City of Pflugerville

Travis and Williamson Counties, Texas

Community Park site

Wilbarger Creek Modeling

and

Floodplain Delineation Project

Technical Memorandum

Engineering Analysis – Hydrology and Hydraulics

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# Wilbarger Creek and Tributary Reach

*Submitted to:*

**The City of Pflugerville, Texas**

*Prepared by:*

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| APAI | Alan Plummer Associates, Inc. |
| City | City of Pflugerville |
| DEM | Digital Elevation Model |
| GIS | Geographic Information System |
| LiDAR | Light Detection and Ranging |
| NRCS | Natural Resources Conservation Services |
| PRF | Peak Rate Factor |
| SCS | Soil Conservation Service |
| Tc | Time of Concentration |
| TR-55 | Technical Release 55 |

# 1 Task Summary

## 1.1 Introduction

The Pflugerville 243 Acre Community Park modeling and floodplain delineation project is located in Travis County, in the Wilbarger Creek watershed. The watershed is primarily suburban in the northwest and agricultural throughout the remainder. Bordered on the west by the Gilleland Creek watershed, the study area watershed has a drainage area of approximately 23 square miles. The climate in the area is sub-tropical, and average rainfall totals 36 inches per year. The approximately 11,700 foot reach of Wilbarger Creek contained within the study area is noted as Zone A (approximate floodplain boundary) on FEMA Panel 48491CO675E, thus existing hydrologic (HEC-MHS) and hydraulic (HEC-RAS) models are not available from FEMA.

# 2 Methodology

## 2.1 Study Details

### 2.1.1 Scope

Hydrologic and hydraulic analyses were completed for the study area identified in the contract scope of services. The modeling for this project included the annual chance events based on peak discharges computed under the Pflugerville 243 Acre Community Park Modeling and Mapping Scope of Services. The hydrologic methods for this analysis included the use of U.S. Army Corps of Engineers HEC-GeoHMS and HEC-HMS softwares to develop a high-level model of existing and fully developed (future) conditions in the watershed. The hydraulic methods included the U.S. Army Corps of Engineers HEC-GeoRAS and HEC-RAS softwares for a detailed analysis of the approximately 11,700 of Wilbarger Creek channel and 1,100 feet of tributary channel contained within the 243 acre study area. Field reconnaissance was conducted to define Manning's "n" values and other factors that affect conveyance and to lay out hydraulic model cross sections. Digital 2-ft contours were used to prepare the topographic elements of both analyses. These analyses were used to establish flood elevations for the 50%, 20%, 10%, 4%, 2%, 1%, and 0.2% recurrence intervals. In accordance with City of Pflugerville ordinance, the floodway will be developed for the study area.

### 2.1.2 Evaluation of Findings

The computed peak flow rates were compared to available gage data or other reference watersheds in this region. Coordination took place with staff from Schrickel, Rollins, and Associates, Inc. and the City of Pflugerville to evaluate floodplain delineation findings and receive feedback on the hydrologic and hydraulic models. The models were revised as necessary, and the floodplain boundaries were updated on the proposed park site map.

### 2.1.3 Deliverables

A technical memorandum was prepared to summarize the study findings and recommendations.

Hydrologic HEC-HMS models for the 50%, 20%, 10%, 4%, 2%, 1%, and 0.2% recurrence intervals under existing and future land use conditions were constructed. Hydraulic HEC-RAS models for the 50%, 20%, 10%, 4%, 2%, 1%, and 0.2% recurrence intervals under existing and future land use conditions were constructed, and digital profiles of the 1% annual-chance water-surface elevations representing existing conditions were generated. Digital copies of all modeling files (input and output) were provided.

For the modeling based in a Geographic Information System (GIS), deliverables included all input and output data, intermediate data processing products, and GIS data layers.

#### 2.1.4 Software

The following software versions were used in the analysis: U. S. Army Corps of Engineers HEC-HMS version 4.1, HEC-RAS version 5.0.1, HEC-GeoHMS version 10.2, and HEC-GeoRAS version 10.2.

## 2.2 **Model Data and Parameters**

#### 2.2.1 Topographic Data

The primary source of elevation data used to develop the hydrologic and hydraulic studies was the City of Pflugerville's 2-ft digital contour dataset derived from light detection and ranging (LiDAR) data collected in 2015.

#### 2.2.2 Land Use Data

The land classification data used to develop the site hydrology was received from the City of Pflugerville. Both existing and future land use datasets were incorporated into the analyses. The existing and future land use categories as received were re-classified using the Natural Resources Conservation Services (NRCS) land use categories. This allowed the City of Pflugerville data to be used for curve number development. The re-classified existing and future land use data are shown in Figures 1 and 2, respectively.

#### 2.2.3 Survey Data

Field reconnaissance of the proposed Community Park site was conducted on March 29, 2016. Digital photos were taken to document the existing site conditions and surface cover. Representative photos from the field reconnaissance are provided in Figures 3 thru 6.

#### 2.2.4 Manning's Roughness Coefficients

Manning's "n" values were assigned to both the hydrologic and hydraulic models. Manning's values were used to compute times of concentration for the hydrologic model and to reflect variable channel and overbank roughness in the hydraulic model. Data and photos collected during field reconnaissance of the study area documented the existing site conditions and surface cover. The Wilbarger Creek channel and overbanks generally contained dense underbrush and multiple fallen trees. Open space

**Figure 1: Land Use, Existing**

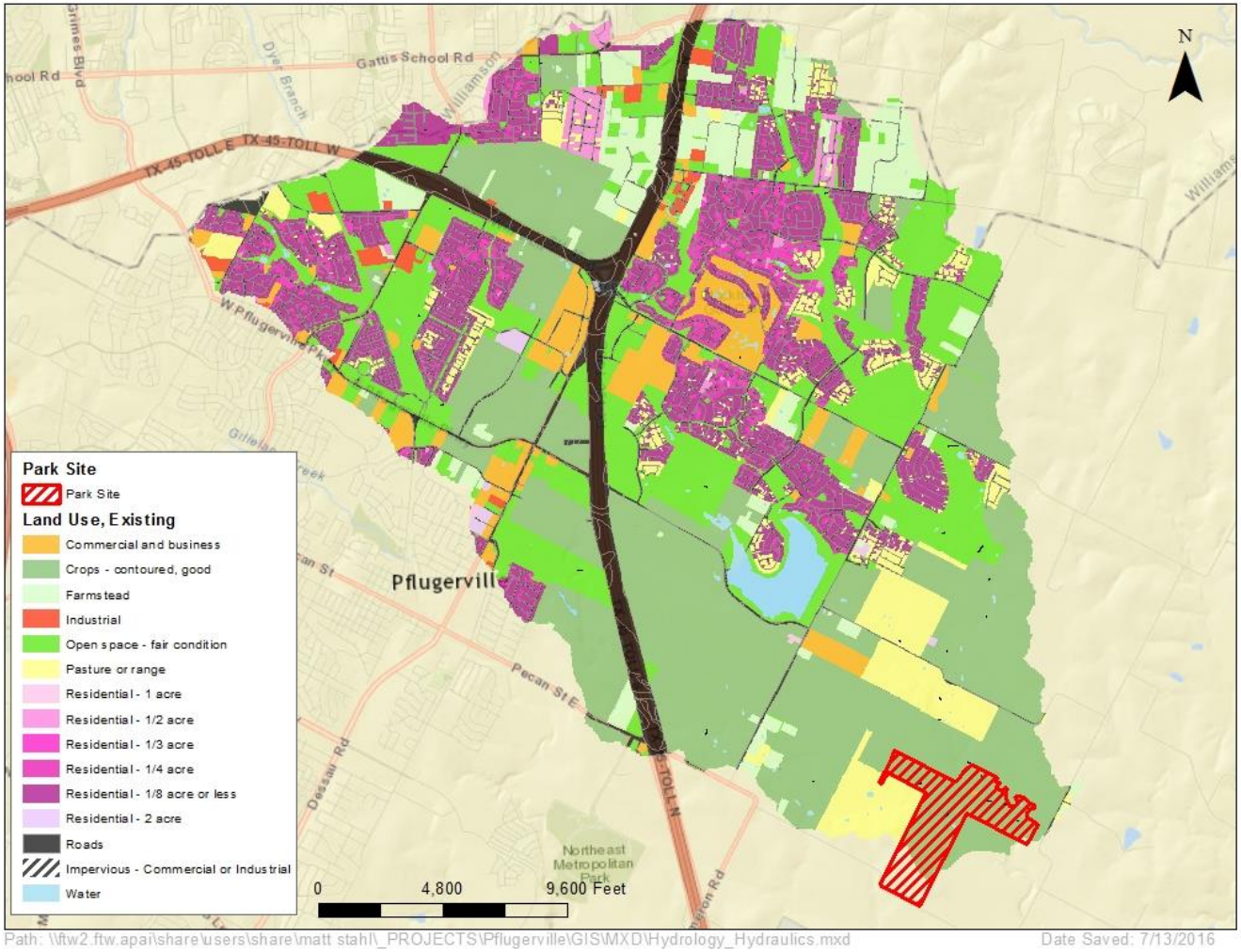


**Figure 2: Land Use, Future**

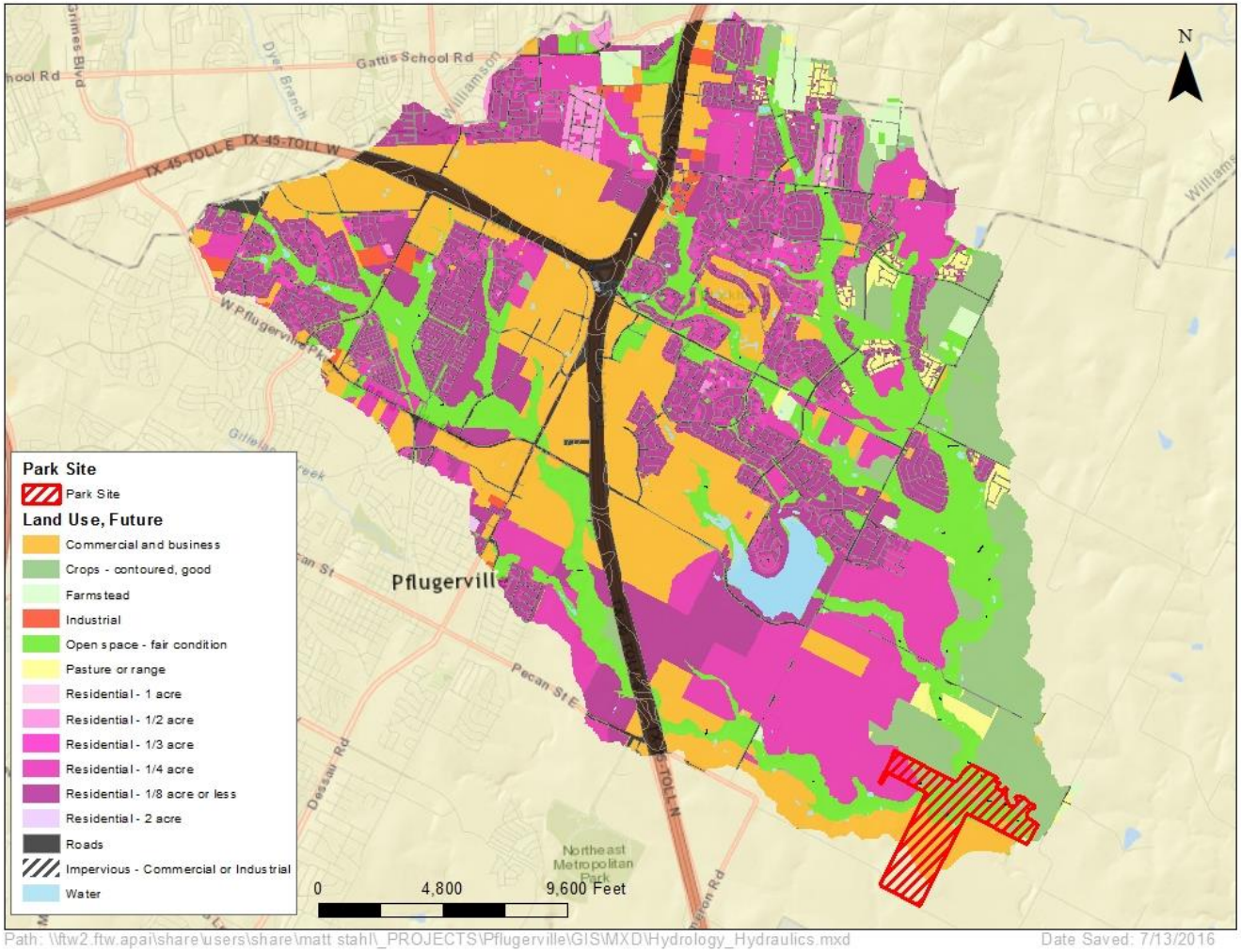


**Figure 3: Looking upstream from low water crossing (image 002)**

**Figure 4: Creek log jam (image 005)**

**Figure 5: Typical channel vegetation (image 008)**

**Figure 6: Middle park area, looking downstream (image 012)**

with grass and/or crop cover was present beyond much of the overbank areas. For Manning's roughness assignment, visual inspection and analysis of ortho-photos from GIS were used to supplement the field reconnaissance photos.

Manning's "n" values were compared to the adjacent watershed, Gilleland Creek, to verify consistency within the eastern Travis County area. In addition, the Manning's "n" values were computed by methodology found in the City of Austin Drainage Criteria Manual, Section 6.3.

The Manning's roughness values used in the hydrologic model ranged from 0.015 to 0.24 (sheet flow) and 0.013 to 0.06 (channelized flow). The Manning's roughness values used in the hydraulic model ranged from 0.07 (channel) to 0.1 (overbank). These Manning's values are summarized in Table 1.

**Table 1: Manning's Coefficients, Hydrologic and Hydraulic Models**

| Model | Sheet flow "n" values | Channel "n" values | Overbank "n" values |
|---|---|---|---|
| Hydrologic Model* | 0.015-0.24 | 0.013-0.06 | - |
| Hydraulic Model | - | 0.07 | 0.1 |

**Used for time of concentration computation. Per the NRCS TR-55 procedures, sheet flow roughness values are distinct from typical channel values.*

## 2.3 Hydrologic Model

### 2.3.1 Geometric Data

The preliminary draft of hydrology inputs to the model used a digital elevation model (DEM) derived from the United States Geological Survey (USGS) 10 meter contours. Refinement of the hydrology inputs was performed using the best available digital elevation data, 2-ft contours from 2015 LiDAR. From the detailed DEM, a hydrologically-correct DEM surface was developed in GIS. Generating the hydrologically-correct surface involved filling all sinks in the raw DEM and generating both flow direction and flow accumulation DEM grids. Based on these hydrologically-correct DEMs, drainage sub-basins were delineated in GIS and flow paths were developed. The resulting sub-basins are shown in Figure 7.

### 2.3.2 Curve Number

Parameters for the NRCS curve number method were developed through the use of GIS and spreadsheet tools. The depth of rainfall excess, initial abstractions (i.e. interception and depression storage, and evapotranspiration), and potential maximum retention of the soil were developed for each sub-basin in the study area watershed. To establish the potential maximum retention of the soil, a curve number is required for each sub-basin. The curve number, a dimensionless number between 0 and 100, is a function of soil classification, land use, antecedent moisture condition, and other factors which impact runoff and retention. The pertinent NRCS soil classification and land use values from TR-55 (Table 2) were used as input to develop curve numbers for the study area. These land use categories were used to re-classify the existing and future land classifications of the study area in GIS.

**Figure 7: Sub-basins**

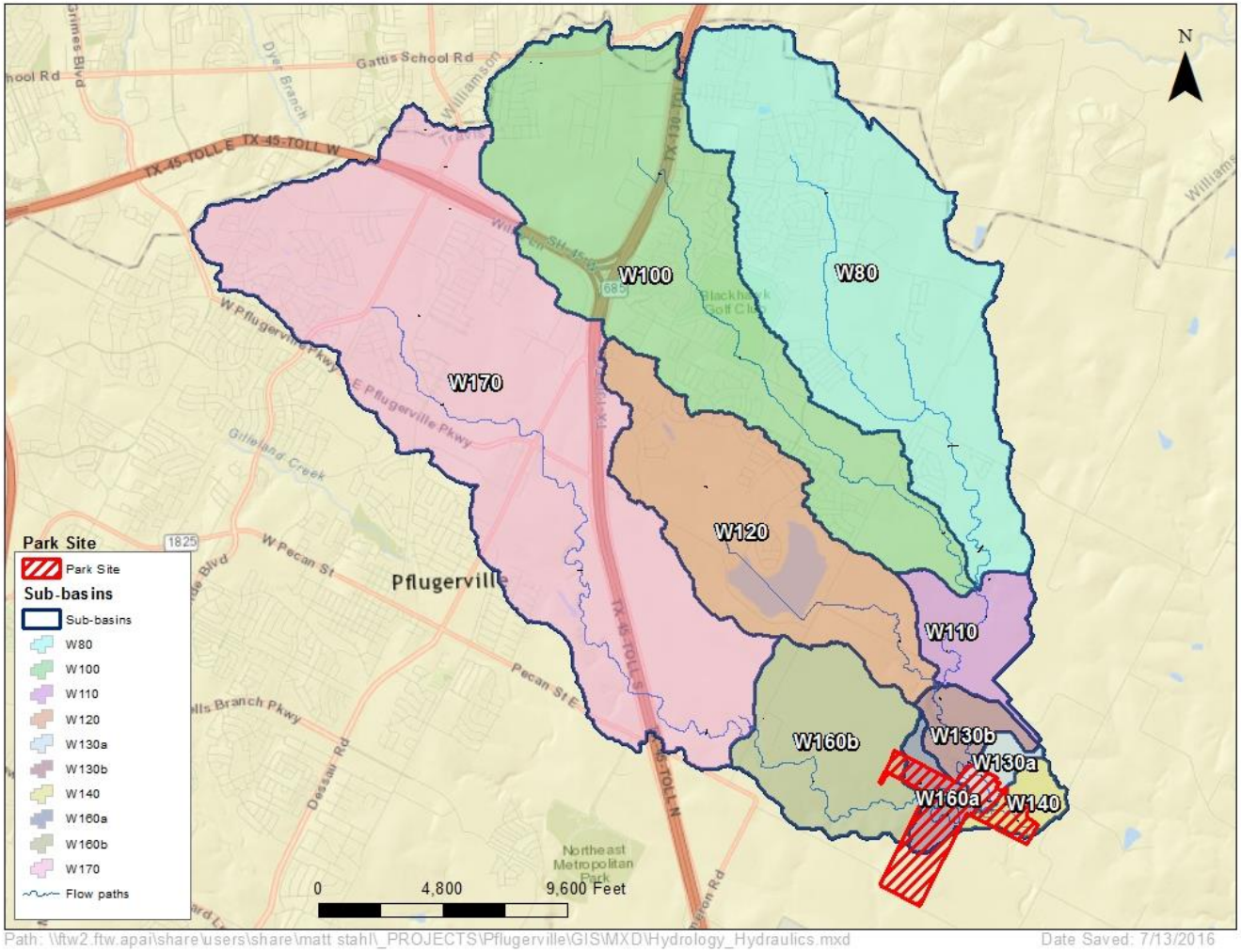


**Table 2: NRCS Curve Number Lookup**

| Land Use Value | Description | A | B | C | D |
|---|---|---|---|---|---|
| 1 | Commercial and business | 89 | 92 | 94 | 95 |
| 2 | Crops - contoured, good | 65 | 75 | 82 | 86 |
| 3 | Farmstead | 59 | 74 | 82 | 86 |
| 4 | Industrial | 81 | 88 | 91 | 93 |
| 5 | Open space - fair condition | 49 | 69 | 79 | 84 |
| 6 | Pasture or range | 49 | 69 | 79 | 84 |
| 7 | Residential - 1 acre | 51 | 68 | 79 | 84 |
| 8 | Residential - 1/2 acre | 54 | 70 | 80 | 85 |
| 9 | Residential - 1/3 acre | 57 | 72 | 81 | 86 |
| 10 | Residential - 1/4 acre | 61 | 75 | 83 | 87 |
| 11 | Residential - 1/8 acre or less | 77 | 85 | 90 | 92 |
| 12 | Residential - 2 acre | 46 | 65 | 77 | 82 |
| 13 | Roads | 98 | 98 | 98 | 98 |
| 14 | Water | 100 | 100 | 100 | 100 |

Through review and analysis of the soil and land use data in GIS, the areas were measured for each land classification and hydrologic soil group combination. NRCS lookup values were then used to compute a curve number grid. Using the grid, an area-weighted, composite curve number was developed for each sub-basin in the study watershed.

Composite curve number summary tables are provided in Appendix A and Appendix B, respectively.

### 2.3.3 Impervious Cover

Through review of existing and future land use data in GIS, the total impervious cover area was estimated. Residential and farmstead parcels were assigned 0.08 acres of impervious land, to account for a typical home and driveway footprint. All paved road area was considered to be 100% impervious. All impervious cover for existing commercial or industrial land area was digitized and measured in GIS, due to the variation in impervious cover observed for this land use category. The impervious cover for future commercial and business land cover was estimated by computing 85% of the existing area for this land classification[1]. The impervious land area was totaled for each sub-basin and input to the hydrologic model. Percent impervious values by sub-basin for existing and future land use are shown in Appendix A and Appendix B, respectively.

[1] As directed by the City of Pflugerville Floodplain Manager for classifications falling under 'Mixed Use' land cover.

### 2.3.4 Time of Concentration

Time of concentration (Tc) was calculated as the sum of travel time of consecutive flow segments located within the drainage area. The first two segments of the longest flow path for each sub-basin generally consisted of two types of flow: sheet flow and shallow concentrated flow. Sheet flow segments were limited to approximately 100 feet. The calculation for these two types of flows was based upon Equation 3-3 and Figure 3-1 of Technical Release 55 (TR-55). The results of these equations were compared to the minimum inlet time for the drainage area, which generally was 15 minutes. The higher of the two times was used in the analysis. The remaining segments consisted of open channel flow. The travel time for each segment was calculated by determining an average velocity using Manning's equation. Depending upon the length, slope, velocity, and surface cover of the channel segment, the overall length of the ditch or open channel may have been sub-divided to depict the flow time more accurately for the drainage area. The sum of the sheet flow, shallow concentrated flow or inlet time (where appropriate), and channel flow determined the time of concentration for the sub-basin area. A lag time was approximated as 60% of the time of concentration for each sub-basin. These lag times were input to the hydrologic model.

A map showing the longest flow path segments that were used to compute the time of concentration is provided in Figure 8. A table showing the detailed time of concentration calculations can be found in Appendix C.

### 2.3.5 Unit Hydrograph

The unit hydrograph for existing and future conditions was created based on the Soil Conservation Service (SCS) Unit Hydrograph Method in HEC-HMS. This method creates the unit hydrograph based on the time-varying discharge calculations set by the basin characteristics and lag time provided by the user. A standard unit hydrograph was defined with 37.5% of the unit runoff occurring before the peak flow rate, which corresponds to a peak rate factor (PRF) of 484.

### 2.3.6 Channel Routing

The main routing method used was the lag method, which represents the translation of flood waves. The single parameter input to the model was the lag time in minutes, such that inflow to the reach is delayed in time by an amount equal to the lag specified. After the lag time passes, inflow becomes outflow. Lag times were computed by the same method as the time of concentration calculations, where routing segments were assigned as needed to represent slope breaks or surface roughness changes. The travel time for each segment was calculated from the average velocity using Manning's equation. The sum of the flow segment travel times determined the lag time for each routing reach. These routing lag times were input to the hydrologic model. Figure 9 shows the routing diagram schematic from the hydrologic model, and a table that provides the detailed routing reach calculations can be found in Appendix D.

Reservoir routing was not performed for Lake Pflugerville, as it was assumed that the reservoir was full at the beginning of the design storm. This reflects a common hydrologic occurrence in Central Texas, in that storms tend to occur within a close period of time.

