

RFP-2 CABIN BRANCH

DRAFT FINAL MITIGATION PLAN

October 2020 – Updated March 2022

U.S. Department of Transportation
Federal Highway Administration

and

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

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1 Twelve Mitigation Plan Components

In accordance with 33 CFR part 322 Compensatory Mitigation for Losses of Aquatic Resources dated April 10, 2008, the following section discusses the fundamental components that apply to the RFP-2 Cabin Branch mitigation site. Site specific fundamental components (objectives, baseline information, determination of credits, mitigation work plan, maintenance plan, and monitoring requirements) are described below and supporting data is provided in the RFP-2 Cabin Branch Stream and Wetland Restoration Phase II Mitigation Design Report provided in Appendix A.

1.0 Project Objectives

The project objectives are to provide compensatory mitigation for the MDOT SHA's Managed Lanes Study (MLS project) through stream restoration, wetland restoration, wetland buffer enhancement, and stream buffer enhancement.

The RFP-2 Cabin Branch project will restore approximately 7,173 linear feet of stream (plus an additional 810 linear feet on Pepco Property), restore and enhance approximately 4.44 acres of forested non-tidal wetlands, and enhance approximately 11.65 acres of non-tidal wetland and riparian buffers. The project is within the middle Potomac - Catoctin Watershed (Federal 8-digit HUC 02070008), Maryland's Seneca Creek Watershed (8-digit HUC 02140208) and Cabin Branch and its associated tributaries are classified as use I-P stream.

The project is located on a former golf course and the stream and adjacent riparian areas exhibit extensive perturbation as a result of past land use practices and increased watershed urbanization. A land-use map for the site is included in Appendix E. Site impacts include channel modifications, utility encroachment, stream piping, impoundment, channelization, bank armoring, channel blockages, and anthropogenic grading associated with historic golf course infrastructure. As a result, Cabin Branch is highly incised and exhibits minimal floodplain connection except during large flood events. Loss of vertical and lateral stability, combined with historic land use impacts, provides an opportunity to generate significant ecological uplift through large scale, multi-feature restoration in a highly urbanized area. The project also proposes daylighting and creation of natural stream channels for over 2,300 linear feet of currently piped water courses. Historic land use changes have also had significant impacts to the stream valley and what would have been forested floodplain complexes. The creation of water hazards and amenity ponds, in combination with stream channel incision, installation of subsurface drainages, and golf course grading has eliminated almost all wetlands within the project site. As a result of this mitigation project, six open water ponds will be converted to non-tidal forested wetlands that will provide significant ecological and system wide improvements, eliminate thermal pollution, and other important co-benefits to the site and watershed.

Stream design objectives include creation of a self-sustaining planform, cross-section, and profile utilizing natural channel design. The design incorporates priority II and III restoration that includes channel relocation and increases in bed elevation to ensure functioning bank height and entrenchment ratios that will increase floodplain connectivity to either the existing floodplain or proposed floodplain benches. Woody and other habitat structures will be utilized to further promote stability while increasing ecological uplift. Riffle/pool features have been designed to maintain bedform diversity, promote macroinvertebrate and fish habitat, as well as increase hyporheic exchange. This restoration design will result in eight functional assessment categories currently non-functioning or functioning at risk and

restore them to functioning. These include decreased bank height ratio, increased entrenchment ratios, increase floodplain drainage, increased vertical stability, riparian vegetation enhancement, increased lateral stability, aquatic habitat improvement including stable pool to pool spacing, greater pool depths, sediment and nutrient reductions, detritus retainment, and macroinvertebrate habitat. In addition, performance standards and monitoring requirements have been proposed that will validate these goals.

Wetland design objectives include the conversion of open water ponds to forested non-tidal wetlands. The existing ponds will be filled with suitable soil to the appropriate elevation necessary to ensure wetland hydrology. All subsurface and other drainage features will be disconnected, and vegetation will be planted based on reference wetlands in proximity to the project site. In addition to ground water hydrology the proposed wetlands have been integrated into the stream design and will receive flood inputs at larger than bankfull events. This wetland/stream integration provides the greatest overall benefit to the system.

1.1 Site Selection

Site selection for public mitigation sites was based on the traditional mitigation site search that is discussed in Section 5.3.1 of the Compensatory Mitigation Plan (CMP). The private mitigation sites were selected based on MDOT SHA's RFP process that is discussed in Section 5.3.2 of the CMP.

1.2 Site Protection Instrument

The property for the RFP-2 Cabin Branch mitigation project is owned by Green Bloom MV Park LLC and Green Bloom MV Development, LLC. HGS, LLC has obtained an option agreement and Right-of Entry Agreement with the owners that grants the rights to use the property for stream and wetland mitigation, a copy of the option agreement is provided in Appendix B. Pursuant to the Maryland Nontidal Wetlands Protection Act Rules (COMAR 26.23.04), and the Federal Clean Water Act, plus its implementing regulations at 33 CFR Part 332.7(a), the mitigation acreage for this project will be protected by implementing an easement in the form of the MDOT SHA's Grant of Mitigation Easement Template. This easement will grant rights to both United States Army Corps of Engineers (USACE) and the Maryland Department of Environment (MDE) as required under state and federal rules.

The permanent conservation easement will be recorded in the Land Records of the applicable jurisdiction. All natural resource functions, values and credits will be assigned to the MDOT SHA. The easement will provide project site access and control and allow the MDOT SHA to perform future inspections and maintenance responsibilities once the warranty period and any mandated post-construction monitoring period has expired. Documentation that the easement has been executed and recorded will be submitted to MDE and USACE within 60 days of construction completion. The easement will be acquired in accordance with applicable state and federal laws and policies, including but not limited to the Uniform Relocation Assistance and Real Property Acquisition Act (1970). Once the MDOT SHA determines the site is successful, ownership (in the form of a conservation easement) will be assigned or transferred to the MDOT SHA.

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1.3 Baseline Information

The RFP-2 Cabin Branch mitigation site is located at 19550 Montgomery Village Avenue, Gaithersburg, Maryland 20886, and the site's subject parcels are highlighted in Figure 1 below. The existing conditions of the proposed mitigation area are described in Appendix A, this information includes wetland delineations, surveys, groundwater well data and more.

Figure 1: Cabin Branch Mitigation Project Site Parcels



1.4 Determination of Credits

Mitigation credit at the RFP-2 Cabin Branch site will be generated by providing functional uplift to approximately 7,173 linear feet of Cabin Branch and it's associated tributaries, restoring approximately 4.37 acres of forested non-tidal wetlands, and enhancing approximately 11.71 acres of non-tidal wetland and riparian buffers. The Stream Function-Based Rapid Assessment is included in Appendix C. Wetland mitigation credits at the RFP-2 Cabin Branch site were determined by calculating the area (acres) of each mitigation type against its ratio. Stream mitigation credits at the RFP-2 Cabin Branch site were calculated using the Maryland Stream Mitigation Framework (MSMF, USACE, 2022) which was recently provided in beta version. The Stream Mitigation Calculator spreadsheet, see Appendix D, was used to determine the mitigation potential of the RFP-2 Cabin Branch mitigation site, measured in functional feet. A functional foot is defined as a linear foot of stream of perfect quality (100% or 1.0 score) and a drainage area of 1 square mile. A functional foot relates to streams of any flow type and quality in a stream network and these factors influence the value of a linear foot of stream as a functional foot.

Table 1: Mitigation Credit Summary

ACTIVITY	LINEAR FEET (LF) ACREAGE (AC)	CREDIT RATIO	CREDIT	STREAM GAINS (FUNCTIONAL FEET)
STREAM RESTORATION	7,173 LF	1:1	7,173	5,149
STREAM RESTORATION (PEPCO PROPERTY)	810 LF	1:1	810	433
WETLAND RESTORATION (PFO)	4.38 AC	1:1	4.38	-
WETLAND ENHANCEMENT	0.06 AC	4:1	0.01	-
WETLAND BUFFER ENHANCEMENT	2.45 AC	15:1	0.16	-
TOTAL WETLAND CREDIT			4.55	-
RIPARIAN BUFFER (35 FOOT BUFFER)	8.27 AC	-	-	-
RIPARIAN BUFFER ENHANCEMENT	0.93 AC	15:1	0.06	-

1.5 Mitigation Work Plan

The RFP-2 Cabin Branch Stream Restoration and Wetland Mitigation Phase II project plan includes plan views with proposed grading and planform alignment, typical sections and details, and landscaping plant schedules and notes. The specific activities required to implement the restoration components of the RFP-2 Cabin Branch Mitigation Site are outlined in the Sequence of Construction on Sheet 15 of the RFP-2 Cabin Branch Stream Restoration and Wetland Mitigation Phase II Erosion & Sediment Control Plan dated. In general, the primary stream restoration objectives include a self-sustaining channel planform and geometry through increases in bank height ratios (BHR) and channel relocation where necessary. Changes in BHR will be accomplished with either raising the existing channel bottom elevation by modifying the channel longitudinal profile and/or in conjunction with floodplain grading. Profile changes will provide stable riffle/pool sequences that are currently missing from the existing channel. In areas where the current planform is outside of design standards, channel relocation will be completed in conjunction with floodplain grading and wetland restoration to provide the greatest ecological uplift to the overall riparian corridor. The proposed stream work will generally take the existing channels from “Not Functioning” to “Functioning”. The highest functional uplift occurs in currently piped streams that will not be free flowing systems within the riparian/floodplain complex. This provides significant geomorphic improvements to these previously impacted systems. Stream and wetland buffer enhancement will also be completed (see planting plan) to establish a forested riparian complex within the Cabin Branch floodplain. Wetland restoration is being achieved by the filling of existing open water ponds to an elevation conducive of forested wetland establishment. In addition to POW to PFO conversion, and existing PEM wetland will be enhanced and included as part of a larger wetland restoration area. A detailed summary of all proposed restoration can be found in Appendix A: RFP-2 Cabin Branch Stream and Wetland Restoration Phase II Mitigation Design Report. All Mitigation work will be completed under the supervision of an approved qualified restoration specialist. All activities including site access, staging, and stockpiling will occur completely within the boundaries of the subject properties and Limits of Disturbance.

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1.6 Maintenance Plan

HGS, LLC will be responsible for the maintenance of the mitigation site following construction. HGS, LLC will monitor and control invasive species within the project site per MDE's Performance Standards and Monitoring Protocol for Permittee Responsible Nontidal Wetland Mitigation Sites dated October 30, 2020. Both stream and wetland monitoring will be conducted for 10 years with reports submitted in Years 1, 3, 5, 7, and 10. However, starting in Year 5 if the site meets all final year performance standards for at least two (2) consecutive years the Permittee may request termination of additional monitoring. The planting plan calls for a higher than necessary density of planting to account for deer browse and die-off, if extensive deer browse of riparian plantings occurs, it will be assessed during post-construction monitoring. Installed structures, specific features in the floodplain (habitat depressions, micro-topography, etc.) and within the channel (riffles, pools, grade control structures, etc.) will be observed after major storm events to determine if these features are functioning as designed. Post-construction, a report will be prepared to document any concerns or issues occurring within the project area that may require maintenance or more significant repairs. Adaptive management issues will be addressed by HGS, LLC in a timely manner. Any issues related to vegetation establishment or stream stability within the project area will be brought to the attention of both the USACE and MDE to determine if adaptive management may be warranted.

Following construction, the project will be monitored regularly to determine the progress and continued viability of the project. Monitoring will be conducted per Section 1.8 of this report or until the regulatory agencies agree that no further monitoring is needed. If remediation action is needed, HGS, LLC will prepare a remediation plan to be submitted for agency approval. HGS, LLC will be responsible for implementing any remedial actions.

The presence of invasive species as defined in Section I(A)(3) of *Performance Standards and Monitoring Protocol for Permittee Responsible Non-Tidal Wetland Mitigation Sites* (October 30, 2020) at this site will require invasive species management control. HGS, LLC will adhere Invasive Species Management protocol outlined in the monitoring plan as part of its regular maintenance activities and as outlined on Sheet 50 of the RFP-2 Cabin Branch Stream Restoration and Wetland Mitigation Phase II 65% Plans.

1.7 Performance Standards

Performance standards for the RFP-2 Cabin Branch mitigation site will be in accordance with the *Performance Standards and Monitoring Protocol for Permittee-responsible Nontidal Wetland Mitigation Sites in Maryland*, October 30, 2020. Site-specific monitoring and performance standards for stream and wetland restoration are developed based on the proposed stream restoration goals and objectives. The site-specific stream restoration monitoring and performance standards for the RFP-2 Cabin Branch mitigation site were developed to demonstrate achievement of the proposed restoration goals. Each wetland and stream restoration goal has one or more quantifiable and measurable objectives that are the basis of the proposed performance standards and monitoring requirements. Performance standards are outlined in the mitigation monitoring plan on sheet 50 of the RFP-2 Cabin Branch Stream Restoration and Wetland Mitigation Phase II 65% Plans. In addition to the performance standards, the stream will be evaluated at least twice during the monitoring period using the Maryland Stream Mitigation Framework calculator.

1.8 Monitoring Requirements

Monitoring requirements will be negotiated with the agencies and determined for the RFP-2 Cabin Branch mitigation site during the development of the Phase II Mitigation Design Plans. All mitigation sites will be evaluated in accordance with the *Performance Standards and Monitoring Protocol for Permittee-responsible Nontidal Wetland Mitigation Sites in Maryland*, October 30, 2020.

A monitoring plan for the RFP-2 Cabin Branch mitigation site is provided on Sheets 50-51 of the 65% Phase II plans to document site performance and achievement of approved performance standards. The approved maintenance and monitoring plan will be implemented, following the completion of construction, for the entire maintenance and monitoring period by HGS, LLC, until final regulatory release is secured from MDE and USACE. HGS, LLC will prepare and submit an as-built plan and Construction Completion Report for agency review and approval within 60 days of completing construction. HGS, LLC will begin monitoring the site immediately following the completion of construction and maintain the restoration as needed throughout the Maintenance and Monitoring period. At the first monitoring visits, HGS, LLC will examine the project's initial response to the restoration actions completed. HGS, LLC will provide a regular schedule for subsequent monitoring visits for data gathering, maintenance, and corrective action as needed. A flexible, adaptive management approach shall be applied to address any problems or deficiencies as they arise. Required maintenance activities will be implemented by HGS, LLC as needed ensuring that the site stay on a steady trajectory to achieving self-sustaining equilibrium and functionality. Annual monitoring reports will be prepared and submitted on or before December 31st in each monitoring year.

1.9 Long-term Management Plan

The purpose of the long-term management plan is to ensure that the RFP-2 Cabin Branch mitigation site is monitored and managed after the maintenance and monitoring period is complete and it has been transferred to the Long-Term Steward (LTS). In this case, since all property rights will be assigned to the MDOT SHA once the mitigation site has been determined to be successful, the MDOT SHA will be the LTS. The long-term management plan will establish objectives, priorities, and tasks to monitor, manage, and report on the wetlands and waters of the U.S. plus other valuable habitats on the RFP-2 Cabin Branch mitigation site after all performance standards have been achieved.

The long-term management plan will be prepared by HGS, LLC and implemented by MDOT SHA. The long-term management plan will be subject to final approval by MDE and USACE. During the 10-year monitoring period, the site's overall development and its trajectory toward achieving self-maintenance will be closely monitored and evaluated. Long-term maintenance requirements will be evaluated during or after monitoring year 5. The long-term management plan may be revised during or after monitoring year 5 to more accurately reflect long-term monitoring requirements as the end of the maintenance and monitoring period gets closer. Both MDE and USACE will have review and approval authority over any changes to the long-term management plan.

1.10 Adaptive Management Plan

HGS, LLC shall complete any remedial actions or adaptive management strategies deemed necessary for site success by the USACE and MDE and shall continue monitoring as required by the USACE and MDE until the site is deemed successful and approved by the USACE and MDE. Adaptive management measures

will be applied to ensure that project goals and objectives are achieved. Measures will include reviewing and assessing prevailing field conditions and data, adjusting plans or making field edits and/or post-construction corrective actions. Any construction-related adaptive management measures will be implemented under the direction of the project biologist and/or engineer in order to achieve specific design objectives within current site constraints. Monitoring data will be reviewed carefully to determine the need for any adjustments. Specific focus will be placed on making frequent observations immediately following construction until the site has stabilized and succeeding on a proper trajectory to self-maintenance.

HGS, LLC will advise MDE/USACE in writing of any material changes to the approved final mitigation plan and provide adequate justification. A material change would be one where the composition of the mitigation types change by more than about 10-15%, or change in such a way that the mitigation requirements can no longer be met. Any material changes between the approved design drawings and completed project will be shown on the as-built construction drawings and documented in the Construction Completion Report (CCR). Corrective actions implemented during the growing season will be formally documented in the corresponding annual monitoring report.

1.11 Financial Assurance

MDOT SHA frequently manages and implements roadway projects requiring compensatory mitigation, and has a funded program dedicated to the management and monitoring of its mitigation sites. MDOT SHA has committed funding for the design, construction, and monitoring of the mitigation site as part of the compensatory mitigation for the MLS project. MDOT SHA establishes upfront funding for monitoring based on estimates of past monitoring on similar projects. On an annual basis, SHA reviews its need for funding and includes costs associated with monitoring, management, and remediation. The state has allocated funds to complete the aspects of this project including mitigation and maintenance and has self-interest in completing the mitigation project, in accordance with performance standards. The RFP-2 Cabin Branch mitigation site is funded by MDOT SHA through a full delivery contract to provide stream and wetland mitigation credits. MDOT SHA is making payments to HGS, LLC according to a milestone payment schedule. Delivery milestones include Phase 2 mitigation plan approval, final design, construction, as-builts, monitoring reports, and regulatory approval of mitigation site success.

The purpose of the financial assurance is to establish compliance with the Federal Compensatory Mitigation Rules at 33 CFR 332.3(n). The financial assurances will be posted to ensure a high level of confidence that the compensatory mitigation project will be successfully completed in accordance with its approved performance standards. The amount of the financial assurance will be based on the fair market costs to implement/construct the project and meet the approved performance standards. The financial assurance will utilize the USACE Baltimore District's Sample Compensatory Mitigation Performance Bond template, or another assurance form acceptable to the USACE and MDE, and the assurance amount will consider the relevant "Typical Compensatory Mitigation Cost Estimate Components" (USACE 2010). There are two (2) forms of financial assurances proposed for the RFP-2 Cabin Branch mitigation site:

(1) Construction Assurance and

(2) Maintenance and Monitoring Assurance (inclusive of Interim Monitoring). The construction estimate will include soil erosion and sediment controls, site preparation, earthwork, planting and seeding. The

maintenance and monitoring amount will include the cost to monitor the site, prepare annual monitoring reports and the projected costs associated with periodic maintenance activities. The construction portion of the financial assurance shall be released upon written approval from MDE/USACE indicating that construction is substantially complete in accordance with the approved plans. Assuming the project meets its annual performance-based milestones, HGS, LLC will request that the maintenance and monitoring portion of the financial assurance be reduced on an annual basis, such that it only covers the costs to monitor and maintain the site through the end of the maintenance and monitoring period. HGS, LLC will submit a spreadsheet-base estimate outlining proposed financial assurance cost components with the financial assurances under separate cover for review and approval by the USACE and MDE.

The financial assurances will be posted prior to construction and maintained until all permit requirements have been fully satisfied and the USACE and MDE releases the permittee from its mitigation requirements under the issued permits. Final release of the maintenance and monitoring portion of the financial assurance shall occur once the final submitted annual report to MDE/USACE demonstrates that the success criteria approved for the entire project have been satisfied.

1.12 Advance Mitigation

Advanced Mitigation is no longer being proposed.

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1.13 References

Maryland Department of Environment (MDE), 2008. Code of Maryland Title 5. October 6, 2008. MD Nontidal Wetlands Protection Act, COMAR 26.23.

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Appendix A: RFP-2 Cabin Branch Stream and Wetland Restoration Phase II Mitigation Design Report

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RFP-2 Cabin Branch Stream and Wetland Restoration
Phase II Mitigation Design Report

Cabin Branch and Unnamed Tributaries

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65% DRAFT; UPDATED 3/10/2022

I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the state of Maryland.
License No. 52852, Expiration Date 6/14/2022.

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Project Summary

1.1. Introduction

The project area covers four (4) parcels, two owned by USL2 MR Montgomery Village Business TR & two owned by Potomac Electric Power Company totaling 128.39-acres (outlined in Figure 1). The site is generally located at 19550 Montgomery Village Avenue, Gaithersburg, Montgomery County, Maryland. RES is seeking agreements with both landowners for access and easements, a sample easement agreement document in included in Appendix G.

Cabin Branch Runs East to West along the length of the project area. There are five (5) unnamed tributaries draining to Cabin Branch in the project area. Of the five tributaries carrying flow to Cabin Branch, three (3) of these are currently piped and one is routed along a concrete channel. Cabin Branch joins Great Seneca Creek approximately half a mile downstream of the project terminus, before draining ultimately to the Potomac River. In addition to the existing streams the site contains nine (9) ponds that were constructed as amenity ponds for the golf course.

This site contains approximately 5,634 feet of Cabin Branch, 1,256 feet of unpiped unnamed tributaries, and 2,000 feet of pipe/channelized unnamed tributaries to Cabin Branch. The stream restoration is being proposed on both Cabin Branch (Reach 1 & 2) and the unnamed tributaries to Cabin Branch (Tributaries 1-5) within the identified parcels and shown in Figure 1. The wetland restoration included in this mitigation plan covers six (6) ponds.

This report discusses the background information and basis of design for the proposed stream and wetland restoration.

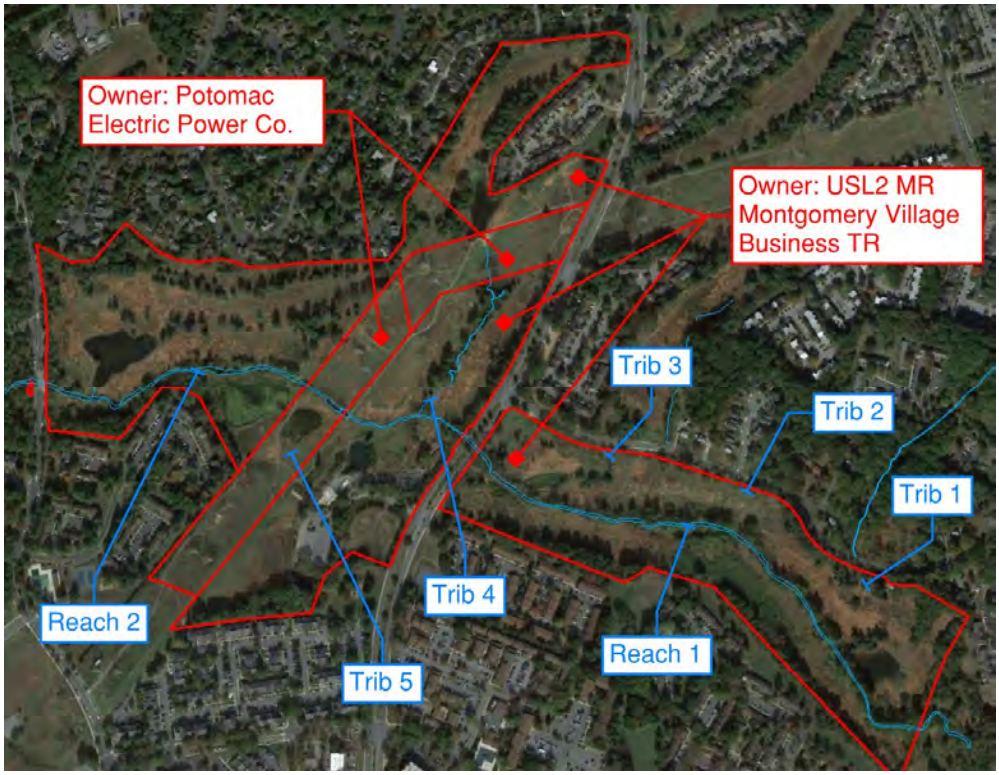

Figure 1: Parcel Boundaries as shown on Google Earth

1.2. Site Selection

The Cabin Branch Stream Mitigation site (see Figure 2) was selected because it provides an opportunity to conduct large-scale, multi-feature restoration in a highly urbanized area and the proposed stream segments have the potential for significant ecological uplift upon restoration. Located within the fairway of a former golf course, the proposed restoration reaches have experienced severe channel degradation and diminished water quality from historic land use practices. Converting the adjacent land use from golf course fairways and greens into a restored floodplain with wetland features and a forested riparian buffer will greatly benefit Cabin Branch. Reestablishing Cabin Branch's connection to a restored floodplain and wetlands will enhance the treatment of water within the stream and its tributaries resulting in improved water quality within the system. Relocating the stream channel to improve hydrology and morphology of the stream can be done with minimal impact to fringing forested area since the historic fairway contains few native trees.

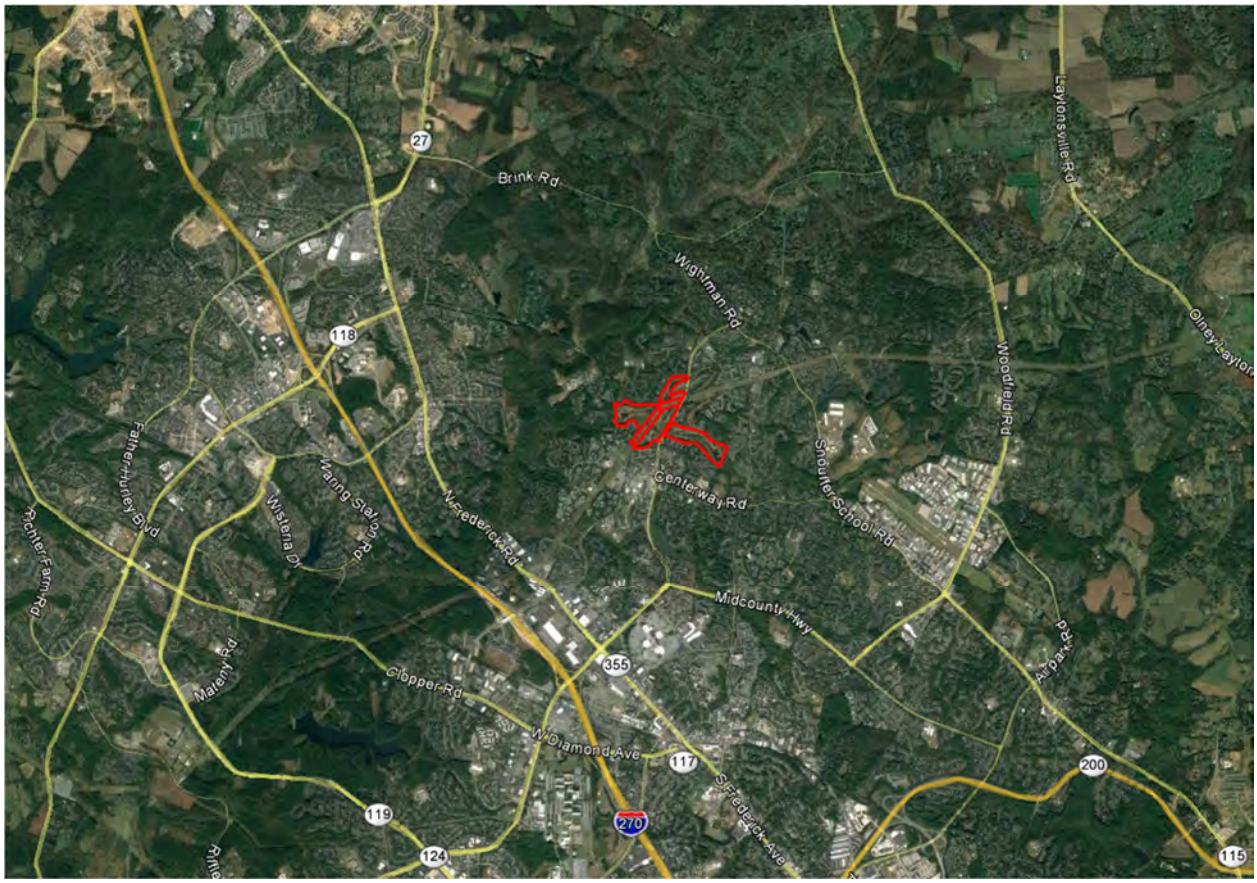

Figure 2: Project Location Map (Not to Scale)

Cabin Branch is a third-order major tributary with a drainage area of 4.3 square miles of urban development with little or no stormwater management. The Montgomery County Department of Environmental Protection has classified the Cabin Branch sub-watershed as in 'Fair' condition based on biological monitoring data. Conditions within the stream channel exhibit significant bank erosion, over-widening and incision. Continued development within the watershed has disrupted the hydrology of the stream and caused out-of-bank flood events. Tributaries flowing

into Cabin Branch are degraded or piped channels, and as a result, are experiencing active head cuts and erosion. Further information is provided in the Existing Stream Assessment Section.

During the feasibility review of the Cabin Branch Project, several potential wetland restoration areas were identified and further assessed. The proposed wetland restoration areas were chosen based on the presence existing ponds that were no longer providing benefit to the property, presence of hydric soils, depth of groundwater, landscape position, and current conditions. Furthermore, due to the existing pond configuration the proposed wetland restoration area will require minimal grading to reconnect and redistribute hydrology which will increase both short and long-term success.

1.3. Existing Site Conditions

The proposed restoration project lies within the floodplain of Cabin Branch and its unnamed tributaries on an abandoned golf course property. Surrounding the project are existing and proposed urban residential areas. The site is currently in a transitional period from an intensively managed golf course, to a naturalized meadow and early growth forest. Much of the site is comprised of grassland species such as meadow fescue (Festuca pratensis), red top grass (Agrostis gigantea), common milkweed (Asclepias syriaca) and species of golden rod (Solidago spp.). Dense thickets of box elder (Acer negundo) have begun growing within areas in the eastern project limits. A tree line exists adjacent to Cabin Branch throughout the site and contains species such as black willow (Salix nigra), pin oak (Quercus palustris), and American sycamore (Platanus occidentalis). Additionally, invasive species such as Japanese stiltgrass (Microstegium vimineum), Japanese honeysuckle (Lonicera japonica), small carpet grass (Arthraxon hispidus), and Chinese bushclover (Lespedeza cuneate) were observed within the project limits. However, these species were not observed to be dominant throughout the site, nor were any large monocultures observed. The site also has nine (9) golf course amenity ponds in various conditions and provide very little ecological resource. A Waters of the United States (WOUS) Delineation was completed by RES in September 2020. A copy of the Wetland Delineation Report is included in Appendix A. The entire project area is underlain by hydric Hatboro Silt Loam soils; however, the landscape, soils, and hydrology are highly disturbed and manipulated due to its previous development as a golf course. After construction, the limits of disturbance will be revegetated to re-establish riparian vegetation in areas that are impacted.

Cabin Branch drains approximately 2,800-acres by the time it leaves the project area, as shown in Figure 3. The existing drainage area is approximately 21.3% impervious based on the 2011 National Land Cover Database (NLCD). On the site, water is generally flowing from east to west. The topography is flat in the fielded areas with steep valley walls.

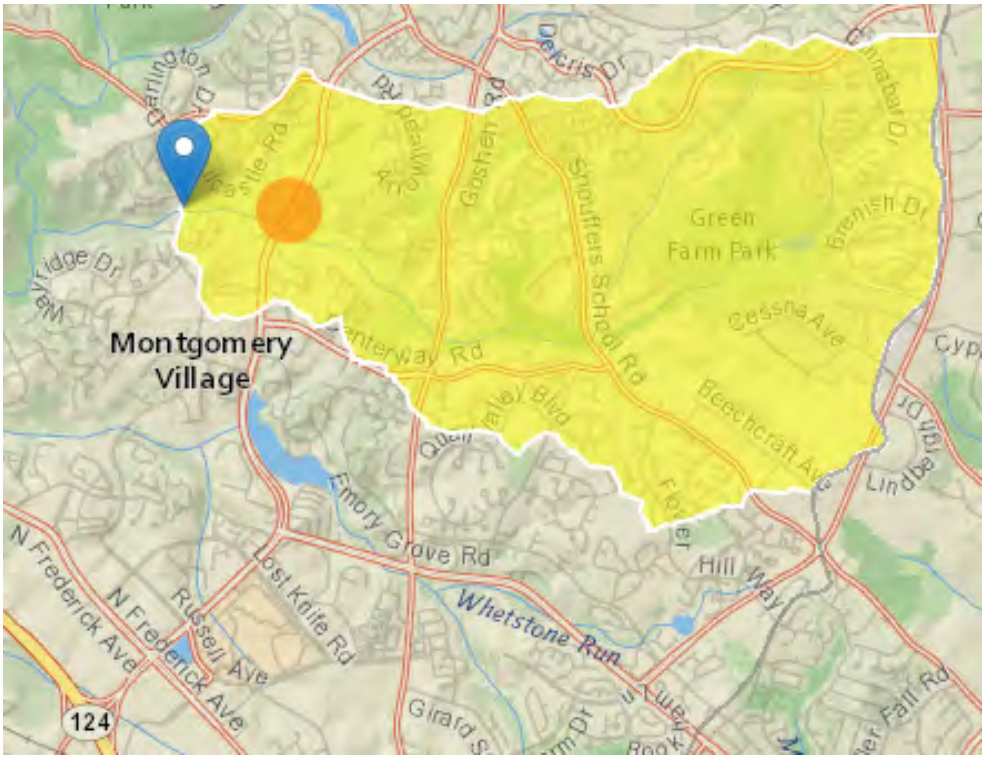

Figure 3: Watershed map from StreamStats.

Cabin Branch and Tributary 4 are the two streams currently daylighted on the site, both are incised with bank-height ratios greater than 1.5. Cabin Branch has a very low sinuosity, has been tightly pinched between multiple utilities and the golf course, and has numerous irrigation and pedestrian crossing structures that are in various stages of disrepair. The other tributaries (1-3 & 5) have either been piped underneath the existing golf course or have been routed through a concrete channel. Additionally, a section of Cabin Branch has been impounded to create a source of water for the irrigation system that previously served the golf course. Additionally, nine (9) ponds are onsite to provide aesthetics to the golf course. These ponds provide very minimal habitat and have failed structures. Figures 4-9 show photos of the existing streams and ponds.



Figure 4: Representative Photo of Reach 1 at the Outlet of a Piped Tributary



Figure 5: Existing Concrete Pedestrian Bridge that has Collapsed



Figure 6: Existing Impoundment for Irrigation along Reach 2



Figure 7: Looking Along the Path of a Dilapidated Storm Sewer Pipe



Figure 8: Representative Photo of Reach 2



Figure 9: Existing Pond with Failing Riser

Existing Stream Assessment

1.4. Existing Site Assessment

Existing site assessments including a geomorphic assessment and level III analyses were completed on Cabin Branch and Tributary 4 in December 2019; Tributaries 1-3 and 5 are currently piped. The Bank Assessment for Non-point source Consequences of Sediment (BANCS) summary is included in Appendix B.

1.5. Channel Pattern

The sinuosity of both existing streams is approximately 1.13. The sinuosity will be increased targeting somewhere between 1.2 & 1.4 depending on channel size.

1.6. Channel Profile

The existing channel profile along Cabin Branch shows very little riffle pool sequencing, facet features, and is mostly plainbed. This is partially due to the numerous debris jams (see figure 10), impoundments and their associated backwaters along Cabin Branch. Tributary 4 has more existing facet features, however, has multiple headcuts that provide vertical instability along the system.



Figure 10: Collapsed Pedestrian Bridge and associated Debris Jam along Reach 1 (Image 1) and Beaver Dam along Reach 2 (Image 2, Beavers have since vacated the site)

1.7. Channel Cross-Section

Channel cross-sections were collected using a rod and level in January-March 2020. Channel cross-sections were taken at locations where there appeared to be good field indicators of bankfull along Cabin Branch (CB) and Tributary 4 (T4). Additionally, supplemental cross-sections were taken along Tributaries 1 & 3 upstream (US) of the crossings under Stewartown Road, See Figure 11. Table 1 below summarizes the geomorphic data collected from the cross-sections.



Figure 11: Existing Cross-Section Location Map

XS	Drainage Area (AC)	Bkf Width (FT)	Bkf Depth (FT)	Bkf Area (SF)	W/D	Aib (SF)	Aib/Bkf Area (%)
CB-1	2246.60	17.1	2.29	39	7.47	19	49%
CB-2	2349.92	20.8	1.95	40.5	10.67	19	47%
CB-3	2351.71	21.30	1.89	40.2	11.27	19.3	48%
CB-4	2379.92	20.3	1.94	39.3	10.46	12.8	33%
CB-5	2413.01	20.20	1.7	34.4	11.88	-	-
CB-6	2693.14	19.04	2.19	41.8	8.69	20.5	49%
CB-7	2766.25	22.5	2.03	45.8	11.08	25	55%
CB-8	2767.66	20.20	2.05	41.5	9.85	22.4	54%
US-1	56.07	6.57	0.65	4.25	10.11	-	NA
US-2	58.10	8.14	0.32	2.61	25.44	-	NA
US-3	84.15	6.53	0.64	4.2	10.20	-	NA
US-4	86.70	4.69	0.54	2.53	8.69	-	NA
US-5	76.18	5.52	0.5	2.77	11.04	-	NA
T4-1	82.70	3.51	0.44	1.53	7.98	-	NA
T4-2	84.55	2.93	0.55	1.62	5.33	-	NA
T4-3a	58.59	4.24	0.47	1.99	9.02	-	NA
T4-3	50.08	4.59	0.47	2.18	9.77	-	NA

Table 1: Ex. Channel Cross-Sections Bankfull Area and Width Summary

The collected channel cross-section data showed that the channels are incised. Smaller tributaries were completely entrenched. Cabin Branch had sections that were entrenched, with entrenchment ratios as low as 1.4 and areas that were not entrenched, even though the bankfull channel was disconnected from the floodplain for the entire reach. The average cross-sectional area along Cabin Branch was about 2.1 times larger than the bankfull area, thus making it capable of passing flows approximately 3.6 times larger than the bankfull discharge. Tributary 4 has an existing cross-sectional area about 3.2 times the bankfull area and can pass approximately 7.5 times the bankfull discharge before overtopping the banks.

Based upon the collected data and field observations the reaches have a mixture of segments that are transitioning from a Rosgen C to a Rosgen F and others that are Rosgen F, or a Stage IV, in the channel evolution model (CEM).

Stream Design

1.8. Design Philosophy and Approach

After the initial site walk it was apparent that the site and stream had many challenges facing restoration on the proposed property, however, its location within an urban environment and the wide area of undeveloped adjacent floodplain provided an optimal location for true ecological uplift. Generally, the existing Cabin Branch channel has very little sinuosity and poor riffle-pool sequencing. The upper one-third of Cabin Branch had been excessively riprapped over the years to provide bank protection, whereas the lower two-thirds of Cabin Branch as well as Tributary 4 exhibited high levels of bank erosion and over widening.

With these observations in mind it was determined that in the upper one-third of the stream where the banks were currently protected the best restoration method would be to keep the existing alignment but cut down the bank height to provide floodplain access as well as use structures to modify the existing profile to create a riffle-pool sequence within the existing channel. Keeping within the existing channel footprint also minimizes additional clearing and potential impacts. In the lower two-thirds of the stream where the banks weren't protected and were highly eroded there were also numerous utilities running adjacent to and crossing the stream. Due to these factors it was decided to design a new alignment that could create higher sinuosity, create a higher functioning cross-section, better floodplain access and a better relationship to the utilities crossing the stream. This would create a Rosgen B/C channel in the upper third and a Rosgen C in the lower two thirds.

Tributary 4's drainage comes through two outfalls and at the outfalls of both pipes the channel is deeply incised and has no floodplain connectivity. Additionally, Tributary 4 crosses two large gas-lines, runs near electrical distribution poles and runs over multiple sanitary sewers lines, further downcutting or over-widening in this channel could create damaging impacts to the adjacent infrastructure. With these additional factors in mind, it was decided to bring the channel up as much as possible connecting it the existing floodplain or to a created floodplain bench, allowing for ecological uplift and infrastructure protection simultaneously. The vertical rise in the profile was combined with a modified horizontal alignment to provide higher sinuosity and flow control to mimic a more natural channel. This design philosophy will create a Rosgen C channel in Tributary 4.

1.9. Proposed Channel Cross-Section Design

The existing cross-section drainage areas and associated bankfull areas collected in the field were used to create a site-specific bankfull area curve, which was then compared with relevant regional curves, these curves are all shown in Figure 12. This comparison showed a good correlation of the data collected (R^2 = .96) as well as in comparison to the selected regional curves.

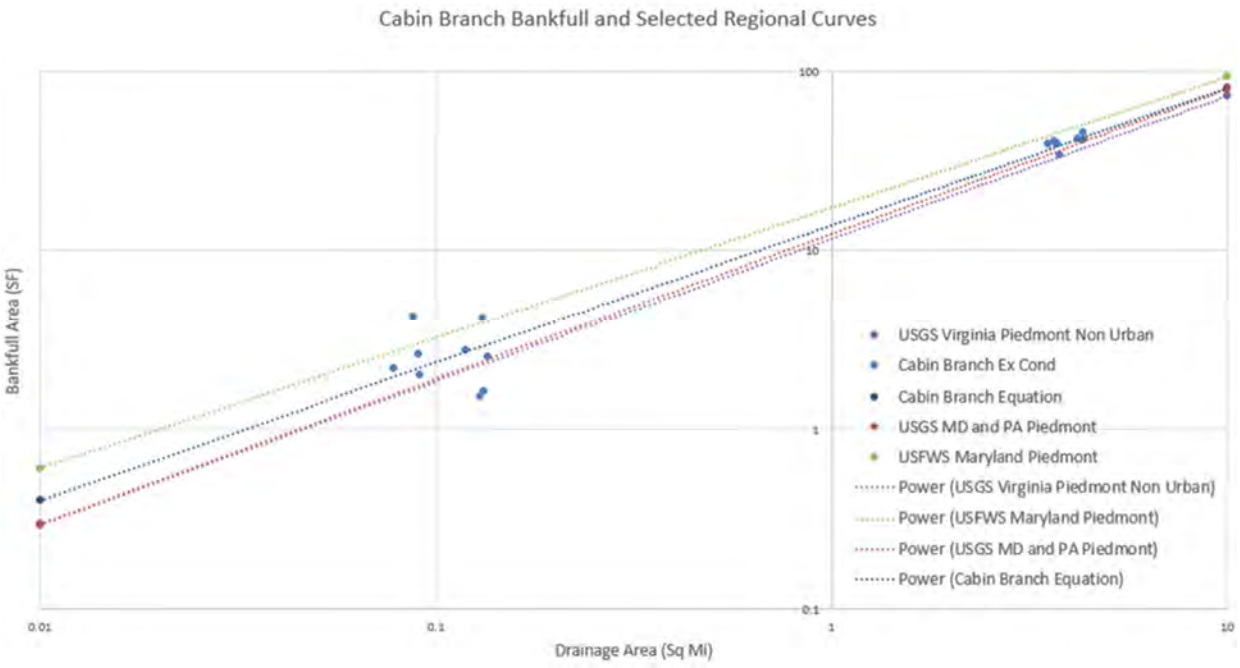

Figure 12: Site Specific Bankfull Area Curve in Comparison to Selected Regional Curves

Using the drainage area to the downstream terminus of each Reach/Sub-Reach (as shown in Figure 13), existing channel cross-section data and site specific/regional curves, target bankfull widths, areas, max depths and discharges were determined for each proposed Reach/Sub-reach. Proposed channel cross-sections were engineered to achieve the target bankfull area, desired geometry and discharge. The proposed channel cross-section geometry is summarized in Table 2; the complete geometry is provided in the plans.



Figure 13: Reach Map for Cabin Branch Stream Restoration

CROSS-SECTION GEOMETRY							
REACH	RIFFLE BOTTOM WIDTH (FT)	MAX RIFFLE DEPTH* (FT)	RIFFLE BANKFULL WIDTH (FT)	POOL BANKFULL WIDTH (FT)	MAX POOL DEPTH (FT)	RIFFLE BANKFULL AREA (SF)	BANKFULL DISCHARGE (CFS)
1	12.0	2.3	23.2	27.8	4.3	40.2	190.6
2	14.0	2.4	25.6	30.7	4.6	47.1	236.5
T1A	4.2	0.6	6.6	7.9	1.2	3.2	8.5
T1B	4.2	0.6	6.6	7.9	1.2	3.2	8.9
T1-1	3.0	0.5	5.0	6.0	0.9	2.0	2.5
T2	1.7	0.3	3.2	3.8	0.6	0.8	1.4
T3A	2.2	0.5	4.6	5.5	0.9	1.7	2.9
T3B	3.0	0.7	6.2	7.4	1.2	3.0	7.4
T3-1	2.2	0.5	4.6	5.5	0.9	1.7	3.8
T4A	3.0	0.5	5.0	6.0	0.9	2.0	7.2
T4B	3.6	0.6	3.6	4.3	1.2	2.8	11.3
T4-1	2.0	0.4	3.8	4.6	0.8	1.2	4.5
T5	2.2	0.5	4.6	5.5	0.9	1.7	5.4

Table 2: Proposed Channel Cross-Section Geometry

Using the design bankfull widths and proprietary dimensionless ratios developed from previously collected reference reach data by RES, the following (see Table 3) Riffle Length Minimums/Maximums, Pool Length Minimums/Maximums and Minimum Radius of Curvatures were calculated and used in laying out the proposed alignments. The proposed alignments create approximately 8,615 LF of restored stream channel, excluding easements and the PEPCO property generates 7,350 LF of mitigation stream length.

PLANIMETRIC DESIGN LIMITS

REACH	MIN RIFFLE LENGTH (FT)	MAX RIFFLE LENGTH (FT)	MIN POOL LENGTH (FT)	MAX POOL LENGTH (FT)	MIN RADIUS OF CURVATURE (FT)
1	23.2	78.9	27.8	113.7	58.0
2	25.6	87.0	30.7	125.4	64.0
T1A	6.6	22.4	7.9	32.3	16.5
T1B	6.6	22.4	7.9	32.3	16.5
T1-1	5.0	17.0	6.0	24.5	12.5
T2	3.2	10.9	3.8	15.7	8.0
T3A	4.6	15.6	5.5	22.5	11.5
T3B	6.2	21.1	7.4	30.4	15.5
T3-1	4.6	15.6	5.5	22.5	11.5
T4A	5.0	17.0	6.0	24.5	12.5
T4B	3.6	12.2	4.3	17.6	9.0
T4-1	3.8	12.9	4.6	18.6	9.5
T5	4.6	15.6	5.5	22.5	11.5

Table 3: Proposed Stream Planimetric Design Limits by Reach

1.10.Proposed Profile Design

To achieve a stable stream system this restoration plan was completed using natural channel design principles and utilizes the installation of in-stream structures and channel grading to control elevation and flow patterns. Riffle facet slopes are set to mimic the valley slopes and associated valley slope changes, while pools are flat. In-stream structures, such as Rock Offset Cross Vanes, were utilized to stabilize confluences and to maintain ideal riffle facet slopes in each reach while keeping the proposed stream at an elevation that could ultimately be tied into the downstream and upstream reaches and created no rise in the 100-yr WSE. Pool run and glide slopes are not engineered but left to naturalize in the field. Pool max depths are designed to occur at the mid-point of the pools.

1.11.In-stream Structures

In-stream structures are used for both vertical and horizontal stabilization of the stream channels. These structures redirect the erosive forces of the water away from the outer bend of the stream helping to minimize bank erosion. Vertically they prevent the migration of headcuts and other instabilities through the system, as well as concentrating flows to maintain pool features. Since the stream contracts as the water passes over the structure, contraction scour calculations are used to determine the structure depth and stone size for the structure. For the purposes of these calculations the Offset Cross-vane data is used as it contracts the flow the greatest which would in return create the highest scour. Contraction scour calculations for in-stream structures are detailed in the Stream Restoration Design National Engineering Handbook; Technical Supplement 14-B. The equation and a summary of the calculations and the associated rock sizes are summarized in Table 4 below.

$$Z_s = \left(-0.0118 + 1.394\left(\frac{h_d}{W}\right) + 5.514\left(\frac{Sq_{10}}{W^{\frac{3}{2}}\sqrt{32.2}}\right)\right) W$$

Where:

$$Z_s = depth\ of\ scour, ft$$

$$h_d = height\ of\ structure\ drop, ft$$

$$W = Average\ Active\ Channel\ Width, ft$$

$$q_{10} = 10yr\ design\ flow\ per\ unit\ width\ over\ structure\ invert, cfs/ft$$

$$S = average\ bankfull\ slope, ft/ft$$

REACH	RIFFLE BASE WIDTH (W) (FT)	MAX STRUCTURE DROP (HD) (FT)	BANKFULL SLOPE (S) (FT/FT)	STRUCTURE WIDTH (FT)	DESIGN FLOW/INVERT WIDTH (CFS/FT)	FACTORED -SCOUR DEPTH (F-ZS) (FT)	MIN. ROCK HEIGHT (A) (FT)	MIN. ROCK DEPTH (B) (FT)	MIN. ROCK LENGTH (C.) (FT)
1	12	0.5	0.0048	5.8	33	0.90	0.4	0.7	0.9
2	14	0.5	0.0058	6.4	36	0.88	0.4	0.7	0.9
T1A	4.2	0.5	0.0087	1.65	6	1.01	0.5	0.8	1.0
T1B	4.2	0.5	0.0096	1.65	6	1.01	0.5	0.8	1.0
T1-1	3	0	0.0028	1.25	8	-0.03	0.0	0.0	0.0
T2	1.7	0.25	0.011	0.8	13	0.65	0.3	0.5	0.6
T2	1.7	0.15	0.0212	0.8	13	0.58	0.3	0.4	0.6
T3A	2.2	0.1	0.006	1.15	9	0.22	0.1	0.2	0.2
T3B	3	0.5	0.008	1.55	6	1.04	0.5	0.8	1.0
T3-1	2.2	0.5	0.0101	1.15	9	1.09	0.5	0.8	1.1
T4A	3	0.75	0.0522	1.25	8	1.87	0.9	1.4	1.9
T4A	3	0.5	0.0235	1.25	8	1.15	0.6	0.9	1.2
T4B	3.6	0.5	0.0215	0.9	11	1.17	0.6	0.9	1.2
T4-1	2	0.25	0.0453	0.95	11	0.98	0.5	0.7	1.0
T5	2.2	0.25	0.0233	1.15	9	0.68	0.3	0.5	0.7
T5	2.2	0.5	0.0160	1.15	9	1.14	0.6	0.9	1.1

Table 4: Summary of Scour Calculations and Stone Sizes.

1.12. Riffle Mix Design

In a riffle-pool system the slope of a stream is taken in the riffle, therefore, the riffle stone mix must be designed to appropriately handle the erosive forces the stream exerts. The intention of this is to create a threshold design mix to minimize the risk of incision or vertical scour in the future. This project utilizes two Riffle Mixes. For the first Riffle Mix, Mix 1 the D100 of the designed mix is 256mm, and the D84 is 121.5mm, with the largest moveable particle size based on the Rosgen and Colorado Curve for all sub-reaches utilizing this mix being 109mm, therefore, below the D100 of the proposed design mix and close to the D84. For the second Riffle Mix, Mix 2, the D100 of the designed mix is 180mm, and the D84 is 85, with the largest

moveable particle size based on the Rosgen and Colorado Curve for all sub-reaches being 60mm, therefore, below the D100 of the proposed design mix. In this mix the D84 is higher than the largest moveable particle sizes by a larger amount given the variable flow and flashiness of the reaches where this mix is utilized. Table 5 shows a summary of each reach's max shear and the associated largest moveable particle in comparison to the Design D100 of the applicable proposed Riffle Mix.

REACH	Max BKF Shear Stress (lb/sq ft)	Largest Moveable Particle - Shields (mm)	Largest Moveable Particle - Rosgen (mm)	Design Mix D84 (mm)	Design Mix D100 (mm)
1	0.50	38	91	121.54	256
2	0.64	49	109	121.54	256
T1A	0.26	19	56	85	180
T1B	0.28	21	60	85	180
T1-1	0.07	5	20	85	180
T2	0.16	12	40	85	180
T3A	0.13	9	34	85	180
T3B	0.23	17	52	85	180
T3-1	0.22	16	49	85	180
T4A	0.55	42	98	121.54	256
T4B	0.60	46	105	121.54	256
T4-1	0.63	48	108	121.54	256
T5	0.45	34	84	121.54	256

1.13. Proposed Outfall Protection Sizing

At all daylighted storm sewer pipes and existing outfalls tying into the heads of restored channels, outfall protection was designed in accordance with D-4-2 Standards and Specifications for Plunge Pool as detailed in the 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control. The facilities (Type I) were sized based upon the max pipe discharge and an assumed tailwater depth of 0.8 times the pipe diameter; details are provided in the construction plans. Max pipe discharge was calculated using the pipes slope, manning's n and diameter.

1.14. Hydraulics and Hydrology Modeling

Hydrology models were used to estimate the 2-Yr, 10-Yr and 100-Yr flows. Zoning data was used to estimate base land use for ultimate development conditions, which was primarily Urban Residential, with some industrial and minor open space. Rainfall depths were based on NOAA Atlas 14 for Montgomery County. WinTR-20 was used to characterize each sub-drainage area to develop a composite curve numbers (CN) and time of concentrations (TC). Drainage Area delineations, zoning maps, and TC flow paths are all provided in the plans. NOAA Atlas information, Win TR-55 & TR20 outputs are all provided in Appendix C. The output flows from WinTR-20 will be used in the HEC-RAS models for existing and proposed conditions for the change analysis for 2/10-Yr shear stress and 2/10-Yr velocity as required by Maryland

Department of the Environment. The preliminary 2/10-Yr shear stress and 2/10-Yr velocity Tables can be found in Appendix H. 2 The 100-Yr flows were calculated however, for the purposes of the Floodplain Study the flows used and approved in the previous study in this area will be used in order to properly determine the impacts of this project to the 100-Yr WSE.

Reach	Max Inflow	2_Yr	10_Yr	100_Yr
Reach 1	NA	1106.9	2192.5	4215.6*
Reach 2	NA	1155.2	2276.3	4364.6*
Trib 1	201.66	118.5	203.9	333.4
Trib 2	33.55	21.6	33.9	50.7
Trib 3	59.39	106.0	180.2	294.5
Trib 4	106.21	132.4	228.6	370.6*
Trib 5	86.96	78.82	142.25	275.54

Table 5: 2, 10, & 100-Yr Peak Discharges
**For the Floodplain Study/Analysis the 100-Yr flows from the previously approved study were used.*

1.15. Floodplain Study

The proposed project is located within a FEMA Zone AE. Floodplain Study (FPDS No. 281949) established a revised 100-yr floodplain based upon proposed development surrounding the restoration area; this model was used as the existing model in the Floodplain Analysis for the mitigation project. In order to ensure continuity between the previously approved floodplain model and the modeling required for this project, the same 100-yr flows and Manning's n are intended to be utilized. The 100-yr discharges in the approved study are similar those RES calculated, and the Manning's n is the same as RES calculated based upon the D84 of the Pebble Count data.

For this project to not create impacts to the proposed and existing developments surrounding the site it is imperative that the work along Cabin Branch results in a no-rise condition on the project parcel or on adjacent parcels. To ensure that the proposed design is feasible a preliminary Floodplain Analysis was run along the proposed reaches of Cabin Branch and Tributary 4. This preliminary assessment showed no rises in the 100-Yr water surface elevation along Cabin Branch that cannot be addressed in further design development. Tributary 4 showed two increases however the rise is completely contained within the existing valley and thus does not create any offsite impacts. A comparison of existing and proposed 100-yr water surface elevations for both Cabin Branch and Tributary 4 are provided in Appendix D as well as the existing and proposed cross-sections.

Wetland Design

1.16. Wetland Restoration Feasibility Analysis

The entire project area is mapped as being underlain by Hatboro Silt Loam, 0-3% slope, frequently flooded. The Hatboro Silt Loam soil series has a hydric rating of 100, and under normal conditions will have groundwater within 6 inches of the soil surface well into the growing season. Groundwater is the primary hydrologic source governing the formation of wetlands in these soils, with the hydrology being supplemented by periodic overbank flooding from adjacent streams. In their natural condition, these soils and their associated hydrology supported a forested wetland community.

Development of a golf course on these soils required extensive manipulation of the landscape and the hydrology. Ponds were excavated and underground drainage systems were installed to provide the necessary drainage to develop the golf course. Although the ponds were excavated to depths that normally would intercept the groundwater, it is likely that they were lined with clay to ensure that water levels remained consistent for aesthetics purposes.

The conceptual design for wetland restoration involves draining five ponds and backfilling with suitable soils to appropriate elevations for wetland restoration, see Table 7 for Wetland Restoration Summary. To determine the appropriate elevations, groundwater monitoring wells were installed adjacent to each pond planned for restoration. Additionally, surface elevations in the ponds were measured twice during monitoring well download events to compare with the groundwater elevations. This will assist in the determination of whether the pond levels are artificially elevated due to pond liners being present. When the ponds are drained prior to backfilling with soils, a determination will be made as to whether a clay liner is present, and what the thickness of the liner is. If liners are present, the liners will be ripped to the depth necessary to restore groundwater influence prior to backfilling with soils translocated from onsite sources. The use of soils from onsite sources will ensure that the backfilled areas are comprised of soils of similar permeability and texture as would be found naturally. All backfilling will be to an elevation 6'" below final grade, and Class A topsoil will be placed to a depth of 6" to bring wetland cell elevations to final grade. Upon approval of final grade elevations by the Engineer, organic compost will be spread evenly across the wetland planting zones at a rate of 60 CY per acre. The entire wetland planting area will be disked and/or ripped to incorporate the compost into the soil and create microtopography throughout the wetland cell.

Wetland Cell	Acreage	Wetland Type
Cell #1	1.19	PFO
Cell #2	0.29	PFO
Cell #3	0.40	PFO
Cell #4	1.51	PFO
Cell #5	1.25	PFO

Table 6: Wetland Mitigation Summary

1.17. Water Budget Development

Each wetland restoration location is a standalone site, independent of the other locations for site hydrology. This required that water budget models be developed for each wetland cell of the proposed site to simulate the balance of the hydrologic inputs and outputs and estimate the water table elevation for the proposed design. Each water budget was prepared using the Wetbud software, which is modeled on the methods described in *Planning Hydrology for Constructed Wetlands* by Gary Pierce (Pierce method). The model balances water sources (inputs), including precipitation and adjacent surface runoff, with water losses (outputs), including evapotranspiration, exfiltration, and weir overflow. Historic precipitation data was obtained from the Gaithersburg Montgomery County NOAA GSOD station, which is located approximately 1.3 miles east of the Site. Evapotranspiration rates were calculated via the Penman-Monteith method.

Water budgets were prepared using data from a dry year, a normal year, and a wet year. It was determined that 2007 was an historically dry year, 1988 was normal, and 2003 was wet. The water budgets demonstrate that each of the five (5) locations will have more than enough water to support establishment of wetlands in normal and wet years, and just enough to support establishment of wetlands in a dry year. The models, however, do not take into account

overbank flooding from Cabin Branch; nor do they take into account actual groundwater elevations. These sites will all experience overbank flooding and high groundwater; therefore, we believe the models likely underestimate the actual hydrology. To address the potential for too much water, the design incorporates low elevation inlet and outlet weirs to allow excess water to exit the site to prevent drowning of the young trees.

The Well Data is in Appendix E and the collected water budgets are included in Appendix F.

1.18. Integration with Stream Design

Stream designers coordinated directly with the wetland designers to ensure that the streambank grading would not impact the wetland grading; and to incorporate stream design elements that will allow restoration of periodic overbank flooding from the restored stream channels into the wetlands to help ensure successful wetland establishment.

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Appendix A: Wetland Delineation Report Package

Wetland Delineation Report Site Information Summary
MDSHA 495-270 PRM Cabin Branch Site
39.177500, -77.202865
(30.93 Acres)
Montgomery County, Maryland

Date: August 12, 2021

Applicant/Property Owner
Resource Environmental Solutions, LLC
5367 Telephone Road
Warrenton, Virginia 20187
Email: Reid Cook - rcook@res.us

Consulting Agent
Resource Environmental Solutions, LLC
5367 Telephone Road
Warrenton, Virginia 20187
Email: Reid Cook - rcook@res.us

Latitude/ Longitude in Decimal Degrees using coordinate plane (NAD 1983)
39.177500, -77.202865

Has a previous delineation or JD been performed?
A previous delineation was conducted in January of 2014 by Soltesz. Project number unknown.

Hydrologic Unit Code (HUC)
8 Digit: 02070008
11 Digit: 02070008030
14 Digit: 02070008030129

USGS Topographic Sheet
Gaithersburg Quadrangle, 7.5 Minute

Nearest Waterbody (example given)
Cabin Branch runs east to west throughout the project site, eventually converging with Great Seneca Creek approximately 0.60 miles to the west of the project limits. Additionally, North Creek Lake and Lake Whetstone are approximately 0.50 and 0.60 miles to the north and south of the project limits respectively.

Delineation Methods
U.S. Army Corps of Engineers 1987 Wetland Delineation Manual in conjunction with the April 2012 Eastern Mountains and Piedmont Regional Supplement, Version 2.0. The U.S. Army Corps of Engineers *2016 National Wetland Plant List* was used.

On-Site Investigation Date
Wetland boundary delineation and site data collection was conducted on September 10, 2020.

Wetland Delineation Plan
The proposed wetland boundaries and Data Sampling Point locations are depicted on the plan entitled "Waters of the US Delineation Map" prepared by Resource Environmental Solutions, LLC on September 24, 2020.

Wetland Investigation Results

Wetlands: One palustrine emergent (PEM) wetland was observed within the project limits, for a total of 0.06 acres of the project site.

Stream Channels: Approximately 7,008 linear feet of stream channels were observed within the project limits, totaling 1.81 acres. All streams were observed to be R3/perennial in nature.

Other Waters: Numerous Palustrine Open Water (POW) bodies were identified throughout the project site. These POW features totaled approximately 4.61 acres of the project site.

Water bodies onsite identified as Section 10: No water bodies identified as Section 10 were identified onsite.

Uplands: Approximately 24.45 acres of the project site were determined to be upland in nature. These uplands are characterized by Data Sampling Points 3, 4, 5, and 7.

100-Year Floodplains
As depicted on the Federal Emergency Management Agency's (FEMA) on-line Flood Insurance Rate Map #24031C0187D, effective 9/269/2006. The FEMA floodplain map identifies Zone X, Area of Minimal Flood Hazard; and Zone AE, a Regulatory Floodway.

National Wetlands Inventory
The on-line National Wetland Inventory identifies freshwater ponds classified as PUBHx and freshwater riverine classified as R5UBH.

USDA Soil Survey
The National Resource Conservation Service (NRCS) soils report identifies numerous soil types throughout the project. The most common soil type within the project limits is 54 Hatboro Silt Loam. This soil type runs adjacent to the perennial Cabin Branch stream throughout the entire project limits. W Water Census soils were the next common soils type within the project limits, covering approximately 9.3% of the project area. All soils except for W Water Census are listed as hydric by the NRCS.

Notes: The project property was once used as a golf course, and as such has been previously developed.

Table 1: Soils Table

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent AOI	Listing as a Hydric Soil
1C	Gaila Silt Loam, 8-15% slopes	0.5	1.5%	Yes
5B	Glenville Silt Loam, 3-8% slopes	0.0	0.0%	Yes
6A	Baile Silt Loam, 0-3% slopes	2.0	6.6%	Yes
16D	Brinklow-Blocktown Channery Silt Loams, 15-25% slopes	0.6	2.1%	Yes
54A	Hatboro Silt Loam, 0-3% slopes Frequently Flooded	22.7	73.5%	Yes
66UB	Wheaton-Urban Lan Complex, 0-8% slopes	0.2	0.7%	Yes
66UC	Wheaton-Urban Lan Complex, 8-15% slopes	1.9	6.0%	Yes
W	Census Water	3.0	9.3%	No
Totals for AOI		**30.9**	**100%**	

Table 2: Water of the U.S.

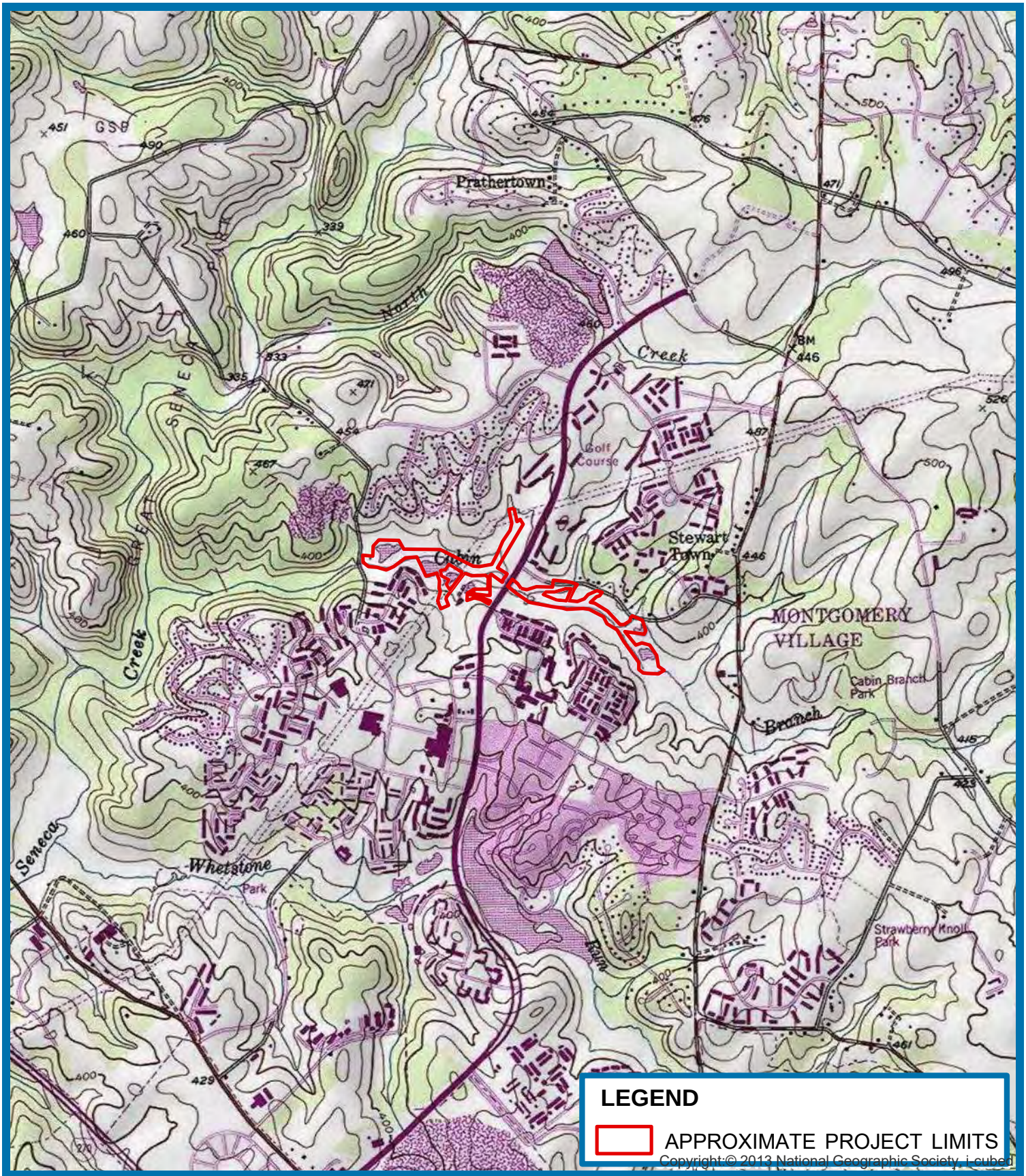
Wetland/Water	**Latitude**	**Longitude**	**Acreage/ Length (feet)**	**Cowardin Class**	**Class of Aquatic Resource**
POW/1	39.17488	-77.194143	0.11	POW	Non-Tidal
POW/2	39.175332	-77.194577	0.85	POW	Non-Tidal
POW/3	39.176305	-77.194985	0.13	POW	Non-Tidal
POW/4	39.177946	-77.20052	0.37	POW	Non-Tidal
POW/5	39.17908	-77.205946	1.68	POW	Non-Tidal
POW/6	39.17976	-77.208462	1.46	POW	Non-Tidal
POW/7	39.1785	-77.20531	0.03	POW	Non-Tidal
PEM-1	39.176269	-77.194785	0.06	PEM	Non-Tidal
Streams					
R3-CBU	39.177268	-77.1973	2,982	R3	Non-Tidal
R3-T5	39.177924	-77.205483	459	R3	Non-Tidal
R3-T4	39.180125	-77.201821	1,021	R3	Non-Tidal
R3-T41	39.180616	-77.201403	70	R3	Non-Tidal
R3-T6	39.179224	-77.208909	53	R3	Non-Tidal
R3-CBL	39.179601	-77.205883	2,421	R3	Non-Tidal

Attachment A

Figures:

Project Location Map, Project Vicinity, National Wetland Inventory Map,

Aerial Imagery Map, Soils Map



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PROJECT LOCATION MAP

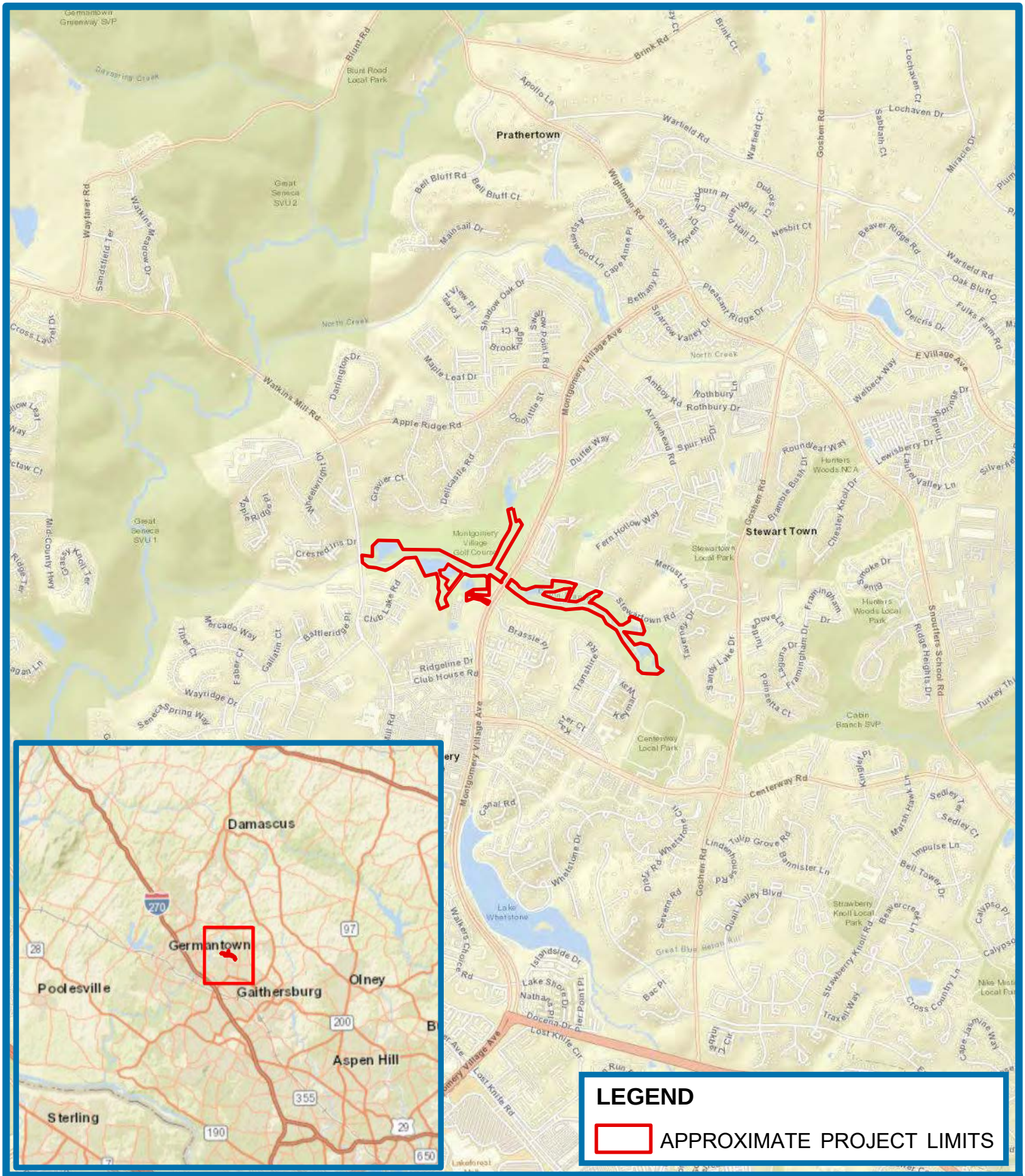
CABIN BRANCH

MONTGOMERY COUNTY, MARYLAND

USGS Topo Quads: Gaithersburg
Latitude: 39.1781
Longitude: -77.2018
Approx. Project Area: 30.93 acres

Elevation: 344 - 384 feet
Scale: 1 inch = 2,000 feet
Source: http://resources.arcgis.com/ USA Topo Maps

N



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VICINITY MAP

CABIN BRANCH

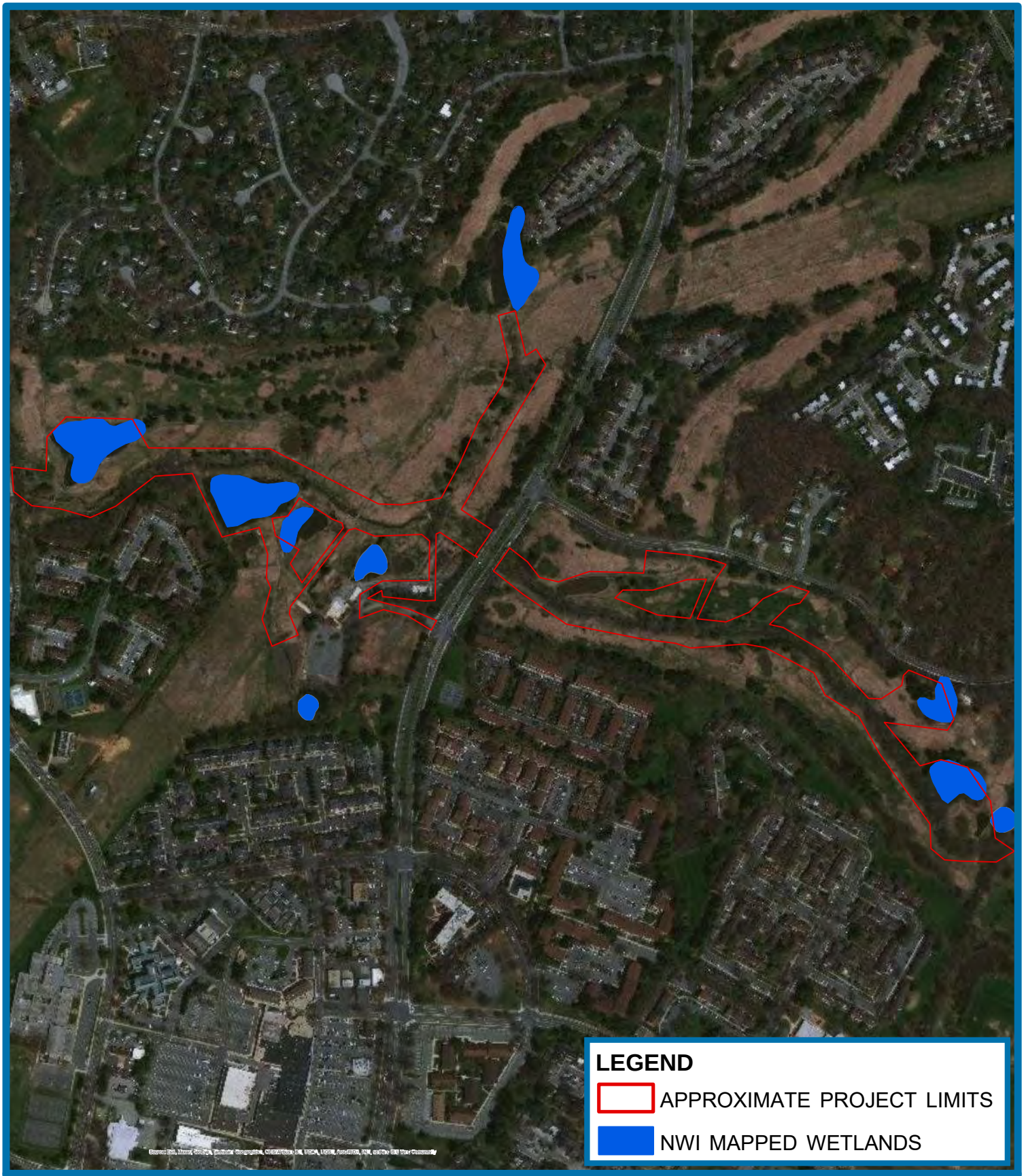
MONTGOMERY COUNTY, MARYLAND

Street Map Source:
World Street Map
ESRI ArcGIS Online

N

1 inch = 2,000 feet

Document Path: R:\Resgis\richmondgis\GIS_Work\Active_Jobs\102054_Cabin_Branch_BaseMaps\maps\102054_Vicinity.mxd - Date Saved: 9/25/2020



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NATIONAL WETLANDS INVENTORY MAP

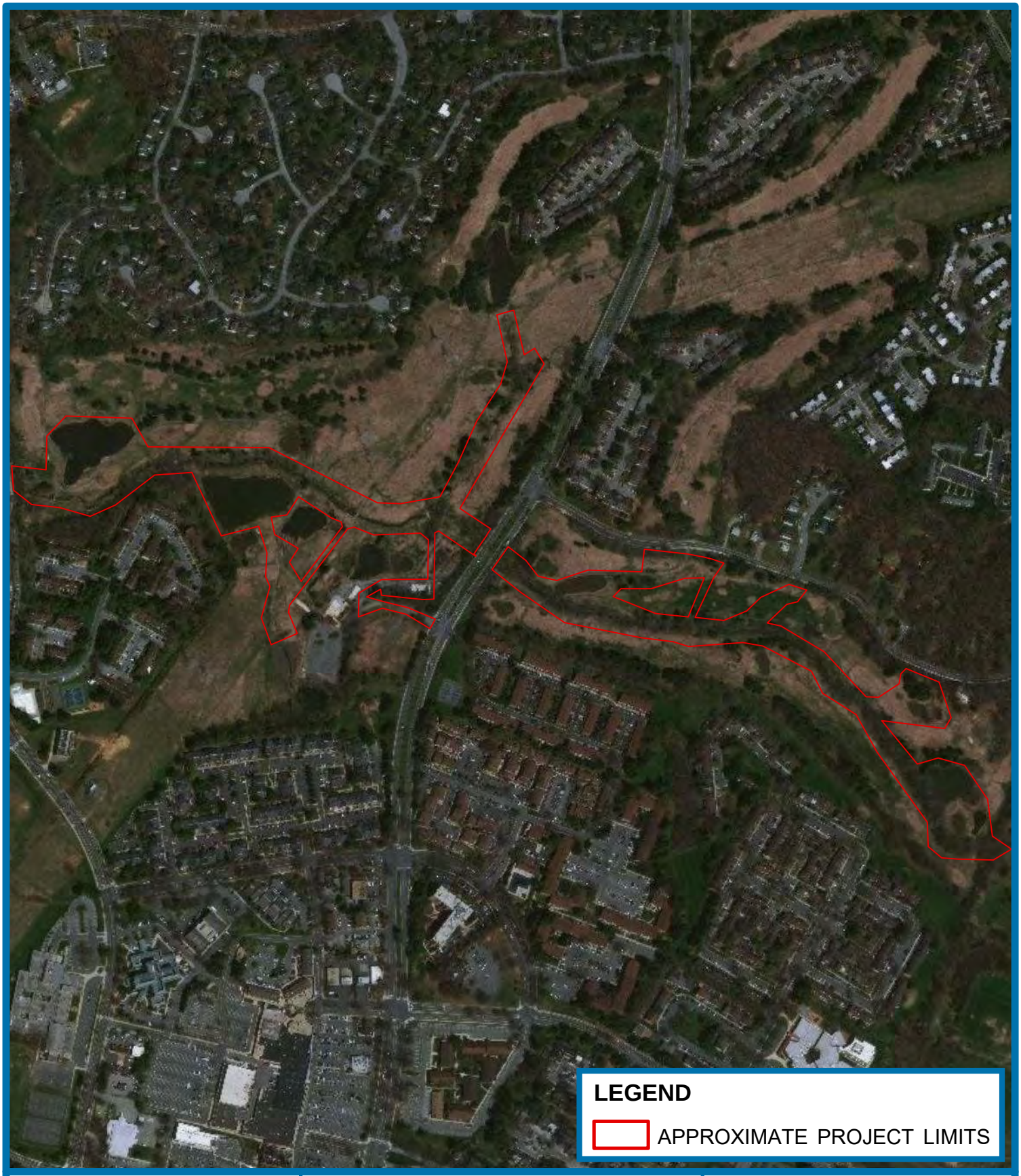
CABIN BRANCH
MONTGOMERY COUNTY, MARYLAND

Digital Ortho Photo Source:
World Imagery
ESRI ArcGIS Online
National Inventory Wetlands (NWI)
Source
http://www.fws.gov/

N

1 inch = 600 feet

Document Path: R:\Resgis\richmondgis\GIS_Work\Active_Jobs\102054_Cabin_Branch_BaseMaps\maps\102054_NWI.mxd - Date Saved: 9/25/2020



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AERIAL IMAGERY

CABIN BRANCH

MONTGOMERY COUNTY, MARYLAND

Digital Orthophoto Source:
World Imagery
ESRI ArcGIS Online

N

1 inch = 600 feet

Document Path: R:\Resgis\richmondgis\GIS_Work\Active_Jobs\102054_Cabin_Branch_BaseMaps\maps\102054_Aerial_Imagery.mxd - Date Saved: 9/25/2020

Custom Soil Resource Report
Soil Map



Attachment B

Wetland Delineation Data Sheets

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont

Project/Site:	MDSHA 495-270 PRM Cabin Branch Site	City/County:	Montgomery County	Sampling Date:	10-Sep-2020
Applicant/Owner:	Resource Environmental Solutions, LLC	State:	Maryland	Sampling Point:	
Investigator(s):	Jacob Fleckenstein, Daniel Buczek	Section, Township, Range:	Montgomery Village		
Landform (hillslope, terrace, etc.):	Flat	Local relief (concave, convex, none):	None	Slope (%):	0-3
Subregion (LRR or MLRA):	148 Northern Piedmont	Lat:	39.179586	Long:	-77.210214
Datum:	WGS83				
Soil Map Unit Name:	54A Hatboro Silt Loam, Frequently Flooded	NWI Classification:	None		

Are climatic/hydrologic conditions of the site typical for this time of the year? Y (If no, explain in remarks)

Are vegetation , soil , or hydrology significantly disturbed? Are "normal circumstances" present? Yes

Are vegetation , soil , or hydrology naturally problematic? (If needed, explain any answers in remarks)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present?	Y	**Is the sampled area within a wetland?**	N
Hydric soil present?	N		
Indicators of wetland hydrology present?	N		

Remarks: (Explain alternative procedures here or in a separate report)

Data Point 7 exists in the western limits of the project, to the north of Data Point 6. The data point displays upland features.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)				Secondary Indicators (minimum of two required)
	Surface Water (A1)		True Aquatic Plants (B14)	Surface Soil Cracks (B6)
	High Water Table (A2)		Hydrogen Sulfide Odor (C1)	Sparsely Vegetated Concave Surface (B8)
	Saturation (A3)		Oxidized Rhizospheres on Living Roots (C3)	Drainage Patterns (B10)
	Water Marks (B1)		Presence of Reduced Iron (C4)	Moss Trim Lines (B16)
	Sediment Deposits (B2)		Recent Iron Reduction in Tilled Soils (C6)	Dry-Season Water Table (C2)
	Drift Deposits (B3)		Thin Muck Surface (C7)	Crayfish Burrows (C8)
	Algal Mat or Crust (B4)		Other (Explain in Remarks)	Saturation Visible on Aerial Imagery (C9)
	Iron Deposits (B5)			Stunted or Stressed Plants (D1)
	Inundation Visible on Aerial Imagery (B7)			Geomorphic Position (D2)
	Water-Stained Leaves (B9)			Shallow Aquitard (D3)
	Aquatic Fauna (B13)			Microtopographic Relief (D4)
				FAC-Neutral Test (D5)

Field Observations:

Surface water present?	Yes		No	X	Depth (inches):
Water table present?	Yes		No	X	Depth (inches):
Saturation present? (includes capillary fringe)	Yes		No	X	Depth (inches):

Wetland Hydrology Present? N

Describe recorded data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Wetland Hydrology was not present at this data point.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: DP-7

		Absolute % Cover	Dominant Species?	Indicator Staus
Tree Stratum (Plot size: 30 feet)				
1	*Acer rubrum*	60	Y	FAC
2	*Diospyros virginiana*	15	Y	FAC
3				
4				
5				
6				
7				
		75	=Total Cover	
Sapling stratum (Plot size: 15 feet)				
1				
2				
3				
4				
5				
6				
7				
		0	=Total Cover	
Shrub stratum (Plot size: 15 feet)				
1				
2				
3				
4				
5				
6				
7				
		0	=Total Cover	
Herb stratum (Plot size: 5 feet)				
1	*Microstegium vimineum*	70	Y	FAC
2	*Boehmeria cylindrica*	15	N	FACW
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
		85	=Total Cover	
Woody vine stratum (Plot size: 30 feet)				
1				
2				
3				
4				
5				
		0	=Total Cover	

Dominance Test Worksheet:

Number of Dominant Species that are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across all Strata:	3	(B)
Percent of Dominant Species that are OBL, FACW, or FAC:	100.00%	(A/B)

Prevalence Index Worksheet:

Total % Cover of:

OBL species	0	x 1 =	0	
FACW species	15	x 2 =	30	
FAC species	145	x 3 =	435	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column totals	160	(A)	465	(B)
Prevalence Index = B/A =			2.91	

Hydrophytic Vegetation Indicators:

	1 – Rapid Test for Hydrophytic Vegetation
X	2 – Dominance Test is >50%
X	3 – Prevalence Index is ≤3.0[1]
	4 – Morphogical Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
	Problematic hydrophytic vegetation[1] (explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Y

Remarks: (Include photo numbers here or on a separate sheet)

Hydrophytic Vegetation was dominant at this data point.

