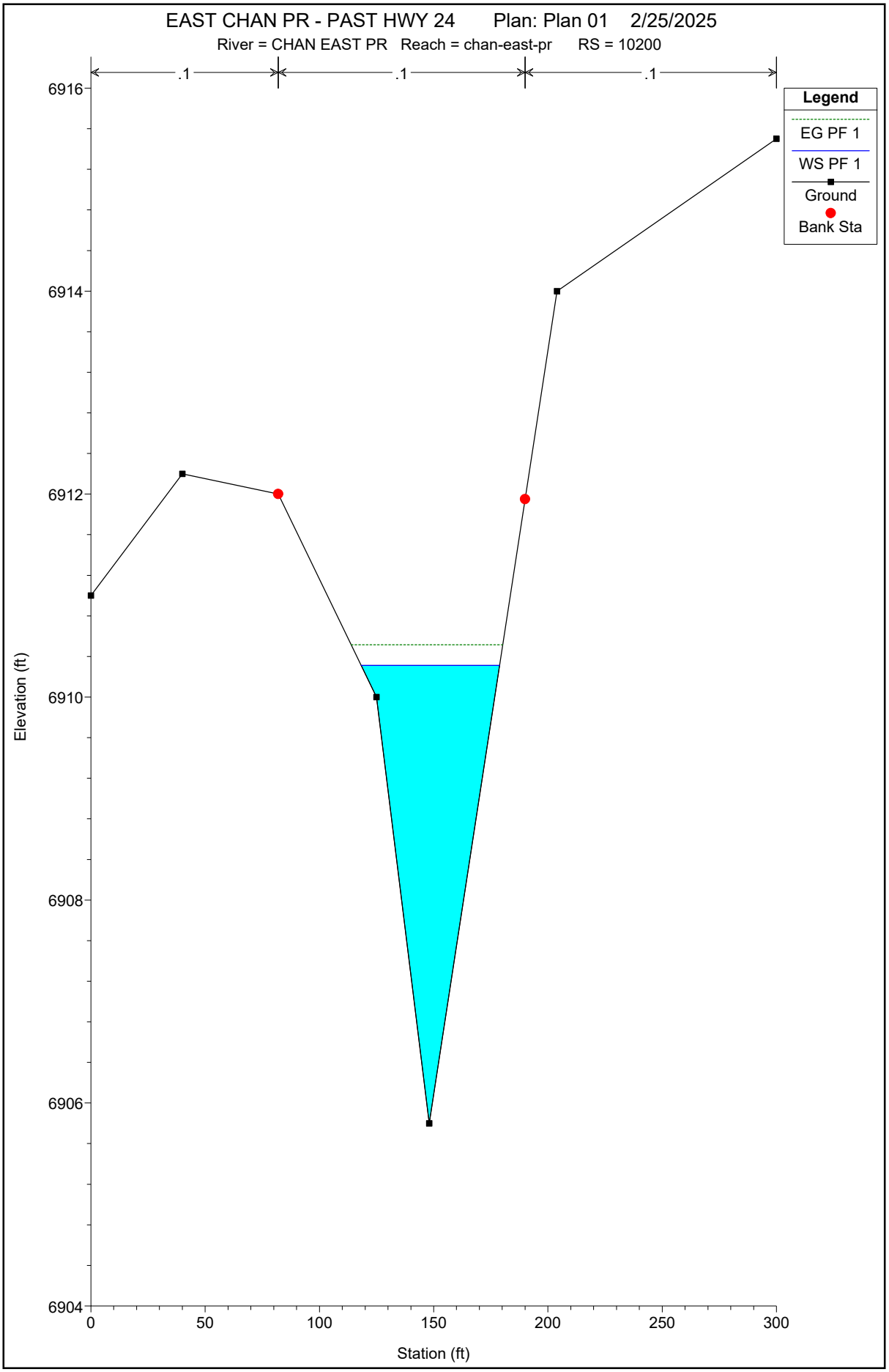

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 10700
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6926
6924
6922
6920
6918
6916
6914
6912
0
50
100
150
200
250
300
Station (ft)

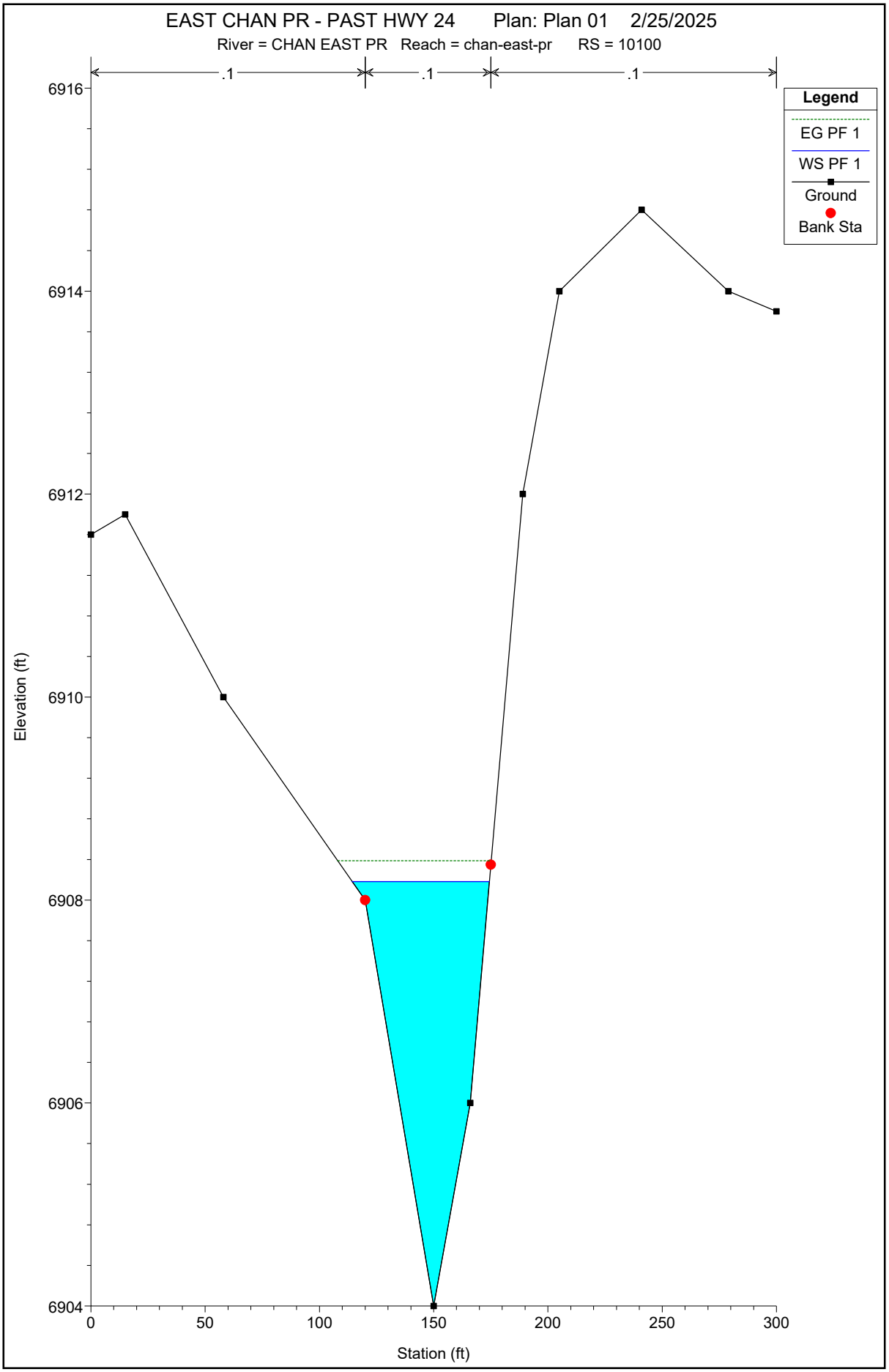

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 10600
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6924
6922
6920
6918
6916
6914
6912
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

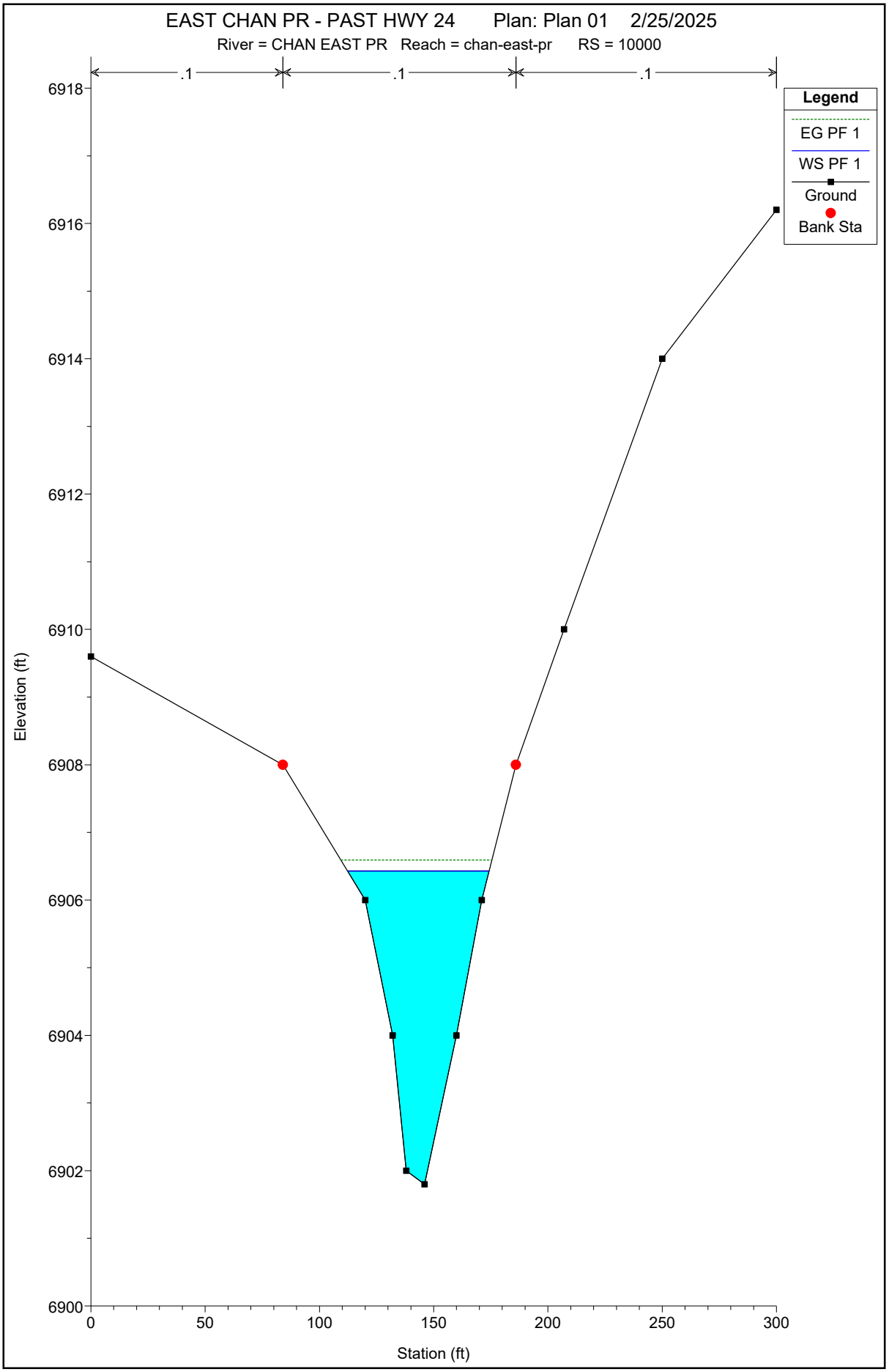

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 10500
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6924
6922
6920
6918
6916
6914
6912
6910
6908
0
50
100
150
200
250
300
Station (ft)

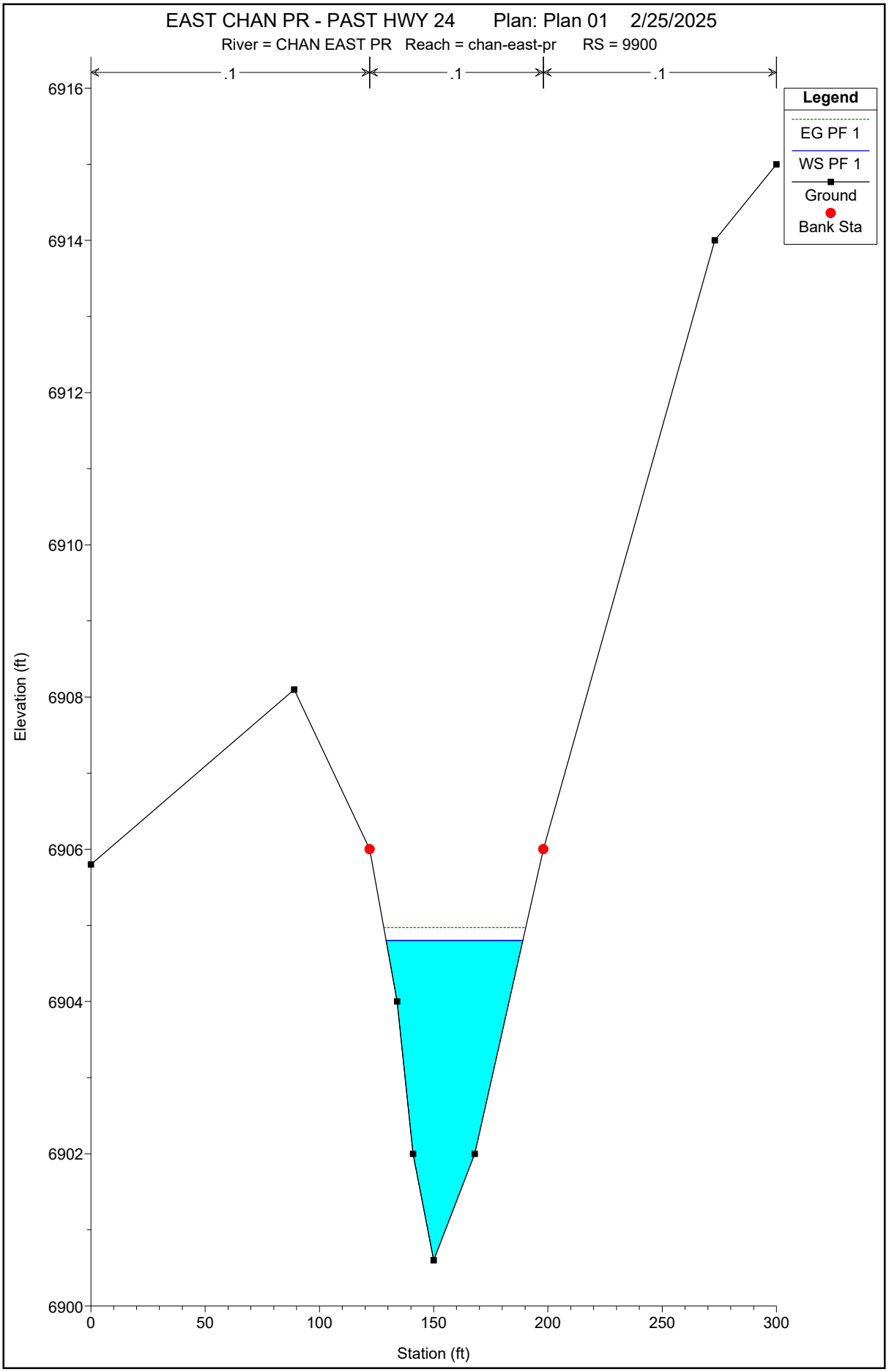

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 10400
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6920
6918
6916
6914
6912
6910
6908
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

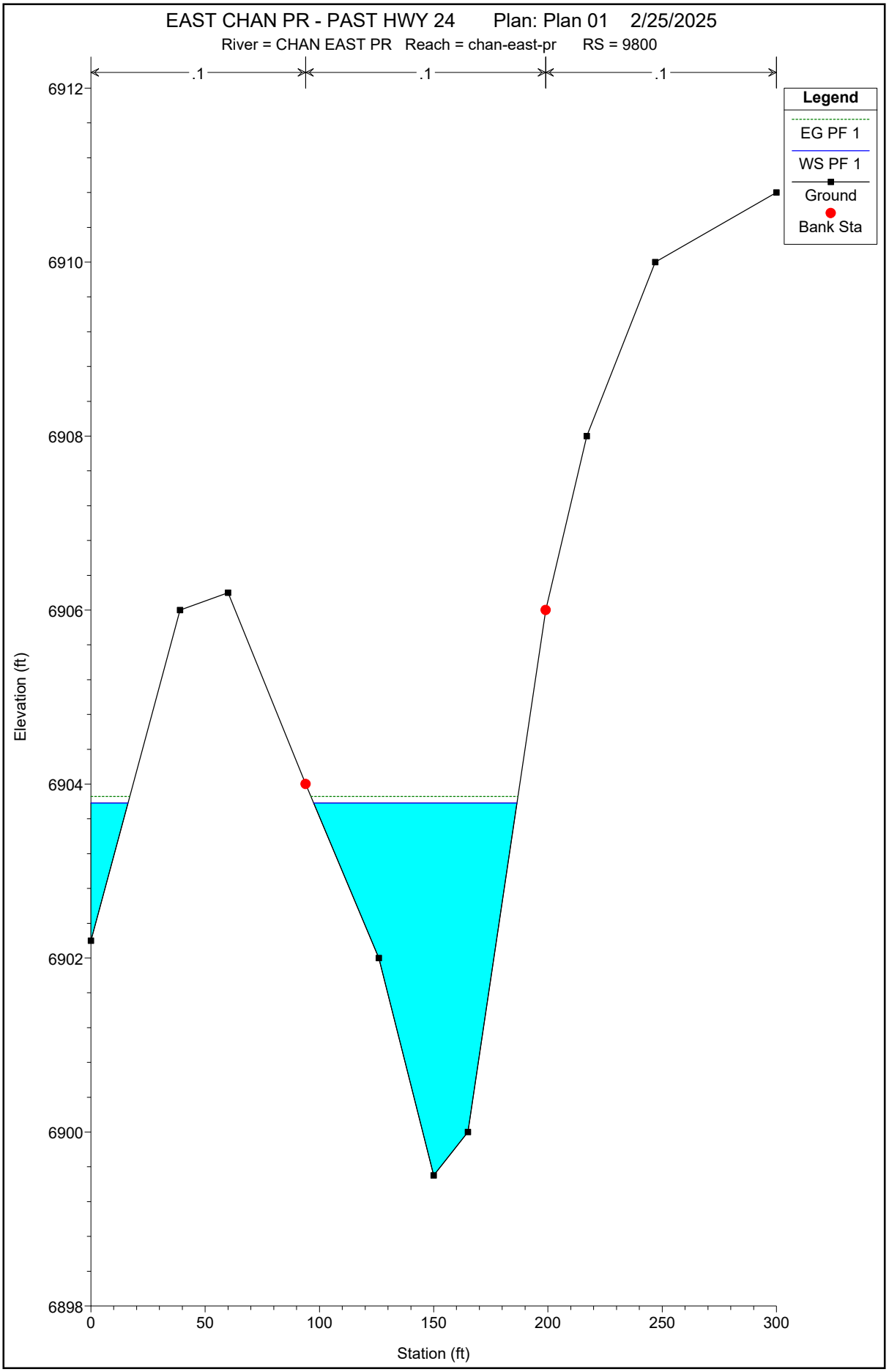

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 10300
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6916
6914
6912
6910
6908
6906
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

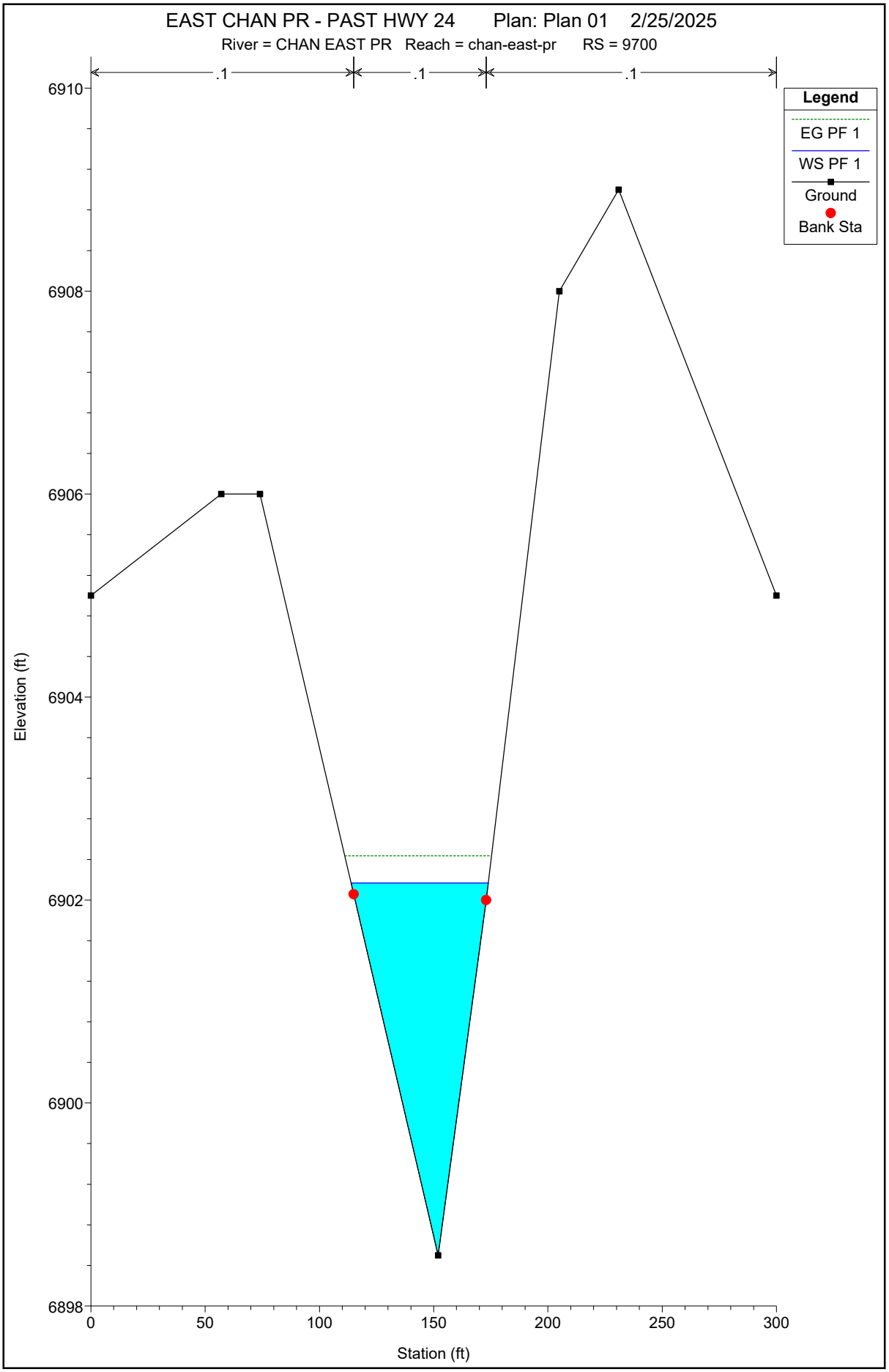

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 10200
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6916
6914
6912
6910
6908
6906
6904
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

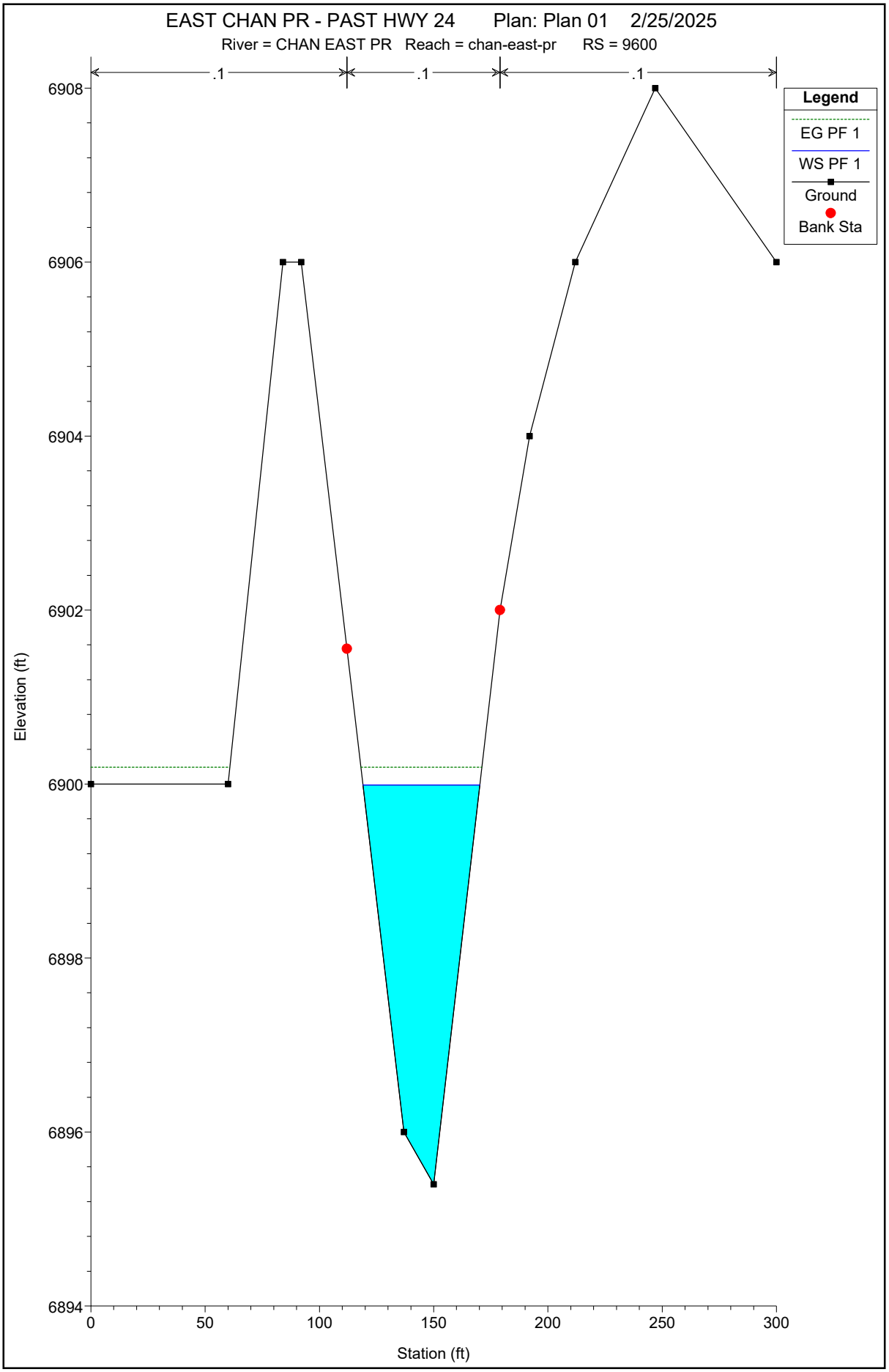

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 10100
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6916
6914
6912
6910
6908
6906
6904
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

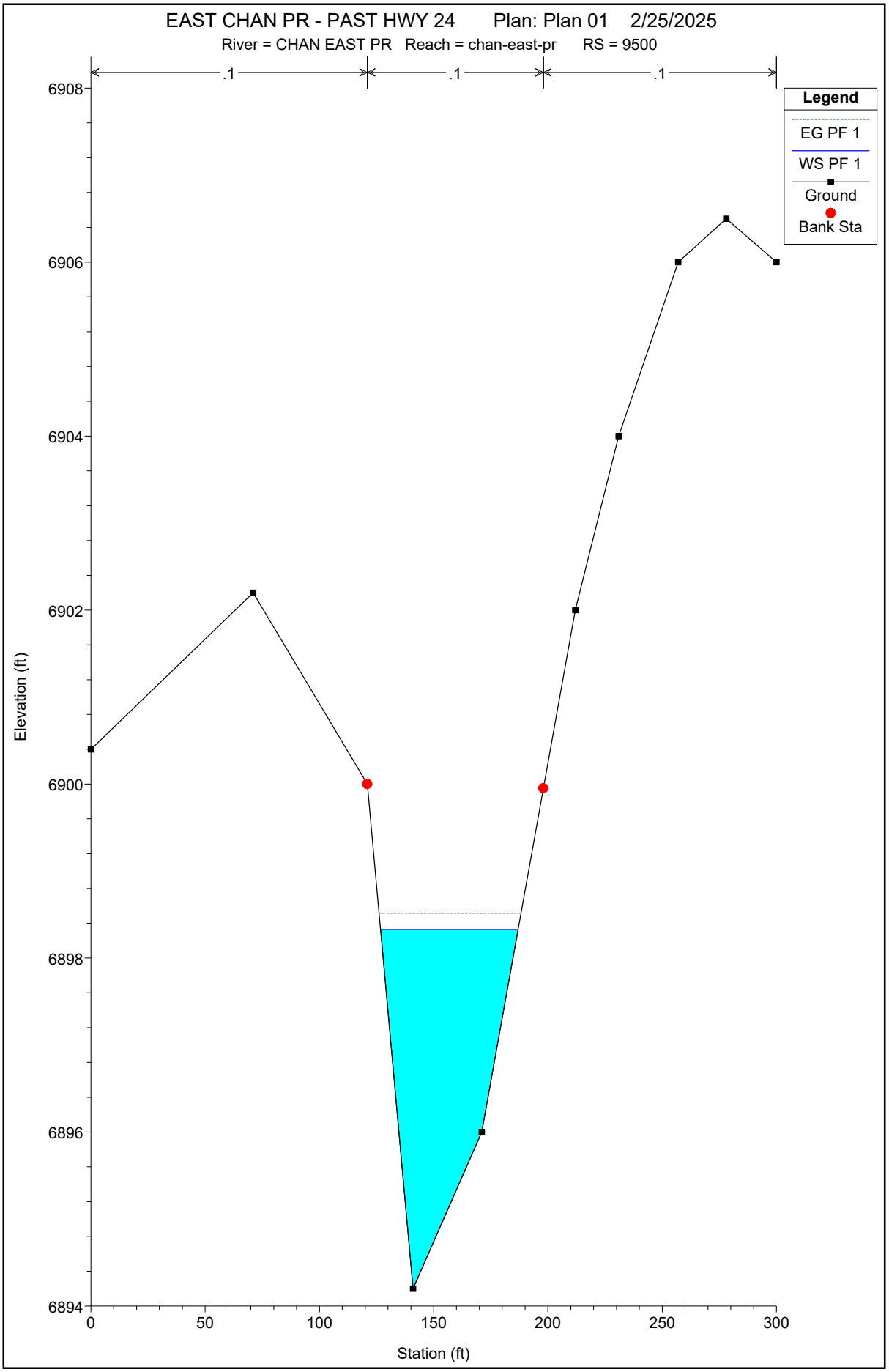

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 10000
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6918
6916
6914
6912
6910
6908
6906
6904
6902
6900
0
50
100
150
200
250
300
Station (ft)

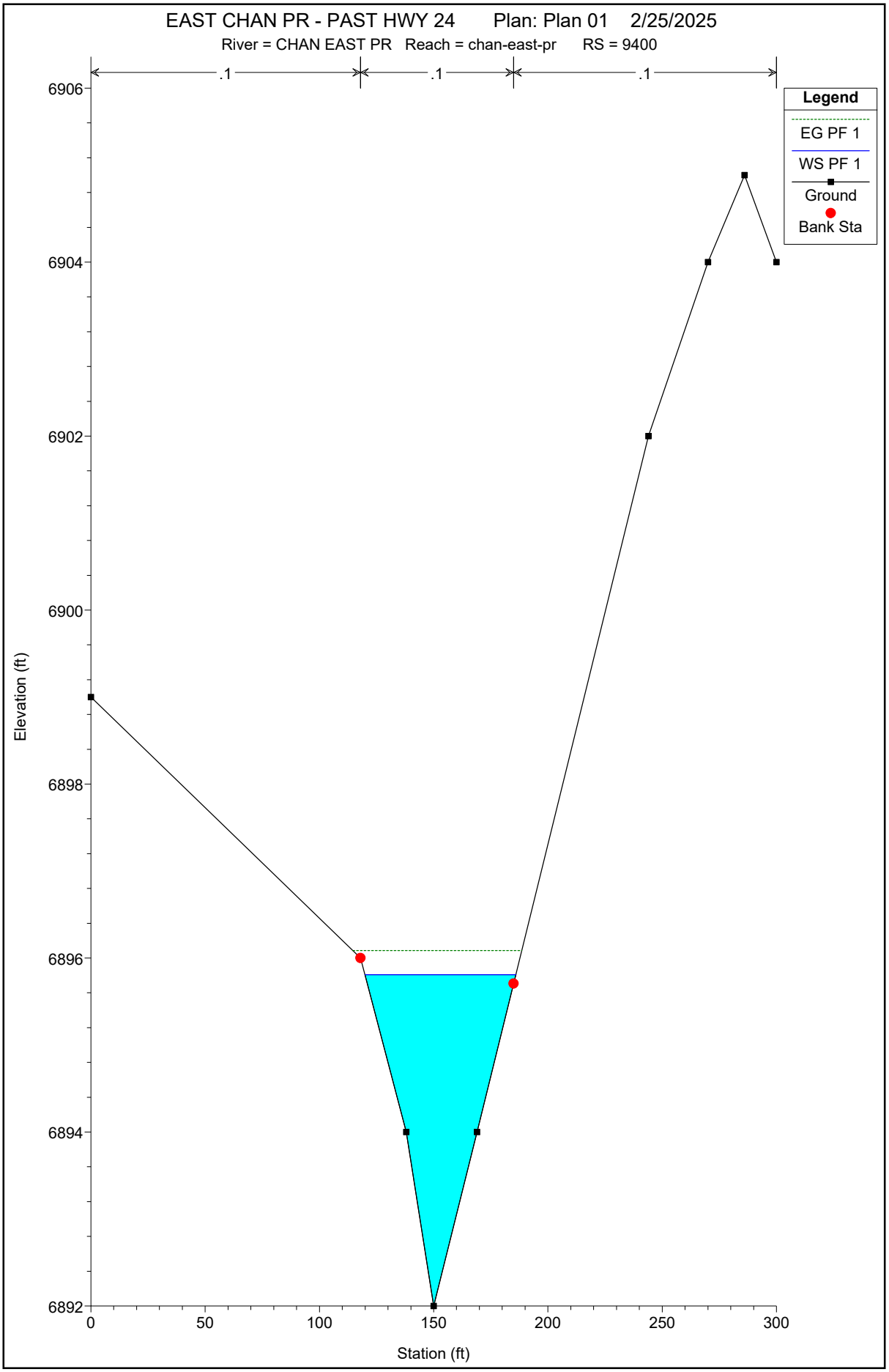

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 9900
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6916
6914
6912
6910
6908
6906
6904
6902
6900
0
50
100
150
200
250
300
Station (ft)

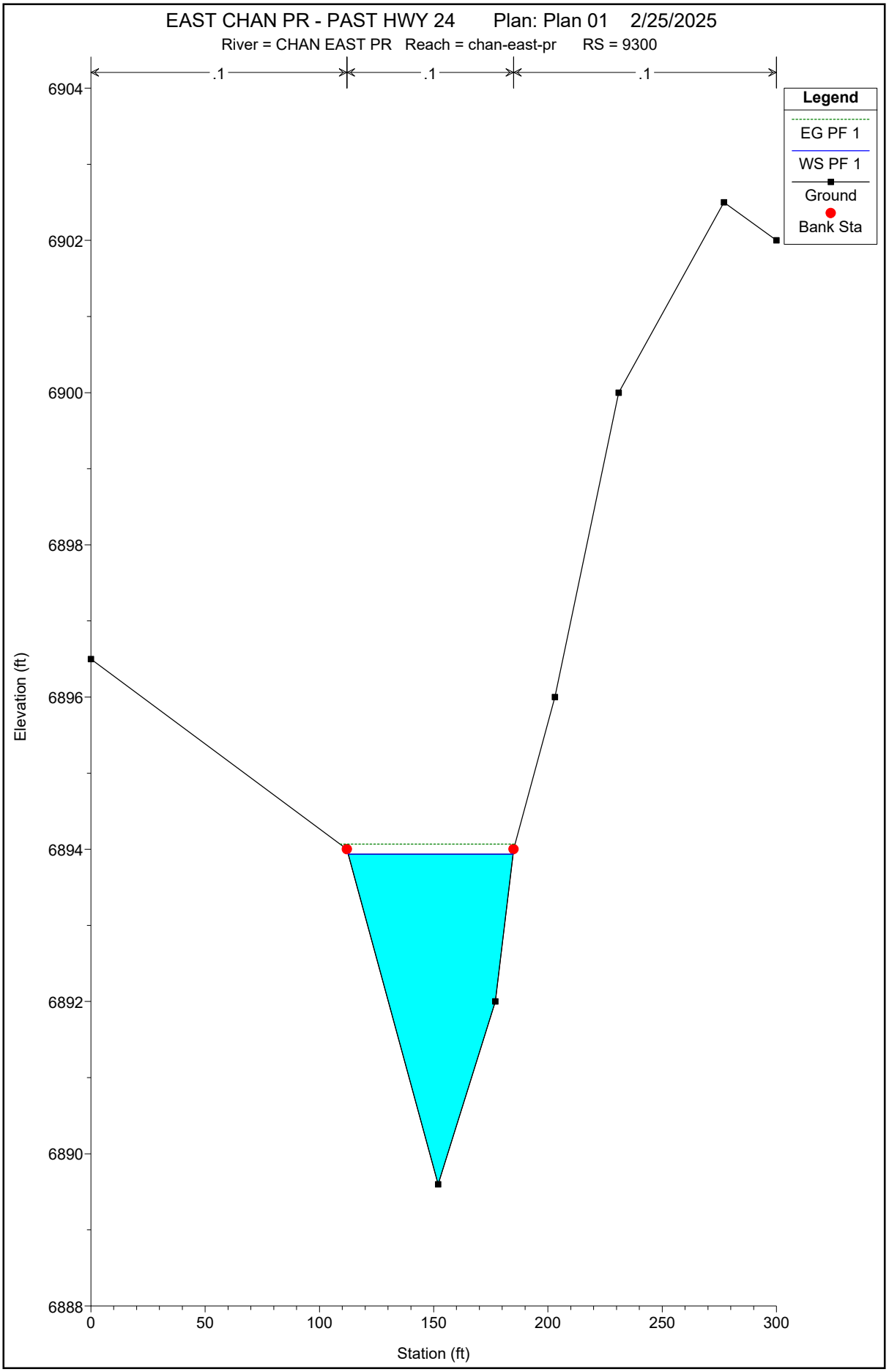

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 9800
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6912
6910
6908
6906
6904
6902
6900
6898
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

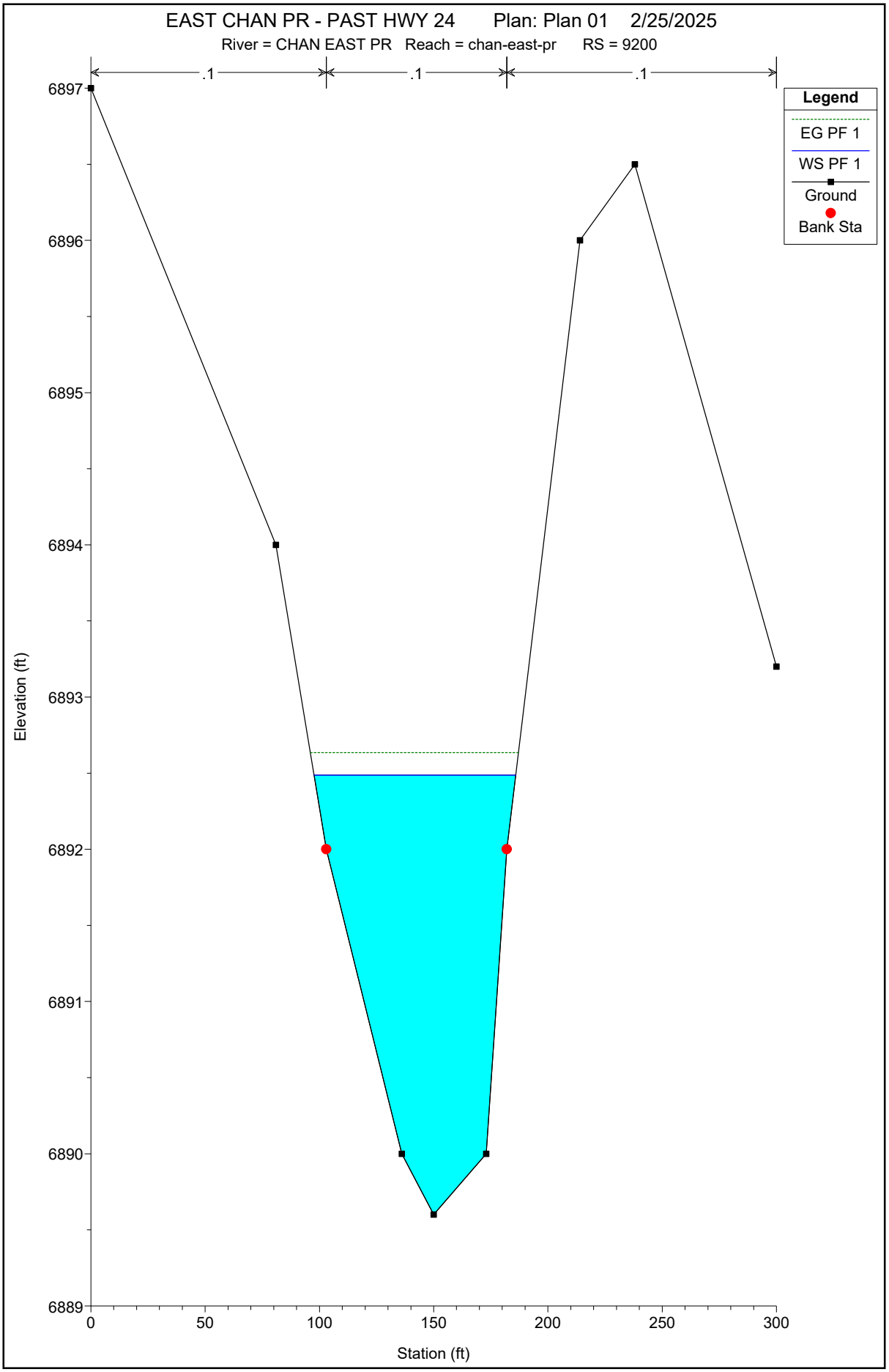

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 9700
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6910
6908
6906
6904
6902
6900
6898
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

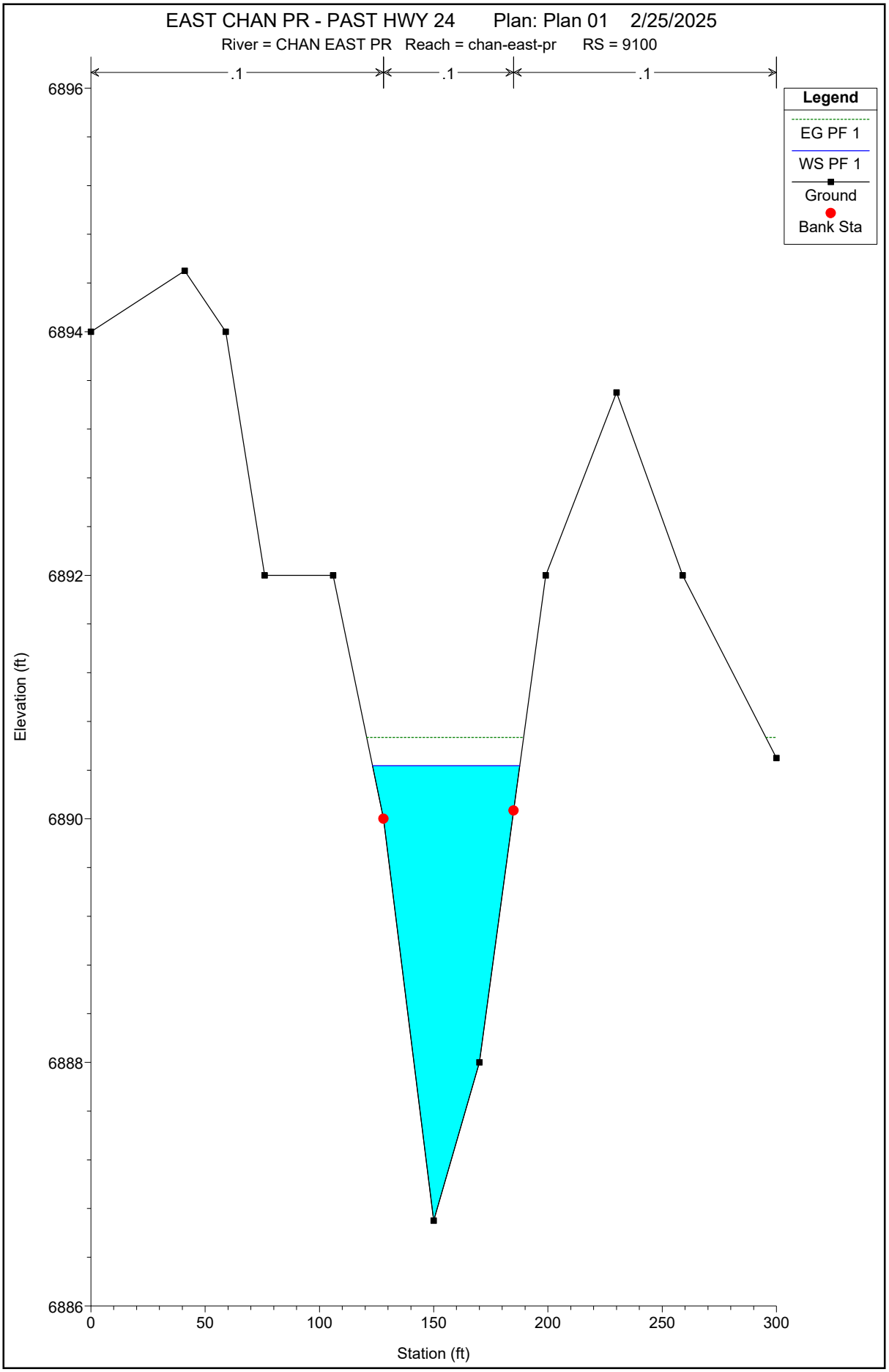

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 9600
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6908
6906
6904
6902
6900
6898
6896
6894
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

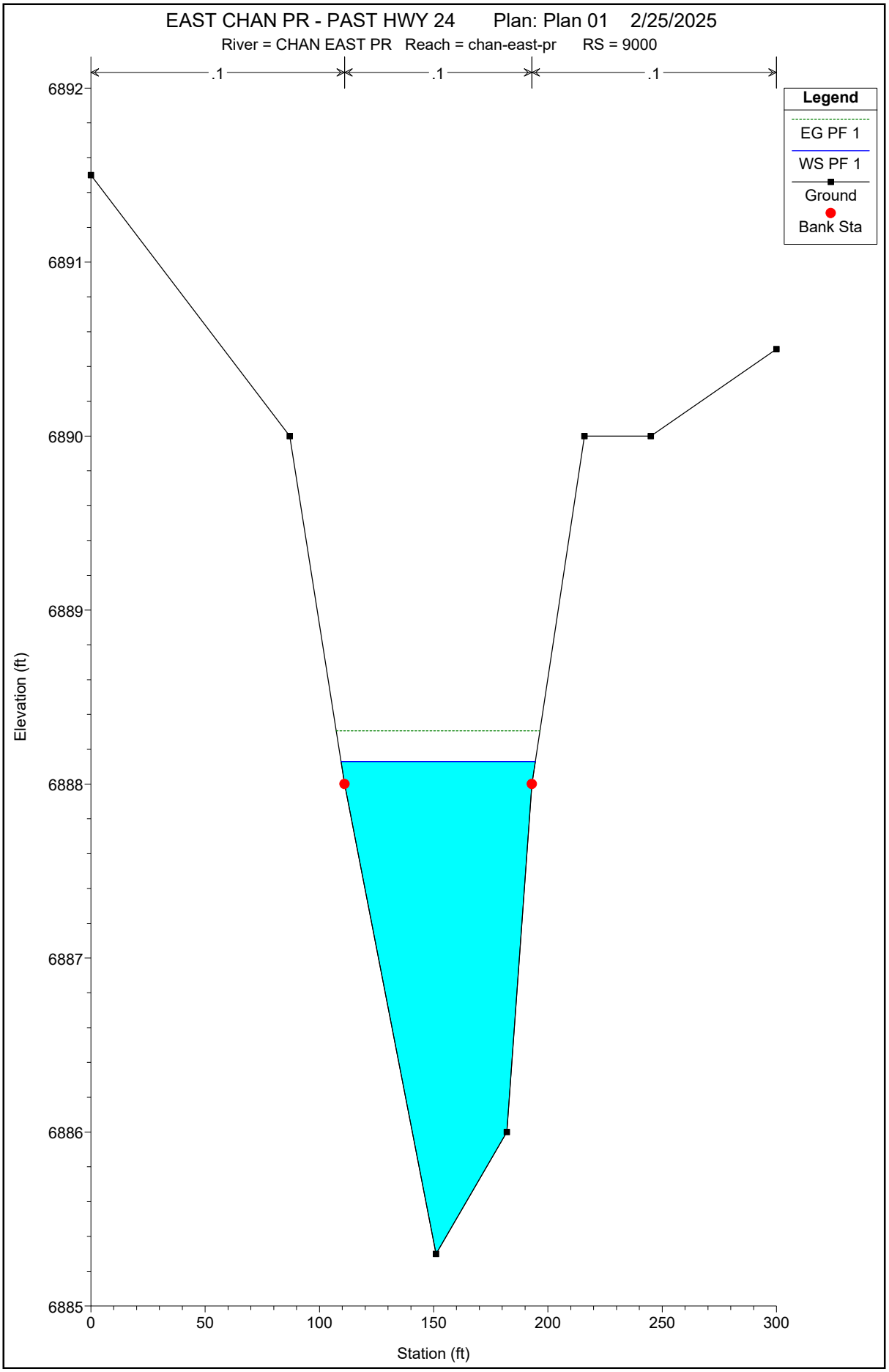

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 9500
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6908
6906
6904
6902
6900
6898
6896
6894
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

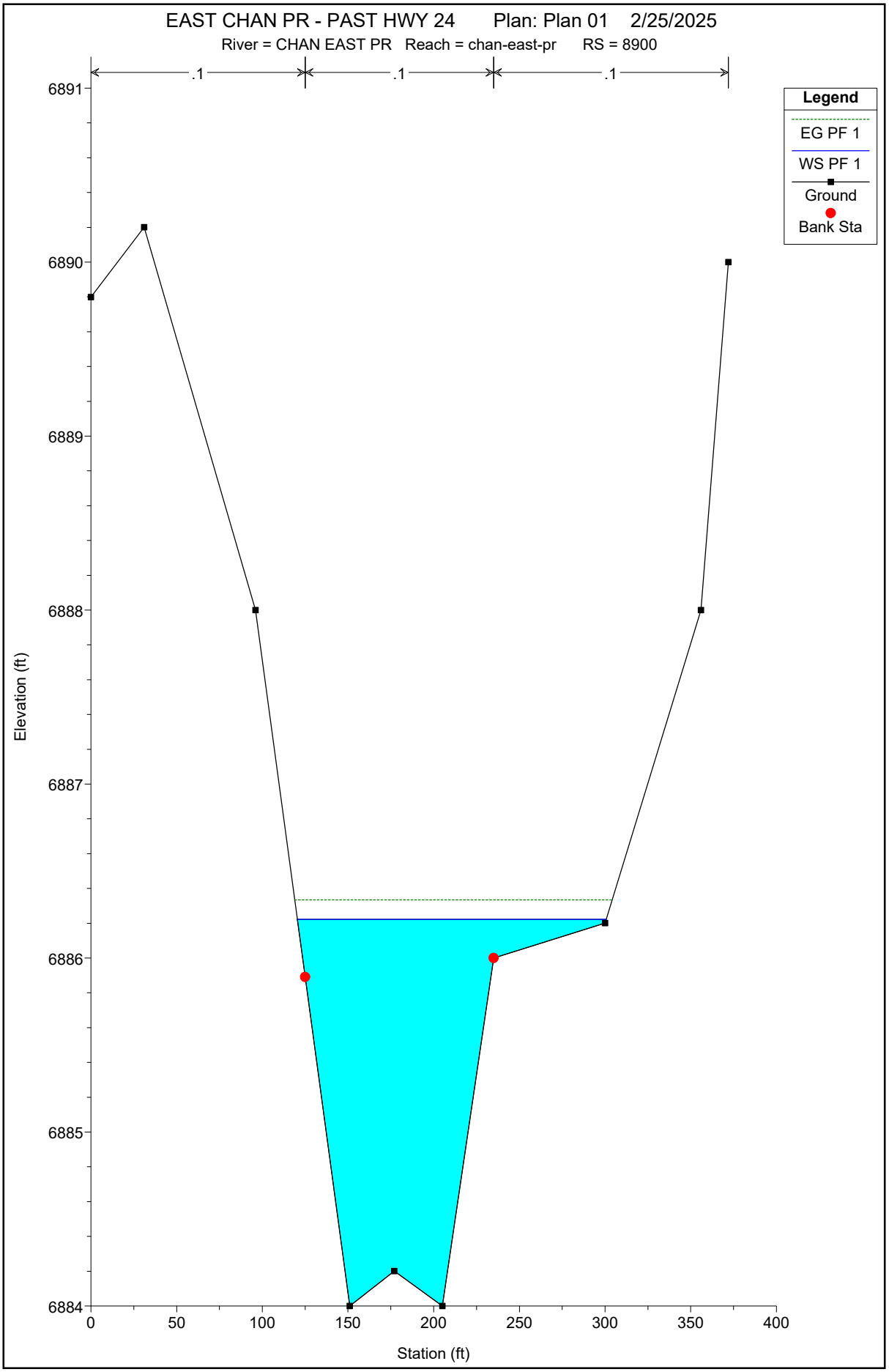

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 9400
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6906
6904
6902
6900
6898
6896
6894
6892
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