**Figure 8: Longest Flow Paths**

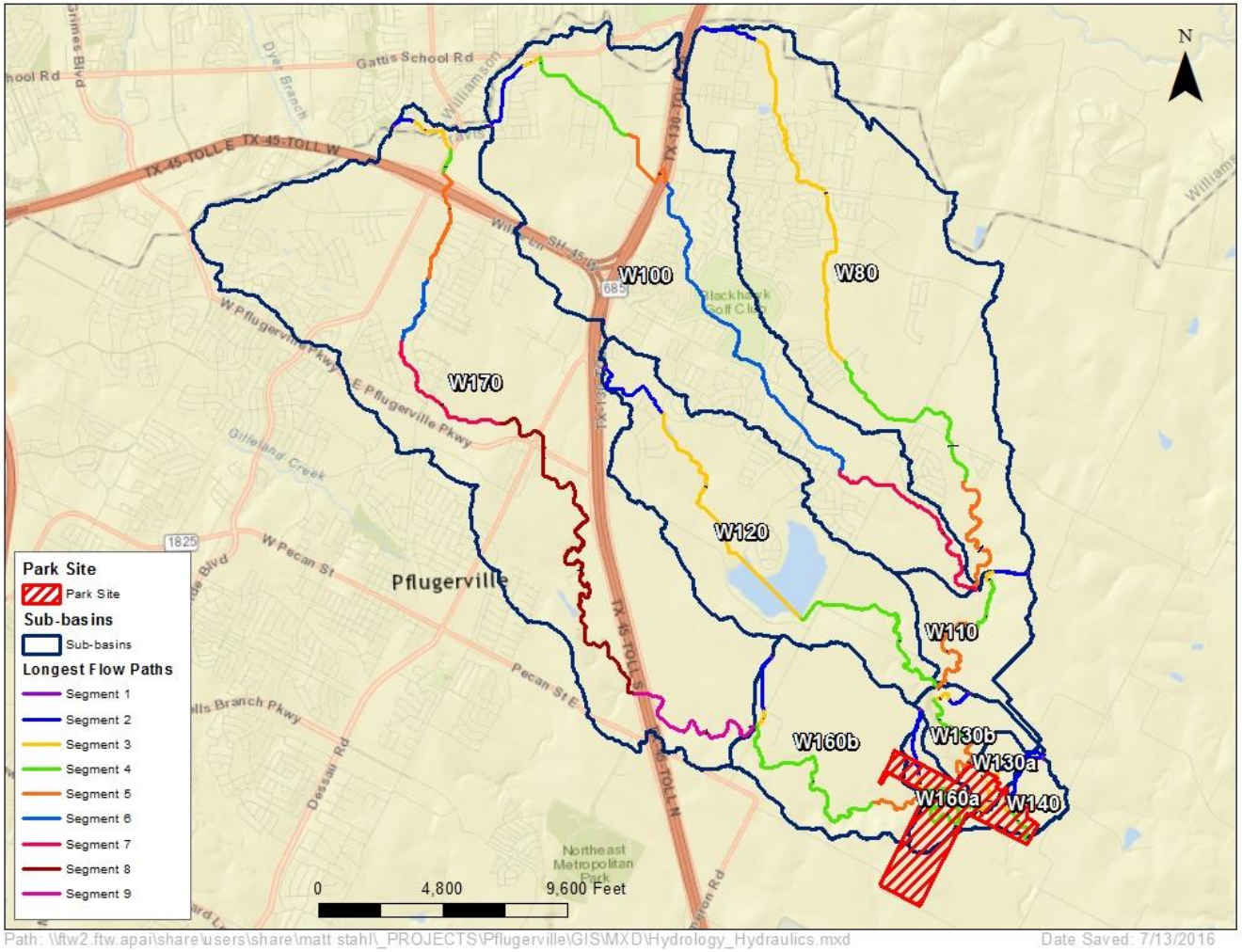
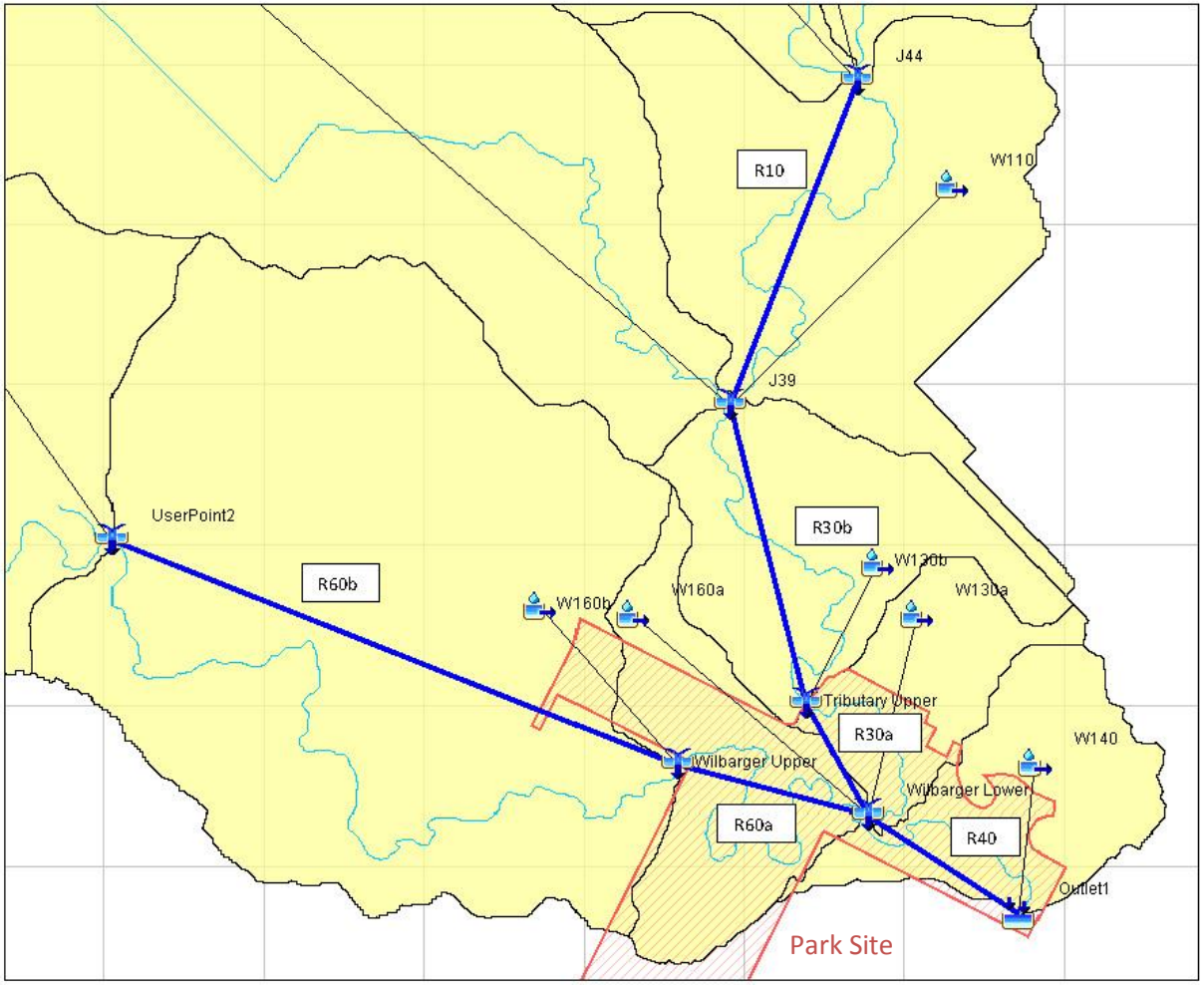


**Figure 9: Routing Diagram**



### 2.3.7 Results

A summary table provides the hydrologic model flow results at key junctions and basins for the 50%, 20%, 10%, 4%, 2%, 1%, and 0.2% recurrence intervals. These represent the 2, 5, 10, 25, 50, 100, and 500-yr storm events, for existing land use (Table 3) and future land use (Table 4).

**Table 3: Flow Results, Existing**

| HEC-HMS Junction/Basin | Area (sq. mi) | HEC-HMS Model Flow (cfs), Existing | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | 500-yr |
| Tributary Upper (Junction) | 12.9 | 2,710 | 4,490 | 5,720 | 7,320 | 8,620 | 9,610 | 14,280 |
| Wilbarger Upper (Junction) | 8.8 | 1,865 | 3,080 | 3,930 | 5,030 | 5,920 | 6,600 | 9,800 |
| Wilbarger Lower 1 (Junction) | 22.5 | 4,560 | 7,560 | 9,640 | 12,330 | 14,520 | 16,190 | 24,040 |
| Wilbarger Lower 2 (Junction) | 22.7 | 4,680 | 7,770 | 9,910 | 12,680 | 14,940 | 16,660 | 24,750 |

**Table 4: Flow Results, Future**

| HEC-HMS Junction/Basin | Area (sq. mi) | HEC-HMS Model Flow (cfs), Future | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | 500-yr |
| Tributary Upper (Junction) | 12.9 | 2,950 | 4,710 | 5,930 | 7,510 | 8,800 | 9,900 | 14,450 |
| Wilbarger Upper (Junction) | 8.8 | 2,190 | 3,390 | 4,210 | 5,280 | 6,160 | 6,990 | 10,030 |
| Wilbarger Lower 1 (Junction) | 22.5 | 5,130 | 8,080 | 10,110 | 12,760 | 14,930 | 16,860 | 24,430 |
| Wilbarger Lower 2 (Junction) | 22.7 | 5,250 | 8,290 | 10,390 | 13,120 | 15,360 | 17,340 | 25,150 |

### 2.3.8 Validation of Results

#### *2.3.8.1 Validation 1*

A first hydrologic comparison was made with results from the USGS Report, "The Effects of Urbanization on Floods in the Austin Metropolitan Area", Water Resources Investigations Report 86-4069, 1986:

- Contributing Drainage Area (CDA) = 22.7 miles squared
- Total Impervious Cover Percentage (TIMP) = 21%
- The hydrologic equations are as follows:
  - $Q_{100} = 1{,}554\ (CDA)^{0.678} X\ (1 + TIMP/100)^{1.474}$
  - $Q_{25} = 1{,}064\ (CDA)^{0.674} X\ (1 + TIMP/100)^{1.476}$
  - $Q_{10} = 780\ (CDA)^{0.663} X\ (1 + TIMP/100)^{1.526}$
- Using this approach, the 100-yr peak flow rate was computed for the study area and found to be within 2% of the modeled flow rate, for existing land use:
  - Report $Q_{100} = 16{,}990$ cfs
  - Model $Q_{100} = 16{,}660$ cfs

*2.3.8.2 Validation 2*

A second hydrologic comparison was made with results from the USGS Report, "Multiple Regression Equations to Estimate Peak Flow Frequency for Streams in Hays County, Texas", Water Resources Investigations Report 95-4019, 1995. The following is noted in the report, "The purpose of this report is to present and qualify equations to estimate peak-flow frequency for large streams with natural drainage basins in Hays County. The equations were developed in an area encompassing Hays County and 11 other counties immediately adjacent to or one county away from Hays County".

- The study included gage data from the San Gabriel River and Berry Creek near Georgetown and upper Wilbarger Creek.
- The equations are as follows:
  - $Q_{100} = 416\ (CDA)^{0.788} X\ (SS)^{0.325}$
  - $Q_{25} = 1{,}034\ (CDA)^{0.686}$
  - $Q_{10} = 732\ (CDA)^{0.667}$
  - CDA = contributing drainage area, in square miles
  - SF = shape factor
  - SS = stream slope in feet per mile
- Using this approach, the 100-yr peak flow rate was computed for the study area and found to be 33% lower than the modeled flow rate:
  - Regression $Q_{100} = 12{,}540$ cfs
  - Model $Q_{100} = 16{,}660$ cfs

*2.3.8.3 Validation 3*

A third comparison of the hydrologic model results was made to flow results from the 2009 Gilleland Creek modeling report by the City of Austin, entitled ""Gilleland Creek Modeling and Mapping Project, Technical Support Data Notebook, Engineering Analysis, Hydraulics, Gilleland Creek Tributaries 1, 1A, 1B, 1C, 2, and 3", June 2009.

- From report Table 4, the flows for Gilleland Creek, with a contributing drainage area of 18.8 square miles, were as follows:
  - Q100 = 18,000 cfs
  - Q25 = 12,600 cfs
  - Q10 = 9,200 cfs
  - Q500 = 26,100 cfs
- Using this approach, the 100-yr peak flow rate was computed for the Gilleland Creek drainage area and found to be 8% higher than the modeled flow rate for the 22.7 square mile Wilbarger Creek study area:
  - Gilleland $Q_{100} = 18{,}000$ cfs
  - Model $Q_{100} = 16{,}660$ cfs

- Dividing the 100-yr storm event by the contributing drainage area, the Gilleland Creek watershed reports 958 cfs per square mile, while the Wilbarger Creek watershed reports a somewhat lower 736 cfs per square mile. Though smaller by contributing area, the Gilleland Creek watershed is more urbanized and has a higher impervious cover level than Wilbarger Creek, thus, the peak flow rates from the Gilleland Creek study are reasonably higher per square mile of drainage area than in Wilbarger Creek.

The modeled hydrologic results were reviewed against these three hydrologic validation methods and determined to be reasonably comparable. This comparison built sufficient confidence in the modeled flow results to move forward with the hydraulic model building and floodplain delineation.

## 2.4 Hydraulic Model

### 2.4.1 Boundary Conditions

The upstream and downstream boundary conditions applied in the model were based on the assumption of sub-critical flow and the calculation of normal depth in the study reaches. Normal depth is computed by the model based on the user-entered energy slope. The energy slope was approximated by the elevation-based slope of the channel bottom.

### 2.4.2 Geometric Data

#### *2.4.2.1 Cross Sections*

The initial layout and spacing of cross sections was determined by field reconnaissance using a hard copy map. Cross sections were placed along the channel such that the interval between any two cross sections measured approximately 500 feet. The interval of cross sections near the confluence of the Upper Wilbarger and Tributary reaches ranges between 1,110 and 1,500 feet. This interval was necessary to avoid intersection of the cross sections on the tributary and main channel. Final layout and spacing was established using the HecGeoRAS software. Additional cross sections were placed in some areas along the channel to better define the channel where the topographic information was unique or unknown, curvatures or bends occur along the channel, or significant changes in the channel's longitudinal slope were identified.

The cross sections were developed in HECGeoRAS using ArcGIS and then exported to HEC-RAS (version 5.0.1). The cross sections were refined and additional surface and overbank information was added from the GIS dataset into HEC-RAS. The topographic information was based upon 2015 LiDAR data from the City of Pflugerville. The cross sections profiles are provided in Appendix F.

#### *2.4.2.2 Manning's coefficients*

The Manning's "n" values for the Wilbarger Creek study area channel and overbanks were assigned in the hydraulic model based on field reconnaissance and comparison with Manning's values from the Gilleland Creek floodplain study. Manning's values from the 2009 Gilleland Creek report ranged from

0.035 to 0.085 for the channels and from 0.04 to 0.12 for the overbank areas. The initial roughness values that were assigned in the hydraulic model were increased somewhat to fall more in line with the Gilleland Creek report Manning's values. The final roughness values used in the hydraulic model are typically 0.07 for channels and 0.10 for the overbank areas.

Where appropriate, composite Manning's "n" values were developed and assigned in the model using Equation 6-2 for existing and natural channels from the City of Austin, TX Drainage Criteria Manual, Section 6.3.1:

Manning's "n" = (n0 + n1 + n2 + n3 + n4) x m, where

n0 = material involved
n1 = degree of irregularity
n2 = relative effect of channel cross section
n3 = relative effect of obstructions
n4 = vegetation
m = degree of meandering

#### *2.4.2.3 Expansion and Contraction Coefficients*

Expansion and contraction coefficients of 0.1 and 0.3, respectively, were applied to account for variability in all cross sections.

#### *2.4.2.4 Bridges and Culverts*

No bridges or culverts are present in the existing study area.

#### *2.4.2.5 Ineffective Flow Areas*

Ineffective flow areas were not incorporated into the model, due to the absence of structures in the study reaches.

### 2.4.3 Flow Change

Flow change locations were identified according to the upstream flow boundaries and the confluence of river reaches contained within the study area. The hydrologic flows were taken from the HEC-HMS model junctions and applied at the corresponding flow change locations in the HEC-RAS model. A summary of flow change locations is provided for existing land use (Table 5) and future land use (Table 6) conditions. Consistency in the magnitude of flows across the watershed was verified through computation of the 100-yr storm event divided by area (cfs/sqmi). This value ranged from 726 to 751 cfs/sqmi for existing conditions (Table 5) and from 756 to 795 cfs/sqmi for future conditions (Table 6).

**Table 5: Table of Flow Results, Existing**

| HEC-HMS Junction/Basin | HEC-RAS Section | HEC-HMS Model Flow (cfs), Existing | | | | | | | $Q_{100}$/Area (cfs/sq. mi.) |
|---|---|---|---|---|---|---|---|---|---|
| | | 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | 500-yr | |
| Tributary Upper | 3191 | 2,710 | 4,490 | 5,720 | 7,320 | 8,620 | 9,610 | 14,280 | 744 |
| Wilbarger Upper | 11714 | 1,865 | 3,080 | 3,930 | 5,030 | 5,920 | 6,600 | 9,800 | 751 |
| Wilbarger Lower1 | 3613 | 4,560 | 7,560 | 9,640 | 12,330 | 14,520 | 16,190 | 24,040 | 726 |
| Wilbarger Lower2 | 1638 | 4,680 | 7,770 | 9,910 | 12,680 | 14,940 | 16,660 | 24,750 | 740 |

**Table 6: Table of Flow Results, Future**

| HEC-HMS Junction/Basin | HEC-RAS Section | HEC-HMS Model Flow (cfs), Future | | | | | | | $Q_{100}$/Area (cfs/sq. mi.) |
|---|---|---|---|---|---|---|---|---|---|
| | | 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | 500-yr | |
| Tributary Upper | 3191 | 2,950 | 4,710 | 5,930 | 7,510 | 8,800 | 9,900 | 14,450 | 766 |
| Wilbarger Upper | 11714 | 2,190 | 3,390 | 4,210 | 5,280 | 6,160 | 6,990 | 10,030 | 795 |
| Wilbarger Lower1 | 3613 | 5,130 | 8,080 | 10,110 | 12,760 | 14,930 | 16,860 | 24,430 | 756 |
| Wilbarger Lower2 | 1638 | 5,250 | 8,290 | 10,390 | 13,120 | 15,360 | 17,340 | 25,150 | 770 |

### 2.4.4 Results

#### *2.4.4.1 Floodplain Delineation and Mapping*

The draft floodplain was generated using HEC-GeoRAS, and then the floodplain was digitally refined after the engineer completed a review of the floodplain limits. The refined 100-yr floodplain for existing and future conditions is displayed in Figure 10.

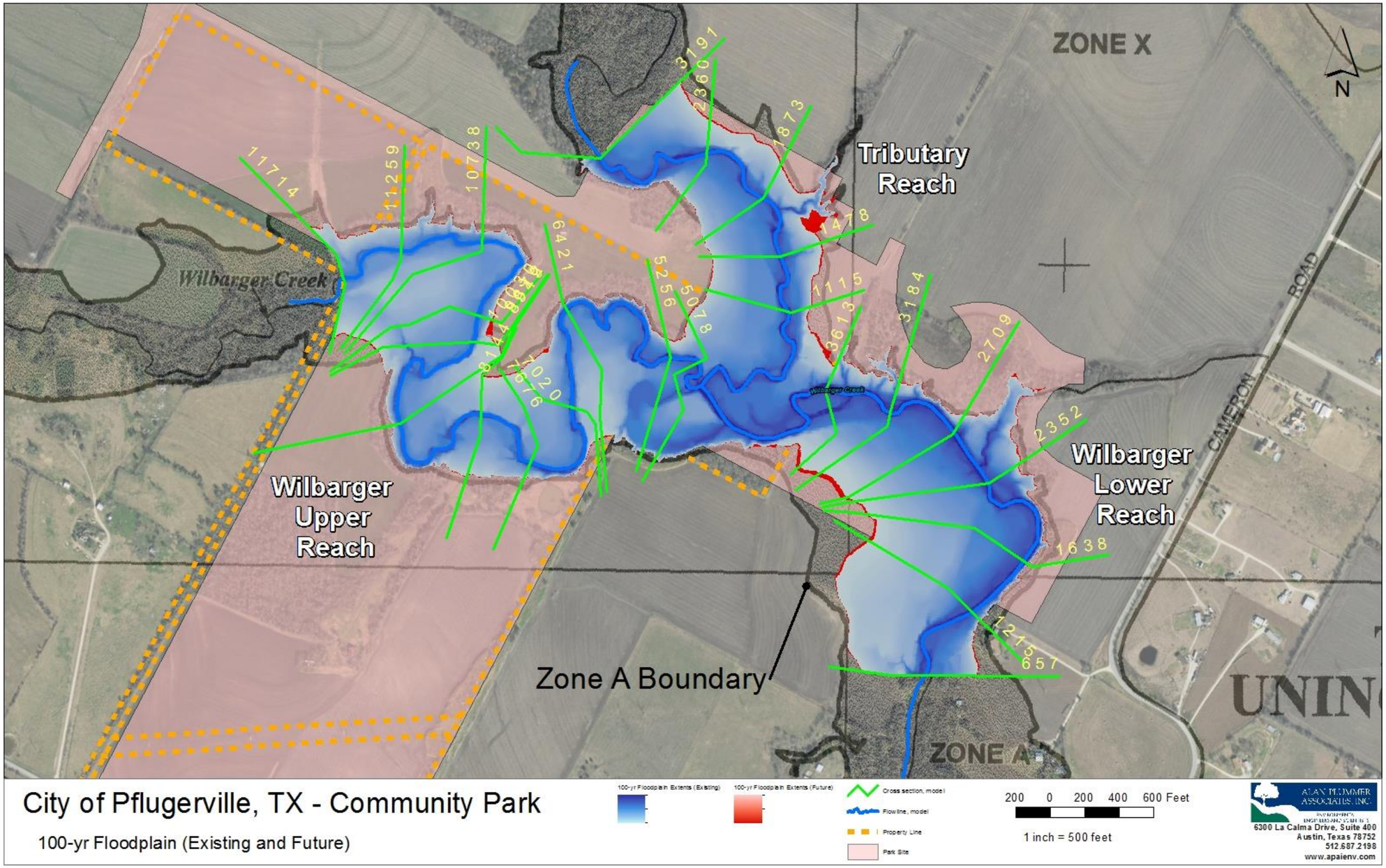
#### *2.4.4.2 Profile Plots*

The water surface profiles for the hydraulic model can be found in Appendix E.

#### *2.4.4.3 Floodway*

The floodway is to be developed before submittal to FEMA.

**Figure 10: Model Floodplain, 100-yr Event (Existing and Future)**



# Appendix A

## Curve Number, Existing Conditions

| Composite Curve Numbers - Existing Conditions | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Area | Land Use-Soil Group by Area (ac) | | | | Land Use-Soil Group by Percent | | | | Land Use-Soil Lookup (TR-55) | | | | Composite | Percent |
| Sub-basin | Land Classification | Area (ac) | (sq. mi.) | A | B | C | D | A | B | C | D | A | B | C | D | CN | Impervious |
| W80 | Commercial and business | 80.8 | 0.1 | 0.0 | 0.0 | 25.6 | 55.3 | 0.0 | 0.0 | 0.0 | 0.0 | 89 | 92 | 94 | 95 | 2.5 | |
| | Crops - contoured, good | 380.0 | 0.6 | 0.0 | 0.0 | 15.8 | 364.2 | 0.0 | 0.0 | 0.0 | 0.1 | 65 | 75 | 82 | 86 | 10.7 | |
| | Farmstead | 317.8 | 0.5 | 0.0 | 0.0 | 132.2 | 185.7 | 0.0 | 0.0 | 0.0 | 0.1 | 59 | 74 | 82 | 86 | 8.8 | |
| | Industrial | 11.8 | 0.0 | 0.0 | 0.0 | 11.0 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 81 | 88 | 91 | 93 | 0.4 | |
| | Open space - fair condition | 958.3 | 1.5 | 0.0 | 0.0 | 48.2 | 910.1 | 0.0 | 0.0 | 0.0 | 0.3 | 49 | 69 | 79 | 84 | 26.2 | |
| | Pasture or range | 205.6 | 0.3 | 0.0 | 0.0 | 31.8 | 173.8 | 0.0 | 0.0 | 0.0 | 0.1 | 49 | 69 | 79 | 84 | 5.6 | |
| | Residential - 1 acre | 2.1 | 0.0 | 0.0 | 0.0 | 0.0 | 2.1 | 0.0 | 0.0 | 0.0 | 0.0 | 51 | 68 | 79 | 84 | 0.1 | |
| | Residential - 1/2 acre | 39.2 | 0.1 | 0.0 | 0.0 | 10.3 | 28.8 | 0.0 | 0.0 | 0.0 | 0.0 | 54 | 70 | 80 | 85 | 1.1 | |
| | Residential - 1/3 acre | 41.8 | 0.1 | 0.0 | 0.0 | 20.8 | 21.0 | 0.0 | 0.0 | 0.0 | 0.0 | 57 | 72 | 81 | 86 | 1.1 | |
| | Residential - 1/4 acre | 93.4 | 0.1 | 0.0 | 0.0 | 36.4 | 57.0 | 0.0 | 0.0 | 0.0 | 0.0 | 61 | 75 | 83 | 87 | 2.6 | |
| | Residential - 1/8 acre or less | 568.5 | 0.9 | 0.0 | 0.0 | 194.0 | 374.5 | 0.0 | 0.0 | 0.1 | 0.1 | 77 | 85 | 90 | 92 | 17.0 | |
| | Residential - 2 acre | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 46 | 65 | 77 | 82 | 0.0 | |
| | Roads | 345.3 | 0.5 | 0.0 | 0.0 | 90.0 | 255.3 | 0.0 | 0.0 | 0.0 | 0.1 | 98 | 98 | 98 | 98 | 11.1 | |
| | Water | 14.2 | 0.0 | 0.0 | 0.0 | 2.2 | 12.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100 | 100 | 100 | 100 | 0.5 | |
| | **TOTAL** | **3,058.8** | **4.8** | **0.0** | **0.0** | **618.2** | **2,440.6** | **0.0** | **0.0** | **0.2** | **0.8** | | | | | **87.5** | **24.8%** |
| W100 | Commercial and business | 320.0 | 0.5 | 0.0 | 0.0 | 139.2 | 180.8 | 0.0 | 0.0 | 0.0 | 0.1 | 89 | 92 | 94 | 95 | 9.8 | |
| | Crops - contoured, good | 592.5 | 0.9 | 0.0 | 0.0 | 274.9 | 317.7 | 0.0 | 0.0 | 0.1 | 0.1 | 65 | 75 | 82 | 86 | 16.2 | |
| | Farmstead | 297.9 | 0.5 | 0.0 | 0.0 | 148.8 | 149.1 | 0.0 | 0.0 | 0.0 | 0.0 | 59 | 74 | 82 | 86 | 8.1 | |
| | Industrial | 35.4 | 0.1 | 0.0 | 0.0 | 15.9 | 19.5 | 0.0 | 0.0 | 0.0 | 0.0 | 81 | 88 | 91 | 93 | 1.1 | |
| | Open space - fair condition | 486.0 | 0.8 | 0.0 | 0.0 | 132.6 | 353.4 | 0.0 | 0.0 | 0.0 | 0.1 | 49 | 69 | 79 | 84 | 13.1 | |
| | Pasture or range | 111.8 | 0.2 | 0.0 | 0.0 | 46.4 | 65.4 | 0.0 | 0.0 | 0.0 | 0.0 | 49 | 69 | 79 | 84 | 3.0 | |
| | Residential - 1 acre | 1.9 | 0.0 | 0.0 | 0.0 | 0.0 | 1.9 | 0.0 | 0.0 | 0.0 | 0.0 | 51 | 68 | 79 | 84 | 0.1 | |
| | Residential - 1/2 acre | 86.7 | 0.1 | 0.0 | 0.0 | 50.1 | 36.6 | 0.0 | 0.0 | 0.0 | 0.0 | 54 | 70 | 80 | 85 | 2.3 | |
| | Residential - 1/3 acre | 43.8 | 0.1 | 0.0 | 0.0 | 23.5 | 20.3 | 0.0 | 0.0 | 0.0 | 0.0 | 57 | 72 | 81 | 86 | 1.2 | |
| | Residential - 1/4 acre | 112.2 | 0.2 | 0.0 | 0.0 | 53.0 | 59.2 | 0.0 | 0.0 | 0.0 | 0.0 | 61 | 75 | 83 | 87 | 3.1 | |
| | Residential - 1/8 acre or less | 469.2 | 0.7 | 0.0 | 0.0 | 193.1 | 276.1 | 0.0 | 0.0 | 0.1 | 0.1 | 77 | 85 | 90 | 92 | 13.9 | |
| | Residential - 2 acre | 2.5 | 0.0 | 0.0 | 0.0 | 0.0 | 2.5 | 0.0 | 0.0 | 0.0 | 0.0 | 46 | 65 | 77 | 82 | 0.1 | |
| | Roads | 494.6 | 0.8 | 0.0 | 0.0 | 250.0 | 244.6 | 0.0 | 0.0 | 0.1 | 0.1 | 98 | 98 | 98 | 98 | 15.8 | |
| | Water | 20.5 | 0.0 | 0.0 | 0.0 | 2.1 | 18.3 | 0.0 | 0.0 | 0.0 | 0.0 | 100 | 100 | 100 | 100 | 0.7 | |
| | **TOTAL** | **3,075.0** | **4.8** | **0.0** | **0.0** | **1,329.5** | **1,745.5** | **0.0** | **0.0** | **0.4** | **0.6** | | | | | **88.4** | **29.9%** |
| W110 | Commercial and business | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 89 | 92 | 94 | 95 | 0.0 | |
| | Crops - contoured, good | 343.9 | 0.5 | 0.0 | 0.0 | 0.0 | 343.9 | 0.0 | 0.0 | 0.0 | 0.8 | 65 | 75 | 82 | 86 | 73.0 | |
| | Farmstead | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 59 | 74 | 82 | 86 | 0.0 | |
| | Industrial | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 81 | 88 | 91 | 93 | 0.0 | |
| | Open space - fair condition | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 49 | 69 | 79 | 84 | 0.0 | |
| | Pasture or range | 53.0 | 0.1 | 0.0 | 0.0 | 0.0 | 53.0 | 0.0 | 0.0 | 0.0 | 0.1 | 49 | 69 | 79 | 84 | 11.0 | |
| | Residential - 1 acre | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 51 | 68 | 79 | 84 | 0.0 | |
| | Residential - 1/2 acre | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 54 | 70 | 80 | 85 | 0.0 | |
| | Residential - 1/3 acre | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 57 | 72 | 81 | 86 | 0.0 | |
| | Residential - 1/4 acre | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 61 | 75 | 83 | 87 | 0.0 | |
| | Residential - 1/8 acre or less | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 77 | 85 | 90 | 92 | 0.0 | |
| | Residential - 2 acre | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 46 | 65 | 77 | 82 | 0.4 | |
| | Roads | 4.5 | 0.0 | 0.0 | 0.0 | 0.0 | 4.5 | 0.0 | 0.0 | 0.0 | 0.0 | 98 | 98 | 98 | 98 | 1.1 | |
| | Water | 1.6 | 0.0 | 0.0 | 0.0 | 0.0 | 1.6 | 0.0 | 0.0 | 0.0 | 0.0 | 100 | 100 | 100 | 100 | 0.4 | |
| | **TOTAL** | **405.0** | **0.6** | **0.0** | **0.0** | **0.0** | **405.0** | **0.0** | **0.0** | **0.0** | **1.0** | | | | | **85.9** | **1.2%** |
| W120 | Commercial and business | 78.4 | 0.1 | 0.0 | 0.0 | 21.0 | 57.4 | 0.0 | 0.0 | 0.0 | 0.0 | 89 | 92 | 94 | 95 | 4.6 | |
| | Crops - contoured, good | 331.8 | 0.5 | 0.0 | 0.0 | 20.3 | 311.5 | 0.0 | 0.0 | 0.0 | 0.2 | 65 | 75 | 82 | 86 | 17.5 | |
| | Farmstead | 29.9 | 0.0 | 0.0 | 0.0 | 0.0 | 29.9 | 0.0 | 0.0 | 0.0 | 0.0 | 59 | 74 | 82 | 86 | 1.6 | |
| | Industrial | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 81 | 88 | 91 | 93 | 0.0 | |
| | Open space - fair condition | 429.8 | 0.7 | 0.0 | 0.0 | 20.6 | 409.2 | 0.0 | 0.0 | 0.0 | 0.3 | 49 | 69 | 79 | 84 | 22.1 | |
| | Pasture or range | 256.1 | 0.4 | 0.0 | 0.0 | 0.9 | 255.2 | 0.0 | 0.0 | 0.0 | 0.2 | 49 | 69 | 79 | 84 | 13.2 | |
| | Residential - 1 acre | 2.5 | 0.0 | 0.0 | 0.0 | 0.0 | 2.5 | 0.0 | 0.0 | 0.0 | 0.0 | 51 | 68 | 79 | 84 | 0.1 | |
| | Residential - 1/2 acre | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 54 | 70 | 80 | 85 | 0.0 | |
| | Residential - 1/3 acre | 2.7 | 0.0 | 0.0 | 0.0 | 0.0 | 2.7 | 0.0 | 0.0 | 0.0 | 0.0 | 57 | 72 | 81 | 86 | 0.1 | |
| | Residential - 1/4 acre | 17.4 | 0.0 | 0.0 | 0.0 | 0.0 | 17.4 | 0.0 | 0.0 | 0.0 | 0.0 | 61 | 75 | 83 | 87 | 0.9 | |
| | Residential - 1/8 acre or less | 168.5 | 0.3 | 0.0 | 0.0 | 1.1 | 167.4 | 0.0 | 0.0 | 0.0 | 0.1 | 77 | 85 | 90 | 92 | 9.5 | |
| | Residential - 2 acre | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 46 | 65 | 77 | 82 | 0.0 | |
| | Roads | 125.9 | 0.2 | 0.0 | 0.0 | 3.6 | 122.3 | 0.0 | 0.0 | 0.0 | 0.1 | 98 | 98 | 98 | 98 | 7.6 | |
| | Water | 185.2 | 0.3 | 0.0 | 0.0 | 0.0 | 185.2 | 0.0 | 0.0 | 0.0 | 0.1 | 100 | 100 | 100 | 100 | 11.4 | |
| | **TOTAL** | **1,628.6** | **2.5** | **0.0** | **0.0** | **67.5** | **1,561.1** | **0.0** | **0.0** | **0.0** | **1.0** | | | | | **88.6** | **15.6%** |

