Appendix I

LOCATION HYDRAULIC STUDY

LOCATION HYDRAULIC STUDY

COASTAL RAIL TRAIL

ROSE CREEK BIKEWAY

April 27, 2015

Prepared for:
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LOCATION HYDRAULIC STUDY OVERVIEW

This report provides a Location Hydraulic Study in accordance with Caltrans criteria as outlined in their September 26, 2012, *Standard Environmental Reference; Environmental Handbook, Volume 1; Chapter 17 – Floodplains* as well as their March 7, 2014, *Highway Design Manual*. *Top 804 – Floodplain Encroachments.* These documents define a Location Hydraulic Study as a preliminary investigative study of base floodplain (100-year floodplain) encroachments by a proposed highway action. The Study must be performed by a registered engineer with hydraulic expertise. In other words, a Location Hydraulic Study is performed to evaluate the base (100 year) flood and a proposed action's impact(s) on the base floodplain. This Study involves the use of *Flood Insurance Study* data, National Flood Insurance Program (NFIP) maps, and existing conditions analyses for baseline conditions, and a hydraulic computer model to determine the new base flood elevations.

The encroachment in this report is caused by the San Diego Association of Governments' (SANDAG) proposed Coastal Rail Trail Rose Creek Bikeway project and involves construction of a 14-foot bicycle path along Rose Canyon Creek in the city of San Diego. The majority of the bicycle path will be along the channel banks or overbank area although a bicycle bridge will be constructed immediately downstream of the Santa Fe Street bridge to allow bicyclists to cross Rose Creek. This Location Hydraulic Study evaluates the project impacts to Rose Creek and Interstate 5. The subsequent sections provide an introduction to the project as well as a summary of the hydraulic analyses in accordance with Location Hydraulic Study requirements. The following two pages summarize the technical information required for a Location Hydraulic Study from the *Highway Design Manual.*

Figure 804.7A

Technical Information for Location Hydraulic Study

Dist. 11 Co. San Diego Rte. 5 P.M. 23.6
EA N/A Bridge No. 57-289
Floodplain Description Rose Canyon Creek 100-year floodplain has been delineated by FEMA along the project reach with a Zone AE designation. A 500-year shaded Zone X flooplain has also been delineated.

1. Description of Proposal (include any physical barriers i.e. concrete barriers, soundwalls, etc. and design elements to minimize floodplain impacts)
   Project proposes to construct a 14-foot wide bicycle path along Rose Canyon Creek from Mission Bay Drive to Interstate 5 and further upstream near Jutland Drive. A bicycle bridge will cross the creek immediately downstream of the Santa Fe Street Bridge.

2. ADT: Current 196,000 Projected Unchanged by project

3. Hydraulic Data: Base Flood Q_{100} = 12,000 CFS
   WSE_{100} = 31' at I-5 The flood of record, if greater than Q_{100}: N/A
   Q = N/A CFS WSE = N/A
   Overtopping flood Q = N/A CFS WSE = N/A
   Are NFIP maps available? Yes X No
   Are NFIP studies available? Yes X No

		Yes	No
4.	Is the highway location alternative within a regulatory floodway?		X
5.	Attach map with flood limits outlined showing all buildings or other improvements within the base floodplain. See attached FIRMs		
	Potential Q_{100} backwater damages:		
A.	Residences?		X
B.	Other Bldgs?		X
C.	Crops?		X
D.	Natural and beneficial Floodplain values?		X
6.	Type of Traffic:		
A.	Emergency supply or evacuation route?		X
B.	Emergency vehicle access?		X
C.	Practicable detour available?		X
D.	School bus or mail route?		X

7. Estimated duration of traffic interruption for 100-year event 0 hours.

8. Estimated value of Q_{100} flood damages (if any) - moderate risk level.
   A. Roadway $ 0
   B. Property $ 0
   Total $ 0

9. Assessment of Level of Risk
   Low X Moderate ___ High ___
   For High Risk projects, during design phase, additional Design Study Risk Analysis may be necessary to determine design alternative.

INTRODUCTION

The San Diego Association of Governments (SANDAG) has initiated preliminary engineering plans prepared by Nasland Engineering for the Coastal Rail Trail – Rose Creek Alignment project. The project proposes a 14-foot wide bicycle path along Rose Canyon Creek from Mission Bay Drive to Santa Fe Street (see the Vicinity Map). The path will extend along the east side of the creek with segments aligned either just above or within the existing channel bank. A retaining wall will be constructed to support the segments within the channel banks. The path will pass under the existing bridges at Mission Bay Drive and Interstate 5. The existing Rose Canyon Creek channel in the vicinity of Mission Bay Drive is a concrete rectangular channel. A concrete structure will be extended along wall/floor at Mission Bay Drive to create the path under that bridge. Similarly, a concrete structure will be aligned adjacent to the southerly pier of the Interstate 5 bridge so that the path runs under this bridge adjacent to the pier. The remainder of Rose Canyon Creek along the project reach is natural. The path will also cross Rose Canyon Creek along the downstream side of the existing Santa Fe Street bridge. A proposed bicycle path bridge with a 14-foot wide travel way will be constructed for the crossing.

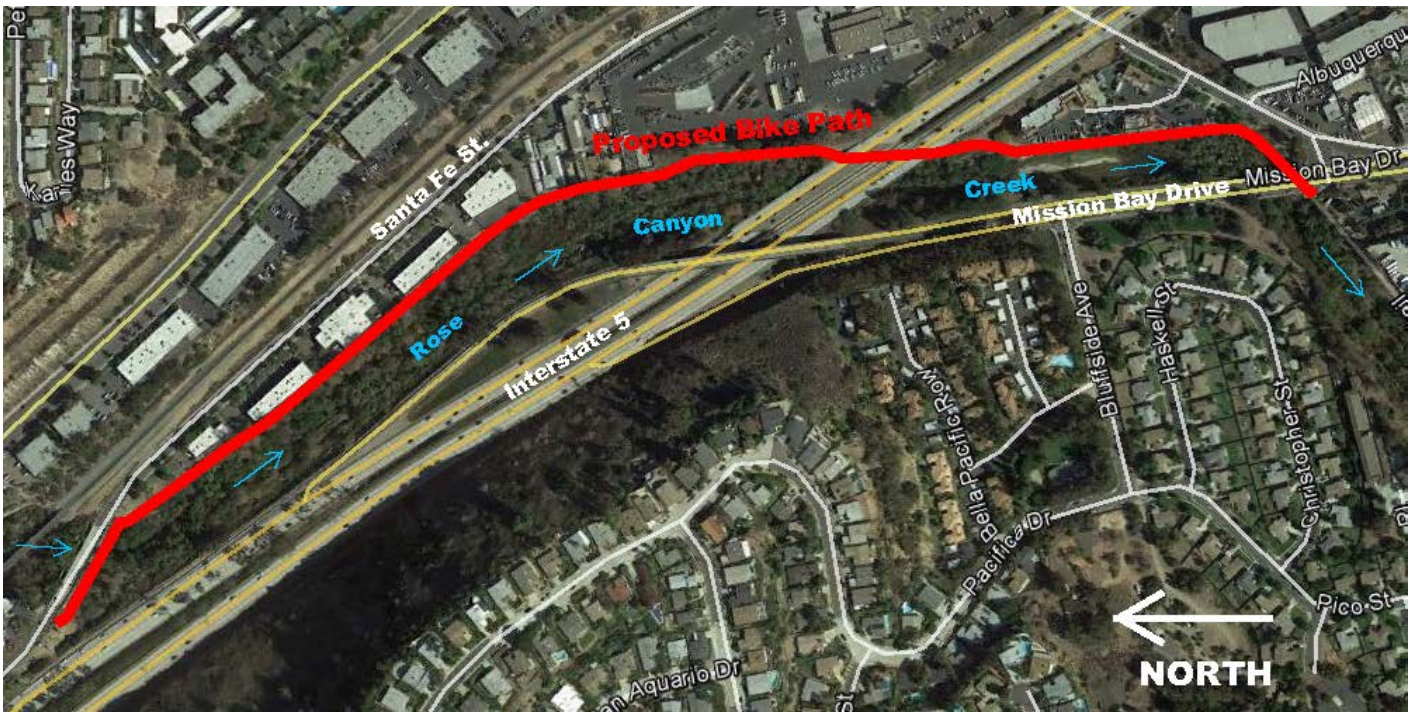


Figure 1. Vicinity Map

Rose Canyon Creek along the project site is delineated on the Federal Emergency Management Agency's *Flood Insurance Rate Maps* (FIRM). Portions of the two FIRM panels covering the project area are included in the map pocket. The FIRMS designate a Zone AE 100-year floodplain along the creek, but no floodway. Since the project area is FEMA-mapped it is subject to the FEMA regulations, which are adopted through the City of San Diego's *Municipal Code.* The project must meet the *Municipal Code* criteria as related to floodplain impacts for areas with a defined 100-year floodplain, but no floodway.

The project parallels SANDAG's Mid-Coast Corridor Transit Project. The Mid-Coast Corridor centers on Interstate 5 and extends from Downtown San Diego on the south to University City on the north. The SANDAG project proposes a trolley extension and associated facilities (new track, stations, bridges, facility upgrades, etc.) within the corridor. The extension includes a new bridge across Rose Creek (the Rose Creek South Bridge) on the east side of the existing railroad bridge, which is approximately 100 feet upstream of the Santa Fe Street Bridge. SANDAG has prepared a May 21, 2013, *Location Hydraulic Study for Rose Creek South Bridge, Draft Rev 4*, for their project. SANDAG's hydraulic analysis begins just downstream of the Santa Fe Street Bridge and extends upstream for over 2.7 miles.

This report contains pre- (existing condition) and post-project (proposed condition) hydraulic analyses of Rose Canyon Creek for the Coastal Rail Trail – Rose Creek Alignment project. The proposed improvements in the post-project modeling include the bicycle path and its bridge. The SANDAG analysis was appended to the upstream end of the Coastal Rail Trail analyses in order to assess the bicycle path/bridge impacts on the SANDAG project.

HYDRAULIC ANALYSES

Hydraulic analyses using the US Army Corps of Engineers' HEC-RAS model were performed to assess the existing and proposed condition 100-year hydraulic conditions and impacts along the project area. Separate analyses were performed for a "Southerly Project Segment" and a "Northerly Project Segment." The proposed improvements associated with the Southerly Project Segment will be constructed from Mission Bay Drive to Santa Fe Street. However, the existing and proposed condition HEC-RAS models were extended upstream approximately 0.5 miles in order to also assess impacts on the proposed South Bridge project from Parsons Brinckerhoff's May 21, 2013, *Location Hydraulic Study for Rose Creek South Bridge.* The proposed South Bridge project is by SANDAG and will construct a new bridge over Rose Canyon Creek a short distance upstream of Santa Fe Street. Parsons Brinckerhoff's proposed South Bridge HEC-RAS data was added to the existing and proposed condition HEC-RAS analyses in this report at and above station 8931. Therefore, the Southerly Project Segment HEC-RAS analyses in this report are based on the assumption that the South Bridge project is complete.

The Northerly Project Segment improvements will be constructed along the westerly edge of Rose Canyon Creek over 2,800 feet upstream of the Santa Fe Street bridge. The Northerly Project Segment HEC-RAS analyses were performed separately from the Southerly Project Segment analyses because the two project areas are not continuous, and because different baseline information is available for the two segements. Unlike the Southerly Project Segment, a proposed condition analysis was not available for the Northerly Project Segment. However, a 2014 Letter of Map Revision by HDR Engineering, Inc. was available. The Northerly Project Segment analyses use the LOMR's existing condition HEC-RAS. The Northerly Project Segment's existing condition analysis is identical to the LOMR analysis except that the model was reduced to only cover the project area. The Northerly Project Segment's proposed condition analysis modifies the existing condition analysis to reflect the proposed improvements. There are no other proposed improvements

for this segment like there are for the Southerly Project Segment, so it was appropriate to base the analyses on the recent LOMR HEC-RAS.

The following describes the HEC-RAS input parameters and results for the Southerly Project Segment and Northerly Project Segment.

Southerly Project Segment

The HEC-RAS cross-sections and reach lengths were obtained from three sources. The majority of the study reach (cross-sections 5102 to 8930 – see the HEC-RAS Work Map in the map pocket) was based on 1-foot contour interval topographic mapping flown in December 2013. The mapping performed by Nasland Engineering (Nasland), is on North American Vertical Datum of 1988 (NAVD 88). The HEC-RAS analyses in this report are on this datum. The five downstream-most cross-sections (cross-sections 4567 to 5044) were based on SANGIS' 1999 2-foot contour interval mapping. A field review revealed that this mapping is still representative of the current creek conditions. This mapping is on National Geodetic Vertical Datum of 1929 (NGVD 29). Nasland indicated that NGVD 29 elevations are converted to NAVD 88 by adding 2.2 feet, so the cross-sections created from the SANGIS mapping were adjusted by 2.2 feet. The cross-sections (and all related data) above 8930 were obtained from the SANDAG HEC-RAS analysis, which is on NAVD 88 and was prepared by Parsons Brinckerhoff.

The existing improvements were modeled as follows. The Mission Bay Drive bridge, Interstate 5 bridge, and the rectangular concrete channel were modeled from as-built drawings and the December 2013 topographic mapping. This mapping reflects sediment deposition and vegetation along portions of the rectangular concrete channel. The rectangular concrete channel contains what are referred to as training walls (per the as-built drawings) along the bend just upstream of the Mission Bay Drive bridge. The training walls are four vertical concrete walls in the direction of flow spaced evenly across the channel bottom. The training walls reduce the flow superelevation along the curved portion of the channel, and were modeled from the as-built drawings and December 2013 topographic mapping. The existing bridges at and upstream of Santa Fe Drive were replicated from the SANDAG Mid-Coast HEC-RAS analysis. A 72-inch aboveground sewer pipeline crossing exists just upstream of the Santa Fe Drive bridge and was copied from the SANDAG HEC-RAS.

The proposed improvements were modeled as follows. The proposed bicycle path and bicycle path bridge were modeled based on the plans from Nasland and Simon Wong Engineering, respectively. A blocked obstruction was used at the appropriate cross-sections to reflect the bicycle path. The path under the Mission Bay Drive bridge will convey water under the cantilever, but due to limitations in the HEC-RAS blocked obstruction option, this area was modeled as entirely blocked, which will yield slightly conservative results, i.e., a higher water surface elevation. SANDAG's Rose Creek South bridge was included in both the existing and proposed condition analyses. This bridge was replicated from the SANDAG HEC-RAS data.

Additional input parameters are as follows. Floating debris was modeled on the Interstate 5 bridge piers. The debris was assumed to be 3 feet wide (twice the pier width) and 5 feet high. The roughness coefficients at and below the proposed bicycle path bridge were partially based on current field conditions observed from aerial photography (Google Earth) and a site visit. A roughness of 0.05 to 0.07 was used for the natural channel areas depending on the density of vegetation. A

roughness of 0.014 was used for the existing concrete rectangular channel. This segment is subject to relatively high 100-year flow velocities of over 8 to over 14 feet per second, so a low roughness representing removal of vegetation from the concrete surface during high flow was assumed. Above the proposed bicycle path bridge, the SANDAG HEC-RAS roughness coefficients (0.015 to 0.035) were used (cross-sections at and upstream of 8931). The 100-year flow rate of 12,000 cubic feet per second was obtained from the FEMA *Flood Insurance Study* data. Encroachments were used to represent ineffective flow at bridges or associated with shallow depths in the overbank areas.

The study reach is primarily a naturally-lined channel with dense, mature vegetation. Therefore, the subcritical flow regime as used. There is a segment of the channel near Mission Bay Drive that is concrete-lined; however, sediment has deposited on the concrete channel bottom and supports mature vegetation, so this segment was also modeled under the subcritical flow regime. This flow regime is appropriate given the mature vegetation and low channel gradients. For subcritical flow, a downstream boundary condition must be established. In this case, the FIRM's 100-year water surface elevation was used. The downstream-most HEC-RAS cross-section is 4567. This cross-section is approximately 700 feet downstream of the Mission Bay Drive centerline. The cross-section location has been added to FIRM No. 0602951611G in the map pocket. The 100-year water surface elevation at this location is approximately 18.3 feet NAVD 88. Therefore, the starting water surface elevation was selected to be 18.3 feet. Mission Bay and the Pacific Ocean are a short distance below the study reach. However, the proximity of these two waterbodies will not impact the starting water surface elevations. The mean higher high tide is approximately 5 feet NAVD 88. This is considerably lower than the starting water surface elevation of 18.3 feet. Therefore, the hydraulic results will not be impacted by tidal variations or sea level rise. In addition, Rose Canyon Creek is protected by tsunamis because it is sheltered within the easterly portion of Mission Bay and not subject to direct coastal influences.

The existing and proposed condition 100-year HEC-RAS results are included in Appendix A and summarized in Table 1. The existing and proposed condition results are combined in the tabulated output and cross-section plots in Appendix A to allow a comparison of results. Table 1 shows that the greatest impact from the proposed project is from cross-section 5465 to 5725 where the water surface elevation can rise up to 0.7 feet over existing conditions. However, a review of the cross-section plots in Appendix A reveals that the 100-year flow will be contained within the concrete trapezoidal channel/bicycle path in this reach. Furthermore, the topographic mapping used to create the cross-sections in this area reflects the sedimentation and vegetation that has established within the rectangular concrete channel. It is possible that some or all of this will be washed away during a high flow event, which will yield lower water surface elevations.

A comparison of the HEC-RAS results also reveals the following findings. The 100-year water surface elevation just downstream of the Mission Bay Drive bridge increases 0.4 feet from the project and exceeds the existing concrete channel banks, but the flow is contained within the adjacent earthen slopes. The rise does not impact insurable structures. It is possible that some or all of the vegetation will be washed away from the rectangular concrete channel during a high flow event yielding lower water surface elevations.

Cross-section	Existing Condition 100-Year Water Surface Elevation, ft	Proposed Condition 100-Year Water Surface Elevation, ft	Difference (Prop. – Exist.), ft
8990	52.9	52.9	0.0
8946	52.8	52.9	0.1
8945, upstream of 72” sewer	52.8	52.9	0.1
8939, downstream of 72” sewer	51.2	51.3	0.1
8938	51.2	51.3	0.1
8931	51.2	51.3	0.1
8930, upstream of Santa Fe Street	51.0	51.1	0.1
8880, downstream of Santa Fe Street, upstream end of project & bicycle path bridge	50.2	50.3	0.1
8859, downstream of bicycle path bridge	50.1	50.1	0.0
8689	47.6	47.6	0.0
8489	46.2	46.2	0.0
8289	45.3	45.2	-0.1
8089	44.1	44.1	0.0
7887	43.6	43.6	0.0
7687	42.3	42.3	0.0
7482	40.9	40.9	0.0
7280	38.6	38.7	0.1
7078	38.3	38.5	0.2
6874	38.1	38.2	0.1
6662, upstream of Interstate 5	37.4	37.5	0.1
6378, downstream of Interstate 5	34.7	34.8	0.1
6115	30.5	30.4	-0.1
5985	28.1	28.1	0.0
5885	25.2	25.2	0.0
5725	24.8	25.5	0.7
5595	25.0	25.7	0.7
5466	25.2	25.8	0.6
5465	25.0	25.7	0.7
5405	25.0	25.1	0.1
5328, upstream of Mission Bay Dr.	25.1	25.5	0.4
5238, downstream of Mission Bay Dr.	24.8	25.2	0.4
5174	24.5	24.4	-0.1
5102, downstream end of project	21.4	21.4	0.0

Table 1. Hydraulic Summary Table

The natural channel between the concrete rectangular channel and the Interstate 5 bridge (cross-sections 5985 to 6378) will not experience adverse water surface impacts from the project. At and just upstream of the Interstate 5 bridge, the 100-year water surface elevations will increase marginally (0.1 to 0.2 feet). The plots for cross-sections 6520 to 7280 show that the bridge and adjacent channel have capacity for the increase. The project does not adversely affect water surface elevations from cross-section 7482 to the proposed bicycle path bridge. On the other hand, the 100-year water surface elevations will experience a small increase (0.1 feet) upstream of the proposed bicycle path bridge up to cross-section 8946. The cross-section plots indicate that the existing channel has capacity for the increase in this reach. The project impacts essentially dissipate above cross-section 8946.

The existing condition results show a much higher 100-year water surface elevation at the Interstate 5 bridge than the FIRM. For instance, the existing condition elevation is approximately 37 feet, while the FIRM shows 31 feet. A review of the effective HEC-2 used to create the FIRM reveals two primary differences between the models. First, the effective HEC-2 analysis assumed a low roughness of n=0.035 near the bridge, while the recent existing condition analysis uses roughness coefficients varying from 0.050 to 0.070. In addition, the bridge cross-sections from the effective analysis are nearly trapezoidal with a much wider bottom width. For instance, the cross-section downstream of the bridge in the effective HEC-2 is 120 feet wide, while the cross-section in the updated analysis is approximately 26 feet wide. Since the FIRM analysis was performed circa 1980, while the updated analysis is based on recent topographic mapping, the updated analysis is more accurate.

As mentioned above, the proposed condition model is based on December 2013 topographic mapping. This mapping reflects sediment, debris, and vegetation that have deposited and grown on the rectangular concrete-lined channel near Mission Bay Drive. It is possible that some of the sediment, debris, and vegetation will be removed during construction along the easterly and southerly edges of the concrete channel. Therefore, an additional proposed condition analysis was performed to reflect clearing between and including cross-sections 5102 to 5725. The analysis is included in Appendix C along with a figure representing the clearing area. At these cross-sections, the sediment, debris, and vegetation was assumed to be entirely removed within the area represented on the figure resulting in exposure of the underlying concrete. A comparison of the proposed condition results with and without the clearing is included in Appendix C along with graphical cross-section plots showing removal. The comparison reveals that the clearing can lower the proposed condition 100-year water surface elevations by as much as approximately 4 feet. The HEC-RAS results indicate that the 100-year flow velocities are fairly high within the concrete-lined channel. Therefore, it is possible that the 100-year flow will naturally remove much of the deposited material and vegetation resulting in lower water surface elevations than predicted by the HEC-RAS modeling. Nonetheless, for the purposes of analyzing flood inundation, it is appropriate to include the sediment, debris, and vegetation.

Northerly Project Segment

A portion of the Coastal Rail Trail project will involve improvements along the westerly edge of Rose Canyon Creek over 2,800 feet upstream of the Santa Fe Street bridge. Santa Fe Street is adjacent to the westerly edge of Rose Canyon Creek at this northerly project segment. A retaining wall will be constructed within the creek bank as part of the Santa Fe Street widening in this area.

The wall will be approximately 8 feet from the current top of slope and will be just over 900 feet long. A HEC-RAS analysis was performed to determine the impact from the retaining wall on the 100-year floodplain.

The HEC-RAS was based on an existing condition HEC-RAS analysis by HDR Engineering, Inc. for SANDAG. The existing condition analysis was prepared for a 2014 Letter of Map Revision used to update the existing hydraulic conditions in Rose Canyon Creek. According to the LOMR, the HEC-RAS cross-sections were based on topographic survey points, breaklines and bathymetric data near the rail line which were obtained from Parsons Brinkerhoff (2012), Aguirre and Associates (2013) and SANGIS (1999) 2-foot County topographic data. The cross-sections are on NAVD 88. The LOMR also states that Manning's roughness coefficients were based on field visits, aerial photos, and the USGS Manning's roughness estimation methodology (USGS 1989), which accounts for vegetation, obstructions, sinuosity, cross-section variation, etc. The FEMA flow rates were assumed for the modeling.

In order to model the retaining wall proposed by the Coastal Rail Trail project, the existing condition HEC-RAS was modified with blocked obstructions at the wall location along the right channel bank. The cross-sections further upstream and downstream of the retaining wall area were removed from the proposed condition HEC-RAS analysis to limit the study reach to the project area. No other alterations were made to the existing condition model in order to create the proposed condition model. The 100-year downstream starting water surface elevation at cross-section 3934 was set to the existing condition water surface elevation of 68.56 feet NAVD 88.

The existing and proposed condition HEC-RAS results are included in Appendix B. The graphical cross-section plots show that the proposed retaining wall is outside the 100-year floodplain except at cross-section 4733, where the lower tip of the wall just reaches the floodplain. The tabulated results show that the existing and proposed condition water surface elevations are identical throughout the study reach. Based on these results, the wall is essentially outside of the 100-year floodplain, so will not impact the creek. It is understood that SANDAG may propose future channelization and bridge improvements near this area. Since the retaining wall is beyond the 100-year floodplain, it should not adversely impact the hydraulics of the future projects.

SCOUR ANALYSES

Bridges over natural stream areas can experience local scour. Local scour is due to a local flow obstruction by a bridge pier/bent or abutment. The proposed bicycle path bridge and the existing Interstate 5 bridge have been analyzed for local scour. For the Interstate 5 bridge, the span essentially extends over the natural Rose Canyon Creek channel, so the abutments do not project into the watercourses and abutment scour has not been analyzed. For the bicycle path bridge, the upstream end of the abutments are at or above the 100-year water surface elevation, so abutment scour has not been analyzed either.

Local pier scour is associated with accelerated flow and the resulting vortices leading to a removal of material near a bridge pier. The Colorado State University (CSU) equation from the April 2012

Hydraulic Engineering Circular No. 18 (HEC-18) is the standard pier scour formula and has the following form:

$$y_s/y_1 = 2.0\ K_1\ K_2\ K_3\ (a/y_1)^{0.65}\ F_r^{0.43}$$

where,

y_s = scour depth, feet
y_1 = flow depth directly upstream of the pier, feet
a = pier width
K_1 = correction factor for pier nose shape
K_2 = correction factor for angle of attack of flow
K_3 = correction factor for bed condition
F_r = Froude Number directly upstream of pier

For the Interstate 5 bridge, the CSU equation input values are: y_1 = 13.4 feet from the 100-year HEC-RAS results at cross-section 6662, a = 1.5 feet and K_1 = 1.0 (for a round nose pier) from the as-built plans, K_2 = 1.0 for no angle of attack, K_3 = 1.1 for a plane bed, and F_r = 0.47 from the HEC-RAS results at cross-section 6662. Using these values yields a pier scour depth of 5.1 feet at the existing piers. If debris accumulates on the piers, the effective pier width will be increased. For example, it is common to assume 1-foot of debris on either side of a pier. If "a" is increased from 1.5 to 3.5 feet to account for debris, the scour depth increases to 8.9 feet. From as-built data, the existing piers have a depth of 14 feet.

The as-built plans show that the piers are supported on 6-foot wide by 4-foot tall footings, so additional scour analyses are needed to account for the complex pier foundations. The local complex scour for the Interstate 5 bridge is based on two components: pier stem scour and pile cap scour. The pier stem scour is associated with the portion of the pier above the footings, while the pile cap scour is associated with the footings. The pier stem scour is based on the above equation, with consideration of a $K_{h\ pier}$ coefficient that accounts for the height of the pier stem above the bed and shielding effect by the pile cap overhand distance in front of the pier stem (1.5 feet from as-builts). The $K_{h\ pier}$ coefficient is determined from the ratio of the height of the pier stem above the bed before scour (h_1 = 4 feet based on thickness of pile cap) over the pier width (a). In this case, the ratio is 2.67 (4 ÷ 1.5 = 2.67). For a ratio of 2.67, the $K_{h\ pier}$ coefficient approaches zero (see Figure 2 from HEC-18 report). Therefore, the pier stem scour is negligible.

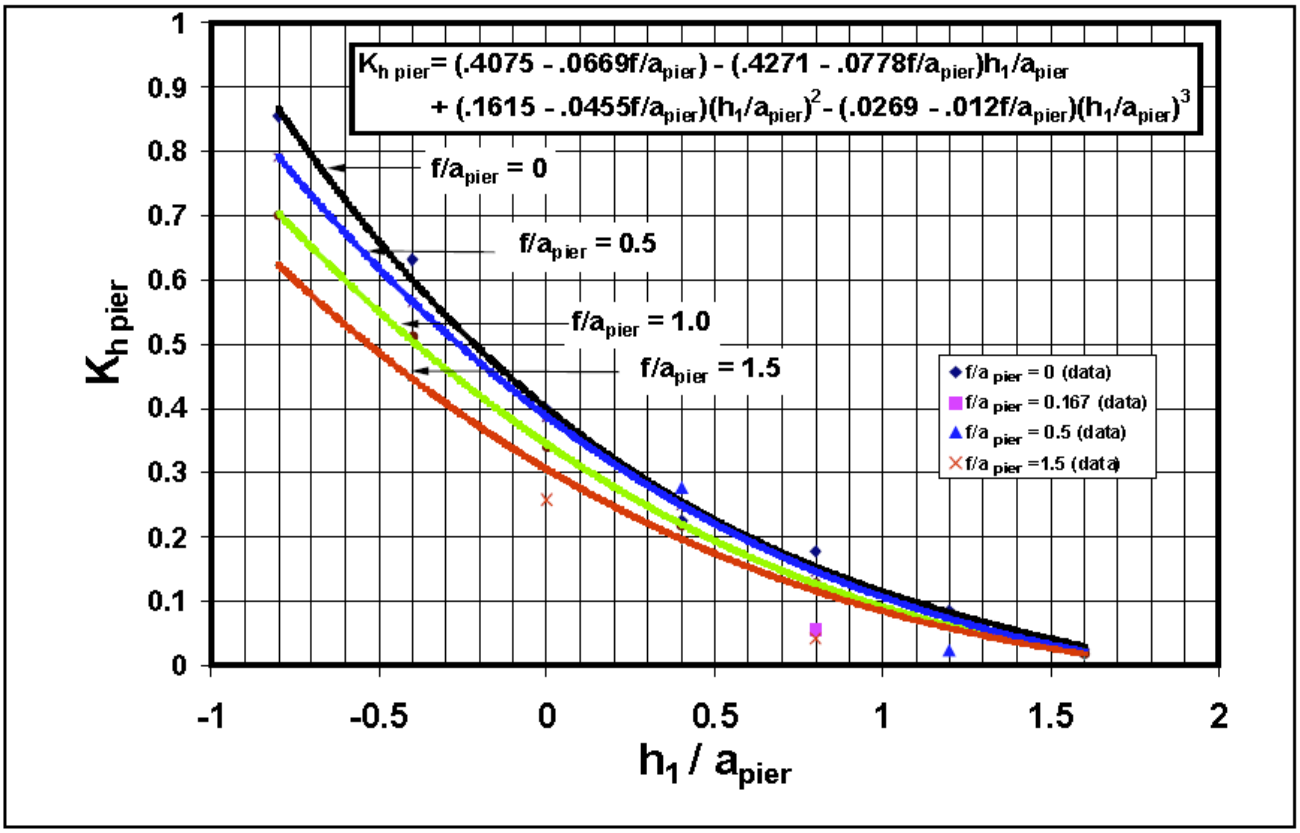


Figure 2. Suspended Pier Scour Ratio from HEC-18

Pile cap (footing) scour can be analyzed for two cases according to HEC-18. Case 1 is when the bottom of the footing is above the channel bed. Case 2 is when the bottom is on or below the bed. Since the as-builts show that the footings are buried at least 6 feet below the bed, Case 2 applies. Case 2 defines several equations (the values are also provided):

$y_2 = y_1 + (y_{s\ pier}/2)$, ft = 4 + (0/2) = 4', y_1 is the flow depth to the top of footing

$V_2 = V_1\ (y_1/y_2)$, fps = 9.21 (4/4) = 9.21 fps

$V_f / V_2 = \ln (10.93 \times y_f / k_s + 1) / \ln (10.93 \times y_2 / k_s + 1)$
$= \ln (10.93 \times 1{,}228.6 + 1) / \ln (10.93 \times 5{,}714.3 + 1)$
$= 0.86$, so $V_f = 7.93$ fps

where (the variables not listed are defined above in the pier scour equation),

V_f = average velocity in the flow zone below the top of footing, fps
V_2 = average adjusted velocity in vertical flow approaching pier, fps
ln = natural log to base e
y_f = $h_1 + y_{s\ pier}/2$ = distance from the bed (after degradation, contraction scour, and pier stem scour) to the top of footing, ft – Per as-builts, bottom of footing is at 9', so top is

at 13' NGVD 29. Channel bed is at 23.8' feet NAVD 88 or 21.6' NGVD 29, so y_f = 8.6' (21.6-13 = 8.6).

k_s = grain roughness of the bed, ft (sand to sand/gravel/cobbles per as-builts, so use 2 mm) = 0.007'

y_2 = adjusted depth of flow upstream of the pier including degradation, contraction scour, and half of the pier stem scour, ft

For Case 2, HEC-18 states that the exposed footing is treated like a short pier in a shallow stream of depth equal to the top of height of the footing above the bed. The portion of flow over the top of the footing is ignored. The full footing width is used in the computations. The footing scour depth is then calculated using these values and the following equation (similar to the first equation):

$$y_{spc}/y_f = 2.0\ K_1\ K_2\ K_3\ (a_{pc}/y_f)^{0.65}\ (V_f/\sqrt{g y_f})^{.43}$$

where (the variables not listed are defined above),

y_{spc} = footing scour depth, ft

a_{spc} = footing width, ft = 6'

Solving for this equation yields a footing scour depth of 10.9 feet. The total complex scour is the sum of the pier stem scour and the footing scour or 10.9 feet. This is less than the individual pier scour of 5.1 feet (and 8.9 feet assuming 1-foot of debris accumulated on either side of a pier) initially calculated above and is due to the additional scour from the footing.