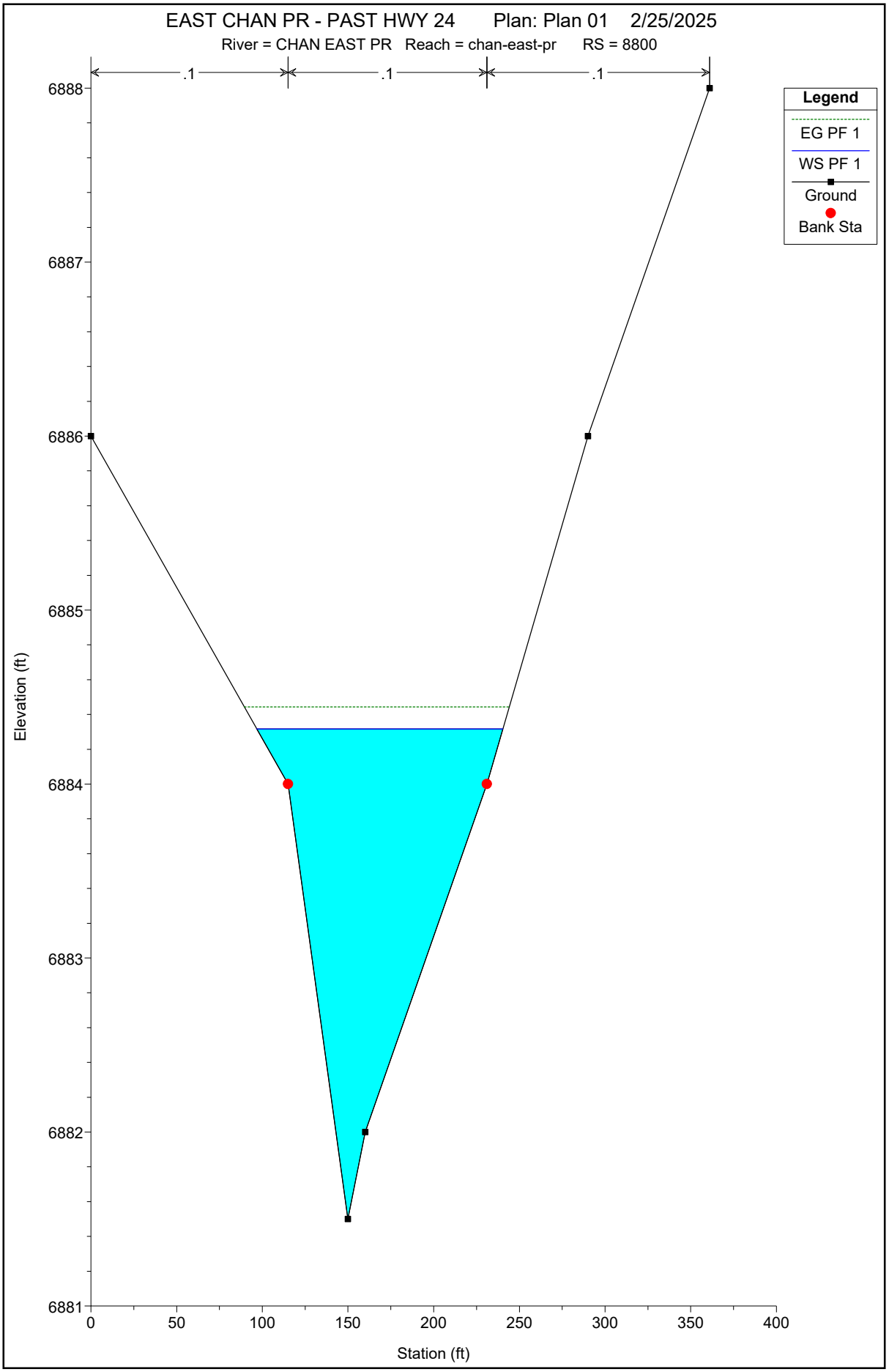

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 9300
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6904
6902
6900
6898
6896
6894
6892
6890
6888
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

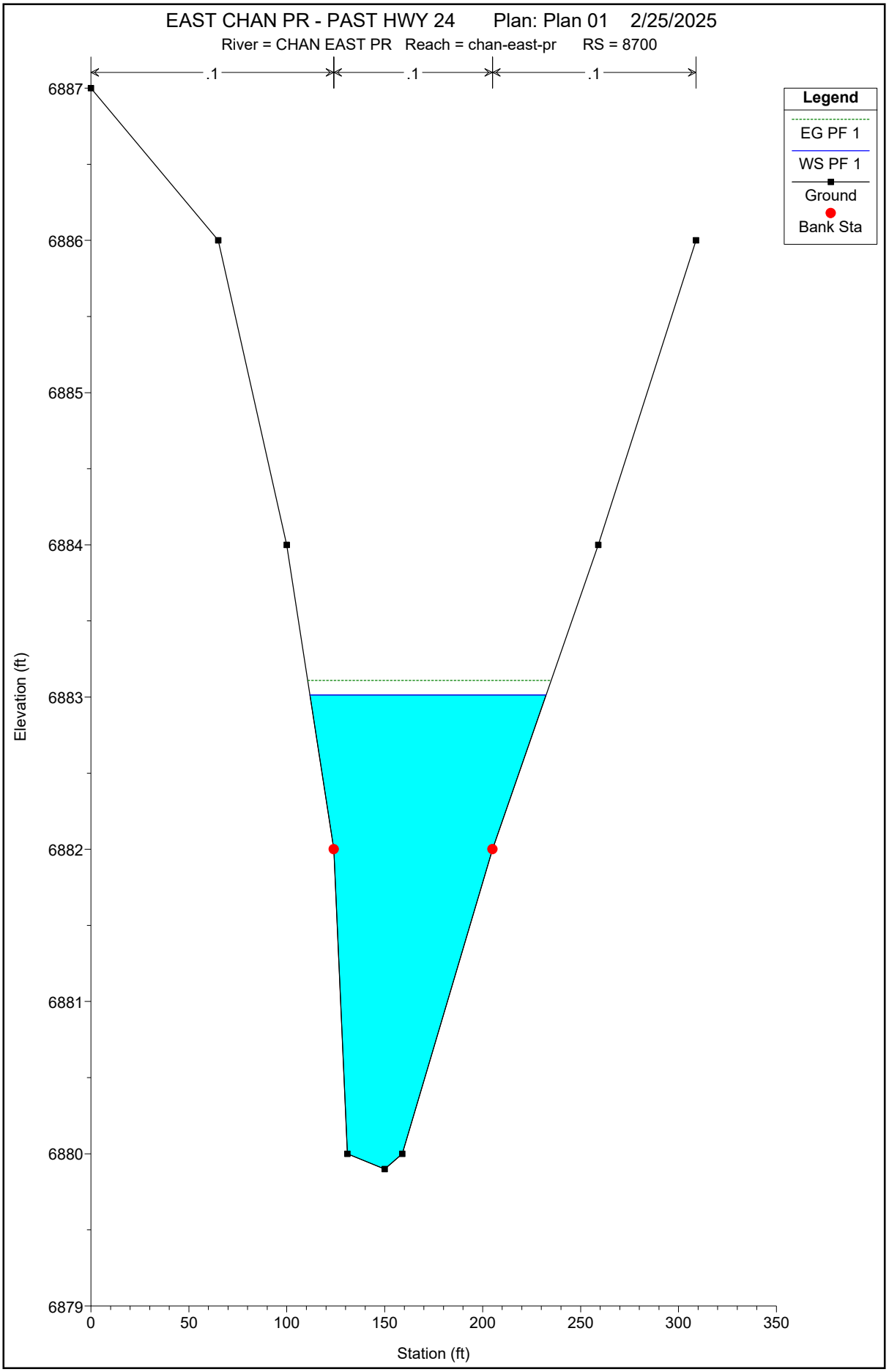

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 9200
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6897
6896
6895
6894
6893
6892
6891
6890
6889
0
50
100
150
200
250
300
Station (ft)

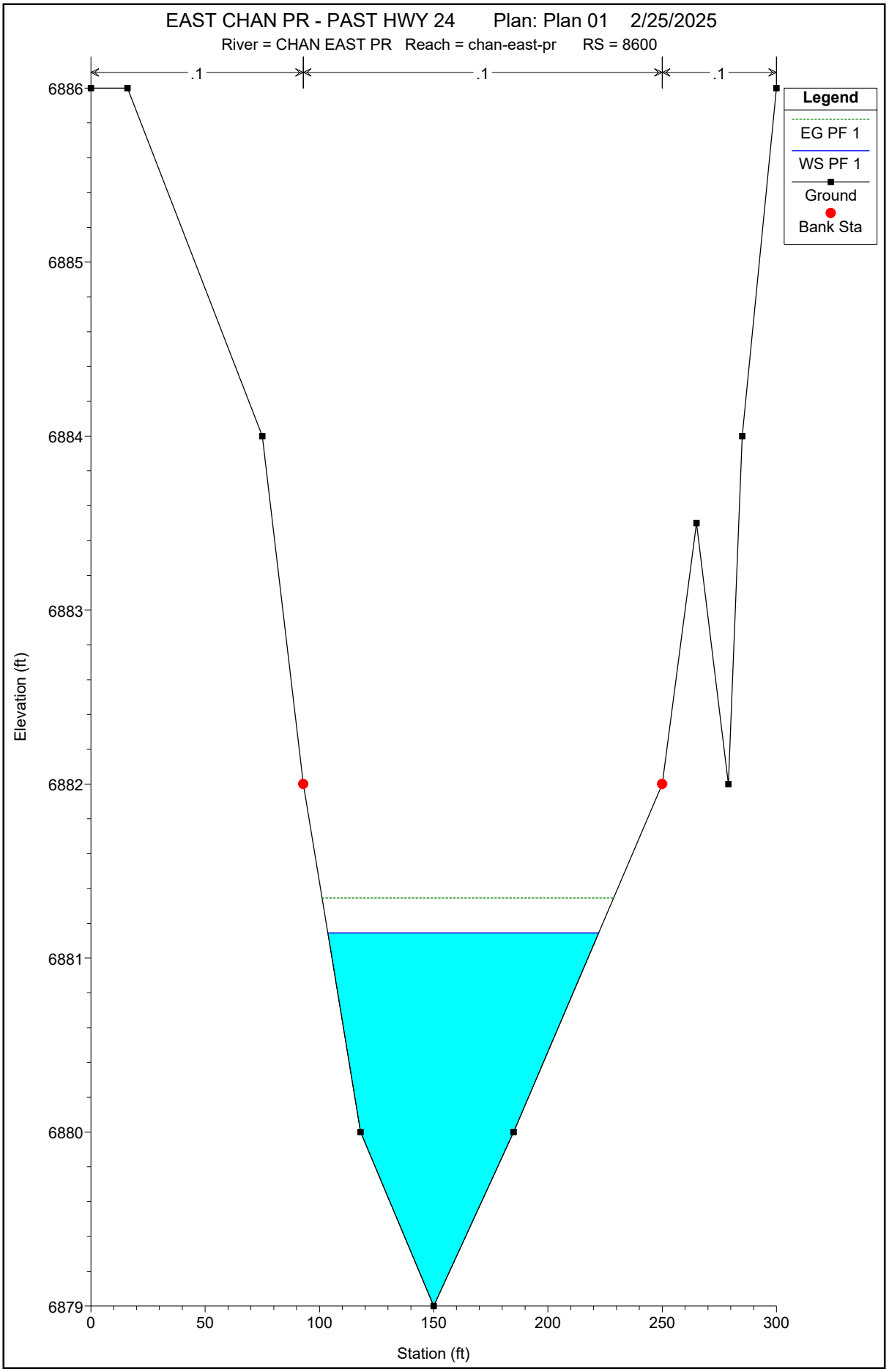

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 9100
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6896
6894
6892
6890
6888
6886
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

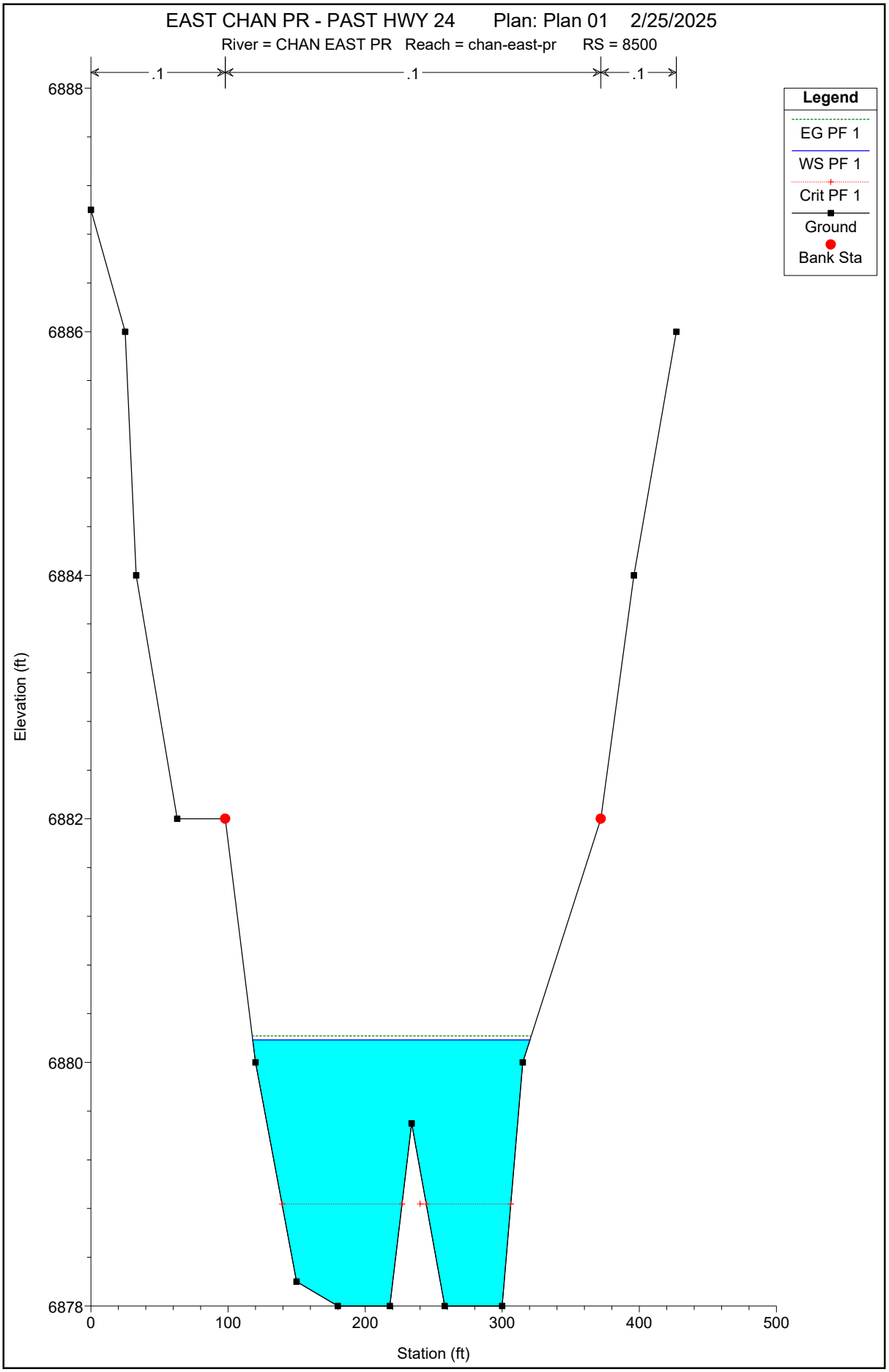

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 9000
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6892
6891
6890
6889
6888
6887
6886
6885
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

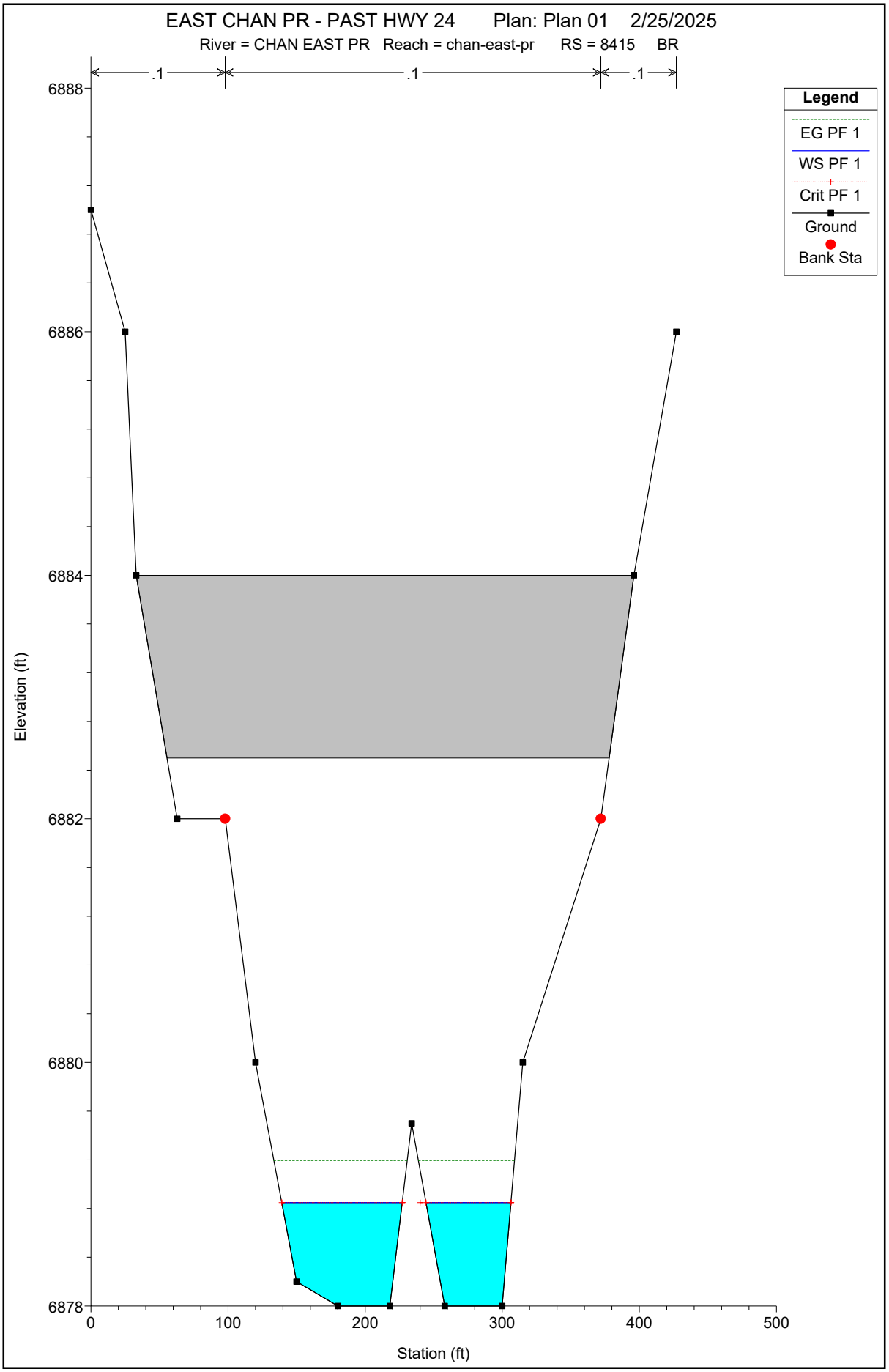

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 8900
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6891
6890
6889
6888
6887
6886
6885
6884
0
50
100
150
200
250
300
350
400
Station (ft)

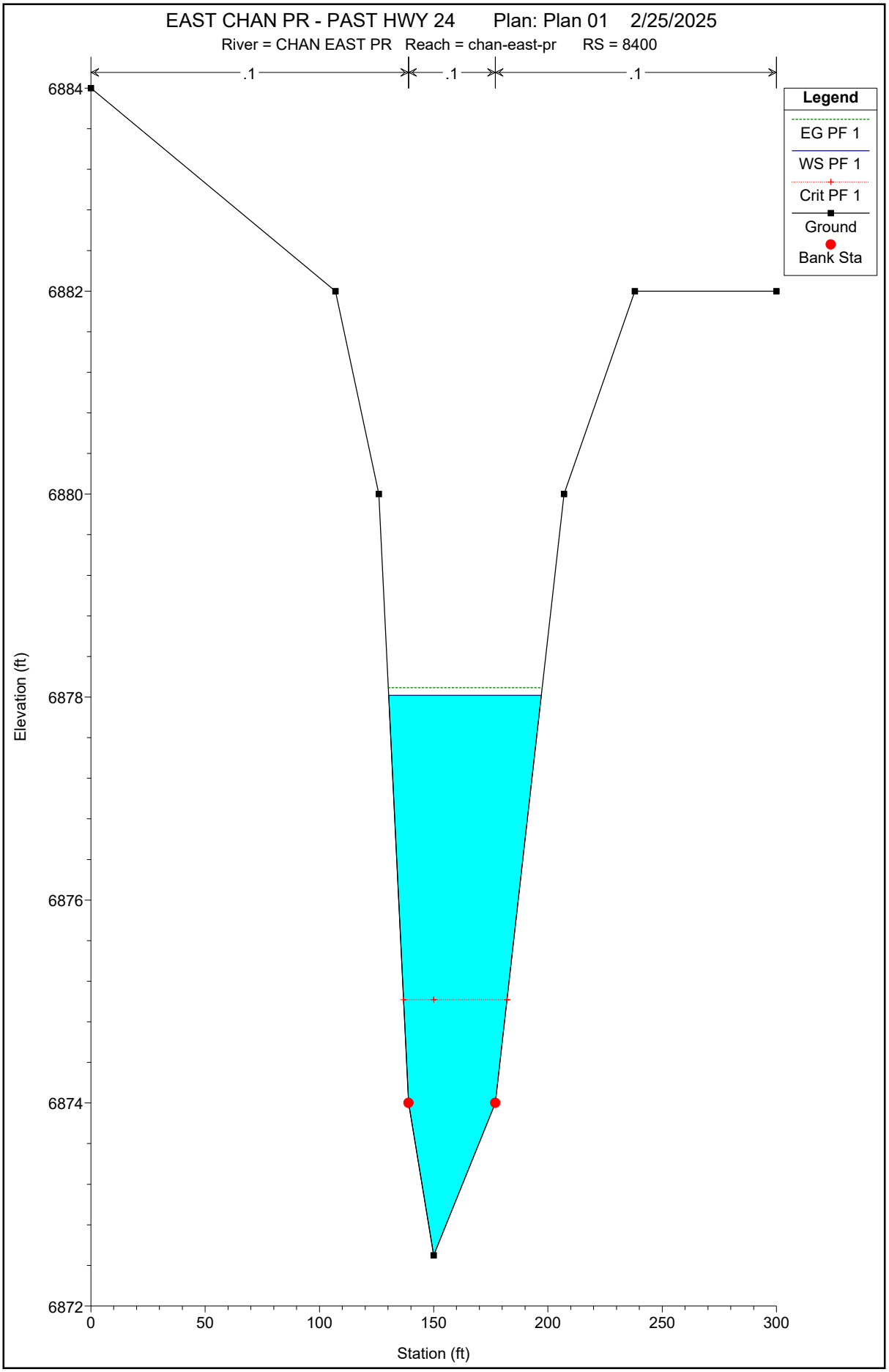

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 8800
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6888
6887
6886
6885
6884
6883
6882
6881
0
50
100
150
200
250
300
350
400
Station (ft)

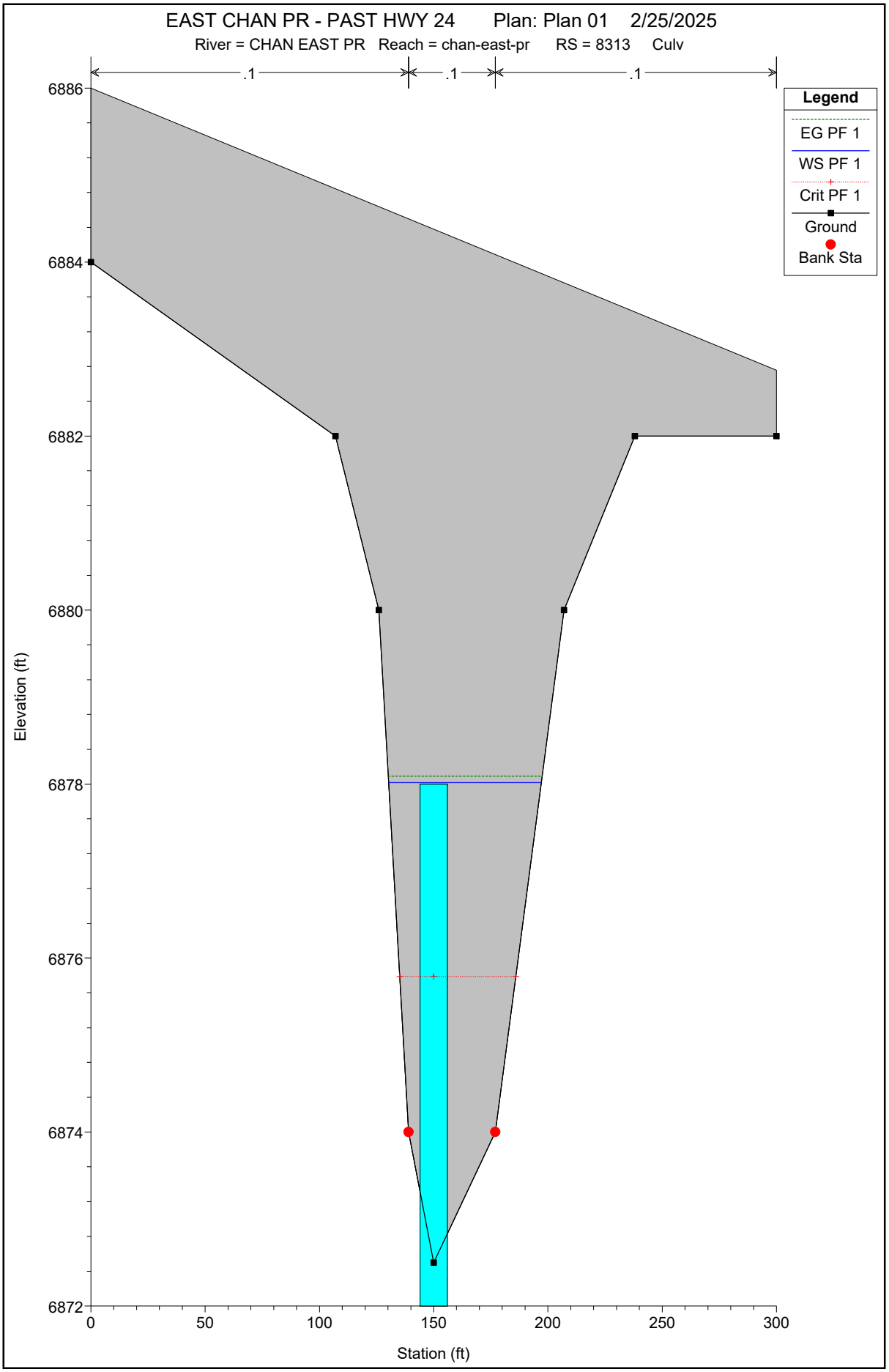

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 8700
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6887
6886
6885
6884
6883
6882
6881
6880
6879
0
50
100
150
200
250
300
350
Station (ft)

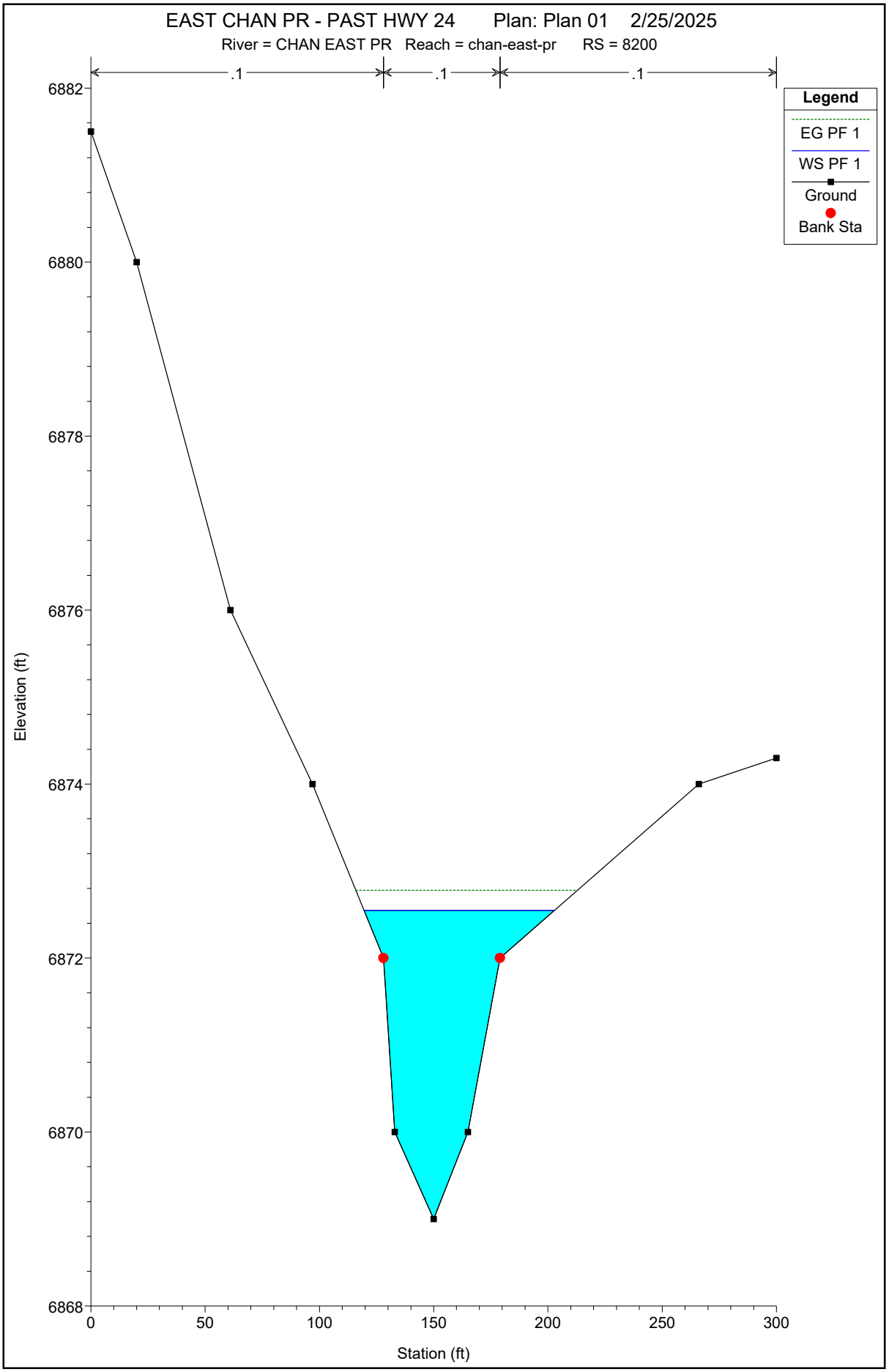

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 8600
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6886
6885
6884
6883
6882
6881
6880
6879
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

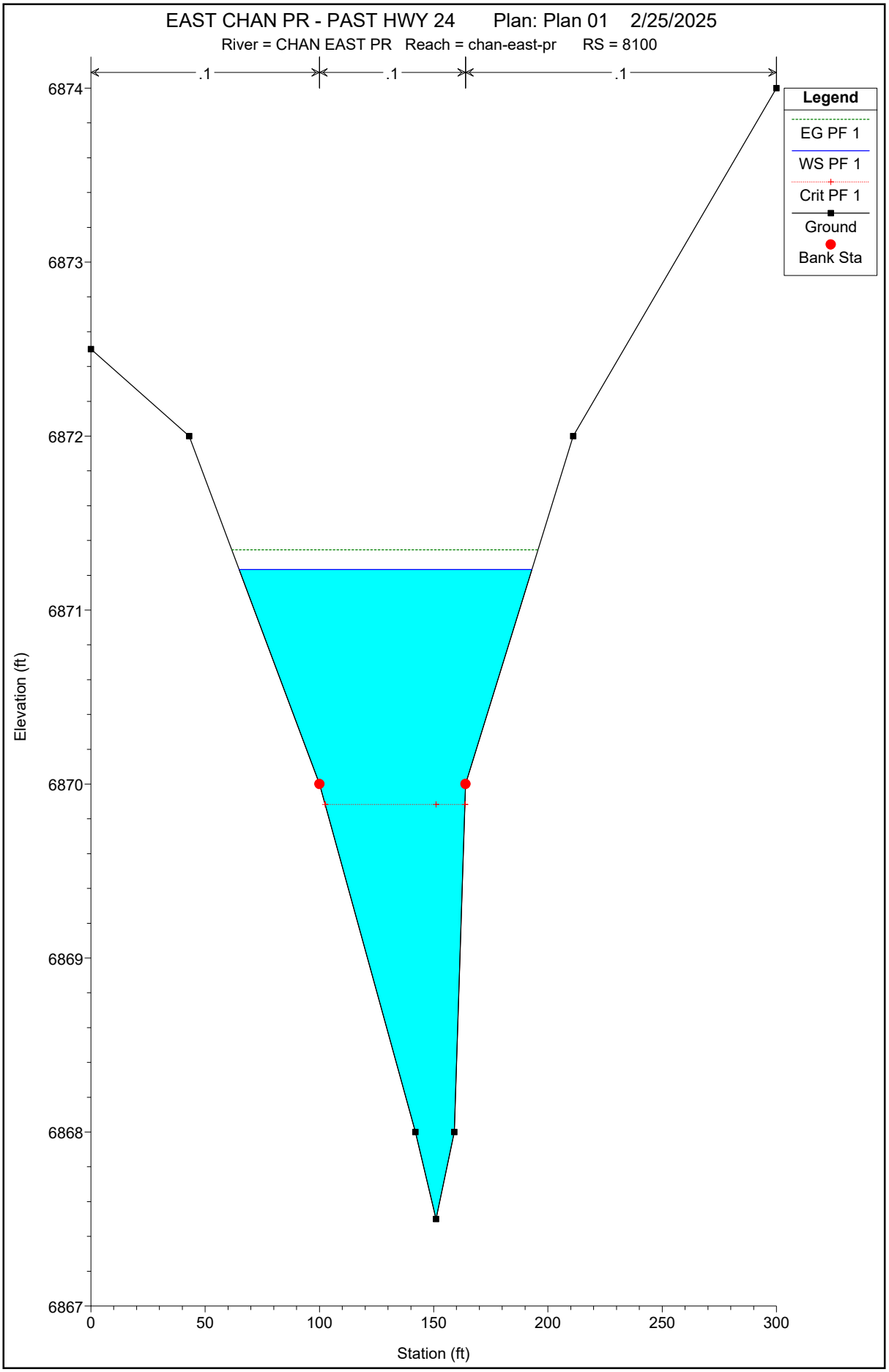

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 8500
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6888
6886
6884
6882
6880
6878
Elevation (ft)
0
100
200
300
400
500
Station (ft)

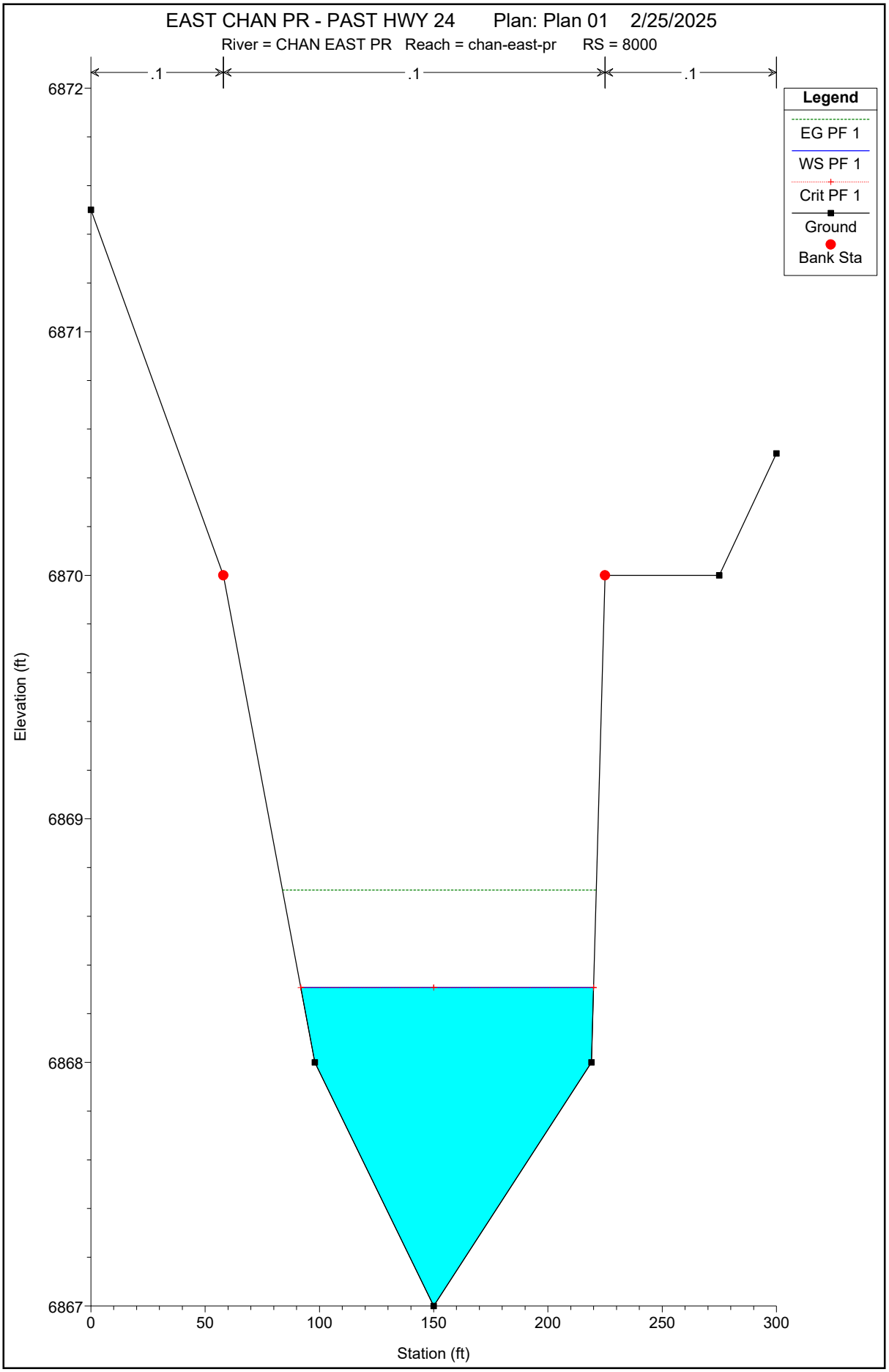

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 8415 BR
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6888
6886
6884
6882
6880
6878
Elevation (ft)
0
100
200
300
400
500
Station (ft)


EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 8400
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6884
6882
6880
6878
6876
6874
6872
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

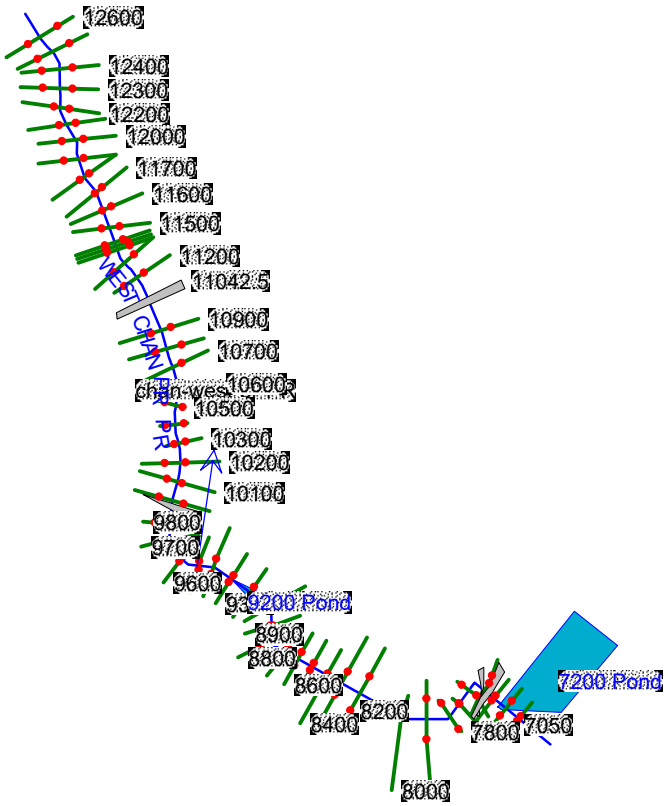

EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 8313 Culv
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6886
6884
6882
6880
6878
6876
6874
6872
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)


EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 8200
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6882
6880
6878
6876
6874
6872
6870
6868
0
50
100
150
200
250
300
Station (ft)


EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 8100
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6874
6873
6872
6871
6870
6869
6868
6867
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)


EAST CHAN PR - PAST HWY 24 Plan: Plan 01 2/25/2025
River = CHAN EAST PR Reach = chan-east-pr RS = 8000
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6872
6871
6870
6869
6868
6867
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

PROPOSED WEST CHANNEL 100-Y
W/ POND FAILURES



PROPOSED WEST CHANNEL 100-Y
W/ POND FAILURES

HEC-RAS Plan: PR River: WEST CHAN PR PR Reach: chan-west-pr-PR Profile: PF 1

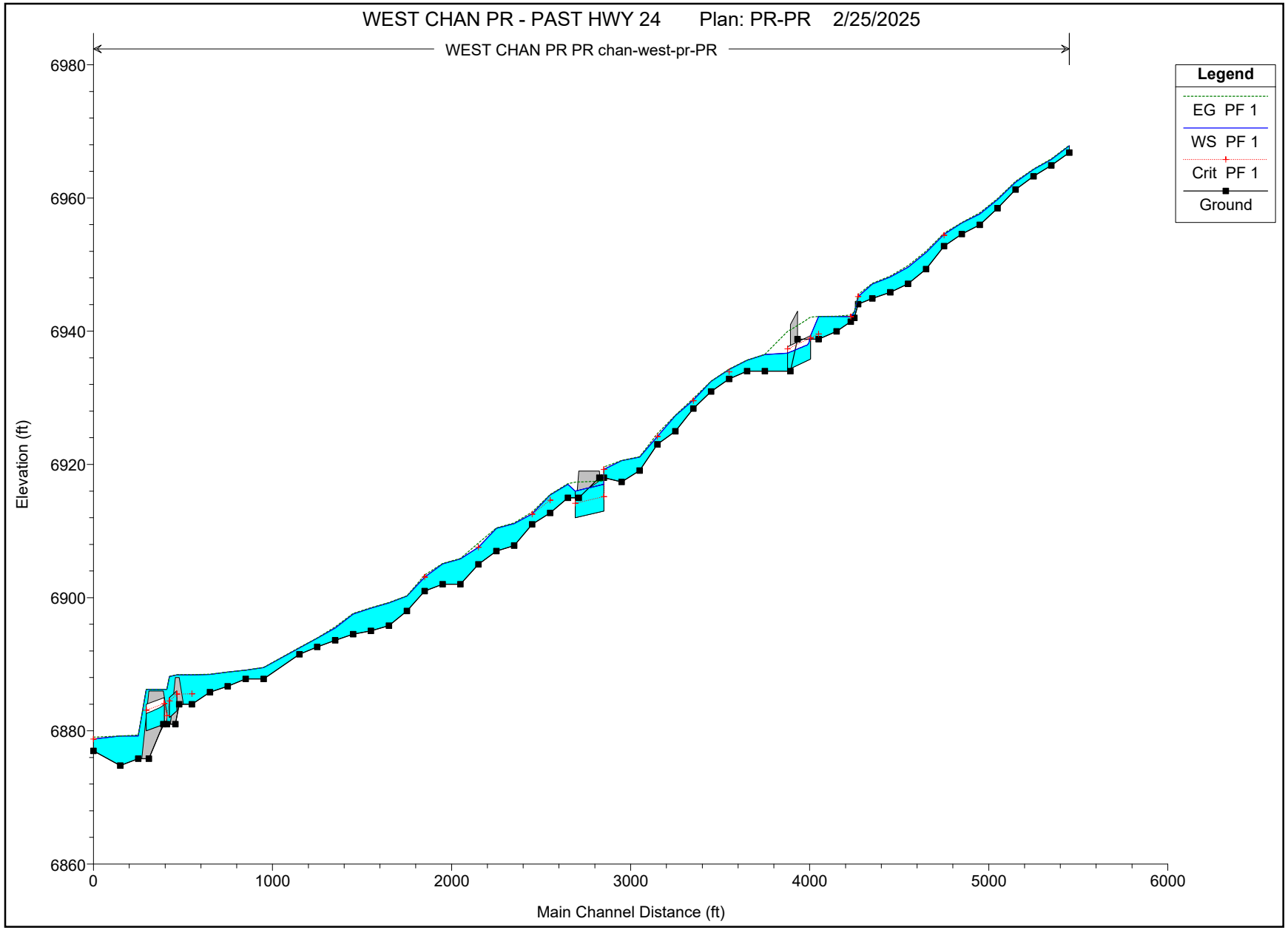
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
chan-west-pr-PR	12600	PF 1	216.00	6966.83	6967.84		6967.92	0.019298	2.35	91.77	162.15	0.55
chan-west-pr-PR	12500	PF 1	216.00	6964.90	6965.80		6965.90	0.021156	2.58	83.56	137.43	0.58
chan-west-pr-PR	12400	PF 1	216.00	6963.25	6964.29		6964.36	0.011605	2.07	104.20	152.72	0.44
chan-west-pr-PR	12300	PF 1	216.00	6961.27	6962.38		6962.52	0.033590	2.97	72.63	136.85	0.72
chan-west-pr-PR	12200	PF 1	216.00	6958.46	6959.77		6959.92	0.020750	3.12	74.33	122.34	0.61
chan-west-pr-PR	12100	PF 1	216.00	6955.98	6957.61		6957.78	0.022067	3.33	64.96	75.51	0.63
chan-west-pr-PR	12000	PF 1	216.00	6954.57	6956.24		6956.33	0.009980	2.38	90.64	95.81	0.43
chan-west-pr-PR	11900	PF 1	216.00	6952.76	6954.55	6954.40	6954.72	0.030195	3.25	66.42	100.94	0.71
chan-west-pr-PR	11800	PF 1	216.00	6949.31	6951.82		6952.04	0.023942	3.79	57.03	57.62	0.67
chan-west-pr-PR	11700	PF 1	216.00	6947.11	6949.61		6949.86	0.019906	4.02	53.71	42.97	0.63
chan-west-pr-PR	11600	PF 1	216.00	6945.84	6948.14		6948.31	0.012252	3.25	67.02	59.07	0.50
chan-west-pr-PR	11500	PF 1	216.00	6944.91	6947.09		6947.19	0.009984	2.42	89.37	92.48	0.43
chan-west-pr-PR	11420.03	PF 1	216.00	6944.06	6945.20	6945.20	6945.52	0.064325	4.54	47.55	77.24	1.02
chan-west-pr-PR	11400	PF 1	216.00	6942.00	6942.85		6942.94	0.012119	2.41	89.80	107.97	0.46
chan-west-pr-PR	11379.97	PF 1	216.00	6941.43	6942.19	6942.19	6942.44	0.068031	4.04	53.48	108.10	1.01
chan-west-pr-PR	11300	PF 1	216.00	6939.98	6942.23		6942.24	0.000425	0.83	261.06	126.04	0.10
chan-west-pr-PR	11200	PF 1	216.00	6938.82	6942.20	6939.60	6942.21	0.000209	0.71	306.22	110.15	0.07
chan-west-pr-PR	11042.5		Culvert									
chan-west-pr-PR	10900	PF 1	216.00	6934.00	6936.49		6936.53	0.010071	1.68	128.34	106.54	0.27
chan-west-pr-PR	10800	PF 1	216.00	6934.00	6935.64		6935.67	0.007563	1.38	156.86	144.60	0.23
chan-west-pr-PR	10700	PF 1	216.00	6932.83	6934.24	6933.91	6934.32	0.030748	2.32	99.53	146.12	0.45
chan-west-pr-PR	10600	PF 1	216.00	6930.96	6932.46		6932.50	0.011636	1.72	149.30	191.95	0.29
chan-west-pr-PR	10500	PF 1	216.00	6928.39	6929.68	6929.56	6929.90	0.100808	3.75	57.67	81.46	0.78
chan-west-pr-PR	10400	PF 1	216.00	6924.96	6927.33		6927.39	0.010868	1.93	112.01	80.45	0.29
chan-west-pr-PR	10300	PF 1	216.00	6923.02	6924.21	6924.21	6924.61	0.161997	5.09	42.47	54.04	1.01
chan-west-pr-PR	10200	PF 1	290.50	6919.08	6921.10		6921.16	0.011548	2.06	141.06	96.13	0.30
chan-west-pr-PR	10100	PF 1	290.50	6917.36	6920.58		6920.62	0.003103	1.48	200.17	100.06	0.17
chan-west-pr-PR	10000	PF 1	290.50	6918.00	6919.27	6919.27	6919.62	0.170378	4.76	61.00	89.13	1.01
chan-west-pr-PR	9915		Culvert									
chan-west-pr-PR	9800	PF 1	290.50	6915.00	6917.02		6917.11	0.022710	2.37	122.67	112.71	0.40
chan-west-pr-PR	9700	PF 1	290.50	6912.70	6915.42	6914.65	6915.50	0.012291	2.67	144.44	134.62	0.33
chan-west-pr-PR	9600	PF 1	290.50	6911.00	6912.57	6912.54	6912.87	0.100387	4.93	72.07	102.07	0.84
chan-west-pr-PR	9500	PF 1	290.50	6907.80	6911.13		6911.21	0.006463	2.30	136.08	71.53	0.25
chan-west-pr-PR	9400	PF 1	290.50	6907.00	6910.40		6910.46	0.008532	1.97	155.33	135.31	0.26
chan-west-pr-PR	9300	PF 1	290.50	6905.00	6907.56	6907.56	6908.21	0.138923	6.48	44.80	34.99	1.01
chan-west-pr-PR	9200	PF 1	290.50	6902.00	6905.82		6905.89	0.007939	2.15	134.93	64.52	0.26

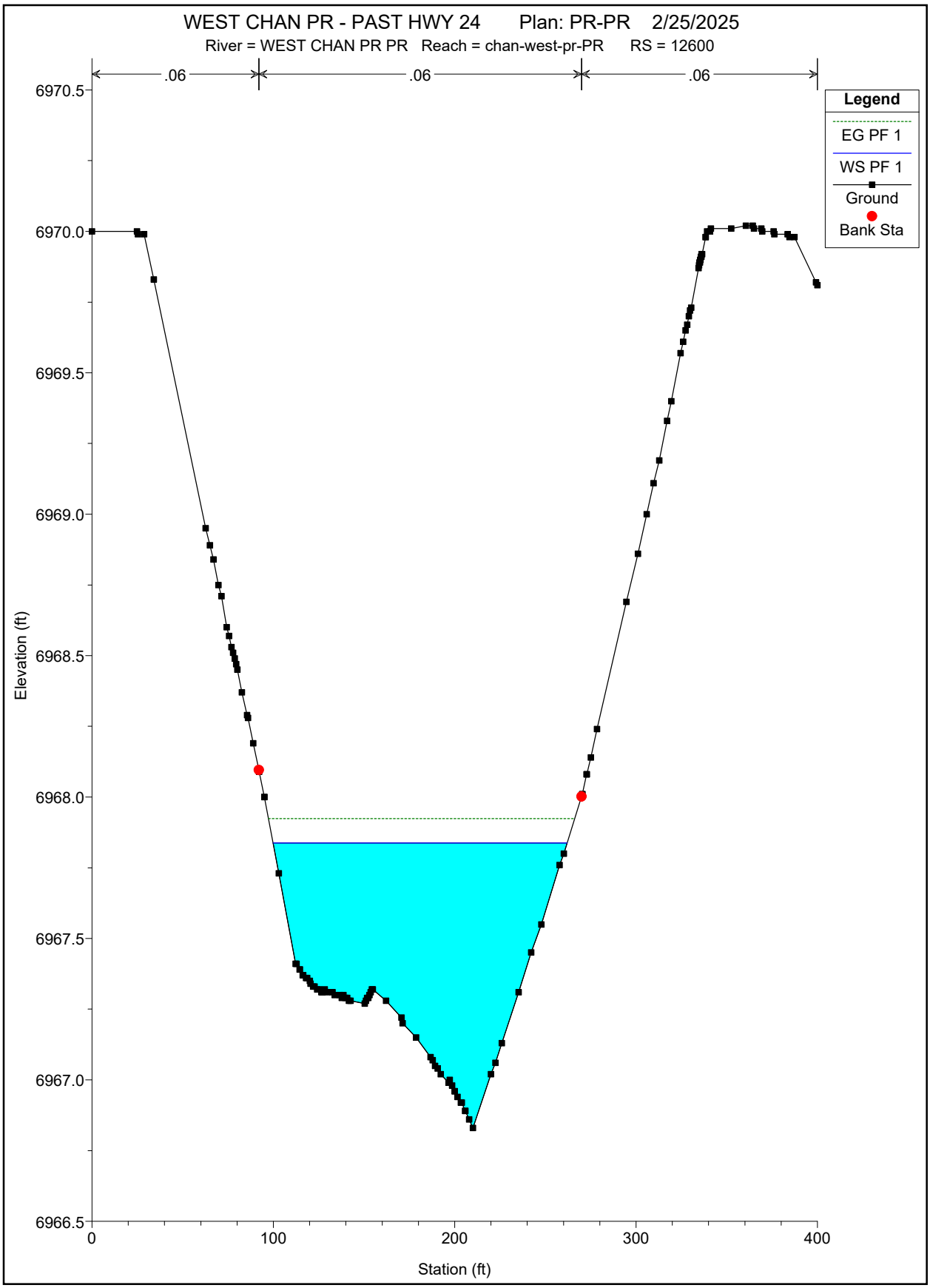
PROPOSED WEST CHANNEL 100-Y
W/ POND FAILURES

