East Sedona Water Storage Tank, Booster Pump Station and Related Appurtenances

Drainage Report
April 2018

ARIZONA WATER COMPANY

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1 GENERAL LOCATION AND DESCRIPTION

1.1 INTRODUCTION

Arizona Water Company recently completed a water masterplan for the east Sedona area to address water demands, water supply sources, storage, and booster pump station requirements. The masterplan recommended the East Sedona Water Facility to provide water storage and a pumping facility. The selected site is located at the intersection of W Mallard Dr and Hwy 179 as shown in Figure 1 below.

Figure 1 Vicinity Map

1.2 Location and Ownership

Table 1-1 Location and Ownership Information

1. Owner/Developer Name.	**Arizona Water Company**
2. Assessor's Parcel Number(s).	401-33-031
3. City, County, State Highway and local streets within 3 miles of the subdivision, or the area to be served by the drainage improvements.	City of Sedona, Coconino County State Route 179
4. Township, range, section, ¼ sections.	T17N R06E
5. Major drainageways and facilities.	Unnamed wash along Bell Rock Trail
6. Names of surrounding developments.	Yavapino Estates Mystic Hills

1.2.1 General project description.

The project major components include the following facilities:

- Water storage tank with 1.5 million gallon (Mgal) maximum capacity
- Booster station
- Ancillary Facilities

1.3 Description of Property

1.3.1 Area in acres.

The site area is documented at 1.05 Acres.

1.3.2 Ground cover (type of ground cover and vegetation).

Based on a geotechnical evaluation conducted by Ninyo & Moore, the site area soil is a GM/SM classification. See Appendix A for the geotechnical logs from the study. The soil is described as red, dry to damp, ranges from medium to very dense, and is comprised of silty sand as well as fine to coarse silty gravel. Pockets within the area were found to have a GP soil classification, described as fine to coarse gravel with sand, however, for the analyses conducted only the GM/SM soil was used in order to take a conservative approach. The excavation explored depths from 2 to 3.5 feet, as well

as down to 31 feet for drilled core samples. Groundwater was not encountered during the study. The vegetation is classified as grass and brush with approximately 30% cover over the site area.

1.3.3 Major drainageways, floodplains.

The existing site grade slopes to the northwest corner. Under SR 179 construction, ADOT constructed two culverts to convey storm water runoff from east to west of the highway. There are also additional culverts on the north and northwest end of the site area within the residential zone.

1.3.4 Existing irrigation facilities, such as ditches and canals.

The existing site has no irrigation facilities.

1.3.5 Existing and proposed land use.

The existing parcel is a vacant parcel located in a residential area. The proposed land use is for the construction of a water facility, including a below grade water tank, a booster station and auxiliary facilities.

2 DRAINAGE BASINS AND SUB-BASINS

2.1 Major Basin Description

2.1.1 Reference to all drainageway planning studies such as flood hazard delineation reports, drainageway planning reports, and flood insurance rate maps (FIRMs).

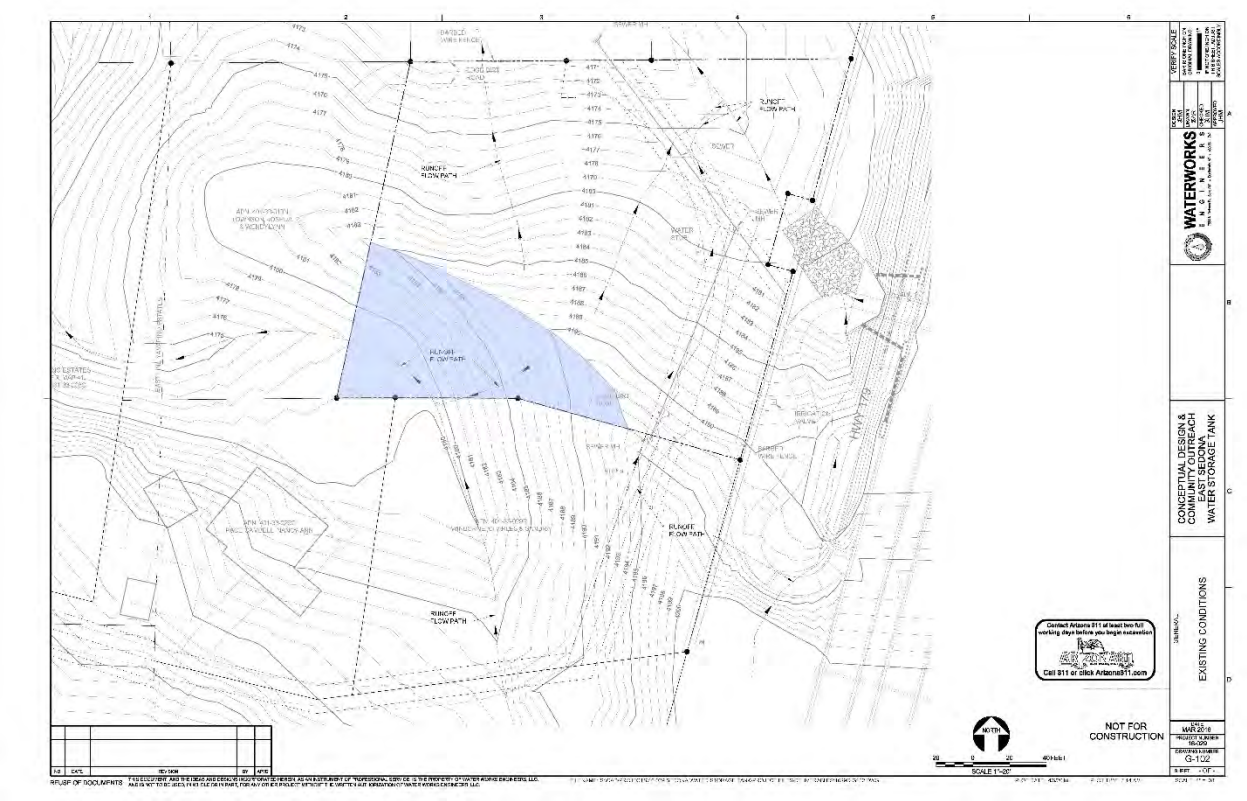
The site area is located outside of the 100-year flood zone. Refer to Appendix B for the floodplain analysis, including the FEMA flood zone map of the area. The drainage design and analysis will follow the City of Sedona Land Development Code.

Calculations were done using the rational drainage equation for 2, 10, 25, and 100-year 1-hour storms, as well as for a 100-year 2-hour storm, as required by the City of Sedona Land Development Code.

2.1.2 Basin drainage characteristics, existing and planned land uses within the basin, as defined by the Planning Department.

The proposed site grading elevations will be similar to the existing side grading. The site grade will generally slope to the north while maintaining the southwest corner drainage. Storm water will be managed via surface runoff. The drainage patterns are shown in Figure 2 below.

Figure 2 Existing Site Grading Conditions



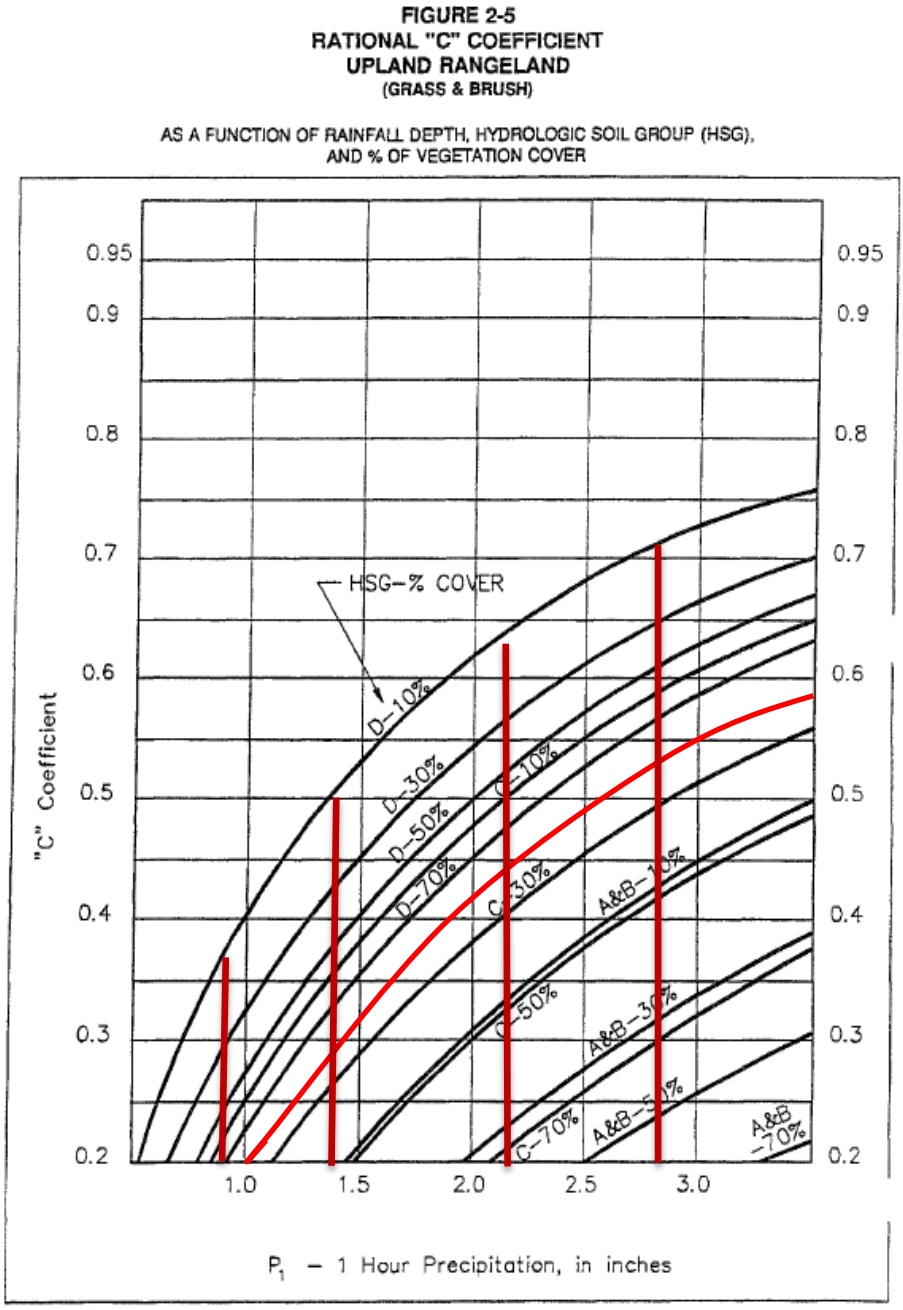
2.1.3 *Identification of all nearby irrigation facilities within ½ mile of the property boundary, which will influence or be influenced by the local drainage.*

There are no irrigation facilities within half a mile of the property boundary that will be impacted by the local drainage.

2.1.4 *Soils Classification Map.*

Based on the upland rangeland classification for the site area, and the consideration of approximately 30% vegetation cover, a rational coefficient of "C" was selected, as shown in Figure 3 below.

Figure 3 Rational "C" Coefficient Upland Rangeland



Based on the graph and the "C" classification, the C-coefficient value were estimated as follow for the various design storms:

Table 2-1 C Factor Values

Storm Frequency	C Factor
2 yrs – 1 hr	0.2
10 yrs – 1 hr	0.3
25 yrs – 1 hr	0.45
100 yrs – 1 hr	0.55
100 yrs – 2 hrs	

A lower "C" coefficient value indicates a higher infiltration rate and a lower runoff rate.

2.1.5 IDENTIFICATION OF ALL DETENTION FACILITIES.

There are no existing detention facilities at the site area.

2.2 SUB-BASIN DESCRIPTION DRAINAGE DESIGN MANUAL FOR YAVAPAI COUNTY DOCUMENTATION REQUIREMENTS 19-4 JULY 2015

2.2.1 DISCUSSION OF HISTORIC DRAINAGE PATTERNS OF THE PROPERTY IN QUESTION.

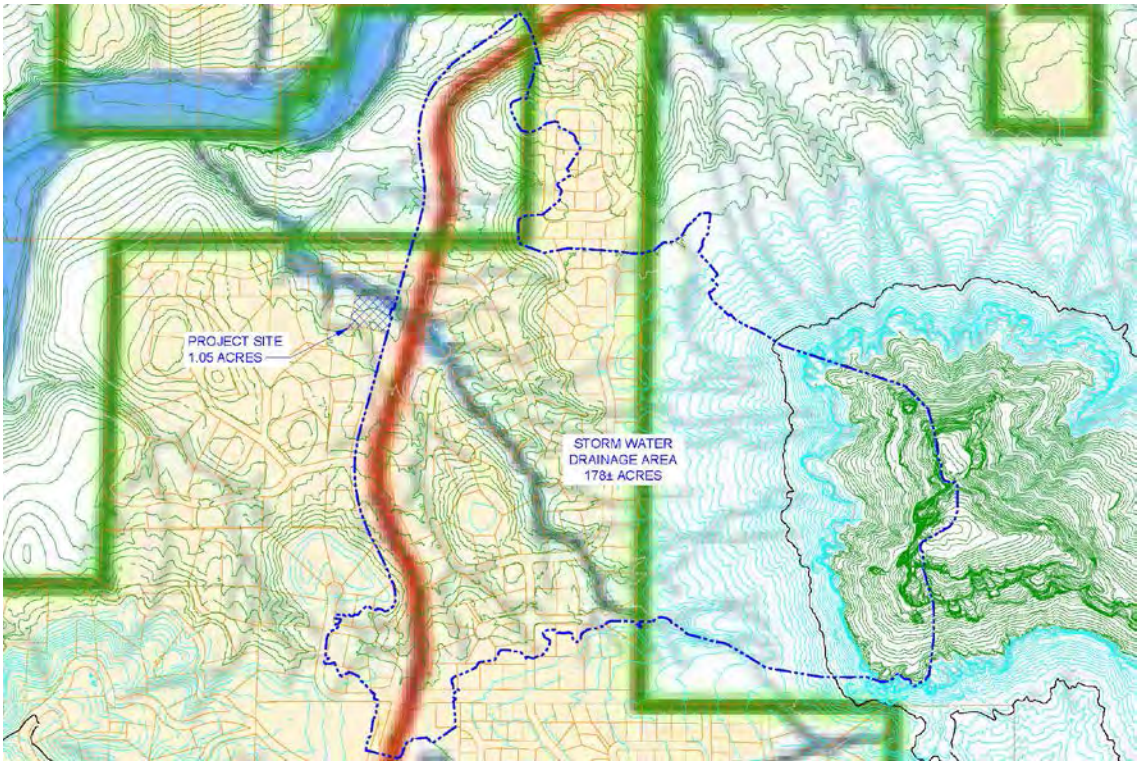
It is assumed that the historic general drainage is preserved. There may be minor modifications to limited natural or constructed drainage channels implemented under SR179 construction or other local residential construction projects. This project will not alter any of the historical drainage patterns.