## Composite Curve Numbers - Existing Conditions

| Sub-basin | Land Classification | Area (ac) | Area (sq. mi.) | Land Use-Soil Group by Area (ac) | | | | Land Use-Soil Group by Percent | | | | Land Use-Soil Lookup (TR-55) | | | | Composite CN | Percent Impervious |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | A | B | C | D | A | B | C | D | A | B | C | D | | |
| W130 | Commercial and business | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 89 | 92 | 94 | 95 | 0.2 | |
| | Crops - contoured, good | 217.5 | 0.3 | 0.0 | 0.0 | 0.0 | 217.5 | 0.0 | 0.0 | 0.0 | 0.7 | 65 | 75 | 82 | 86 | 60.3 | |
| | Farmstead | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 59 | 74 | 82 | 86 | 0.0 | |
| | Industrial | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 81 | 88 | 91 | 93 | 0.0 | |
| | Open space - fair condition | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 49 | 69 | 79 | 84 | 0.0 | |
| | Pasture or range | 90.2 | 0.1 | 0.0 | 0.0 | 0.0 | 90.2 | 0.0 | 0.0 | 0.0 | 0.3 | 49 | 69 | 79 | 84 | 24.4 | |
| | Residential - 1 acre | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 51 | 68 | 79 | 84 | 0.0 | |
| | Residential - 1/2 acre | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 54 | 70 | 80 | 85 | 0.0 | |
| | Residential - 1/3 acre | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 57 | 72 | 81 | 86 | 0.0 | |
| | Residential - 1/4 acre | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 61 | 75 | 83 | 87 | 0.0 | |
| | Residential - 1/8 acre or less | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 77 | 85 | 90 | 92 | 0.0 | |
| | Residential - 2 acre | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 46 | 65 | 77 | 82 | 0.0 | |
| | Roads | 1.1 | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 | 0.0 | 0.0 | 0.0 | 0.0 | 98 | 98 | 98 | 98 | 0.3 | |
| | Water | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 100 | 100 | 100 | 100 | 0.2 | |
| | **TOTAL** | **310.1** | **0.5** | **0.0** | **0.0** | **0.0** | **310.1** | **0.0** | **0.0** | **0.0** | **1.0** | | | | | **85.5** | **0.4%** |
| W140 | Commercial and business | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 89 | 92 | 94 | 95 | 0.0 | |
| | Crops - contoured, good | 145.0 | 0.2 | 0.0 | 0.0 | 0.0 | 145.0 | 0.0 | 0.0 | 0.0 | 1.0 | 65 | 75 | 82 | 86 | 83.1 | |
| | Farmstead | 1.5 | 0.0 | 0.0 | 0.0 | 0.0 | 1.5 | 0.0 | 0.0 | 0.0 | 0.0 | 59 | 74 | 82 | 86 | 0.9 | |
| | Industrial | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 81 | 88 | 91 | 93 | 0.0 | |
| | Open space - fair condition | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 49 | 69 | 79 | 84 | 0.0 | |
| | Pasture or range | 1.6 | 0.0 | 0.0 | 0.0 | 0.0 | 1.6 | 0.0 | 0.0 | 0.0 | 0.0 | 49 | 69 | 79 | 84 | 0.9 | |
| | Residential - 1 acre | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 51 | 68 | 79 | 84 | 0.0 | |
| | Residential - 1/2 acre | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 54 | 70 | 80 | 85 | 0.0 | |
| | Residential - 1/3 acre | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 57 | 72 | 81 | 86 | 0.0 | |
| | Residential - 1/4 acre | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 61 | 75 | 83 | 87 | 0.0 | |
| | Residential - 1/8 acre or less | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 77 | 85 | 90 | 92 | 0.0 | |
| | Residential - 2 acre | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 46 | 65 | 77 | 82 | 0.0 | |
| | Roads | 1.6 | 0.0 | 0.0 | 0.0 | 0.0 | 1.6 | 0.0 | 0.0 | 0.0 | 0.0 | 98 | 98 | 98 | 98 | 1.1 | |
| | Water | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 100 | 100 | 100 | 100 | 0.2 | |
| | **TOTAL** | **150.2** | **0.2** | **0.0** | **0.0** | **0.0** | **150.2** | **0.0** | **0.0** | **0.0** | **1.0** | | | | | **86.1** | **1.2%** |
| W160 | Commercial and business | 34.2 | 0.1 | 0.0 | 0.0 | 0.0 | 34.2 | 0.0 | 0.0 | 0.0 | 0.0 | 89 | 92 | 94 | 95 | 3.0 | |
| | Crops - contoured, good | 781.8 | 1.2 | 0.0 | 0.0 | 0.6 | 781.2 | 0.0 | 0.0 | 0.0 | 0.7 | 65 | 75 | 82 | 86 | 61.7 | |
| | Farmstead | 48.6 | 0.1 | 0.0 | 0.0 | 0.0 | 48.6 | 0.0 | 0.0 | 0.0 | 0.0 | 59 | 74 | 82 | 86 | 3.8 | |
| | Industrial | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 81 | 88 | 91 | 93 | 0.0 | |
| | Open space - fair condition | 1.9 | 0.0 | 0.0 | 0.0 | 0.0 | 1.9 | 0.0 | 0.0 | 0.0 | 0.0 | 49 | 69 | 79 | 84 | 0.1 | |
| | Pasture or range | 209.2 | 0.3 | 0.0 | 0.0 | 0.0 | 209.2 | 0.0 | 0.0 | 0.0 | 0.2 | 49 | 69 | 79 | 84 | 16.1 | |
| | Residential - 1 acre | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 51 | 68 | 79 | 84 | 0.0 | |
| | Residential - 1/2 acre | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 54 | 70 | 80 | 85 | 0.0 | |
| | Residential - 1/3 acre | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 57 | 72 | 81 | 86 | 0.0 | |
| | Residential - 1/4 acre | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 61 | 75 | 83 | 87 | 0.0 | |
| | Residential - 1/8 acre or less | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 77 | 85 | 90 | 92 | 0.0 | |
| | Residential - 2 acre | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 46 | 65 | 77 | 82 | 0.0 | |
| | Roads | 9.6 | 0.0 | 0.0 | 0.0 | 0.0 | 9.6 | 0.0 | 0.0 | 0.0 | 0.0 | 98 | 98 | 98 | 98 | 0.9 | |
| | Water | 4.6 | 0.0 | 0.0 | 0.0 | 0.0 | 4.6 | 0.0 | 0.0 | 0.0 | 0.0 | 100 | 100 | 100 | 100 | 0.4 | |
| | **TOTAL** | **1,090.3** | **1.7** | **0.0** | **0.0** | **0.6** | **1,089.7** | **0.0** | **0.0** | **0.0** | **1.0** | | | | | **86.1** | **1.1%** |
| W170 | Commercial and business | 251.1 | 0.4 | 0.0 | 0.0 | 110.7 | 140.5 | 0.0 | 0.0 | 0.0 | 0.0 | 89 | 92 | 94 | 95 | 5.0 | |
| | Crops - contoured, good | 1641.5 | 2.6 | 0.0 | 0.0 | 197.5 | 1444.0 | 0.0 | 0.0 | 0.0 | 0.3 | 65 | 75 | 82 | 86 | 29.8 | |
| | Farmstead | 110.0 | 0.2 | 0.0 | 0.0 | 40.9 | 69.0 | 0.0 | 0.0 | 0.0 | 0.0 | 59 | 74 | 82 | 86 | 2.0 | |
| | Industrial | 63.6 | 0.1 | 0.0 | 0.0 | 16.1 | 47.5 | 0.0 | 0.0 | 0.0 | 0.0 | 81 | 88 | 91 | 93 | 1.2 | |
| | Open space - fair condition | 1028.8 | 1.6 | 0.0 | 0.0 | 204.6 | 824.3 | 0.0 | 0.0 | 0.0 | 0.2 | 49 | 69 | 79 | 84 | 18.1 | |
| | Pasture or range | 108.9 | 0.2 | 0.0 | 0.0 | 15.9 | 93.0 | 0.0 | 0.0 | 0.0 | 0.0 | 49 | 69 | 79 | 84 | 1.9 | |
| | Residential - 1 acre | 3.1 | 0.0 | 0.0 | 0.0 | 0.3 | 2.8 | 0.0 | 0.0 | 0.0 | 0.0 | 51 | 68 | 79 | 84 | 0.1 | |
| | Residential - 1/2 acre | 4.8 | 0.0 | 0.0 | 0.0 | 2.4 | 2.4 | 0.0 | 0.0 | 0.0 | 0.0 | 54 | 70 | 80 | 85 | 0.1 | |
| | Residential - 1/3 acre | 28.3 | 0.0 | 0.0 | 0.0 | 6.1 | 22.2 | 0.0 | 0.0 | 0.0 | 0.0 | 57 | 72 | 81 | 86 | 0.5 | |
| | Residential - 1/4 acre | 91.3 | 0.1 | 0.0 | 0.0 | 25.0 | 66.4 | 0.0 | 0.0 | 0.0 | 0.0 | 61 | 75 | 83 | 87 | 1.7 | |
| | Residential - 1/8 acre or less | 571.0 | 0.9 | 0.0 | 0.0 | 162.8 | 408.2 | 0.0 | 0.0 | 0.0 | 0.1 | 77 | 85 | 90 | 92 | 11.1 | |
| | Residential - 2 acre | 31.1 | 0.0 | 0.0 | 0.0 | 15.6 | 15.4 | 0.0 | 0.0 | 0.0 | 0.0 | 46 | 65 | 77 | 82 | 0.5 | |
| | Roads | 757.4 | 1.2 | 0.0 | 0.0 | 148.5 | 608.9 | 0.0 | 0.0 | 0.0 | 0.1 | 98 | 98 | 98 | 98 | 15.8 | |
| | Water | 15.0 | 0.0 | 0.0 | 0.0 | 0.9 | 14.2 | 0.0 | 0.0 | 0.0 | 0.0 | 100 | 100 | 100 | 100 | 0.3 | |
| | **TOTAL** | **4,706.1** | **7.4** | **0.0** | **0.0** | **947.2** | **3,758.8** | **0.0** | **0.0** | **0.2** | **0.8** | | | | | **88.2** | **27.6%** |
| | **TOTAL** | **14,424.1** | **22.5** | **0.0** | **0.0** | **2,963.0** | **11,461.1** | | | | | **TOTAL** | | | | | **22.6%** |
| | **AVERAGE** | **1,803.0** | **2.8** | **0.0** | **0.0** | **370.4** | **1,432.6** | **0.0** | **0.0** | **0.1** | **0.9** | **AVERAGE** | | | | **87.0** | **12.7%** |

# Appendix B

## Curve Number, Future Conditions

## Composite Curve Numbers - Future Conditions

| Sub-basin | Land Classification | Area (ac) | Area (sq. mi.) | Land Use-Soil Group by Area (ac) | | | | Land Use-Soil Group by Percent | | | | Land Use-Soil Lookup (TR-55) | | | | Composite CN | Percent Impervious |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | A | B | C | D | A | B | C | D | A | B | C | D | | |
| W80 | Commercial and business | 151.3 | 0.2 | 0.0 | 0.0 | 61.7 | 89.6 | 0.0 | 0.0 | 0.0 | 0.0 | 89 | 92 | 94 | 95 | 4.5 | |
| | Crops - contoured, good | 432.2 | 0.7 | 0.0 | 0.0 | 17.9 | 414.3 | 0.0 | 0.0 | 0.0 | 0.1 | 65 | 75 | 82 | 86 | 11.6 | |
| | Farmstead | 318.5 | 0.5 | 0.0 | 0.0 | 136.7 | 181.8 | 0.0 | 0.0 | 0.0 | 0.1 | 59 | 74 | 82 | 86 | 8.4 | |
| | Industrial | 11.8 | 0.0 | 0.0 | 0.0 | 11.0 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 81 | 88 | 91 | 93 | 0.3 | |
| | Open space - fair condition | 942.3 | 1.5 | 0.0 | 0.0 | 38.1 | 904.2 | 0.0 | 0.0 | 0.0 | 0.3 | 49 | 69 | 79 | 84 | 24.8 | |
| | Pasture or range | 205.8 | 0.3 | 0.0 | 0.0 | 30.7 | 175.1 | 0.0 | 0.0 | 0.0 | 0.1 | 49 | 69 | 79 | 84 | 5.4 | |
| | Residential - 1 acre | 2.1 | 0.0 | 0.0 | 0.0 | | 2.1 | 0.0 | 0.0 | 0.0 | 0.0 | 51 | 68 | 79 | 84 | 0.1 | |
| | Residential - 1/2 acre | 39.2 | 0.1 | 0.0 | 0.0 | 10.3 | 28.8 | 0.0 | 0.0 | 0.0 | 0.0 | 54 | 70 | 80 | 85 | 1.0 | |
| | Residential - 1/3 acre | 40.8 | 0.1 | 0.0 | 0.0 | 20.5 | 20.3 | 0.0 | 0.0 | 0.0 | 0.0 | 57 | 72 | 81 | 86 | 1.1 | |
| | Residential - 1/4 acre | 91.4 | 0.1 | 0.0 | 0.0 | 35.4 | 56.0 | 0.0 | 0.0 | 0.0 | 0.0 | 61 | 75 | 83 | 87 | 2.4 | |
| | Residential - 1/8 acre or less | 572.6 | 0.9 | 0.0 | 0.0 | 193.6 | 379.0 | 0.0 | 0.0 | 0.1 | 0.1 | 77 | 85 | 90 | 92 | 16.4 | |
| | Residential - 2 acre | 0.8 | 0.0 | 0.0 | 0.0 | 0.8 | | 0.0 | 0.0 | 0.0 | 0.0 | 46 | 65 | 77 | 82 | 0.0 | |
| | Roads | 366.2 | 0.6 | 0.0 | 0.0 | 97.9 | 268.3 | 0.0 | 0.0 | 0.0 | 0.1 | 98 | 98 | 98 | 98 | 11.3 | |
| | Water | 14.0 | 0.0 | 0.0 | 0.0 | 1.8 | 12.2 | 0.0 | 0.0 | 0.0 | 0.0 | 100 | 100 | 100 | 100 | 0.4 | |
| | **TOTAL** | **3,189.0** | **5.0** | **0.0** | **0.0** | **656.4** | **2,532.6** | **0.0** | **0.0** | **0.2** | **0.8** | | | | | **87.7** | **24.8%** |
| W100 | Commercial and business | 841.4 | 1.3 | 0.0 | 0.0 | 491.4 | 350.0 | 0.0 | 0.0 | 0.2 | 0.1 | 89 | 92 | 94 | 95 | 25.2 | |
| | Crops - contoured, good | 202.5 | 0.3 | 0.0 | 0.0 | 19.2 | 183.3 | 0.0 | 0.0 | 0.0 | 0.1 | 65 | 75 | 82 | 86 | 5.5 | |
| | Farmstead | 155.0 | 0.2 | 0.0 | 0.0 | 57.4 | 97.6 | 0.0 | 0.0 | 0.0 | 0.0 | 59 | 74 | 82 | 86 | 4.1 | |
| | Industrial | 35.4 | 0.1 | 0.0 | 0.0 | 15.9 | 19.5 | 0.0 | 0.0 | 0.0 | 0.0 | 81 | 88 | 91 | 93 | 1.0 | |
| | Open space - fair condition | 351.1 | 0.5 | 0.0 | 0.0 | 95.8 | 255.3 | 0.0 | 0.0 | 0.0 | 0.1 | 49 | 69 | 79 | 84 | 9.2 | |
| | Pasture or range | 74.1 | 0.1 | 0.0 | 0.0 | 24.5 | 49.6 | 0.0 | 0.0 | 0.0 | 0.0 | 49 | 69 | 79 | 84 | 1.9 | |
| | Residential - 1 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 51 | 68 | 79 | 84 | 0.0 | |
| | Residential - 1/2 acre | 90.4 | 0.1 | 0.0 | 0.0 | 54.1 | 36.3 | 0.0 | 0.0 | 0.0 | 0.0 | 54 | 70 | 80 | 85 | 2.3 | |
| | Residential - 1/3 acre | 41.3 | 0.1 | 0.0 | 0.0 | 21.9 | 19.4 | 0.0 | 0.0 | 0.0 | 0.0 | 57 | 72 | 81 | 86 | 1.1 | |
| | Residential - 1/4 acre | 111.3 | 0.2 | 0.0 | 0.0 | 52.8 | 58.5 | 0.0 | 0.0 | 0.0 | 0.0 | 61 | 75 | 83 | 87 | 3.0 | |
| | Residential - 1/8 acre or less | 711.0 | 1.1 | 0.0 | 0.0 | 271.4 | 439.6 | 0.0 | 0.0 | 0.1 | 0.1 | 77 | 85 | 90 | 92 | 20.5 | |
| | Residential - 2 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 46 | 65 | 77 | 82 | 0.0 | |
| | Roads | 523.7 | 0.8 | 0.0 | 0.0 | 266.7 | 257.0 | 0.0 | 0.0 | 0.1 | 0.1 | 98 | 98 | 98 | 98 | 16.3 | |
| | Water | 21.1 | 0.0 | 0.0 | 0.0 | 2.6 | 18.4 | 0.0 | 0.0 | 0.0 | 0.0 | 100 | 100 | 100 | 100 | 0.7 | |
| | **TOTAL** | **3,158.2** | **4.9** | **0.0** | **0.0** | **1,373.6** | **1,784.6** | **0.0** | **0.0** | **0.4** | **0.6** | | | | | **90.8** | **29.9%** |
| W110 | Commercial and business | 305.9 | 0.5 | 0.0 | 0.0 | | 305.9 | 0.0 | 0.0 | 0.0 | 0.8 | 89 | 92 | 94 | 95 | 79.2 | |
| | Crops - contoured, good | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 65 | 75 | 82 | 86 | 0.0 | |
| | Farmstead | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 59 | 74 | 82 | 86 | 0.0 | |
| | Industrial | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 81 | 88 | 91 | 93 | 0.0 | |
| | Open space - fair condition | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 49 | 69 | 79 | 84 | 0.0 | |
| | Pasture or range | 55.2 | 0.1 | 0.0 | 0.0 | | 55.2 | 0.0 | 0.0 | 0.0 | 0.2 | 49 | 69 | 79 | 84 | 12.6 | |
| | Residential - 1 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 51 | 68 | 79 | 84 | 0.0 | |
| | Residential - 1/2 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 54 | 70 | 80 | 85 | 0.0 | |
| | Residential - 1/3 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 57 | 72 | 81 | 86 | 0.0 | |
| | Residential - 1/4 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 61 | 75 | 83 | 87 | 0.0 | |
| | Residential - 1/8 acre or less | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 77 | 85 | 90 | 92 | 0.0 | |
| | Residential - 2 acre | 2.0 | 0.0 | 0.0 | 0.0 | | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 46 | 65 | 77 | 82 | 0.4 | |
| | Roads | 2.5 | 0.0 | 0.0 | 0.0 | | 2.5 | 0.0 | 0.0 | 0.0 | 0.0 | 98 | 98 | 98 | 98 | 0.7 | |
| | Water | 1.6 | 0.0 | 0.0 | 0.0 | | 1.6 | 0.0 | 0.0 | 0.0 | 0.0 | 100 | 100 | 100 | 100 | 0.4 | |
| | **TOTAL** | **367.1** | **0.6** | **0.0** | **0.0** | **0.0** | **367.1** | **0.0** | **0.0** | **0.0** | **1.0** | | | | | **93.3** | **1.2%** |
| W120 | Commercial and business | 512.1 | 0.8 | 0.0 | 0.0 | 39.1 | 473.1 | 0.0 | 0.0 | 0.0 | 0.3 | 89 | 92 | 94 | 95 | 30.1 | |
| | Crops - contoured, good | 198.1 | 0.3 | 0.0 | 0.0 | 2.3 | 195.9 | 0.0 | 0.0 | 0.0 | 0.1 | 65 | 75 | 82 | 86 | 10.5 | |
| | Farmstead | 11.5 | 0.0 | 0.0 | 0.0 | | 11.5 | 0.0 | 0.0 | 0.0 | 0.0 | 59 | 74 | 82 | 86 | 0.6 | |
| | Industrial | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 81 | 88 | 91 | 93 | 0.0 | |
| | Open space - fair condition | 30.0 | 0.0 | 0.0 | 0.0 | 1.5 | 28.5 | 0.0 | 0.0 | 0.0 | 0.0 | 49 | 69 | 79 | 84 | 1.6 | |
| | Pasture or range | 218.4 | 0.3 | 0.0 | 0.0 | 0.2 | 218.2 | 0.0 | 0.0 | 0.0 | 0.1 | 49 | 69 | 79 | 84 | 11.4 | |
| | Residential - 1 acre | 1.5 | 0.0 | 0.0 | 0.0 | | 1.5 | 0.0 | 0.0 | 0.0 | 0.0 | 51 | 68 | 79 | 84 | 0.1 | |
| | Residential - 1/2 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 54 | 70 | 80 | 85 | 0.0 | |
| | Residential - 1/3 acre | 1.9 | 0.0 | 0.0 | 0.0 | | 1.9 | 0.0 | 0.0 | 0.0 | 0.0 | 57 | 72 | 81 | 86 | 0.1 | |
| | Residential - 1/4 acre | 14.5 | 0.0 | 0.0 | 0.0 | | 14.5 | 0.0 | 0.0 | 0.0 | 0.0 | 61 | 75 | 83 | 87 | 0.8 | |
| | Residential - 1/8 acre or less | 307.5 | 0.5 | 0.0 | 0.0 | 9.9 | 297.6 | 0.0 | 0.0 | 0.0 | 0.2 | 77 | 85 | 90 | 92 | 17.5 | |
| | Residential - 2 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 46 | 65 | 77 | 82 | 0.0 | |
| | Roads | 134.5 | 0.2 | 0.0 | 0.0 | 2.9 | 131.5 | 0.0 | 0.0 | 0.0 | 0.1 | 98 | 98 | 98 | 98 | 8.2 | |
| | Water | 185.2 | 0.3 | 0.0 | 0.0 | | 185.2 | 0.0 | 0.0 | 0.0 | 0.1 | 100 | 100 | 100 | 100 | 11.5 | |
| | **TOTAL** | **1,615.1** | **2.5** | **0.0** | **0.0** | | | **0.0** | **0.0** | **0.0** | **1.0** | | | | | **92.3** | **18.3%** |