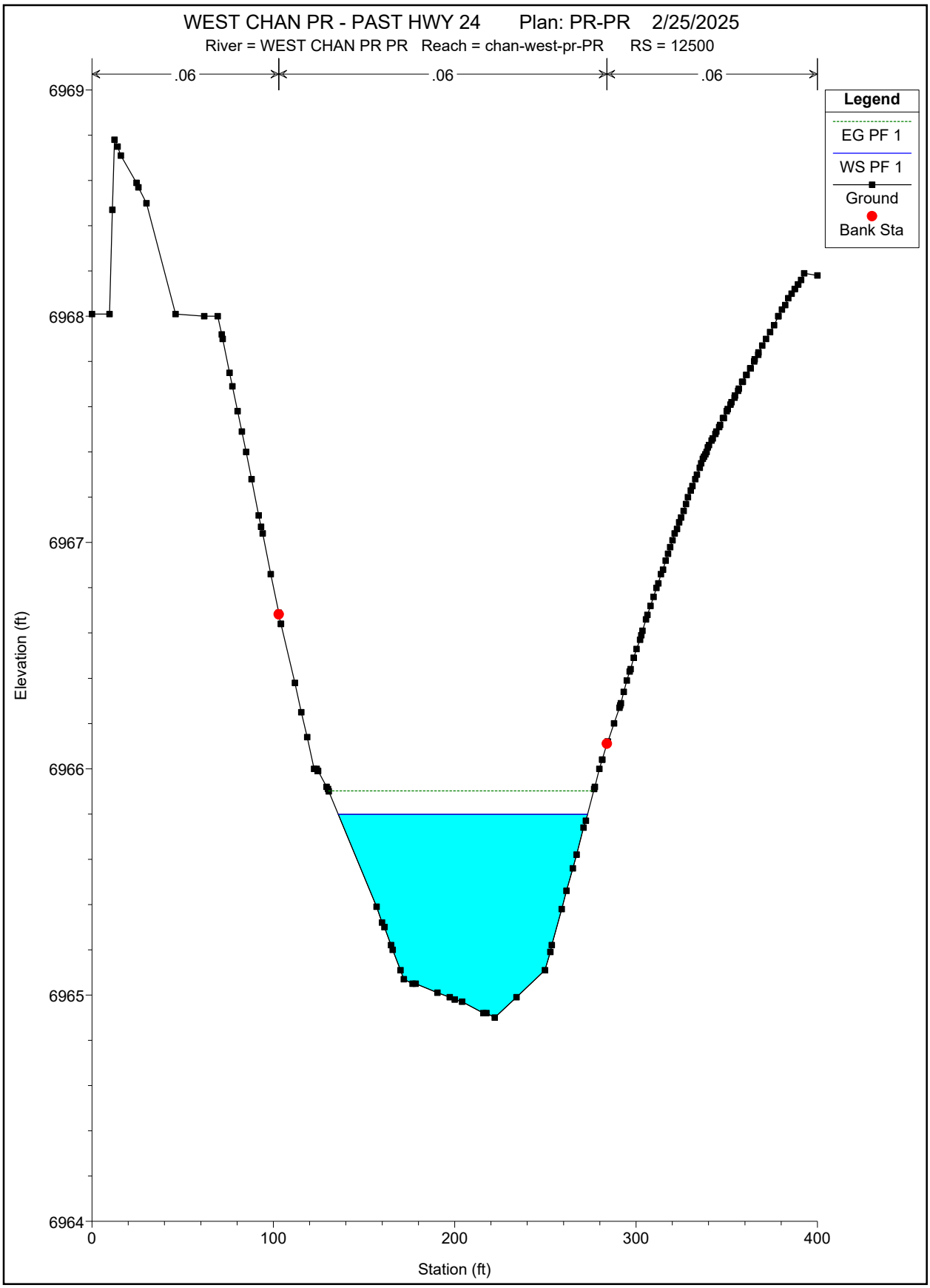
HEC-RAS Plan: PR River: WEST CHAN PR PR Reach: chan-west-pr-PR Profile: PF 1 (Continued)

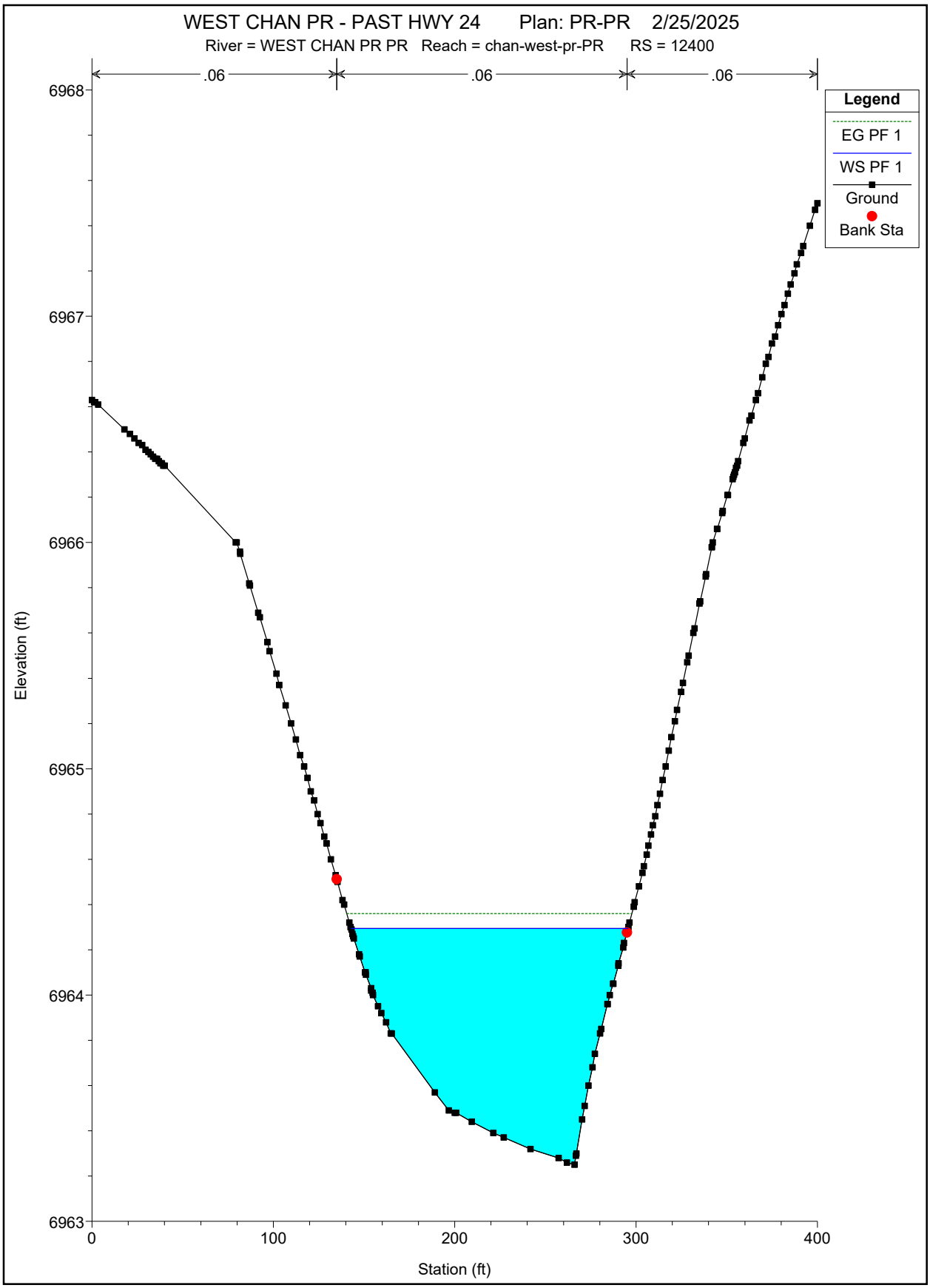
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
chan-west-pr-PR	9000	PF 1	290.50	6902.00	6905.07		6905.13	0.007248	2.05	178.71	172.88	0.25
chan-west-pr-PR	8900	PF 1	290.50	6901.00	6903.08	6903.08	6903.40	0.085842	5.85	76.67	117.58	0.82
chan-west-pr-PR	8800	PF 1	290.50	6898.00	6900.23		6900.29	0.011119	1.98	146.47	102.56	0.29
chan-west-pr-PR	8700	PF 1	290.50	6895.80	6899.21		6899.29	0.009019	2.31	125.98	59.71	0.28
chan-west-pr-PR	8600	PF 1	290.50	6895.00	6898.44		6898.50	0.006950	1.90	159.50	119.19	0.24
chan-west-pr-PR	8500	PF 1	290.50	6894.50	6897.53		6897.63	0.011068	2.70	128.33	103.32	0.32
chan-west-pr-PR	8400	PF 1	290.50	6893.60	6895.44		6895.62	0.045214	4.39	95.35	112.00	0.60
chan-west-pr-PR	8300	PF 1	290.50	6892.60	6893.91		6893.93	0.008398	1.43	252.49	386.92	0.24
chan-west-pr-PR	8200	PF 1	290.50	6891.50	6892.45		6892.51	0.028930	1.99	151.67	249.74	0.42
chan-west-pr-PR	8000	PF 1	290.50	6887.80	6889.52		6889.54	0.009019	1.94	243.38	316.42	0.27
chan-west-pr-PR	7900	PF 1	290.50	6887.80	6889.12		6889.13	0.002461	0.84	385.07	401.20	0.13
chan-west-pr-PR	7800	PF 1	290.50	6886.70	6888.81		6888.83	0.003590	1.15	264.13	199.00	0.17
chan-west-pr-PR	7700	PF 1	290.50	6885.80	6888.49		6888.50	0.002992	1.53	277.98	193.00	0.17
chan-west-pr-PR	7600	PF 1	290.50	6884.00	6888.42	6885.56	6888.42	0.000344	0.62	558.58	246.00	0.06
chan-west-pr-PR	7497		Culvert									
chan-west-pr-PR	7460	PF 1	290.50	6881.00	6886.22	6882.28	6886.22	0.000026	0.21	1808.20	613.00	0.02
chan-west-pr-PR	7400		Culvert									
chan-west-pr-PR	7300	PF 1	290.50	6875.80	6879.22		6879.38	0.012950	3.22	94.63	44.32	0.35
chan-west-pr-PR	7200	PF 1	290.50	6874.80	6879.24		6879.25	0.000298	0.63	543.46	213.74	0.06
chan-west-pr-PR	7050	PF 1	290.50	6877.00	6878.78	6878.78	6879.06	0.079079	4.93	81.94	138.45	0.77

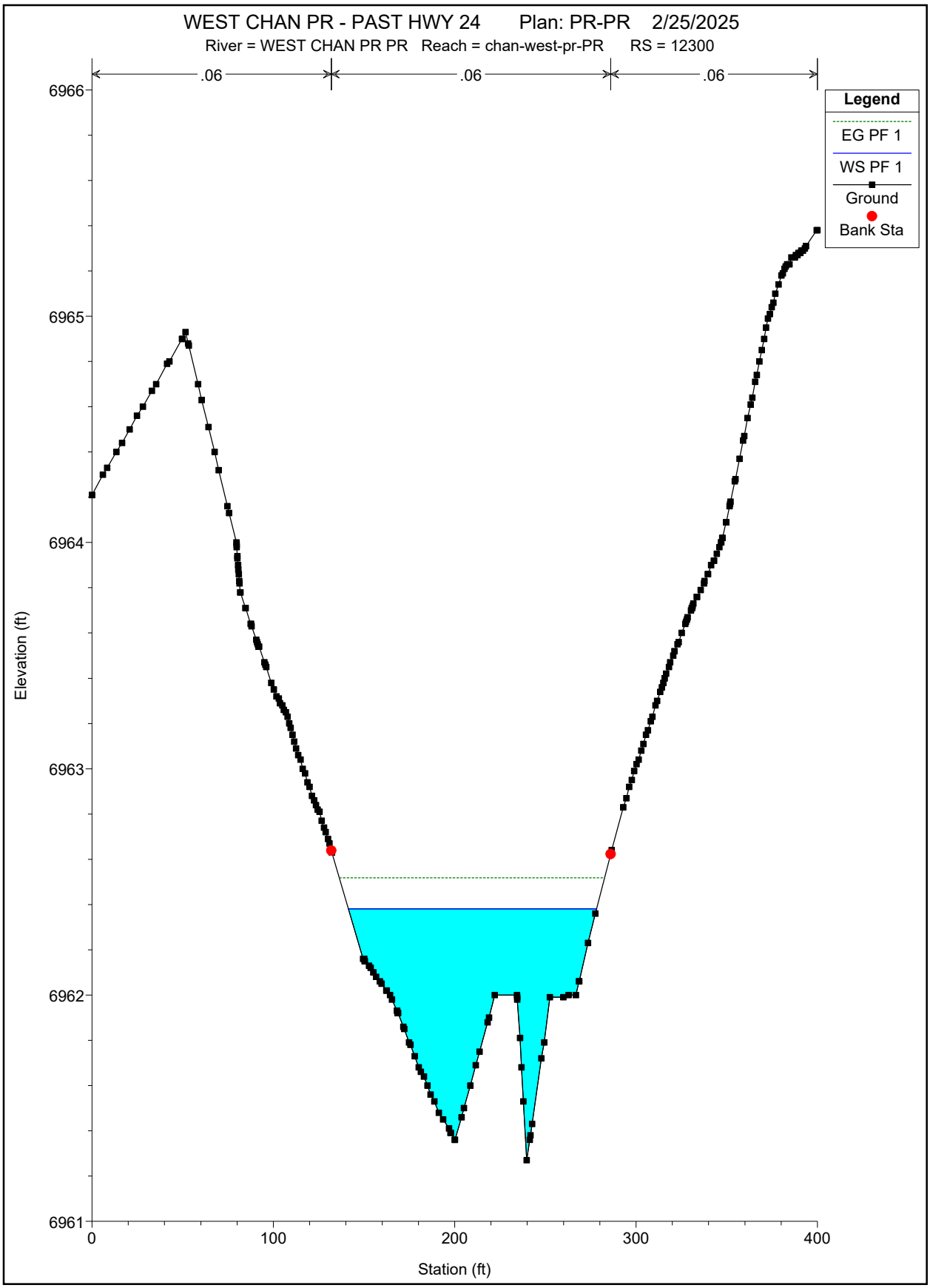
PROPOSED WEST CHANNEL 100-Y
W/ POND FAILURES

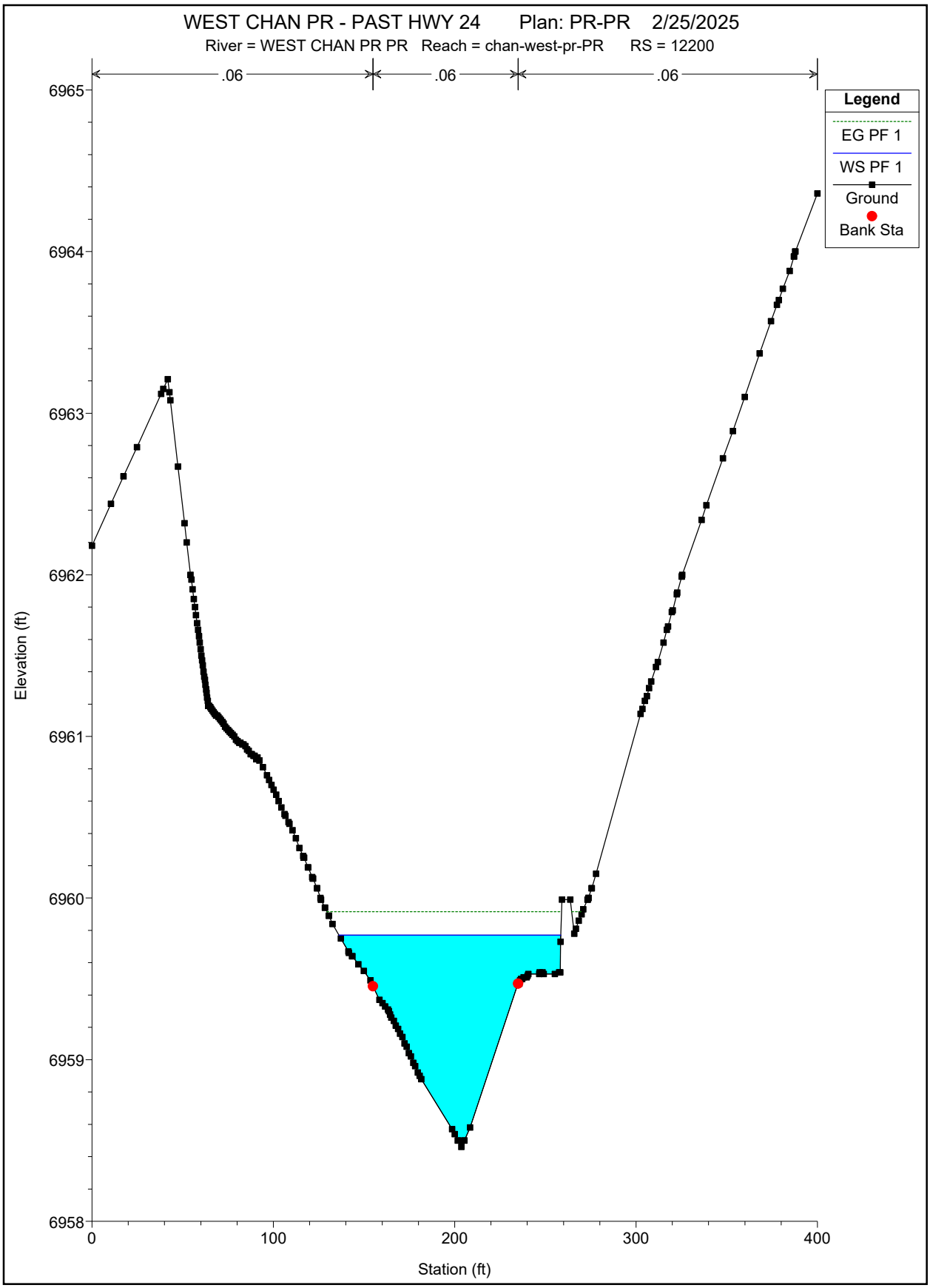


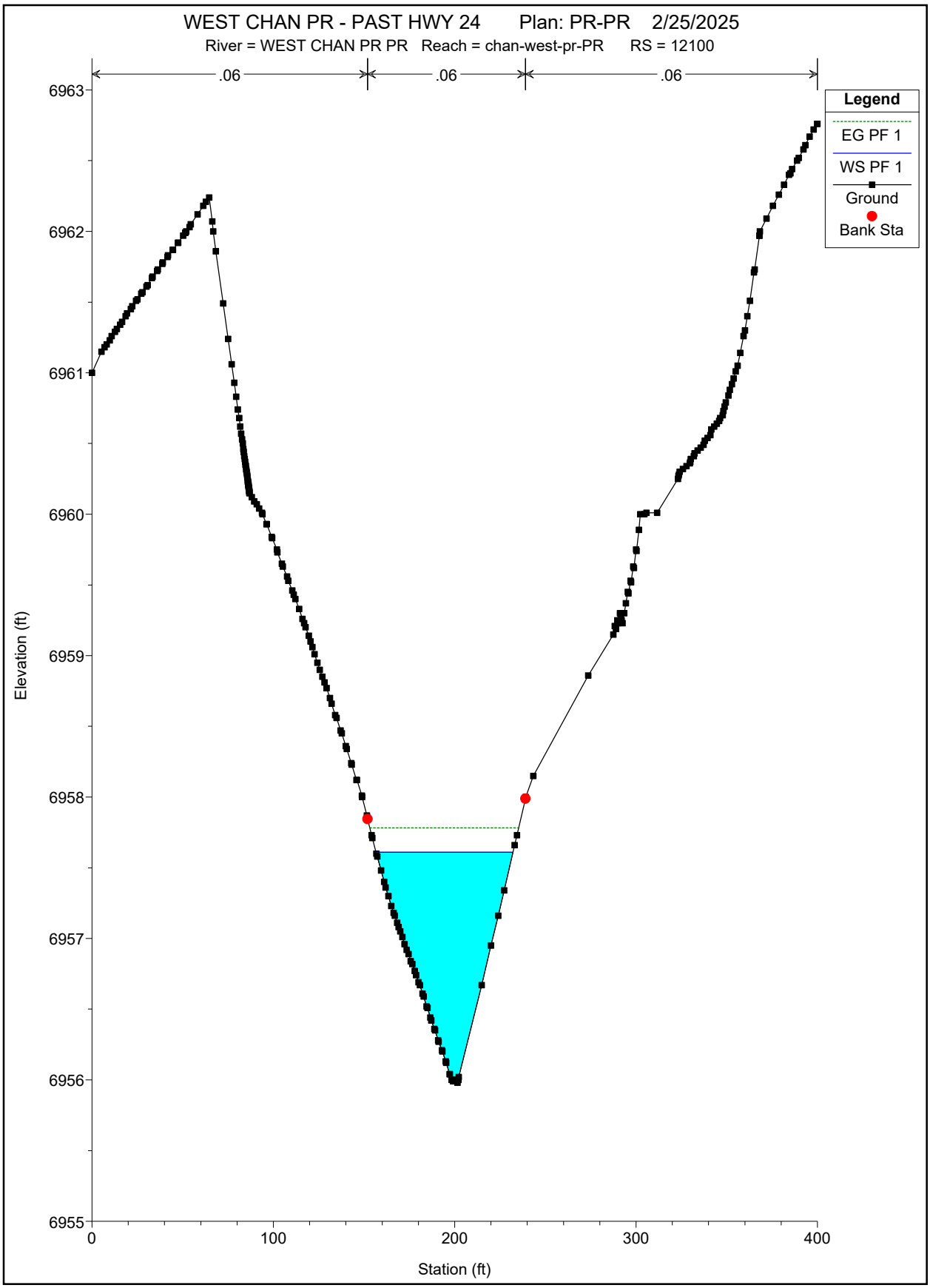

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 12600
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6970.5
6970.0
6969.5
6969.0
6968.5
6968.0
6967.5
6967.0
6966.5
Elevation (ft)
0
100
200
300
400
Station (ft)

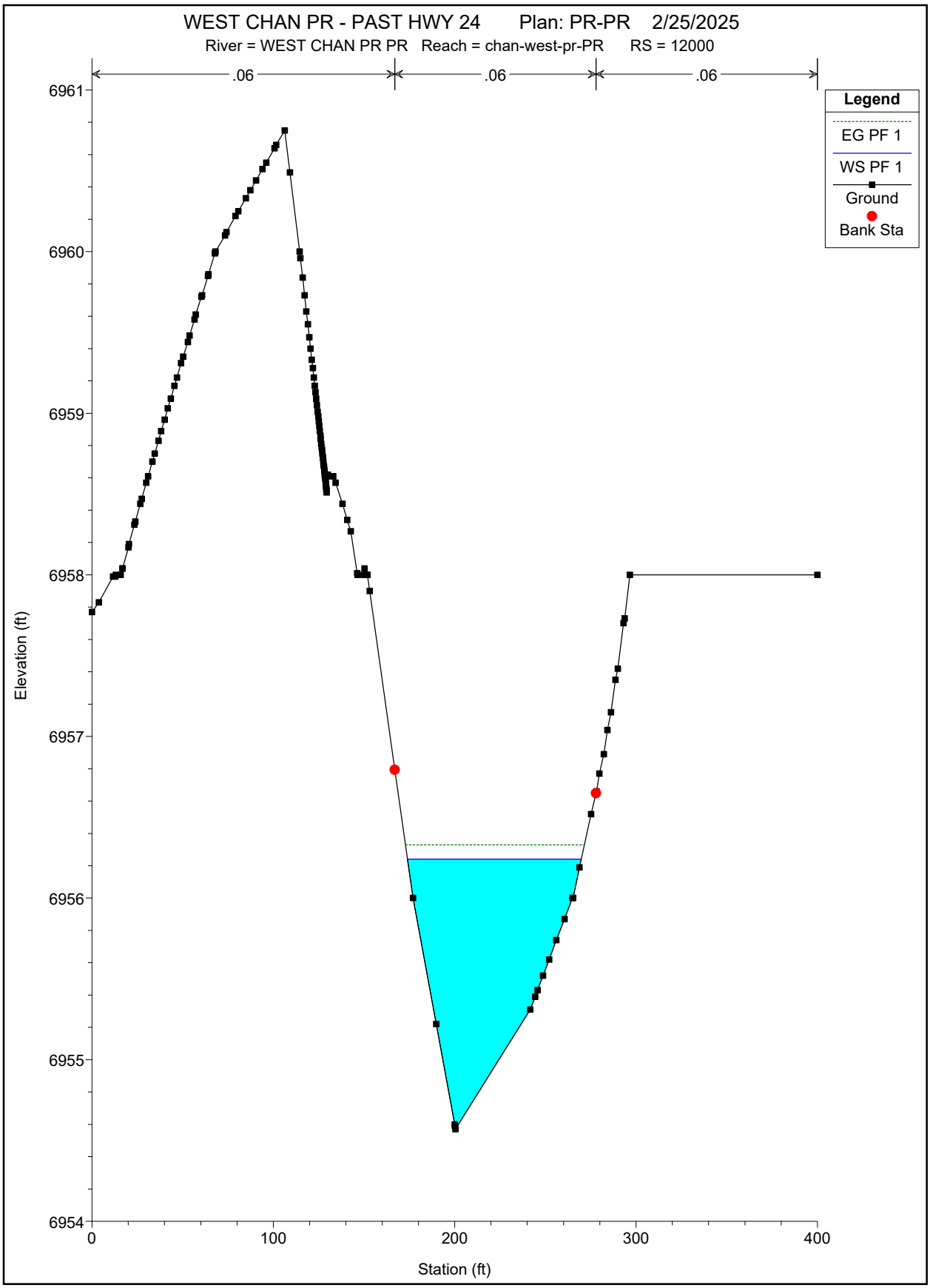

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 12500
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6969
6968
6967
6966
6965
6964
Elevation (ft)
0
100
200
300
400
Station (ft)

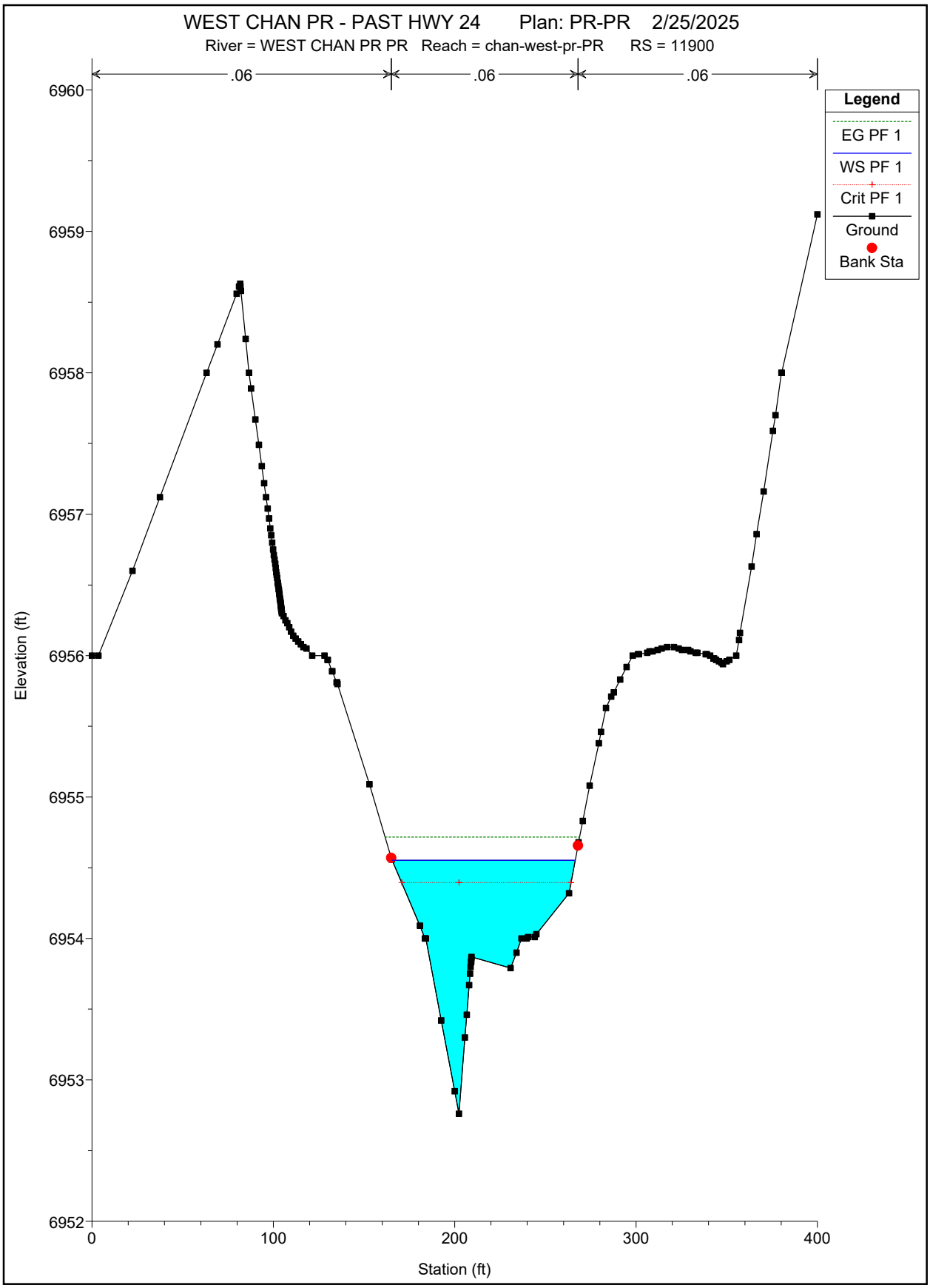

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 12400
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6968
6967
6966
6965
6964
6963
Elevation (ft)
0
100
200
300
400
Station (ft)

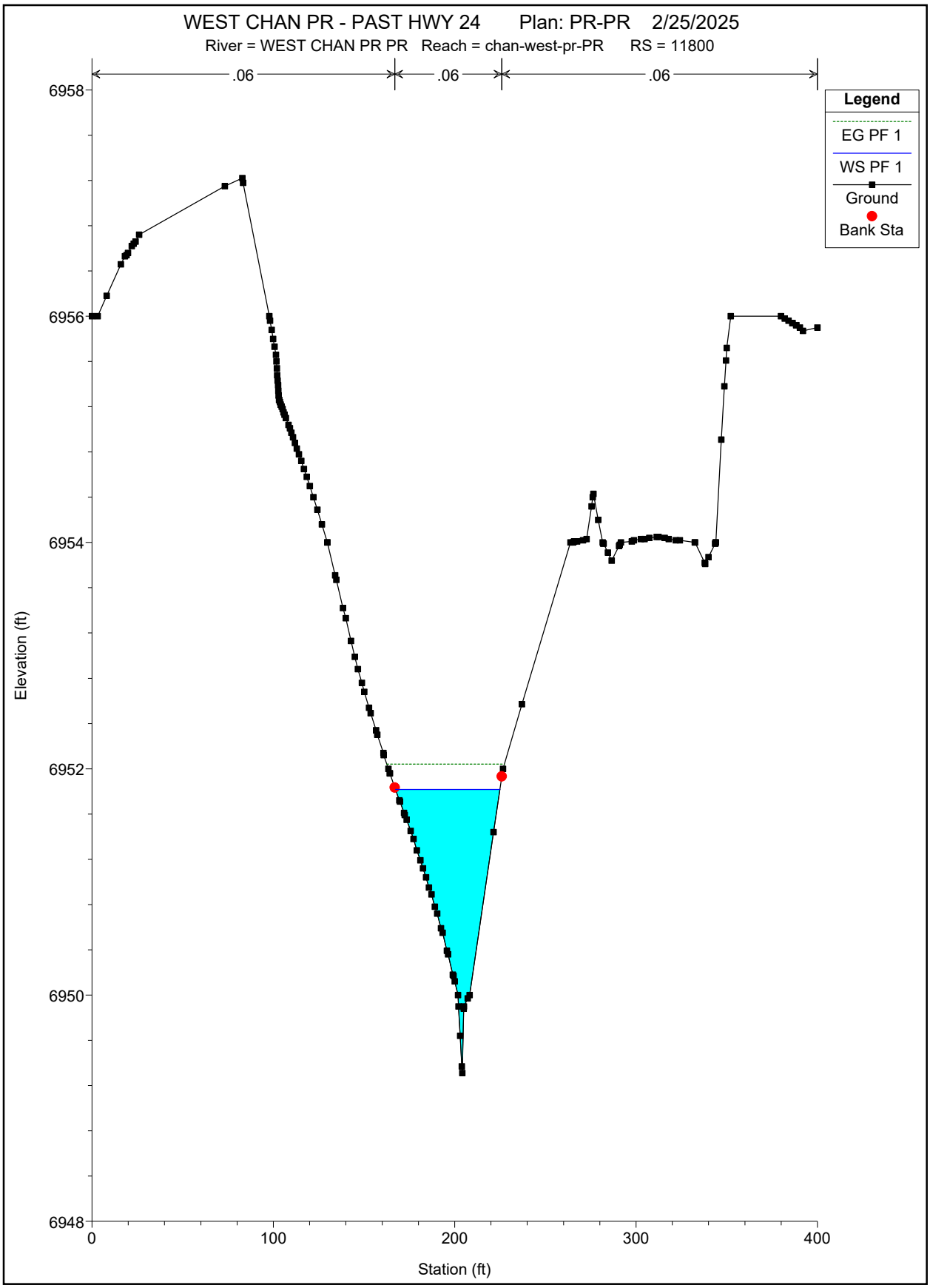

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 12300
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6966
6965
6964
6963
6962
6961
Elevation (ft)
0
100
200
300
400
Station (ft)

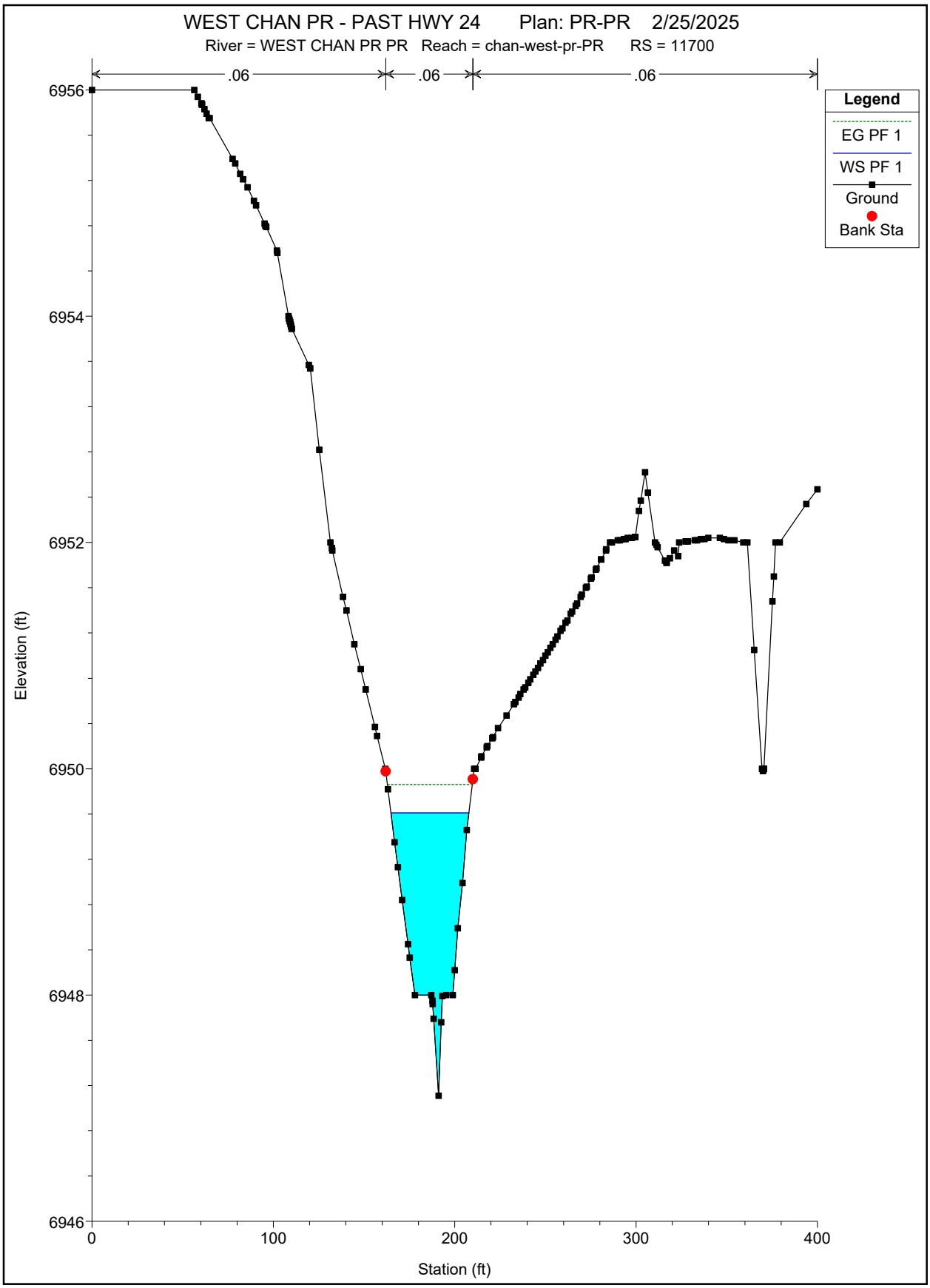

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 12200
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6965
6964
6963
6962
6961
6960
6959
6958
0
100
200
300
400
Station (ft)

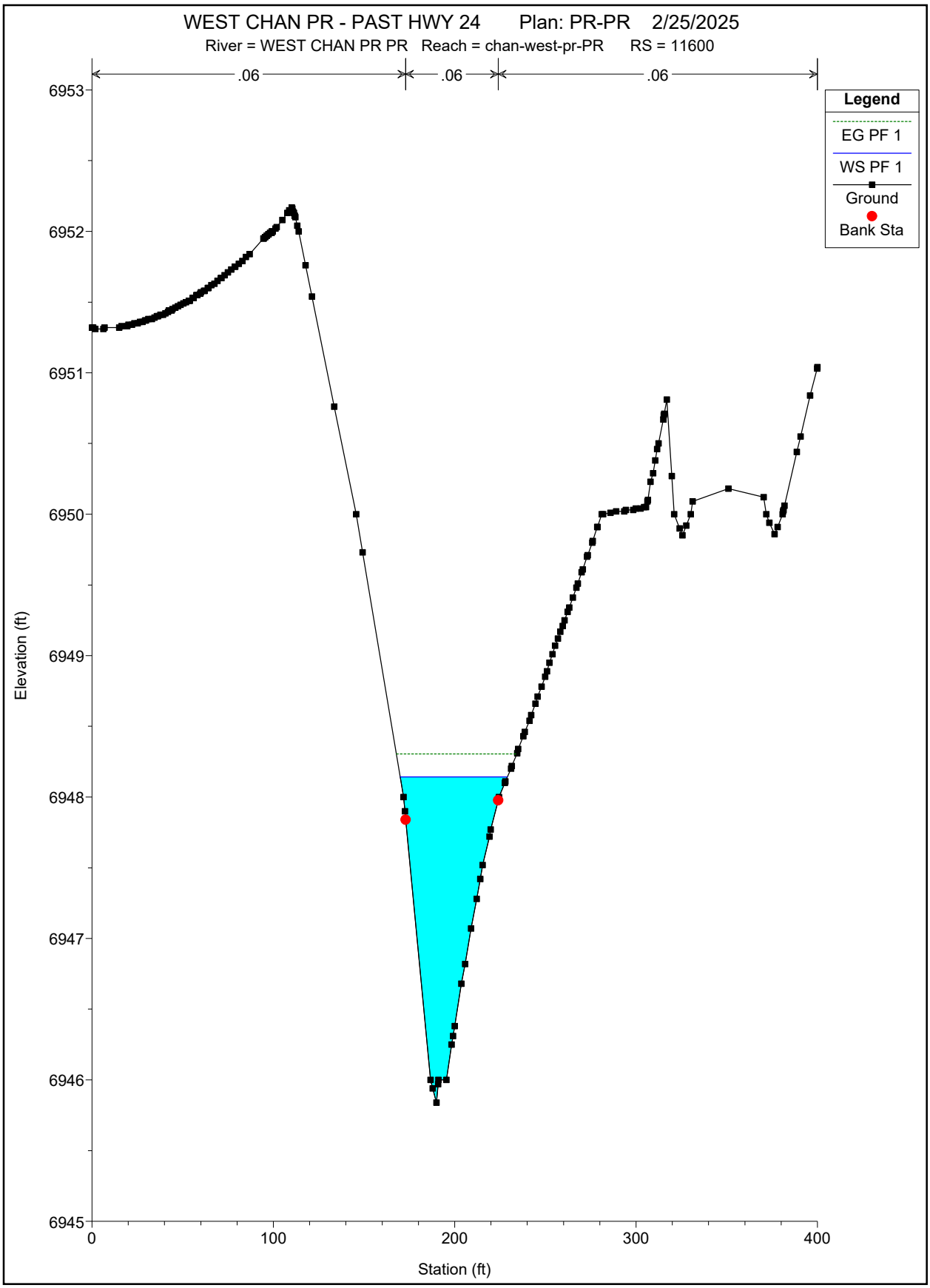

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 12100
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6963
6962
6961
6960
6959
6958
6957
6956
6955
0
100
200
300
400
Station (ft)

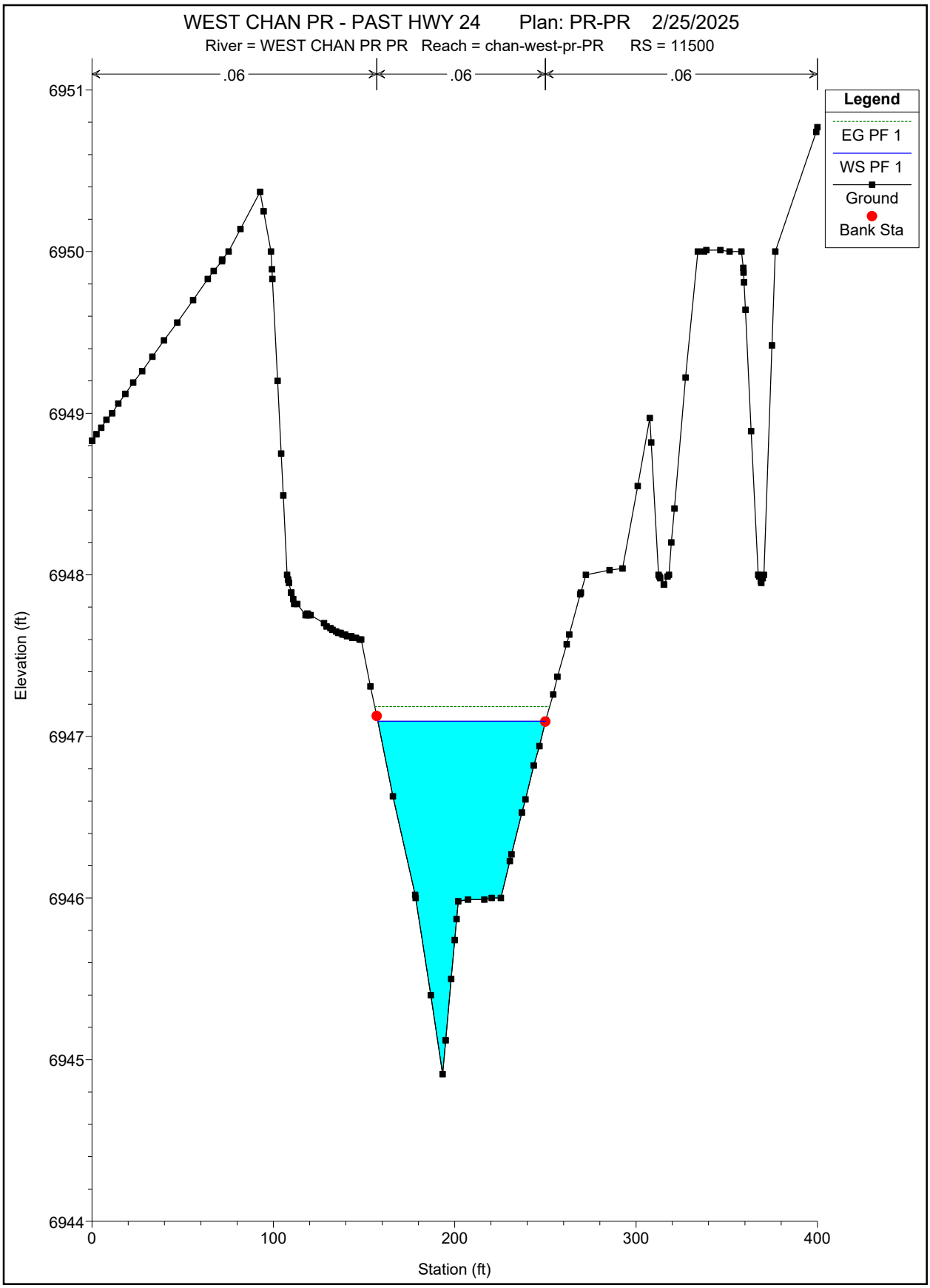

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 12000
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6961
6960
6959
6958
6957
6956
6955
6954
0
100
200
300
400
Station (ft)

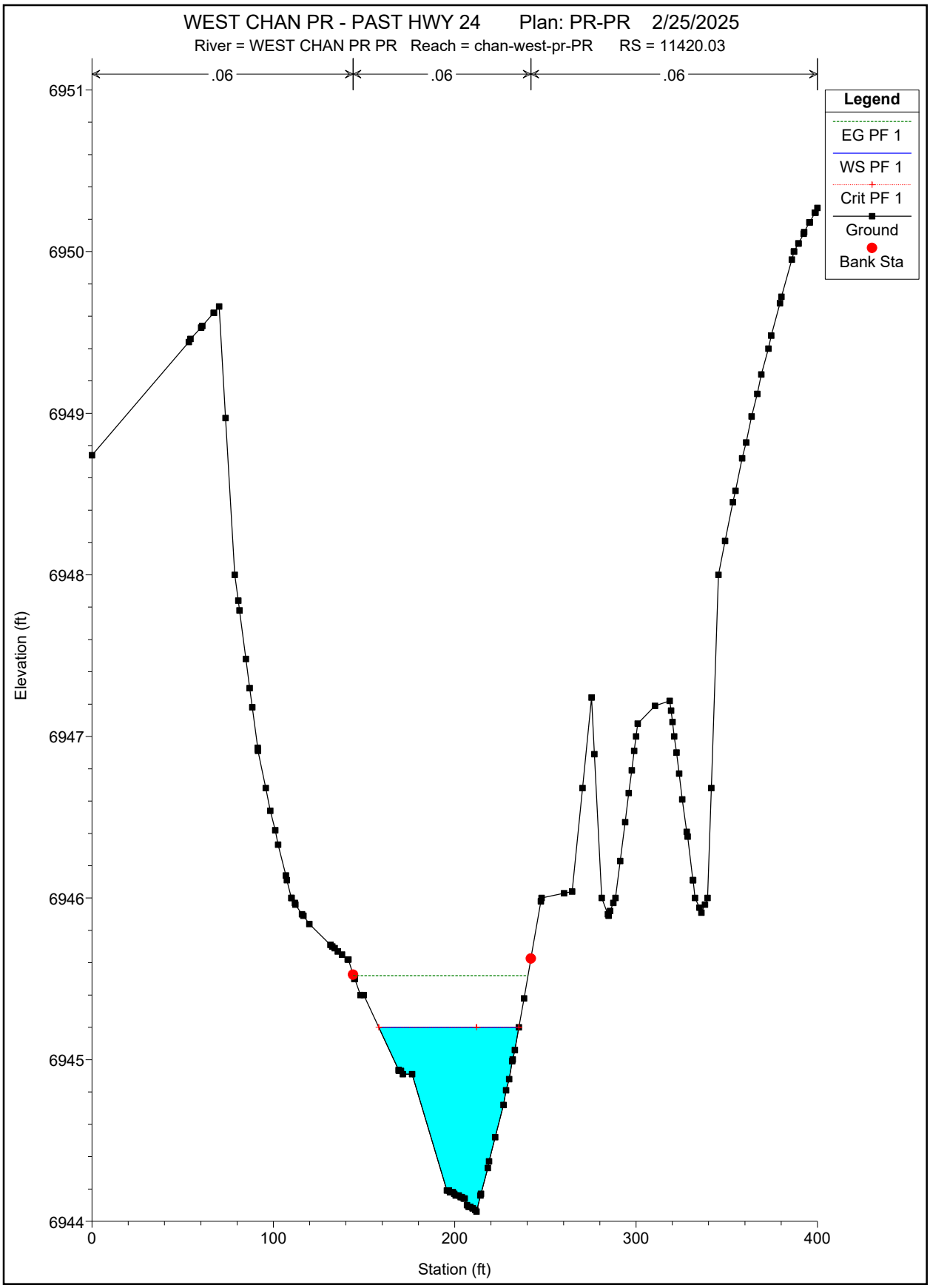

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 11900
.06
.06
.06
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6960
6959
6958
6957
6956
6955
6954
6953
6952
0
100
200
300
400
Station (ft)

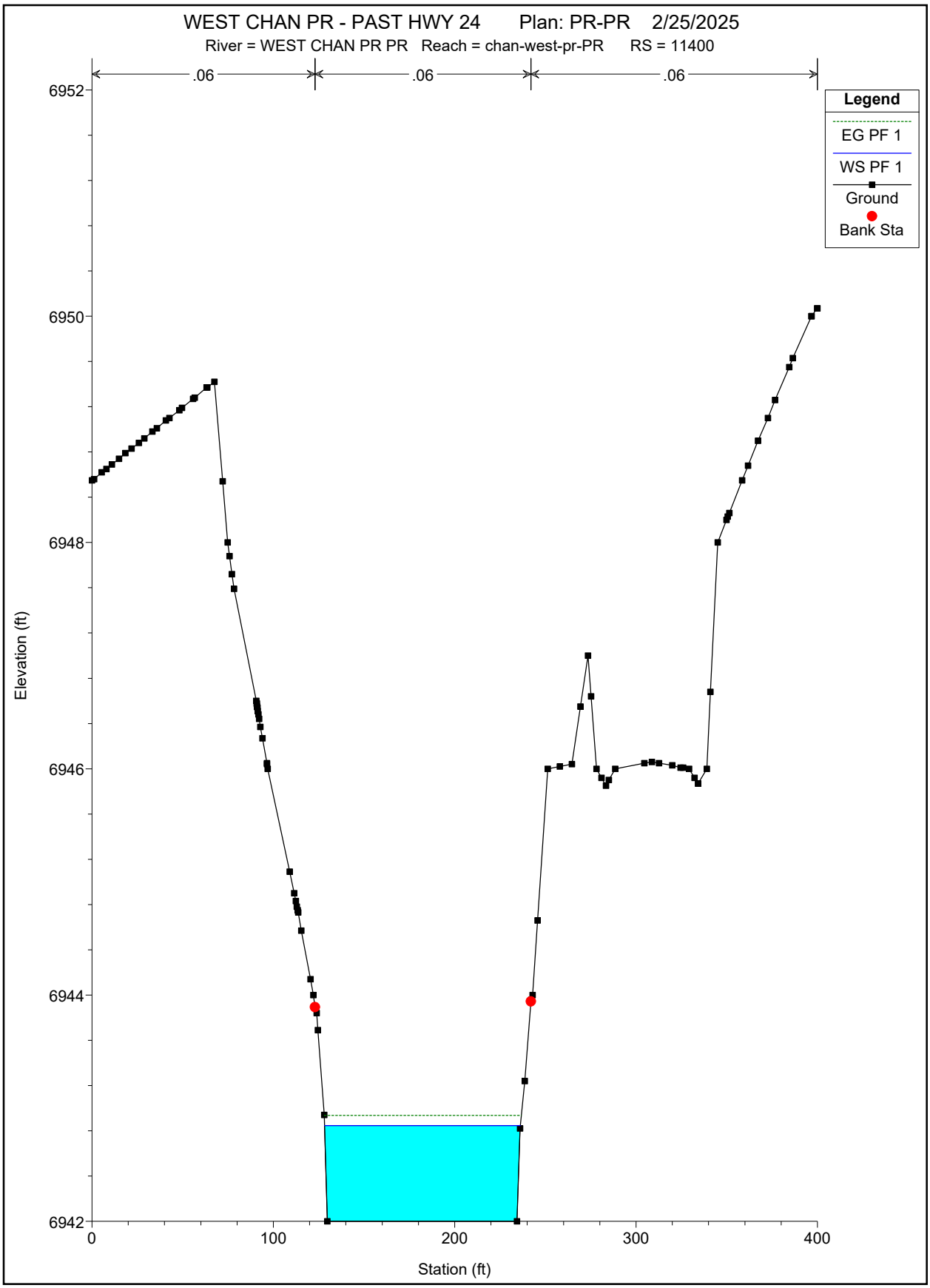

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 11800
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6958
6956
6954
6952
6950
6948
Elevation (ft)
0
100
200
300
400
Station (ft)

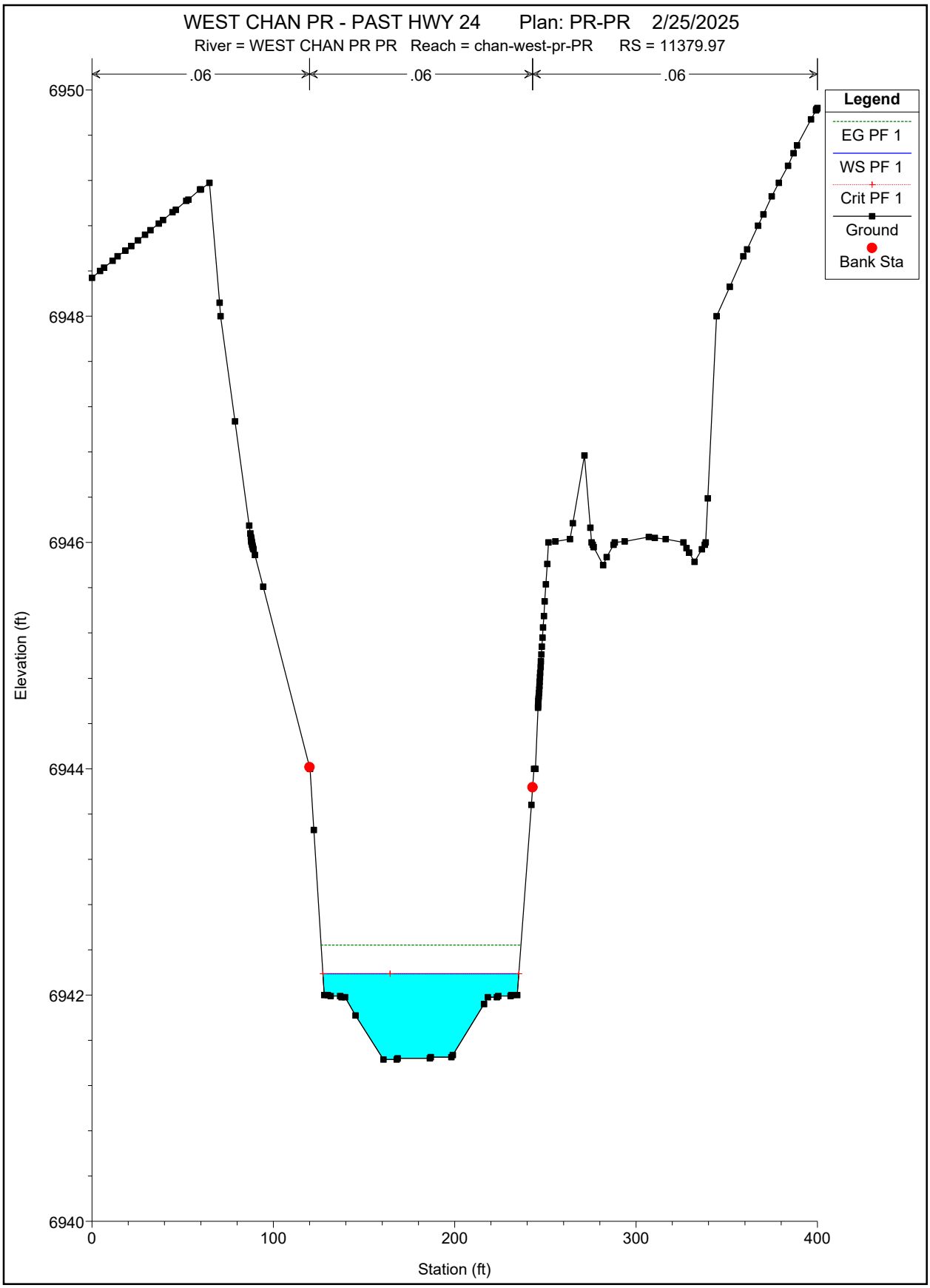

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 11700
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6956
6954
6952
6950
6948
6946
Elevation (ft)
0
100
200
300
400
Station (ft)