2.2.2 DISCUSSION OF OFF-SITE DRAINAGE PATTERNS AND IMPACT ON DEVELOPMENT UNDER EXISTING AND FULLY DEVELOPED BASIN CONDITIONS, AS DEFINED BY THE PLANNING DEPARTMENT.

The site area is located adjacent to an unnamed drainage area of approximately 180 acres, as shown in Figure 4 below. The two culverts from the SR 179 construction previously discussed convey the storm water runoff from east to west of the highway. According to ADOT documents, the box culvert is capable of conveying up to 240 cfs during a 100-year storm and 190 cfs during a 50-year storm. The second culvert is a 54" pipe capable of conveying 68 cfs during a 100-year storm

and 55 cfs during a 50-year storm. Additional drainage is also provided from SR 179 and ultimately the site runoff is less than 1% of flow in the wash, as shown in the subsequent sections.

Figure 4 Sedona Watershed Analysis



2.2.3 *Discussion of proposed methods for managing stormwater quality during the construction phase.*

Managing storm water quality depends on sedimentation control and management of soil erosion on construction sites. These issues are very important in Sedona. The following recommended erosion and sedimentation control practices will be specified to manage soil erosion and control sedimentation during construction:

- Preservation of existing trees and natural vegetation on the site where feasible.
- Installation of perimeter fencing using for example, silt fences that are trenched in and backfilled.
- Rock dams or straw bales are suggested in concentrated flow locations such as ditches or swales.
- Erosion control blankets
- Straw mulch
- Temporary or permanent seeding with native grasses or wild flowers

- Rip rap on steep slopes
- Placement of crushed rock or gravel on job site access driveways to control mud and dirt on public roads

3 DRAINAGE FACILITY DESIGN

3.1 GENERAL CONCEPT

3.1.1 DISCUSSION OF EXISTING DRAINAGE PATTERNS.

The existing drainage patterns flow to the north and southwest corner.

3.1.2 DISCUSSION OF OFF-SITE RUNOFF CONSIDERATIONS.

Due to the topography of the property, off-site runoff is minimal and does not impact the drainage design. As per the City of Sedona's Land Development Code, the Rational Drainage Equation was used in order to calculate runoff to better understand and manage flood risks.

3.1.3 DISCUSSION OF ANTICIPATED AND PROPOSED DRAINAGE PATTERNS AND IMPROVEMENTS.

The tank and building are located to preserve the existing drainage courses in their natural pre-construction conditions, as much as practically possible. Soil stabilization, when needed, will be performed using native rocks from the excavation performed at the site. The rocks will be laid in naturally shaped areas where the drainages are most prone to erosion along the northwest area of the site. The site area will be stabilized by preserving vegetative cover with permanent landscaping installed in a timely manner to prevent rapid runoff, erosion, and downstream siltation. A retention basin will also be added at the southwest corner of the site area in order to capture the southwest flow. Additionally, a manhole will be added on the north side to capture the balance of the flow.

3.1.4 DISCUSSIONS OF THE CONTENT OF TABLES, CHARTS, FIGURES, MAPS OR DRAWINGS PRESENTED IN THE REPORT.

As discussed in section 2.1.4, the C coefficient was estimated to range between 0.2 and 0.55 for the native soil. The following C factors were used for the site after construction:

- Landscaped area 0.55
- Concrete tank and building area 1
- Driveway area 0.88
- Backfill ring around tank 0.50

For the 2-year and 10-year 1-hour storms, the mean precipitation frequency estimates were used from Table 8.2 in the City of Sedona's Land Development Code. For the 25-year and 100-year 1-

hour storms (as well as the 100-year 2-year storm), the upper limit precipitation frequency estimates was used from Table 8.3 in the City of Sedona's Land Development Code. Using these values, runoff calculations were done on the existing and the proposed future conditions. Table 3-1 below summarizes the precipitation frequency estimates used.

Table 3-1 Precipitation Frequency Estimates

Frequency (yr)	60-min	120-min
2	0.86	NA
10	1.41	NA
25	2.10	NA
100	2.84	3.12

The results of the 2, 10, 25 and 100-yr runoff calculations are summarized in Table 3-2 shown below.

Table 3-2 Runoff Calculations Summary for 1-hr Duration

Storm Frequency	Inch in 1 hr.	Exist Conditions	Project Conditions	Increase
(yr)		(cfs)	(cfs)	(cfs)
2	0.86	0.18	0.36	0.18
10	1.41	0.44	0.68	0.24
25	2.1	0.99	1.22	0.22
100	2.84	1.64	1.82	0.18

A runoff coefficient sensitivity analysis was also performed using C coefficient values of 0.70 and 0.25. The stormwater runoff flow calculated from a 1-hour 100-year storm under existing conditions was 1.64 cfs. The flow increased to 1.82 cfs under the proposed future conditions. The sensitivity analysis results also showed that the peak discharge flow still increased by less than 1 cfs from existing to proposed future conditions. For full tables of the runoff calculations see Appendix C.

3.1.5 DISCUSSION OF HYDROLOGIC, HYDRAULIC AND OTHER ANALYSIS METHODOLOGIES USED IN THE REPORT.

3.1.5.1 On Site Drainage

According to the City of Sedona Land Development Code, stormwater storage is required either when the development is 1 acre or larger or when the post-development flow will exceed pre-development flow by ≥ 1 cfs. Although the runoff calculation results determined the increase in flow for all storm intensities were less than 1 cfs (Table 3-2), retention basins were still included in the design.

The Rational Method calculations were used to calculate the runoff volume for the existing and proposed future conditions. The excess runoff for the proposed future conditions compared to the existing conditions was then calculated in order to determine the retention volume required. Taking into account the retention volume that will be provided by the proposed SW and N retention basins, no extra retention volume would be required to adequately manage stormwater runoff from any of the storm frequencies calculated for the 1-hour or 2-hour duration. The results are shown in Table 3-3 below.

Table 3-3 Retention Basin Calculations

Storm Frequency	Inch in 1 hr.	Exist Cndts	Project Cndts	Increase	Required	Match Existing Cndts	Proposed Retention 1	Proposed Retention 2	Total	Storm Water Flow w Proposed Retention	% Reduction
(yr)		(cfs)	(cfs)	(cfs)	(cft)	(cft)	(cft)	(cft)	(cft)	(cfs)	%
2	0.86	0.18	0.36	0.18	0	657	450	1005	1455	0.00	100.0%
10	1.41	0.44	0.68	0.24	0	865	450	1005	1455	0.28	59.2%
25	2.1	0.99	1.22	0.22	0	811	450	1005	1455	0.81	33.2%
100	2.84	1.64	1.82	0.18	0	668	450	1005	1455	1.42	22.2%

3.1.5.2 Hydrology and Hydraulics in Adjacent Wash

A floodplain analysis for the unnamed wash was also conducted using USACE HEC-RAS floodplain modeling software for existing and proposed conditions. The analysis was completed for 100-year and 50-year storm events. Manning's roughness values of 0.040 and 0.050 were used for the main channel and overbanks, respectively. The analysis was also performed using a subcritical flow regime. The analyses showed no difference in watershed elevation between existing and proposed conditions for the 100-year or 50-year storm events. The floodplain analysis report performed by Lyon Engineering is included in Appendix B.

3.2 Specific Details

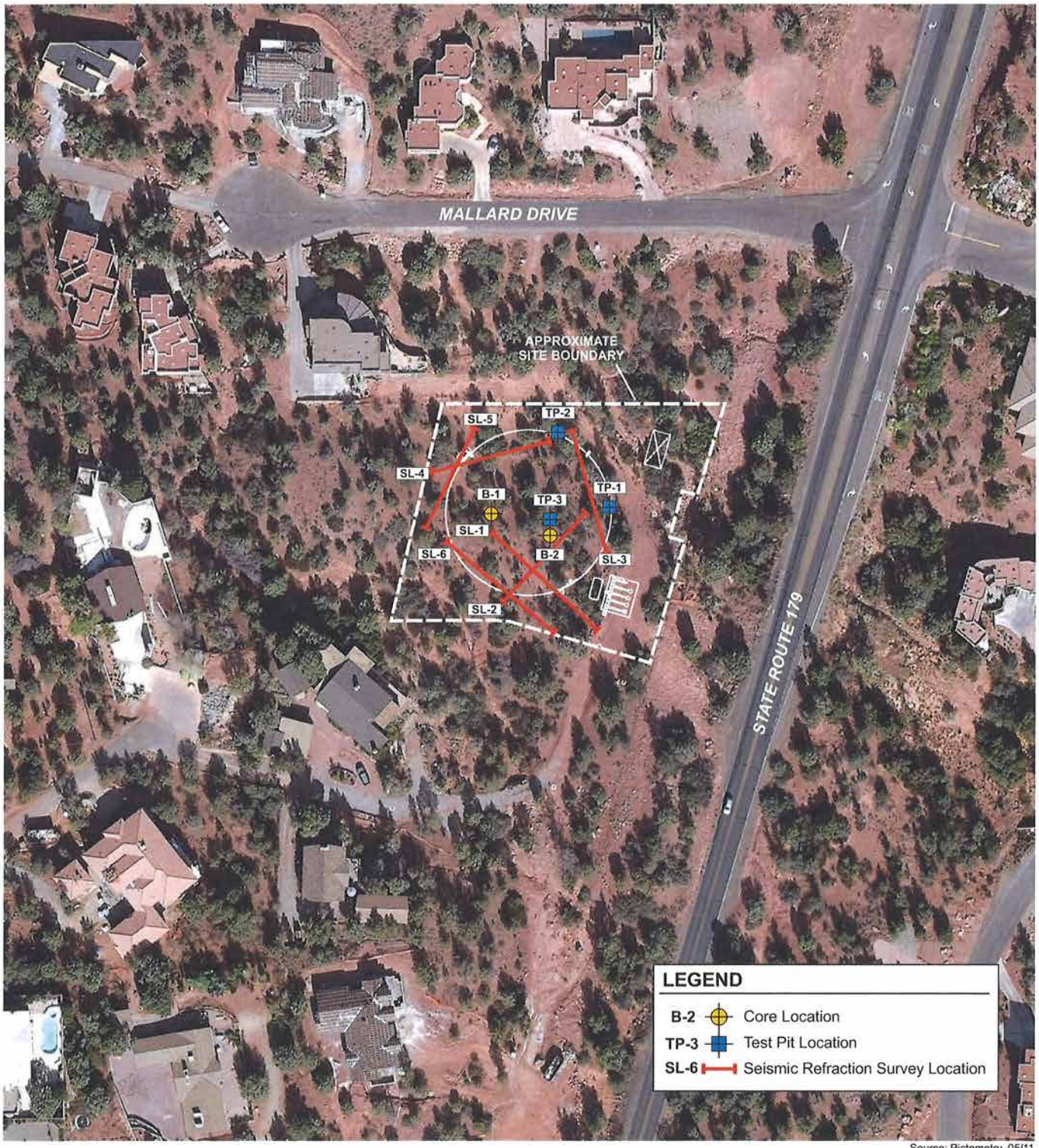
3.2.1 Discussion of drainage problems encountered and solutions at specific design points.

The site area is located outside the 100-year flood zone condition.

3.2.2 Discussion of detention storage and outlet design.

The retention basin located at the SW corner of the site has a retention volume of 450 cft. The retention located at the north side of the site will consist of an 8 ft manhole with a 20 ft depth for a total volume of 1005 cft. The manhole will include a pump system that will pump water out after the storm has recessed. The total retention volume between the areas is 1455 cft. The pumping capacity will be limited to 1.64 cfs to match the existing conditions.

Appendix A Geotechnical Report Logs



Source: Pictometry, 05/11.

N

0 120

Approximate Scale:
1 inch = 120 feet

Note: Dimensions, directions, and locations are approximate.

Ninyo & Moore	EXPLORATION LOCATIONS	FIGURE
PROJECT NO: 603971001	DATE: 10/16	GEOTECHNICAL EVALUATION CHAPEL HILLS WATER CAMPUS - MALLARD DRIVE AND STATE ROUTE 179 SEDONA, ARIZONA	2

file no: 3971srl1016

Ninyo & Moore

TEST PIT LOG

CHAPEL HILLS WATER CAMPUS
MALLARD DRIVE AND STATE ROUTE 179
SEDONA, ARIZONA

PROJECT NO.	DATE
603971001	10/16

DATE EXCAVATED 11/13/12 TEST PIT NO. TP-1

GROUND ELEVATION -- LOGGED BY DM

METHOD OF EXCAVATION JD 310 SG Backhoe, 14" Bucket

LOCATION Sedona, Arizona

DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0						GM	COLLUVIUM: Red, dry, very dense, fine to coarse silty GRAVEL.
				3.0	87.5		Backhoe refusal on bedrock.
2							Total Depth = 2 feet. (Refusal) Groundwater not encountered during excavation. Backfilled on 11/13/12 promptly after completion of excavating. Note: Groundwater, though not encountered at the time of excavating, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
4							
6							
8							
10							

SCALE = 1 in./2 ft.