## Composite Curve Numbers - Future Conditions

| Sub-basin | Land Classification | Area (ac) | Area (sq. mi.) | Land Use-Soil Group by Area (ac) | | | | Land Use-Soil Group by Percent | | | | Land Use-Soil Lookup (TR-55) | | | | Composite CN | Percent Impervious |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | A | B | C | D | A | B | C | D | A | B | C | D | | |
| W130 | Commercial and business | 21.7 | 0.0 | 0.0 | 0.0 | | 21.7 | 0.0 | 0.0 | 0.0 | 0.1 | 89 | 92 | 94 | 95 | 5.0 | |
| | Crops - contoured, good | 300.2 | 0.5 | 0.0 | 0.0 | | 300.2 | 0.0 | 0.0 | 0.0 | 0.7 | 65 | 75 | 82 | 86 | 62.2 | |
| | Farmstead | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 59 | 74 | 82 | 86 | 0.0 | |
| | Industrial | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 81 | 88 | 91 | 93 | 0.0 | |
| | Open space - fair condition | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 49 | 69 | 79 | 84 | 0.0 | |
| | Pasture or range | 88.9 | 0.1 | 0.0 | 0.0 | | 88.9 | 0.0 | 0.0 | 0.0 | 0.2 | 49 | 69 | 79 | 84 | 18.0 | |
| | Residential - 1 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 51 | 68 | 79 | 84 | 0.0 | |
| | Residential - 1/2 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 54 | 70 | 80 | 85 | 0.0 | |
| | Residential - 1/3 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 57 | 72 | 81 | 86 | 0.0 | |
| | Residential - 1/4 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 61 | 75 | 83 | 87 | 0.0 | |
| | Residential - 1/8 acre or less | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 77 | 85 | 90 | 92 | 0.0 | |
| | Residential - 2 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 46 | 65 | 77 | 82 | 0.0 | |
| | Roads | 3.8 | 0.0 | 0.0 | 0.0 | | 3.8 | 0.0 | 0.0 | 0.0 | 0.0 | 98 | 98 | 98 | 98 | 0.9 | |
| | Water | 0.6 | 0.0 | 0.0 | 0.0 | | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 100 | 100 | 100 | 100 | 0.2 | |
| | **TOTAL** | **415.2** | **0.6** | **0.0** | **0.0** | **0.0** | **415.2** | **0.0** | **0.0** | **0.0** | **1.0** | | | | | **86.2** | **1.2%** |
| W140 | Commercial and business | 96.9 | 0.2 | 0.0 | 0.0 | | 96.9 | 0.0 | 0.0 | 0.0 | 0.4 | 89 | 92 | 94 | 95 | 38.8 | |
| | Crops - contoured, good | 126.0 | 0.2 | 0.0 | 0.0 | | 126.0 | 0.0 | 0.0 | 0.0 | 0.5 | 65 | 75 | 82 | 86 | 45.7 | |
| | Farmstead | 6.4 | 0.0 | 0.0 | 0.0 | | 6.4 | 0.0 | 0.0 | 0.0 | 0.0 | 59 | 74 | 82 | 86 | 2.3 | |
| | Industrial | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 81 | 88 | 91 | 93 | 0.0 | |
| | Open space - fair condition | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 49 | 69 | 79 | 84 | 0.0 | |
| | Pasture or range | 4.5 | 0.0 | 0.0 | 0.0 | | 4.5 | 0.0 | 0.0 | 0.0 | 0.0 | 49 | 69 | 79 | 84 | 1.6 | |
| | Residential - 1 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 51 | 68 | 79 | 84 | 0.0 | |
| | Residential - 1/2 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 54 | 70 | 80 | 85 | 0.0 | |
| | Residential - 1/3 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 57 | 72 | 81 | 86 | 0.0 | |
| | Residential - 1/4 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 61 | 75 | 83 | 87 | 0.0 | |
| | Residential - 1/8 acre or less | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 77 | 85 | 90 | 92 | 0.0 | |
| | Residential - 2 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 46 | 65 | 77 | 82 | 0.0 | |
| | Roads | 3.2 | 0.0 | 0.0 | 0.0 | | 3.2 | 0.0 | 0.0 | 0.0 | 0.0 | 98 | 98 | 98 | 98 | 1.3 | |
| | Water | 0.3 | 0.0 | 0.0 | 0.0 | | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 100 | 100 | 100 | 100 | 0.1 | |
| | **TOTAL** | **237.2** | **0.4** | **0.0** | **0.0** | **0.0** | **237.2** | **0.0** | **0.0** | **0.0** | **1.0** | | | | | **89.8** | **2.6%** |
| W160 | Commercial and business | 395.1 | 0.6 | 0.0 | 0.0 | 16.3 | 378.8 | 0.0 | 0.0 | 0.0 | 0.2 | 89 | 92 | 94 | 95 | 18.6 | |
| | Crops - contoured, good | 1007.4 | 1.6 | 0.0 | 0.0 | 19.9 | 987.5 | 0.0 | 0.0 | 0.0 | 0.5 | 65 | 75 | 82 | 86 | 43.0 | |
| | Farmstead | 33.8 | 0.1 | 0.0 | 0.0 | | 33.8 | 0.0 | 0.0 | 0.0 | 0.0 | 59 | 74 | 82 | 86 | 1.4 | |
| | Industrial | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 81 | 88 | 91 | 93 | 0.0 | |
| | Open space - fair condition | 1.9 | 0.0 | 0.0 | 0.0 | | 1.9 | 0.0 | 0.0 | 0.0 | 0.0 | 49 | 69 | 79 | 84 | 0.1 | |
| | Pasture or range | 218.4 | 0.3 | 0.0 | 0.0 | | 218.4 | 0.0 | 0.0 | 0.0 | 0.1 | 49 | 69 | 79 | 84 | 9.1 | |
| | Residential - 1 acre | 1.4 | 0.0 | 0.0 | 0.0 | | 1.4 | 0.0 | 0.0 | 0.0 | 0.0 | 51 | 68 | 79 | 84 | 0.1 | |
| | Residential - 1/2 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 54 | 70 | 80 | 85 | 0.0 | |
| | Residential - 1/3 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 57 | 72 | 81 | 86 | 0.0 | |
| | Residential - 1/4 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 61 | 75 | 83 | 87 | 0.0 | |
| | Residential - 1/8 acre or less | 219.0 | 0.3 | 0.0 | 0.0 | 26.2 | 192.8 | 0.0 | 0.0 | 0.0 | 0.1 | 77 | 85 | 90 | 92 | 10.0 | |
| | Residential - 2 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 46 | 65 | 77 | 82 | 0.0 | |
| | Roads | 128.7 | 0.2 | 0.0 | 0.0 | 8.2 | 120.5 | 0.0 | 0.0 | 0.0 | 0.1 | 98 | 98 | 98 | 98 | 6.3 | |
| | Water | 6.0 | 0.0 | 0.0 | 0.0 | | 6.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100 | 100 | 100 | 100 | 0.3 | |
| | **TOTAL** | **2,011.7** | **3.1** | **0.0** | **0.0** | **70.6** | **1,941.1** | **0.0** | **0.0** | **0.0** | **1.0** | | | | | **88.9** | **7.3%** |
| W170 | Commercial and business | 1203.0 | 1.9 | 0.0 | 0.0 | 384.8 | 818.2 | 0.0 | 0.0 | 0.1 | 0.2 | 89 | 92 | 94 | 95 | 29.2 | |
| | Crops - contoured, good | 219.8 | 0.3 | 0.0 | 0.0 | 40.6 | 179.2 | 0.0 | 0.0 | 0.0 | 0.0 | 65 | 75 | 82 | 86 | 4.8 | |
| | Farmstead | 20.6 | 0.0 | 0.0 | 0.0 | 14.0 | 6.6 | 0.0 | 0.0 | 0.0 | 0.0 | 59 | 74 | 82 | 86 | 0.4 | |
| | Industrial | 51.1 | 0.1 | 0.0 | 0.0 | 12.7 | 38.5 | 0.0 | 0.0 | 0.0 | 0.0 | 81 | 88 | 91 | 93 | 1.2 | |
| | Open space - fair condition | 443.0 | 0.7 | 0.0 | 0.0 | 73.0 | 370.0 | 0.0 | 0.0 | 0.0 | 0.1 | 49 | 69 | 79 | 84 | 9.4 | |
| | Pasture or range | 35.9 | 0.1 | 0.0 | 0.0 | 3.5 | 32.4 | 0.0 | 0.0 | 0.0 | 0.0 | 49 | 69 | 79 | 84 | 0.8 | |
| | Residential - 1 acre | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 51 | 68 | 79 | 84 | 0.0 | |
| | Residential - 1/2 acre | 5.0 | 0.0 | 0.0 | 0.0 | 2.6 | 2.3 | 0.0 | 0.0 | 0.0 | 0.0 | 54 | 70 | 80 | 85 | 0.1 | |
| | Residential - 1/3 acre | 28.0 | 0.0 | 0.0 | 0.0 | 6.5 | 21.5 | 0.0 | 0.0 | 0.0 | 0.0 | 57 | 72 | 81 | 86 | 0.6 | |
| | Residential - 1/4 acre | 85.4 | 0.1 | 0.0 | 0.0 | 25.5 | 59.9 | 0.0 | 0.0 | 0.0 | 0.0 | 61 | 75 | 83 | 87 | 1.9 | |
| | Residential - 1/8 acre or less | 1143.6 | 1.8 | 0.0 | 0.0 | 213.7 | 930.0 | 0.0 | 0.0 | 0.1 | 0.2 | 77 | 85 | 90 | 92 | 26.9 | |
| | Residential - 2 acre | 3.7 | 0.0 | 0.0 | 0.0 | | 3.7 | 0.0 | 0.0 | 0.0 | 0.0 | 46 | 65 | 77 | 82 | 0.1 | |
| | Roads | 647.6 | 1.0 | 0.0 | 0.0 | 147.9 | 499.7 | 0.0 | 0.0 | 0.0 | 0.1 | 98 | 98 | 98 | 98 | 16.3 | |
| | Water | 13.6 | 0.0 | 0.0 | 0.0 | 0.9 | 12.7 | 0.0 | 0.0 | 0.0 | 0.0 | 100 | 100 | 100 | 100 | 0.3 | |
| | **TOTAL** | **3,900.4** | **6.1** | **0.0** | **0.0** | **925.6** | **2,974.8** | **0.0** | **0.0** | **0.2** | **0.8** | | | | | **92.0** | **26.3%** |
| | **TOTAL** | **14,894.1** | **23.3** | **0.0** | **0.0** | **3,026.2** | **10,252.7** | | | | | **TOTAL** | | | | | **24.4%** |
| | **AVERAGE** | **1,861.8** | **2.9** | **0.0** | **0.0** | **432.3** | **1,464.7** | **0.0** | **0.0** | **0.1** | **0.9** | **AVERAGE** | | | | **90.1** | **14.0%** |

# Appendix C

## Time of Concentration, Calculations

| Sub-basin, HMS Model | Total Flow Length (ft), Longest Flow Path | Sheet Flow Segment 1 Length | n | $P_2$ (in) | Slope | $T_t$ (min) | Shallow Concentrated Flow Segment 2 Length | Cover | S | $T_t$ (min) | Inlet Time* (min) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| W80 | 33,961 | 100 | 0.24 | 3.44 | 0.028 | 12.1 | 2,441 | Unpaved | 0.022 | 16.8 | 28.9 |
| W100 | 38,102 | 100 | 0.015 | 3.44 | 0.017 | 1.6 | 3,025 | Paved | 0.021 | 17.2 | 18.8 |
| W110 | 4,576 | 76 | 0.17 | 3.44 | 0.020 | 8.4 | 1,295 | Unpaved | 0.031 | 7.6 | 16.1 |
| W120 | 25,128 | 100 | 0.24 | 3.44 | 0.001 | 46.8 | 4,100 | Unpaved | 0.013 | 37.7 | 84.4 |
| W130a | 4,872 | 112 | 0.17 | 3.44 | 0.006 | 19.0 | 1,972 | Unpaved | 0.013 | 18.0 | 37.0 |
| W130b | 10,296 | 102 | 0.17 | 3.44 | 0.002 | 26.9 | 968 | Unpaved | 0.008 | 11.1 | 38.0 |
| W140 | 4,852 | 100 | 0.17 | 3.44 | 0.0003 | 56.0 | 2,335 | Unpaved | 0.011 | 22.9 | 78.9 |
| W160a | 10,586 | 104 | 0.17 | 3.44 | 0.009 | 14.6 | 2,724 | Unpaved | 0.015 | 23.1 | 37.7 |
| W160b | 15,755 | 100 | 0.17 | 3.44 | 0.017 | 11.2 | 2,124 | Unpaved | 0.013 | 19.1 | 30.4 |
| W170 | 45,630 | 100 | 0.24 | 3.44 | 0.017 | 14.7 | 884 | Paved | 0.023 | 4.8 | 19.5 |

**Open Channel Flow**

**Segment 3**

| | Description | Length | n | S | Area | P, wetted | R, hydraulic | Q | V (ft/s) | $T_t$ (min) |
|---|---|---|---|---|---|---|---|---|---|---|
| W80 | grass, scrub brush | 15,182 | 0.050 | 0.005 | 147.51 | 104.74 | 1.41 | 397.9 | 2.7 | 93.8 |
| W100 | concrete flume | 805 | 0.013 | 0.013 | 7.71 | 40.85 | 0.19 | 33.7 | 4.4 | 3.1 |
| W110 | grass, scrub brush | 729 | 0.050 | 0.023 | 34.41 | 69.43 | 0.50 | 96.6 | 2.8 | 4.3 |
| W120 | grass, scrub brush | 11,326 | 0.050 | 0.004 | 103.62 | 100.18 | 1.03 | 197.2 | 1.9 | 99.2 |
| W130a | trees, scrub brush | 2,788 | 0.058 | 0.009 | 303.04 | 79.68 | 3.80 | 1833.0 | 6.0 | 7.7 |
| W130b | trees, scrub brush | 835 | 0.058 | 0.008 | 45.52 | 123.68 | 0.37 | 55.0 | 1.2 | 11.5 |
| W140 | trees, scrub brush | 685 | 0.058 | 0.032 | 78.64 | 39.84 | 1.97 | 571.1 | 7.3 | 1.6 |
| W160a | grass | 800 | 0.035 | 0.022 | 48.91 | 64.87 | 0.75 | 253.4 | 5.2 | 2.6 |
| W160b | streets | 651 | 0.035 | 0.014 | 32.36 | 41.63 | 0.78 | 137.0 | 4.2 | 2.6 |
| W170 | grass, streets | 2,143 | 0.025 | 0.012 | 13.53 | 42.19 | 0.32 | 41.6 | 3.1 | 11.6 |

**Segment 4**

| | Description | Length | n | S | Area | P, wetted | R, hydraulic | Q | V (ft/s) | $T_t$ (min) |
|---|---|---|---|---|---|---|---|---|---|---|
| W80 | trees, scrub brush | 9,000 | 0.058 | 0.004 | 220.18 | 169.07 | 1.30 | 414.2 | 1.9 | 79.7 |
| W100 | grass, scrub brush | 5,297 | 0.050 | 0.007 | 182.05 | 94.73 | 1.92 | 676.7 | 3.7 | 23.7 |
| W110 | trees, scrub brush | 2,476 | 0.058 | 0.002 | 30.26 | 50.36 | 0.60 | 22.5 | 0.7 | 55.4 |
| W120 | grass, scrub brush | 9,602 | 0.050 | 0.007 | 68.64 | 44.48 | 1.54 | 232.9 | 3.4 | 47.2 |
| W130a | | | | | | | | | | |
| W130b | trees, scrub brush | 2,846 | 0.058 | 0.003 | 122.44 | 54.30 | 2.25 | 272.1 | 2.2 | 21.3 |
| W140 | trees | 1,732 | 0.060 | 0.005 | 74.86 | 37.32 | 2.01 | 199.7 | 2.7 | 10.8 |
| W160a | trees | 6,958 | 0.06 | 0.003 | 111.25 | 60.10 | 1.85 | 216.1 | 1.9 | 59.7 |
| W160b | trees, scrub brush | 10,234 | 0.058 | 0.003 | 99.28 | 91.24 | 1.09 | 153.4 | 1.5 | 110.4 |
| W170 | grass/concrete channels | 1,073 | 0.025 | 0.007 | 73.28 | 70.65 | 1.04 | 386.3 | 5.3 | 3.4 |

**Segment 5**

| | Description | Length | n | S | Area | P, wetted | R, hydraulic | Q | V (ft/s) | $T_t$ (min) |
|---|---|---|---|---|---|---|---|---|---|---|
| W80 | trees, scrub brush | 7,238 | 0.058 | 0.002 | 276.44 | 168.59 | 1.64 | 492.8 | 1.8 | 67.7 |
| W100 | grass | 3,648 | 0.035 | 0.002 | 109.27 | 105.56 | 1.04 | 204.2 | 1.9 | 32.5 |
| W110 | trees, scrub brush | 5,215 | 0.058 | 0.00153 | 40.70 | 46.10 | 0.88 | 37.6 | 0.9 | 94.0 |
| W120 | | | | | | | | | | |
| W130a | | | | | | | | | | |
| W130b | trees | 2,846 | 0.060 | 0.002 | 150.74 | 116.46 | 1.29 | 200.8 | 1.3 | 35.6 |
| W140 | | | | | | | | | | |
| W160a | | | | | | | | | | |
| W160b | trees | 2,646 | 0.06 | 0.003 | 109.89 | 54.95 | 2.00 | 235.7 | 2.1 | 20.6 |
| W170 | concr channel | 4,975 | 0.025 | 0.008 | 113.25 | 39.40 | 2.87 | 1193.1 | 10.5 | 7.9 |

**Segment 6**

| | Description | Length | n | S | Area | P, wetted | R, hydraulic | Q | V (ft/s) | $T_t$ (min) |
|---|---|---|---|---|---|---|---|---|---|---|
| W80 | | | | | | | | | | |
| W100 | grass, trees | 16,055 | 0.055 | 0.005 | 71.48 | 57.77 | 1.24 | 156.9 | 2.2 | 121.9 |
| W110 | | | | | | | | | | |
| W120 | | | | | | | | | | |
| W130a | | | | | | | | | | |
| W130b | trees | 902 | 0.060 | 0.002 | 123.84 | 77.21 | 1.60 | 198.6 | 1.6 | 9.4 |
| W140 | | | | | | | | | | |
| W160a | | | | | | | | | | |
| W160b | | | | | | | | | | |
| W170 | grass, scrub brush | 3,151 | 0.05 | 0.007 | 47.48 | 38.50 | 1.23 | 136.0 | 2.9 | 18.3 |

**Segment 7**

| | Description | Length | n | S | Area | P, wetted | R, hydraulic | Q | V (ft/s) | $T_t$ (min) |
|---|---|---|---|---|---|---|---|---|---|---|
| W80 | | | | | | | | | | |
| W100 | grass, trees | 9,172 | 0.055 | 0.004 | 69.37 | 90.80 | 0.76 | 98.4 | 1.4 | 107.7 |
| W110 | | | | | | | | | | |
| W120 | | | | | | | | | | |
| W130a | | | | | | | | | | |
| W130b | trees | 1,797 | 0.060 | 0.00223 | 310.05 | 80.95 | 3.83 | 890.5 | 2.9 | 10.4 |
| W140 | | | | | | | | | | |
| W160a | | | | | | | | | | |
| W160b | | | | | | | | | | |
| W170 | trees, scrub brush | 6,325 | 0.058 | 0.005 | 277.39 | 86.59 | 3.20 | 1102.0 | 4.0 | 26.5 |

**Segment 8**

| | Description | Length | n | S | Area | P, wetted | R, hydraulic | Q | V (ft/s) | $T_t$ (min) |
|---|---|---|---|---|---|---|---|---|---|---|
| W80 | | | | | | | | | | |
| W100 | | | | | | | | | | |
| W110 | | | | | | | | | | |
| W120 | | | | | | | | | | |
| W130a | | | | | | | | | | |
| W130b | | | | | | | | | | |
| W140 | | | | | | | | | | |
| W160a | | | | | | | | | | |
| W160b | | | | | | | | | | |
| W170 | trees, scrub brush | 19,201 | 0.058 | 0.003 | 77.84 | 50.66 | 1.54 | 156.2 | 2.0 | 159.5 |

**Segment 9**

| | Description | Length | n | S | Area | P, wetted | R, hydraulic | Q | V (ft/s) | $T_t$ (min) |
|---|---|---|---|---|---|---|---|---|---|---|
| W80 | | | | | | | | | | |
| W100 | | | | | | | | | | |
| W110 | | | | | | | | | | |
| W120 | | | | | | | | | | |
| W130a | | | | | | | | | | |
| W130b | | | | | | | | | | |
| W140 | | | | | | | | | | |
| W160a | | | | | | | | | | |
| W160b | | | | | | | | | | |
| W170 | trees, scrub brush | 7,778 | 0.058 | 0.003 | 316.27 | 145.35 | 2.18 | 693.2 | 2.2 | 59.1 |

**Total Time of Concentration (Tc)**

| | Total Flow Length (ft), Longest Flow Path | Total Tc (min) | Lag Time (min) |
|---|---|---|---|
| W80 | 33,961 | 270 | 162 |
| W100 | 38,102 | 308 | 185 |
| W110 | 4,576 | 170 | 102 |
| W120 | 25,128 | 231 | 138 |
| W130a | 4,872 | 45 | 27 |
| W130b | 10,296 | 126 | 76 |
| W140 | 4,852 | 91 | 55 |
| W160a | 10,586 | 100 | 60 |
| W160b | 15,755 | 164 | 98 |
| W170 | 45,630 | 306 | 184 |

# Appendix D

## Routing Reach, Calculations

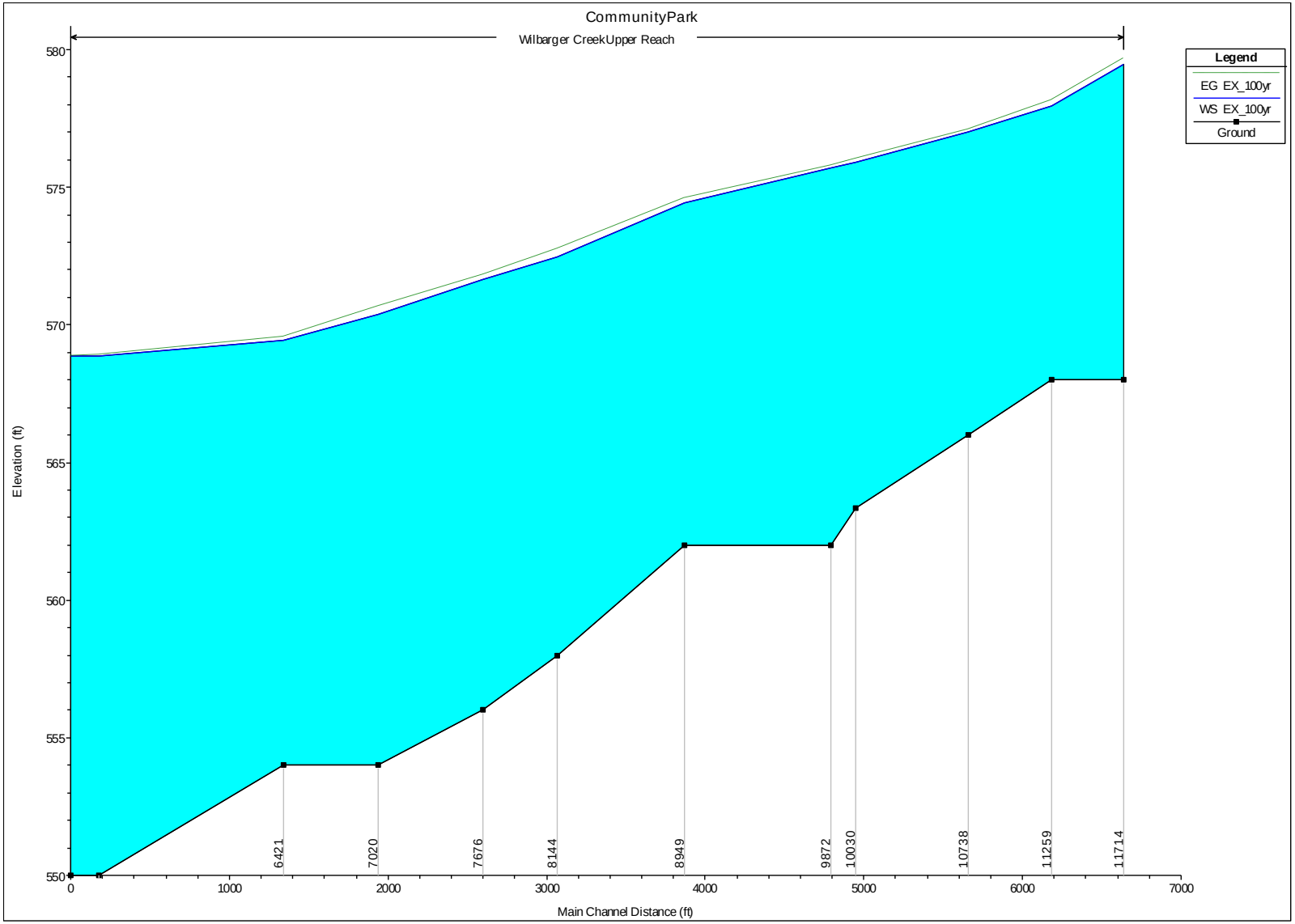
| Routing Reaches | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Segment 1** | | | | | | | | | | |
| **Sub-basin, HMS Model** | **Description** | **Length** | **n** | **S** | **Area** | **P, wetted** | **R, hydraulic** | **Q** | **V (ft/s)** | **$T_t$ (min)** |
| R10 | trees, scrub brush | 2,476 | 0.058 | 0.002 | 30.26 | 50.36 | 0.60 | 22.5 | 0.7 | 55.4 |
| R30a | trees, scrub brush | 2,788 | 0.058 | 0.003 | 303.04 | 79.68 | 3.80 | 1016.5 | 3.4 | 13.9 |
| R30b | trees, scrub brush | 835 | 0.058 | 0.008 | 45.52 | 123.68 | 0.37 | 55.0 | 1.2 | 11.5 |
| R40 | trees | 3,373 | 0.060 | 0.005 | 74.86 | 37.32 | 2.01 | 199.7 | 2.7 | 21.1 |
| R60a | trees | 6,958 | 0.06 | 0.003 | 111.25 | 60.10 | 1.85 | 217.7 | 2.0 | 59.3 |
| R60b | trees, scrub brush | 10,234 | 0.058 | 0.003 | 99.28 | 91.24 | 1.09 | 153.4 | 1.5 | 110.4 |
| **Segment 2** | | | | | | | | | | |
| **Sub-basin, HMS Model** | **Description** | **Length** | **n** | **S** | **Area** | **P, wetted** | **R, hydraulic** | **Q** | **V (ft/s)** | **$T_t$ (min)** |
| R10 | trees, scrub brush | 5,215 | 0.058 | 0.00153 | 40.70 | 46.10 | 0.88 | 37.6 | 0.9 | 94.0 |
| R30a | | | | | | | | | | |
| R30b | trees, scrub brush | 2,846 | 0.058 | 0.003 | 122.44 | 54.30 | 2.25 | 272.1 | 2.2 | 21.3 |
| R40 | | | | | | | | | | |
| R60a | | | | | | | | | | |
| R60b | trees | 2,646 | 0.06 | 0.003 | 109.89 | 54.95 | 2.00 | 235.7 | 2.1 | 20.6 |
| **Segment 3** | | | | | | | | | | |
| **Sub-basin, HMS Model** | **Description** | **Length** | **n** | **S** | **Area** | **P, wetted** | **R, hydraulic** | **Q** | **V (ft/s)** | **$T_t$ (min)** |
| R10 | | | | | | | | | | |
| R30a | | | | | | | | | | |
| R30b | trees | 2,846 | 0.060 | 0.002 | 150.74 | 116.46 | 1.29 | 200.8 | 1.3 | 35.6 |
| R40 | | | | | | | | | | |
| R60a | | | | | | | | | | |
| R60b | | | | | | | | | | |

| Total Travel Time | |
|---|---|
| **Sub-basin, HMS Model** | **Total Tt (min)** |
| R10 | 149 |
| R30a | 14 |
| R30b | 68 |
| R40 | 21 |
| R60a | 59 |
| R60b | 131 |