SOIL Sampling Point: DP-7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (In.)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 4/2	100%					Loam	
6-18	10YR 4/3	95%	10YR 4/2	2%	C	M	Loam	Faint
			10YR 4/4	3%	C	M	Loam	Faint

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, MS = Masked Sand Grains. [2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators:

- Histisol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- 2 cm Muck (A10) **(LRR N)**
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Dark Surface (S7)
- Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- Thin Dark Surface (S9) **(MLRA 147, 148)**
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- Umbric Surface (F13) **(MLRA 136, 122)**
- Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- 2cm Muck (A10) **(MLRA 147)**
- Coast Prairie Redox (A16) **(MLRA 147, 148)**
- Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (explain in remarks)

[3]Indicators of hydrophytic vegetation and weltand hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? N

Remarks:

Hydric Soil indicators were not present.

PHOTOGRAPHS Sampling Point: DP-7



Photograph 1. Soils photograph of the data point.



Photograph 2. Overview photograph of the data point.

Attachment C

Waters of the U.S. Delineation Map

1 INCH = 200 FEET

0 200 400 600 FEET

LEGEND

- APPROXIMATE PROJECT LIMITS
- PERENNIAL STREAM LIMITS (R3)
- PALUSTRINE OPEN WATER (POW) WETLAND LIMITS
- PALUSTRINE EMERGENT (PEM) WETLAND LIMITS
- UPLAND DATA POINT
- WETLAND DATA POINT

SITE DATA:
TOTAL PROJECT AREA = 30.93 +/- AC
TOTAL WATERS OF THE U.S. = 6.48 +/- AC

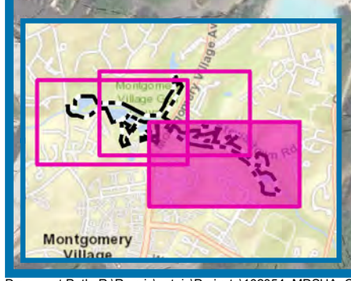
STREAMS
TOTAL R3 STREAMS = 1.81 +/- AC (7,008 +/- LF)
TOTAL STREAMS = 1.81 +/- AC (7,008 +/- LF)

OPEN WATER
TOTAL POW = 4.61 +/- AC

WETLANDS
TOTAL PEM = 0.06 +/- AC
TOTAL PFO = 0.00 +/- AC
TOTAL PSS = 0.00 +/- AC
TOTAL WETLANDS = 0.06 +/- AC

SHEET 02
SHEET 01

R3-CBU
R3-CBU
R3-CBU
POW-3
PEM-1
POW-2
POW-1
DP-1
DP-2
DP-3
DP-4
DP-5



NOTES:

1. BASE MAPPING OBTAINED FROM ESRI.
2. LIMITS OF WETLANDS AND STREAMS DEPICTED ON THIS MAP WERE DELINEATED AND GPS LOCATED BY RES.
3. WETLANDS WERE DELINEATED On SEPTEMBER 10, 2020 BY RES IN ACCORDANCE WITH PROCEDURES OUTLINED IN THE U.S. ARMY CORPS OF ENGINEERS WETLAND DELINEATION MANUAL, AS WELL AS THE REGIONAL SUPPLEMENT TO THE U.S. ARMY CORPS OF ENGINEERS WETLAND DELINEATION MANUAL: ATLANTIC AND GULF COASTAL PLAIN REGION (VERSION 2.0) / EASTERN MOUNTAINS AND PIEDMONT REGION. OTHER WATERS OF THE U.S. ARE DELINEATED BASED ON THE PRESENCE OF AN ORDINARY HIGH WATER MARK, AS DEFINED BY THE U.S. ARMY CORPS OF ENGINEERS DEFINITION OF A WATER OF THE U.S.

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PROJECT: CABIN BRANCH
APPLICANT: MDSHA

WATERS OF THE U.S.
DELINEATION MAP

MONTGOMEREY COUNTY, MARYLAND

PROJECT MANAGER: RC
DRAWN: TB
JOB NUMBER: 102054
DATE: 09/25/2020
REVISIONS: TB – 03/09/2021
TB – 08/12/2021

1 INCH = 200 FEET

0 200 400 600 FEET

LEGEND

- APPROXIMATE PROJECT LIMITS
- PERENNIAL STREAM LIMITS (R3)
- PALUSTRINE OPEN WATER (POW) WETLAND LIMITS
- PALUSTRINE EMERGENT (PEM) WETLAND LIMITS
- UPLAND DATA POINT
- WETLAND DATA POINT

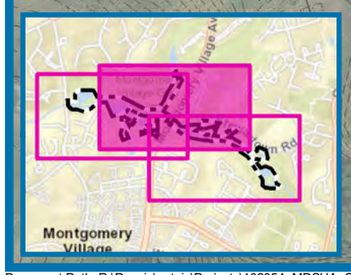
SITE DATA:
TOTAL PROJECT AREA = 30.93 +/- AC
TOTAL WATERS OF THE U.S. = 6.48 +/- AC

STREAMS
TOTAL R3 STREAMS = 1.81 +/- AC (7,008 +/- LF)
TOTAL STREAMS = 1.81 +/- AC (7,008 +/- LF)

OPEN WATER
TOTAL POW = 4.61 +/- AC

WETLANDS
TOTAL PEM = 0.06 +/- AC
TOTAL PFO = 0.00 +/- AC
TOTAL PSS = 0.00 +/- AC
TOTAL WETLANDS = 0.06 +/- AC

R3-T4
R3-T41
R3-CBL
R3-CBL
R3-T4
R3-T5
POW-5
EXISTING CHANNEL IS CULVERTED
POW-4
R3-CBU
R3-CBU
SHEET 03
SHEET 02
SHEET 02
SHEET 01



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PROJECT: CABIN BRANCH
APPLICANT: MDSHA

WATERS OF THE U.S. DELINEATION MAP

MONTGOMEREY COUNTY, MARYLAND

PROJECT MANAGER: RC
DRAWN: TB
JOB NUMBER: 102054
DATE: 09/25/2020
REVISIONS: TB – 03/09/2021
TB – 08/12/2021

1 INCH = 200 FEET

0 200 400 600 FEET

LEGEND

- APPROXIMATE PROJECT LIMITS
- PERENNIAL STREAM LIMITS (R3)
- PALUSTRINE OPEN WATER (POW) WETLAND LIMITS
- PALUSTRINE EMERGENT (PEM) WETLAND LIMITS
- UPLAND DATA POINT
- WETLAND DATA POINT

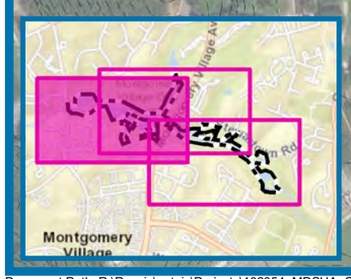
SITE DATA:
TOTAL PROJECT AREA = 30.93 +/- AC
TOTAL WATERS OF THE U.S. = 6.48 +/- AC

STREAMS
TOTAL R3 STREAMS = 1.81 +/- AC (7,008 +/- LF)
TOTAL STREAMS = 1.81 +/- AC (7,008 +/- LF)

OPEN WATER
TOTAL POW = 4.61 +/- AC

WETLANDS
TOTAL PEM = 0.06 +/- AC
TOTAL PFO = 0.00 +/- AC
TOTAL PSS = 0.00 +/- AC
TOTAL WETLANDS = 0.06 +/- AC

POW-7
DP-7
DP-6
R3-T6
R3-CBL
POW-6
R3-CBL
R3-CBL
SHEET 03
SHEET 02
R3-T4
POW-5
R3-T5
EXISTING CHANNEL IS CULVERTED



NOTES:
1. BASE MAPPING OBTAINED FROM ESRI.
2. LIMITS OF WETLANDS AND STREAMS DEPICTED ON THIS MAP WERE DELINEATED AND GPS LOCATED BY RES.
3. WETLANDS WERE DELINEATED On SEPTEMBER 10, 2020 BY RES IN ACCORDANCE WITH PROCEDURES OUTLINED IN THE U.S. ARMY CORPS OF ENGINEERS WETLAND DELINEATION MANUAL, AS WELL AS THE REGIONAL SUPPLEMENT TO THE U.S. ARMY CORPS OF ENGINEERS WETLAND DELINEATION MANUAL: ATLANTIC AND GULF COASTAL PLAIN REGION (VERSION 2.0) / EASTERN MOUNTAINS AND PIEDMONT REGION. OTHER WATERS OF THE U.S. ARE DELINEATED BASED ON THE PRESENCE OF AN ORDINARY HIGH WATER MARK, AS DEFINED BY THE U.S. ARMY CORPS OF ENGINEERS DEFINITION OF A WATER OF THE U.S.

res
CORPORATE | 6575 WEST LOOP SOUTH, SUITE 300, BELLAIRE, TX 77401
P: 713.520.5400
www.res.us

PROJECT: CABIN BRANCH
APPLICANT: MDSHA

WATERS OF THE U.S. DELINEATION MAP

MONTGOMEREY COUNTY, MARYLAND

PROJECT MANAGER: RC
DRAWN: TB
JOB NUMBER: 102054
DATE: 09/25/2020
REVISIONS: TB – 03/09/2021
TB – 08/12/2021

Attachment D

Palustrine Open Water (POW)
Photographs

Palustrine Open Water (POW) PHOTOGRAPHS
Cabin Branch

POW—1



Photograph of POW Pond 1

Palustrine Open Water (POW) PHOTOGRAPHS
Cabin Branch

POW—2





Photographs of POW Pond 2

Palustrine Open Water (POW) PHOTOGRAPHS
Cabin Branch

POW—3







Photographs of POW Pond 3

Palustrine Open Water (POW) PHOTOGRAPHS
Cabin Branch

POW—4





Photographs of POW Pond 4

Palustrine Open Water (POW) PHOTOGRAPHS
Cabin Branch

POW—5





Photographs of POW Pond 5

Palustrine Open Water (POW) PHOTOGRAPHS
Cabin Branch

POW—6





Photographs of POW Pond 6

Palustrine Open Water (POW) PHOTOGRAPHS
Cabin Branch

POW—7







Photographs of POW Pond 7

Attachment E

NRCS Soils Report

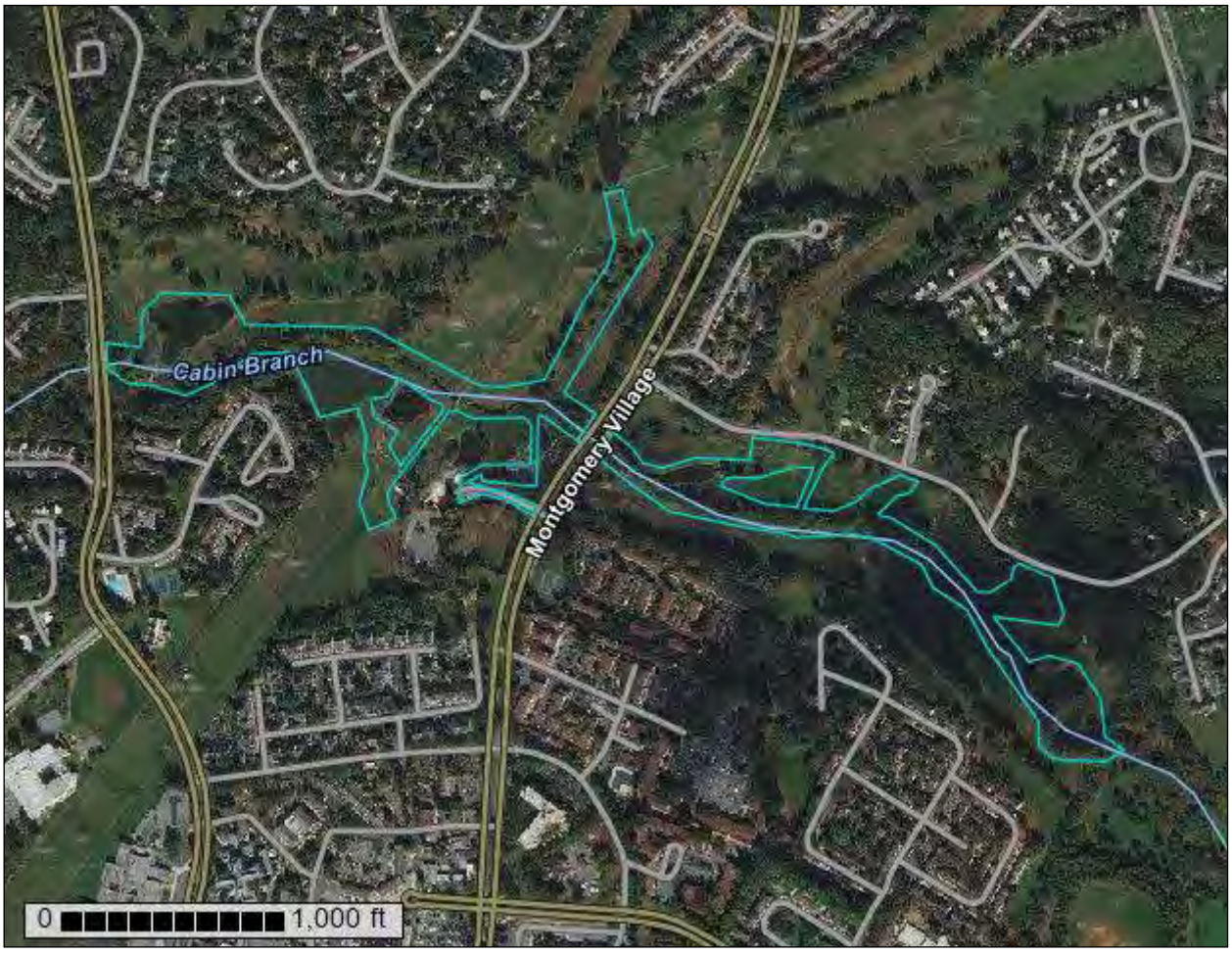
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Montgomery County, Maryland



September 25, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:7,660 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 100 200 400 600

Feet
0 350 700 1400 2100

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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

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

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

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

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

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

Soil Survey Area: Montgomery County, Maryland
Survey Area Data: Version 16, Jun 12, 2020

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

Date(s) aerial images were photographed: May 3, 2015—Feb 22, 2017

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1C	Gaila silt loam, 8 to 15 percent slopes	0.5	1.5%
5B	Glenville silt loam, 3 to 8 percent slopes	0.0	0.0%
6A	Baile silt loam, 0 to 3 percent slopes	2.0	6.6%
16D	Brinklow-Blocktown channery silt loams, 15 to 25 percent slopes	0.6	2.1%
54A	Hatboro silt loam, 0 to 3 percent slopes, frequently flooded	22.7	73.5%
66UB	Wheaton-Urban land complex, 0 to 8 percent slopes	0.2	0.7%
66UC	Wheaton-Urban land complex, 8 to 15 percent slopes	1.9	6.0%
W	Census water	3.0	9.6%
Totals for Area of Interest		**30.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas

are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Montgomery County, Maryland

1C—Gaila silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: kx7n
Elevation: 100 to 2,000 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 120 to 255 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Gaila and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gaila

Typical profile

H1 - 0 to 8 inches: silt loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 1.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Baile

Percent of map unit: 5 percent
Landform: Flats
Hydric soil rating: Yes

5B—Glenville silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tmch
Elevation: 20 to 1,090 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 150 to 192 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Glenville and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glenville

Setting

Landform: Drainageways, swales
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Base slope, head slope, interfluve
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear
Parent material: Colluvium derived from metamorphic rock over schist, gneiss or phyllite residuum

Typical profile

Ap - 0 to 11 inches: silt loam
Bt1 - 11 to 20 inches: channery silt loam
Bt2 - 20 to 30 inches: silt loam
Btx - 30 to 40 inches: silt loam
C1 - 40 to 59 inches: loam
C2 - 59 to 82 inches: loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 29 to 31 inches to fragipan
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.03 to 0.11 in/hr)
Depth to water table: About 18 to 22 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C/D

Hydric soil rating: No

Minor Components

Unnamed

Percent of map unit: 15 percent
Landform: Drainageways
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear
Hydric soil rating: No

Baile

Percent of map unit: 10 percent
Landform: Swales, drainageways
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: Yes

6A—Baile silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: kxb9
Elevation: 250 to 980 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 120 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Baile and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Baile

Setting

Landform: Swales, hillslopes, depressions, drainageways
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Linear, concave

Typical profile

A - 0 to 9 inches: silt loam
Btg - 9 to 32 inches: silty clay loam
Cg - 32 to 65 inches: loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water capacity: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Minor Components

Glenville

Percent of map unit: 15 percent
Landform: Drainageways, swales
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

16D—Brinklow-Blocktown channery silt loams, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: kx79
Elevation: 300 to 2,000 feet
Mean annual precipitation: 7 to 55 inches
Mean annual air temperature: 45 to 61 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Brinklow and similar soils: 50 percent
Blocktown and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brinklow

Setting

Landform: Knolls
Down-slope shape: Convex
Across-slope shape: Linear

Parent material: Gravelly residuum weathered from low base phyllites and schists.

Typical profile

Ap - 0 to 10 inches: channery silt loam
Bt,BC - 10 to 25 inches: channery loam
Cr - 25 to 35 inches: bedrock
R - 35 to 39 inches: bedrock

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Blocktown

Setting

Landform: Knolls
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Gravelly residuum weathered from low base phyllites and schists.

Typical profile

Ap - 0 to 6 inches: channery silt loam
Bt - 6 to 17 inches: extremely channery silt loam
Cr - 17 to 21 inches: bedrock
R - 21 to 25 inches: bedrock

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Glenelg
Percent of map unit: 10 percent
Hydric soil rating: No

Occoquan
Percent of map unit: 5 percent
Hydric soil rating: No

Baile
Percent of map unit: 5 percent
Landform: Flats
Hydric soil rating: Yes

54A—Hatboro silt loam, 0 to 3 percent slopes, frequently flooded

Map Unit Setting
National map unit symbol: kx9f
Elevation: 200 to 600 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 57 degrees F
Frost-free period: 180 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition
Hatboro and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hatboro

Setting
Landform: Channels on flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mica bearing loamy alluvium

Typical profile
Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 8 inches: silt loam
Bg - 8 to 18 inches: silt loam
Cg - 18 to 66 inches: loam

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)

Depth to water table: About 0 to 10 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Available water capacity: Very high (about 12.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

66UB—Wheaton-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: kxb6
Elevation: 200 to 2,000 feet
Mean annual precipitation: 7 to 50 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 120 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Wheaton and similar soils: 50 percent
Urban land: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wheaton

Typical profile

H1 - 0 to 6 inches: silt loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 1.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Baile
Percent of map unit: 5 percent
Landform: Flats
Hydric soil rating: Yes

Glenville
Percent of map unit: 5 percent
Hydric soil rating: No

Blocktown
Percent of map unit: 5 percent
Hydric soil rating: No

Brinklow
Percent of map unit: 5 percent
Hydric soil rating: No

66UC—Wheaton-Urban land complex, 8 to 15 percent slopes

Map Unit Setting
National map unit symbol: kxb7
Elevation: 200 to 2,000 feet
Mean annual precipitation: 7 to 50 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 120 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition
Wheaton and similar soils: 50 percent
Urban land: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wheaton

Setting
Landform: Ridges, hills, interfluves, knolls
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Human transported material derived from gneiss

Typical profile
H1 - 0 to 6 inches: silt loam
H2 - 6 to 68 inches: channery loam

Properties and qualities
Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained

Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Brinklow

Percent of map unit: 5 percent
Hydric soil rating: No

Blocktown

Percent of map unit: 5 percent
Hydric soil rating: No

Glenville

Percent of map unit: 5 percent
Hydric soil rating: No

Baile

Percent of map unit: 5 percent
Landform: Flats
Hydric soil rating: Yes

W—Census water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

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Appendix B: BANCS Summary

NUTRIENT REDUCTION SUMMARY

Site Name: RFP-2 Cabin Branch

50% Efficiency			
	TSS	**P**	**N**
(Left and Right Banks)	**ton/year**	**lbs/year**	**lbs/year**
Cabin Branch Upper	109.50	114.98	249.66
Cabin Branch Lower	164.00	172.20	373.92
Tributary 4	78.20	82.10	178.28
Sum	**351.70**	**369.28**	**801.86**

Urban Stream Restoration Load Reduction

Based on September 2014 Expert Panel Report and DEQ Chesapeake Bay TMDL Special Condition Guidance March 2015

Step 1: Estimate Stream Erosion Rates

	Cabin Branch Upper		Cabin Branch Lower		Tributary 4	
	Left Bank	**Right Bank**	**Left Bank**	**Right Bank**	**Left Bank**	**Right Bank**
Total Annual Load (TSS ton/year)	**107.53**	**111.47**	**157.80**	**170.20**	**65.36**	**91.03**

Step 2: Convert Stream Bank Erosion Rates to Nutrient Loads

Default concentrations of P and N may be used. Use site specific or NRCS data for Bulk Density.

Soil Data	**Bulk Density** lbs/cf	**P** lbs/ton	**N** lbs/ton
Rates (Cabin Branch)	84.3	1.05	2.28
Rates (Trib 4)	89.3	1.05	2.28

	Cabin Branch Upper		Cabin Branch Lower		Tributary 4	
	Left Bank	**Right Bank**	**Left Bank**	**Right Bank**	**Left Bank**	**Right Bank**
P lbs/year	112.91	117.04	165.69	178.71	68.63	95.58
N lbs/year	245.17	254.15	359.78	388.06	149.02	207.55

Step 3: Estimate Stream Restoration Efficiency

The efficiency of the stream restoration at reducing loads from bank erosion are applied to the estimate annual load to determine the actual load reduction or "prevented sediment".

Default Rate **50%** Efficiency per Expert Panel Report

Cabin Branch Upper	**(Left and Right Bank)**			
Total Load Reduction for Project	**Restoration Efficiencies**	**TSS ton/year**	**P lbs/year**	**N lbs/year**
	50%	109.50	114.98	249.66

Cabin Branch Lower	**(Left and Right Bank)**			
Total Load Reduction for Project	**Restoration Efficiencies**	**TSS ton/year**	**P lbs/year**	**N lbs/year**
	50%	164.00	172.20	373.92

Tributary 4	**(Left and Right Bank)**			
Total Load Reduction for Project	**Restoration Efficiencies**	**TSS ton/year**	**P lbs/year**	**N lbs/year**
	50%	78.20	82.10	178.28

Worksheet 3-13. Summary form of annual streambank erosion estimates for various study reaches.

Str: **RFP-2 Cabin Branch** Location: **Cabin Branch Upper**

Graph Total Stream Length (ft): Date:

Ob: Valley Type: Stream Type:

(1) Station (ft)	(2) BEHI rating	(3) NBS rating	(4) Bank erosion rate (Hickey Curves) (ft/yr)	(5) Length of bank (ft)	(6) Study bank height (ft)	(7) Erosion subtotal [(4)×(5)×(6)] (ft^3/yr)	(8) Erosion subtotal (tons/yr)	(9) Phophorous Concentration(lb per ton of sediment)	(10) Phosphorous Loading (lbs/yr)	(11) Nitrogen Concentration(lb per ton of sediment)	(12) Nitrogen Loading (lbs/yr)
1341L	Moderate	Low	0.13	321.94	4.60	185.11	7.80	1.05	8.19	2.28	17.79
1342L	Very Low	Low	0.00	284.64	5.40	0.00	0.00	1.05	0.00	2.28	0.00
1345L	Moderate	Low	0.13	260.01	6.10	198.26	8.36	1.05	8.77	2.28	19.05
1347L	Very Low	Low	0.00	217.56	6.50	0.00	0.00	1.05	0.00	2.28	0.00
1351L	Moderate	Low	0.13	58.04	3.80	27.57	1.16	1.05	1.22	2.28	2.65
1353L	Moderate	Low	0.13	121.31	5.20	78.85	3.32	1.05	3.49	2.28	7.58
1355L	High	Moderate	0.64	28.31	5.00	90.59	3.82	1.05	4.01	2.28	8.71
1356L	Very Low	Low	0.00	68.88	3.50	0.00	0.00	1.05	0.00	2.28	0.00
1357L	High	Low	0.40	183.02	4.00	292.84	12.34	1.05	12.96	2.28	28.14
1359L	High	Moderate	0.64	89.31	5.30	302.94	12.77	1.05	13.41	2.28	29.11
1361L	Moderate	Low	0.13	84.36	4.50	47.45	2.00	1.05	2.10	2.28	4.56
1362L	Very High	Moderate	0.64	93.38	5.10	304.79	12.85	1.05	13.49	2.28	29.29
1365L	Moderate	Low	0.13	71.91	3.20	28.77	1.21	1.05	1.27	2.28	2.76
1367L	High	Moderate	0.64	70.43	6.20	279.45	11.78	1.05	12.37	2.28	26.86
1368L	Moderate	Low	0.13	98.20	3.50	42.96	1.81	1.05	1.90	2.28	4.13
1370L	High	Moderate	0.64	71.48	6.20	283.64	11.96	1.05	12.55	2.28	27.26
1372L	Moderate	Low	0.13	268.94	4.00	134.47	5.67	1.05	5.95	2.28	12.92
1376L	Very Low	Low	0.00	130.21	4.20	0.00	0.00	1.05	0.00	2.28	0.00
1377L	Moderate	Low	0.13	170.45	4.00	85.22	3.59	1.05	3.77	2.28	8.19
1380L	High	Low	0.40	210.20	2.00	168.16	7.09	1.05	7.44	2.28	16.16
LEFT BANK TOTALS				2902.57			107.53		112.90		245.16
1340R	Moderate	Low	0.13	344.04	5.50	236.53	9.97	1.05	10.47	2.28	22.73
1343R	Very Low	Low	0.00	130.52	5.70	0.00	0.00	1.05	0.00	2.28	0.00
1344R	Moderate	Low	0.13	349.22	6.10	266.28	11.22	1.05	11.79	2.28	25.59
1348R	High	Moderate	0.64	37.62	4.50	108.34	4.57	1.05	4.79	2.28	10.41
1350R	Moderate	Low	0.13	154.88	4.50	87.12	3.67	1.05	3.86	2.28	8.37
1352R	Moderate	Low	0.13	75.88	2.10	19.92	0.84	1.05	0.88	2.28	1.91
1354R	High	Moderate	0.64	105.14	4.70	316.26	13.33	1.05	14.00	2.28	30.39
1356R	Very Low	Low	0.00	68.88	3.50	0.00	0.00	1.05	0.00	2.28	0.00
1358R	Moderate	Low	0.13	250.58	3.50	109.63	4.62	1.05	4.85	2.28	10.54
1360R	Moderate	Moderate	0.30	53.21	5.30	84.61	3.57	1.05	3.74	2.28	8.13
1363R	Moderate	Low	0.13	118.42	2.50	37.01	1.56	1.05	1.64	2.28	3.56
1364R	High	Moderate	0.64	67.73	4.20	182.06	7.67	1.05	8.06	2.28	17.50
1366R	Moderate	Low	0.13	125.53	2.30	36.09	1.52	1.05	1.60	2.28	3.47
1369R	High	Moderate	0.64	40.92	5.20	136.20	5.74	1.05	6.03	2.28	13.09
1371R	Moderate	Low	0.13	131.70	2.90	47.74	2.01	1.05	2.11	2.28	4.59
1373R	High	Moderate	0.64	133.53	4.10	350.39	14.77	1.05	15.51	2.28	33.67
1375R	Moderate	Low	0.13	133.72	4.50	75.22	3.17	1.05	3.33	2.28	7.23
1376R	Very Low	Low	0.00	130.21	4.20	0.00	0.00	1.05	0.00	2.28	0.00
1378R	High	Low	0.40	167.67	4.50	301.80	12.72	1.05	13.36	2.28	29.00
1379R	High	Moderate	0.64	92.80	4.20	249.46	10.51	1.05	11.04	2.28	23.97
RIGHT BANK TOTALS				2712.20			111.47		117.05		254.16

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Worksheet 3-13. Summary form of annual streambank erosion estimates for various study reaches.

Stream: **RFP-2 Cabin Branch** Location: **Cabin Branch Lower**

Graph: Total Stream Length (ft): Date:

Observers: Valley Type: Stream Type:

(1) Station (ft)	(2) BEHI rating	(3) NBS rating	(4) Bank erosion rate (Hickey Curves) (ft/yr)	(5) Length of bank (ft)	(6) Study bank height (ft)	(7) Erosion subtotal [(4)×(5)×(6)] (ft^3/yr)	(8) Erosion subtotal (tons/yr)	(9) Phophorous Concentration(lb per ton of sediment)	(10) Phosphorous Loading (lbs/yr)	(11) Nitrogen Concentration(lb per ton of sediment)	(12) Nitrogen Loading (lbs/yr)
1382L	Low	Low	0.02	268.69	2.00	10.75	0.45	1.05	0.48	2.28	1.03
1383L	High	Low	0.40	143.29	5.50	315.25	13.29	1.05	13.95	2.28	30.30
1404L	High	Moderate	0.64	141.28	4.20	379.76	16.01	1.05	16.81	2.28	36.50
1409L	Moderate	Low	0.13	306.26	6.20	237.35	10.00	1.05	10.50	2.28	22.81
1412L	High	Moderate	0.64	154.18	6.40	631.54	26.62	1.05	27.95	2.28	60.69
1415L	Moderate	Low	0.13	165.15	4.40	90.83	3.83	1.05	4.02	2.28	8.73
1417L	High	Moderate	0.64	258.95	4.20	696.06	29.34	1.05	30.81	2.28	66.89
1419L	Moderate	Low	0.13	336.63	3.00	126.24	5.32	1.05	5.59	2.28	12.13
1421L	High	Moderate	0.64	35.82	3.30	75.66	3.19	1.05	3.35	2.28	7.27
1422L	Moderate	Moderate	0.30	150.90	2.80	126.76	5.34	1.05	5.61	2.28	12.18
1424L	Moderate	Low	0.13	41.73	3.30	17.21	0.73	1.05	0.76	2.28	1.65
1425L	Very High	Moderate	0.64	90.99	5.00	291.16	12.27	1.05	12.89	2.28	27.98
1427L	Moderate	Low	0.13	36.86	2.40	11.06	0.47	1.05	0.49	2.28	1.06
1429L	High	Moderate	0.64	215.37	4.40	606.48	25.56	1.05	26.84	2.28	58.28
1432L	Moderate	Low	0.13	56.77	3.50	24.84	1.05	1.05	1.10	2.28	2.39
1435L	High	Moderate	0.64	32.17	5.00	102.95	4.34	1.05	4.56	2.28	9.89
1436L	Very Low	Low	0.00	79.90	0.00	0.00	0.00	1.05	0.00	2.28	0.00
LEFT BANK TOTALS				2514.96			157.80		165.69		359.79
1381R	High	Low	0.40	134.93	4.50	242.88	10.24	1.05	10.75	2.28	23.34
1403R	High	Moderate	0.64	78.97	5.00	252.70	10.65	1.05	11.18	2.28	24.28
1405R	High	Moderate	0.64	77.37	4.80	237.69	10.02	1.05	10.52	2.28	22.84
1407R	High	Moderate	0.64	421.05	4.00	1077.88	45.43	1.05	47.70	2.28	103.59
1410R	Very Low	Low	0.00	208.73	4.50	0.00	0.00	1.05	0.00	2.28	0.00
1411R	Moderate	Low	0.13	61.99	5.00	38.75	1.63	1.05	1.71	2.28	3.72
1413R	Very Low	Low	0.00	56.24	5.70	0.00	0.00	1.05	0.00	2.28	0.00
1414R	Moderate	Low	0.13	85.32	6.10	65.06	2.74	1.05	2.88	2.28	6.25
1416R	Moderate	Low	0.13	177.85	5.00	111.16	4.69	1.05	4.92	2.28	10.68
1418R	High	Moderate	0.64	167.64	4.00	429.16	18.09	1.05	18.99	2.28	41.24
1420R	Moderate	Low	0.13	342.45	3.80	162.66	6.86	1.05	7.20	2.28	15.63
1423R	High	Moderate	0.64	196.97	4.10	516.85	21.79	1.05	22.87	2.28	49.67
1426R	High	Moderate	0.64	47.75	3.00	91.68	3.86	1.05	4.06	2.28	8.81
1428R	Very High	Moderate	0.64	47.94	5.20	159.55	6.72	1.05	7.06	2.28	15.33
1430R	Moderate	Low	0.13	31.51	3.90	15.36	0.65	1.05	0.68	2.28	1.48
1431R	High	Moderate	0.64	179.54	4.10	471.11	19.86	1.05	20.85	2.28	45.27
1433R	Moderate	Low	0.13	41.37	4.00	20.69	0.87	1.05	0.92	2.28	1.99
1434R	High	Moderate	0.64	52.60	4.30	144.76	6.10	1.05	6.41	2.28	13.91
1436R	Very Low	Low	0.00	79.90	0.00	0.00	0.00	1.05	0.00	2.28	0.00
RIGHT BANK TOTALS				2490.13			170.20		178.71		388.05

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Worksheet 3-13. Summary form of annual streambank erosion estimates for various study reaches.

Stream: **RFP-2 Cabin Branch** Location: **Tributary 4**

Graph: Total Stream Length (ft): Date:

Observers: Valley Type: Stream Type:

(1) Station (ft)	(2) BEHI rating	(3) NBS rating	(4) Bank erosion rate (Hickey Curves) (ft/yr)	(5) Length of bank (ft)	(6) Study bank height (ft)	(7) Erosion subtotal [(4)×(5)×(6)] (ft^3/yr)	(8) Erosion subtotal (tons/yr)	(9) Phophorous Concentration(lb per ton of sediment)	(10) Phosphorous Loading (lbs/yr)	(11) Nitrogen Concentration(lb per ton of sediment)	(12) Nitrogen Loading (lbs/yr)
1385L	High	Moderate	0.64	144.56	5.20	481.09	21.48	1.05	22.55	2.28	48.98
1386L	Moderate	Low	0.13	100.02	1.70	21.25	0.95	1.05	1.00	2.28	2.16
1387L	High	Moderate	0.64	50.52	3.70	119.62	5.34	1.05	5.61	2.28	12.18
1389L	Moderate	Low	0.13	13.48	1.40	2.36	0.11	1.05	0.11	2.28	0.24
1391L	Very High	Moderate	0.64	52.90	4.30	145.58	6.50	1.05	6.83	2.28	14.82
1393L	High	Moderate	0.64	38.97	5.00	124.70	5.57	1.05	5.85	2.28	12.69
1394L	High	Low	0.40	54.75	2.50	54.75	2.44	1.05	2.57	2.28	5.57
1396L	High	Moderate	0.64	93.63	4.70	281.63	12.57	1.05	13.20	2.28	28.67
1401L	High	Moderate	0.64	165.38	2.20	232.86	10.40	1.05	10.92	2.28	23.71
LEFT BANK TOTALS				714.20			65.36		68.63		149.02
1385R	High	Moderate	0.64	144.56	5.20	481.09	21.48	1.05	22.55	2.28	48.98
1388R	High	Low	0.40	33.32	1.60	21.33	0.95	1.05	1.00	2.28	2.17
1390R	Very High	Moderate	0.64	37.21	6.10	145.25	6.49	1.05	6.81	2.28	14.79
1392R	High	Low	0.40	41.79	2.20	36.78	1.64	1.05	1.72	2.28	3.74
1393R	High	Moderate	0.64	38.97	5.00	124.70	5.57	1.05	5.85	2.28	12.69
1395R	Very High	Moderate	0.64	72.22	5.10	235.73	10.53	1.05	11.05	2.28	24.00
1397R	High	Low	0.40	171.13	2.00	136.90	6.11	1.05	6.42	2.28	13.94
1398R	High	Moderate	0.64	371.53	2.80	665.79	29.73	1.05	31.21	2.28	67.78
1400R	High	Low	0.40	271.13	1.60	173.52	7.75	1.05	8.14	2.28	17.66
1402R	High	Moderate	0.64	13.10	2.10	17.61	0.79	1.05	0.83	2.28	1.79
RIGHT BANK TOTALS				1194.96			91.03		95.58		207.54

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Appendix C: NOAA Atlas 14 Documentation, TR-55 and Outputs TR-20 Outputs

NOAA Atlas 14, Volume 2, Version 3
Location name: Montgomery Village, Maryland, USA*
Latitude: 39.1773°, Longitude: -77.1994°
Elevation: 366.33 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.341** (0.309-0.377)	**0.408** (0.370-0.451)	**0.486** (0.439-0.537)	**0.543** (0.490-0.599)	**0.616** (0.551-0.679)	**0.670** (0.597-0.739)	**0.724** (0.641-0.799)	**0.775** (0.682-0.859)	**0.842** (0.734-0.937)	**0.895** (0.774-0.999)
10-min	**0.545** (0.494-0.602)	**0.653** (0.591-0.721)	**0.779** (0.704-0.859)	**0.869** (0.784-0.958)	**0.981** (0.878-1.08)	**1.07** (0.950-1.18)	**1.15** (1.02-1.27)	**1.23** (1.08-1.36)	**1.33** (1.16-1.48)	**1.41** (1.22-1.57)
15-min	**0.682** (0.617-0.753)	**0.821** (0.743-0.906)	**0.985** (0.890-1.09)	**1.10** (0.991-1.21)	**1.24** (1.11-1.37)	**1.35** (1.20-1.49)	**1.45** (1.29-1.61)	**1.55** (1.37-1.72)	**1.68** (1.46-1.87)	**1.77** (1.53-1.97)
30-min	**0.934** (0.846-1.03)	**1.13** (1.03-1.25)	**1.40** (1.26-1.54)	**1.59** (1.44-1.76)	**1.84** (1.65-2.03)	**2.03** (1.81-2.24)	**2.23** (1.97-2.46)	**2.41** (2.13-2.67)	**2.67** (2.33-2.97)	**2.86** (2.48-3.20)
60-min	**1.17** (1.06-1.29)	**1.42** (1.29-1.57)	**1.79** (1.62-1.98)	**2.07** (1.87-2.29)	**2.45** (2.20-2.70)	**2.76** (2.46-3.04)	**3.07** (2.72-3.39)	**3.39** (2.98-3.75)	**3.83** (3.34-4.26)	**4.18** (3.62-4.67)
2-hr	**1.37** (1.24-1.52)	**1.67** (1.52-1.85)	**2.12** (1.92-2.34)	**2.48** (2.23-2.73)	**2.98** (2.67-3.28)	**3.39** (3.02-3.74)	**3.84** (3.39-4.23)	**4.30** (3.77-4.75)	**4.98** (4.31-5.52)	**5.53** (4.74-6.17)
3-hr	**1.48** (1.34-1.64)	**1.80** (1.62-1.99)	**2.28** (2.06-2.53)	**2.66** (2.39-2.95)	**3.22** (2.87-3.56)	**3.68** (3.26-4.07)	**4.17** (3.67-4.62)	**4.70** (4.10-5.22)	**5.47** (4.70-6.09)	**6.11** (5.19-6.83)
6-hr	**1.83** (1.66-2.04)	**2.21** (2.00-2.46)	**2.79** (2.52-3.10)	**3.27** (2.94-3.63)	**3.99** (3.55-4.42)	**4.60** (4.06-5.09)	**5.26** (4.61-5.83)	**5.98** (5.19-6.65)	**7.06** (6.02-7.89)	**7.97** (6.71-8.94)
12-hr	**2.23** (2.01-2.51)	**2.69** (2.42-3.02)	**3.41** (3.06-3.83)	**4.03** (3.59-4.52)	**4.97** (4.39-5.57)	**5.80** (5.07-6.49)	**6.73** (5.81-7.54)	**7.77** (6.62-8.72)	**9.35** (7.81-10.5)	**10.7** (8.81-12.1)
24-hr	**2.57** (2.35-2.86)	**3.11** (2.84-3.45)	**3.99** (3.64-4.43)	**4.77** (4.33-5.28)	**5.97** (5.38-6.57)	**7.04** (6.28-7.71)	**8.24** (7.28-9.00)	**9.61** (8.39-10.5)	**11.7** (10.1-12.7)	**13.6** (11.5-14.7)
2-day	**2.99** (2.72-3.31)	**3.61** (3.29-4.01)	**4.63** (4.21-5.14)	**5.50** (4.99-6.10)	**6.81** (6.14-7.53)	**7.96** (7.12-8.78)	**9.23** (8.19-10.2)	**10.7** (9.36-11.7)	**12.8** (11.1-14.1)	**14.6** (12.5-16.1)
3-day	**3.16** (2.88-3.50)	**3.82** (3.49-4.24)	**4.89** (4.45-5.42)	**5.81** (5.27-6.43)	**7.19** (6.48-7.93)	**8.39** (7.51-9.24)	**9.72** (8.63-10.7)	**11.2** (9.86-12.3)	**13.5** (11.7-14.8)	**15.4** (13.2-16.9)
4-day	**3.33** (3.05-3.70)	**4.03** (3.68-4.47)	**5.15** (4.70-5.71)	**6.11** (5.56-6.76)	**7.56** (6.82-8.33)	**8.82** (7.90-9.71)	**10.2** (9.07-11.2)	**11.8** (10.4-12.9)	**14.1** (12.2-15.5)	**16.1** (13.8-17.8)
7-day	**3.87** (3.55-4.25)	**4.66** (4.28-5.11)	**5.88** (5.41-6.46)	**6.93** (6.35-7.60)	**8.51** (7.74-9.29)	**9.87** (8.92-10.8)	**11.4** (10.2-12.4)	**13.0** (11.6-14.2)	**15.5** (13.6-16.9)	**17.6** (15.3-19.3)
10-day	**4.42** (4.07-4.84)	**5.31** (4.89-5.82)	**6.63** (6.09-7.25)	**7.73** (7.09-8.45)	**9.34** (8.52-10.2)	**10.7** (9.70-11.7)	**12.1** (10.9-13.2)	**13.7** (12.3-15.0)	**16.0** (14.1-17.5)	**18.0** (15.7-19.6)
20-day	**5.98** (5.55-6.47)	**7.12** (6.61-7.69)	**8.60** (7.97-9.29)	**9.81** (9.08-10.6)	**11.5** (10.6-12.4)	**12.8** (11.8-13.8)	**14.2** (13.0-15.3)	**15.7** (14.3-16.9)	**17.7** (16.0-19.1)	**19.4** (17.4-20.9)
30-day	**7.37** (6.89-7.90)	**8.71** (8.15-9.35)	**10.4** (9.68-11.1)	**11.7** (10.9-12.5)	**13.5** (12.6-14.5)	**15.0** (13.9-16.0)	**16.5** (15.2-17.6)	**18.0** (16.5-19.3)	**20.1** (18.3-21.5)	**21.7** (19.7-23.3)
45-day	**9.25** (8.69-9.86)	**10.9** (10.3-11.6)	**12.7** (12.0-13.6)	**14.2** (13.3-15.1)	**16.0** (15.0-17.1)	**17.4** (16.3-18.6)	**18.8** (17.6-20.1)	**20.2** (18.8-21.5)	**22.0** (20.4-23.5)	**23.3** (21.5-24.9)
60-day	**11.0** (10.4-11.7)	**13.0** (12.2-13.7)	**15.0** (14.1-15.9)	**16.5** (15.5-17.5)	**18.5** (17.4-19.6)	**19.9** (18.7-21.1)	**21.3** (20.0-22.6)	**22.7** (21.2-24.1)	**24.4** (22.7-25.9)	**25.6** (23.7-27.2)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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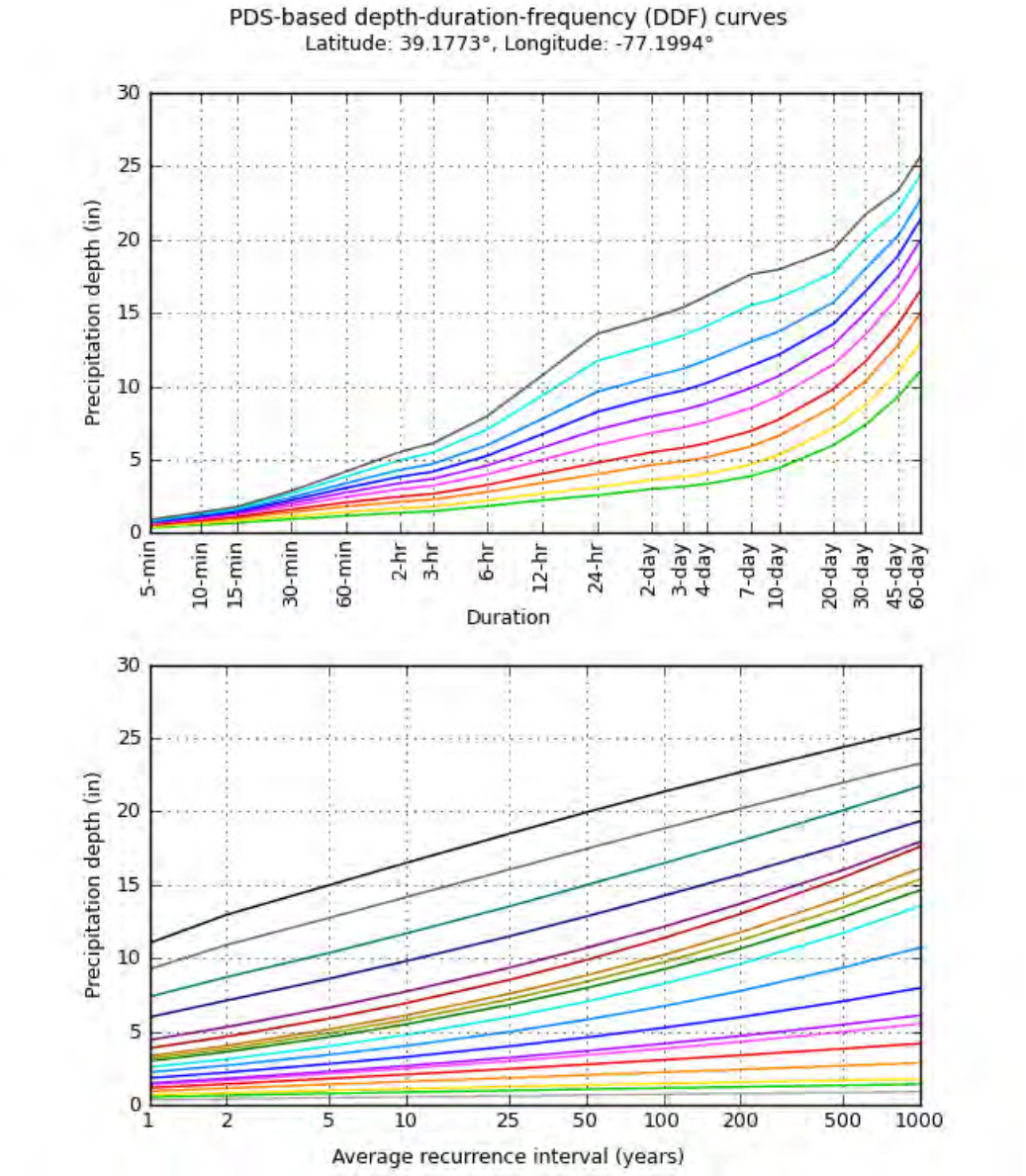
PF graphical



NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Fri Oct 30 15:16:03 2020

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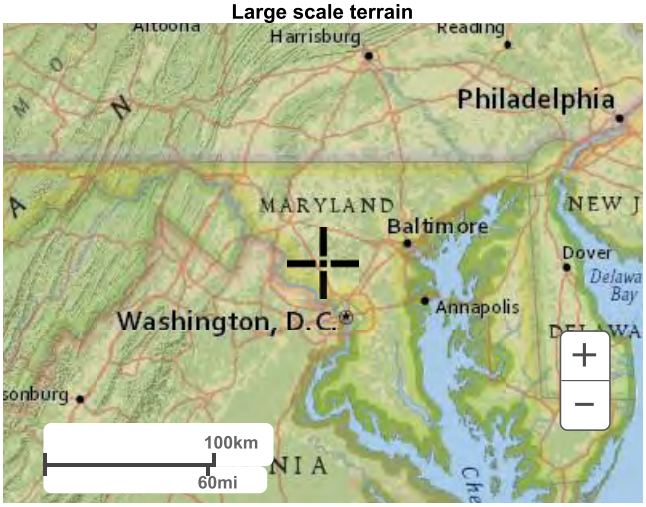
Maps & aerials

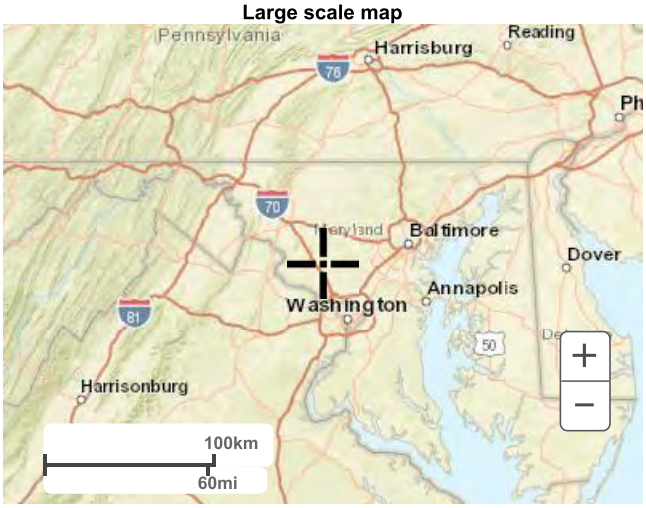
Small scale terrain



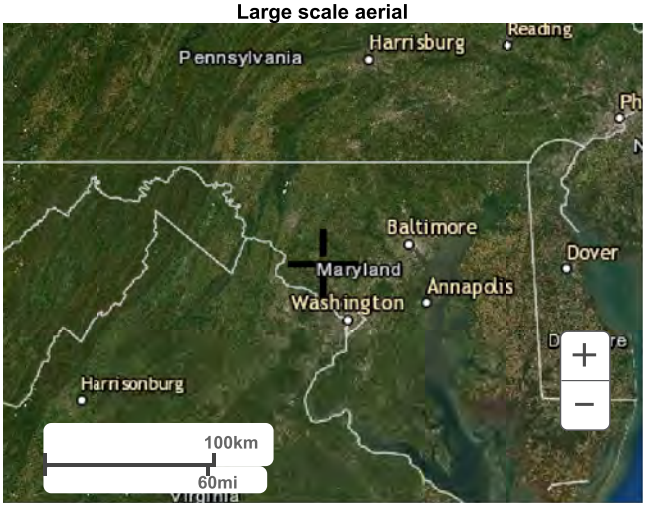
Large scale terrain



Large scale map



Large scale aerial



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National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Cabin Branch
MD SHA Cabin Branch SUBS 1-9
Montgomery NOAA_C County, Maryland

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
SUB DA1	Paved; curbs and storm sewers	B	216	98
	Industrial	B	335	88
	Industrial	C	1	91
	Industrial	D	66	93
	Residential districts (1/8 acre)	B	178	85
	Residential districts (1/8 acre)	C	7	90
	Residential districts (1/8 acre)	D	20	92
	Residential districts (1/4 acre)	B	446	75
	Residential districts (1/4 acre)	C	14	83
	Residential districts (1/4 acre)	D	65	87
	Residential districts (1/2 acre)	B	709	70
	Residential districts (1/2 acre)	C	43	80
	Residential districts (1/2 acre)	D	117	85
	Residential districts (1 acre)	B	24	68
	Residential districts (1 acre)	D	11	84
	Total Area / Weighted Curve Number		2252	80
			====	==
SUB DA2	Paved; curbs and storm sewers	B	6	98
	Commercial & business	B	6	92
	Industrial	B	5	88
	Residential districts (1/8 acre)	B	69	85
	Residential districts (1/8 acre)	D	2	92
	Residential districts (1/2 acre)	B	9	70
	Total Area / Weighted Curve Number		97	85
			==	==
SUB DA3	Paved; curbs and storm sewers	B	3	98
	Paved; curbs and storm sewers	C	1	98
	Paved; curbs and storm sewers	D	1	98
	Residential districts (1/8 acre)	B	54	85
	Residential districts (1/8 acre)	C	10	90
	Residential districts (1/8 acre)	D	11	92
	Residential districts (1/2 acre)	B	9	70
	Residential districts (1/2 acre)	D	1	85
	Total Area / Weighted Curve Number		90	86
			==	==
SUB DA4B	Paved; curbs and storm sewers	B	1.2	98
	Paved; curbs and storm sewers	D	.49	98
	Residential districts (1/8 acre)	B	44.85	85
	Residential districts (1/8 acre)	C	2	90
	Residential districts (1/8 acre)	D	11.46	92
	Total Area / Weighted Curve Number		60	87
			==	==
SUB DA5	Paved; curbs and storm sewers	B	9	98
	Commercial & business	B	3	92
	Commercial & business	D	4	95
	Residential districts (1/8 acre)	B	33	85
	Residential districts (1/8 acre)	D	1	92
	Residential districts (1/4 acre)	B	25	75
	Residential districts (1/2 acre)	B	8	70
	Residential districts (1/2 acre)	D	2	85

Sub-Area Land Use and Curve Number Details (continued)

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
	Total Area / Weighted Curve Number		85	83
SUB DA6A	Paved; curbs and storm sewers	B	1.43	98
	Paved; curbs and storm sewers	C	.85	98
	Paved; curbs and storm sewers	D	.36	98
	Residential districts (1/8 acre)	B	23.47	85
	Residential districts (1/8 acre)	C	.86	90
	Residential districts (1/8 acre)	D	2.91	92
	Residential districts (1/2 acre)	B	.12	70
	Total Area / Weighted Curve Number		30	87
SUB DA7	Commercial & business	B	3	92
	Commercial & business	D	5	95
	Residential districts (1/8 acre)	B	2	85
	Residential districts (1/8 acre)	C	2	90
	Residential districts (1/8 acre)	D	2	92
	Residential districts (1/2 acre)	B	1	70
	Residential districts (1/2 acre)	C	1	80
	Residential districts (1/2 acre)	D	3	85
	Total Area / Weighted Curve Number		19	89
SUB DA8	Paved; curbs and storm sewers	B	2	98
	Paved; curbs and storm sewers	D	2	98
	Commercial & business	B	12	92
	Commercial & business	D	7	95
	Residential districts (1/8 acre)	B	16	85
	Residential districts (1/8 acre)	D	2	92
	Residential districts (1/2 acre)	B	5	70
	Residential districts (1/2 acre)	D	2	85
	Residential districts (1 acre)	D	1	84
	Total Area / Weighted Curve Number		49	88
SUB DA9	Paved; curbs and storm sewers	B	4	98
	Paved; curbs and storm sewers	D	4	98
	Residential districts (1/8 acre)	B	16	85
	Residential districts (1/8 acre)	C	4	90
	Residential districts (1/8 acre)	D	16	92
	Residential districts (1/4 acre)	B	27	75
	Residential districts (1/4 acre)	C	23	83
	Residential districts (1/4 acre)	D	1	87
	Residential districts (1/2 acre)	B	2	70
	Residential districts (1 acre)	B	2	68
	Total Area / Weighted Curve Number		99	84
SUB DA4A	Paved; curbs and storm sewers	B	.8	98
	Paved; curbs and storm sewers	D	.51	98
	Residential districts (1/8 acre)	B	7.15	85
	Residential districts (1/8 acre)	D	.54	92

Sub-Area Land Use and Curve Number Details (continued)

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
	Total Area / Weighted Curve Number		9	87
			=	==

Cabin Branch
MD SHA Cabin Branch SUBS 6B
Montgomery NOAA_C County, Maryland

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
SUB DA6B	Paved; curbs and storm sewers	B	4.74	98
	Paved; curbs and storm sewers	C	.32	98
	Paved; curbs and storm sewers	D	.85	98
	Commercial & business	B	.28	92
	Commercial & business	C	.16	94
	Commercial & business	D	2.32	95
	Residential districts (1/8 acre)	B	.13	85
	Residential districts (1 acre)	B	.2	68
	Total Area / Weighted Curve Number		9	96
			=	==

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Cabin Branch
MD SHA Cabin Branch SUBS 1-9
Montgomery NOAA_C County, Maryland

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)	
SUB DA1								
SHEET	100	0.0105	0.240				0.312	A1-BI
SHALLOW	613	0.0580	0.050				0.044	B1-C1
CHANNEL	18437					3.500	1.463	C1-D1
					Time of Concentration		1.819	
SUB DA2								
SHEET	100	0.0130	0.240				0.287	A2-B2
SHALLOW	1141	0.0260	0.050				0.122	B2-C2
SHALLOW	833	0.0260	0.025				0.071	C2-D2
CHANNEL	2206					3.500	0.175	D2-E2
					Time of Concentration		.655	
SUB DA3								
SHEET	100	0.0100	0.240				0.318	A3-B3
SHALLOW	337	0.0180	0.025				0.034	B3-C3
SHALLOW	2360	0.0230	0.050				0.268	B3-C3
CHANNEL	240					8.000	0.008	C3-D3
CHANNEL	1485					3.500	0.118	C3-D3
					Time of Concentration		0.746	
SUB DA4B								
SHEET	100	0.0210	0.240				0.237	A4B-B4B
SHALLOW	420	0.0250	0.050				0.046	B4B-C4B
CHANNEL	1331					3.500	0.106	C4B-D4B,E4B-F4B
CHANNEL	580					8.000	0.020	D4B-E4B
					Time of Concentration		.409	
SUB DA5								
SHEET	100	0.0570	0.240				0.159	A5-B5
SHALLOW	120	0.0890	0.050				0.007	B5-C5
SHALLOW	1000	0.1030	0.025				0.043	B5-C5
CHANNEL	642					8.000	0.022	C5-D5
CHANNEL	1647					3.500	0.131	C5-D5
					Time of Concentration		.362	
SUB DA6A								
SHEET	100	0.0040	0.240				0.459	A6A-B6A
SHALLOW	320	0.0160	0.025				0.035	B6A-C6A
SHALLOW	256	0.0500	0.050				0.020	D6A-E6A
CHANNEL	1525					8.000	0.053	C6A-D6A
CHANNEL	278					3.500	0.022	E6A-F6A
					Time of Concentration		.589	
SUB DA7								
SHEET	100	0.0500	0.240				0.167	A7-B7

Sub-Area Time of Concentration Details (continued)

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)	
SHALLOW	947	0.0440	0.050				0.078	B7-C7
CHANNEL	919					3.500	0.073	C7-D7
					Time of Concentration		.318	
SUB DA8								
SHEET	100	0.0150	0.240				0.271	A8-B8
SHALLOW	392	0.0800	0.050				0.024	B8-C8,D8-E8
SHALLOW	124	0.0500	0.025				0.008	B8-C8,D8-E8
CHANNEL	700					8.000	0.024	C8-D8
CHANNEL	1346					3.500	0.107	E8-F8
					Time of Concentration		.434	
SUB DA9								
SHEET	100	0.0600	0.240				0.155	A9-B9
SHALLOW	870	0.0500	0.050				0.067	B9-C9
SHALLOW	670	0.0380	0.025				0.047	C9-D9
CHANNEL	619					8.000	0.021	D9-E9
CHANNEL	1029					3.500	0.082	E9-F9
					Time of Concentration		.372	
SUB DA4A								
SHEET	100	0.0800	0.240				0.139	A4A-B4A
SHALLOW	313	0.0580	0.050				0.022	B4A-C4A
CHANNEL	446					3.500	0.035	C4A-D4A
CHANNEL	418					8.000	0.015	D4A-E4A
					Time of Concentration		0.211	

KJA

Cabin Branch
MD SHA Cabin Branch SUBS 6B
Montgomery NOAA_C County, Maryland

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)	
SUB DA6B								
SHEET	100	0.0250	0.011				0.019	A6B-B6B
SHALLOW	556	0.0200	0.025				0.054	B6B-C6B
CHANNEL	1357					8.000	0.047	C6B-D6B
					Time of Concentration		.12	

WinTR-20 Printed Page File Beginning of Input Data List
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WinTR-20: Version 3.20                  0         0         0.5       0
NOAA 14 precipitation, smoothed values  Ohio River Basin
Lat (dd): 39.1913 Lon (dd): -77.2120°  MD Montgomery County

SUB-AREA:
          DA 1      Reach 1             3.51875   80.       1.819     YY  Y
          DA 2      Reach 1             0.1515625 85.       0.655     YY  Y
          DA 3      Reach 2             0.1406250 86.       0.746     YY  Y
          DA 5      Reach 3             0.1328125 83.       0.362     YY  Y
          DA 7      Reach 4             0.0296875 89.       0.318     YY  Y
          DA 8      Reach 4             0.0765625 88.       0.434     YY  Y
          DA 9      Outlet              0.1546875 84.       0.372     YY  Y
          DA 4A     Reach 2             0.0140625 87.       0.211
          DA 4B     Reach 2             0.0937500 87.       0.409
          DA 6A     Reach 3             0.0468750 87.       0.589
          DA 6B     Reach 3             0.0140625 96.       0.120


STREAM REACH:
          Reach 1   Reach 2   X-Sec 1             1628.     1628.
          Reach 2   Reach 3   X-Sec 2             612.      612.
          Reach 3   Reach 4   X-Sec 3             1143.     1143.
          Reach 4   Outlet    X-Sec 4             1043.     1043.