FIGURE A-1

Ninyo & Moore

TEST PIT LOG

CHAPEL HILLS WATER CAMPUS
MALLARD DRIVE AND STATE ROUTE 179
SEDONA, ARIZONA

PROJECT NO.	DATE
603971001	10/16

DATE EXCAVATED 11/13/12 TEST PIT NO. TP-2

GROUND ELEVATION -- LOGGED BY DM

METHOD OF EXCAVATION JD 310 SG Backhoe, 14" Bucket

LOCATION Sedona, Arizona

DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0						SM	COLLUVIUM: Red, dry to damp, medium dense, silty SAND; few fine to coarse gravel.
							Backhoe refusal on bedrock.
2							Total Depth = 2 feet. (Refusal) Groundwater not encountered during excavation. Backfilled on 11/13/12 promptly after completion of excavating. Note: Groundwater, though not encountered at the time of excavating, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
4							
6							
8							
10							

SCALE - 1 in./2 ft.

FIGURE A-2

Ninyo & Moore

TEST PIT LOG

CHAPEL HILLS WATER CAMPUS
MALLARD DRIVE AND STATE ROUTE 179
SEDONA, ARIZONA

PROJECT NO.	DATE
603971001	10/16

DATE EXCAVATED 11/13/12 TEST PIT NO. TP-3

GROUND ELEVATION -- LOGGED BY DM

METHOD OF EXCAVATION JD 310 SG Backhoe, 14" Bucket

LOCATION Sedona, Arizona

DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0				2.7	112.1	GM	COLLUVIUM: Red, dry to damp, very dense, fine to coarse silty GRAVEL.
2							Backhoe refusal on bedrock.
4							Total Depth = 3.5 feet. (Refusal) Groundwater not encountered during excavation. Backfilled on 11/13/12 promptly after completion of excavating. Note: Groundwater, though not encountered at the time of excavating, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
6							
8							
10							

SCALE = 1 in./2 ft.

FIGURE A-3

DATE DRILLED 10/06/16 CORE NO. B-1

GROUND ELEVATION 4,194'± (MSL) SHEET 1 OF 1

METHOD OF DRILLING Core Rig D-120 DRILLER D&S Drilling, Inc.

BASELINE STATION N/A LATERAL OFFSET N/A

SAMPLED BY DCW LOGGED BY DCW REVIEWED BY FAR

DEPTH (feet)	Samples: Driven	BLOWS/FOOT	INTERVAL CORED (feet)	RECOVERY (%)	RQD (%)	DRILLING RATE (minutes per ft.)	FRACTURE DIP (degrees)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0									GP	COLLUVIUM: Dry, dense, fine to coarse GRAVEL with sand; trace silty.
										SCHNEBLY HILL FORMATION: Reddish brown; moist; soft; highly weathered SANDSTONE; very intensely fractured.
										No recovery; sandstone clast in shoe.
10										@ 11' to 16': Reddish brown; moist; moderately soft; moderately weathered; intensely to moderately fractured.
			5	80	63	11				
										@ 16' to 21':Reddish brown; moist; moderately hard; moderately weathered; moderately to slightly fractured.
			5	95	92	10				
20										@ 21' to 26': Reddish brown; moist; moderately hard; moderately weathered; slightly fractured.
			5	100	95	7				
										@ 26' to 31': Reddish brown, moist, moderately hard; slightly weathered; slightly fractured.
			5	90	70	5				
30										Total Depth = 31 feet. Groundwater not encountered during drilling. Backfilled on 10/06/16 shortly after completion of drilling.

Notes:
Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.

The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.

Ninyo & Moore

CORE LOG

MALLARD DRIVE AND HIGHWAY 179
SEDONA, ARIZONA

PROJECT NO.	DATE	FIGURE
603971001	10/16	A-4

DATE DRILLED 6 CORE NO. B-2

GROUND ELEVATION 4,194'± (MSL) SHEET 1 OF 1

METHOD OF DRILLING Core Rig D-120 DRILLER 4,194'± (MSL)

BASELINE STATION N/A LATERAL OFFSET N/A

SAMPLED BY DCW LOGGED BY DCW REVIEWED BY FAR

DEPTH (feet)	Samples: Driven	BLOWS/FOOT	INTERVAL CORED (feet)	RECOVERY (%)	RQD (%)	DRILLING RATE (minutes per ft.)	FRACTURE DIP (degrees)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0									GP	COLLUVIUM: Reddish brown, dry, dense, fine to coarse GRAVEL with sand.
10										SCHNEBLY HILL FORMATION: Reddish brown; moist; soft; high weathered SANDSTONE; very intensely fractured. No recovery; sandstone clast in shoe.
20			5	40	47	3				@ 16' to 22': Reddish brown; moist; moderately hard; slightly weathered; moderately to slightly fractured.
			5	90	85	5				@ 22' to 27':
30			3	20	17	4				@ 27' to 30': Reddish brown, moist, moderately hard; moderately weathered; intensely to moderately fractured.

Total Depth = 30 feet.
Groundwater not encountered during drilling.
Backfilled on 10/06/16 shortly after completion of drilling.

Notes:
Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.

The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.

Ninyo & Moore

CORE LOG

MALLARD DRIVE AND HIGHWAY 179
SEDONA, ARIZONA

PROJECT NO.	DATE	FIGURE
603971001	10/16	A-5

Appendix B Floodplain Analysis/FEMA Flood Insurance Rate Map (FIRM)

LYON ENGINEERING
Civil Engineers • Land Surveyors

February 7, 2018

John Matta, P.E.
Waterworks Engineers
7500 N. Dobson Road, Suite 200
Scottsdale, AZ 85256

Re: East Sedona Water Storage Tank Floodplain Analysis

Mr. Matta:

Lyon Engineering has completed a floodplain analysis on the East Sedona Water Storage Tank project, which is located on the west side of Highway 179, near the intersection of Mallard Drive in East Sedona. Two scenarios (existing and proposed conditions) were analyzed and mapped. It was determined that the proposed grading does not encroach nor affect the 100-year or 50-year floodplains through the Unnamed Wash. The existing and proposed floodplain limits are identical, as no channel geometry or other conditions are proposed to change within the 100-year or 50-year floodplain limits. Attached is the floodplain exhibit for the project.

The project is located in Zone X on the effective Flood Insurance Rate Map (FIRM), Map 04005C7659G, dated September 3, 2010. Zone X is defined by FEMA as an area outside the 500-year floodplain, indicating that the project is not in a major floodplain. Attached is the effective FIRM indicating the project location.

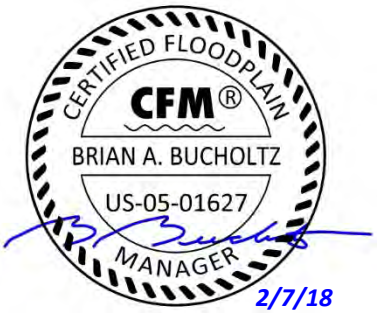
The floodplain analysis was completed in HEC-RAS floodplain modeling software. Topography for the project (1' contours) was provided by Waterworks Engineers in January 2018. Cross-sections were placed relatively close together (60-80 feet apart) to determine the most accurate floodplain limits. Both the 100-year (240 cfs) and the 50-year (190 cfs) flows were obtained from the Highway 179 ADOT plans at the upstream box culvert.

There were no ineffective flow areas, no obstructions, and no culverts/bridges necessary to input throughout the reach. All topography and calculations are completed on vertical datum NAVD 1988. Manning's roughness values for the modeling ranged from 0.040 in the main channel to 0.050 in locations with more vegetation. The models were run in a subcritical flow regime, resulting in the highest and most conservative water surface elevations (WSEs). The required downstream boundary conditions were input as known WSEs, obtained from the attached CulvertMaster and FlowMaster calculation worksheets for the existing driveway crossing at the downstream boundary. It is also verified in CulvertMaster that the upstream (Highway 179) box culvert outlet depths are similar to the calculated flow depths at the most upstream cross-section.

Attached are the existing and proposed HEC-RAS profile and cross-section results. As stated above, it was determined that the proposed grading does not encroach nor affect the 100-year OR 50-year floodplains through the Unnamed Wash. See the attached comparison tables on the following page.

Respectfully Submitted,

Brian A. Bucholtz, P.E., CFM
Floodplain Manager
Project Engineer
brianbucholtz@lyonengineering.com



100-Year Floodplain Results

Cross-Section	Existing WSE	Proposed WSE	Difference (ft)
1000.00	4167.72	4167.72	0.00
1081.47	4167.72	4167.72	0.00
1155.75	4169.03	4169.03	0.00
1229.31	4170.81	4170.81	0.00
1308.24	4173.86	4173.86	0.00
1366.36	4176.75	4176.75	0.00
1440.65	4180.75	4180.75	0.00

50-Year Floodplain Results

Cross-Section	Existing WSE	Proposed WSE	Difference (ft)
1000.00	4167.17	4167.17	0.00
1081.47	4167.17	4167.17	0.00
1155.75	4168.83	4168.83	0.00
1229.31	4170.62	4170.62	0.00
1308.24	4173.66	4173.66	0.00
1366.36	4176.56	4176.56	0.00
1440.65	4180.56	4180.56	0.00

Effective FIRM

MAP SCALE 1" = 500'

250 0 500 1000

FEET

METER

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 7659G

FIRM

FLOOD INSURANCE RATE MAP

COCONINO COUNTY, ARIZONA

AND INCORPORATED AREAS

PANEL 7659 OF 8475

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COCONINO COUNTY	040019	7659	G
SEDONA, CITY OF	040130	7659	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
04005C7659G

EFFECTIVE DATE
SEPTEMBER 3, 2010

Federal Emergency Management Agency

CulvertMaster and FlowMaster
Calculation Worksheets

Culvert Calculator Report
Driveway Culverts - 100-Year

Solve For: Discharge

Culvert Summary					
Allowable HW Elevation	4,167.72	ft	Headwater Depth/Height	2.44	
Computed Headwater Elev	4,167.72	ft	Discharge	118.15	cfs
Inlet Control HW Elev.	4,167.72	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	4,166.38	ft	Control Type	Inlet Control	

Grades					
Upstream Invert	4,161.00	ft	Downstream Invert	4,160.00	ft
Length	25.00	ft	Constructed Slope	4.00	%

Hydraulic Profile					
Profile	S2		Depth, Downstream	2.35	ft
Slope Type	Steep		Normal Depth	2.34	ft
Flow Regime	Supercritical		Critical Depth	2.48	ft
Velocity Downstream	10.93	ft/s	Critical Slope	3.74	%

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	2.75	ft
Section Size	33 inch		Rise	2.75	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	4,166.38	ft	Upstream Velocity Head	1.71	ft
Ke	0.70		Entrance Loss	1.20	ft

Inlet Control Properties					
Inlet Control HW Elev.	4,167.72	ft	Flow Control	Submerged	
Inlet Type	Mitered to slope		Area Full	11.9	ft²
K	0.02100		HDS 5 Chart	2	
M	1.33000		HDS 5 Scale	2	
C	0.04630		Equation Form	1	
Y	0.75000				

Worksheet for Driveway Weir - 100-Year

Project Description

Solve For	Discharge

Input Data

Headwater Elevation		4167.72	ft
Crest Elevation		4165.50	ft
Tailwater Elevation		4164.00	ft
Crest Surface Type	Paved		
Crest Breadth		1.50	ft
Crest Length		12.00	ft

Results

Discharge	122.53	ft^3/s
Headwater Height Above Crest	2.22	ft
Tailwater Height Above Crest	-1.50	ft
Weir Coefficient	3.09	US
Submergence Factor	1.00	
Adjusted Weir Coefficient	3.09	US
Flow Area	26.64	ft^2
Velocity	4.60	ft/s
Wetted Perimeter	16.44	ft
Top Width	12.00	ft

Culvert Calculator Report
Driveway Culverts - 50-Year

Solve For: Discharge

Culvert Summary					
Allowable HW Elevation	4,167.17	ft	Headwater Depth/Height	2.24	
Computed Headwater Elev	4,167.17	ft	Discharge	110.83	cfs
Inlet Control HW Elev.	4,167.17	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	4,166.07	ft	Control Type	Inlet Control	

Grades					
Upstream Invert	4,161.00	ft	Downstream Invert	4,160.00	ft
Length	25.00	ft	Constructed Slope	4.00	%

Hydraulic Profile					
Profile	S2		Depth, Downstream	2.20	ft
Slope Type	Steep		Normal Depth	2.18	ft
Flow Regime	Supercritical		Critical Depth	2.42	ft
Velocity Downstream	10.87	ft/s	Critical Slope	3.36	%

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	2.75	ft
Section Size	33 inch		Rise	2.75	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	4,166.07	ft	Upstream Velocity Head	1.55	ft
Ke	0.70		Entrance Loss	1.09	ft

Inlet Control Properties					
Inlet Control HW Elev.	4,167.17	ft	Flow Control	Submerged	
Inlet Type	Mitered to slope		Area Full	11.9	ft²
K	0.02100		HDS 5 Chart	2	
M	1.33000		HDS 5 Scale	2	
C	0.04630		Equation Form	1	
Y	0.75000				

Worksheet for Driveway Weir - 50-Year

Project Description

Solve For	Discharge

Input Data

Headwater Elevation		4167.17	ft
Crest Elevation		4165.50	ft
Tailwater Elevation		4164.00	ft
Crest Surface Type	Paved		
Crest Breadth		1.50	ft
Crest Length		12.00	ft

Results

Discharge	79.95	ft^3/s
Headwater Height Above Crest	1.67	ft
Tailwater Height Above Crest	-1.50	ft
Weir Coefficient	3.09	US
Submergence Factor	1.00	
Adjusted Weir Coefficient	3.09	US
Flow Area	20.04	ft^2
Velocity	3.99	ft/s
Wetted Perimeter	15.34	ft
Top Width	12.00	ft