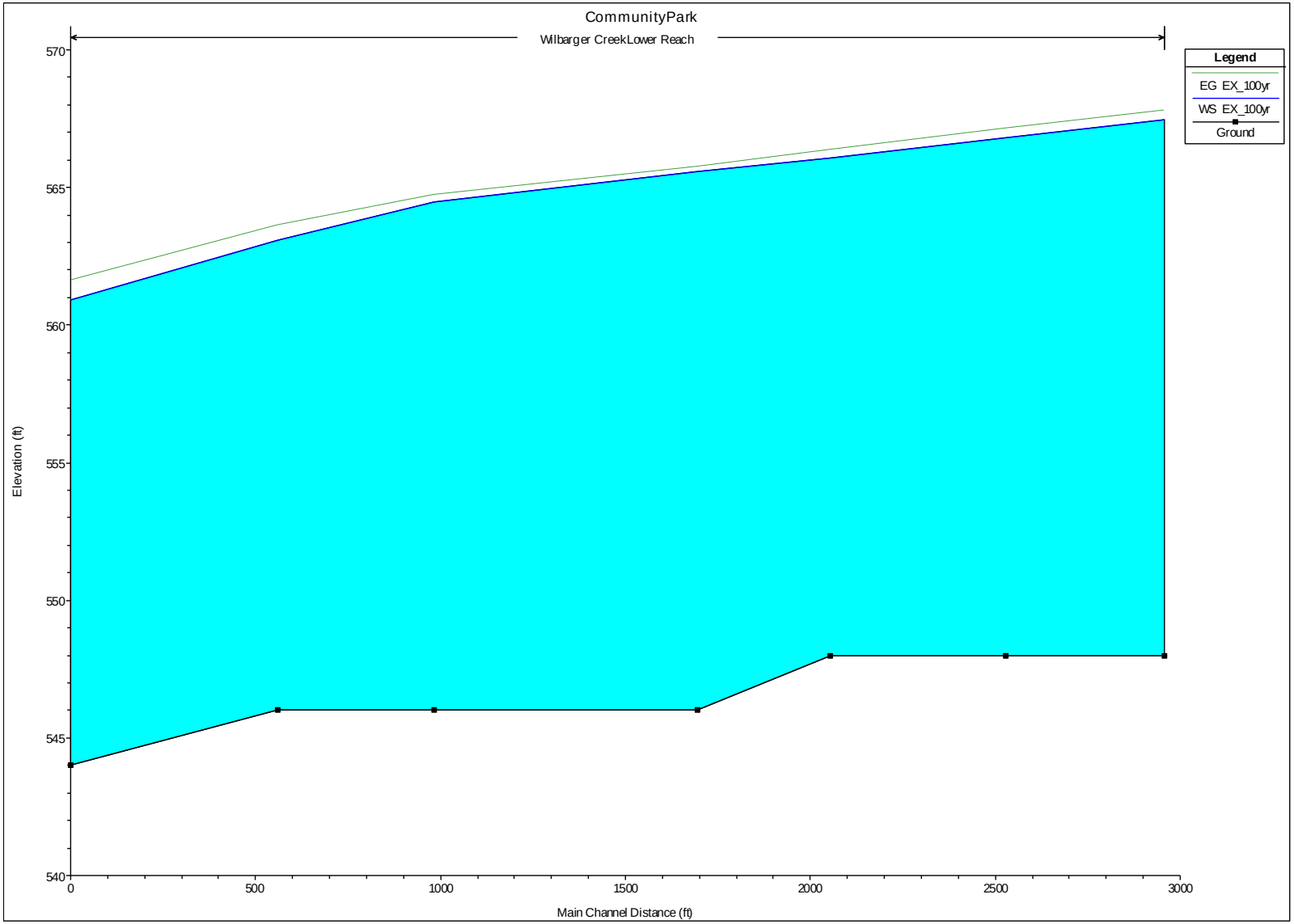
# Appendix E

## Water Surface Profiles

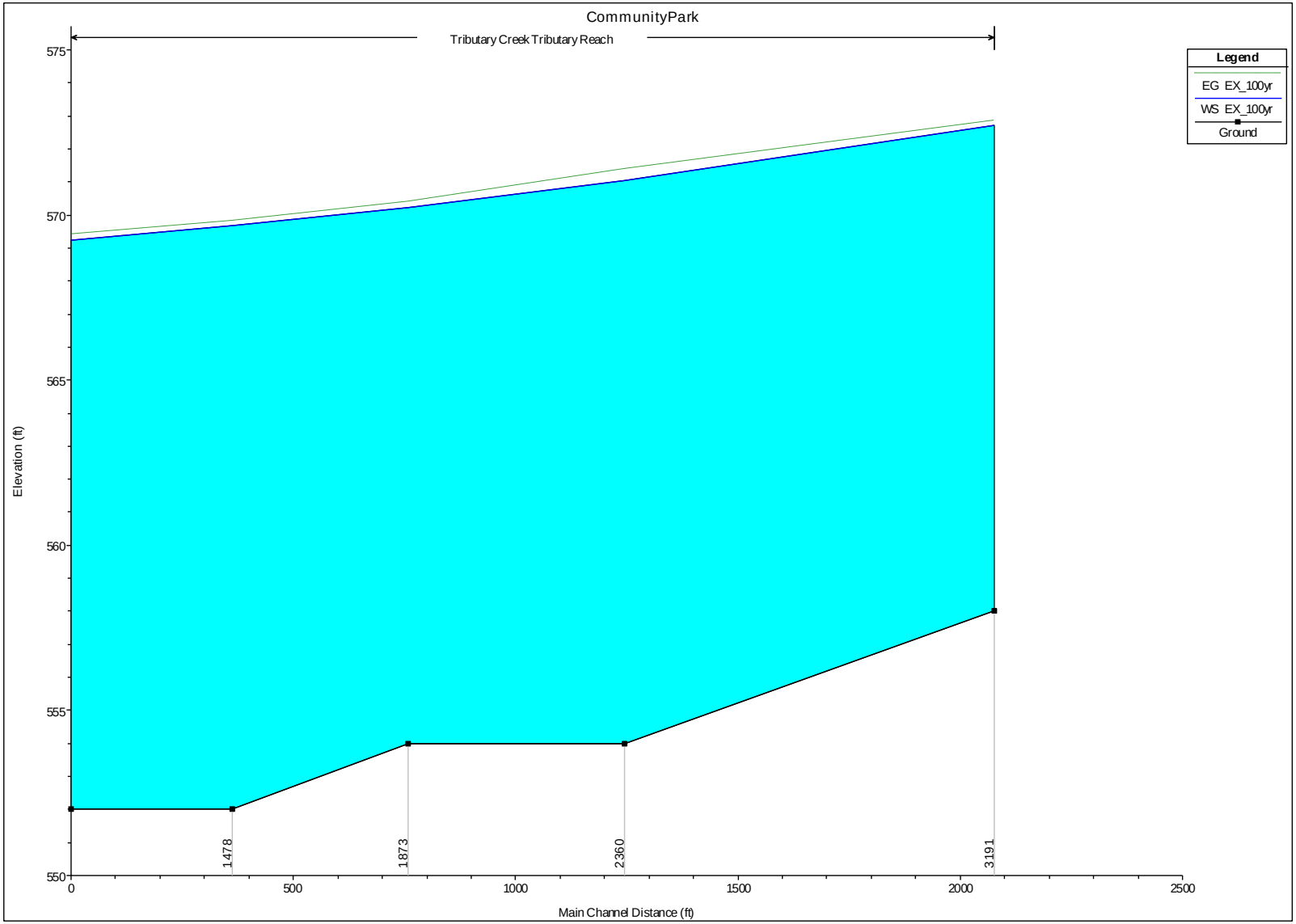
# Water Surface Profile, 100-yr – Wilbarger Creek Upper Reach