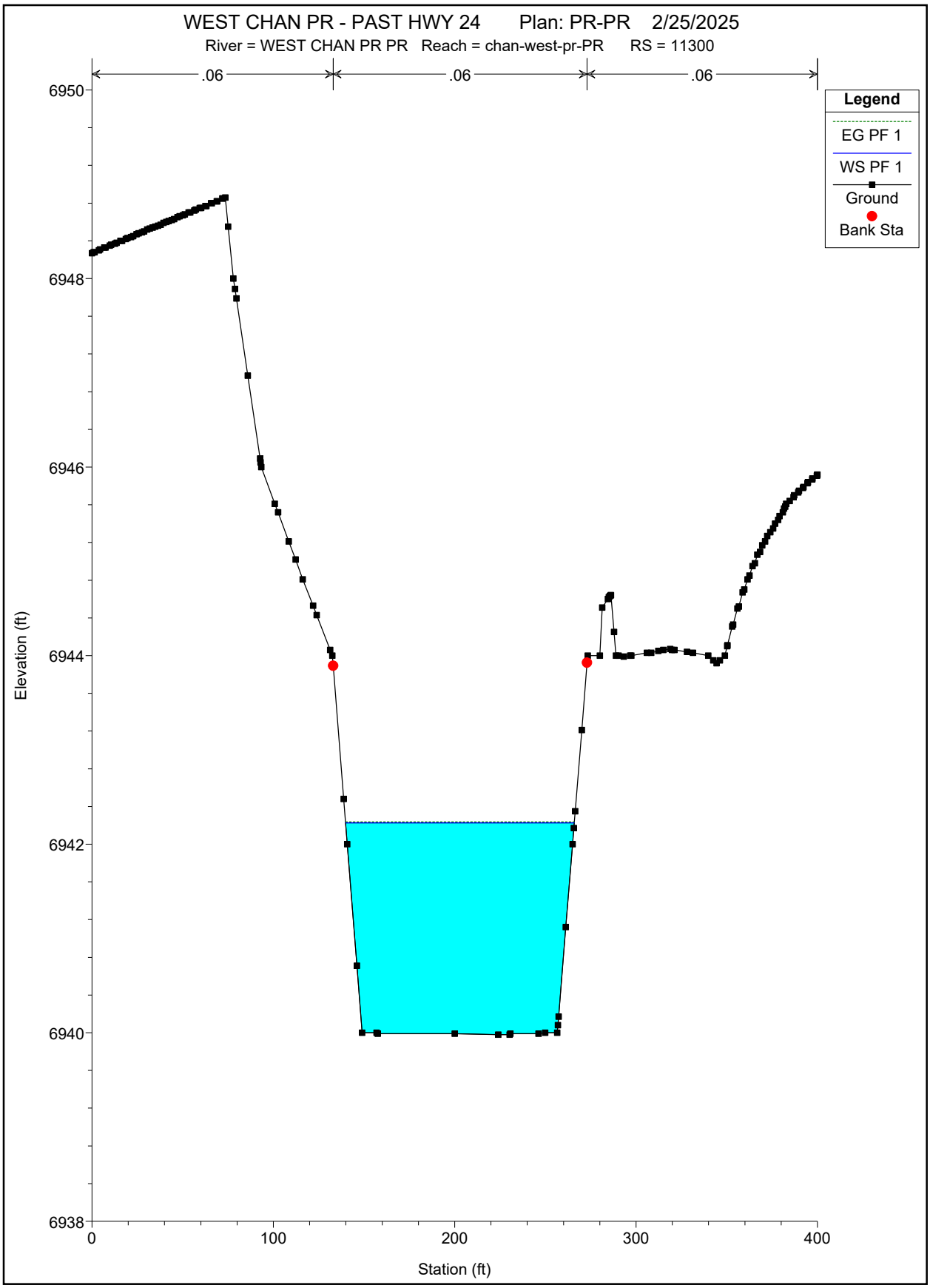

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 11600
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6953
6952
6951
6950
6949
6948
6947
6946
6945
0
100
200
300
400
Station (ft)

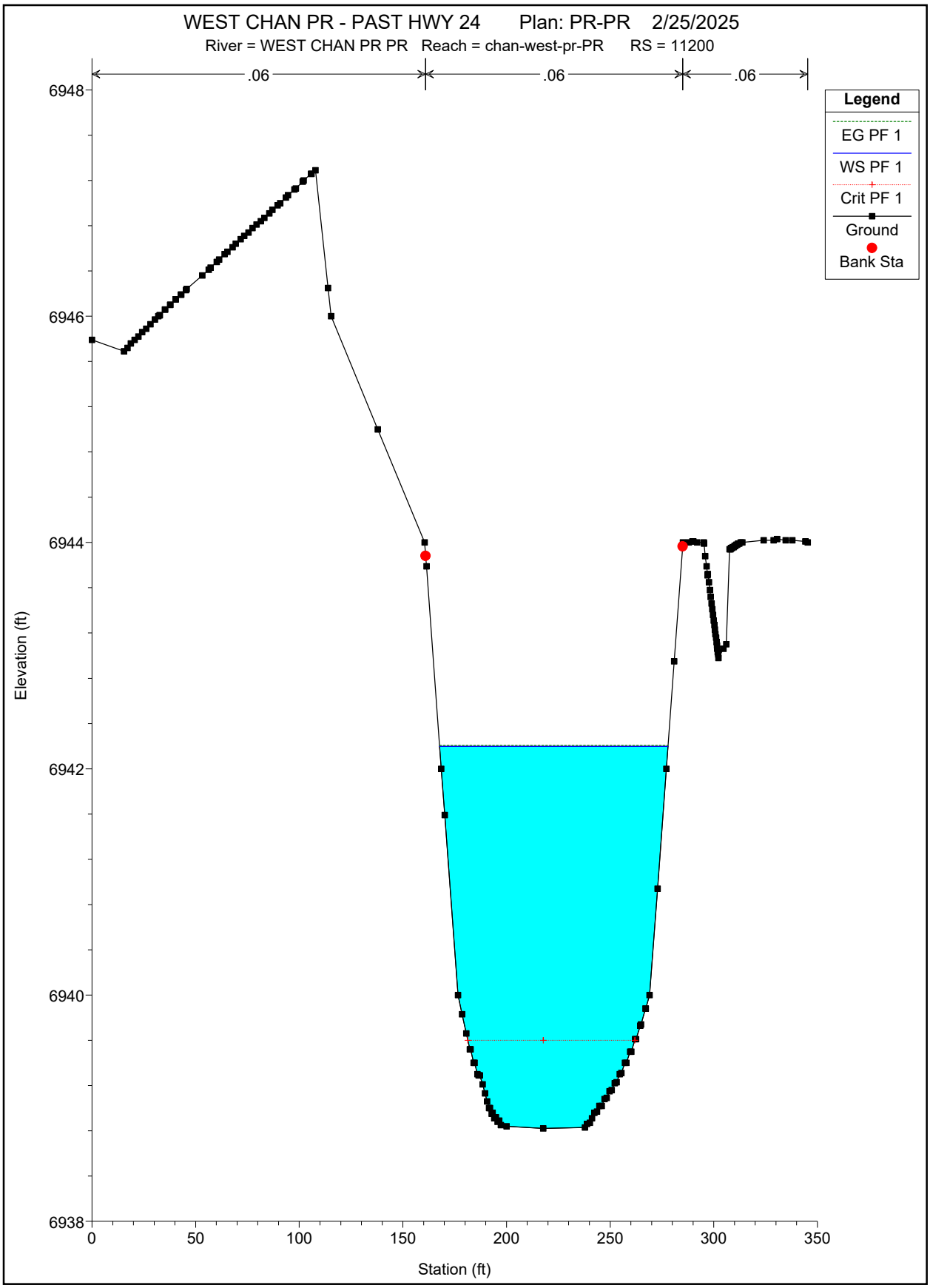

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 11500
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6951
6950
6949
6948
6947
6946
6945
6944
0
100
200
300
400
Station (ft)

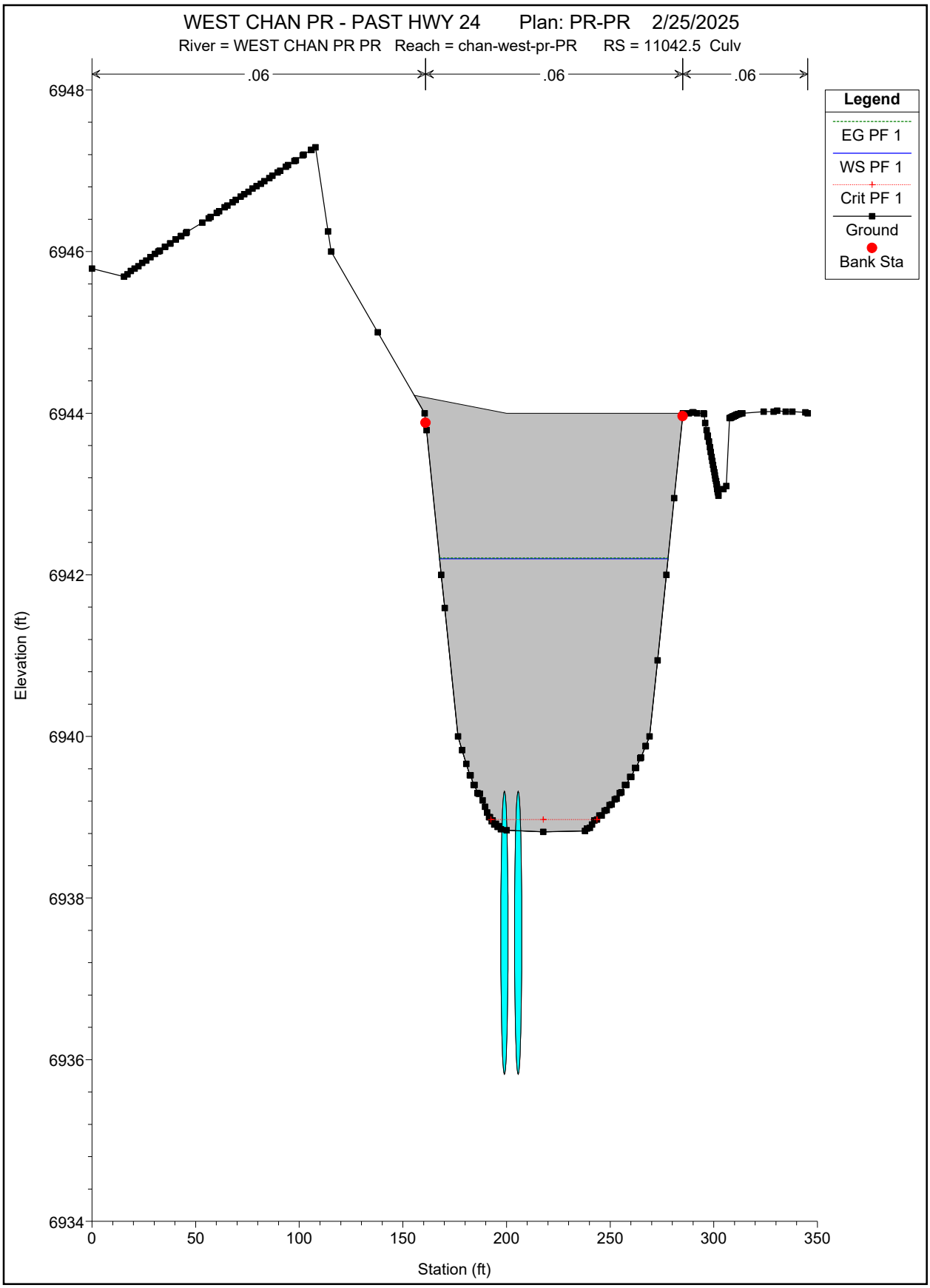

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 11420.03
.06
.06
.06
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
6951
6950
6949
6948
6947
6946
6945
6944
0
100
200
300
400

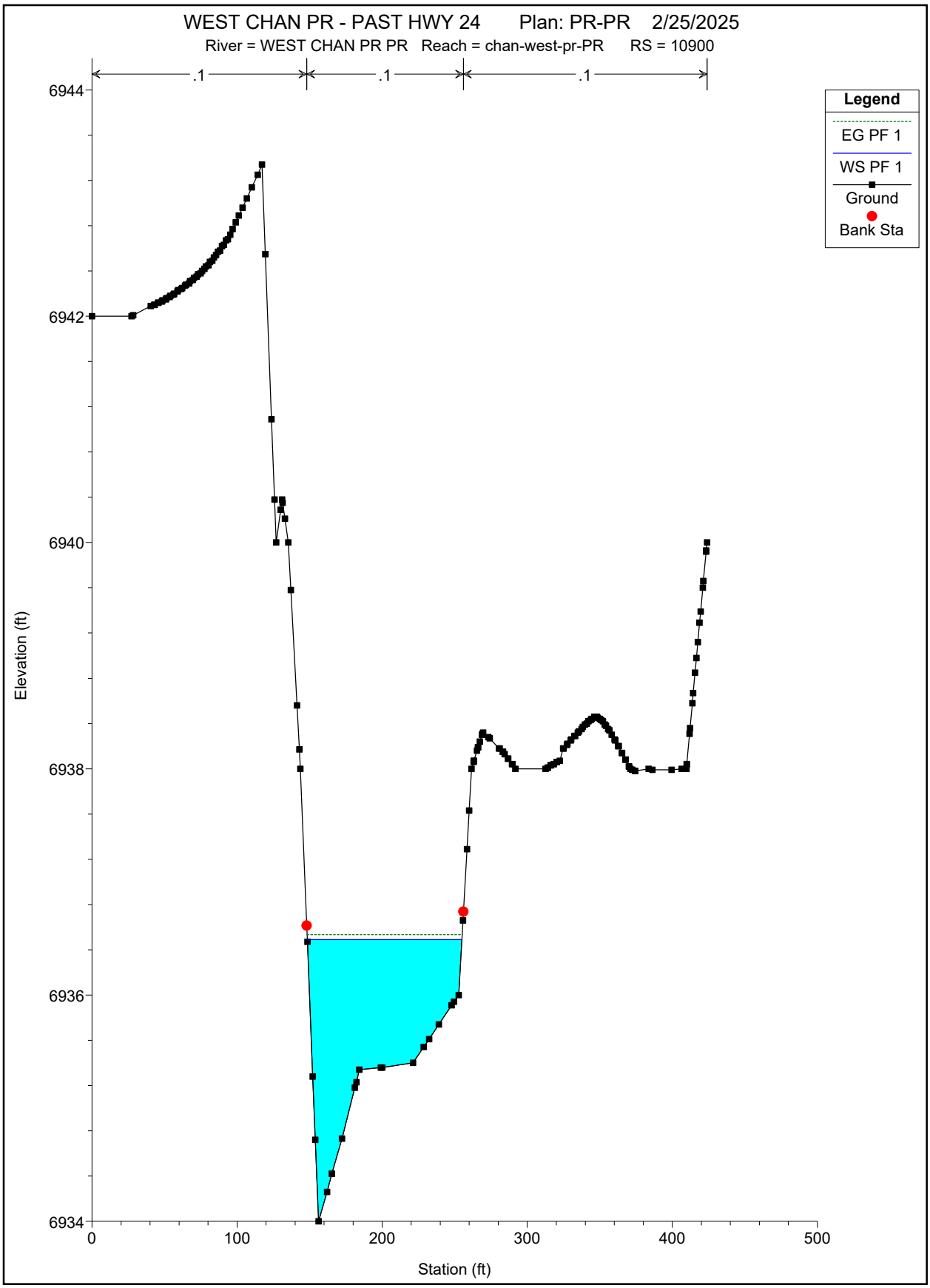

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 11400
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6952
6950
6948
6946
6944
6942
Elevation (ft)
0
100
200
300
400
Station (ft)

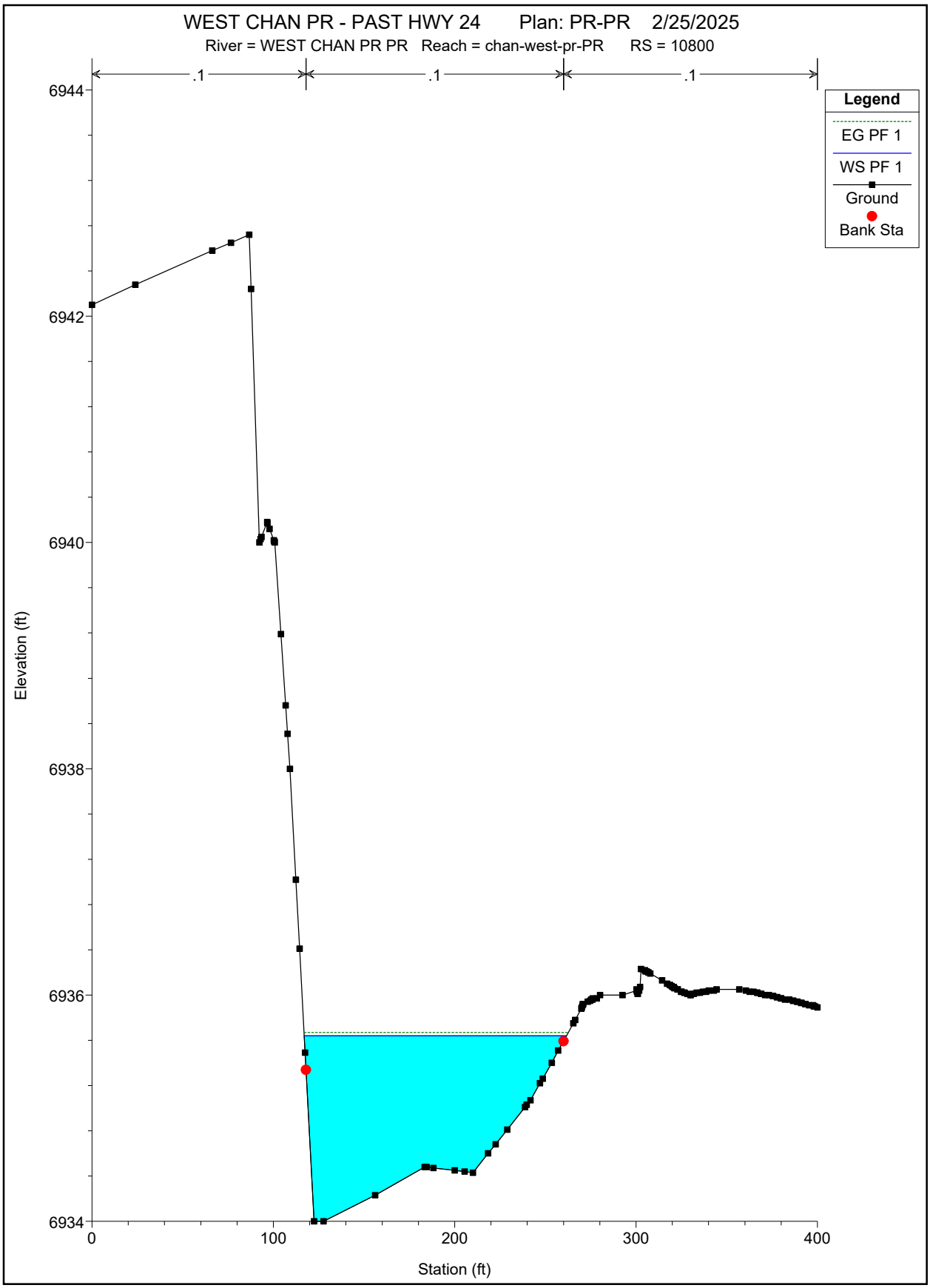

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 11379.97
.06
.06
.06
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6950
6948
6946
6944
6942
6940
Elevation (ft)
0
100
200
300
400
Station (ft)

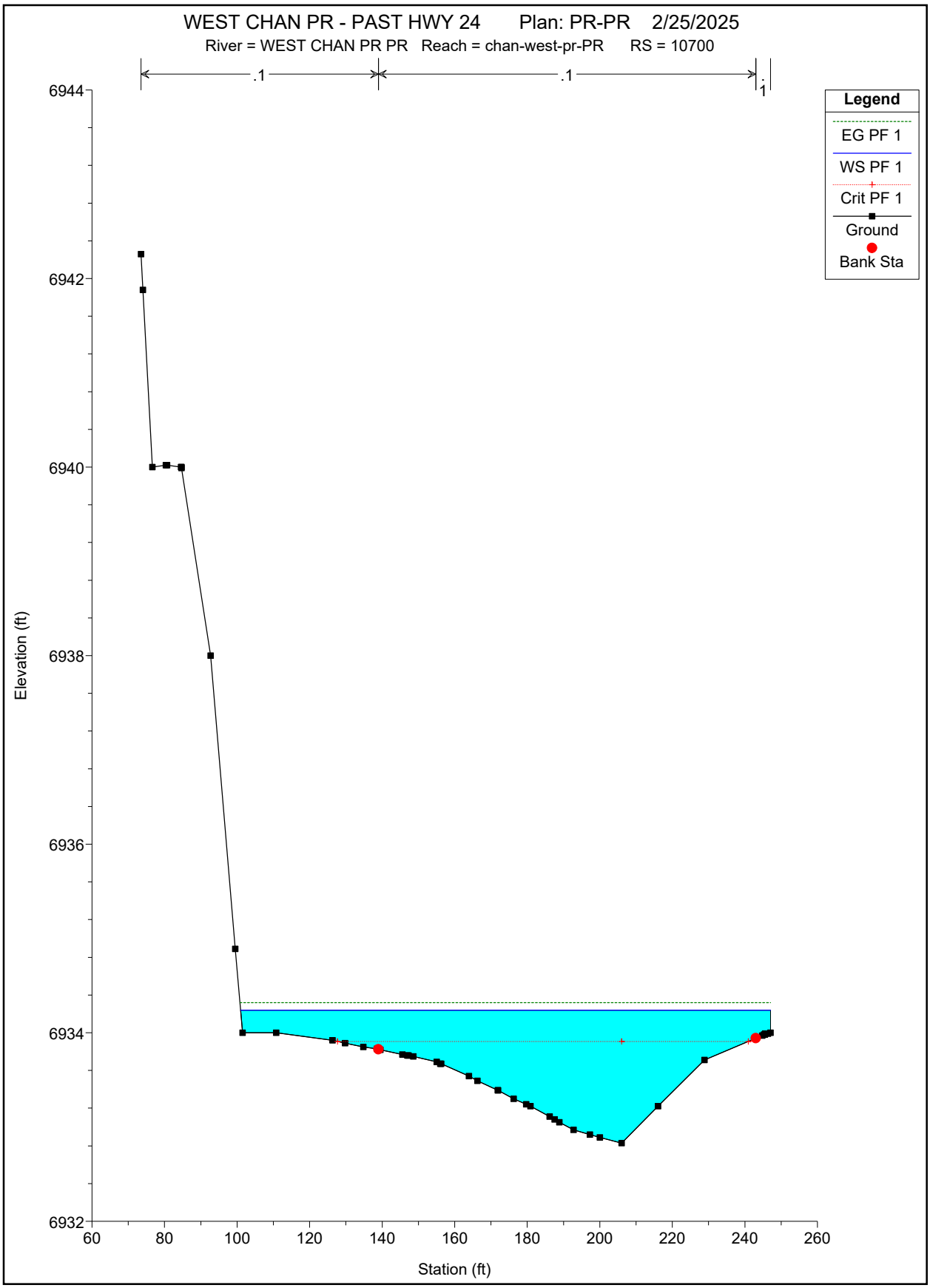

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 11300
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6950
6948
6946
6944
6942
6940
6938
0
100
200
300
400
Station (ft)

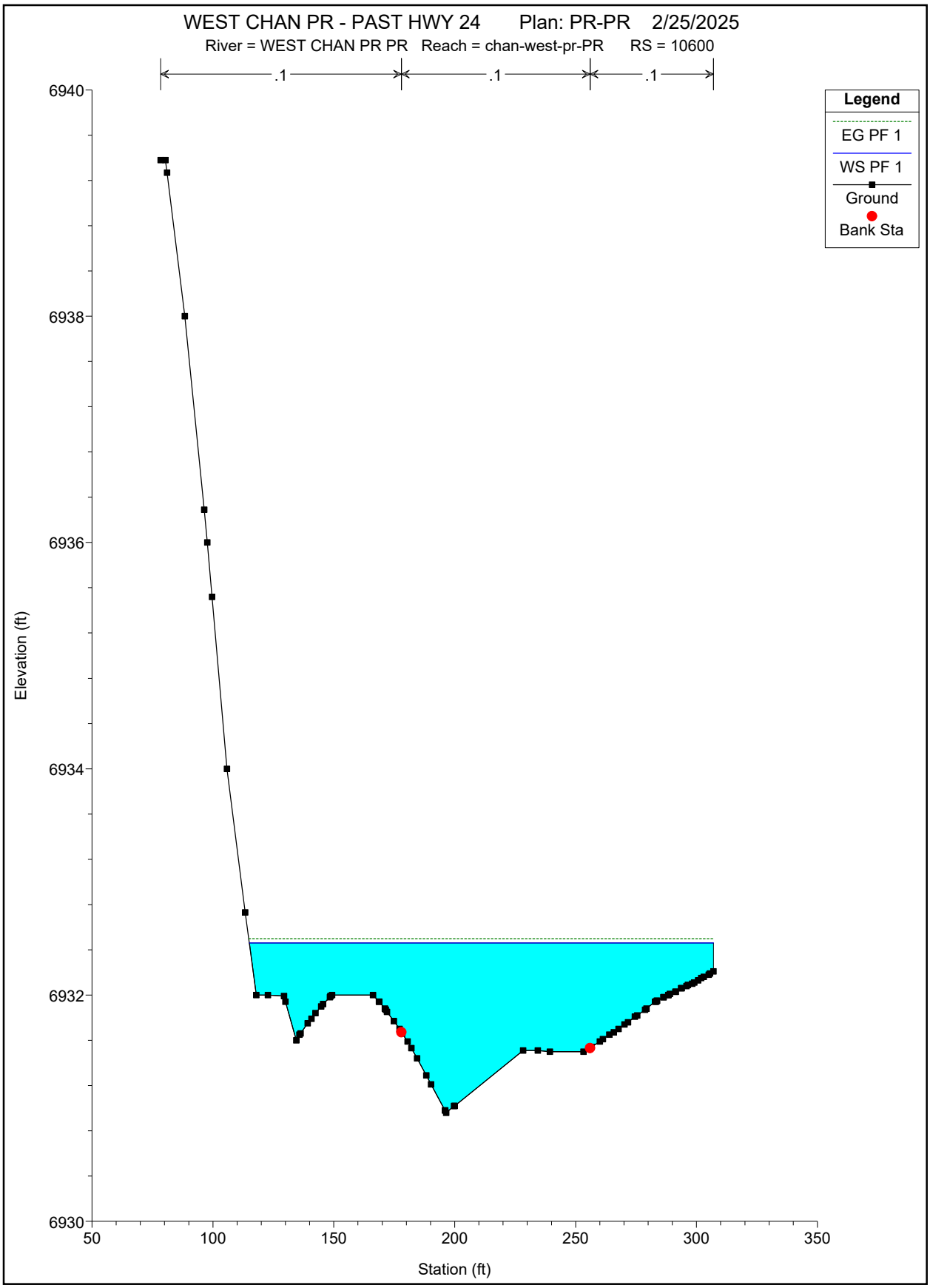

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 11200
.06
.06
.06
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6948
6946
6944
6942
6940
6938
0
50
100
150
200
250
300
350
Station (ft)

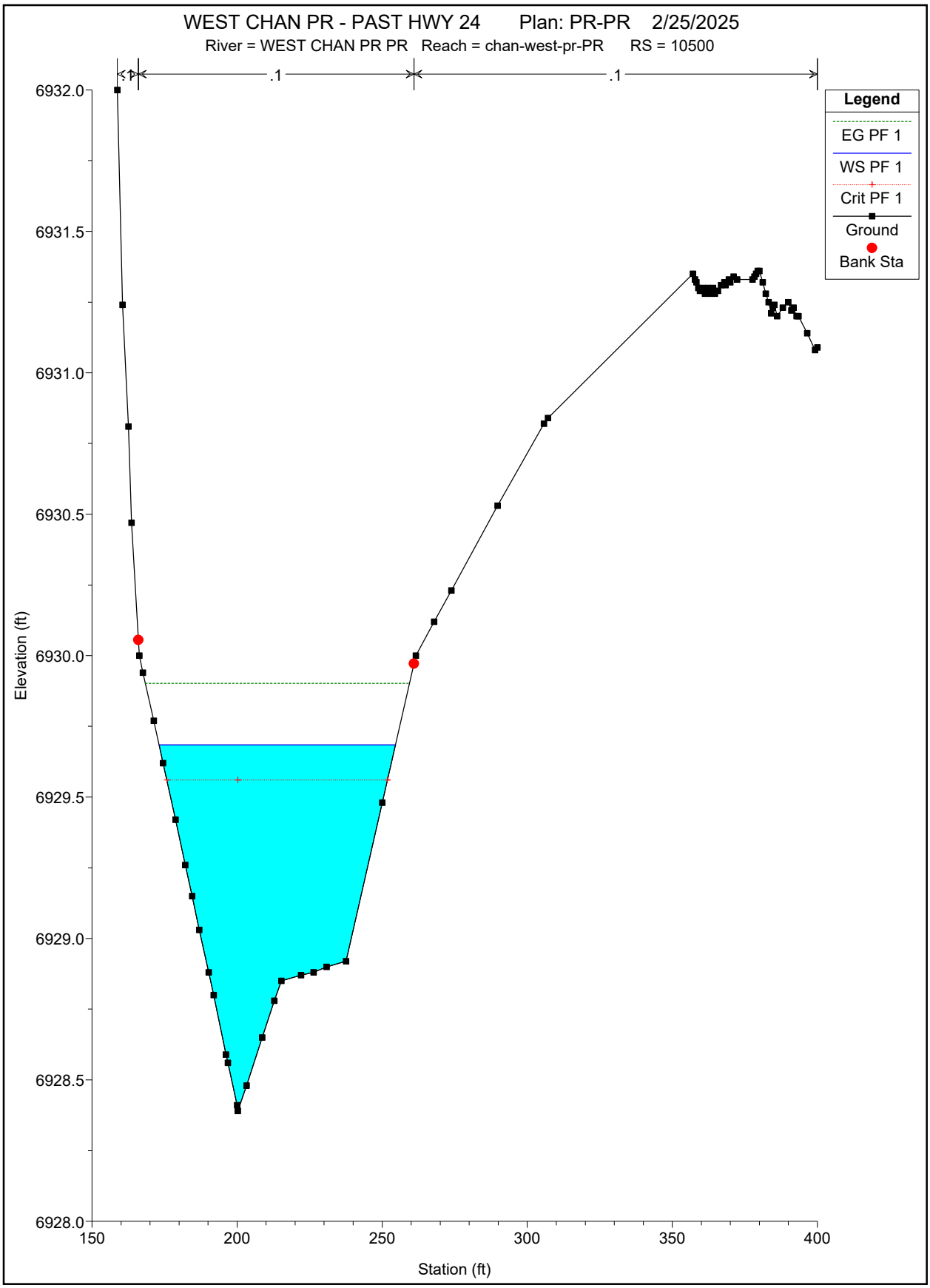

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 11042.5 Culv
.06
.06
.06
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6948
6946
6944
6942
6940
6938
6936
6934
0
50
100
150
200
250
300
350
Station (ft)

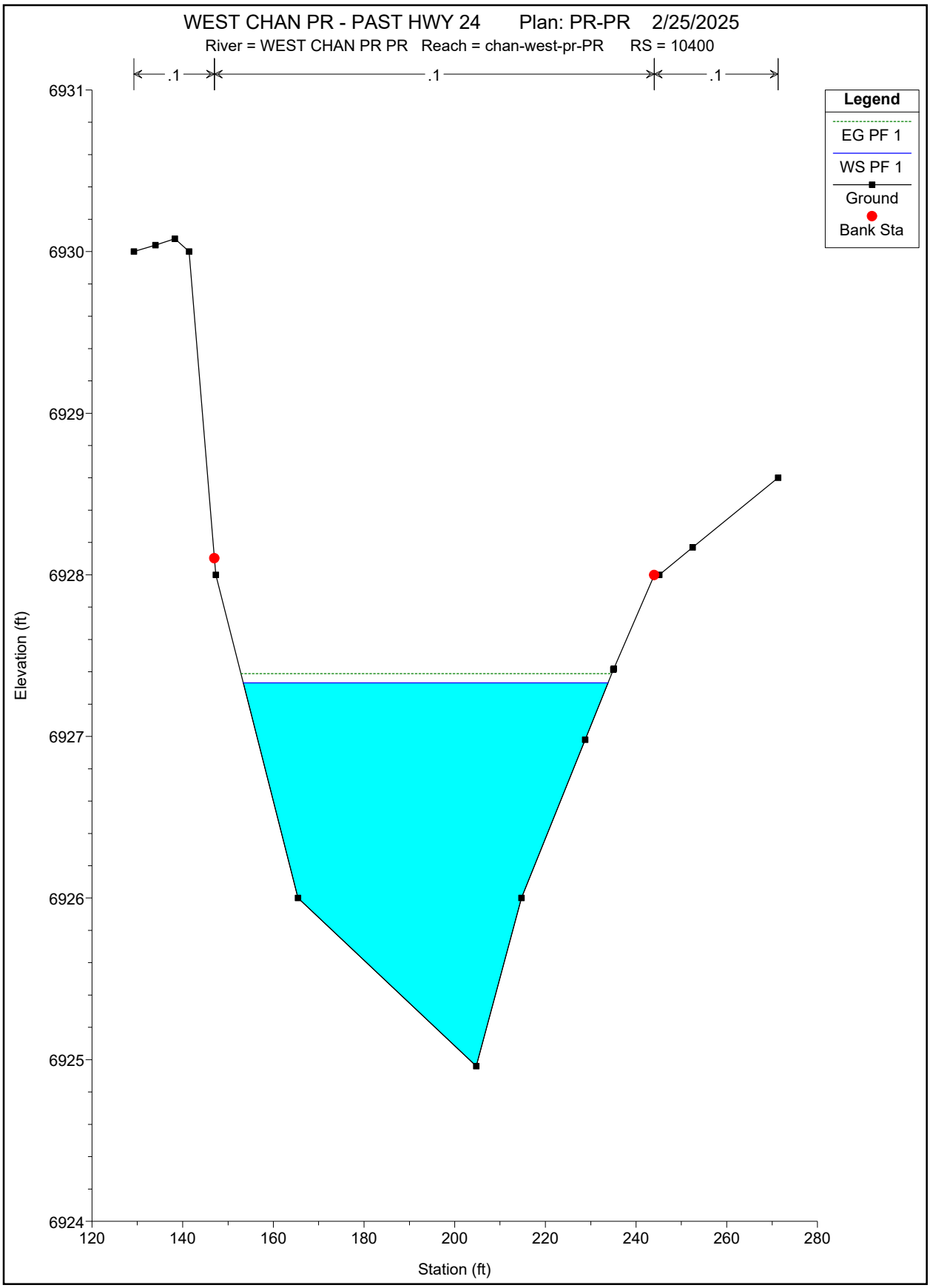

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 10900
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6944
6942
6940
6938
6936
6934
Elevation (ft)
0
100
200
300
400
500
Station (ft)

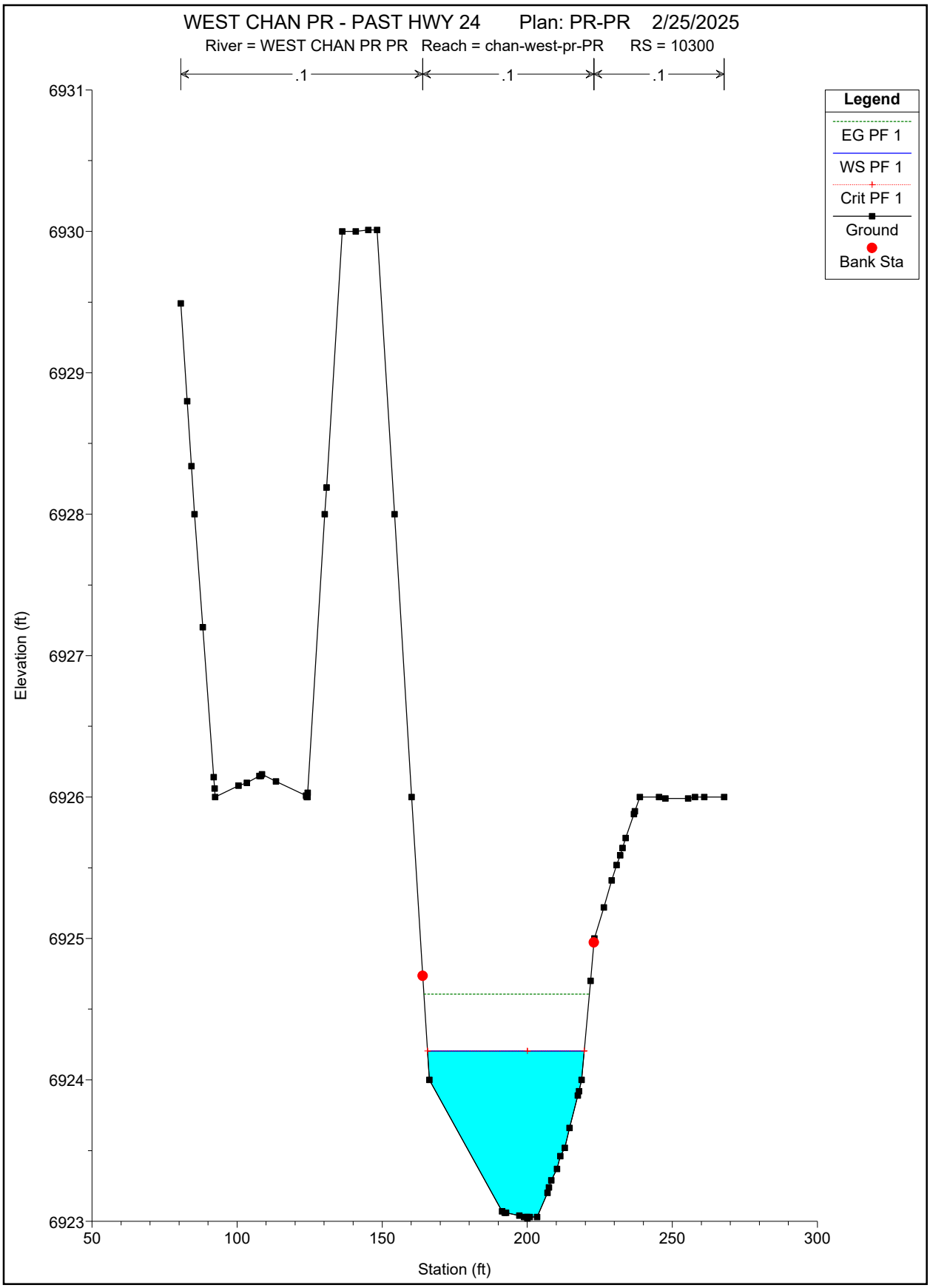

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 10800
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6944
6942
6940
6938
6936
6934
Elevation (ft)
0
100
200
300
400
Station (ft)

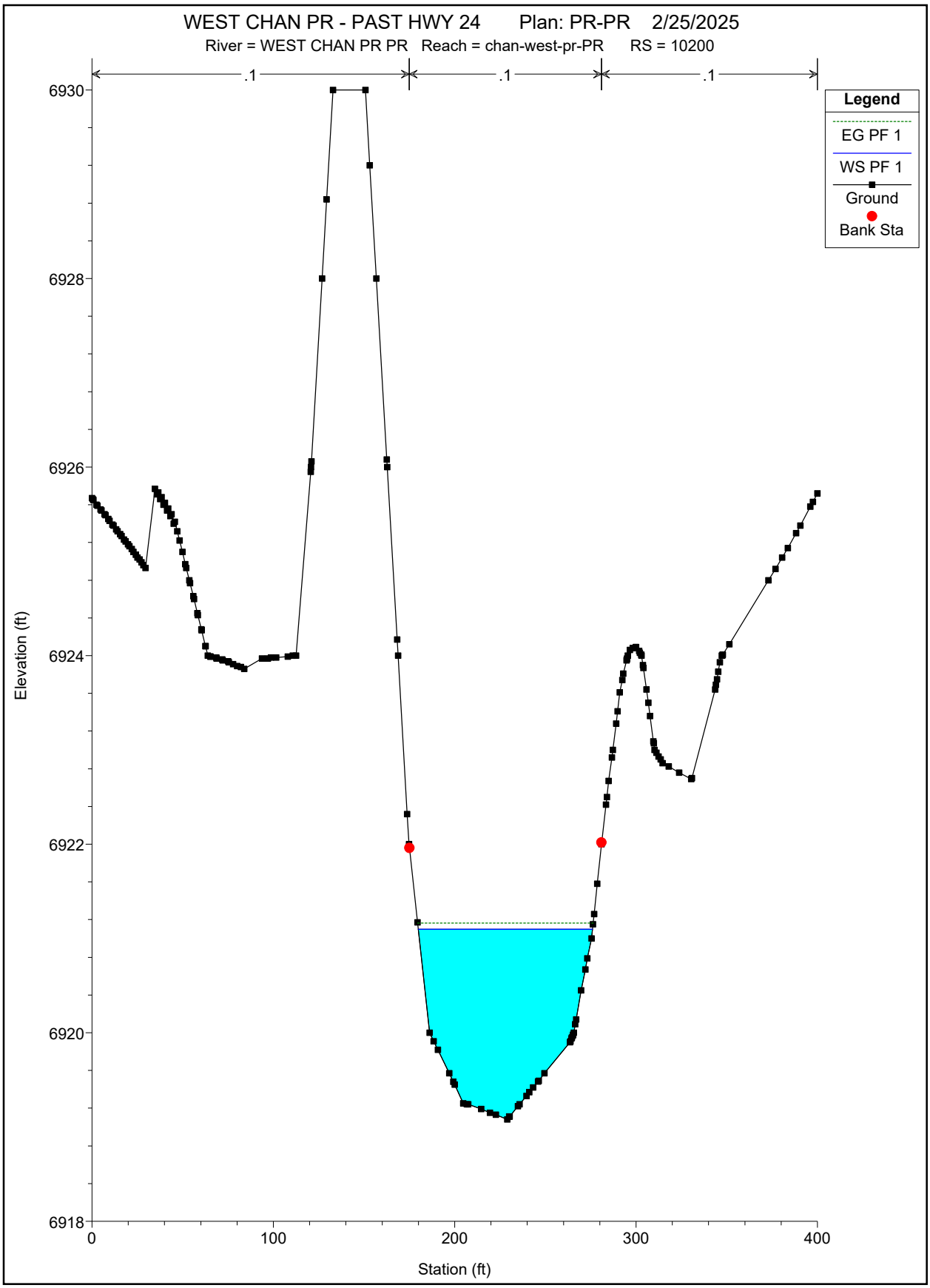

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 10700
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6944
6942
6940
6938
6936
6934
6932
60
80
100
120
140
160
180
200
220
240
260
Station (ft)

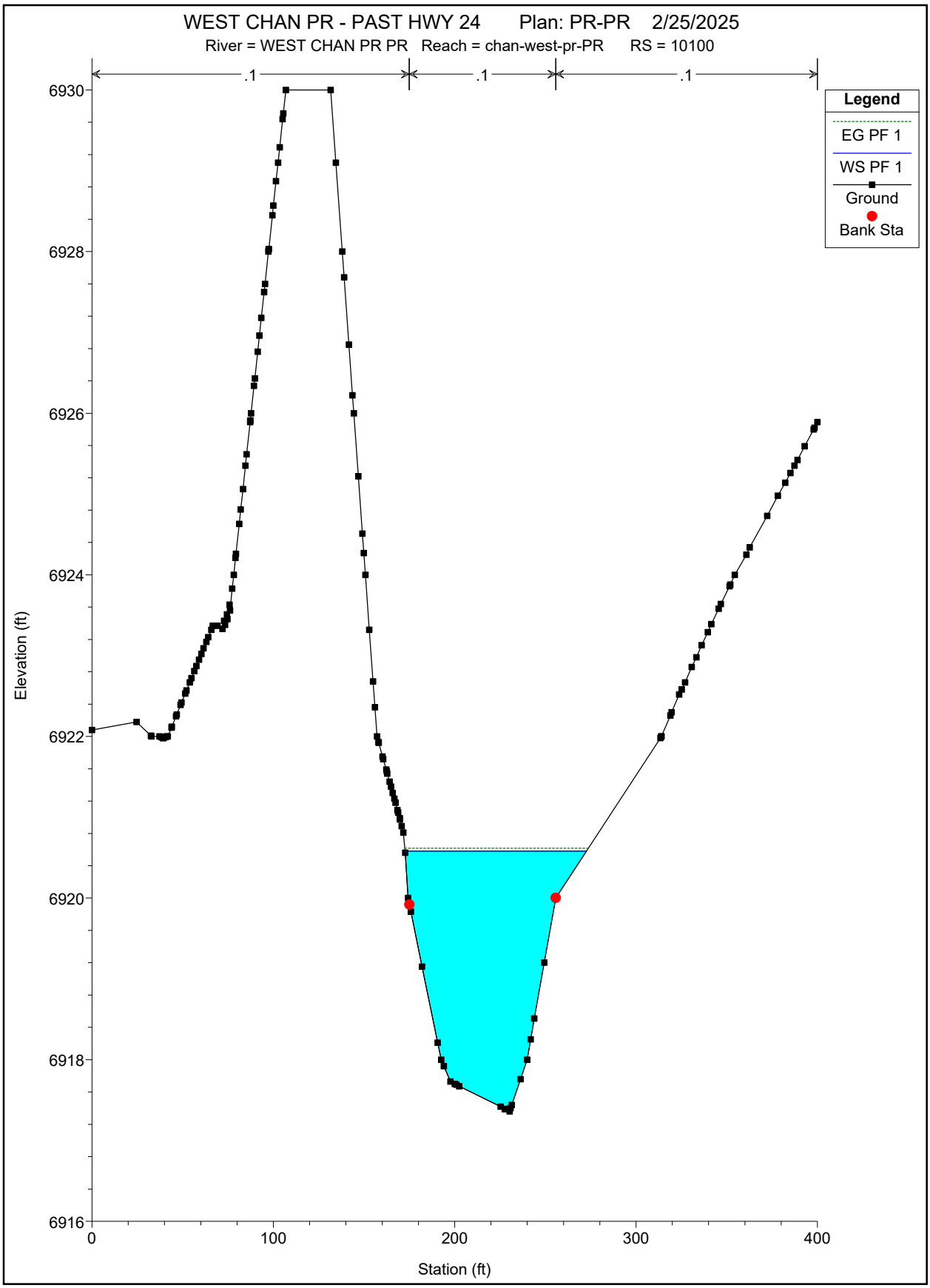

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 10600
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6940
6938
6936
6934
6932
6930
Elevation (ft)
50
100
150
200
250
300
350
Station (ft)

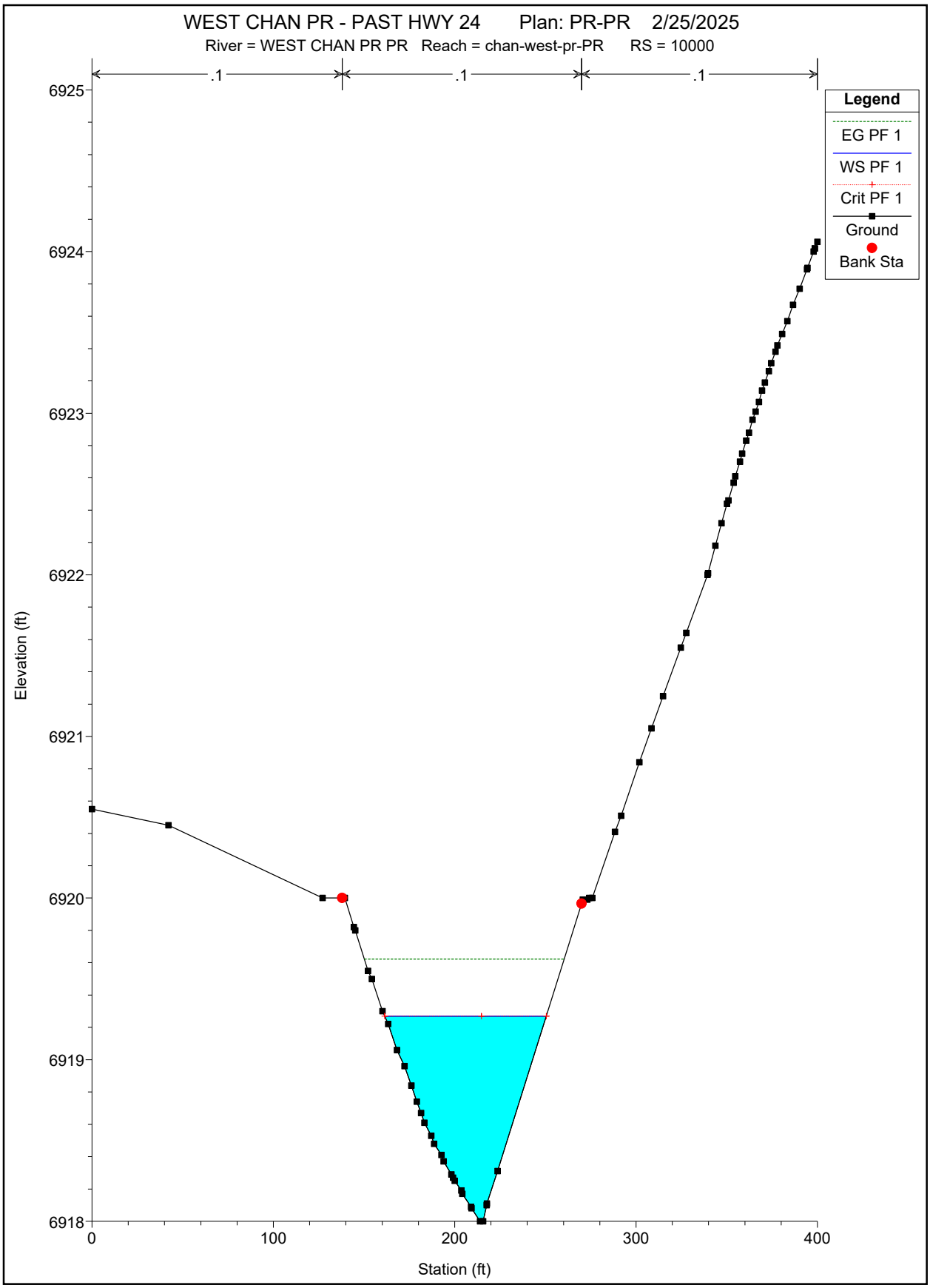

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 10500
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6932.0
6931.5
6931.0
6930.5
6930.0
6929.5
6929.0
6928.5
6928.0
150
200
250
300
350
400
Station (ft)

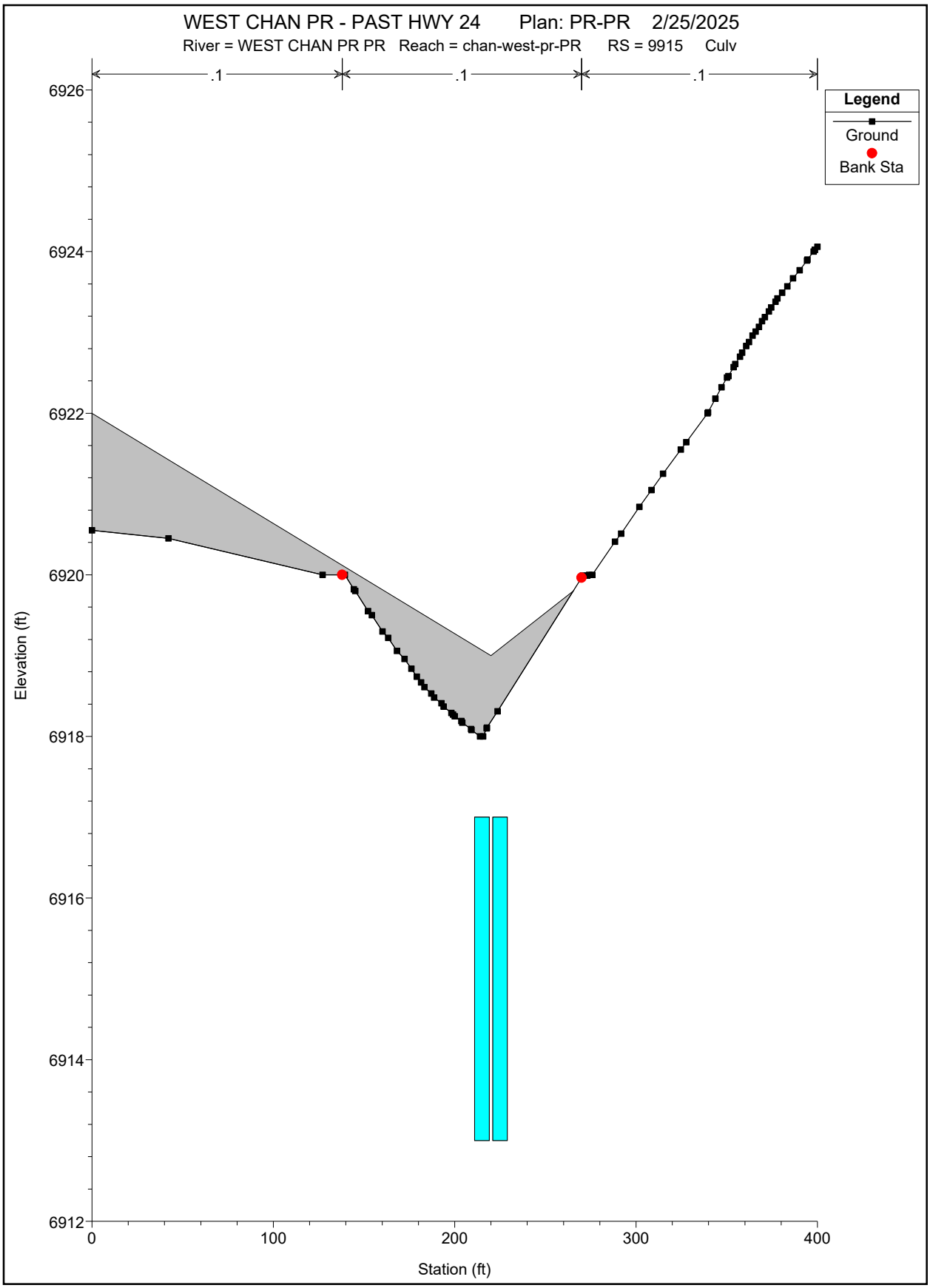

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 10400
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6931
6930
6929
6928
6927
6926
6925
6924
120
140
160
180
200
220
240
260
280
Station (ft)