Culvert Calculator Report
Highway 179 Box - 100-Year

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	4,193.00	ft	Headwater Depth/Height	0.41	
Computed Headwater Elev	4,184.45	ft	Discharge	240.00	cfs
Inlet Control HW Elev.	4,184.06	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	4,184.45	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	4,180.40	ft	Downstream Invert	4,178.40	ft
Length	85.00	ft	Constructed Slope	2.35	%

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.37	ft
Slope Type	Steep		Normal Depth	1.16	ft
Flow Regime	Supercritical		Critical Depth	2.32	ft
Velocity Downstream	14.56	ft/s	Critical Slope	0.29	%

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	12.00	ft
Section Size	12 x 10 ft		Rise	10.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	4,184.45	ft	Upstream Velocity Head	1.16	ft
Ke	0.50		Entrance Loss	0.58	ft

Inlet Control Properties					
Inlet Control HW Elev.	4,184.06	ft	Flow Control	N/A	
Inlet Type	45° non-offset wingwall flares		Area Full	120.0	ft²
K	0.49700		HDS 5 Chart	12	
M	0.66700		HDS 5 Scale	1	
C	0.03390		Equation Form	2	
Y	0.80300				

Culvert Calculator Report
Highway 179 Box - 50-Year

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	4,193.00	ft	Headwater Depth/Height	0.35	
Computed Headwater Elev	4,183.87	ft	Discharge	190.00	cfs
Inlet Control HW Elev.	4,183.53	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	4,183.87	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	4,180.40	ft	Downstream Invert	4,178.40	ft
Length	85.00	ft	Constructed Slope	2.35	%

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.15	ft
Slope Type	Steep		Normal Depth	1.00	ft
Flow Regime	Supercritical		Critical Depth	1.98	ft
Velocity Downstream	13.77	ft/s	Critical Slope	0.29	%

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	12.00	ft
Section Size	12 x 10 ft		Rise	10.00	ft
Number Sections	1				

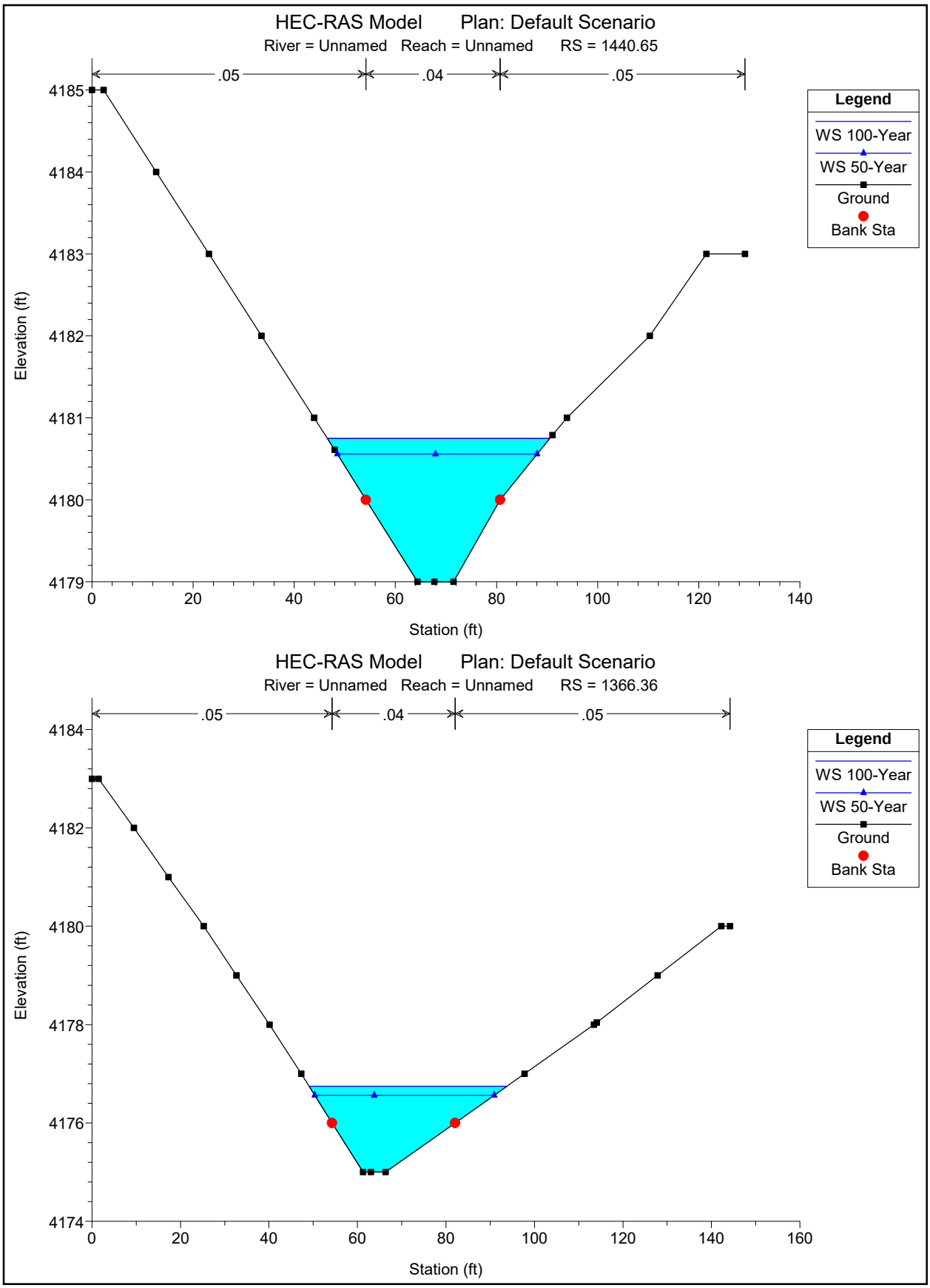
Outlet Control Properties					
Outlet Control HW Elev.	4,183.87	ft	Upstream Velocity Head	0.99	ft
Ke	0.50		Entrance Loss	0.50	ft

Inlet Control Properties					
Inlet Control HW Elev.	4,183.53	ft	Flow Control	N/A	
Inlet Type	45° non-offset wingwall flares		Area Full	120.0	ft²
K	0.49700		HDS 5 Chart	12	
M	0.66700		HDS 5 Scale	1	
C	0.03390		Equation Form	2	
Y	0.80300				

Existing HEC-RAS
Profile and Cross-Section Results

HEC-RAS Plan: Default Scenario River: Unnamed Reach: Unnamed

Reach	River Sta	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)	
Unnamed	1000.00	240.00	4162.00	4167.72	4163.90	4167.74	0.000122	1.24	271.89	87.27	0.10
Unnamed	1000.00	190.00	4162.00	4167.17	4163.69	4167.19	0.000121	1.15	226.32	78.35	0.09
Unnamed	1081.47	240.00	4165.00	4167.43	4167.27	4167.91	0.010906	6.12	50.64	42.99	0.76
Unnamed	1081.47	190.00	4165.00	4167.05	4167.05	4167.62	0.016042	6.44	35.77	35.26	0.89
Unnamed	1155.75	240.00	4167.00	4169.03	4169.03	4169.64	0.016994	6.56	42.56	39.45	0.92
Unnamed	1155.75	190.00	4167.00	4168.83	4168.83	4169.38	0.017936	6.15	34.87	35.66	0.92
Unnamed	1229.31	240.00	4169.00	4170.81	4170.81	4171.38	0.018677	6.20	42.36	41.20	0.94
Unnamed	1229.31	190.00	4169.00	4170.62	4170.62	4171.13	0.019963	5.81	34.96	37.91	0.95
Unnamed	1308.24	240.00	4172.00	4173.86	4173.86	4174.44	0.017434	6.29	42.85	41.29	0.92
Unnamed	1308.24	190.00	4172.00	4173.66	4173.66	4174.19	0.019032	5.95	34.81	37.28	0.94
Unnamed	1366.36	240.00	4175.00	4176.75	4176.75	4177.30	0.018353	6.10	43.52	44.72	0.93
Unnamed	1366.36	190.00	4175.00	4176.56	4176.56	4177.06	0.019684	5.72	35.67	40.54	0.94
Unnamed	1440.65	240.00	4179.00	4180.75	4180.75	4181.31	0.018057	6.18	43.18	43.96	0.93
Unnamed	1440.65	190.00	4179.00	4180.56	4180.56	4181.07	0.019384	5.80	35.27	39.53	0.94


HEC-RAS Model Plan: Default Scenario
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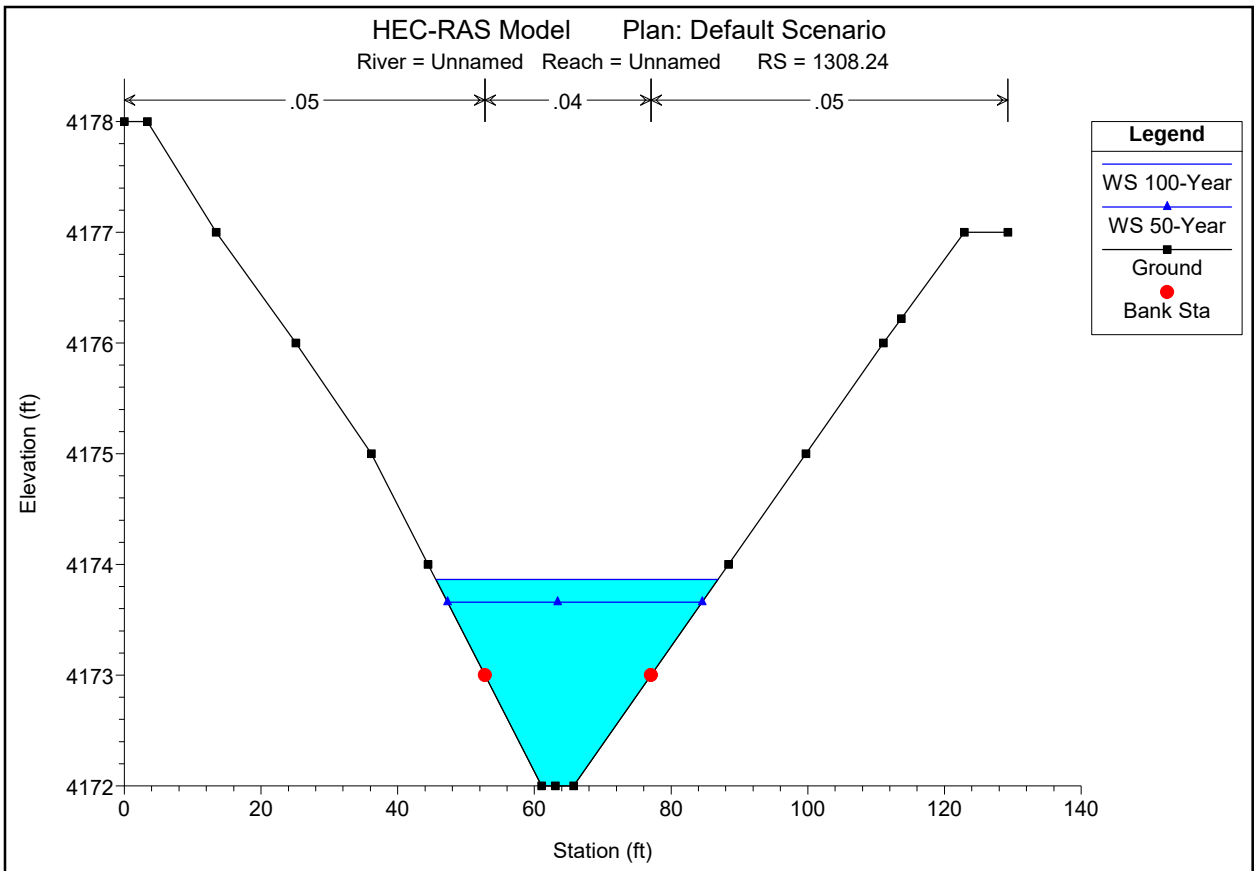
.05
.04
.05
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
4185
4184
4183
4182
4181
4180
4179
0
20
40
60
80
100
120
140
HEC-RAS Model Plan: Default Scenario
River = Unnamed Reach = Unnamed RS = 1366.36
.05
.04
.05
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
4184
4182
4180
4178
4176
4174
0
20
40
60
80
100
120
140
160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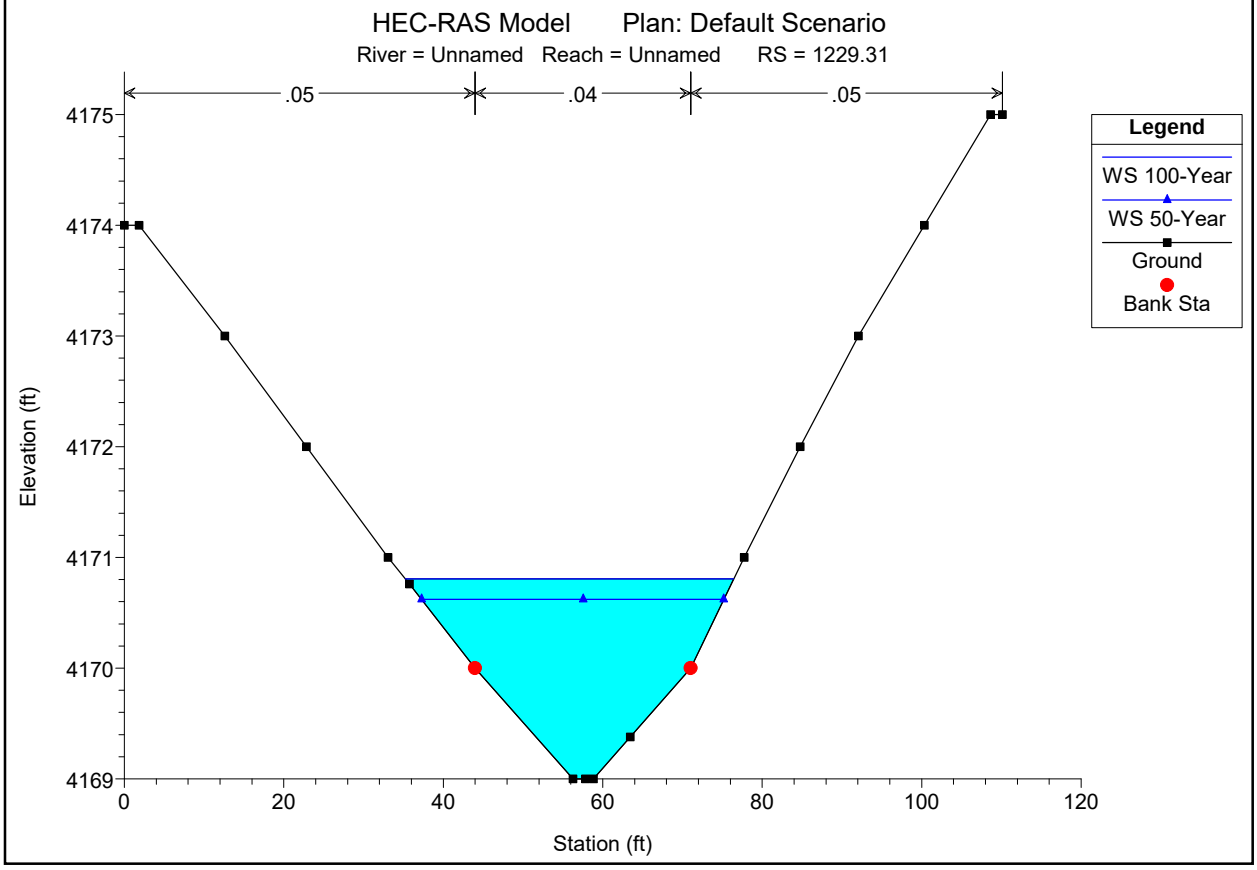
.05
.04
.05
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
4178
4177
4176
4175
4174
4173
4172
0
20
40
60
80
100
120
140
Station (ft)