# Water Surface Profile, 100-yr – Wilbarger Creek Lower Reach

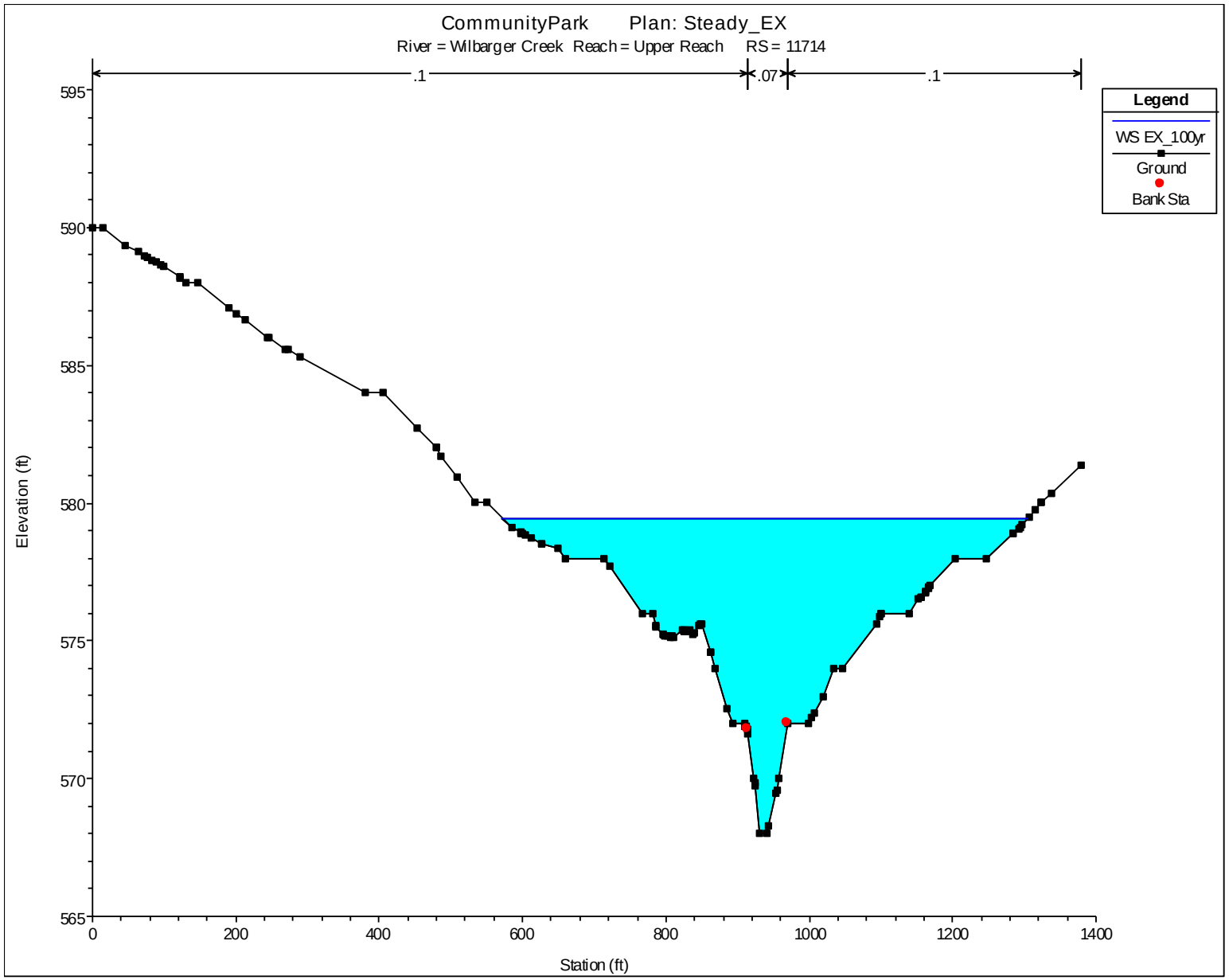


# Water Surface Profile, 100-yr – Tributary Reach



# Appendix F

## Model Cross Sections


CommunityPark Plan: Steady_EX
River = Wilbarger Creek Reach = Upper Reach RS = 11714
.1
.07
.1
Legend
WS EX_100yr
Ground
Bank Sta
Elevation (ft)
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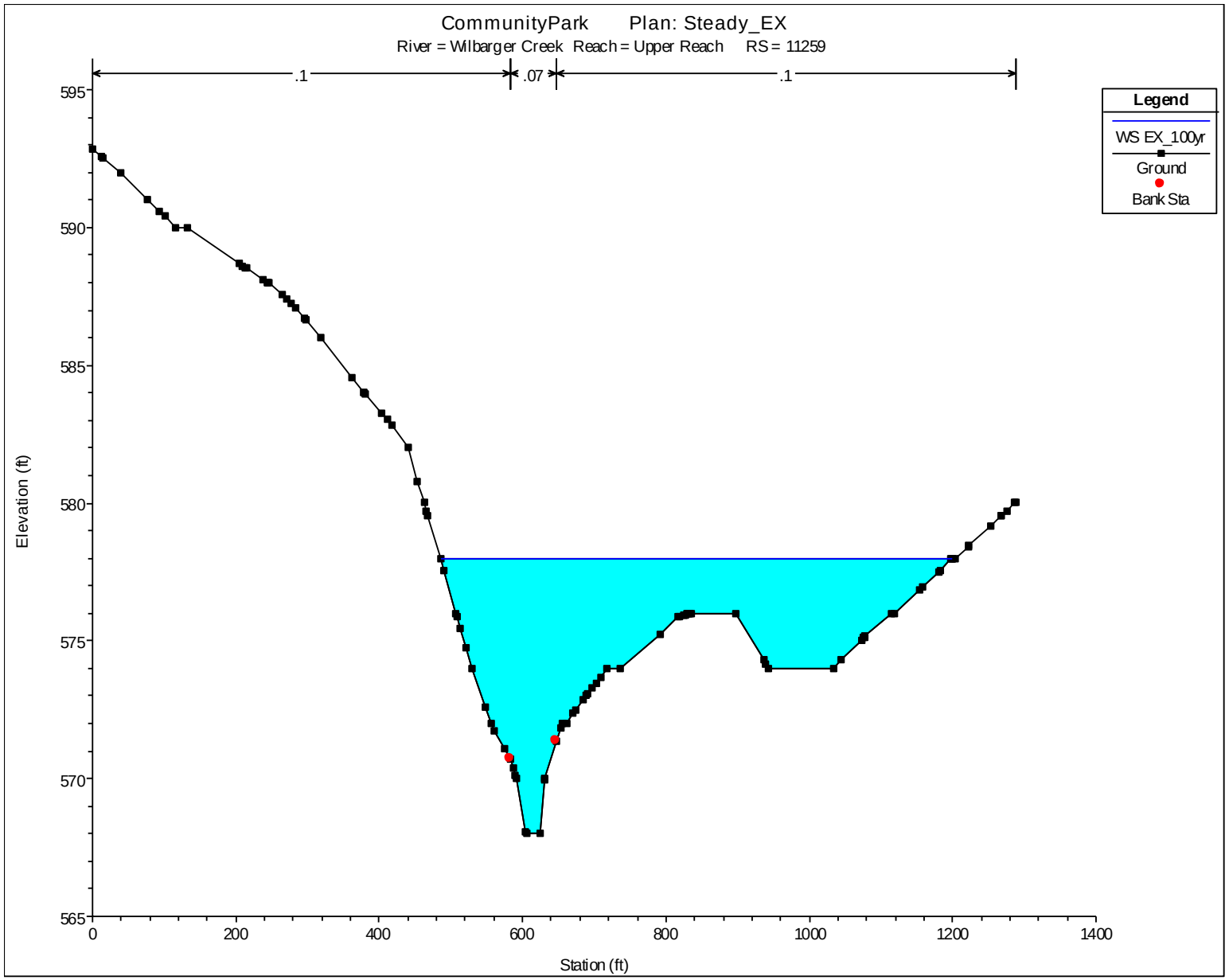
590
585
580
575
570
565
0
200
400
600
800
1000
1200
1400
Station (ft)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River = Wilbarger Creek Reach = Upper Reach RS = 11259
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.1
Legend
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Ground
Bank Sta
Elevation (ft)
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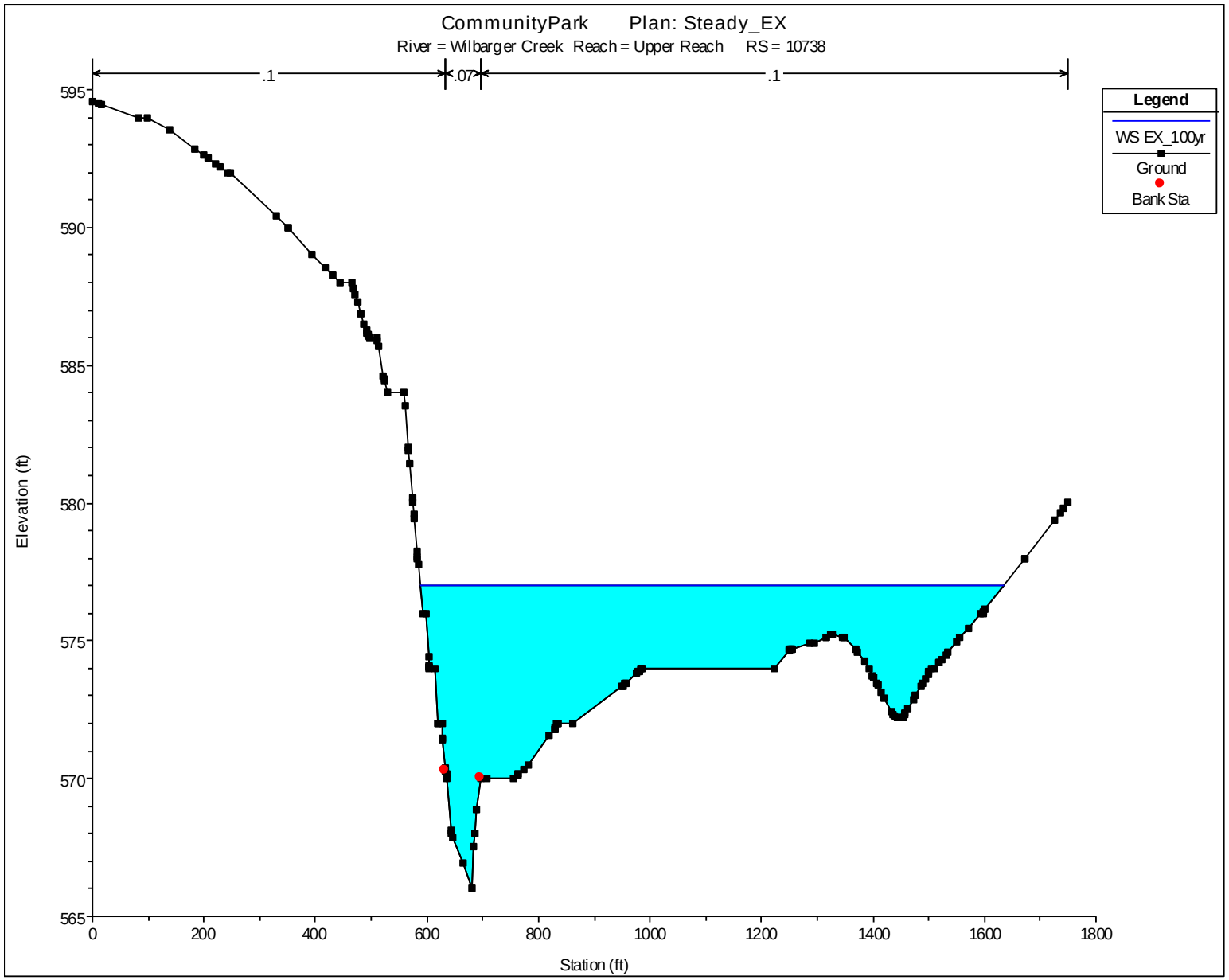
590
585
580
575
570
565
0
200
400
600
800
1000
1200
1400
Station (ft)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River = Wilbarger Creek Reach = Upper Reach RS = 10738
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.07
.1
Legend
WS EX_100yr
Ground
Bank Sta
Elevation (ft)
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590
585
580
575
570
565
0
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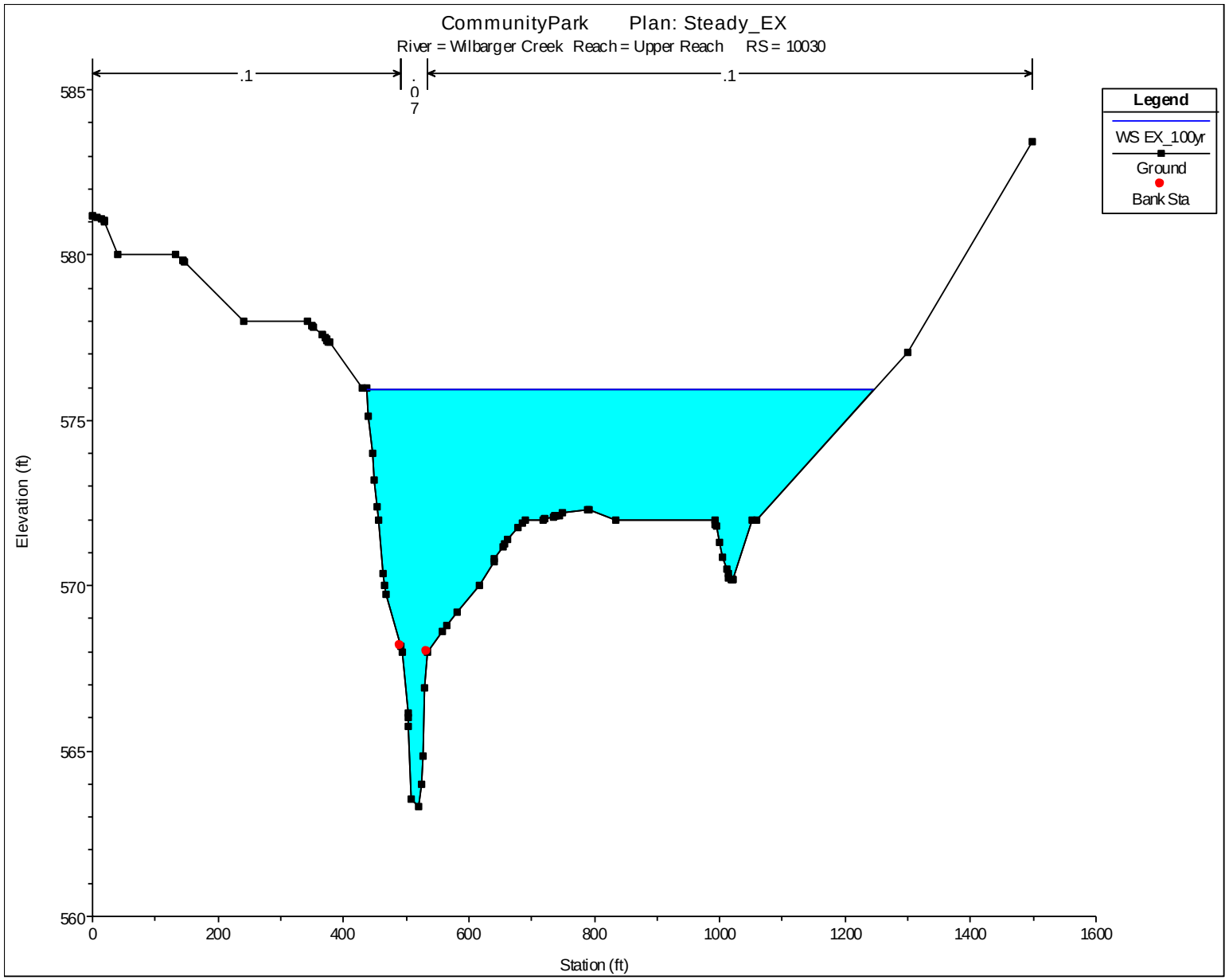
400
600
800
1000
1200
1400
1600
1800
Station (ft)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.07
.1
Legend
WS EX_100yr
Ground
Bank Sta
Elevation (ft)
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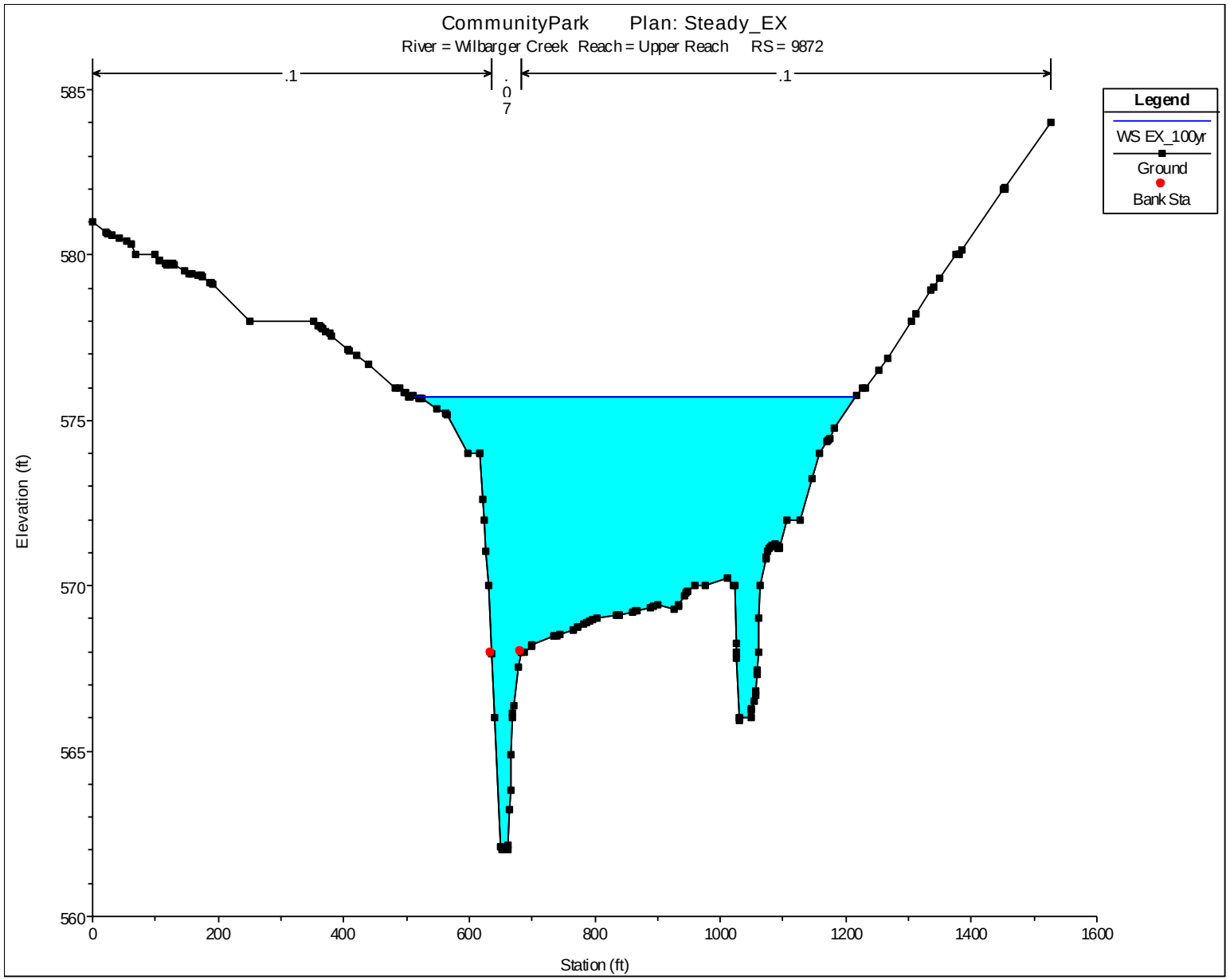
580
575
570
565
560
0
200
400
600
800
1000
1200
1400
1600
Station (ft)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.07
.1
Legend
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Ground
Bank Sta
Elevation (ft)
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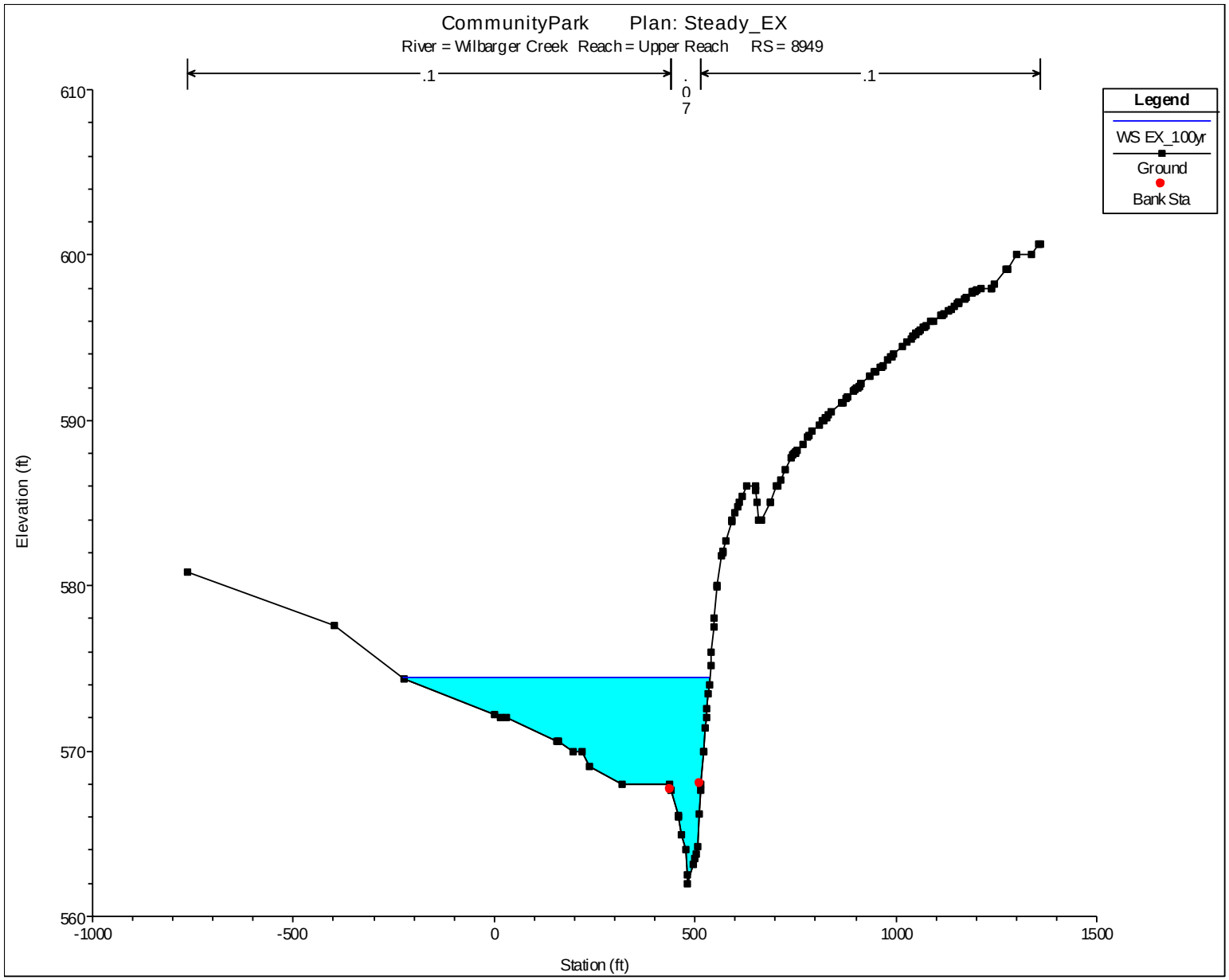
580
575
570
565
560
0
200
400
600
800
1000
1200
1400
1600
Station (ft)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.07
.1
Legend
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Bank Sta
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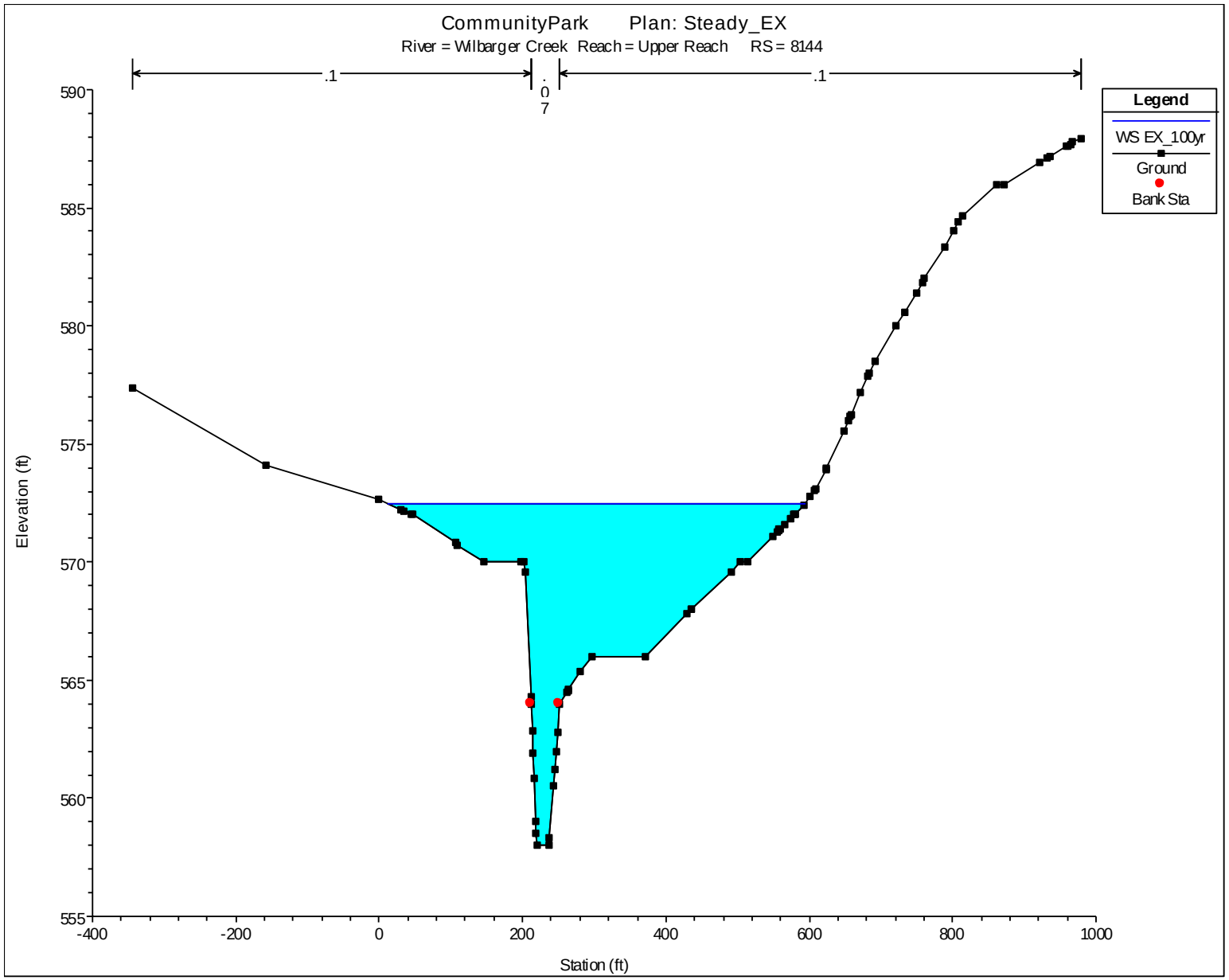
600
590
580
570
560
Elevation (ft)
-1000
-500
0
500
1000
1500
Station (ft)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.07
.1
Legend
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Ground
Bank Sta
Elevation (ft)
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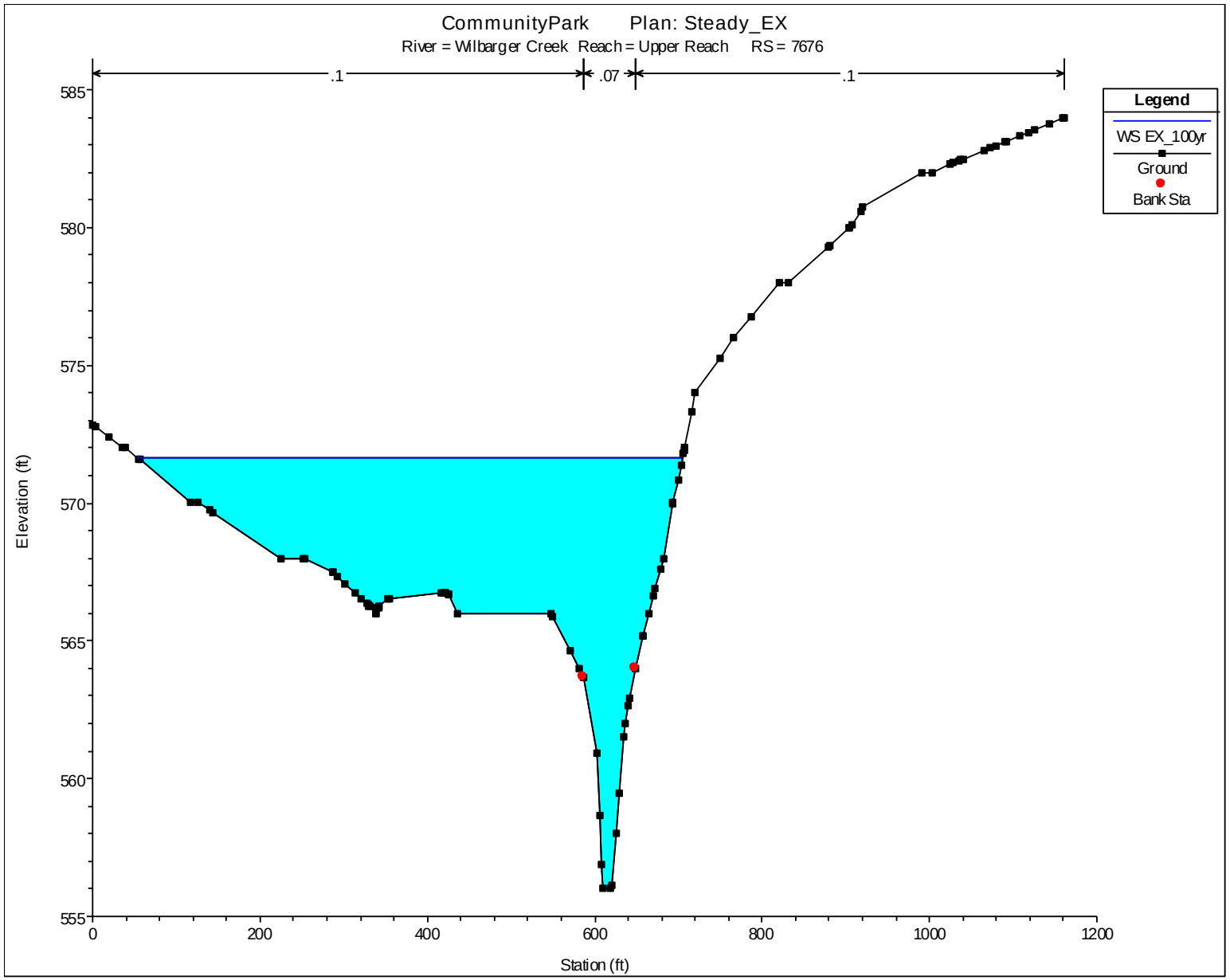
585
580
575
570
565
560
555
-400
-200
0
200
400
600
800
1000
Station (ft)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.07
.1
Legend
WS EX_100yr
Ground
Bank Sta
Elevation (ft)
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580
575
570
565
560
555
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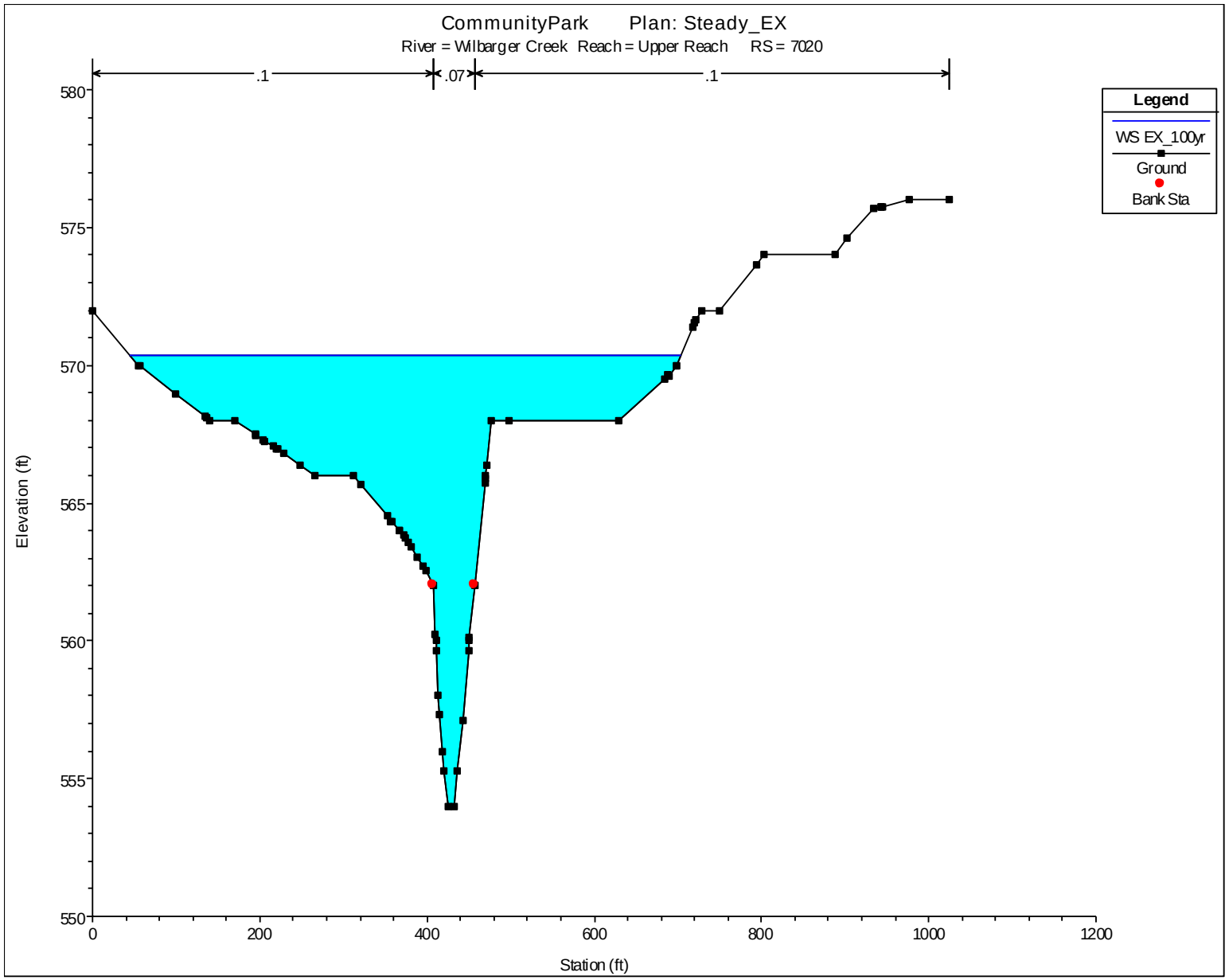
400
600
800
1000
1200
Station (ft)


CommunityPark Plan: Steady_EX
River = Wilbarger Creek Reach = Upper Reach RS = 7020
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.07
.1
Legend
WS EX_100yr
Ground
Bank Sta
Elevation (ft)
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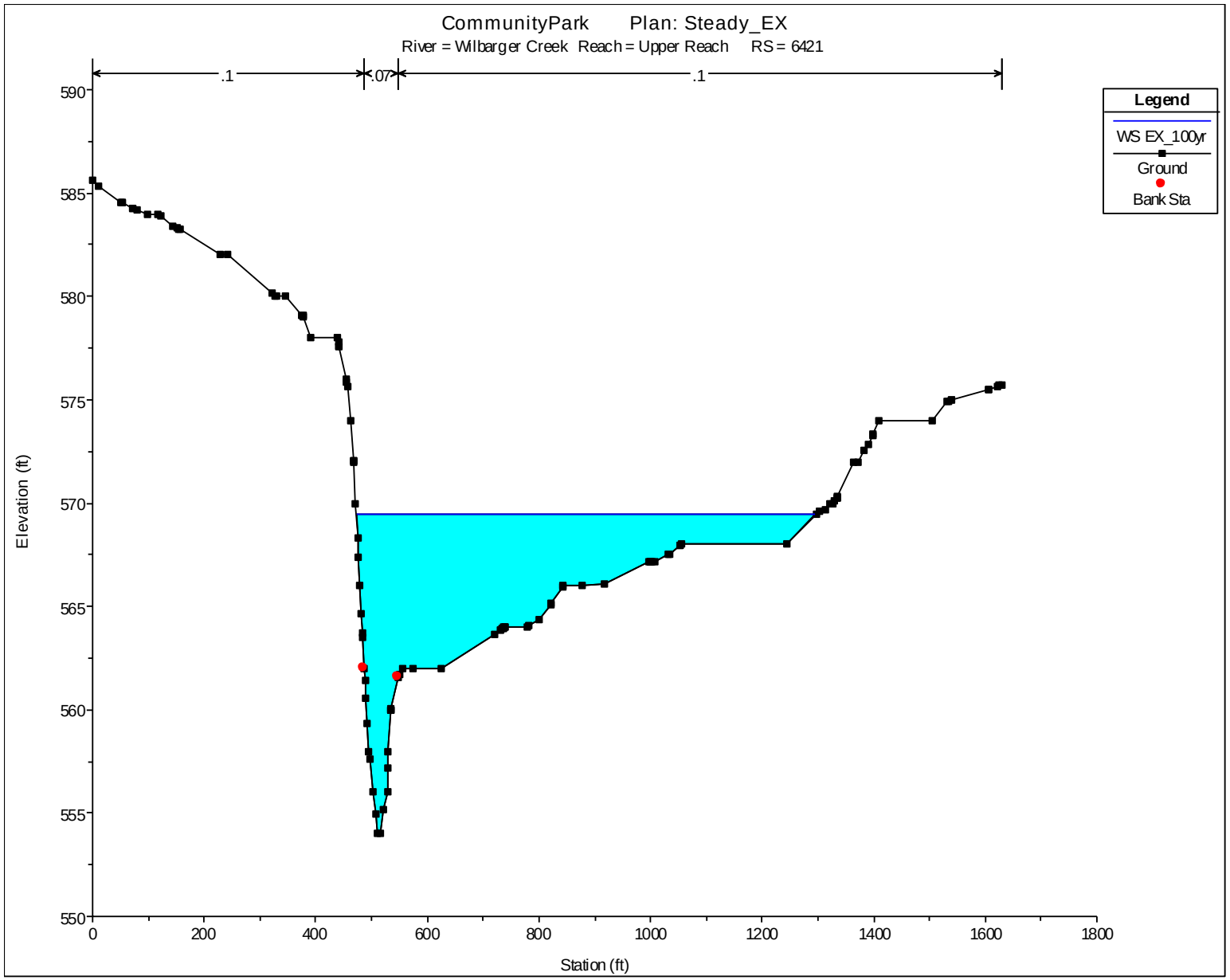
575
570
565
560
555
550
0
200
400
600
800
1000
1200
Station (ft)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.07
.1
Legend
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Ground
Bank Sta
Elevation (ft)
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580
575
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565
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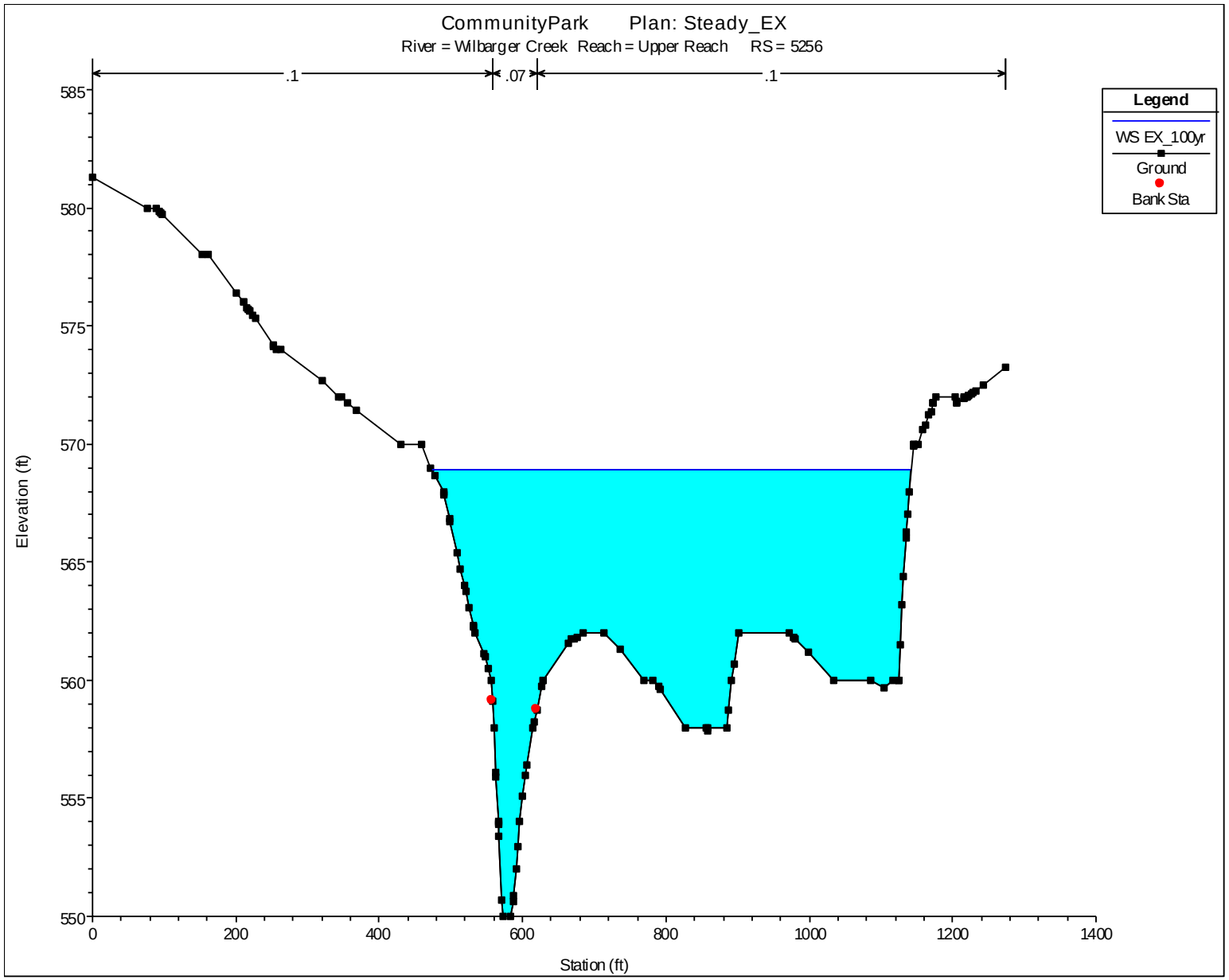
0
200
400
600
800
1000
1200
1400
1600
1800
Station (ft)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River = Wilbarger Creek Reach = Upper Reach RS = 5256
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.07
.1
Legend
WS EX_100yr
Ground
Bank Sta
Elevation (ft)
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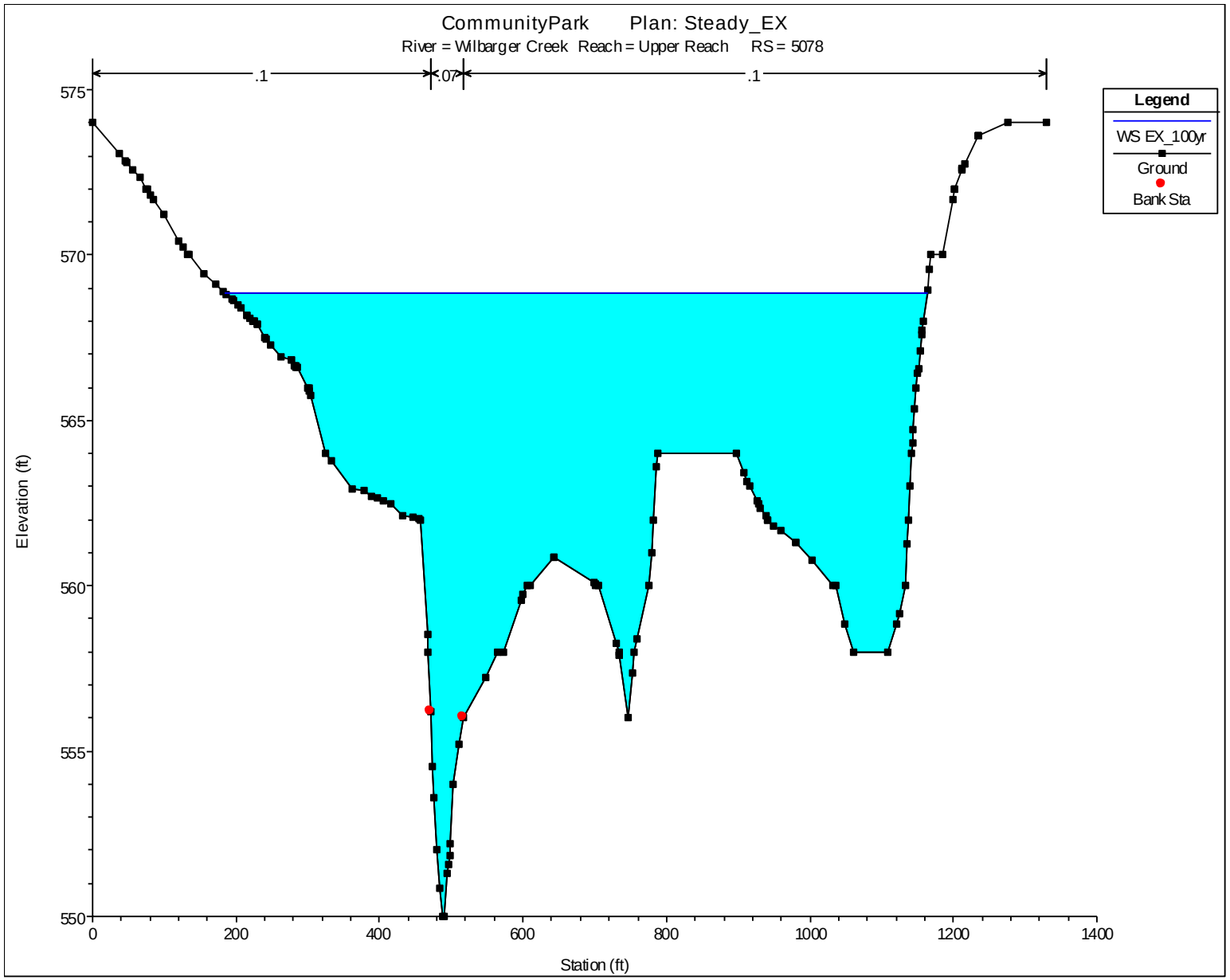
580
575
570
565
560
555
550
0
200
400
600
800
1000
1200
1400
Station (ft)