STORM ANALYSIS:
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          10_yr_stm                   4.77      10_yr_tbl 2
          100_yr_stm                  8.24      100_yr_tbl2


STREAM CROSS SECTION:
          X-Sec 1   368.6
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                    365.73    5.        6.03      14.61     .001269
                    366.80    50.       23.59     18.24     0.001876
                    367.45    100.      35.99     20.42     0.002167
                    368.67    250.      63.55     24.58     0.002664
                    369.98    500.      98.55     29.02     0.003130
                    371.03    1000.     169.24    138.03    0.005036
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                    361.94    100.      27.71     20.51     0.005081
                    362.82    250.      47.38     24.37     0.006780
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          X-Sec 3   350.18
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          X-Sec 4   348.59
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RAINFALL DISTRIBUTION:

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GLOBAL OUTPUT:

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WinTR-20 Printed Page File End of Input Data List

NOAA 14 precipitation, smoothed values Ohio River Basin
Lat (dd): 39.1913 Lon (dd): -77.2120° MD Montgomery County

Name of printed page file:
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STORM 2_yr_stm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 1	3.519		1.333		13.20	1051.4	298.79

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
10.000	0.1	0.9	1.5	2.2	3.2	4.4	5.8
10.700	7.3	9.0	10.9	12.8	14.9	17.1	19.6
11.400	22.6	26.0	30.4	36.2	44.6	57.7	80.3
12.100	117.9	173.4	247.1	338.7	451.3	578.0	705.6
12.800	821.3	916.5	986.8	1031.1	1051.4	1044.8	1018.8
13.500	978.1	924.6	859.8	787.6	714.7	648.9	592.1
14.200	542.4	499.4	462.5	430.3	401.8	376.9	356.0
14.900	338.3	322.9	309.3	297.3	286.2	275.8	265.8
15.600	256.4	247.3	238.3	229.7	221.3	213.3	205.7
16.300	198.5	191.8	185.7	180.0	174.8	170.2	166.0
17.000	162.2	158.6	155.2	152.0	148.9	145.9	143.0
17.700	140.4	138.0	135.8	133.8	131.9	130.1	128.3
18.400	126.5	124.7	123.0	121.3	119.6	118.0	116.3
19.100	114.6	113.0	111.3	109.7	108.0	106.3	104.7
19.800	103.0	101.4	99.7	98.0	96.4	94.7	93.0
20.500	91.4	89.7	88.0	86.4	84.7	83.0	81.3
21.200	79.6	77.9	76.3	74.6	72.9	71.2	69.4
21.900	67.7	66.0	64.3	62.6	60.9	59.1	57.4
22.600	55.7	54.0	52.2	50.5	48.8	47.0	45.3
23.300	43.5	41.8	40.1	38.3	36.6	34.8	33.1
24.000	31.3	29.6	27.8	26.0	24.2	22.3	20.5
24.700	18.7	16.9	15.1	13.5	11.9	10.5	9.2
25.400	8.0	6.9	6.0	5.2	4.5	3.9	3.3
26.100	2.9	2.5	2.2	1.9	1.6	1.4	1.2
26.800	1.0	0.9	0.8	0.6	0.6	0.0	

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 2	0.152		1.678		12.47	118.5	781.71

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
9.000	0.0	0.5	0.7	0.8	1.0	1.2	1.3
9.700	1.5	1.7	1.9	2.1	2.3	2.5	2.7
10.400	2.9	3.1	3.2	3.3	3.2	3.1	3.1
11.100	3.4	3.8	4.4	5.2	6.1	7.2	8.8

NOAA 14 precipitation, smoothed values Ohio River Basin
Lat (dd): 39.1913 Lon (dd): -77.2120° MD Montgomery County

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
11.800	11.5	16.1	24.5	40.9	67.8	97.9	116.0
12.500	117.0	105.3	86.8	69.1	55.1	44.1	35.7
13.200	29.4	24.5	20.6	17.3	14.5	12.5	11.4
13.900	11.0	10.9	11.1	11.2	11.2	11.2	11.1
14.600	11.1	11.0	10.9	10.8	10.7	10.6	10.3
15.300	9.9	9.3	8.8	8.3	8.0	7.7	7.5
16.000	7.4	7.3	7.2	7.1	7.0	6.9	6.8
16.700	6.7	6.6	6.6	6.5	6.4	6.3	6.2
17.400	6.2	6.1	6.0	5.9	5.9	5.8	5.7
18.100	5.6	5.5	5.5	5.4	5.3	5.2	5.1
18.800	5.1	5.0	4.9	4.8	4.7	4.7	4.6
19.500	4.5	4.4	4.3	4.2	4.2	4.1	4.0
20.200	3.9	3.8	3.8	3.7	3.6	3.5	3.4
20.900	3.3	3.3	3.2	3.1	3.0	2.9	2.8
21.600	2.8	2.7	2.6	2.5	2.4	2.3	2.3
22.300	2.2	2.1	2.0	1.9	1.8	1.7	1.7
23.000	1.6	1.5	1.4	1.3	1.2	1.2	1.1
23.700	1.0	0.9	0.8	0.7	0.6	0.5	0.0

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 1	3.670	Upstream	1.347	371.13	13.22	1078.6	293.86

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
9.000	0.0	0.5	0.7	0.8	1.0	1.2	1.3
9.700	1.5	1.7	1.9	2.2	3.2	3.9	4.9
10.400	6.1	7.5	9.0	10.6	12.3	14.0	16.0
11.100	18.3	20.9	24.0	27.7	32.1	37.6	45.2
11.800	56.1	73.7	104.9	158.8	241.2	345.6	455.6
12.500	568.7	683.3	792.3	890.4	971.6	1030.9	1066.8
13.200	1078.0	1069.3	1039.4	995.4	939.1	872.3	798.9
13.900	726.1	659.9	603.4	553.5	510.6	473.6	441.4
14.600	412.9	388.1	367.2	349.1	333.6	319.9	307.6
15.300	296.1	285.1	274.6	264.8	255.2	246.1	237.2
16.000	228.7	220.6	212.8	205.6	198.8	192.6	186.8
16.700	181.5	176.8	172.6	168.7	165.0	161.5	158.2
17.400	155.0	152.0	149.0	146.3	143.8	141.6	139.5
18.100	137.5	135.6	133.7	131.9	130.0	128.2	126.5
18.800	124.7	123.0	121.2	119.5	117.7	116.0	114.2
19.500	112.5	110.7	109.0	107.3	105.5	103.8	102.0
20.200	100.3	98.5	96.8	95.0	93.3	91.5	89.8
20.900	88.0	86.3	84.5	82.7	81.0	79.2	77.4
21.600	75.6	73.8	72.0	70.2	68.4	66.6	64.8
22.300	63.0	61.2	59.4	57.6	55.8	54.0	52.2
23.000	50.3	48.5	46.7	44.9	43.0	41.2	39.4
23.700	37.6	35.7	33.9	32.0	30.2	28.3	26.0

NOAA 14 precipitation, smoothed values Ohio River Basin
Lat (dd): 39.1913 Lon (dd): -77.2120° MD Montgomery County

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
24.400	24.2	22.3	20.5	18.7	16.9	15.1	13.5
25.100	11.9	10.5	9.2	8.0	6.9	6.0	5.2
25.800	4.5	3.9	3.3	2.9	2.5	2.2	1.9
26.500	1.6	1.4	1.2	1.0	0.9	0.8	0.6
27.200	0.6	0.0					

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 1	3.670	Downstream	1.347	371.13	13.26	1077.7	293.63

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
9.100	0.0	0.8	0.8	0.9	1.1	1.2	1.4
9.800	1.6	1.8	2.0	2.6	3.5	4.4	5.4
10.500	6.7	8.1	9.7	11.3	13.0	14.8	16.9
11.200	19.4	22.2	25.6	29.6	34.4	40.8	49.7
11.900	63.1	85.2	124.8	192.6	286.0	394.9	506.5
12.600	619.0	732.3	838.0	929.5	1000.9	1048.3	1073.2
13.300	1076.3	1057.5	1021.9	972.2	910.6	839.8	766.1
14.000	696.3	634.2	580.4	533.5	493.4	458.8	428.4
14.700	401.6	378.5	358.9	341.9	327.2	314.3	302.4
15.400	291.2	280.4	270.2	260.5	251.1	242.1	233.4
16.100	225.1	217.1	209.6	202.5	196.0	189.9	184.4
16.800	179.4	174.9	170.8	167.0	163.4	160.0	156.8
17.500	153.7	150.6	147.8	145.2	142.8	140.7	138.6
18.200	136.7	134.8	132.9	131.1	129.2	127.5	125.7
18.900	123.9	122.2	120.4	118.7	116.9	115.2	113.5
19.600	111.7	110.0	108.2	106.5	104.8	103.0	101.3
20.300	99.5	97.8	96.0	94.3	92.5	90.8	89.0
21.000	87.2	85.5	83.7	81.9	80.2	78.4	76.6
21.700	74.8	73.0	71.2	69.4	67.6	65.8	64.0
22.400	62.2	60.4	58.6	56.8	55.0	53.2	51.4
23.100	49.5	47.7	45.9	44.1	42.2	40.4	38.6
23.800	36.7	34.9	33.1	31.2	29.4	27.3	25.2
24.500	23.4	21.5	19.7	17.9	16.1	14.4	12.8
25.200	11.3	9.9	8.6	7.5	6.5	5.6	4.8
25.900	4.2	3.6	3.1	2.7	2.3	2.0	1.7
26.600	1.5	1.3	1.1	1.0	0.8	0.7	0.6
27.300	0.0						

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 3	0.141		1.754		12.54	106.0	753.51

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
8.800	0.0	0.6	0.6	0.7	0.8	1.0	1.1
9.500	1.3	1.5	1.7	1.9	2.1	2.3	2.4
10.200	2.6	2.8	3.0	3.2	3.3	3.4	3.4
10.900	3.3	3.3	3.5	3.8	4.3	5.0	5.8
11.600	6.8	8.2	10.4	14.2	20.9	33.7	54.2
12.300	79.0	98.6	106.0	102.1	90.4	75.0	60.8
13.000	49.5	40.5	33.4	27.8	23.4	19.7	16.6
13.700	14.1	12.5	11.6	11.2	11.0	11.0	10.9
14.400	10.7	10.7	10.6	10.5	10.4	10.3	10.2
15.100	10.1	9.9	9.6	9.1	8.6	8.2	7.8
15.800	7.6	7.3	7.2	7.0	6.9	6.8	6.7
16.500	6.6	6.5	6.4	6.4	6.3	6.2	6.1
17.200	6.0	6.0	5.9	5.8	5.8	5.7	5.6
17.900	5.5	5.5	5.4	5.3	5.2	5.1	5.1
18.600	5.0	4.9	4.8	4.8	4.7	4.6	4.5
19.300	4.5	4.4	4.3	4.2	4.2	4.1	4.0
20.000	3.9	3.8	3.8	3.7	3.6	3.5	3.5
20.700	3.4	3.3	3.2	3.1	3.1	3.0	2.9
21.400	2.8	2.7	2.7	2.6	2.5	2.4	2.3
22.100	2.3	2.2	2.1	2.0	1.9	1.9	1.8
22.800	1.7	1.6	1.6	1.5	1.4	1.3	1.2
23.500	1.2	1.1	1.0	0.9	0.8	0.8	0.7
24.200	0.6	0.0					

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 4A	0.014		1.582		12.18	21.6	1538.44

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
11.000	0.0	0.6	0.7	0.8	0.9	1.1	1.4
11.700	2.1	3.0	4.8	8.4	16.3	21.1	13.6
12.400	8.5	5.6	4.0	2.8	2.2	1.9	1.7
13.100	1.5	1.3	1.1	0.9	0.7	0.7	1.0
13.800	1.1	1.1	1.1	1.1	1.1	1.1	1.1
14.500	1.1	1.1	1.0	1.0	1.0	1.0	0.9
15.200	0.8	0.7	0.7	0.7	0.7	0.7	0.7
15.900	0.7	0.7	0.7	0.7	0.7	0.6	0.6
16.600	0.6	0.6	0.6	0.6	0.6	0.6	0.6
17.300	0.6	0.6	0.6	0.6	0.5	0.5	0.5
18.000	0.5	0.5	0.5	0.5	0.0		

NOAA 14 precipitation, smoothed values Ohio River Basin
Lat (dd): 39.1913 Lon (dd): -77.2120° MD Montgomery County

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 4B	0.094		1.828		12.29	104.9	1119.41

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
8.500	0.0	0.5	0.6	0.7	0.7	0.8	0.9
9.200	1.0	1.2	1.4	1.5	1.6	1.8	1.9
9.900	2.0	2.2	2.3	2.4	2.5	2.7	2.8
10.600	2.9	2.6	2.4	2.3	2.6	3.1	3.7
11.300	4.3	5.1	5.9	7.0	9.1	12.7	18.8
12.000	30.3	54.2	89.1	104.8	91.7	68.2	49.9
12.700	36.3	26.7	20.4	16.4	13.7	11.6	9.9
13.400	8.4	7.0	5.9	5.8	6.3	6.9	7.2
14.100	7.3	7.3	7.3	7.3	7.2	7.1	7.0
14.800	7.0	6.9	6.8	6.7	6.3	5.7	5.3
15.500	5.1	4.9	4.8	4.7	4.6	4.6	4.5
16.200	4.5	4.4	4.4	4.3	4.3	4.2	4.2
16.900	4.1	4.1	4.0	4.0	3.9	3.9	3.8
17.600	3.8	3.7	3.7	3.6	3.6	3.5	3.5
18.300	3.4	3.4	3.3	3.3	3.2	3.2	3.1
19.000	3.1	3.0	2.9	2.9	2.8	2.8	2.7
19.700	2.7	2.6	2.6	2.5	2.5	2.4	2.4
20.400	2.3	2.3	2.2	2.2	2.1	2.0	2.0
21.100	1.9	1.9	1.8	1.8	1.7	1.7	1.6
21.800	1.6	1.5	1.5	1.4	1.3	1.3	1.2
22.500	1.2	1.1	1.1	1.0	1.0	0.9	0.9
23.200	0.8	0.7	0.7	0.6	0.6	0.5	0.0

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 2	3.919	Upstream	1.374	365.76	13.22	1120.0	285.80

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
8.500	0.0	0.5	0.6	0.7	1.3	1.4	1.6
9.200	2.6	2.9	3.4	3.9	4.4	4.9	5.4
9.900	5.9	6.4	7.4	8.6	9.7	11.1	12.6
10.600	14.3	15.8	17.1	18.7	20.8	24.1	27.6
11.300	31.7	36.6	42.3	49.6	60.1	75.8	100.8
12.000	144.9	229.3	357.2	483.3	593.6	686.0	775.1
12.700	861.8	941.9	1012.8	1068.7	1104.1	1119.6	1115.0
13.400	1090.1	1049.2	995.3	931.5	859.7	785.7	715.7
14.100	653.6	599.7	552.7	512.5	477.7	447.2	420.2
14.800	396.9	377.1	360.0	344.9	331.2	318.4	306.3
15.500	294.8	284.0	273.8	264.1	254.7	245.8	237.3
16.200	229.2	221.5	214.2	207.6	201.4	195.7	190.5

NOAA 14 precipitation, smoothed values Ohio River Basin
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Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
16.900	185.9	181.7	177.8	174.1	170.5	167.1	163.9
17.600	160.7	157.8	155.0	152.5	150.2	148.1	145.9
18.300	143.9	141.4	139.4	137.5	135.6	133.7	131.8
19.000	129.9	128.0	126.2	124.3	122.4	120.5	118.7
19.700	116.8	114.9	113.1	111.2	109.3	107.4	105.6
20.400	103.7	101.8	99.9	98.0	96.1	94.3	92.4
21.100	90.5	88.6	86.7	84.8	82.8	80.9	79.0
21.800	77.1	75.2	73.2	71.3	69.4	67.4	65.5
22.500	63.6	61.6	59.7	57.7	55.8	53.8	51.9
23.200	49.9	47.9	46.0	44.0	42.1	40.1	37.6
23.900	35.7	33.8	31.9	29.9	27.4	25.1	23.3
24.600	21.5	19.7	17.9	16.1	14.4	12.8	11.3
25.300	9.9	8.6	7.5	6.5	5.6	4.8	4.2
26.000	3.6	3.1	2.7	2.3	2.0	1.7	1.5
26.700	1.3	1.1	1.0	0.8	0.7	0.6	0.0

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 2	3.919	Downstream	1.374	365.76	13.25	1119.8	285.75

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
8.700	0.0	0.6	1.1	1.4	1.6	2.1	2.8
9.400	3.3	3.8	4.3	4.8	5.3	5.8	6.3
10.100	7.1	8.3	9.4	10.7	12.3	13.9	15.5
10.800	16.8	18.3	20.3	23.4	26.7	30.7	35.4
11.500	40.9	47.7	57.3	71.5	94.0	132.3	205.6
12.200	325.9	454.5	569.3	664.5	754.5	842.3	923.5
12.900	996.9	1056.8	1098.0	1118.2	1117.5	1097.3	1059.6
13.600	1008.6	947.2	877.2	803.0	731.4	667.4	611.9
14.300	563.3	521.5	485.5	454.0	426.1	402.1	381.5
15.000	363.8	348.4	334.4	321.4	309.1	297.4	286.5
15.700	276.2	266.3	256.9	247.9	239.3	231.0	223.2
16.400	215.9	209.1	202.8	197.0	191.7	186.9	182.7
17.100	178.7	174.9	171.3	167.9	164.6	161.5	158.4
17.800	155.6	153.1	150.8	148.6	146.4	144.4	141.9
18.500	139.9	138.0	136.0	134.1	132.2	130.4	128.5
19.200	126.6	124.7	122.9	121.0	119.1	117.2	115.4
19.900	113.5	111.6	109.8	107.9	106.0	104.1	102.2
20.600	100.4	98.5	96.6	94.7	92.8	90.9	89.0
21.300	87.1	85.2	83.3	81.4	79.5	77.5	75.6
22.000	73.7	71.8	69.8	67.9	66.0	64.0	62.1
22.700	60.1	58.2	56.2	54.3	52.3	50.4	48.4
23.400	46.4	44.5	42.5	40.6	38.1	36.2	34.3
24.100	32.3	30.4	28.2	25.6	23.8	21.9	20.1
24.800	18.3	16.5	14.8	13.1	11.6	10.2	8.9
25.500	7.7	6.7	5.8	5.0	4.3	3.7	3.2

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
26.200	2.8	2.4	2.1	1.8	1.6	1.3	1.2
26.900	1.0	0.9	0.7	0.6	0.0		

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 5	0.133		1.533		12.26	132.4	996.97

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
9.300	0.0	0.5	0.7	0.8	1.0	1.1	1.3
10.000	1.4	1.6	1.7	1.9	2.0	2.2	2.3
10.700	2.1	1.9	2.0	2.3	2.8	3.4	4.1
11.400	4.9	5.8	7.0	9.6	14.0	21.6	36.9
12.100	70.3	118.5	130.5	105.1	75.3	54.3	39.1
12.800	28.8	22.4	18.5	15.7	13.5	11.7	9.9
13.500	8.3	7.0	7.3	8.3	9.0	9.3	9.4
14.200	9.4	9.4	9.3	9.2	9.1	9.0	8.9
14.900	8.8	8.7	8.5	7.9	7.1	6.7	6.4
15.600	6.2	6.1	6.0	6.0	5.9	5.8	5.8
16.300	5.7	5.7	5.6	5.5	5.5	5.4	5.3
17.000	5.3	5.2	5.1	5.1	5.0	4.9	4.9
17.700	4.8	4.8	4.7	4.6	4.6	4.5	4.4
18.400	4.4	4.3	4.2	4.2	4.1	4.0	4.0
19.100	3.9	3.8	3.7	3.7	3.6	3.5	3.5
19.800	3.4	3.3	3.3	3.2	3.1	3.1	3.0
20.500	2.9	2.9	2.8	2.7	2.6	2.6	2.5
21.200	2.4	2.4	2.3	2.2	2.2	2.1	2.0
21.900	1.9	1.9	1.8	1.7	1.7	1.6	1.5
22.600	1.5	1.4	1.3	1.2	1.2	1.1	1.0
23.300	1.0	0.9	0.8	0.7	0.7	0.6	0.5
24.000	0.0						

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 6A	0.047		1.810		12.40	42.7	911.69

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
9.300	0.4	0.6	0.6	0.7	0.8	0.9	0.9
10.000	1.0	1.1	1.1	1.2	1.2	1.3	1.4
10.700	1.4	1.3	1.2	1.3	1.4	1.6	1.8
11.400	2.1	2.5	2.9	3.6	4.7	6.6	10.1
12.100	16.8	27.6	38.3	42.7	40.2	33.8	26.5

NOAA 14 precipitation, smoothed values Ohio River Basin
Lat (dd): 39.1913 Lon (dd): -77.2120° MD Montgomery County

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
12.800	20.7	16.1	12.7	10.2	8.4	7.1	5.9
13.500	5.0	4.2	3.6	3.4	3.4	3.5	3.6
14.200	3.6	3.6	3.6	3.6	3.6	3.6	3.5
14.900	3.5	3.5	3.4	3.3	3.1	2.9	2.8
15.600	2.6	2.5	2.5	2.4	2.4	2.3	2.3
16.300	2.3	2.2	2.2	2.2	2.2	2.1	2.1
17.000	2.1	2.1	2.0	2.0	2.0	2.0	1.9
17.700	1.9	1.9	1.8	1.8	1.8	1.8	1.7
18.400	1.7	1.7	1.7	1.6	1.6	1.6	1.6
19.100	1.5	1.5	1.5	1.5	1.4	1.4	1.4
19.800	1.4	1.3	1.3	1.3	1.2	1.2	1.2
20.500	1.2	1.1	1.1	1.1	1.1	1.0	1.0
21.200	1.0	1.0	0.9	0.9	0.9	0.8	0.8
21.900	0.8	0.8	0.7	0.7	0.7	0.7	0.6
22.600	0.6	0.6	0.5	0.5	0.0		

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Time (hr)	Rate (cfs)	Rate (csm)
DA 6B	0.014		2.399		12.13	35.1	2495.32

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
8.100	0.0	0.5	0.5	0.5	0.5	0.6	0.6
8.800	0.6	0.6	0.6	0.8	0.8	0.9	0.9
9.500	0.9	0.9	1.0	1.0	1.0	1.0	1.0
10.200	1.1	1.1	1.1	1.1	0.7	0.7	0.8
10.900	1.0	1.2	1.4	1.6	1.9	2.1	2.3
11.600	3.4	4.5	6.7	10.4	18.2	32.9	22.0
12.300	11.1	6.8	5.0	3.4	2.6	2.3	2.1
13.000	1.9	1.6	1.4	1.2	0.9	0.7	1.1
13.700	1.3	1.3	1.3	1.3	1.3	1.3	1.3
14.400	1.2	1.2	1.2	1.2	1.2	1.2	1.1
15.100	1.0	0.9	0.8	0.8	0.8	0.8	0.8
15.800	0.8	0.8	0.8	0.8	0.8	0.7	0.7
16.500	0.7	0.7	0.7	0.7	0.7	0.7	0.7
17.200	0.7	0.7	0.6	0.6	0.6	0.6	0.6
17.900	0.6	0.6	0.6	0.6	0.6	0.6	0.5
18.600	0.5	0.5	0.5	0.5	0.0		

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Time (hr)	Rate (cfs)	Rate (csm)
Reach 3	4.112	Upstream	1.388	352.51	13.22	1142.0	277.69

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
8.100	0.0	0.5	0.5	0.5	0.5	0.6	0.6
8.800	1.2	1.7	2.0	2.3	2.9	4.0	5.3
9.500	6.0	6.7	7.5	8.2	9.0	9.7	10.7
10.200	12.2	13.6	15.1	16.9	18.3	19.6	20.8
10.900	22.5	25.1	29.0	33.3	38.5	44.5	51.4
11.600	61.1	75.1	96.9	132.5	197.5	325.7	493.7
12.300	634.2	723.8	785.0	846.0	910.5	975.2	1037.5
13.000	1089.9	1125.6	1141.5	1137.4	1114.1	1073.6	1020.9
13.700	959.4	890.3	816.8	745.6	681.7	626.3	577.6
14.400	535.7	499.5	467.9	439.9	415.7	395.0	377.2
15.100	361.2	346.4	332.5	319.5	307.4	296.1	285.6
15.800	275.6	266.1	256.9	248.2	239.9	231.9	224.5
16.500	217.6	211.2	205.3	199.9	195.1	190.7	186.6
17.200	182.7	179.1	175.6	172.2	168.9	165.8	162.9
17.900	160.2	157.8	155.5	153.3	151.1	148.5	146.4
18.600	144.4	142.3	140.3	138.3	135.9	133.9	131.9
19.300	130.0	128.0	126.0	124.1	122.1	120.1	118.2
20.000	116.2	114.2	112.2	110.3	108.3	106.3	104.3
20.700	102.4	100.4	98.4	96.4	94.4	92.4	90.4
21.400	88.4	86.4	84.4	82.4	80.4	78.3	76.3
22.100	74.3	72.3	70.2	68.2	66.1	64.1	62.1
22.800	60.0	58.0	55.5	53.4	51.4	49.3	47.3
23.500	45.3	43.2	41.2	38.7	36.7	34.3	32.3
24.200	30.4	28.1	25.5	23.8	21.9	20.1	18.3
24.900	16.5	14.8	13.1	11.6	10.2	8.9	7.7
25.600	6.7	5.8	5.0	4.3	3.7	3.2	2.8
26.300	2.4	2.1	1.8	1.6	1.3	1.2	1.0
27.000	0.9	0.7	0.6	0.0			

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 3	4.112	Downstream	1.387	352.50	13.34	1131.6	275.16

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
9.500	0.0	4.0	6.1	7.3	8.1	8.9	9.7
10.200	10.8	12.1	13.5	15.1	16.7	18.1	19.4
10.900	20.8	22.7	25.5	29.0	33.3	38.5	44.4
11.600	51.8	62.0	76.9	100.4	140.3	215.1	339.0
12.300	482.2	607.0	700.2	773.6	840.0	905.1	969.3
13.000	1029.5	1079.6	1113.9	1130.3	1127.8	1106.6	1069.4
13.700	1019.7	960.0	892.6	822.0	753.4	690.4	634.3
14.400	585.0	542.2	505.1	472.6	444.2	419.6	398.3
15.100	379.9	363.3	348.2	334.1	321.0	308.8	297.5
15.800	286.8	276.7	267.1	257.9	249.1	240.7	232.8
16.500	225.4	218.4	212.0	206.0	200.6	195.7	191.2
17.200	187.1	183.2	179.5	175.9	172.5	169.2	166.1

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
17.900	163.2	160.5	158.1	155.7	153.5	151.1	148.8
18.600	146.7	144.6	142.5	140.5	138.4	136.2	134.1
19.300	132.1	130.1	128.2	126.2	124.2	122.2	120.3
20.000	118.3	116.3	114.4	112.4	110.4	108.5	106.5
20.700	104.5	102.5	100.5	98.6	96.6	94.6	92.6
21.400	90.6	88.6	86.6	84.6	82.5	80.5	78.5
22.100	76.5	74.4	72.4	70.4	68.3	66.3	64.3
22.800	62.2	60.2	58.1	55.8	53.6	51.6	49.5
23.500	47.5	45.4	43.4	41.3	39.0	36.7	34.6
24.200	32.5	30.5	28.1	25.9	24.0	22.1	20.3
24.900	18.4	16.6	14.9	13.3	11.8	10.3	9.1
25.600	7.9	6.8	5.9	5.1	4.4	3.8	3.3
26.300	2.9	2.5	2.1	1.8	1.6	1.4	1.2
27.000	1.0	0.9	0.7	0.0			

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 7	0.030		1.938		12.23	40.9	1379.35

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
9.100	0.0	0.5	0.6	0.7	0.7	0.8	0.8
9.800	0.9	0.9	0.9	1.0	1.0	1.1	1.1
10.500	1.2	1.2	1.0	0.9	0.9	1.1	1.3
11.200	1.6	1.9	2.1	2.5	2.9	4.0	5.7
11.900	8.5	14.0	25.4	39.4	37.9	27.0	18.5
12.600	12.9	9.1	6.7	5.3	4.4	3.8	3.3
13.300	2.9	2.4	2.0	1.7	1.9	2.2	2.4
14.000	2.4	2.4	2.4	2.4	2.4	2.4	2.3
14.700	2.3	2.3	2.3	2.2	2.2	2.0	1.8
15.400	1.7	1.6	1.6	1.6	1.5	1.5	1.5
16.100	1.5	1.5	1.4	1.4	1.4	1.4	1.4
16.800	1.4	1.3	1.3	1.3	1.3	1.3	1.3
17.500	1.2	1.2	1.2	1.2	1.2	1.2	1.1
18.200	1.1	1.1	1.1	1.1	1.1	1.0	1.0
18.900	1.0	1.0	1.0	1.0	0.9	0.9	0.9
19.600	0.9	0.9	0.9	0.8	0.8	0.8	0.8
20.300	0.8	0.7	0.7	0.7	0.7	0.7	0.7
21.000	0.6	0.6	0.6	0.6	0.6	0.6	0.5
21.700	0.5	0.0					

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 8	0.077		1.906		12.31	86.6	1130.60

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
8.400	0.3	0.6	0.6	0.7	0.7	0.8	0.8
9.100	0.9	1.0	1.2	1.3	1.5	1.6	1.7
9.800	1.8	1.9	2.0	2.1	2.3	2.4	2.5
10.500	2.6	2.6	2.5	2.2	2.2	2.4	2.7
11.200	3.2	3.8	4.5	5.2	6.1	7.8	10.7
11.900	15.7	24.8	43.5	71.1	86.3	78.8	60.5
12.600	44.6	32.8	24.2	18.4	14.7	12.1	10.2
13.300	8.7	7.3	6.1	5.2	4.9	5.3	5.7
14.000	6.0	6.1	6.1	6.1	6.1	6.0	6.0
14.700	5.9	5.8	5.8	5.7	5.6	5.3	4.9
15.400	4.5	4.3	4.1	4.0	3.9	3.9	3.8
16.100	3.8	3.7	3.7	3.7	3.6	3.6	3.5
16.800	3.5	3.5	3.4	3.4	3.3	3.3	3.2
17.500	3.2	3.2	3.1	3.1	3.0	3.0	2.9
18.200	2.9	2.9	2.8	2.8	2.7	2.7	2.6
18.900	2.6	2.5	2.5	2.5	2.4	2.4	2.3
19.600	2.3	2.2	2.2	2.2	2.1	2.1	2.0
20.300	2.0	1.9	1.9	1.8	1.8	1.8	1.7
21.000	1.7	1.6	1.6	1.5	1.5	1.4	1.4
21.700	1.3	1.3	1.3	1.2	1.2	1.1	1.1
22.400	1.0	1.0	0.9	0.9	0.9	0.8	0.8
23.100	0.7	0.7	0.6	0.6	0.5	0.0	

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 4	4.219	Upstream	1.400	350.54	13.32	1142.6	270.84

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
8.400	0.0	0.6	0.6	0.7	0.7	0.8	0.8
9.100	0.9	1.5	1.8	2.0	2.2	6.4	8.6
9.800	9.9	10.9	11.9	12.9	14.1	15.6	17.1
10.500	18.9	20.5	21.6	22.5	23.9	26.1	29.5
11.200	33.8	39.0	45.1	52.1	60.8	73.8	93.3
11.900	124.6	179.1	284.0	449.5	606.3	712.8	779.1
12.600	831.1	881.9	936.0	993.0	1048.5	1095.5	1127.5
13.300	1141.9	1137.5	1114.7	1076.3	1026.5	967.5	900.8
14.000	830.4	761.9	699.0	642.8	593.4	550.6	513.4
14.700	480.8	452.3	427.6	406.3	387.6	370.6	354.8
15.400	340.2	326.9	314.5	303.0	292.3	282.1	272.4
16.100	263.1	254.3	245.9	237.9	230.4	223.4	216.9
16.800	210.9	205.4	200.4	195.9	191.7	187.7	184.0
17.500	180.4	176.9	173.5	170.4	167.4	164.7	162.2
18.200	159.8	157.4	155.0	152.7	150.4	148.3	146.2
18.900	144.1	142.0	139.7	137.5	135.5	133.4	131.4
19.600	129.3	127.3	125.3	123.3	121.2	119.2	117.2
20.300	115.1	113.1	111.1	109.0	107.0	104.9	102.9

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
21.000	100.9	98.8	96.7	94.7	92.6	90.6	88.5
21.700	86.4	83.8	81.8	79.7	77.6	75.6	73.5
22.400	71.4	69.3	67.3	65.2	63.1	61.0	58.8
23.100	56.5	54.3	52.2	50.1	48.0	45.5	43.4
23.800	41.3	39.0	36.7	34.6	32.5	30.5	28.1
24.500	26.0	24.0	22.1	20.3	18.4	16.6	14.9
25.200	13.3	11.8	10.3	9.1	7.9	6.8	5.9
25.900	5.1	4.4	3.8	3.3	2.9	2.5	2.1
26.600	1.8	1.6	1.4	1.2	1.0	0.9	0.7
27.300	0.0						

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 4	4.219	Downstream	1.400	350.54	13.37	1142.4	270.78

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
8.700	0.0	0.7	0.7	0.8	0.9	1.0	1.7
9.400	1.9	2.1	4.9	7.9	9.5	10.6	11.5
10.100	12.4	13.6	15.0	16.5	18.1	19.9	21.2
10.800	22.1	23.3	25.2	28.1	32.0	36.8	42.5
11.500	49.2	57.0	68.1	84.6	110.4	153.7	234.3
12.200	380.2	548.6	675.8	755.7	810.9	861.4	914.0
12.900	970.1	1027.0	1078.1	1116.4	1138.1	1141.3	1125.8
13.600	1093.1	1047.4	992.0	928.0	858.5	788.8	723.4
14.300	664.4	612.4	567.0	527.6	493.3	463.3	437.1
15.000	414.4	394.8	377.2	360.9	345.9	332.1	319.4
15.700	307.5	296.5	286.1	276.2	266.8	257.8	249.2
16.400	241.0	233.3	226.1	219.4	213.2	207.5	202.4
17.100	197.7	193.4	189.3	185.4	181.8	178.2	174.9
17.800	171.6	168.6	165.8	163.2	160.7	158.4	156.0
18.500	153.6	151.3	149.1	147.0	144.9	142.9	140.6
19.200	138.4	136.3	134.2	132.2	130.2	128.1	126.1
19.900	124.1	122.0	120.0	118.0	116.0	113.9	111.9
20.600	109.8	107.8	105.8	103.7	101.7	99.6	97.6
21.300	95.5	93.5	91.4	89.3	87.2	85.1	82.6
22.000	80.5	78.5	76.4	74.3	72.2	70.2	68.1
22.700	66.0	63.9	61.8	59.7	57.4	55.2	53.0
23.400	50.9	48.8	46.7	44.2	42.2	39.9	37.6
24.100	35.4	33.3	31.3	29.1	26.8	24.8	22.8
24.800	21.0	19.2	17.4	15.6	13.9	12.4	10.9
25.500	9.6	8.3	7.2	6.3	5.4	4.7	4.1
26.200	3.5	3.0	2.6	2.3	2.0	1.7	1.5
26.900	1.3	1.1	0.9	0.8	0.0		

NOAA 14 precipitation, smoothed values Ohio River Basin
Lat (dd): 39.1913 Lon (dd): -77.2120° MD Montgomery County

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 9	0.155		1.605		12.28	159.4	1030.46

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
9.100	0.0	0.6	0.8	1.0	1.2	1.4	1.5
9.800	1.7	1.9	2.1	2.3	2.5	2.7	2.8
10.500	3.0	3.1	2.8	2.6	2.6	3.1	3.7
11.200	4.5	5.4	6.3	7.4	9.0	12.2	17.5
11.900	26.8	44.8	84.1	140.9	157.8	129.5	93.3
12.600	67.5	48.7	35.7	27.7	22.8	19.3	16.5
13.300	14.2	12.1	10.1	8.5	8.7	9.9	10.8
14.000	11.1	11.2	11.2	11.2	11.1	11.0	10.9
14.700	10.8	10.7	10.6	10.4	10.2	9.5	8.6
15.400	8.0	7.7	7.5	7.3	7.2	7.1	7.1
16.100	7.0	6.9	6.8	6.8	6.7	6.6	6.5
16.800	6.4	6.4	6.3	6.2	6.1	6.1	6.0
17.500	5.9	5.8	5.8	5.7	5.6	5.5	5.4
18.200	5.4	5.3	5.2	5.1	5.0	5.0	4.9
18.900	4.8	4.7	4.6	4.6	4.5	4.4	4.3
19.600	4.2	4.1	4.1	4.0	3.9	3.8	3.7
20.300	3.6	3.6	3.5	3.4	3.3	3.2	3.2
21.000	3.1	3.0	2.9	2.8	2.7	2.7	2.6
21.700	2.5	2.4	2.3	2.2	2.2	2.1	2.0
22.400	1.9	1.8	1.7	1.6	1.6	1.5	1.4
23.100	1.3	1.2	1.1	1.1	1.0	0.9	0.8
23.800	0.7	0.6	0.5	0.0			

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
OUTLET	4.373		1.407		13.36	1155.2	264.15

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
8.700	0.0	0.7	0.7	0.8	0.9	1.6	2.5
9.400	2.9	3.3	6.2	9.4	11.2	12.5	13.6
10.100	14.7	16.1	17.6	19.3	21.2	23.0	24.0
10.800	24.7	25.9	28.2	31.8	36.5	42.2	48.9
11.500	56.6	66.0	80.2	102.0	137.1	198.6	318.4
12.200	521.1	706.4	805.3	849.1	878.4	910.1	949.7
12.900	997.8	1049.8	1097.4	1132.9	1152.3	1153.4	1135.8
13.600	1101.6	1056.2	1001.9	938.7	869.6	800.0	734.6
14.300	675.6	623.5	578.0	538.5	504.1	473.9	447.6
15.000	424.9	405.0	386.7	369.5	353.9	339.8	326.8
15.700	314.9	303.7	293.2	283.3	273.8	264.7	256.0
16.400	247.8	240.0	232.7	226.0	219.7	213.9	208.7

NOAA 14 precipitation, smoothed values Ohio River Basin
Lat (dd): 39.1913 Lon (dd): -77.2120° MD Montgomery County

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
17.100	203.9	199.5	195.4	191.4	187.7	184.1	180.6
17.800	177.3	174.2	171.3	168.6	166.1	163.6	161.2
18.500	158.7	156.3	154.1	151.9	149.7	147.6	145.2
19.200	142.9	140.8	138.6	136.5	134.4	132.3	130.2
19.900	128.1	125.9	123.8	121.7	119.6	117.5	115.4
20.600	113.2	111.1	109.0	106.9	104.7	102.6	100.5
21.300	98.3	96.2	94.0	91.9	89.7	87.5	84.9
22.000	82.8	80.6	78.5	76.3	74.1	72.0	69.8
22.700	67.6	65.5	63.3	61.1	58.7	56.4	54.2
23.400	52.0	49.8	47.6	45.0	42.9	40.5	38.2
24.100	35.4	33.3	31.3	29.1	26.8	24.8	22.8
24.800	21.0	19.2	17.4	15.6	13.9	12.4	10.9
25.500	9.6	8.3	7.2	6.3	5.4	4.7	4.1
26.200	3.5	3.0	2.6	2.3	2.0	1.7	1.5
26.900	1.3	1.1	0.9	0.8	0.0		

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Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 1	3.519		2.693		13.21	2078.7	590.74

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
7.700	0.549E-01	0.7	1.1	1.7	2.5	3.4	4.5
8.400	5.8	7.3	9.0	10.8	12.8	15.0	17.3
9.100	19.7	22.3	25.1	28.1	31.4	35.0	38.9
9.800	43.1	47.6	52.3	57.3	62.5	67.9	73.5
10.500	79.1	84.7	90.1	95.3	100.3	105.1	109.9
11.200	114.9	120.6	127.6	136.3	147.7	163.8	186.9
11.900	221.3	275.5	358.1	474.1	623.3	805.2	1022.4
12.600	1257.9	1489.8	1696.8	1864.1	1984.1	2054.7	2077.4
13.300	2052.5	1992.3	1904.6	1793.7	1663.5	1521.1	1379.2
14.000	1251.4	1138.7	1039.2	952.6	877.3	811.3	752.7
14.700	701.3	658.3	621.0	588.5	560.0	534.9	512.1
15.400	491.0	471.4	453.2	435.9	419.4	403.7	388.8
16.100	374.7	361.4	349.0	337.6	327.2	317.5	308.7
16.800	300.9	293.8	287.3	281.2	275.5	270.0	264.7
17.500	259.7	255.0	250.5	246.6	243.1	239.9	236.8
18.200	233.8	230.9	228.0	225.2	222.5	219.8	217.1
18.900	214.4	211.8	209.2	206.5	203.9	201.3	198.7
19.600	196.0	193.4	190.8	188.2	185.6	183.0	180.4
20.300	177.8	175.1	172.5	169.9	167.3	164.7	162.1
21.000	159.5	156.9	154.2	151.6	149.0	146.3	143.7
21.700	141.0	138.4	135.7	133.1	130.4	127.8	125.1
22.400	122.4	119.8	117.1	114.4	111.7	109.1	106.4
23.100	103.7	101.0	98.3	95.6	93.0	90.3	87.6

NOAA 14 precipitation, smoothed values Ohio River Basin
Lat (dd): 39.1913 Lon (dd): -77.2120° MD Montgomery County

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
23.800	84.9	82.2	79.5	76.7	73.8	70.7	67.4
24.500	63.8	59.9	55.7	51.2	46.7	42.1	37.7
25.200	33.5	29.5	25.8	22.4	19.4	16.7	14.4
25.900	12.5	10.8	9.4	8.1	7.0	6.1	5.3
26.600	4.5	3.9	3.4	2.9	2.5	2.2	1.9
27.300	1.6	1.4	1.2	1.0	0.9	0.7	0.6
28.000	0.5	0.0					

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 2	0.152		3.154		12.45	203.9	1345.33

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
6.600	0.0	0.5	0.6	0.7	0.9	1.0	1.1
7.300	1.3	1.4	1.6	1.7	1.8	2.0	2.1
8.000	2.3	2.4	2.6	2.8	2.9	3.1	3.2
8.700	3.4	3.6	3.7	3.9	4.1	4.3	4.7
9.400	5.1	5.6	6.0	6.4	6.8	7.1	7.4
10.100	7.7	8.0	8.4	8.7	9.0	9.2	9.2
10.800	8.9	8.6	8.6	9.2	10.3	11.9	13.7
11.500	15.9	18.5	22.3	28.6	38.8	55.7	84.9
12.200	127.7	173.5	200.6	200.6	180.9	150.7	121.3
12.900	97.0	78.0	63.2	52.1	43.5	36.5	30.6
13.600	25.7	21.9	19.7	18.6	18.2	18.2	18.2
14.300	18.1	18.0	17.9	17.8	17.7	17.5	17.4
15.000	17.2	17.0	16.6	15.9	15.2	14.4	13.8
15.700	13.3	12.9	12.6	12.4	12.2	12.1	11.9
16.400	11.8	11.7	11.5	11.4	11.3	11.2	11.0
17.100	10.9	10.8	10.7	10.6	10.5	10.3	10.2
17.800	10.1	10.0	9.9	9.7	9.6	9.5	9.4
18.500	9.3	9.1	9.0	8.9	8.8	8.7	8.5
19.200	8.4	8.3	8.2	8.1	7.9	7.8	7.7
19.900	7.6	7.4	7.3	7.2	7.1	7.0	6.8
20.600	6.7	6.6	6.5	6.3	6.2	6.1	6.0
21.300	5.9	5.7	5.6	5.5	5.4	5.2	5.1
22.000	5.0	4.9	4.7	4.6	4.5	4.4	4.2
22.700	4.1	4.0	3.9	3.8	3.6	3.5	3.4
23.400	3.3	3.1	3.0	2.9	2.8	2.6	2.5
24.100	2.4	2.1	1.8	1.3	1.0	0.6	0.0

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 1	3.670	Upstream	2.712	372.15	13.19	2128.1	579.82

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
6.600	0.0	0.5	0.6	0.7	0.9	1.0	1.1
7.300	1.3	1.4	1.6	1.7	1.9	2.7	3.3
8.000	4.0	4.9	6.0	7.3	8.7	10.4	12.2
8.700	14.2	16.4	18.7	21.2	23.8	26.6	29.8
9.400	33.2	37.0	41.0	45.3	49.8	54.7	59.8
10.100	65.1	70.6	76.3	82.1	88.1	93.9	99.3
10.800	104.2	108.8	113.7	119.0	125.2	132.5	141.3
11.500	152.2	166.6	186.1	215.6	260.1	331.2	443.0
12.200	601.7	798.1	1006.6	1223.8	1438.9	1640.5	1818.1
12.900	1961.2	2062.0	2115.6	2126.3	2095.9	2028.7	1935.2
13.600	1819.3	1685.4	1540.8	1398.0	1270.3	1156.8	1057.4
14.300	970.7	895.4	829.2	770.5	719.8	675.8	638.3
15.000	605.7	577.0	551.4	528.0	506.2	485.8	467.0
15.700	449.2	432.3	416.3	401.2	386.9	373.5	361.0
16.400	349.4	338.8	329.0	320.1	312.1	305.0	298.3
17.100	292.2	286.3	280.7	275.3	270.2	265.3	260.8
17.800	256.8	253.1	249.7	246.5	243.4	240.4	237.4
18.500	234.5	231.6	228.8	226.0	223.2	220.5	217.7
19.200	215.0	212.2	209.5	206.7	204.0	201.2	198.5
19.900	195.8	193.0	190.3	187.6	184.8	182.1	179.4
20.600	176.7	173.9	171.2	168.4	165.7	163.0	160.2
21.300	157.5	154.7	151.9	149.2	146.4	143.6	140.8
22.000	138.1	135.3	132.5	129.7	126.9	124.1	121.3
22.700	118.5	115.7	112.9	110.1	107.3	104.5	101.7
23.400	98.9	96.1	93.3	90.5	87.6	84.8	82.0
24.100	79.1	75.9	72.4	68.7	64.7	60.5	55.7
24.800	51.2	46.7	42.1	37.7	33.5	29.5	25.8
25.500	22.4	19.4	16.7	14.4	12.5	10.8	9.4
26.200	8.1	7.0	6.1	5.3	4.5	3.9	3.4
26.900	2.9	2.5	2.2	1.9	1.6	1.4	1.2
27.600	1.0	0.9	0.7	0.6	0.0		

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 1	3.670	Downstream	2.712	372.14	13.23	2124.6	578.86

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
6.800	0.4	0.7	0.8	0.9	1.0	1.2	1.3
7.500	1.5	1.6	1.7	2.1	2.8	3.5	4.3
8.200	5.2	6.4	7.7	9.2	10.9	12.8	14.8
8.900	17.1	19.4	21.9	24.6	27.5	30.8	34.3
9.600	38.1	42.2	46.6	51.2	56.2	61.3	66.7
10.300	72.3	78.0	83.9	89.8	95.5	100.7	105.5
11.000	110.2	115.2	120.8	127.2	134.9	144.3	156.2
11.700	172.0	194.5	227.2	278.3	360.2	486.0	658.6
12.400	860.5	1071.8	1287.1	1499.8	1696.0	1865.3	1994.3

NOAA 14 precipitation, smoothed values Ohio River Basin
Lat (dd): 39.1913 Lon (dd): -77.2120° MD Montgomery County

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
13.100	2080.0	2120.6	2119.0	2078.8	2003.6	1903.1	1781.1
13.800	1642.7	1498.3	1360.1	1235.5	1126.7	1030.5	947.3
14.500	875.2	811.4	755.3	706.4	664.6	628.2	596.8
15.200	569.2	544.4	521.5	500.1	480.2	461.7	444.1
15.900	427.5	411.8	397.0	382.9	369.8	357.5	346.2
16.600	335.8	326.3	317.7	310.0	303.0	296.5	290.4
17.300	284.6	279.1	273.8	268.7	263.9	259.6	255.7
18.000	252.1	248.8	245.6	242.5	239.5	236.5	233.6
18.700	230.8	228.0	225.2	222.4	219.7	216.9	214.1
19.400	211.4	208.6	205.9	203.2	200.4	197.7	195.0
20.100	192.2	189.5	186.8	184.0	181.3	178.6	175.8
20.800	173.1	170.4	167.6	164.9	162.1	159.4	156.6
21.500	153.9	151.1	148.3	145.6	142.8	140.0	137.2
22.200	134.5	131.7	128.9	126.1	123.3	120.5	117.7
22.900	114.9	112.1	109.3	106.5	103.7	100.9	98.1
23.600	95.3	92.4	89.6	86.8	84.0	81.1	78.1
24.300	74.9	71.4	67.6	63.5	59.2	54.4	49.9
25.000	45.3	40.8	36.4	32.3	28.4	24.8	21.5
25.700	18.6	16.0	13.8	12.0	10.4	9.0	7.8
26.400	6.7	5.8	5.0	4.4	3.8	3.2	2.8
27.100	2.4	2.1	1.8	1.5	1.3	1.1	1.0
27.800	0.8	0.7	0.0				

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 3	0.141		3.250		12.48	180.2	1281.10

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
6.500	0.115E-01	0.6	0.7	0.8	0.9	1.1	1.2
7.200	1.3	1.5	1.6	1.7	1.9	2.0	2.1
7.900	2.3	2.4	2.6	2.7	2.9	3.0	3.2
8.600	3.3	3.5	3.6	3.8	4.0	4.1	4.4
9.300	4.7	5.1	5.5	5.9	6.3	6.7	7.0
10.000	7.3	7.6	7.9	8.2	8.5	8.8	9.0
10.700	9.1	8.9	8.7	8.6	9.0	9.8	11.0
11.400	12.6	14.5	16.8	20.0	25.1	33.2	46.5
12.100	69.0	102.3	140.8	170.0	180.1	173.0	153.7
12.800	128.4	105.1	85.9	70.5	58.2	48.6	40.8
13.500	34.3	28.9	24.6	21.5	19.6	18.6	18.1
14.200	17.8	17.5	17.2	17.1	16.9	16.7	16.6
14.900	16.4	16.3	16.1	15.8	15.3	14.7	14.0
15.600	13.4	12.8	12.5	12.1	11.9	11.7	11.5
16.300	11.3	11.2	11.1	10.9	10.8	10.7	10.6
17.000	10.5	10.3	10.2	10.1	10.0	9.9	9.8
17.700	9.7	9.6	9.5	9.3	9.2	9.1	9.0
18.400	8.9	8.8	8.7	8.6	8.4	8.3	8.2

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
19.100	8.1	8.0	7.9	7.8	7.6	7.5	7.4
19.800	7.3	7.2	7.1	7.0	6.8	6.7	6.6
20.500	6.5	6.4	6.3	6.2	6.0	5.9	5.8
21.200	5.7	5.6	5.5	5.3	5.2	5.1	5.0
21.900	4.9	4.8	4.7	4.5	4.4	4.3	4.2
22.600	4.1	4.0	3.8	3.7	3.6	3.5	3.4
23.300	3.3	3.1	3.0	2.9	2.8	2.7	2.6
24.000	2.4	2.3	2.1	1.8	1.5	1.1	0.8
24.700	0.6	0.0					

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Time (hr)	Rate (cfs)	Rate (csm)
DA 4A	0.014		3.159		12.17	33.9	2411.76

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
8.900	0.0	0.5	0.6	0.7	0.7	0.8	0.8
9.600	0.8	0.8	0.9	0.9	0.9	1.0	1.0
10.300	1.0	1.0	1.1	1.0	0.7	0.8	1.0
11.000	1.2	1.4	1.7	1.9	2.2	2.5	3.2
11.700	4.7	6.6	9.9	15.5	26.8	33.1	22.1
12.400	14.4	9.9	7.1	4.9	3.9	3.4	3.0
13.100	2.6	2.3	2.0	1.6	1.3	1.2	1.6
13.800	1.7	1.8	1.8	1.7	1.7	1.7	1.7
14.500	1.7	1.7	1.6	1.6	1.6	1.6	1.5
15.200	1.3	1.2	1.2	1.2	1.2	1.2	1.1
15.900	1.1	1.1	1.1	1.1	1.1	1.1	1.1
16.600	1.1	1.0	1.0	1.0	1.0	1.0	1.0
17.300	1.0	1.0	1.0	0.9	0.9	0.9	0.9
18.000	0.9	0.9	0.9	0.9	0.9	0.8	0.8
18.700	0.8	0.8	0.8	0.8	0.8	0.8	0.7
19.400	0.7	0.7	0.7	0.7	0.7	0.7	0.7
20.100	0.7	0.6	0.6	0.6	0.6	0.6	0.6
20.800	0.6	0.6	0.5	0.5	0.5	0.5	0.5
21.500	0.0						

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Time (hr)	Rate (cfs)	Rate (csm)
DA 4B	0.094		3.347		12.28	169.9	1812.53

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
6.200	0.3	0.6	0.7	0.8	0.8	0.9	1.0
6.900	1.1	1.2	1.3	1.4	1.5	1.6	1.7
7.600	1.8	1.9	2.0	2.1	2.2	2.3	2.4
8.300	2.5	2.6	2.7	2.8	2.9	3.0	3.2
9.000	3.3	3.4	3.7	4.2	4.5	4.8	5.1
9.700	5.3	5.5	5.7	5.9	6.1	6.3	6.5
10.400	6.7	6.8	6.9	6.3	5.7	5.7	6.4
11.100	7.6	8.9	10.5	12.1	13.9	16.3	21.0
11.800	28.9	41.3	61.6	98.4	149.0	169.7	149.0
12.500	113.4	84.9	62.6	46.3	35.4	28.6	23.9
13.200	20.3	17.2	14.5	12.1	10.1	9.6	10.3
13.900	11.0	11.4	11.5	11.5	11.5	11.4	11.3
14.600	11.2	11.1	11.0	10.8	10.7	10.5	9.9
15.300	9.2	8.6	8.3	8.1	7.9	7.8	7.7
16.000	7.6	7.5	7.5	7.4	7.3	7.2	7.2
16.700	7.1	7.0	6.9	6.9	6.8	6.7	6.6
17.400	6.5	6.5	6.4	6.3	6.2	6.2	6.1
18.100	6.0	5.9	5.9	5.8	5.7	5.6	5.6
18.800	5.5	5.4	5.3	5.3	5.2	5.1	5.0
19.500	4.9	4.9	4.8	4.7	4.6	4.6	4.5
20.200	4.4	4.3	4.2	4.2	4.1	4.0	3.9
20.900	3.9	3.8	3.7	3.6	3.6	3.5	3.4
21.600	3.3	3.2	3.2	3.1	3.0	2.9	2.8
22.300	2.8	2.7	2.6	2.5	2.5	2.4	2.3
23.000	2.2	2.1	2.1	2.0	1.9	1.8	1.7
23.700	1.7	1.6	1.5	1.4	1.3	1.0	0.6
24.400	0.0						

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 2	3.919	Upstream	2.748	366.86	13.20	2201.4	561.77

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
6.200	0.0	0.6	0.7	0.8	1.4	1.6	2.2
6.900	2.7	3.1	3.4	3.8	4.1	4.5	4.9
7.600	5.2	5.6	6.3	7.2	8.1	9.1	10.3
8.300	11.7	13.3	15.1	17.1	19.2	21.5	24.0
9.000	27.2	30.0	33.4	37.1	41.1	45.4	49.9
9.700	54.6	59.6	64.8	70.3	76.0	81.9	88.0
10.400	94.2	100.6	106.6	111.6	116.2	120.9	126.5
11.100	133.2	141.1	150.6	161.9	175.2	192.6	217.9
11.800	255.1	311.7	402.2	554.9	770.6	991.0	1193.9
12.500	1375.4	1552.1	1721.0	1874.8	2009.0	2112.0	2177.1
13.200	2201.4	2186.7	2135.7	2051.2	1943.1	1816.8	1676.0
13.900	1530.5	1391.6	1267.0	1157.6	1061.1	977.6	905.1
14.600	841.1	784.7	735.5	693.4	656.7	624.9	596.2

NOAA 14 precipitation, smoothed values Ohio River Basin
Lat (dd): 39.1913 Lon (dd): -77.2120° MD Montgomery County

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
15.300	570.1	545.9	523.5	502.8	483.6	465.5	448.4
16.000	432.4	417.2	403.0	389.5	377.1	365.5	355.0
16.700	345.2	336.4	328.5	321.3	314.6	308.3	302.3
17.400	296.6	291.1	285.8	280.8	276.3	272.2	268.4
18.100	264.9	261.5	258.2	255.0	251.9	248.8	245.7
18.800	242.7	239.7	236.7	233.8	230.8	227.8	224.9
19.500	221.9	219.0	216.1	213.1	210.2	207.3	204.3
20.200	201.4	198.4	195.5	192.6	189.6	186.7	183.8
20.900	180.8	177.9	174.9	172.0	169.0	166.1	162.6
21.600	159.6	156.7	153.7	150.7	147.8	144.8	141.8
22.300	138.9	135.9	132.9	129.9	126.9	123.9	120.9
23.000	117.9	114.9	111.9	108.9	105.9	102.9	99.9
23.700	96.9	93.9	90.9	87.8	84.7	81.2	77.3
24.400	72.8	68.7	64.3	59.7	54.4	49.9	45.3
25.100	40.8	36.4	32.2	28.3	24.8	21.5	18.6
25.800	16.0	13.8	12.0	10.4	9.0	7.8	6.7
26.500	5.8	5.0	4.3	3.8	3.2	2.8	2.4
27.200	2.1	1.8	1.5	1.3	1.1	1.0	0.8
27.900	0.7	0.0					

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 2	3.919	Downstream	2.748	366.86	13.24	2200.7	561.59

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
6.400	0.0	0.6	1.2	1.6	1.9	2.6	3.0
7.100	3.3	3.7	4.0	4.4	4.8	5.1	5.5
7.800	6.0	7.0	7.8	8.8	10.0	11.3	12.9
8.500	14.6	16.5	18.6	20.9	23.3	26.4	29.2
9.200	32.4	36.0	40.0	44.2	48.6	53.3	58.2
9.900	63.3	68.7	74.4	80.2	86.2	92.5	98.8
10.600	105.0	110.3	114.9	119.5	124.9	131.2	138.8
11.300	147.9	158.6	171.3	187.2	210.1	243.4	294.0
12.000	373.3	505.7	708.1	930.4	1138.9	1325.7	1503.9
12.700	1674.8	1833.1	1973.3	2087.0	2162.9	2197.6	2193.9
13.400	2152.2	2076.6	1975.0	1853.6	1716.4	1570.9	1429.1
14.100	1300.8	1187.1	1087.0	999.9	924.4	858.2	799.8
14.800	748.7	704.7	666.6	633.5	603.9	577.1	552.5
15.500	529.6	508.4	488.8	470.4	453.1	436.8	421.4
16.200	406.9	393.2	380.5	368.7	357.8	347.8	338.8
16.900	330.6	323.3	316.4	310.0	304.0	298.2	292.6
17.600	287.3	282.2	277.5	273.3	269.5	265.9	262.4
18.300	259.1	255.9	252.7	249.6	246.6	243.5	240.5
19.000	237.6	234.6	231.6	228.7	225.7	222.8	219.8
19.700	216.9	213.9	211.0	208.1	205.1	202.2	199.3
20.400	196.3	193.4	190.5	187.5	184.6	181.7	178.7

NOAA 14 precipitation, smoothed values Ohio River Basin
Lat (dd): 39.1913 Lon (dd): -77.2120° MD Montgomery County

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
21.100	175.8	172.8	169.9	166.9	163.4	160.5	157.5
21.800	154.5	151.6	148.6	145.6	142.7	139.7	136.7
22.500	133.7	130.7	127.7	124.8	121.8	118.8	115.8
23.200	112.8	109.8	106.8	103.7	100.7	97.7	94.7
23.900	91.7	88.7	85.6	82.2	78.4	74.0	69.9
24.600	65.6	61.1	55.8	51.1	46.6	42.1	37.6
25.300	33.4	29.4	25.7	22.4	19.4	16.7	14.4
26.000	12.5	10.8	9.4	8.1	7.0	6.1	5.2
26.700	4.5	3.9	3.4	2.9	2.5	2.2	1.9
27.400	1.6	1.4	1.2	1.0	0.9	0.7	0.0

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 5	0.133		2.965		12.27	228.6	1721.07

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
7.100	0.5	0.6	0.7	0.9	1.0	1.1	1.2
7.800	1.3	1.4	1.6	1.7	1.8	2.0	2.1
8.500	2.2	2.4	2.5	2.6	2.8	2.9	3.1
9.200	3.5	4.0	4.4	4.7	4.9	5.2	5.5
9.900	5.7	6.0	6.2	6.5	6.7	7.0	7.2
10.600	7.2	6.5	5.9	6.2	7.2	8.6	10.3
11.300	12.1	14.1	16.3	19.4	26.0	36.7	53.8
12.000	82.7	137.4	210.0	224.4	182.6	134.2	98.8
12.700	71.8	52.8	41.1	33.9	28.8	24.7	21.2
13.400	18.0	14.9	12.5	12.6	14.0	14.9	15.3
14.100	15.4	15.4	15.3	15.2	15.1	14.9	14.8
14.800	14.6	14.5	14.3	14.0	13.1	12.0	11.3
15.500	10.9	10.7	10.5	10.4	10.3	10.2	10.1
16.200	10.0	9.9	9.8	9.7	9.6	9.5	9.4
16.900	9.3	9.2	9.1	9.0	8.9	8.8	8.7
17.600	8.6	8.5	8.4	8.3	8.2	8.1	8.0
18.300	7.9	7.8	7.7	7.6	7.5	7.4	7.3
19.000	7.2	7.1	7.0	6.9	6.8	6.6	6.5
19.700	6.4	6.3	6.2	6.1	6.0	5.9	5.8
20.400	5.7	5.6	5.5	5.4	5.3	5.2	5.1
21.100	5.0	4.9	4.8	4.7	4.6	4.5	4.3
21.800	4.2	4.1	4.0	3.9	3.8	3.7	3.6
22.500	3.5	3.4	3.3	3.2	3.1	3.0	2.9
23.200	2.8	2.7	2.5	2.4	2.3	2.2	2.1
23.900	2.0	1.9	1.7	1.2	0.7	0.0	

NOAA 14 precipitation, smoothed values Ohio River Basin
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Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 6A	0.047		3.337		12.41	70.6	1505.42

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
6.900	0.0	0.5	0.6	0.6	0.7	0.7	0.8
7.600	0.8	0.9	0.9	1.0	1.0	1.1	1.1
8.300	1.2	1.2	1.3	1.3	1.4	1.4	1.5
9.000	1.6	1.6	1.7	1.9	2.0	2.2	2.3
9.700	2.5	2.6	2.7	2.8	2.9	3.0	3.1
10.400	3.2	3.3	3.3	3.3	3.1	3.0	3.0
11.100	3.3	3.8	4.4	5.1	5.9	6.8	8.3
11.800	10.7	14.7	21.2	32.4	48.7	64.4	70.4
12.500	66.4	56.4	44.9	35.3	27.7	21.9	17.7
13.200	14.6	12.2	10.3	8.6	7.2	6.2	5.7
13.900	5.5	5.6	5.7	5.7	5.7	5.7	5.7
14.600	5.6	5.6	5.5	5.5	5.4	5.4	5.2
15.300	5.0	4.7	4.5	4.3	4.1	4.0	4.0
16.000	3.9	3.8	3.8	3.8	3.7	3.7	3.6
16.700	3.6	3.6	3.5	3.5	3.4	3.4	3.4
17.400	3.3	3.3	3.3	3.2	3.2	3.1	3.1
18.100	3.1	3.0	3.0	2.9	2.9	2.9	2.8
18.800	2.8	2.8	2.7	2.7	2.6	2.6	2.6
19.500	2.5	2.5	2.5	2.4	2.4	2.3	2.3
20.200	2.3	2.2	2.2	2.1	2.1	2.1	2.0
20.900	2.0	1.9	1.9	1.9	1.8	1.8	1.8
21.600	1.7	1.7	1.6	1.6	1.6	1.5	1.5
22.300	1.4	1.4	1.4	1.3	1.3	1.2	1.2
23.000	1.2	1.1	1.1	1.0	1.0	1.0	0.9
23.700	0.9	0.9	0.8	0.8	0.7	0.6	0.5
24.400	0.0						

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 6B	0.014		4.130		12.13	47.7	3394.36

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
5.400	0.0	0.5	0.5	0.5	0.6	0.6	0.6
6.100	0.6	0.6	0.7	0.7	0.7	0.7	0.7
6.800	0.7	0.8	0.8	0.8	0.8	0.8	0.8
7.500	0.9	0.9	0.9	0.9	0.9	1.0	1.0
8.200	1.0	1.0	1.0	1.0	1.0	1.1	1.1
8.900	1.1	1.1	1.3	1.5	1.5	1.5	1.5
9.600	1.6	1.6	1.6	1.6	1.7	1.7	1.7
10.300	1.7	1.8	1.8	1.2	1.1	1.4	1.8

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
11.000	2.1	2.5	2.9	3.2	3.6	4.0	6.0
11.700	8.0	11.5	16.6	26.5	45.0	31.1	17.1
12.400	11.2	8.3	5.6	4.2	3.8	3.4	3.0
13.100	2.6	2.2	1.9	1.5	1.1	1.6	1.9
13.800	1.9	1.9	1.9	1.9	1.9	1.8	1.8
14.500	1.8	1.8	1.8	1.7	1.7	1.7	1.4
15.200	1.3	1.3	1.3	1.3	1.2	1.2	1.2
15.900	1.2	1.2	1.2	1.2	1.2	1.1	1.1
16.600	1.1	1.1	1.1	1.1	1.1	1.1	1.0
17.300	1.0	1.0	1.0	1.0	1.0	1.0	1.0
18.000	0.9	0.9	0.9	0.9	0.9	0.9	0.9
18.700	0.9	0.8	0.8	0.8	0.8	0.8	0.8
19.400	0.8	0.8	0.8	0.7	0.7	0.7	0.7
20.100	0.7	0.7	0.7	0.6	0.6	0.6	0.6
20.800	0.6	0.6	0.6	0.6	0.6	0.5	0.5
21.500	0.5	0.0					

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 3	4.112	Upstream	2.766	353.51	13.23	2240.2	544.74

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
5.400	0.0	0.5	0.5	0.5	0.6	0.6	0.6
6.100	0.6	0.6	0.7	0.7	1.3	1.9	2.3
6.800	2.6	3.4	4.3	5.1	5.7	6.3	6.8
7.500	7.4	7.9	8.5	9.2	10.3	11.4	12.6
8.200	13.9	15.5	17.2	19.1	21.2	23.5	26.0
8.900	28.7	32.0	35.2	39.1	43.4	47.9	52.6
9.600	57.5	62.6	67.9	73.4	79.2	85.2	91.4
10.300	97.8	104.4	111.1	116.8	121.2	125.3	130.5
11.000	137.3	145.7	155.8	167.6	181.4	197.4	219.4
11.700	252.3	302.3	379.1	503.8	720.3	997.3	1236.1
12.400	1402.9	1534.5	1664.5	1795.6	1924.9	2045.4	2145.8
13.100	2212.0	2239.0	2229.2	2182.0	2101.3	1996.5	1874.4
13.800	1738.1	1593.4	1452.0	1323.9	1210.2	1110.0	1022.7
14.500	947.0	880.6	822.0	770.7	726.4	688.1	654.3
15.200	623.5	595.4	569.8	546.3	524.7	504.8	486.1
15.900	468.6	452.1	436.5	421.8	408.0	395.1	383.2
16.600	372.2	362.0	352.8	344.5	337.0	330.0	323.5
17.300	317.3	311.3	305.6	300.1	294.9	290.1	285.7
18.000	281.7	277.9	274.4	270.9	267.5	264.2	261.0
18.700	257.7	254.5	251.4	248.3	245.1	242.0	238.9
19.400	235.8	232.7	229.6	226.5	223.4	220.3	217.2
20.100	214.1	211.0	207.9	204.9	201.8	198.7	195.6
20.800	192.5	189.4	186.3	183.2	180.1	177.0	173.9
21.500	170.2	167.1	163.5	160.4	157.3	154.2	151.1

NOAA 14 precipitation, smoothed values Ohio River Basin
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Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
22.200	148.0	144.8	141.7	138.6	135.4	132.3	129.2
22.900	126.0	122.9	119.7	116.6	113.4	110.3	107.1
23.600	104.0	100.8	97.7	94.5	91.3	88.0	84.0
24.300	79.5	74.0	69.8	65.5	61.0	55.8	51.1
25.000	46.5	42.0	37.6	33.4	29.4	25.7	22.3
25.700	19.3	16.7	14.4	12.4	10.8	9.3	8.1
26.400	7.0	6.1	5.2	4.5	3.9	3.4	2.9
27.100	2.5	2.2	1.9	1.6	1.4	1.2	1.0
27.800	0.9	0.7	0.0				

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Time (hr)	Rate (cfs)	Rate (csm)
Reach 3	4.112	Downstream	2.766	353.51	13.30	2232.6	542.88

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
6.900	0.0	3.2	4.3	5.2	5.8	6.4	6.9
7.600	7.5	8.1	8.7	9.5	10.6	11.7	12.9
8.300	14.3	15.9	17.7	19.7	21.8	24.2	26.7
9.000	29.6	32.7	36.2	40.2	44.5	49.1	53.8
9.700	58.8	63.9	69.2	74.8	80.7	86.7	93.0
10.400	99.4	106.1	112.5	117.7	122.1	126.6	132.3
11.100	139.5	148.3	158.8	171.2	185.5	203.2	228.4
11.800	266.1	323.5	413.5	564.1	798.3	1055.8	1269.9
12.500	1429.9	1565.6	1696.4	1827.3	1954.0	2068.8	2158.6
13.200	2214.2	2232.6	2213.5	2158.5	2072.8	1964.5	1839.2
13.900	1701.2	1558.6	1421.9	1297.5	1187.0	1089.9	1005.4
14.600	931.8	867.2	810.2	760.6	717.7	680.3	647.1
15.300	616.9	589.4	564.3	541.2	520.0	500.3	481.9
16.000	464.6	448.4	433.0	418.5	405.0	392.3	380.6
16.700	369.8	359.9	350.9	342.8	335.4	328.5	322.0
17.400	315.8	309.9	304.3	298.9	293.7	289.0	284.8
18.100	280.8	277.1	273.5	270.1	266.7	263.4	260.2
18.800	257.0	253.8	250.6	247.5	244.4	241.3	238.1
19.500	235.0	231.9	228.8	225.7	222.7	219.6	216.5
20.200	213.4	210.3	207.2	204.1	201.0	197.9	194.8
20.900	191.7	188.6	185.5	182.4	179.3	176.2	172.9
21.600	169.5	166.0	162.8	159.6	156.5	153.4	150.3
22.300	147.2	144.1	140.9	137.8	134.7	131.5	128.4
23.000	125.3	122.1	119.0	115.8	112.7	109.5	106.4
23.700	103.2	100.0	96.9	93.7	90.5	87.0	82.9
24.400	77.8	73.1	68.8	64.4	59.7	54.7	50.0
25.100	45.4	40.9	36.6	32.4	28.5	24.9	21.6
25.800	18.7	16.1	13.9	12.1	10.5	9.1	7.8
26.500	6.8	5.9	5.1	4.4	3.8	3.3	2.8
27.200	2.4	2.1	1.8	1.5	1.3	1.1	1.0
27.900	0.8	0.0					

NOAA 14 precipitation, smoothed values Ohio River Basin
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Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 7	0.030		3.519		12.24	63.4	2133.95

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
6.700	0.0	0.5	0.6	0.6	0.6	0.7	0.7
7.400	0.7	0.8	0.8	0.8	0.9	0.9	0.9
8.100	1.0	1.0	1.0	1.1	1.1	1.1	1.2
8.800	1.2	1.3	1.3	1.4	1.5	1.7	1.8
9.500	1.9	2.0	2.0	2.1	2.2	2.2	2.3
10.200	2.3	2.4	2.5	2.5	2.5	2.1	1.9
10.900	2.1	2.5	3.0	3.5	4.1	4.7	5.3
11.600	6.3	8.6	12.0	17.3	26.1	42.5	61.7
12.300	58.8	43.1	30.6	21.9	15.6	11.4	9.1
13.000	7.6	6.5	5.7	4.9	4.1	3.4	2.9
13.700	3.1	3.5	3.7	3.8	3.8	3.7	3.7
14.400	3.7	3.6	3.6	3.6	3.5	3.5	3.4
15.100	3.3	3.1	2.8	2.7	2.6	2.6	2.5
15.800	2.5	2.5	2.4	2.4	2.4	2.4	2.3
16.500	2.3	2.3	2.3	2.2	2.2	2.2	2.2
17.200	2.1	2.1	2.1	2.1	2.1	2.0	2.0
17.900	2.0	2.0	1.9	1.9	1.9	1.9	1.8
18.600	1.8	1.8	1.8	1.7	1.7	1.7	1.7
19.300	1.6	1.6	1.6	1.6	1.5	1.5	1.5
20.000	1.5	1.4	1.4	1.4	1.4	1.3	1.3
20.700	1.3	1.3	1.2	1.2	1.2	1.2	1.1
21.400	1.1	1.1	1.1	1.0	1.0	1.0	1.0
22.100	0.9	0.9	0.9	0.8	0.8	0.8	0.8
22.800	0.7	0.7	0.7	0.7	0.6	0.6	0.6
23.500	0.6	0.5	0.5	0.0			

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 8	0.077		3.445		12.32	138.1	1804.35

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
6.000	0.0	0.5	0.6	0.7	0.7	0.8	0.9
6.700	1.0	1.0	1.1	1.2	1.3	1.4	1.4
7.400	1.5	1.6	1.7	1.8	1.9	1.9	2.0
8.100	2.1	2.2	2.3	2.4	2.5	2.6	2.7
8.800	2.8	2.8	2.9	3.1	3.3	3.7	4.0
9.500	4.3	4.5	4.7	4.8	5.0	5.2	5.3
10.200	5.5	5.6	5.8	6.0	6.0	5.6	5.1
10.900	5.0	5.5	6.4	7.5	8.8	10.2	11.7
11.600	13.7	17.4	23.6	33.5	49.5	78.1	117.7

NOAA 14 precipitation, smoothed values Ohio River Basin
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Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
12.300	138.0	126.1	98.7	74.5	55.6	41.4	31.5
13.000	25.2	20.9	17.6	14.9	12.6	10.5	8.8
13.700	8.1	8.5	9.1	9.4	9.5	9.5	9.5
14.400	9.4	9.3	9.3	9.2	9.1	9.0	8.9
15.100	8.7	8.3	7.7	7.2	6.9	6.7	6.6
15.800	6.5	6.4	6.3	6.2	6.2	6.1	6.0
16.500	6.0	5.9	5.9	5.8	5.7	5.7	5.6
17.200	5.5	5.5	5.4	5.4	5.3	5.2	5.2
17.900	5.1	5.0	5.0	4.9	4.9	4.8	4.7
18.600	4.7	4.6	4.5	4.5	4.4	4.3	4.3
19.300	4.2	4.2	4.1	4.0	4.0	3.9	3.8
20.000	3.8	3.7	3.6	3.6	3.5	3.5	3.4
20.700	3.3	3.3	3.2	3.1	3.1	3.0	2.9
21.400	2.9	2.8	2.7	2.7	2.6	2.6	2.5
22.100	2.4	2.4	2.3	2.2	2.2	2.1	2.0
22.800	2.0	1.9	1.8	1.8	1.7	1.6	1.6
23.500	1.5	1.5	1.4	1.3	1.3	1.2	1.1
24.200	0.9	0.6	0.0				

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 4	4.219	Upstream	2.783	351.49	13.29	2252.6	533.94

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
6.000	0.0	0.5	0.6	0.7	0.7	0.8	0.9
6.700	1.0	1.6	1.7	5.0	6.2	7.2	8.0
7.400	8.6	9.3	10.0	10.7	11.4	12.4	13.5
8.100	14.8	16.1	17.7	19.4	21.3	23.4	25.7
8.800	28.1	30.8	33.8	37.2	41.1	45.6	50.3
9.500	55.2	60.3	65.5	70.8	76.4	82.2	88.3
10.200	94.5	101.0	107.7	114.5	120.9	125.4	129.1
10.900	133.7	140.3	148.9	159.4	171.8	186.1	202.5
11.600	223.2	254.4	301.6	374.2	489.1	684.6	977.5
12.300	1252.5	1439.0	1559.2	1662.0	1767.6	1880.0	1994.6
13.000	2101.6	2186.1	2237.5	2252.4	2230.2	2172.3	2084.5
13.700	1975.7	1851.2	1714.0	1571.7	1435.1	1310.8	1200.3
14.400	1103.1	1018.4	944.7	879.9	822.8	773.1	730.0
15.100	692.4	658.5	627.5	599.3	573.8	550.5	529.1
15.800	509.3	490.8	473.4	457.0	441.6	427.0	413.3
16.500	400.6	388.8	377.9	367.9	358.8	350.6	343.1
17.200	336.2	329.6	323.4	317.4	311.6	306.1	300.9
17.900	296.1	291.7	287.7	283.9	280.2	276.7	273.3
18.600	269.9	266.5	263.2	260.0	256.7	253.5	250.3
19.300	247.1	243.9	240.7	237.5	234.3	231.2	228.0
20.000	224.8	221.6	218.4	215.2	212.1	208.9	205.7
20.700	202.5	199.3	196.2	193.0	189.8	186.6	183.4

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
21.400	180.2	176.8	173.3	169.7	166.4	163.2	160.0
22.100	156.8	153.6	150.4	147.1	143.9	140.7	137.5
22.800	134.2	131.0	127.8	124.6	121.3	118.1	114.8
23.500	111.6	108.4	105.1	101.4	98.1	94.9	91.6
24.200	87.8	83.3	77.8	73.1	68.8	64.4	59.7
24.900	54.7	50.0	45.4	40.9	36.6	32.4	28.5
25.600	24.9	21.6	18.7	16.1	13.9	12.1	10.5
26.300	9.1	7.8	6.8	5.9	5.1	4.4	3.8
27.000	3.3	2.8	2.4	2.1	1.8	1.5	1.3
27.700	1.1	1.0	0.8	0.0			

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 4	4.219	Downstream	2.783	351.49	13.33	2251.8	533.77

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
6.600	0.0	0.9	1.5	1.6	3.7	5.8	6.8
7.300	7.7	8.4	9.0	9.7	10.4	11.1	11.9
8.000	13.0	14.2	15.5	17.0	18.6	20.4	22.5
8.700	24.7	27.1	29.7	32.5	35.7	39.4	43.6
9.400	48.3	53.2	58.2	63.3	68.6	74.0	79.7
10.100	85.7	91.9	98.3	104.9	111.7	118.4	123.7
10.800	127.5	131.6	137.3	145.1	154.8	166.4	179.9
11.500	195.4	213.7	239.9	279.7	340.5	434.9	591.1
12.200	849.6	1144.9	1369.6	1512.8	1618.8	1722.6	1832.3
12.900	1946.7	2058.1	2153.4	2219.6	2249.9	2243.3	2200.1
13.600	2123.9	2023.1	1905.0	1772.6	1631.4	1491.4	1361.6
14.300	1245.3	1142.6	1052.8	974.7	906.3	846.1	793.3
15.000	747.5	707.7	672.4	640.2	610.9	584.3	560.1
15.700	537.9	517.5	498.4	480.6	463.8	448.0	433.0
16.400	419.0	405.9	393.7	382.4	372.0	362.5	354.0
17.100	346.2	339.1	332.3	326.0	319.9	314.0	308.4
17.800	303.1	298.1	293.5	289.4	285.5	281.8	278.2
18.500	274.7	271.3	267.9	264.6	261.4	258.1	254.9
19.200	251.7	248.5	245.2	242.0	238.9	235.7	232.5
19.900	229.3	226.1	222.9	219.8	216.6	213.4	210.2
20.600	207.0	203.9	200.7	197.5	194.3	191.1	187.9
21.300	184.7	181.5	178.3	174.8	171.2	167.8	164.5
22.000	161.3	158.1	154.9	151.7	148.5	145.3	142.0
22.700	138.8	135.6	132.4	129.1	125.9	122.7	119.5
23.400	116.2	113.0	109.7	106.5	103.2	99.5	96.3
24.100	93.0	89.5	85.3	80.0	75.0	70.6	66.3
24.800	61.7	56.7	51.9	47.4	42.8	38.4	34.1
25.500	30.1	26.4	23.0	19.9	17.2	14.8	12.8
26.200	11.1	9.6	8.3	7.2	6.2	5.4	4.7
26.900	4.0	3.5	3.0	2.6	2.2	1.9	1.6

NOAA 14 precipitation, smoothed values Ohio River Basin
Lat (dd): 39.1913 Lon (dd): -77.2120° MD Montgomery County

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
27.600	1.4	1.2	1.0	0.9	0.0		

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Time (hr)	Rate (cfs)	Rate (csm)
DA 9	0.155		3.059		12.28	270.1	1746.26

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
6.700	0.0	0.6	0.7	0.8	0.9	1.1	1.2
7.400	1.4	1.5	1.6	1.8	1.9	2.1	2.2
8.100	2.4	2.5	2.7	2.9	3.0	3.2	3.3
8.800	3.5	3.7	3.8	4.1	4.6	5.2	5.7
9.500	6.0	6.4	6.7	7.0	7.3	7.6	7.9
10.200	8.2	8.5	8.8	9.1	9.1	8.2	7.4
10.900	7.7	8.9	10.7	12.7	14.9	17.4	20.0
11.600	23.7	31.5	44.2	64.4	98.1	161.3	245.8
12.300	267.1	221.1	163.5	120.7	88.0	64.7	50.2
13.000	41.2	34.8	29.7	25.5	21.7	18.0	15.1
13.700	14.9	16.4	17.6	18.1	18.2	18.2	18.1
14.400	18.0	17.8	17.7	17.5	17.3	17.1	16.9
15.100	16.6	15.5	14.3	13.4	13.0	12.7	12.5
15.800	12.3	12.2	12.0	11.9	11.8	11.7	11.6
16.500	11.4	11.3	11.2	11.1	11.0	10.9	10.7
17.200	10.6	10.5	10.4	10.3	10.2	10.0	9.9
17.900	9.8	9.7	9.5	9.4	9.3	9.2	9.1
18.600	9.0	8.8	8.7	8.6	8.5	8.3	8.2
19.300	8.1	8.0	7.9	7.7	7.6	7.5	7.4
20.000	7.2	7.1	7.0	6.9	6.7	6.6	6.5
20.700	6.4	6.3	6.1	6.0	5.9	5.8	5.6
21.400	5.5	5.4	5.3	5.1	5.0	4.9	4.8
22.100	4.6	4.5	4.4	4.3	4.1	4.0	3.9
22.800	3.8	3.6	3.5	3.4	3.3	3.1	3.0
23.500	2.9	2.8	2.6	2.5	2.4	2.3	2.0
24.200	1.5	0.8	0.0				

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Time (hr)	Rate (cfs)	Rate (csm)
OUTLET	4.373		2.793		13.32	2276.3	520.48

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
6.600	0.0	0.9	2.1	2.3	4.5	6.7	7.9
7.300	8.9	9.7	10.5	11.3	12.2	13.0	14.0

NOAA 14 precipitation, smoothed values Ohio River Basin
Lat (dd): 39.1913 Lon (dd): -77.2120° MD Montgomery County

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
8.000	15.3	16.6	18.1	19.7	21.5	23.5	25.7
8.700	28.0	30.6	33.3	36.3	39.8	43.9	48.8
9.400	54.0	59.2	64.5	70.0	75.6	81.3	87.3
10.100	93.6	100.1	106.8	113.7	120.8	127.5	131.9
10.800	135.0	139.3	146.2	155.7	167.5	181.3	197.2
11.500	215.4	237.5	271.4	323.9	404.9	533.1	752.4
12.200	1095.3	1412.0	1590.7	1676.3	1739.5	1810.6	1897.0
12.900	1996.9	2099.3	2188.2	2249.3	2275.4	2265.0	2218.1
13.600	2139.0	2038.0	1921.4	1790.2	1649.5	1509.7	1379.8
14.300	1263.4	1160.5	1070.6	992.3	923.8	863.4	810.4
15.000	764.4	724.3	687.9	654.5	624.3	597.2	572.7
15.700	550.3	529.8	510.6	492.6	475.7	459.8	444.7
16.400	430.6	417.3	405.0	393.6	383.1	373.5	364.8
17.100	357.0	349.7	342.8	336.3	330.1	324.2	318.4
17.800	313.0	307.9	303.2	298.9	294.9	291.1	287.4
18.500	283.8	280.3	276.8	273.3	269.9	266.6	263.2
19.200	259.9	256.5	253.2	249.9	246.6	243.3	240.0
19.900	236.7	233.4	230.1	226.8	223.5	220.1	216.8
20.600	213.5	210.2	206.9	203.6	200.3	197.0	193.7
21.300	190.4	187.0	183.6	180.0	176.4	172.8	169.4
22.000	166.1	162.8	159.4	156.1	152.8	149.4	146.1
22.700	142.7	139.4	136.0	132.7	129.3	126.0	122.6
23.400	119.2	115.9	112.5	109.1	105.7	101.9	98.5
24.100	95.0	90.9	86.2	80.0	75.0	70.6	66.3
24.800	61.7	56.7	51.9	47.4	42.8	38.4	34.1
25.500	30.1	26.4	23.0	19.9	17.2	14.8	12.8
26.200	11.1	9.6	8.3	7.2	6.2	5.4	4.7
26.900	4.0	3.5	3.0	2.6	2.2	1.9	1.6
27.600	1.4	1.2	1.0	0.9	0.0		

STORM 100_yr_stm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 1	3.519		5.850		13.14	3948.0	1121.98

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
5.100	0.403E-01	0.7	1.3	2.1	3.2	4.7	6.5
5.800	8.7	11.3	14.3	17.7	21.4	25.5	29.8
6.500	34.5	39.4	44.5	49.9	55.4	61.2	67.1
7.200	73.1	79.3	85.7	92.2	98.8	105.5	112.3
7.900	119.3	126.3	133.4	140.6	147.9	155.3	162.8
8.600	170.3	177.9	185.5	193.2	201.0	208.9	217.1
9.300	225.6	234.5	244.0	254.0	264.8	276.2	288.3
10.000	300.7	313.5	326.4	339.5	352.7	365.8	378.3
10.700	389.7	400.0	409.5	418.4	427.0	436.1	447.4