HEC-RAS Model Plan: Default Scenario
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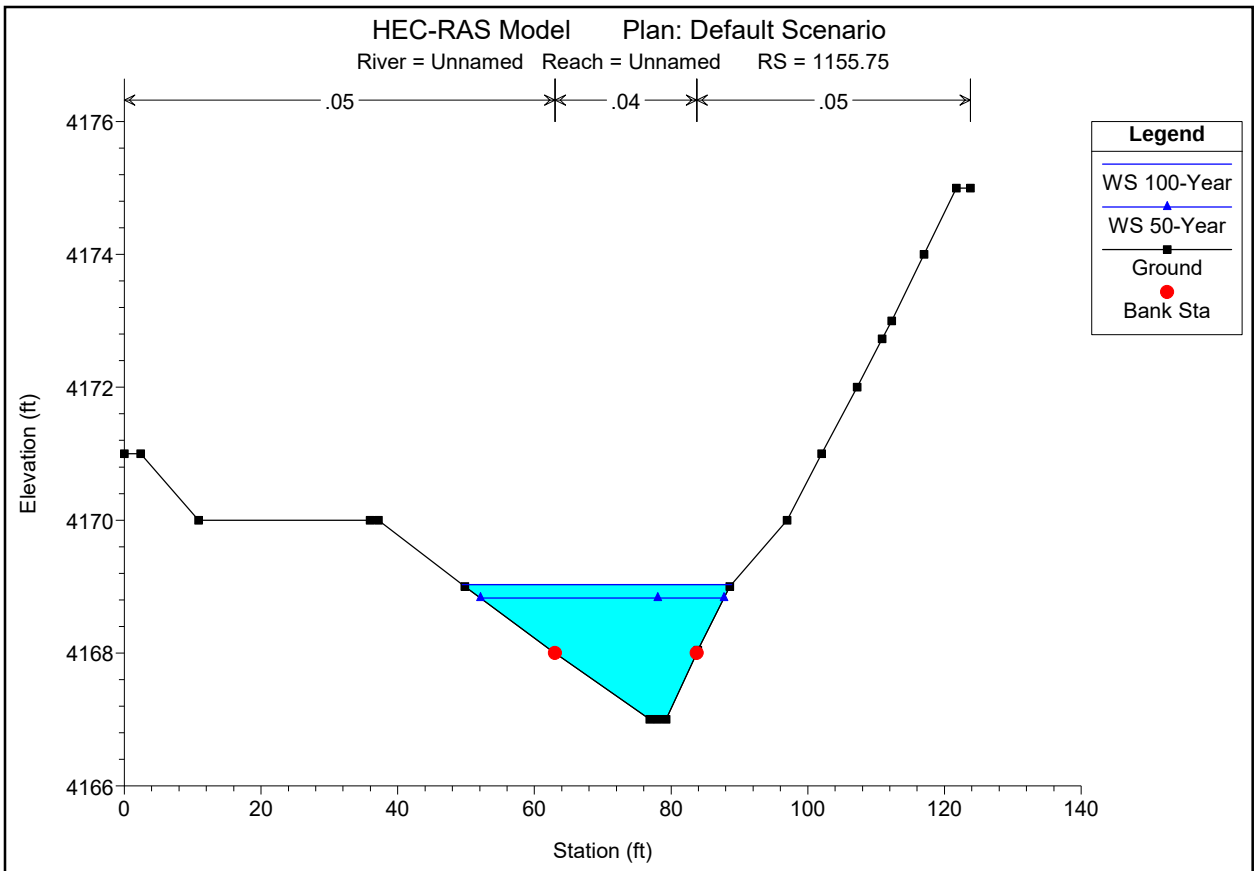
.05
.04
.05
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
4175
4174
4173
4172
4171
4170
4169
0
20
40
60
80
100
120
Station (ft)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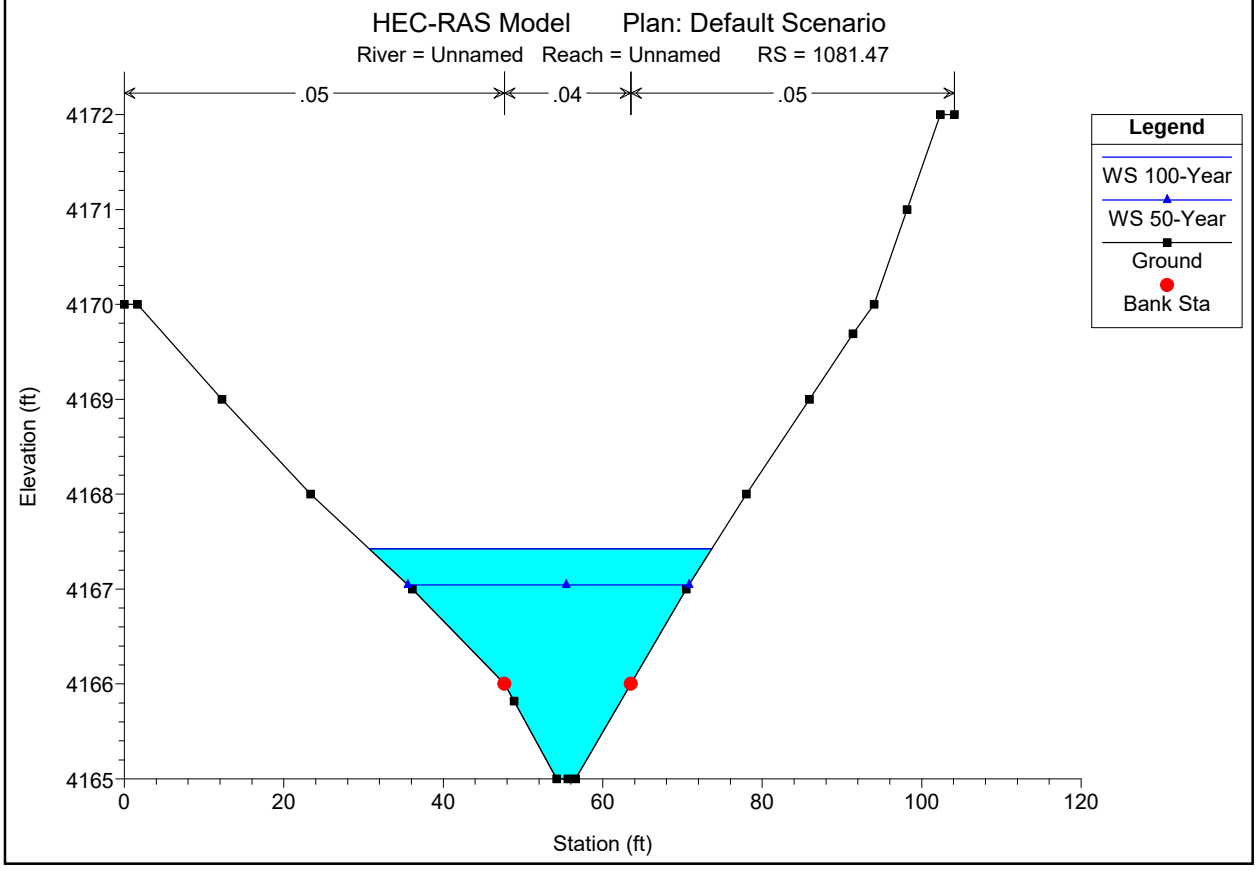
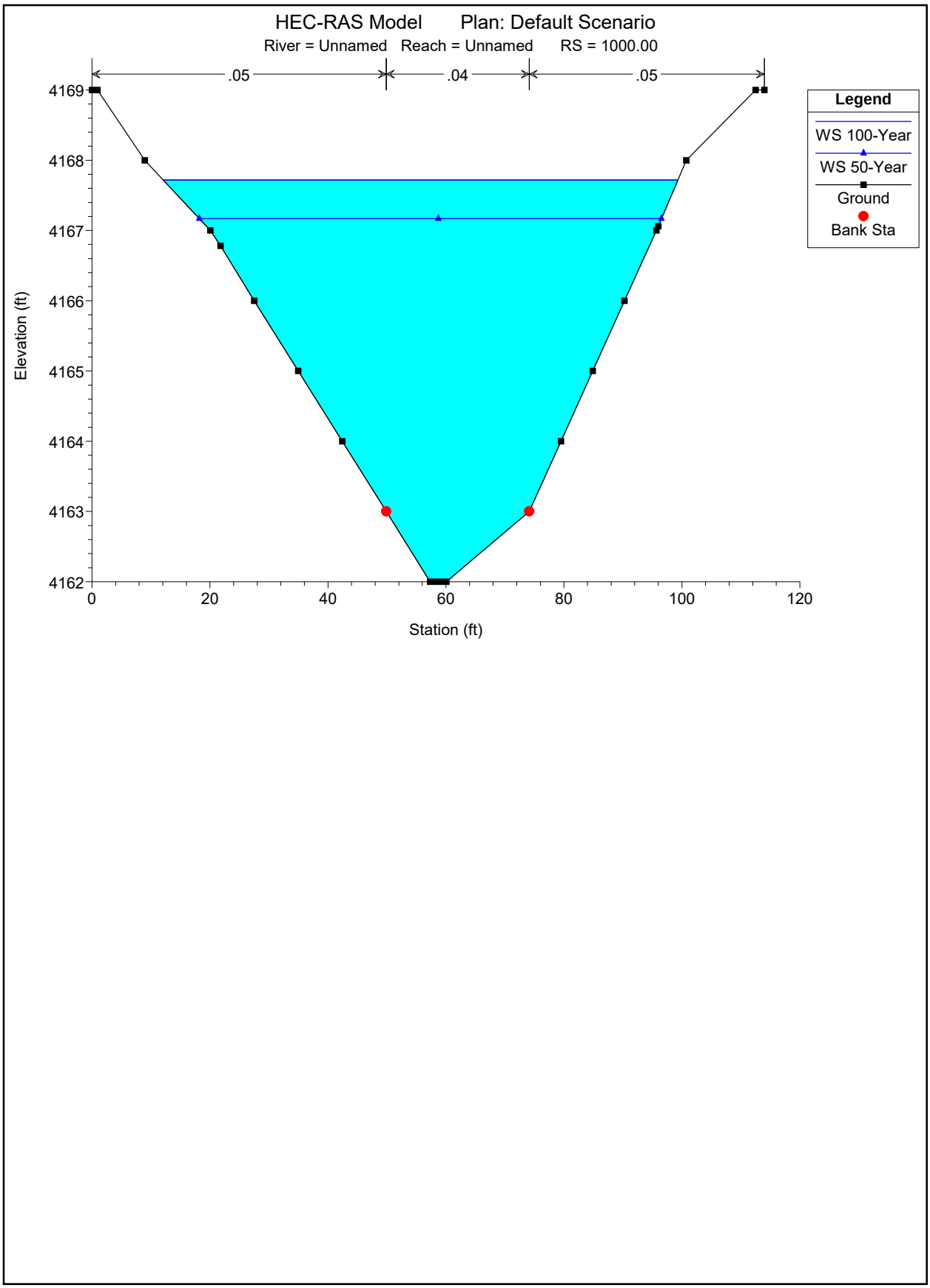
.05
.04
.05
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
4176
4174
4172
4170
4168
4166
0
20
40
60
80
100
120
140