CommunityPark Plan: Steady_EX
River = Wilbarger Creek Reach = Upper Reach RS = 5078
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.07
.1
Legend
WS EX_100yr
Ground
Bank Sta
Elevation (ft)
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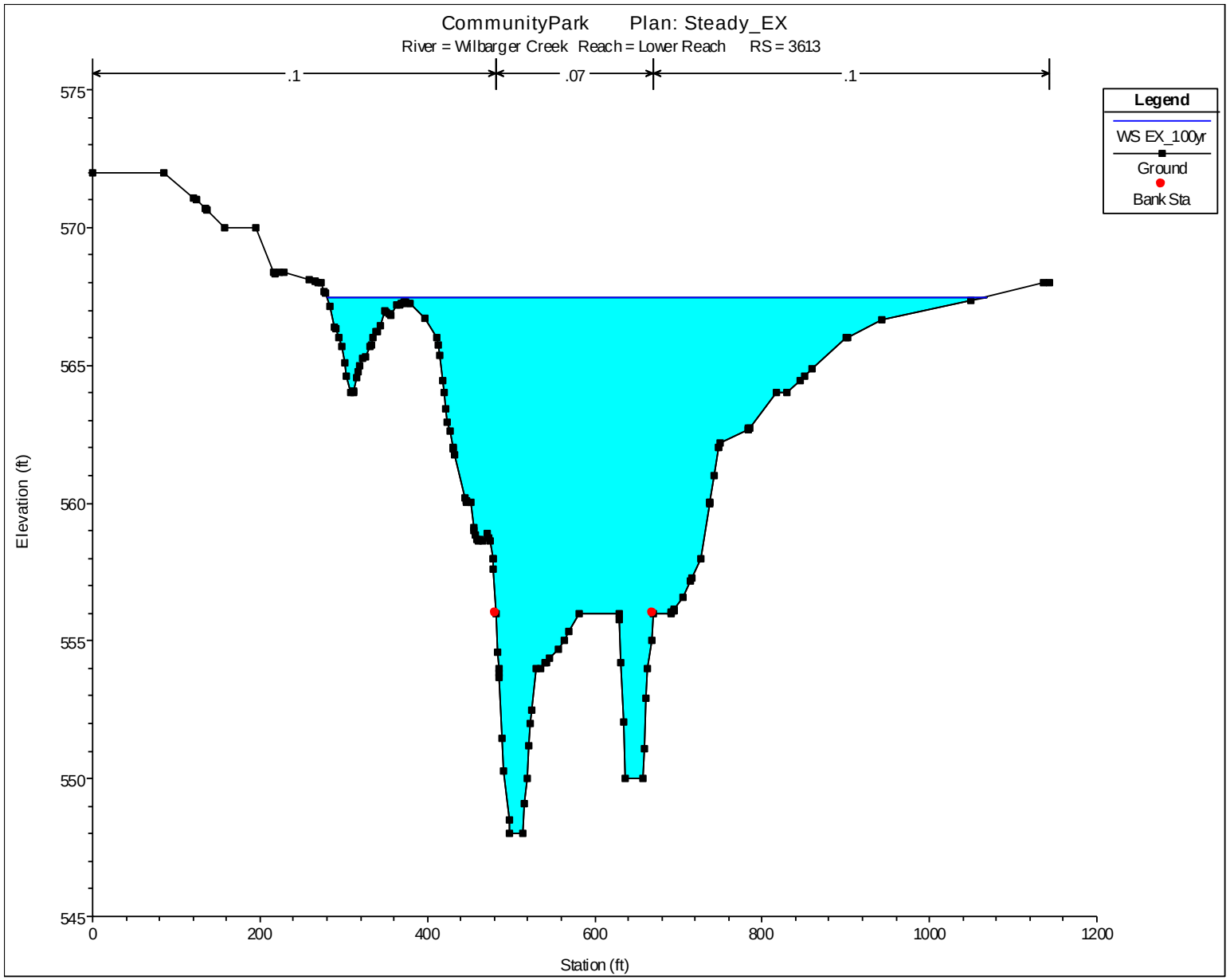
570
565
560
555
550
0
200
400
600
800
1000
1200
1400
Station (ft)


CommunityPark Plan: Steady_EX
River = Wilbarger Creek Reach = Lower Reach RS = 3613
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.07
.1
Legend
WS EX_100yr
Ground
Bank Sta
Elevation (ft)
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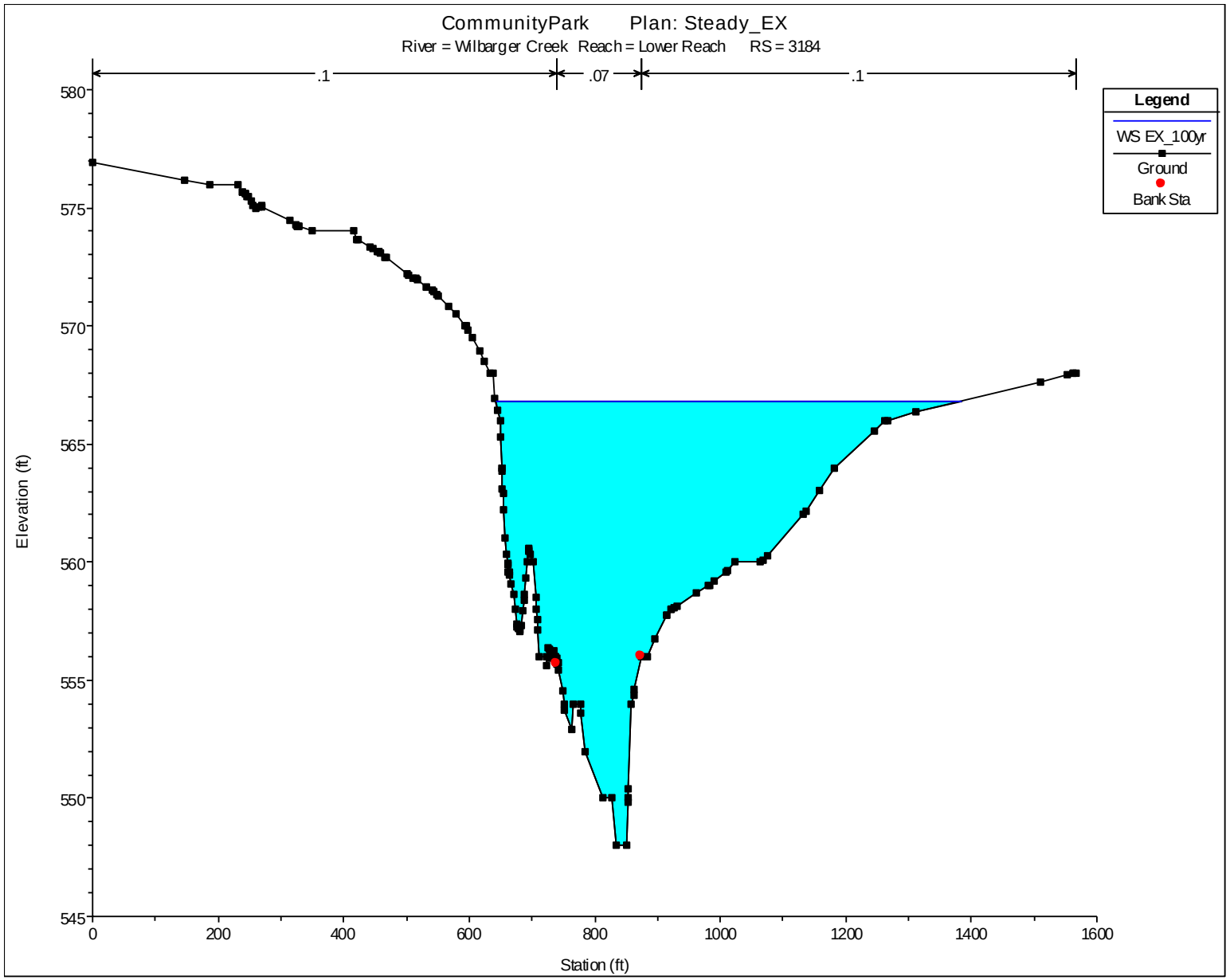
570
565
560
555
550
545
0
200
400
600
800
1000
1200
Station (ft)


CommunityPark Plan: Steady_EX
River = Wilbarger Creek Reach = Lower Reach RS = 3184
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.07
.1
Legend
WS EX_100yr
Ground
Bank Sta
Elevation (ft)
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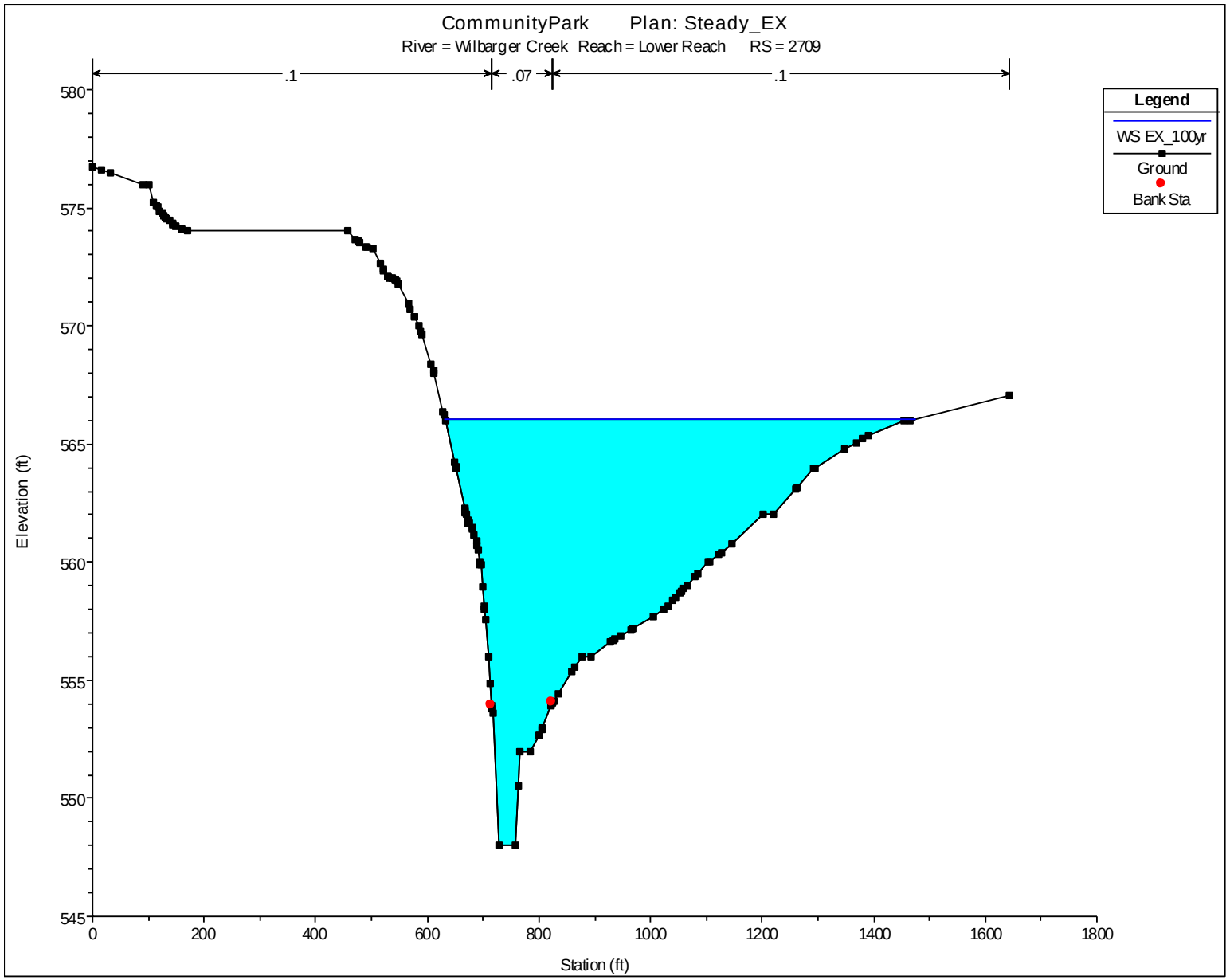
575
570
565
560
555
550
545
0
200
400
600
800
1000
1200
1400
1600
Station (ft)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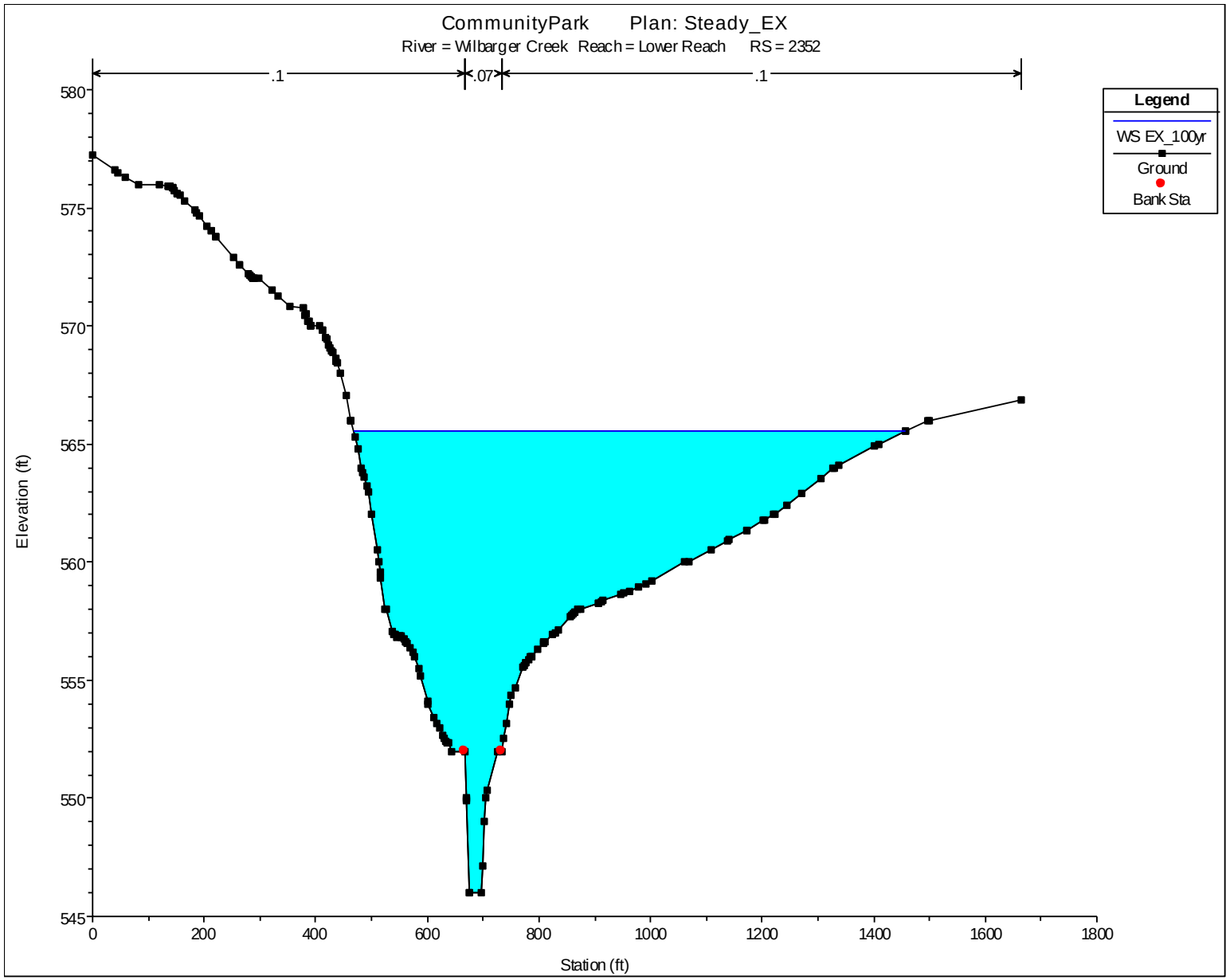
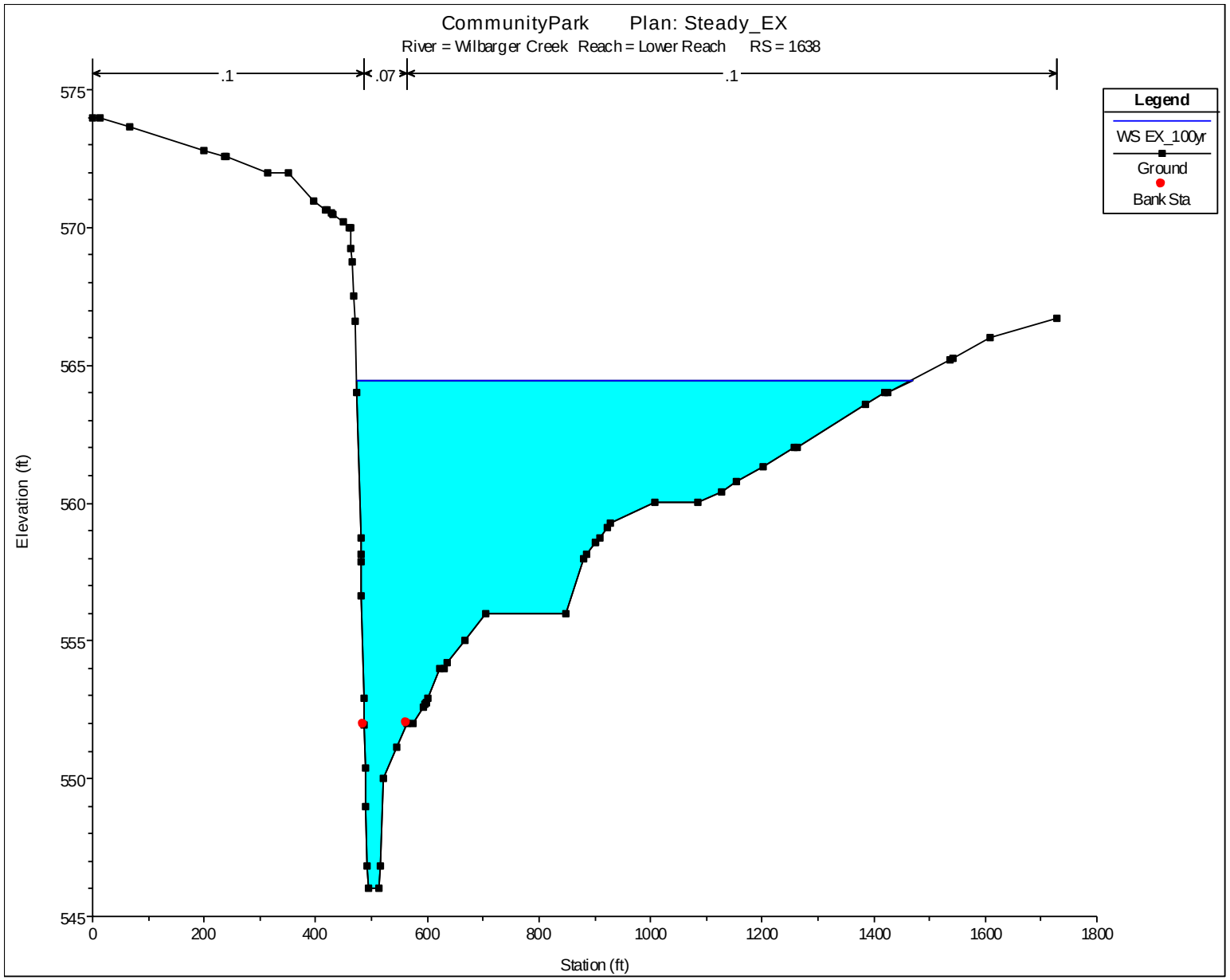
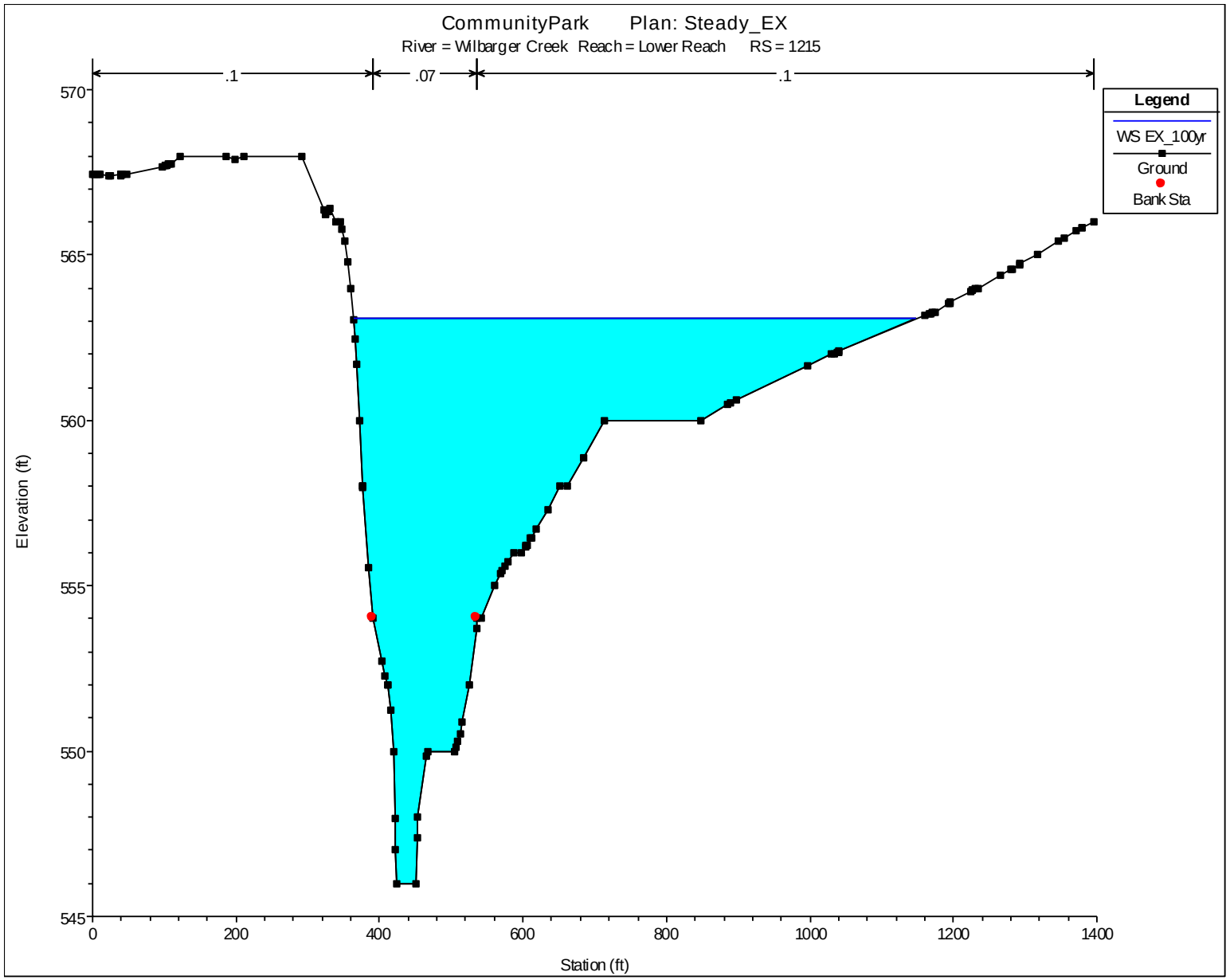
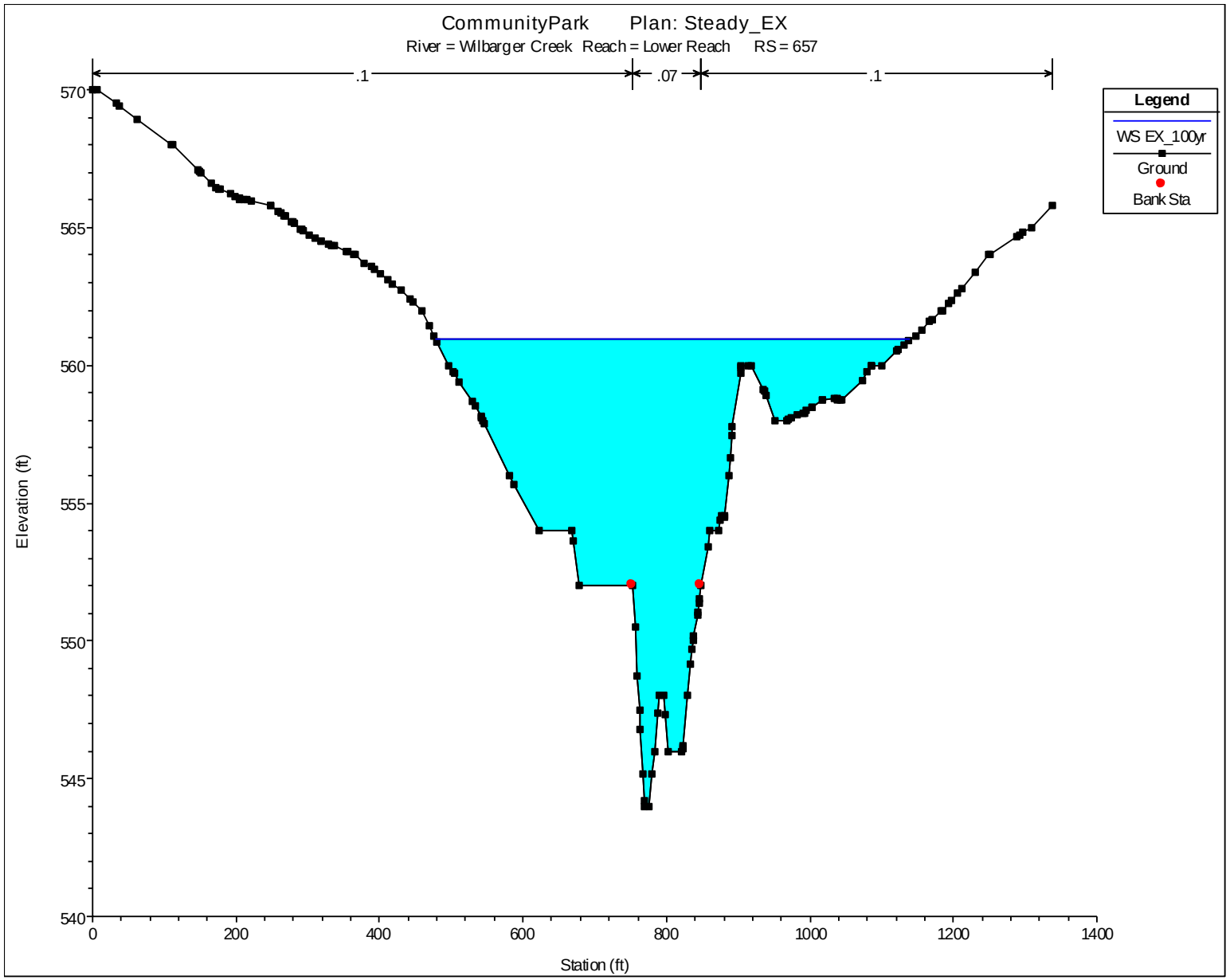
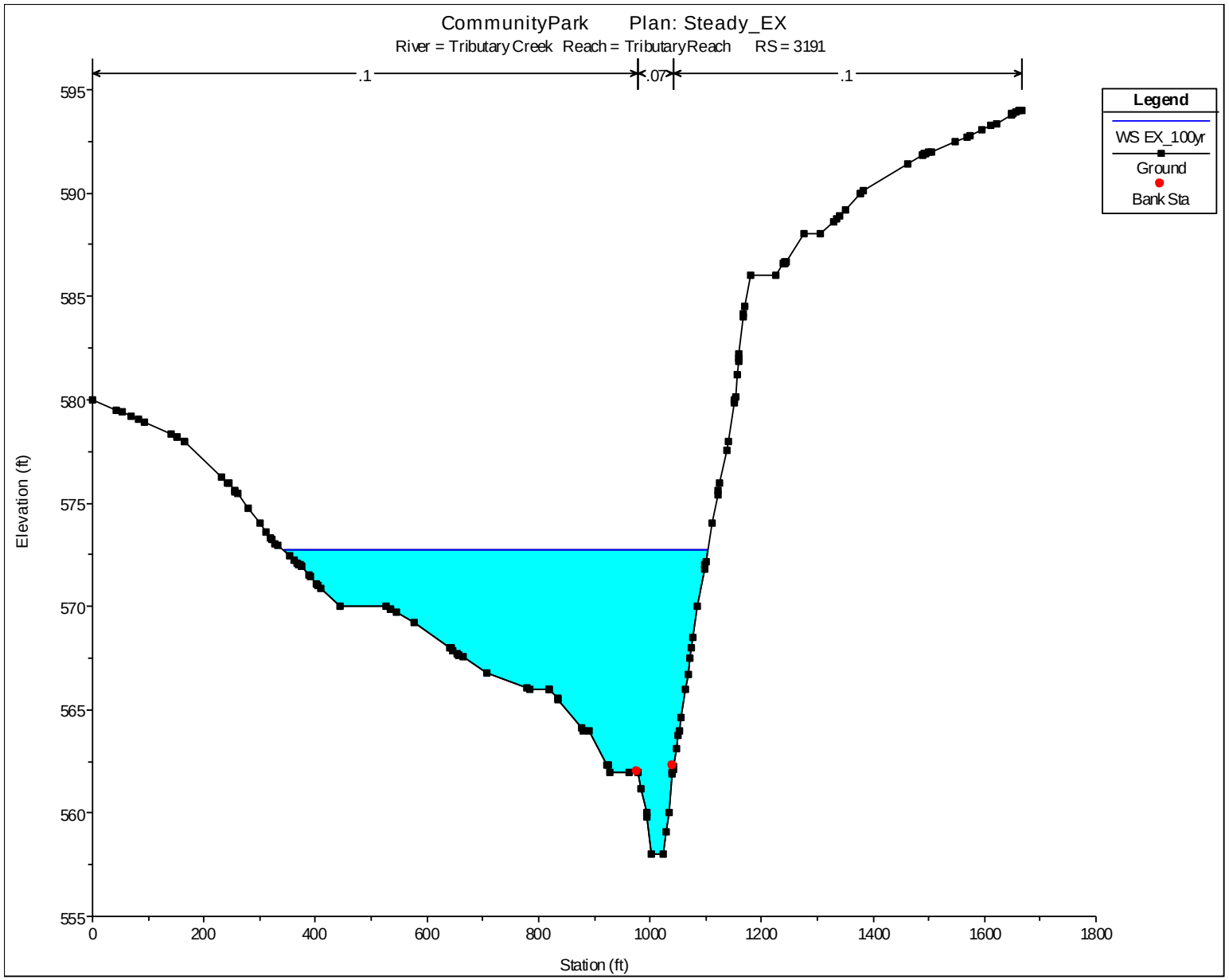
.07
.1
Legend
WS EX_100yr
Ground
Bank Sta
Elevation (ft)
580
575
570
565
560
555
550
545
0
200
400
600
800
1000
1200
1400
1600
1800
Station (ft)