NOAA 14 precipitation, smoothed values Ohio River Basin
Lat (dd): 39.1913 Lon (dd): -77.2120° MD Montgomery County

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
11.400	463.6	486.5	518.3	562.3	623.0	706.8	823.4
12.100	991.7	1227.6	1514.4	1850.2	2227.5	2628.4	3022.8
12.800	3371.5	3643.8	3824.5	3920.8	3942.9	3891.8	3776.2
13.500	3613.0	3409.3	3167.7	2906.3	2652.6	2418.9	2207.7
14.200	2018.4	1851.7	1706.6	1581.0	1468.9	1371.4	1287.3
14.900	1214.4	1151.1	1096.3	1048.4	1005.9	966.2	930.0
15.600	896.5	865.0	835.4	807.7	782.0	757.7	735.0
16.300	713.9	694.3	676.3	659.6	644.1	630.5	618.0
17.000	606.3	595.1	584.5	574.3	564.4	555.0	546.1
17.700	537.7	530.2	523.2	516.6	510.2	504.1	498.1
18.400	492.2	486.4	480.7	475.0	469.4	463.8	458.3
19.100	452.7	447.1	441.6	436.0	430.5	424.9	419.4
19.800	413.9	408.3	402.8	397.3	391.7	386.2	380.7
20.500	375.1	369.6	364.1	358.5	353.0	347.4	341.9
21.200	336.4	330.8	325.2	319.7	314.1	308.5	303.0
21.900	297.4	291.8	286.2	280.7	275.1	269.5	263.9
22.600	258.3	252.7	247.1	241.5	235.9	230.2	224.6
23.300	219.0	213.4	207.8	202.1	196.5	190.9	185.3
24.000	179.6	173.7	167.5	160.9	153.8	146.0	137.3
24.700	127.9	118.0	107.7	97.4	87.3	77.5	68.3
25.400	59.8	52.1	45.1	38.9	33.5	29.0	25.1
26.100	21.8	18.9	16.4	14.2	12.2	10.6	9.1
26.800	7.9	6.8	5.9	5.0	4.3	3.7	3.2
27.500	2.7	2.3	2.0	1.7	1.5	1.2	1.0
28.200	0.9	0.7	0.6	0.0			

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Time (hr)	Rate (cfs)	Rate (csm)
DA 2	0.152		6.443		12.43	333.4	2199.78

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
4.300	0.0	0.6	0.8	1.0	1.3	1.5	1.8
5.000	2.1	2.3	2.6	2.9	3.2	3.5	3.8
5.700	4.1	4.4	4.8	5.1	5.4	5.7	6.1
6.400	6.4	6.7	7.1	7.4	7.8	8.1	8.5
7.100	8.8	9.2	9.5	9.9	10.2	10.6	11.0
7.800	11.3	11.7	12.0	12.4	12.8	13.1	13.5
8.500	13.9	14.2	14.6	15.0	15.3	15.7	16.1
9.200	16.7	17.4	18.4	19.3	20.2	20.9	21.6
9.900	22.2	22.8	23.4	23.9	24.4	24.9	25.4
10.600	25.7	25.3	24.1	23.0	23.0	24.5	27.6
11.300	32.0	37.2	43.0	49.7	58.7	72.1	92.4
12.000	122.4	167.9	230.0	294.4	329.7	328.9	299.6
12.700	254.5	209.9	172.4	141.7	117.6	98.8	83.5
13.400	70.7	59.4	49.6	42.0	37.4	35.2	34.5
14.100	34.5	34.5	34.3	34.2	34.0	33.8	33.5

NOAA 14 precipitation, smoothed values Ohio River Basin
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Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
14.800	33.2	32.9	32.6	32.3	31.7	30.8	29.7
15.500	28.7	27.8	27.1	26.5	26.1	25.7	25.4
16.200	25.1	24.8	24.5	24.2	24.0	23.7	23.5
16.900	23.2	23.0	22.8	22.5	22.3	22.0	21.8
17.600	21.5	21.3	21.1	20.8	20.6	20.3	20.1
18.300	19.8	19.6	19.3	19.1	18.9	18.6	18.4
19.000	18.1	17.9	17.6	17.4	17.1	16.9	16.6
19.700	16.4	16.1	15.9	15.6	15.4	15.1	14.9
20.400	14.7	14.4	14.2	13.9	13.7	13.4	13.2
21.100	12.9	12.7	12.4	12.2	11.9	11.7	11.4
21.800	11.2	10.9	10.7	10.4	10.2	9.9	9.7
22.500	9.4	9.2	8.9	8.7	8.4	8.2	7.9
23.200	7.7	7.4	7.2	6.9	6.7	6.4	6.2
23.900	5.9	5.7	5.4	4.8	4.0	3.1	2.2
24.600	1.5	1.0	0.7	0.0			

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 1	3.670	Upstream	5.875	373.29	13.13	4054.5	1104.68

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
4.300	0.0	0.6	0.8	1.0	1.3	1.5	1.8
5.000	2.1	2.4	3.3	4.2	5.3	6.8	8.5
5.700	10.6	13.2	16.1	19.4	23.1	27.1	31.5
6.400	36.2	41.2	46.4	51.9	57.6	63.5	69.6
7.100	75.9	82.3	88.9	95.6	102.4	109.4	116.5
7.800	123.7	131.0	138.3	145.8	153.4	161.1	168.8
8.500	176.6	184.5	192.5	200.5	208.6	216.7	225.0
9.200	233.8	243.1	252.9	263.3	274.2	285.7	297.9
9.900	310.5	323.6	336.8	350.3	364.0	377.6	391.2
10.600	404.0	414.9	424.1	432.5	441.4	451.4	463.7
11.300	479.7	501.1	529.4	568.0	621.0	695.1	799.2
12.000	948.7	1162.4	1458.4	1808.8	2180.0	2556.4	2928.1
12.700	3277.0	3581.5	3809.0	3966.2	4038.5	4041.6	3975.3
13.400	3846.8	3671.9	3456.2	3209.7	2943.9	2687.8	2453.4
14.100	2242.1	2053.0	1886.0	1742.3	1615.4	1502.6	1404.9
14.800	1320.5	1247.4	1183.7	1129.0	1080.2	1036.7	995.9
15.500	958.6	924.2	892.0	861.9	833.8	807.8	783.0
16.200	760.1	738.7	718.8	700.6	683.6	668.0	654.0
16.900	641.3	629.3	617.9	607.0	596.5	586.5	576.8
17.600	567.6	559.0	551.2	544.0	537.2	530.6	524.2
18.300	517.9	511.8	505.7	499.8	493.9	488.0	482.2
19.000	476.4	470.6	464.7	458.9	453.1	447.4	441.6
19.700	435.8	430.0	424.2	418.4	412.7	406.9	401.1
20.400	395.3	389.5	383.8	378.0	372.2	366.4	360.6
21.100	354.8	349.0	343.2	337.4	331.6	325.8	320.0

NOAA 14 precipitation, smoothed values Ohio River Basin
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Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
21.800	314.1	308.3	302.5	296.7	290.8	285.0	279.1
22.500	273.3	267.5	261.6	255.8	249.9	244.0	238.2
23.200	232.3	226.4	220.6	214.7	208.8	202.9	197.1
23.900	191.2	185.2	179.1	172.4	165.0	156.9	148.2
24.600	138.8	128.9	118.6	107.7	97.4	87.2	77.5
25.300	68.3	59.8	52.1	45.1	38.9	33.5	29.0
26.000	25.1	21.8	18.9	16.4	14.2	12.2	10.6
26.700	9.1	7.9	6.8	5.9	5.0	4.3	3.7
27.400	3.2	2.7	2.3	2.0	1.7	1.5	1.2
28.100	1.0	0.9	0.7	0.6	0.0		

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 1	3.670	Downstream	5.875	373.29	13.21	4049.9	1103.43

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
4.500	0.3	0.9	1.1	1.4	1.6	1.9	2.2
5.200	2.7	3.7	4.6	5.8	7.3	9.3	11.5
5.900	14.2	17.2	20.7	24.5	28.7	33.2	38.0
6.600	43.1	48.4	54.0	59.7	65.7	71.8	78.2
7.300	84.6	91.3	98.0	104.9	111.9	119.0	126.3
8.000	133.6	141.0	148.5	156.2	163.8	171.6	179.5
8.700	187.4	195.3	203.4	211.5	219.7	228.1	237.1
9.400	246.5	256.6	267.2	278.3	290.1	302.4	315.2
10.100	328.3	341.7	355.2	368.9	382.5	395.8	408.0
10.800	418.3	427.2	435.6	444.8	455.6	469.2	487.1
11.500	510.8	542.2	585.2	644.8	729.5	848.8	1021.0
12.200	1266.5	1579.6	1940.1	2313.5	2690.4	3057.2	3388.5
12.900	3664.4	3870.6	3996.9	4047.1	4027.1	3933.9	3787.3
13.600	3596.1	3368.9	3115.0	2850.9	2601.0	2375.5	2172.0
14.300	1991.8	1833.9	1695.8	1574.2	1466.0	1373.1	1293.2
15.000	1223.8	1163.7	1111.2	1064.5	1021.8	982.2	946.1
15.700	912.5	881.1	851.7	824.4	798.8	774.7	752.3
16.400	731.3	712.2	694.4	677.9	662.9	649.4	636.9
17.100	625.1	613.9	603.2	592.9	583.0	573.5	564.5
17.800	556.1	548.6	541.5	534.8	528.3	521.9	515.7
18.500	509.6	503.6	497.6	491.8	485.9	480.1	474.3
19.200	468.5	462.7	456.9	451.1	445.3	439.5	433.7
19.900	427.9	422.1	416.4	410.6	404.8	399.0	393.2
20.600	387.5	381.7	375.9	370.1	364.3	358.5	352.7
21.300	346.9	341.1	335.3	329.5	323.7	317.9	312.1
22.000	306.2	300.4	294.6	288.7	282.9	277.1	271.2
22.700	265.4	259.5	253.7	247.8	241.9	236.1	230.2
23.400	224.3	218.5	212.6	206.7	200.8	195.0	189.1
24.100	183.1	176.7	169.8	162.1	153.8	144.9	135.3
24.800	125.3	114.8	104.0	93.7	83.7	74.2	65.2

NOAA 14 precipitation, smoothed values Ohio River Basin
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Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
25.500	57.0	49.5	42.8	36.9	31.9	27.6	23.9
26.200	20.7	18.0	15.5	13.4	11.6	10.0	8.7
26.900	7.5	6.5	5.6	4.8	4.1	3.5	3.0
27.600	2.6	2.2	1.9	1.6	1.4	1.2	1.0
28.300	0.8	0.7	0.0				

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 3	0.141		6.562		12.50	294.5	2093.88

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
4.200	0.0	0.6	0.8	1.0	1.3	1.5	1.7
4.900	2.0	2.3	2.5	2.8	3.1	3.4	3.7
5.600	3.9	4.2	4.5	4.8	5.2	5.5	5.8
6.300	6.1	6.4	6.7	7.0	7.4	7.7	8.0
7.000	8.3	8.7	9.0	9.3	9.7	10.0	10.4
7.700	10.7	11.0	11.4	11.7	12.0	12.4	12.7
8.400	13.1	13.4	13.7	14.1	14.4	14.8	15.1
9.100	15.5	15.9	16.6	17.4	18.2	19.0	19.8
9.800	20.5	21.1	21.6	22.2	22.7	23.2	23.7
10.500	24.1	24.4	24.3	23.5	22.6	22.3	23.1
11.200	25.2	28.6	32.9	37.9	43.8	51.2	62.0
11.900	78.0	101.8	137.7	186.3	240.0	280.4	294.3
12.600	283.4	254.9	217.4	182.0	152.0	127.3	107.1
13.300	90.7	77.0	65.2	54.9	46.6	40.5	36.9
14.000	34.9	33.9	33.4	32.9	32.5	32.1	31.8
14.700	31.5	31.2	31.0	30.7	30.3	29.9	29.2
15.400	28.3	27.4	26.5	25.8	25.2	24.7	24.3
16.100	24.0	23.6	23.4	23.1	22.8	22.6	22.3
16.800	22.1	21.9	21.6	21.4	21.2	20.9	20.7
17.500	20.5	20.3	20.0	19.8	19.6	19.3	19.1
18.200	18.9	18.7	18.4	18.2	18.0	17.7	17.5
18.900	17.3	17.1	16.8	16.6	16.4	16.1	15.9
19.600	15.7	15.4	15.2	15.0	14.8	14.5	14.3
20.300	14.1	13.8	13.6	13.4	13.1	12.9	12.7
21.000	12.4	12.2	12.0	11.7	11.5	11.3	11.0
21.700	10.8	10.6	10.4	10.1	9.9	9.6	9.4
22.400	9.2	9.0	8.7	8.5	8.3	8.0	7.8
23.100	7.6	7.3	7.1	6.9	6.6	6.4	6.2
23.800	5.9	5.7	5.5	5.2	4.8	4.2	3.4
24.500	2.6	1.9	1.3	0.9	0.7	0.0	

NOAA 14 precipitation, smoothed values Ohio River Basin
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Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 4A	0.014		6.617		12.17	50.7	3605.55

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
5.300	0.0	0.5	0.6	0.6	0.6	0.7	0.7
6.000	0.7	0.8	0.8	0.8	0.8	0.9	0.9
6.700	1.0	1.0	1.0	1.1	1.1	1.1	1.2
7.400	1.2	1.2	1.3	1.3	1.3	1.4	1.4
8.100	1.4	1.5	1.5	1.5	1.6	1.6	1.6
8.800	1.7	1.7	1.7	1.8	2.0	2.1	2.2
9.500	2.2	2.3	2.3	2.4	2.4	2.5	2.5
10.200	2.6	2.6	2.6	2.7	2.4	1.8	1.9
10.900	2.4	3.0	3.6	4.3	5.0	5.7	6.4
11.600	7.8	10.5	14.3	19.5	26.6	41.0	49.5
12.300	34.5	24.4	17.6	13.0	9.5	7.9	6.9
13.000	6.1	5.3	4.6	3.8	3.1	2.3	2.2
13.700	2.9	3.2	3.3	3.3	3.2	3.2	3.2
14.400	3.2	3.1	3.1	3.1	3.0	3.0	3.0
15.100	2.8	2.6	2.5	2.5	2.4	2.4	2.4
15.800	2.4	2.3	2.3	2.3	2.3	2.2	2.2
16.500	2.2	2.2	2.1	2.1	2.1	2.1	2.1
17.200	2.0	2.0	2.0	2.0	1.9	1.9	1.9
17.900	1.9	1.8	1.8	1.8	1.8	1.8	1.7
18.600	1.7	1.7	1.7	1.6	1.6	1.6	1.6
19.300	1.5	1.5	1.5	1.5	1.5	1.4	1.4
20.000	1.4	1.4	1.3	1.3	1.3	1.3	1.2
20.700	1.2	1.2	1.2	1.2	1.1	1.1	1.1
21.400	1.1	1.0	1.0	1.0	1.0	0.9	0.9
22.100	0.9	0.9	0.8	0.8	0.8	0.8	0.8
22.800	0.7	0.7	0.7	0.7	0.6	0.6	0.6
23.500	0.6	0.5	0.5	0.0			

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 4B	0.094		6.681		12.30	262.1	2796.13

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
3.900	0.0	0.6	0.7	0.9	1.1	1.3	1.4
4.600	1.6	1.8	2.0	2.2	2.4	2.6	2.8
5.300	3.0	3.2	3.4	3.6	3.8	4.0	4.2
6.000	4.4	4.7	4.9	5.1	5.3	5.5	5.8
6.700	6.0	6.2	6.4	6.7	6.9	7.1	7.3
7.400	7.6	7.8	8.0	8.2	8.5	8.7	8.9
8.100	9.2	9.4	9.6	9.8	10.1	10.3	10.5

NOAA 14 precipitation, smoothed values Ohio River Basin
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Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
8.800	10.7	11.0	11.2	11.5	12.1	13.0	13.7
9.500	14.2	14.6	15.0	15.3	15.7	16.0	16.3
10.200	16.6	16.9	17.2	17.5	17.3	15.7	13.9
10.900	13.9	15.9	19.0	22.6	26.7	31.0	35.4
11.600	40.8	50.2	65.4	88.0	119.4	168.8	234.8
12.300	261.9	233.8	184.9	143.6	109.8	84.4	67.1
13.000	55.5	47.1	40.2	34.1	28.6	23.4	19.1
13.700	17.8	19.0	20.5	21.1	21.4	21.4	21.4
14.400	21.2	21.1	20.9	20.7	20.5	20.3	20.1
15.100	19.8	19.0	18.0	17.2	16.7	16.4	16.2
15.800	16.0	15.8	15.6	15.5	15.3	15.2	15.0
16.500	14.9	14.7	14.5	14.4	14.2	14.1	13.9
17.200	13.8	13.6	13.5	13.3	13.2	13.0	12.9
17.900	12.7	12.6	12.4	12.3	12.1	11.9	11.8
18.600	11.6	11.5	11.3	11.2	11.0	10.9	10.7
19.300	10.6	10.4	10.2	10.1	9.9	9.8	9.6
20.000	9.5	9.3	9.2	9.0	8.8	8.7	8.5
20.700	8.4	8.2	8.1	7.9	7.8	7.6	7.4
21.400	7.3	7.1	7.0	6.8	6.7	6.5	6.4
22.100	6.2	6.0	5.9	5.7	5.6	5.4	5.3
22.800	5.1	5.0	4.8	4.6	4.5	4.3	4.2
23.500	4.0	3.9	3.7	3.5	3.4	3.2	3.0
24.200	2.3	1.4	0.7	0.0			

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 2	3.919	Upstream	5.921	368.21	13.17	4199.6	1071.67

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
3.900	0.0	0.6	0.7	0.9	1.7	2.1	2.8
4.600	3.7	4.4	5.1	5.8	6.5	7.3	8.3
5.300	9.7	11.7	13.4	15.5	17.9	20.7	23.9
6.000	27.6	31.6	35.9	40.7	45.8	51.1	56.8
6.700	62.7	68.8	75.2	81.8	88.5	95.4	102.5
7.400	109.7	117.0	124.5	132.1	139.8	147.7	155.6
8.100	163.6	171.8	180.0	188.3	196.6	205.1	213.6
8.800	222.2	230.8	239.5	248.5	258.2	268.7	279.8
9.500	291.2	303.1	315.4	328.3	341.5	355.2	369.2
10.200	383.5	397.9	412.4	426.8	439.9	449.7	457.7
10.900	466.1	476.9	490.6	507.8	529.5	556.6	590.6
11.600	634.6	697.3	786.8	915.2	1097.0	1369.2	1737.3
12.300	2116.3	2478.0	2810.0	3130.1	3431.3	3698.3	3920.5
13.000	4084.0	4176.6	4198.9	4155.3	4042.5	3877.8	3672.1
13.700	3436.0	3177.5	2911.2	2660.1	2433.8	2230.0	2049.1
14.400	1890.6	1752.1	1629.9	1521.2	1427.7	1347.3	1277.5
15.100	1216.6	1162.6	1114.1	1069.8	1028.7	991.3	956.7

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
15.800	924.5	894.5	866.6	840.5	815.9	793.0	771.6
16.500	752.0	733.8	716.9	701.5	687.6	674.7	662.5
17.200	650.9	639.8	629.1	618.7	608.9	599.5	590.7
17.900	582.7	575.3	568.1	561.2	554.4	547.8	541.3
18.600	534.9	528.5	522.3	516.0	509.8	503.6	497.3
19.300	491.1	484.9	478.7	472.5	466.3	460.1	453.9
20.000	447.7	441.5	435.4	429.2	423.0	416.8	410.6
20.700	404.4	398.2	392.0	385.8	379.6	373.4	367.2
21.400	361.0	354.7	348.5	342.3	336.1	329.8	323.6
22.100	317.4	311.1	304.9	298.6	292.4	286.1	279.9
22.800	273.6	267.3	261.0	254.8	248.5	242.2	235.9
23.500	229.7	223.4	217.1	210.5	204.0	197.7	191.2
24.200	183.8	175.3	166.2	156.4	146.7	136.6	126.2
24.900	115.4	104.0	93.7	83.7	74.2	65.2	57.0
25.600	49.5	42.7	36.9	31.9	27.6	23.9	20.7
26.300	17.9	15.5	13.4	11.6	10.0	8.7	7.5
27.000	6.4	5.6	4.8	4.1	3.5	3.0	2.6
27.700	2.2	1.9	1.6	1.4	1.2	1.0	0.8
28.400	0.7	0.0					

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 2	3.919	Downstream	5.921	368.21	13.21	4197.9	1071.23

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
4.200	0.0	1.3	2.0	2.4	3.6	4.2	4.9
4.900	5.6	6.3	7.1	8.0	9.3	11.2	12.9
5.600	14.9	17.2	19.9	23.0	26.5	30.4	34.7
6.300	39.3	44.3	49.6	55.1	61.0	67.1	73.4
7.000	79.9	86.5	93.4	100.4	107.6	114.9	122.3
7.700	129.9	137.6	145.4	153.3	161.3	169.4	177.6
8.400	185.9	194.2	202.6	211.1	219.7	228.3	237.0
9.100	245.8	255.4	265.6	276.5	287.9	299.6	311.8
9.800	324.5	337.7	351.3	365.2	379.4	393.7	408.2
10.500	422.6	436.3	447.1	455.4	463.6	473.6	486.4
11.200	502.5	522.8	548.3	580.2	620.9	677.6	758.5
11.900	874.7	1039.2	1281.6	1626.9	2008.1	2376.4	2715.3
12.600	3038.6	3345.6	3624.5	3860.7	4041.2	4155.0	4197.1
13.300	4172.3	4080.3	3929.0	3734.3	3506.4	3253.2	2987.4
14.000	2731.4	2497.5	2287.3	2099.6	1934.5	1791.0	1664.2
14.700	1551.7	1453.8	1369.7	1296.9	1233.5	1177.8	1127.8
15.400	1082.4	1040.3	1001.9	966.5	933.7	903.0	874.5
16.100	847.9	822.9	799.5	777.7	757.5	739.0	721.7
16.800	705.8	691.5	678.4	666.0	654.2	643.0	632.1
17.500	621.7	611.7	602.1	593.2	585.0	577.4	570.2
18.200	563.2	556.4	549.7	543.2	536.7	530.4	524.1

NOAA 14 precipitation, smoothed values Ohio River Basin
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Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
18.900	517.8	511.6	505.4	499.1	492.9	486.7	480.5
19.600	474.3	468.1	461.9	455.7	449.5	443.3	437.1
20.300	431.0	424.8	418.6	412.4	406.2	400.0	393.8
21.000	387.6	381.4	375.2	369.0	362.8	356.5	350.3
21.700	344.1	337.9	331.6	325.4	319.2	312.9	306.7
22.400	300.4	294.2	287.9	281.7	275.4	269.1	262.9
23.100	256.6	250.3	244.0	237.8	231.5	225.2	218.9
23.800	212.6	205.8	199.6	193.1	186.0	177.8	168.9
24.500	159.2	149.5	139.6	129.2	118.5	107.2	96.6
25.200	86.6	76.9	67.8	59.3	51.6	44.6	38.5
25.900	33.2	28.8	24.9	21.6	18.7	16.2	14.0
26.600	12.1	10.5	9.0	7.8	6.7	5.8	5.0
27.300	4.3	3.7	3.2	2.7	2.3	2.0	1.7
28.000	1.4	1.2	1.0	0.9	0.7	0.0	

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 5	0.133		6.205		12.26	370.6	2790.14

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
4.600	0.5	0.7	0.9	1.2	1.4	1.6	1.9
5.300	2.1	2.4	2.6	2.9	3.1	3.4	3.7
6.000	3.9	4.2	4.5	4.8	5.1	5.3	5.6
6.700	5.9	6.2	6.5	6.8	7.1	7.4	7.7
7.400	8.0	8.3	8.6	9.0	9.3	9.6	9.9
8.100	10.2	10.5	10.8	11.2	11.5	11.8	12.1
8.800	12.4	12.7	13.1	13.5	14.5	15.6	16.4
9.500	17.1	17.6	18.1	18.6	19.0	19.5	19.9
10.200	20.3	20.8	21.2	21.7	21.3	18.6	16.5
10.900	17.4	20.6	25.0	30.0	35.4	41.1	47.0
11.600	54.6	68.8	91.5	124.7	170.8	246.6	346.1
12.300	363.4	302.2	232.0	177.0	133.5	102.5	82.6
13.000	69.5	59.5	51.0	43.5	36.4	29.5	24.1
13.700	23.9	26.6	28.6	29.4	29.6	29.6	29.5
14.400	29.2	29.0	28.7	28.5	28.2	27.9	27.6
15.100	27.1	25.8	24.4	23.4	22.9	22.5	22.2
15.800	21.9	21.7	21.5	21.3	21.1	20.9	20.7
16.500	20.5	20.3	20.1	19.8	19.6	19.4	19.2
17.200	19.0	18.8	18.6	18.4	18.2	18.0	17.7
17.900	17.5	17.3	17.1	16.9	16.7	16.5	16.3
18.600	16.1	15.8	15.6	15.4	15.2	15.0	14.8
19.300	14.6	14.4	14.1	13.9	13.7	13.5	13.3
20.000	13.1	12.8	12.6	12.4	12.2	12.0	11.8
20.700	11.6	11.4	11.1	10.9	10.7	10.5	10.3
21.400	10.1	9.8	9.6	9.4	9.2	9.0	8.8
22.100	8.5	8.3	8.1	7.9	7.7	7.5	7.3

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
22.800	7.0	6.8	6.6	6.4	6.2	6.0	5.7
23.500	5.5	5.3	5.1	4.9	4.6	4.4	4.0
24.200	2.8	1.5	0.7	0.0			

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 6A	0.047		6.675		12.39	111.4	2376.25

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
4.300	0.0	0.5	0.6	0.7	0.8	0.9	1.0
5.000	1.1	1.2	1.2	1.3	1.4	1.6	1.7
5.700	1.8	1.9	2.0	2.1	2.2	2.3	2.4
6.400	2.5	2.6	2.7	2.8	2.9	3.1	3.2
7.100	3.3	3.4	3.5	3.6	3.7	3.8	4.0
7.800	4.1	4.2	4.3	4.4	4.5	4.6	4.8
8.500	4.9	5.0	5.1	5.2	5.3	5.4	5.6
9.200	5.8	6.1	6.4	6.7	7.0	7.2	7.4
9.900	7.6	7.7	7.9	8.1	8.2	8.4	8.5
10.600	8.6	8.3	7.8	7.4	7.5	8.3	9.5
11.300	11.1	12.9	14.9	17.2	20.4	25.3	32.8
12.000	43.7	60.2	82.6	103.6	111.4	105.8	91.5
12.700	74.9	60.6	48.9	39.8	33.0	27.7	23.4
13.400	19.8	16.5	13.7	11.6	10.6	10.4	10.5
14.100	10.6	10.7	10.7	10.7	10.6	10.5	10.5
14.800	10.4	10.3	10.2	10.1	9.8	9.5	9.1
15.500	8.8	8.5	8.3	8.2	8.1	8.0	7.9
16.200	7.8	7.7	7.6	7.5	7.5	7.4	7.3
16.900	7.2	7.2	7.1	7.0	6.9	6.8	6.8
17.600	6.7	6.6	6.5	6.5	6.4	6.3	6.2
18.300	6.2	6.1	6.0	5.9	5.8	5.8	5.7
19.000	5.6	5.5	5.5	5.4	5.3	5.2	5.2
19.700	5.1	5.0	4.9	4.8	4.8	4.7	4.6
20.400	4.5	4.5	4.4	4.3	4.2	4.1	4.1
21.100	4.0	3.9	3.8	3.8	3.7	3.6	3.5
21.800	3.4	3.4	3.3	3.2	3.1	3.1	3.0
22.500	2.9	2.8	2.7	2.7	2.6	2.5	2.4
23.200	2.4	2.3	2.2	2.1	2.0	2.0	1.9
23.900	1.8	1.7	1.6	1.4	1.1	0.8	0.5
24.600	0.0						

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 6B	0.014		7.704		12.13	64.5	4586.90

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
2.800	0.0	0.5	0.5	0.6	0.6	0.7	0.7
3.500	0.7	0.8	0.8	0.8	0.9	0.9	0.9
4.200	1.0	1.0	1.0	1.1	1.1	1.1	1.2
4.900	1.2	1.2	1.3	1.3	1.3	1.4	1.4
5.600	1.4	1.5	1.5	1.5	1.6	1.6	1.6
6.300	1.7	1.7	1.7	1.7	1.8	1.8	1.8
7.000	1.9	1.9	1.9	2.0	2.0	2.0	2.0
7.700	2.1	2.1	2.1	2.2	2.2	2.2	2.2
8.400	2.3	2.3	2.3	2.3	2.4	2.4	2.4
9.100	2.7	2.9	2.9	3.0	3.0	3.1	3.1
9.800	3.1	3.2	3.2	3.2	3.3	3.3	3.3
10.500	3.4	2.2	2.0	2.7	3.4	4.2	5.0
11.200	5.7	6.5	7.3	8.1	11.0	14.6	20.1
11.900	26.3	36.7	60.7	43.8	26.9	19.1	14.3
12.600	10.2	8.2	7.3	6.5	5.7	5.0	4.2
13.300	3.4	2.6	1.8	2.8	3.4	3.4	3.4
14.000	3.4	3.3	3.3	3.3	3.2	3.2	3.2
14.700	3.1	3.1	3.1	3.0	2.7	2.6	2.5
15.400	2.5	2.5	2.5	2.4	2.4	2.4	2.4
16.100	2.3	2.3	2.3	2.3	2.2	2.2	2.2
16.800	2.2	2.1	2.1	2.1	2.1	2.0	2.0
17.500	2.0	2.0	2.0	1.9	1.9	1.9	1.9
18.200	1.8	1.8	1.8	1.8	1.7	1.7	1.7
18.900	1.7	1.6	1.6	1.6	1.6	1.5	1.5
19.600	1.5	1.5	1.5	1.4	1.4	1.4	1.4
20.300	1.3	1.3	1.3	1.3	1.2	1.2	1.2
21.000	1.2	1.1	1.1	1.1	1.1	1.0	1.0
21.700	1.0	1.0	0.9	0.9	0.9	0.9	0.9
22.400	0.8	0.8	0.8	0.8	0.7	0.7	0.7
23.100	0.7	0.6	0.6	0.6	0.6	0.5	0.5
23.800	0.0						

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 3	4.112	Upstream	5.945	354.91	13.20	4280.1	1040.75

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
2.800	0.0	0.5	0.5	0.6	0.6	0.7	0.7
3.500	0.7	0.8	0.8	0.8	0.9	0.9	0.9
4.200	1.0	2.3	3.5	4.1	5.8	6.9	7.9
4.900	8.9	10.0	11.1	12.4	14.1	16.4	18.5
5.600	20.8	23.5	26.7	30.2	34.1	38.4	43.1
6.300	48.1	53.5	59.2	65.2	71.5	78.0	84.8
7.000	91.7	98.8	106.1	113.6	121.2	129.0	136.9
7.700	144.9	153.0	161.3	169.7	178.1	186.7	195.3
8.400	204.0	212.8	221.7	230.7	239.7	248.8	257.9

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
9.100	267.6	278.5	290.2	302.3	314.6	327.2	340.2
9.800	353.6	367.4	381.7	396.2	411.0	426.0	441.1
10.500	456.2	468.4	476.1	482.4	491.8	505.9	524.6
11.200	547.7	575.8	609.6	650.1	703.6	781.2	895.4
11.900	1058.3	1290.2	1648.9	2098.9	2501.4	2808.6	3067.0
12.600	3317.0	3561.9	3794.5	3998.4	4156.0	4252.2	4279.9
13.300	4242.8	4139.3	3977.1	3775.2	3545.6	3294.3	3030.1
14.000	2775.0	2541.4	2331.2	2143.3	1977.9	1834.0	1706.8
14.700	1593.9	1495.6	1411.1	1337.8	1273.5	1216.1	1164.3
15.400	1117.6	1074.6	1035.4	999.6	966.3	935.3	906.4
16.100	879.5	854.1	830.4	808.3	787.8	768.9	751.4
16.800	735.2	720.5	707.1	694.4	682.3	670.7	659.6
17.500	648.8	638.5	628.7	619.4	610.9	603.0	595.4
18.200	588.1	581.0	574.1	567.2	560.5	553.8	547.2
18.900	540.6	534.0	527.5	521.0	514.4	507.9	501.4
19.600	494.9	488.3	481.8	475.3	468.8	462.3	455.8
20.300	449.3	442.8	436.3	429.8	423.3	416.8	410.3
21.000	403.7	397.2	390.7	384.1	377.6	371.1	364.5
21.700	358.0	351.5	344.9	338.3	331.8	325.2	318.7
22.400	312.1	305.5	299.0	292.4	285.8	279.2	272.6
23.100	266.0	259.4	252.8	246.2	239.6	233.0	226.4
23.800	219.2	212.2	205.7	198.7	190.2	180.4	170.4
24.500	159.7	149.5	139.5	129.1	118.5	107.1	96.6
25.200	86.5	76.8	67.7	59.2	51.5	44.6	38.5
25.900	33.2	28.7	24.9	21.6	18.7	16.2	14.0
26.600	12.1	10.5	9.0	7.8	6.7	5.8	5.0
27.300	4.3	3.7	3.2	2.7	2.3	2.0	1.7
28.000	1.4	1.2	1.0	0.9	0.7	0.0	

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 3	4.112	Downstream	5.944	354.90	13.25	4271.5	1038.67

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
4.300	0.0	1.1	3.5	4.8	6.2	7.3	8.3
5.000	9.4	10.4	11.6	13.1	15.1	17.2	19.4
5.700	21.9	24.8	28.0	31.7	35.8	40.2	45.1
6.400	50.3	55.8	61.6	67.7	74.1	80.7	87.5
7.100	94.5	101.7	109.1	116.6	124.3	132.1	140.0
7.800	148.1	156.3	164.6	173.0	181.5	190.1	198.8
8.500	207.5	216.4	225.3	234.2	243.3	252.4	261.7
9.200	271.9	283.1	295.0	307.2	319.6	332.4	345.5
9.900	359.1	373.1	387.4	402.1	417.0	432.0	447.1
10.600	461.2	471.3	478.4	486.1	497.4	513.4	533.8
11.300	558.9	589.2	625.7	671.1	734.3	826.3	959.9
12.000	1149.8	1430.6	1833.7	2261.7	2621.2	2908.0	3165.4

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
12.700	3413.7	3654.8	3875.2	4060.5	4193.6	4262.2	4264.3
13.400	4201.4	4073.7	3896.0	3683.6	3445.5	3189.0	2928.8
14.100	2682.6	2458.6	2257.0	2078.2	1921.5	1784.0	1662.4
14.800	1555.3	1462.3	1382.3	1312.6	1251.0	1195.7	1145.9
15.500	1100.6	1059.1	1021.3	986.4	954.0	923.9	895.8
16.200	869.5	844.7	821.7	800.2	780.4	762.0	745.0
16.900	729.4	715.2	702.1	689.6	677.7	666.3	655.3
17.600	644.8	634.6	625.0	616.0	607.8	600.0	592.6
18.300	585.3	578.3	571.4	564.5	557.8	551.2	544.6
19.000	538.0	531.5	524.9	518.4	511.8	505.3	498.8
19.700	492.3	485.8	479.3	472.8	466.3	459.7	453.2
20.400	446.7	440.2	433.7	427.2	420.7	414.2	407.7
21.100	401.2	394.6	388.1	381.6	375.0	368.5	362.0
21.800	355.4	348.9	342.3	335.8	329.2	322.6	316.1
22.500	309.5	302.9	296.4	289.8	283.2	276.6	270.0
23.200	263.4	256.8	250.2	243.6	237.0	230.4	223.6
23.900	216.4	209.7	202.9	195.3	186.3	176.4	166.1
24.600	155.6	145.5	135.4	124.9	114.0	103.0	92.6
25.300	82.6	73.2	64.3	56.2	48.8	42.2	36.4
26.000	31.4	27.2	23.6	20.4	17.7	15.3	13.3
26.700	11.5	9.9	8.5	7.4	6.4	5.5	4.7
27.400	4.1	3.5	3.0	2.6	2.2	1.9	1.6
28.100	1.3	1.1	1.0	0.8	0.0		

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 7	0.030		6.908		12.23	94.0	3166.28

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
4.000	0.0	0.5	0.6	0.6	0.7	0.8	0.8
4.700	0.9	1.0	1.0	1.1	1.2	1.2	1.3
5.400	1.4	1.4	1.5	1.6	1.6	1.7	1.8
6.100	1.9	1.9	2.0	2.1	2.1	2.2	2.3
6.800	2.4	2.4	2.5	2.6	2.6	2.7	2.8
7.500	2.9	2.9	3.0	3.1	3.2	3.2	3.3
8.200	3.4	3.4	3.5	3.6	3.6	3.7	3.8
8.900	3.9	3.9	4.1	4.4	4.7	4.9	5.0
9.600	5.1	5.2	5.3	5.4	5.5	5.6	5.7
10.300	5.8	5.9	6.0	5.8	4.8	4.3	4.8
11.000	5.8	7.0	8.4	9.8	11.3	12.8	14.9
11.700	19.0	25.3	34.3	46.4	67.0	91.7	87.8
12.400	67.3	50.4	37.6	27.9	21.5	17.6	15.0
13.100	13.0	11.2	9.5	7.9	6.3	5.2	5.6
13.800	6.4	6.8	6.9	6.9	6.9	6.8	6.8
14.500	6.7	6.6	6.6	6.5	6.4	6.4	6.2
15.200	5.9	5.5	5.4	5.2	5.2	5.1	5.1

NOAA 14 precipitation, smoothed values Ohio River Basin
Lat (dd): 39.1913 Lon (dd): -77.2120° MD Montgomery County

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
15.900	5.0	5.0	4.9	4.9	4.8	4.8	4.7
16.600	4.7	4.6	4.6	4.5	4.5	4.4	4.4
17.300	4.3	4.3	4.2	4.2	4.1	4.1	4.0
18.000	4.0	3.9	3.9	3.8	3.8	3.7	3.7
18.700	3.6	3.6	3.5	3.5	3.4	3.4	3.3
19.400	3.3	3.2	3.2	3.1	3.1	3.0	3.0
20.100	2.9	2.9	2.8	2.8	2.7	2.7	2.6
20.800	2.6	2.5	2.5	2.4	2.4	2.3	2.3
21.500	2.2	2.2	2.1	2.1	2.0	2.0	1.9
22.200	1.9	1.8	1.8	1.7	1.7	1.6	1.6
22.900	1.5	1.5	1.4	1.4	1.3	1.3	1.2
23.600	1.2	1.1	1.1	1.0	1.0	0.9	0.6
24.300	0.0						

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 8	0.077		6.799		12.29	211.2	2758.83

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
3.800	0.0	0.6	0.7	0.9	1.0	1.2	1.3
4.500	1.5	1.6	1.8	1.9	2.1	2.3	2.4
5.200	2.6	2.8	2.9	3.1	3.3	3.5	3.6
5.900	3.8	4.0	4.2	4.4	4.5	4.7	4.9
6.600	5.1	5.3	5.5	5.7	5.8	6.0	6.2
7.300	6.4	6.6	6.8	7.0	7.1	7.3	7.5
8.000	7.7	7.9	8.1	8.3	8.4	8.6	8.8
8.700	9.0	9.2	9.4	9.5	9.8	10.3	10.9
9.400	11.5	12.0	12.4	12.7	13.0	13.2	13.5
10.100	13.7	14.0	14.2	14.5	14.7	14.6	13.4
10.800	12.0	11.8	13.1	15.5	18.5	21.8	25.3
11.500	28.9	33.4	40.6	52.4	70.1	94.7	133.0
12.200	184.8	211.2	195.0	158.0	123.7	95.5	73.8
12.900	58.4	48.1	40.5	34.5	29.3	24.5	20.1
13.600	16.5	15.0	15.6	16.7	17.3	17.5	17.6
14.300	17.6	17.5	17.3	17.2	17.0	16.9	16.7
15.000	16.5	16.3	15.7	14.9	14.3	13.8	13.5
15.700	13.3	13.1	13.0	12.9	12.7	12.6	12.5
16.400	12.3	12.2	12.1	12.0	11.8	11.7	11.6
17.100	11.5	11.3	11.2	11.1	11.0	10.8	10.7
17.800	10.6	10.5	10.3	10.2	10.1	10.0	9.8
18.500	9.7	9.6	9.4	9.3	9.2	9.1	8.9
19.200	8.8	8.7	8.6	8.4	8.3	8.2	8.0
19.900	7.9	7.8	7.7	7.5	7.4	7.3	7.2
20.600	7.0	6.9	6.8	6.6	6.5	6.4	6.3
21.300	6.1	6.0	5.9	5.8	5.6	5.5	5.4
22.000	5.2	5.1	5.0	4.9	4.7	4.6	4.5

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
22.700	4.4	4.2	4.1	4.0	3.8	3.7	3.6
23.400	3.5	3.3	3.2	3.1	2.9	2.8	2.7
24.100	2.5	2.0	1.3	0.7	0.0		

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 4	4.219	Upstream	5.967	352.90	13.24	4313.9	1022.55

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
3.800	0.0	0.6	0.7	1.4	1.6	1.8	3.1
4.500	5.8	7.2	8.8	10.1	11.4	12.7	14.0
5.200	15.4	17.1	19.4	21.7	24.2	26.9	30.1
5.900	33.6	37.5	41.8	46.5	51.6	57.1	62.8
6.600	68.9	75.3	81.9	88.8	95.9	103.1	110.6
7.300	118.2	126.0	133.9	142.0	150.2	158.5	167.0
8.000	175.5	184.2	192.9	201.8	210.7	219.7	228.8
8.700	238.0	247.2	256.5	265.8	275.6	286.6	298.7
9.400	311.4	324.2	337.1	350.2	363.8	377.7	392.0
10.100	406.7	421.7	437.0	452.4	467.8	481.5	489.5
10.800	494.7	502.6	516.4	535.9	560.7	590.5	625.8
11.500	667.4	719.3	793.9	904.0	1064.3	1290.9	1630.6
12.200	2110.1	2560.7	2883.5	3116.4	3326.8	3537.2	3750.1
12.900	3951.2	4123.6	4247.0	4307.8	4303.2	4233.8	4100.1
13.600	3917.7	3704.2	3467.5	3212.4	2953.0	2707.0	2483.1
14.300	2281.4	2102.4	1945.6	1807.9	1686.0	1578.6	1485.5
15.000	1405.2	1335.1	1272.6	1216.2	1165.6	1119.7	1077.8
15.700	1039.7	1004.6	972.0	941.7	913.4	886.9	862.0
16.400	838.8	817.1	797.2	778.6	761.4	745.7	731.3
17.100	717.9	705.3	693.3	681.7	670.5	659.8	649.5
17.800	639.7	630.5	622.1	614.1	606.5	599.1	591.9
18.500	584.8	577.8	570.9	564.1	557.3	550.5	543.8
19.200	537.1	530.4	523.7	517.0	510.3	503.6	496.9
19.900	490.2	483.6	476.9	470.2	463.5	456.8	450.1
20.600	443.4	436.7	430.1	423.4	416.7	410.0	403.3
21.300	396.6	389.9	383.2	376.4	369.7	363.0	356.3
22.000	349.5	342.8	336.1	329.3	322.6	315.8	309.1
22.700	302.4	295.6	288.8	282.0	275.3	268.5	261.7
23.400	255.0	248.2	241.4	234.6	227.6	220.3	213.3
24.100	206.3	197.7	187.5	177.1	166.1	155.6	145.5
24.800	135.4	124.9	114.0	103.0	92.6	82.7	73.2
25.500	64.3	56.2	48.8	42.2	36.4	31.4	27.2
26.200	23.6	20.4	17.7	15.3	13.3	11.5	9.9
26.900	8.5	7.4	6.4	5.5	4.7	4.1	3.5
27.600	3.0	2.6	2.2	1.9	1.6	1.3	1.1
28.300	1.0	0.8	0.0				

NOAA 14 precipitation, smoothed values Ohio River Basin
Lat (dd): 39.1913 Lon (dd): -77.2120° MD Montgomery County

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach 4	4.219	Downstream	5.966	352.90	13.29	4311.4	1021.97

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
4.100	0.0	1.3	1.7	1.9	4.8	6.5	8.1
4.800	9.5	10.8	12.1	13.4	14.7	16.3	18.3
5.500	20.6	23.0	25.6	28.5	31.8	35.5	39.7
6.200	44.2	49.1	54.4	60.0	65.9	72.2	78.7
6.900	85.4	92.4	99.6	106.9	114.5	122.2	130.0
7.600	138.0	146.2	154.4	162.8	171.3	180.0	188.7
8.300	197.4	206.3	215.3	224.4	233.5	242.7	251.9
9.000	261.3	270.7	281.1	292.7	305.2	318.0	330.8
9.700	343.8	357.1	370.9	385.0	399.5	414.4	429.5
10.400	444.8	460.2	475.2	486.1	492.1	498.3	509.1
11.100	525.9	548.1	575.5	608.0	646.5	692.5	754.8
11.800	846.4	981.0	1173.0	1450.6	1870.4	2351.0	2736.5
12.500	3007.3	3224.3	3434.3	3646.4	3854.7	4043.0	4191.9
13.200	4284.0	4311.2	4273.5	4170.4	4010.1	3810.6	3584.9
13.900	3338.2	3079.0	2825.3	2590.4	2377.9	2187.9	2020.3
14.600	1873.6	1744.2	1629.8	1529.7	1443.4	1368.6	1302.5
15.300	1243.2	1189.8	1141.7	1097.9	1058.1	1021.5	987.7
16.000	956.3	927.1	899.7	874.0	850.0	827.5	806.8
16.700	787.5	769.6	753.2	738.2	724.4	711.4	699.1
17.400	687.3	675.9	665.0	654.5	644.4	634.9	626.1
18.100	618.0	610.2	602.7	595.4	588.2	581.2	574.2
18.800	567.4	560.6	553.8	547.1	540.4	533.7	527.0
19.500	520.3	513.6	506.9	500.2	493.5	486.8	480.1
20.200	473.4	466.7	460.1	453.4	446.7	440.0	433.3
20.900	426.6	420.0	413.3	406.6	399.8	393.1	386.4
21.600	379.7	373.0	366.3	359.6	352.8	346.1	339.4
22.300	332.6	325.9	319.1	312.4	305.7	298.9	292.1
23.000	285.3	278.6	271.8	265.0	258.3	251.5	244.7
23.700	237.9	231.1	223.8	216.7	209.8	202.1	192.4
24.400	182.2	171.5	160.7	150.4	140.4	130.0	119.4
25.100	108.3	97.6	87.5	77.8	68.6	60.1	52.3
25.800	45.3	39.1	33.8	29.2	25.3	21.9	19.0
26.500	16.5	14.2	12.3	10.6	9.2	7.9	6.8
27.200	5.9	5.1	4.4	3.8	3.2	2.8	2.4
27.900	2.0	1.7	1.5	1.2	1.0	0.9	0.0

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
DA 9	0.155		6.325		12.28	432.6	2796.50

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
4.300	0.0	0.6	0.8	1.1	1.3	1.6	1.9
5.000	2.1	2.4	2.7	3.0	3.3	3.6	3.9
5.700	4.3	4.6	4.9	5.2	5.6	5.9	6.2
6.400	6.6	6.9	7.3	7.6	8.0	8.3	8.7
7.100	9.0	9.4	9.7	10.1	10.5	10.8	11.2
7.800	11.6	11.9	12.3	12.7	13.0	13.4	13.8
8.500	14.2	14.5	14.9	15.3	15.6	16.0	16.5
9.200	17.6	19.0	20.0	20.8	21.4	22.0	22.5
9.900	23.1	23.6	24.1	24.6	25.1	25.7	26.1
10.600	25.7	22.7	20.1	20.9	24.6	29.7	35.6
11.300	42.0	48.8	55.8	64.7	81.0	107.4	145.8
12.000	199.1	286.2	400.7	427.4	361.1	278.4	213.2
12.700	161.1	123.7	99.3	83.2	71.1	60.9	51.9
13.400	43.5	35.3	28.8	28.2	31.1	33.5	34.4
14.100	34.7	34.7	34.6	34.3	34.0	33.7	33.4
14.800	33.1	32.8	32.4	31.8	30.4	28.8	27.6
15.500	26.9	26.4	26.1	25.8	25.5	25.3	25.0
16.200	24.7	24.5	24.3	24.0	23.8	23.5	23.3
16.900	23.0	22.8	22.5	22.3	22.1	21.8	21.6
17.600	21.3	21.1	20.8	20.6	20.3	20.1	19.8
18.300	19.6	19.3	19.1	18.8	18.6	18.3	18.1
19.000	17.8	17.6	17.3	17.1	16.8	16.6	16.3
19.700	16.1	15.8	15.6	15.3	15.1	14.8	14.6
20.400	14.3	14.1	13.8	13.6	13.3	13.1	12.8
21.100	12.6	12.3	12.0	11.8	11.5	11.3	11.0
21.800	10.8	10.5	10.3	10.0	9.8	9.5	9.3
22.500	9.0	8.8	8.5	8.2	8.0	7.7	7.5
23.200	7.2	7.0	6.7	6.5	6.2	6.0	5.7
23.900	5.5	5.2	4.7	3.4	1.9	0.9	0.0

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
OUTLET	4.373		5.979		13.28	4364.6	997.98

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)						
4.100	0.0	1.3	1.7	2.5	5.6	7.5	9.4
4.800	11.1	12.7	14.2	15.8	17.4	19.3	21.6
5.500	24.2	26.9	29.8	33.1	36.7	40.8	45.2
6.200	50.1	55.3	60.9	66.9	73.2	79.8	86.6
6.900	93.7	101.0	108.6	116.3	124.2	132.3	140.5
7.600	148.8	157.4	166.0	174.8	183.6	192.6	201.7
8.300	210.9	220.1	229.5	238.9	248.4	257.9	267.6
9.000	277.3	287.3	298.7	311.7	325.2	338.7	352.2
9.700	365.8	379.7	393.9	408.6	423.6	439.0	454.7
10.400	470.5	486.4	501.0	508.8	512.2	519.2	533.7
11.100	555.6	583.8	617.5	656.8	702.3	757.2	835.9

NOAA 14 precipitation, smoothed values Ohio River Basin
Lat (dd): 39.1913 Lon (dd): -77.2120° MD Montgomery County

Line Start Time (hr)	Flow Values @ time increment of 0.100 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
11.800	953.7	1126.8	1372.1	1736.7	2271.0	2778.1	3097.7
12.500	3285.7	3437.5	3595.4	3770.1	3954.0	4126.2	4263.0
13.200	4344.9	4363.1	4317.0	4205.7	4038.9	3838.7	3616.0
13.900	3371.6	3113.4	2860.0	2625.1	2412.5	2222.2	2054.3
14.600	1907.3	1777.7	1662.9	1562.5	1475.8	1400.4	1333.0
15.300	1272.0	1217.4	1168.6	1124.3	1084.1	1047.3	1013.2
16.000	981.6	952.1	924.5	898.5	874.2	851.6	830.6
16.700	811.1	792.9	776.2	761.0	746.9	733.7	721.2
17.400	709.1	697.5	686.3	675.5	665.2	655.5	646.5
18.100	638.1	630.0	622.3	614.7	607.3	600.0	592.8
18.800	585.7	578.7	571.7	564.7	557.7	550.8	543.8
19.500	536.8	529.9	522.9	516.0	509.1	502.1	495.2
20.200	488.2	481.3	474.4	467.4	460.5	453.6	446.6
20.900	439.7	432.8	425.8	418.8	411.9	404.9	398.0
21.600	391.0	384.1	377.1	370.1	363.1	356.1	349.1
22.300	342.1	335.1	328.1	321.2	314.2	307.1	300.1
23.000	293.1	286.0	279.0	272.0	265.0	258.0	250.9
23.700	243.9	236.8	229.3	221.9	214.5	205.5	194.3
24.400	183.2	171.5	160.7	150.4	140.4	130.0	119.4
25.100	108.3	97.6	87.5	77.8	68.6	60.1	52.3
25.800	45.3	39.1	33.8	29.2	25.3	21.9	19.0
26.500	16.5	14.2	12.3	10.6	9.2	7.9	6.8
27.200	5.9	5.1	4.4	3.8	3.2	2.8	2.4
27.900	2.0	1.7	1.5	1.2	1.0	0.9	0.0

NOAA 14 precipitation, smoothed values Ohio River Basin
Lat (dd): 39.1913 Lon (dd): -77.2120° MD Montgomery County

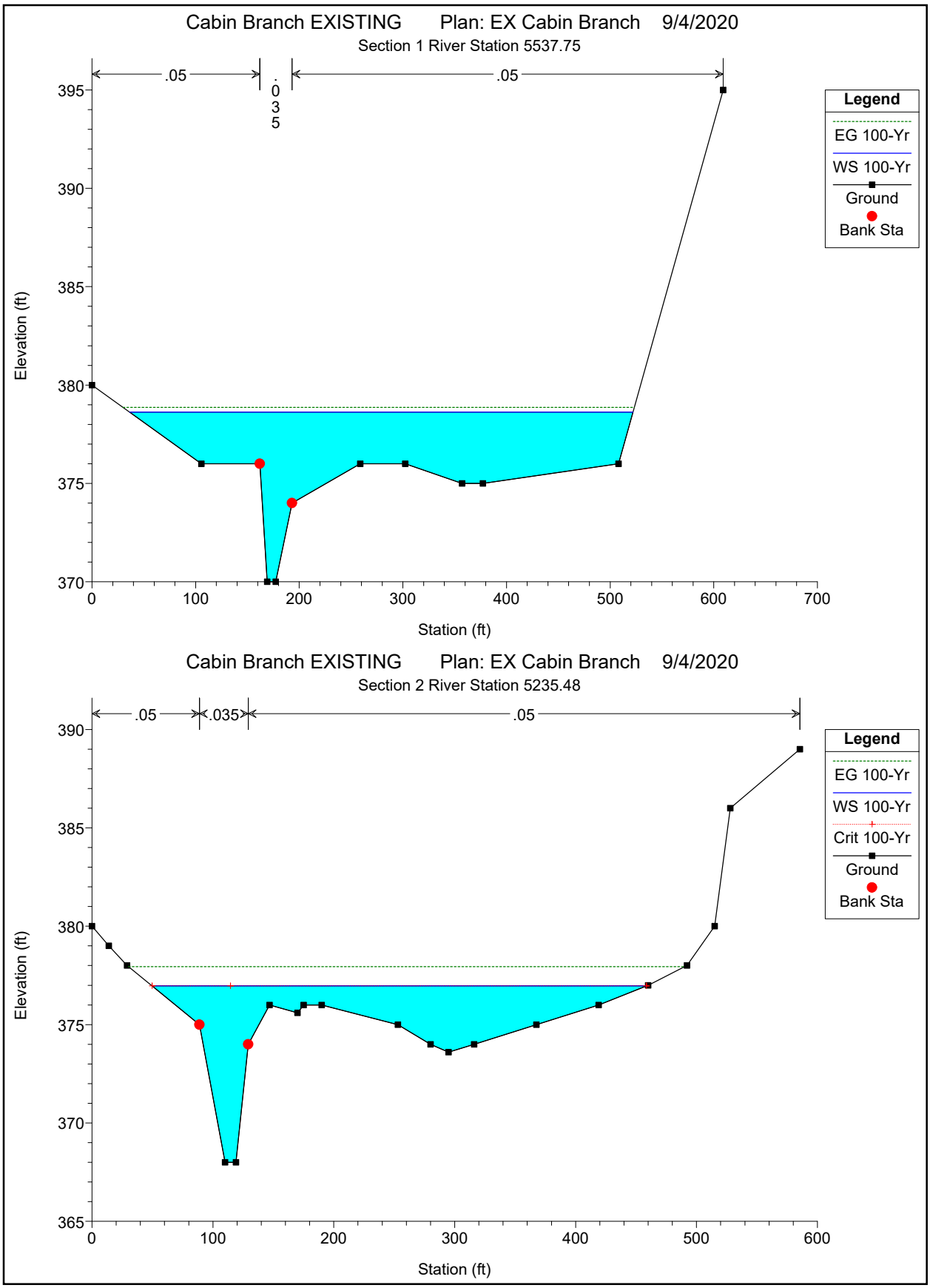
Area or Reach Identifier	Drainage Area (sq mi)	Peak Flow by Storm 2_yr_stm (cfs)	10_yr_stm (cfs)	100_yr_stm (cfs)	(cfs)	(cfs)
DA 1	3.519	1051.4	2078.7	3948.0		
DA 2	0.152	118.5	203.9	333.4		
DA 3	0.141	106.0	180.2	294.5		
DA 5	0.133	132.4	228.6	370.6		
DA 7	0.030	40.9	63.4	94.0		
DA 8	0.077	86.6	138.1	211.2		
DA 9	0.155	159.4	270.1	432.6		
DA 4A	0.014	21.6	33.9	50.7		
DA 4B	0.094	104.9	169.9	262.1		
DA 6A	0.047	42.7	70.6	111.4		
DA 6B	0.014	35.1	47.7	64.5		
Reach 1	3.670	1078.6	2128.1	4054.5		
DOWNSTREAM		1077.7	2124.6	4049.9		
Reach 2	3.919	1120.0	2201.4	4199.6		
DOWNSTREAM		1119.8	2200.7	4197.9		
Reach 3	4.112	1142.0	2240.2	4280.1		
DOWNSTREAM		1131.6	2232.6	4271.5		
Reach 4	4.219	1142.6	2252.6	4313.9		
DOWNSTREAM		1142.4	2251.8	4311.4		
OUTLET	4.373	1155.2	2276.3	4364.6		

Appendix D: Floodplain Impacts Analysis

This analysis was completed by inserting our proposed restoration cross-sections into the approved floodplain study delineation done by VIKA for the proposed adjacent restoration. All elevations are thus in NGVD29 which is approximately 0.7' higher than the elevations shown in the restoration plans which are all in NAVD88.

Cabin Branch 100-YR WSE Comparison											
EXISTING 100YR WSE					PROPOSED 100YR WSE - 9/3/2020						
Reach	River Sta	Profile	Q Total (cfs)	W.S. Elev (ft)	Reach	River Sta	Profile	Q Total (cfs)	W.S. Elev (ft)	Comparison	Notes:
reach 1	5537.75	100-Yr	4467	378.62	reach 1	5537.75	100-Yr	4467	377.24	-1.38	
reach 1	5235.48	100-Yr	4467	376.97	reach 1	5235.48	100-Yr	4467	376.37	-0.60	
reach 1	4897.4	100-Yr	4558	374.25	reach 1	4897.4	100-Yr	4558	374.22	-0.03	
reach 1	4560.78	100-Yr	4558	373.02	reach 1	4560.78	100-Yr	4558	372.97	-0.05	
reach 1	4120.22	100-Yr	4558	371.49	reach 1	4120.22	100-Yr	4558	371.36	-0.13	
reach 1	3727.06	100-Yr	4782	369.17	reach 1	3727.06	100-Yr	4782	369.17	0.00	
reach 1	3333.78	100-Yr	4782	366.70	reach 1	3333.78	100-Yr	4782	366.80	0.10	Futher design development can cut back the right bank/bench further to reduce rise.
reach 1	3038.54	100-Yr	4782	366.74	reach 1	3038.54	100-Yr	4782	366.70	-0.04	
reach 1	2663.59	100-Yr	4782	365.69	reach 1	2663.59	100-Yr	4782	365.63	-0.06	
reach 1	2641.79	100-Yr	4782	365.85	reach 1	2641.79	100-Yr	4782	365.83	-0.02	
reach 1	2566.29		Culvert		reach 1	2566.29		Culvert		0.00	
reach 1	2490.76	100-Yr	4782	362.92	reach 1	2490.76	100-Yr	4782	362.83	-0.09	
reach 1	2477.96	100-Yr	5004	362.08	reach 1	2477.96	100-Yr	5004	361.94	-0.14	
reach 1	2158.36	100-Yr	5004	360.63	reach 1	2158.36	100-Yr	5004	360.39	-0.24	
reach 1	1821.54	100-Yr	5004	358.04	reach 1	1821.54	100-Yr	5004	358.08	0.04	Futher design development can cut back the left bank/bench further to reduce rise.
reach 1	1420.06	100-Yr	5004	356.03	reach 1	1420.06	100-Yr	5004	356.13	0.10	Futher design development can cut back the right bank/bench further to reduce rise.
reach 1	1133.82	100-Yr	5004	355.58	reach 1	1133.82	100-Yr	5004	355.27	-0.31	
reach 1	766.03	100-Yr	5004	354.12	reach 1	766.03	100-Yr	5004	354.24	0.12	Futher design development can cut back the right or left bank/bench further to reduce rise.
reach 1	404.14	100-Yr	5004	354.41	reach 1	404.14	100-Yr	5004	354.45	0.04	Futher design development can flatten the left bank/bench further to reduce rise.
reach 1	139.08	100-Yr	5004	353.88	reach 1	139.08	100-Yr	5004	353.89	0.01	
reach 1	103.57	100-Yr	5004	353.66	reach 1	103.57	100-Yr	5004	353.73	0.07	Further design development will modify tie-in to existing to prevent impact
reach 1	85.37	100-Yr	5004	352.04	reach 1	85.37	100-Yr	5004	351.88	-0.16	
reach 1	49		Bridge		reach 1	49		Bridge		0.00	
reach 1	9.06	100-Yr	5004	350.24	reach 1	9.06	100-Yr	5004	350.24	0.00	
reach 1	0	100-Yr	5004	350.21	reach 1	0	100-Yr	5004	350.21	0.00	
reach 1	-41	100-Yr	5004	345.98	reach 1	-41	100-Yr	5004	345.98	0.00	

Tributary 4 100-YR WSE Comparison											
EXISTING 100YR WSE					***MODIFIED 100YR WSE - 9/4/2020***						
Reach	River Sta	Profile	Q Total (cfs)	W.S. Elev (ft)	Reach	River Sta	Profile	Q Total (cfs)	W.S. Elev (ft)	***Comparison***	***Notes:***
Reach 1	1117.4	100 Yr	307	391.45	Reach 1	1117.4	100 Yr	307	391.45	0.00	
Reach 1	869.4	100 Yr	307	386.97	Reach 1	869.4	100 Yr	307	386.97	0.00	
Reach 1	609.53	100 Yr	307	386.34	Reach 1	609.53	100 Yr	307	386.34	0.00	
Reach 1	532.54	100 Yr	307	375.7	Reach 1	532.54	100 Yr	307	376.19	0.49	Ex. channel was very incised; proposed WSE is still within valley
Reach 1	324.63	100 Yr	487	370.33	Reach 1	324.63	100 Yr	487	371.62	1.29	Ex. channel XS is exagurated in size at this location, rise is within ex. Valley
Reach 1	132.8	100 Yr	487	368.76	Reach 1	132.8	100 Yr	487	368.78	0.02	
Reach 1	0	100 Yr	487	366.49	Reach 1	0	100 Yr	487	366.16	-0.33	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Section 1 River Station 5537.75
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.05
Legend
EG 100-Yr
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
395
390
385
380
375
370
0
100
200
300
400
500
600
700
Station (ft)
Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section 2 River Station 5235.48
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.035
.05
Legend
EG 100-Yr
WS 100-Yr
Crit 100-Yr
Ground
Bank Sta
Elevation (ft)
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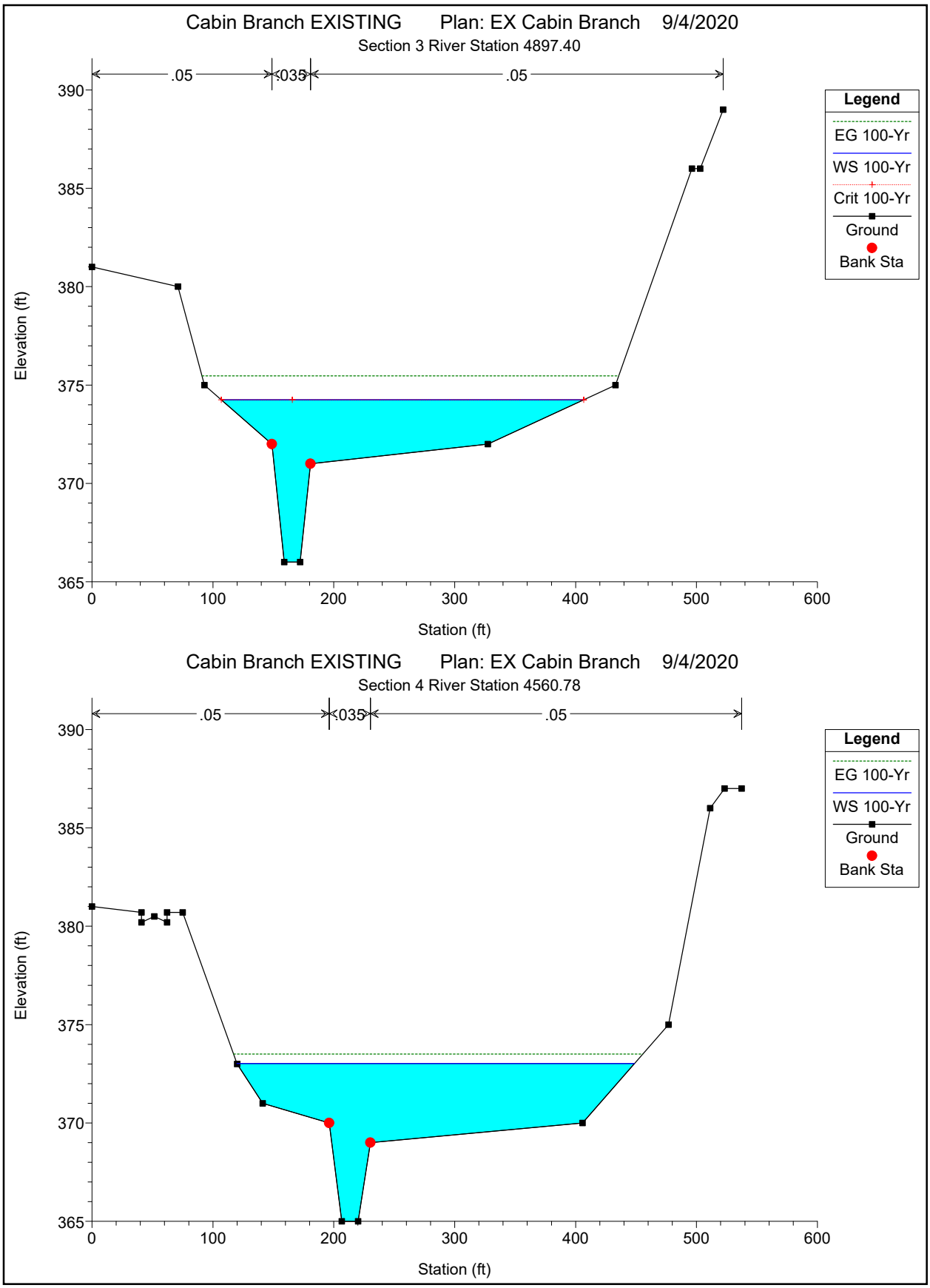
385
380
375
370
365
0
100
200
300
400
500
600
Station (ft)


Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section 3 River Station 4897.40
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.035
.05
Legend
EG 100-Yr
WS 100-Yr
Crit 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
390
385
380
375
370
365
0
100
200
300
400
500
600
Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section 4 River Station 4560.78
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.035
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Legend
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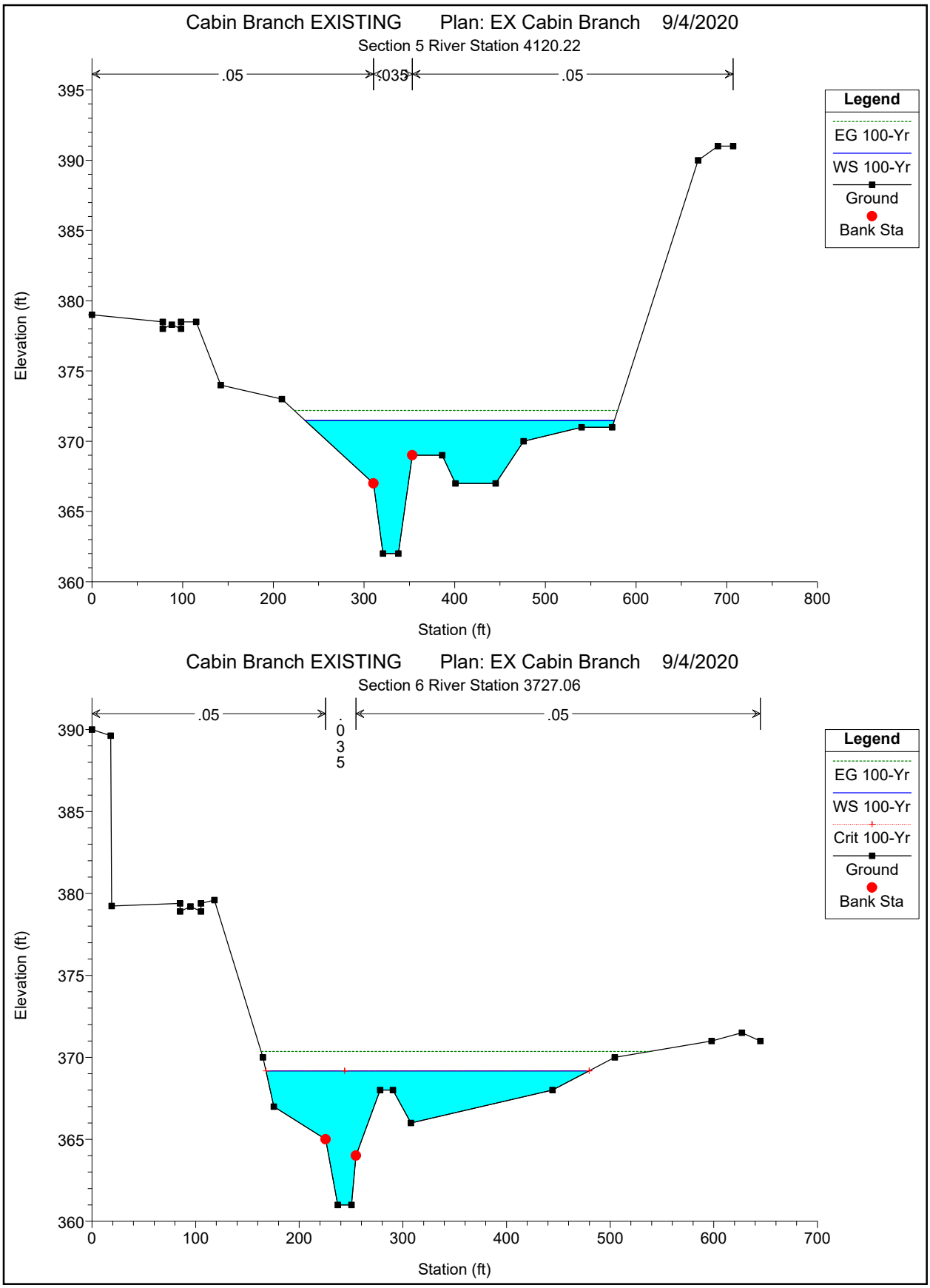
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section 5 River Station 4120.22
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.035
.05
Legend
EG 100-Yr
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section 6 River Station 3727.06
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Legend
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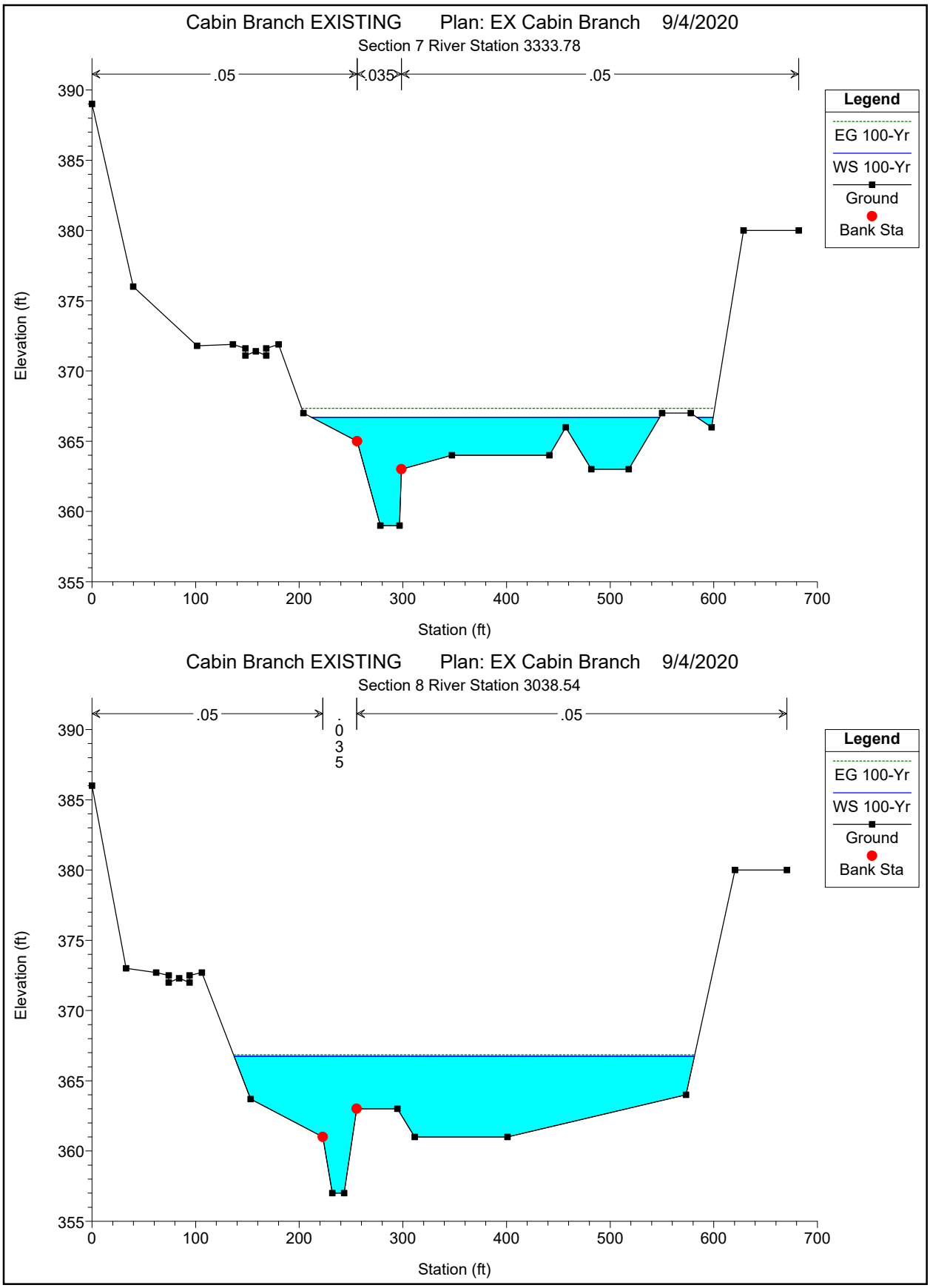
WS 100-Yr
Crit 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section 7 River Station 3333.78
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Legend
EG 100-Yr
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section 8 River Station 3038.54
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.035
.05
Legend
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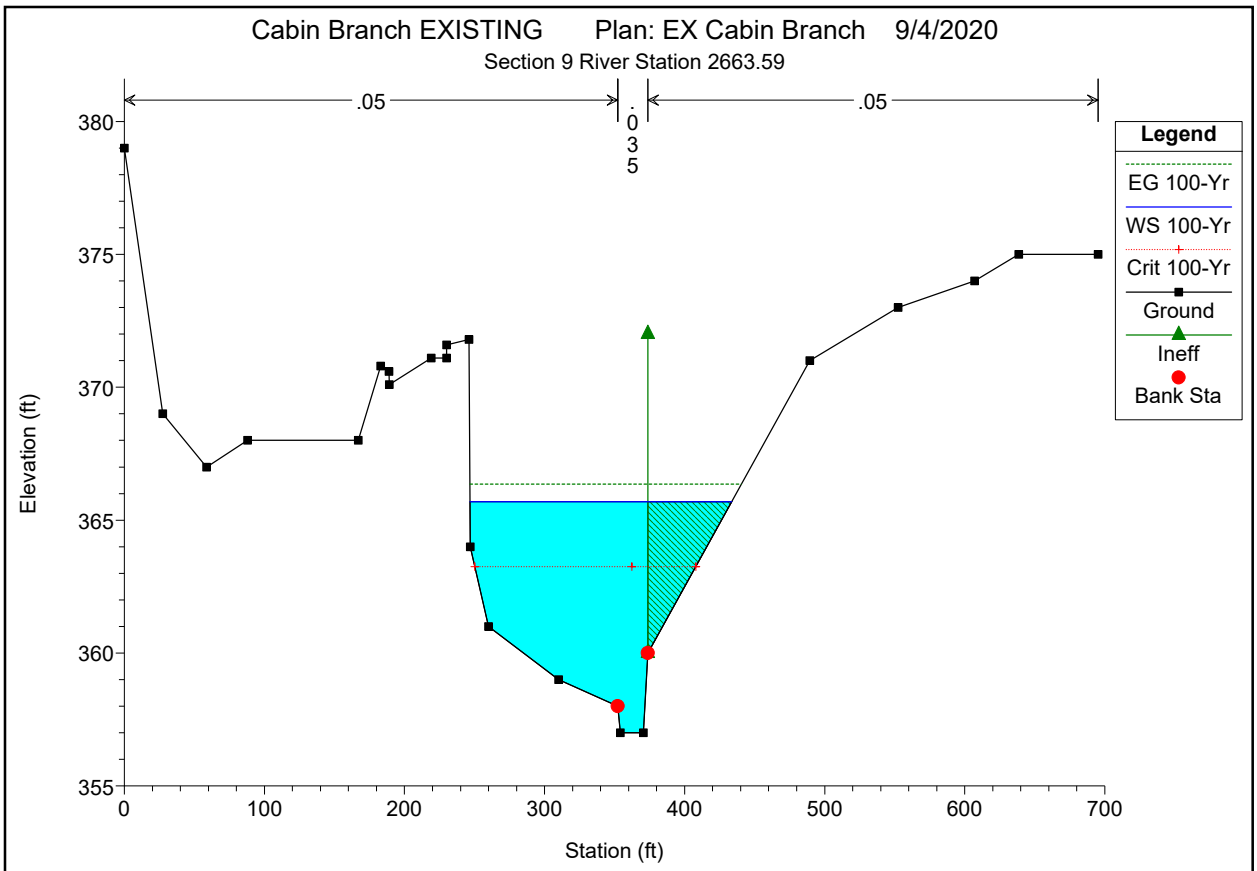
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section 9 River Station 2663.59
.05
.035
.05
Legend
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WS 100-Yr
Crit 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
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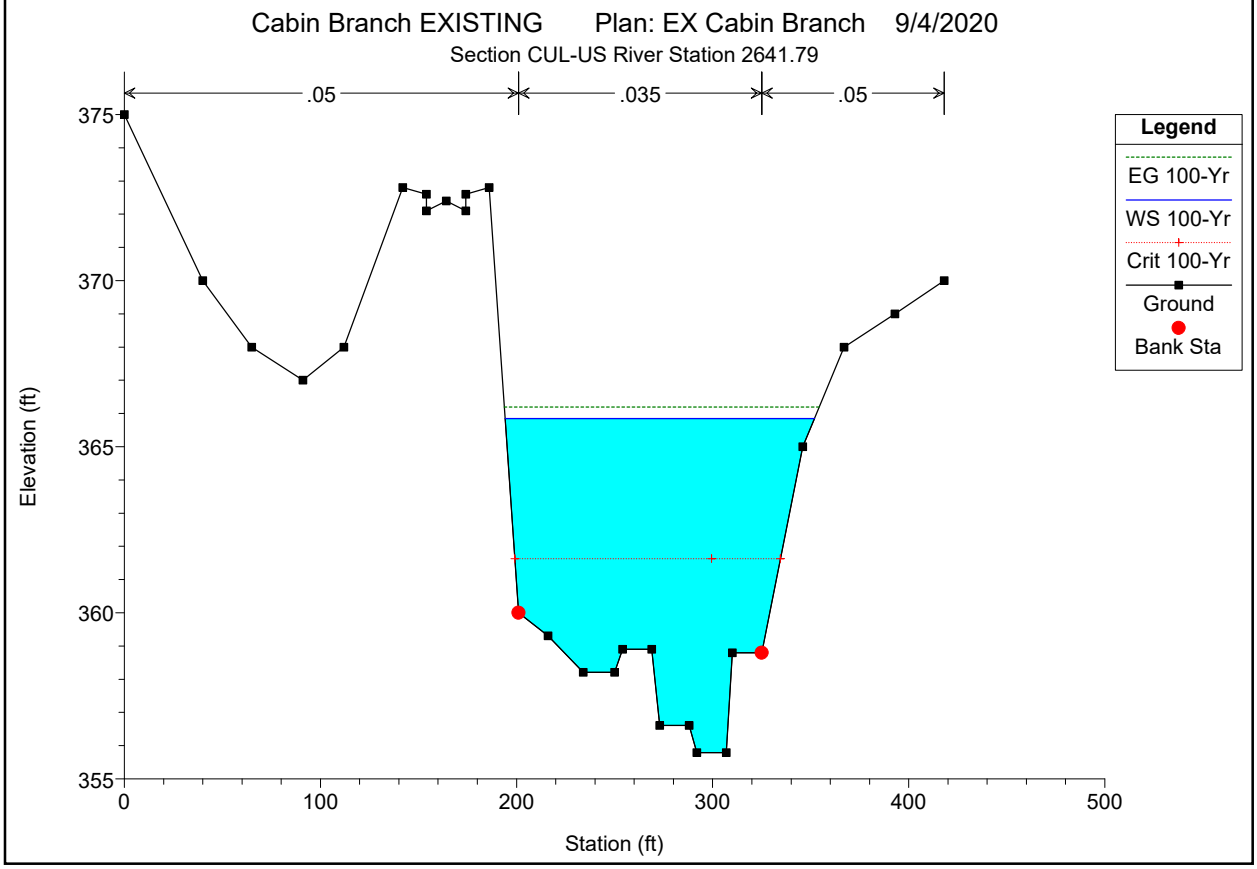
Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section CUL-US River Station 2641.79
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.035
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Legend
EG 100-Yr
WS 100-Yr
Crit 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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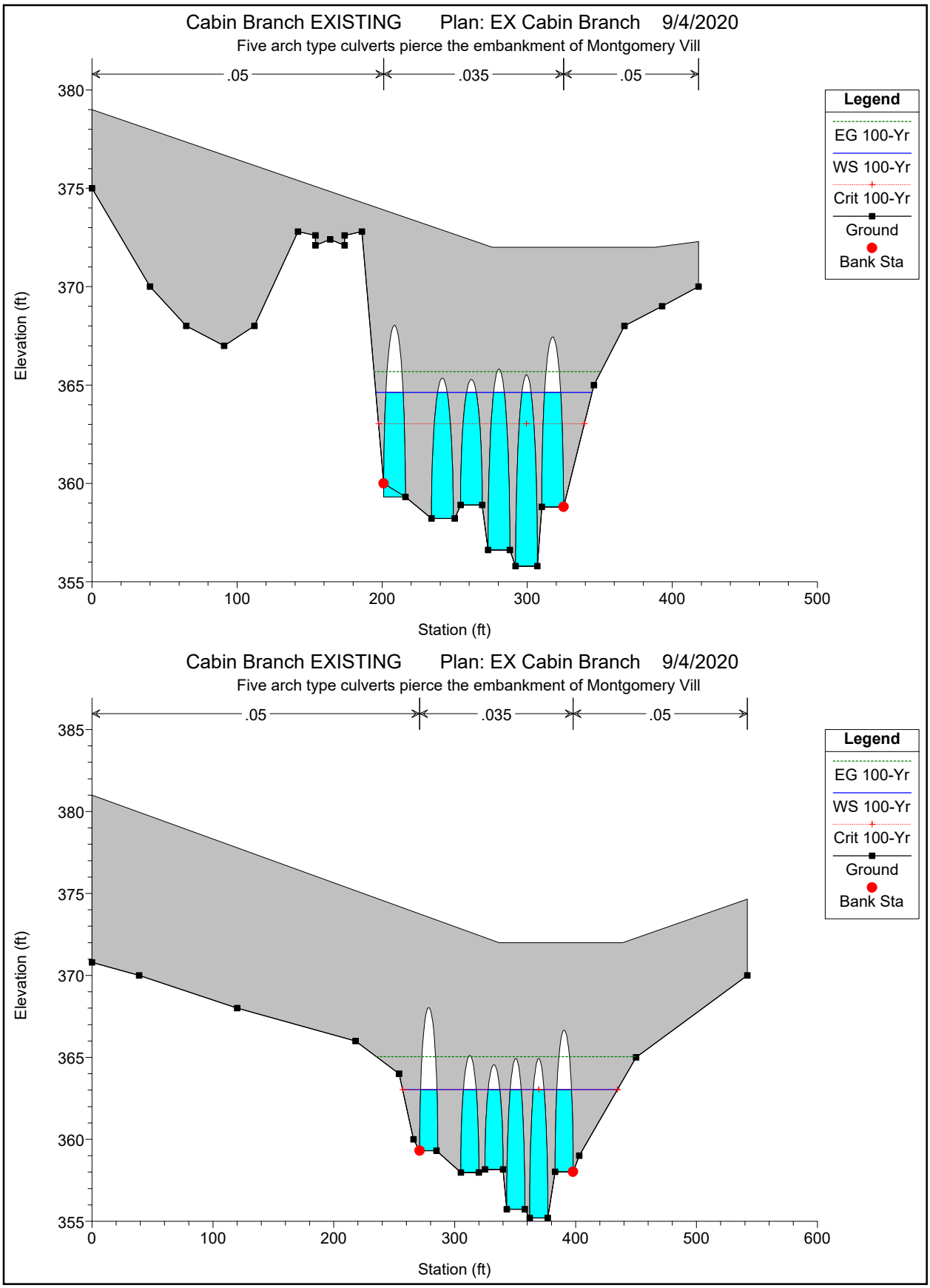
Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Five arch type culverts pierce the embankment of Montgomery Vill
.05
.035
.05
Legend
EG 100-Yr
WS 100-Yr
Crit 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
380
375
370
365
360
355
0
100
200
300
400
500
Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Five arch type culverts pierce the embankment of Montgomery Vill
.05
.035
.05
Legend
EG 100-Yr
WS 100-Yr
Crit 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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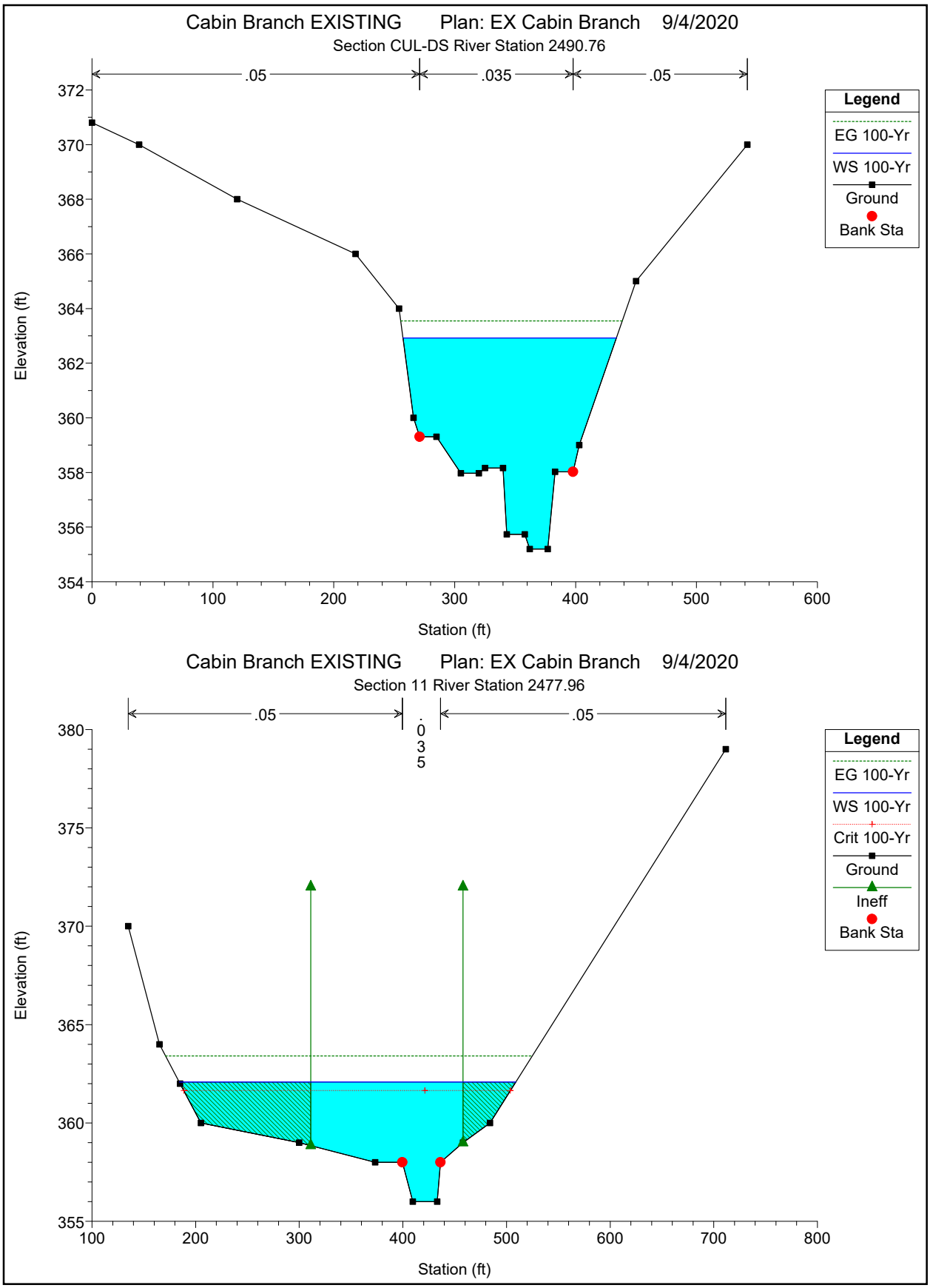
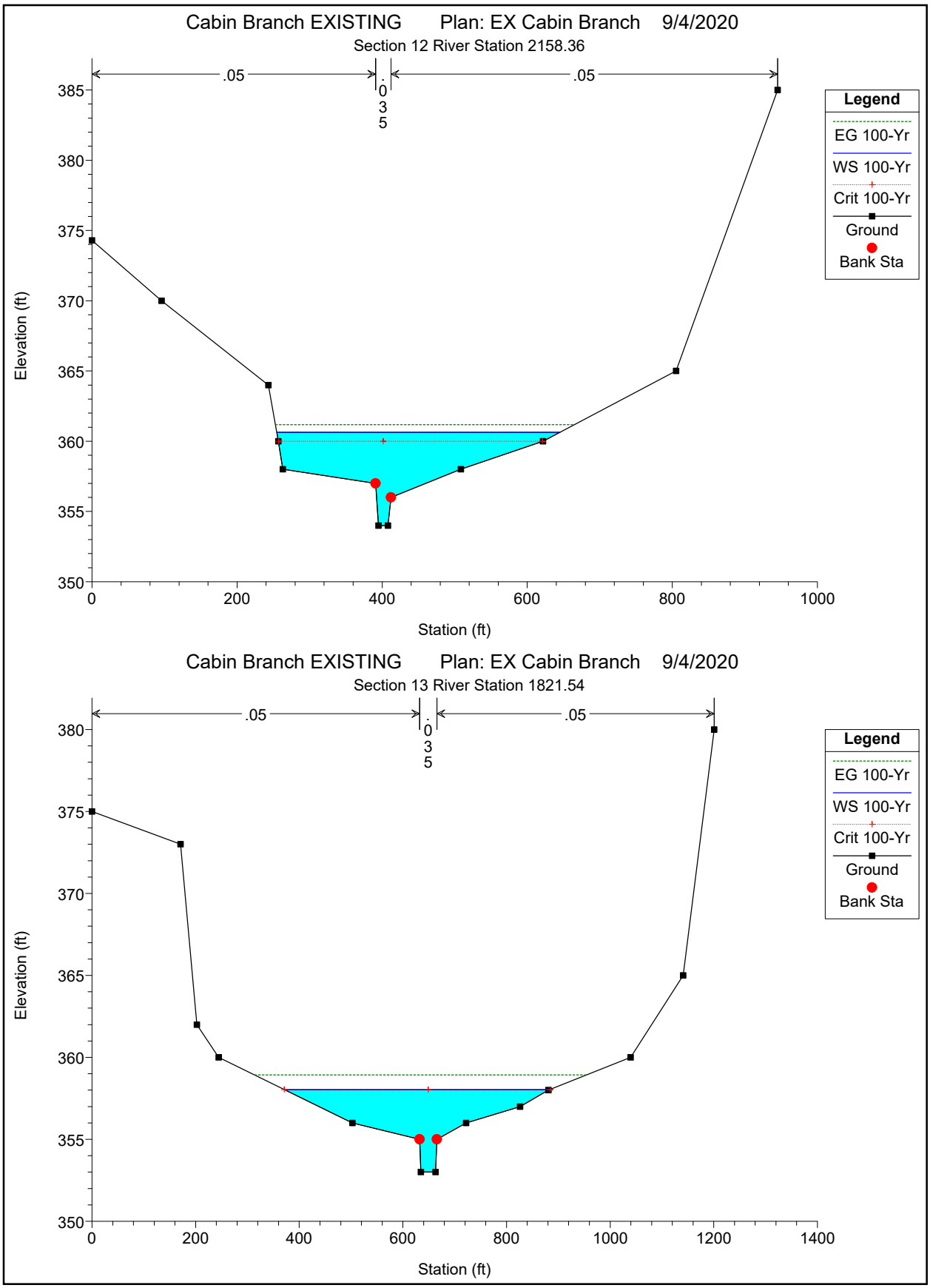

Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section CUL-DS River Station 2490.76
.05
.035
.05
Legend
EG 100-Yr
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section 11 River Station 2477.96
.05
.035
.05
Legend
EG 100-Yr
WS 100-Yr
Crit 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section 12 River Station 2158.36
.05
.05
.035
Legend
EG 100-Yr
WS 100-Yr
Crit 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section 13 River Station 1821.54
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Legend
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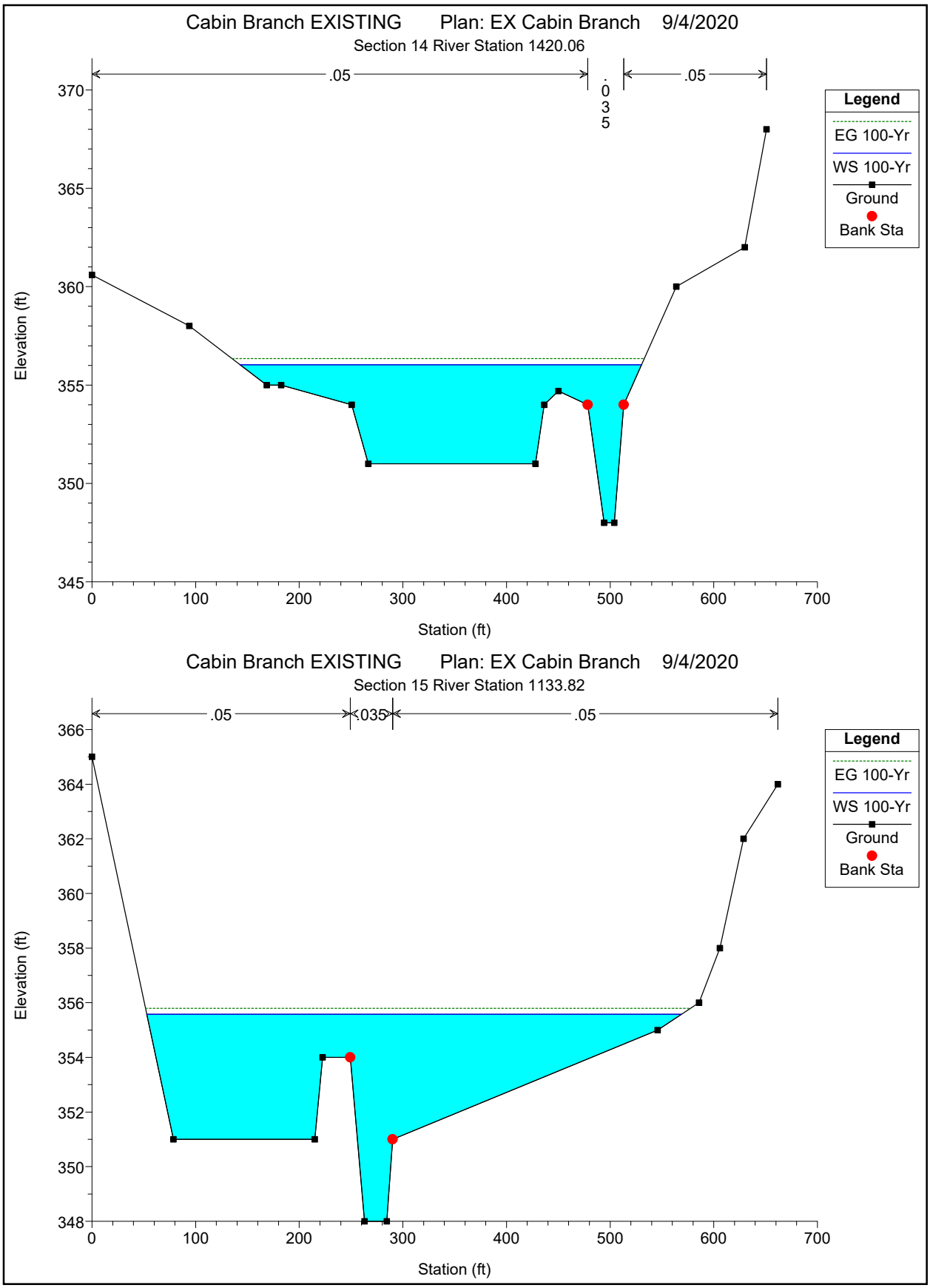
Crit 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section 14 River Station 1420.06
.05
.035
.05
Legend
EG 100-Yr
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
370
365
360
355
350
345
0
100
200
300
400
500
600
700
Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section 15 River Station 1133.82
.05
.035
.05
Legend
EG 100-Yr
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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600
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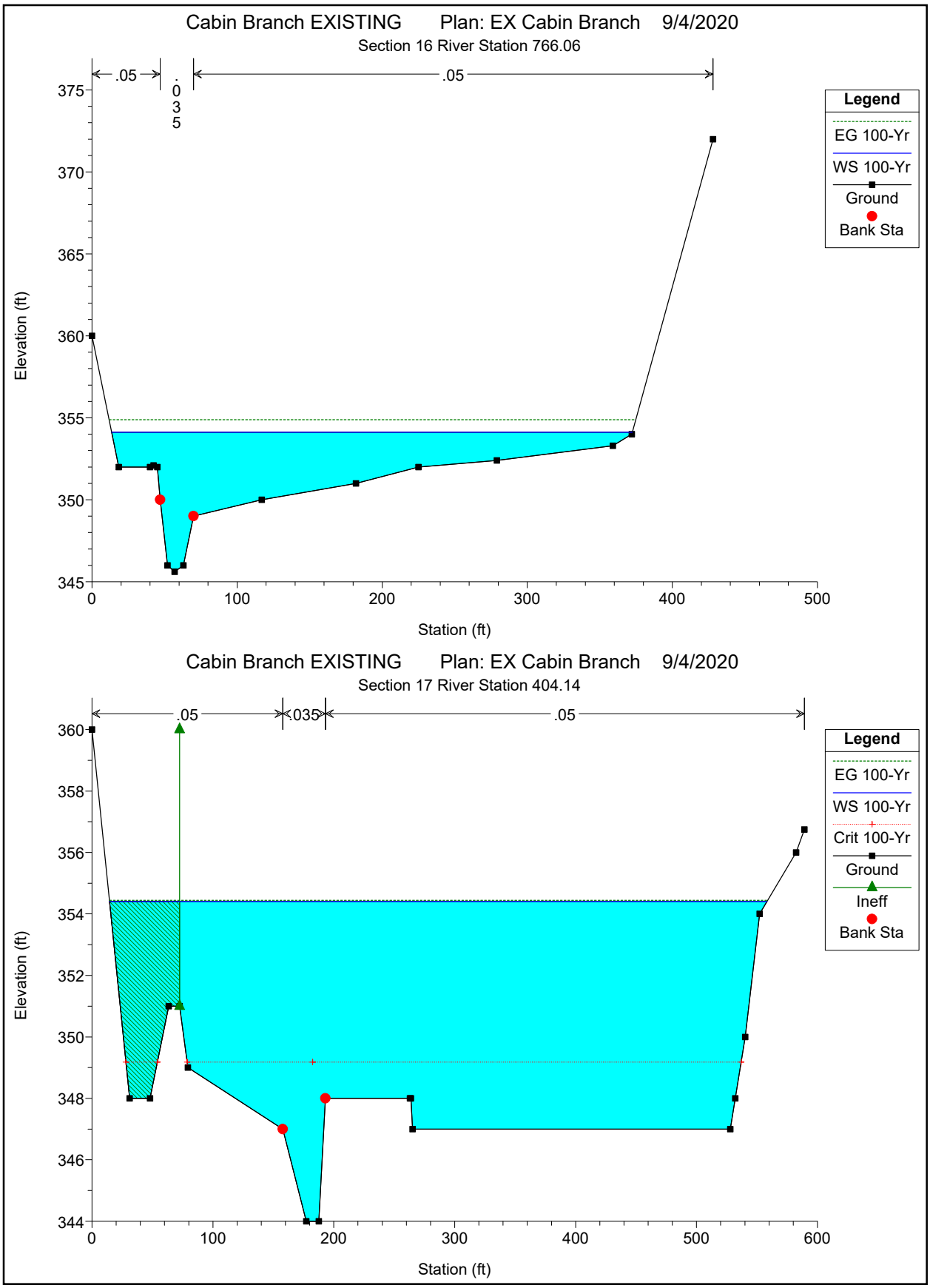
Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section 16 River Station 766.06
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.035
.05
Legend
EG 100-Yr
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section 17 River Station 404.14
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.035
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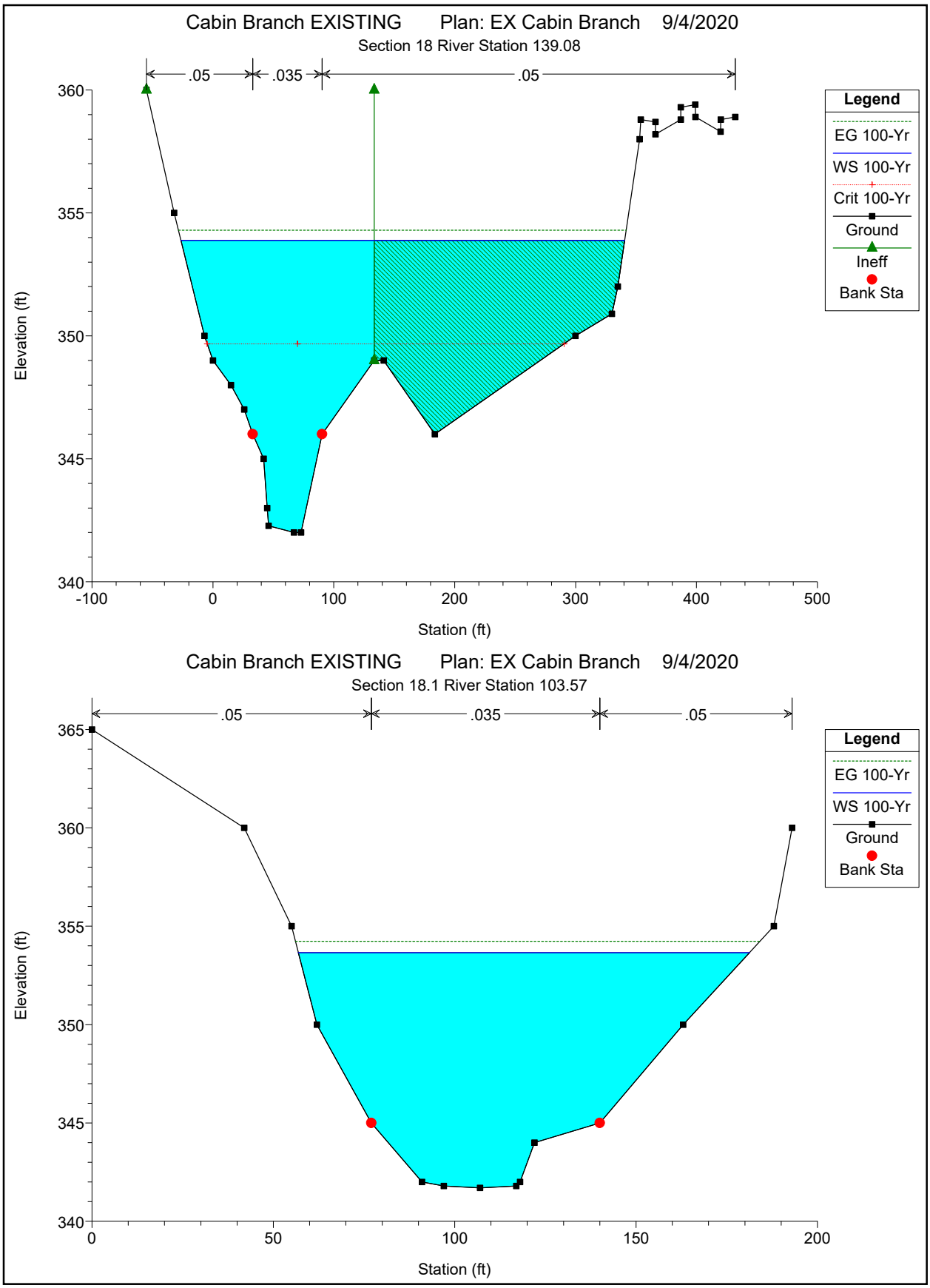
Legend
EG 100-Yr
WS 100-Yr
Crit 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section 18 River Station 139.08
.05
.035
.05
Legend
EG 100-Yr
WS 100-Yr
Crit 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
360
355
350
345
340
-100
0
100
200
300
400
500
Station (ft)
Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section 18.1 River Station 103.57
.05
.035
.05
Legend
EG 100-Yr
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
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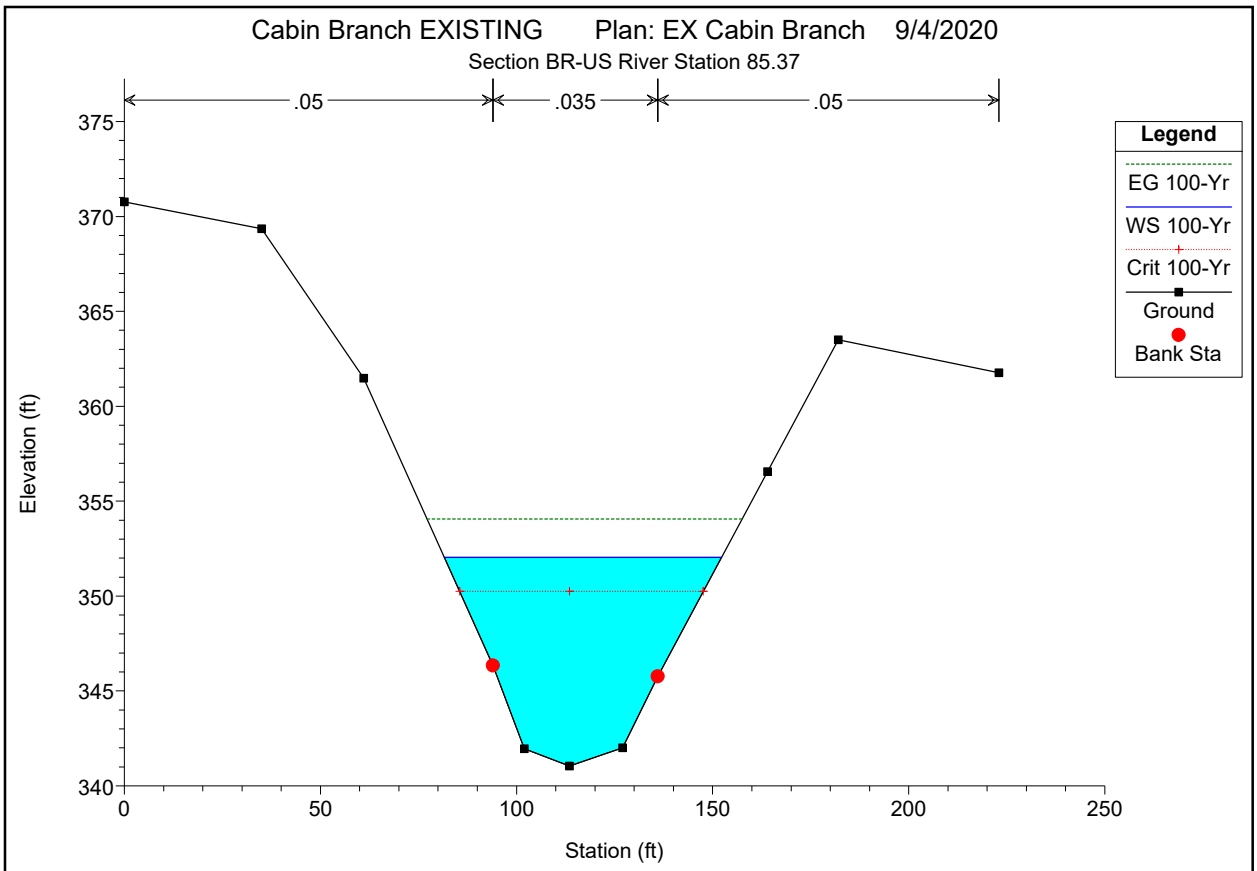
100
150
200
Station (ft)


Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section BR-US River Station 85.37
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.035
.05
Legend
EG 100-Yr
WS 100-Yr
Crit 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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360
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345
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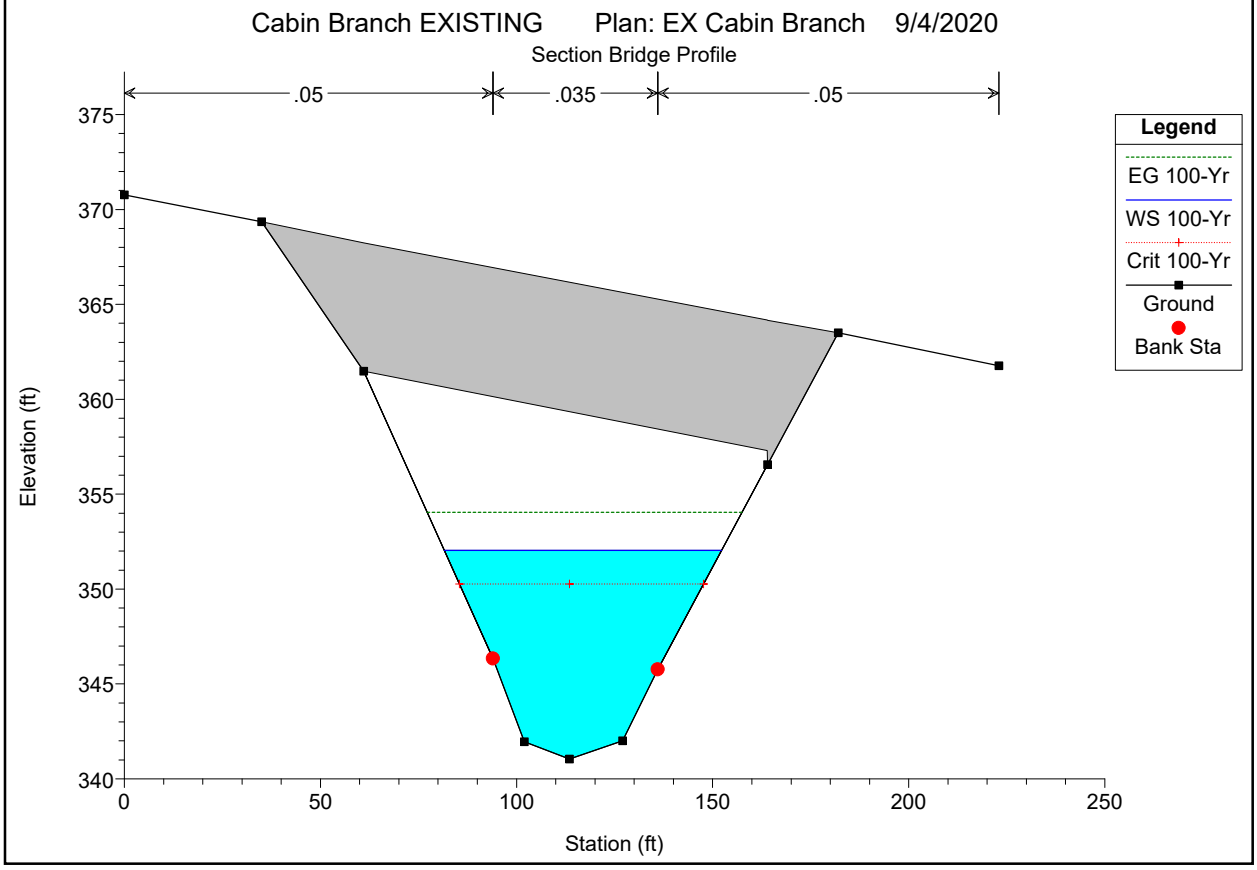
200
250


Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section Bridge Profile
.05
.035
.05
Legend
EG 100-Yr
WS 100-Yr
Crit 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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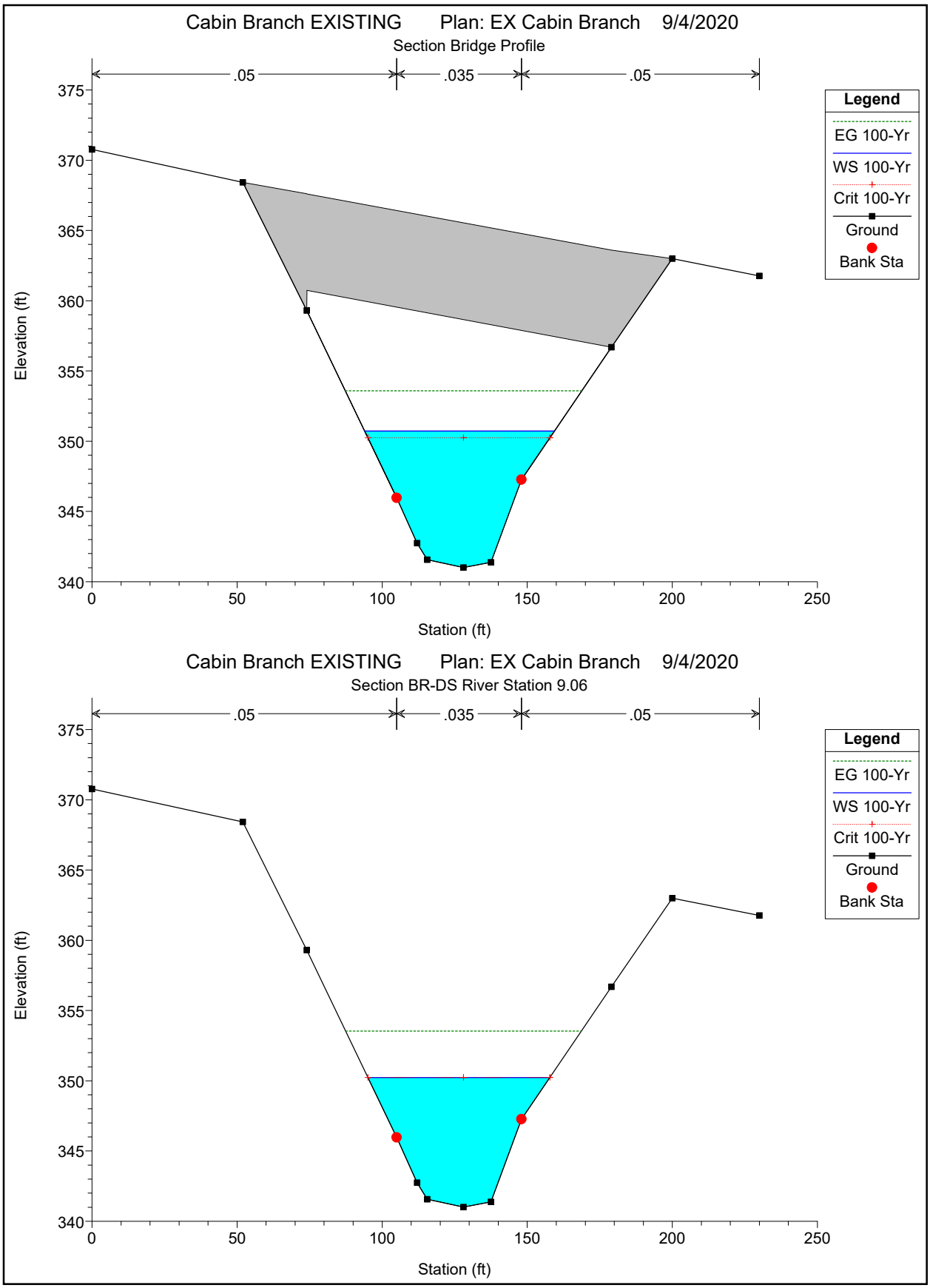
200
250


Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section Bridge Profile
.05
.035
.05
Legend
EG 100-Yr
WS 100-Yr
Crit 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
375
370
365
360
355
350
345
340
0
50
100
150
200
250
Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section BR-DS River Station 9.06
.05
.035
.05
Legend
EG 100-Yr
WS 100-Yr
Crit 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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360
355
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345
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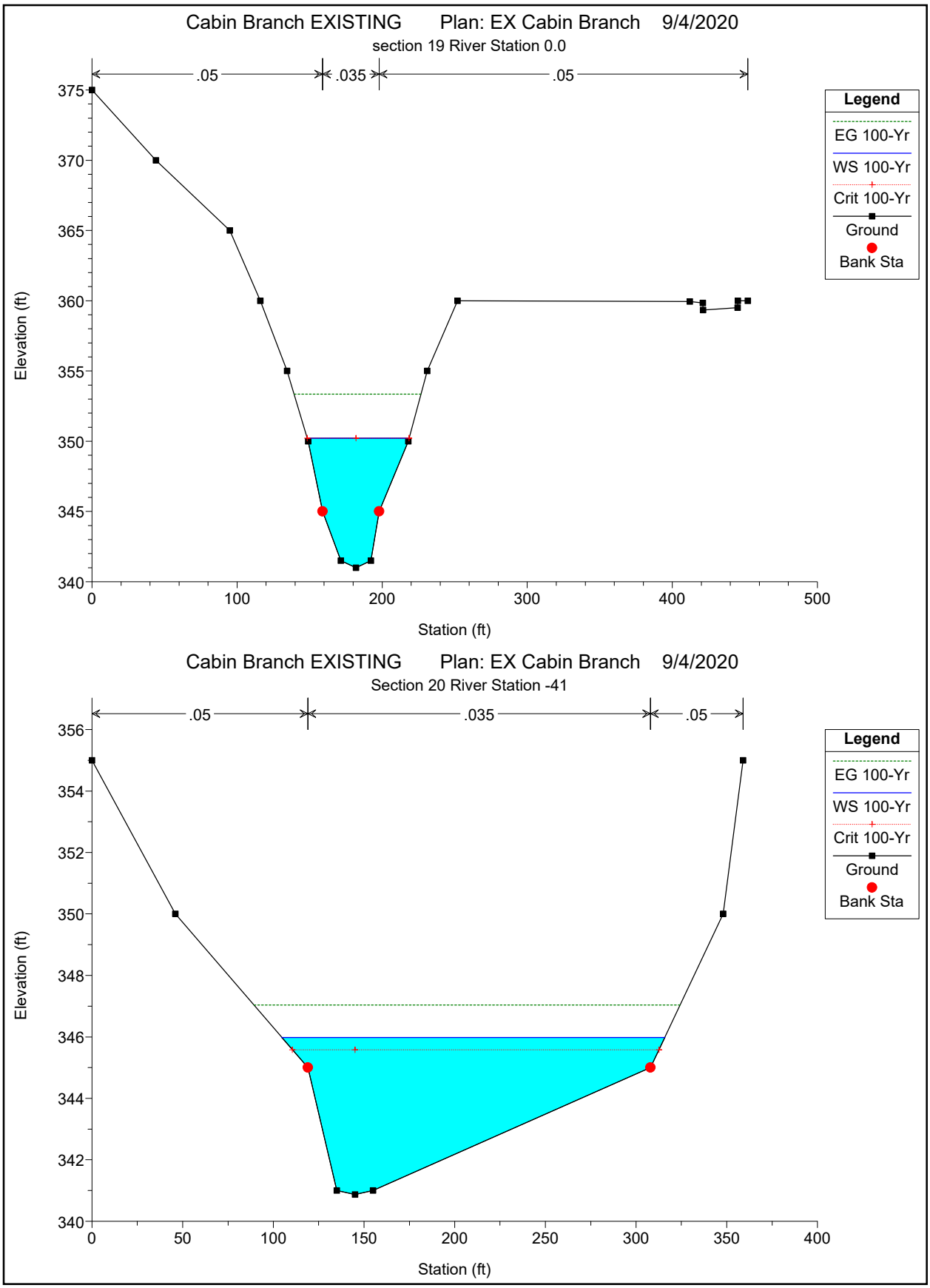
100
150
200
250


Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
section 19 River Station 0.0
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.035
.05
Legend
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WS 100-Yr
Crit 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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370
365
360
355
350
345
340
0
100
200
300
400
500
Cabin Branch EXISTING Plan: EX Cabin Branch 9/4/2020
Section 20 River Station -41
.05
.035
.05
Legend
EG 100-Yr
WS 100-Yr
Crit 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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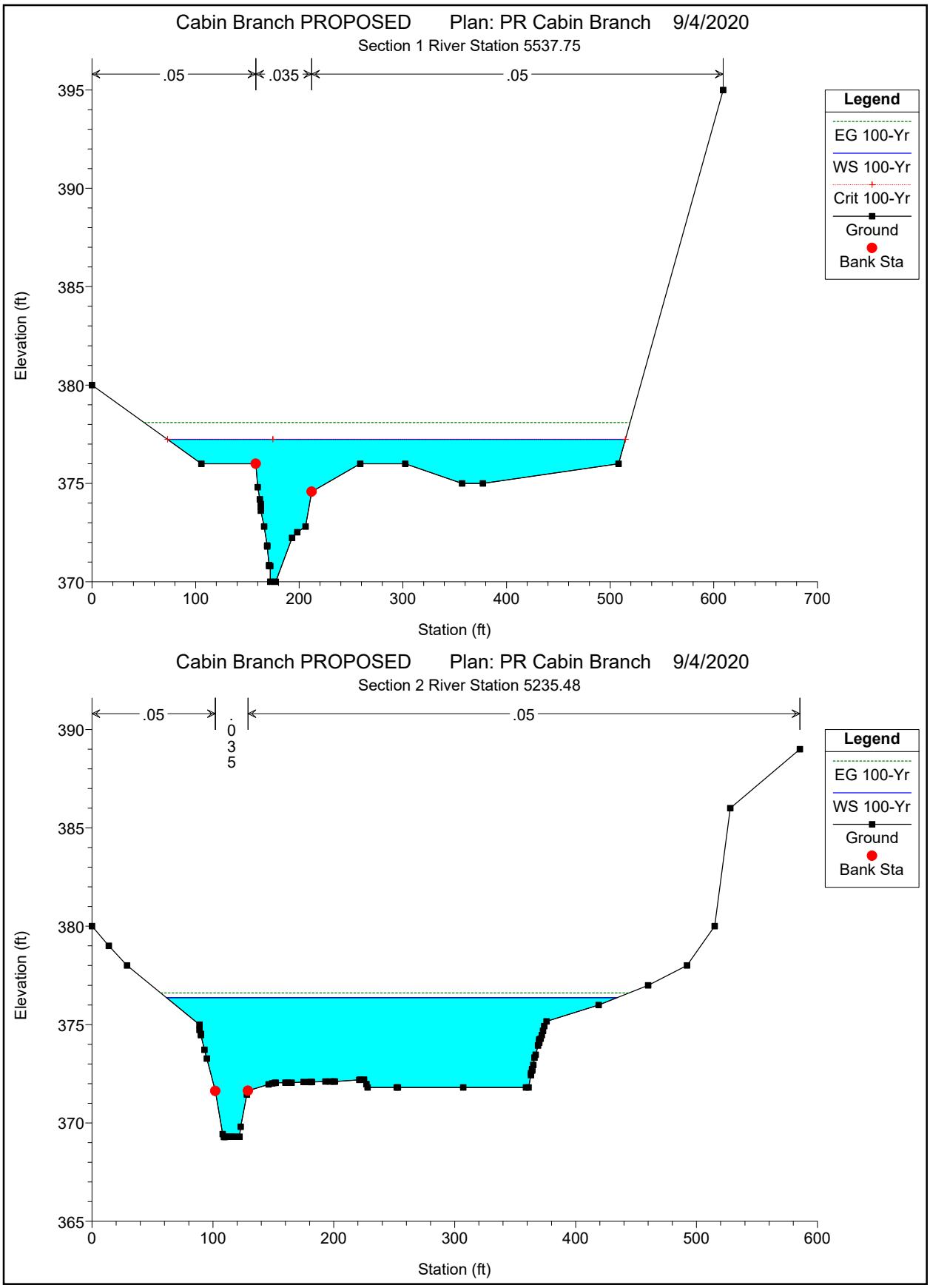
Cabin Branch PROPOSED Plan: PR Cabin Branch 9/4/2020
Section 1 River Station 5537.75
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.035
.05
Legend
EG 100-Yr
WS 100-Yr
Crit 100-Yr
Ground
Bank Sta
Elevation (ft)
395
390
385
380
375
370
0
100
200
300
400
500
600
700
Station (ft)
Cabin Branch PROPOSED Plan: PR Cabin Branch 9/4/2020
Section 2 River Station 5235.48
.05
.035
.05
Legend
EG 100-Yr
WS 100-Yr
Ground
Bank Sta
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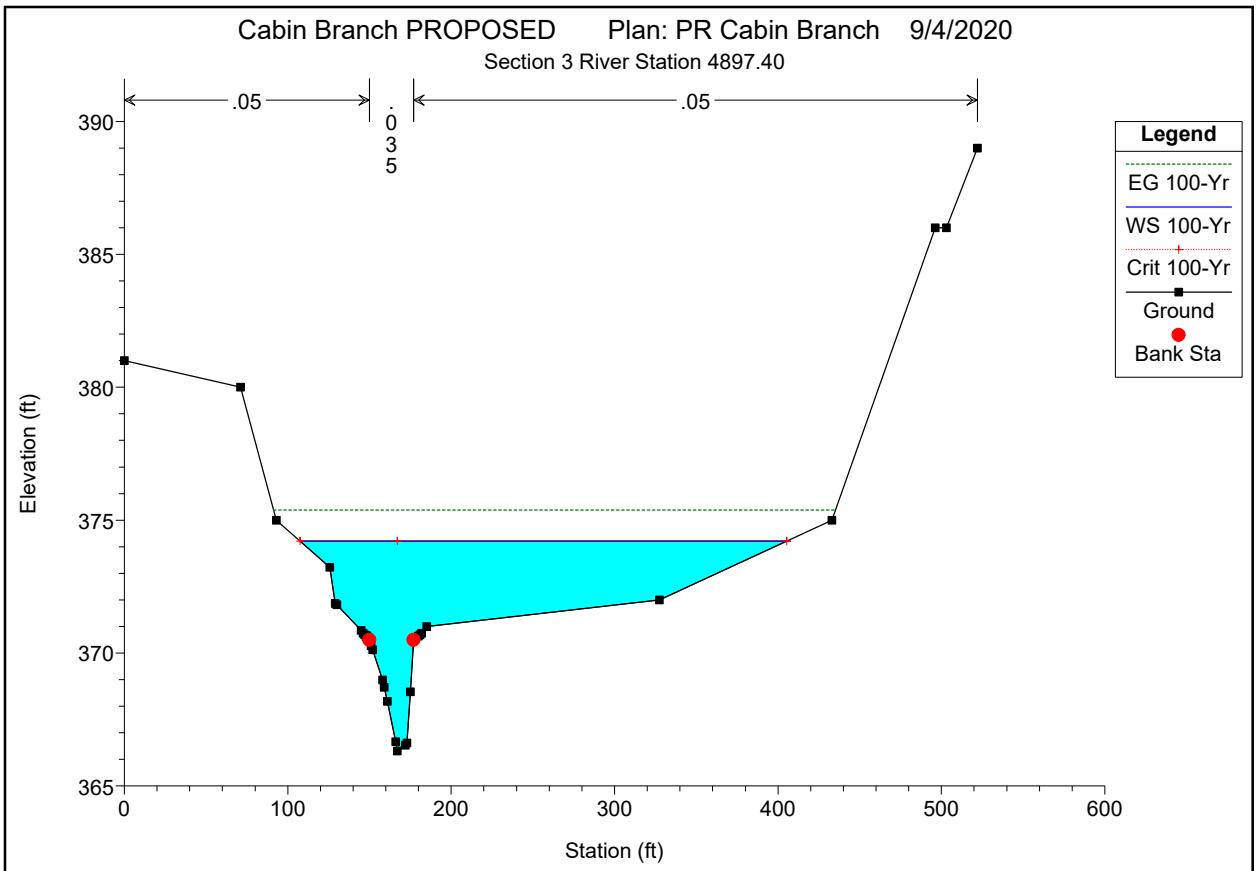
600
Station (ft)