HEC-RAS Model Plan: Default Scenario
River = Unnamed Reach = Unnamed RS = 1081.47
.05
.04
.05
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
4172
4171
4170
4169
4168
4167
4166
4165
0
20
40
60
80
100
120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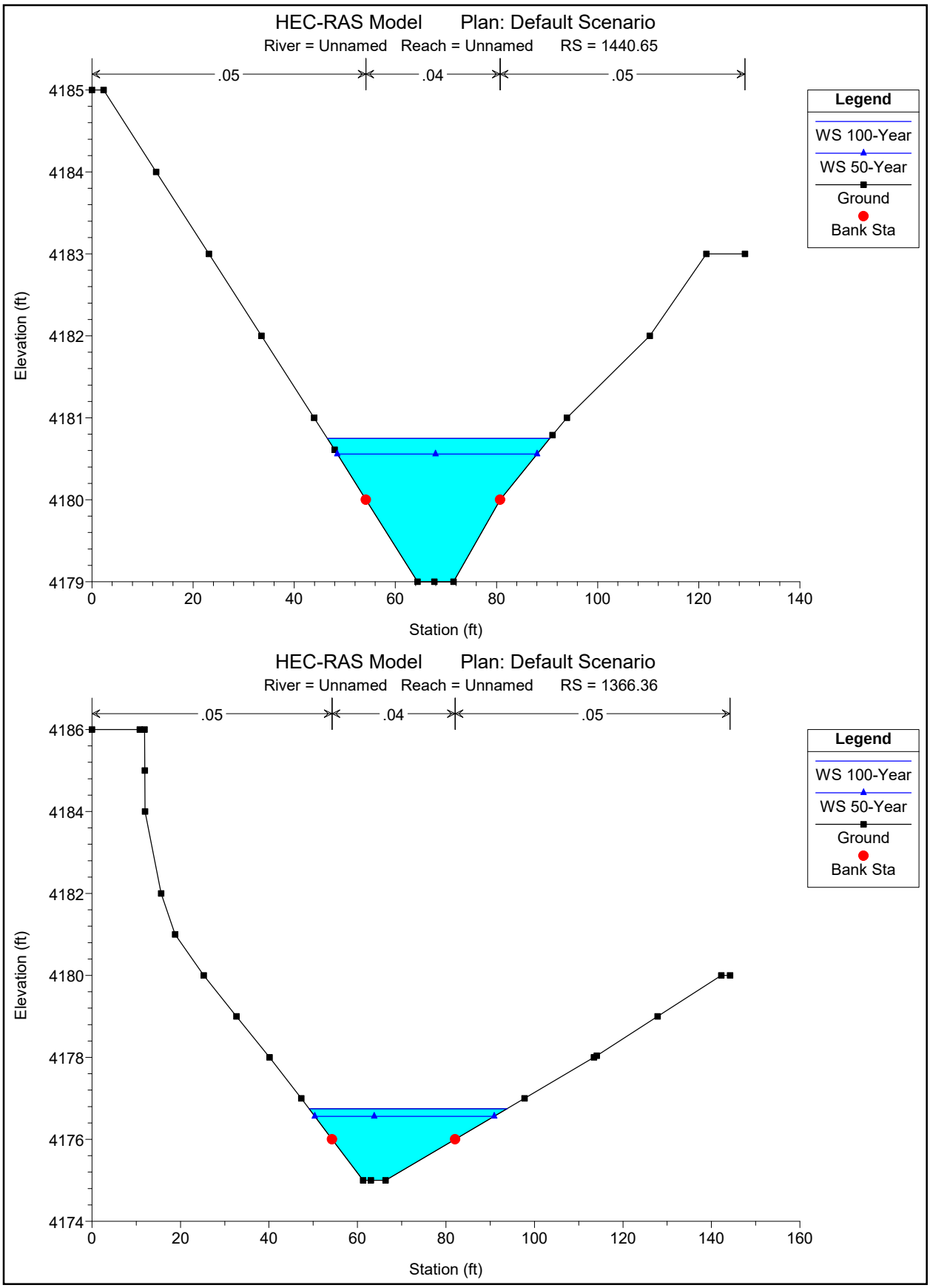
Plan: Default Scenario
River = Unnamed
Reach = Unnamed
RS = 1000.00
.05
.04
.05
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
4169
4168
4167
4166
4165
4164
4163
4162
0
20
40
60
80
100
120

Proposed HEC-RAS
Profile and Cross-Section Results

HEC-RAS Plan: Default Scenario River: Unnamed Reach: Unnamed

Reach	River Sta	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)	
Unnamed	1000.00	240.00	4162.00	4167.72	4163.90	4167.74	0.000122	1.24	271.89	87.27	0.10
Unnamed	1000.00	190.00	4162.00	4167.17	4163.69	4167.19	0.000121	1.15	226.32	78.35	0.09
Unnamed	1081.47	240.00	4165.00	4167.43	4167.27	4167.91	0.010906	6.12	50.64	42.99	0.76
Unnamed	1081.47	190.00	4165.00	4167.05	4167.05	4167.62	0.016042	6.44	35.77	35.26	0.89
Unnamed	1155.75	240.00	4167.00	4169.03	4169.03	4169.64	0.016994	6.56	42.56	39.45	0.92
Unnamed	1155.75	190.00	4167.00	4168.83	4168.83	4169.38	0.017936	6.15	34.87	35.66	0.92
Unnamed	1229.31	240.00	4169.00	4170.81	4170.81	4171.38	0.018677	6.20	42.36	41.20	0.94
Unnamed	1229.31	190.00	4169.00	4170.62	4170.62	4171.13	0.019963	5.81	34.96	37.91	0.95
Unnamed	1308.24	240.00	4172.00	4173.86	4173.86	4174.44	0.017434	6.29	42.85	41.29	0.92
Unnamed	1308.24	190.00	4172.00	4173.66	4173.66	4174.19	0.019032	5.95	34.81	37.28	0.94
Unnamed	1366.36	240.00	4175.00	4176.75	4176.75	4177.30	0.018353	6.10	43.52	44.72	0.93
Unnamed	1366.36	190.00	4175.00	4176.56	4176.56	4177.06	0.019684	5.72	35.67	40.54	0.94
Unnamed	1440.65	240.00	4179.00	4180.75	4180.75	4181.31	0.018057	6.18	43.18	43.96	0.93
Unnamed	1440.65	190.00	4179.00	4180.56	4180.56	4181.07	0.019384	5.80	35.27	39.53	0.94