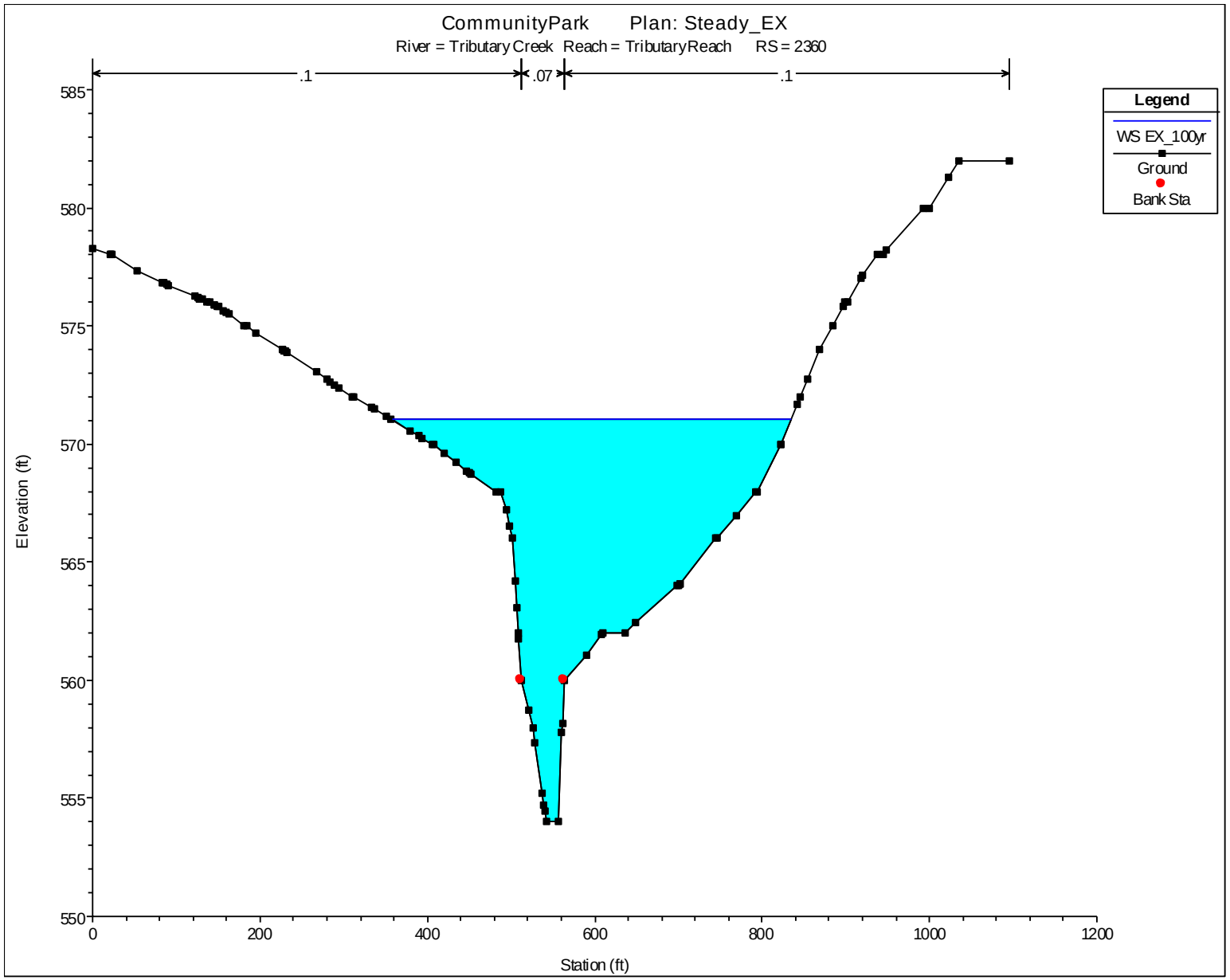

CommunityPark Plan: Steady_EX
River = Wilbarger Creek Reach = Lower Reach RS = 2352
.1
.07
.1
Legend
WS EX_100yr
Ground
Bank Sta
Elevation (ft)
580
575
570
565
560
555
550
545
0
200
400
600
800
1000
1200
1400
1600
1800
Station (ft)

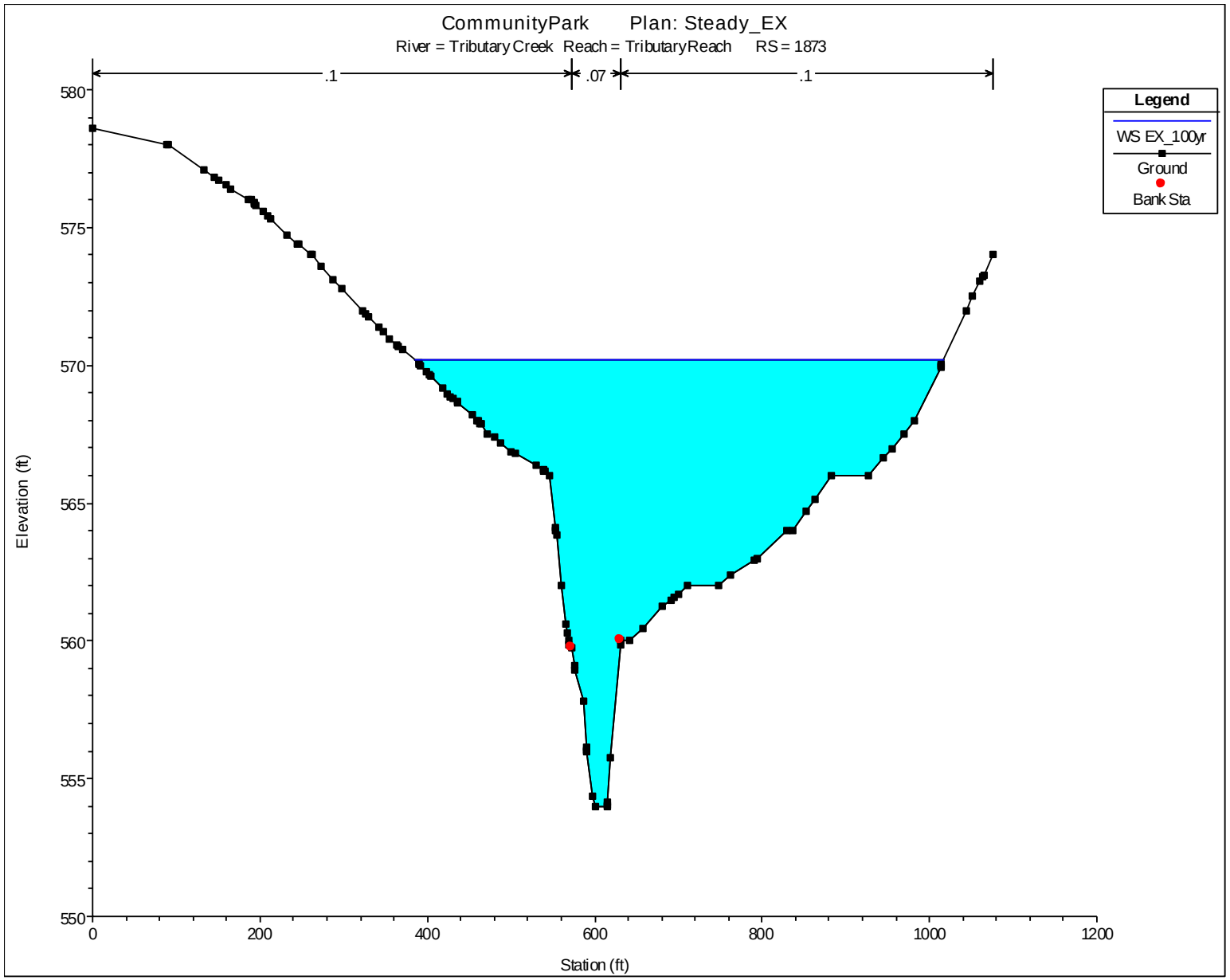

CommunityPark Plan: Steady_EX
River = Wilbarger Creek Reach = Lower Reach RS = 1638
.1
.07
.1
Legend
WS EX_100yr
Ground
Bank Sta
Elevation (ft)
575
570
565
560
555
550
545
0
200
400
600
800
1000
1200
1400
1600
1800
Station (ft)

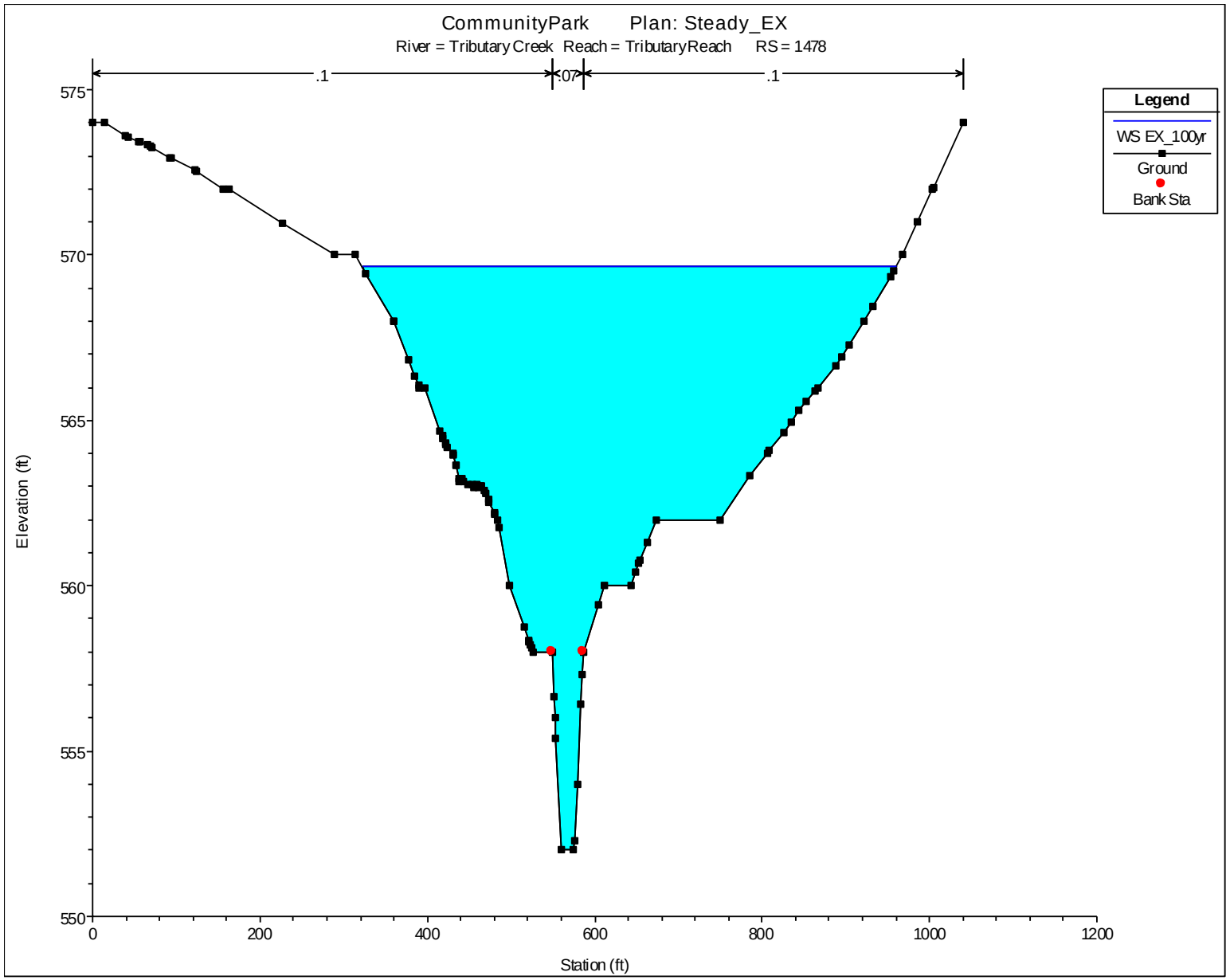

CommunityPark Plan: Steady_EX
River = Wilbarger Creek Reach = Lower Reach RS = 1215
.1
.07
.1
Legend
WS EX_100yr
Ground
Bank Sta
570
565
560
555
550
545
Elevation (ft)
0
200
400
600
800
1000
1200
1400
Station (ft)

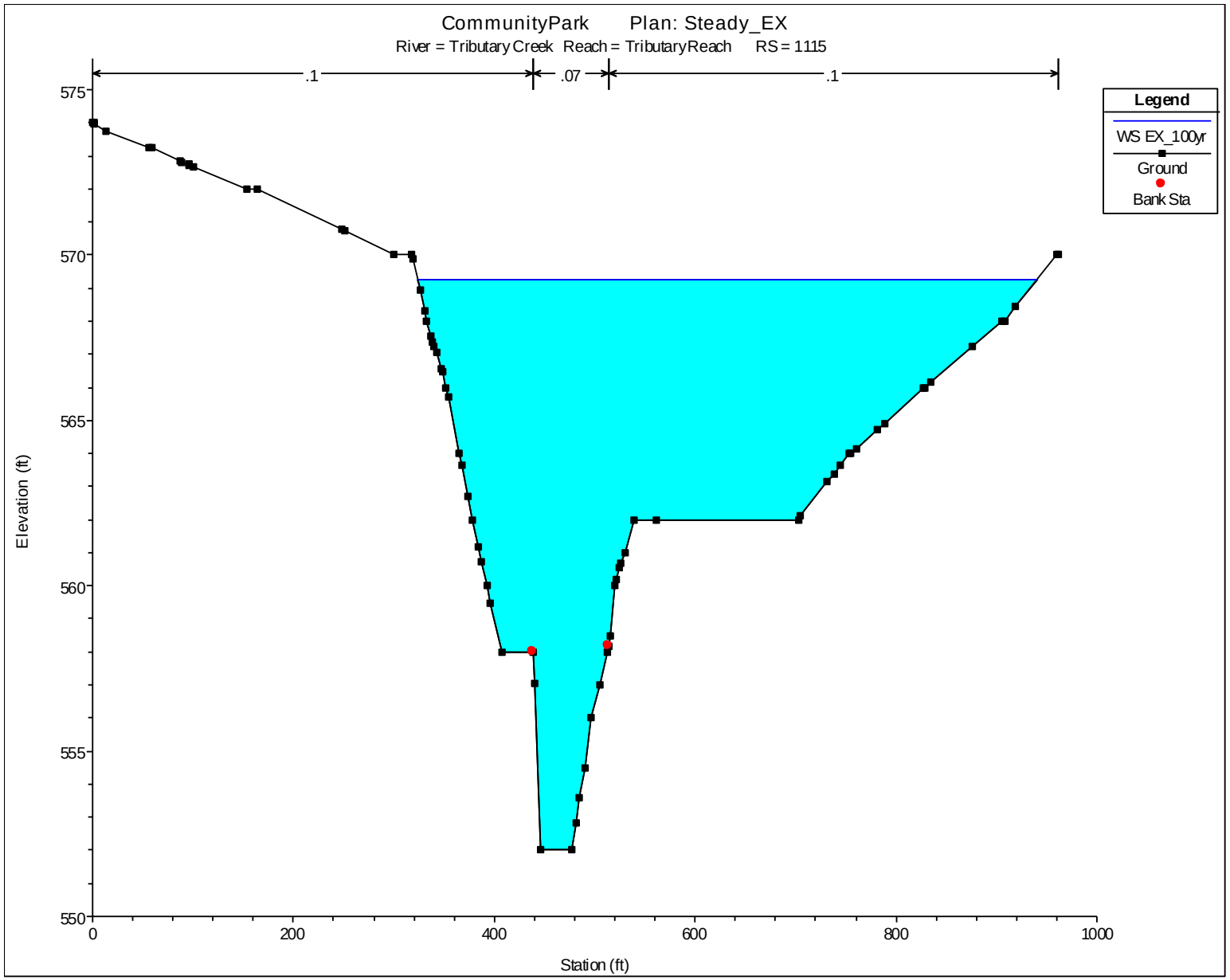

CommunityPark Plan: Steady_EX
River = Wilbarger Creek Reach = Lower Reach RS = 657
.1
.07
.1
Legend
WS EX_100yr
Ground
Bank Sta
Elevation (ft)
570
565
560
555
550
545
540
0
200
400
600
800
1000
1200
1400
Station (ft)


CommunityPark Plan: Steady_EX
River = Tributary Creek Reach = TributaryReach RS = 3191
.1
.07
.1
Legend
WS EX_100yr
Ground
Bank Sta
Elevation (ft)
595
590
585
580
575
570
565
560
555
0
200
400
600
800
1000
1200
1400
1600
1800
Station (ft)


CommunityPark Plan: Steady_EX
River = Tributary Creek Reach = TributaryReach RS = 2360
.1
.07
.1
Legend
WS EX_100yr
Ground
Bank Sta
Elevation (ft)
585
580
575
570
565
560
555
550
0
200
400
600
800
1000
1200
Station (ft)


CommunityPark Plan: Steady_EX
River = Tributary Creek Reach = TributaryReach RS = 1873
.1
.07
.1
Legend
WS EX_100yr
Ground
Bank Sta
Elevation (ft)
580
575
570
565
560
555
550
0
200
400
600
800
1000
1200
Station (ft)


CommunityPark Plan: Steady_EX
River = Tributary Creek Reach = TributaryReach RS = 1478
.1
.07
.1
Legend
WS EX_100yr
Ground
Bank Sta
Elevation (ft)
575
570
565
560
555
550
0
200
400
600
800
1000
1200
Station (ft)


CommunityPark Plan: Steady_EX
River = Tributary Creek Reach = TributaryReach RS = 1115
.1
.07
.1
Legend
WS EX_100yr
Ground
Bank Sta
Elevation (ft)
575
570
565
560
555
550
0
200
400
600
800
1000
Station (ft)