A cross-section of the proposed bicycle path under the Interstate 5 bridge from Nasland's plans is included in Figure 3. This cross-section will follow the bridge pier then turn gradually up the channel bank as it extends upstream of the pier. The bike path contains a vertical element that acts as a pier. However, at the upstream end, the vertical element will be aligned up the channel bank, so it will not create an abrupt obstruction to flow like a pier will. The vertical element should be no wider than 1 foot given its purpose. Assuming it acts as a 1 foot wide pier and using the same assumptions as the prior pier scour analysis, yields a pier scour depth of 3.9 feet. This will not affect the adjacent Interstate 5 pier. The vertical element should be designed for its pier scour depth. In addition, the interface with the greater pier scour from the Interstate 5 bridge should be considered on the final engineering plans.

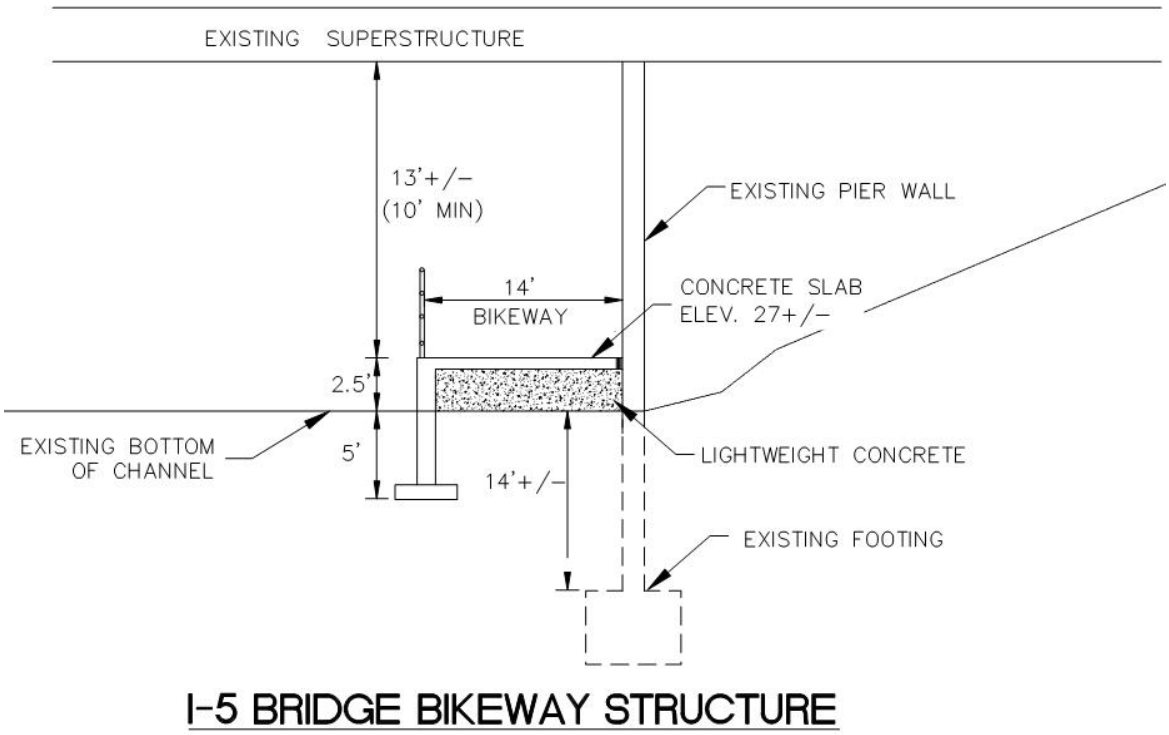


Figure 3. Cross-section of Bicycle Path under Interstate 5 Bridge

The bicycle path will be supported by a retaining wall along a portion of the Rose Canyon Creek channel banks. The retaining wall is considered a longitudinal structure and unless properly designed could be subject to undermining during flow events. The probable mechanism causing scour along a vertical wall when the flow is parallel to the wall is an increase in boundary shear stress produced by locally increased velocity gradients that result from the reduced roughness of the vertical wall, as compared to the natural channel. The September 2009, *Hydraulic Engineering Circular No. 23, Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance-Third Edition,* provides a more detailed discussion of scour at longitudinal structures. A detailed assessment of this scour shall be performed during final engineering to ensure that the retaining walls are adequately protected against scour.

General scour can occur in a natural channel leading to lowering or scour of the channel bed. For the Interstate 5 bridge, the existing concrete rectangular channel begins approximately 350 feet downstream. According to the December 2013 topographic mapping, the elevation at the upper edge of the concrete channel bottom is approximately 21 feet NAVD 88. The concrete channel has existed for several decades and acts as a grade control that prevents the upstream channel near the Interstate 5 bridge from general scour below this elevation. Consequently, the primary scour component at the Interstate 5 bridge will be local scour.

For the proposed bicycle path bridge, the CSU equation input values are: y_1 = 14.6 feet from the proposed condition 100-year HEC-RAS results at cross-section 8880, a = 4.0 feet and K_1 = 1.0 (for a cylindrical pier) from the proposed plans, K_2 = 1.0 for no angle of attack, K_3 = 1.1 for a plane bed,

and F_r = 0.46 from the HEC-RAS results at cross-section 8880. Using these values yields a pier scour depth of 9.9 feet. The pier shall be designed with consideration of this depth.

CONCLUSION

Preliminary 100-year hydraulic analyses have been performed for Coastal Rail Trail – Rose Creek Alignment project by SANDAG with engineering drawings by Nasland Engineering. The analyses model a proposed bicycle path and associated bridge along Rose Canyon Creek. The analyses also include the upstream proposed condition hydraulic data for SANDAG's Mid-Coast Corridor Transit Project. The results indicate that the project will increase water surface elevations within portions of Rose Canyon Creek, which is anticipated because portions of the project encroach within the 100-year floodplain. However, the increases are primarily contained within the channel banks. The 100-year water surface can exceed the rectangular concrete channel banks just downstream of Mission Bay Drive, but is contained within the adjacent earthen slopes. The water surface impacts upstream of the project are 0.1 feet or less and generally diminish before the upstream railroad bridge.

The City of San Diego *Municipal Code* is based on NFIP regulations, and Section 143.0146(a)(2) governs proposed development in a Special Flood Hazard Area where base flood elevations have been determined, but the floodway has not been designated. The project is within this category – a Zone AE floodplain with no floodway is mapped over Rose Canyon Creek on the FEMA FIRMs. The *Municipal Code* allows for increases in base flood of up to a foot. The project meets this requirement.

Local pier scour can occur at the Interstate 5 and proposed bicycle path bridges. The local pier scour is of a magnitude that is reasonable and will be included in the project final design. Typically, the pile caps and piles shall account for the amount of local scour.

The project also includes a northerly project segment along Rose Canyon Creek. This will involve a 14-foot wide bicycle path along the west side of Santa Fe Street between the Santa Fe Street/Rose Creek Bridge and the Santa Fe Street cul-de-sac to the north. To facilitate this bicycle path, portions of Santa Fe Street will be widened easterly to provide a 26 foot wide dual way vehicular roadway for a total paved width of 40 feet. An approximate 925 foot long segment of Santa Fe Street parallels Rose Creek. An encroachment into Rose Creek along this segment is necessary to facilitate the bicycle path and roadways widths. Hydraulic analyses show that the encroachment (retaining wall and associated fill) essentially will not be within the current 100-year floodplain. The only alternative to not encroaching into this section of Rose Creek would be to discontinue the bicycle path along this section; but this would not be consistent with the purpose and need of the project and the SANDAG Active Transportation goals of providing safe bicycle routes.

APPENDIX A

Southerly Project Segment
100-Year Hydraulic Analyses

HEC-RAS River: RIVER-1 Reach: Reach-1 Profile: PF 1

Reach	River Sta	Profile	Plan	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)	
Reach-1	11533	PF 1	Exist Cond	12000.00	51.00	61.0	61.0	65.12	0.0017	16.23	742	95.88	1.00
Reach-1	11533	PF 1	Prop Cond	12000.00	51.00	61.0	61.0	65.12	0.0017	16.23	742	95.88	1.00
Reach-1	11333	PF 1	Exist Cond	12000.00	50.00	61.0	59.8	64.14	0.0011	14.16	857	99.32	0.81
Reach-1	11333	PF 1	Prop Cond	12000.00	50.00	61.0	59.8	64.14	0.0011	14.16	857	99.32	0.81
Reach-1	11134	PF 1	Exist Cond	12000.00	50.00	59.7	59.7	63.77	0.0017	16.09	749	96.51	1.00
Reach-1	11134	PF 1	Prop Cond	12000.00	50.00	59.7	59.7	63.77	0.0017	16.09	749	96.51	1.00
Reach-1	10933	PF 1	Exist Cond	12000.00	48.00	58.1	58.1	62.27	0.0018	16.30	736	91.50	1.00
Reach-1	10933	PF 1	Prop Cond	12000.00	48.00	58.1	58.1	62.27	0.0018	16.30	736	91.50	1.00
Reach-1	10733	PF 1	Exist Cond	12000.00	48.00	57.9	57.9	61.83	0.0018	15.93	755	99.14	1.00
Reach-1	10733	PF 1	Prop Cond	12000.00	48.00	57.9	57.9	61.83	0.0018	15.93	755	99.14	1.00
Reach-1	10533	PF 1	Exist Cond	12000.00	47.00	56.9	56.9	60.95	0.0018	16.22	740	91.02	1.00
Reach-1	10533	PF 1	Prop Cond	12000.00	47.00	56.9	56.9	60.95	0.0018	16.22	740	91.02	1.00
Reach-1	10334	PF 1	Exist Cond	12000.00	46.00	55.9	55.9	60.01	0.0017	16.18	745	93.98	1.00
Reach-1	10334	PF 1	Prop Cond	12000.00	46.00	55.9	55.9	60.01	0.0017	16.18	745	93.98	1.00
Reach-1	10133	PF 1	Exist Cond	12000.00	45.00	55.0	55.0	59.05	0.0018	16.18	742	91.20	1.00
Reach-1	10133	PF 1	Prop Cond	12000.00	45.00	55.0	55.0	59.05	0.0018	16.18	742	91.20	1.00
Reach-1	9933	PF 1	Exist Cond	12000.00	44.00	53.8	53.8	57.97	0.0018	16.35	734	107.86	1.00
Reach-1	9933	PF 1	Prop Cond	12000.00	44.00	53.8	53.8	57.97	0.0018	16.35	734	107.86	1.00
Reach-1	9732	PF 1	Exist Cond	12000.00	43.00	52.9	52.9	57.02	0.0018	16.25	739	92.95	1.00
Reach-1	9732	PF 1	Prop Cond	12000.00	43.00	52.9	52.9	57.02	0.0018	16.25	739	92.95	1.00
Reach-1	9529	PF 1	Exist Cond	12000.00	42.00	52.2	52.2	56.23	0.0017	16.17	747	99.52	0.99
Reach-1	9529	PF 1	Prop Cond	12000.00	42.00	52.2	52.2	56.23	0.0017	16.17	747	99.52	0.99
Reach-1	9332	PF 1	Exist Cond	12000.00	42.00	51.6	51.6	55.64	0.0017	16.10	748	104.63	0.99
Reach-1	9332	PF 1	Prop Cond	12000.00	42.00	51.6	51.6	55.64	0.0017	16.10	748	104.63	0.99
Reach-1	9156	PF 1	Exist Cond	12000.00	42.00	51.6	50.6	54.26	0.0066	13.16	912	116.89	0.83
Reach-1	9156	PF 1	Prop Cond	12000.00	42.00	51.7	50.6	54.29	0.0064	13.02	921	117.07	0.82
Reach-1	9150.1	PF 1	Exist Cond	12000.00	40.55	53.3		53.49	0.0001	3.48	3478	349.30	0.18
Reach-1	9150.1	PF 1	Prop Cond	12000.00	40.55	53.3		53.53	0.0001	3.46	3494	350.26	0.18
Reach-1	9150	PF 1	Exist Cond	12000.00	40.55	53.3	45.5	53.49	0.0001	3.48	3478	349.30	0.18
Reach-1	9150	PF 1	Prop Cond	12000.00	40.55	53.3	45.5	53.53	0.0001	3.46	3494	350.26	0.18

HEC-RAS River: RIVER-1 Reach: Reach-1 Profile: PF 1 (Continued)

Reach	River Sta	Profile	Plan	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)	
Reach-1	9148			Inl Struct									
Reach-1	9145	PF 1	Exist Cond	12000.00	40.58	53.2		53.36	0.0003	3.43	3517	352.29	0.18
Reach-1	9145	PF 1	Prop Cond	12000.00	40.58	53.2		53.40	0.0003	3.42	3533	353.76	0.18
Reach-1	9144.9	PF 1	Exist Cond	12000.00	40.58	53.2		53.36	0.0003	3.48	3515	352.15	0.18
Reach-1	9144.9	PF 1	Prop Cond	12000.00	40.58	53.2		53.40	0.0003	3.46	3531	353.63	0.18
Reach-1	9140.2	PF 1	Exist Cond	12000.00	39.59	53.1	45.7	53.35	0.0003	3.78	3178	299.66	0.20
Reach-1	9140.2	PF 1	Prop Cond	12000.00	39.59	53.2	45.7	53.40	0.0003	3.76	3192	299.86	0.20
Reach-1	9115			Bridge									
Reach-1	9105	PF 1	Exist Cond	12000.00	39.59	53.0	45.7	53.22	0.0004	3.82	3138	299.07	0.21
Reach-1	9105	PF 1	Prop Cond	12000.00	39.59	53.0	45.7	53.27	0.0004	3.81	3152	299.27	0.21
Reach-1	9100	PF 1	Exist Cond	12000.00	39.59	53.0	45.7	53.22	0.0004	3.82	3138	299.06	0.21
Reach-1	9100	PF 1	Prop Cond	12000.00	39.59	53.0	45.7	53.26	0.0004	3.81	3151	299.26	0.21
Reach-1	9085			Bridge									
Reach-1	9070	PF 1	Exist Cond	12000.00	39.59	53.0		53.18	0.0004	3.84	3126	298.89	0.21
Reach-1	9070	PF 1	Prop Cond	12000.00	39.59	53.0		53.23	0.0004	3.82	3140	299.09	0.21
Reach-1	8990	PF 1	Exist Cond	12000.00	38.83	52.9		53.15	0.0004	4.18	2872	264.23	0.22
Reach-1	8990	PF 1	Prop Cond	12000.00	38.83	52.9		53.19	0.0004	4.16	2884	264.46	0.22
Reach-1	8946	PF 1	Exist Cond	12000.00	37.91	52.8		53.13	0.0005	4.34	2763	258.20	0.23
Reach-1	8946	PF 1	Prop Cond	12000.00	37.91	52.9		53.17	0.0004	4.32	2775	258.57	0.23
Reach-1	8945	PF 1	Exist Cond	12000.00	37.91	52.8	44.9	53.13	0.0005	4.34	2763	258.20	0.23
Reach-1	8945	PF 1	Prop Cond	12000.00	37.91	52.9	44.9	53.18	0.0004	4.32	2775	258.56	0.23
Reach-1	8942			Bridge									
Reach-1	8939	PF 1	Exist Cond	12000.00	37.91	51.2	44.9	51.62	0.0007	5.10	2355	245.51	0.29
Reach-1	8939	PF 1	Prop Cond	12000.00	37.91	51.3	44.9	51.66	0.0007	5.07	2366	245.86	0.29
Reach-1	8938	PF 1	Exist Cond	12000.00	37.91	51.2		51.62	0.0007	5.10	2355	245.51	0.29
Reach-1	8938	PF 1	Prop Cond	12000.00	37.91	51.3		51.66	0.0007	5.07	2365	245.85	0.29
Reach-1	8931	PF 1	Exist Cond	12000.00	37.91	51.2		51.61	0.0007	5.10	2353	245.46	0.29
Reach-1	8931	PF 1	Prop Cond	12000.00	37.91	51.3		51.65	0.0007	5.08	2364	245.81	0.29

HEC-RAS River: RIVER-1 Reach: Reach-1 Profile: PF 1 (Continued)

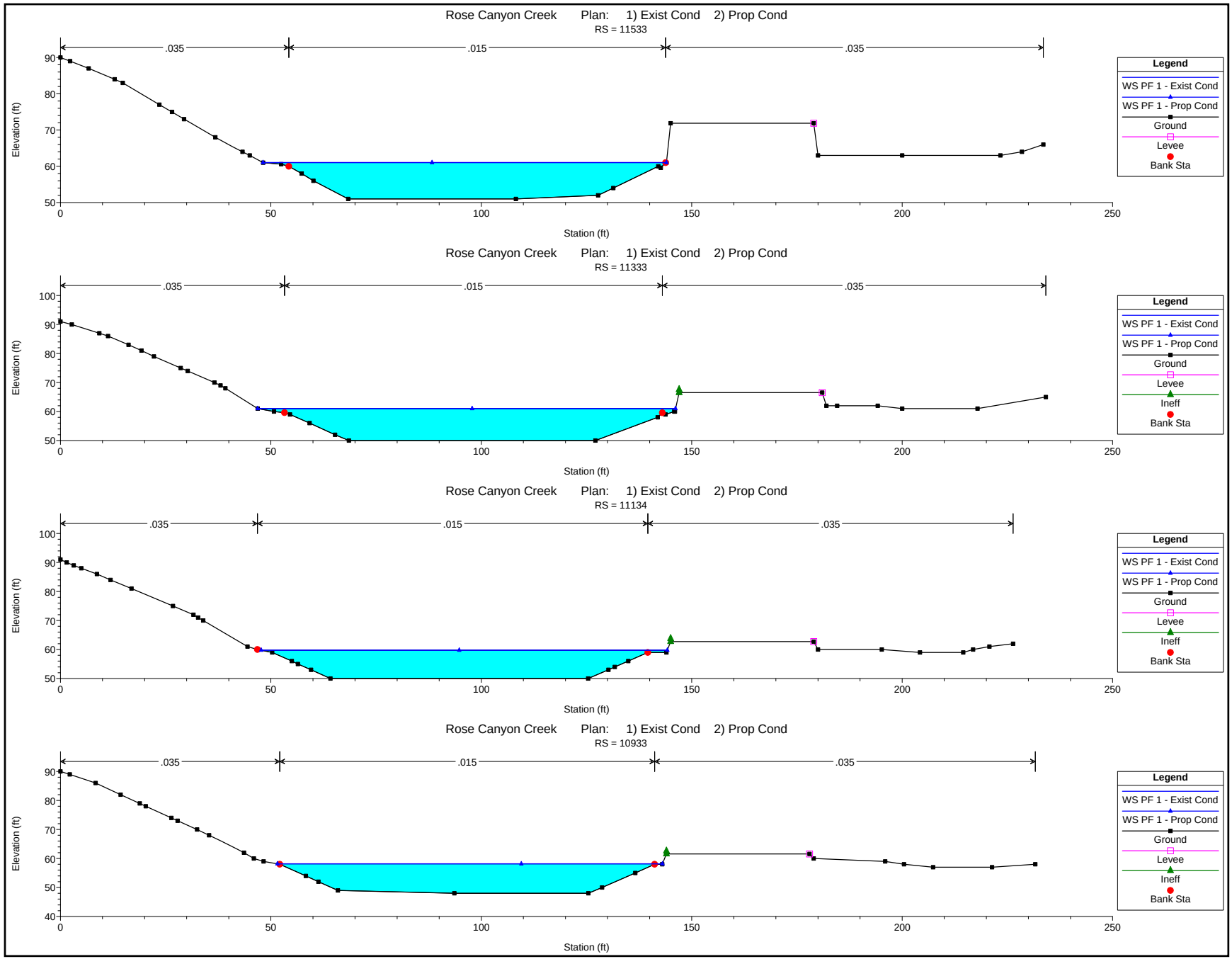
Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	8930	PF 1	Exist Cond	12000.00	39.00	51.0	45.7	51.60	0.0038	6.83	2091	232.51	0.35
Reach-1	8930	PF 1	Prop Cond	12000.00	39.00	51.1	45.7	51.64	0.0037	6.80	2102	232.71	0.34
Reach-1	8905			Bridge									
Reach-1	8880	PF 1	Exist Cond	12000.00	35.70	50.2		51.17	0.0073	9.24	1667	233.44	0.47
Reach-1	8880	PF 1	Prop Cond	12000.00	35.70	50.3	47.6	51.22	0.0071	9.15	1683	234.04	0.46
Reach-1	8859	PF 1	Exist Cond	12000.00	36.70	50.1		51.00	0.0080	8.65	1692	261.11	0.48
Reach-1	8859	PF 1	Prop Cond	12000.00	36.70	50.1		50.99	0.0080	8.66	1691	261.06	0.48
Reach-1	8689	PF 1	Exist Cond	12000.00	36.80	47.6		49.13	0.0118	10.79	1321	188.34	0.60
Reach-1	8689	PF 1	Prop Cond	12000.00	36.80	47.6		49.13	0.0117	10.77	1321	186.91	0.60
Reach-1	8489	PF 1	Exist Cond	12000.00	35.70	46.2		47.20	0.0069	8.20	1564	183.75	0.46
Reach-1	8489	PF 1	Prop Cond	12000.00	35.70	46.2		47.21	0.0069	8.18	1565	182.86	0.46
Reach-1	8289	PF 1	Exist Cond	12000.00	31.00	45.3		46.09	0.0042	8.08	1792	182.85	0.38
Reach-1	8289	PF 1	Prop Cond	12000.00	31.00	45.2		46.09	0.0044	8.24	1746	172.10	0.38
Reach-1	8089	PF 1	Exist Cond	12000.00	31.00	44.1		45.11	0.0056	8.87	1631	181.47	0.43
Reach-1	8089	PF 1	Prop Cond	12000.00	31.00	44.2		45.11	0.0054	8.72	1626	169.49	0.42
Reach-1	7887	PF 1	Exist Cond	12000.00	31.00	43.6		44.18	0.0030	6.30	2043	194.45	0.31
Reach-1	7887	PF 1	Prop Cond	12000.00	31.00	43.6		44.20	0.0030	6.34	1999	174.95	0.31
Reach-1	7687	PF 1	Exist Cond	12000.00	31.50	42.3		43.29	0.0066	8.47	1603	186.34	0.45
Reach-1	7687	PF 1	Prop Cond	12000.00	31.50	42.3		43.29	0.0066	8.47	1587	177.84	0.45
Reach-1	7482	PF 1	Exist Cond	12000.00	28.80	40.9		42.09	0.0050	9.14	1455	185.70	0.53
Reach-1	7482	PF 1	Prop Cond	12000.00	28.80	40.9		42.10	0.0050	9.13	1451	179.89	0.53
Reach-1	7280	PF 1	Exist Cond	12000.00	27.80	38.6		40.57	0.0110	11.76	1132	173.96	0.76
Reach-1	7280	PF 1	Prop Cond	12000.00	27.80	38.7		40.63	0.0104	11.54	1154	174.58	0.74
Reach-1	7078	PF 1	Exist Cond	12000.00	25.70	38.3		39.26	0.0028	8.14	1764	206.72	0.42
Reach-1	7078	PF 1	Prop Cond	12000.00	25.70	38.5		39.37	0.0027	8.02	1794	208.84	0.41
Reach-1	6874	PF 1	Exist Cond	12000.00	22.80	38.1		38.75	0.0017	7.07	2096	197.42	0.33
Reach-1	6874	PF 1	Prop Cond	12000.00	22.80	38.2		38.88	0.0016	6.98	2127	198.71	0.33
Reach-1	6662	PF 1	Exist Cond	12000.00	23.80	37.4	32.5	38.16	0.0031	8.75	1897	196.85	0.44
Reach-1	6662	PF 1	Prop Cond	12000.00	23.80	37.5	32.8	38.30	0.0032	8.94	1890	197.60	0.45

HEC-RAS River: RIVER-1 Reach: Reach-1 Profile: PF 1 (Continued)

Reach	River Sta	Profile	Plan	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)	
Reach-1	6520			Bridge									
Reach-1	6378	PF 1	Exist Cond	12000.00	21.50	34.7		35.78	0.0047	11.44	1713	191.50	0.55
Reach-1	6378	PF 1	Prop Cond	12000.00	21.50	34.8	31.4	35.87	0.0051	11.85	1685	191.60	0.57
Reach-1	6115	PF 1	Exist Cond	12000.00	21.50	30.5	30.5	33.60	0.0186	17.51	1003	161.72	1.03
Reach-1	6115	PF 1	Prop Cond	12000.00	21.50	30.4	30.4	33.56	0.0189	17.53	971	146.99	1.04
Reach-1	5985	PF 1	Exist Cond	12000.00	21.30	28.1	28.1	31.54	0.0015	14.81	815	120.16	1.00
Reach-1	5985	PF 1	Prop Cond	12000.00	21.30	28.1	28.1	31.54	0.0015	14.81	815	120.16	1.00
Reach-1	5885	PF 1	Exist Cond	12000.00	18.20	25.2	25.2	28.58	0.0015	14.83	814	119.55	1.00
Reach-1	5885	PF 1	Prop Cond	12000.00	18.20	25.2	25.2	28.58	0.0015	14.83	814	119.55	1.00
Reach-1	5725	PF 1	Exist Cond	12000.00	15.70	24.8		26.77	0.0006	11.34	1063	120.17	0.67
Reach-1	5725	PF 1	Prop Cond	12000.00	15.70	25.5		27.21	0.0005	10.47	1151	120.21	0.60
Reach-1	5595	PF 1	Exist Cond	12000.00	14.50	25.0		26.57	0.0004	10.03	1203	119.71	0.56
Reach-1	5595	PF 1	Prop Cond	12000.00	14.50	25.7		27.06	0.0003	9.39	1284	119.75	0.50
Reach-1	5466	PF 1	Exist Cond	12000.00	14.00	25.2		26.44	0.0003	9.07	1327	121.54	0.48
Reach-1	5466	PF 1	Prop Cond	12000.00	14.00	25.8		26.96	0.0002	8.57	1404	119.35	0.44
Reach-1	5465	PF 1	Exist Cond	12000.00	14.00	25.0		26.43	0.0007	9.47	1272	120.78	0.51
Reach-1	5465	PF 1	Prop Cond	12000.00	14.00	25.7		26.95	0.0005	8.90	1352	119.20	0.47
Reach-1	5405	PF 1	Exist Cond	12000.00	14.00	25.0		26.39	0.0007	9.51	1263	118.72	0.51
Reach-1	5405	PF 1	Prop Cond	12000.00	14.00	25.1		26.85	0.0011	10.69	1123	119.15	0.61
Reach-1	5328	PF 1	Exist Cond	12000.00	14.00	25.1	20.6	26.27	0.0005	8.64	1389	147.18	0.46
Reach-1	5328	PF 1	Prop Cond	12000.00	14.00	25.5	20.8	26.59	0.0005	8.49	1414	150.22	0.45
Reach-1	5283			Bridge									
Reach-1	5238	PF 1	Exist Cond	12000.00	14.00	24.8		26.06	0.0055	8.93	1347	158.52	0.48
Reach-1	5238	PF 1	Prop Cond	12000.00	14.00	25.2		26.40	0.0050	8.65	1390	159.30	0.46
Reach-1	5174	PF 1	Exist Cond	12000.00	13.90	24.5		25.72	0.0053	8.59	1372	148.35	0.47
Reach-1	5174	PF 1	Prop Cond	12000.00	13.90	24.4	21.8	25.95	0.0084	9.62	1219	148.34	0.56
Reach-1	5102	PF 1	Exist Cond	12000.00	15.00	21.4	21.4	24.75	0.0294	14.67	819	128.01	1.02
Reach-1	5102	PF 1	Prop Cond	12000.00	15.00	21.4	21.4	24.75	0.0294	14.67	819	128.01	1.02

HEC-RAS River: RIVER-1 Reach: Reach-1 Profile: PF 1 (Continued)

Reach	River Sta	Profile	Plan	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)	
Reach-1	5044	PF 1	Exist Cond	12000.00	9.48	21.2		22.25	0.0041	8.18	1472	132.49	0.42
Reach-1	5044	PF 1	Prop Cond	12000.00	9.48	21.2		22.25	0.0041	8.18	1472	132.49	0.42
Reach-1	4983	PF 1	Exist Cond	12000.00	9.42	20.8		21.97	0.0048	8.68	1388	128.23	0.45
Reach-1	4983	PF 1	Prop Cond	12000.00	9.42	20.8		21.97	0.0048	8.68	1388	128.23	0.45
Reach-1	4942	PF 1	Exist Cond	12000.00	7.70	20.6		21.75	0.0054	8.93	1495	179.71	0.48
Reach-1	4942	PF 1	Prop Cond	12000.00	7.70	20.6		21.75	0.0054	8.93	1495	179.71	0.48
Reach-1	4763	PF 1	Exist Cond	12000.00	7.70	19.5		20.68	0.0066	8.81	1432	179.39	0.51
Reach-1	4763	PF 1	Prop Cond	12000.00	7.70	19.5		20.68	0.0066	8.81	1432	179.39	0.51
Reach-1	4567	PF 1	Exist Cond	12000.00	7.70	18.3	14.6	19.46	0.0059	9.16	1436	161.31	0.50
Reach-1	4567	PF 1	Prop Cond	12000.00	7.70	18.3	14.6	19.46	0.0059	9.16	1436	161.31	0.50


Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 11533
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.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Levee
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 11333
.035
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Levee
Ineff
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 11134
.035
.015
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Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Levee
Ineff
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 10933
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.015
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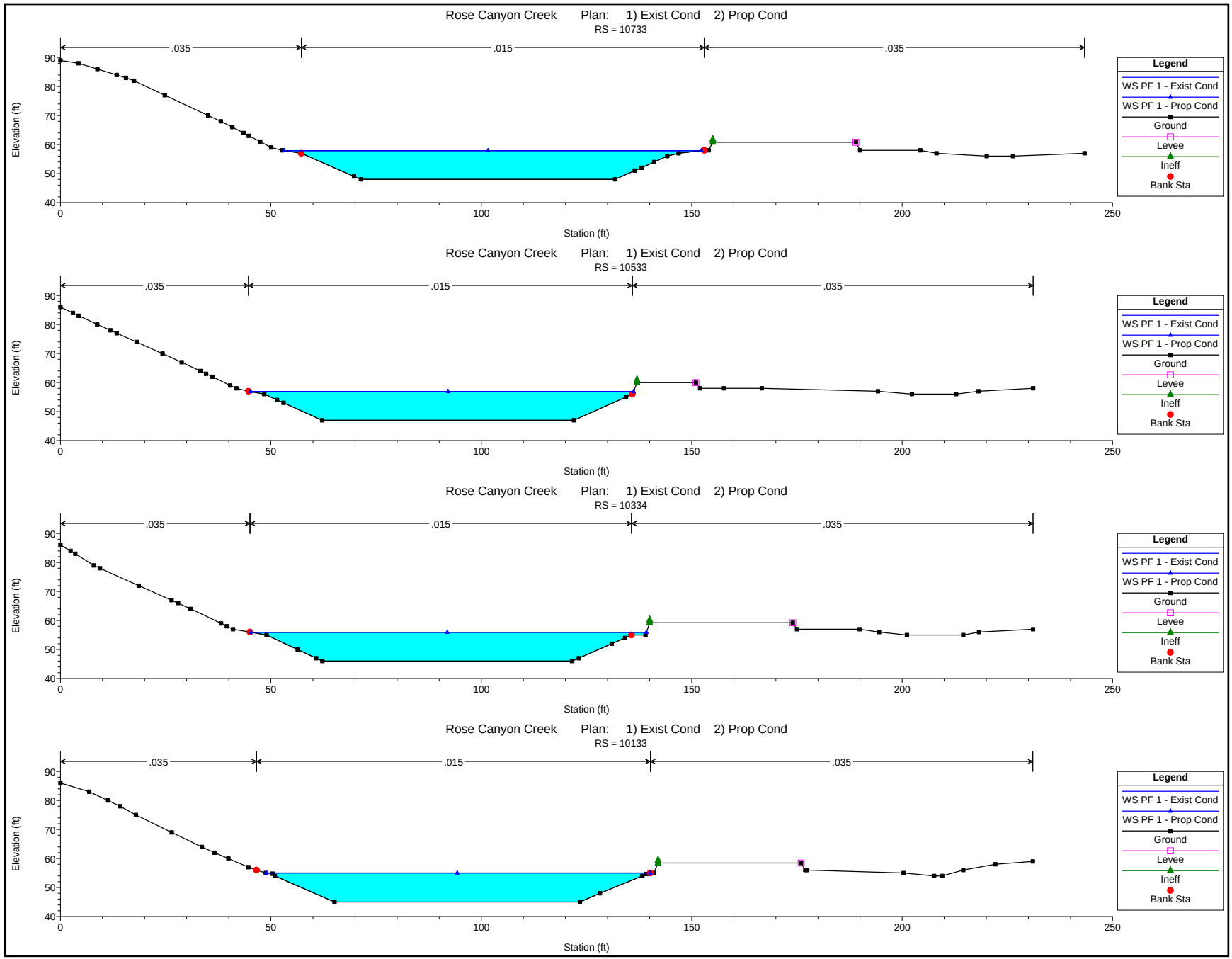
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Levee
Ineff
Bank Sta


Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 10733
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Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Levee
Ineff
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 10533
.035
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Levee
Ineff
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 10334
.035
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Levee
Ineff
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 10133
.035
.015
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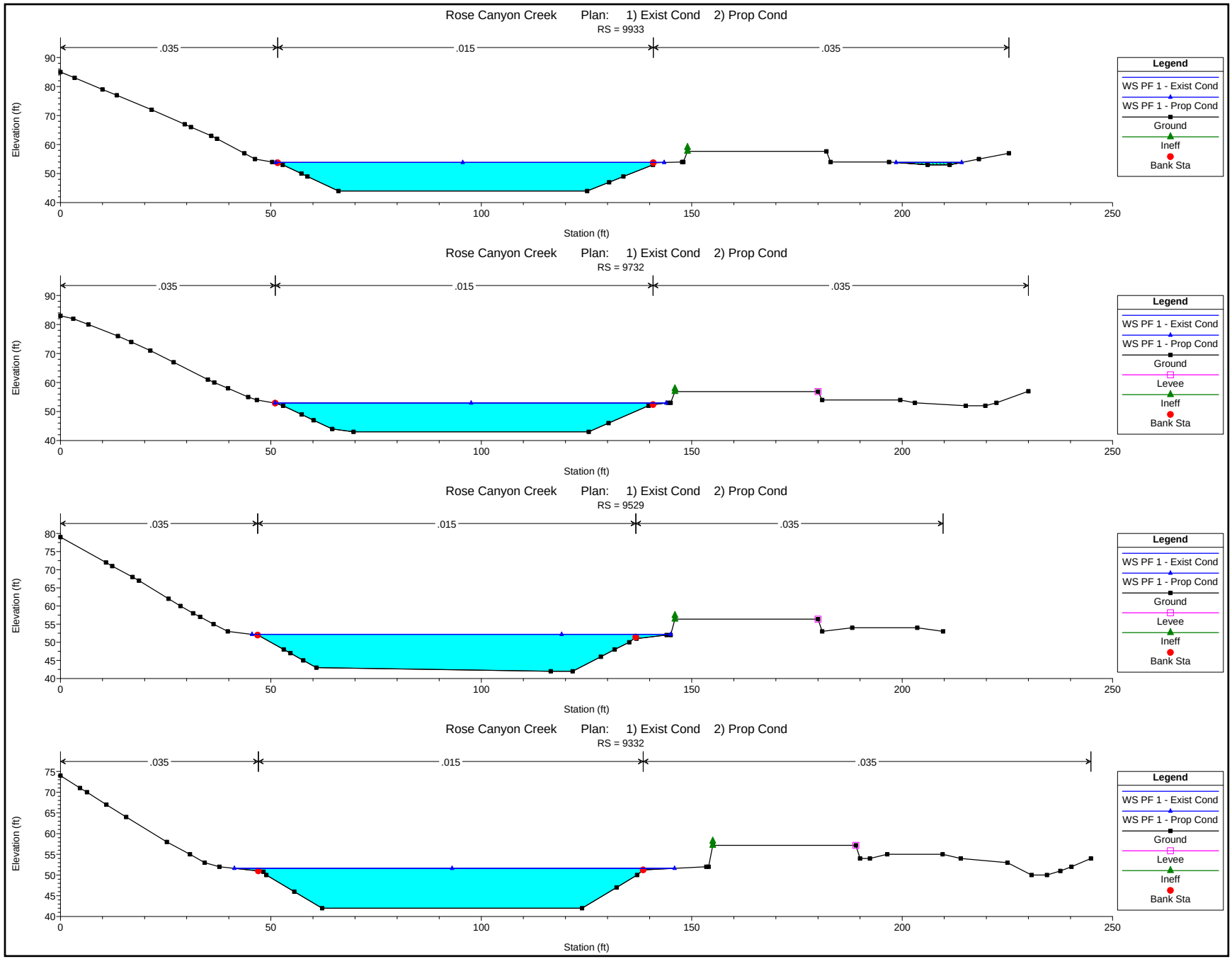
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Levee
Ineff
Bank Sta


Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 9933
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Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Ineff
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 9732
.035
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Levee
Ineff
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 9529
.035
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Levee
Ineff
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 9332
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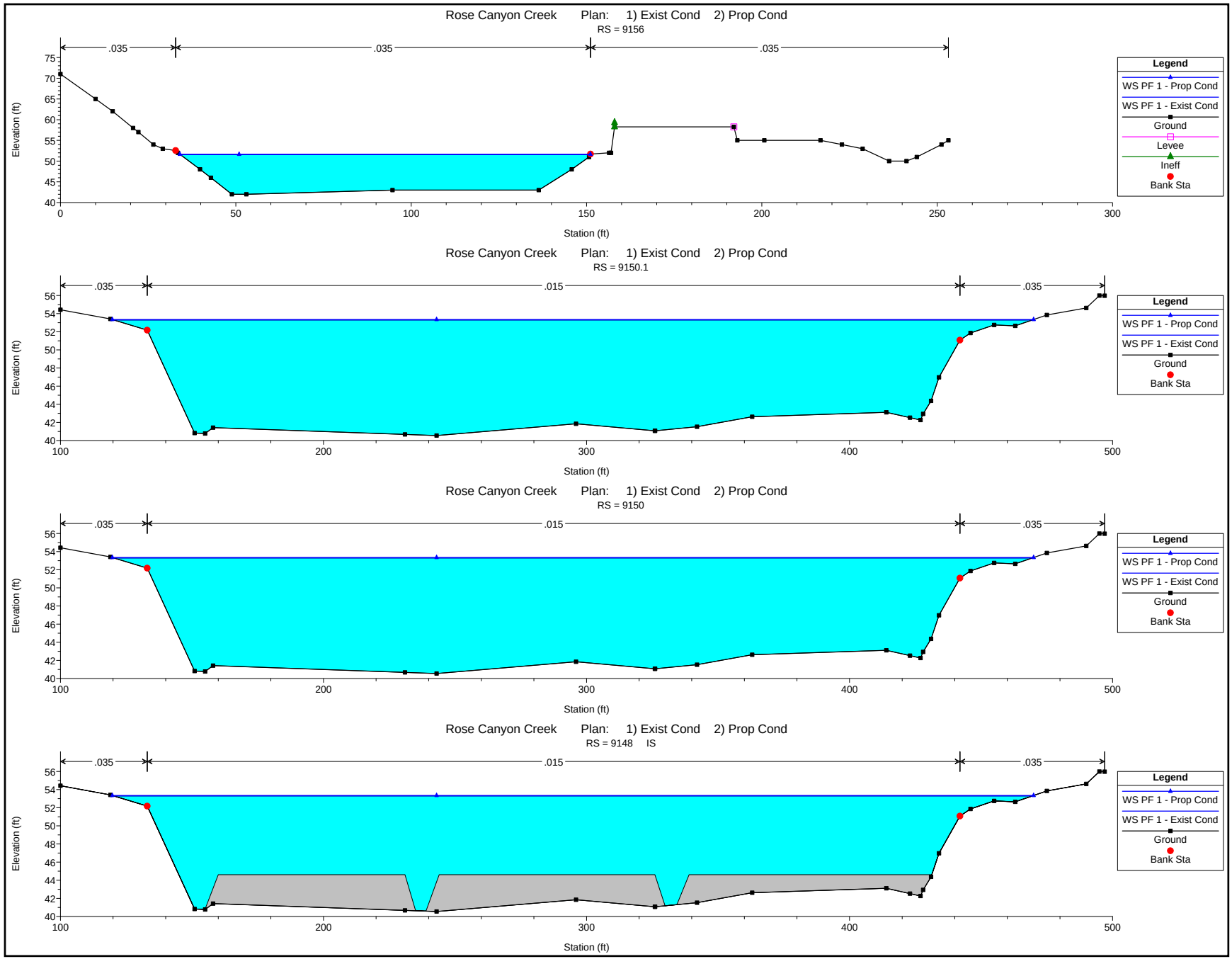
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Levee
Ineff
Bank Sta


Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 9156
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Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Levee
Ineff
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 9150.1
.035
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 9150
.035
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
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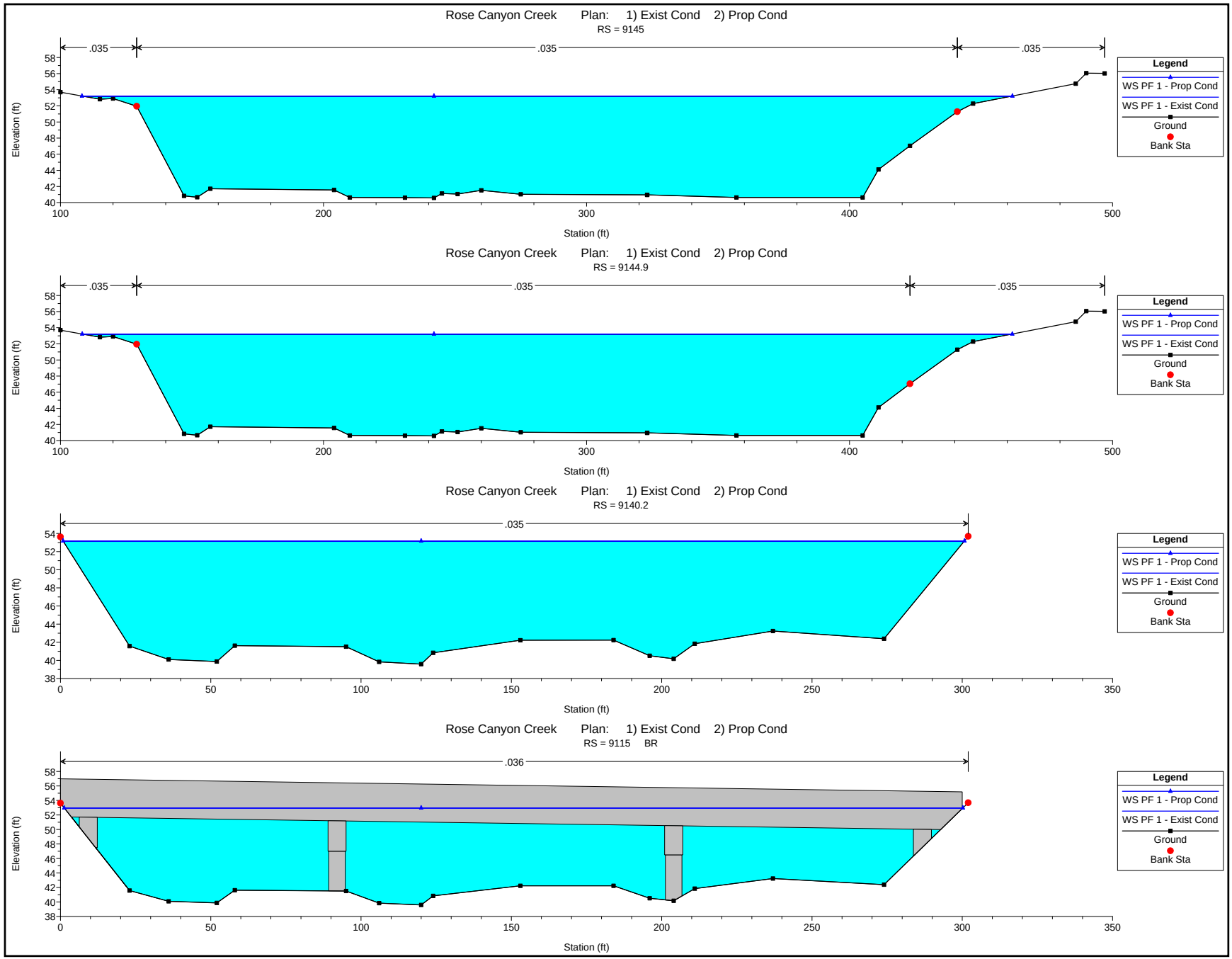
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta


Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 9145
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.035
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Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 9144.9
.035
.035
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 9140.2
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 9115 BR
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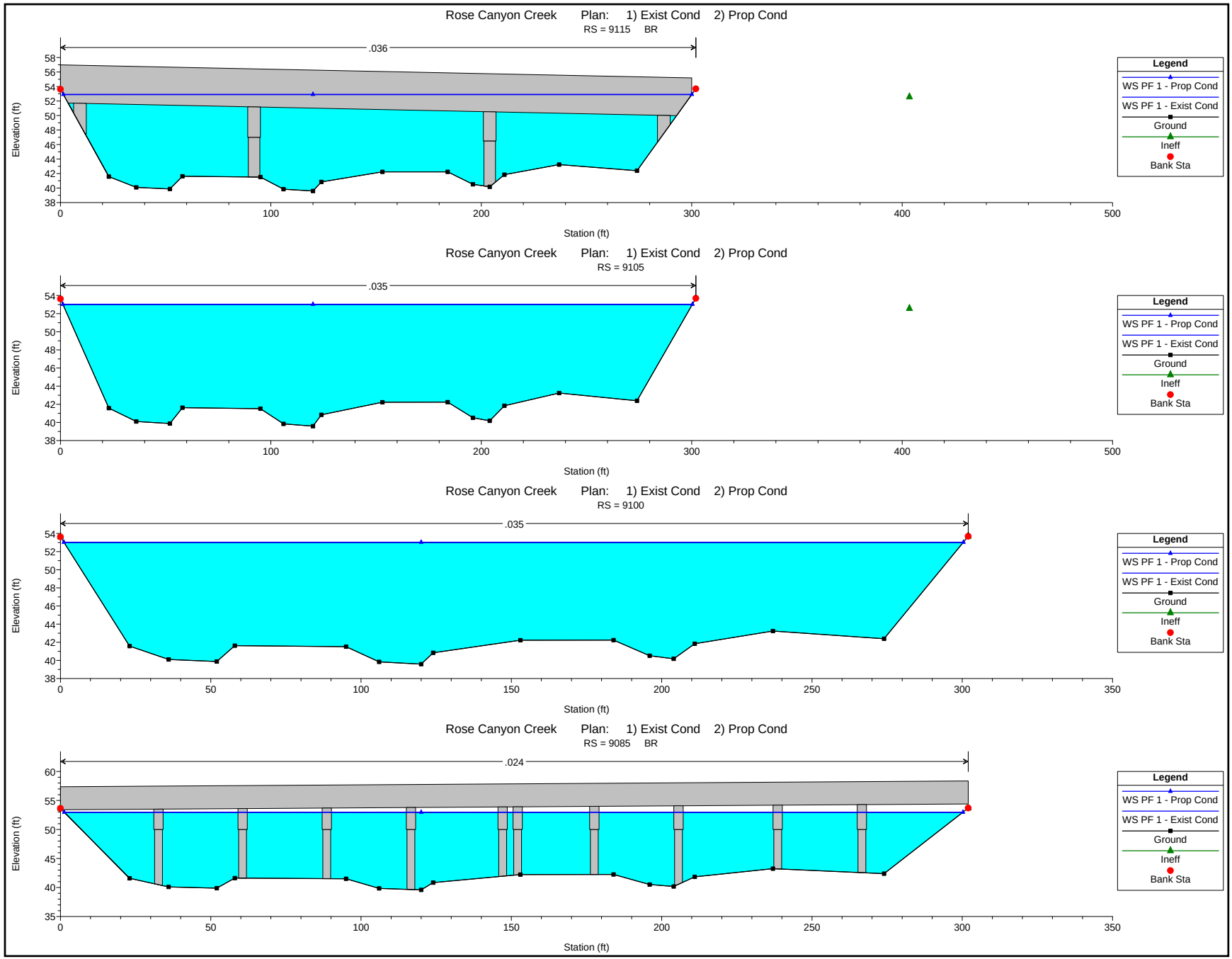
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta


Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 9115 BR
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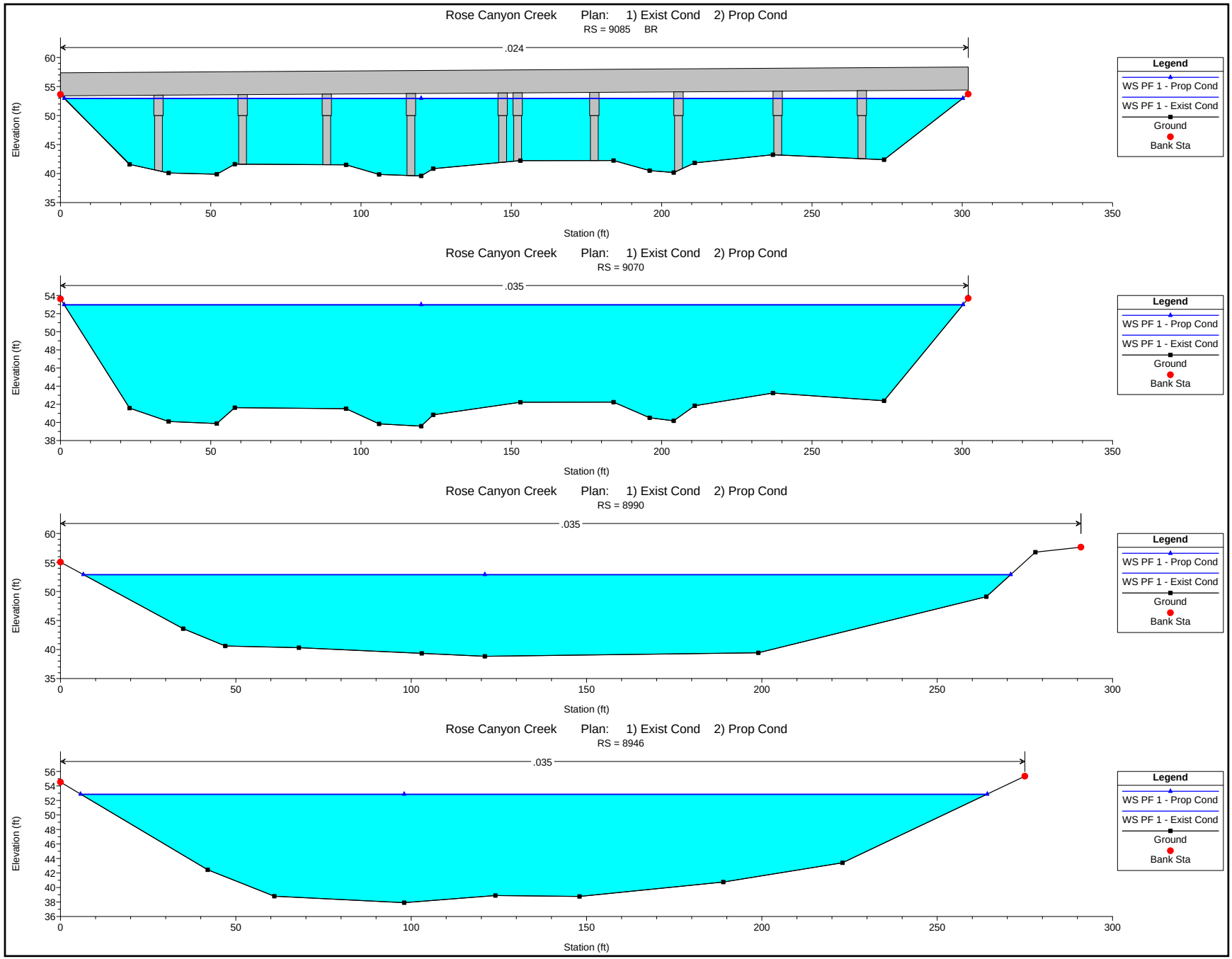
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Ineff
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 9105
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Ineff
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 9100
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Ineff
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 9085 BR
.024
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Ineff
Bank Sta


Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 9085 BR
.024
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 9070
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 8990
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
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Elevation (ft)
Station (ft)
Legend
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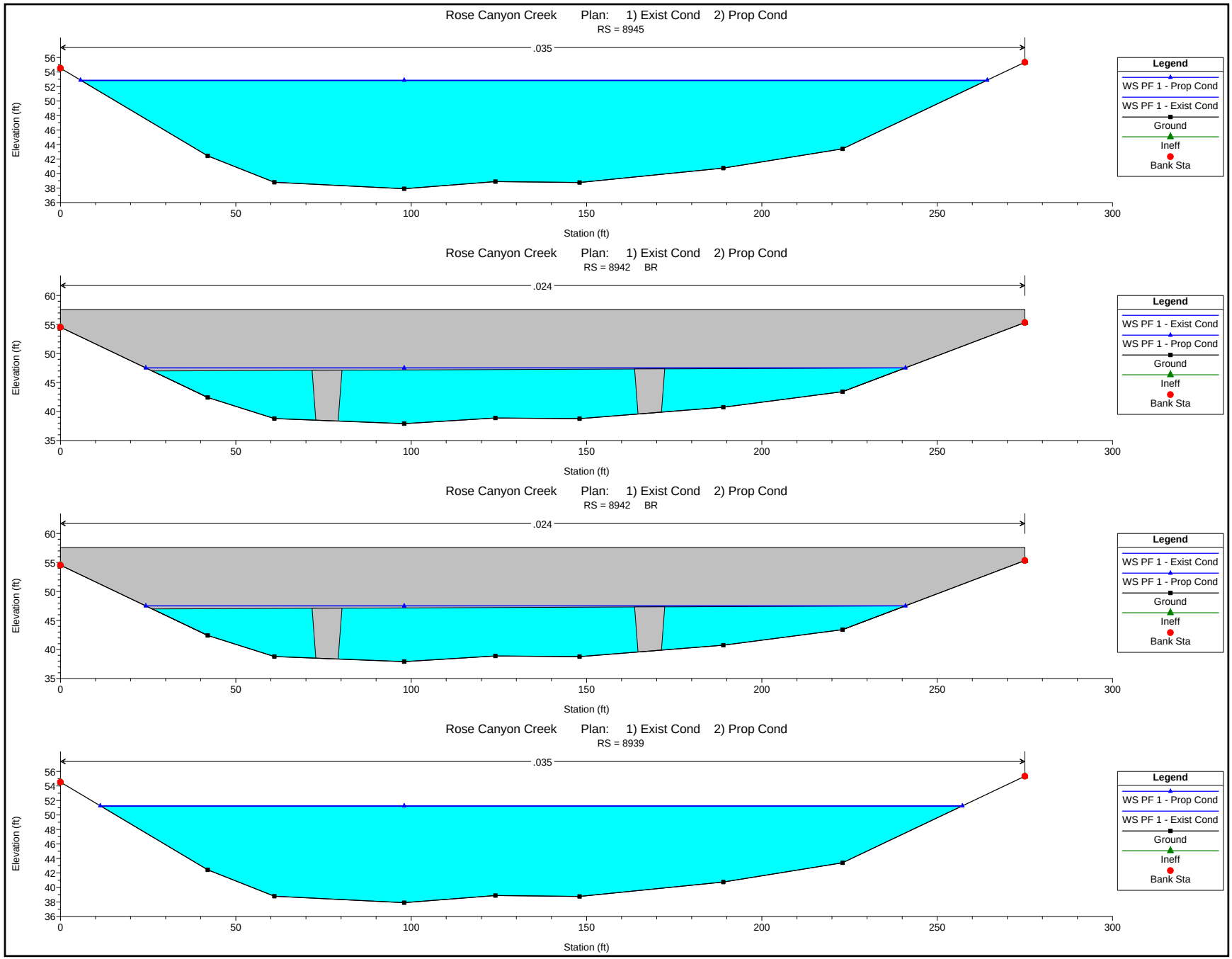
WS PF 1 - Exist Cond
Ground
Bank Sta


Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 8945
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Ineff
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 8942 BR
.024
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Ineff
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 8942 BR
.024
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Ineff
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
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Elevation (ft)
Station (ft)
Legend
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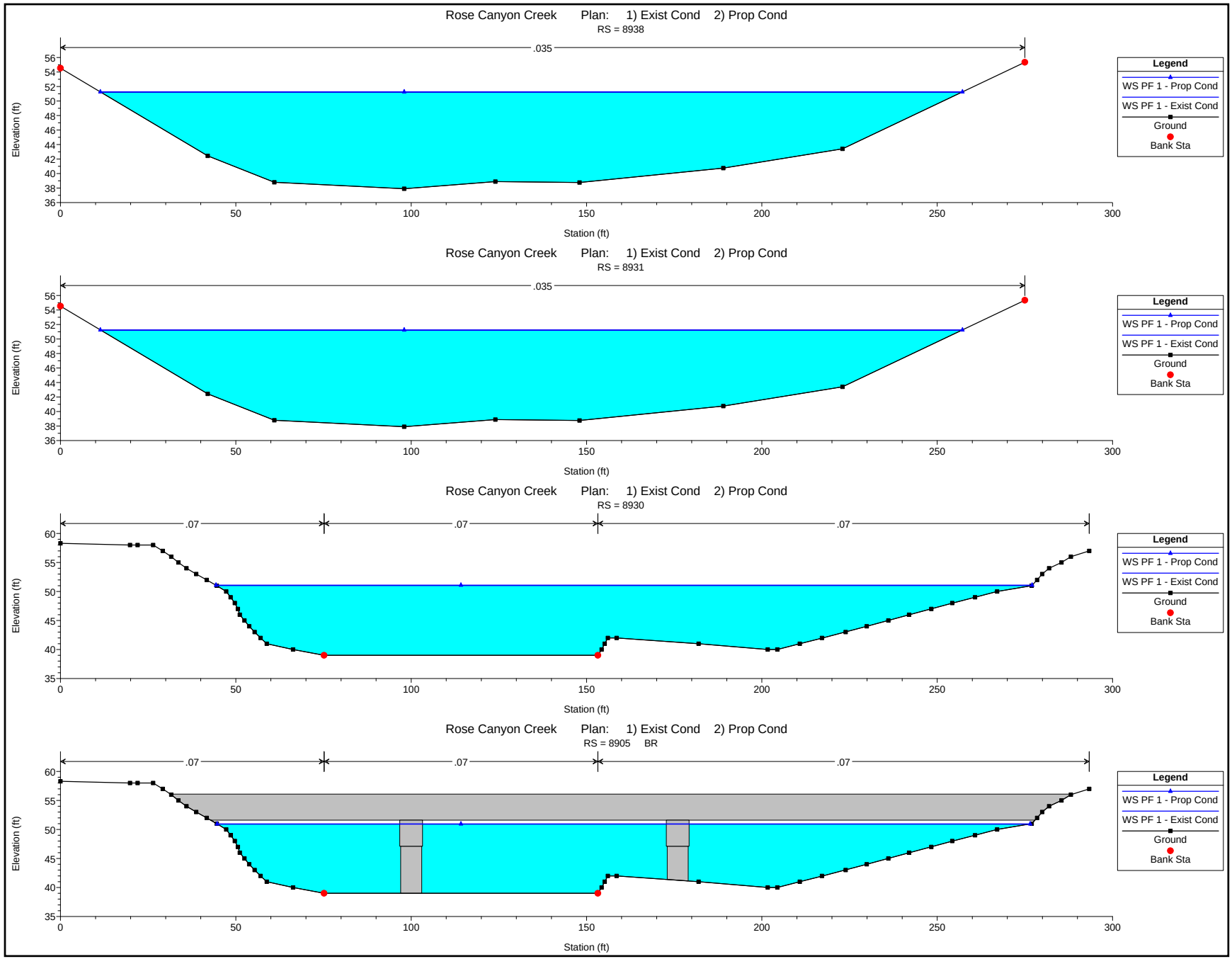
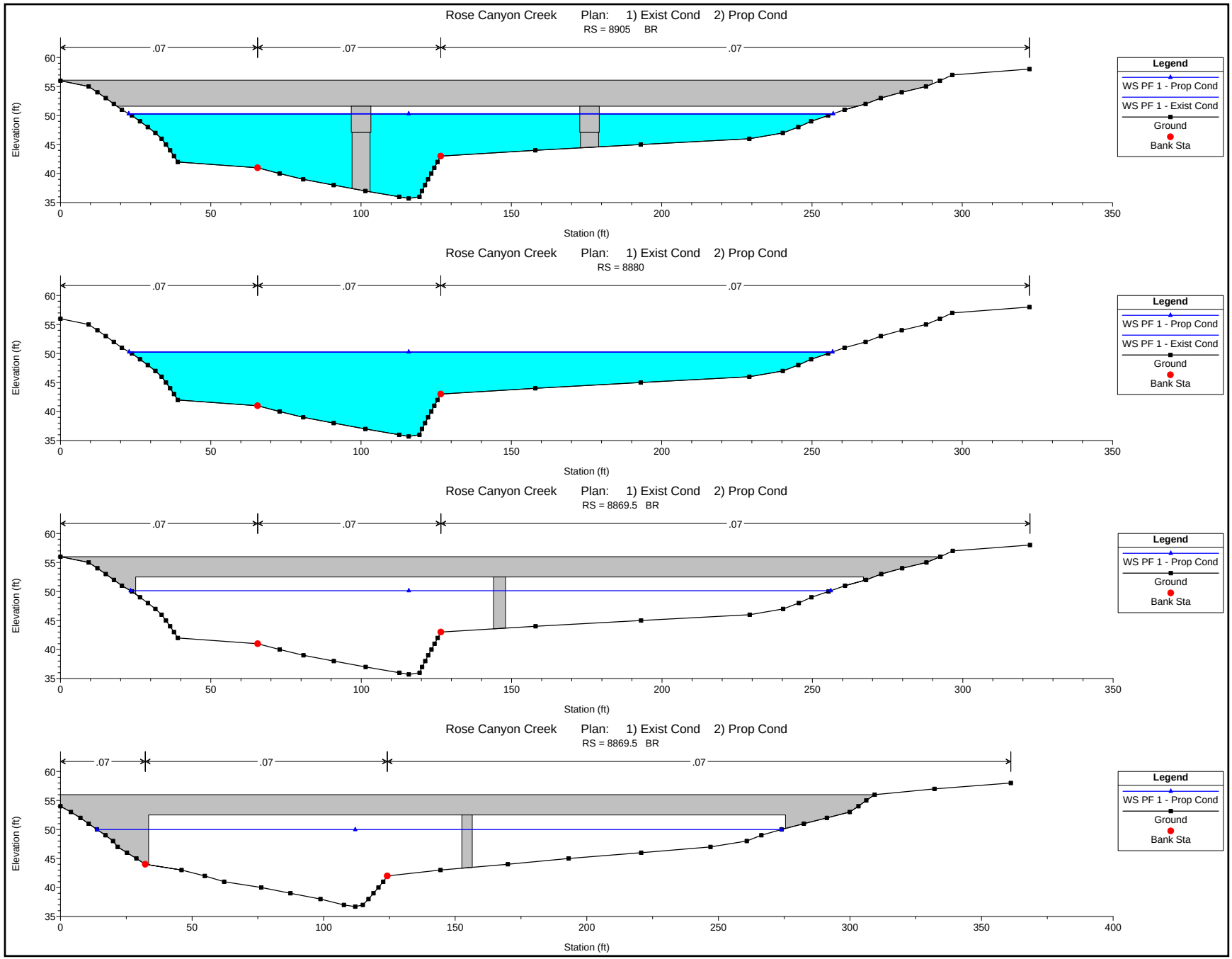
WS PF 1 - Exist Cond
Ground
Ineff
Bank Sta


Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 8938
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 8931
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 8930
.07
.07
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 8905 BR
.07
.07
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta


Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 8905 BR
.07
.07
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 8880
.07
.07
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 8869.5 BR
.07
.07
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 8869.5 BR
.07
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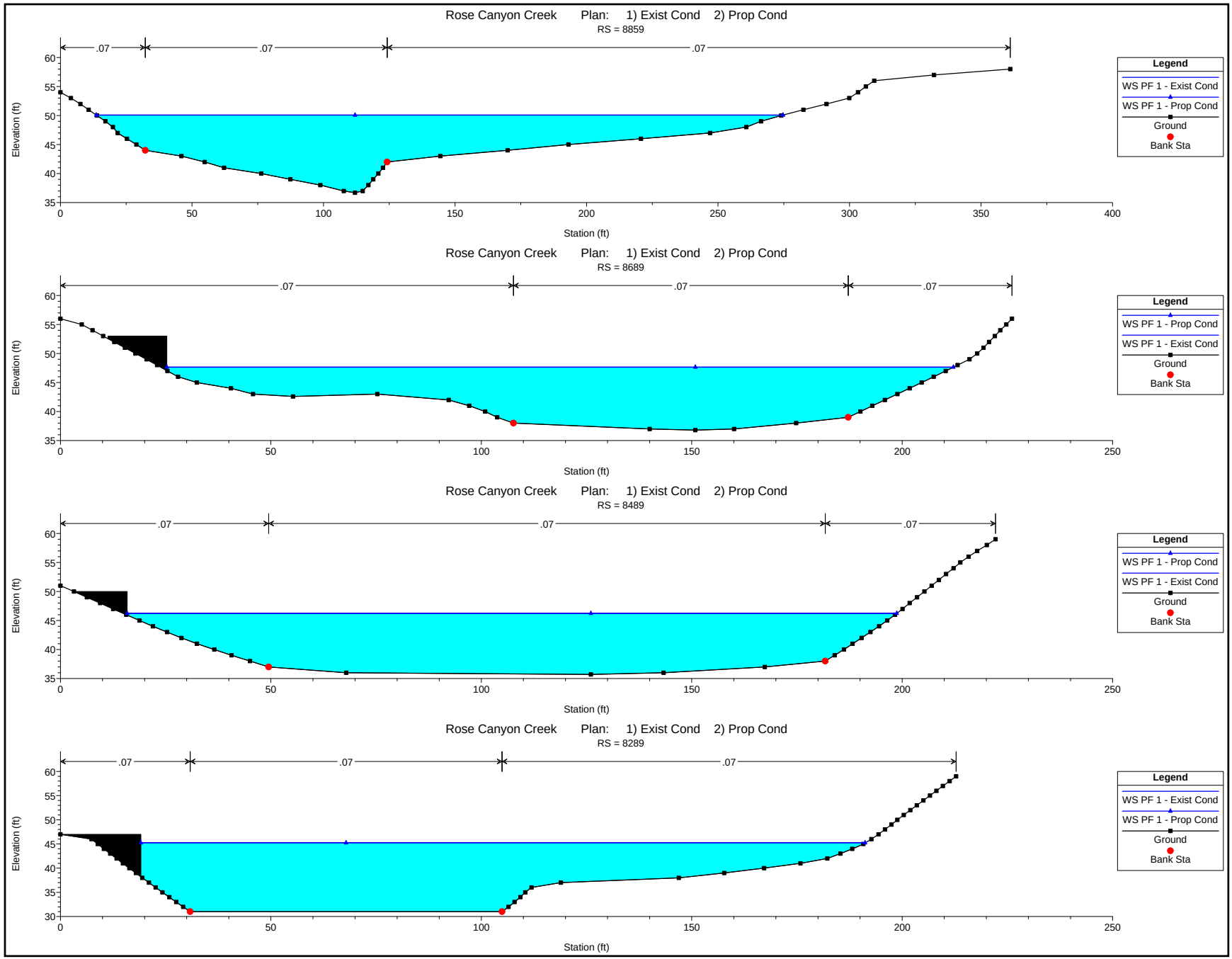
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
Ground
Bank Sta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RS = 8859
.07
.07
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Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 8689
.07
.07
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 8489
.07
.07
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
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Elevation (ft)
Station (ft)
Legend
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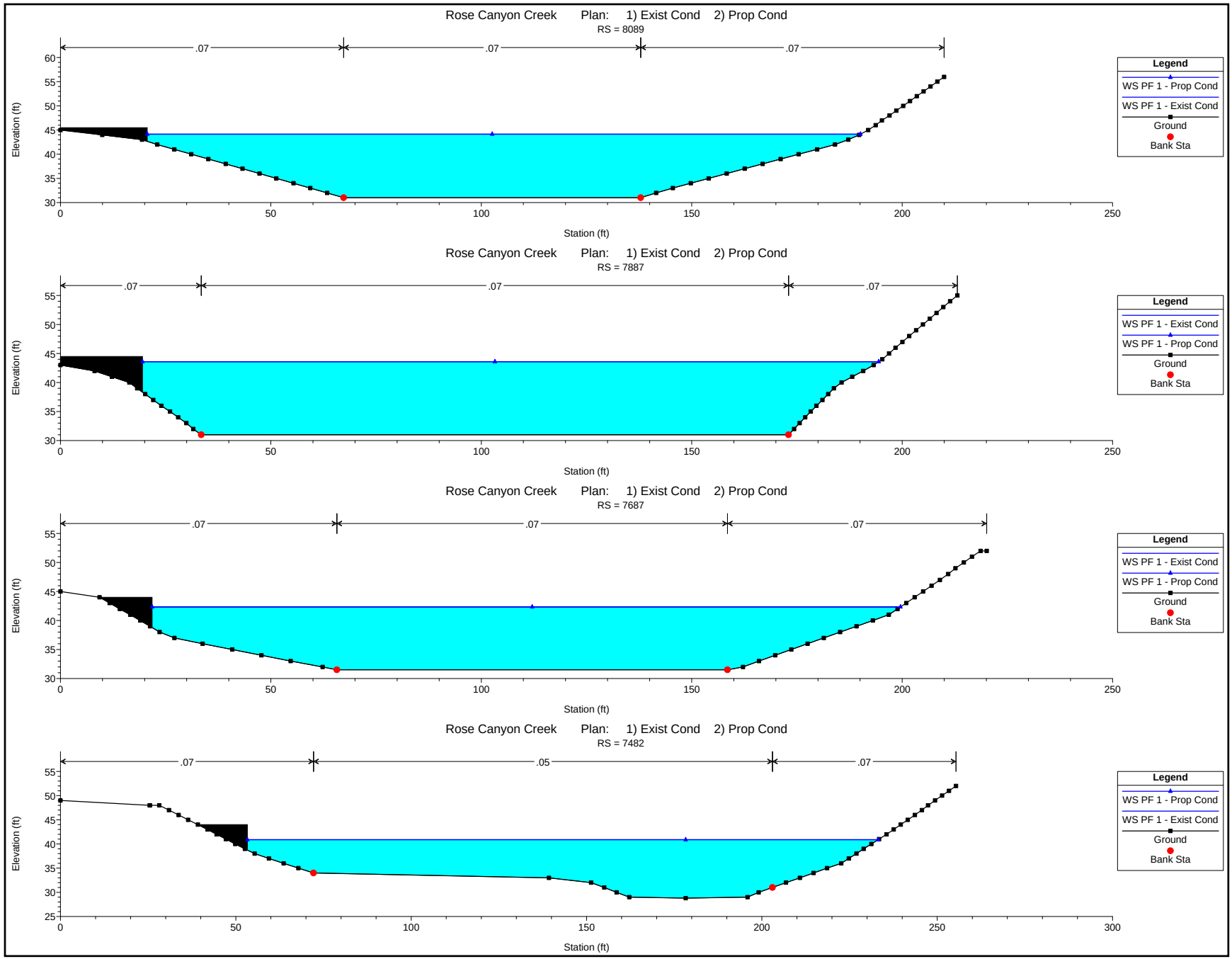
WS PF 1 - Prop Cond
Ground
Bank Sta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.07
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 7887
.07
.07
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 7687
.07
.07
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 7482
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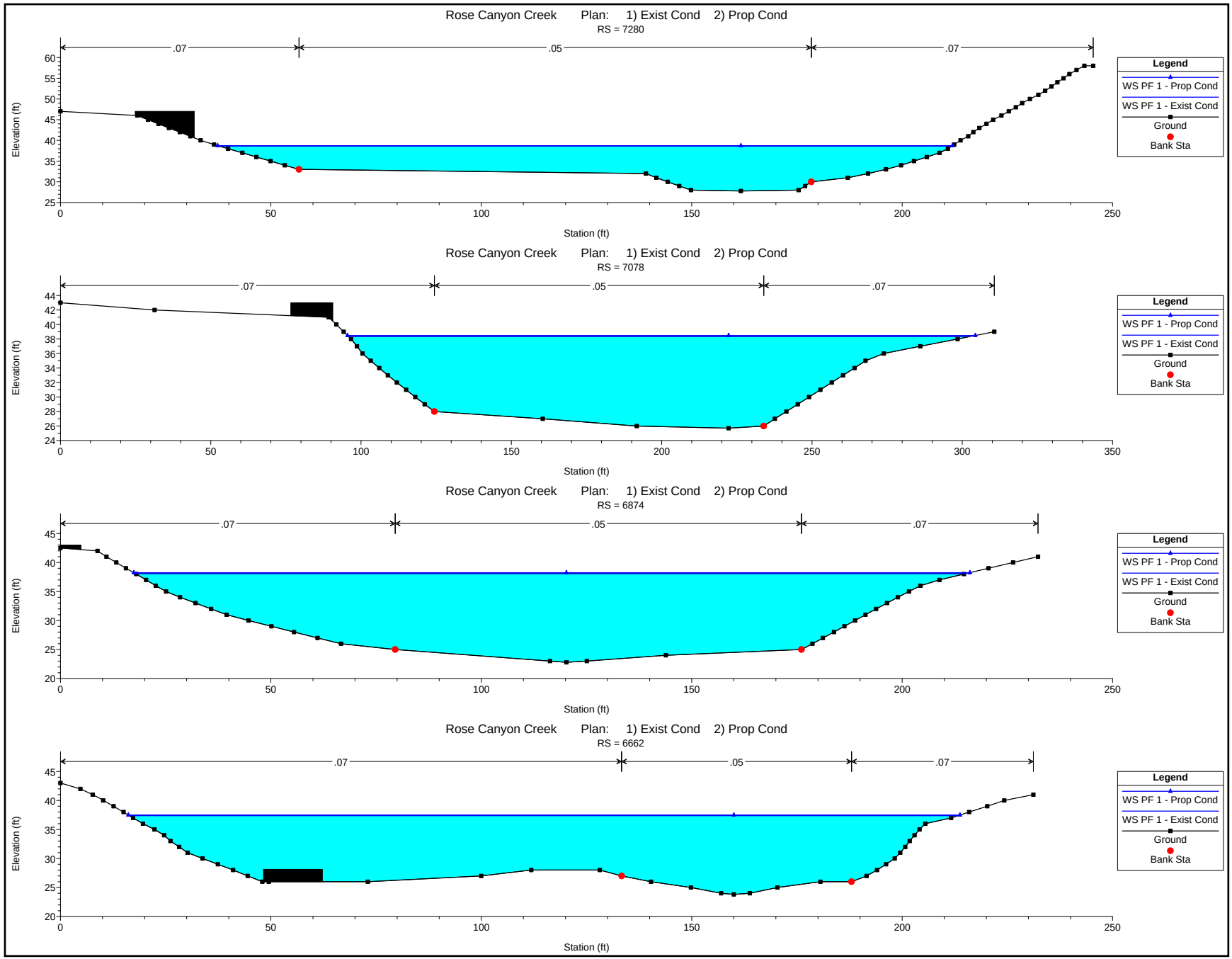
.05
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 7078
.07
.05
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 6874
.07
.05
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 6662
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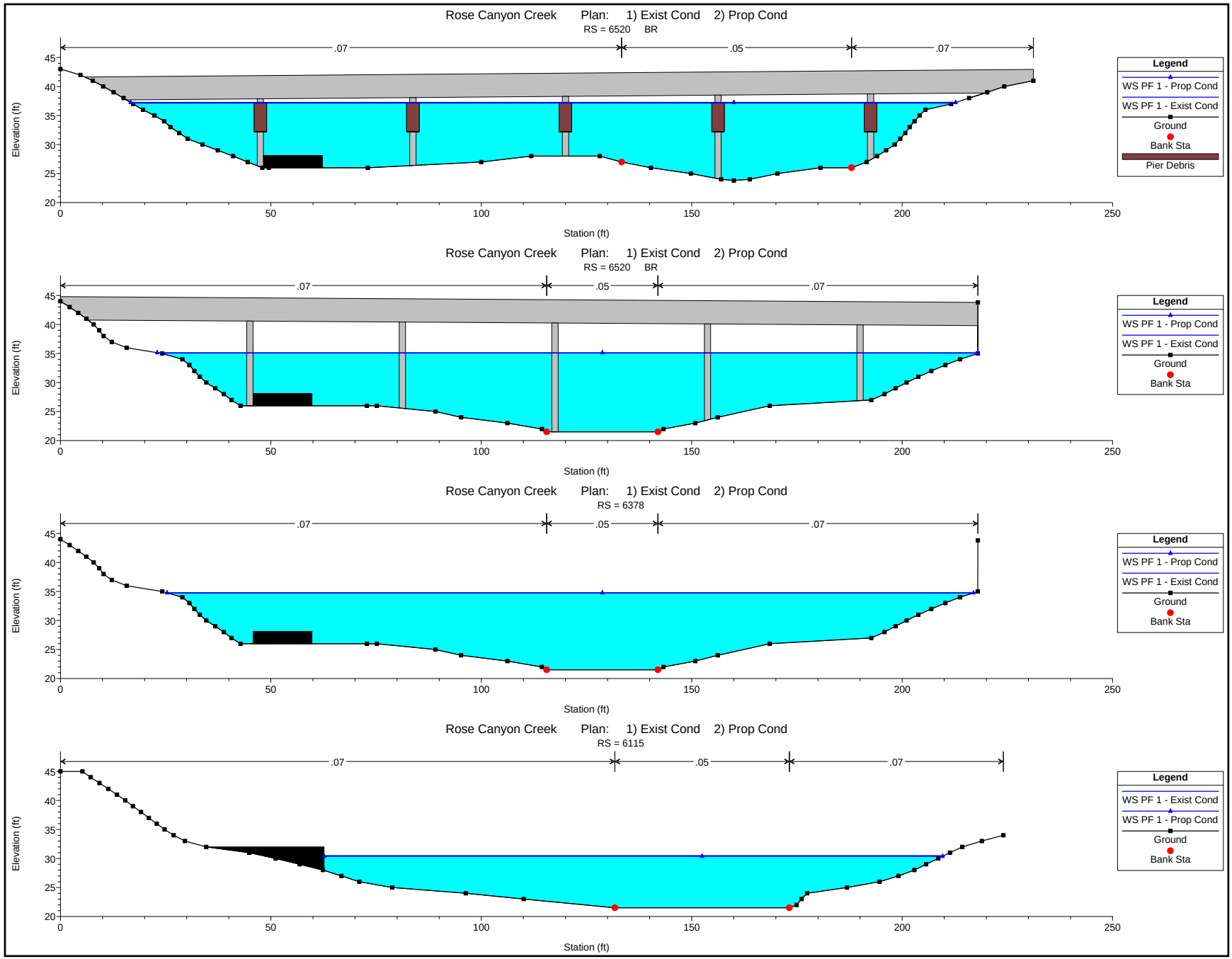
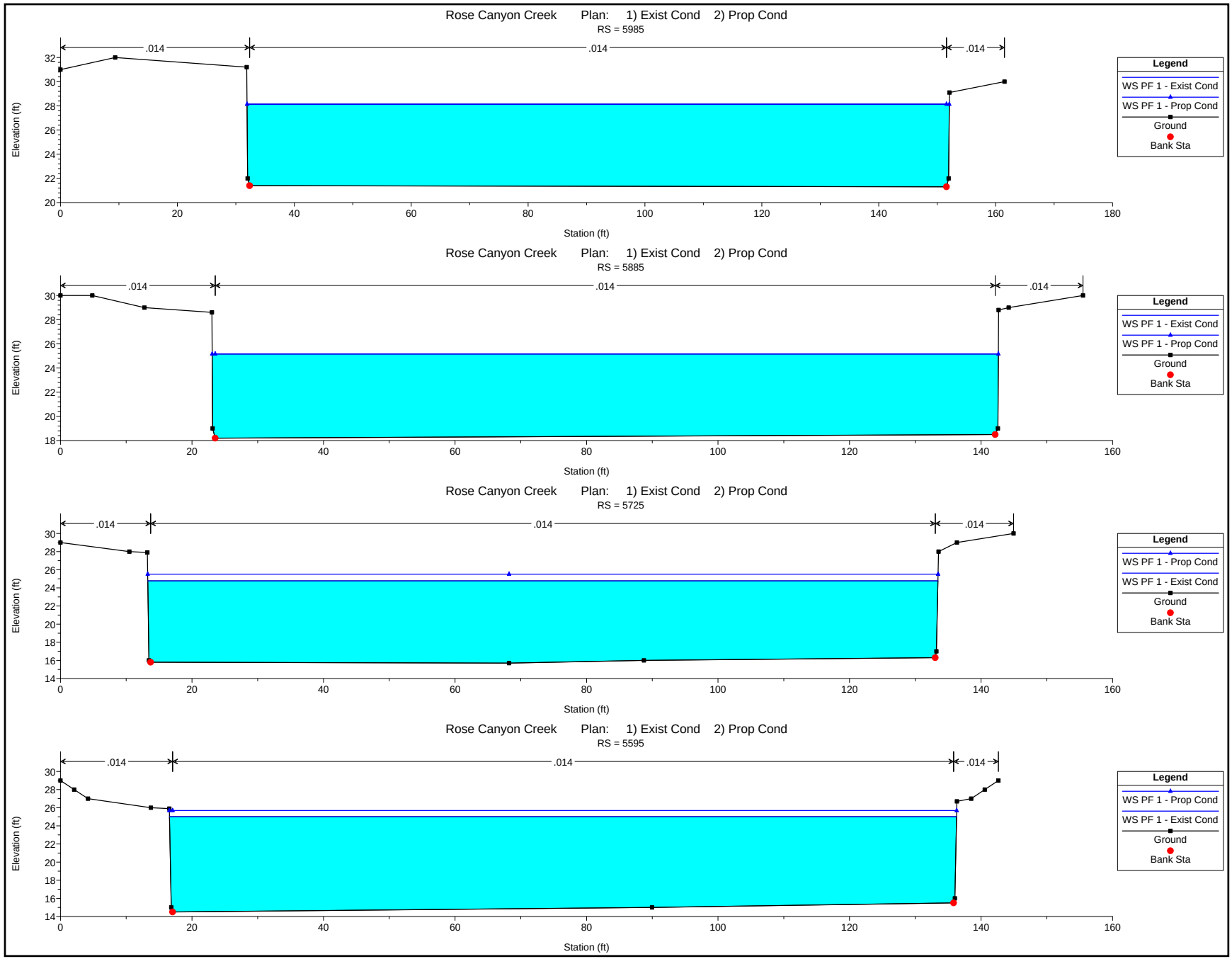
.05
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta


Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 6520 BR
.07
.05
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Pier Debris
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 6520 BR
.07
.05
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 6378
.07
.05
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 6115
.07
.05
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Bank Sta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.014
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 5885
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 5725
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
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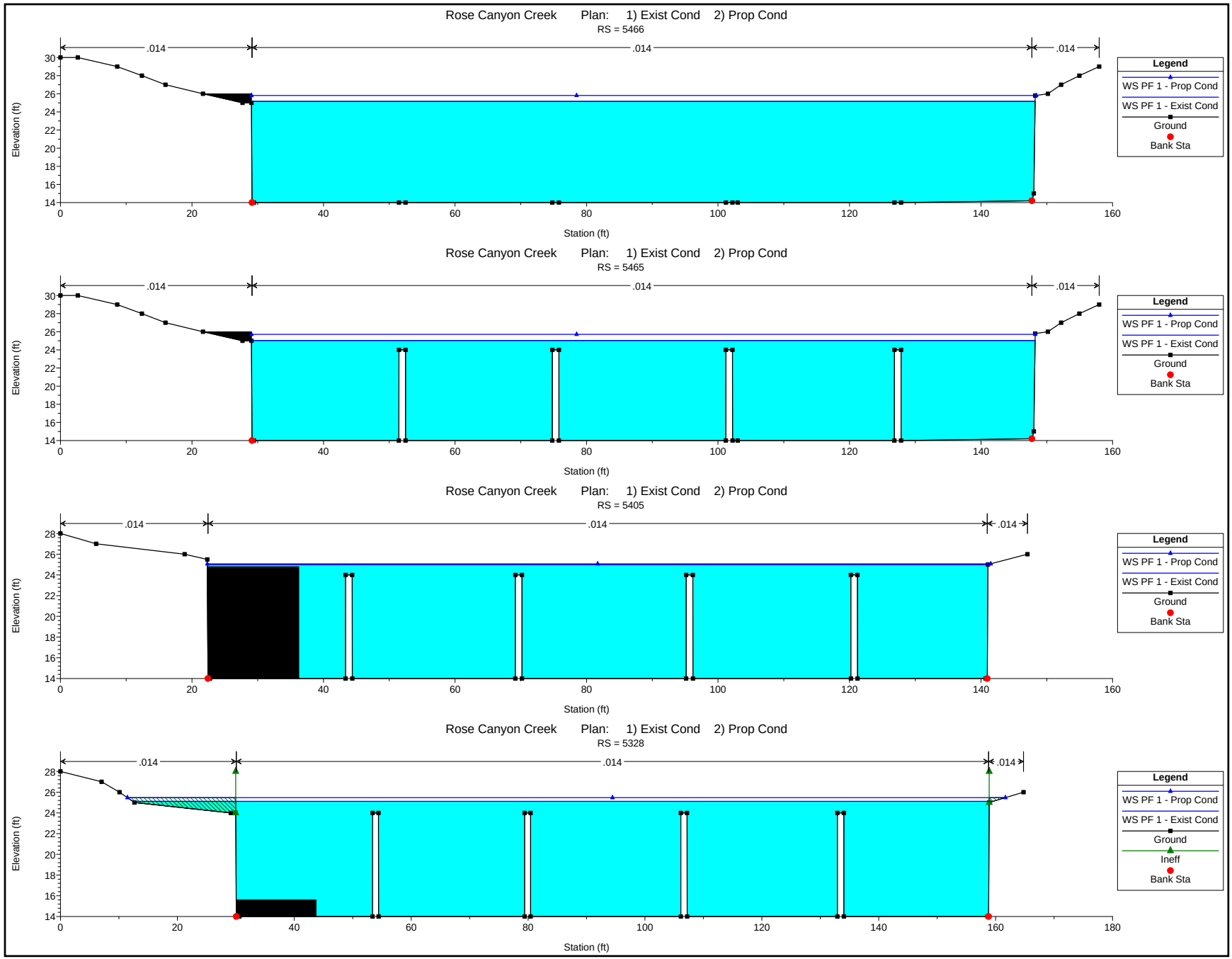
.014
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta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.014
.014
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 5465
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 5405
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 5328
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.014
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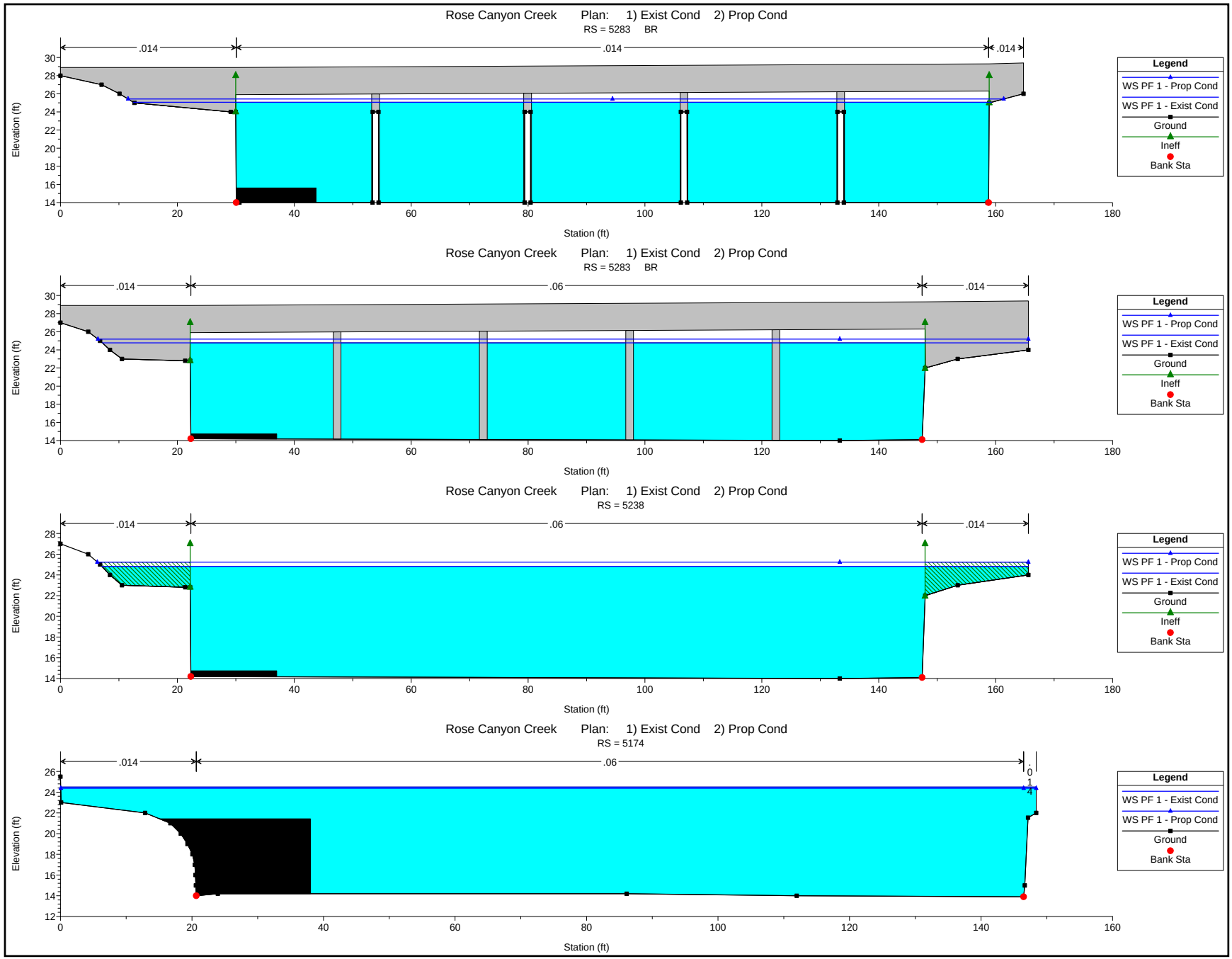
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Ineff
Bank Sta


Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 5283 BR
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Ineff
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 5283 BR
.014
.06
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Ineff
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 5238
.014
.06
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Prop Cond
WS PF 1 - Exist Cond
Ground
Ineff
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
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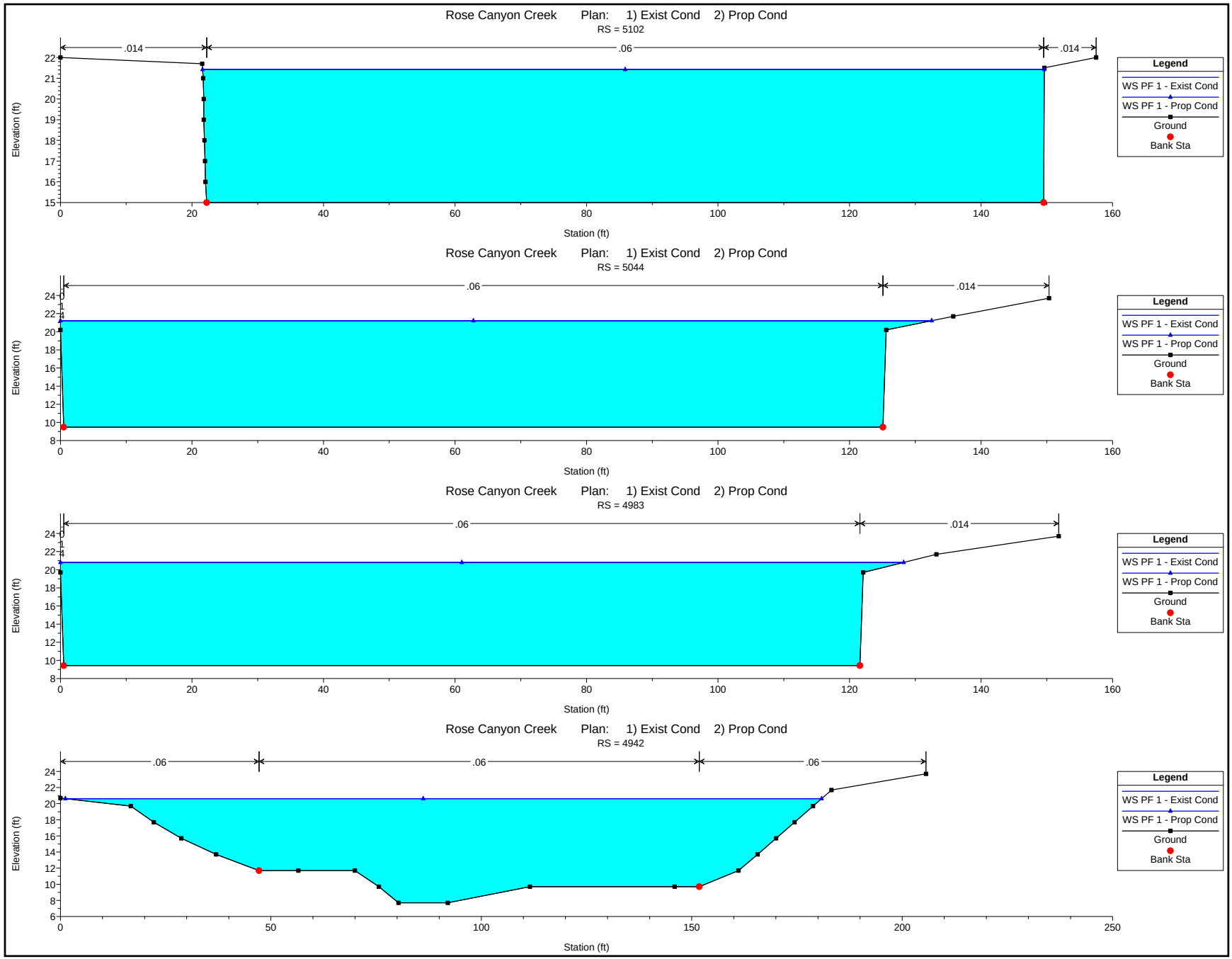
.014
.06
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Bank Sta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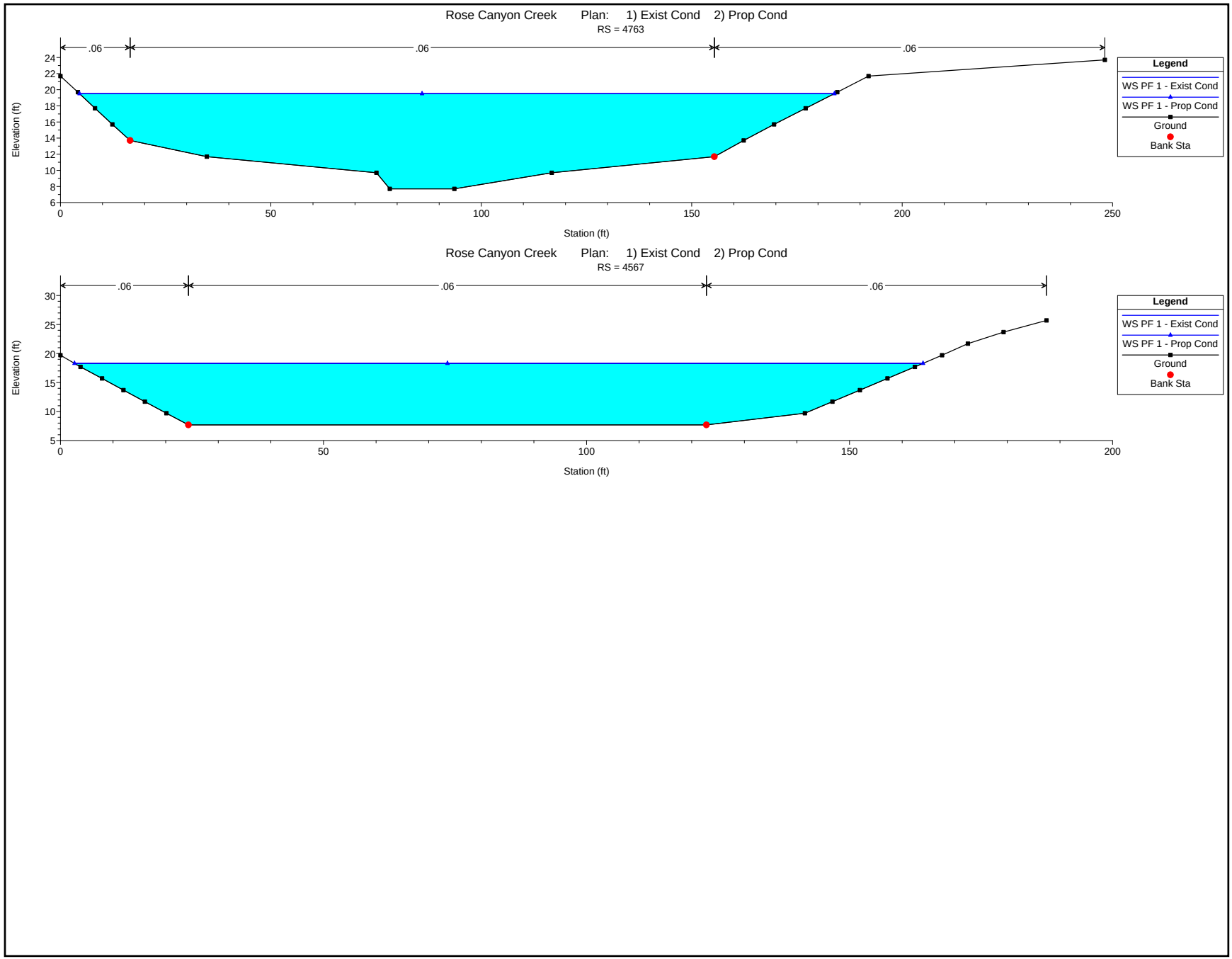
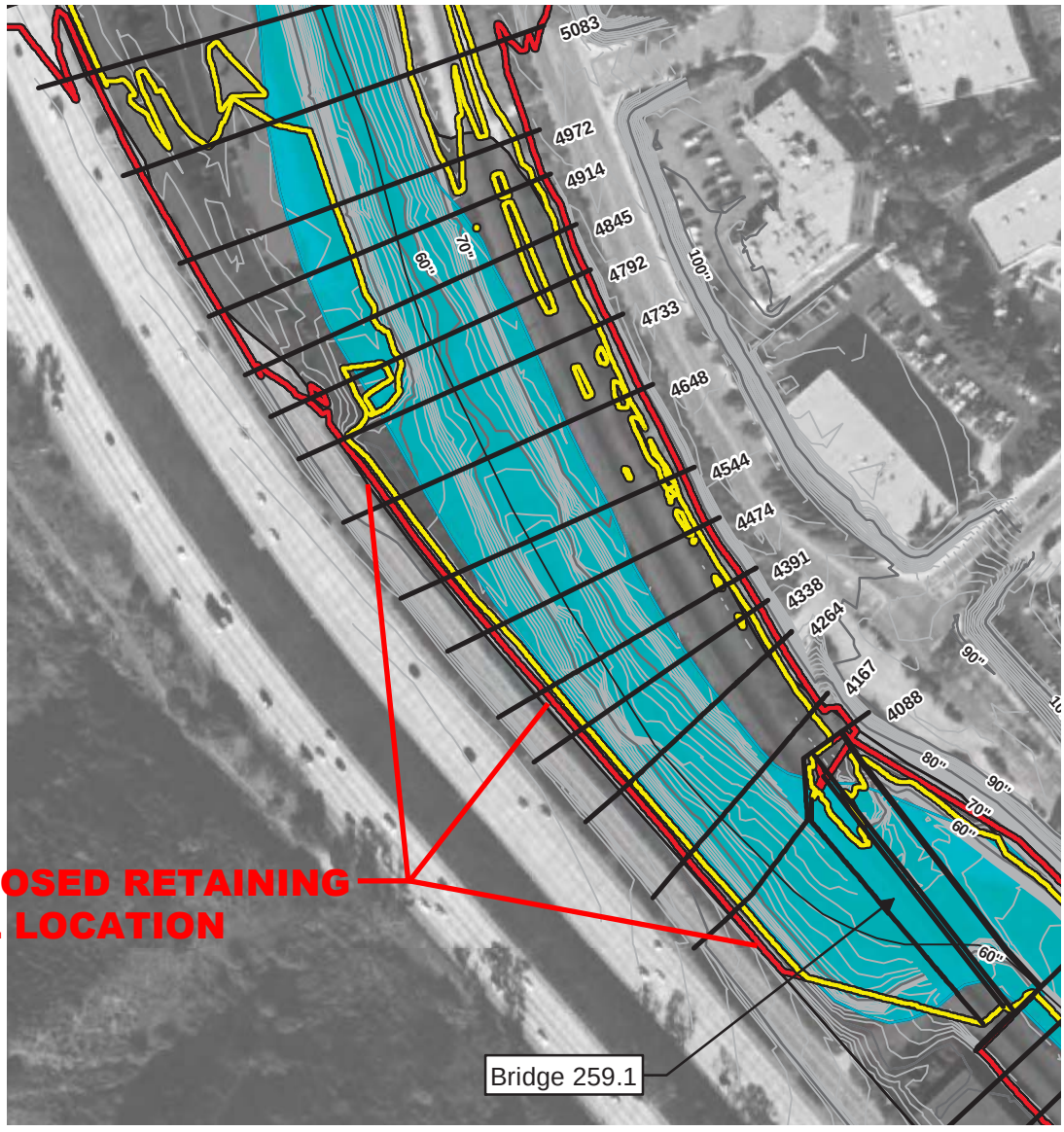
RS = 5102
.014
.06
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 5044
.06
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 4983
.06
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 4942
.06
.06
.06
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Bank Sta


Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 4763
.06
.06
.06
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Bank Sta
Rose Canyon Creek Plan: 1) Exist Cond 2) Prop Cond
RS = 4567
.06
.06
.06
Elevation (ft)
Station (ft)
Legend
WS PF 1 - Exist Cond
WS PF 1 - Prop Cond
Ground
Bank Sta

APPENDIX B

Northerly Project Segment
100-Year Hydraulic Analyses

1"=200'

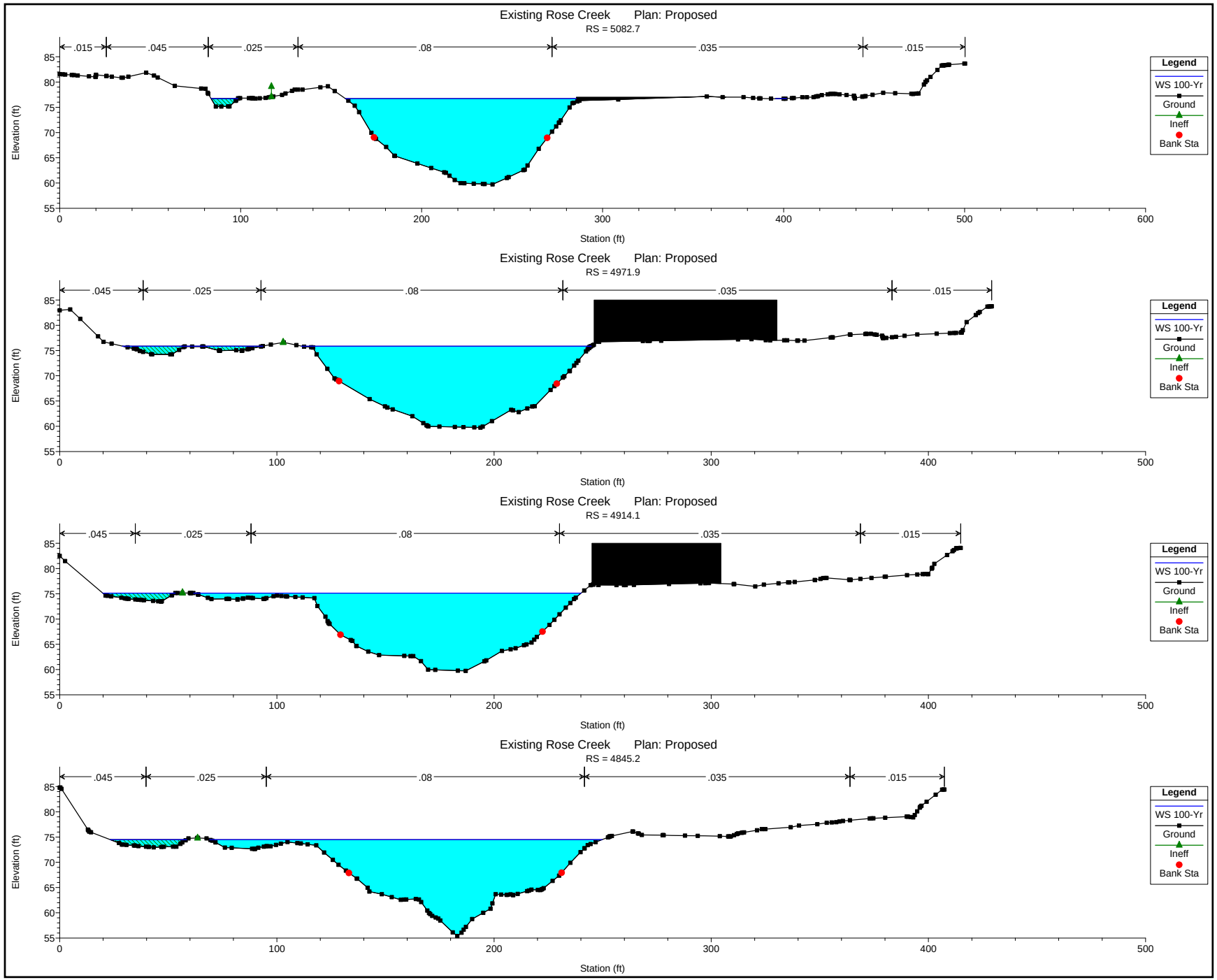


PROPOSED RETAINING WALL LOCATION

PORTION OF HDR ENGINEERING LOMR WORK MAP COVERING STUDY REACH

HEC-RAS River: Rose Creek Reach: Rose CanyonCreek Profile: 100-Yr

Reach	River Sta	Profile	Plan	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)	
Rose CanyonCreek	5082.7	100-Yr	Exist Cond	12000.00	59.74	76.72	70.9	77.86	0.0069	8.70	1427	148.59	0.41
Rose CanyonCreek	5082.7	100-Yr	Prop Cond	12000.00	59.74	76.72	70.9	77.86	0.0069	8.70	1427	148.58	0.41
Rose CanyonCreek	4971.9	100-Yr	Exist Cond	12000.00	59.74	75.87	70.7	77.05	0.0077	8.83	1405	198.05	0.43
Rose CanyonCreek	4971.9	100-Yr	Prop Cond	12000.00	59.74	75.87	70.7	77.05	0.0077	8.83	1405	198.05	0.43
Rose CanyonCreek	4914.1	100-Yr	Exist Cond	12000.00	59.74	75.13	70.8	76.52	0.0098	9.72	1332	211.84	0.49
Rose CanyonCreek	4914.1	100-Yr	Prop Cond	12000.00	59.74	75.13	70.8	76.52	0.0098	9.72	1332	211.84	0.49
Rose CanyonCreek	4845.2	100-Yr	Exist Cond	12000.00	55.40	74.48	70.2	75.82	0.0102	9.52	1349	215.86	0.48
Rose CanyonCreek	4845.2	100-Yr	Prop Cond	12000.00	55.40	74.48	70.2	75.82	0.0102	9.52	1349	215.85	0.48
Rose CanyonCreek	4791.7	100-Yr	Exist Cond	12000.00	55.41	73.80	69.6	75.24	0.0113	9.79	1297	247.58	0.50
Rose CanyonCreek	4791.7	100-Yr	Prop Cond	12000.00	55.41	73.80	69.6	75.24	0.0113	9.79	1297	247.58	0.50
Rose CanyonCreek	4733.4	100-Yr	Exist Cond	12000.00	59.74	73.44	69.9	74.53	0.0095	8.89	1580	307.05	0.47
Rose CanyonCreek	4733.4	100-Yr	Prop Cond	12000.00	59.74	73.44	69.9	74.53	0.0095	8.89	1580	307.00	0.47
Rose CanyonCreek	4647.9	100-Yr	Exist Cond	12000.00	59.43	72.37	68.8	73.66	0.0104	9.55	1461	272.90	0.50
Rose CanyonCreek	4647.9	100-Yr	Prop Cond	12000.00	59.43	72.37	68.8	73.66	0.0104	9.55	1461	272.90	0.50
Rose CanyonCreek	4544.1	100-Yr	Exist Cond	12000.00	56.38	71.71	66.8	72.68	0.0070	8.35	1644	259.26	0.41
Rose CanyonCreek	4544.1	100-Yr	Prop Cond	12000.00	56.38	71.71	66.8	72.68	0.0070	8.35	1644	259.26	0.41
Rose CanyonCreek	4473.6	100-Yr	Exist Cond	12000.00	55.10	71.27	66.4	72.18	0.0067	7.99	1644	243.08	0.40
Rose CanyonCreek	4473.6	100-Yr	Prop Cond	12000.00	55.10	71.27	66.4	72.18	0.0067	7.99	1644	243.08	0.40
Rose CanyonCreek	4391.3	100-Yr	Exist Cond	12000.00	54.98	70.68	66.3	71.61	0.0069	8.07	1595	231.26	0.41
Rose CanyonCreek	4391.3	100-Yr	Prop Cond	12000.00	54.98	70.68	66.3	71.61	0.0069	8.07	1595	231.26	0.41
Rose CanyonCreek	4337.6	100-Yr	Exist Cond	12000.00	54.98	70.27	66.1	71.24	0.0067	8.15	1541	223.16	0.42
Rose CanyonCreek	4337.6	100-Yr	Prop Cond	12000.00	54.98	70.27	66.1	71.24	0.0067	8.15	1541	223.16	0.42
Rose CanyonCreek	4264.1	100-Yr	Exist Cond	12000.00	54.98	69.66	66.6	70.72	0.0074	8.53	1485	214.94	0.44
Rose CanyonCreek	4264.1	100-Yr	Prop Cond	12000.00	54.98	69.66	66.6	70.72	0.0074	8.53	1485	214.94	0.44
Rose CanyonCreek	4166.8	100-Yr	Exist Cond	12000.00	54.98	68.85	65.1	70.00	0.0073	8.86	1434	205.80	0.46
Rose CanyonCreek	4166.8	100-Yr	Prop Cond	12000.00	54.98	68.85	65.1	70.00	0.0073	8.86	1434	205.80	0.46
Rose CanyonCreek	4088.3	100-Yr	Exist Cond	12000.00	54.98	68.32	64.5	69.42	0.0070	8.84	1479	227.94	0.45
Rose CanyonCreek	4088.3	100-Yr	Prop Cond	12000.00	54.98	68.32	64.5	69.42	0.0070	8.84	1479	227.94	0.45
Rose CanyonCreek	3933.7	100-Yr	Exist Cond	12000.00	49.39	68.56	60.4	68.98	0.0007	5.31	2415	322.56	0.27
Rose CanyonCreek	3933.7	100-Yr	Prop Cond	12000.00	49.39	68.56	60.4	68.98	0.0007	5.31	2415	322.56	0.27


Existing Rose Creek Plan: Proposed
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.015
.045
.025
.08
.035
.015
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Existing Rose Creek Plan: Proposed
RS = 4971.9
.045
.025
.08
.035
.015
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Existing Rose Creek Plan: Proposed
RS = 4914.1
.045
.025
.08
.035
.015
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Existing Rose Creek Plan: Proposed
RS = 4845.2
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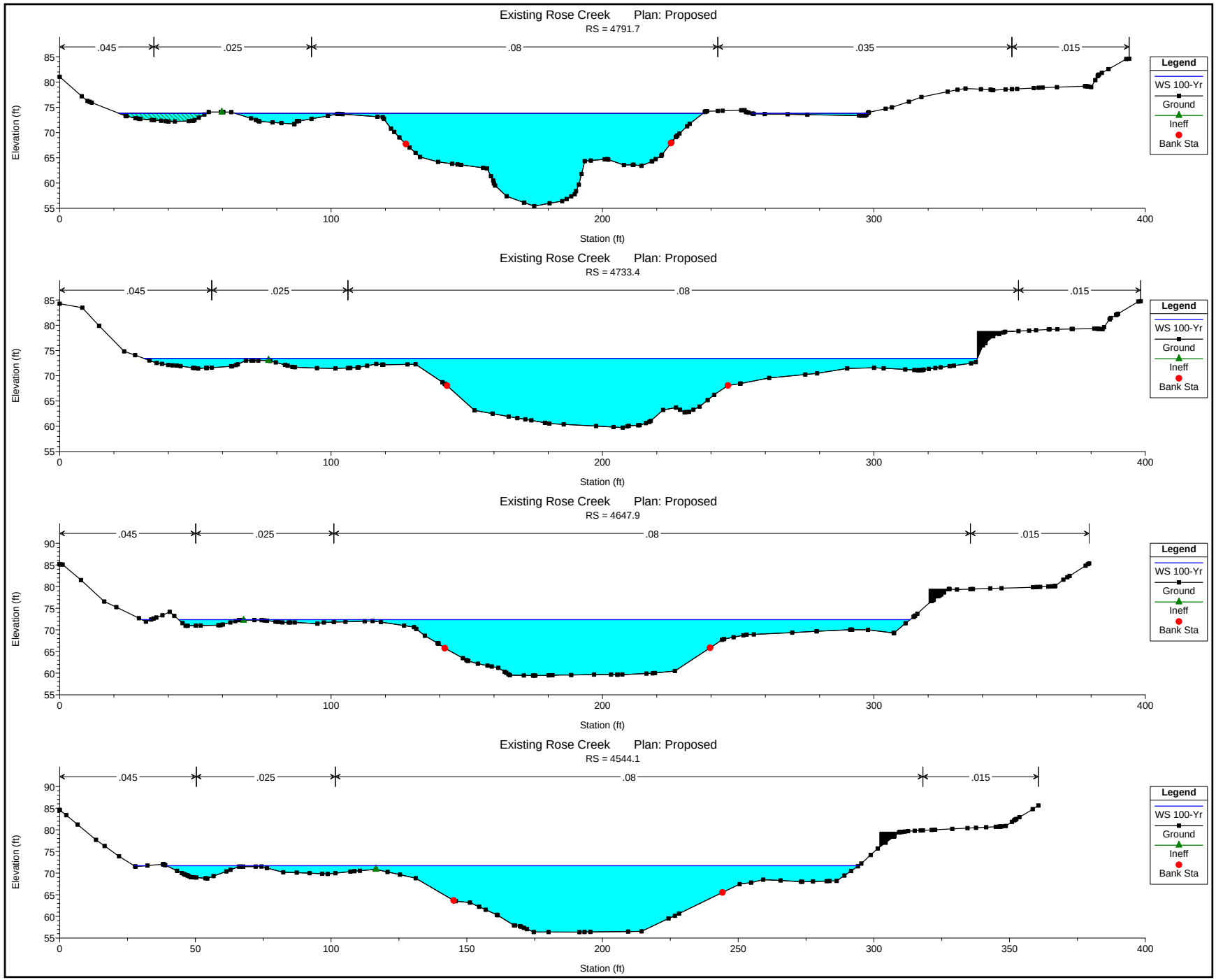
.015
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta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.08
.035
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Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Existing Rose Creek Plan: Proposed
RS = 4733.4
.045
.025
.08
.015
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Existing Rose Creek Plan: Proposed
RS = 4647.9
.045
.025
.08
.015
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Existing Rose Creek Plan: Proposed
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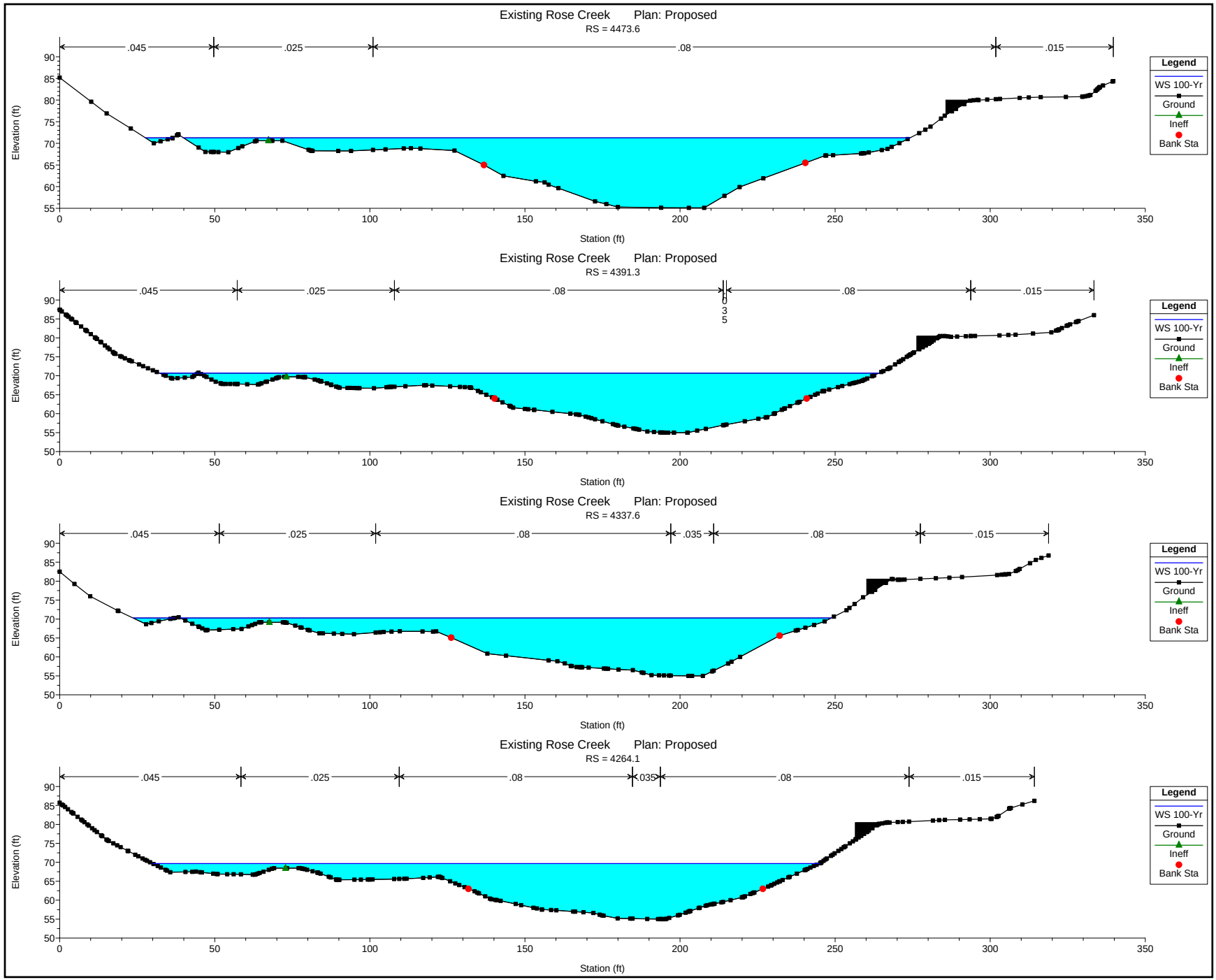
.025
.08
.015
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta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Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Existing Rose Creek Plan: Proposed
RS = 4391.3
.045
.025
.08
.08
.015
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Existing Rose Creek Plan: Proposed
RS = 4337.6
.045
.025
.08
.035
.08
.015
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Existing Rose Creek Plan: Proposed
RS = 4264.1
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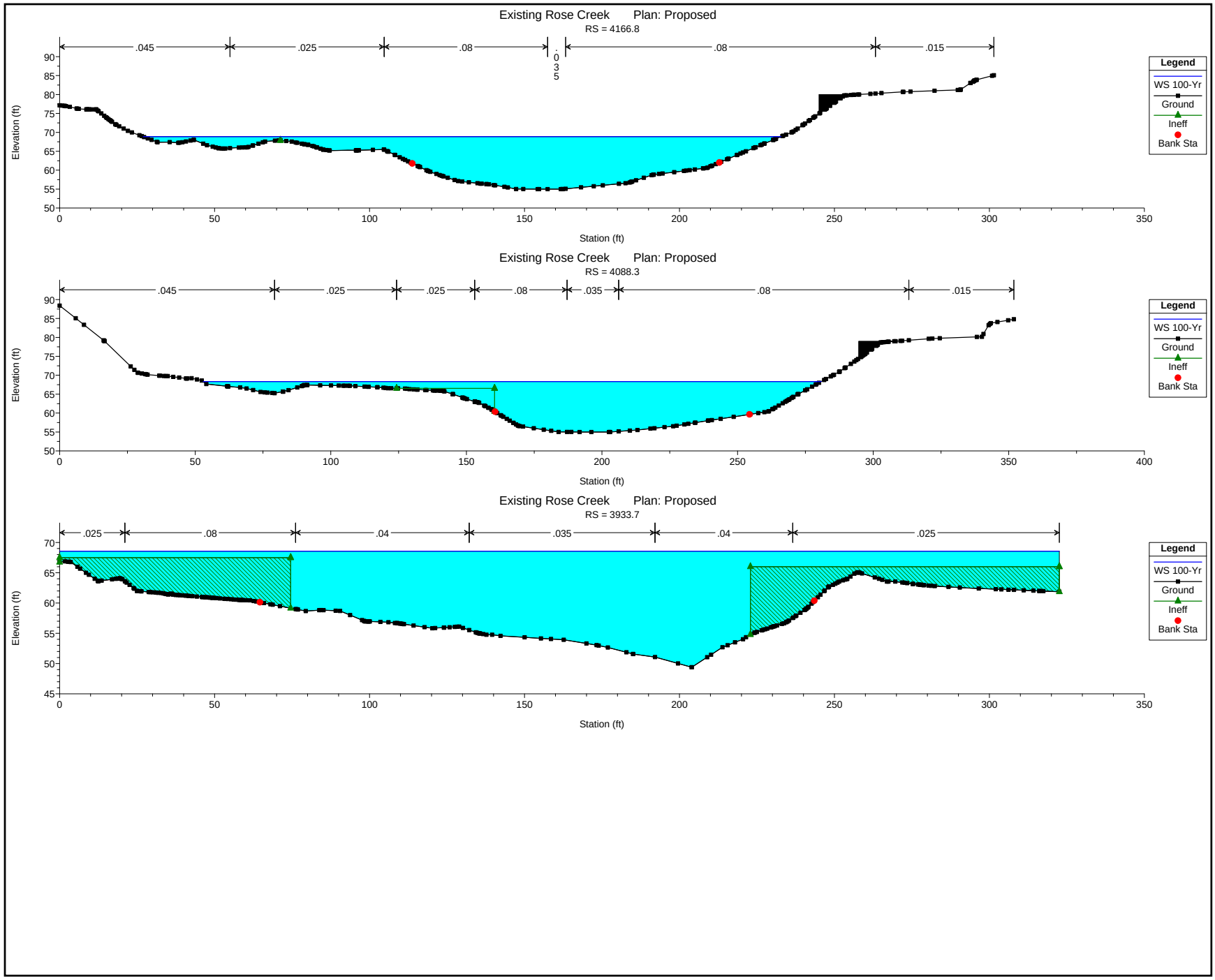
.025
.08
.035
.08
.015
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta


Existing Rose Creek Plan: Proposed
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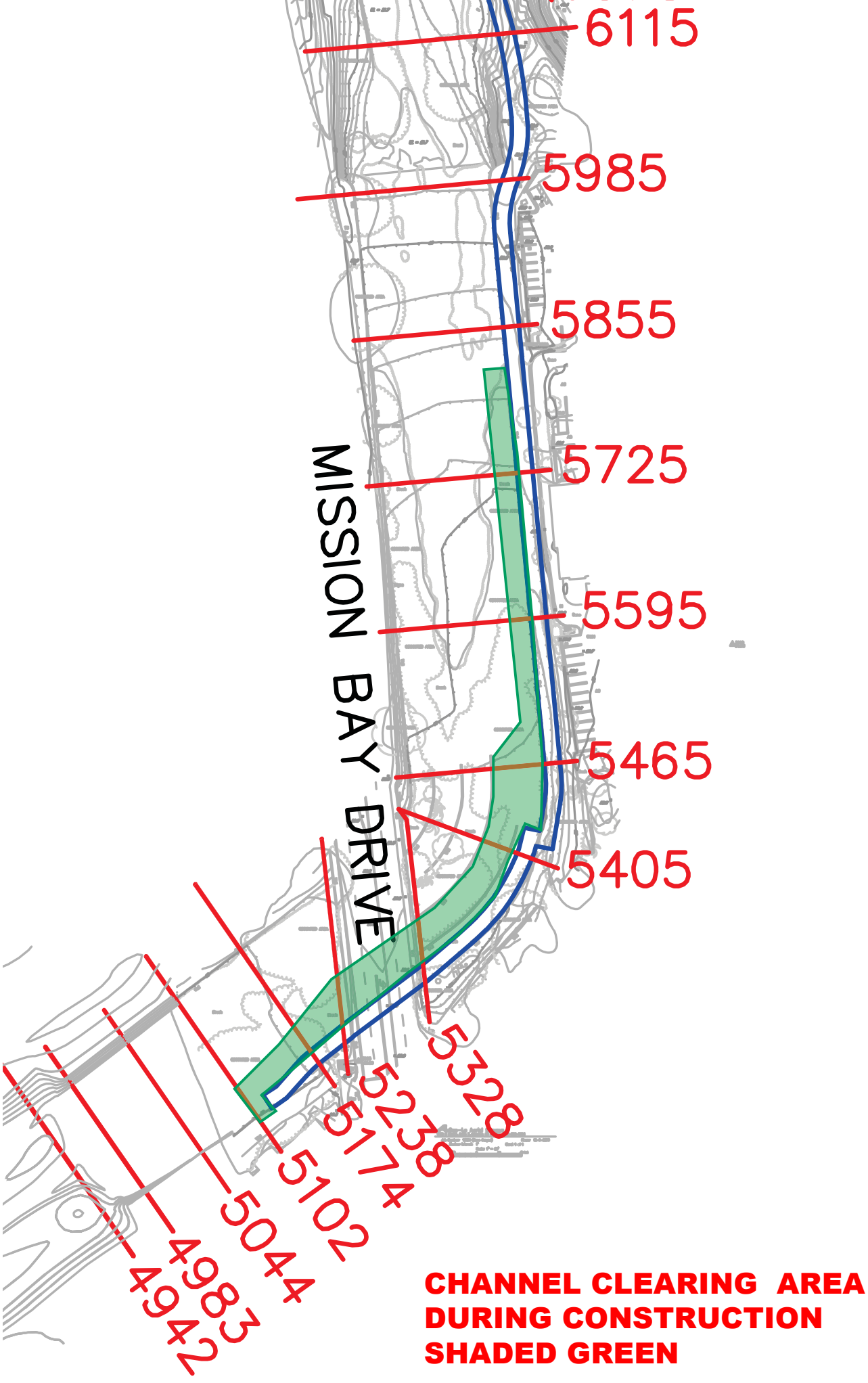
.08
.035
.08
.015
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Existing Rose Creek Plan: Proposed
RS = 4088.3
.045
.025
.025
.08
.035
.08
.015
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Existing Rose Creek Plan: Proposed
RS = 3933.7
.025
.08
.04
.035
.04
.025
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta

APPENDIX C

Southerly Project Segment
100-Year Hydraulic Analysis
with Clearing


6115
5985
5855
5725
5595
5465
5405
MISSION BAY DRIVE
5328
5238
5174
5102
5044
4983
4942
CHANNEL CLEARING AREA
DURING CONSTRUCTION
SHADED GREEN

HEC-RAS River: RIVER-1 Reach: Reach-1 Profile: PF 1

Reach	River Sta	Profile	Plan	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)	
Reach-1	11533	PF 1	PC Clearing	12000.00	51.00	61.0	61.0	65.12	0.0017	16.23	742	95.88	1.00
Reach-1	11533	PF 1	Prop Cond	12000.00	51.00	61.0	61.0	65.12	0.0017	16.23	742	95.88	1.00
Reach-1	11333	PF 1	PC Clearing	12000.00	50.00	61.0	59.8	64.14	0.0011	14.16	857	99.32	0.81
Reach-1	11333	PF 1	Prop Cond	12000.00	50.00	61.0	59.8	64.14	0.0011	14.16	857	99.32	0.81
Reach-1	11134	PF 1	PC Clearing	12000.00	50.00	59.7	59.7	63.77	0.0017	16.09	749	96.51	1.00
Reach-1	11134	PF 1	Prop Cond	12000.00	50.00	59.7	59.7	63.77	0.0017	16.09	749	96.51	1.00
Reach-1	10933	PF 1	PC Clearing	12000.00	48.00	58.1	58.1	62.27	0.0018	16.30	736	91.50	1.00
Reach-1	10933	PF 1	Prop Cond	12000.00	48.00	58.1	58.1	62.27	0.0018	16.30	736	91.50	1.00
Reach-1	10733	PF 1	PC Clearing	12000.00	48.00	57.9	57.9	61.83	0.0018	15.93	755	99.14	1.00
Reach-1	10733	PF 1	Prop Cond	12000.00	48.00	57.9	57.9	61.83	0.0018	15.93	755	99.14	1.00
Reach-1	10533	PF 1	PC Clearing	12000.00	47.00	56.9	56.9	60.95	0.0018	16.22	740	91.02	1.00
Reach-1	10533	PF 1	Prop Cond	12000.00	47.00	56.9	56.9	60.95	0.0018	16.22	740	91.02	1.00
Reach-1	10334	PF 1	PC Clearing	12000.00	46.00	55.9	55.9	60.01	0.0017	16.18	745	93.98	1.00
Reach-1	10334	PF 1	Prop Cond	12000.00	46.00	55.9	55.9	60.01	0.0017	16.18	745	93.98	1.00
Reach-1	10133	PF 1	PC Clearing	12000.00	45.00	55.0	55.0	59.05	0.0018	16.18	742	91.20	1.00
Reach-1	10133	PF 1	Prop Cond	12000.00	45.00	55.0	55.0	59.05	0.0018	16.18	742	91.20	1.00
Reach-1	9933	PF 1	PC Clearing	12000.00	44.00	53.8	53.8	57.97	0.0018	16.35	734	107.86	1.00
Reach-1	9933	PF 1	Prop Cond	12000.00	44.00	53.8	53.8	57.97	0.0018	16.35	734	107.86	1.00
Reach-1	9732	PF 1	PC Clearing	12000.00	43.00	52.9	52.9	57.02	0.0018	16.25	739	92.95	1.00
Reach-1	9732	PF 1	Prop Cond	12000.00	43.00	52.9	52.9	57.02	0.0018	16.25	739	92.95	1.00
Reach-1	9529	PF 1	PC Clearing	12000.00	42.00	52.2	52.2	56.23	0.0017	16.17	747	99.52	0.99
Reach-1	9529	PF 1	Prop Cond	12000.00	42.00	52.2	52.2	56.23	0.0017	16.17	747	99.52	0.99
Reach-1	9332	PF 1	PC Clearing	12000.00	42.00	51.6	51.6	55.64	0.0017	16.10	748	104.63	0.99
Reach-1	9332	PF 1	Prop Cond	12000.00	42.00	51.6	51.6	55.64	0.0017	16.10	748	104.63	0.99
Reach-1	9156	PF 1	PC Clearing	12000.00	42.00	51.7	50.6	54.29	0.0064	13.02	921	117.07	0.82
Reach-1	9156	PF 1	Prop Cond	12000.00	42.00	51.7	50.6	54.29	0.0064	13.02	921	117.07	0.82
Reach-1	9150.1	PF 1	PC Clearing	12000.00	40.55	53.3		53.53	0.0001	3.46	3494	350.26	0.18
Reach-1	9150.1	PF 1	Prop Cond	12000.00	40.55	53.3		53.53	0.0001	3.46	3494	350.26	0.18
Reach-1	9150	PF 1	PC Clearing	12000.00	40.55	53.3	45.5	53.53	0.0001	3.46	3494	350.26	0.18
Reach-1	9150	PF 1	Prop Cond	12000.00	40.55	53.3	45.5	53.53	0.0001	3.46	3494	350.26	0.18
Reach-1	9148			Inl Struct									

HEC-RAS River: RIVER-1 Reach: Reach-1 Profile: PF 1 (Continued)

Reach	River Sta	Profile	Plan	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)	
Reach-1	9145	PF 1	PC Clearing	12000.00	40.58	53.2		53.40	0.0003	3.42	3533	353.76	0.18
Reach-1	9145	PF 1	Prop Cond	12000.00	40.58	53.2		53.40	0.0003	3.42	3533	353.76	0.18
Reach-1	9144.9	PF 1	PC Clearing	12000.00	40.58	53.2		53.40	0.0003	3.46	3531	353.63	0.18
Reach-1	9144.9	PF 1	Prop Cond	12000.00	40.58	53.2		53.40	0.0003	3.46	3531	353.63	0.18
Reach-1	9140.2	PF 1	PC Clearing	12000.00	39.59	53.2	45.7	53.40	0.0003	3.76	3192	299.86	0.20
Reach-1	9140.2	PF 1	Prop Cond	12000.00	39.59	53.2	45.7	53.40	0.0003	3.76	3192	299.86	0.20
Reach-1	9115			Bridge									
Reach-1	9105	PF 1	PC Clearing	12000.00	39.59	53.0	45.7	53.27	0.0004	3.81	3152	299.27	0.21
Reach-1	9105	PF 1	Prop Cond	12000.00	39.59	53.0	45.7	53.27	0.0004	3.81	3152	299.27	0.21
Reach-1	9100	PF 1	PC Clearing	12000.00	39.59	53.0	45.7	53.26	0.0004	3.81	3151	299.26	0.21
Reach-1	9100	PF 1	Prop Cond	12000.00	39.59	53.0	45.7	53.26	0.0004	3.81	3151	299.26	0.21
Reach-1	9085			Bridge									
Reach-1	9070	PF 1	PC Clearing	12000.00	39.59	53.0		53.23	0.0004	3.82	3140	299.09	0.21
Reach-1	9070	PF 1	Prop Cond	12000.00	39.59	53.0		53.23	0.0004	3.82	3140	299.09	0.21
Reach-1	8990	PF 1	PC Clearing	12000.00	38.83	52.9		53.19	0.0004	4.16	2884	264.46	0.22
Reach-1	8990	PF 1	Prop Cond	12000.00	38.83	52.9		53.19	0.0004	4.16	2884	264.46	0.22
Reach-1	8946	PF 1	PC Clearing	12000.00	37.91	52.9		53.17	0.0004	4.32	2775	258.57	0.23
Reach-1	8946	PF 1	Prop Cond	12000.00	37.91	52.9		53.17	0.0004	4.32	2775	258.57	0.23
Reach-1	8945	PF 1	PC Clearing	12000.00	37.91	52.9	44.9	53.18	0.0004	4.32	2775	258.56	0.23
Reach-1	8945	PF 1	Prop Cond	12000.00	37.91	52.9	44.9	53.18	0.0004	4.32	2775	258.56	0.23
Reach-1	8942			Bridge									
Reach-1	8939	PF 1	PC Clearing	12000.00	37.91	51.3	44.9	51.66	0.0007	5.07	2366	245.86	0.29
Reach-1	8939	PF 1	Prop Cond	12000.00	37.91	51.3	44.9	51.66	0.0007	5.07	2366	245.86	0.29
Reach-1	8938	PF 1	PC Clearing	12000.00	37.91	51.3		51.66	0.0007	5.07	2365	245.85	0.29
Reach-1	8938	PF 1	Prop Cond	12000.00	37.91	51.3		51.66	0.0007	5.07	2365	245.85	0.29
Reach-1	8931	PF 1	PC Clearing	12000.00	37.91	51.3		51.65	0.0007	5.08	2364	245.81	0.29
Reach-1	8931	PF 1	Prop Cond	12000.00	37.91	51.3		51.65	0.0007	5.08	2364	245.81	0.29
Reach-1	8930	PF 1	PC Clearing	12000.00	39.00	51.1	45.7	51.64	0.0037	6.80	2102	232.71	0.34
Reach-1	8930	PF 1	Prop Cond	12000.00	39.00	51.1	45.7	51.64	0.0037	6.80	2102	232.71	0.34
Reach-1	8905			Bridge									

HEC-RAS River: RIVER-1 Reach: Reach-1 Profile: PF 1 (Continued)

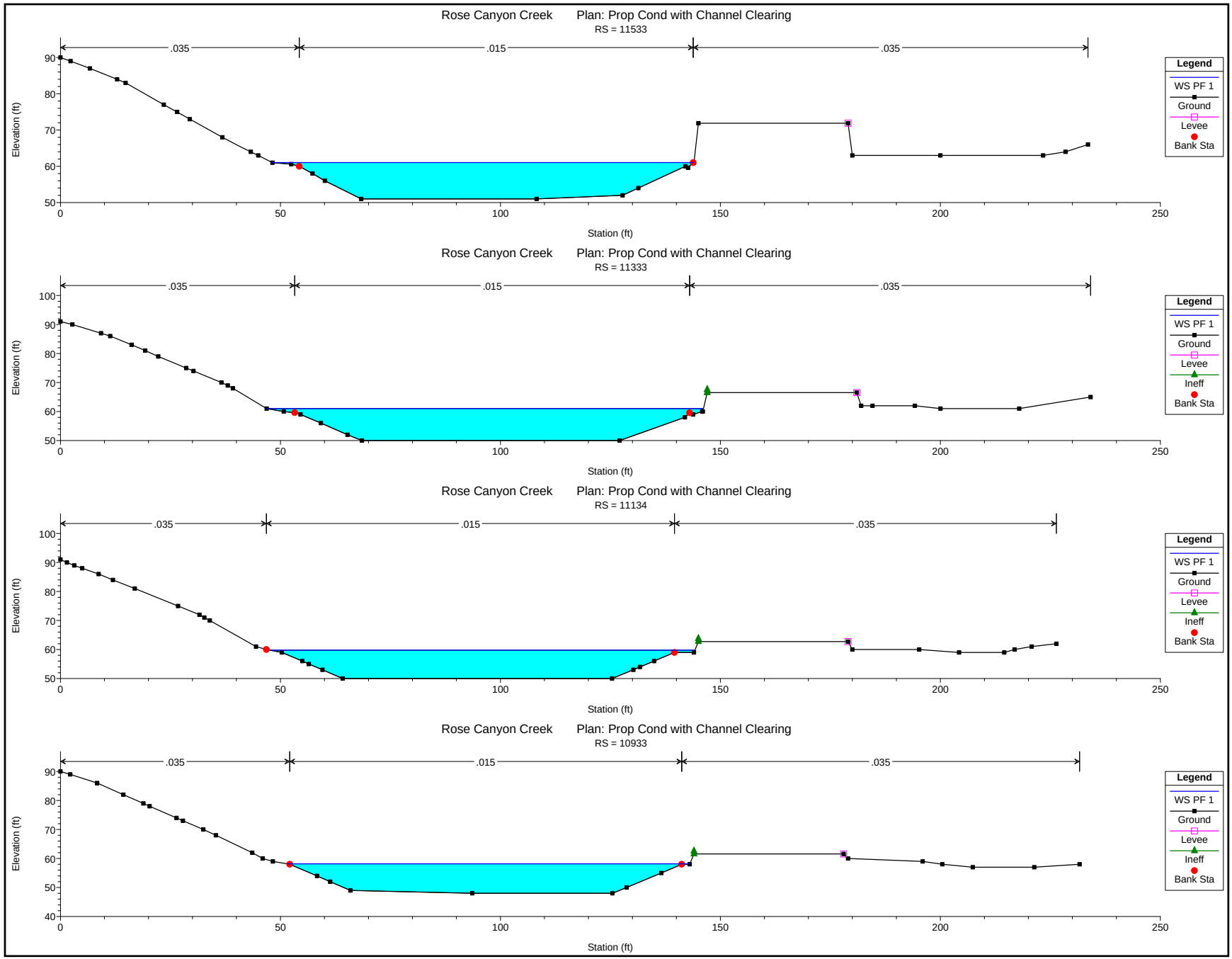
Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	8880	PF 1	PC Clearing	12000.00	35.70	50.3	47.6	51.22	0.0071	9.15	1683	234.04	0.46
Reach-1	8880	PF 1	Prop Cond	12000.00	35.70	50.3	47.6	51.22	0.0071	9.15	1683	234.04	0.46
Reach-1	8869.5			Bridge									
Reach-1	8859	PF 1	PC Clearing	12000.00	36.70	50.1		50.99	0.0080	8.66	1691	261.06	0.48
Reach-1	8859	PF 1	Prop Cond	12000.00	36.70	50.1		50.99	0.0080	8.66	1691	261.06	0.48
Reach-1	8689	PF 1	PC Clearing	12000.00	36.80	47.6		49.13	0.0117	10.77	1321	186.91	0.60
Reach-1	8689	PF 1	Prop Cond	12000.00	36.80	47.6		49.13	0.0117	10.77	1321	186.91	0.60
Reach-1	8489	PF 1	PC Clearing	12000.00	35.70	46.2		47.21	0.0069	8.18	1565	182.86	0.46
Reach-1	8489	PF 1	Prop Cond	12000.00	35.70	46.2		47.21	0.0069	8.18	1565	182.86	0.46
Reach-1	8289	PF 1	PC Clearing	12000.00	31.00	45.2		46.09	0.0044	8.24	1746	172.10	0.38
Reach-1	8289	PF 1	Prop Cond	12000.00	31.00	45.2		46.09	0.0044	8.24	1746	172.10	0.38
Reach-1	8089	PF 1	PC Clearing	12000.00	31.00	44.2		45.11	0.0054	8.72	1626	169.49	0.42
Reach-1	8089	PF 1	Prop Cond	12000.00	31.00	44.2		45.11	0.0054	8.72	1626	169.49	0.42
Reach-1	7887	PF 1	PC Clearing	12000.00	31.00	43.6		44.20	0.0030	6.34	1999	174.95	0.31
Reach-1	7887	PF 1	Prop Cond	12000.00	31.00	43.6		44.20	0.0030	6.34	1999	174.95	0.31
Reach-1	7687	PF 1	PC Clearing	12000.00	31.50	42.3		43.29	0.0066	8.47	1587	177.84	0.45
Reach-1	7687	PF 1	Prop Cond	12000.00	31.50	42.3		43.29	0.0066	8.47	1587	177.84	0.45
Reach-1	7482	PF 1	PC Clearing	12000.00	28.80	40.9		42.10	0.0050	9.13	1451	179.89	0.53
Reach-1	7482	PF 1	Prop Cond	12000.00	28.80	40.9		42.10	0.0050	9.13	1451	179.89	0.53
Reach-1	7280	PF 1	PC Clearing	12000.00	27.80	38.7		40.63	0.0104	11.54	1154	174.58	0.74
Reach-1	7280	PF 1	Prop Cond	12000.00	27.80	38.7		40.63	0.0104	11.54	1154	174.58	0.74
Reach-1	7078	PF 1	PC Clearing	12000.00	25.70	38.5		39.37	0.0027	8.02	1794	208.84	0.41
Reach-1	7078	PF 1	Prop Cond	12000.00	25.70	38.5		39.37	0.0027	8.02	1794	208.84	0.41
Reach-1	6874	PF 1	PC Clearing	12000.00	22.80	38.2		38.88	0.0016	6.98	2127	198.71	0.33
Reach-1	6874	PF 1	Prop Cond	12000.00	22.80	38.2		38.88	0.0016	6.98	2127	198.71	0.33
Reach-1	6662	PF 1	PC Clearing	12000.00	23.80	37.5	32.8	38.30	0.0032	8.94	1890	197.60	0.45
Reach-1	6662	PF 1	Prop Cond	12000.00	23.80	37.5	32.8	38.30	0.0032	8.94	1890	197.60	0.45
Reach-1	6520			Bridge									
Reach-1	6378	PF 1	PC Clearing	12000.00	21.50	34.8	31.4	35.87	0.0051	11.85	1685	191.60	0.57
Reach-1	6378	PF 1	Prop Cond	12000.00	21.50	34.8	31.4	35.87	0.0051	11.85	1685	191.60	0.57
Reach-1	6115	PF 1	PC Clearing	12000.00	21.50	30.4	30.4	33.56	0.0189	17.53	971	146.99	1.04

HEC-RAS River: RIVER-1 Reach: Reach-1 Profile: PF 1 (Continued)

Reach	River Sta	Profile	Plan	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)	
Reach-1	6115	PF 1	Prop Cond	12000.00	21.50	30.4	30.4	33.56	0.0189	17.53	971	146.99	1.04
Reach-1	5985	PF 1	PC Clearing	12000.00	21.30	28.1	28.1	31.54	0.0015	14.81	815	120.16	1.00
Reach-1	5985	PF 1	Prop Cond	12000.00	21.30	28.1	28.1	31.54	0.0015	14.81	815	120.16	1.00
Reach-1	5885	PF 1	PC Clearing	12000.00	18.20	25.2	25.2	28.58	0.0015	14.83	814	119.55	1.00
Reach-1	5885	PF 1	Prop Cond	12000.00	18.20	25.2	25.2	28.58	0.0015	14.83	814	119.55	1.00
Reach-1	5725	PF 1	PC Clearing	12000.00	15.65	22.7	22.7	26.09	0.0015	14.80	814	120.06	1.00
Reach-1	5725	PF 1	Prop Cond	12000.00	15.70	25.5		27.21	0.0005	10.47	1151	120.21	0.60
Reach-1	5595	PF 1	PC Clearing	12000.00	14.50	23.1		25.46	0.0008	12.41	971	119.60	0.77
Reach-1	5595	PF 1	Prop Cond	12000.00	14.50	25.7		27.06	0.0003	9.39	1284	119.75	0.50
Reach-1	5466	PF 1	PC Clearing	12000.00	10.37	23.8		25.06	0.0003	9.05	1329	119.15	0.48
Reach-1	5466	PF 1	Prop Cond	12000.00	14.00	25.8		26.96	0.0002	8.57	1404	119.35	0.44
Reach-1	5465	PF 1	PC Clearing	12000.00	10.37	23.6		25.04	0.0007	9.48	1269	115.14	0.50
Reach-1	5465	PF 1	Prop Cond	12000.00	14.00	25.7		26.95	0.0005	8.90	1352	119.20	0.47
Reach-1	5405	PF 1	PC Clearing	12000.00	10.30	22.6		24.89	0.0015	12.25	980	100.76	0.69
Reach-1	5405	PF 1	Prop Cond	12000.00	14.00	25.1		26.85	0.0011	10.69	1123	119.15	0.61
Reach-1	5328	PF 1	PC Clearing	12000.00	10.20	23.1	19.7	24.54	0.0008	9.67	1242	124.69	0.54
Reach-1	5328	PF 1	Prop Cond	12000.00	14.00	25.5	20.8	26.59	0.0005	8.49	1414	150.22	0.45
Reach-1	5283			Bridge									
Reach-1	5238	PF 1	PC Clearing	12000.00	10.20	22.9		24.35	0.0012	9.72	1238	136.17	0.55
Reach-1	5238	PF 1	Prop Cond	12000.00	14.00	25.2		26.40	0.0050	8.65	1390	159.30	0.46
Reach-1	5174	PF 1	PC Clearing	12000.00	10.10	20.3	20.3	23.97	0.0079	15.34	784	109.04	1.01
Reach-1	5174	PF 1	Prop Cond	12000.00	13.90	24.4	21.8	25.95	0.0084	9.62	1219	148.34	0.56
Reach-1	5102	PF 1	PC Clearing	12000.00	10.03	20.1	20.1	23.40	0.0047	14.51	828	127.82	1.00
Reach-1	5102	PF 1	Prop Cond	12000.00	15.00	21.4	21.4	24.75	0.0294	14.67	819	128.01	1.02
Reach-1	5044	PF 1	PC Clearing	12000.00	9.48	21.2		22.25	0.0041	8.18	1472	132.49	0.42
Reach-1	5044	PF 1	Prop Cond	12000.00	9.48	21.2		22.25	0.0041	8.18	1472	132.49	0.42
Reach-1	4983	PF 1	PC Clearing	12000.00	9.42	20.8		21.97	0.0048	8.68	1388	128.23	0.45
Reach-1	4983	PF 1	Prop Cond	12000.00	9.42	20.8		21.97	0.0048	8.68	1388	128.23	0.45
Reach-1	4942	PF 1	PC Clearing	12000.00	7.70	20.6		21.75	0.0054	8.93	1495	179.71	0.48
Reach-1	4942	PF 1	Prop Cond	12000.00	7.70	20.6		21.75	0.0054	8.93	1495	179.71	0.48
Reach-1	4763	PF 1	PC Clearing	12000.00	7.70	19.5		20.68	0.0066	8.81	1432	179.39	0.51

HEC-RAS River: RIVER-1 Reach: Reach-1 Profile: PF 1 (Continued)

Reach	River Sta	Profile	Plan	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)	
Reach-1	4763	PF 1	Prop Cond	12000.00	7.70	19.5		20.68	0.0066	8.81	1432	179.39	0.51
Reach-1	4567	PF 1	PC Clearing	12000.00	7.70	18.3	14.6	19.46	0.0059	9.16	1436	161.31	0.50
Reach-1	4567	PF 1	Prop Cond	12000.00	7.70	18.3	14.6	19.46	0.0059	9.16	1436	161.31	0.50


Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 11533
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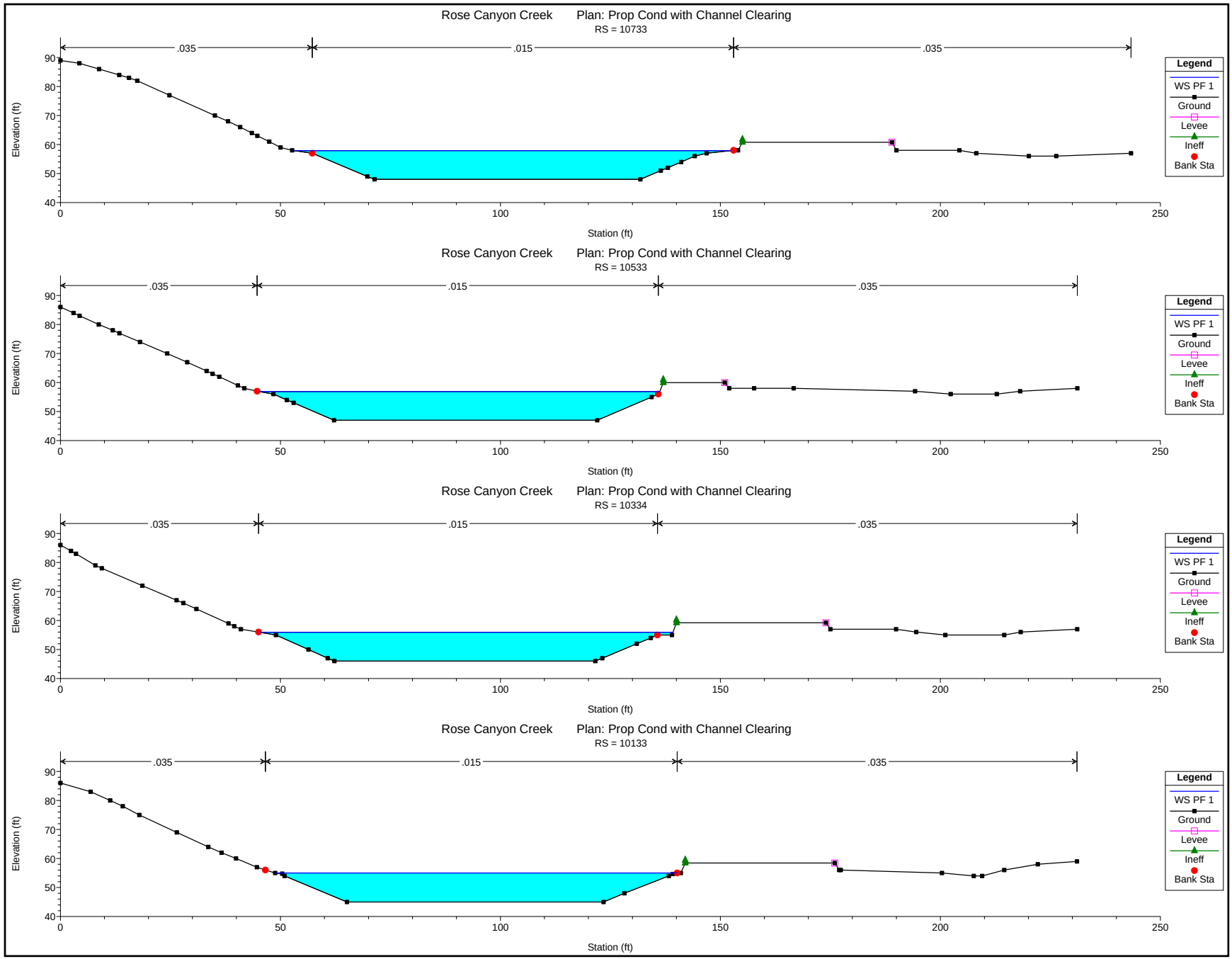
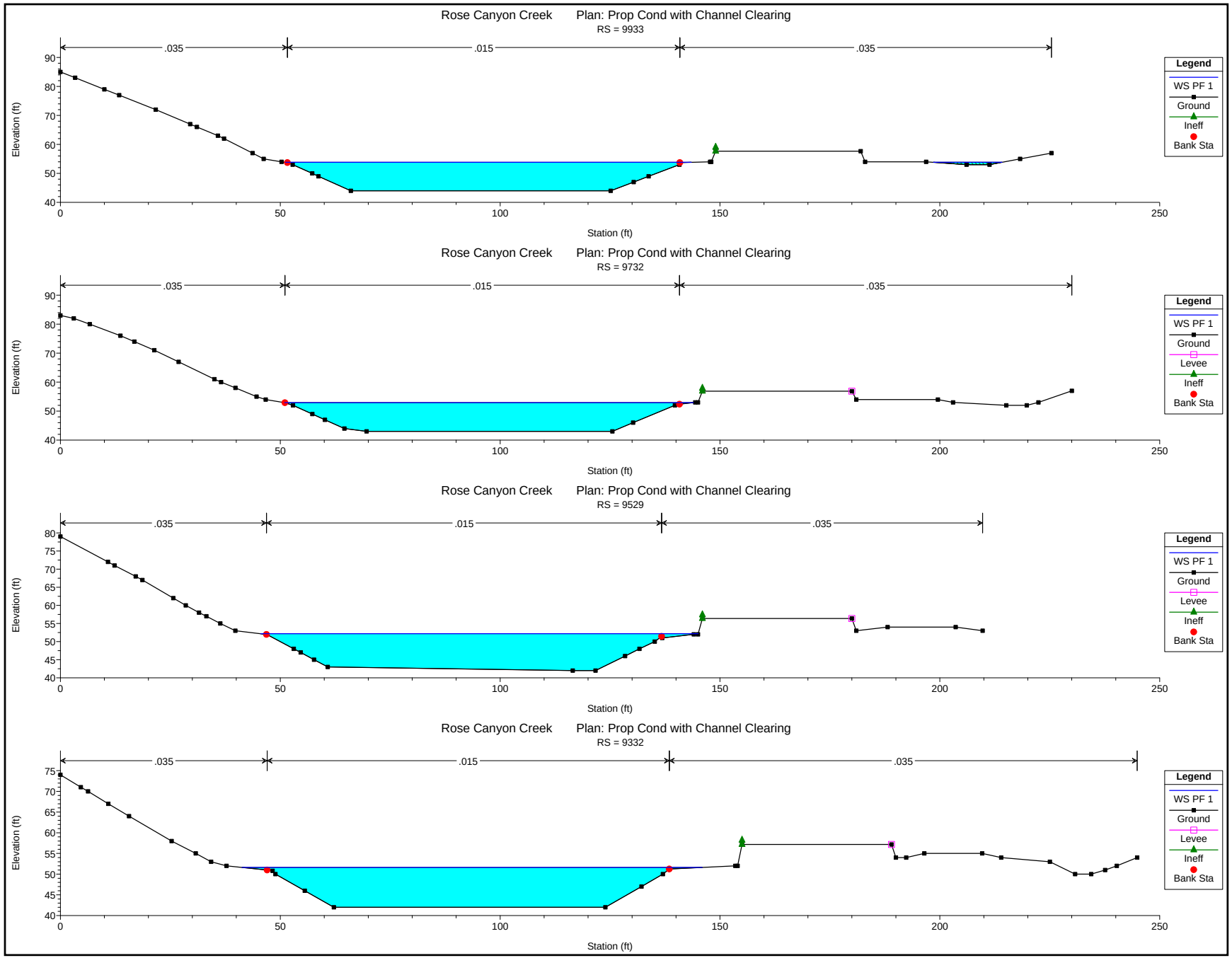
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Levee
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 11333
.035
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Levee
Ineff
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 11134
.035
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Levee
Ineff
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 10933
.035
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Levee
Ineff
Bank Sta


Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 10733
.035
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Levee
Ineff
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 10533
.035
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Levee
Ineff
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 10334
.035
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Levee
Ineff
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 10133
.035
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Levee
Ineff
Bank Sta


Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 9933
.035
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 9732
.035
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Levee
Ineff
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 9529
.035
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Levee
Ineff
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 9332
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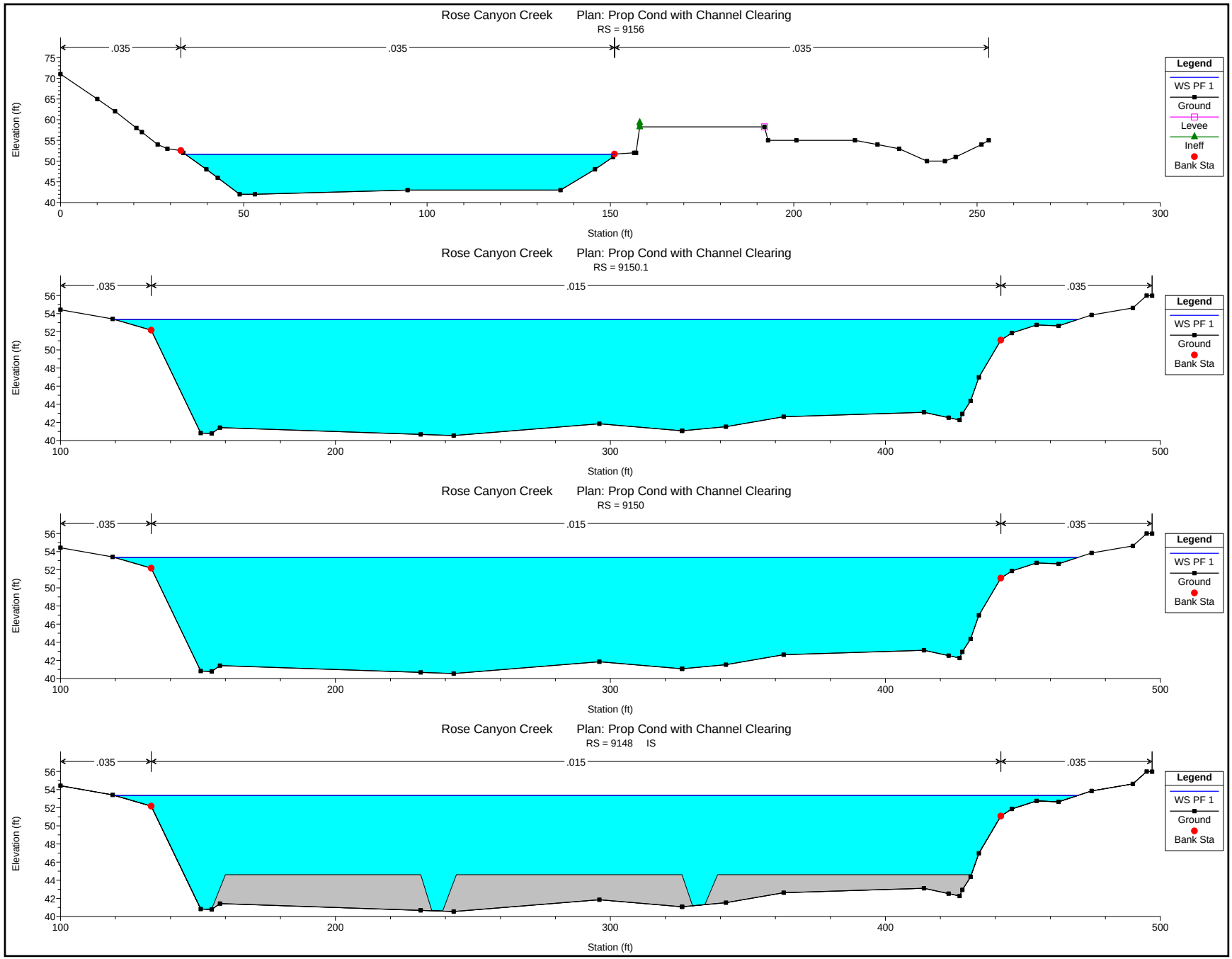
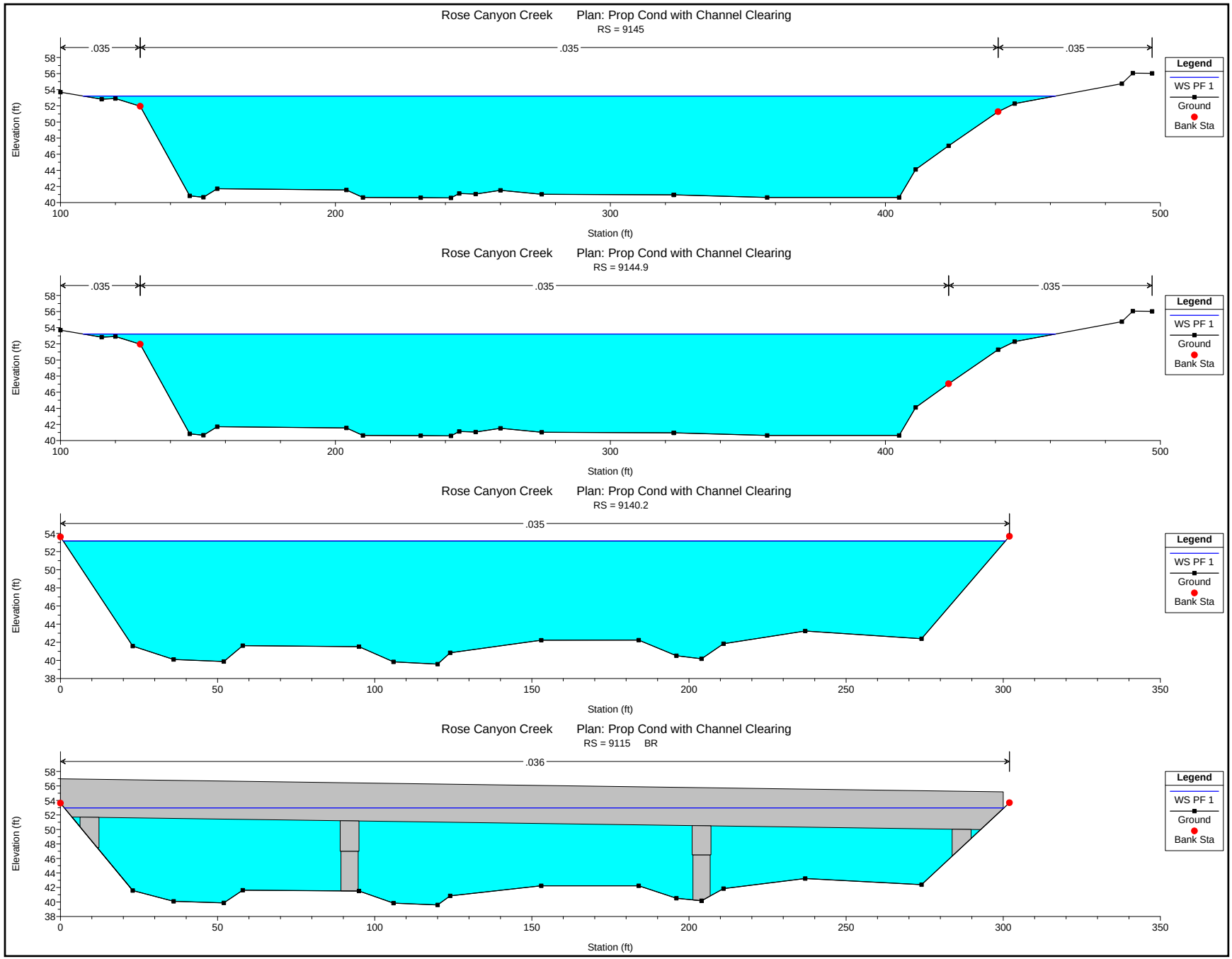
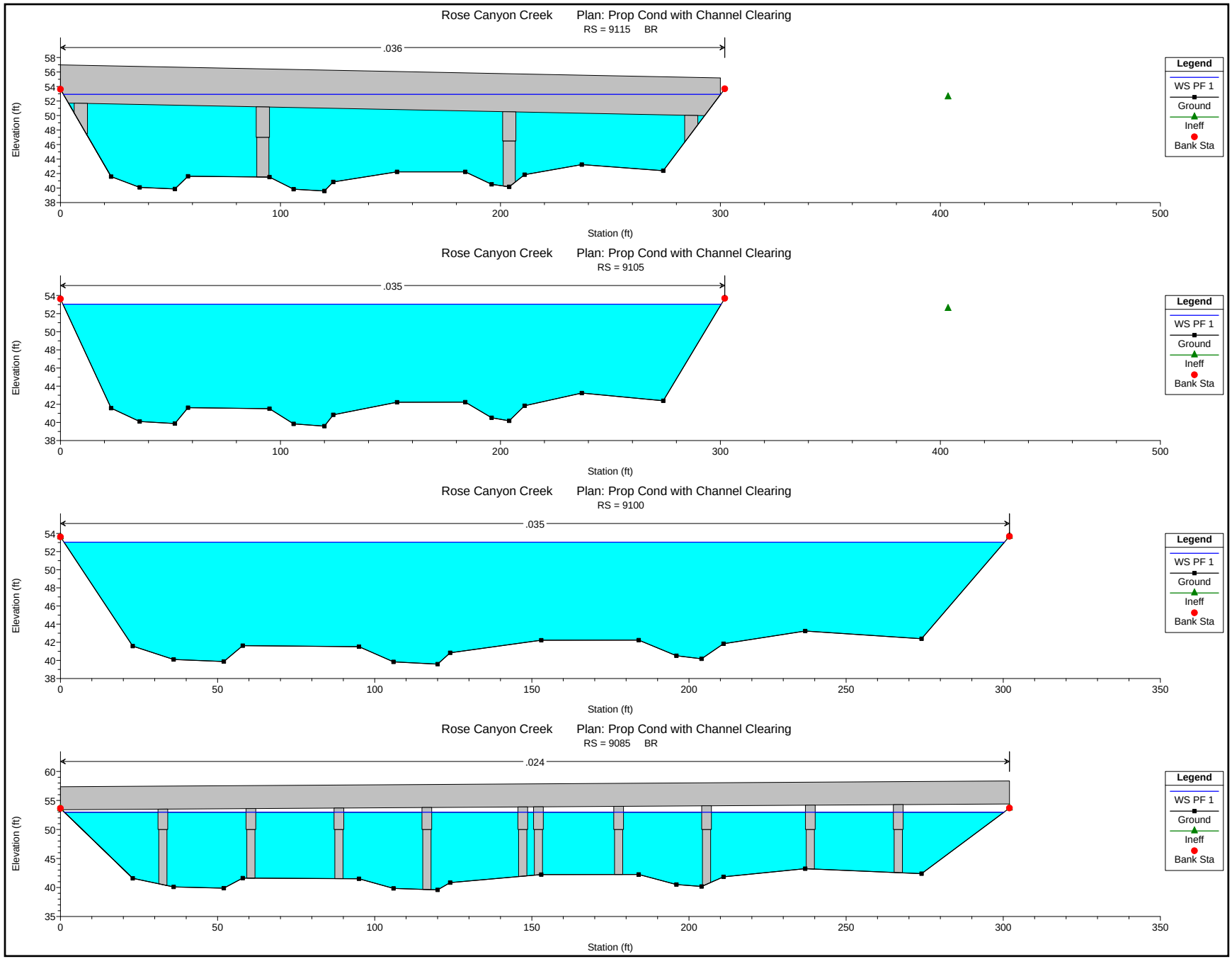
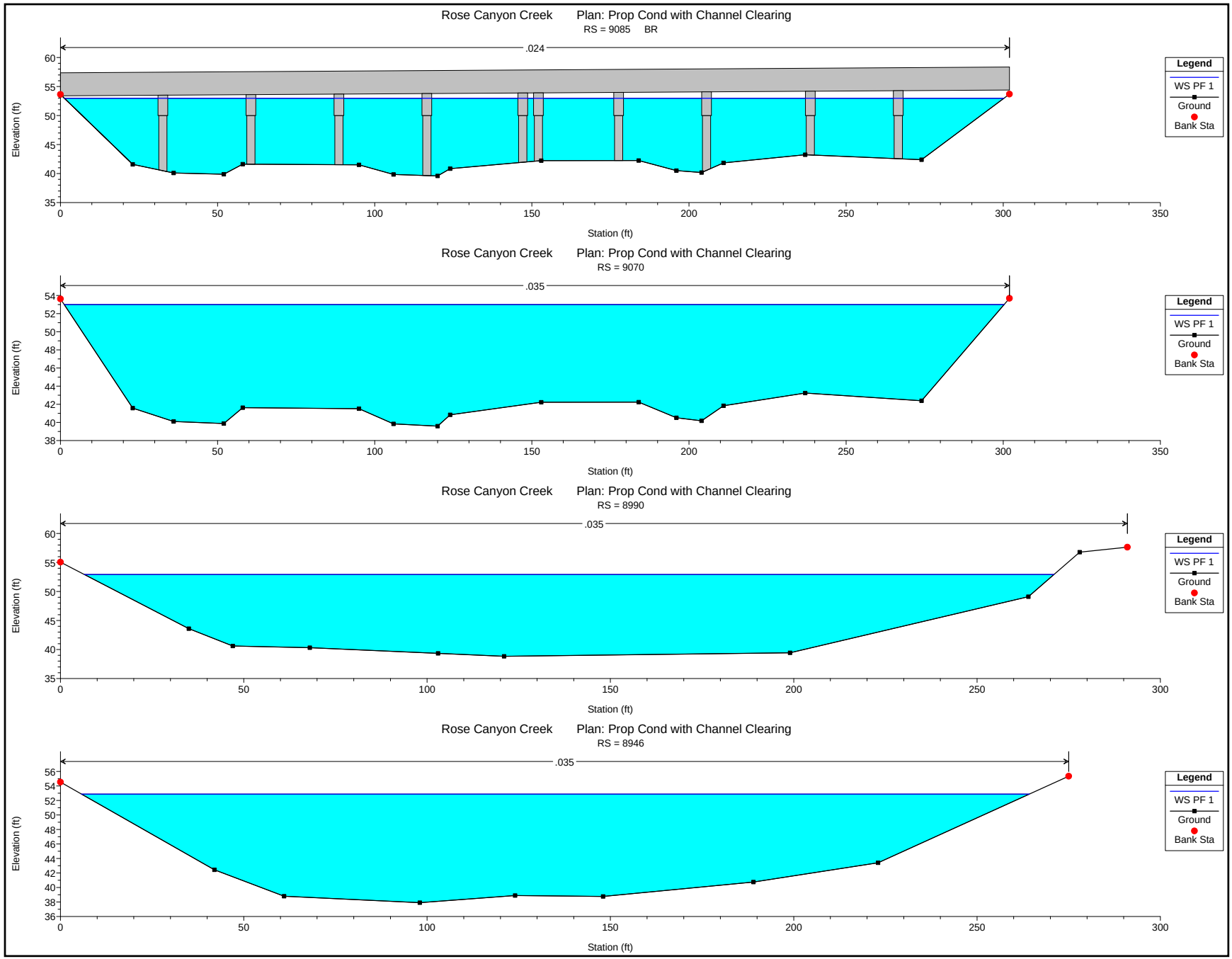
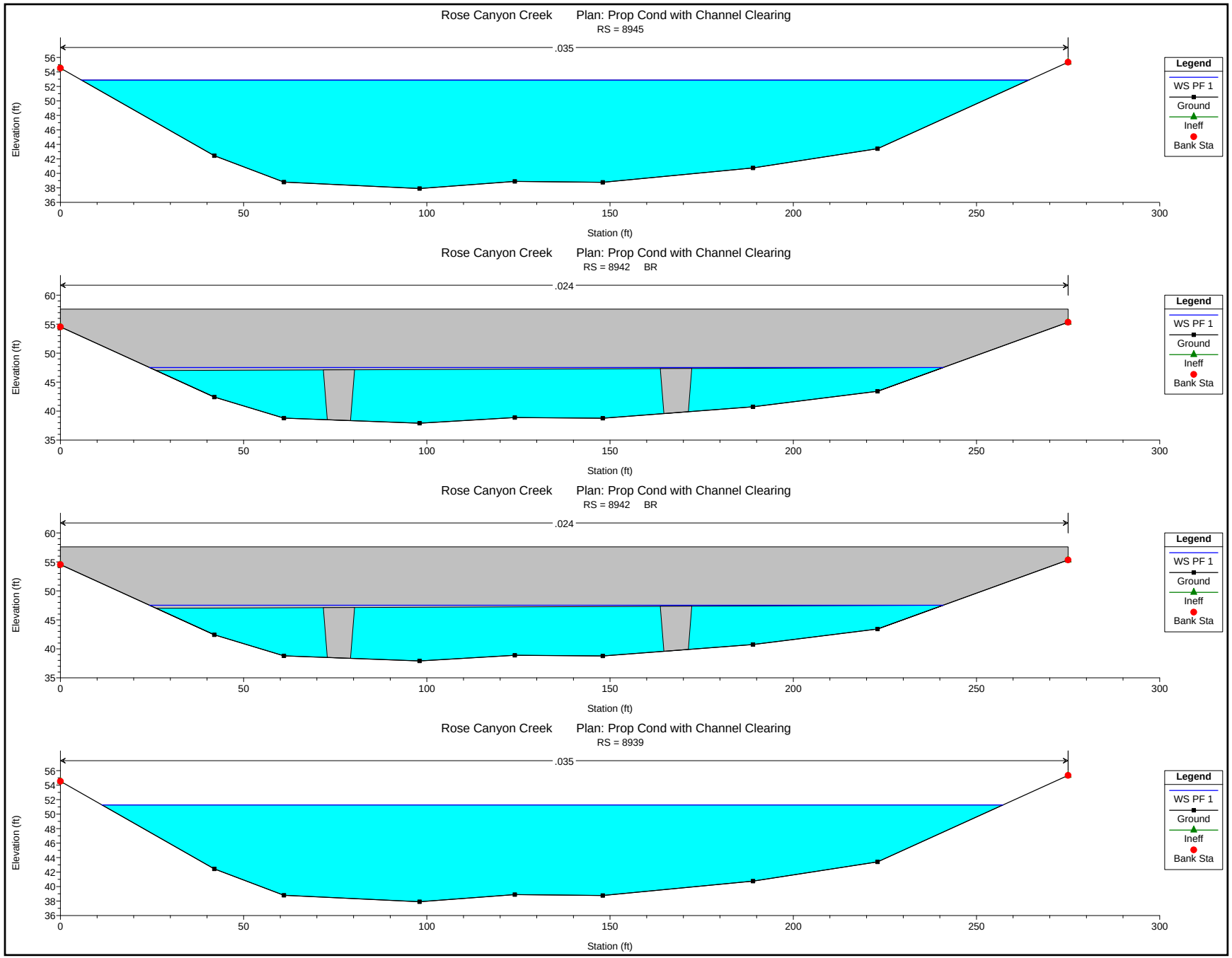
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Levee
Ineff
Bank Sta


Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 9156
.035
.035
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Levee
Ineff
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 9150.1
.035
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 9150
.035
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 9148 IS
.035
.015
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta


Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 9145
.035
.035
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 9144.9
.035
.035
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 9140.2
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 9115 BR
.036
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta


Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 9115 BR
.036
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 9105
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 9100
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 9085 BR
.024
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta


Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 9085 BR
.024
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 9070
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 8990
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 8946
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta


Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 8945
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 8942 BR
.024
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 8942 BR
.024
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 8939
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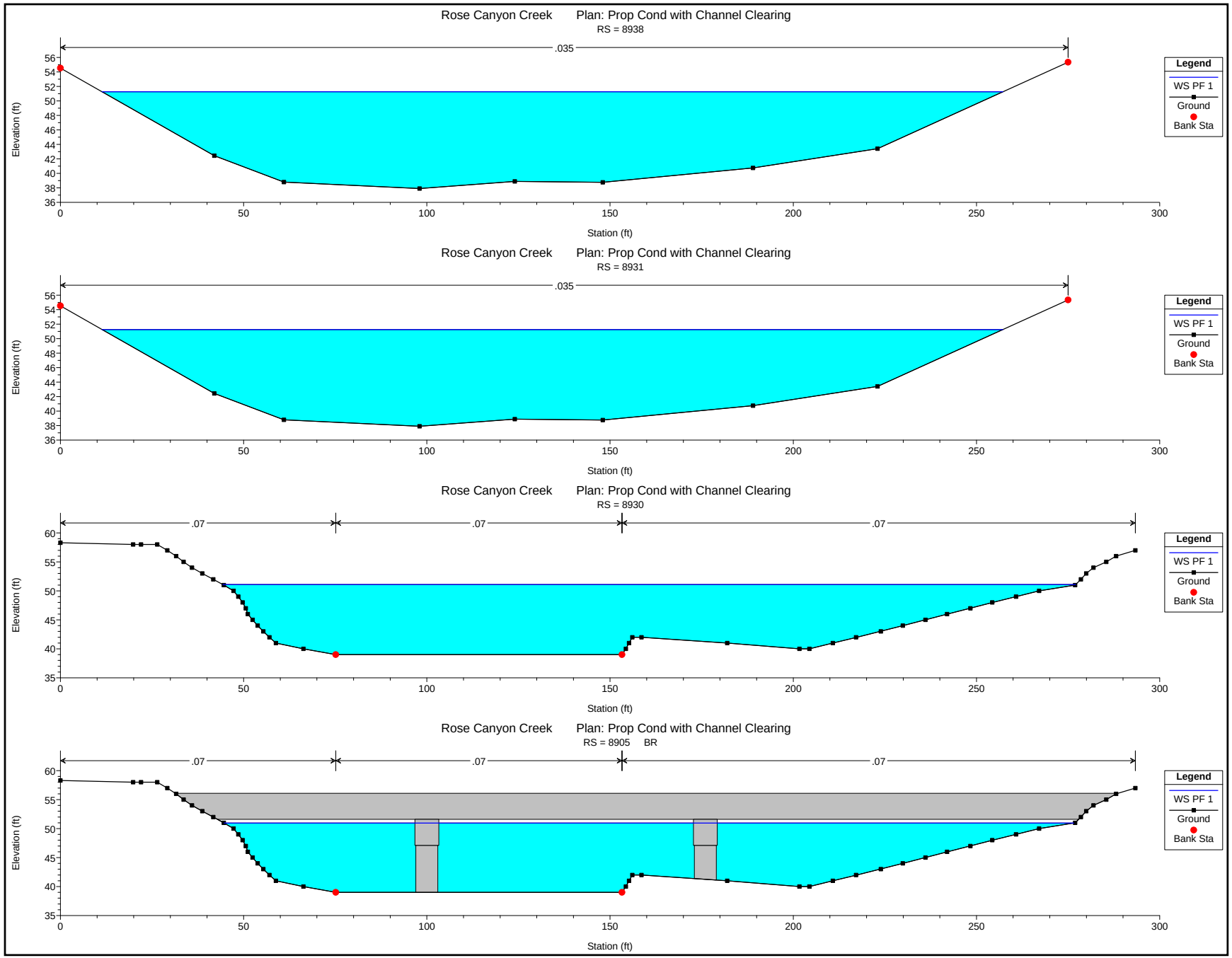
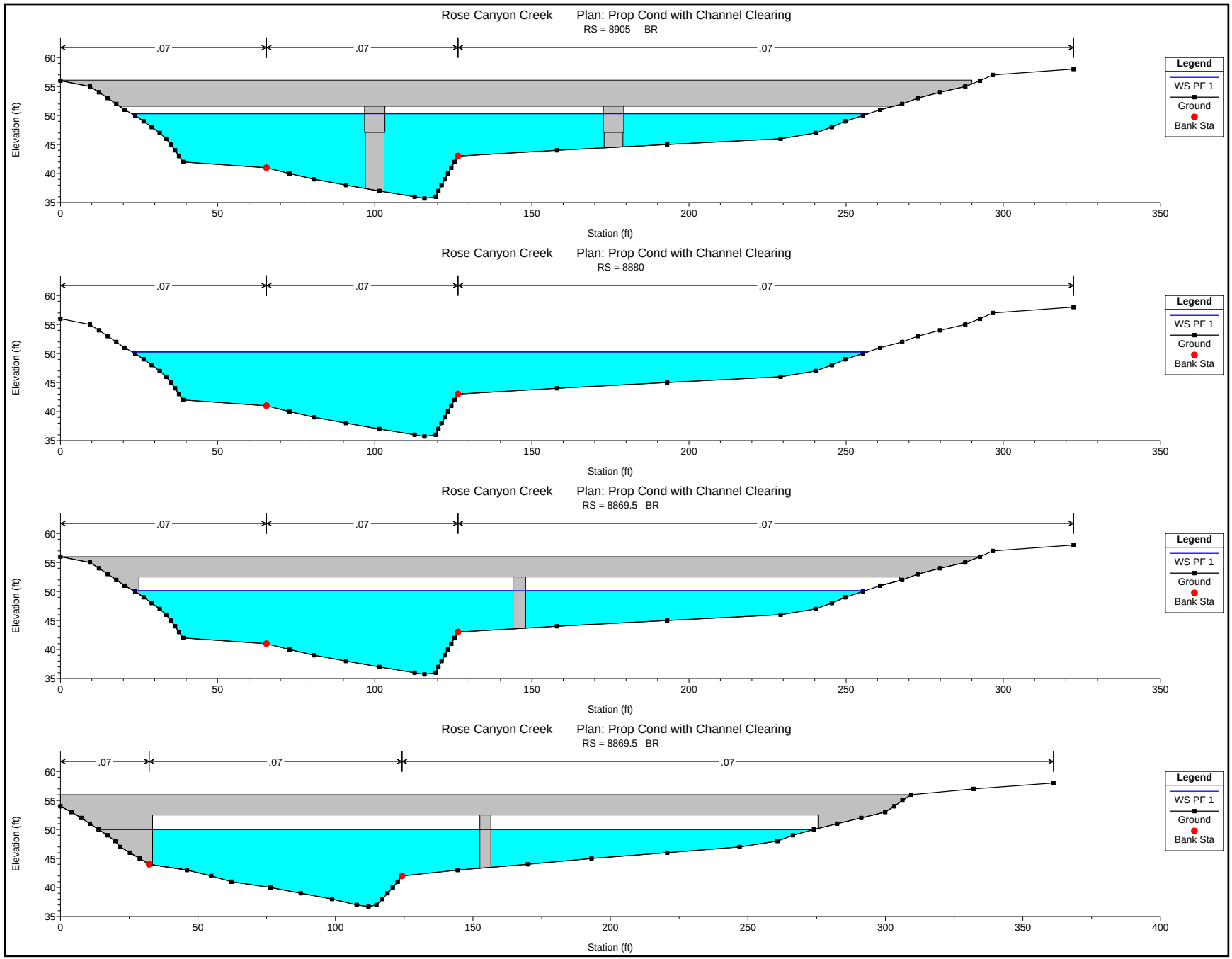
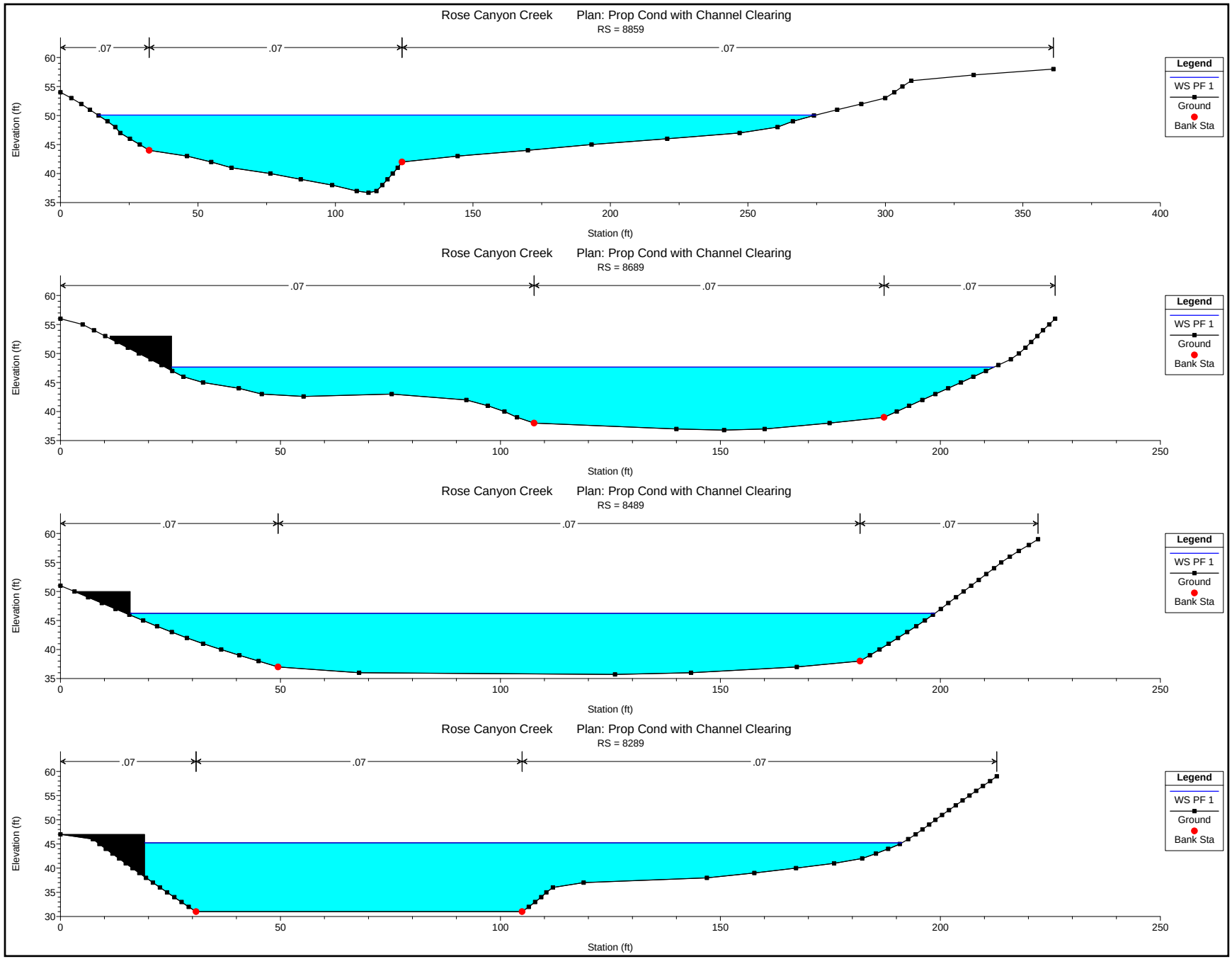
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta


Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 8938
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 8931
.035
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 8930
.07
.07
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 8905 BR
.07
.07
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta


Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 8905 BR
.07
.07
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 8880
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 8869.5 BR
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 8869.5 BR


Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 8859
.07
.07
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 8689
.07
.07
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 8489
.07
.07
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 8289
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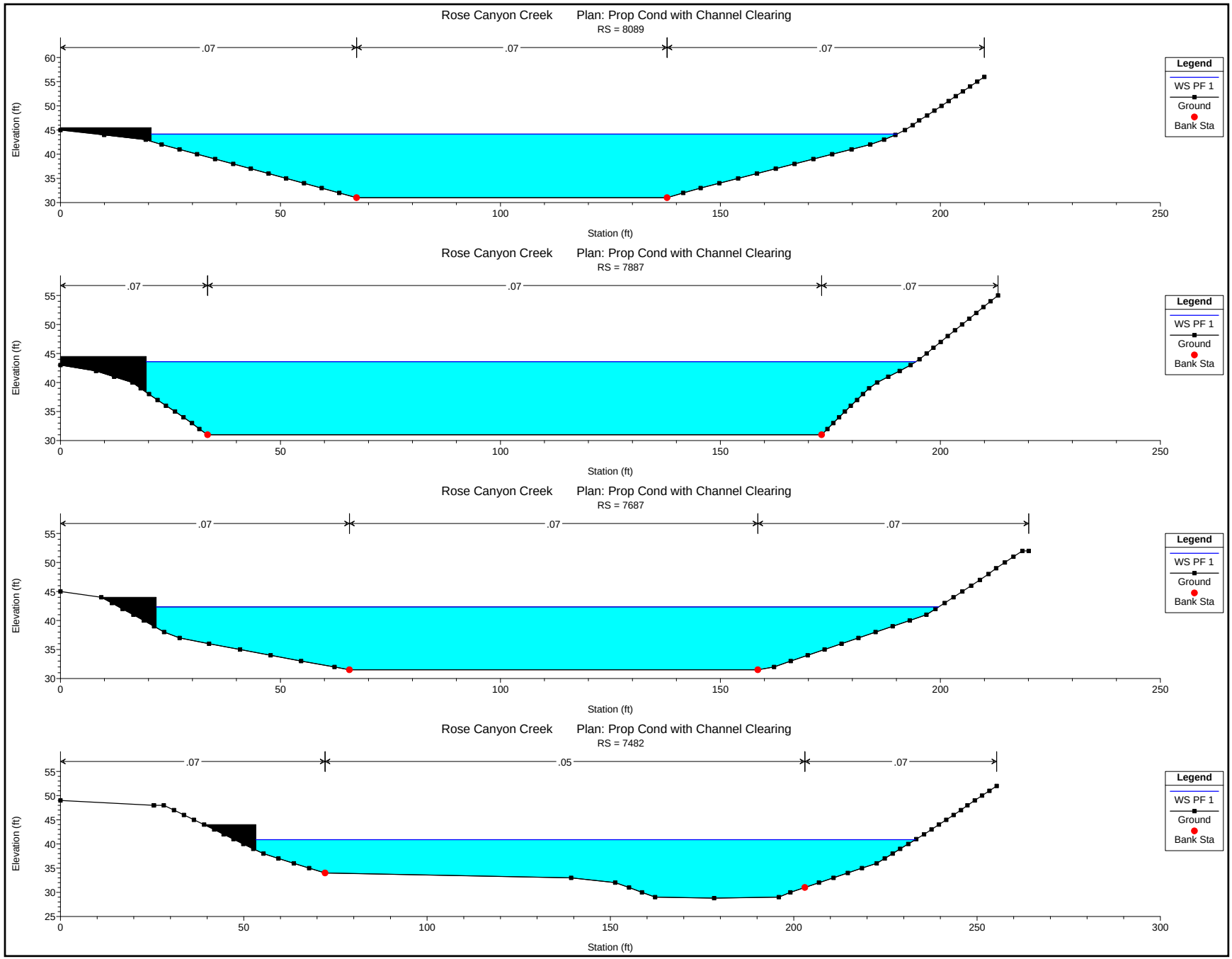
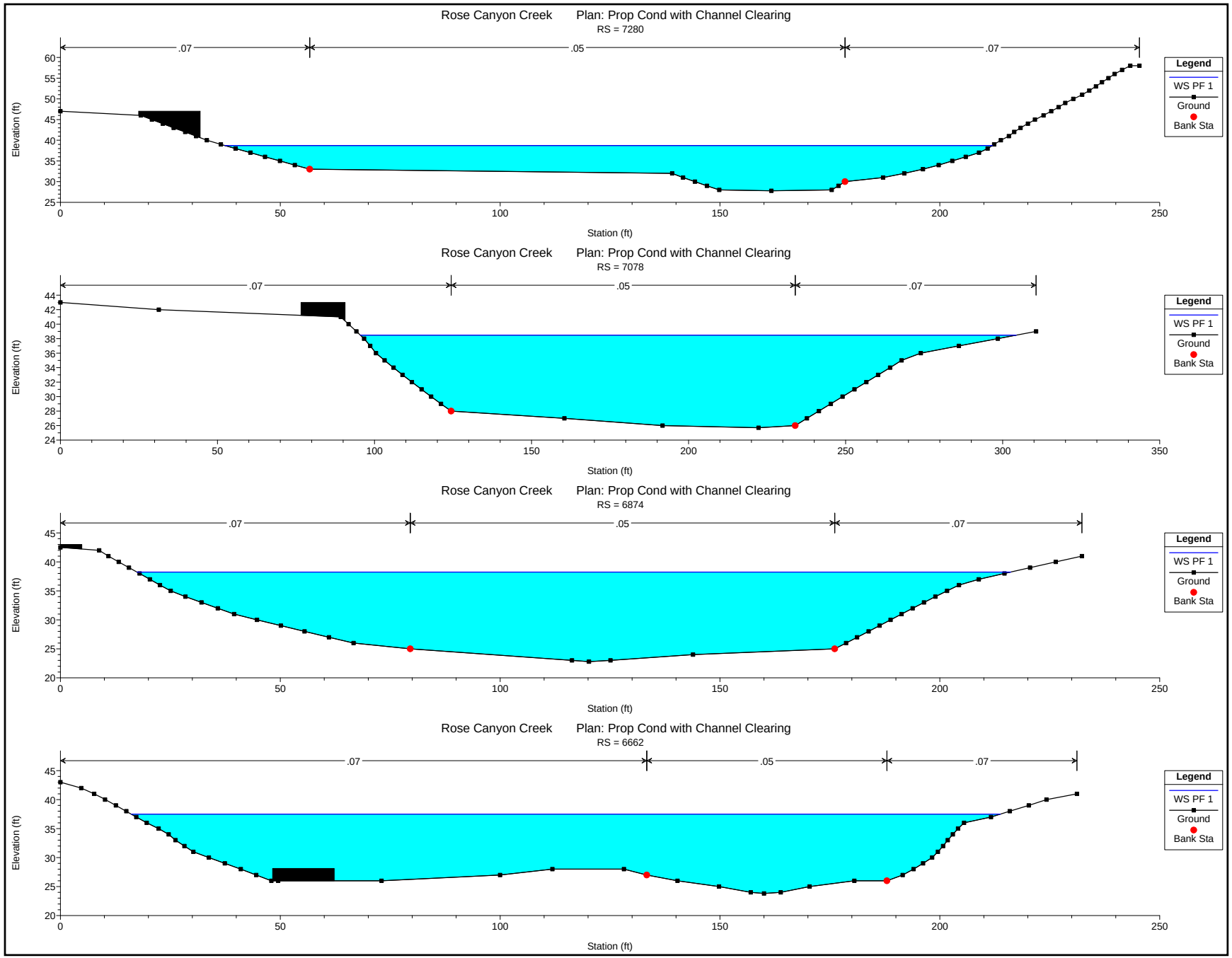
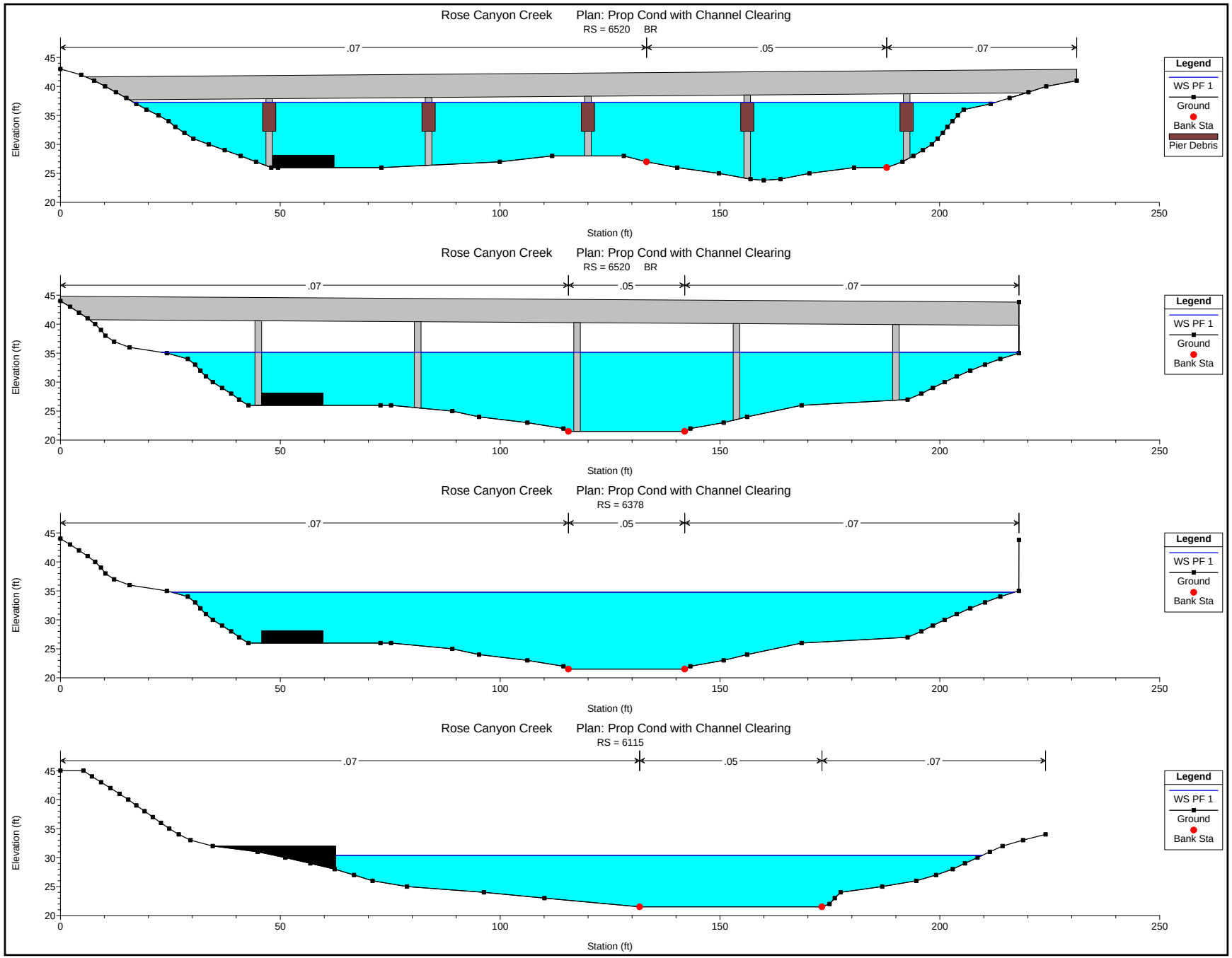
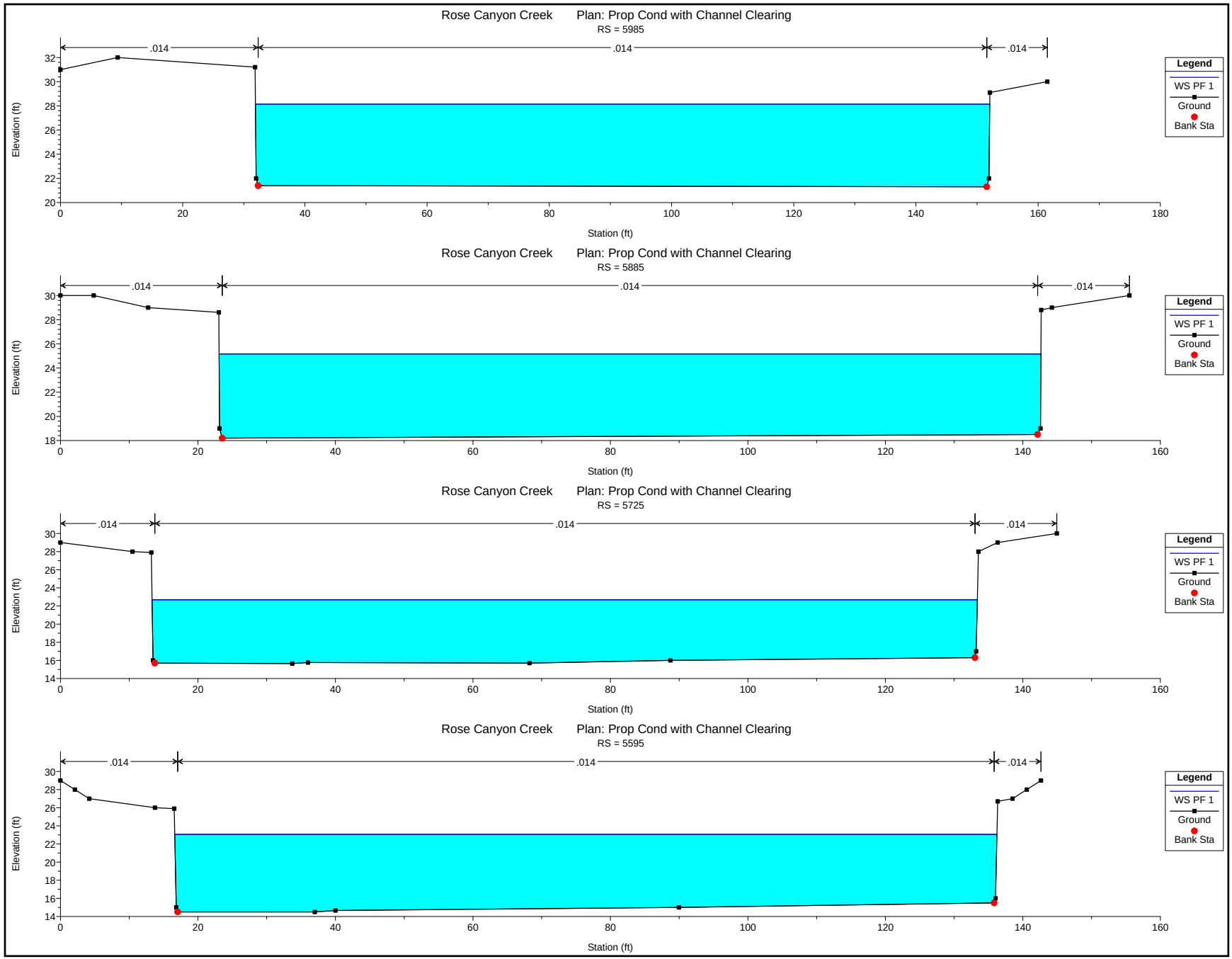
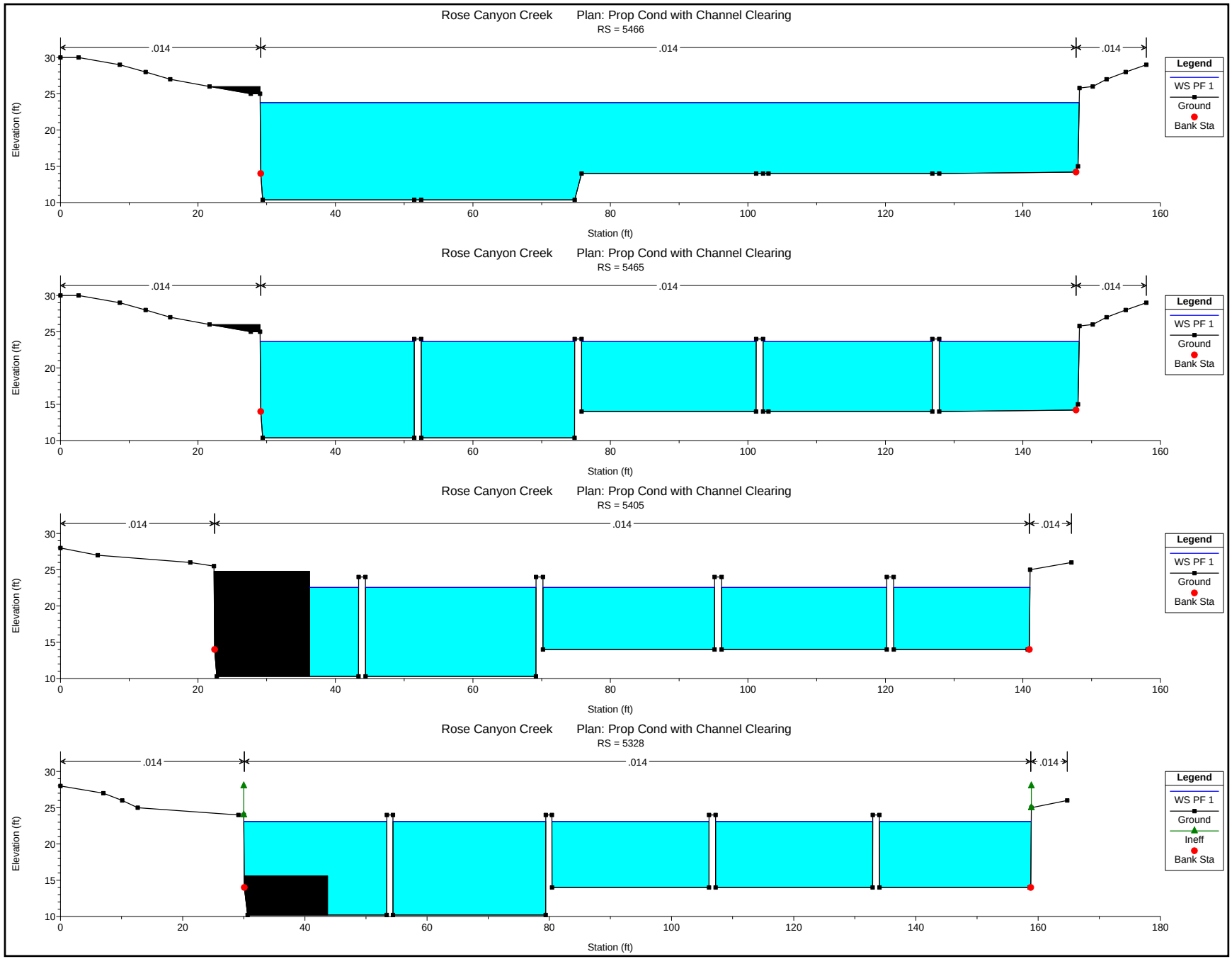
.07
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta

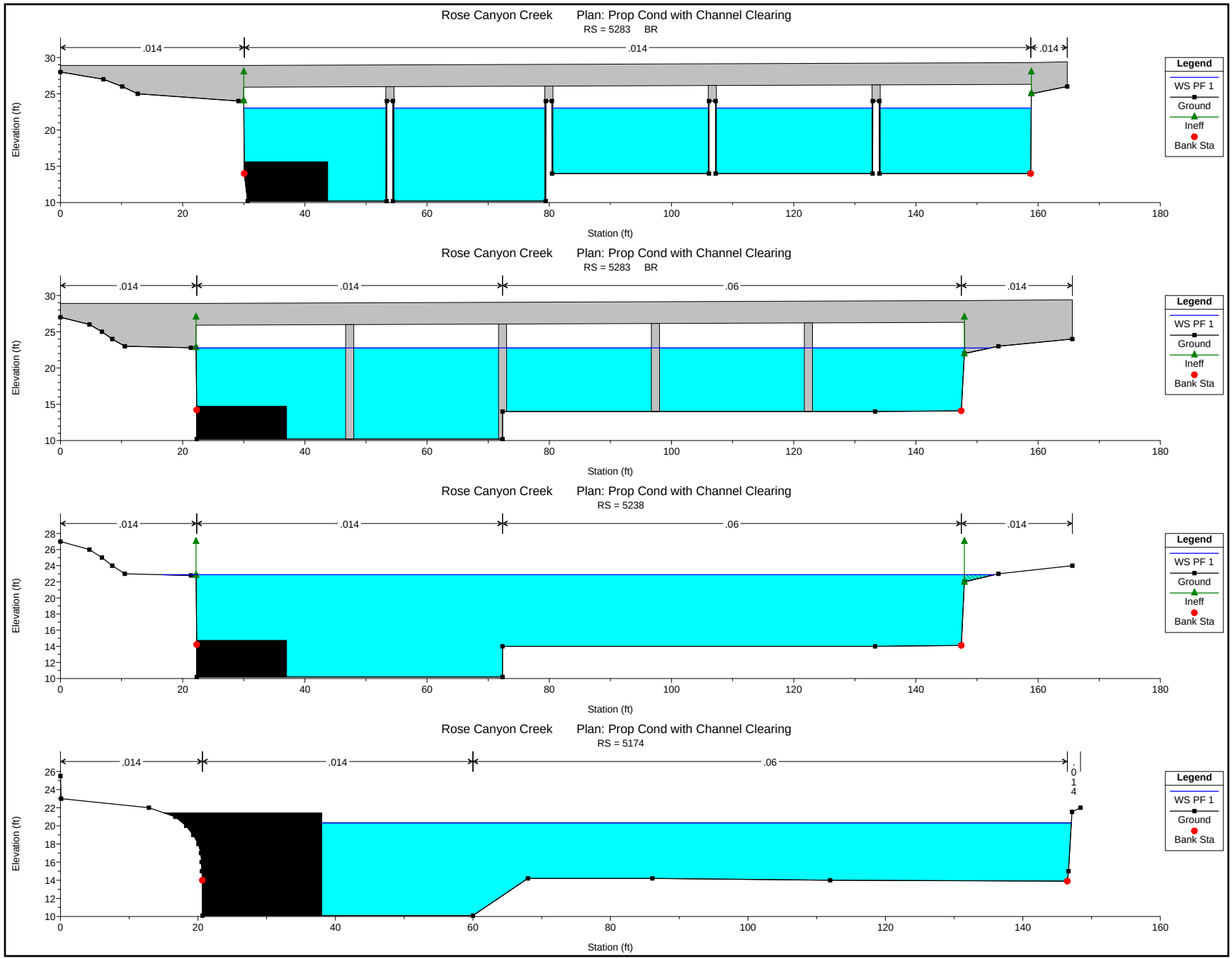

Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 8089
.07
.07
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 7887
.07
.07
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 7687
.07
.07
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 7482
.07
.05
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta

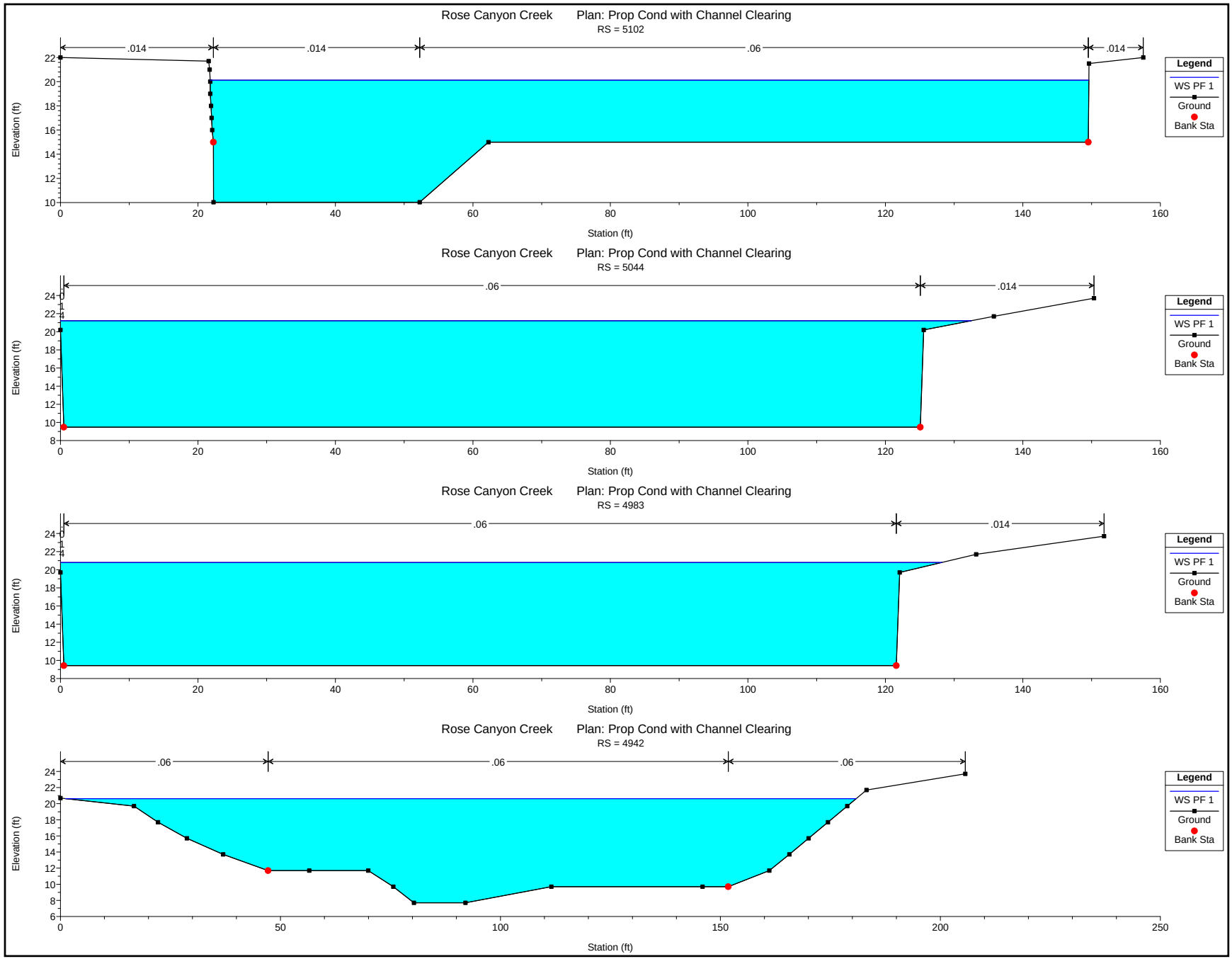

Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 7280
.07
.05
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 7078
.07
.05
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 6874
.07
.05
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 6662
.07
.05
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta

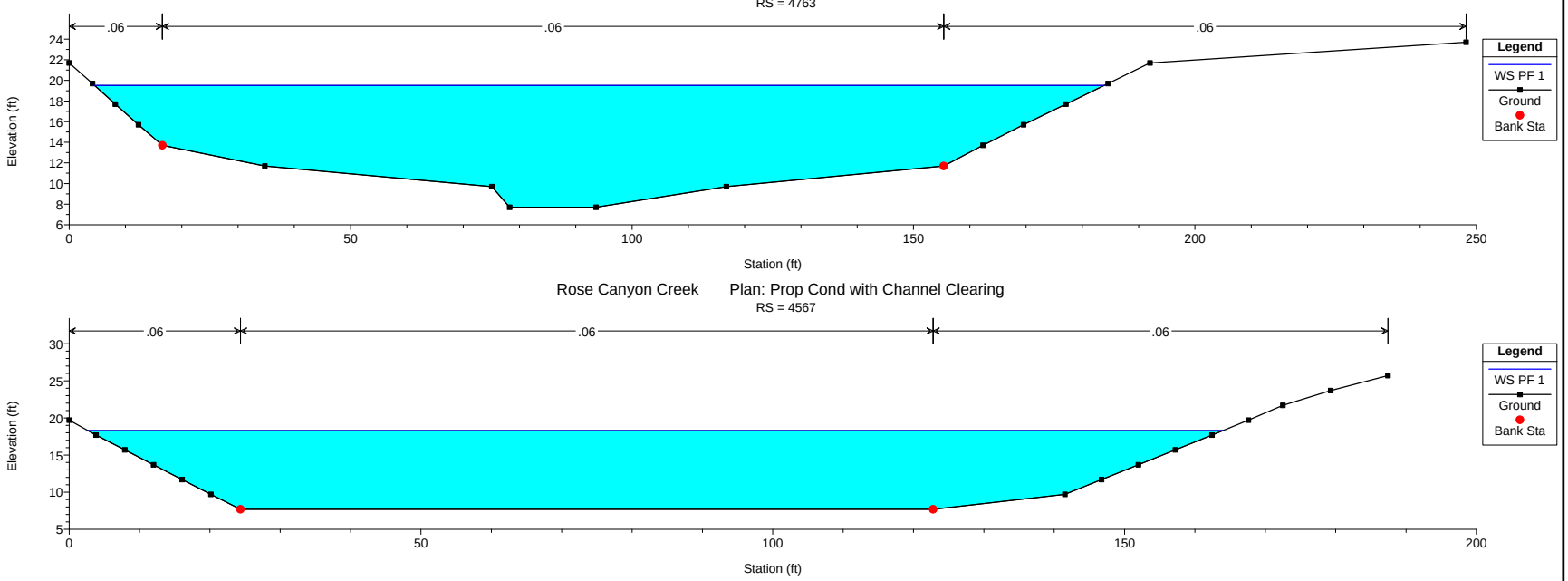

Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 6520 BR
.07
.05
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Pier Debris
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 6520 BR
.07
.05
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 6378
.07
.05
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 6115
.07
.05
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta


Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 5985
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 5885
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 5725
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 5595
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta


Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 5466
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 5465
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 5405
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 5328
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta


Rose Canyon Creek
Plan: Prop Cond with Channel Clearing
RS = 5283 BR
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta
Rose Canyon Creek
Plan: Prop Cond with Channel Clearing
RS = 5283 BR
.014
.014
.06
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta
Rose Canyon Creek
Plan: Prop Cond with Channel Clearing
RS = 5238
.014
.014
.06
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta
Rose Canyon Creek
Plan: Prop Cond with Channel Clearing
RS = 5174
.014
.014
.06
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta


Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 5102
.014
.014
.06
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 5044
.06
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 4983
.06
.014
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 4942
.06
.06
.06
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta


Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 4763
.06
.06
.06
Elevation (ft)
24
22
20
18
16
14
12
10
8
6
0
50
100
150
200
250
Station (ft)
Legend
WS PF 1
Ground
Bank Sta

Rose Canyon Creek Plan: Prop Cond with Channel Clearing
RS = 4567
.06
.06
.06
Elevation (ft)
30
25
20
15
10
5
0
50
100
150
200
Station (ft)
Legend
WS PF 1
Ground
Bank Sta

ance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

0 250 500 750 1,000 FEET

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1611G

FIRM

FLOOD INSURANCE RATE MAP

SAN DIEGO COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 1611 OF 2375

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SAN DIEGO, CITY OF	060295	1611	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06073C1611G

MAP REVISED
MAY 16, 2012

Federal Emergency Management Agency

ance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

0 250 500 750 1,000 FEET

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1603G

FIRM

FLOOD INSURANCE RATE MAP

SAN DIEGO COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 1603 OF 2375

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SAN DIEGO, CITY OF	060295	1603	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06073C1603G

MAP REVISED
MAY 16, 2012

Federal Emergency Management Agency

SEE FIGURE FOR UPSTREAM CROSS–SECTIONS

GRAPHIC SCALE

200 0 100 200 400

1 INCH = 200 FEET

Source: SANDAG, 2012

UPSTREAM SANDAG CROSS–SECTIONS

LEGEND:

HEC–RAS CROSS–SECTION

PROPOSED BICYCLE PATH

HEC–RAS WORK MAP
COASTAL RAIL TRAIL
ROSE CREEK ALIGNMENT