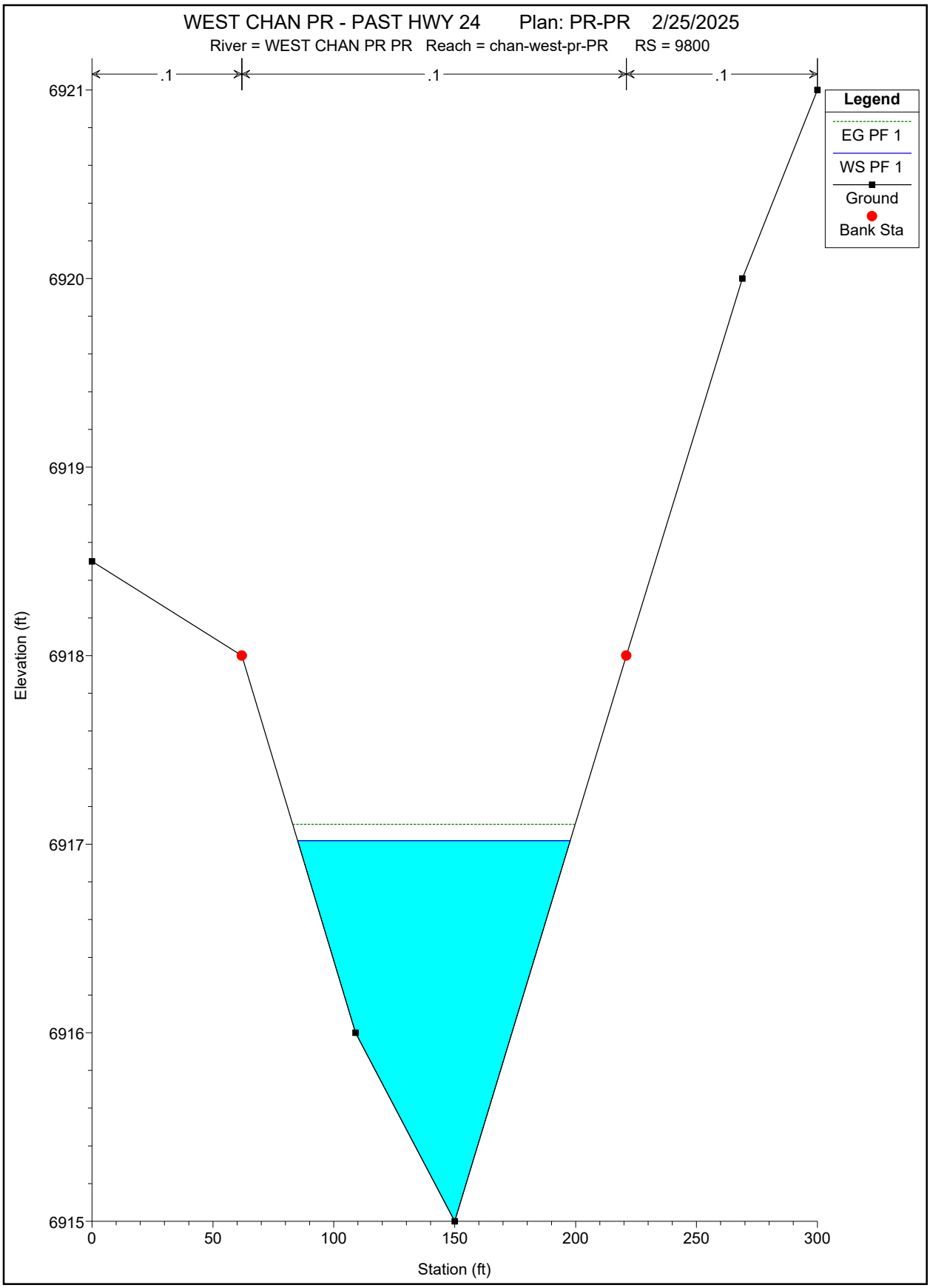

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 10300
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6931
6930
6929
6928
6927
6926
6925
6924
6923
50
100
150
200
250
300
Station (ft)

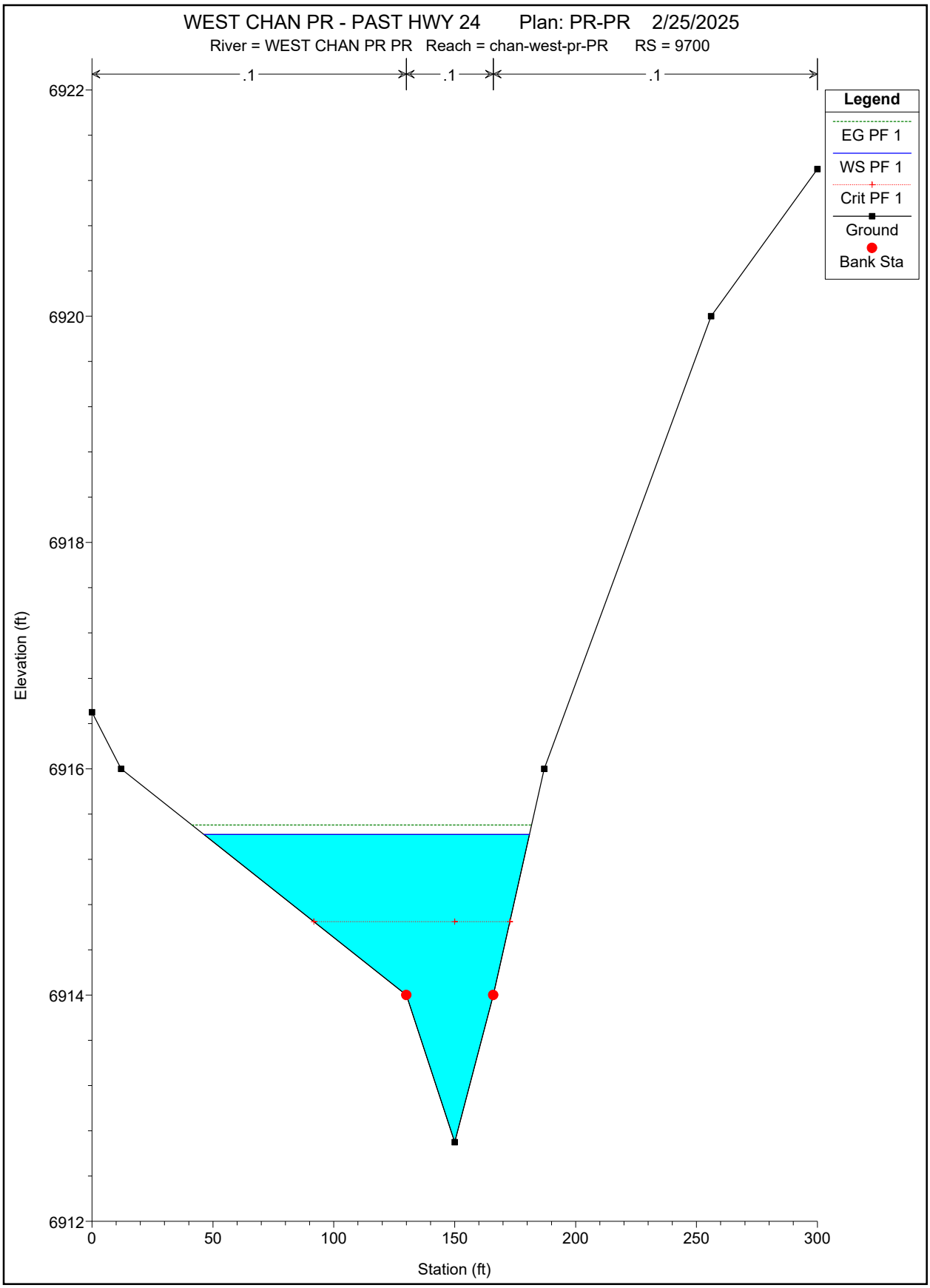

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 10200
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6930
6928
6926
6924
6922
6920
6918
0
100
200
300
400
Station (ft)

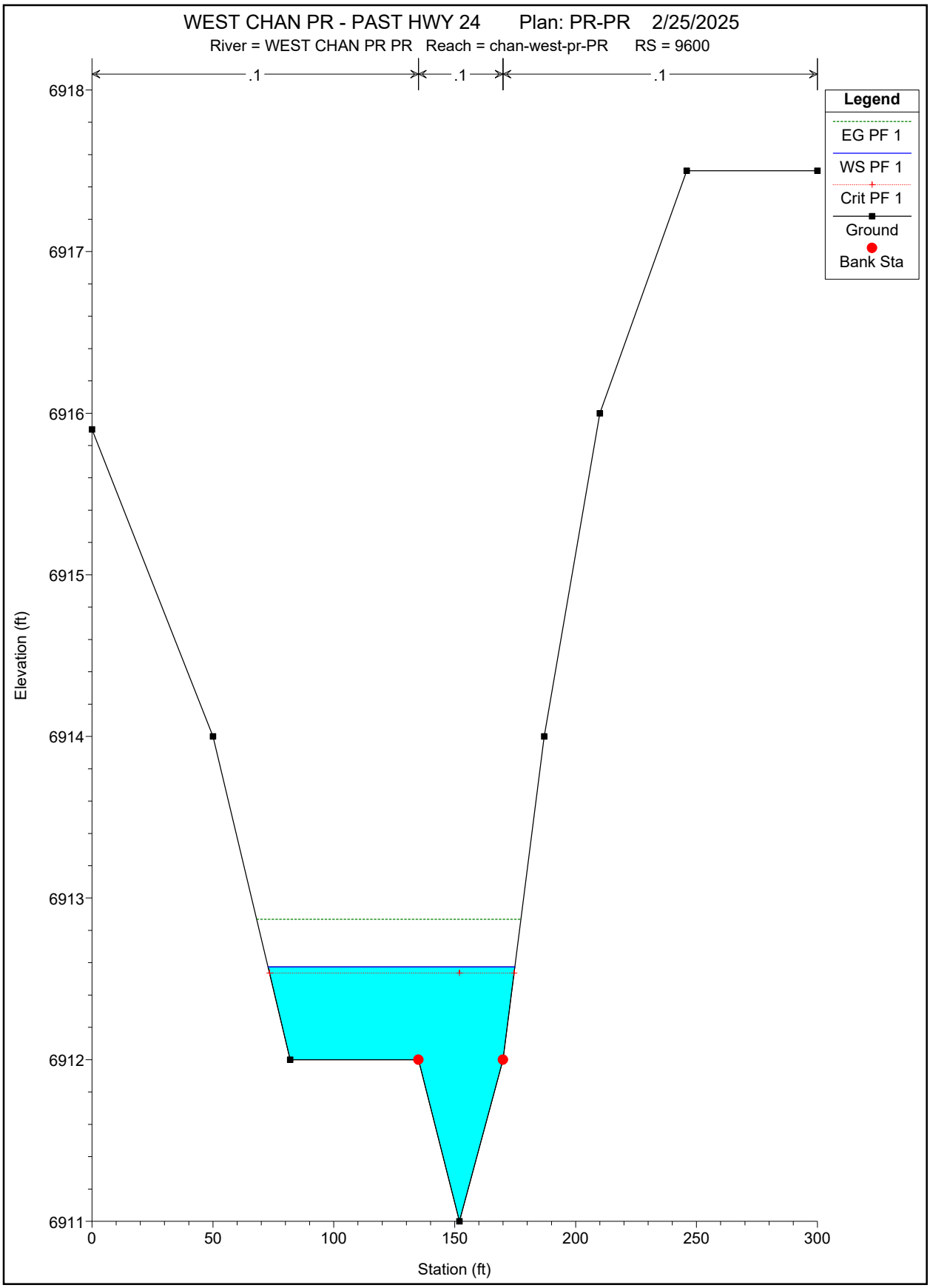

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 10100
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6930
6928
6926
6924
6922
6920
6918
6916
Elevation (ft)
0
100
200
300
400
Station (ft)

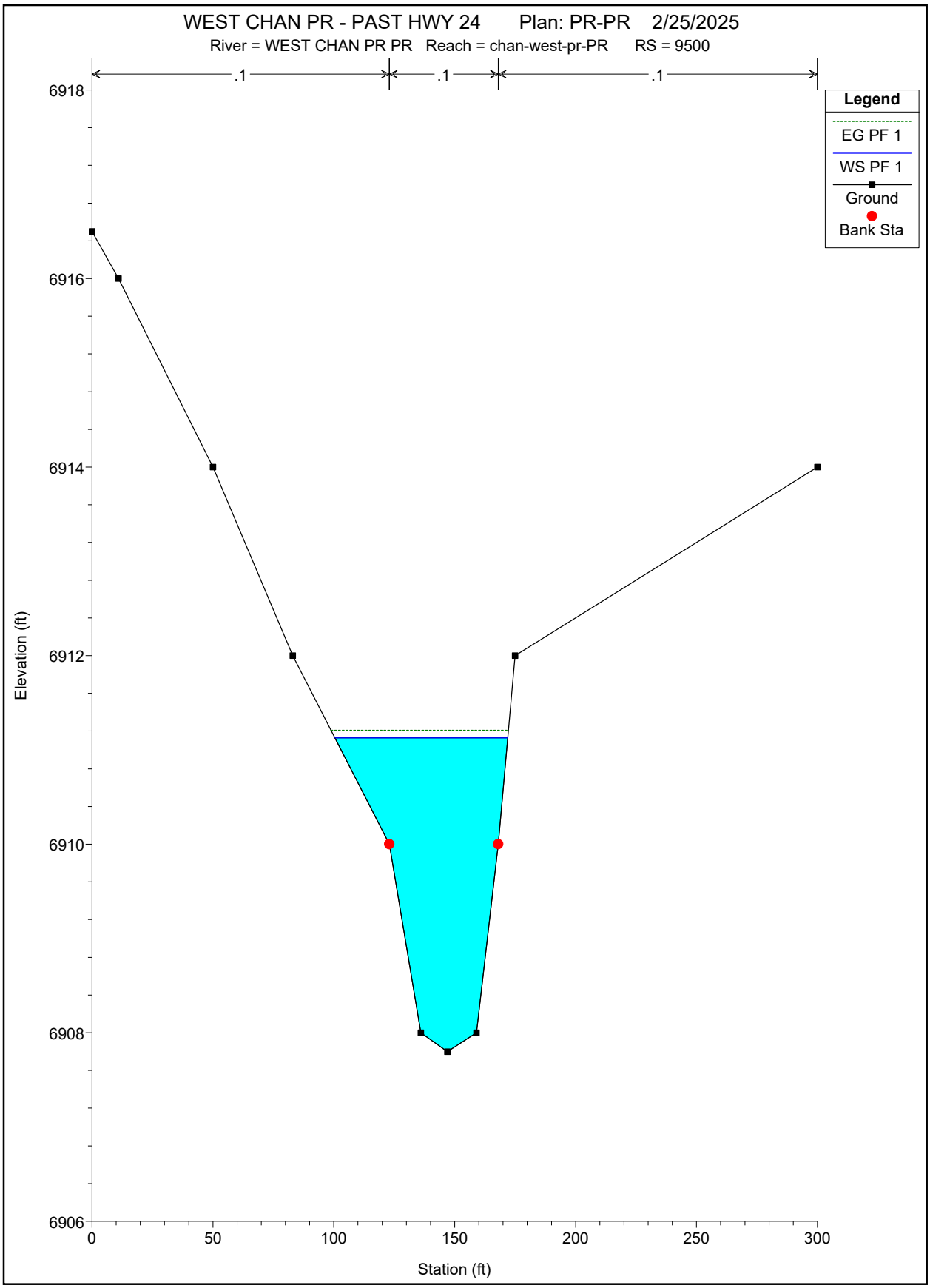

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 10000
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6925
6924
6923
6922
6921
6920
6919
6918
Elevation (ft)
0
100
200
300
400
Station (ft)

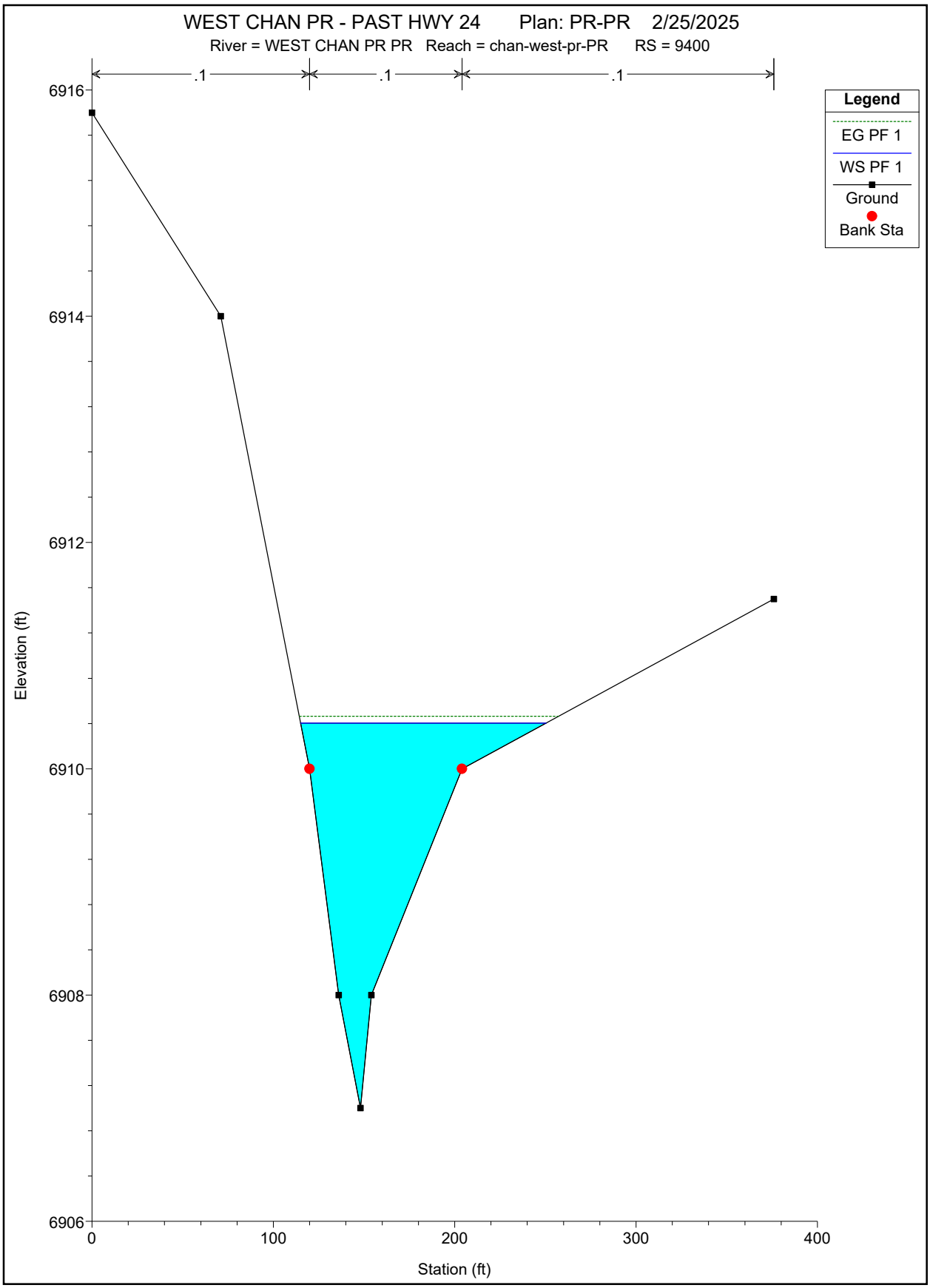

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 9915 Culv
.1
.1
.1
Legend
Ground
Bank Sta
6926
6924
6922
6920
6918
6916
6914
6912
Elevation (ft)
0
100
200
300
400
Station (ft)

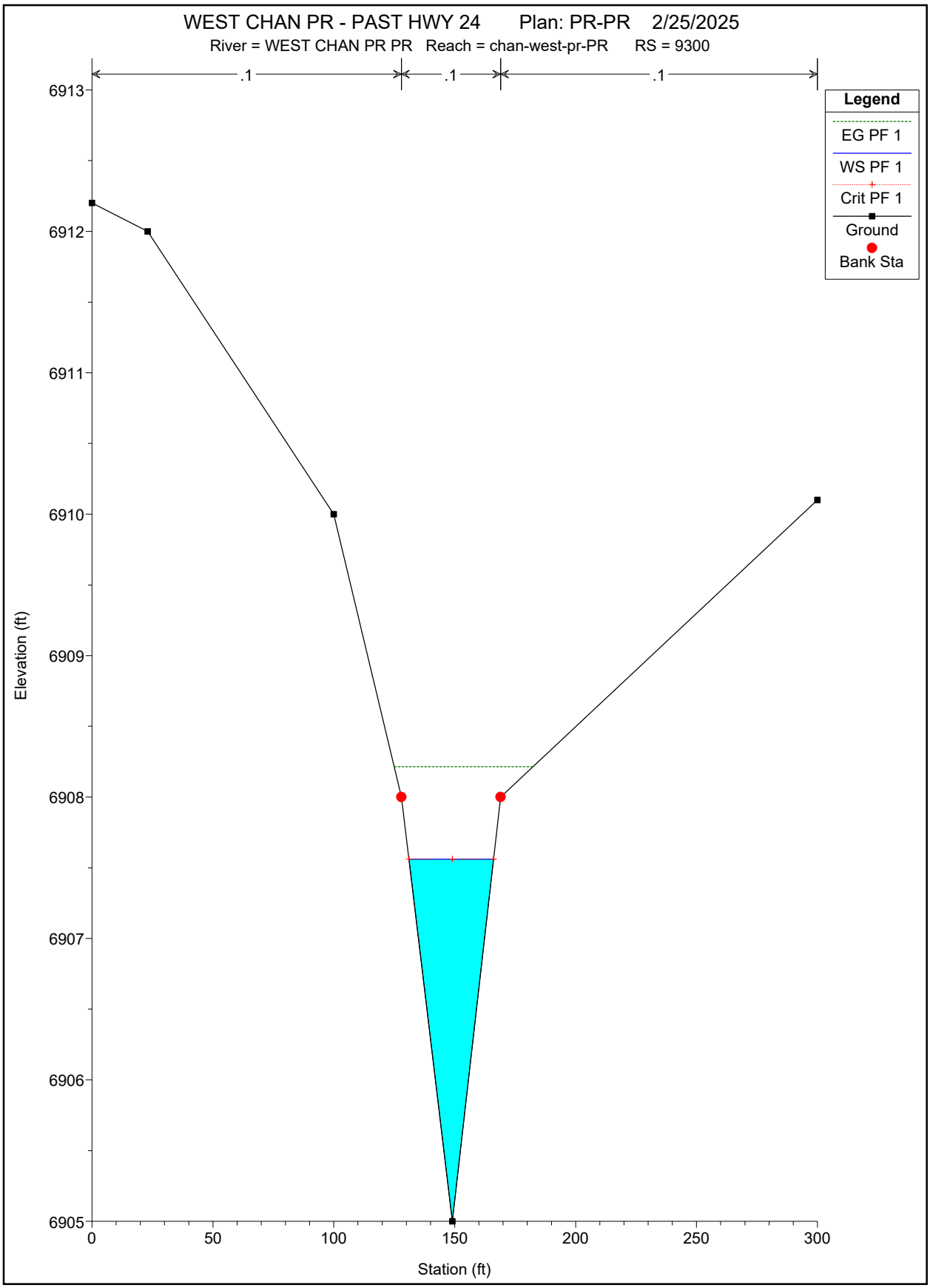

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 9800
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6921
6920
6919
6918
6917
6916
6915
0
50
100
150
200
250
300
Station (ft)

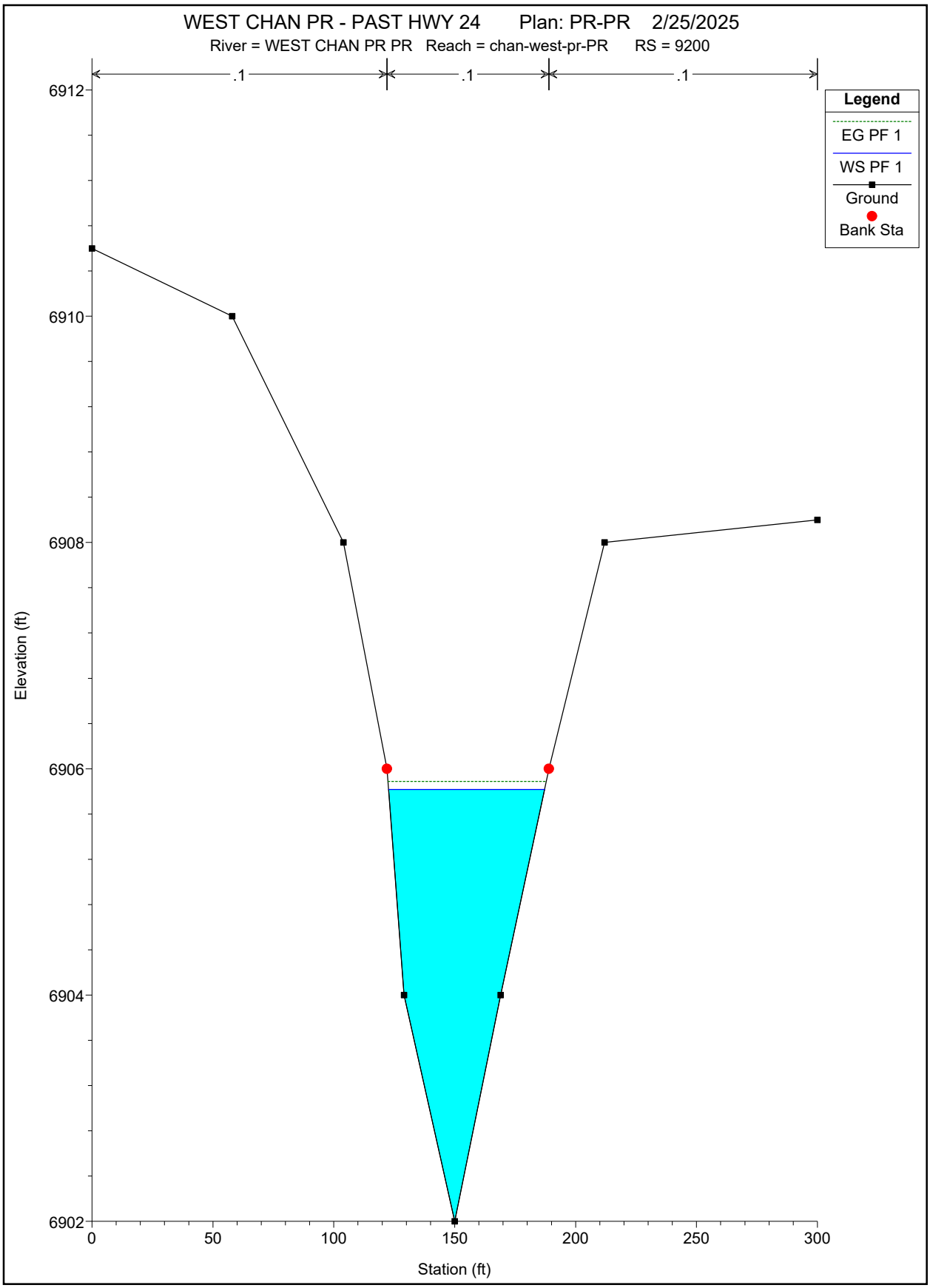

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 9700
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6922
6920
6918
6916
6914
6912
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

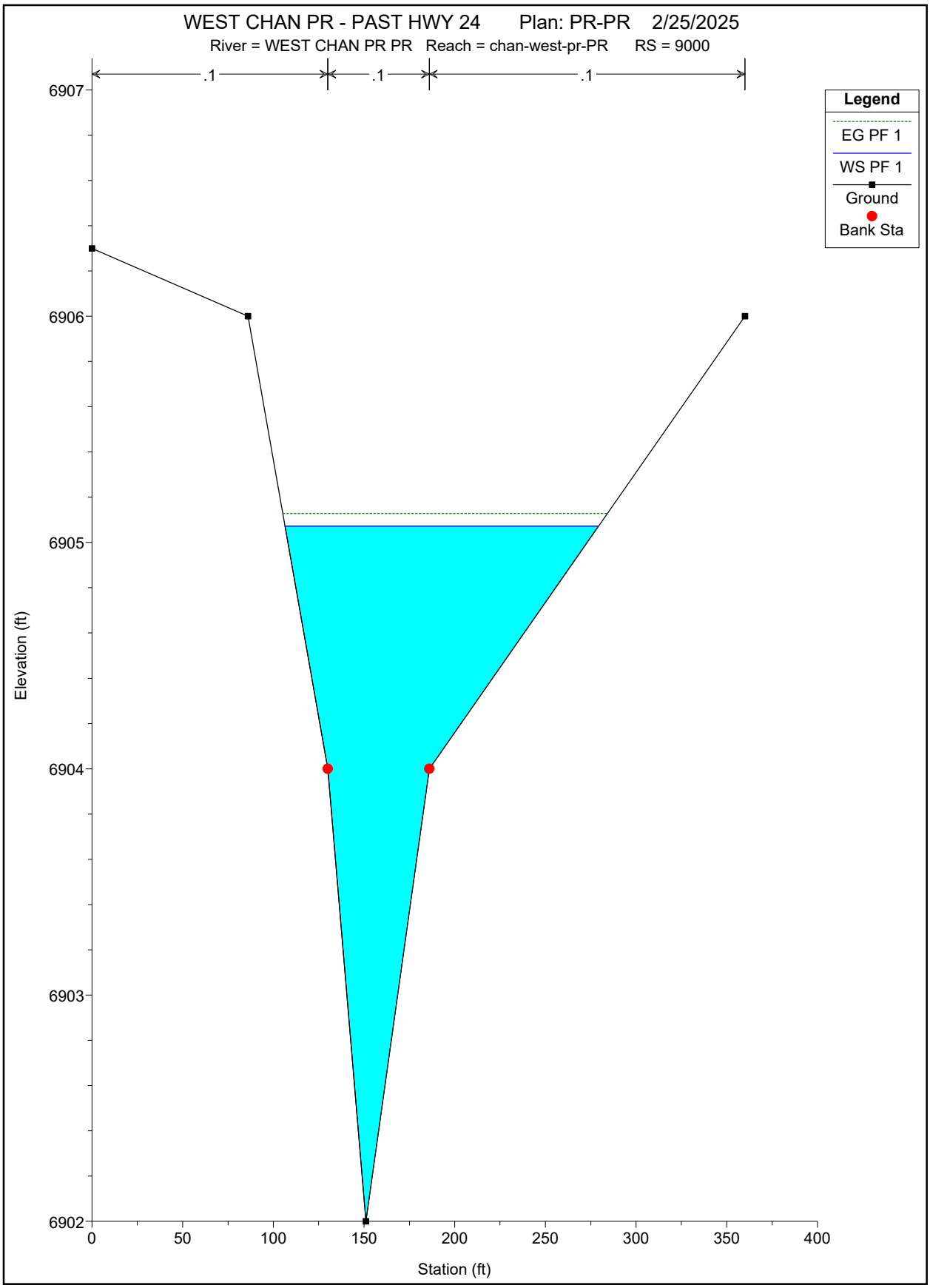

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 9600
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6918
6917
6916
6915
6914
6913
6912
6911
0
50
100
150
200
250
300
Station (ft)

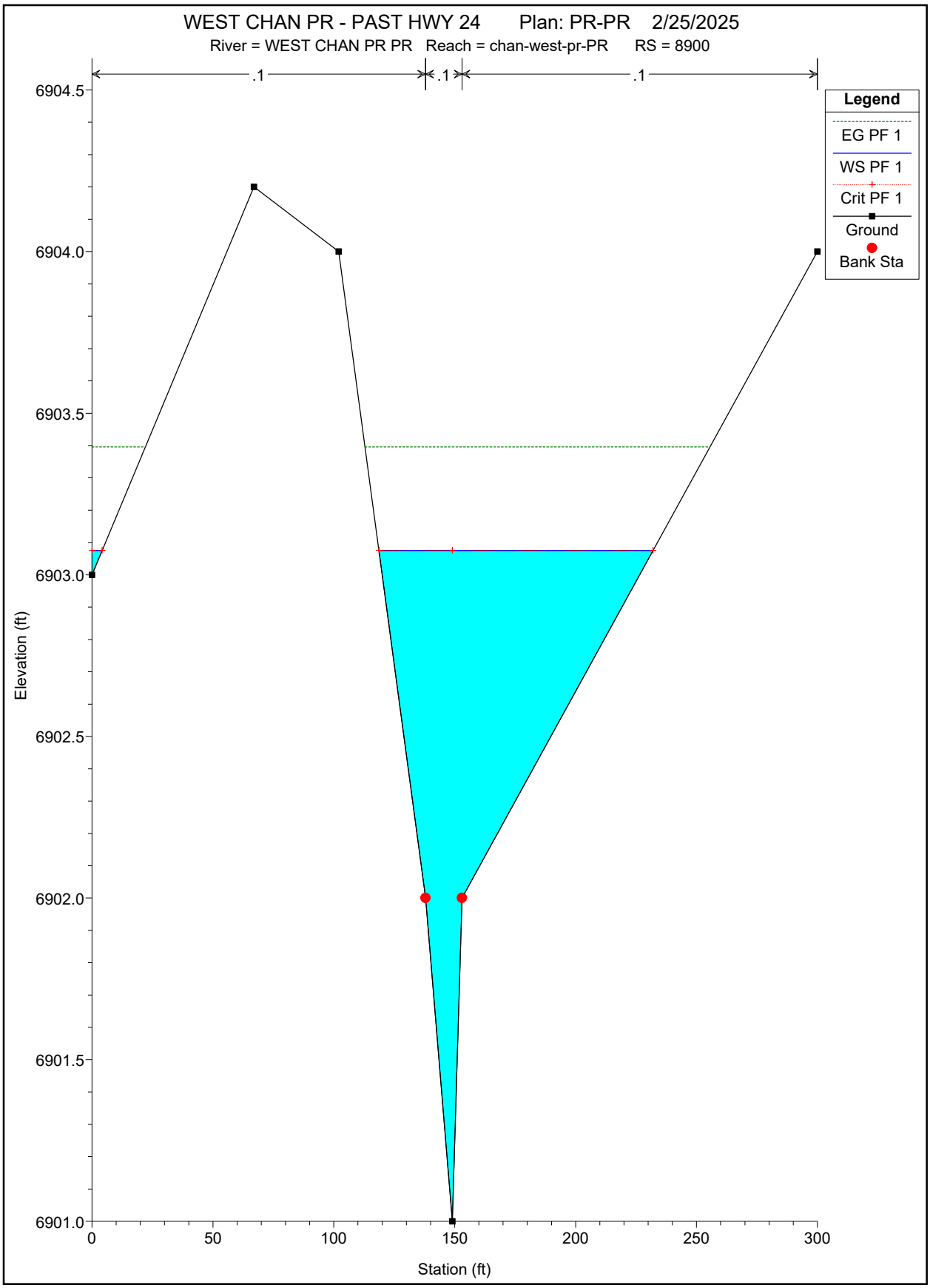

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 9500
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6918
6916
6914
6912
6910
6908
6906
0
50
100
150
200
250
300
Station (ft)

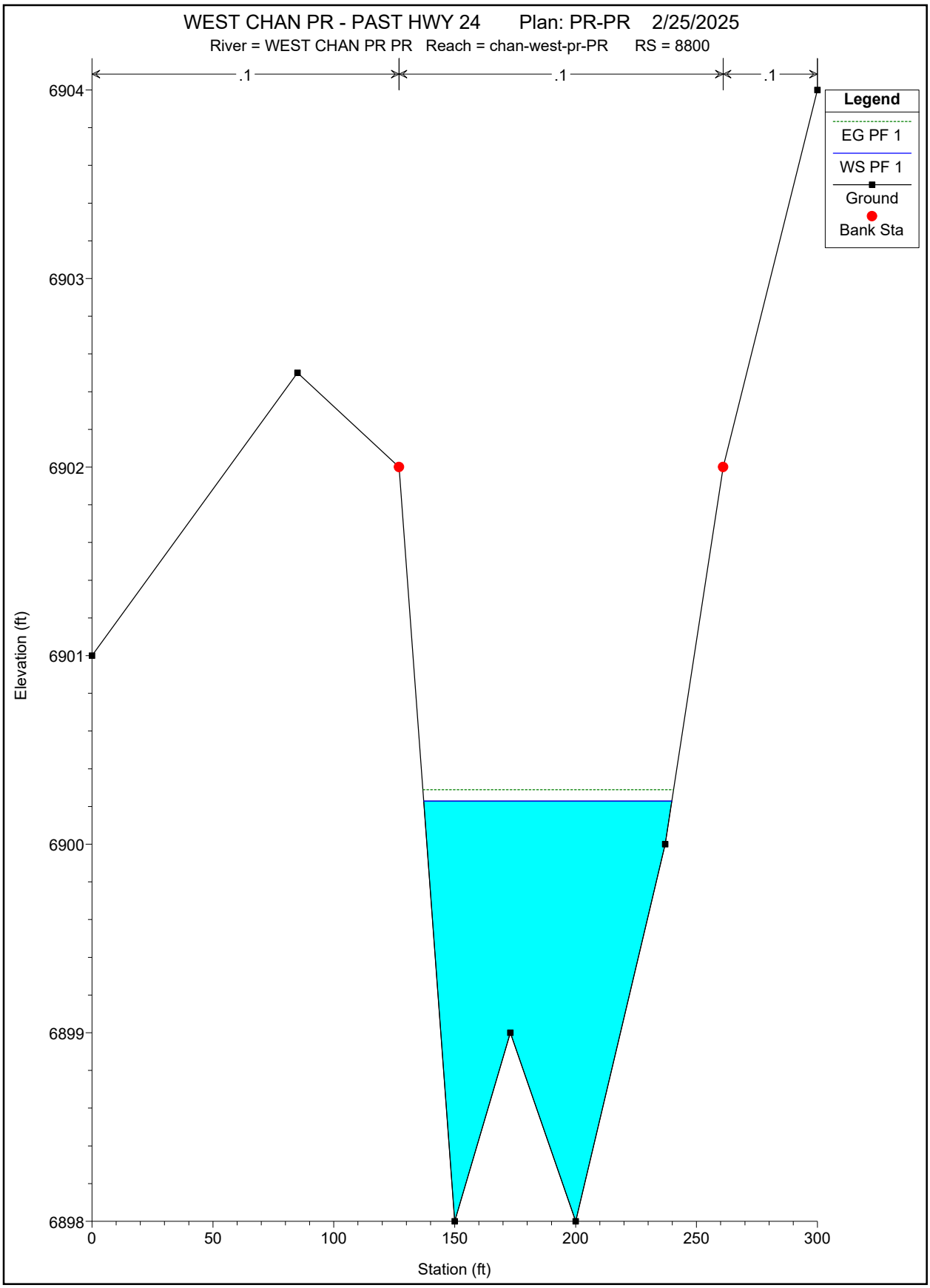

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 9400
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6916
6914
6912
6910
6908
6906
Elevation (ft)
0
100
200
300
400
Station (ft)

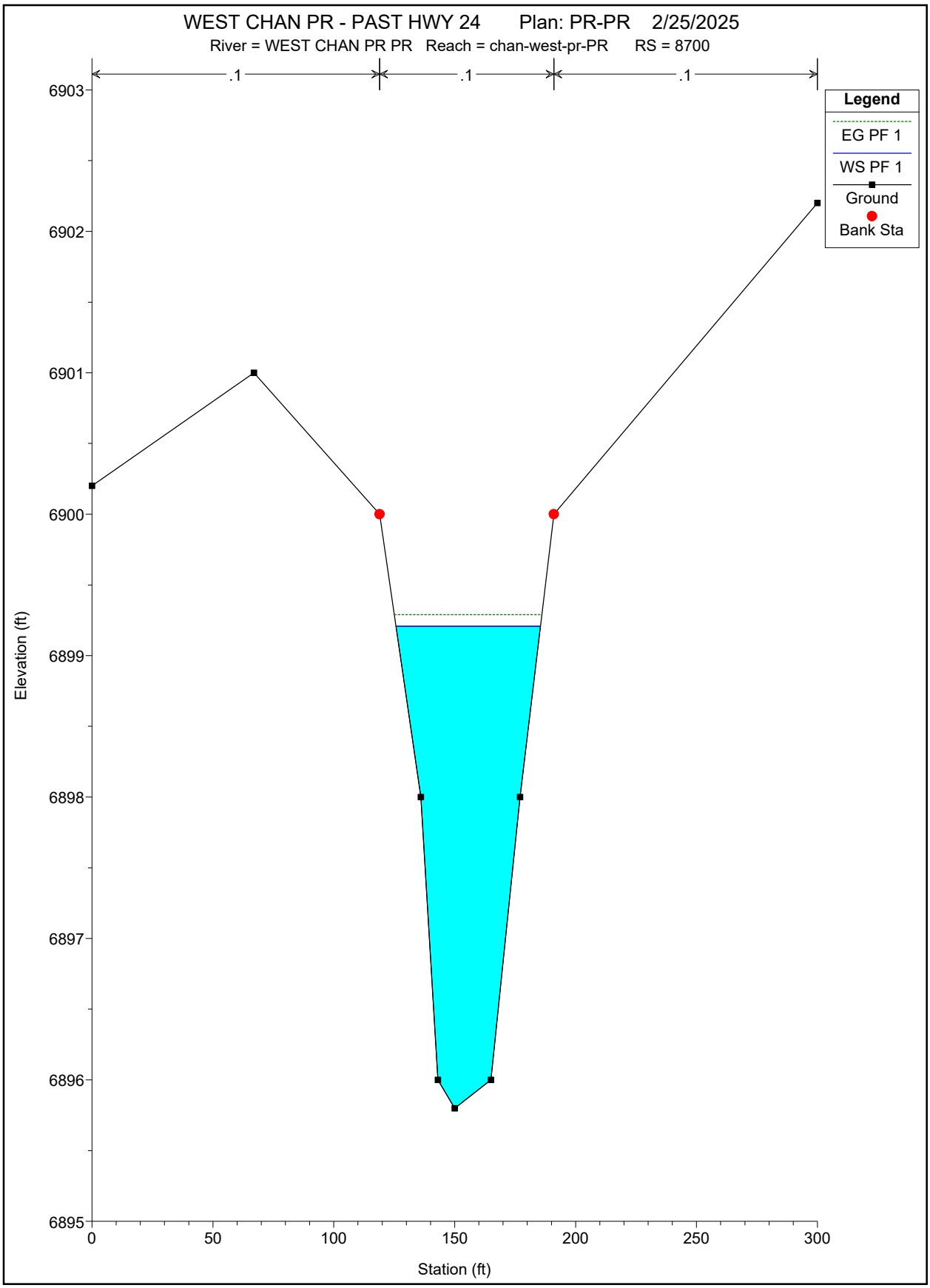

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 9300
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6913
6912
6911
6910
6909
6908
6907
6906
6905
0
50
100
150
200
250
300
Station (ft)

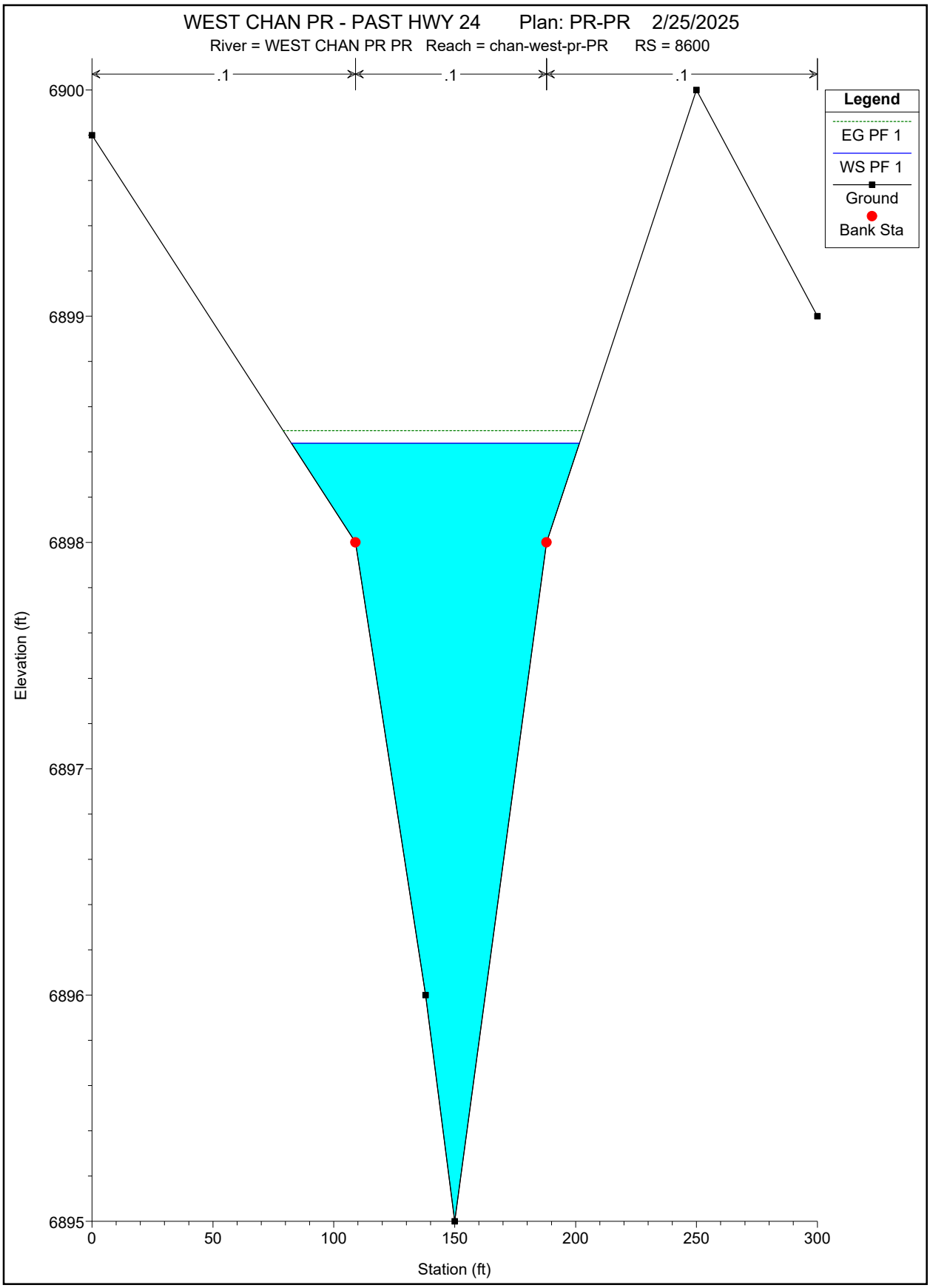

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 9200
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6912
6910
6908
6906
6904
6902
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

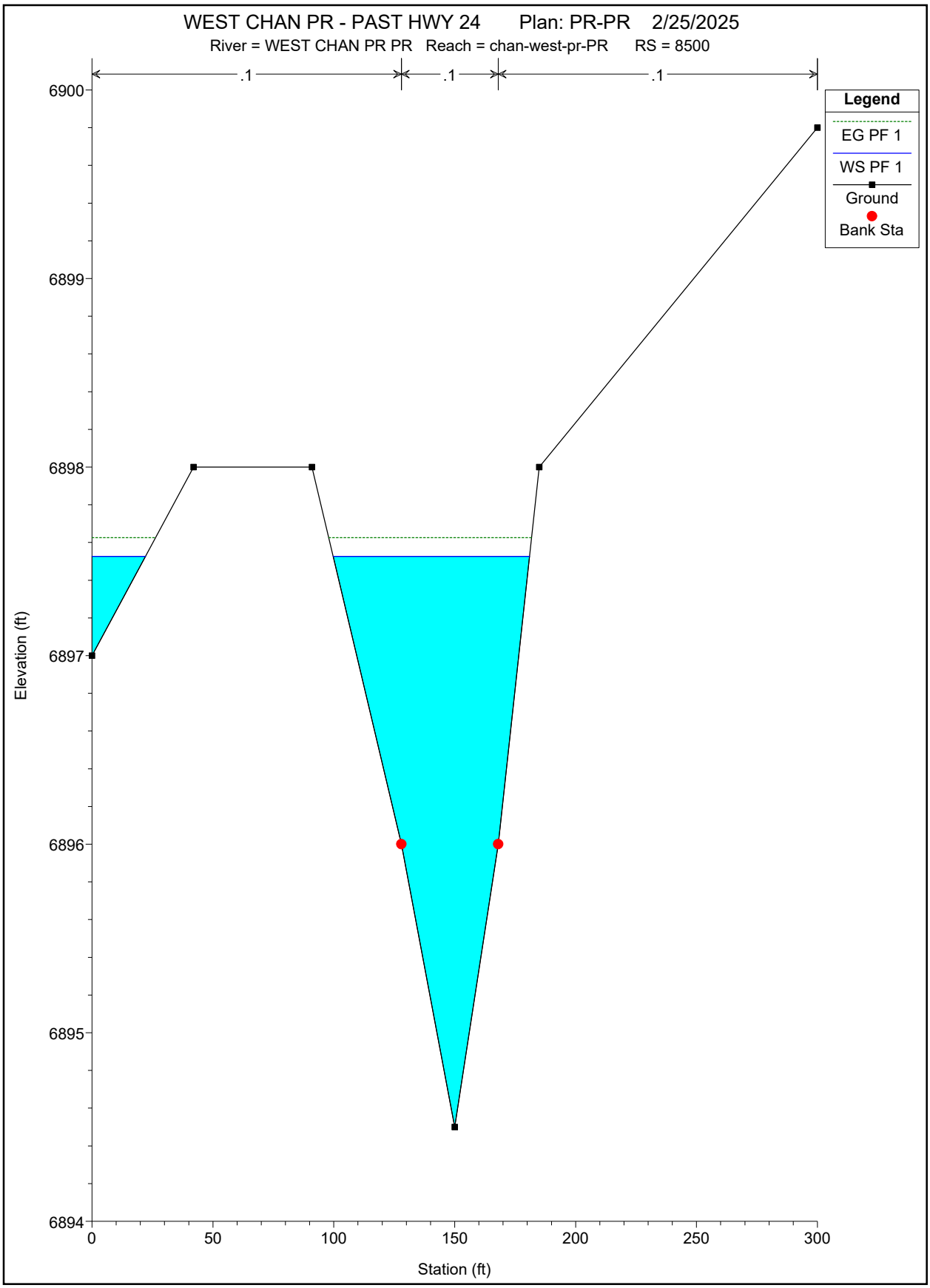

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 9000
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6907
6906
6905
6904
6903
6902
Elevation (ft)
0
50
100
150
200
250
300
350
400
Station (ft)

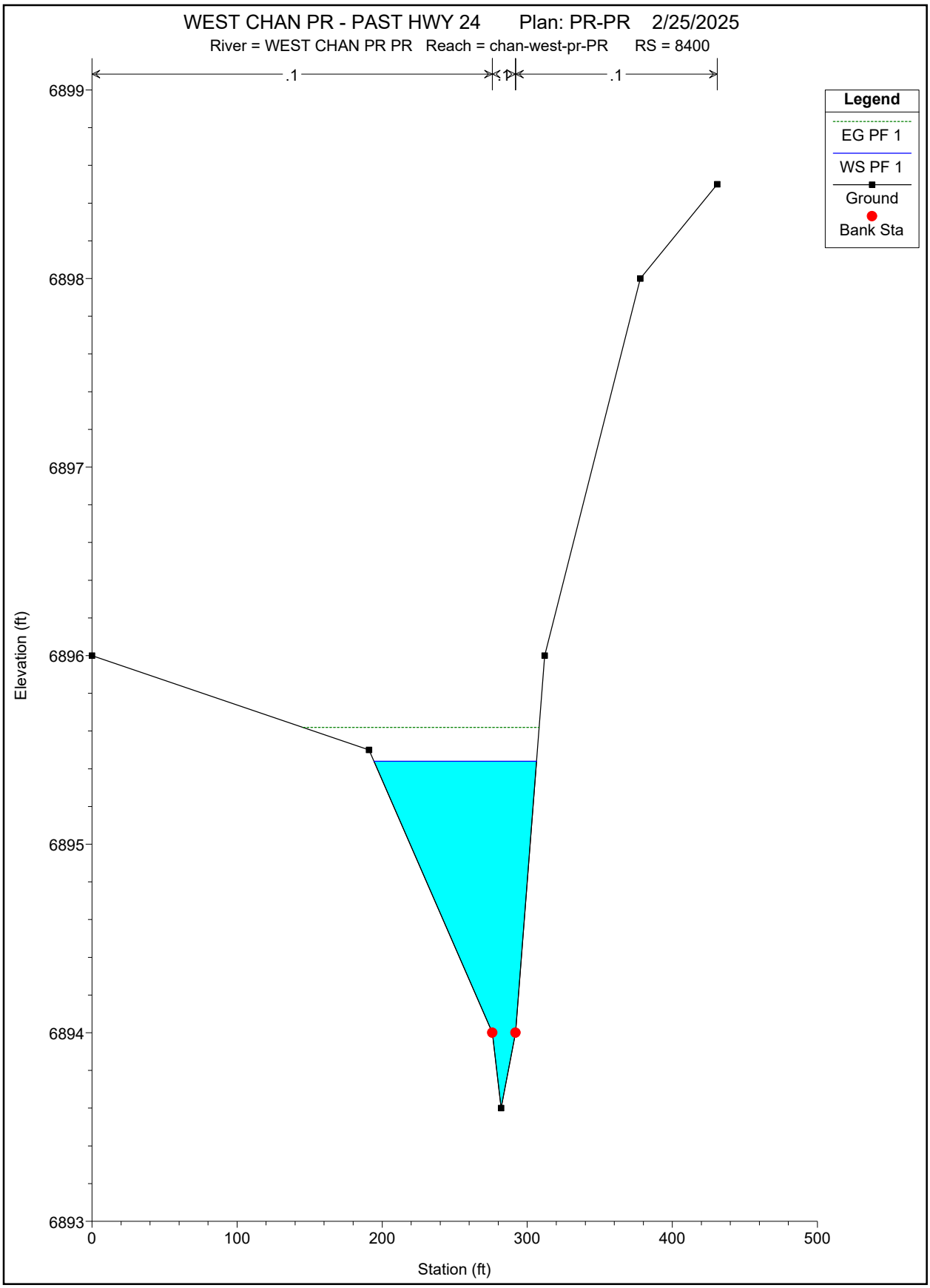

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 8900
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6904.5
6904.0
6903.5
6903.0
6902.5
6902.0
6901.5
6901.0
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