Cabin Branch PROPOSED Plan: PR Cabin Branch 9/4/2020
Section 3 River Station 4897.40
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.035
.05
Legend
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WS 100-Yr
Crit 100-Yr
Ground
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Station (ft)
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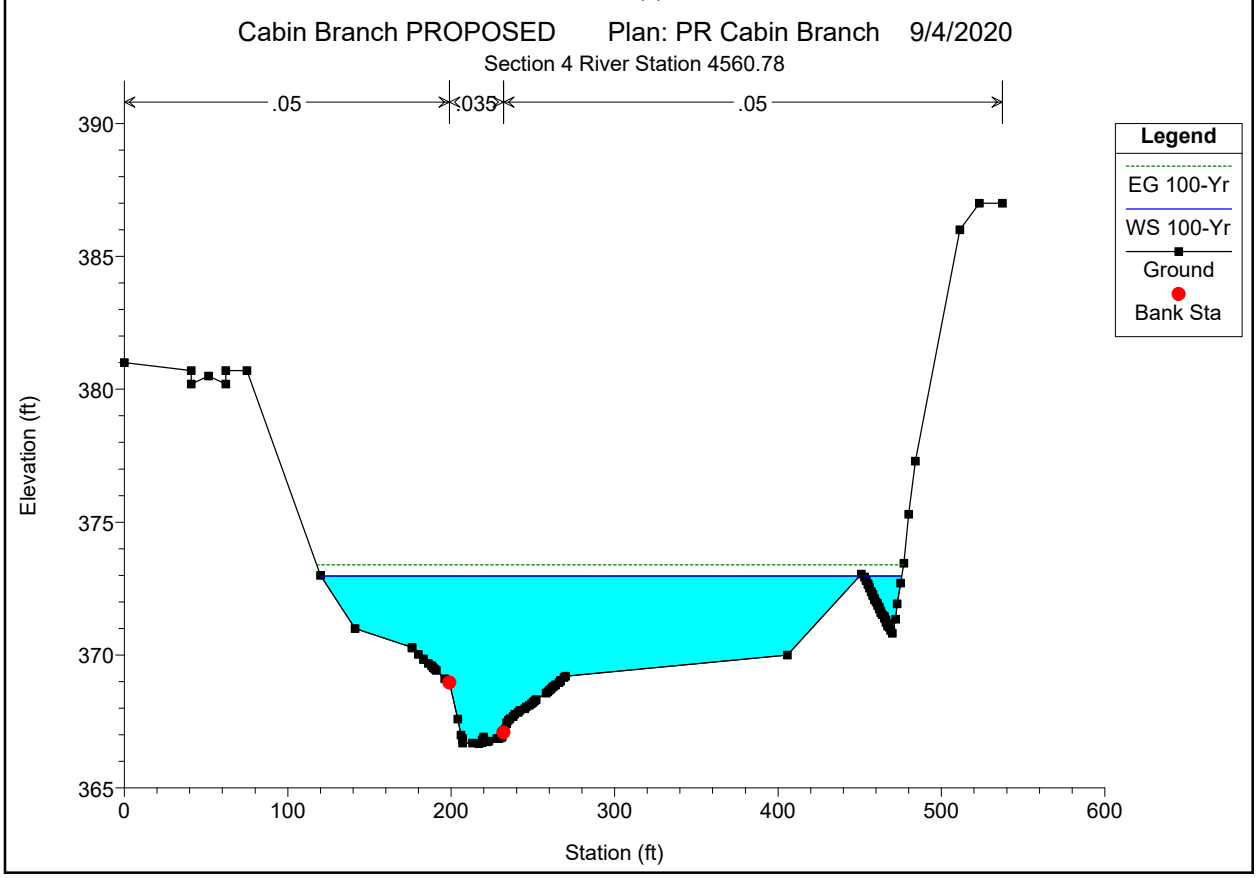
Cabin Branch PROPOSED Plan: PR Cabin Branch 9/4/2020
Section 4 River Station 4560.78
.05
.035
.05
Legend
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WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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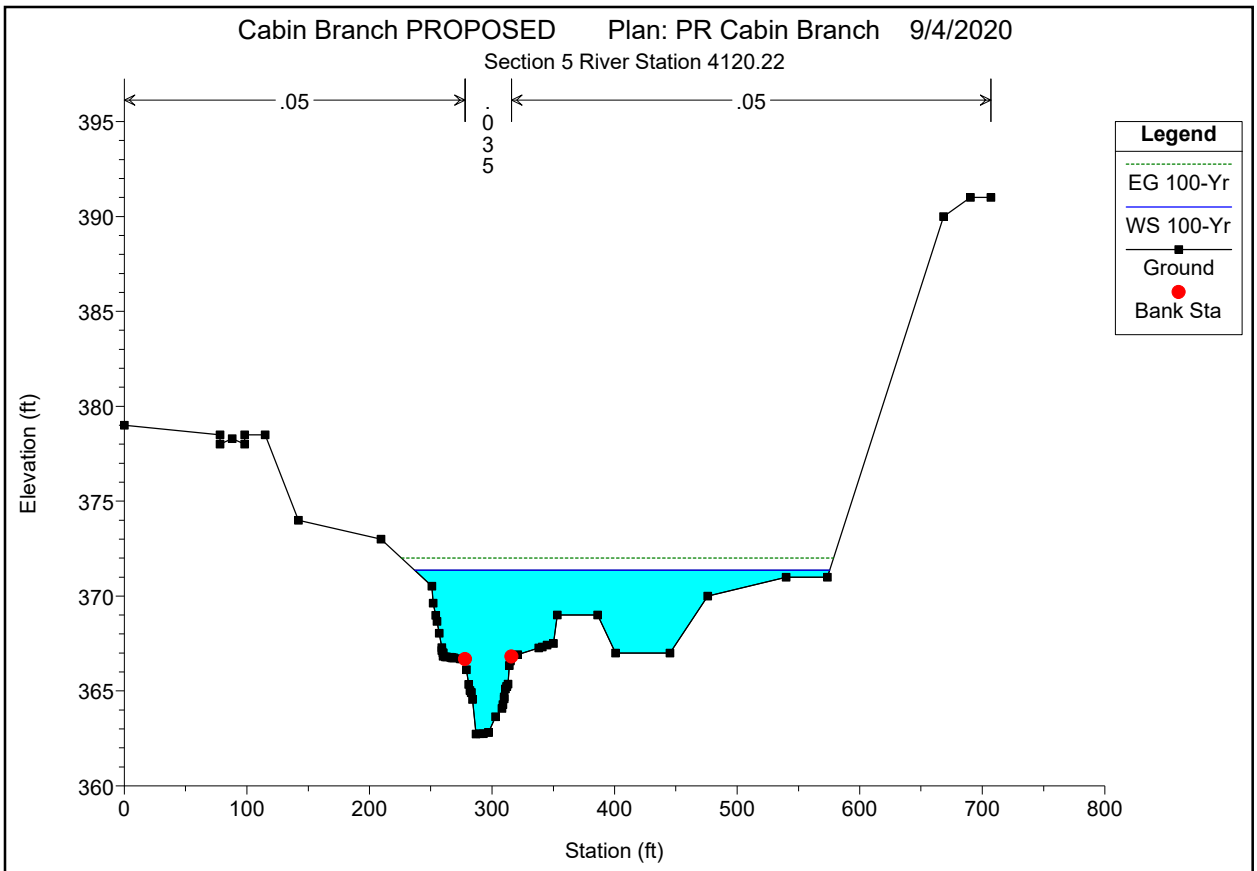
Cabin Branch PROPOSED Plan: PR Cabin Branch 9/4/2020
Section 5 River Station 4120.22
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.035
.05
Legend
EG 100-Yr
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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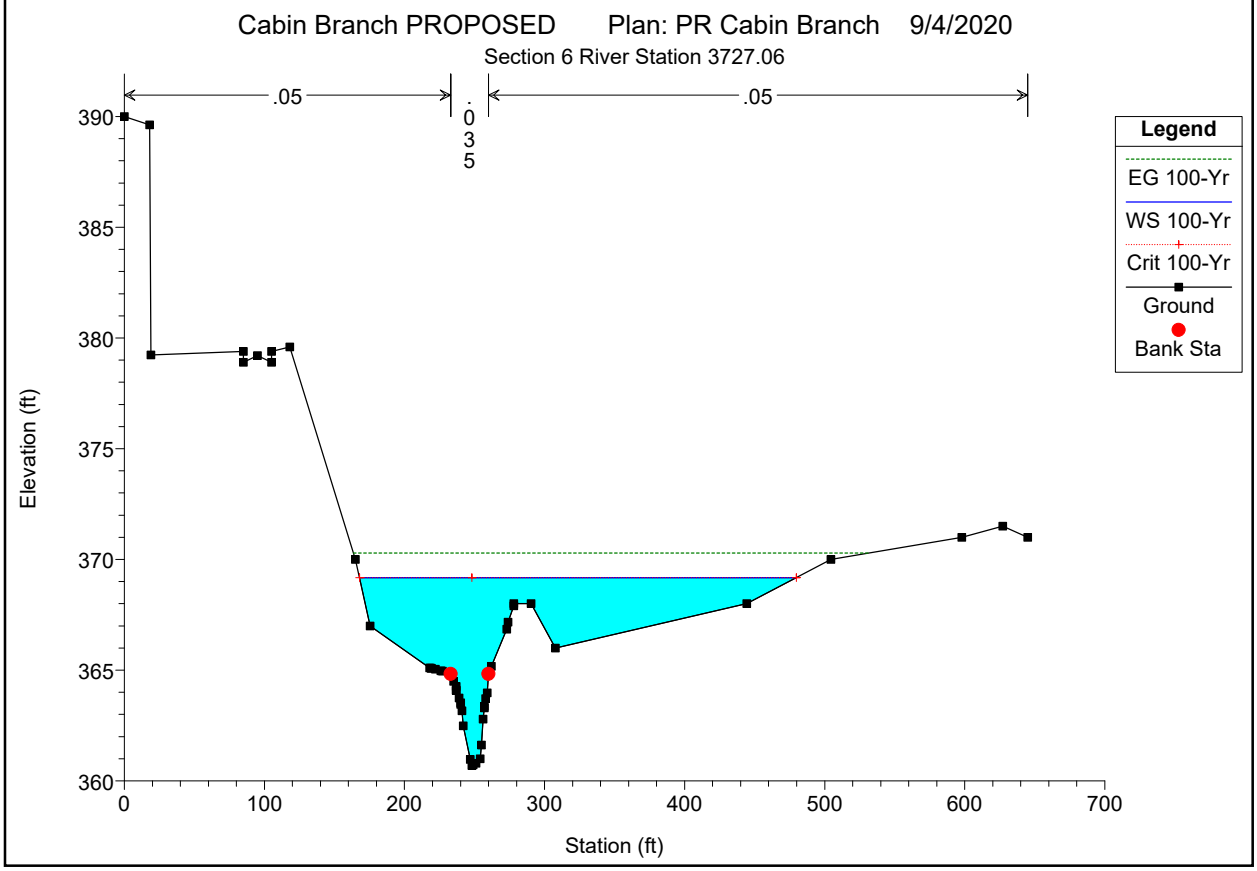
Cabin Branch PROPOSED Plan: PR Cabin Branch 9/4/2020
Section 6 River Station 3727.06
.05
.035
.05
Legend
EG 100-Yr
WS 100-Yr
Crit 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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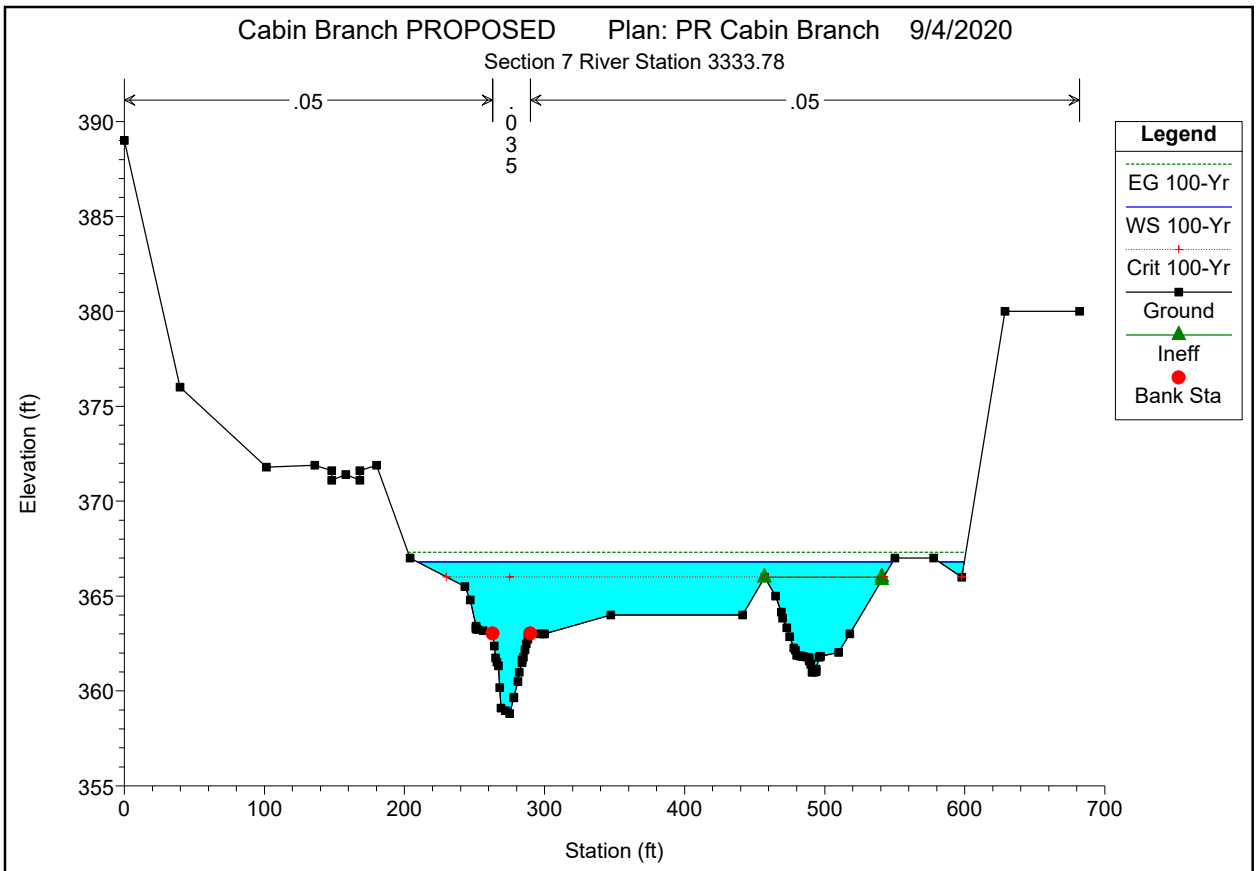
Cabin Branch PROPOSED Plan: PR Cabin Branch 9/4/2020
Section 7 River Station 3333.78
.05
.035
.05
Legend
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WS 100-Yr
Crit 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
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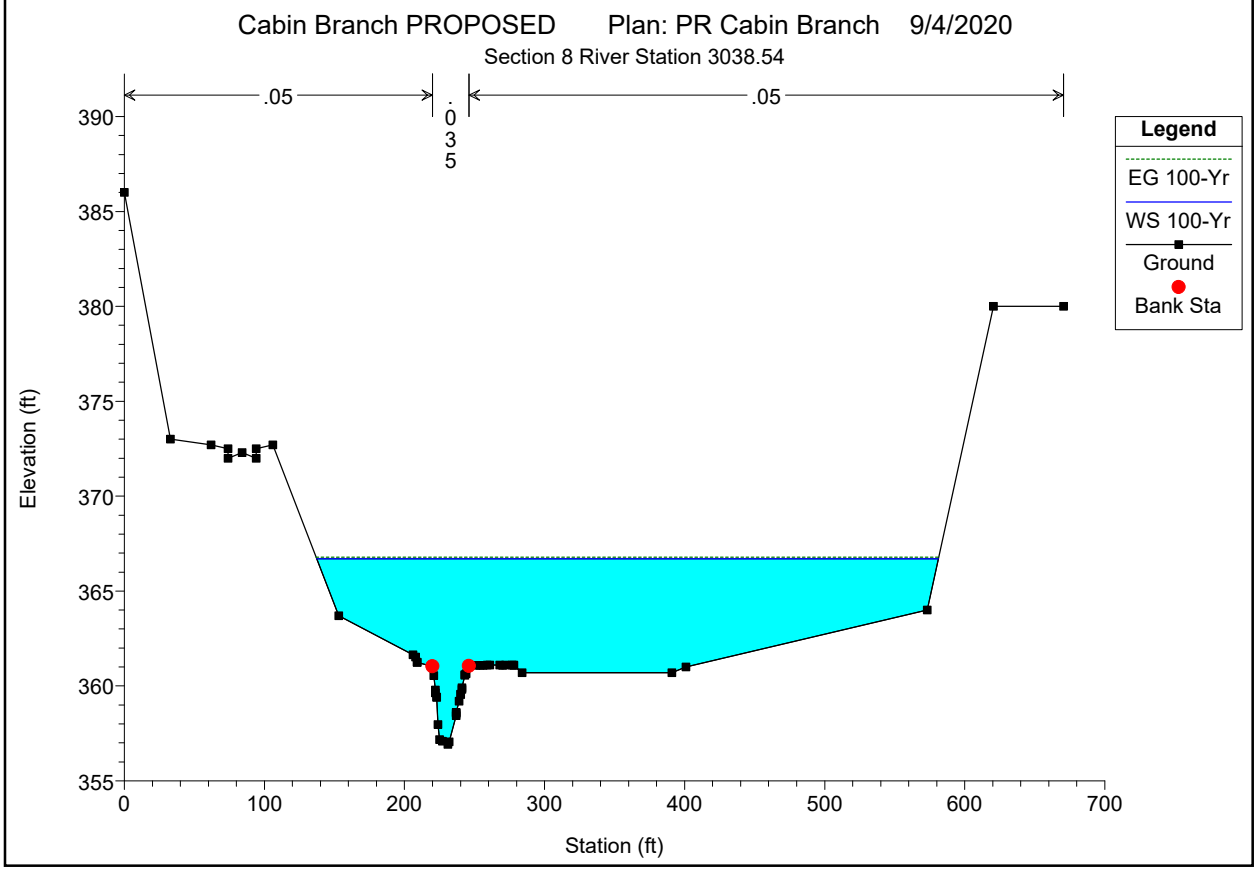
Cabin Branch PROPOSED Plan: PR Cabin Branch 9/4/2020
Section 8 River Station 3038.54
.05
.035
.05
Legend
EG 100-Yr
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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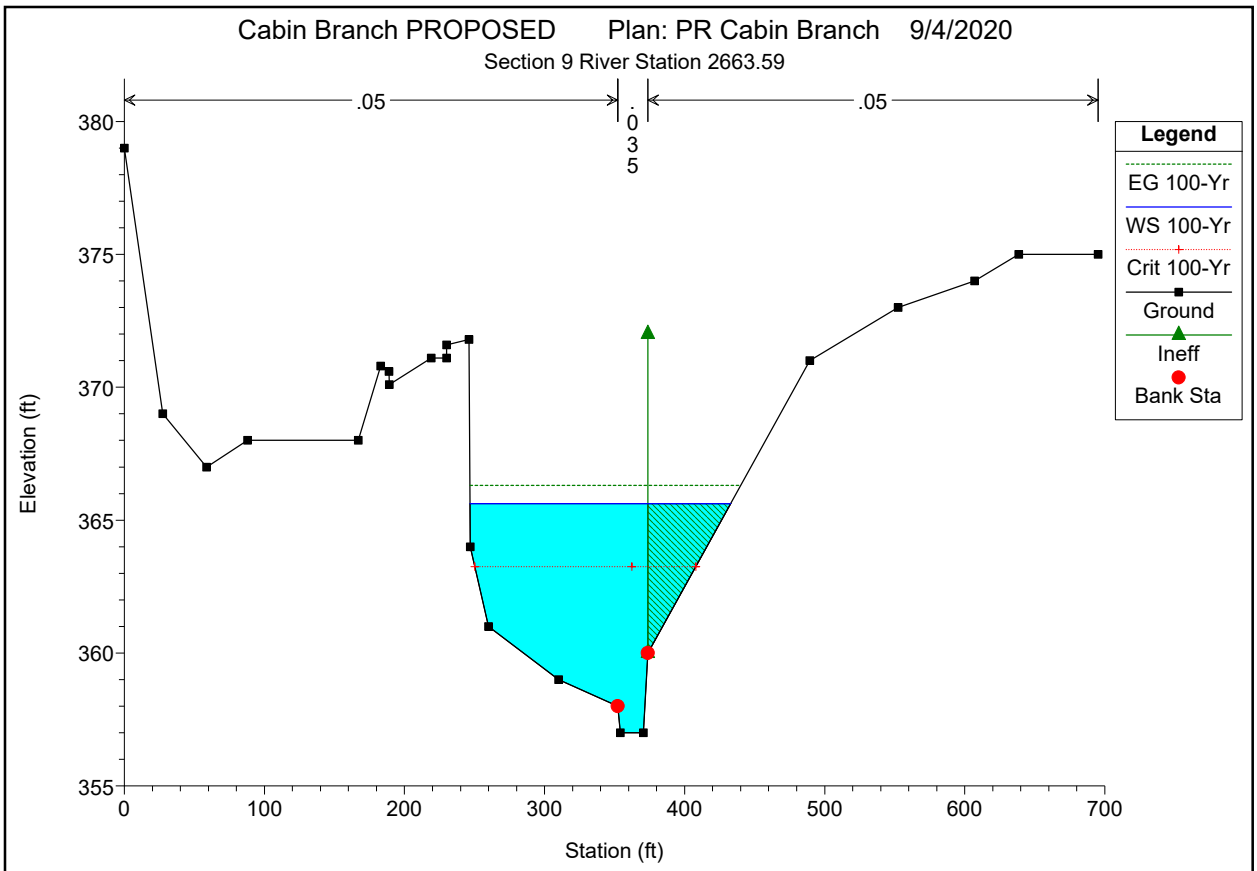
Cabin Branch PROPOSED Plan: PR Cabin Branch 9/4/2020
Section 9 River Station 2663.59
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.035
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WS 100-Yr
Crit 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
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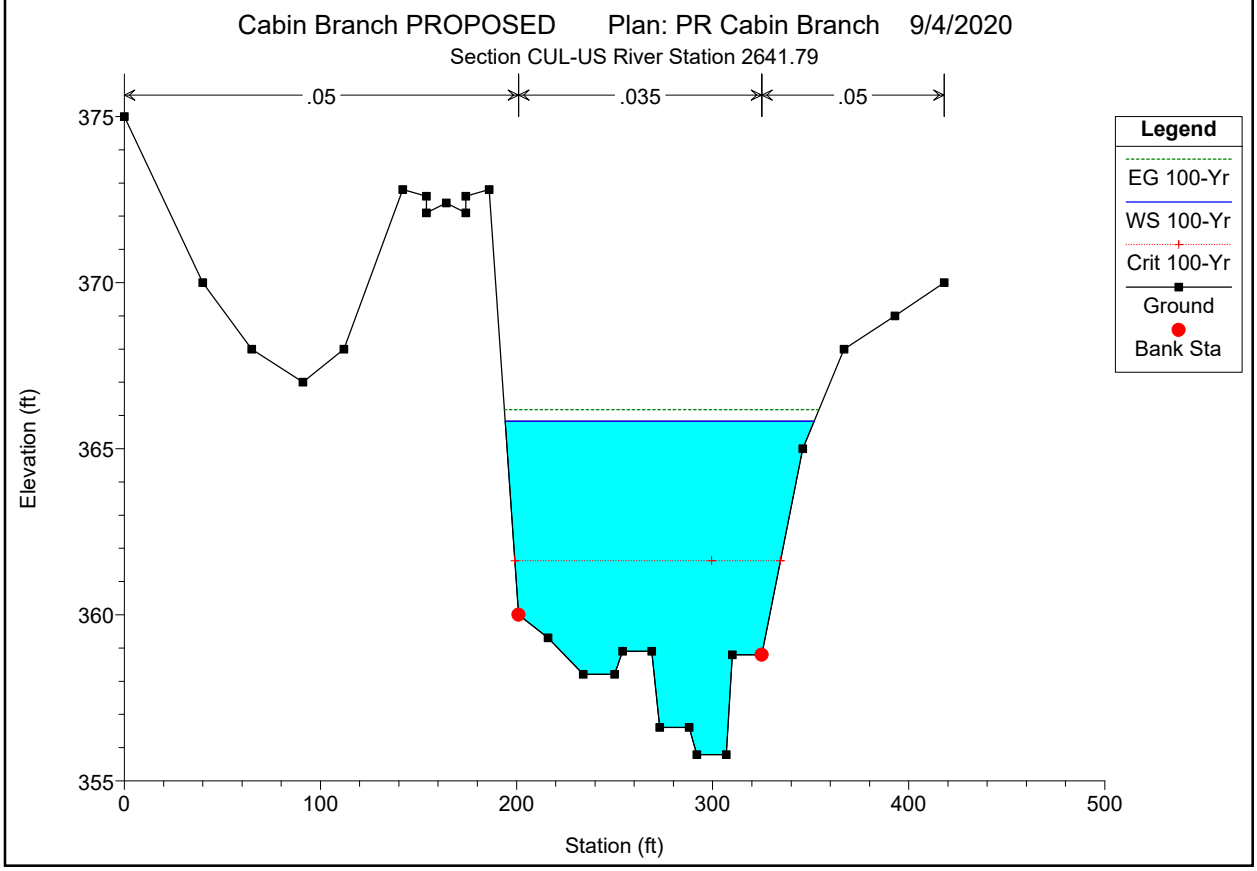
Cabin Branch PROPOSED Plan: PR Cabin Branch 9/4/2020
Section CUL-US River Station 2641.79
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.035
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Legend
EG 100-Yr
WS 100-Yr
Crit 100-Yr
Ground
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Elevation (ft)
Station (ft)
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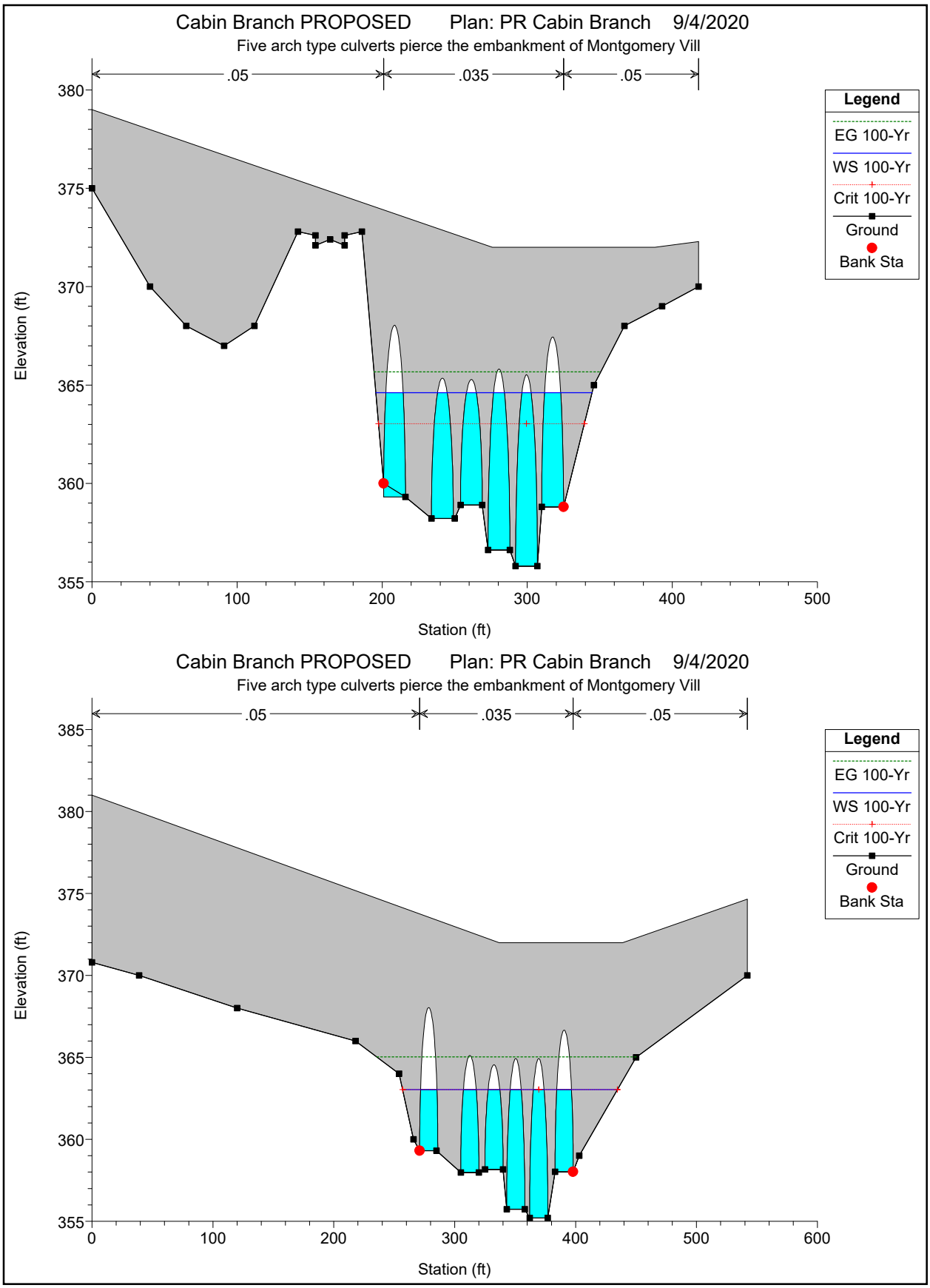
Cabin Branch PROPOSED Plan: PR Cabin Branch 9/4/2020
Five arch type culverts pierce the embankment of Montgomery Vill
.05
.035
.05
Legend
EG 100-Yr
WS 100-Yr
Crit 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
380
375
370
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Cabin Branch PROPOSED Plan: PR Cabin Branch 9/4/2020
Five arch type culverts pierce the embankment of Montgomery Vill
.05
.035
.05
Legend
EG 100-Yr
WS 100-Yr
Crit 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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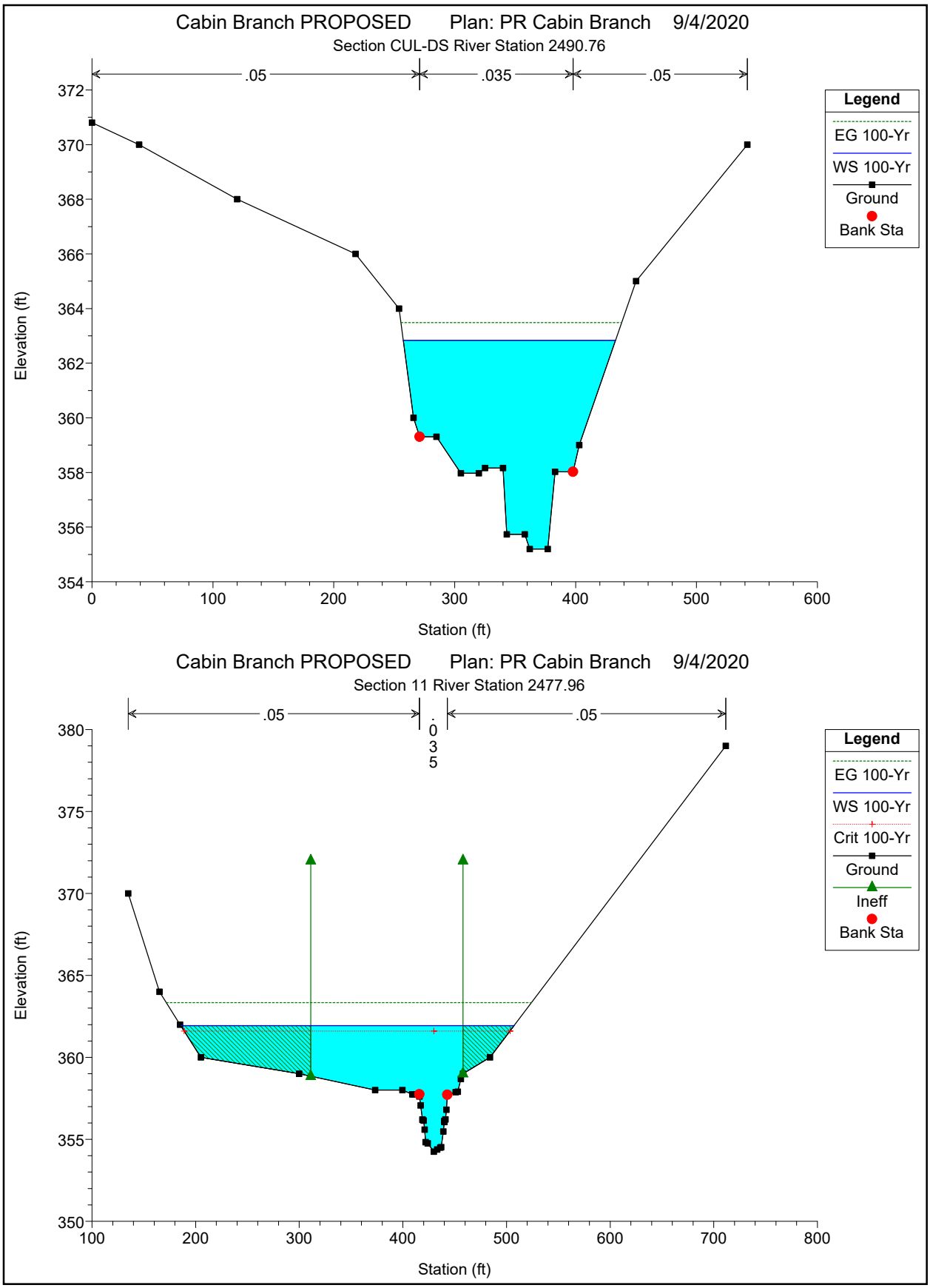
Cabin Branch PROPOSED Plan: PR Cabin Branch 9/4/2020
Section CUL-DS River Station 2490.76
.05
.035
.05
Legend
EG 100-Yr
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
Cabin Branch PROPOSED Plan: PR Cabin Branch 9/4/2020
Section 11 River Station 2477.96
.05
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Legend
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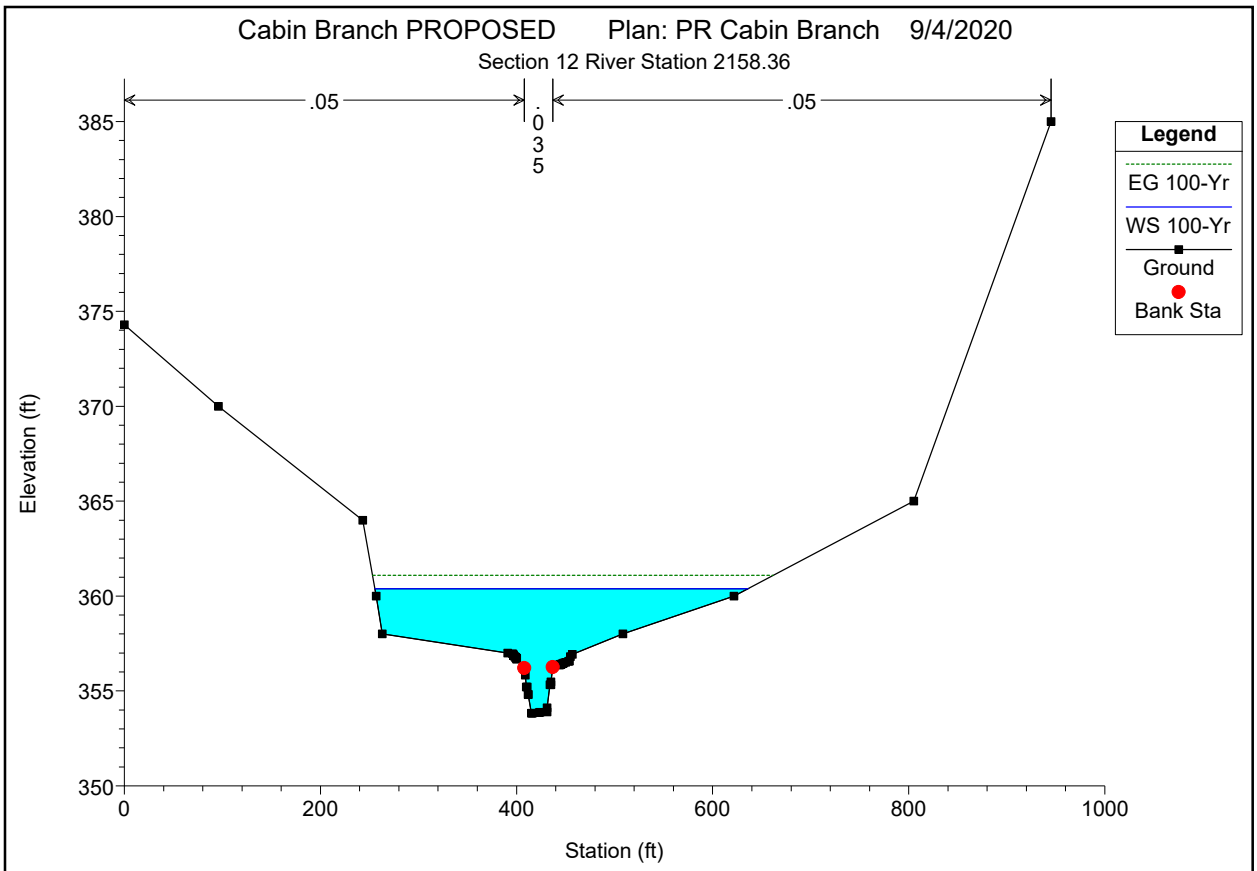
WS 100-Yr
Crit 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Cabin Branch PROPOSED Plan: PR Cabin Branch 9/4/2020
Section 12 River Station 2158.36
.05
.035
.05
Legend
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WS 100-Yr
Ground
Bank Sta
Elevation (ft)
385
380
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350
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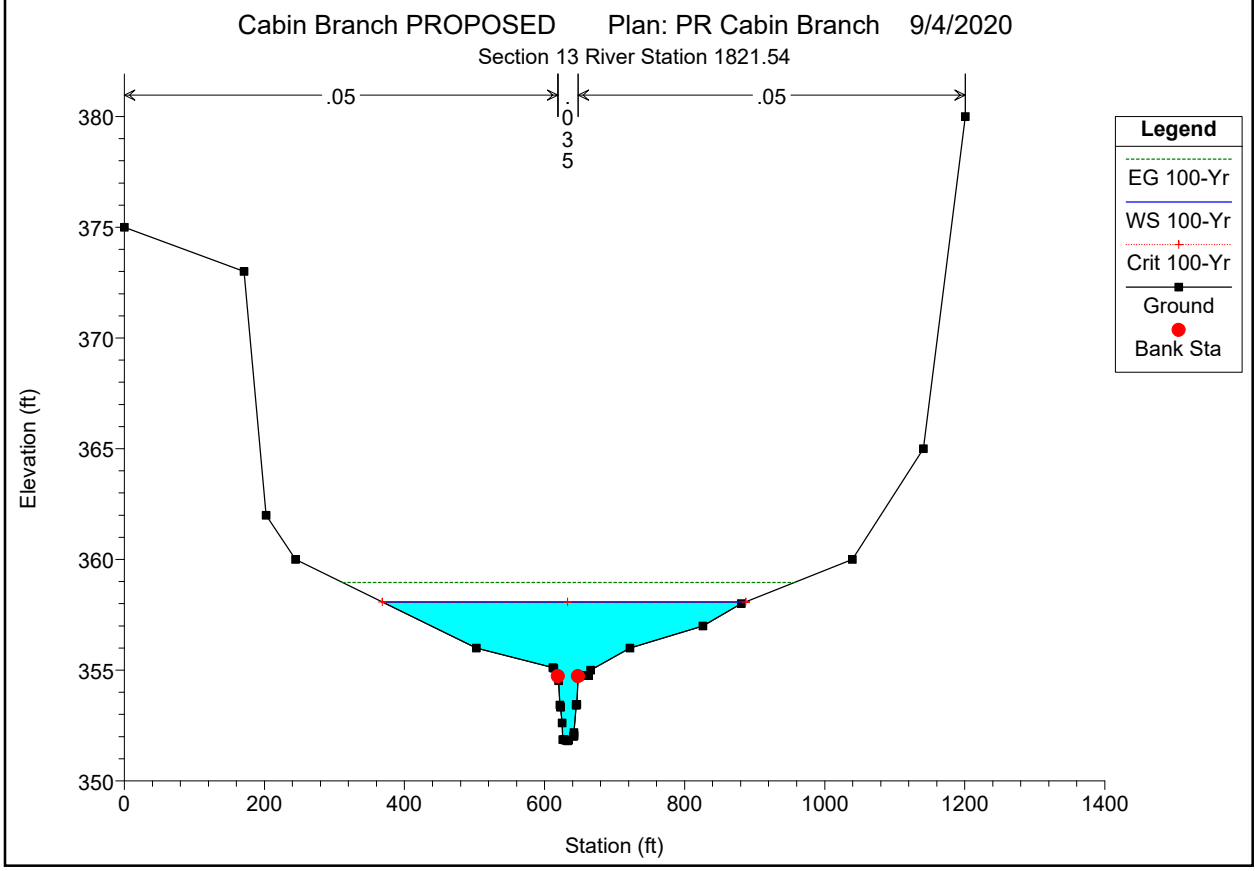
600
800
1000
Station (ft)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Section 13 River Station 1821.54
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WS 100-Yr
Crit 100-Yr
Ground
Bank Sta
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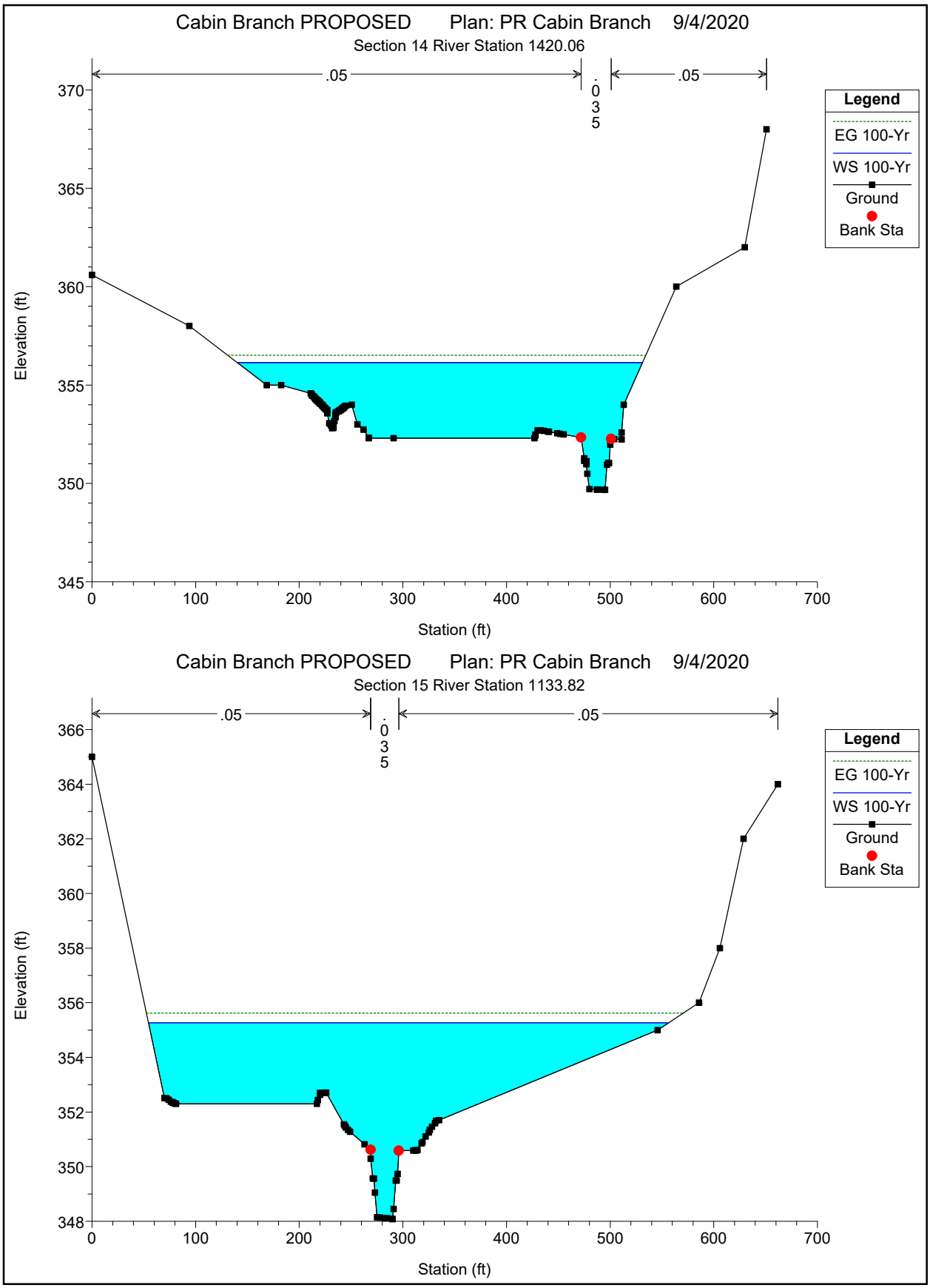
Station (ft)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Ground
Bank Sta
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Station (ft)
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355
350
345
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200
300
400
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600
700
Cabin Branch PROPOSED Plan: PR Cabin Branch 9/4/2020
Section 15 River Station 1133.82
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.035
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Legend
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WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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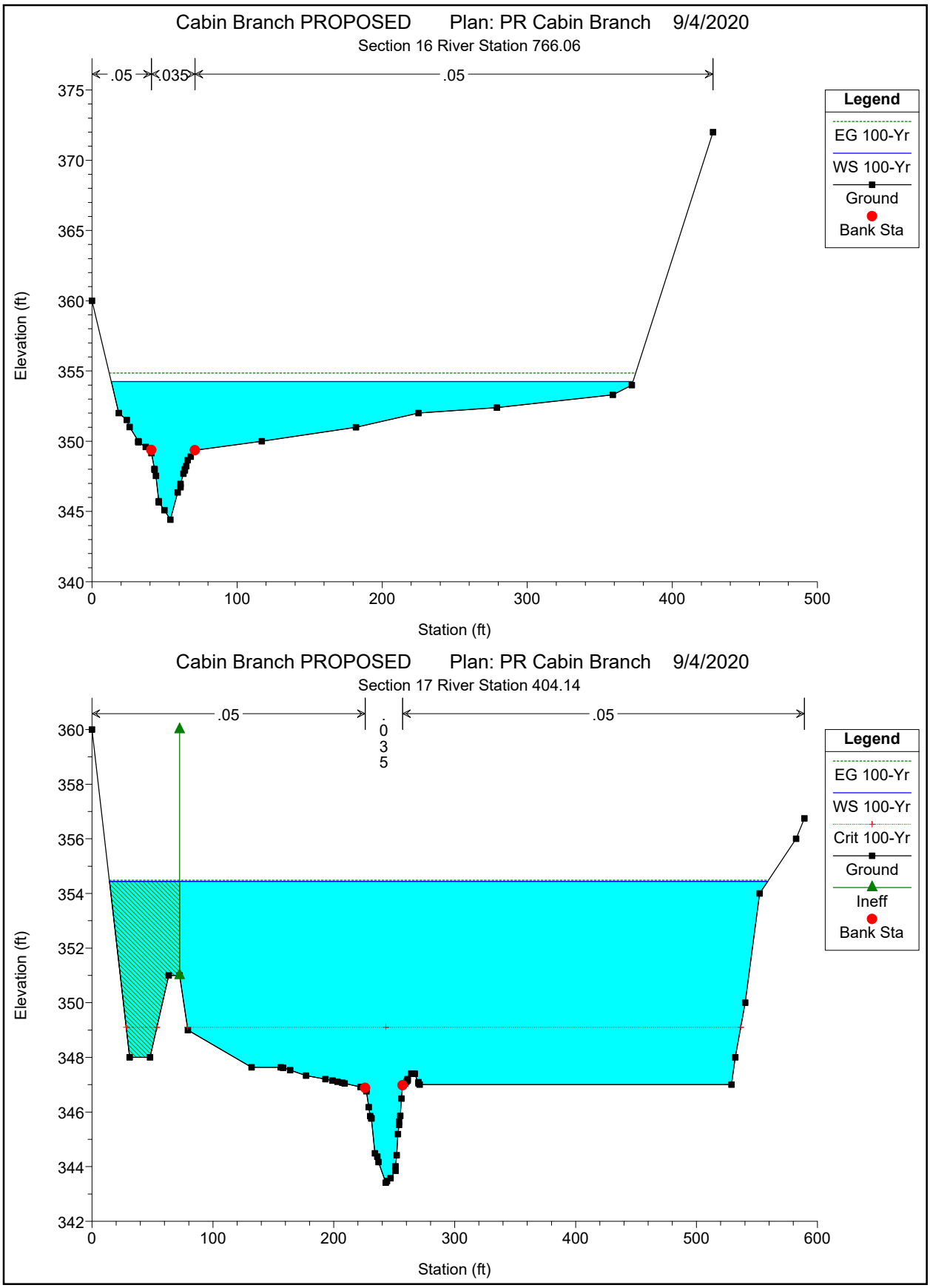
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Bank Sta
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Station (ft)
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Crit 100-Yr
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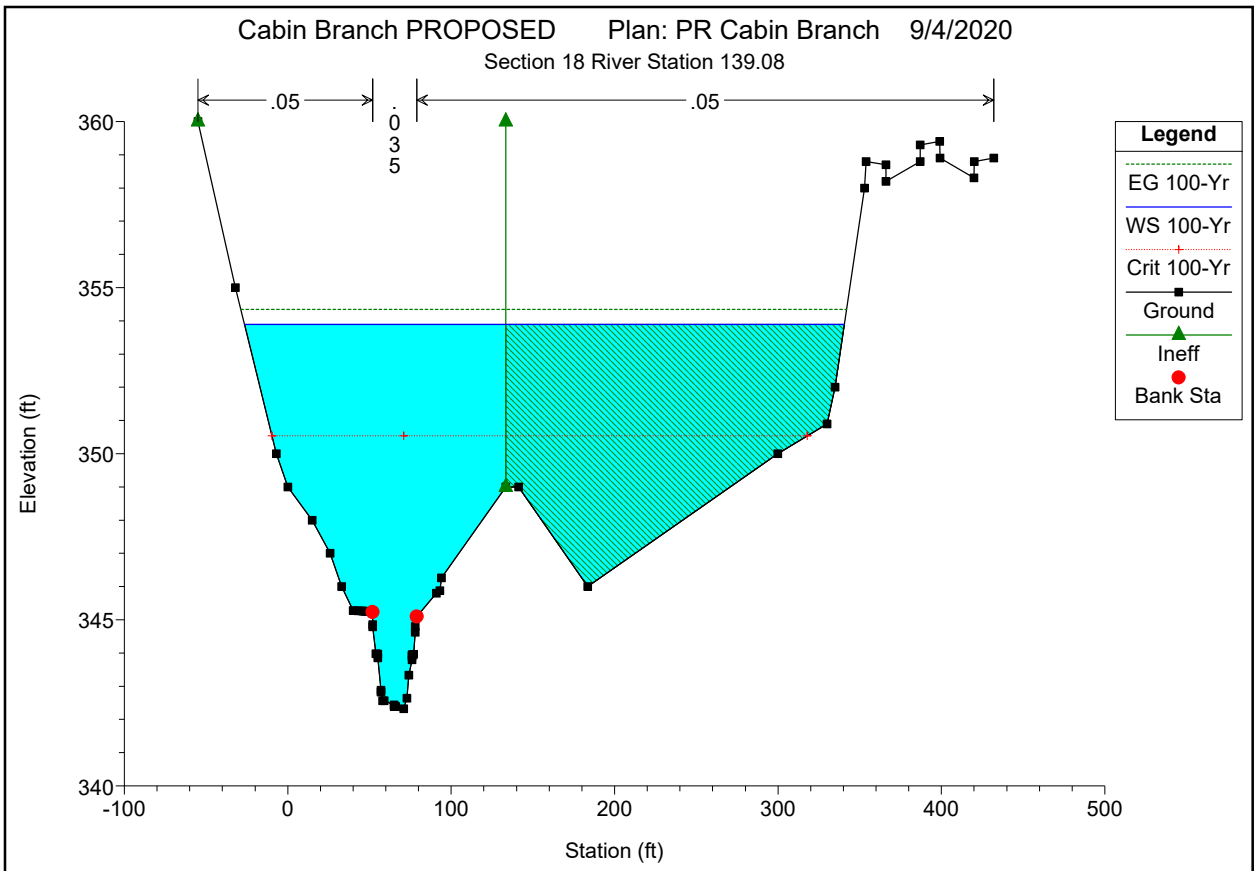
Station (ft)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Crit 100-Yr
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Station (ft)
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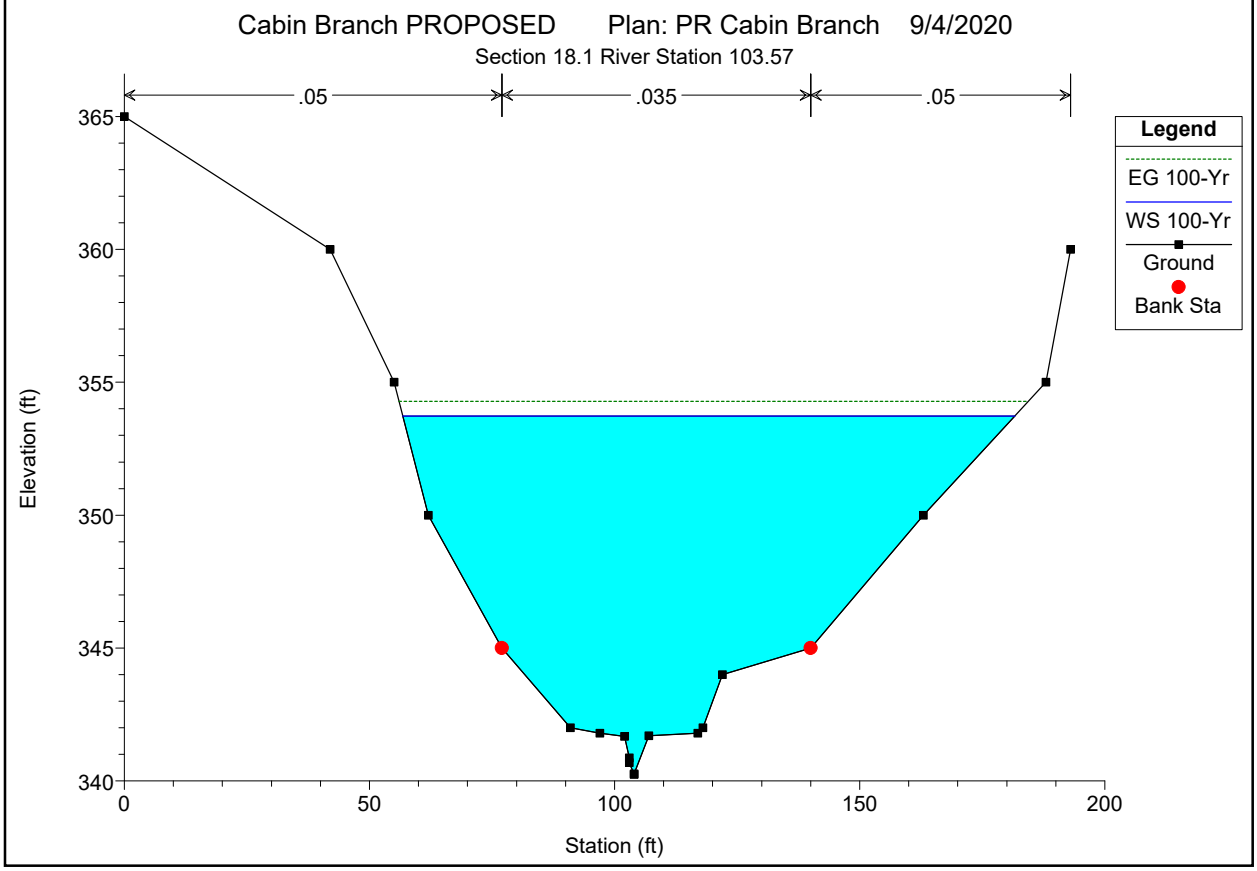
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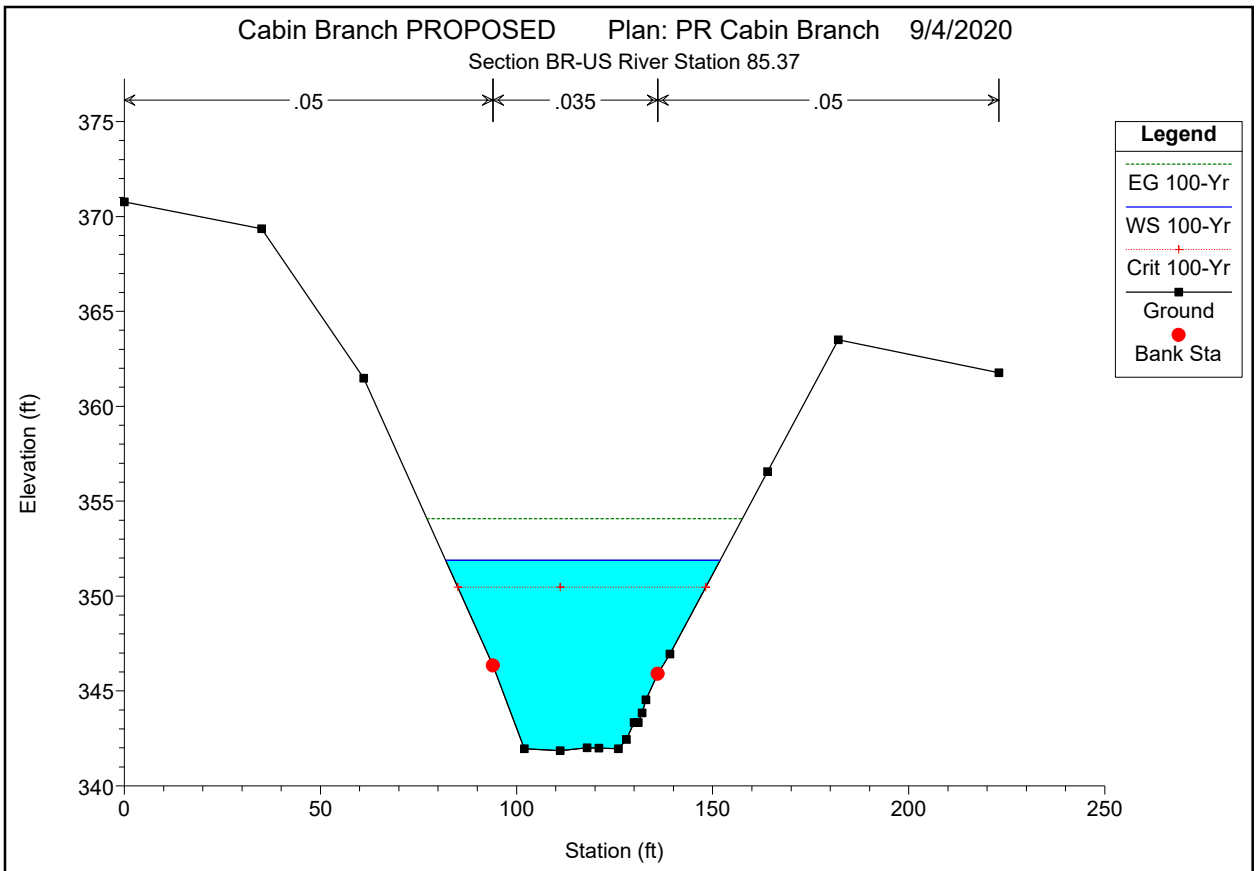
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Crit 100-Yr
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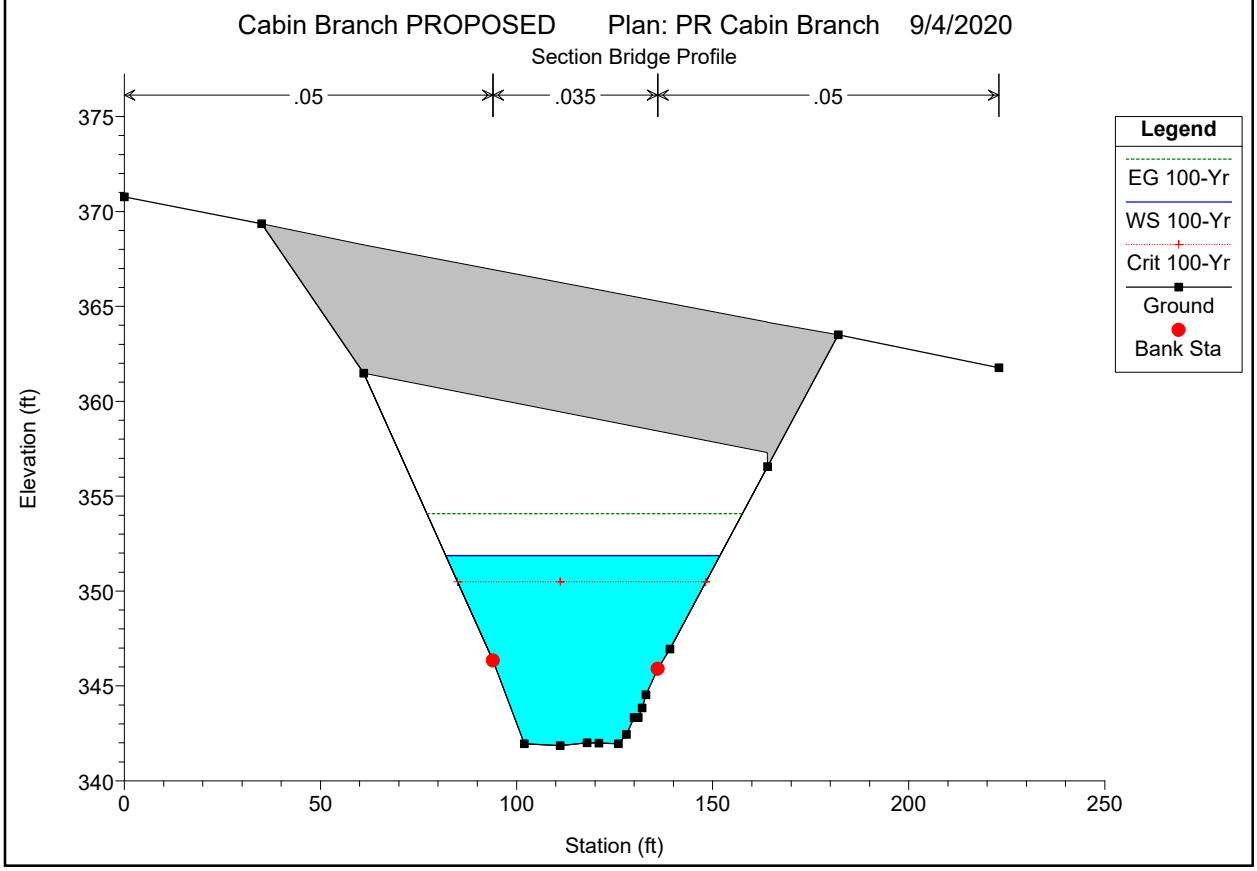
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Crit 100-Yr
Ground
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Station (ft)
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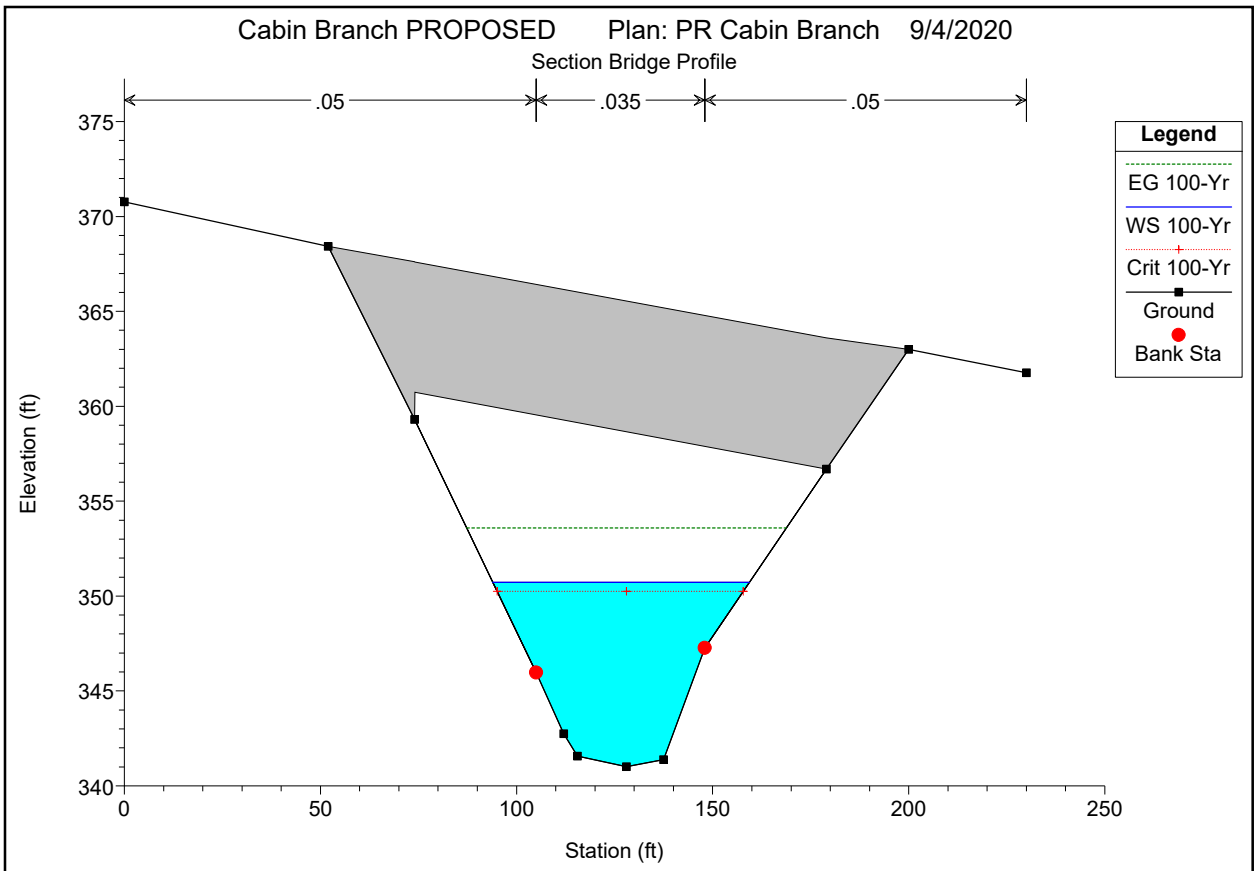
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Legend
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WS 100-Yr
Crit 100-Yr
Ground
Bank Sta
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Station (ft)
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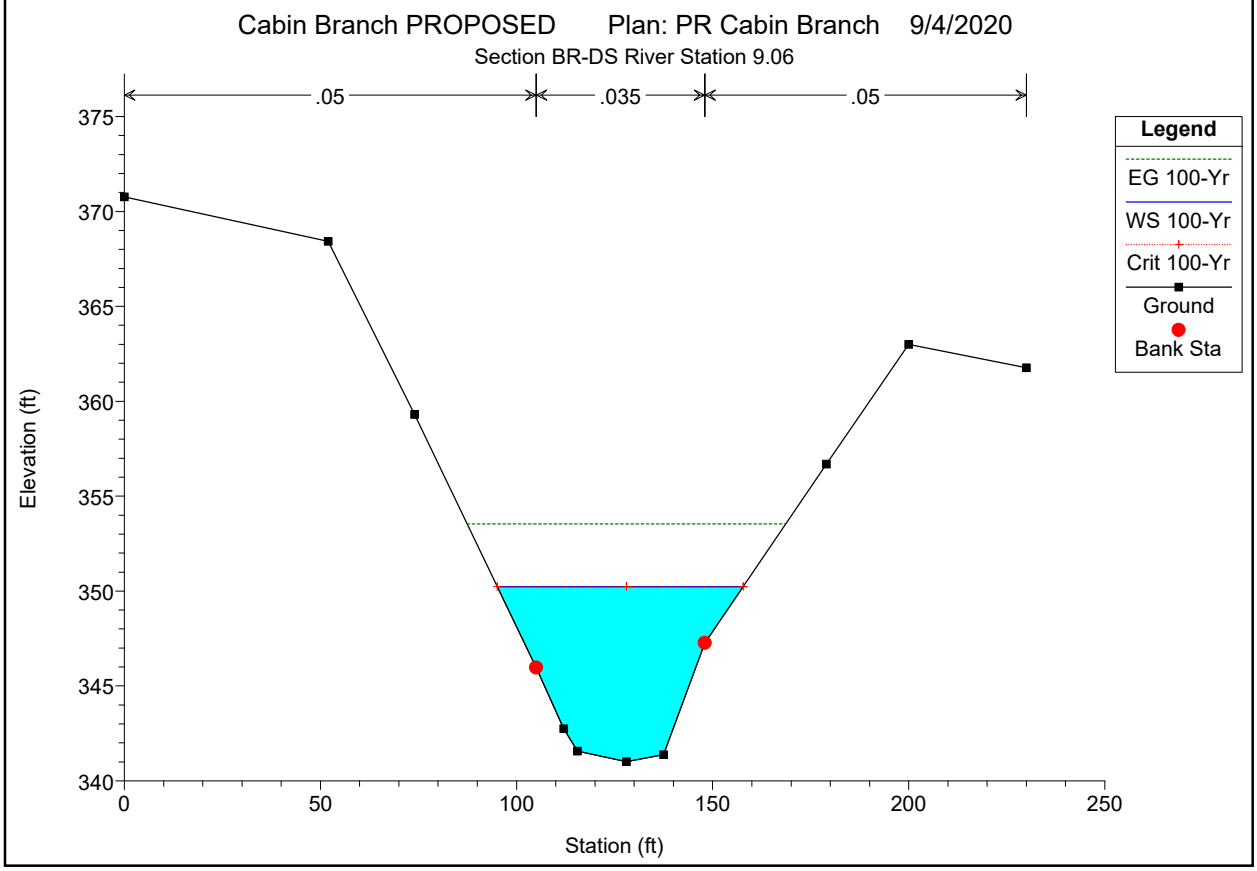
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WS 100-Yr
Crit 100-Yr
Ground
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Station (ft)
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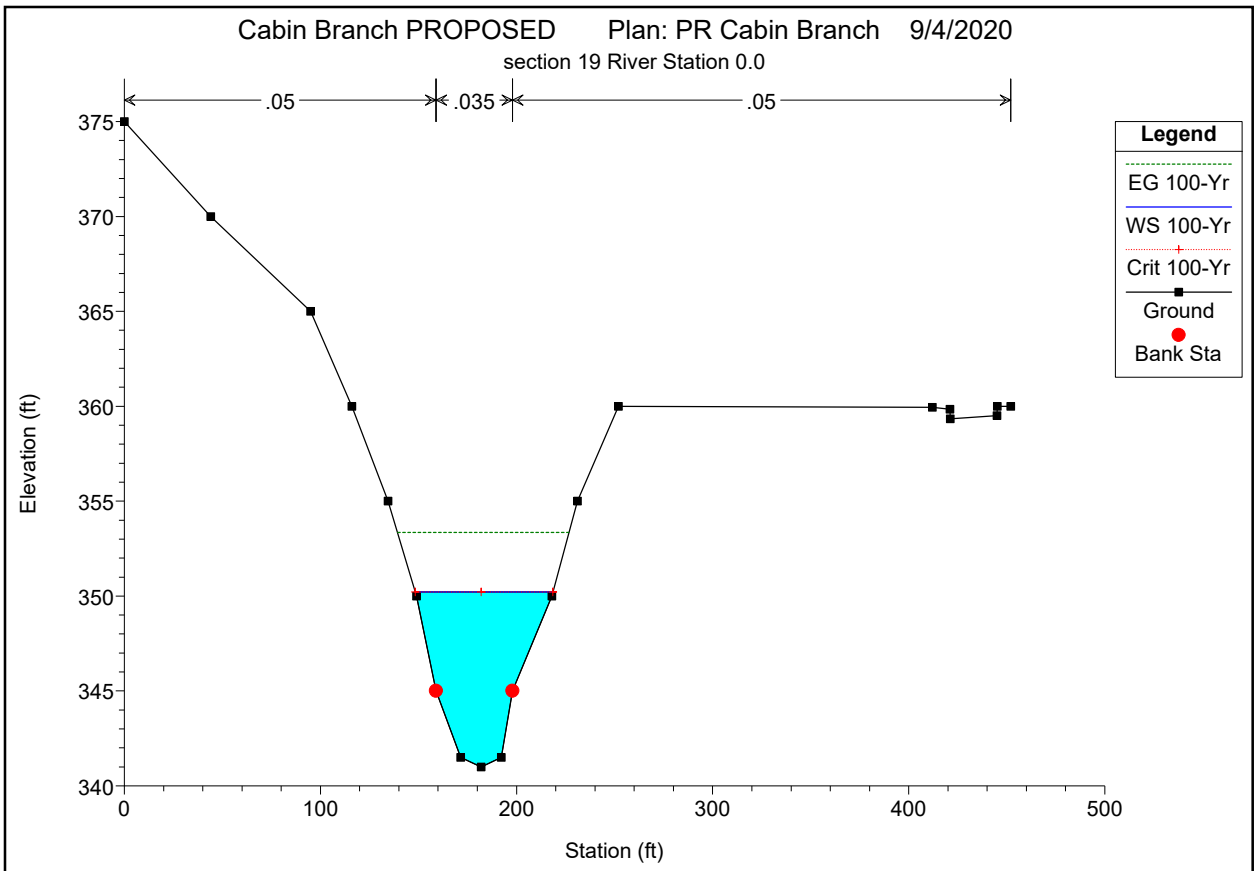
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Crit 100-Yr
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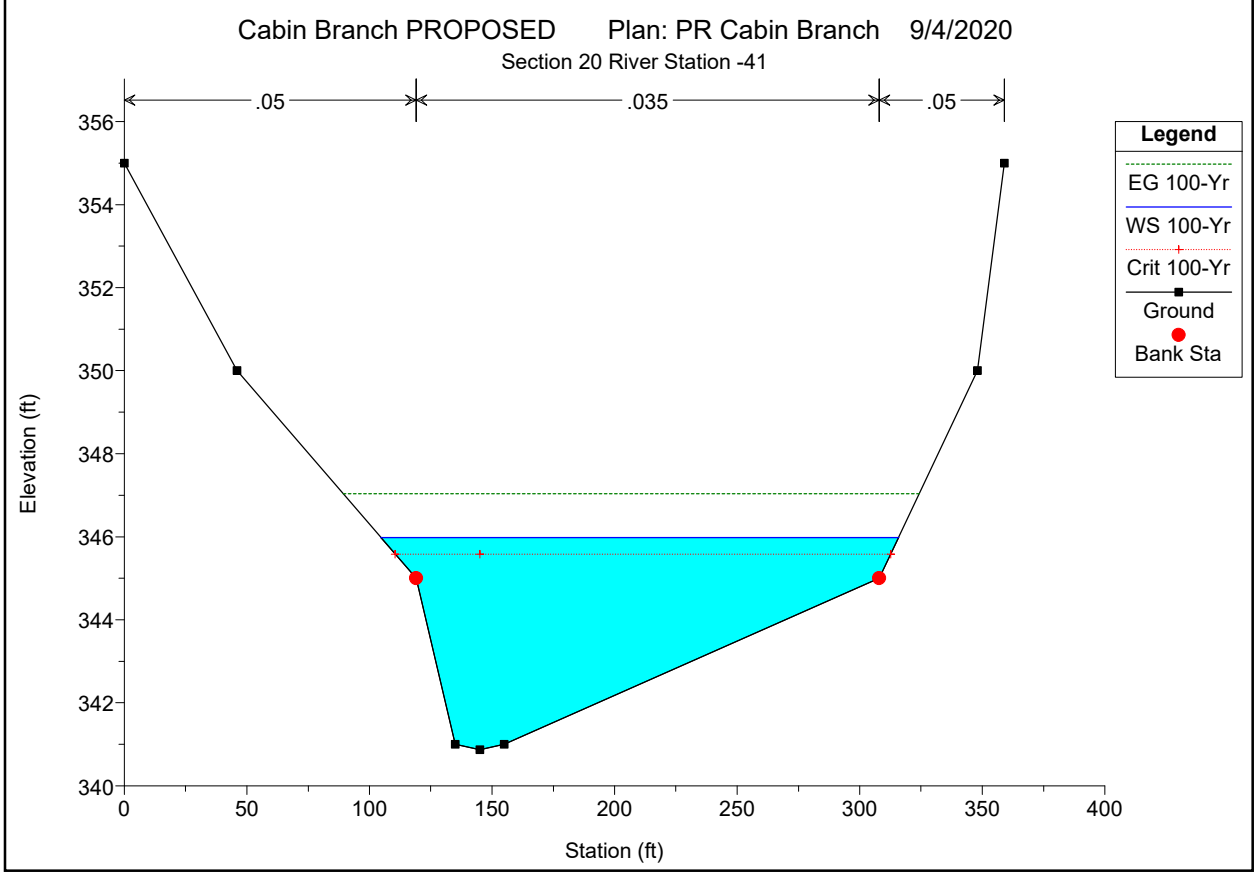
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Crit 100-Yr
Ground
Bank Sta
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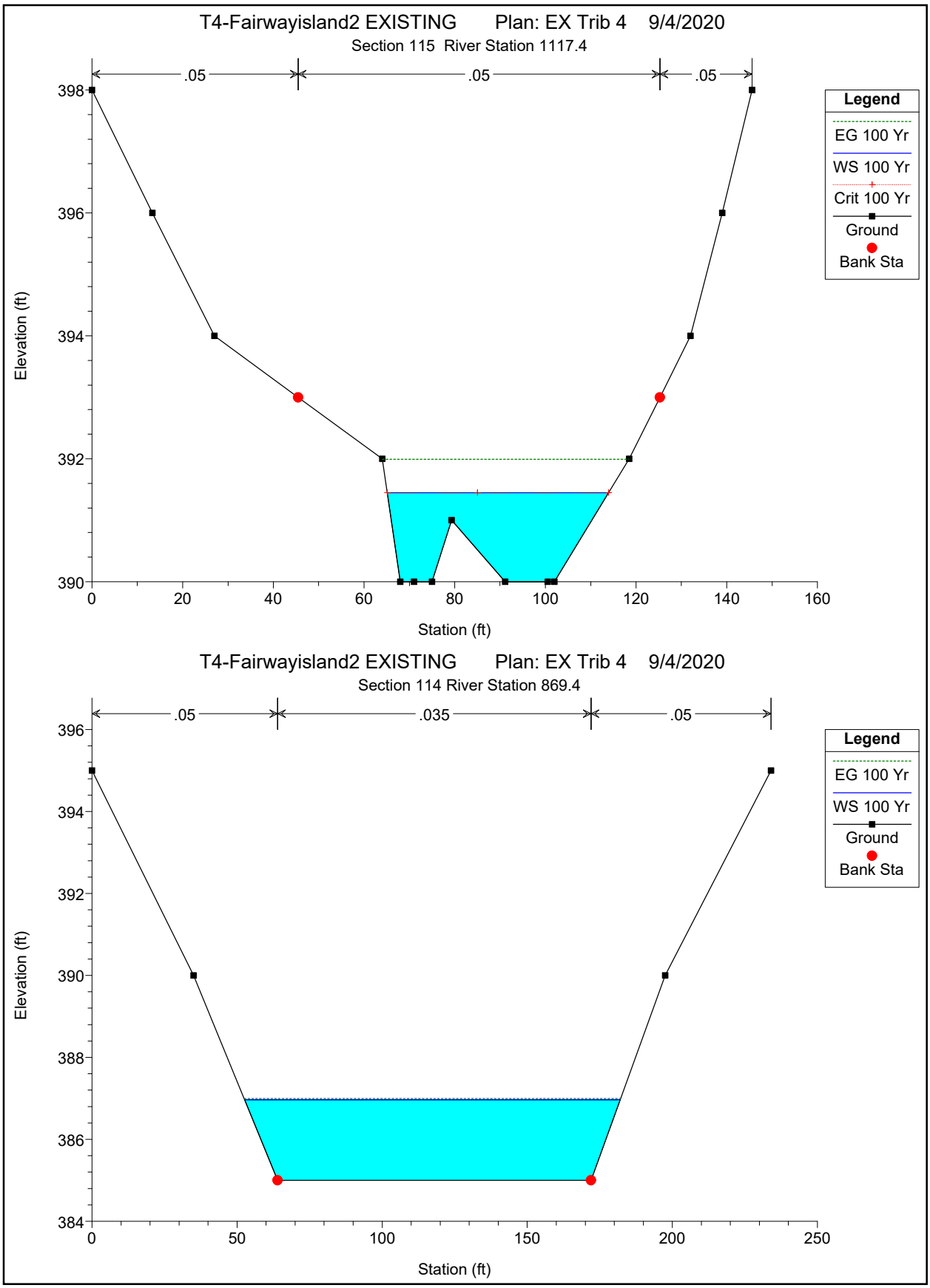
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WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
T4-Fairwayisland2 EXISTING Plan: EX Trib 4 9/4/2020
Section 114 River Station 869.4
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Legend
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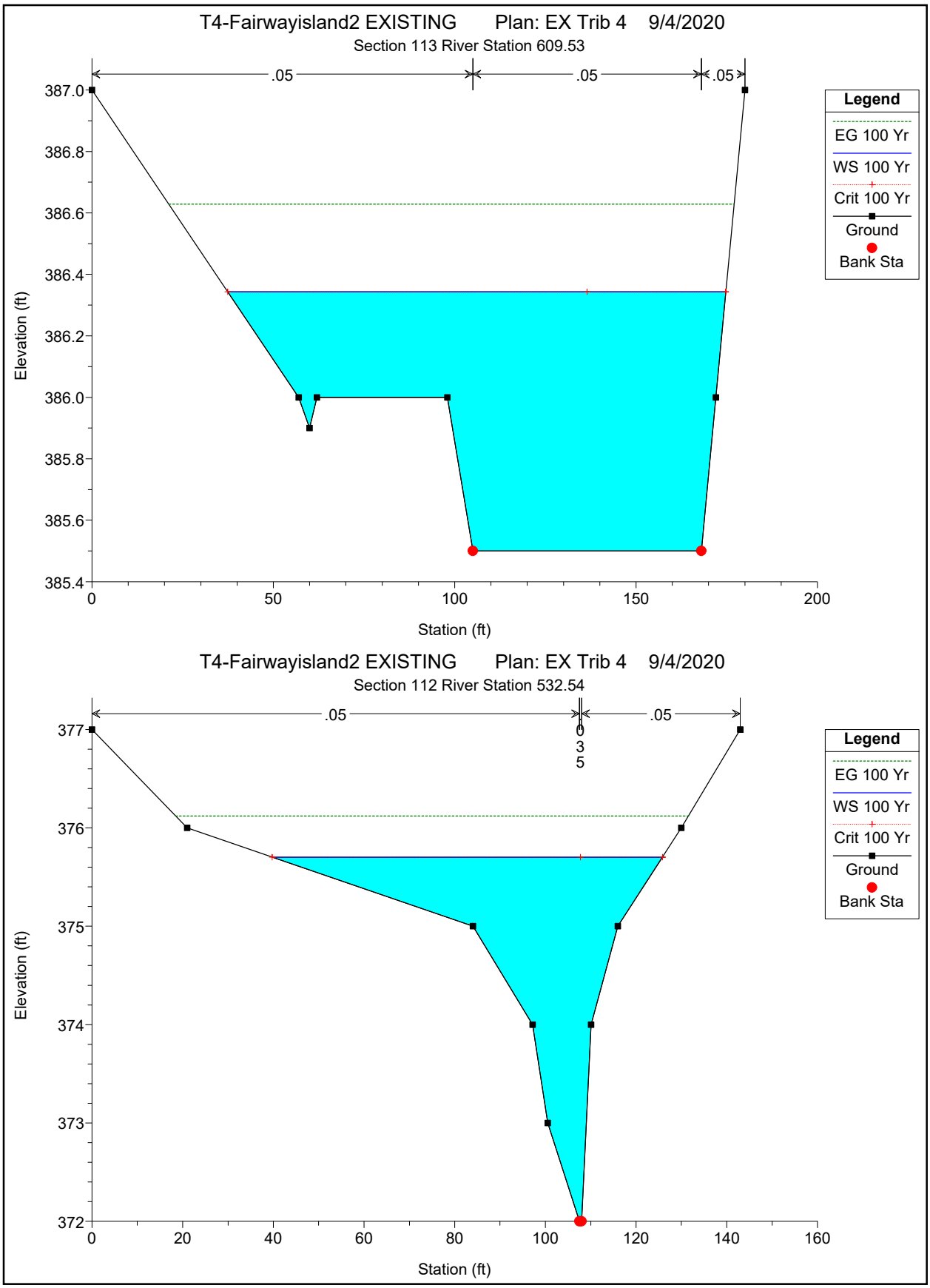
WS 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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Section 113 River Station 609.53
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386.8
386.6
386.4
386.2
386.0
385.8
385.6
385.4
Elevation (ft)
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50
100
150
200
Station (ft)
Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
T4-Fairwayisland2 EXISTING Plan: EX Trib 4 9/4/2020
Section 112 River Station 532.54
.05
.05
377
376
375
374
373
372
Elevation (ft)
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160
Station (ft)
Legend
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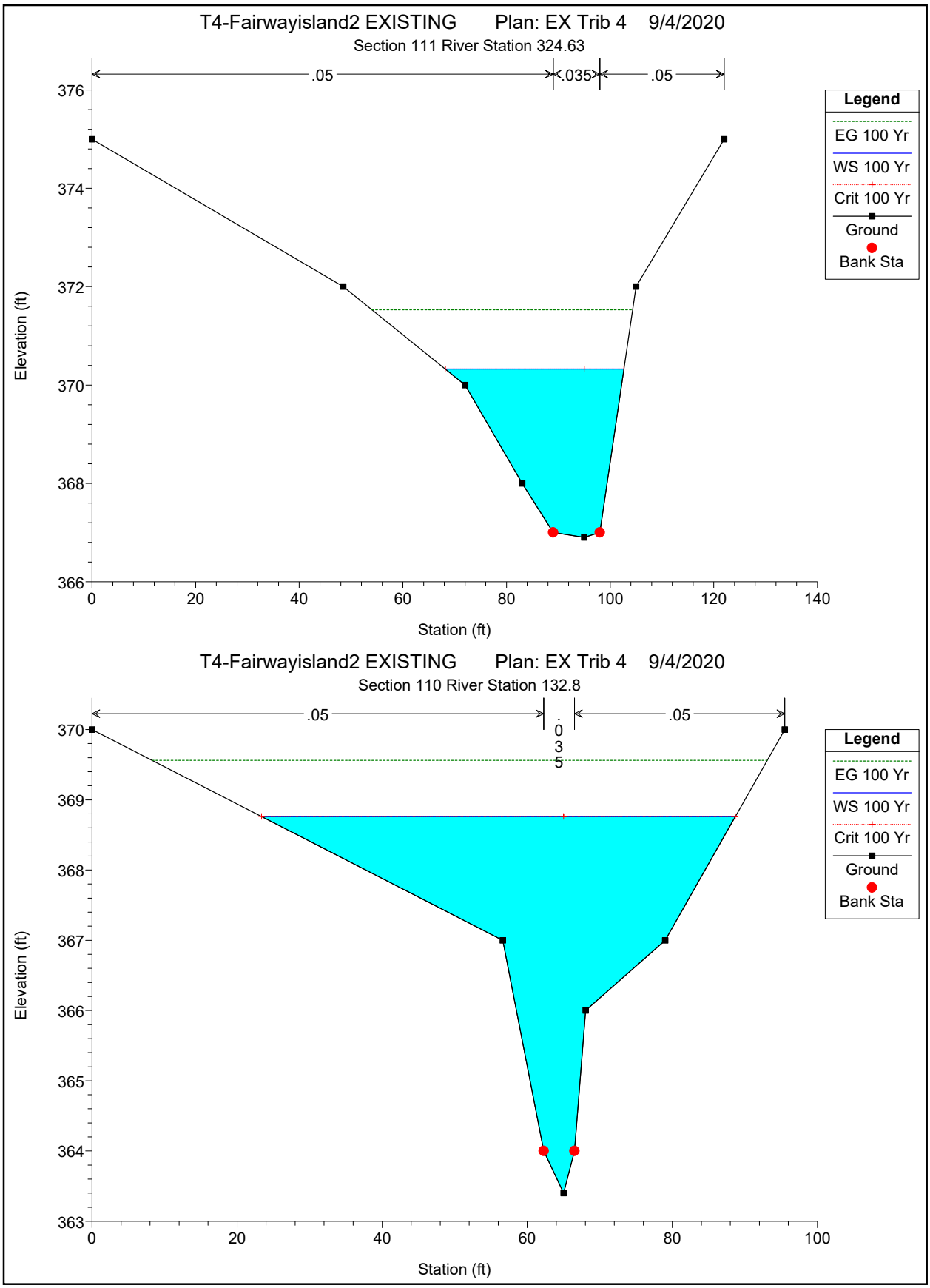
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta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WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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Section 110 River Station 132.8
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Legend
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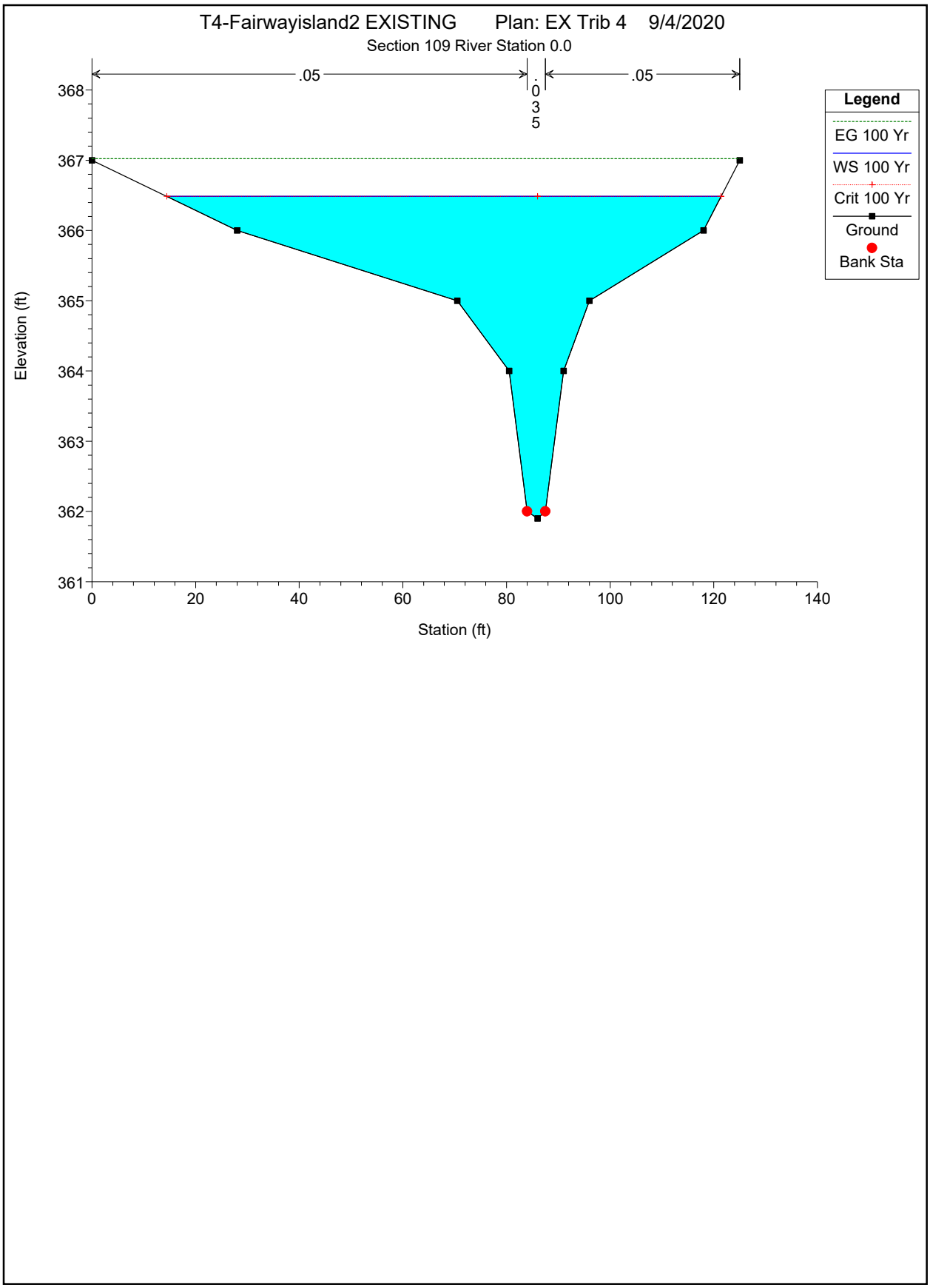
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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Legend
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WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
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Station (ft)
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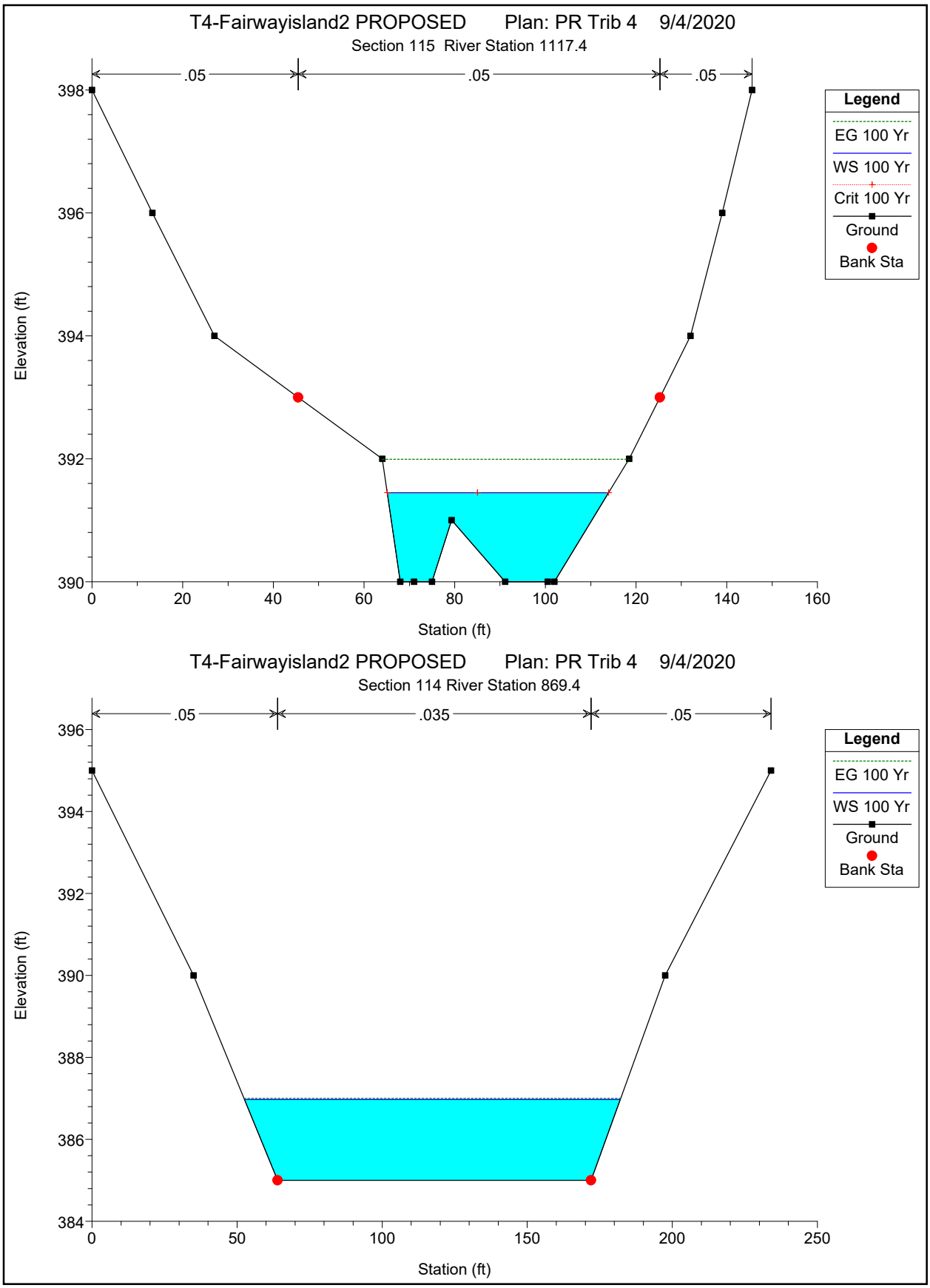
100
120
140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396
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Elevation (ft)
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60
80
100
120
140
160
Station (ft)
Legend
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WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
T4-Fairwayisland2 PROPOSED Plan: PR Trib 4 9/4/2020
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390
388
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Station (ft)
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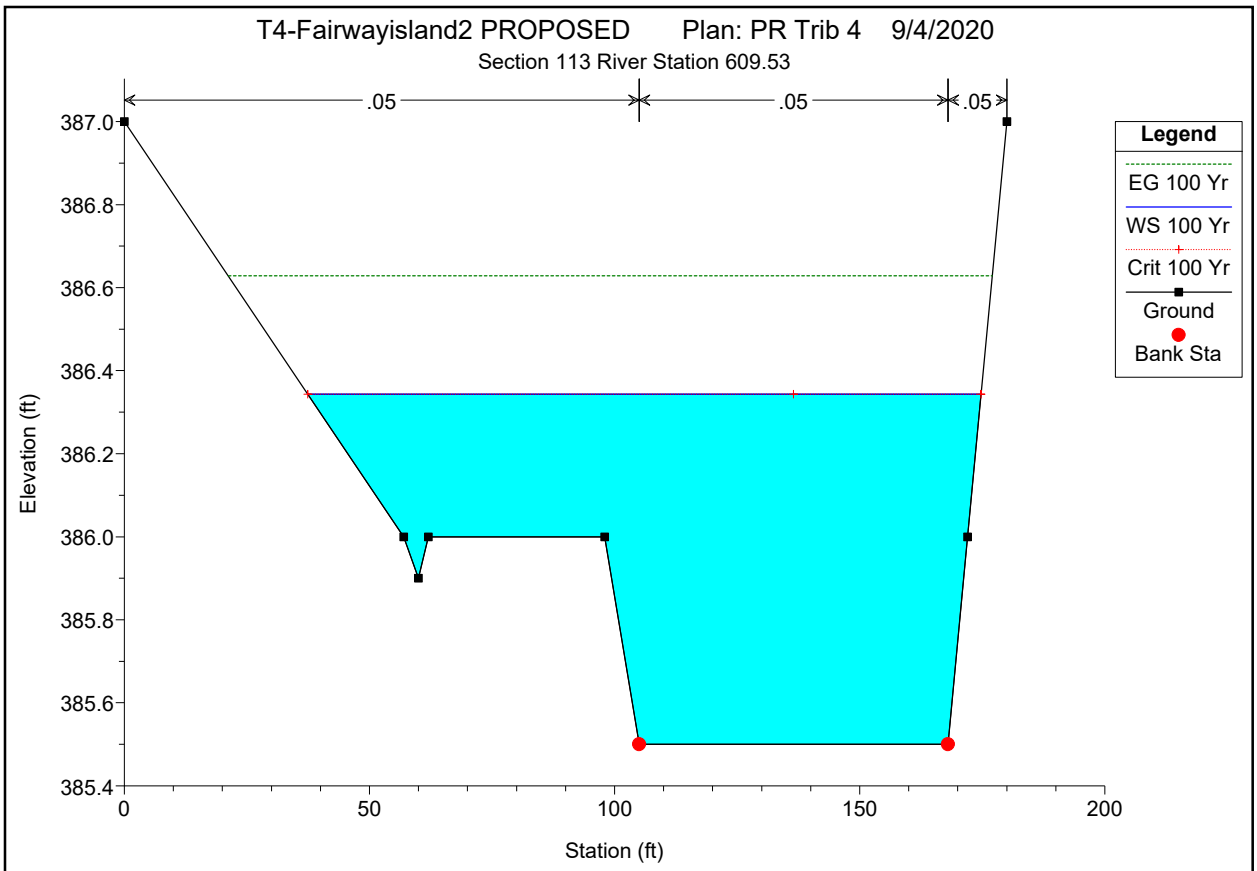
Ground
Bank Sta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WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
387.0
386.8
386.6
386.4
386.2
386.0
385.8
385.6
385.4
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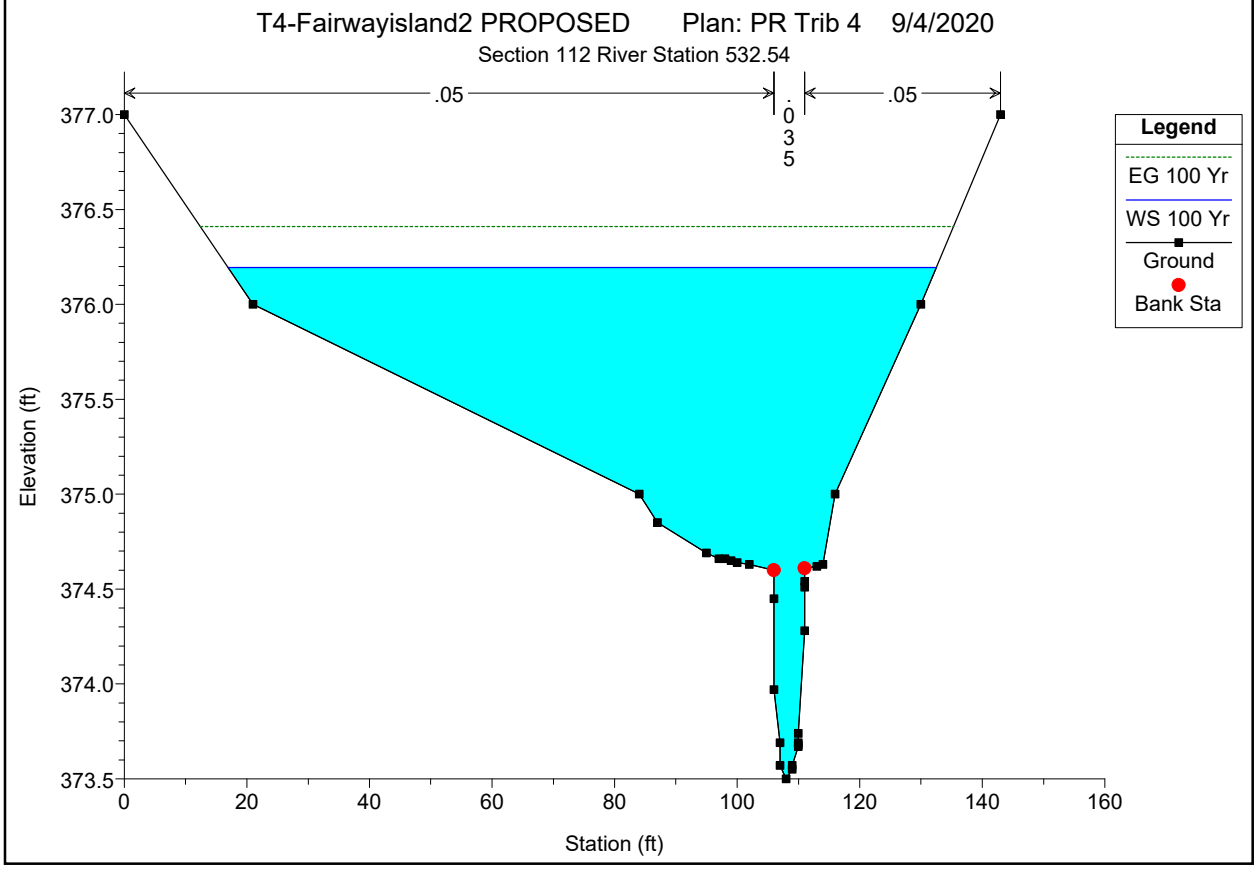
Station (ft)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WS 100 Yr
Ground
Bank Sta
Elevation (ft)
377.0
376.5
376.0
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60
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140
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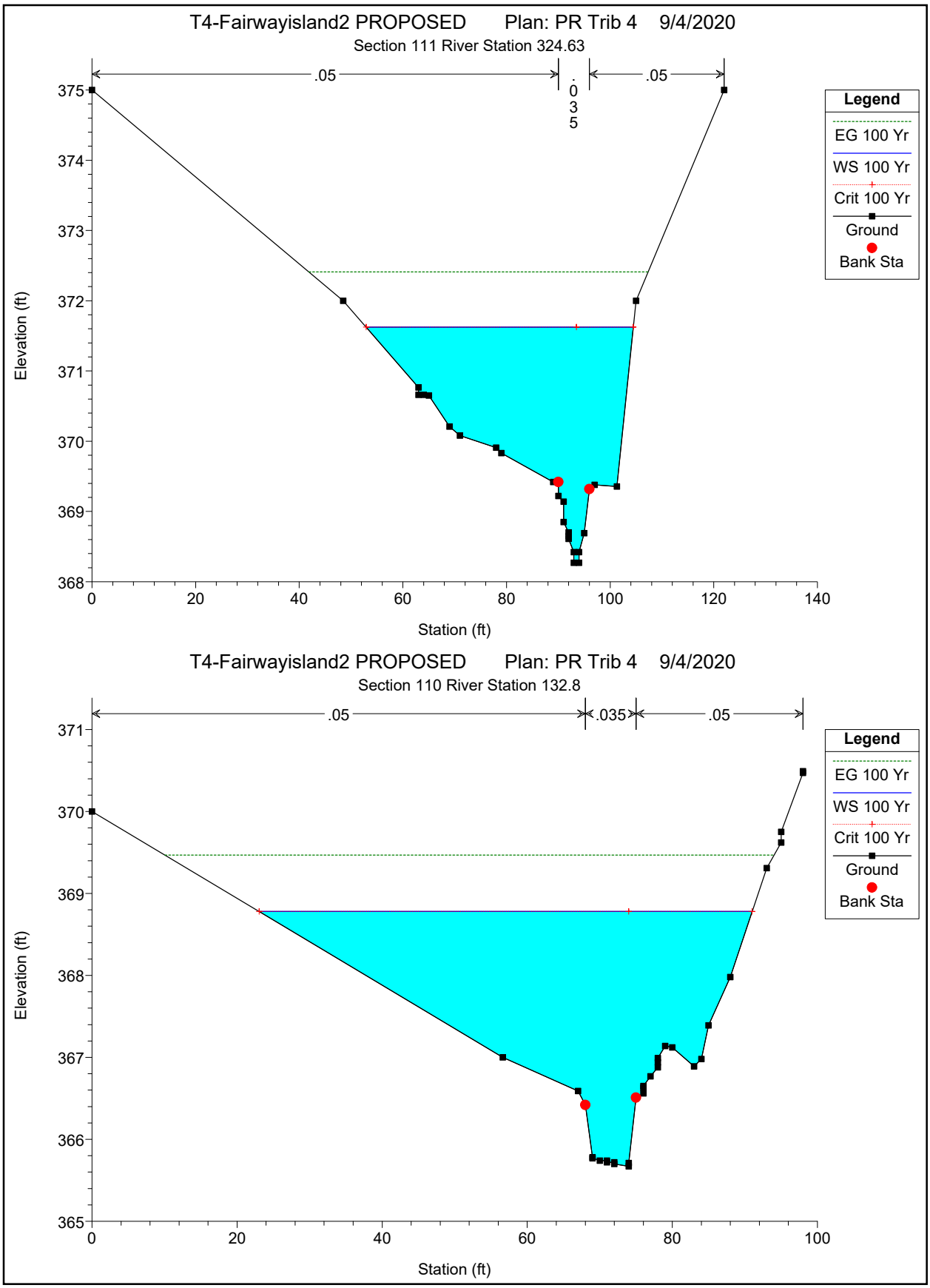
Station (ft)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Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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Section 110 River Station 132.8
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.05
Legend
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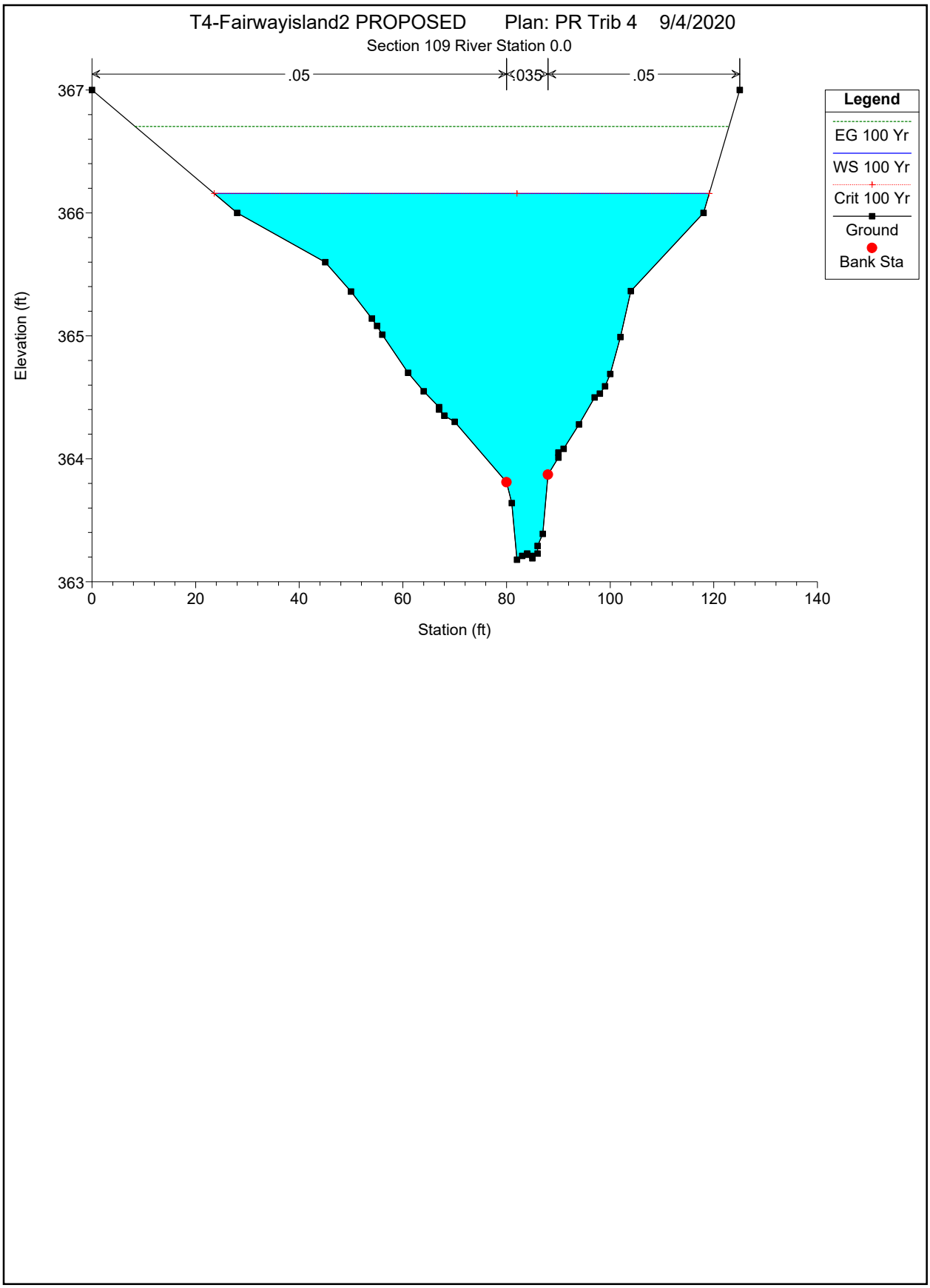
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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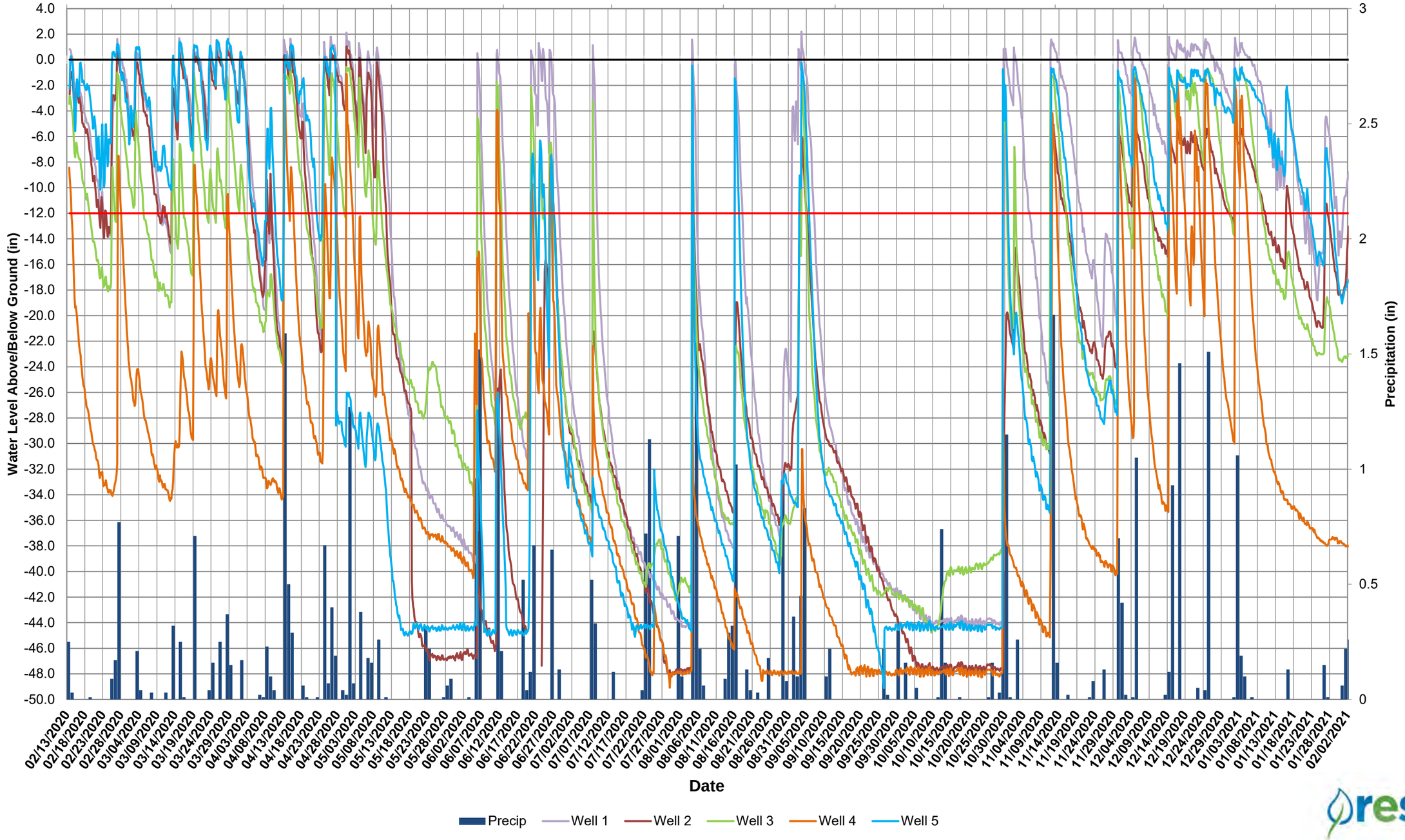
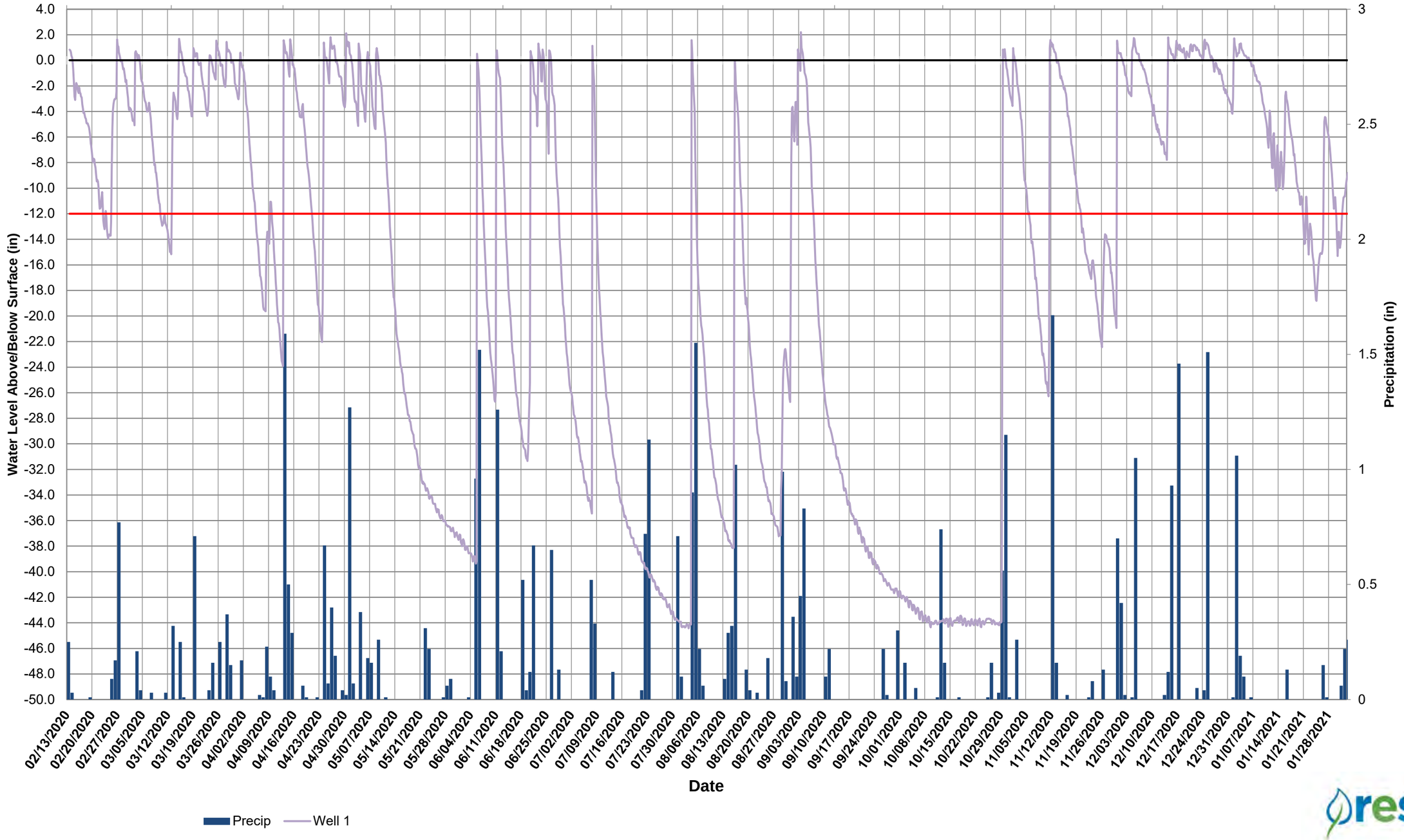
Legend
EG 100 Yr
WS 100 Yr
Crit 100 Yr
Ground
Bank Sta
Elevation (ft)
367
366
365
364
363
0
20
40
60
80
100
120
140
Station (ft)