HEC-RAS Model Plan: Default Scenario
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.05
.04
.05
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Default Scenario
River = Unnamed Reach = Unnamed RS = 1366.36
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.04
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Legend
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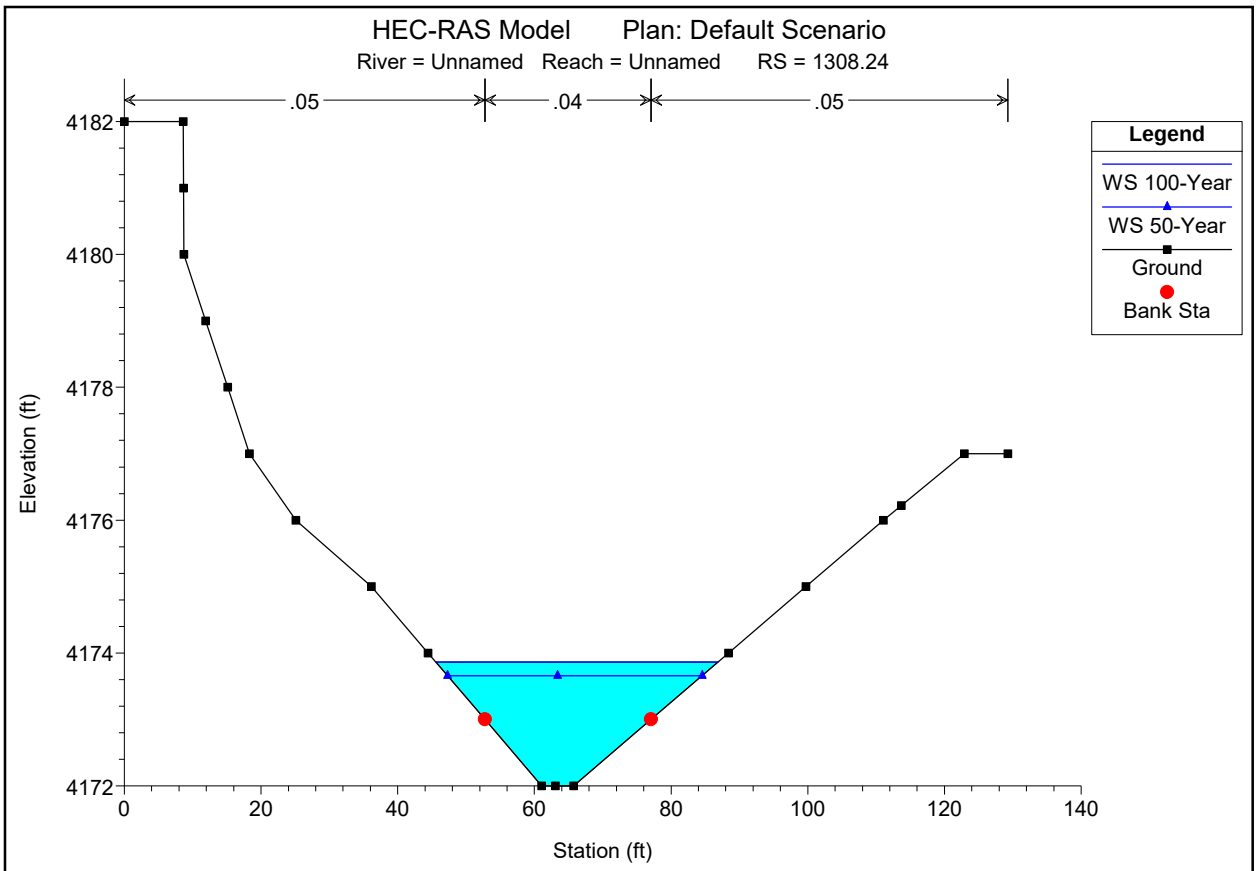
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)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.04
.05
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
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4180
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60
80
100
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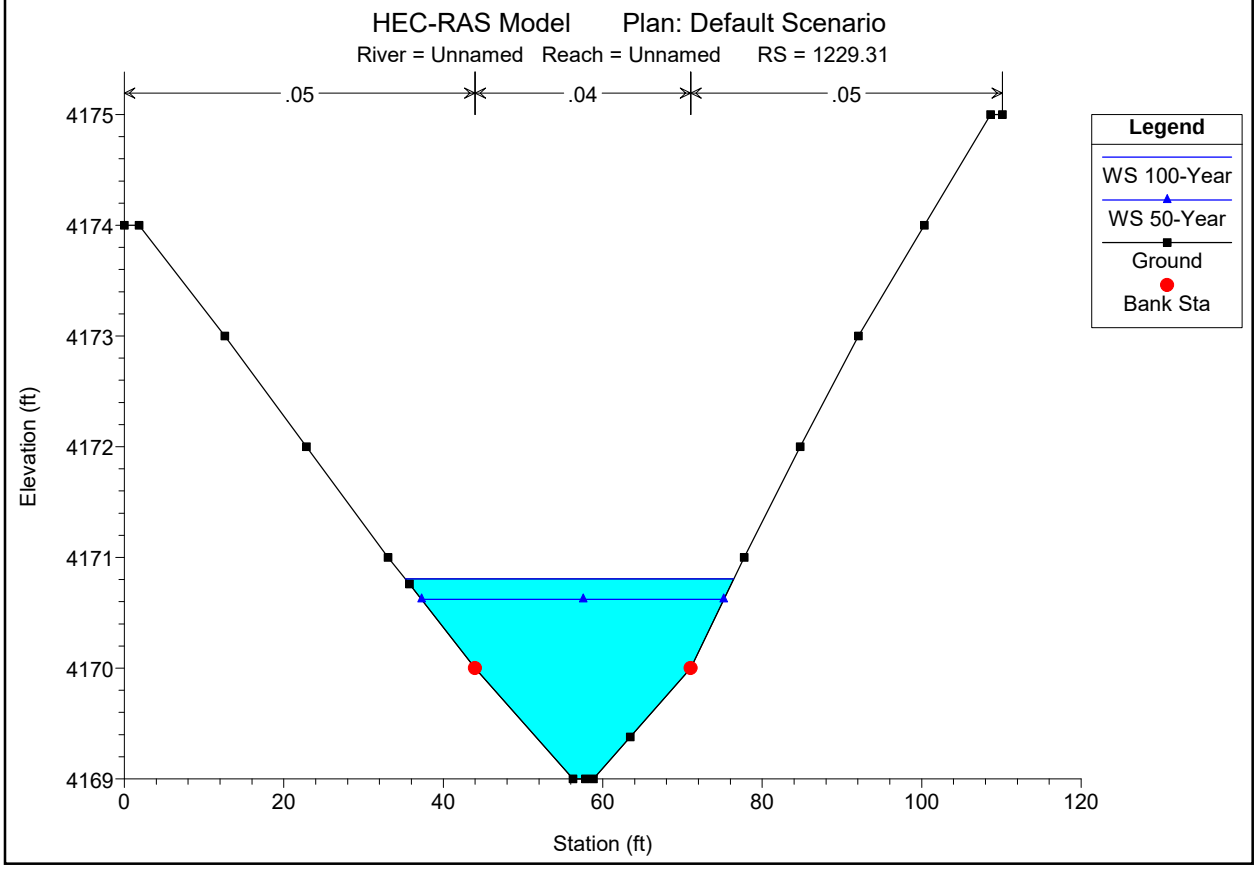
140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Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
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4174
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0
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40
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100
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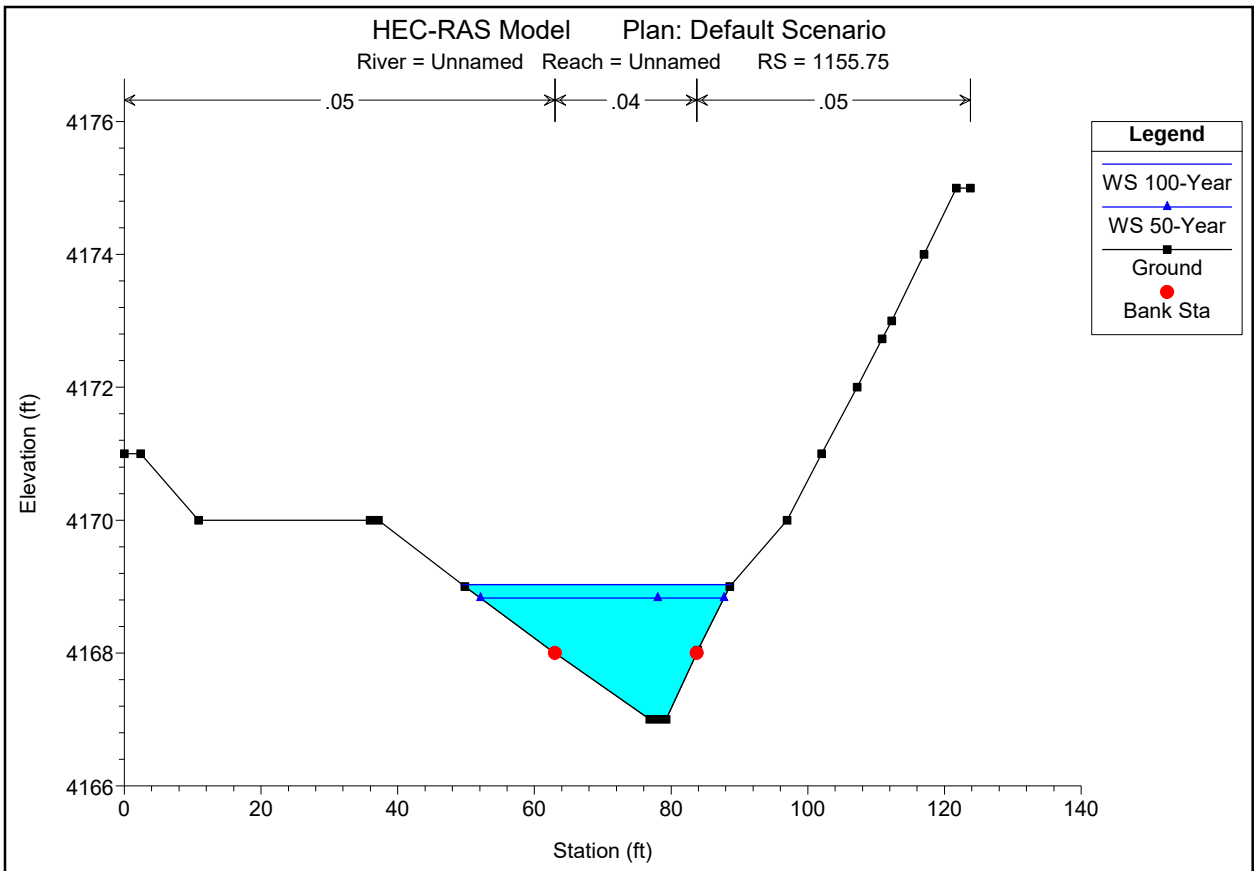
HEC-RAS Model Plan: Default Scenario
River = Unnamed Reach = Unnamed RS = 1155.75
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Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
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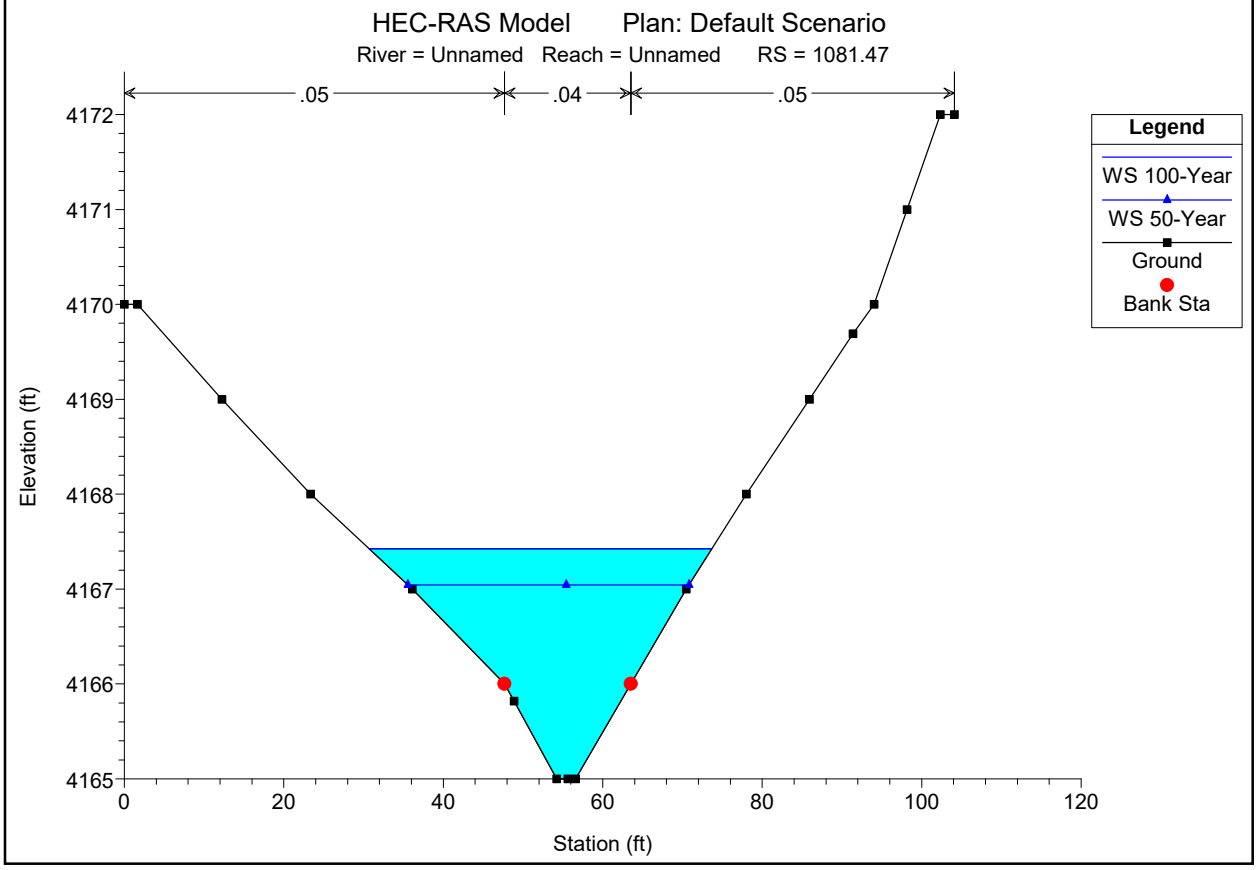
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.04
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Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
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4171
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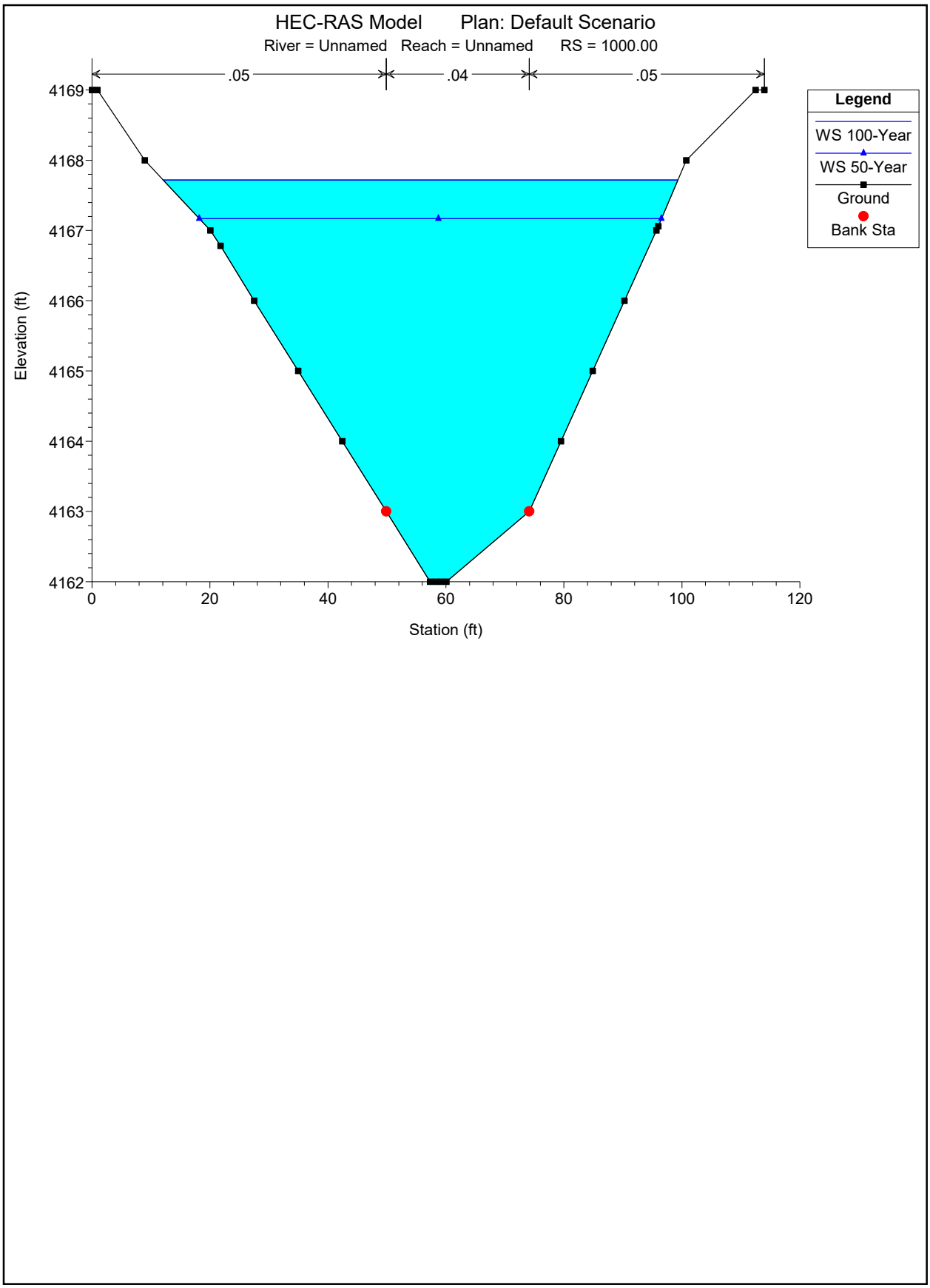
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Plan: Default Scenario
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Reach = Unnamed
RS = 1000.00
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.05
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
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4168
4167
4166
4165
4164
4163
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40
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80
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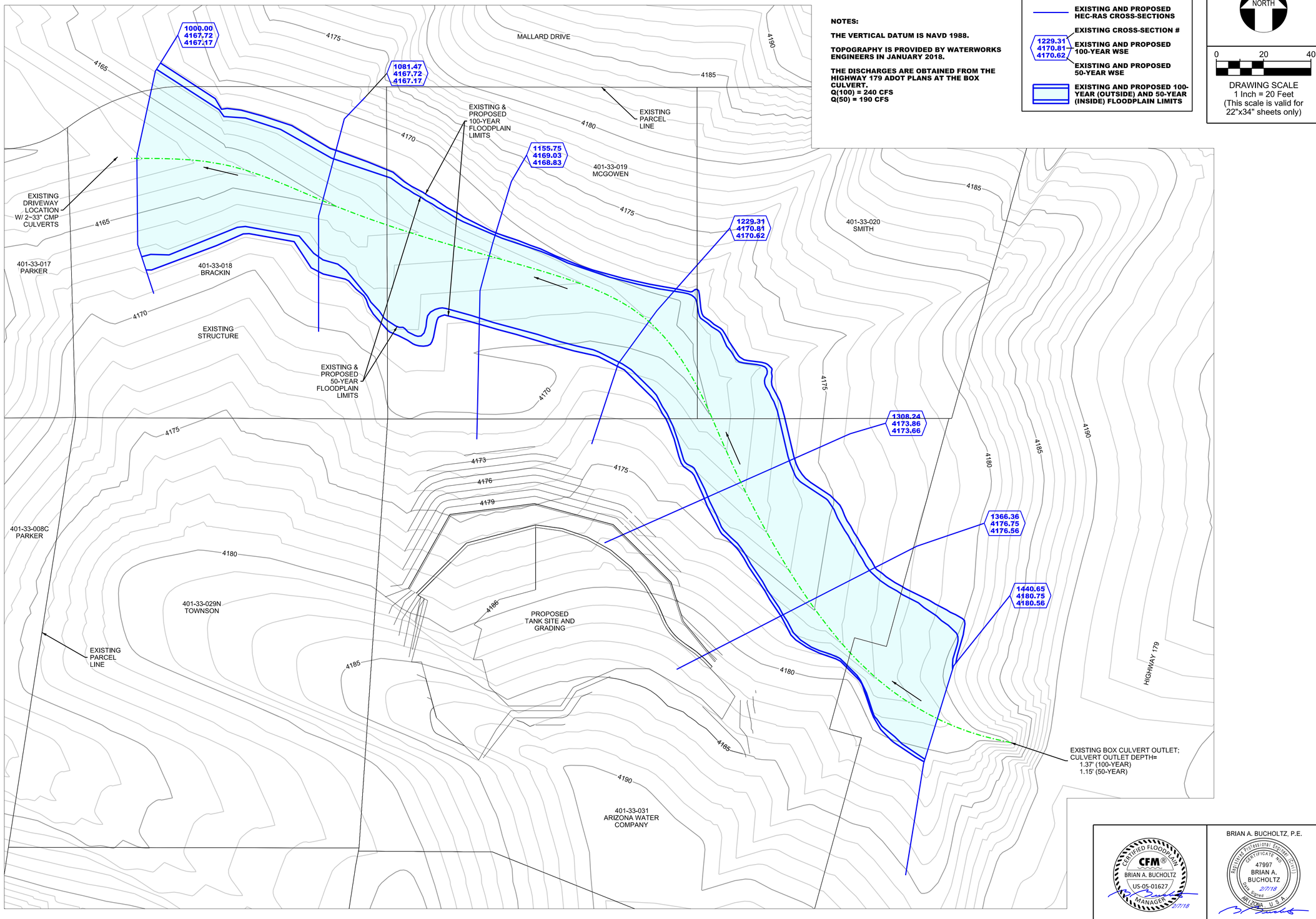

NOTES:

THE VERTICAL DATUM IS NAVD 1988.