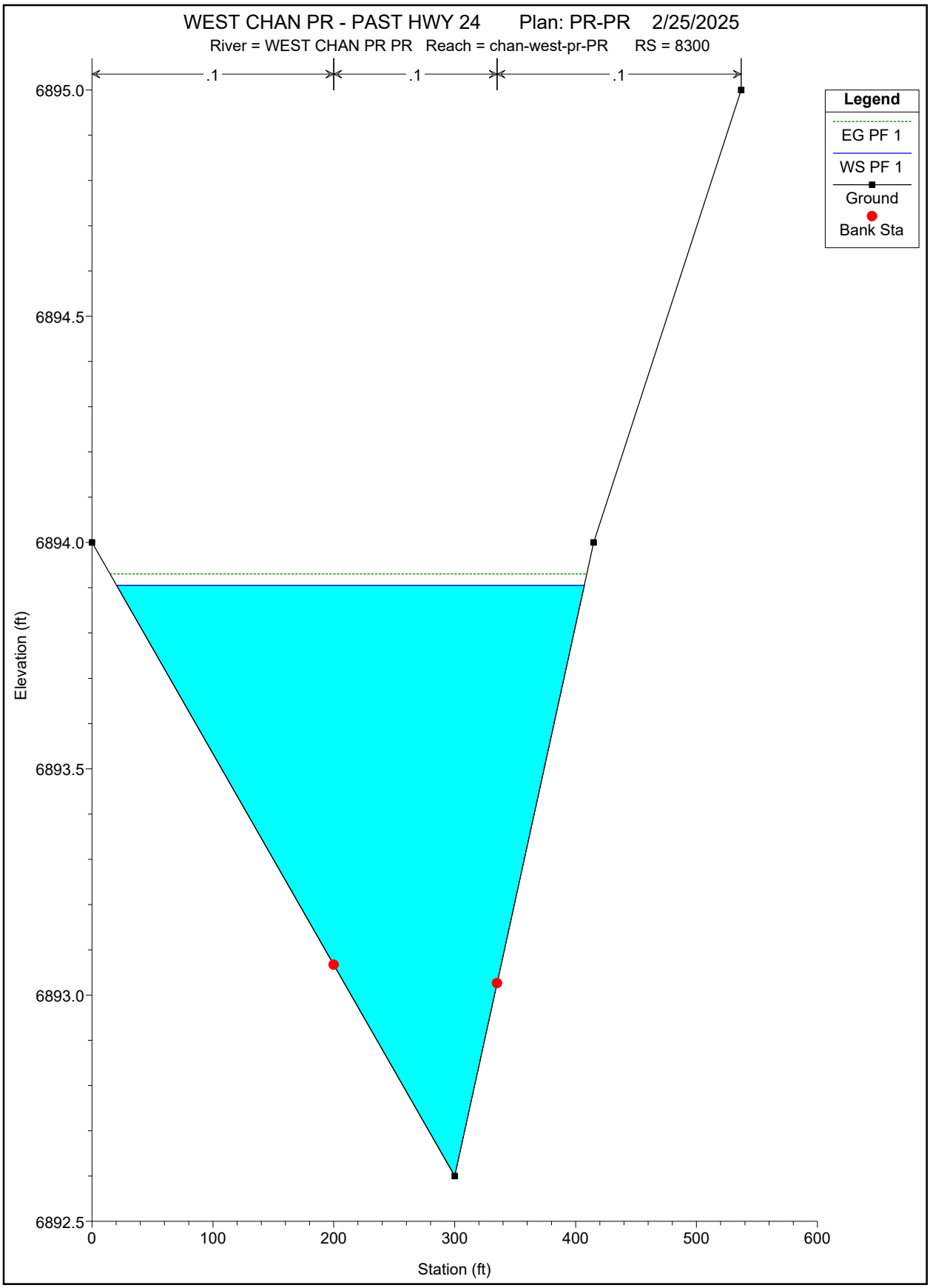

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 8800
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6904
6903
6902
6901
6900
6899
6898
0
50
100
150
200
250
300
Station (ft)

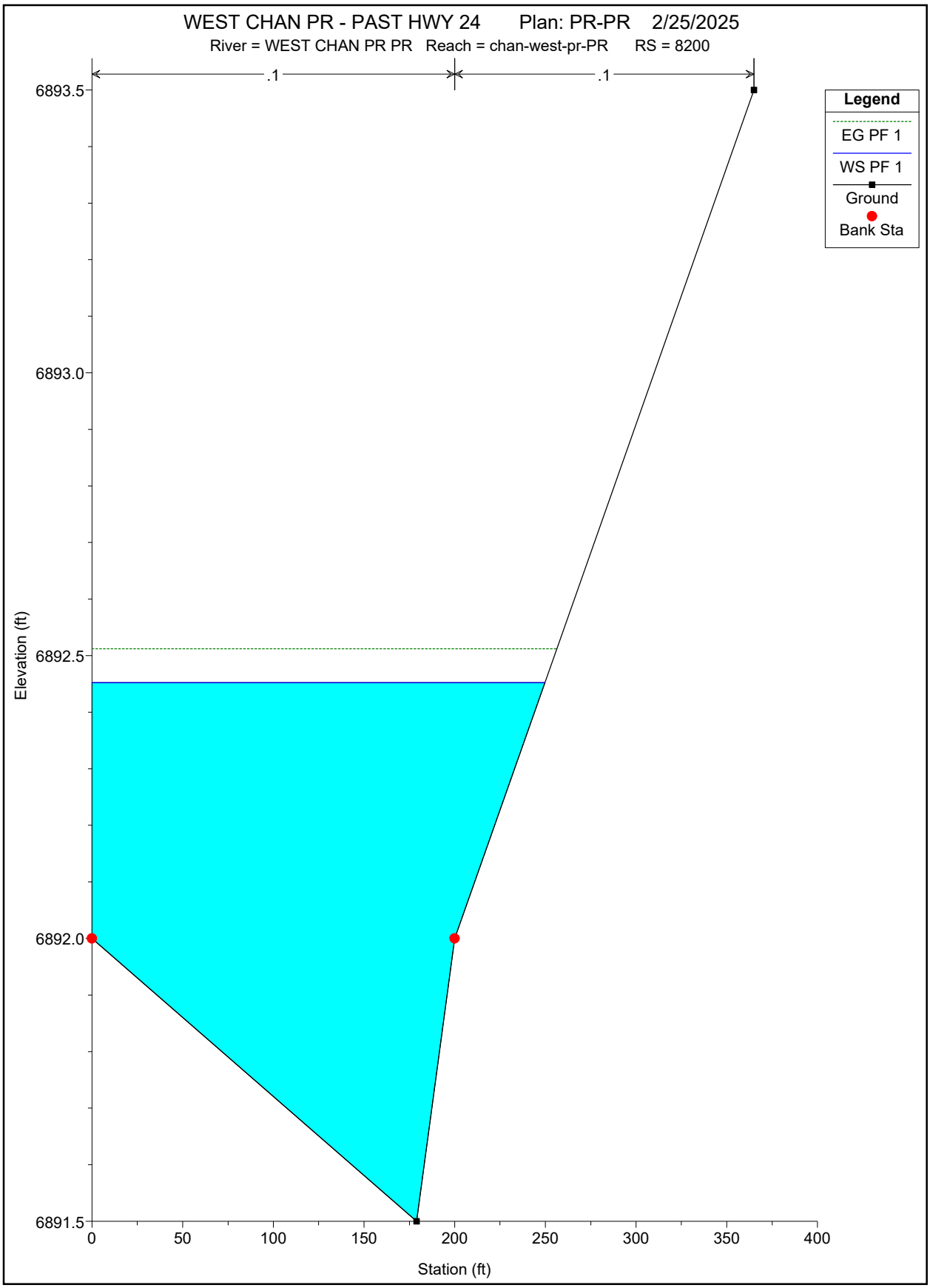

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 8700
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6903
6902
6901
6900
6899
6898
6897
6896
6895
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

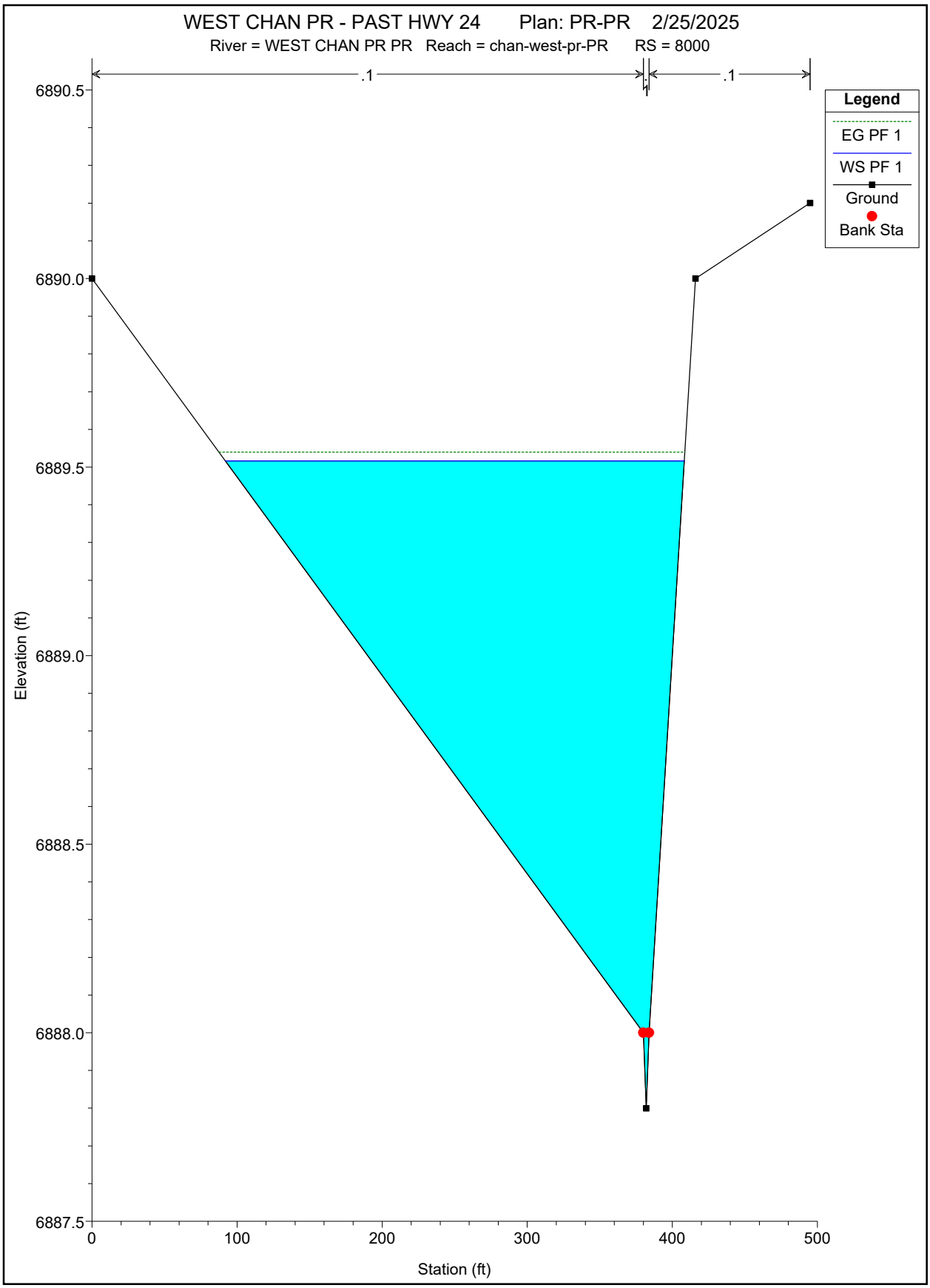

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 8600
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6900
6899
6898
6897
6896
6895
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

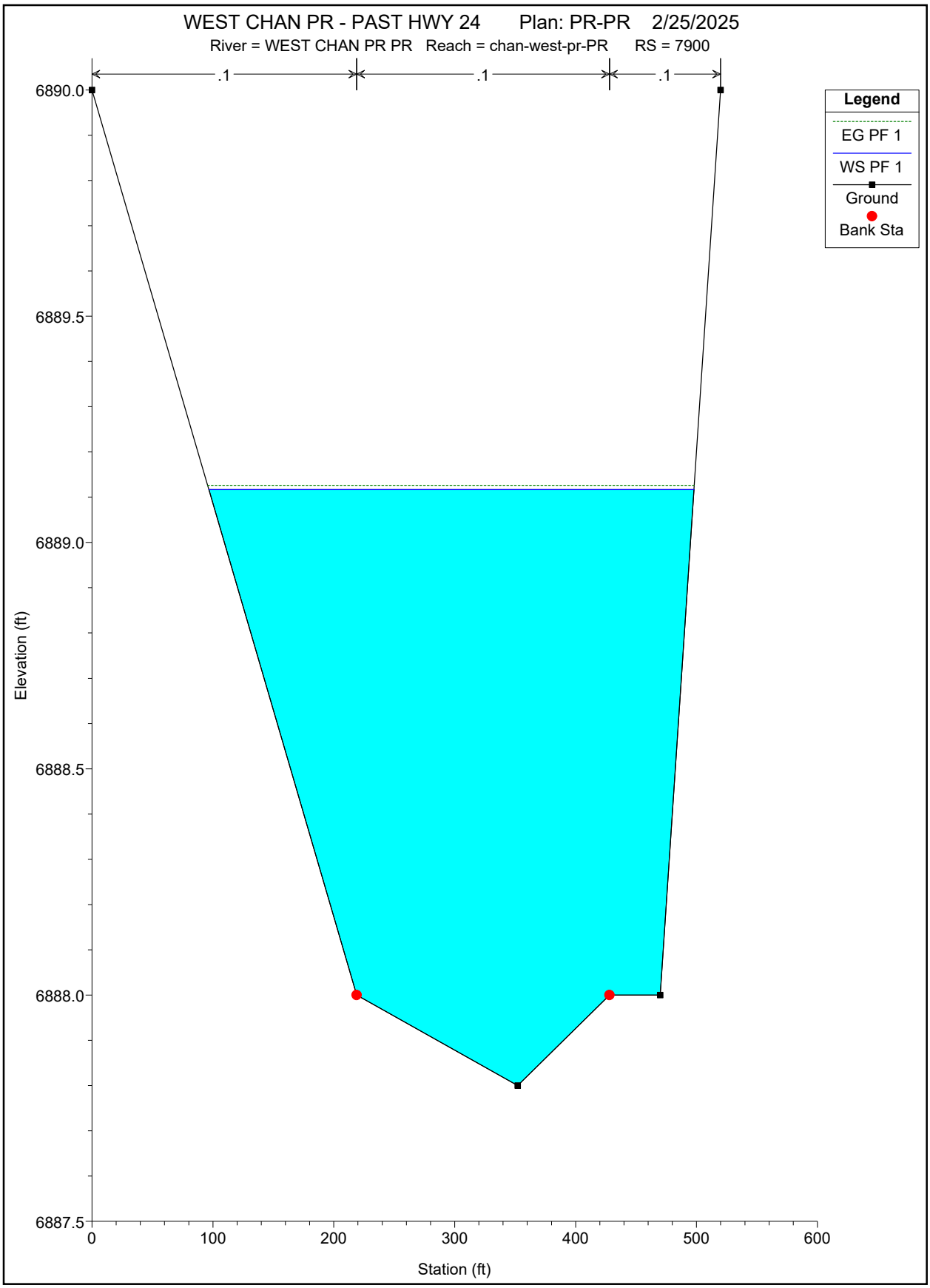

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 8500
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6900
6899
6898
6897
6896
6895
6894
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)

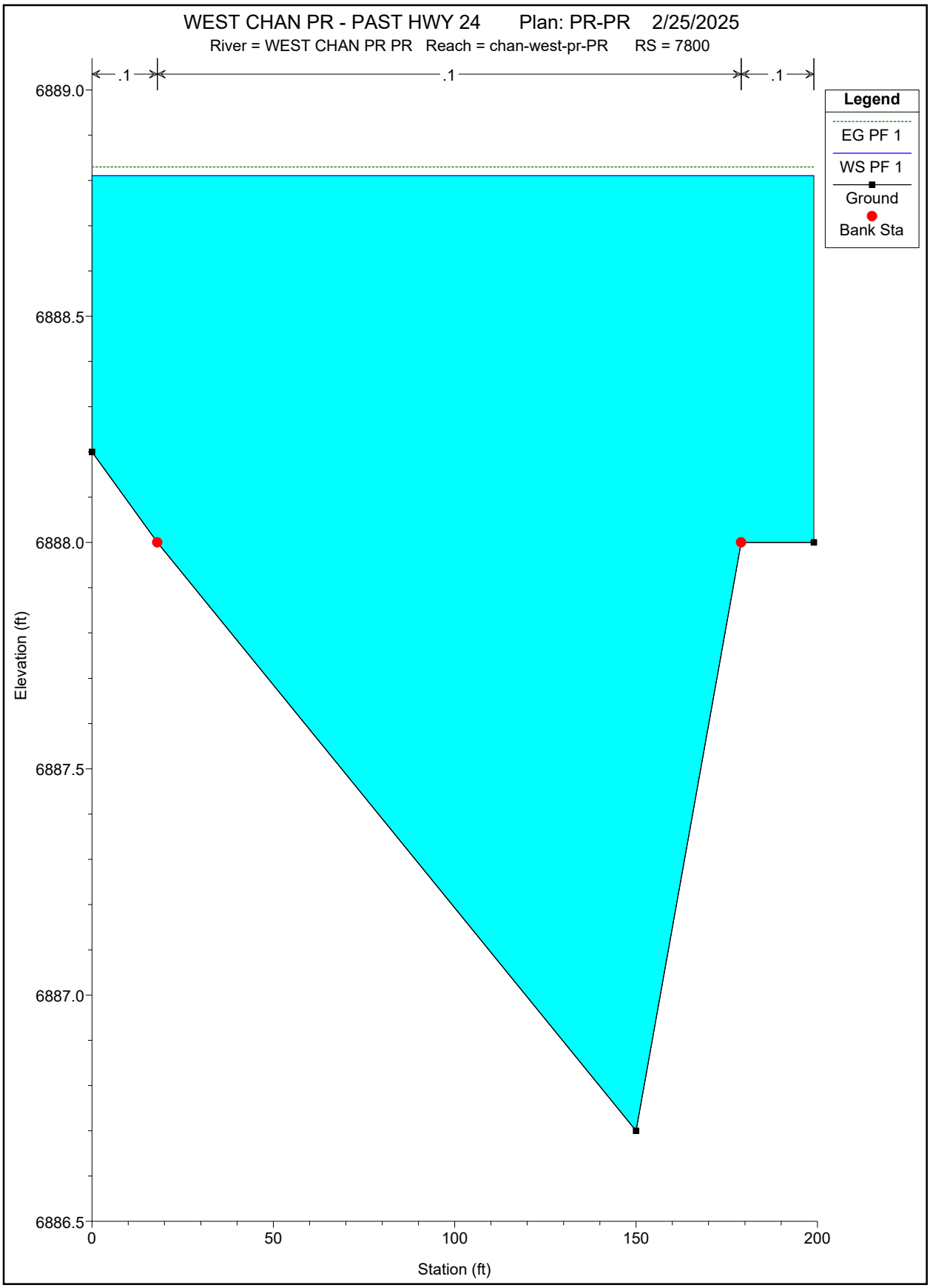

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 8400
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6899
6898
6897
6896
6895
6894
6893
0
100
200
300
400
500
Station (ft)

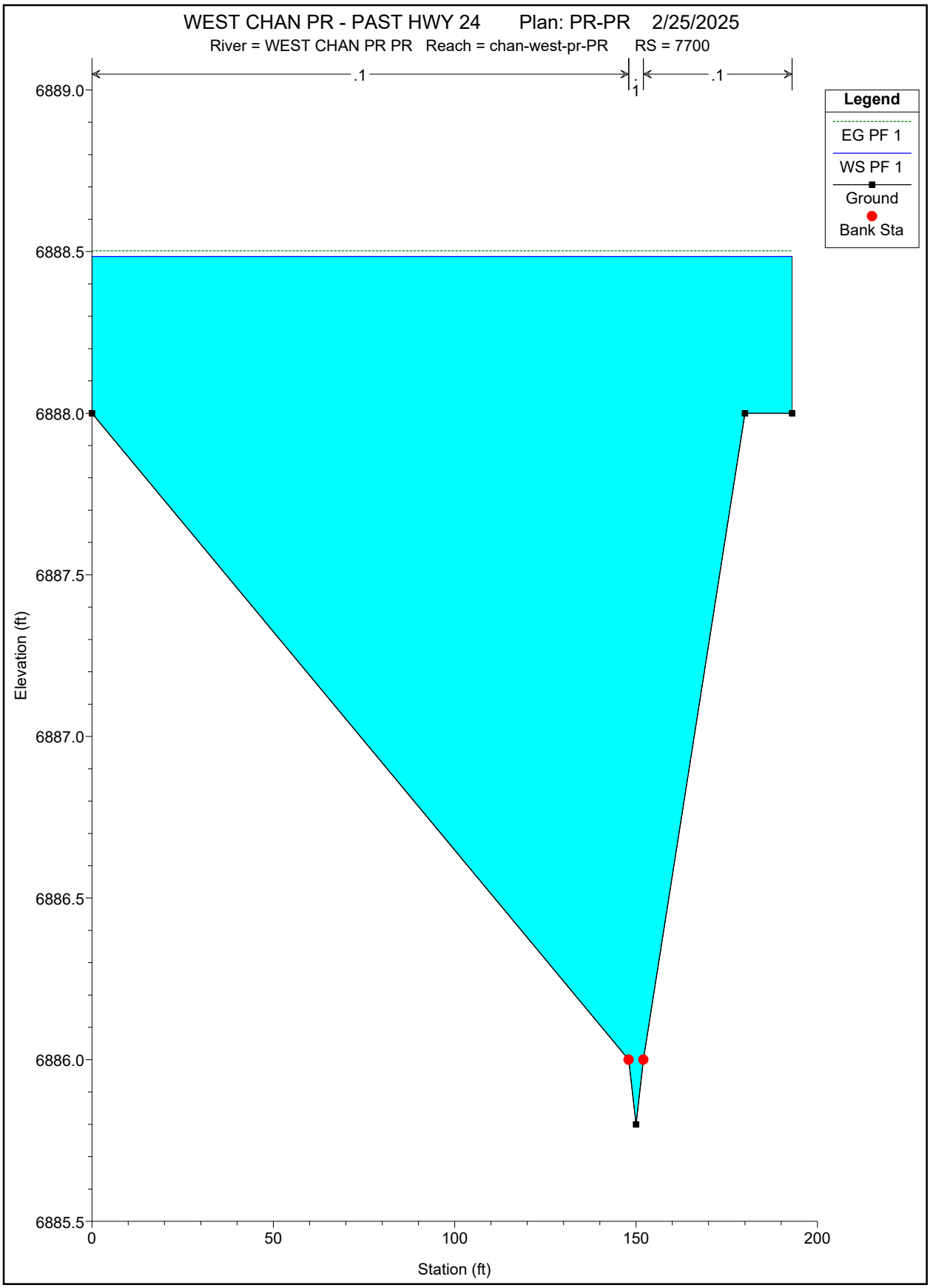

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 8300
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6895.0
6894.5
6894.0
6893.5
6893.0
6892.5
Elevation (ft)
0
100
200
300
400
500
600
Station (ft)

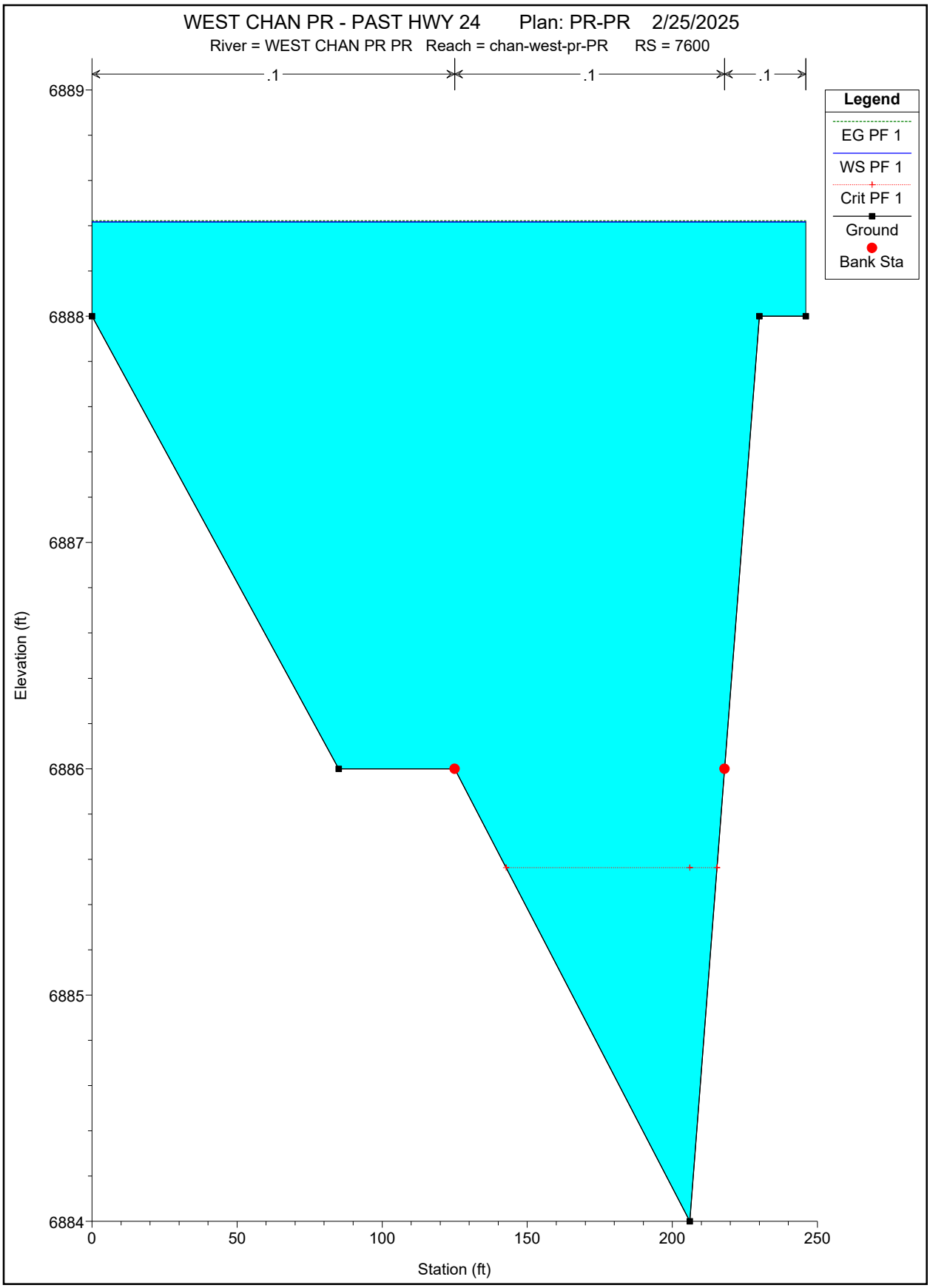

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 8200
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6893.5
6893.0
6892.5
6892.0
6891.5
Elevation (ft)
0
50
100
150
200
250
300
350
400
Station (ft)

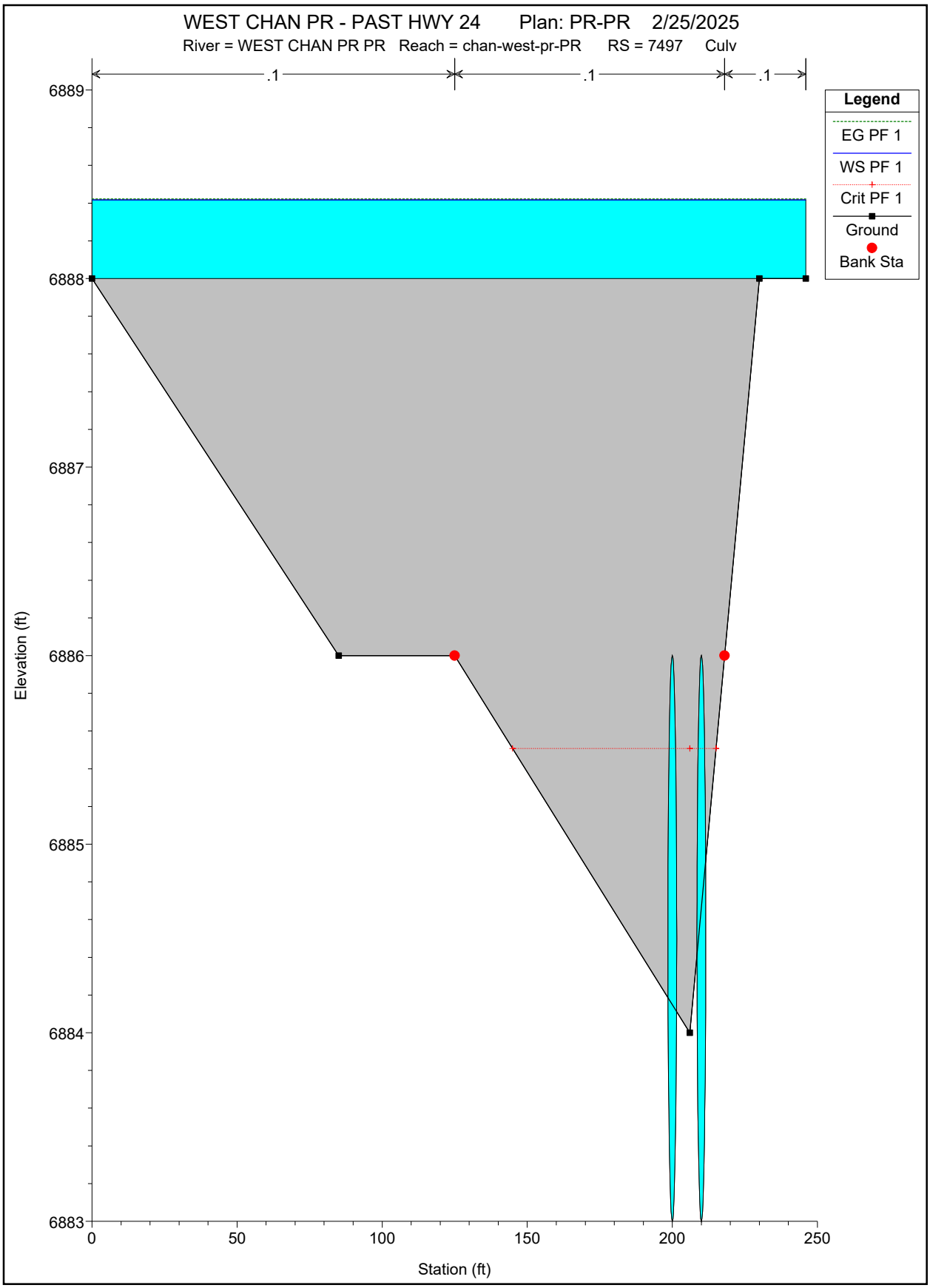

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 8000
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6890.5
6890.0
6889.5
6889.0
6888.5
6888.0
6887.5
Elevation (ft)
0
100
200
300
400
500
Station (ft)

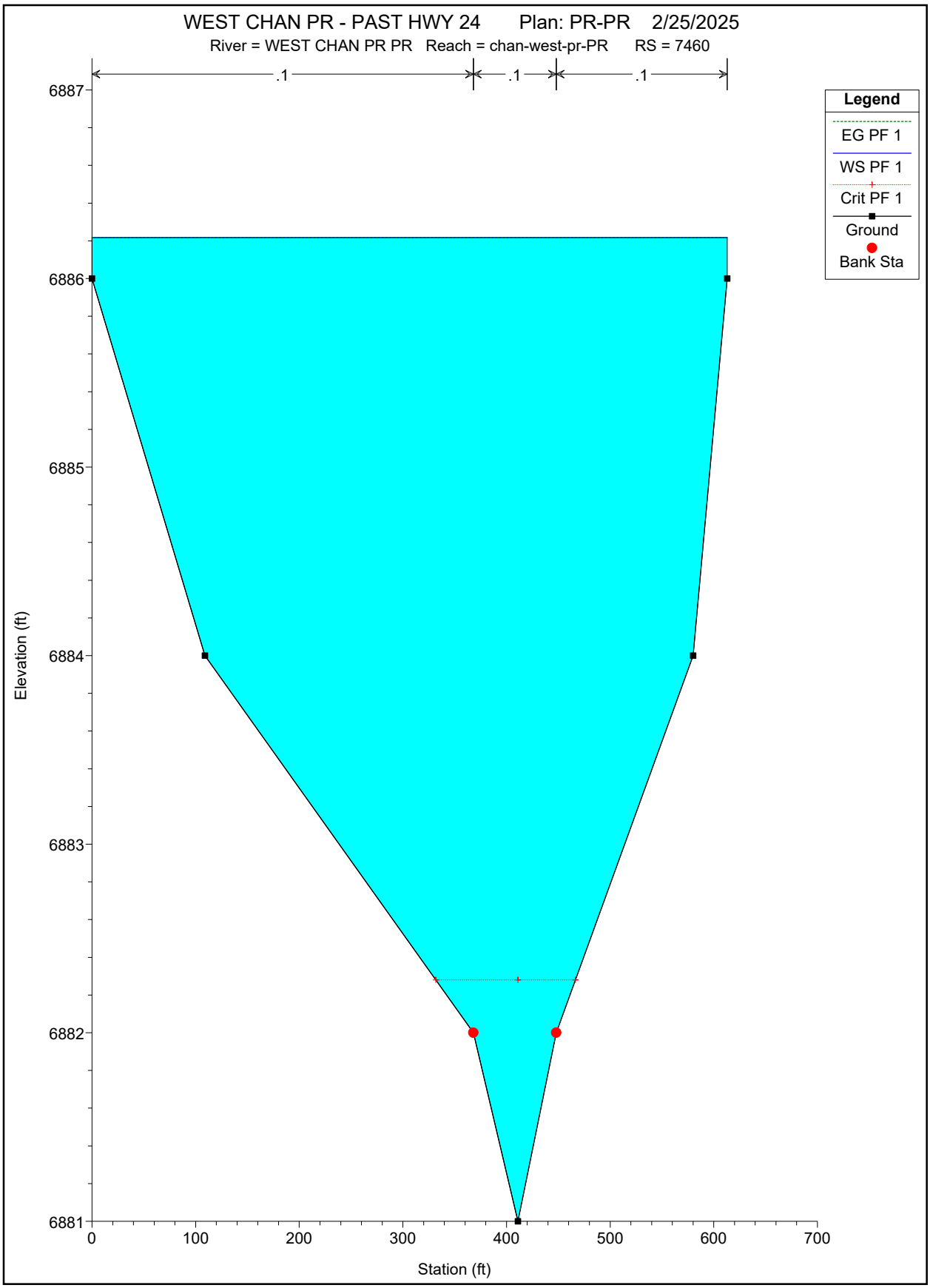

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 7900
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6890.0
6889.5
6889.0
6888.5
6888.0
6887.5
Elevation (ft)
0
100
200
300
400
500
600
Station (ft)

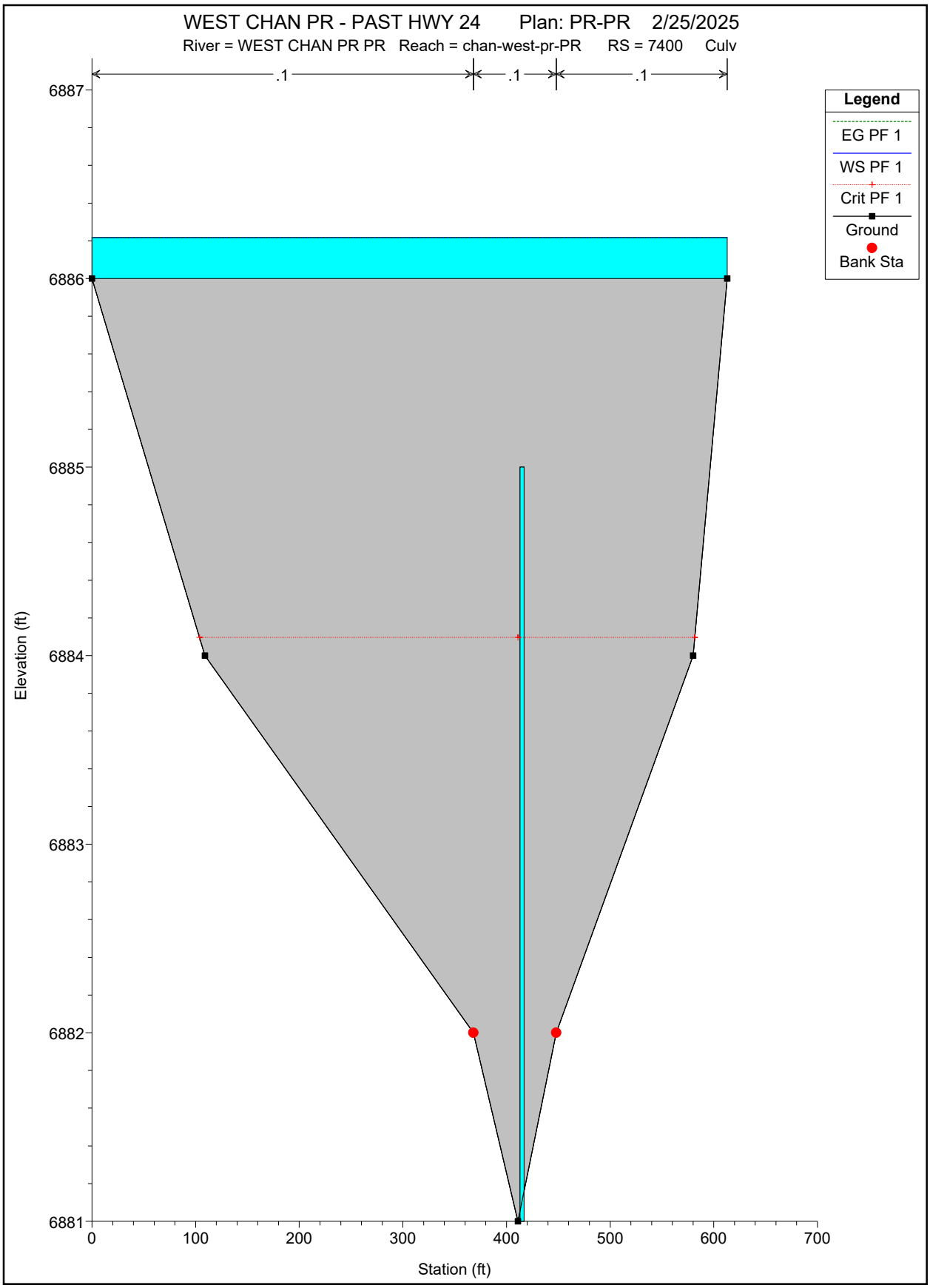

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 7800
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6889.0
6888.5
6888.0
6887.5
6887.0
6886.5
Elevation (ft)
0
50
100
150
200
Station (ft)

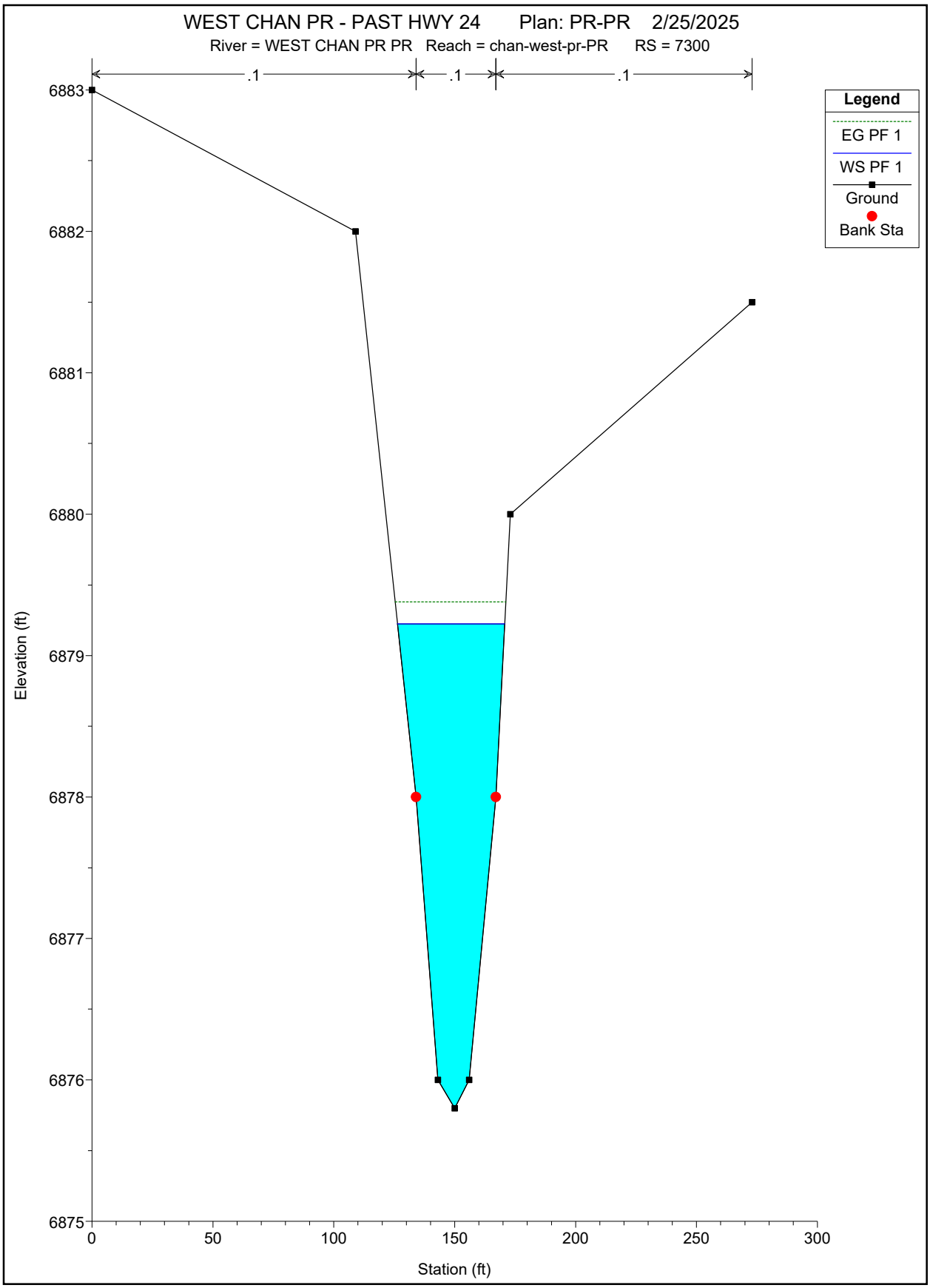

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 7700
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6889.0
6888.5
6888.0
6887.5
6887.0
6886.5
6886.0
6885.5
Elevation (ft)
0
50
100
150
200
Station (ft)

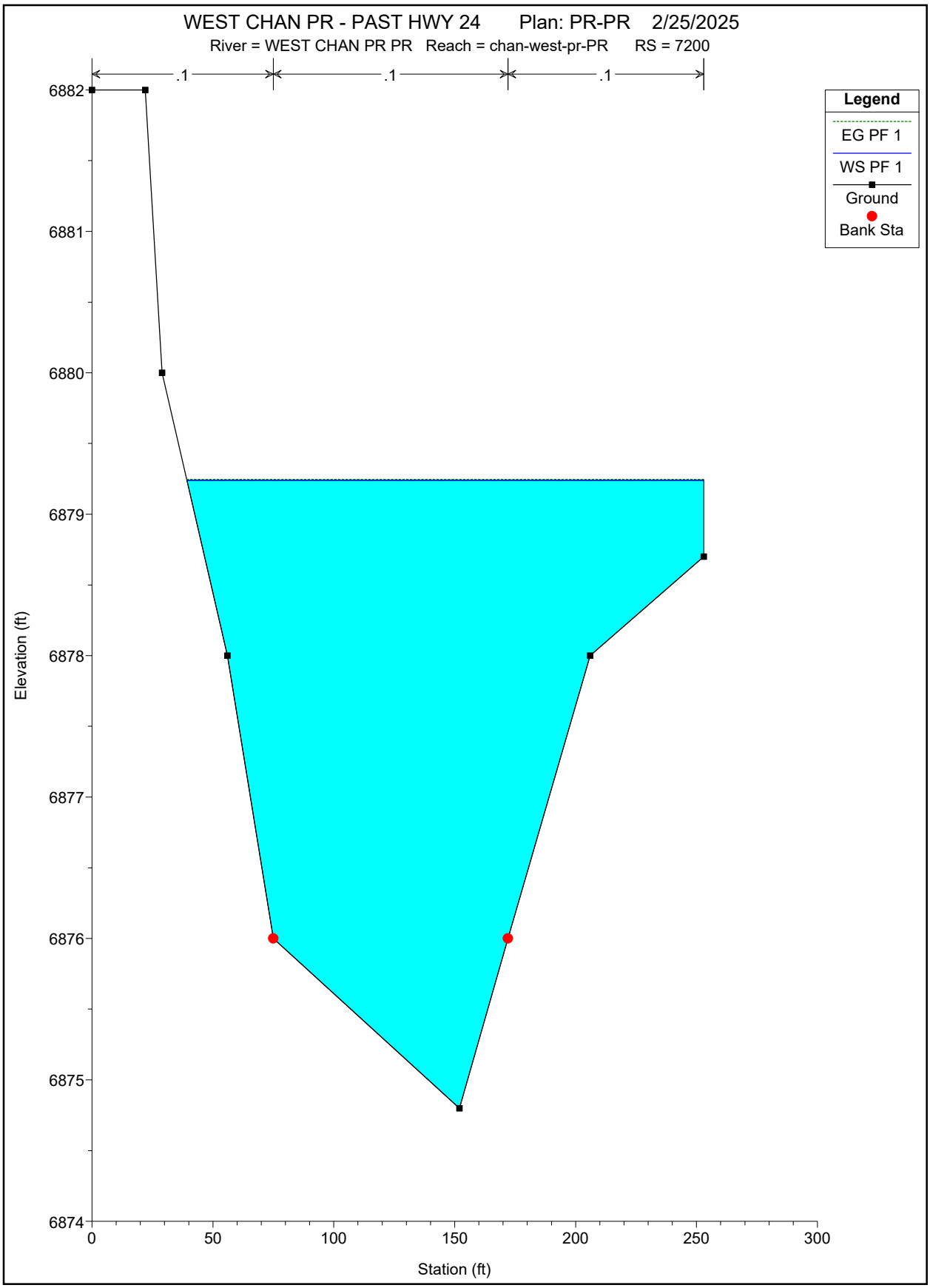

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 7600
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6889
6888
6887
6886
6885
6884
Elevation (ft)
0
50
100
150
200
250
Station (ft)

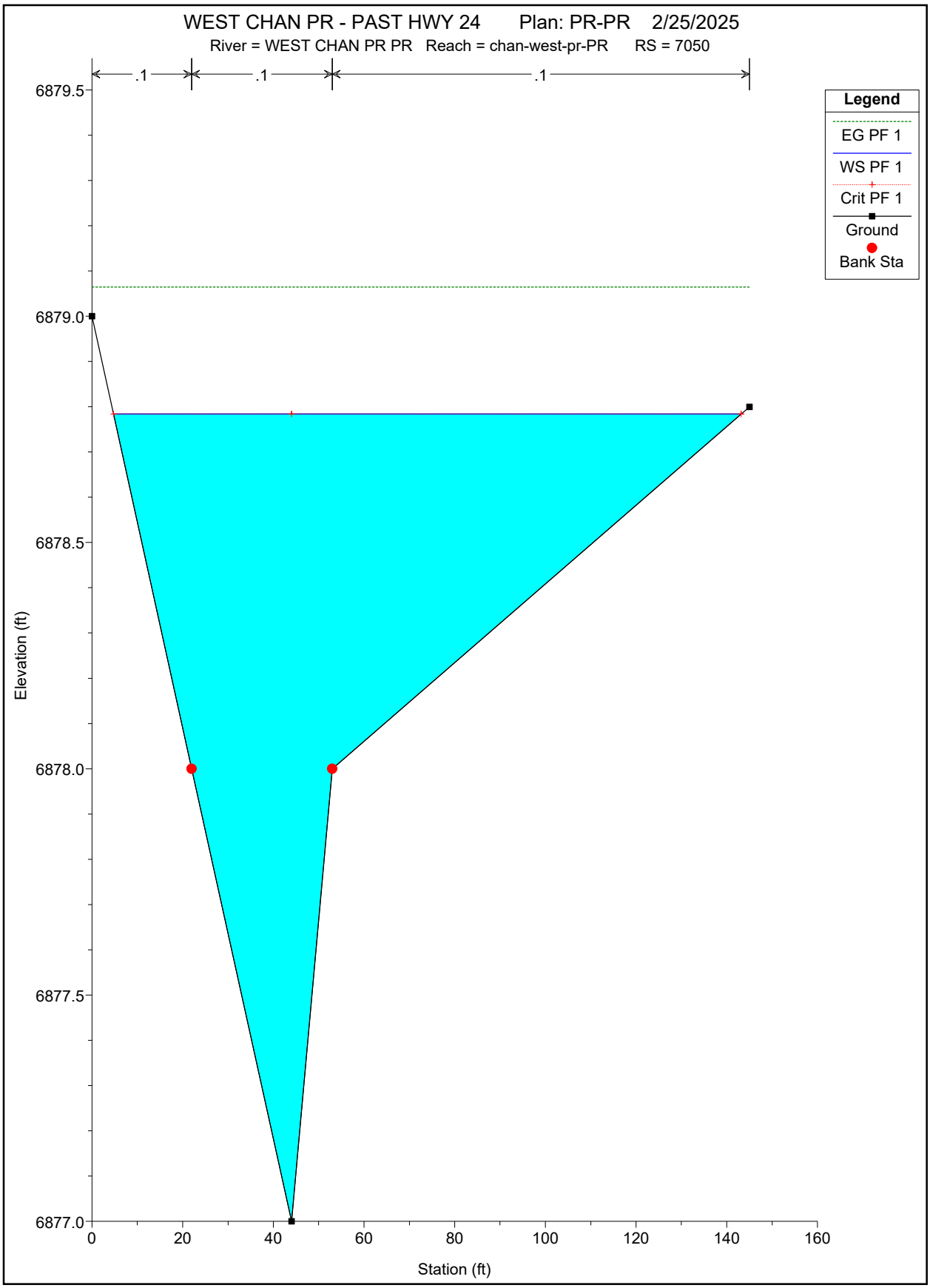

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 7497 Culv
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6889
6888
6887
6886
6885
6884
6883
Elevation (ft)
0
50
100
150
200
250
Station (ft)

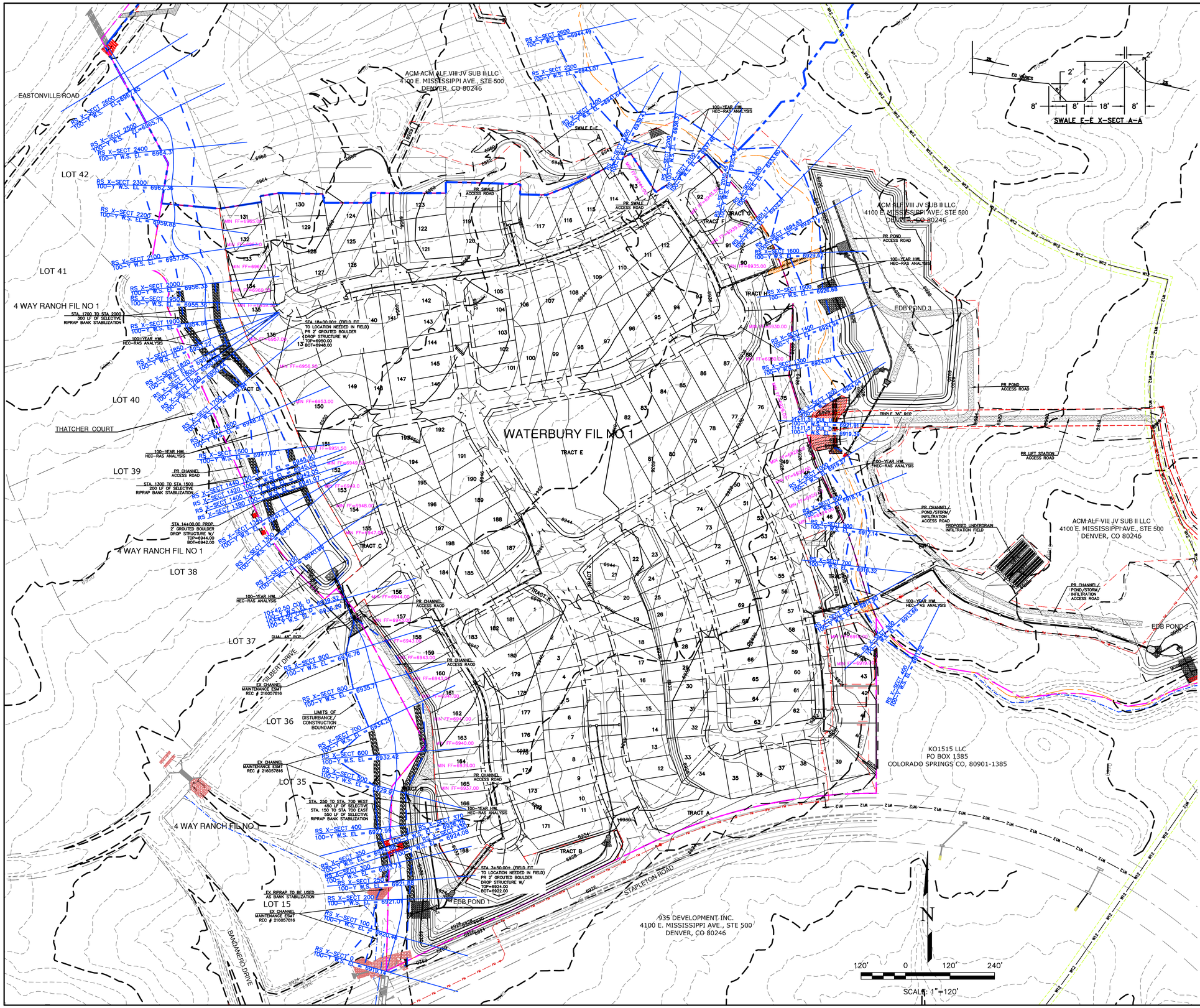

WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 7460
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6887
6886
6885
6884
6883
6882
6881
0
100
200
300
400
500
600
700
Station (ft)


WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 7400 Culv
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6887
6886
6885
6884
6883
6882
6881
Elevation (ft)
0
100
200
300
400
500
600
700
Station (ft)


WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 7300
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6883
6882
6881
6880
6879
6878
6877
6876
6875
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)


WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 7200
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
6882
6881
6880
6879
6878
6877
6876
6875
6874
0
50
100
150
200
250
300
Station (ft)


WEST CHAN PR - PAST HWY 24 Plan: PR-PR 2/25/2025
River = WEST CHAN PR PR Reach = chan-west-pr-PR RS = 7050
.1
.1
.1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
6879.5
6879.0
6878.5
6878.0
6877.5
6877.0
Elevation (ft)
0
20
40
60
80
100
120
140
160
Station (ft)



REVISIONS

NO.	DESCRIPTION	DATE

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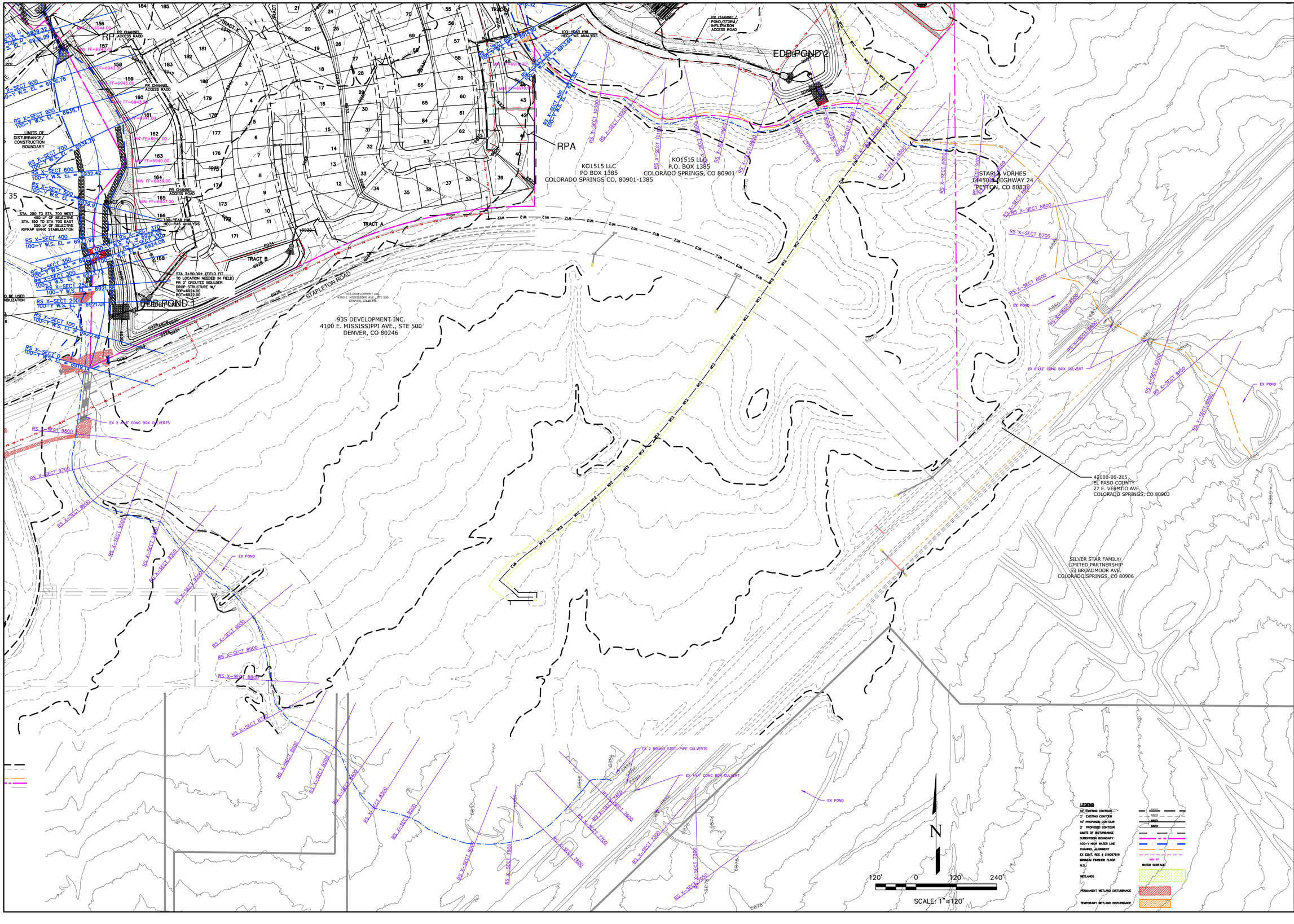
PREPARED FOR:
ACM ALF VIII JV SUB II LLC
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DENVER, CO 80246
303-984-9800

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Creative Civil Engineering Solutions
721 S. 23RD STREET
COLORADO SPRINGS, CO 80904
OFFICE: 719-635-6422
FAX: 719-635-6426
www.tnesinc.com

WATERBURY FILING NO. 1

PROPOSED 100-Y FLOODPLAIN EXHIBIT

DESIGNED BY DLF
DRAWN BY QNA
CHECKED BY QNA
H-SCALE 1" = 100'
V-SCALE N/A
JOB NO. 2356.00
DATE ISSUED 4/17/26
SHEET NO. 1 OF 2



REVISIONS		
NO.	DESCRIPTION	DATE

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WATERBURY FILING NO. 1

PROPOSED 100-Y FLOODPLAIN EXHIBIT
100-Y EVENT & POND FAILURE

DESIGNED BY	DLF
DRAWN BY	QNA
CHECKED BY	QNA
H-SCALE	1" = 100'
V-SCALE	N/A
JOB NO.	2356.00
DATE ISSUED	4/17/26
SHEET NO.	2 OF 2

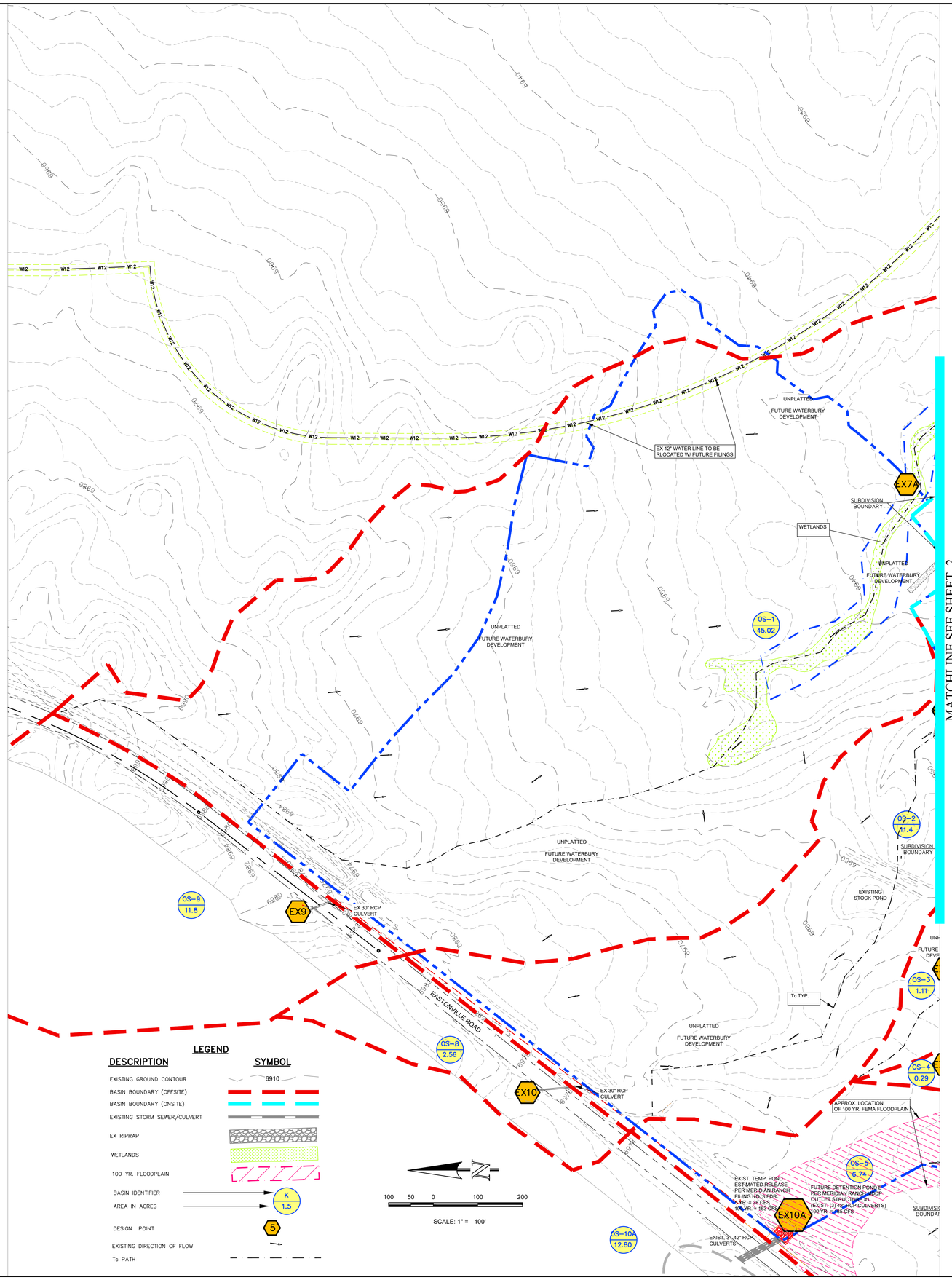
APPENDIX I
DRAINAGE MAPS

FDR ~ EXISTING BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(5)	WEIGHTED CA(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL FLOW Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	TOTAL FLOWS Q(100) (cfs)
EXA	0.87	3.46	0.25	100	3	11.1	1193	1.7%	4.5	4.4	15.4	3.43	5.81	3	20
EXB	0.37	1.47	0.25	100	2	12.6	623	2.2%	5.2	2.0	14.6	3.51	5.96	1	9
EXC	2.23	8.93	0.25	100	2.5	11.7	2420	1.7%	4.6	8.9	20.6	3.01	5.01	7	45
EXD	1.43	5.71	0.25	100	2	12.6	1615	2.6%	5.6	4.8	17.4	3.25	5.47	5	31
EXE	0.52	2.10	0.25	100	8	8.0	1063	2.1%	5.0	3.5	11.5	3.86	6.66	2	14
EXF	0.15	0.58	0.25	100	6	8.8	400	2.5%	5.5	1.2	10.0	4.06	7.07	1	4
OS-1	4.05	16.21	0.25	100	6	8.6	3219	2.3%	5.3	10.1	18.9	3.13	5.24	13	85
OS-2	1.03	4.11	0.25	100	2	12.6	1203	1.0%	3.5	5.7	18.4	3.17	5.32	3	22
OS-3	0.10	0.40	0.25	100	2	12.6	330	2.6%	5.6	1.0	13.6	3.61	6.17	0	2
OS-4	0.03	0.11	0.25	100	2	12.6	230	2.6%	5.7	0.7	13.3	3.64	6.23	0	1
OS-5	0.61	2.43	0.25	80	5	7.8	1000	2.5%	5.5	3.0	10.8	3.96	6.85	2	17
OS-8	FLOW TAKEN FROM MERIDIAN RANCH MDDP													5	11
OS-9	FLOW TAKEN FROM MERIDIAN RANCH MDDP													8	19
OS-10A	FLOW TAKEN FROM MERIDIAN RANCH MDDP													28	185

FDR ~ EXISTING SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Facility Size
EX1A	OS-5, & DP-EX10A	19.54	0.61	2.43	10.8	3.96	6.85	30	202	NORTH BOUNDARY
EX1	EXA, OS-5, & DP-EX10A	29.16	1.47	5.89	15.4	3.43	5.81	33	219	3-42" CULVERTS
EX2	EXB	4.09	0.37	1.47	14.6	3.51	5.96	1	9	STAPLETON ROAD
EX3A	OS-4	1.11	0.03	0.11	13.3	3.64	6.23	0	1	NORTH BOUNDARY
EX3	EXC & OS-4	25.10	2.26	9.03	20.6	3.01	5.01	7	45	EAST BOUNDARY
EX4A	OS-3	1.11	0.10	0.40	13.6	3.61	6.17	0	2	NORTH BOUNDARY
EX4	EXD & OS-3	16.98	1.53	6.11	17.4	3.25	5.47	5	33	EAST BOUNDARY
EX5A	OS-2 & OS-8	13.96	1.03	4.11	18.4	3.17	5.32	8	33	NORTH BOUNDARY
EX5	EXE, OS-2 & OS-8	17.23	1.55	6.20	18.4	3.17	5.32	10	44	EAST BOUNDARY
EX6	EXF	1.62	0.15	0.58	13.8	3.59	6.12	1	4	EAST BOUNDARY
EX7A	OS-1 & OS-9	56.82	4.05	16.21	18.9	3.13	5.24	21	104	POINT ALONG CHANNEL
EX7	EXE, EXF, OS-1, OS-2, OS-8 & OS-9	78.24	5.75	23.00	18.9	3.13	5.24	31	151	DP 30 PROP CONDITION
EX9	OS-9	11.80						8	19	EX 36" RCP Culvert
EX10	OS-8	2.56						5	11	EX 36" RCP Culvert
EX10A	MERIDIAN POND E RELEASE	Meridaian Ranch Filing 3 FDR Calculated Flows						28	185	EX 3-42" RCP Culverts
13	TOTAL OFFSITE EX. STOCK POND INFLOW	Per "Final Drainage Report for Waterbury Filing No. 1" dated September 2016, by Classic Consulting						69	396	EX STOCK POND



REVISIONS

NO.	DESCRIPTION	DATE

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PREPARED FOR:
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www.tnesinc.com

WATERBURY FILING 1

FINAL DRAINAGE REPORT
EXISTING FINAL DRAINAGE MAP 1
OFFSITE MAP

DESIGNED BY	QNA
DRAWN BY	QNA
CHECKED BY	
H-SCALE	1"=100'
V-SCALE	
JOB NO.	1715.00
DATE ISSUED	4/17/26
SHEET NO.	1 OF 2

MATCHLINE SEE SHEET 1

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
BASIN BOUNDARY (OFFSITE)	
BASIN BOUNDARY (ONSITE)	
EXISTING STORM SEWER/CULVERT	
EX RIPRAP	
WETLANDS	
100 YR. FLOODPLAIN	
BASIN IDENTIFIER	K
AREA IN ACRES	1.5
DESIGN POINT	5
EXISTING DIRECTION OF FLOW	
Tc PATH	

100 50 0 100 200

SCALE: 1" = 100'

25' WATER EASEMENT
RECEPTION NO. 207143735
RECEPTION NO. 207143736
RECEPTION NO. 207143737
TC #24

EX 10" PUBLIC INLETS
EX 15" PUBLIC INLETS
EX 18" RCP PUBLIC STORM
EX 24" RCP PUBLIC STORM
EX 12" WATER
EX 12" WATER
EX 15" PUBLIC INLETS
EX 18" RCP PUBLIC STORM
EX 24" RCP PUBLIC STORM
EX C&G

UNPLATTED
FUTURE WATERBURY DEVELOPMENT
SUBDIVISION BOUNDARY
WETLANDS
EX7
EX4
EX3
EX5
EX6
EX7A
EXF 1.62
EXC 24.8
EXD 15.87
EXE 5.83
OS-1 45.02
Tc TYP.
EX2
UNPLATTED
FUTURE 4-WAY RANCH COMMERCIAL DEVELOPMENT
THRETON TERRACE
TOP ROW
EXIST OFF-SITE SWQ POND 3 (IN-LINE)
0.66 AC-FT. WQCV REQ.
1.2 AC-FT. WQCV PROVIDED WITHIN THE EXIST. STOCK POND
PROPOSED IN-FLOW
5-YR. = 69 CFS
100-YR. = 397 CFS
PROPOSED RELEASE
5-YR. = 69 CFS
100 YR. = 396 CFS
HISTORIC RELEASE
5-YR. = 76 CFS
100 YR. = 437 CFS
13
EX. 4'x4' CONC. OUTLET BOX W/ INTEGRAL MICROPOOL AND 24" RCP OUTLET PIPE AND E/C BLANKET AT SPILLWAY
EXIST. DRAINAGE ESMT. (REC # 214087198)
EXIST. STOCK POND CONVERTED TO SWQ FOREBAY FOR MITIGATION OF 4-WAY RANCH FIL. 1 AND PORTIONS OF WATERBURY DEVELOPMENT
PROPERTY LINE
4 -WAY RANCH FILING NO. 1
SUBDIVISION BOUNDARY
EX1
EXA 9.62
EXB 4.09
EX4A
OS-3 1.11
EX3A
OS-4 0.29
EX1A
OS-5 6.74
EX10A
09-2 41.4
EXISTING STOCK POND
APPROX. LOCATION OF 100 YR. FEMA FLOODPLAIN
EXIST. TEMP. POND ESTIMATED RELEASE PER MERIDIAN RANCH FILING NO. 3 FDR: 5-YR. = 26 CFS 100 YR. = 153 CFS
FUTURE DETENTION POND E PER MERIDIAN RANCH DDP. OUTLET STRUCTURE #1 (EXIST. 0) 42 INCH CULVERTS) 100 YR. = 360 CFS
42" RCP
LOT 35
LOT 36
LOT 37
LOT 38
LOT 39
LOT 42
LOT 14
LOT 15
EXIST. 6'x3'x4' CBC
EX. 4'x4' CONC. OUTLET BOX W/ INTEGRAL MICROPOOL AND 24" RCP OUTLET PIPE
EXIST. DRAINAGE ESMT. (BY SEPARATE INSTRUMENT)
EXISTING DRAINAGE EASEMENT REC # 216057816
EXISTING DRAINAGE EASEMENT REC # 216057816
EXISTING 20' DRAINAGE EASEMENT
EXISTING 40' DRAINAGE EASEMENT
EXIST. OFF-SITE SWQ POND 1 0.52 AC-FT. WQCV REQ. 0.66 AC-FT. WQCV PROVIDED WITH INSTALLED CONCRETE OUTLET BOX AND ORIFICE PLATE
EXIST. IN-FLOW
5-YR. = 18 CFS
100-YR. = 133 CFS
EXIST. RELEASE
5-YR. = 13 CFS
100 YR. = 131 CFS
EXIST. OFF-SITE SWQ POND 2 0.34 AC-FT. WQCV REQ. 0.60 AC-FT. WQCV PROVIDED WITH INSTALLED CONCRETE OUTLET BOX AND ORIFICE PLATE
PROPOSED IN-FLOW
5-YR. = 10 CFS
100-YR. = 53 CFS
PROPOSED RELEASE
5-YR. = 0.4 CFS
100 YR. = 51 CFS
EX. ROADSIDE DITHCES
EX. DUAL 54" RCP CULVERTS W/ HEADWALL & RIPRAP OUTLET
EX. DROP STRUCTURES
SEE APPENDIX FOR ALL OFF-SITE SWQ BASINS TRIBUTARY TO THE PROPOSED SWQ PONDS.
EX. 24" RCP CULVERTS & RIPRAP OUTLET
EX. 36" RCP CULVERTS & RIPRAP OUTLET
BANDANERO DRIVE (80' ROW)
GILBERT DRIVE (70' ROW)
THATCHER COURT (50' ROW)

REVISIONS

NO.	DESCRIPTION	DATE

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FAX: 719-635-6426
www.tnesinc.com

WATERBURY FILING 1

FINAL DRAINAGE REPORT
EXISTING FINAL DRAINAGE MAP 2
ONSITE MAP

DESIGNED BY	QNA
DRAWN BY	QNA
CHECKED BY	
H-SCALE	1"=100'
V-SCALE	
JOB NO.	1715.00
DATE ISSUED	4/17/26
SHEET NO.	2 OF 2

FDR FUTURE FINAL ~ PROPOSED BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(5)	WEIGHTED CA(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL FLOW Length (ft)	STREET / CHANNEL FLOW Slope (%)	STREET / CHANNEL FLOW Velocity (fps)	STREET / CHANNEL FLOW Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOW Q(5) (cfs)	TOTAL FLOW Q(100) (cfs)
A	1.52	2.00	0.25	100	2	12.6	420	1.5%	4.3	1.6	14.3	3.54	6.03	5	12
B1	1.03	1.36	0.25	100	2	12.6	400	1.5%	4.3	1.6	14.2	3.55	6.05	4	8
B2	1.61	2.11	0.25	100	2	12.6	550	1.5%	4.3	2.1	14.8	3.49	5.93	6	13
C	0.39	0.51	0.25	20	0.5	5.3	500	2.0%	4.9	1.7	6.9	4.58	8.14	2	4
D	0.95	1.24	0.25	80	2	10.5	300	2.5%	5.5	0.9	11.4	3.87	6.69	4	8
E	0.98	1.29	0.25	100	2	12.6	400	2.5%	5.5	1.2	13.8	3.59	6.12	4	8
F	0.98	1.29	0.25	50	2	7.1	620	1.5%	4.3	2.4	9.5	4.14	7.22	4	9
G1	0.24	0.31	0.25								5.0	5.00	9.06	1	3
G2	0.31	0.41	0.25								5.0	5.00	9.06	2	4
H	0.66	0.86	0.25	50	2	7.1	525	1.5%	4.3	2.0	9.2	4.19	7.33	3	6
I	0.97	2.12	0.25	80	4	8.4	250	2.0%	4.9	0.8	9.2	4.18	7.32	4	16
J	0.85	0.85	0.25	90	6	8.1	850	2.0%	4.9	2.9	10.9	3.94	6.81	3	6
K	0.69	1.37	0.25	100	18	6.1	80	1.0%	3.5	0.4	6.5	4.67	8.33	3	11
L1	1.71	2.24	0.25	100	2	12.6	860	1.4%	4.1	3.5	16.1	3.36	5.69	6	13
L2	0.90	1.18	0.25	55	1.1	9.4	860	1.4%	4.1	3.5	12.8	3.70	6.34	3	7
M1	0.44	0.58	0.25	70	1.5	10.3	200	2.0%	4.9	0.7	11.0	3.92	6.79	2	4
M2	0.16	0.21	0.25	65	3	7.7	0	0.0%	0.0	0.0	7.7	4.43	7.63	1	2
N	0.10	0.13	0.25								5.0	5.00	9.06	1	1
O1	1.27	1.66	0.25	100	2.5	11.7	460	1.5%	4.3	1.8	13.5	3.62	6.19	5	10
O2	0.27	0.35	0.25	100	2	12.6	850	2.0%	4.9	2.9	15.5	3.42	5.80	1	2
O3	0.25	0.33	0.25								5.0	5.00	9.06	1	3
O4	0.17	0.23	0.25								5.0	5.00	9.06	1	2
P	0.06	0.25	0.25								5.0	5.00	9.06	0	2
Q1	0.66	0.87	0.25	55	1.3	8.9	445	2.0%	5.0	1.5	10.4	4.01	6.97	3	6
Q2	0.43	0.56	0.25	55	1.3	8.9	445	2.0%	5.0	1.5	10.4	4.01	6.97	2	4
R	0.46	0.60	0.25	100	4	10.1	700	2.0%	4.9	2.4	12.4	3.75	6.44	2	4
S1	0.70	0.91	0.25	100	6	8.8	175	2.0%	4.9	0.6	9.4	4.16	7.26	3	7
S2	0.06	0.08	0.25								5.0	5.00	9.06	0	1
T1	0.64	0.84	0.25	55	1.1	9.4	390	2.0%	4.9	1.3	10.7	3.97	6.88	3	6
T2	0.55	0.73	0.25	100	2	12.6	245	2.0%	5.0	0.8	13.5	3.63	6.20	2	5
U1	1.97	2.56	0.25	100	2	12.6	520	2.3%	5.3	1.6	14.3	3.54	6.03	7	16
U2	0.85	1.11	0.25	100	2	12.6	385	2.3%	5.4	1.2	13.8	3.59	6.12	3	7
V	0.24	0.32	0.25								5.0	5.00	9.06	1	3
W	2.34	3.07	0.25	100	2	12.6	630	1.6%	4.4	2.4	15.0	3.47	5.89	8	18
X	0.19	0.25	0.25								5.0	5.00	9.06	1	2
Y	0.16	0.21	0.25								5.0	5.00	9.06	1	2
OS-1	5.31	6.97	0.25	100	2	12.6	690	2.0%	5.0	2.3	15.0	3.47	5.90	18	41
OS-2	5.19	6.80	0.25	100	2	12.6	1700	1.8%	4.6	6.1	18.7	3.14	5.27	16	36
OS-3A	0.35	0.47	0.25	55	1.1	9.4	480	1.3%	3.9	2.0	11.4	3.87	6.68	1	3
OS-3B	2.55	3.34	0.25	100	2	12.6	480	1.3%	3.9	2.0	14.7	3.50	5.95	9	20
OS-4	0.98	3.92	0.25	800	26	30.5					30.5	2.48	4.01	2	16
OS-5	0.51	2.03	0.25	80	5	7.8					7.8	4.42	7.82	2	16
OS-6	0.48	0.63	0.25	30	0.6	6.9	900	1.8%	4.7	3.2	10.1	4.05	7.04	2	4
OS-7	0.34	1.35									5.0	5.00	9.06	2	12
OS-8	INFO TAKEN FROM EASTONVILLE ROAD LONDONDERRY DR. TO REX RD. FDR													5	12
OS-9	FLOW TAKEN FROM MERIDIAN RANCH MDDP													8	19
OS-Q1	0.03	0.12	0.25	50	2	7.1	585	2.0%	5.0	2.0	9.1	4.21	7.36	0	1
OS-10	0.31	1.23	0.25	100	2	12.6	300	2.7%	5.7	0.9	13.5	3.62	6.19	1	8
OS-Q1	1.94	2.54	0.25	200	5	16.6	1500	1.5%	4.3	5.8	22.4	2.88	4.78	6	12
OS-Q2	0.42	0.55	0.25	50	1	8.9	900	1.5%	4.3	3.5	12.4	3.75	6.43	2	4
OS-R	2.72	3.57	0.25	50	1	8.9	850	2.7%	5.8	2.5	11.4	3.87	6.69	11	24
OS-S1	2.51	3.30	0.25	100	2	12.6	920	1.2%	3.8	4.0	16.7	3.32	5.60	8	18
OS-S2	0.08	0.10	0.25	100	2	12.6					12.6	3.72	6.39	0	1
OS-T2	0.34	0.45	0.25	100	2	12.6					12.6	3.72	6.39	1	3
OS-W	0.51	0.54	0.25	10	1	2.4					5.0	5.00	9.06	3	5

FDR FUTURE FINAL ~ PROPOSED SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Facility Size
1	A	3.39	1.52	2.00	14.3	3.54	6.03	5	12	10' Type R Sump Inlet
2	C	0.86	0.39	0.51	6.9	4.58	8.14	2	4	5' Type R Sump Inlet
3	B1	2.30	1.03	1.36	14.2	3.55	6.05	4	8	5' Type R Sump Inlet
4	B2	3.58	1.61	2.11	14.8	3.49	5.93	6	13	10' Type R Sump Inlet
5	F & H	3.65	1.64	2.15	9.5	4.14	7.22	7	16	10' Type R Sump Inlet
6	D	2.11	0.95	1.24	11.4	3.87	6.69	4	8	5' Type R Sump Inlets
7	E	2.18	0.98	1.29	13.8	3.59	6.12	4	8	5' Type R Sump Inlets
7A	G1	0.53	0.24	0.31	5.0	5.00	9.06	1	3	5' Type R At-grade Inlet
7B	G2	0.69	0.31	0.41	5.0	5.00	9.06	2	4	5' Type R At-grade Inlet
8	DESIGN POINTS 1-7B & K	22.34	8.13	10.66	14.8	3.49	5.93	28	63	FSD Pond 1
9	OS-9	11.80	FLOW TAKEN FROM MERIDIAN RANCH MDDP					8	19	EX 30" RCP Culvert
9A	OS-9A	12.87	2.14	3.06	9.1	4.21	7.36	9	23	DUAL TYPE C INLETS
10	OS-8	8.43	INFO TAKEN FROM EASTONVILLE ROAD LONDONDERRY DR. TO REX RD. FDR					5	12	EX FSD Pond
10-1	POND RELEASE & DP10	11.80	INFO TAKEN FROM EASTONVILLE ROAD LONDONDERRY DR. TO REX RD. FDR					0.3	5	PR 18" RCP
10A	MERIDIAN POND E RELEASE	Meridaan Ranch Filing 3 FDR Calculated Flows						28	185	EX 3-42" RCP Culverts
11	OS-5, I, DP10A (MERIDIAN POND E RELEASE)	Sum of Basins						34	216	PR 2-48" RCP Culverts
11A	DP 11 & BASIN J	Sum of Basins						37	222	EX Channel
12	OS-6	1.06	0.48	0.63	10.1	4.05	7.04	2	4	18" RCP Culvert
12A	OS-6	Design Point used for 18" culvert xing for Access Road. Use DP 12 Flow						2	4	18" RCP Culvert
13	TOTAL OFFSITE EX. STOCK POND INFLOW	Per "Final Drainage Report for Waterbury Filing No. 1" dated September 2016, by Classic Consulting						69	396	EX STOCK POND
14	L1	3.79	1.71	2.24	16.1	3.36	5.69	6	13	10' Type R Sump Inlet
15	L2	2.00	0.90	1.18	12.8	3.70	6.34	3	7	5' Type R Sump Inlet
16	O1	2.82	1.27	1.66	13.5	3.62	6.19	5	10	10' Type R Sump Inlet
17	O2	0.59	0.27	0.35	15.5	3.42	5.80	1	2	5' Type R Sump Inlet
18	DESIGN POINTS 14-17 & 33-34 AND BASIN OS-4	21.05	5.12	5.43	16.1	3.36	5.69	17	31	Interim FSD Pond 2
19	Q1 & OS-Q1	5.78	2.60	3.41	22.4	2.88	4.78	8	16	10' Type R Sump Inlet
20	Q2 & OS-Q2	1.89	0.85	1.12	12.4	3.75	6.43	3	7	5' Type R Sump Inlet
21	R & OS-R	7.06	3.18	4.17	11.4	3.87	6.69	12	28	10' Type R At-grade Inlet
22	S1 & OS-S1 & DP 21 FLOW BY	7.14	4.46	6.76	16.7	3.32	5.60	15	38	15' Type R Sump Inlet
23	S2 & OS-S2	0.31	0.14	0.18	12.6	3.72	6.39	1	1	15' Type R Sump Inlet
22 & 23 SPLIT	S1, OS-S1, S2, OS-S2, & DP 21 FLOW BY	7.44	4.59	6.95	16.7	3.32	5.60	8	19	2-10' Type R Sump Inlets
24	T1	1.42	0.64	0.84	10.7	3.97	6.88	3	6	5' Type R Sump Inlets
25	T2 & OS-T2	1.99	0.90	1.18	13.5	3.63	6.20	3	7	5' Type R Sump Inlets
26	U1	4.38	1.97	2.58	14.3	3.54	6.03	7	16	10' Type R Sump Inlets
27	U2	1.89	0.85	1.11	13.8	3.59	6.12	3	7	5' Type R Sump Inlets
28	W & OS-W	5.76	2.85	3.61	15.0	3.47	5.89	10	21	2-10' Type R Sump Inlets
29	BASINS G1, G2, R, S1, S2, T1, T2, U1, U2, V, W, X, OS-1, OS-2, OS-3A	72.14	37.28	51.38	22.4	2.88	4.78	115	265	FSD POND 3
30	PR 45, Y & OS-10	3.76	3.03	5.88	13.5	3.62	6.19	11	36	Triple 36" RCP Culverts
30*	DPEXA	UNDEVELOPED UPSTREAM CHANNEL FLOW						31	151	Triple 36" RCP Culverts
30**	FSD POND 3 EMERGENCY SPILLWAY RELEASE &	MHFD DETENTION 100Y PEAK INFLOW							306	Triple 36" RCP Culverts
30A	DP 30 & FSD POND RELEASE	MHFD DETENTION 100Y PEAK INFLOW						12	94	EAST CHANNEL FULLY DEVELOPED UPSTREAM
30A*	DP 30* & FSD POND 3 RELEASE	UPSTREAM CHANNEL FLOW & POND 3 RELEASE						32	188	
31	V	0.54	0.24	0.32	5.0	5.00	9.06	1	3	3-18" DIA INLETS
32	X	0.43	0.19	0.25	5.0	5.00	9.06	1	2	2-18" DIA INLETS
33	O-3	0.56	0.25	0.33	5.0	5.00	9.06	1	3	4-18" DIA INLETS
34	O-4	0.38	0.17	0.23	5.0	5.00	9.06	1	2	3-18" DIA INLETS
EXSA*	OS-2 & OS-8	13.96	1.03	4.11	18.38	3.17	5.32	8	33	NORTH BOUNDARY

FDR FUTIANL~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Design Points/Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Pipe Size*
1	DP 2	0.39	0.51	6.9	4.58	8.14	2	4	18" RCP
2	DP 1 & 2	1.91	2.51	14.3	3.54	6.03	7	15	24" RCP
3	DP 3	1.03	1.36	14.2	3.55	6.05	4	8	18" RCP
4	DP-4	1.61	2.11	14.8	3.49	5.93	6	13	18" RCP
5	DP 3 & 4	2.64	3.47	14.8	3.49	5.93	9	21	24" RCP
6	DP 1-4	4.56	5.97	14.8	3.49	5.93	16	35	36" RCP
7	DP-1-5	6.20	8.12	14.8	3.49	5.93	22	48	36" RCP
8	DP-6	0.95	1.24	11.4	3.87	6.69	4	8	18" RCP
9	DP-7	0.98	1.29	13.8	3.59	6.12	4	8	18" RCP
10	DP-6 & 7	1.97	2.58	13.8	3.59	6.12	7	16	24" RCP
10A	DP-7A	0.24	0.31	5.0	5.00	9.06	1	3	15" RCP
10B	DP-6, 7, 7A, & 7B	2.51	3.30	13.8	3.59	6.12	9	20	24" RCP
10C	POND 1 RELEASE	2.95	3.87	13.8	3.59	6.12	0.4	14.6	24" RCP
11	DP-14	1.71	2.24	16.1	3.36	5.69	6	13	24" RCP
12	DP-15	0.90	1.18	12.8	3.70	6.34	3	7	18" RCP
13	DP 14 & 15	2.61	3.42	16.1	3.36	5.69	9	19	30" RCP
14	DP 16	1.27	1.66	13.5	3.62	6.19	5	10	24" RCP
15	DP 14, 15 & 16	3.88	5.08	16.1	3.36	5.69	13	29	36" RCP
16	DP 17	0.27	0.35	15.5	3.42	5.80	1	2	18" RCP
17	DP 14, 15, 16, 17, 33, & 34	4.57	5.99	16.1	3.36	5.69	15	34	36" RCP
17A	POND 2 RELEASE						0.2	14.8	18" RCP
18	DP 19	2.60	3.41	22.4	2.88	4.78	8	16	24" RCP
19	DP 20	0.85	1.12	12.4	3.75	6.43	3	7	18" RCP
20	DP 18 & 19	3.46	4.53	22.4	2.88	4.78	10	22	24" RCP
21	DP 21 PICK UP						8	14	18" RCP
22	DP 19, 20 & 21	6.23	7.46	22.4	2.88	4.78	18	36	30" RCP
23	DP 22	2.30	3.47	16.7	3.32	5.60	8	19	24" RCP
24	DP 23	2.30	3.47	16.7	3.32	5.60	8	19	24" RCP
25	DP 22 & 23	4.59	6.95	16.7	3.32	5.60	15	39	36" RCP
26	DP 19 -23	10.83	14.40	22.4	2.88	4.78	31	69	36" RCP
27	DP 24	0.64	0.84	10.7	3.97	6.88	3	6	18" RCP
28	DP 25	0.90	1.18	13.5	3.63	6.20	3	7	18" RCP
29	DP 19-25	12.36	16.42	22.4	2.88	4.78	36	78	42" RCP
30	DP 26	1.97	2.58	14.3	3.54	6.03	7	16	24" RCP
31	DP 19-26	14.33	19.00	22.4	2.89	4.79	41	91	42" RCP
32	DP 27	0.85	1.11	13.8	3.59	6.12	3	7	18" RCP
33	DP 19-27, & 31	15.42	20.43	22.4	2.88	4.78	44	98	42" RCP
33A	DPR 33 & PR 37	15.66	20.75	22.4	2.88	4.78	45	99	42" RCP
34	DP 28 SPLIT	1.42	1.81	15.0	3.47	5.89	5	11	24" RCP
34A	DP 28 & 32	3.04	3.86	13.84	3.59	6.12	11	24	30" RCP
35	Pond 3 Release	MHFD UD-DETENTION POND RELEASE					1.3	37.7	36" RCP
36	DP 30	FSD POND 3 EMERGENCY SPILLWAY RELEASE						269.3	TRIPLE 36" RCP
37	DP 31	0.24	0.32	5.00	5.00	9.06	1	3	12" HDPE
38	DP 32	0.19	0.25	5.00	5.00	9.06	1	2	12" HDPE
39	DP 33	0.25	0.33	5.00	5.00	9.06	1	3	12" HDPE
40	DP 34	0.17	0.23	5.00	5.00	9.06	1	2	12" HDPE
43	DP 9 & 9A	2.14	3.06	9.06	4.21	7.36	9	23	24" RCP
44	DP 10 RELEASE	Eastonville Road – Londonderry Drive to Rex Road Segment 1 Improvements FDR					0.3	5	18" RCP
45	PR 43 & 44	Eastonville Road – Londonderry Drive to Rex Road Segment 1 Improvements FDR					9	28	30" RCP

LEGEND

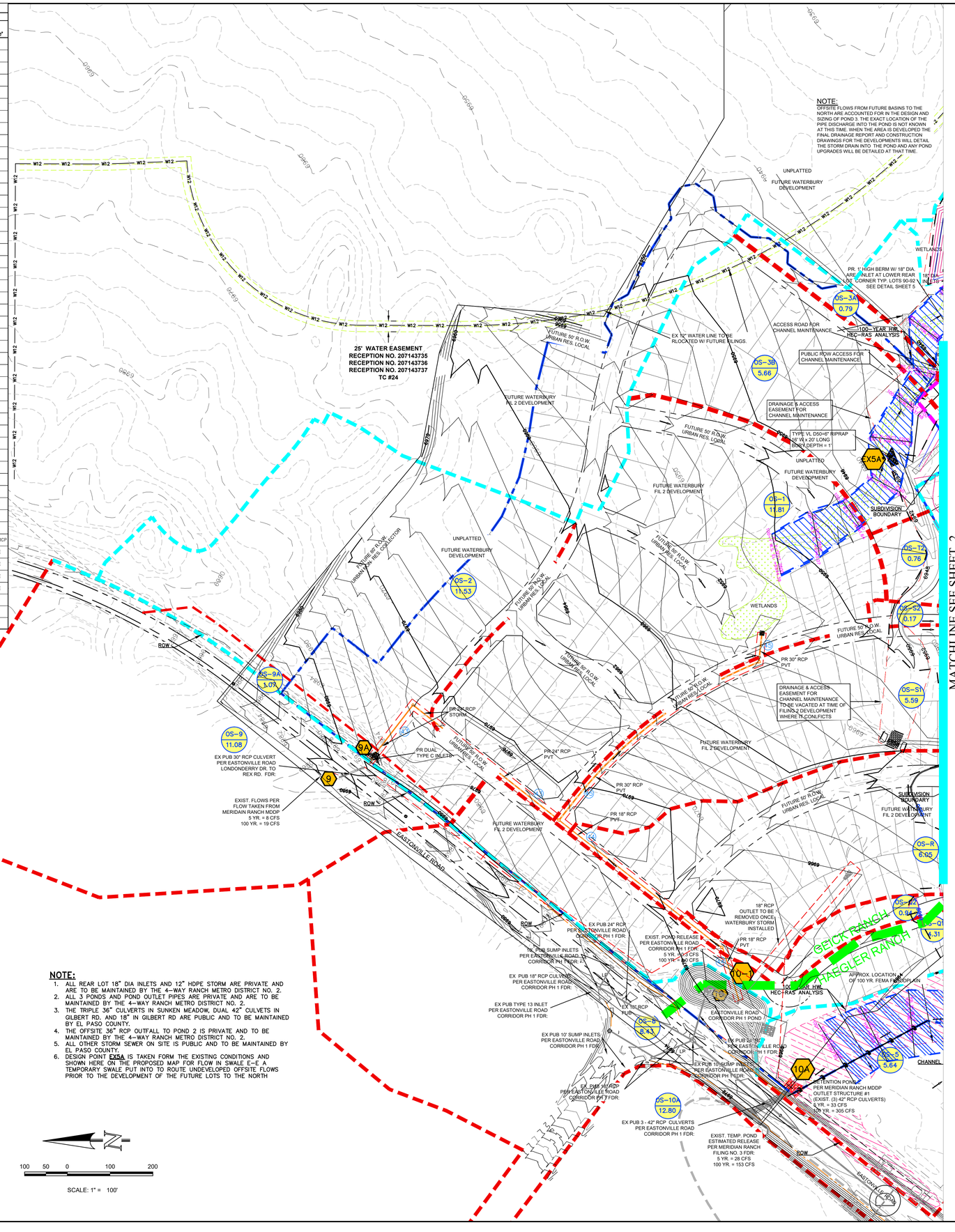
DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
PROPERTY BOUNDARY	
BASIN BOUNDARY (TRIB. TO A POND OR EXCLUDED AREA)	
BASIN BOUNDARY (OFFSITE)	
BASIN BOUNDARY (ONSITE)	
MAJOR DRAINAGE BASIN	
PROP STORM SEWER	
EXIST STORM SEWER	
EX RIPRAP	
WETLANDS	
100 YR. FLOODPLAIN	
100-Y HWL PER HECRAS ANLYSIS	
BASIN IDENTIFIER	K
AREA IN ACRES	1.5
DESIGN POINT	5
PIPE RUN	17
EXISTING DIRECTION OF FLOW	
Tc PATH	

NOTE:

1. ALL REAR LOT 18" DIA INLETS AND 12" HDPE STORM ARE PRIVATE AND ARE TO BE MAINTAINED BY THE 4~WAY RANCH METRO DISTRICT NO. 2.
2. ALL 3 PONDS AND POND OUTLET PIPES ARE PRIVATE AND ARE TO BE MAINTAINED BY THE 4~WAY RANCH METRO DISTRICT NO. 2.
3. THE TRIPLE 36" CULVERTS IN SUNKEN MEADOW, DUAL 42" CULVETS IN GILBERT RD, AND 18" IN GILBERT RD ARE PUBLIC AND TO BE MAINTAINED BY EL PASO COUNTY.
4. THE OFFSITE 36" RCP OUTFALL TO POND 2 IS PRIVATE AND TO BE MAINTAINED BY THE 4~WAY RANCH METRO DISTRICT NO. 2.
5. ALL OTHER STORM SEWER ON SITE IS PUBLIC AND TO BE MAINTAINED BY EL PASO COUNTY.
6. DESIGN POINT EXSA IS TAKEN FORM THE EXISTING CONDITIONS AND SHOWN HERE ON THE PROPOSED MAP FOR FLOW IN SWALE E~E A TEMPORARY SWALE PUT INTO TO ROUTE UNDEVELOPED OFFSITE FLOWS PRIOR TO THE DEVELOPMENT OF THE FUTURE LOTS TO THE NORTH

100 50 0 100 200

SCALE: 1" = 100'



MATCHLINE SEE SHEET 2

REVISIONS NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, TERRA NOVA ENGINEERING AND SURVEYING, INC. APPROVES THEIR USE ONLY FOR PRELIMINARY PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

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WATERBURY FILING 1

FINAL DRAINAGE REPORT
FUTURE FINAL DRAINAGE MAP 1
UPSTREAM OFFSITE MAP

DESIGNED BY	QNA
DRAWN BY	QNA
CHECKED BY	
H-SCALE	1"=100'
V-SCALE	
JOB NO.	2356.00
DATE ISSUED	4/17/26
SHEET NO.	1 OF 2

RUNOFF REDUCTION LEGEND

UNCONNECTED IMPERVIOUS AREA

RECEIVING PERVIOUS AREA

EXCLUDED UNDEVELOPED PERVIOUS AREA
PER THE EXCLUSION IN ECM APPENDIX I.7.1.B.7 – SITES WITH LAND DISTURBANCE TO UNDEVELOPED LAND THAT WILL REMAIN UNDEVELOPED

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
PROPERTY BOUNDARY	
BASIN BOUNDARY (TRIB. TO A POND OR EXCLUDED AREA)	
BASIN BOUNDARY (OFFSITE)	
BASIN BOUNDARY (ONSITE)	
MAJOR DRAINAGE BASIN	
PROP STORM SEWER	
EXIST STORM SEWER	
EX RIPRAP	
WETLANDS	
100 YR. FLOODPLAIN	
100-Y HWL PER HECRAS ANLYSIS	
BASIN IDENTIFIER	K
AREA IN ACRES	1.5
DESIGN POINT	5
PIPE RUN	17
EXISTING DIRECTION OF FLOW	
Tc PATH	

MDDP PBMP SUMMARY TABLE

BASINS	PBMP TRIB. AREA (AC)	PBMP
A, B1, B2, C, D, E, F, G1, G2, H, & K	22.34	FSD POND 1
L1, L2, O1, O2, O3, O4, & OS-4	21.06	FSD POND 2
Q1, OS-Q1, Q2, OS-Q2, R, OS-R, S1, OS-S1, S2, OS-S2, T1, T2, OS-T2,U1, U2, 2, V, X, W, OS-1, OS-2, OS-3A, OS-3B, OS- 7, & OS-9	82.44	FSD POND 3
I, J, M1, P, & Y	8.45	EXCLUDED*
M2 & N	0.58	RUNOFF REDUCTION**

*EXCLUDED UNDEVELOPED PERVIOUS AREA PER THE EXCLUSION IN ECM APPENDIX I.7.1.B.7 - SITES WITH LAND DISTURBANCE TO UNDEVELOPED LAND THAT WILL REMAIN UNDEVELOPED

**UD-BMP VERSION 3.07 RUNOFF REDUCTION WAS USED TO SHOW THAT THIS AREA HAS 100% WQCV REDUCTION BASED UPON THE UNCONNECTED IMPERVIOUS AREA BEING ROUTED OVER THE RECEIVING PERVIOUS AREA.

STORM OWNERSHIP NOTE

1. ALL REAR LOT 18" DIA INLETS AND 12" HDPE STORM ARE PRIVATE AND ARE TO BE MAINTAINED BY THE 4-WAY RANCH METRO DISTRICT NO. 2.
2. ALL 3 PONDS AND POND OUTLET PIPES ARE PRIVATE AND ARE TO BE MAINTAINED BY THE 4-WAY RANCH METRO DISTRICT NO. 2.
3. THE TRIPLE 36" CULVERTS IN SUNKEN MEADOW, DUAL 42" CULVETS IN GILBERT RD. AND 18" IN GILBERT RD ARE PUBLIC AND TO BE MAINTAINED BY EL PASO COUNTY.
4. THE OFFSITE 36" RCP OUTFALL TO POND 2 IS PRIVATE AND TO BE MAINTAINED BY THE 4-WAY RANCH METRO DISTRICT NO. 2.
5. ALL OTHER STORM SEWER ON SITE IS PUBLIC AND TO BE MAINTAINED BY EL PASO COUNTY.
6. DESIGN POINT EX5A IS TAKEN FORM THE EXISTING CONDITIONS AND SHOWN HERE ON THE PROPOSED MAP FOR FLOW IN SWALE E-E A TEMPORARY SWALE PUT INTO TO ROUTE UNDEVELOPED OFFSITE FLOWS PRIOR TO THE DEVELOPMENT OF THE FUTURE LOTS TO THE NORTH

SCALE: 1" = 100'

PREPARED FOR:
ACM ALF VIII JV SUB II LLC
ATTN: JASON POCK
1700 E. MISSISSIPPI AVE., STE 500
DENVER, CO 80246
303-984-9800

Terra Nova Engineering, Inc.
721 S. 23RD STREET
COLORADO SPRINGS, CO 80904
OFFICE: 719-635-6422
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www.tnesllc.com

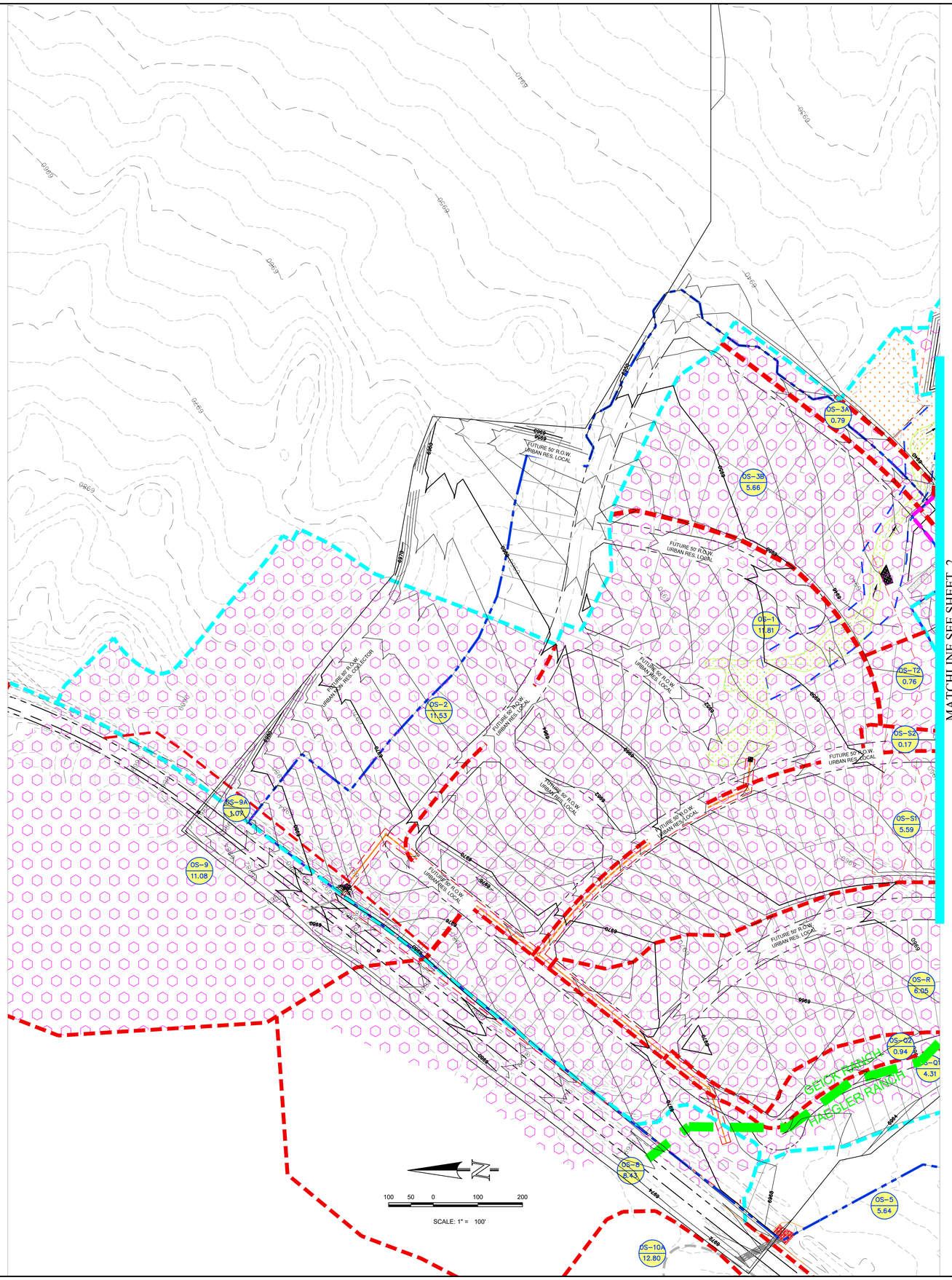
NO.	DESCRIPTION	DATE
REVISIONS		

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WATERBURY FILING 1

FINAL DRAINAGE REPORT
FUTURE FINAL DRAINAGE MAP 2
ONSITE MAP

DESIGNED BY	QNA
DRAWN BY	QNA
CHECKED BY	
H-SCALE	1"=100'
V-SCALE	
JOB NO.	2356.00
DATE ISSUED	4/17/26
SHEET NO.	2 OF 2



POND TRIBUTARY AREA

- POND 1 TRIBUTARY AREA
- POND 2 TRIBUTARY AREA
- POND 3 TRIBUTARY AREA
- EXCLUDED UNDEVELOPED PERVIOUS AREA/ 100% RUNOFF REDUCTION AREA

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
PROPERTY BOUNDARY	
BASIN BOUNDARY (TRIB. TO A POND OR EXCLUDED AREA)	
BASIN BOUNDARY (OFFSITE)	
BASIN BOUNDARY (ONSITE)	
MAJOR DRAINAGE BASIN	
PROP STORM SEWER	
EXIST STORM SEWER	
EX RIPRAP	
WETLANDS	
100 YR. FLOODPLAIN	
100-Y HWL PER HECRAS ANLYSIS	
BASIN IDENTIFIER / AREA IN ACRES	K 1.5
DESIGN POINT	5
PIPE RUN	17
EXISTING DIRECTION OF FLOW	
Tc PATH	

REVISIONS

NO.	DESCRIPTION	DATE

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www.tnesinc.com

WATERBURY FILING 1

FINAL DRAINAGE REPORT
FUTURE POND TRIBUTARY AREA 1
ONSITE MAP

DESIGNED BY	QNA
DRAWN BY	QNA
CHECKED BY	
H-SCALE	1"=100'
V-SCALE	
JOB NO.	2356.00
DATE ISSUED	4/17/26
SHEET NO.	1 OF 2

MATCHLINE SEE SHEET 1

POND TRIBUTARY AREA

POND 1 TRIBUTARY AREA

POND 2 TRIBUTARY AREA

POND 3 TRIBUTARY AREA

EXCLUDED UNDEVELOPED PERVIOUS AREA
PER THE EXCLUSION IN ECM APPENDIX I.7.1.B.7 – SITES WITH LAND DISTURBANCE TO UNDEVELOPED LAND THAT WILL REMAIN UNDEVELOPED

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
PROPERTY BOUNDARY	
BASIN BOUNDARY (TRIB. TO A POND OR EXCLUDED AREA)	
BASIN BOUNDARY (OFFSITE)	
BASIN BOUNDARY (ONSITE)	
MAJOR DRAINAGE BASIN	
PROP STORM SEWER	
EXIST STORM SEWER	
EX RIPRAP	
WETLANDS	
100 YR. FLOODPLAIN	
100-Y HWL PER HECRAS ANLYSIS	
BASIN IDENTIFIER	K
AREA IN ACRES	1.5
DESIGN POINT	5
PIPE RUN	17
EXISTING DIRECTION OF FLOW	
Tc PATH	

100 50 0 100 200

SCALE: 1" = 100'