Appendix E: Well Data

2020-2021 Cabin Branch Hydrological Data



2020-2021 Cabin Branch Well 1 (Wetland 5)



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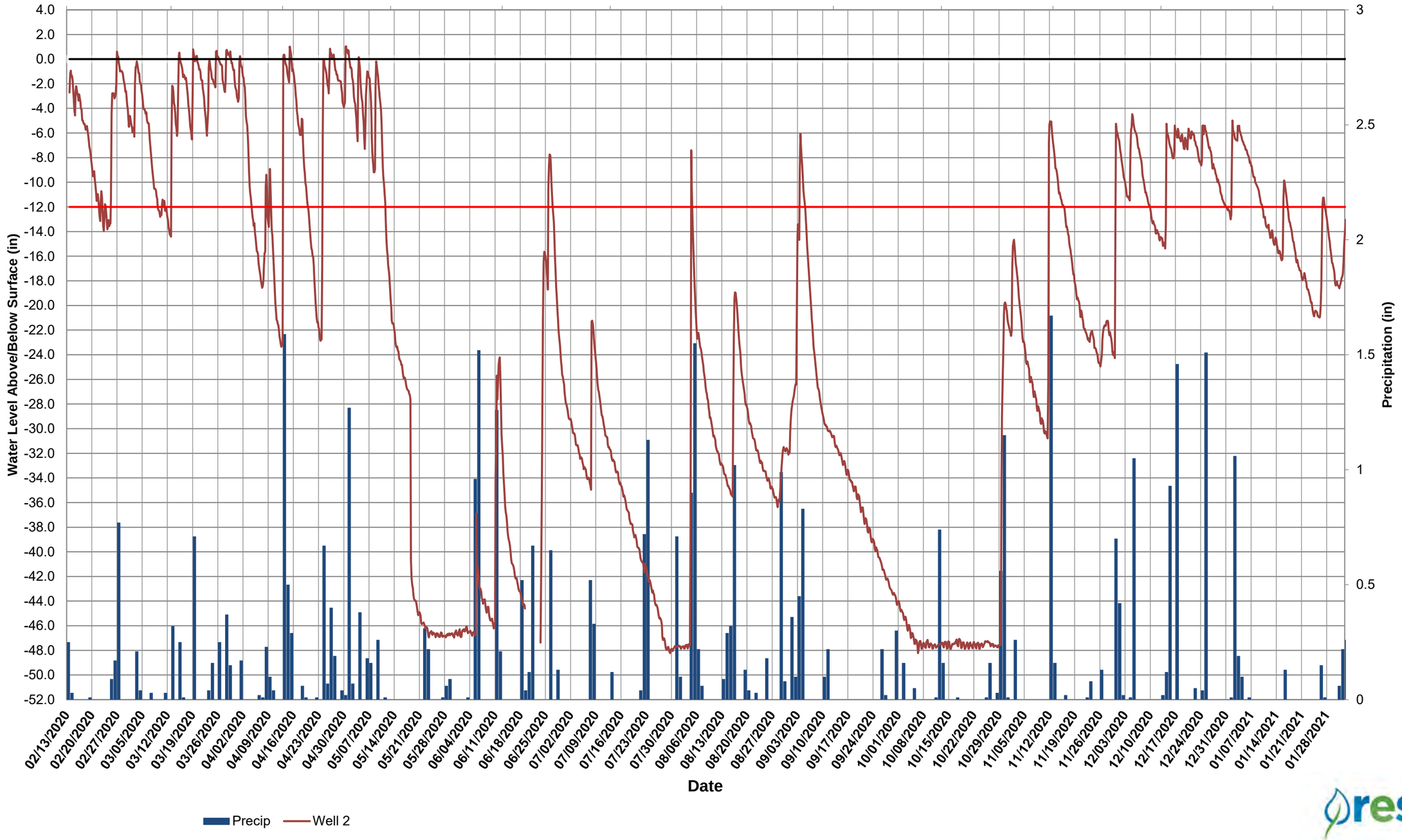

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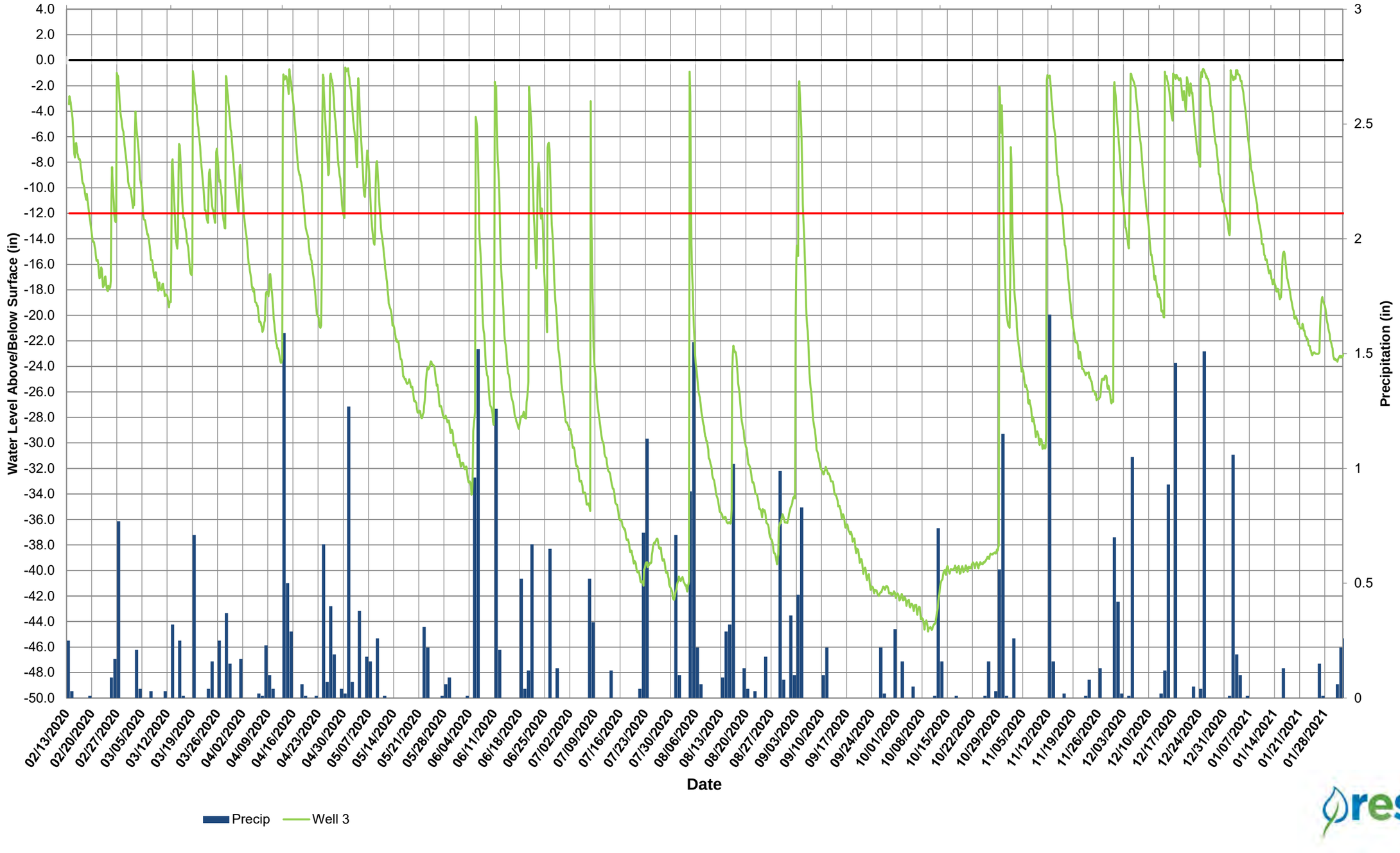

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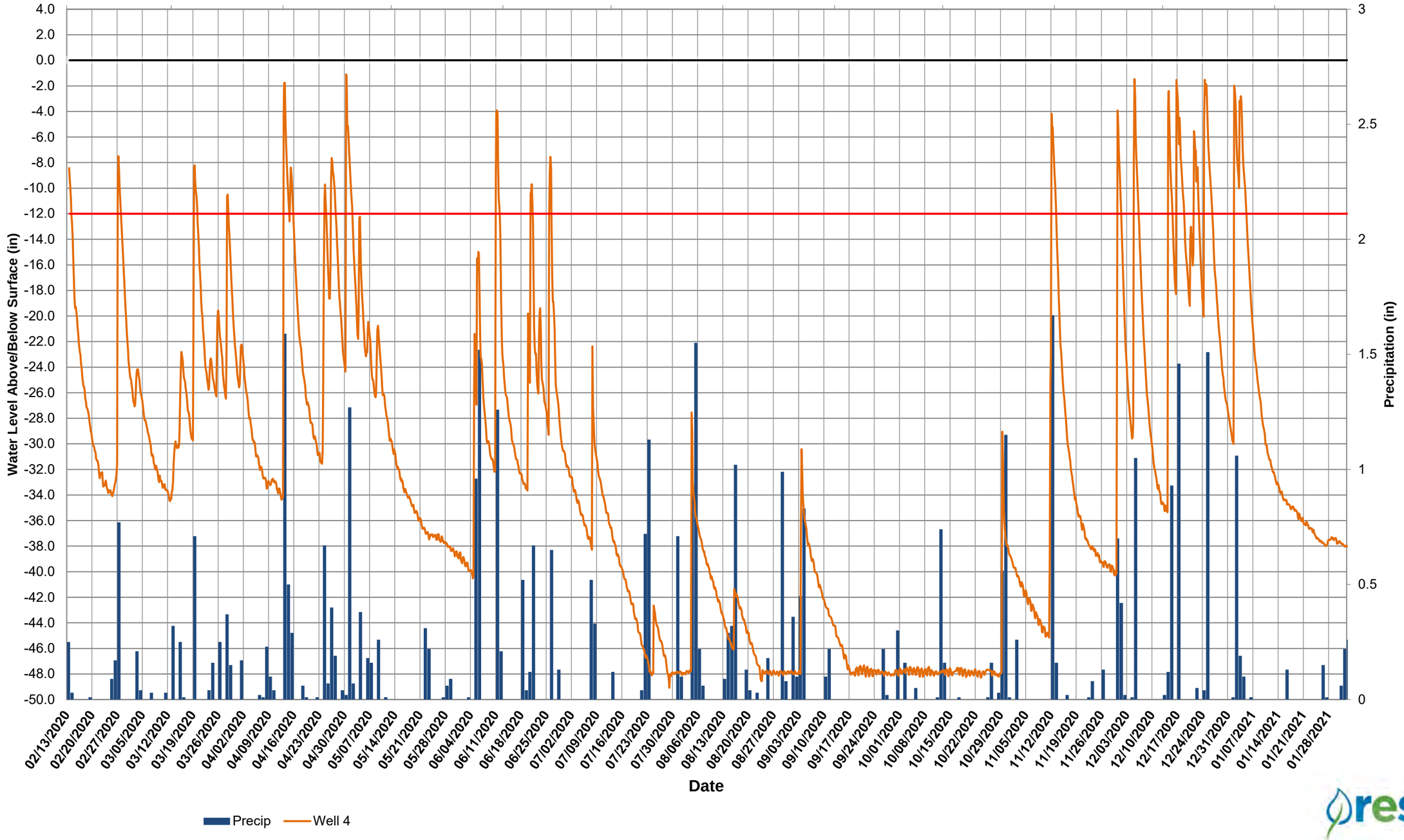

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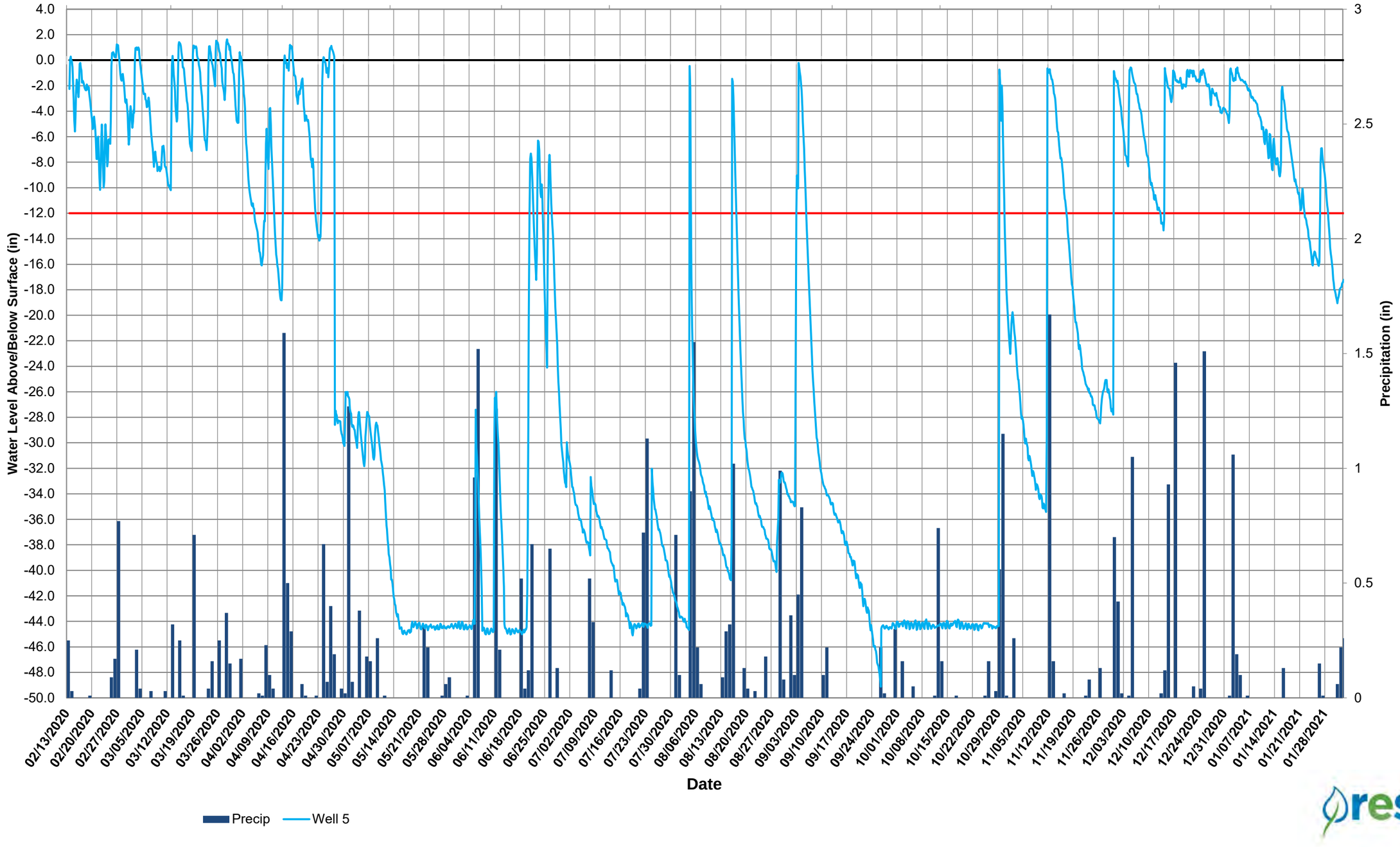


Appendix F: Wetland Water Budgets

Cell 1

Wet Year - 2003

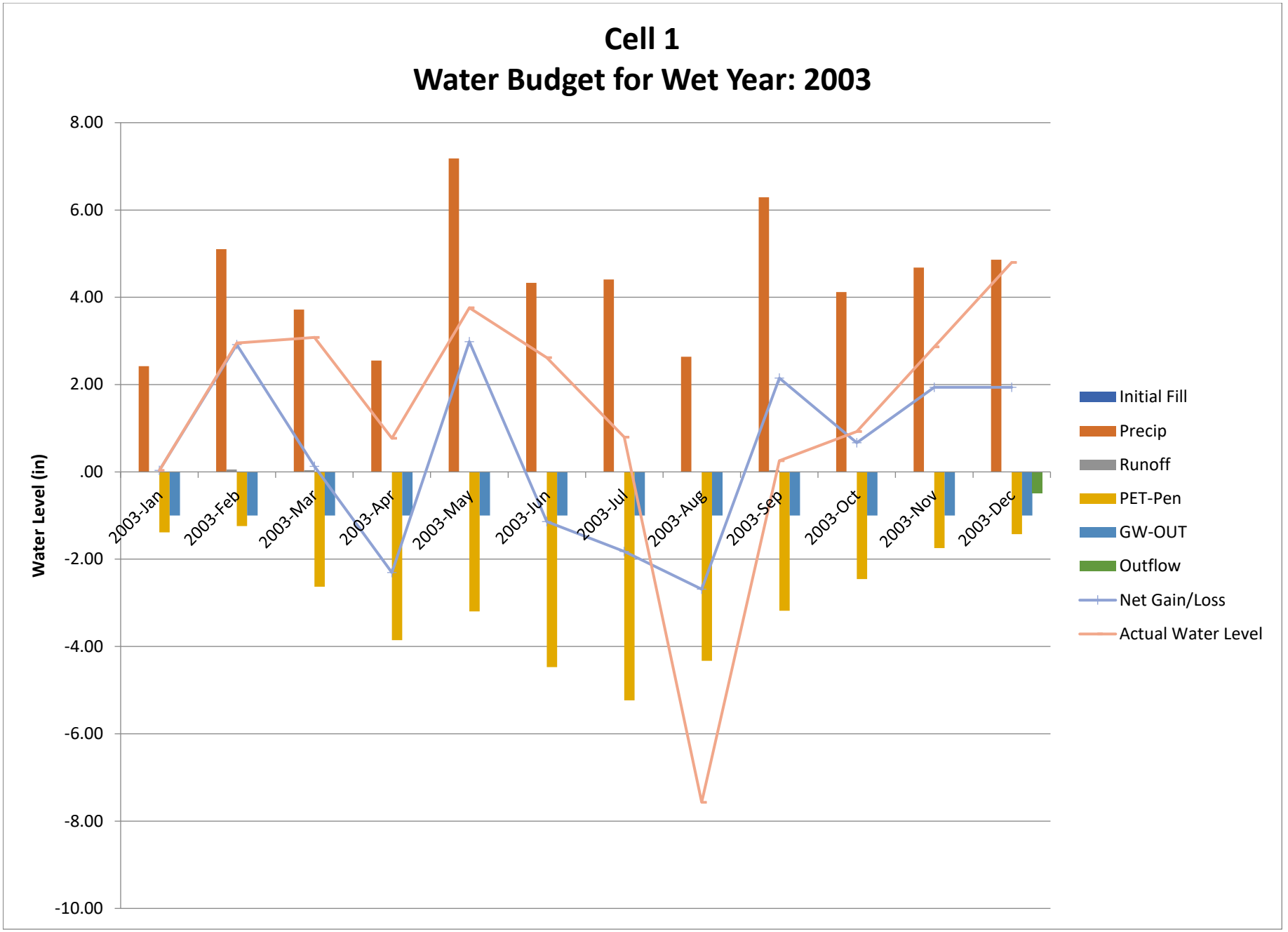
	Precip	Runoff	PET-Pen	GW-OUT	Outflow	Net Gain/Loss	Actual Water Level
2003-Jan	2.42	.00	-1.38	-1.00	.00	.04	.04
2003-Feb	5.10	.06	-1.24	-1.00	.00	2.91	2.95
2003-Mar	3.72	.04	-2.63	-1.00	.00	.13	3.08
2003-Apr	2.55	.00	-3.86	-1.00	.00	-2.31	.77
2003-May	7.18	.00	-3.20	-1.00	.00	2.99	3.76
2003-Jun	4.33	.00	-4.47	-1.00	.00	-1.14	2.62
2003-Jul	4.41	.00	-5.23	-1.00	.00	-1.82	.79
2003-Aug	2.64	.00	-4.33	-1.00	.00	-2.69	-7.57
2003-Sep	6.29	.04	-3.18	-1.00	.00	2.15	.26
2003-Oct	4.12	.00	-2.45	-1.00	.00	.67	.92
2003-Nov	4.68	.00	-1.74	-1.00	.00	1.94	2.86
2003-Dec	4.86	.00	-1.43	-1.00	-.50	1.94	4.80

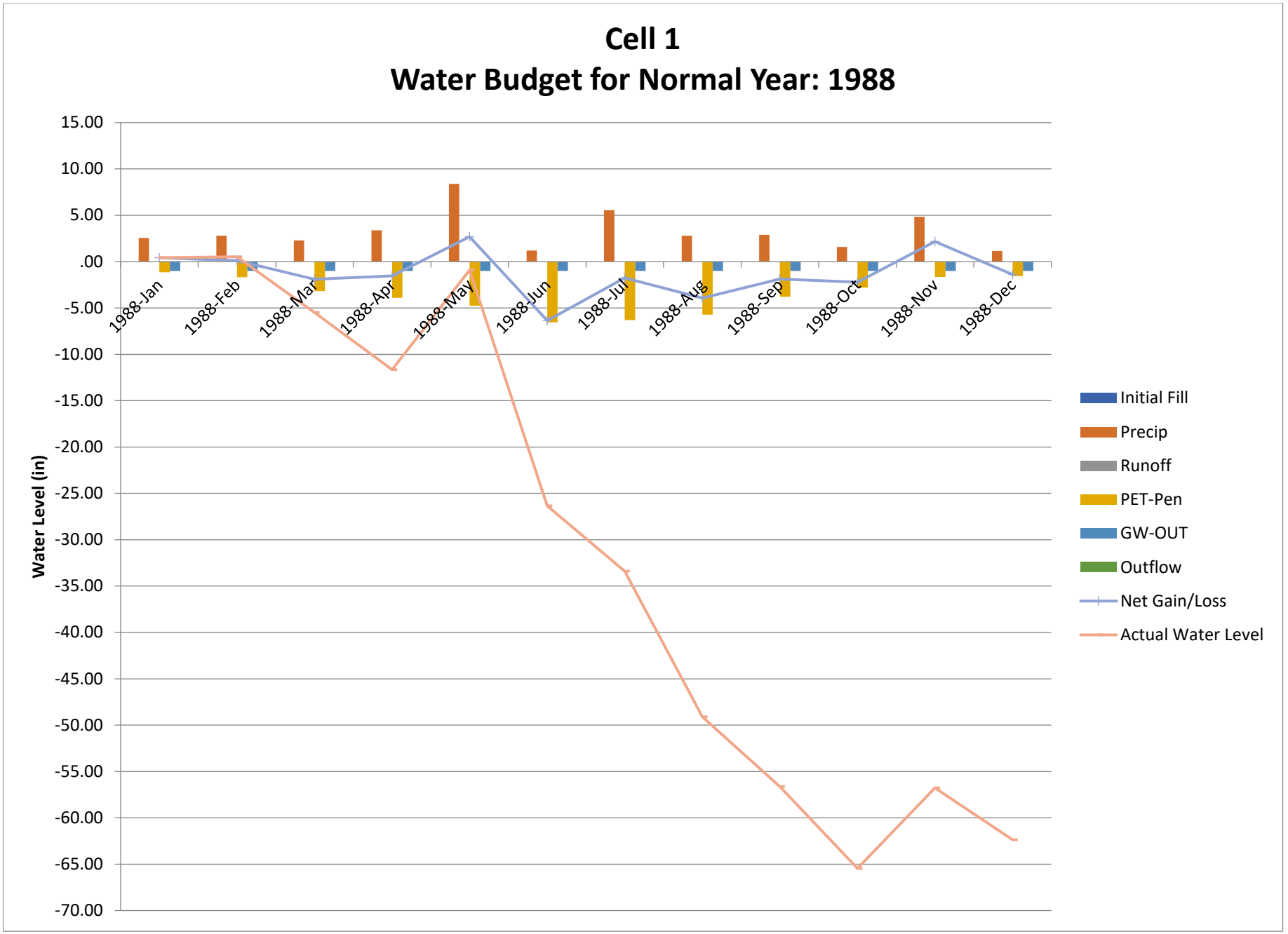
Normal Year - 1988

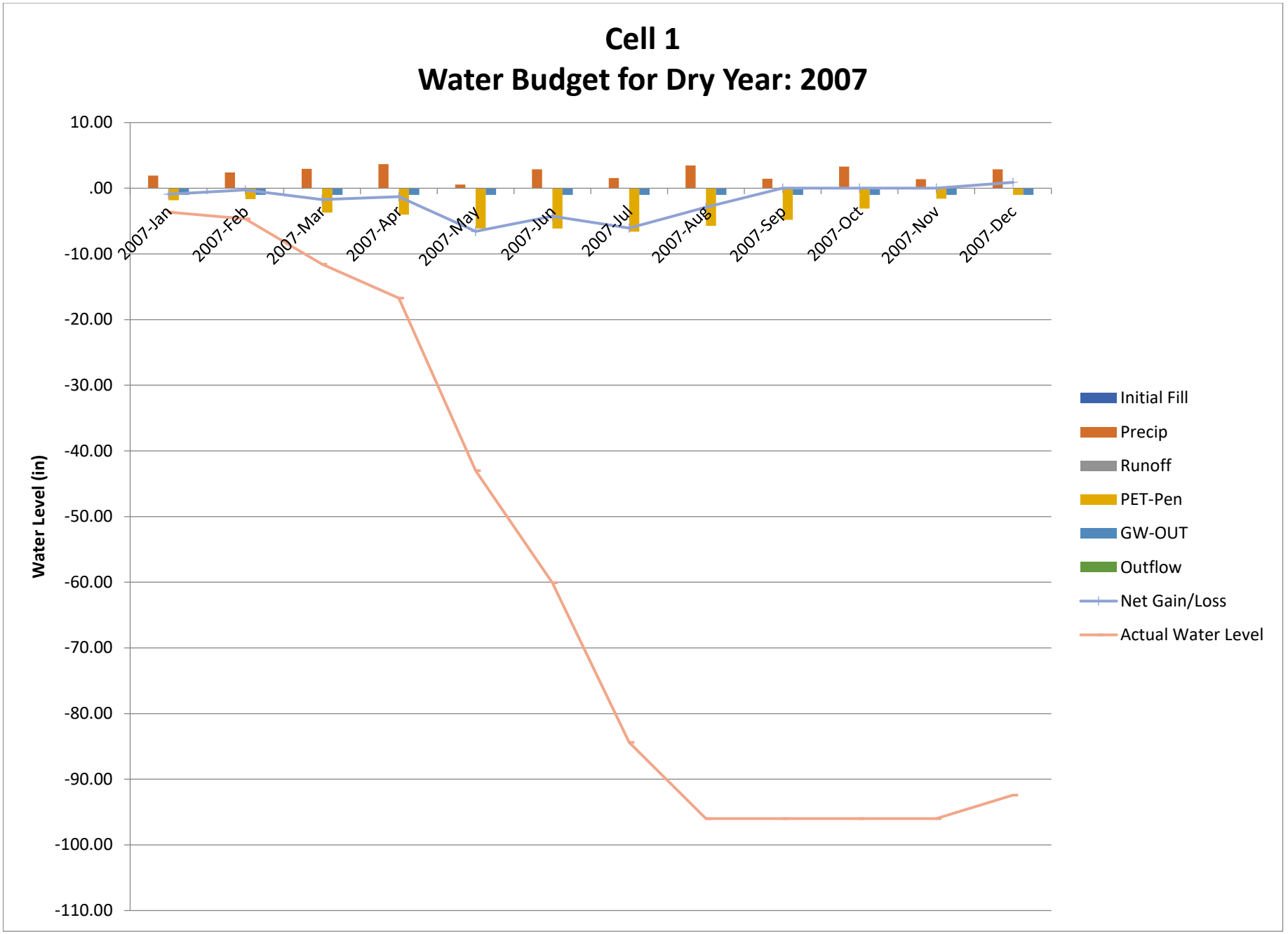
	Precip	Runoff	PET-Pen	GW-OUT	Outflow	Net Gain/Loss	Actual Water Level
1988-Jan	2.56	.00	-1.14	-1.00	.00	.42	.42
1988-Feb	2.80	.00	-1.69	-1.00	.00	.11	.52
1988-Mar	2.29	.00	-3.18	-1.00	.00	-1.89	-5.49
1988-Apr	3.37	.00	-3.91	-1.00	.00	-1.54	-11.65
1988-May	8.38	.05	-4.75	-1.00	.00	2.68	-.91
1988-Jun	1.19	.00	-6.55	-1.00	.00	-6.36	-26.36
1988-Jul	5.56	.00	-6.32	-1.00	.00	-1.76	-33.39
1988-Aug	2.80	.00	-5.73	-1.00	.00	-3.93	-49.11
1988-Sep	2.90	.00	-3.78	-1.00	.00	-1.88	-56.63
1988-Oct	1.58	.00	-2.79	-1.00	.00	-2.21	-65.46
1988-Nov	4.84	.00	-1.67	-1.00	.00	2.17	-56.76
1988-Dec	1.16	.00	-1.56	-1.00	.00	-1.40	-62.37

Dry Year - 2007

	Precip	Runoff	PET-Pen	GW-OUT	Outflow	Net Gain/Loss	Actual Water Level
2007-Jan	1.92	.00	-1.83	-1.00	.00	-.91	-3.64
2007-Feb	2.40	.00	-1.65	-1.00	.00	-.25	-4.66
2007-Mar	2.96	.03	-3.71	-1.00	.00	-1.73	-11.56
2007-Apr	3.68	.05	-4.03	-1.00	.00	-1.29	-16.74
2007-May	.57	.00	-6.14	-1.00	.00	-6.57	-43.01
2007-Jun	2.87	.00	-6.14	-1.00	.00	-4.27	-60.10
2007-Jul	1.56	.00	-6.63	-1.00	.00	-6.07	-84.39
2007-Aug	3.46	.00	-5.73	-1.00	.00	-2.90	-96.00
2007-Sep	1.44	.00	-4.82	-1.00	.00	.00	-96.00
2007-Oct	3.28	.01	-3.10	-1.00	.00	.00	-96.00
2007-Nov	1.38	.00	-1.61	-1.00	.00	.00	-96.00
2007-Dec	2.89	.00	-1.00	-1.00	.00	.89	-92.42


Cell 1
Water Budget for Wet Year: 2003
Water Level (in)
8.00
6.00
4.00
2.00
.00
-2.00
-4.00
-6.00
-8.00
-10.00
2003-Jan
2003-Feb
2003-Mar
2003-Apr
2003-May
2003-Jun
2003-Jul
2003-Aug
2003-Sep
2003-Oct
2003-Nov
2003-Dec
Initial Fill
Precip
Runoff
PET-Pen
GW-OUT
Outflow
Net Gain/Loss
Actual Water Level


Cell 1
Water Budget for Normal Year: 1988
Water Level (in)
15.00
10.00
5.00
.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
-45.00
-50.00
-55.00
-60.00
-65.00
-70.00
1988-Jan
1988-Feb
1988-Mar
1988-Apr
1988-May
1988-Jun
1988-Jul
1988-Aug
1988-Sep
1988-Oct
1988-Nov
1988-Dec
Initial Fill
Precip
Runoff
PET-Pen
GW-OUT
Outflow
Net Gain/Loss
Actual Water Level


Cell 1
Water Budget for Dry Year: 2007
Water Level (in)
10.00
.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-80.00
-90.00
-100.00
-110.00
2007-Jan
2007-Feb
2007-Mar
2007-Apr
2007-May
2007-Jun
2007-Jul
2007-Aug
2007-Sep
2007-Oct
2007-Nov
2007-Dec
Initial Fill
Precip
Runoff
PET-Pen
GW-OUT
Outflow
Net Gain/Loss
Actual Water Level

Cell 2

Wet Year - 2003

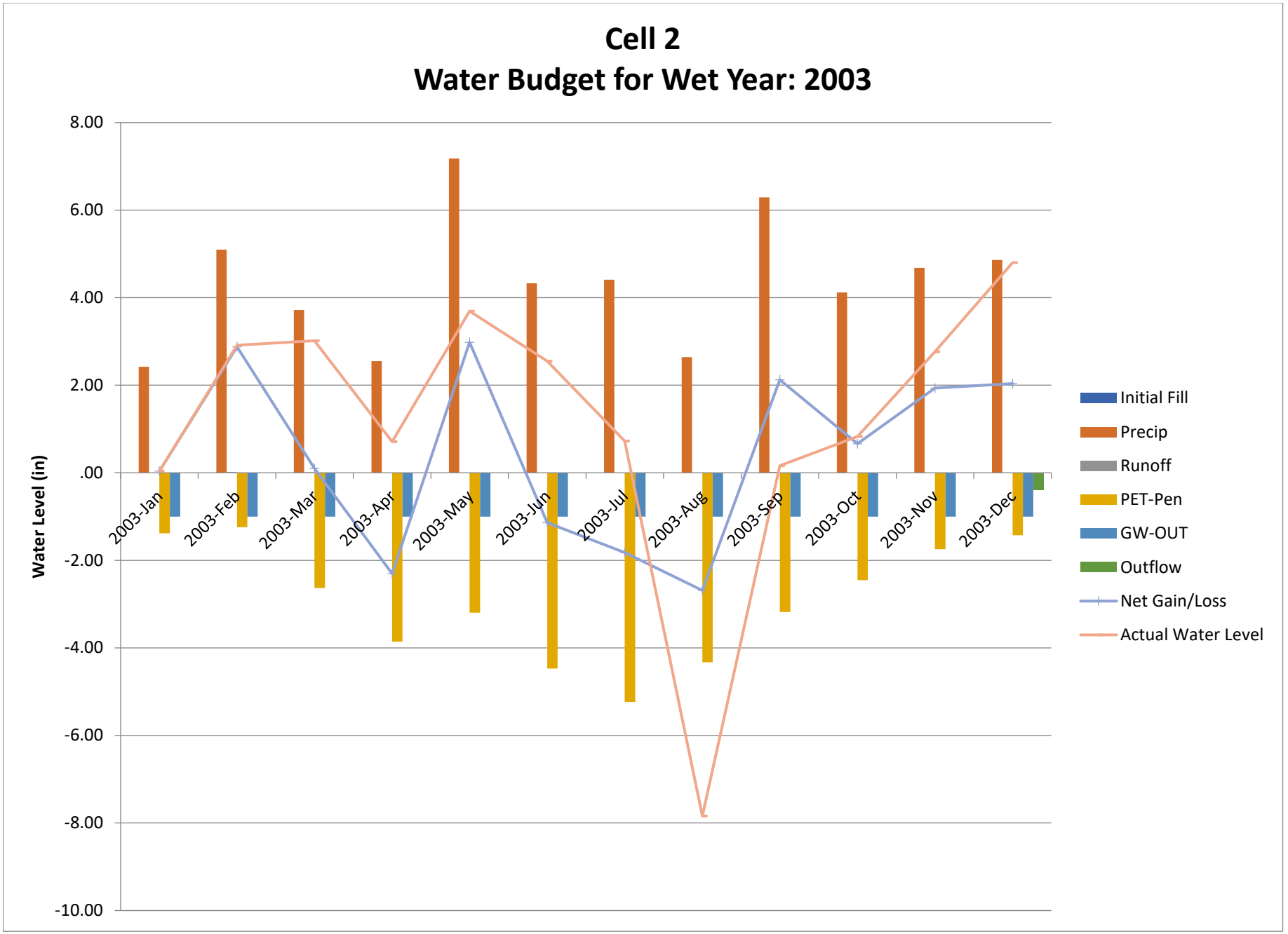
	Precip	Runoff	PET-Pen	GW-OUT	Outflow	Net Gain/Loss	Actual Water Level
2003-Jan	2.42	.00	-1.38	-1.00	.00	.04	.04
2003-Feb	5.10	.02	-1.24	-1.00	.00	2.88	2.91
2003-Mar	3.72	.01	-2.63	-1.00	.00	.10	3.02
2003-Apr	2.55	.00	-3.86	-1.00	.00	-2.31	.71
2003-May	7.18	.00	-3.20	-1.00	.00	2.98	3.69
2003-Jun	4.33	.00	-4.47	-1.00	.00	-1.14	2.55
2003-Jul	4.41	.00	-5.23	-1.00	.00	-1.82	.73
2003-Aug	2.64	.00	-4.33	-1.00	.00	-2.69	-7.84
2003-Sep	6.29	.02	-3.18	-1.00	.00	2.12	.16
2003-Oct	4.12	.00	-2.45	-1.00	.00	.67	.83
2003-Nov	4.68	.00	-1.74	-1.00	.00	1.94	2.76
2003-Dec	4.86	.00	-1.43	-1.00	-.40	2.04	4.80

Normal Year - 1988

	Precip	Runoff	PET-Pen	GW-OUT	Outflow	Net Gain/Loss	Actual Water Level
1988-Jan	2.56	.00	-1.14	-1.00	.00	.42	.42
1988-Feb	2.80	.00	-1.69	-1.00	.00	.11	.52
1988-Mar	2.29	.00	-3.18	-1.00	.00	-1.89	-5.49
1988-Apr	3.37	.00	-3.91	-1.00	.00	-1.54	-11.65
1988-May	8.38	.03	-4.75	-1.00	.00	2.66	-1.00
1988-Jun	1.19	.00	-6.55	-1.00	.00	-6.36	-26.45
1988-Jul	5.56	.00	-6.32	-1.00	.00	-1.76	-33.47
1988-Aug	2.80	.00	-5.73	-1.00	.00	-3.93	-49.20
1988-Sep	2.90	.00	-3.78	-1.00	.00	-1.88	-56.72
1988-Oct	1.58	.00	-2.79	-1.00	.00	-2.21	-65.54
1988-Nov	4.84	.00	-1.67	-1.00	.00	2.17	-56.85
1988-Dec	1.16	.00	-1.56	-1.00	.00	-1.40	-62.45

Dry Year - 2007

	Precip	Runoff	PET-Pen	GW-OUT	Outflow	Net Gain/Loss	Actual Water Level
2007-Jan	1.92	.00	-1.83	-1.00	.00	-.91	-3.64
2007-Feb	2.40	.00	-1.65	-1.00	.00	-.25	-4.66
2007-Mar	2.96	.00	-3.71	-1.00	.00	-1.75	-11.66
2007-Apr	3.68	.03	-4.03	-1.00	.00	-1.32	-16.92
2007-May	.57	.00	-6.14	-1.00	.00	-6.57	-43.19
2007-Jun	2.87	.00	-6.14	-1.00	.00	-4.27	-60.28
2007-Jul	1.56	.00	-6.63	-1.00	.00	-6.07	-84.57
2007-Aug	3.46	.00	-5.73	-1.00	.00	-3.27	-97.65
2007-Sep	1.44	.00	-4.82	-1.00	.00	-4.38	-115.17
2007-Oct	3.28	.00	-3.10	-1.00	.00	-.82	-118.44
2007-Nov	1.38	.00	-1.61	-1.00	.00	-1.23	-123.35
2007-Dec	2.89	.00	-1.00	-1.00	.00	.89	-119.77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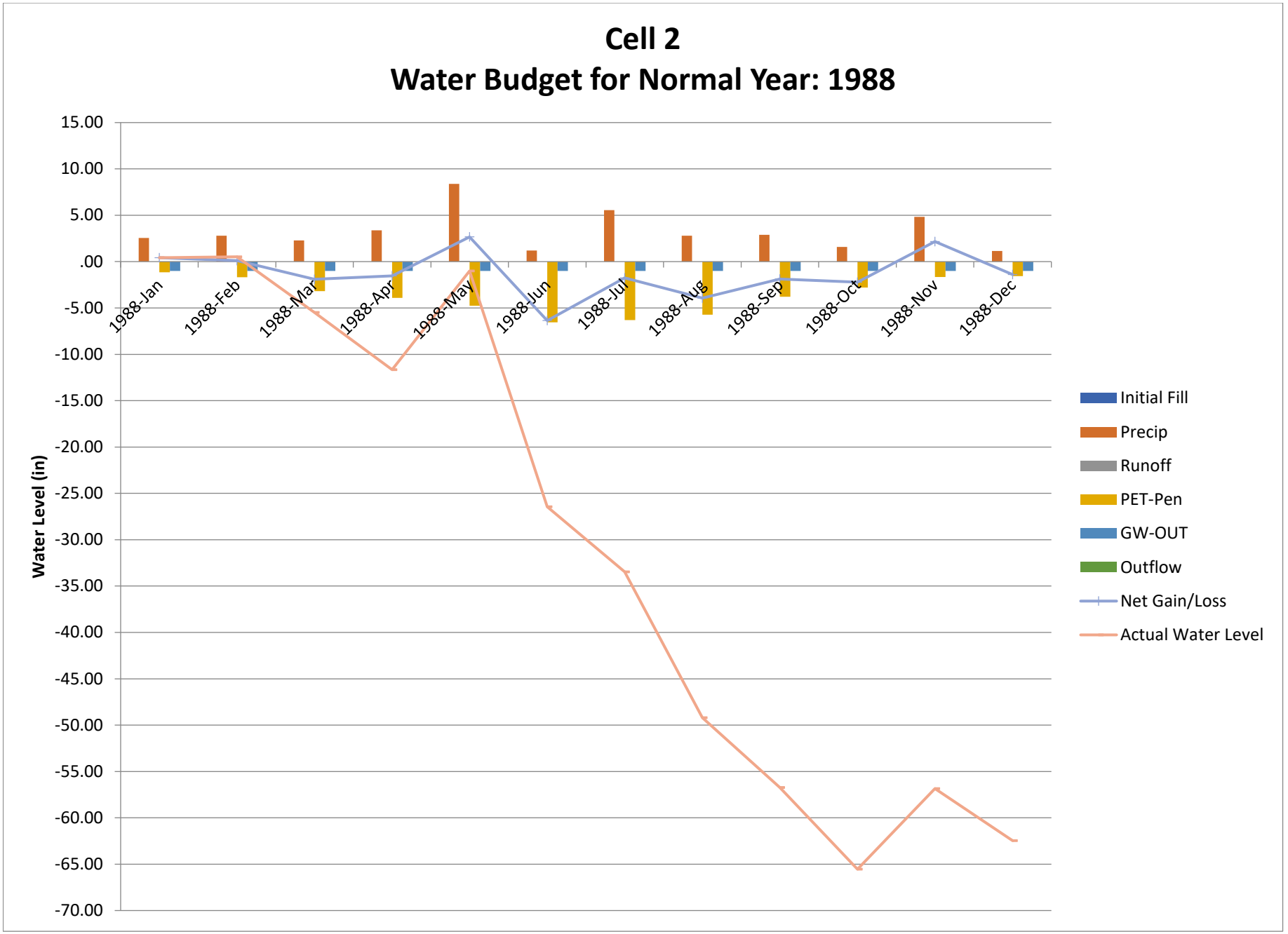
Water Budget for Wet Year: 2003
Water Level (in)
8.00
6.00
4.00
2.00
.00
-2.00
-4.00
-6.00
-8.00
-10.00
2003-Jan
2003-Feb
2003-Mar
2003-Apr
2003-May
2003-Jun
2003-Jul
2003-Aug
2003-Sep
2003-Oct
2003-Nov
2003-Dec
Initial Fill
Precip
Runoff
PET-Pen
GW-OUT
Outflow
Net Gain/Loss
Actual Water Level


Cell 2
Water Budget for Normal Year: 1988
Water Level (in)
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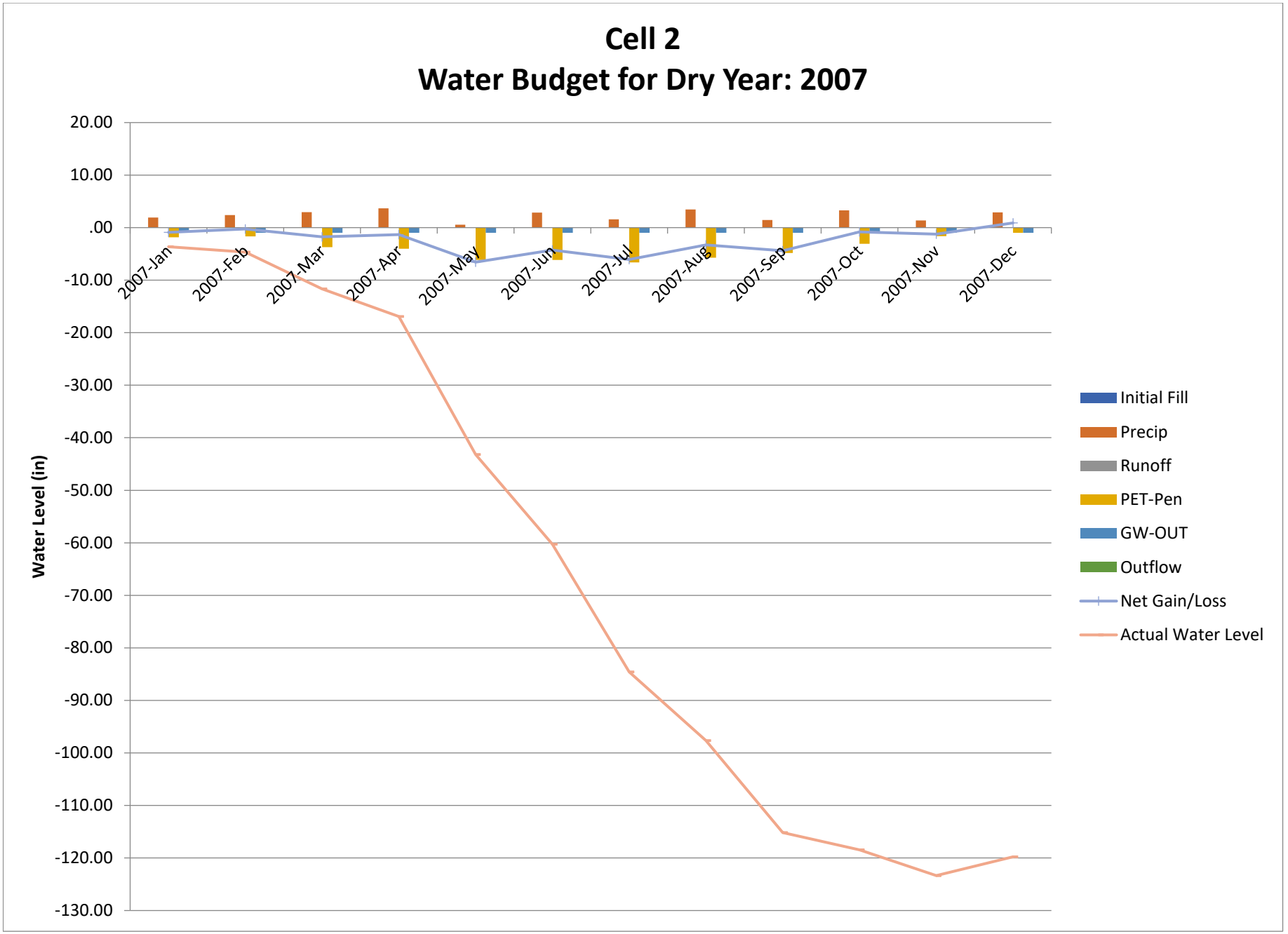
10.00
5.00
.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
-45.00
-50.00
-55.00
-60.00
-65.00
-70.00
1988-Jan
1988-Feb
1988-Mar
1988-Apr
1988-May
1988-Jun
1988-Jul
1988-Aug
1988-Sep
1988-Oct
1988-Nov
1988-Dec
Initial Fill
Precip
Runoff
PET-Pen
GW-OUT
Outflow
Net Gain/Loss
Actual Water Level


Cell 2
Water Budget for Dry Year: 2007
Water Level (in)
20.00
10.00
.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-80.00
-90.00
-100.00
-110.00
-120.00
-130.00
2007-Jan
2007-Feb
2007-Mar
2007-Apr
2007-May
2007-Jun
2007-Jul
2007-Aug
2007-Sep
2007-Oct
2007-Nov
2007-Dec
Initial Fill
Precip
Runoff
PET-Pen
GW-OUT
Outflow
Net Gain/Loss
Actual Water Level

Cell 3

Wet Year - 2003

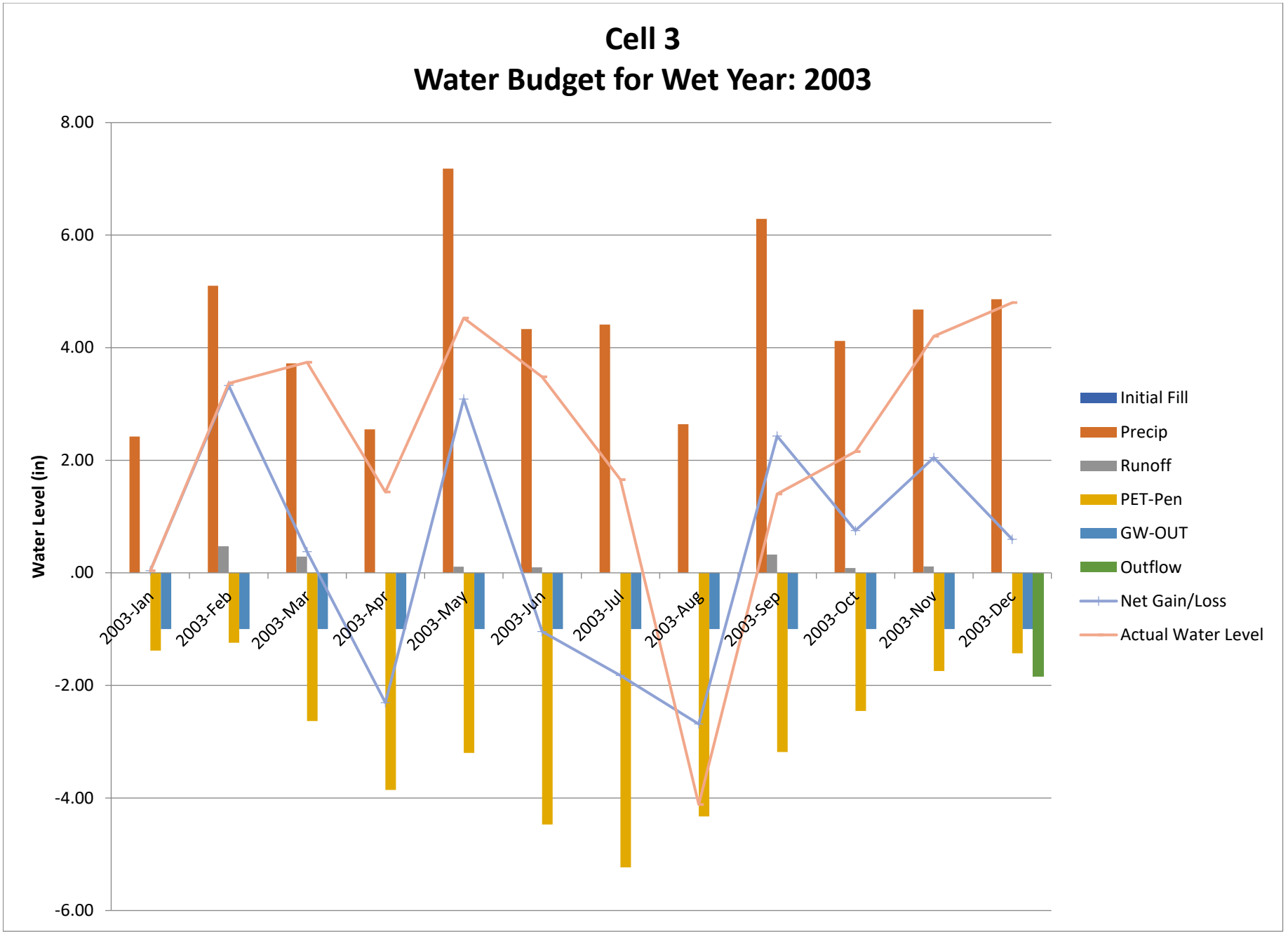
	Precip	Runoff	PET-Pen	GW-OUT	Outflow	Net Gain/Loss	Actual Water Level
2003-Jan	2.42	.00	-1.38	-1.00	.00	.04	.04
2003-Feb	5.10	.47	-1.24	-1.00	.00	3.33	3.37
2003-Mar	3.72	.29	-2.63	-1.00	.00	.38	3.74
2003-Apr	2.55	.00	-3.86	-1.00	.00	-2.31	1.44
2003-May	7.18	.11	-3.20	-1.00	.00	3.09	4.53
2003-Jun	4.33	.10	-4.47	-1.00	.00	-1.04	3.48
2003-Jul	4.41	.00	-5.23	-1.00	.00	-1.82	1.66
2003-Aug	2.64	.00	-4.33	-1.00	.00	-2.69	-4.12
2003-Sep	6.29	.32	-3.18	-1.00	.00	2.43	1.40
2003-Oct	4.12	.09	-2.45	-1.00	.00	.75	2.15
2003-Nov	4.68	.11	-1.74	-1.00	.00	2.05	4.20
2003-Dec	4.86	.00	-1.43	-1.00	-1.84	.60	4.80

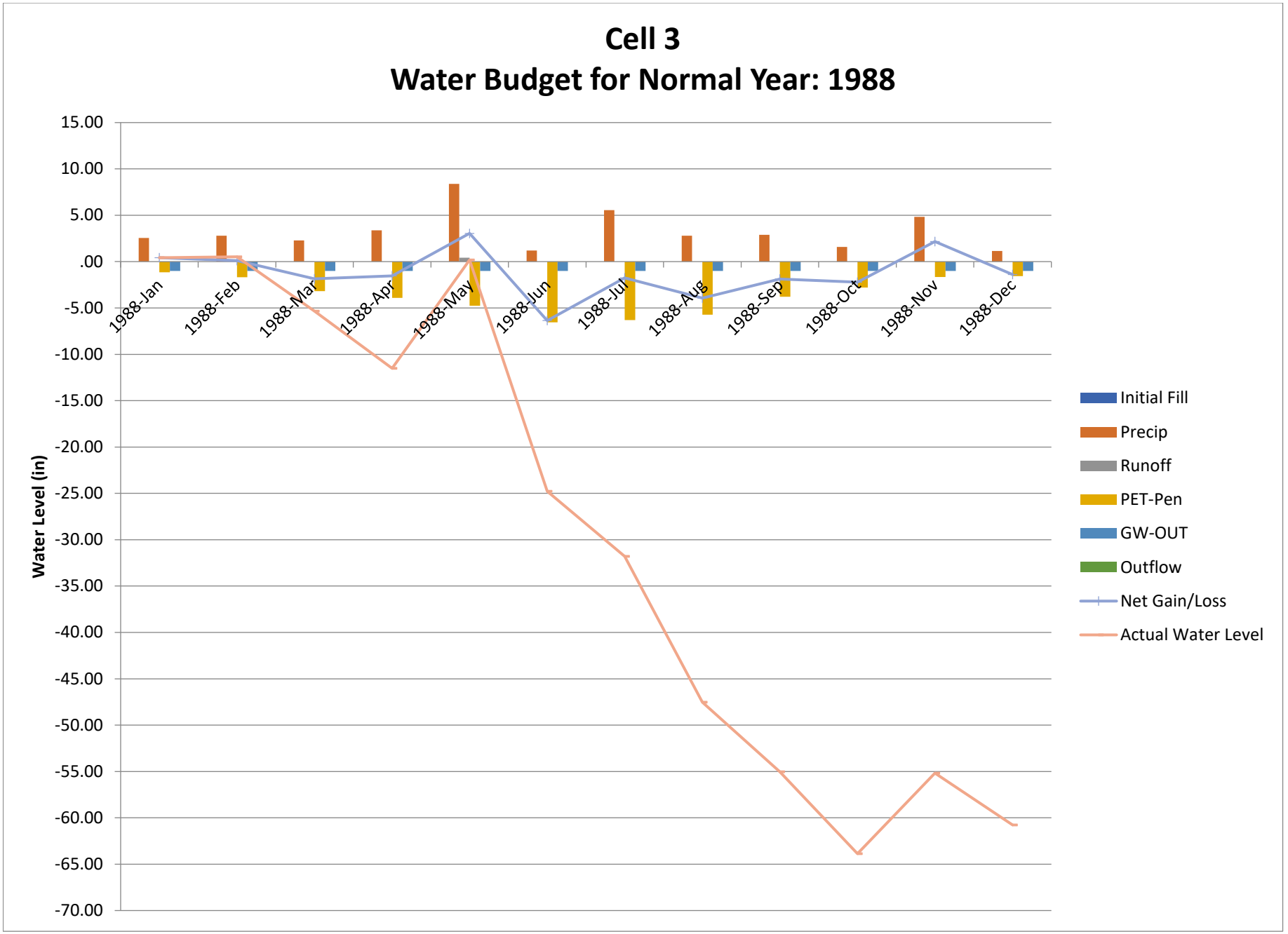
Normal Year - 1988

	Precip	Runoff	PET-Pen	GW-OUT	Outflow	Net Gain/Loss	Actual Water Level
1988-Jan	2.56	.00	-1.14	-1.00	.00	.42	.42
1988-Feb	2.80	.00	-1.69	-1.00	.00	.11	.52
1988-Mar	2.29	.03	-3.18	-1.00	.00	-1.86	-5.35
1988-Apr	3.37	.00	-3.91	-1.00	.00	-1.54	-11.51
1988-May	8.38	.41	-4.75	-1.00	.00	3.05	.17
1988-Jun	1.19	.00	-6.55	-1.00	.00	-6.36	-24.77
1988-Jul	5.56	.00	-6.32	-1.00	.00	-1.76	-31.80
1988-Aug	2.80	.00	-5.73	-1.00	.00	-3.93	-47.52
1988-Sep	2.90	.00	-3.78	-1.00	.00	-1.88	-55.04
1988-Oct	1.58	.00	-2.79	-1.00	.00	-2.21	-63.87
1988-Nov	4.84	.00	-1.67	-1.00	.00	2.17	-55.18
1988-Dec	1.16	.00	-1.56	-1.00	.00	-1.40	-60.78

Dry Year - 2007

	Precip	Runoff	PET-Pen	GW-OUT	Outflow	Net Gain/Loss	Actual Water Level
2007-Jan	1.92	.00	-1.83	-1.00	.00	-.91	-3.64
2007-Feb	2.40	.00	-1.65	-1.00	.00	-.25	-4.66
2007-Mar	2.96	.23	-3.71	-1.00	.00	-1.52	-10.73
2007-Apr	3.68	.33	-4.03	-1.00	.00	-1.01	-14.78
2007-May	.57	.00	-6.14	-1.00	.00	-6.57	-41.05
2007-Jun	2.87	.00	-6.14	-1.00	.00	-4.27	-58.14
2007-Jul	1.56	.00	-6.63	-1.00	.00	-6.07	-82.43
2007-Aug	3.46	.00	-5.73	-1.00	.00	-3.27	-95.50
2007-Sep	1.44	.00	-4.82	-1.00	.00	-4.38	-113.03
2007-Oct	3.28	.17	-3.10	-1.00	.00	-.65	-115.63
2007-Nov	1.38	.00	-1.61	-1.00	.00	-1.23	-120.54
2007-Dec	2.89	.00	-1.00	-1.00	.00	.89	-116.96


Cell 3
Water Budget for Wet Year: 2003
Water Level (in)
8.00
6.00
4.00
2.00
.00
-2.00
-4.00
-6.00
2003-Jan
2003-Feb
2003-Mar
2003-Apr
2003-May
2003-Jun
2003-Jul
2003-Aug
2003-Sep
2003-Oct
2003-Nov
2003-Dec
Initial Fill
Precip
Runoff
PET-Pen
GW-OUT
Outflow
Net Gain/Loss
Actual Water Level


Cell 3
Water Budget for Normal Year: 1988
Water Level (in)
15.00
10.00
5.00
.00
-5.00
-10.00
-15.00
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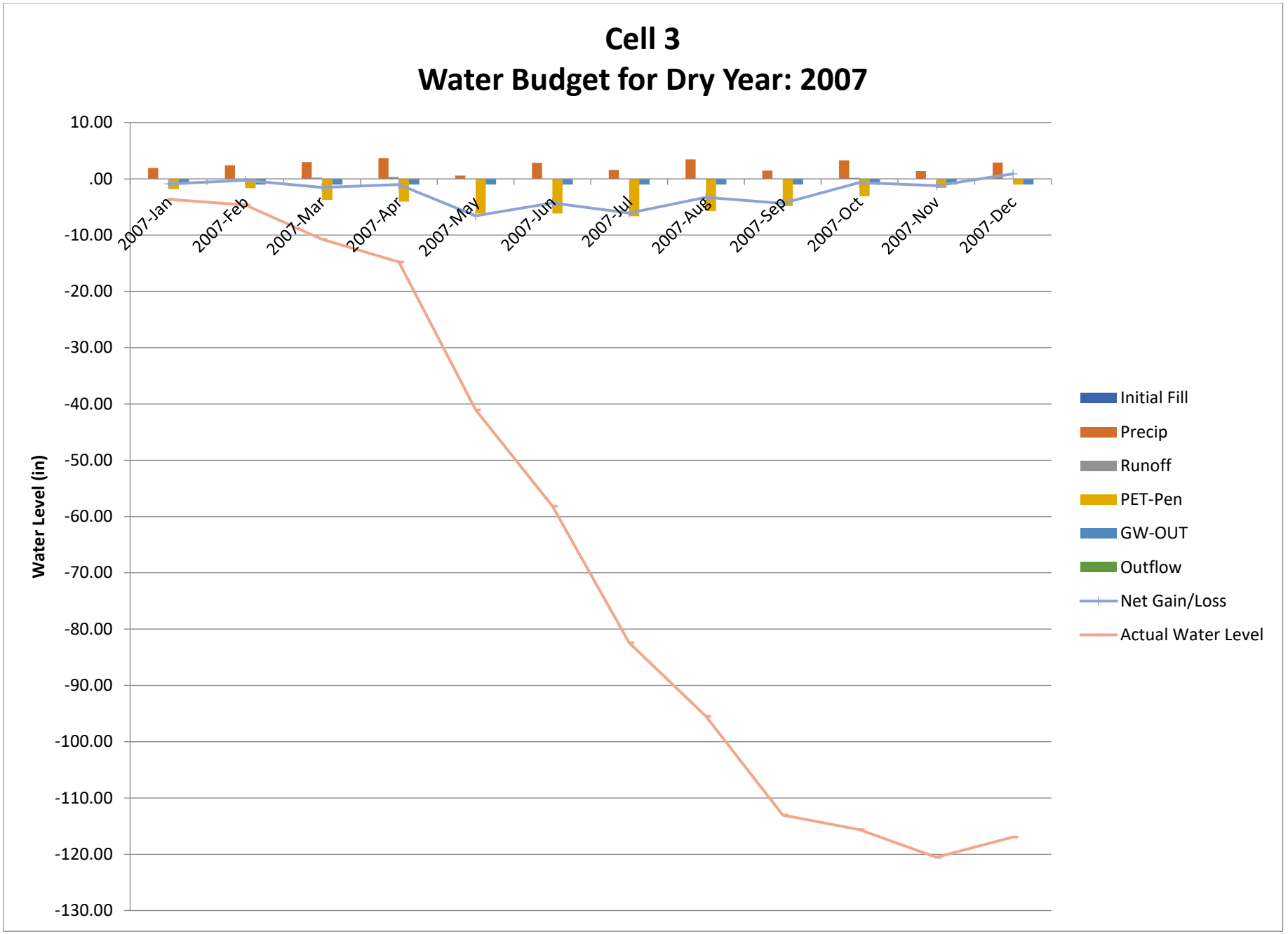
-25.00
-30.00
-35.00
-40.00
-45.00
-50.00
-55.00
-60.00
-65.00
-70.00
1988-Jan
1988-Feb
1988-Mar
1988-Apr
1988-May
1988-Jun
1988-Jul
1988-Aug
1988-Sep
1988-Oct
1988-Nov
1988-Dec
Initial Fill
Precip
Runoff
PET-Pen
GW-OUT
Outflow
Net Gain/Loss
Actual Water Level