TOPOGRAPHY IS PROVIDED BY WATERWORKS ENGINEERS IN JANUARY 2018.

THE DISCHARGES ARE OBTAINED FROM THE HIGHWAY 179 ADOT PLANS AT THE BOX CULVERT.
Q(100) = 240 CFS
Q(50) = 190 CFS

LEGEND

- **EXISTING AND PROPOSED HEC-RAS CROSS-SECTIONS**
- **EXISTING CROSS-SECTION #** (1229.31 / 4170.81 / 4170.62)
- **EXISTING AND PROPOSED 100-YEAR WSE**
- **EXISTING AND PROPOSED 50-YEAR WSE**
- **EXISTING AND PROPOSED 100-YEAR (OUTSIDE) AND 50-YEAR (INSIDE) FLOODPLAIN LIMITS**

NORTH

0 20 40

DRAWING SCALE
1 Inch = 20 Feet
(This scale is valid for 22"x34" sheets only)

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY.

DESIGN	DRAWN	CHECKED	APPROVED
BAB	BAB	SAL	BAB

NO.	DATE	REVISION	BY	APVD
-	-	-	-	-

LYON ENGINEERING
Civil Engineers • Land Surveyors
1650 Willow Creek Rd, Prescott, AZ 86301
Phone: (928) 775-1750, Fax: (928) 776-0685

EAST SEDONA WATER STORAGE TANK SITE

CIVIL

EXISTING AND PROPOSED FLOODPLAIN EXHIBIT

CERTIFIED FLOODPLAIN MANAGER CFM® BRIAN A. BUCHOLTZ US-05-01627 2/7/18

BRIAN A. BUCHOLTZ, P.E.
REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 47997 BRIAN A. BUCHOLTZ
Date Signed 2/7/18
ARIZONA, U.S.A.
EXPIRES 6/30/2020

DATE: FEBRUARY 2018
LYON PROJECT #: 869-05
DRAWING NUMBER: FP.01
SHEET 1 OF 1

FILENAME: G:\Projects\869_Waterworks\869-05 East Sedona Water Tank\CADD\DGN\Drainage\Sedona-Tank-Drainage.dgn

SCALE: 1:20

Appendix C Runoff Calculations

Yavapai County Drainage Policies & Standards	V=C(P/12)A
2 Yr- 1 Hr Storm Rainfall Depth, inch	0.86

Sedona Precipitation Frequency Estimates

Existing						
Description - Existing	**Area, sqft**	**Area, acres**	**C - Value**	**Peak Discharge, cfs**	**Runoff Volume, acre-ft**	**Runoff Volume, cft**
Grass and Brush - Area 1	4,400	0.10	0.20	0.02	0.00	63
Grass and Brush - Area 2	41,338	0.95	0.20	0.16	0.01	593
Pavement & Rooftopes						
Roadway/Concrete Pads	0	0.00		0.00	0.000	0
Reservoir	0	0.00		0.00	0.000	0
Reservoir 10 ft backfill ring						
Total	**45,738**	**1.05**	**0.20**	**0.18**	**0.02**	**656**

Future						
Description - Proposed	**Area, sqft**	**Area, acres**	**C - Value**	**Peak Discharge, cfs**	**Runoff Volume, acre-ft**	**Runoff Volume, cft**
Grass and Brush - Area 1	4,400	0.10	0.20	0.02	0.00	63
Grass and Brush - Area 2	20,356.84	0.47	0.20	0.08	0.01	292
Hillslope Sonoran Desert - Landscaped area above reservoir	2,838	0.07	0.20	0.01	0.001	41
Pavement & Rooftopes						
Roadway/Concrete Pads	360	0.01	0.88	0.01	0.001	23
Reservoir	7,186	0.16	1.00	0.14	0.012	515
Reservoir 10 ft backfill ring	10,598	0.24	0.50	0.10	0.01	380
Total	**45,738**	**1.05**	**0.40**	**0.36**	**0.030**	**1,313**
Excess Runoff - Area 1 (Retention Volume Required, cft)						**0**
Excess Runoff - Area 2 (Retention Volume Required, cft)						**657**
Excess Runoff (Retention Volume Required, cft)						**657**

Yavapai County Drainage Policies & Standards	V=C(P/12)A
10 Yr- 1 Hr Storm Rainfall Depth, inch	1.41

Sedona Precipitation Frequency Estimates

Existing						
Description - Existing	**Area, sqft**	**Area, acres**	**C - Value**	**Peak Discharge, cfs**	**Runoff Volume, acre-ft**	**Runoff Volume, cft**
Grass and Brush - Area 1	4,400	0.10	0.30	0.04	0.00	155
Grass and Brush - Area 2	41,338	0.95	0.30	0.40	0.03	1,457
Pavement & Rooftopes						
Roadway/Concrete Pads	0	0.00		0.00	0.000	0
Reservoir	0	0.00		0.00	0.000	0
Reservoir 10 ft backfill ring						
Total	**45,738**	**1.05**	**0.30**	**0.44**	**0.0**	**1,612**

Future						
Description - Proposed	**Area, sqft**	**Area, acres**	**C - Value**	**Peak Discharge, cfs**	**Runoff Volume, acre-ft**	**Runoff Volume, cft**
Grass and Brush - Area 1	4,400	0.10	0.30	0.04	0.00	155
Grass and Brush - Area 2	20,357	0.47	0.30	0.20	0.02	718
Hillslope Sonoran Desert - Landscaped area above reservoir	2,838	0.07	0.30	0.03	0.00	100
Pavement & Rooftopes						
Roadway/Concrete Pads	360	0.01	0.88	0.01	0.001	37
Reservoir	7,186	0.16	1.00	0.23	0.019	844
Reservoir 10 ft backfill ring	10,598	0.24	0.50	0.17	0.01	623
Total	**45,738**	**1.05**	**0.46**	**0.68**	**0.06**	**2,477**
Excess Runoff - Area 1 (Retention Volume Required, cft)						**0**
Excess Runoff - Area 2 (Retention Volume Required, cft)						**865**
Excess Runoff (Retention Volume Required, cft)						**865**

Yavapai County Drainage Policies & Standards	V=C(P/12)A
25 Yr- 1 Hr Storm Rainfall Depth, inch	2.1

Sedona Precipitation Frequency Estimates

Existing						
Description - Existing	**Area, sqft**	**Area, acres**	**C - Value**	**Peak Discharge, cfs**	**Runoff Volume, acre-ft**	**Runoff Volume, cft**
Grass and Brush - Area 1	4,400	0.10	0.45	0.10	0.01	347
Grass and Brush - Area 2	41,338	0.95	0.45	0.90	0.07	3,255
Pavement & Rooftopes						
Roadway/Concrete Pads	0	0.00		0.00	0.000	0
Reservoir	0	0.00		0.00	0.000	0
Reservoir 10 ft backfill ring						
Total	**45,738**	**1.05**	**0.45**	**0.99**	**0.1**	**3,602**

Future						
Description - Proposed	**Area, sqft**	**Area, acres**	**C - Value**	**Peak Discharge, cfs**	**Runoff Volume, acre-ft**	**Runoff Volume, cft**
Grass and Brush - Area 1	4,400	0.10	0.45	0.10	0.01	347
Grass and Brush - Area 2	20,357	0.47	0.45	0.44	0.04	1,603
Hillslope Sonoran Desert - Landscaped area above reservoir	2,838	0.07	0.45	0.06	0.01	223
Pavement & Rooftopes						
Roadway/Concrete Pads	360	0.01	0.88	0.02	0.001	55
Reservoir	7,186	0.16	1.00	0.35	0.029	1,258
Reservoir 10 ft backfill ring	10,598	0.24	0.50	0.26	0.02	927
Total	**45,738**	**1.05**	**0.55**	**1.22**	**0.10**	**4,413**
Excess Runoff - Area 1 (Retention Volume Required, cft)						**0**
Excess Runoff - Area 2 (Retention Volume Required, cft)						**811**
Excess Runoff (Retention Volume Required, cft)						**811**

Yavapai County Drainage Policies & Standards	V=C(P/12)A	
100 Yr- 1 Hr Storm Rainfall Depth, inch	2.84	City of Sedona Precipitation Frequency Estimates

Existing						
Description – Existing	**Area, sqft**	**Area, acres**	**C - Value**	**Peak Discharge, cfs**	**Runoff Volume, acre-ft**	**Runoff Volume, cft**
Grass and Brush - Area 1	4,400	0.10	0.55	0.16	0.01	573
Grass and Brush - Area 2	41,338	0.95	0.55	1.48	0.12	5,381
Pavement & Rooftops						
Roadway/Concrete Pads	0	0.00		0.00	0.000	0
Reservoir	0	0.00		0.00	0.000	0
Reservoir 10 ft backfill ring						
Total	**45,738**	**1.05**	**0.55**	**1.64**	**0.1**	**5,954**

Future						
Description - Proposed	**Area, sqft**	**Area, acres**	**C - Value**	**Peak Discharge, cfs**	**Runoff Volume, acre-ft**	**Runoff Volume, cft**
Grass and Brush - Area 1	4,400	0.10	0.55	0.16	0.01	573
Grass and Brush - Area 2	20,357	0.47	0.55	0.73	0.06	2,650
Hillslope Sonoran Desert - Landscaped area above reservoir	2,838	0.07	0.55	0.10	0.01	369
Pavement & Rooftops						
Roadway/Concrete Pads	360	0.01	0.88	0.02	0.002	75
Reservoir	7,186	0.16	1.00	0.47	0.039	1,701
Reservoir 10 ft backfill ring	10,598	0.24	0.50	0.35	0.03	1,254
Total	**45,738**	**1.05**	**0.61**	**1.82**	**0.15**	**6,622**
Excess Runoff - Area 1 (Retention Volume Required, cft)						**0**
Excess Runoff - Area 2 (Retention Volume Required, cft)						**668**
Excess Runoff (Retention Volume Required, cft)						**668**

Yavapai County Drainage Policies & Standards	V=C(P/12)A	
100 Yr- 1 Hr Storm Rainfall Depth, inch	2.84	Sedona Precipitation Frequency Estimates

Existing						
Description - Existing	**Area, sqft**	**Area, acres**	**C - Value**	**Peak Discharge, cfs**	**Runoff Volume, acre-ft**	**Runoff Volume, cft**
Grass and Brush - Area 1	4,400	0.10	0.70	0.20	0.02	729
Grass and Brush - Area 2	41,338	0.95	0.70	1.89	0.16	6,848
Pavement & Rooftopes						
Roadway/Concrete Pads	0	0.00		0.00	0.000	0
Reservoir	0	0.00		0.00	0.000	0
Reservoir 10 ft backfill ring						
Total	**45,738**	**1.05**	**0.70**	**2.09**	**0.2**	**7,577**

Future						
Description - Proposed	**Area, sqft**	**Area, acres**	**C - Value**	**Peak Discharge, cfs**	**Runoff Volume, acre-ft**	**Runoff Volume, cft**
Grass and Brush - Area 1	4,400	0.10	0.70	0.20	0.02	729
Grass and Brush - Area 2	20,357	0.47	0.70	0.93	0.08	3,372
Hillslope Sonoran Desert - Landscaped area above reservoir	2,838	0.07	0.70	0.13	0.01	470
Pavement & Rooftopes						
Roadway/Concrete Pads	360	0.01	0.88	0.02	0.002	75
Reservoir	7,186	0.16	1.00	0.47	0.039	1,701
Reservoir 10 ft backfill ring	10,598	0.24	0.50	0.35	0.03	1,254
Total	**45,738**	**1.05**	**0.70**	**2.09**	**0.17**	**7,601**
Excess Runoff - Area 1 (Retention Volume Required, cft)						**0**
Excess Runoff - Area 2 (Retention Volume Required, cft)						**24**
Excess Runoff (Retention Volume Required, cft)						**24**

Yavapai County Drainage Policies & Standards	V=C(P/12)A
100 Yr- 1 Hr Storm Rainfall Depth, inch	2.84

Sedona Precipitation Frequency Estimates

Existing						
Description - Existing	**Area, sqft**	**Area, acres**	**C - Value**	**Peak Discharge, cfs**	**Runoff Volume, acre-ft**	**Runoff Volume, cft**
Grass and Brush - Area 1	4,400	0.10	0.25	0.07	0.01	260
Grass and Brush - Area 2	41,338	0.95	0.25	0.67	0.06	2,446
Pavement & Rooftopes						
Roadway/Concrete Pads	0	0.00		0.00	0.000	0
Reservoir	0	0.00		0.00	0.000	0
Reservoir 10 ft backfill ring						
Total	**45,738**	**1.05**	**0.25**	**0.75**	**0.1**	**2,706**

Future						
Description - Proposed	**Area, sqft**	**Area, acres**	**C - Value**	**Peak Discharge, cfs**	**Runoff Volume, acre-ft**	**Runoff Volume, cft**
Grass and Brush - Area 1	4,400	0.10	0.25	0.07	0.01	260
Grass and Brush - Area 2	20,357	0.47	0.25	0.33	0.03	1,204
Hillslope Sonoran Desert - Landscaped area above reservoir	2,838	0.07	0.25	0.05	0.00	168
Pavement & Rooftopes						
Roadway/Concrete Pads	360	0.01	0.88	0.02	0.002	75
Reservoir	7,186	0.16	1.00	0.47	0.039	1,701
Reservoir 10 ft backfill ring	10,598	0.24	0.50	0.35	0.03	1,254
Total	**45,738**	**1.05**	**0.43**	**1.28**	**0.11**	**4,662**
Excess Runoff - Area 1 (Retention Volume Required, cft)						**0**
Excess Runoff - Area 2 (Retention Volume Required, cft)						**1,956**
Excess Runoff (Retention Volume Required, cft)						**1,956**