PROPOSED FSD POND 2
(1.241 AC-FT WQCV)
(2.762 AC-FT EURV)
(13.026 AC-FT 100-Y)
(3:1 SLOPES / 8' MAX. DEPTH)
PROP DESIGN POINT IN-FLOW
5-YR = 17 CFS
100-YR = 31 CFS
PROP UNDET UD DET IN-FLOW
5-YR = 7.7 CFS
100-YR = 20.6 CFS
PROPOSED RELEASE
5-YR = 9.2 CFS
100-YR = 14.5 CFS

PROPOSED FSD POND 3
(1.307 AC-FT WQCV)
(3.276 AC-FT EURV)
(7.144 AC-FT 100-Y)
(3:1 SLOPES / 8' MAX. DEPTH)
PROP DESIGN POINT IN-FLOW
5-YR = 11 CFS
100-YR = 25 CFS
PROP UNDET UD DET IN-FLOW
5-YR = 3.7 CFS
100-YR = 9.9 CFS
PROPOSED RELEASE
5-YR = 7.3 CFS
100-YR = 15.1 CFS

PROPOSED FSD POND 1
(0.994 AC-FT WQCV)
(0.967 AC-FT EURV)
(4.127 AC-FT 100-Y)
(3:1 SLOPES / 6.5' MAX. DEPTH)
PROP DESIGN POINT IN-FLOW
5-YR = 26 CFS
100-YR = 63 CFS
PROP UNDET UD DET IN-FLOW
5-YR = 12.4 CFS
100-YR = 29.9 CFS
PROPOSED RELEASE
5-YR = 0.4 CFS
100-YR = 14.4 CFS

GEICK RANCH
HAEGLER RANCH

FUTURE 50' R.O.W. URBAN RES. LOCAL

PREPARED FOR:
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REVISIONS

NO.	DESCRIPTION	DATE

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WATERBURY FILING 1

FINAL DRAINAGE REPORT
FUTURE POND TRIBUTARY AREA 2
ONSITE MAP

DESIGNED BY	QNA
DRAWN BY	QNA
CHECKED BY	
H-SCALE	1"=100'
V-SCALE	
JOB NO.	2356.00
DATE ISSUED	4/17/26
SHEET NO.	2 OF 2

FINAL DRAINAGE REPORT INTERIM ~ BASIN RUNOFF SUMMARY

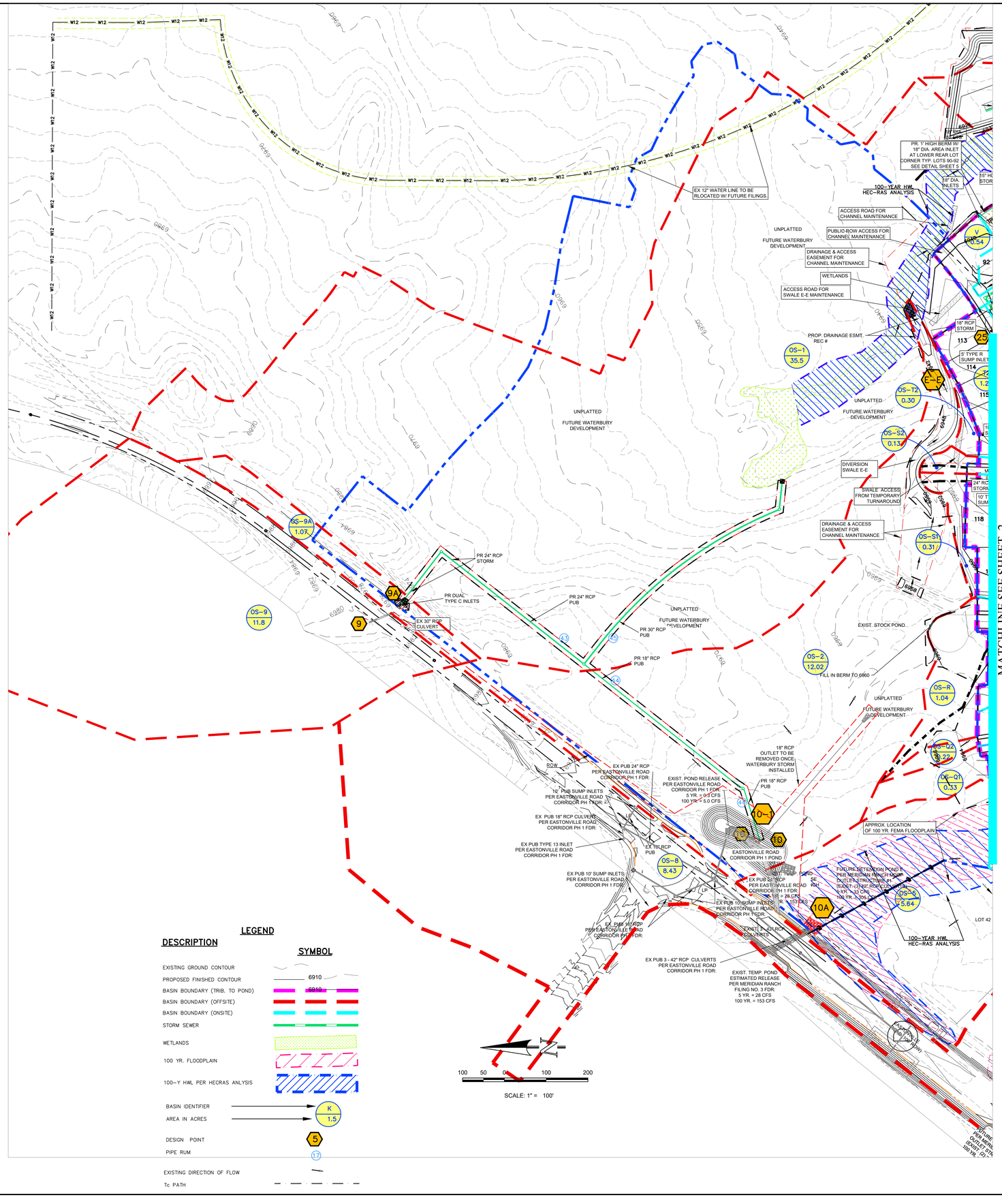
BASIN	WEIGHTED CA(5)	WEIGHTED CA(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL FLOW Length (ft)	STREET / CHANNEL FLOW Slope (%)	STREET / CHANNEL FLOW Velocity (fps)	STREET / CHANNEL FLOW Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	TOTAL FLOWS Q(100) (cfs)
A	1.52	2.00	0.25	100	2	12.6	439	1.5%	4.3	1.6	14.3	3.54	6.03	5	12
B1	1.03	1.36	0.25	100	2	12.6	409	1.5%	4.3	1.6	14.2	3.55	6.05	4	8
B2	1.61	2.11	0.25	100	2	12.6	550	1.5%	4.3	2.1	14.8	3.49	5.93	6	13
C	0.39	0.51	0.25	20	0.5	5.3	500	2.0%	4.9	1.7	6.9	4.56	8.14	2	4
D	0.95	1.24	0.25	80	2	10.5	390	2.5%	5.5	0.9	11.4	3.87	6.69	4	8
E	0.98	1.29	0.25	100	2	12.6	400	2.5%	5.5	1.2	13.8	3.59	6.12	4	8
F	0.98	1.29	0.25	50	2	7.1	629	1.5%	4.3	2.4	9.5	4.14	7.22	4	9
G1	0.17	0.23	0.25								5.0	5.00	9.06	1	2
G2	0.27	0.35	0.25								5.0	5.00	9.06	1	3
H	0.66	0.86	0.25	50	2	7.1	525	1.5%	4.3	2.0	9.2	4.15	7.33	3	6
I	0.97	2.12	0.25	80	4	8.4	250	2.0%	4.9	0.8	9.2	4.16	7.32	4	16
J	0.65	0.85	0.25	90	6	9.1	650	2.0%	4.9	2.2	10.9	3.94	6.81	3	6
K	0.69	1.37	0.25	100	18	6.1	80	1.0%	3.5	0.4	6.5	4.67	8.33	3	11
L1	1.71	2.24	0.25	100	2	12.6	850	1.4%	4.1	3.5	16.1	3.36	5.69	6	13
L2	0.90	1.18	0.25	55	1.1	9.4	850	1.4%	4.1	3.5	12.8	3.70	6.34	3	7
M1	0.45	0.58	0.25	70	1.5	10.3	200	2.0%	4.9	0.7	11.0	3.92	6.79	2	4
M2	0.16	0.21	0.25	65	3	7.7	0	0.0%	0.0	0.0	7.7	4.43	7.83	1	2
N	0.10	0.13	0.25								5.0	5.00	9.06	1	1
O1	1.27	1.66	0.25	100	2.5	11.7	460	1.5%	4.3	1.8	13.5	3.62	6.19	5	10
O2	0.32	0.42	0.25	100	2	12.6	850	2.0%	4.9	2.9	15.5	3.42	5.80	1	2
O3	0.20	0.27	0.25								5.0	5.00	9.06	1	2
O4	0.17	0.23	0.25								5.0	5.00	9.06	1	2
P	0.05	0.25	0.25								5.0	5.00	9.06	0	2
Q1	0.65	0.87	0.25	55	1.3	8.9	445	2.0%	5.0	1.5	10.4	4.01	6.97	3	6
Q2	0.43	0.56	0.25	55	1.3	8.9	445	2.0%	5.0	1.5	10.4	4.01	6.97	2	4
R	0.46	0.60	0.25	100	4	10.1	720	2.0%	4.9	2.4	12.4	3.75	6.44	2	4
S1	0.70	0.91	0.25	100	6	9.8	175	2.0%	4.9	0.6	9.4	4.16	7.26	3	7
S2	0.06	0.08	0.25								5.0	5.00	9.06	0	1
T1	0.64	0.84	0.25	55	1.1	9.4	390	2.0%	4.9	1.3	10.7	3.97	6.88	3	6
T2	0.55	0.73	0.25	100	2	12.6	245	2.0%	5.0	0.8	13.5	3.63	6.20	2	5
U1	1.97	2.58	0.25	100	2	12.6	520	2.3%	5.3	1.6	14.3	3.54	6.03	7	16
U2	0.85	1.11	0.25	100	2	12.6	385	2.3%	5.4	1.2	13.8	3.59	6.12	3	7
V	0.24	0.32	0.25								5.0	5.00	9.06	1	3
W	2.34	3.07	0.25	100	2	12.6	630	1.6%	4.4	2.4	15.0	3.47	5.89	8	18
X	0.19	0.25	0.25								5.0	5.00	9.06	1	2
Y	0.16	0.21	0.25								5.0	5.00	9.06	1	2
OS-1	3.20	12.78	0.25	100	2	12.6	2700	2.3%	5.3	8.5	21.1	2.97	4.94	9	63
OS-2	1.08	4.33	0.25	100	2	12.6	1203	1.0%	3.5	5.7	18.4	3.17	5.32	3	23
OS-4	0.58	3.62	0.25	800	26	30.5					30.5	2.46	4.01	2	16
OS-5	0.51	2.03	0.25	80	5	7.8					7.8	4.42	7.62	2	16
OS-6	0.48	0.63	0.25	30	0.6	6.9	900	1.8%	4.7	3.2	10.1	4.05	7.04	2	4
OS-7	0.34	1.35	0.25								5.0	5.00	9.06	2	12
OS-8	INFO TAKEN FROM EASTONVILLE ROAD LONDONDERRY DR. TO REX RD. FDR													5	12
OS-9	FLOW TAKEN FROM MERIDIAN RANCH MDDP													8	19
OS-9A	0.24	0.48	0.25	50	2	7.1	585	2.0%	5.0	2.0	9.1	4.21	7.36	1	4
OS-Q1	0.03	0.12	0.25	100	2	12.6	135	1.5%	4.3	0.5	13.2	3.66	6.27	0	1
OS-Q2	0.02	0.08	0.25	50	1	8.9	135	1.5%	4.3	0.5	9.5	4.14	7.24	0	1
OS-R	0.09	0.38	0.25	100	2	12.6	50	2.7%	5.8	0.1	12.8	3.70	6.35	0	2
OS-S1	0.03	0.11	0.25								5.0	5.00	9.06	0	1
OS-S2	0.01	0.05	0.25								5.0	5.00	9.06	0	0
OS-T2	0.03	0.11	0.25								5.0	5.00	9.06	0	1

FINAL DRAINAGE REPORT INTERIM~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Design Points/Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Pipe Size
1	DP 2	0.39	0.51	6.9	4.56	8.14	2	4	18" RCP
2	DP 1 & 2	1.91	2.51	14.3	3.54	6.03	7	15	24" RCP
3	DP 3	1.03	1.36	14.2	3.55	6.05	4	8	18" RCP
4	DP 4	1.61	2.11	14.8	3.49	5.93	6	13	18" RCP
5	DP 3 & 4	2.64	3.47	14.8	3.49	5.93	9	21	24" RCP
6	DP 1-4	4.56	5.97	14.8	3.49	5.93	16	35	36" RCP
7	DP-1-5	6.20	8.12	14.8	3.49	5.93	22	48	36" RCP
8	DP-6	0.85	1.24	11.4	3.87	6.69	4	8	18" RCP
9	DP-7	0.98	1.29	13.8	3.59	6.12	4	8	18" RCP
10	DP-6 & 7	1.93	2.53	13.8	3.59	6.12	7	15	24" RCP
10A	DP-7A	0.17	0.23	5.0	5.00	9.06	1	2	15" RCP
10B	DP-6, 7, 7A & 7B	2.37	3.11	13.6	3.59	6.12	9	19	24" RCP
10C	Pond 1 Release						0.4	14.5	18" RCP
11	DP-14	1.71	2.24	16.1	3.36	5.69	6	13	24" RCP
12	DP-15	0.90	1.18	16.1	3.36	5.69	3	7	24" RCP
13	DP 14 & 15	2.61	3.42	16.1	3.36	5.69	9	19	30" RCP
14	DP 16	1.27	1.66	13.5	3.62	6.19	5	10	30" RCP
15	DP 14, 15 & 16	3.88	5.08	16.1	3.36	5.69	13	29	36" RCP
16	DP 17	0.32	0.42	15.5	3.42	5.80	1	2	18" RCP
17	DP 14, 15, 16, & 17	4.57	6.00	16.1	3.36	5.69	15	34	36" RCP
17A	Pond 2 Release						1.1	2.4	18" RCP
18	DP 19	0.69	0.99	13.2	3.66	6.27	3	6	24" RCP
19	DP 20	0.45	0.65	9.5	4.14	7.24	2	5	18" RCP
20	DP 19 & 20	1.15	1.64	13.2	3.66	6.27	4	10	24" RCP
21	DP 21 PICK UP						2	6	18" RCP
22	DP 18, 20 & 21	1.69	2.58	13.2	3.66	6.27	6	16	30" RCP
23	DP 22	0.72	1.02	12.4	3.75	6.44	3	7	24" RCP
24	DP 23	0.07	0.13	5.0	5.00	9.06	0	1	24" RCP
25	DP 22 & 23	0.80	1.15	12.4	3.75	6.44	3	7	30" RCP
26	DP 19 -23	2.49	3.74	13.2	3.66	6.27	9	23	36" RCP
27	DP 24	0.64	0.84	10.7	3.97	6.88	3	6	18" RCP
28	DP 25	0.58	0.84	13.5	3.63	6.20	2	5	18" RCP
29	DP 19-25	3.71	5.42	13.5	3.63	6.20	13	34	36" RCP
30	DP 26	1.97	2.58	14.3	3.54	6.03	7	16	24" RCP
31	DP 19-26	5.68	8.00	14.3	3.54	6.03	20	48	42" RCP
32	DP 27	0.85	1.11	13.8	3.59	6.12	3	7	18" RCP
33	DP 19-27 & 31	6.77	9.43	14.3	3.54	6.03	24	57	42" RCP
34	DP 28 SPLIT FLOW	2.34	3.07	15.03	3.47	5.89	8	18	24" RCP
34A	28 & 32	2.53	3.32	15.0	3.47	5.89	9	20	24" RCP
35	Pond 3 Release	MHFD UD-DETENTION POND RELEASE					1	58	36" RCP
36	DP 30	SUM OF BASINS					22	113	TRIPLE 36" RCP
37	DP 31	0.24	0.32	5.00	5.00	9.06	1	3	15" HDPE
38	DP 32	0.19	0.25	5.00	5.00	9.06	1	2	15" HDPE
39	DP 33	0.20	0.27	5.00	5.00	9.06	1	2	15" HDPE
40	DP 34	0.17	0.23	5.00	5.00	9.06	1	2	15" HDPE
43	DP 9 & 9A	2.14	3.06	9.06	4.21	7.36	9	23	24" RCP
44	DP 10 RELEASE	Eastonville Road – Londonderry Drive to Rex Road Segment1 Improvements FDR					0.3	5	18" RCP
45	PR 43 & 44	Eastonville Road – Londonderry Drive to Rex Road Segment1 Improvements FDR					9	28	30" RCP

FINAL DRAINAGE REPORT INTERIM~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Facility Size
1	A	3.39	1.52	2.00	14.3	3.54	6.03	5	12	10' Type R Sump Inlet
2	C	0.86	0.39	0.51	6.9	4.56	8.14	2	4	5' Type R Sump Inlet
3	B1	2.30	1.03	1.36	14.2	3.55	6.05	4	8	5' Type R Sump Inlet
4	B2	3.58	1.61	2.11	14.8	3.49	5.93	6	13	5' Type R Sump Inlet
5	F & H	3.65	1.64	2.15	9.5	4.14	7.22	7	16	10' Type R Sump Inlet
6	D	2.11	0.95	1.24	11.4	3.87	6.69	4	8	5' Type R Sump Inlets
7	E	2.18	0.98	1.29	13.8	3.59	6.12	4	8	5' Type R Sump Inlets
7A	G1	0.39	0.17	0.23	5.0	5.00	9.06	1	2	5' Type R At-grade Inlet
7B	G2	0.60	0.27	0.35	5.0	5.00	9.06	1	3	5' Type R At-grade Inlet
8	DESIGN POINTS 1-7 & K	22.11	8.13	10.66	14.8	3.49	5.93	28	63	FSD Pond 1
9	OS-9	11.80	FLOW TAKEN FROM MERIDIAN RANCH MDDP					8	19	EX 36" RCP Culvert
9A	OS-9A	12.87	2.14	3.06	9.1	4.21	7.36	9	23	DUAL TYPE C INLETS
10	OS-8	8.43	INFO TAKEN FROM EASTONVILLE ROAD LONDONDERRY DR. TO REX RD. FDR					5	11	EX 36" RCP Culvert
10-1	POND RELEASE & DP10	11.80	INFO TAKEN FROM EASTONVILLE ROAD LONDONDERRY DR. TO REX RD. FDR					0.3	5	PR 18" RCP
10A	MERIDIAN POND E RELEASE	Meridaian Ranch Filing 3 FDR Calculated Flows						28	185	EX 3-42" RCP Culverts
11	OS-5, I, OS-& MERIDIAN POND E RELEASE	Sum of Basins						34	216	PR 2-48" RCP Culverts
11A	DP 11 & BASIN J	Sum of Basins						37	222	PR 2-42" RCP Culverts
12	OS-6	1.06	0.48	0.63	10.1	4.05	7.04	2	4	18" RCP Culvert
12A	OS-6	Design Point used for 18" culvert sizing for Access Road. Use DP 12 Flow						2	4	18" RCP Culvert
13	TOTAL OFFSITE EX. STOCK POND INFLOW	Per "Final Drainage Report for Waterbury Filing No. 1" dated September 2016, by Classic Consulting						69	396	EX STOCK POND
14	L1	3.79	1.71	2.24	16.1	3.36	5.69	6	13	10' Type R Sump Inlet
15	L2	2.00	0.90	1.18	16.1	3.36	5.69	3	7	5' Type R Sump Inlet
16	O1	2.82	1.27	1.66	13.5	3.62	6.19	5	10	5' Type R Sump Inlet
17	O2	0.71	0.32	0.42	15.5	3.42	5.80	1	2	5' Type R Sump Inlet
18	DESIGN POINTS 14-17 & BASIN OS-4	20.23	5.18	5.50	16.1	3.36	5.69	17	31	Interim FSD Pond 2
19	Q1 & OS-Q1	1.81	0.69	0.99	13.2	3.66	6.27	3	6	10' Type R Sump Inlet
20	Q2 & OS-Q2	1.18	0.45	0.65	9.5	4.14	7.24	2	5	5' Type R Sump Inlet
21	R & OS-R	2.06	0.55	0.98	12.4	3.75	6.44	2	6	10' Type R At-grade Inlet
22	S1 & OS-S1	1.86	0.72	1.02	12.4	3.75	6.44	3	7	10' Type R Sump Inlet
23	S2 & OS-S2	0.27	0.07	0.13	5.0	5.00	9.06	0	1	10' Type R Sump Inlet
24	T1	1.42	0.64	0.84	10.7	3.97	6.88	3	6	5' Type R Sump Inlets
25	T2 & OS-T2	1.54	0.58	0.84	13.5	3.63	6.20	2	5	5' Type R Sump Inlets
26	U1	4.38	1.97	2.58	14.3	3.54	6.03	7	16	10' Type R Sump Inlets
27	U2	1.89	0.85	1.11	13.8	3.59	6.12	3	7	5' Type R Sump Inlets
28	W	5.20	2.34	3.07	15.0	3.47	5.89	8	18	2-10' Type R Sump Inlets
32	DESIGN POINTS 19-28 & OS-7	26.31	9.21	13.55	15.0	3.47	5.89	32	80	FSD POND 3
E-E	OS-2	12.02	1.08	4.33	18.4	3.17	5.32	3	23	DIVERSION SWALE E-E
30	Y, OS-1, OS-2, PR 45	50.02	7.57	22.88	21.1	2.97	4.94	22	113	Triple 36" RCP Culverts
31	V	0.54	0.24	0.32	5.0	5.00	9.06	1	3	18" DIA INLETS
32	X	0.43	0.19	0.25	5.0	5.00	9.06	1	2	18" DIA INLETS
33	O-3	0.45	0.20	0.27	5.0	5.00	9.06	1	2	18" DIA INLETS
34	O-4	0.38	0.17	0.23	5.0	5.00	9.06	1	2	18" DIA INLETS



REVISIONS

NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, TERRA NOVA ENGINEERING AND SURVEYING, INC. APPROVES THEIR USE ONLY FOR PRELIMINARY PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

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WATERBURY FILING NO. 1

INTERIM PROPOSED DRAINAGE MAP OFF-SITE

DESIGNED BY	QNA
DRAWN BY	QNA
CHECKED BY	
H-SCALE	1"=100
V-SCALE	NA
JOB NO.	2356.00
DATE ISSUED	4/17/26
SHEET NO.	1 OF 2

MATCHLINE SEE SHEET 1

MATCHLINE SEE SHEET 3

RUNOFF REDUCTION LEGEND

UNCONNECTED IMPERVIOUS AREA

RECEIVING PERVIOUS AREA

EXCLUDED UNDEVELOPED IMPERVIOUS AREA PER THE EXCLUSION IN ECM APPENDIX I.7.1.B.7 – SITES WITH LAND DISTURBANCE AND UNDEVELOPED LAND THAT WILL REMAIN UNDEVELOPED

EXCLUDED/IMPERVIOUS AREA PER THE EXCLUSION IN ECM APPENDIX I.7.1.C.1.A – LESS THAN 1 ACRE OF DEVELOPED ROADWAY AREA

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY (TRIB. TO POND)	
BASIN BOUNDARY (OFFSITE)	
BASIN BOUNDARY (ONSITE)	
STORM SEWER	
WETLANDS	
100 YR. FLOODPLAIN	
100-YR HWL PER HECRAS ANLYSIS	
BASIN IDENTIFIER	K
AREA IN ACRES	1.5
DESIGN POINT	5
PIPE RUM	17
EXISTING DIRECTION OF FLOW	
To PATH	

SCALE: 1"= 100'

FDR PBMP SUMMARY TABLE

BASINS	PBMP TRIB. AREA (AC)	PBMP
A, B1, B2, C, D, E, F, G1, G2, H, & K	22.11	FSD POND 1
L1, L2, O1, O2, O3 O4, & OS-4	20.23	FSD POND 2
Q1, OS-Q1, Q2, OS-Q2, R, OS-R, S1, OS-S1, S2, OS-S2, T1, T2, OS-T2, U1, U2, V, X, W, & OS- 7	26.31	FSD POND 3
I, J, M1, P, & Y	8.45	EXCLUDED*
M2 & N	0.58	RUNOFF REDUCTION**

*EXCLUDED UNDEVELOPED PERVIOUS AREA PER THE EXCLUSION IN ECM APPENDIX I.7.1.B.7 - SITES WITH LAND DISTURBANCE TO UNDEVELOPED LAND THAT WILL REMAIN UNDEVELOPED

**UD-BMP VERSION 3.07 RUNOFF REDUCTION WAS USED TO SHOW THAT THIS AREA HAS 100% WQCV REDUCTION BASED UPON THE UNCONNECTED IMPERVIOUS AREA BEING ROUTED OVER THE RECEIVING PERVIOUS AREA

REVISIONS

NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE PLANS ARE APPROVED BY WHITE AS APPROPRIATE REVIEWING AGENCIES, TERRA NOVA ENGINEERING AND SURVEYING, INC. APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

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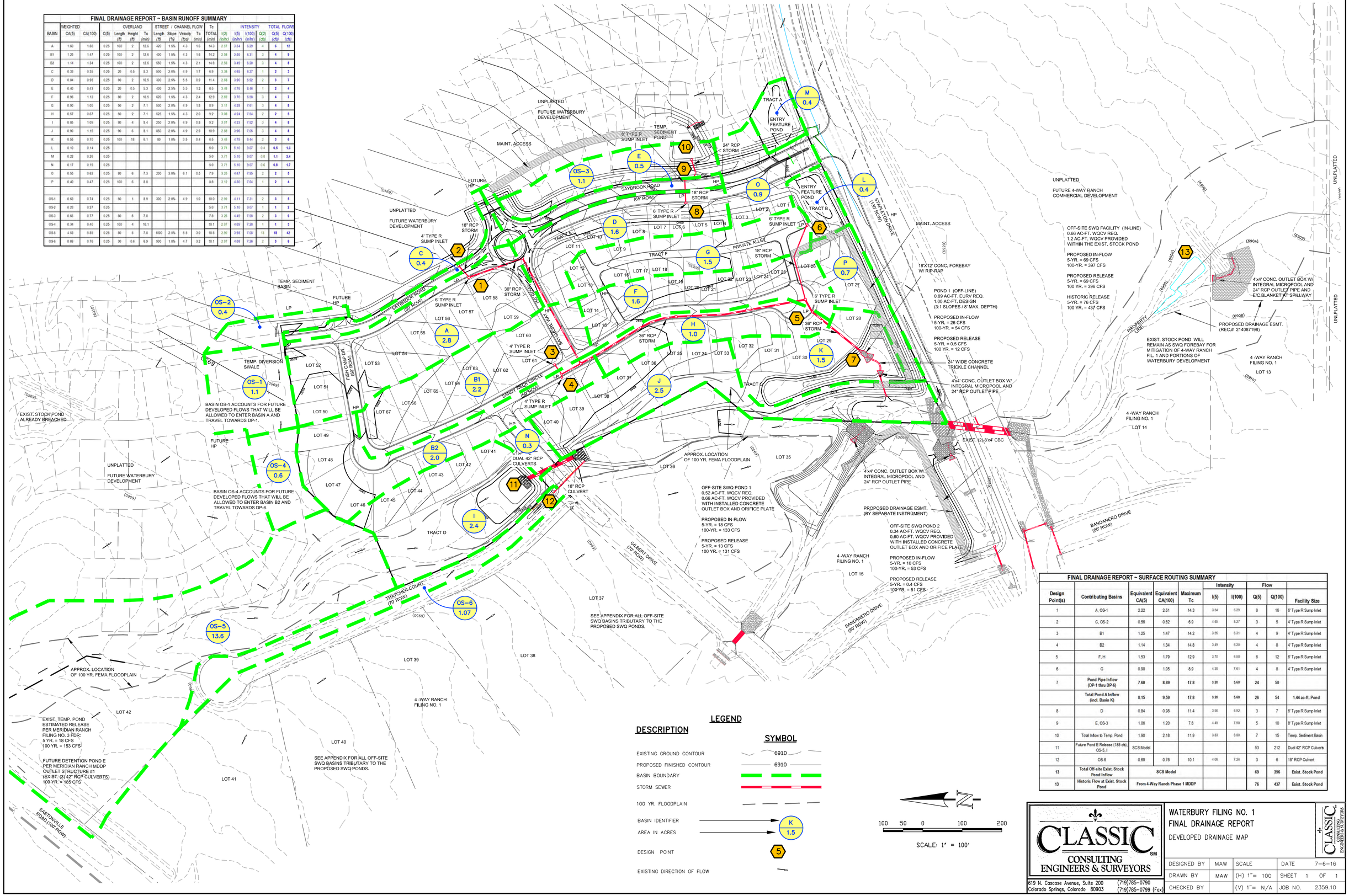
WATERBURY FILING NO. 1

INTERIM PROPOSED DRAINAGE MAP ON-SITE

DESIGNED BY	QNA
DRAWN BY	QNA
CHECKED BY	
H-SCALE	1"=100
V-SCALE	NA
JOB NO.	2356.00
DATE ISSUED	4/17/26
SHEET NO.	2 OF 2

FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(5)	WEIGHTED CA(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL FLOW Length (ft)	STREET / CHANNEL FLOW Slope (%)	STREET / CHANNEL FLOW Velocity (fps)	STREET / CHANNEL FLOW Tc (min)	Tc TOTAL (min)	INTENSITY I(2) (in/hr)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(2) (cfs)	TOTAL FLOWS Q(5) (cfs)	TOTAL FLOWS Q(100) (cfs)
A	1.60	1.88	0.25	100	2	12.6	420	1.9%	4.3	1.6	14.3	2.37	3.54	6.29	4	6	12
B1	1.25	1.47	0.25	100	2	12.6	400	1.9%	4.3	1.6	14.2	2.38	3.55	6.31	3	4	9
B2	1.14	1.34	0.25	100	2	12.6	550	1.9%	4.3	2.1	14.8	2.33	3.49	6.20	3	4	8
C	0.33	0.35	0.25	20	0.5	5.3	500	2.0%	4.9	1.7	6.9	3.38	4.65	8.27	1	2	3
D	0.84	0.98	0.25	80	2	10.5	300	2.5%	5.5	0.9	11.4	2.63	3.90	6.92	2	3	7
E	0.40	0.43	0.25	20	0.5	5.3	400	2.5%	5.5	1.2	6.5	3.46	4.76	8.46	1	2	4
F	0.96	1.12	0.25	80	2	10.5	620	1.9%	4.3	2.4	12.9	2.69	3.70	6.58	3	4	7
G	0.90	1.05	0.25	50	2	7.1	530	2.0%	4.9	1.8	8.9	3.11	4.28	7.61	3	4	8
H	0.57	0.67	0.25	50	2	7.1	525	1.9%	4.3	2.0	9.2	3.08	4.24	7.54	2	2	5
I	0.85	1.09	0.25	80	4	9.4	250	2.0%	4.9	0.8	9.2	3.07	4.23	7.52	3	4	8
J	0.90	1.15	0.25	90	6	8.1	850	2.0%	4.9	2.9	10.9	2.88	3.96	7.05	3	4	8
K	0.55	0.70	0.25	100	18	6.1	80	1.0%	3.5	0.4	6.5	3.45	4.75	8.44	2	3	6
L	0.10	0.14	0.25								5.0	3.71	5.10	9.07	0.4	0.5	1.3
M	0.22	0.26	0.25								5.0	3.71	5.10	9.07	0.8	1.1	2.4
N	0.17	0.19	0.25								5.0	3.71	5.10	9.07	0.6	0.8	1.7
O	0.55	0.62	0.25	80	6	7.3	200	3.0%	6.1	0.5	7.9	3.25	4.47	7.95	2	2	5
P	0.40	0.47	0.25	100	6	8.8					8.8	3.12	4.30	7.64	1	2	4
OS-1	0.63	0.74	0.25	50	1	8.9	300	2.0%	4.9	1.0	10.0	2.99	4.11	7.31	2	3	5
OS-2	0.23	0.27	0.25								5.0	3.71	5.10	9.07	1	1	2
OS-3	0.66	0.77	0.25	80	5	7.8					7.8	3.26	4.49	7.98	2	3	6
OS-4	0.34	0.40	0.25	100	4	10.1					10.1	2.97	4.09	7.26	1	1	3
OS-5	4.53	5.89	0.25	80	5	7.8	1000	2.0%	5.5	3.0	10.8	2.90	3.98	7.08	13	18	42
OS-6	0.69	0.76	0.25	30	0.6	6.9	900	1.8%	4.7	3.2	10.1	2.97	4.08	7.26	2	3	6



LEGEND

DESCRIPTION

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY	
STORM SEWER	
100 YR. FLOODPLAIN	
BASIN IDENTIFIER	K
AREA IN ACRES	1.5
DESIGN POINT	5
EXISTING DIRECTION OF FLOW	

100 50 0 100 200

SCALE: 1" = 100'

FINAL DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Facility Size
1	A, OS-1	2.22	2.61	14.3	3.54	6.29	8	16	6' Type R Sump Inlet
2	C, OS-2	0.56	0.62	6.9	4.65	8.27	3	5	4' Type R Sump Inlet
3	B1	1.25	1.47	14.2	3.55	6.31	4	9	4' Type R Sump Inlet
4	B2	1.14	1.34	14.8	3.49	6.20	4	8	4' Type R Sump Inlet
5	F, H	1.53	1.79	12.9	3.70	6.58	6	12	6' Type R Sump Inlet
6	G	0.90	1.05	8.9	4.28	7.61	4	8	4' Type R Sump Inlet
7	**Pond Pipe Inflow (DP-1 thru DP-6)**	**7.60**	**8.89**	**17.8**	**3.20**	**5.68**	**24**	**50**	
	Total Pond A Inflow (incl. Basin K)	**8.15**	**9.59**	**17.8**	**3.20**	**5.68**	**26**	**54**	**1.44 ac-ft. Pond**
8	D	0.84	0.98	11.4	3.90	6.92	3	7	6' Type R Sump Inlet
9	E, OS-3	1.06	1.20	7.8	4.49	7.98	5	10	8' Type R Sump Inlet
10	Total Inflow to Temp. Pond	1.90	2.18	11.9	3.83	6.80	7	15	Temp. Sediment Basin
11	Future Pond E Release (185 cfs) OS-5, I	SCS Model					53	212	Dual 42" RCP Culverts
12	OS-6	0.69	0.76	10.1	4.08	7.26	3	6	18" RCP Culvert
13	**Total Off-site Exist. Stock Pond Inflow**	**SCS Model**					**69**	**396**	**Exist. Stock Pond**
13	**Historic Flow at Exist. Stock Pond**	**From 4-Way Ranch Phase 1 MDDP**					**76**	**437**	**Exist. Stock Pond**

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WATERBURY FILING NO. 1
FINAL DRAINAGE REPORT
DEVELOPED DRAINAGE MAP

DESIGNED BY	MAW	SCALE		DATE	7-6-16
DRAWN BY	MAW	(H) 1"=	100	SHEET	1 OF 1
CHECKED BY		(V) 1"=	N/A	JOB NO.	2359.10

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APPENDIX J
OPERATIONS AND MAINTENA NCE

Waterbury Filing No. 1
Operations and Maintenance Manual
Extended Detention Basin, Diversion Swale E-E & Grass Buffers

County Job No. PUDSP-21-005 & SF237

Extended detention basins have low to moderate maintenance requirements. Routine and non-routine maintenance is necessary to assure performance, enhance aesthetics, and protect structural integrity. Dry basins can result in nuisance complaints if not properly designed or maintained. Bio-degradable pesticides may be required to limit insect problems. Frequent debris removal and grass-mowing can reduce aesthetic complaints. If a shallow wetland or marshy area is included, mosquito breeding and nuisance odors could occur if the water becomes stagnant.

ACM ALF VIII JV SUB II LLC
Contact Person: Jason Pock
Phone: 303-984-9800 EXT 107
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Mailing Address: 4100 E. Mississippi Avenue, STE 500, Colorado Springs, CO 80246

1. Waterbury Filing No. 1 Extended Detention Basins, Diversion Swale E-E & Grass Buffers Maintained by Waterbury Metropolitan District #1.

There are 3 Extended Detention Basin on the Waterbury Filing No. 1 property that Waterbury Metropolitan District #1 owns and maintains. The following are details of this detention basin. Attached to this manual is a map showing the detention basin location.

Extended Detention Basin Pond 1– Extended Detention Basin with WQCV. This full spectrum detention basin will be built in 2026. The final drainage report for Waterbury Filing No. 1 covers the drainage calculations for this pond.

Extended Detention Basin Pond 2– Extended Detention Basin with WQCV. This full spectrum detention basin will be built in 2026. The final drainage report for Waterbury Filing No. 1 covers the drainage calculations for this pond.

Extended Detention Basin Pond 3– Extended Detention Basin with WQCV. This full spectrum detention basin will be built in 2026. The final drainage report for Waterbury Filing No. 1 covers the drainage calculations for this pond.

Diversion Swale E-E- This Swale will be built in 2026. The final drainage report for Waterbury Filing No. 1 covers the drainage calculations for this swale.

Grasse Buffer- These Grass Buffers will be used as Receiving Pervious Areas. The final drainage report for Waterbury Filing No. 1 covers the Runoff Reduction calculations for these Receiving Pervious Areas (RPA).

2. Access

The Extended Detention Basin Pond 1can be accessed from the Saybrook Road and the from a second access road that parallels the channel behind lots 156-165 and up to the top of the pond berm. There is a gravel access ramp on the east corner of the Extended Detention Basin.

The Extended Detention Basin Pond 2 & 3 can be accessed from the end of Sunken Meadow Drive with a maintenance road to both. There is a gravel access ramp on the east corner of the Extended Detention Basin 3.

The Swale E-E can be accessed from the end of Megansett Way Public ROW and Muddy Pond Public ROW with a maintenance road to both. There is a temporary access at the end of the roadway.

The Grass Buffers (Receiving Pervious Area RPA) can be accessed through the homeowner's yard side yard easements or directly from Gilbert Drive.

3. Inspections

Inspection and Frequency

 Annually inspect detention basin to ensure that the basin continues to function as initially intended. The annual inspection should evaluate the forebay, pond side slopes, inflow channel, the spillway condition, the depth of sediment in the forebay, outlet structure, trash rack, downstream channel, and the condition of the downstream face of the pond. A site survey will be the best indication of excessive sediment buildup and degradation of the spillway. In addition, an inspection of the vegetation on the berm, inside the detention area and the downstream face of the spillway should be conducted. Any bare areas should be noted and repaired using native grasses. Any sloughing or erosion of the embankment should be noted and repaired. Items to record will include any items inspected and the mowing frequency of the vegetation on the facility.

 Just before annual storm seasons (that is, April and May) and following significant rainfall events, inspect for litter and debris that may plug outlets. Of notable importance, the inspections should also include the water quality orifice plate and trash rack to ensure plugging has not occurred.

 A baseline survey should be performed at the time of construction and comparison surveys conducted every ten to twenty years after to monitor overall performance of the pond. Results of inspections should be recorded and kept at a central location for review and recording by the district.

Inspection Personnel
A qualified engineer, surveyor, or certified storm water inspector should conduct inspections of the facility.

4.0 Operations
No specific operating instructions are required.

5.0 Maintenance
Maintenance of the Extended Detention Basin shall be in accordance with the guidelines included in Table EDB-1, below.

Table EDB-1

Required Action	Maintenance Objective	Frequency of Action
Lawn mowing and lawn care	Occasional mowing to limit unwanted. Maintain irrigated turf grass as 2 to 4 inches tall and non-irrigated native turf grasses at 4 to 6.	Routine – Depending on aesthetic requirements.
Debris and litter removal	Remove debris and litter from the entire pond to minimize outlet clogging and improve aesthetics. Outlet structure trash racks should be clear of any blockage.	Routine – Including just before annual storm seasons (that is, April and May) and following significant rainfall events.
Erosion and sediment control	Repair and revegetate eroded areas in the basin and channels.	Nonroutine – Periodic and repair as necessary based on inspection.
Structural	Repair pond inlets, outlets, forebays, low flow channel liners, and energy dissipators whenever damage is discovered.	Nonroutine – Repair as needed based on regular inspections.
Inspections	Inspect basins to insure that the basin continues to function as initially intended. Examine the outlet for clogging, erosion, slumping, excessive sedimentation levels, overgrowth, embankment	Routine – Annual inspection of hydraulic and structural facilities. Also check for obvious problems during routine maintenance visits, especially for plugging of outlets.

	and spillway integrity, and damage to any structural element.	
Nuisance control	Address odor, insects, and overgrowth issues associated with stagnant or standing water in the bottom zone.	Nonroutine – Handle as necessary per inspection or local complaints.
Sediment removal	Remove accumulated sediment from the forebay, micro-pool, and the bottom of the basin.	Nonroutine – Performed when sediment accumulation occupies 20 percent of the WQCV. This may vary considerably, but expect to do this every 10 to 20 years, as necessary per inspection if no construction activities take place in the tributary watershed. More often if they do. The forebay and the micro-pool will require more frequent cleanout than other areas of the basin, say every 1 or 2 years.

Maintenance of the Grass Buffers and Swales (Receiving Pervious Areas & Diversion Swale) shall be in accordance with the guidelines included in Table RPA-1, below.

Table RPA-1

Required Action	Maintenance Objective	Frequency of Action
Inspection	Check for sediment accumulation and rill and gully development. Inspect vegetation for uniform coverage.	Routine – at least twice annually for uniform cover and traffic impacts.
Debris and litter removal	Remove litter and debris to prevent rill and gully development from preferential flow paths around accumulated debris, enhance aesthetics, and prevent	Routine This should be done as needed based on inspection, but no less than two times per year.

	floatables from being washed offsite.	
Aeration	Aeration is done by punching holes in the ground using an aerator with hollow punches that pull the soil cores or "plugs" from the ground. Holes should be at least 2 inches deep and no more than 4 inches apart.	Routine – Should be performed at least once per year when the ground is not frozen.
Mowing	When starting from seed, mow native/drought-tolerant grasses only when required to deter weeds during the first three years. Following this period mowing of native/drought tolerant grass may stop or be reduced to maintain a length of no less than six inches.	Routine – Mowing of manicured grasses may vary from as frequently as weekly during the summer, to no mowing during the winter.
Added Fertilizer, Herbicide, and Pesticide Application	Use the minimum amount of biodegradable nontoxic fertilizers and herbicides needed to establish and maintain dense vegetation cover that is reasonably free of weeds. Fertilizer application may be significantly reduced or eliminated by the use of mulch-mowers, as opposed to bagging and removing clippings. To keep clippings out of receiving waters, maintain a 25-foot buffer adjacent to open water areas where clippings are bagged. Hand-pull the weeds in areas with limited weed problems.	Nonroutine – Frequency of fertilizer, herbicide, and pesticide application should be on an as-needed basis only and should decrease following establishment of vegetation.
Sediment removal	For Grass Buffers: Using a shovel, remove sediment	Nonroutine – Remove sediment as needed based

	at the interface between the impervious area and buffer For Grass Swales: Remove accumulated sediment near culverts and in channels to maintain flow capacity. Spot replace the grass areas as necessary.	on inspection. Frequency depends on site-specific conditions. For planning purposes, it can be estimated that 3 to 10% of the swale length or buffer interface length will require sediment removal on an annual basis. Reseed and/or patch damage areas in buffer, sideslopes and/or channel to maintain healthy vegetative cover. Over time, and depending on pollutant load, portion of butter/sale may need to be rehabilitated due to sediment deposition. Periodic sediment removal will reduce the frequency of revegetation required. Expect turf replacement for the buffer interface area every 10 to 20 years.
Irrigation Schedule and Maintenance	Check for broken sprinkler heads and repair them, as needed. Do not overwater. Signs of overwatering and/or broken sprinkler heads may include soggy areas and unevenly distributed areas of lush growth. Completely drain and blowout the irrigation system before the first winter freeze each year. Upon reactivation of the irrigation system in the spring, inspect all components and replace damaged parts, as needed.	Adjust irrigation schedules throughout the growing season to provide the proper irrigation application rate to maintain healthy vegetation. Less irrigation is typically needed in early summer and fall, with more irrigation needed during July and August. Native grass should not require irrigation after establishment, except during prolonged dry periods when supplemental, temporary irrigation may aid in maintaining healthy vegetation cover.

Waterbury Filing No. 1
Operations and Maintenance Manual
Open Drainage Channel Inspections and Maintenance (O&M)

County Job No. PCF SF237

Routine maintenance of the open drainage channel system consists of litter and debris pickup, vegetation management, erosion control, and sediment removal when necessary. Removal of excessive shrubs and trees is required to ensure that the channel will flow in conformance with the original design. Mowing and vegetation management shall be performed with care to ensure that soils remain stable and not to cause erosion. Noxious weed management shall be performed as necessary and as required under project approval conditions. All dead trees and trees growing in the flowline of a structure such as a bridge or culvert shall be removed.

Removal of sediment shall be performed with the use of equipment such as a skid steer, backhoe, and front-end loader. The removed materials shall be hauled to an acceptable landfill site unless otherwise legally permitted to be utilized elsewhere. Materials are not to be stored onsite. Equipment shall utilize the designated access roads and shall not be used in a manner to cause damage to adjacent vegetated and stable areas to the extent possible. If drainage channels contain wetlands many activities, including maintenance, may be subject to regulation and permitting.

Erosion control and restoration work such as side slope reconstruction, revegetation, riprap installation, and other stabilization methods will require the use of heavy equipment.

Maintaining altered watercourses is a minimum requirement of the National Flood Insurance Program (NFIP). In fact, failure to maintain such watercourses may result in a revision to the community's Flood Insurance Rate Map (FIRM). If a stream is altered after the community's FIRM is published, the NFIP requires the community to ensure that the channel's carrying capacity is not adversely altered. This is required in 44 CFR 60.3(b)(7) of the Federal Emergency Management Agency's (FEMA's) NFIP regulations.

Table 1 – General Channel Maintenance Guidelines

Activity	Maintenance Action	Frequency of Action
Mowing, vegetation management, and lawn care	Occasional mowing to limit unwanted vegetation on areas outside of the bottom of the channel and the banks. Maintain irrigated turf grass as 2 to 4 inches tall and non-irrigated native turf grasses at 4 to 6. Vegetation along the channel banks and in the bottom of the channel shall be left uncut and allowed to grow.	Routine – depending on aesthetic requirements.
Debris and litter removal	Remove debris and litter from the entire channel to improve flow characteristics and aesthetics. Dispose of as appropriate.	Routine – including annual, pre-storm season (April and May) and following significant rainfall events.
Erosion and sediment control	Repair and revegetate eroded areas in the channel.	Non-routine –as necessary based on inspection.
Structural	Repair inflow structures, low flow channel linings, and energy dissipation structures as needed.	Non-routine – repair as needed based on regular inspections.
Inspections	Inspect channel to ensure continued function as initially intended. Check for erosion, slumping, excessive sedimentation, overgrowth, embankment and inflow integrity, and damage to any structural elements. Report any illicit discharge immediately.	Routine – annual inspection of hydraulic and structural facilities. Also check for obvious problems during routine maintenance visits.
Nuisance control	Address odor, insects, and other issues associated with stagnant or standing water.	Non-routine –as necessary per inspection or complaint.
Sediment removal	Remove accumulated sediment from the channel bottom.	Non-routine –as necessary per inspection.

<u>Routine Maintenance Activities</u>

The majority of this work consists of scheduled mowing, litter and debris pickups for the drainage channel during the growing season. It also includes activities such as weed control. These activities normally will be performed numerous times during the year. These items typically do not require any prior correspondence with EPC, however, completed inspection and maintenance forms shall be retained and submitted to EPC for each inspection and maintenance upon request. The Routine Maintenance Activities are summarized below, and further described in the following sections.

Table 2 – Summary of Routine Maintenance Activities

Activity	Maintenance Action	Look for:	Minimum Frequency
Mowing	2”-4” irrigated grass height; 4-6” natural grass height on areas outside of the bottom of the channel and the banks	Excessive grass height/aesthetics	Routine – twice annually
Litter / Debris Removal	Remove and dispose of litter and debris	Litter / debris in drainage channel	Routine – twice annually

Woody growth control / weed removal	Treat w/herbicide or hand pull	Noxious weeds, undesirable vegetation	Routine – minimum twice annually

Properly dispose of litter and debris materials at an approved landfill or recycling facility. It should be noted that major debris removal may require other regulatory permits prior to completing the work.

Noxious weeds and other unwanted vegetation must be treated as needed throughout the drainage channel. This activity can be performed either through mechanical means (mowing/pulling) or with herbicide. Consultation with the County Environmental Division is recommended prior to the use of herbicide. Herbicides should be utilized sparingly and as a last resort. All herbicide applications should be in accordance with the manufacturer's recommendations.

Minor Maintenance Activities

This work consists of a variety of isolated or small-scale maintenance/operational problems. Most of this work can be completed by a small crew, hand tools, and small equipment. These items may require prior approval from EPC depending on the scope of work. Completed inspection and maintenance forms shall be retained for each inspection and maintenance period. In the event that the drainage channel needs to be dewatered, care should be given to ensure sediment, filter material and other pollutants are not discharged. The appropriate permits shall be obtained prior to any dewatering activity.

Table 3 – Summary of Minor Maintenance Activities

Activity	Maintenance Action	Look for:	Minimum Frequency
Sediment/Pollutant Removal	Remove and dispose of accumulated sediment from the channel bottom.	Minor sediment and pollution build-up in channel bottom; potential decrease in channel flow rate	Non-routine – as needed based on inspection.
Erosion Repair	Repair eroded areas and revegetate; address cause.	Rills/gullies on sides of channel	Non-routine – as needed, based on inspection.

Major Maintenance Activities

This work consists of larger maintenance/operational problems and failures within the stormwater drainage facilities. This work will likely require approval from EPC Engineering to ensure the proper maintenance is performed. This work requires that Engineering Staff review the original design and construction drawings to assess the situation and necessary maintenance activities. This work may also require more specialized maintenance

equipment, design plans/details, surveying, and assistance through private contractors and consultants. In the event that the drainage channel needs to be dewatered, care should be given to ensure sediment, filter material and other pollutants are not discharged. The appropriate permits shall be obtained prior to any dewatering activity.

Table 4 – Summary of Major Maintenance Activities

Activity	Maintenance Action	Look for:	Minimum Frequency
Major Sediment / Pollutant Removal	Remove and dispose of sediment. Repair vegetation as necessary	Large quantities of sediment in the channel and reduced conveyance rate/capacity	Non-routine –as necessary based on inspection.
Major Erosion Repair	Repair erosion – find cause of problem and address to avoid future erosion	Severe erosion including gullies, excessive soil displacement, unusual areas of settlement, holes	Non-routine –as necessary based on inspection.
Structural Repair	Structural repair to restore portions of the channel to its original design	Deterioration and/or damage to structural components – broken concrete, damaged pipe, drop/check structures or dissipators	Non-routine –as necessary based on inspection.
Drainage Channel Rebuild	Contact EPC Engineering	Overall channel failure	Non-routine –as needed due to complete failure of drainage channel

Inspection Procedures

Periodic inspections of drainage channels and associated stormwater control measures in developed areas are needed in every community to prevent the accumulation of debris deposited by storms, dumping, or natural processes. Inspections must be conducted at least once each year and after each storm that could adversely impact the drainage system. Inspections are also needed in response to citizen complaints.

Conduct annual visual inspections during the dry season to determine if there are problem inlets where sediment/trash or other pollutants accumulate. Inspection and maintenance records should be used to determine problem areas that may need to be checked more often. Appropriate action must be taken after an inspection identifies the need for maintenance or cleaning.

The attached form includes the typical information necessary for and during an inspection. Similar forms or electronic record keeping may be utilized if all relevant information is recorded. The entity responsible for channel maintenance is required to submit the periodic inspection reports upon request by County Staff. Inspections involving decisions about structural issues shall be signed by a licensed professional engineer.

Inspections of inflow structures including detention spillways and water quality outlet pipes discharging to the channel shall be coordinated with channel inspections.

Illicit discharges such as dumping of home goods or garbage, appliances, yard wastes, paint spills, abandoned oil containers and other pollutants shall be immediately reported to EPC Staff and other agencies as appropriate. Reference El Paso County Ordinance No. 07-01, as amended. EPC recommends that the responsible entity encourage public reporting of improper waste disposal by posting “No Dumping” signs, neighborhood notices, and/or social media when available, with contact information to report violations.

Wetlands

If drainage channels contain wetlands many activities, including maintenance, may be subject to regulation and permitting. The responsible maintenance entity shall maintain wetlands vegetation as appropriate and in consultation with the proper authorities including the U.S. Army Corps of Engineers when applicable. The responsible maintenance entity shall ensure proper training / licensing of contractors and staff to minimize the potential for damages to the wetlands.

All applicable safety and environmental considerations with regards to the application of any pesticides or herbicides shall be verified. It is also strongly encouraged that the responsible entity employ or consult a wetlands specialist or certified arborist with the ability to identify invasive/exotic species. Due to the sensitive nature of using chemicals near water bodies, a written Quality Assurance/Quality Control (QA/QC) plan shall be implemented.

Employees shall be trained in accordance with any local, state, and federal regulations and laws prior to any application of chemicals. A copy of the QA/QC plan must be submitted to the County Environmental Division prior to any chemical applications. In addition to the QA/QC plan, copies of the Safety Data Sheets (SDS) for all the chemicals being used shall be provided upon request.

The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. The basis of the CWA was enacted in 1948 and was called the Federal Water Pollution Control Act, but the Act was significantly reorganized and expanded in 1972. "Clean Water Act" became the Act's common name with amendments in 1972.

Section 404 - establishes a program to regulate the discharge of dredged and fill material into waters of the United States, including wetlands. CWA Section 404(b)(1) Guidelines – U.S. Environmental Protection Agency (EPA) (Although they are called “guidelines,” these criteria are established in regulations (40 CFR Part 230) and are legally binding.)
https://www.epa.gov/cwa-404/clean-water-laws-regulations-and-executive-orders-related-section-404

Open Drainage Channel Inspection Report Form

Date: _____ Inspector: _____

Type of inspection: Post-Storm _____ Complaint _____ Routine _____

Location: (Identify stream or basin name, downstream and upstream streets or reference points, and location of problem. Provide sketch as needed.)

_____

_____

_____

Type of problem: Litter ___ Minor ___ Obstruction ___ Structural ___ Illicit Discharge** ___

Recommended maintenance: _____

_____

_____

Is equipment needed? _____ If so, list equipment needed: _____

_____

Date: _____ Offsite Right of entry needed? _____

Work order description: _____

_____

_____

_____

_____

State permit(s) needed? _____ Work order number: _____

Date: Crew chief: _____

Maintenance performed: _____

_____

_____

_____

Inspected by: _____

Use other side for additional recommendations for this site.

****Report illicit discharges to the County and appropriate agencies.**