Cell 3
Water Budget for Dry Year: 2007
Water Level (in)
10.00
.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-80.00
-90.00
-100.00
-110.00
-120.00
-130.00
2007-Jan
2007-Feb
2007-Mar
2007-Apr
2007-May
2007-Jun
2007-Jul
2007-Aug
2007-Sep
2007-Oct
2007-Nov
2007-Dec
Initial Fill
Precip
Runoff
PET-Pen
GW-OUT
Outflow
Net Gain/Loss
Actual Water Level

Cell 4

Wet Year - 2003

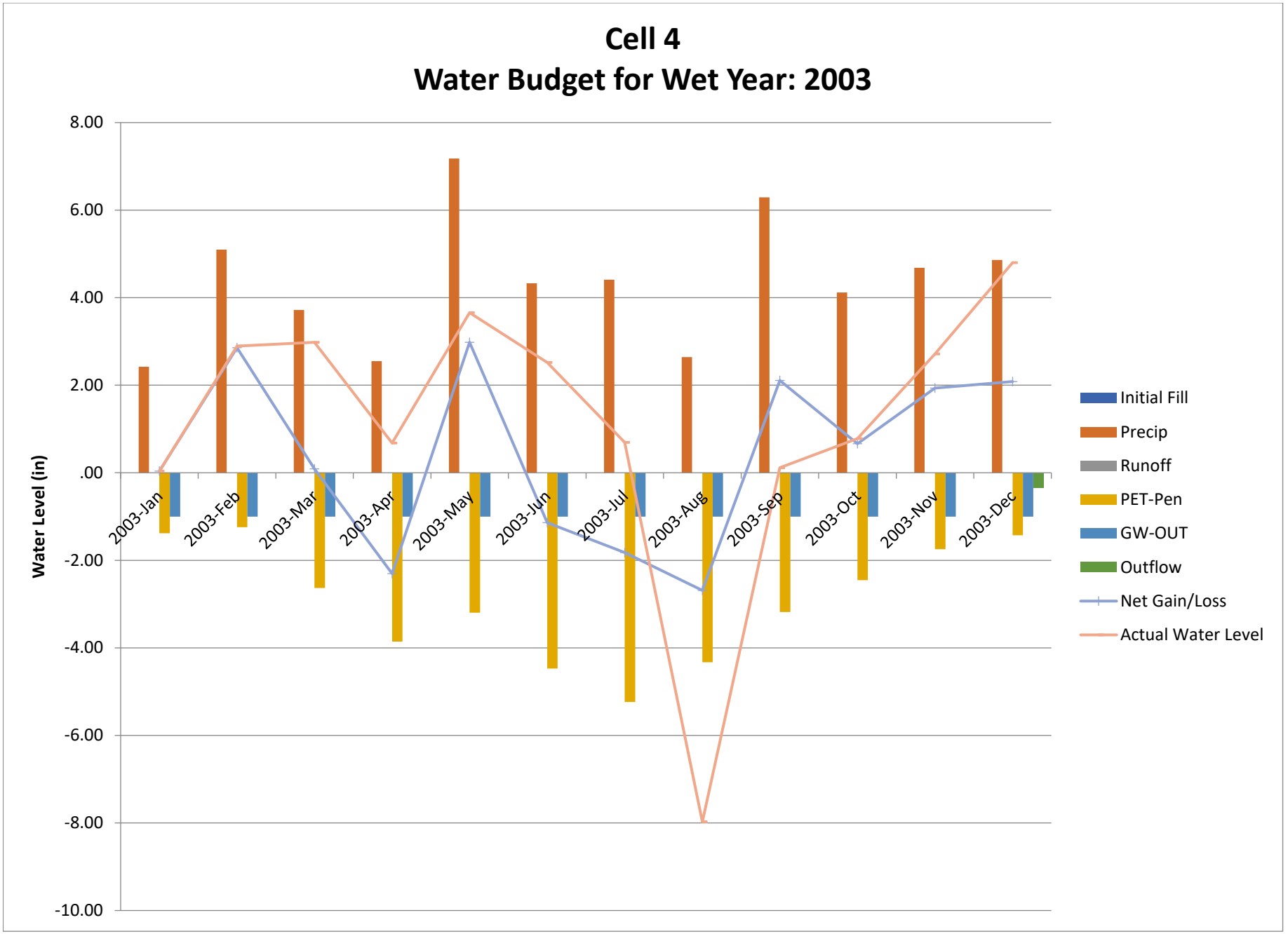
	Precip	Runoff	PET-Pen	GW-OUT	Outflow	Net Gain/Loss	Actual Water Level
2003-Jan	2.42	.00	-1.38	-1.00	.00	.04	.04
2003-Feb	5.10	.00	-1.24	-1.00	.00	2.86	2.89
2003-Mar	3.72	.00	-2.63	-1.00	.00	.09	2.98
2003-Apr	2.55	.00	-3.86	-1.00	.00	-2.31	.68
2003-May	7.18	.00	-3.20	-1.00	.00	2.98	3.66
2003-Jun	4.33	.00	-4.47	-1.00	.00	-1.14	2.52
2003-Jul	4.41	.00	-5.23	-1.00	.00	-1.82	.69
2003-Aug	2.64	.00	-4.33	-1.00	.00	-2.69	-7.97
2003-Sep	6.29	.00	-3.18	-1.00	.00	2.11	.11
2003-Oct	4.12	.00	-2.45	-1.00	.00	.67	.78
2003-Nov	4.68	.00	-1.74	-1.00	.00	1.94	2.71
2003-Dec	4.86	.00	-1.43	-1.00	-.35	2.09	4.80

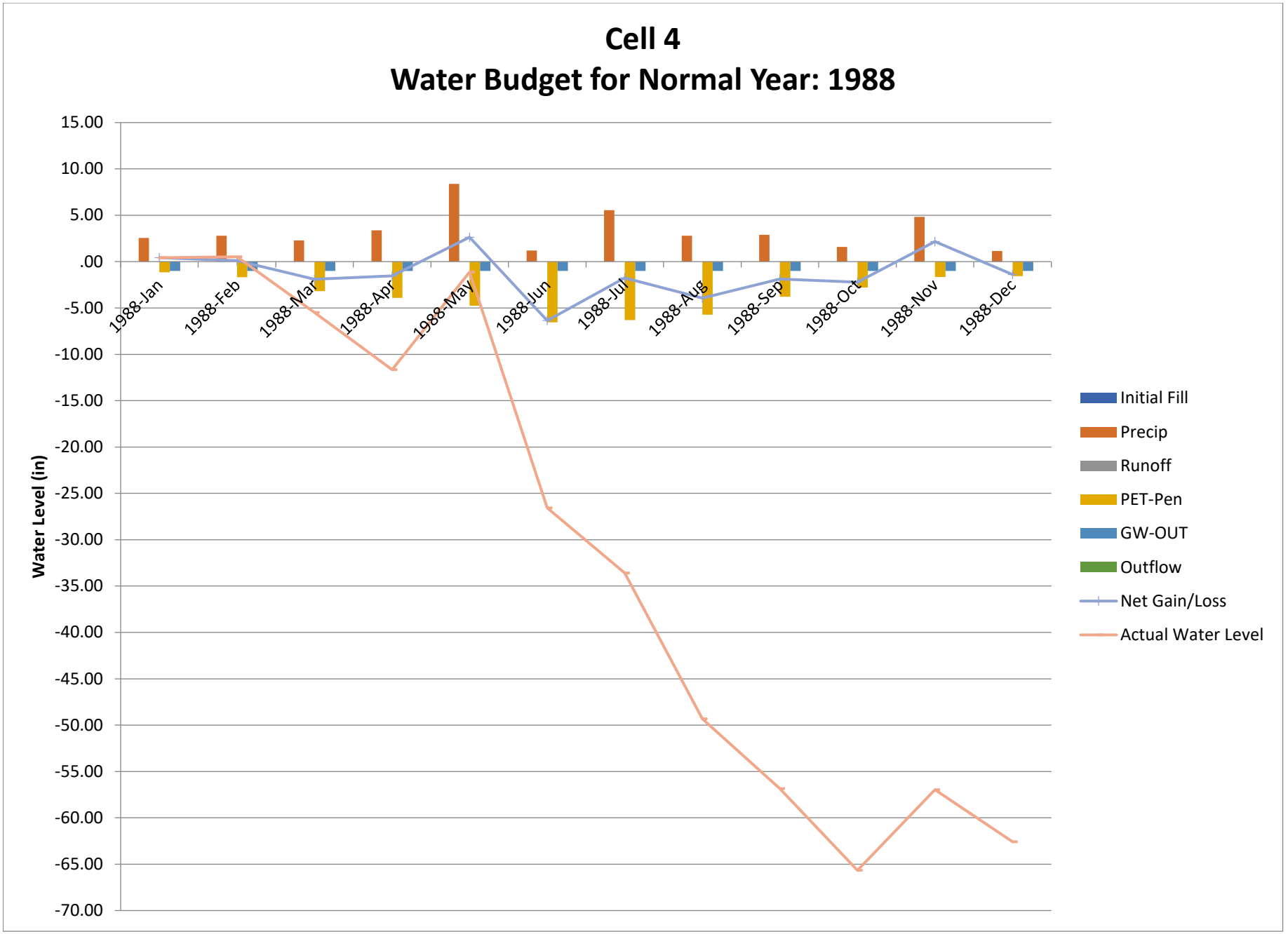
Normal Year - 1988

	Precip	Runoff	PET-Pen	GW-OUT	Outflow	Net Gain/Loss	Actual Water Level
1988-Jan	2.56	.00	-1.14	-1.00	.00	.42	.42
1988-Feb	2.80	.00	-1.69	-1.00	.00	.11	.52
1988-Mar	2.29	.00	-3.18	-1.00	.00	-1.89	-5.49
1988-Apr	3.37	.00	-3.91	-1.00	.00	-1.54	-11.65
1988-May	8.38	.00	-4.75	-1.00	.00	2.63	-1.12
1988-Jun	1.19	.00	-6.55	-1.00	.00	-6.36	-26.57
1988-Jul	5.56	.00	-6.32	-1.00	.00	-1.76	-33.60
1988-Aug	2.80	.00	-5.73	-1.00	.00	-3.93	-49.32
1988-Sep	2.90	.00	-3.78	-1.00	.00	-1.88	-56.84
1988-Oct	1.58	.00	-2.79	-1.00	.00	-2.21	-65.66
1988-Nov	4.84	.00	-1.67	-1.00	.00	2.17	-56.97
1988-Dec	1.16	.00	-1.56	-1.00	.00	-1.40	-62.57

Dry Year - 2007

	Precip	Runoff	PET-Pen	GW-OUT	Outflow	Net Gain/Loss	Actual Water Level
2007-Jan	1.92	.00	-1.83	-1.00	.00	-.91	-3.64
2007-Feb	2.40	.00	-1.65	-1.00	.00	-.25	-4.66
2007-Mar	2.96	.00	-3.71	-1.00	.00	-1.75	-11.67
2007-Apr	3.68	.00	-4.03	-1.00	.00	-1.35	-17.05
2007-May	.57	.00	-6.14	-1.00	.00	-6.57	-43.33
2007-Jun	2.87	.00	-6.14	-1.00	.00	-4.27	-60.42
2007-Jul	1.56	.00	-6.63	-1.00	.00	-6.07	-84.70
2007-Aug	3.46	.00	-5.73	-1.00	.00	-3.27	-97.78
2007-Sep	1.44	.00	-4.82	-1.00	.00	-4.38	-115.30
2007-Oct	3.28	.00	-3.10	-1.00	.00	-.82	-118.57
2007-Nov	1.38	.00	-1.61	-1.00	.00	-1.23	-123.48
2007-Dec	2.89	.00	-1.00	-1.00	.00	.89	-119.90


Cell 4
Water Budget for Wet Year: 2003
Water Level (in)
8.00
6.00
4.00
2.00
.00
-2.00
-4.00
-6.00
-8.00
-10.00
2003-Jan
2003-Feb
2003-Mar
2003-Apr
2003-May
2003-Jun
2003-Jul
2003-Aug
2003-Sep
2003-Oct
2003-Nov
2003-Dec
Initial Fill
Precip
Runoff
PET-Pen
GW-OUT
Outflow
Net Gain/Loss
Actual Water Level


Cell 4
Water Budget for Normal Year: 1988
Water Level (in)
15.00
10.00
5.00
.00
-5.00
-10.00
-15.00
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-25.00
-30.00
-35.00
-40.00
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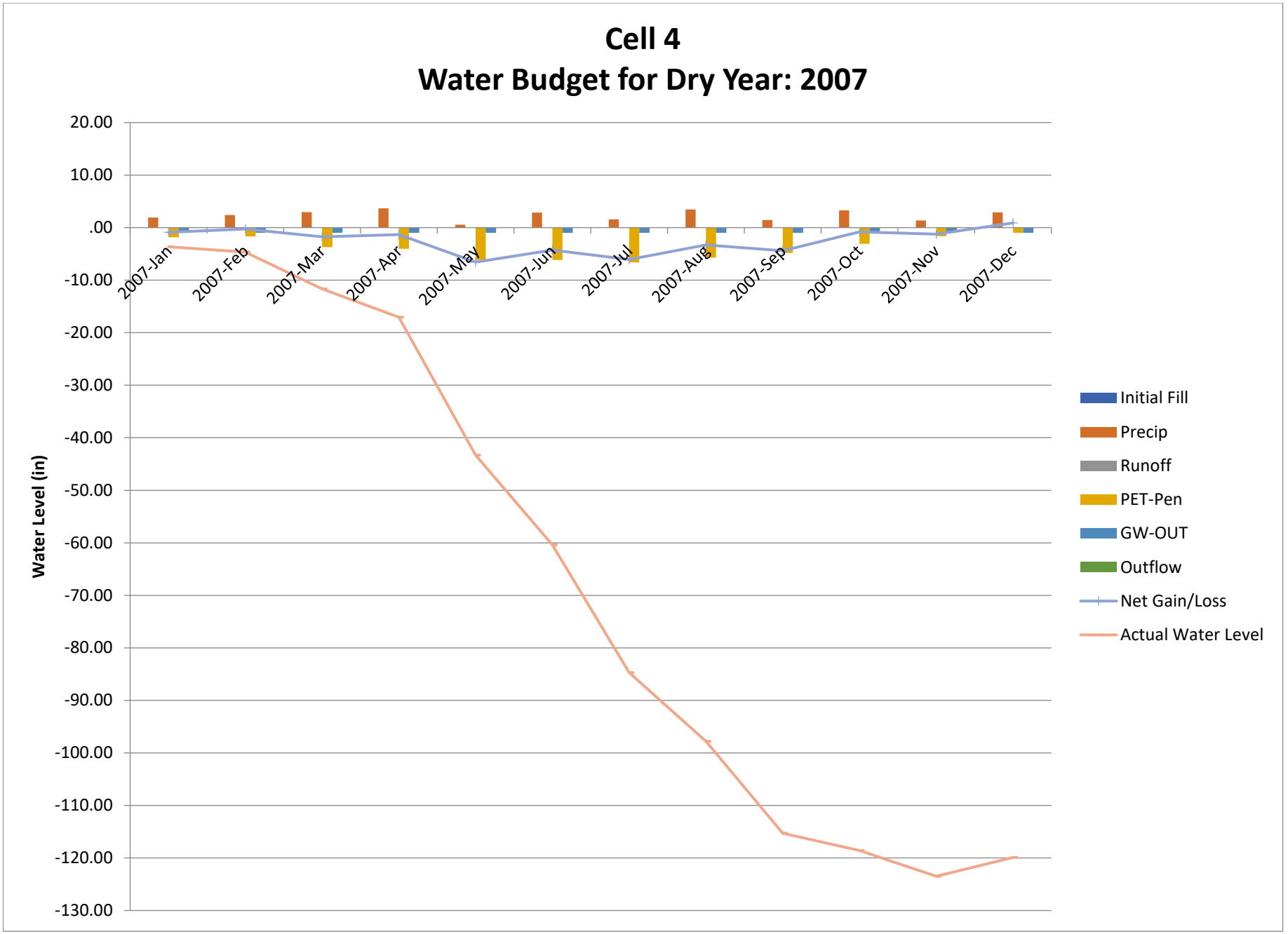
-65.00
-70.00
1988-Jan
1988-Feb
1988-Mar
1988-Apr
1988-May
1988-Jun
1988-Jul
1988-Aug
1988-Sep
1988-Oct
1988-Nov
1988-Dec
Initial Fill
Precip
Runoff
PET-Pen
GW-OUT
Outflow
Net Gain/Loss
Actual Water Level


Cell 4
Water Budget for Dry Year: 2007
Water Level (in)
20.00
10.00
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-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-80.00
-90.00
-100.00
-110.00
-120.00
-130.00
2007-Jan
2007-Feb
2007-Mar
2007-Apr
2007-May
2007-Jun
2007-Jul
2007-Aug
2007-Sep
2007-Oct
2007-Nov
2007-Dec
Initial Fill
Precip
Runoff
PET-Pen
GW-OUT
Outflow
Net Gain/Loss
Actual Water Level

Cell 5

Wet Year - 2003

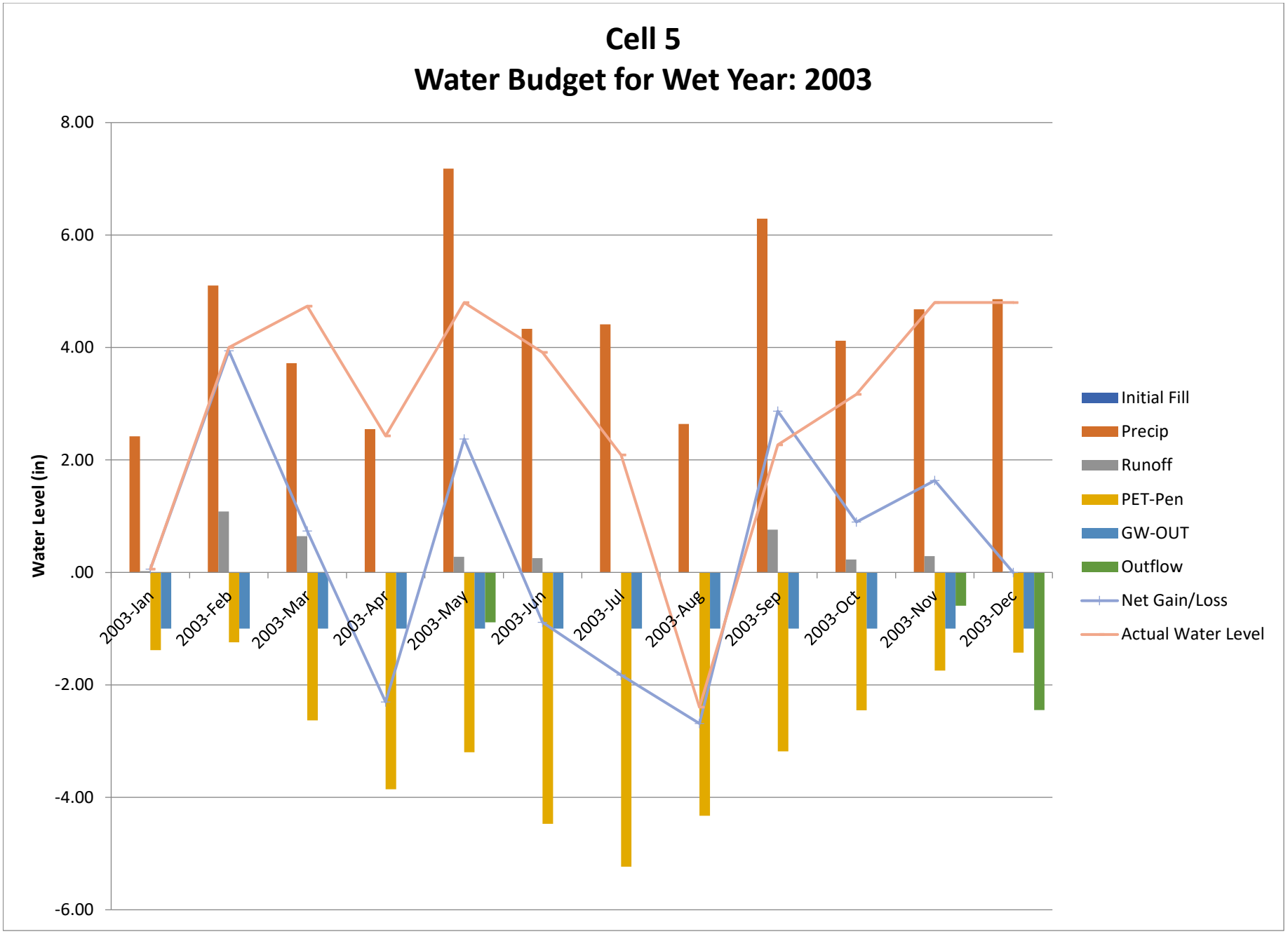
	Precip	Runoff	PET-Pen	GW-OUT	Outflow	Net Gain/Loss	Actual Water Level
2003-Jan	2.42	.02	-1.38	-1.00	.00	.06	.06
2003-Feb	5.10	1.08	-1.24	-1.00	.00	3.94	4.00
2003-Mar	3.72	.65	-2.63	-1.00	.00	.73	4.73
2003-Apr	2.55	.00	-3.86	-1.00	.00	-2.31	2.43
2003-May	7.18	.28	-3.20	-1.00	-.89	2.37	4.80
2003-Jun	4.33	.25	-4.47	-1.00	.00	-.89	3.91
2003-Jul	4.41	.00	-5.23	-1.00	.00	-1.82	2.09
2003-Aug	2.64	.00	-4.33	-1.00	.00	-2.69	-2.40
2003-Sep	6.29	.76	-3.18	-1.00	.00	2.87	2.27
2003-Oct	4.12	.23	-2.45	-1.00	.00	.90	3.17
2003-Nov	4.68	.29	-1.74	-1.00	-.59	1.63	4.80
2003-Dec	4.86	.02	-1.43	-1.00	-2.45	.00	4.80

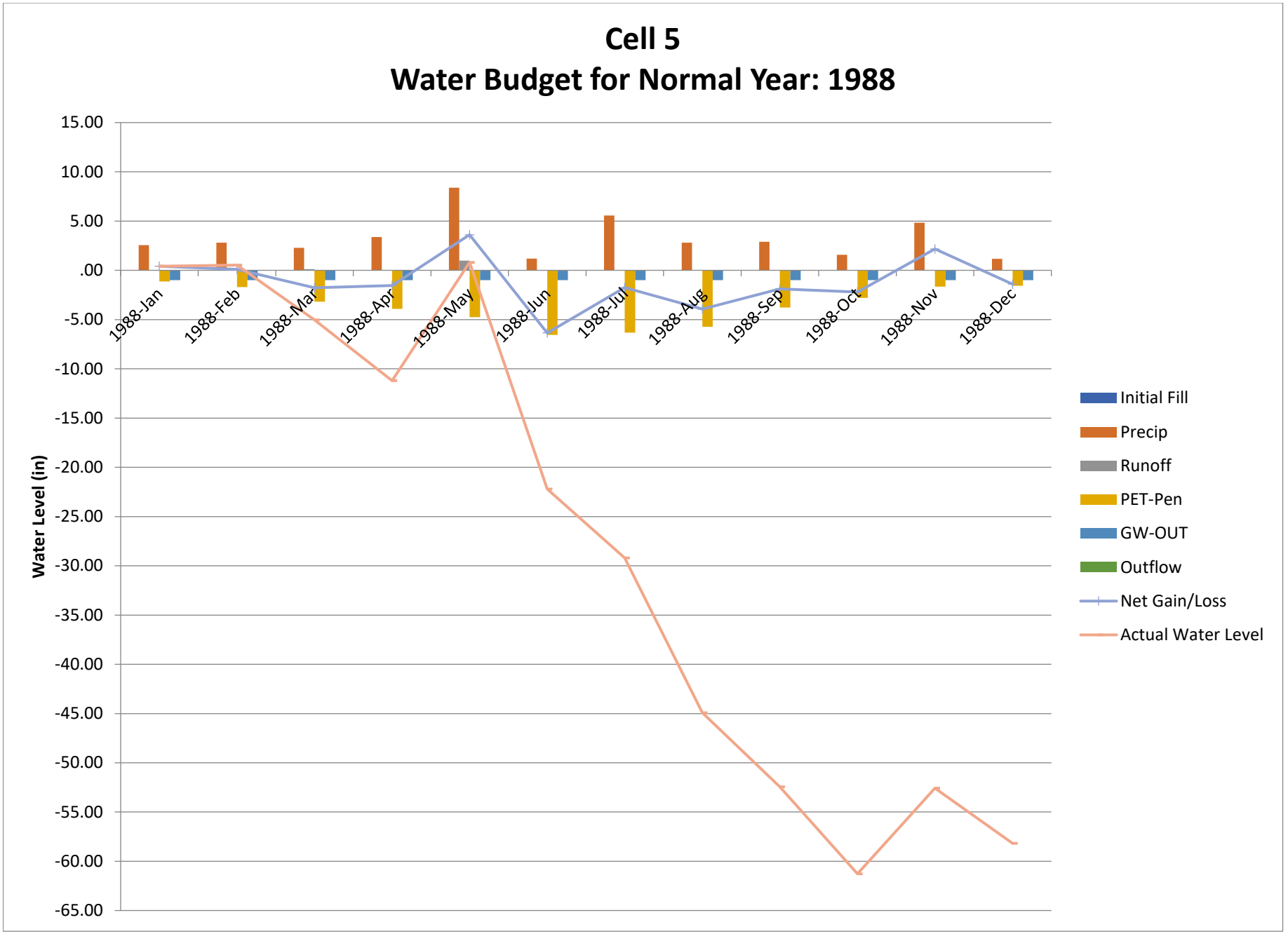
Normal Year - 1988

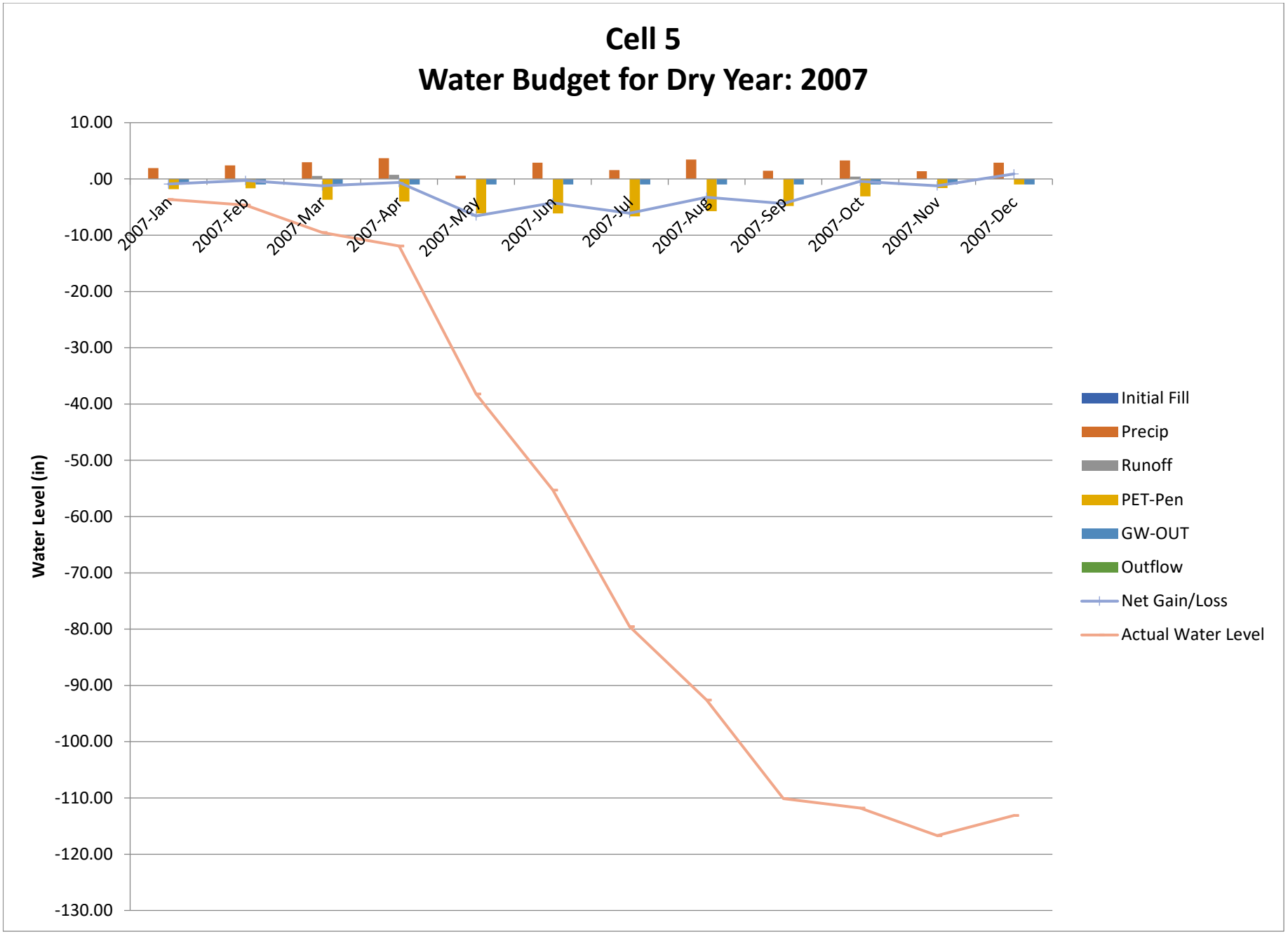
	Precip	Runoff	PET-Pen	GW-OUT	Outflow	Net Gain/Loss	Actual Water Level
1988-Jan	2.56	.00	-1.14	-1.00	.00	.42	.42
1988-Feb	2.80	.00	-1.69	-1.00	.00	.11	.52
1988-Mar	2.29	.11	-3.18	-1.00	.00	-1.78	-5.04
1988-Apr	3.37	.00	-3.91	-1.00	.00	-1.54	-11.20
1988-May	8.38	.98	-4.75	-1.00	.00	3.61	.81
1988-Jun	1.19	.00	-6.55	-1.00	.00	-6.36	-22.20
1988-Jul	5.56	.01	-6.32	-1.00	.00	-1.75	-29.21
1988-Aug	2.80	.00	-5.73	-1.00	.00	-3.93	-44.93
1988-Sep	2.90	.00	-3.78	-1.00	.00	-1.88	-52.45
1988-Oct	1.58	.00	-2.79	-1.00	.00	-2.21	-61.27
1988-Nov	4.84	.00	-1.67	-1.00	.00	2.17	-52.58
1988-Dec	1.16	.00	-1.56	-1.00	.00	-1.40	-58.18

Dry Year - 2007

	Precip	Runoff	PET-Pen	GW-OUT	Outflow	Net Gain/Loss	Actual Water Level
2007-Jan	1.92	.00	-1.83	-1.00	.00	-.91	-3.64
2007-Feb	2.40	.00	-1.65	-1.00	.00	-.25	-4.66
2007-Mar	2.96	.54	-3.71	-1.00	.00	-1.21	-9.51
2007-Apr	3.68	.74	-4.03	-1.00	.00	-.60	-11.93
2007-May	.57	.00	-6.14	-1.00	.00	-6.57	-38.20
2007-Jun	2.87	.00	-6.14	-1.00	.00	-4.27	-55.29
2007-Jul	1.56	.00	-6.63	-1.00	.00	-6.07	-79.57
2007-Aug	3.46	.02	-5.73	-1.00	.00	-3.25	-92.59
2007-Sep	1.44	.00	-4.82	-1.00	.00	-4.38	-110.11
2007-Oct	3.28	.40	-3.10	-1.00	.00	-.42	-111.78
2007-Nov	1.38	.00	-1.61	-1.00	.00	-1.23	-116.69
2007-Dec	2.89	.00	-1.00	-1.00	.00	.89	-113.12


Cell 5
Water Budget for Wet Year: 2003
Water Level (in)
8.00
6.00
4.00
2.00
.00
-2.00
-4.00
-6.00
2003-Jan
2003-Feb
2003-Mar
2003-Apr
2003-May
2003-Jun
2003-Jul
2003-Aug
2003-Sep
2003-Oct
2003-Nov
2003-Dec
Initial Fill
Precip
Runoff
PET-Pen
GW-OUT
Outflow
Net Gain/Loss
Actual Water Level


Cell 5
Water Budget for Normal Year: 1988
Water Level (in)
15.00
10.00
5.00
.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
-45.00
-50.00
-55.00
-60.00
-65.00
1988-Jan
1988-Feb
1988-Mar
1988-Apr
1988-May
1988-Jun
1988-Jul
1988-Aug
1988-Sep
1988-Oct
1988-Nov
1988-Dec
Initial Fill
Precip
Runoff
PET-Pen
GW-OUT
Outflow
Net Gain/Loss
Actual Water Level


Cell 5
Water Budget for Dry Year: 2007
Water Level (in)
10.00
.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-80.00
-90.00
-100.00
-110.00
-120.00
-130.00
2007-Jan
2007-Feb
2007-Mar
2007-Apr
2007-May
2007-Jun
2007-Jul
2007-Aug
2007-Sep
2007-Oct
2007-Nov
2007-Dec
Initial Fill
Precip
Runoff
PET-Pen
GW-OUT
Outflow
Net Gain/Loss
Actual Water Level

Appendix G: Sample Easement Agreement Document

CONSERVATION EASEMENT

SHA Plat Number _____ (Rev. _____)

THIS PERPETUAL CONSERVATION EASEMENT (this "EASEMENT") is made this _____ day of _____, 20_____, from _____ (hereinafter, the "GRANTOR") unto the State Highway Administration of the Maryland Department of Transportation, acting for and on behalf of the State of Maryland (hereinafter, "MDOT SHA" or the "GRANTEE").

RECITALS

WHEREAS, GRANTOR is the owner of land acquired by a deed dated _____ and recorded among the Land Records of _____ County, Maryland, in Liber No. _____, folio ___, (the PROPERTY") as shown and described on State Highway Administration Plat numbered _____, which plat has been or is intended to be filed for record with the electronically recorded by the Maryland State Archives; and

WHEREAS, the purpose of the EASEMENT is to provide access and long term protection of the Stream Restoration project known as _____ for SHA Contract number _____, which includes design, construction, inspection, adaptive management, monitoring, and verification for stream restoration (the "WORK"); and

WHEREAS, the extent of the WORK to be completed is survey, design, construction (grading, structure placement and planting), inspection, adaptive management (grading, structure placement, planting and integrated vegetation management), monitoring, and verification; and

WHEREAS, it is the intent of the parties that notwithstanding the possible effect of the common law doctrine of merger, this EASEMENT shall not merge with the fee simple title, but shall remain effective and shall run with the land; and

WHEREAS, the total payment per §10-912(b) of the Tax-General Article of the Annotated Code of Maryland is _____ and 00/100 Dollars ($_____.00); and

Note: use one of the two following WHEREAS clauses, as appropriate and delete the one that does not apply:

WHEREAS, the undersigned certify(ies) under the penalties of perjury that the following is true to the best of his/her/their knowledge, information and belief, that in accordance with §10-912(d)(1)(i) of the Tax-General Article of the Annotated Code of Maryland, he/she/they is/are a resident(s) of the State of Maryland.

or

WHEREAS, GRANTOR is a resident entity under Section 10-912(a)(4) of the Tax-General Article of the Annotated Code of Maryland, the undersigned is an agent of GRANTOR, and the undersigned has the authority to sign this document on GRANTOR's behalf.

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CONSERVATION EASEMENT

SHA Plat Number _____ (Rev. _____)

THIS PERPETUAL CONSERVATION EASEMENT (this "EASEMENT") is made this _____ day of _____, 20_____, from _____ (hereinafter, the "GRANTOR") unto the State Highway Administration of the Maryland Department of Transportation, acting for and on behalf of the State of Maryland (hereinafter, "MDOT SHA" or the "GRANTEE").

RECITALS

WHEREAS, GRANTOR is the owner of land acquired by a deed dated _____ and recorded among the Land Records of _____ County, Maryland, in Liber No. _____, folio ___, (the PROPERTY") as shown and described on State Highway Administration Plat numbered _____, which plat has been or is intended to be filed for record with the electronically recorded by the Maryland State Archives; and

WHEREAS, the purpose of the EASEMENT is to provide access and long term protection of the Stream Restoration project known as _____ for SHA Contract number _____, which includes design, construction, inspection, adaptive management, monitoring, and verification for stream restoration (the "WORK"); and

WHEREAS, the extent of the WORK to be completed is survey, design, construction (grading, structure placement and planting), inspection, adaptive management (grading, structure placement, planting and integrated vegetation management), monitoring, and verification; and

WHEREAS, it is the intent of the parties that notwithstanding the possible effect of the common law doctrine of merger, this EASEMENT shall not merge with the fee simple title, but shall remain effective and shall run with the land; and

WHEREAS, the total payment per §10-912(b) of the Tax-General Article of the Annotated Code of Maryland is _____ and 00/100 Dollars ($_____.00); and

Note: use one of the two following WHEREAS clauses, as appropriate and delete the one that does not apply:

WHEREAS, the undersigned certify(ies) under the penalties of perjury that the following is true to the best of his/her/their knowledge, information and belief, that in accordance with §10-912(d)(1)(i) of the Tax-General Article of the Annotated Code of Maryland, he/she/they is/are a resident(s) of the State of Maryland.

or

WHEREAS, GRANTOR is a resident entity under Section 10-912(a)(4) of the Tax-General Article of the Annotated Code of Maryland, the undersigned is an agent of GRANTOR, and the undersigned has the authority to sign this document on GRANTOR's behalf.

NOW, THEREFORE, for and in consideration of the foregoing and the covenants, terms, conditions and restrictions hereinafter set forth (the "Terms"), the receipt and sufficiency of which are hereby acknowledged by the parties, GRANTOR unconditionally and irrevocably hereby grants and conveys unto GRANTEE, its successors and assigns, a perpetual conservation easement, containing _____ square feet or _____ of an acre of land, more or less, and identified as _____ on State Highway Administration Plat numbered _____, which plat has been or is intended to be filed for record with and electronically recorded by the Maryland State Archives ("EASEMENT AREA"), together with the perpetual right of access to the EASEMENT AREA on, over, and through the PROPERTY, as and when needed.

A reduced copy of State Highway Administration Plat numbered _____ is attached hereto and incorporated herein as **Exhibit No. 1**.

BEING a part of the same land conveyed by a deed dated _____ and recorded among the Land Records of _____ County, Maryland in Liber No._____, folio ___, from _____ unto _____.

ARTICLE I. DURATION OF EASEMENT

This EASEMENT shall be perpetual. It is an easement in gross and as such is inheritable and assignable and runs with the land as an incorporeal interest in the EASEMENT AREA, enforceable with respect to the EASEMENT AREA by GRANTEE, its successors and assigns, against GRANTOR and its successors and assigns. The Terms contained herein shall run with the EASEMENT AREA and shall bind GRANTOR, its successors and assigns.

ARTICLE II. PROHIBITED ACTIVITIES

A. No commercial or recreational activities and no removal of vegetation shall occur on the EASEMENT AREA, except for:

1. passive recreational activities (including hunting and fishing) that do not result in the destruction of, or harm the viability of vegetation in the EASEMENT AREA;
2. wildlife management with the approval of MDOT SHA; and
3. forest management, and tree maintenance practices pursuant to a forest stewardship plan prepared by a licensed, registered forester, with the approval of MDOT SHA.

B. No materials may be dumped, placed or stored in the EASEMENT AREA, including, but not limited to, ashes, yard waste, sawdust, bark, trash, garbage, rubbish, dredge spoil, chemicals, pesticides, fertilizers, abandoned vehicles, appliances, or machinery.

C. No excavation of materials is permitted in the EASEMENT AREA, including, but not limited to, dredging, mining and removal of loam, gravel, soil, rock, sand, coal and petroleum.

D. No building, facility, means of access or other structure shall be constructed in the EASEMENT AREA after the date of the recordation of this EASEMENT.

E. These additional activities are also prohibited within the EASEMENT AREA:

1. use of motorized vehicles;
2. agricultural use including use for cropland, waste lagoons, or pastureland;

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3. placing structures or foundations;

4. placing of impervious surfaces;

5. placing of signs without approval;

6. grading; and

7. disposing of liquids other than clean water runoff.

ARTICLE III. MISCELLANEOUS

A. GRANTOR and its assigns shall disclose these Terms in any subsequent sales contracts, leases, mortgages, deeds and/or other legal instruments by which any interest in the EASEMENT AREA is conveyed.

B. GRANTOR shall notify GRANTEE in writing of the names and addresses of any party to whom the EASEMENT AREA, or any part thereof, is to be granted, conveyed or otherwise transferred, at or prior to the time said transfer is consummated.

C. All written notice required by these Terms shall be sent to:

GRANTOR
_____
_____

GRANTEE
Maryland Department of Transportation State Highway Administration
Office of Environmental Design, Water Programs Division
707 North Calvert Street,
Mail Stop C-303
Baltimore, MD 21202

D. GRANTEE, its employees and agents, and its successors and assigns, may perpetually and at all reasonable times enter the EASEMENT AREA to perform inspections, monitoring, verification, adaptive management (grading, structure placement, planting and integrated vegetation management) and/or to determine whether GRANTOR, or its successors and assigns, is complying with the Terms of this EASEMENT. The obligation of providing access to and from the EASEMENT AREA shall run with the land and bind the GRANTOR, and any subsequent owner of the PROPERTY.

E. Upon any breach of any of the Terms, GRANTEE shall have the right to enforce this EASEMENT in accordance with any or all of the remedies provided in Annotated Code of Maryland Natural Resources Article, Section 5-1612, and COMAR 08.19.06.03.

F. GRANTEE's remedies shall be cumulative and shall be in addition to any other rights and remedies available to GRANTEE either at law or in equity.

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G. No failure on the part of GRANTEE to enforce any Term hereof shall discharge or invalidate such Term or any other Term hereof or affect the right of GRANTEE to enforce the same in the event of a subsequent breach or default.

H. This EASEMENT shall be construed pursuant to the laws of the State of Maryland.

I. This instrument sets forth the entire agreement of the parties with respect to the EASEMENT and supersedes all prior discussions, negotiations, understandings or agreements relating to the EASEMENT. If any Term is found to be invalid, the remainder of the Terms of this EASEMENT, and the application of such Term to persons or circumstances other than those as to which it is found to be invalid, shall not be affected thereby.

J. This EASEMENT is based upon a form that assumes there exists a single GRANTOR and a single GRANTEE. In the event that this assumption is wrong for this EASEMENT, then, as appropriate, any Term assuming a singular GRANTOR or GRANTEE shall be interpreted to mean multiple GRANTORs or GRANTEEs, as the case may be.

K. The terms "GRANTOR" and "GRANTEE" wherever used herein, and any pronouns used in place thereof, shall include, respectively, the above-named GRANTOR and its successors and assigns, and the above-named GRANTEE and its successors and assigns.

L. SUBJECT TO and excepting from the operation and effect of this EASEMENT, any and all rights and reservations that may have been granted or reserved on, over, within, across or through the EASEMENT AREA by former owners of the Property or their predecessors in title and/or covenants or restrictions which may have been established with respect to the EASEMENT AREA by such former owners or their predecessors in title, and further subject to and excepting from the operation and effect of this EASEMENT, any and all existing rights now held or used by any public utility or public utilities across or adjacent to the EASEMENT AREA herein conveyed.

M. All exhibits referenced herein are attached hereto and made a part hereof.

N. The Recitals set forth above constitute an integral part of this EASEMENT and are incorporated herein by reference.

TO HAVE AND TO HOLD the land and premises above described and mentioned for a Perpetual Stream Restoration Easement unto the proper use and benefit of the State of Maryland, to the use of the State Highway Administration of the Maryland Department of Transportation, its successors and assigns forever subject to the rights, easements privileges and controls herein mentioned. The covenants agreed to and the terms, conditions, and restrictions imposed as aforesaid shall be binding upon GRANTOR, and its successors and assigns, and all other successors to them in interest.

WITNESS the due execution of this EASEMENT on the day and year first above written.

Note: If GRANTOR is an entity use this type of signature block:

ATTEST: GRANTOR:

_____ By: _____

Name: _____

Title: _____

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Or Note: If GRANTOR is an individual use this type of signature block:

WITNESS: GRANTOR:

_____ _____

Name: _____

State of Maryland, County of _____

I HEREBY CERTIFY that, before me, the undersigned officer, a NOTARY PUBLIC of the STATE OF MARYLAND, in and for the County aforesaid, personally appeared _____, known to me, or satisfactorily proven to be the person whose name is subscribed to this EASEMENT, who signed the same in my presence and acknowledged that he/she executed the same for the purposes therein contained and in the capacity therein stated.

AS WITNESS MY HAND AND NOTARIAL SEAL, this ____ day of _____ in the year ___.

_____

Notary Public

My Commission expires:

I HEREBY CERTIFY that this instrument has been prepared by or under the supervision of the undersigned, an attorney admitted to practice before the Court of Appeals of Maryland.

_____

Assistant Attorney General

Please return to: Maryland Department of Transportation State Highway Administration
Director, Office of Environmental Design
Mail Stop C-303
707 North Calvert Street
Baltimore, MD 21202

n/oag/environ/easement/conservationeasement/6-21-17

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Appendix H: 2/10/100-Yr Shear Stress and 2/10/100-Yr Velocity Tables

2, 10 AND 100 YEAR SHEAR AND VELOCITY COMPARISON

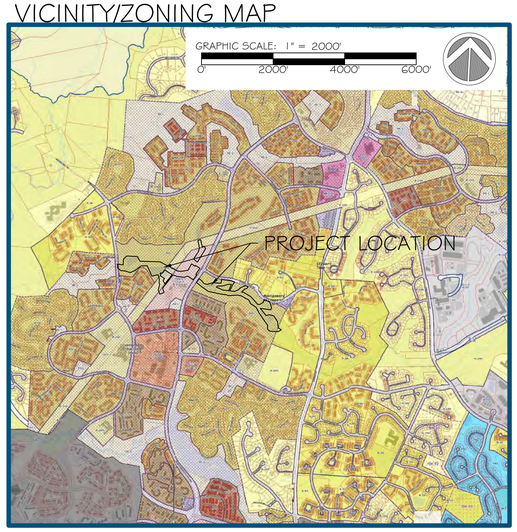
For the Stability Justification for Velocity, a "Stable Velocity" is anything less than 8 LF/S, anything showing a "Decrease" is a location where the proposed velocity is lower than the existing velocity, "No Change" is where the proposed velocity did not change from the existing velocity, anywhere showing "Minor Increase" is within 10% of the existing velocity, and anywhere that calls out Coir 700 Matting is a location where the higher velocity will be stable because of the 12 LF/S that Coir 700 Matting can withstand, thus the velocity will not create a detrimental effect to the channel.

For the Stability Justification for Shear, a "Stable Shear Value" is values that are greater than 10% of the existing shear but less than 2.0 LB/SF and is thus stable with the use of Coir 400 Matting which can withstand shear up to 3.0 LB/SF, anything showing a "Decrease" is a location where the proposed shear is lower than the existing shear, "No Change" is where the proposed shear stress did not change from the existing shear stress, and anywhere showing "Minor Increase" is within 10% of the existing shear.

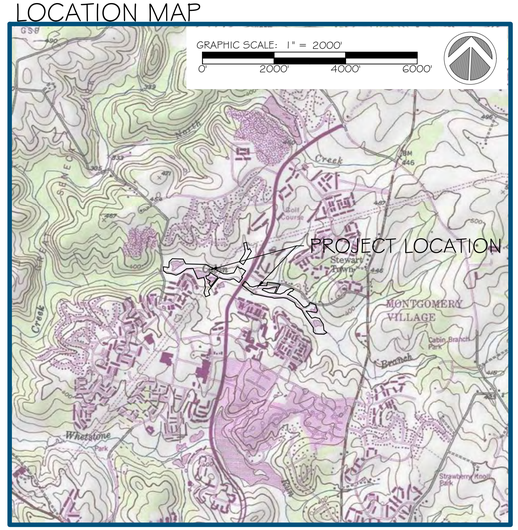
EXISTING							PROPOSED							COMPARISON	
River	Reach	River Sta	Profile	Q Total (cfs)	Vel Chnl (ft/s)	Shear Chan (lb/sq ft)	River	Reach	River Sta	Profile	Q Total (cfs)	Vel Chnl (ft/s)	Shear Chan (lb/sq ft)	Shear Stability Justification	Velocity Stability Justification
Fairway Island Trib	T4	2112.28	2YR	132.4	6.42	1.4	Fairway Island Trib	T4	2044.8	2YR	132.4	7.91	1.93	Stable Shear Value	Stable Velocity
Fairway Island Trib	T4	2112.28	10YR	228.6	7.73	1.85	Fairway Island Trib	T4	2044.8	10YR	228.6	8.86	2.29	Coir 700 Matting	Coir 700 Matting
Fairway Island Trib	T4	2112.28	100YR	370.6	9.06	2.34	Fairway Island Trib	T4	2044.8	100YR	370.6	9.77	2.66	Coir 700 Matting	Coir 700 Matting
Fairway Island Trib	T4	1897.05	2YR	132.4	7.6	1.96	Fairway Island Trib	T4	1837.98	2YR	132.4	8.36	2.2	Coir 700 Matting	Coir 700 Matting
Fairway Island Trib	T4	1897.05	10YR	228.6	8.83	2.45	Fairway Island Trib	T4	1837.98	10YR	228.6	9.43	2.59	Coir 700 Matting	Coir 700 Matting
Fairway Island Trib	T4	1897.05	100YR	370.6	5.92	0.89	Fairway Island Trib	T4	1837.98	100YR	370.6	10.47	2.97	Coir 700 Matting	Coir 700 Matting
Fairway Island Trib	T4	1700.6	2YR	132.4	5.49	0.86	Fairway Island Trib	T4	1655.81	2YR	132.4	6.75	1.33	Stable Shear Value	Stable Velocity
Fairway Island Trib	T4	1700.6	10YR	228.6	6.73	1.22	Fairway Island Trib	T4	1655.81	10YR	228.6	7.33	1.45	Stable Shear Value	Stable Velocity
Fairway Island Trib	T4	1700.6	100YR	370.6	9.46	2.35	Fairway Island Trib	T4	1655.81	100YR	370.6	8.55	1.86	Decrease	Decrease
Fairway Island Trib	T4	1567.59	2YR	132.4	7.13	1.58	Fairway Island Trib	T4	1514.24	2YR	132.4	8.72	2.39	Coir 700 Matting	Coir 700 Matting
Fairway Island Trib	T4	1567.59	10YR	228.6	8.02	1.85	Fairway Island Trib	T4	1514.24	10YR	228.6	10.59	3.31	Coir 700 Matting	Coir 700 Matting
Fairway Island Trib	T4	1567.59	100YR	370.6	8.43	1.83	Fairway Island Trib	T4	1514.24	100YR	370.6	11.75	3.79	Coir 700 Matting	Coir 700 Matting
Cabin Branch	R1	6716.3	2YR	1106.9	7.21	1.19	Cabin Branch	R1	6379.02	2YR	1106.9	6.84	1.07	Decrease	Decrease
Cabin Branch	R1	6716.3	10YR	2192.5	6.72	0.95	Cabin Branch	R1	6379.02	10YR	2192.5	8.07	1.4	Stable Shear Value	Coir 700 Matting
Cabin Branch	R1	6716.3	100YR	4215.6	6.59	0.84	Cabin Branch	R1	6379.02	100YR	4215.6	10.19	2.13	Coir 700 Matting	Coir 700 Matting
Cabin Branch	R1	6414.25	2YR	1106.9	6.78	1.08	Cabin Branch	R1	6124.71	2YR	1106.9	2.85	0.19	Decrease	Decrease
Cabin Branch	R1	6414.25	10YR	2192.5	7.46	1.22	Cabin Branch	R1	6124.71	10YR	2192.5	3.21	0.22	Decrease	Decrease
Cabin Branch	R1	6414.25	100YR	4215.6	8.96	1.63	Cabin Branch	R1	6124.71	100YR	4215.6	4.37	0.39	Decrease	Decrease
Cabin Branch	R1	6074.52	2YR	1106.9	7.05	1.05	Cabin Branch	R1	5783.17	2YR	1106.9	8.65	1.65	Stable Shear Value	Coir 700 Matting
Cabin Branch	R1	6074.52	10YR	2192.5	8.59	1.45	Cabin Branch	R1	5783.17	10YR	2192.5	8.97	1.59	Stable Shear Value	Coir 700 Matting
Cabin Branch	R1	6074.52	100YR	4215.6	10.35	1.99	Cabin Branch	R1	5783.17	100YR	4215.6	10.94	2.24	Coir 700 Matting	Coir 700 Matting
Cabin Branch	R1	5738.14	2YR	1106.9	10.56	2.67	Cabin Branch	R1	5447.84	2YR	1106.9	6.5	1.17	Decrease	Decrease
Cabin Branch	R1	5738.14	10YR	2192.5	11.97	3.22	Cabin Branch	R1	5447.84	10YR	2192.5	6.08	0.87	Decrease	Decrease
Cabin Branch	R1	5738.14	100YR	4215.6	8.51	1.41	Cabin Branch	R1	5447.84	100YR	4215.6	6.56	0.89	Decrease	Decrease
Cabin Branch	R1	5295.94	2YR	1106.9	5.3	0.59	Cabin Branch	R1	4996.42	2YR	1106.9	4.67	0.46	Decrease	Decrease
Cabin Branch	R1	5295.94	10YR	2192.5	5.86	0.66	Cabin Branch	R1	4996.42	10YR	2192.5	5.84	0.66	No Change	Decrease
Cabin Branch	R1	5295.94	100YR	4215.6	7.42	1	Cabin Branch	R1	4996.42	100YR	4215.6	7.58	1.03	Stable Shear Value	Stable Velocity
Cabin Branch	R1	4901.12	2YR	1106.9	9.58	2.02	Cabin Branch	R1	4612.7	2YR	1106.9	8.62	1.63	Decrease	Decrease
Cabin Branch	R1	4901.12	10YR	2192.5	9.87	1.86	Cabin Branch	R1	4612.7	10YR	2192.5	9.49	1.79	Decrease	Decrease
Cabin Branch	R1	4901.12	100YR	4215.6	11.13	2.2	Cabin Branch	R1	4612.7	100YR	4215.6	11.18	2.32	Coir 700 Matting	Coir 700 Matting
Cabin Branch	R1	4507.96	2YR	1106.9	8.34	1.58	Cabin Branch	R1	4222.05	2YR	1106.9	8.52	1.75	Stable Shear Value	Coir 700 Matting
Cabin Branch	R1	4507.96	10YR	2192.5	12.7	3.62	Cabin Branch	R1	4222.05	10YR	2192.5	12.24	3.42	Decrease	Decrease
Cabin Branch	R1	4507.96	100YR	4215.6	6.22	0.71	Cabin Branch	R1	4222.05	100YR	4215.6	6.46	0.79	Stable Shear Value	Stable Velocity
Cabin Branch	R1	4211.67	2YR	1106.9	2.49	0.13	Cabin Branch	R1	3905.14	2YR	1106.9	3.49	0.26	Stable Shear Value	Stable Velocity
Cabin Branch	R1	4211.67	10YR	2192.5	3.27	0.21	Cabin Branch	R1	3905.14	10YR	2192.5	3.85	0.29	Stable Shear Value	Stable Velocity
Cabin Branch	R1	4211.67	100YR	4215.6	2.82	0.14	Cabin Branch	R1	3905.14	100YR	4215.6	3.07	0.16	Stable Shear Value	Stable Velocity
Cabin Branch	R1	3835.96	2YR	1106.9	3.05	0.18	Cabin Branch	R1	3520.98	2YR	1106.9	2.98	0.17	Decrease	Decrease
Cabin Branch	R1	3835.96	10YR	2192.5	4.15	0.32	Cabin Branch	R1	3520.98	10YR	2192.5	4.09	0.31	Decrease	Decrease
Cabin Branch	R1	3835.96	100YR	4215.6	4.45	0.33	Cabin Branch	R1	3520.98	100YR	4215.6	4.38	0.32	Decrease	Decrease
Cabin Branch	R1	3811.77	2YR	1106.9	6.48	1.39	Cabin Branch	R1	3496.28	2YR	1106.9	6.5	1.37	Decrease	Stable Velocity
Cabin Branch	R1	3811.77	10YR	2192.5	5.38	0.75	Cabin Branch	R1	3496.28	10YR	2192.5	5.8	0.86	Stable Shear Value	Stable Velocity
Cabin Branch	R1	3811.77	100YR	4215.6	4.26	0.36	Cabin Branch	R1	3496.28	100YR	4215.6	4.73	0.44	Stable Shear Value	Stable Velocity
Cabin Branch	R1	3700		Culvert			Cabin Branch	R1	3370		Culvert			No Change	No Change
Cabin Branch	R1	3660.55	2YR	1106.9	4.36	0.55	Cabin Branch	R1	3345.43	2YR	1106.9	4.42	0.55	No Change	Stable Velocity
Cabin Branch	R1	3660.55	10YR	2192.5	4.46	0.48	Cabin Branch	R1	3345.43	10YR	2192.5	4.59	0.5	Stable Shear Value	Stable Velocity
Cabin Branch	R1	3660.55	100YR	4215.6	8.99	1.96	Cabin Branch	R1	3345.43	100YR	4215.6	8.4	1.64	Decrease	Decrease
Cabin Branch	R1	3647.79	2YR	1106.9	8.08	1.61	Cabin Branch	R1	3332.38	2YR	1106.9	7.54	1.24	Decrease	Decrease
Cabin Branch	R1	3647.79	10YR	2192.5	11.08	2.79	Cabin Branch	R1	3332.38	10YR	2192.5	10.87	2.43	Decrease	Decrease
Cabin Branch	R1	3647.79	100YR	4215.6	10.18	2.1	Cabin Branch	R1	3332.38	100YR	4215.6	10.88	2.23	Coir 700 Matting	Coir 700 Matting
Cabin Branch	R2	3326.87	2YR	1155.2	9.53	2.07	Cabin Branch	R2	3006.19	2YR	1155.2	8.07	1.47	Decrease	Decrease
Cabin Branch	R2	3326.87	10YR	2276.3	11.01	2.56	Cabin Branch	R2	3006.19	10YR	2276.3	9.02	1.7	Decrease	Decrease
Cabin Branch	R2	3326.87	100YR	4364.6	11.61	2.66	Cabin Branch	R2	3006.19	100YR	4364.6	9.67	1.82	Decrease	Decrease
Cabin Branch	R2	2988.4	2YR	1155.2	10.34	2.62	Cabin Branch	R2	2679.03	2YR	1155.2	7.15	1.15	Decrease	Decrease
Cabin Branch	R2	2988.4	10YR	2276.3	9.83	1.98	Cabin Branch	R2	2679.03	10YR	2276.3	9.07	1.76	Decrease	Decrease
Cabin Branch	R2	2988.4	100YR	4364.6	10.74	2.19	Cabin Branch	R2	2679.03	100YR	4364.6	11.61	2.75	Coir 700 Matting	Coir 700 Matting
Cabin Branch	R2	2583.32	2YR	1155.2	2.41	0.14	Cabin Branch	R2	2244.79	2YR	1155.2	4.42	0.44	Stable Shear Value	Stable Velocity
Cabin Branch	R2	2583.32	10YR	2276.3	3.23	0.23	Cabin Branch	R2	2244.79	10YR	2276.3	5.72	0.69	Stable Shear Value	Stable Velocity
Cabin Branch	R2	2583.32	100YR	4364.6	4.71	0.45	Cabin Branch	R2	2244.79	100YR	4364.6	6.75	0.89	Stable Shear Value	Stable Velocity
Cabin Branch	R2	2296.95	2YR	1155.2	3.56	0.27	Cabin Branch	R2	1956.53	2YR	1155.2	7.39	1.21	Stable Shear Value	Stable Velocity
Cabin Branch	R2	2296.95	10YR	2276.3	4.14	0.34	Cabin Branch	R2	1956.53	10YR	2276.3	6.77	0.93	Stable Shear Value	Stable Velocity
Cabin Branch	R2	2296.95	100YR	4364.6	5.05	0.47	Cabin Branch	R2	1956.53	100YR	4364.6	6.91	0.89	Stable Shear Value	Stable Velocity
Cabin Branch	R2	2053.69	2YR	1155.2	8.85	1.82	Cabin Branch	R2	1714.55	2YR	1155.2	8.71	1.7	Decrease	Decrease
Cabin Branch	R2	2053.69	10YR	2276.3	9.38	1.82	Cabin Branch	R2	1714.55	10YR	2276.3	9.68	1.88	Stable Shear Value	Coir 700 Matting
Cabin Branch	R2	2053.69	100YR	4364.6	11.43	2.52	Cabin Branch	R2	1714.55	100YR	4364.6	11.73	2.58	Coir 700 Matting	Coir 700 Matting
Cabin Branch	R2	1563.85	2YR	1155.2	1.19	0.03	Cabin Branch	R2	1268.3	2YR	1155.2	3.07	0.21	Stable Shear Value	Stable Velocity
Cabin Branch	R2	1563.85	10YR	2276.3	1.63	0.05	Cabin Branch	R2	1268.3	10YR	2276.3	2.82	0.16	Stable Shear Value	Stable Velocity
Cabin Branch	R2	1563.85	100YR	4364.6	1.77	0.05	Cabin Branch	R2	1268.3	100YR	4364.6	2.44	0.1	Stable Shear Value	Stable Velocity
Cabin Branch	R2	1316.79	2YR	1155.2	6.92	1.08	Cabin Branch	R2	1066.4	2YR	1155.2	8.77	1.68	Stable Shear Value	Coir 700 Matting
Cabin Branch	R2	1316.79	10YR	2276.3	6.06	0.71	Cabin Branch	R2	1066.4	10YR	2276.3	6.79	0.86	Stable Shear Value	Stable Velocity
Cabin Branch	R2	1316.79	100YR	4364.6	4.99	0.42	Cabin Branch	R2	1066.4	100YR	4364.6	5.4	0.48	Stable Shear Value	Stable Velocity
Cabin Branch	R2	1207.8	2YR	1155.2	9.91	2.21	Cabin Branch	R2	954	2YR	1155.2	8.22	1.45	Decrease	Decrease
Cabin Branch	R2	1207.8	10YR	2276.3	11.24	2.46	Cabin Branch	R2	954	10YR	2276.3	10.35	2.05	Decrease	Decrease
Cabin Branch	R2	1207.8	100YR	4364.6	13.34	3.08	Cabin Branch	R2	954	100YR	4364.6	12.85	2.83	Decrease	Decrease
Clubside Trib	T5	1395.38	2YR	78.82	5.74	1.15	Clubside Trib	T5	1571.29	2YR	78.82	5.06	0.97	Decrease	Decrease
Clubside Trib	T5	1395.38	10YR	142.25	6.7	1.42	Clubside Trib	T5	1571.29	10YR	142.25	6.02	1.23	Decrease	Decrease
Clubside Trib	T5	1395.38	100YR	275.54	7.51	1.69	Clubside Trib	T5	1571.29	100YR	275.54	7.22	1.57	Decrease	Decrease
Clubside Trib	T5	1170.79	2YR	78.82	7.86	2.44	Clubside Trib	T5	1334.68	2YR	78.82	5.47	1.07	Decrease	Decrease
Clubside Trib	T5	1170.79	10YR	142.25	9.79	3.48	Clubside Trib	T5	1334.68	10YR	142.25	6.27	1.32	Decrease	Decrease
Clubside Trib	T5	1170.79	100YR	275.54	12.2	4.79	Clubside Trib	T5	1334.68	100YR	275.54	7.51	1.75	Decrease	Decrease

RFP-2 CABIN BRANCH STREAM RESTORATION AND WETLAND MITIGATION PHASE 11 MONTGOMERY COUNTY, MARYLAND

VICINITY/ZONING MAP

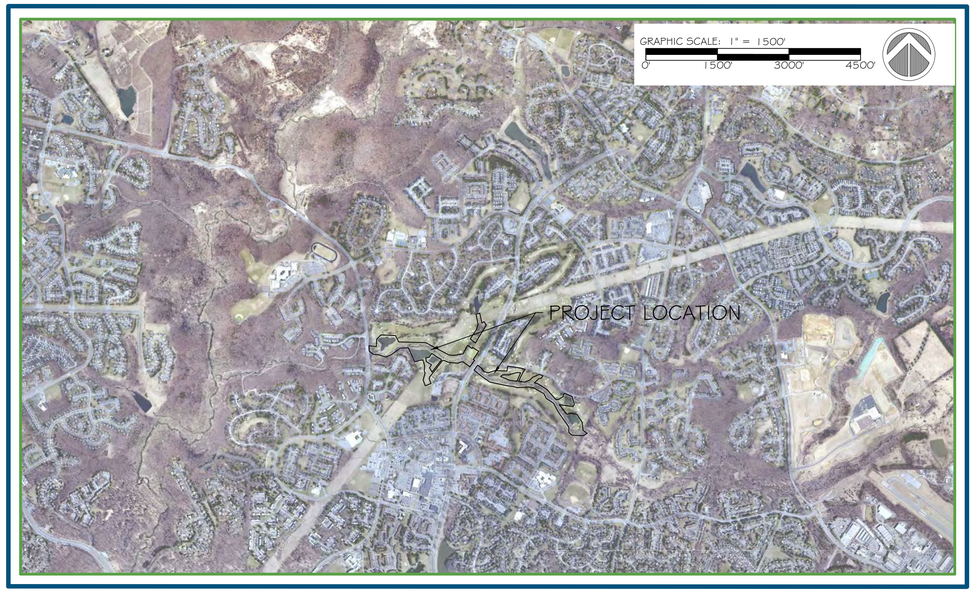


LOCATION MAP

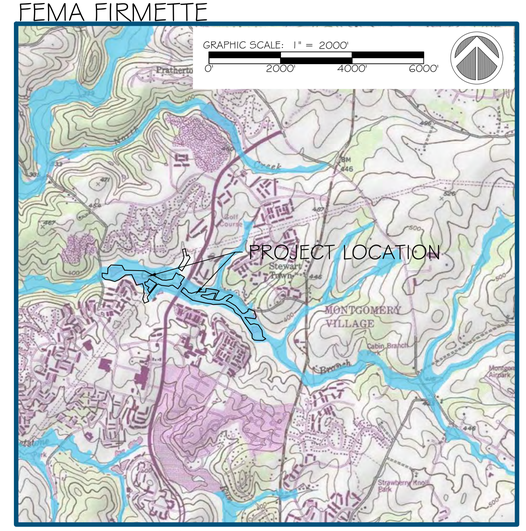


LATITUDE: N 39° 10' 43"
LONGITUDE: W 77° 12' 08"

AERIAL PHOTOGRAPH-PROJECT OVERVIEW



FEMA FIRMETTE



REFERENCE FEMA MAP: 24031C0187D

PROJECT SUMMARY

RFP - 2 CABIN BRANCH STREAM AND WETLAND MITIGATION PROJECT

THE CABIN BRANCH PROJECT WILL RESTORE APPROXIMATELY 7,983 LINEAR FEET OF STREAM, CREATE APPROXIMATELY 4.40 ACRES OF FORESTED NON-TIDAL WETLANDS, AND ENHANCE APPROXIMATELY 11.67 ACRES OF NON-TIDAL WETLAND AND RIPARIAN BUFFERS. THE PROJECT IS WITHIN THE MIDDLE POTOMAC - CATOCTIN WATERSHED (FEDERAL 8-DIGIT HUC 02070008) AND LOCATED AT 19550 MONTGOMERY VILLAGE DRIVE GAITHERSBURG, MD. CABIN BRANCH AND ITS ASSOCIATED TRIBUTARIES ARE CLASSIFIED AS USE I-P STREAM. ALL WETLAND, STREAM, AND BUFFER COMPONENTS WILL BE FULLY INTEGRATED TO PROVIDE THE GREATEST FUNCTIONAL UPLIFT WHILE GENERATING PERMITTEE RESPONSIBLE COMPENSATORY MITIGATION CREDITS FOR THE I-495 & I-270 MANAGED LANES STUDY.

THE PROJECT IS LOCATED ON A FORMER GOLF COURSE AND THE STREAM AND ADJACENT RIPARIAN AREAS EXHIBIT EXTENSIVE PERTURBATION AS A RESULT OF PAST LAND USE PRACTICES AND INCREASED WATERSHED URBANIZATION. SITE IMPACTS INCLUDE CHANNEL MODIFICATIONS, UTILITY ENCROACHMENT, STREAM PIPING, IMPOUNDMENT, CHANNELIZATION, BANK ARMORING, CHANNEL BLOCKAGES, AND ANTHROPOGENIC GRADING ASSOCIATED WITH HISTORIC GOLF COURSE INFRASTRUCTURE. AS A RESULT, CABIN BRANCH IS HIGHLY INCISED AND EXHIBITS MINIMAL FLOODPLAIN CONNECTION EXCEPT DURING LARGE FLOOD EVENTS. LOSS OF VERTICAL AND LATERAL STABILITY, COMBINED WITH HISTORIC LAND USE IMPACTS, PROVIDES AN OPPORTUNITY TO GENERATE SIGNIFICANT ECOLOGICAL UPLIFT THROUGH LARGE SCALE, MULTI-FEATURE RESTORATION IN A HIGHLY URBANIZED AREA. THE PROJECT ALSO PROPOSES DAYLIGHTING AND CREATION OF NATURAL STREAM CHANNELS FOR OVER 2,300 LINEAR FEET OF CURRENTLY PIPED WATER COURSES. HISTORIC LAND USE CHANGES HAVE ALSO HAD SIGNIFICANT IMPACTS TO THE STREAM VALLEY AND WHAT WOULD HAVE BEEN FORESTED FLOODPLAIN COMPLEXES. THE CREATION OF WATER HAZARDS AND AMENITY PONDS, IN COMBINATION WITH STREAM CHANNEL INCISION, INSTALLATION OF SUBSURFACE DRAINAGES, AND GOLF COURSE GRADING HAS ELIMINATED ALMOST ALL WETLANDS WITHIN THE PROJECT SITE. AS A RESULT OF THIS MITIGATION PROJECT, SIX OPEN WATER PONDS WILL BE CONVERTED TO NON-TIDAL FORESTED WETLANDS THAT WILL PROVIDE SIGNIFICANT ECOLOGICAL AND SYSTEM WIDE IMPROVEMENTS, ELIMINATE THERMAL POLLUTION, AND OTHER IMPORTANT CO-BENEFITS TO THE SITE AND WATERSHED.

STREAM DESIGN OBJECTIVES INCLUDE CREATION OF A SELF-SUSTAINING PLANFORM, CROSS-SECTION, AND PROFILE UTILIZING NATURAL CHANNEL DESIGN. THE DESIGN INCORPORATES PRIORITY II AND III RESTORATION THAT INCLUDES CHANNEL RELOCATION AND INCREASES IN BED ELEVATION TO ENSURE FUNCTIONING BANK HEIGHT AND ENTRENCHMENT RATIOS THAT WILL INCREASE FLOODPLAIN CONNECTIVITY TO EITHER THE EXISTING FLOODPLAIN OR PROPOSED FLOODPLAIN BENCHES. WOODY AND OTHER HABITAT STRUCTURES WILL BE UTILIZED TO FURTHER PROMOTE STABILITY WHILE INCREASING ECOLOGICAL UPLIFT. RIFFLE/POOL FEATURES HAVE BEEN DESIGNED TO MAINTAIN BEDFORM DIVERSITY, PROMOTE MACROINVERTEBRATE AND FISH HABITAT, AS WELL AS INCREASE HYPORHEIC EXCHANGE. THIS RESTORATION DESIGN WILL RESULT IN EIGHT FUNCTIONAL ASSESSMENT CATEGORIES CURRENTLY NON-FUNCTIONING OR FUNCTIONING AT RISK AND RESTORE THEM TO FUNCTIONING.

WETLAND DESIGN OBJECTIVES INCLUDE THE CONVERSION OF OPEN WATER PONDS TO FORESTED NON-TIDAL WETLANDS. THE EXISTING PONDS WILL BE FILLED WITH SUITABLE SOIL TO THE APPROPRIATE ELEVATION NECESSARY TO ENSURE WETLAND HYDROLOGY. ALL SUBSURFACE AND OTHER DRAINAGE FEATURES WILL BE DISCONNECTED AND VEGETATION WILL BE PLANTED BASED ON REFERENCE WETLANDS IN PROXIMITY TO THE PROJECT SITE. IN ADDITION TO GROUND WATER HYDROLOGY THE PROPOSED WETLANDS HAVE BEEN INTEGRATED INTO THE STREAM DESIGN AND WILL RECEIVE FLOOD INPUTS AT LARGER THAN BANKFULL EVENTS. THIS WETLAND/STREAM INTEGRATION PROVIDES THE GREATEST OVERALL BENEFIT TO THE SYSTEM.

CREDIT SUMMARY

ACTIVITY	LINEAR FEET (LF) ACREAGE (AC)	CREDIT RATIO	CREDIT	STREAM GAINS (FUNCTIONAL FEET)
STREAM RESTORATION	7,173 LF	1:1	7,173	5,149
STREAM RESTORATION (PEPCO PROPERTY)	810 LF	1:1	810	433
WETLAND RESTORATION (PFO)	4.38	1:1	4.38	-
WETLAND ENHANCEMENT	0.06	4:1	0.01	-
WETLAND BUFFER ENHANCEMENT	2.45	15:1	0.16	-
TOTAL WETLAND CREDIT			4.55	-
RIPARIAN BUFFER (35 FOOT BUFFER)	8.27 AC	-	-	-
RIPARIAN BUFFER ENHANCEMENT	0.93 AC	15:1	0.06	-

SHEET INDEX:

1 - COVER SHEET
2 - NOTES / NARRATIVE
3 - DRAINAGE AREA MAPS
4 - EXISTING CONDITIONS KEY SHEET
5 - 16 - EXISTING CONDITIONS
17 - MITIGATION MASTER PLAN
18 - DESIGN KEY SHEET
19 - 37 - STREAM GRADING PLANS & PROFILES
38 - 42 - WETLAND GRADING PLANS & PROFILES
43 - 46 - TYPICAL STREAM DETAILS
47 - PLANTING NOTES AND DETAILS
48 - 49 - PLANTING PLAN
50 - 51 - MONITORING PLAN

APPLICANT/AGENT:
NAME: HGS, LLC A RES COMPANY
ADDRESS: 5367 TELEPHONE ROAD
WARRENTON, VIRGINIA 20187

PROPERTY OWNER #1:
NAME: USL2 MR MONT VILLAGE BUSINESS TR
ADDRESS: 19550 MONTGOMERY VILLAGE AVE.
GAITHERSBURG, MD 20886
ZONING: TLD, CRN-0.55
ACREAGE: 111.87

PROPERTY OWNER #2:
NAME: POTOMAC ELECTRIC POWER CO
ADDRESS: C/O CORP TAX DEPT, STE 5617
701 9TH ST NW
WASHINGTON, DC 20068
ZONING: R-200
ACREAGE: 16.52

PROFESSIONAL CERTIFICATION.
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 52852, EXPIRATION DATE: 6/14/2022

NOT FOR CONSTRUCTION

FOR ALL WORK WITHIN THE LIMITS OF THE PARCELS OWNED BY POTOMAC ELECTRIC POWER COMPANY THE FOLLOWING NOTES SHALL APPLY:

GRANTOR's PROPERTIES Workspace Notes

A. Notify GRANTOR at least seventy-two (72) hours prior to start of work on GRANTOR's PROPERTIES. Notify GRANTOR again at the completion of work. Failure to notify GRANTOR may trigger a stop work order.

B. Remove all construction debris from GRANTOR's PROPERTIES at the completion of the work.

C. Stabilize all disturbed areas by grading, seeding and/or mulching.

PROJECT STATUS	
DATE	DESCRIPTION
6/26/2020	CONCEPT PLAN
11/9/2020	65% MITIGATION PLAN
2/15/2021	65% MITIGATION PLAN REV.
9/3/2021	65% MITIGATION PLAN REV. 2

JOB NUMBER: PRJ102054

RFP-2 CABIN BRANCH

RFP-2 CABIN BRANCH

PROJECT MANAGER: RC	JOB NUMBER: PRJ102054
DESIGNED: BW/SS/JC	DESIGN TYPE: 404 MITIGATION
DRAWN: JC	PLAN DATE: 11/22/2021

HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

BEST MANAGEMENT PRACTICES FOR WORKING IN NONTIDAL WETLANDS, WETLAND BUFFERS, WATERWAYS, AND 100-YEAR FLOODPLAINS

1. NO EXCESS FILL, CONSTRUCTION MATERIAL, OR DEBRIS SHALL BE STOCKPILED OR STORED IN NONTIDAL WETLANDS, NONTIDAL WETLAND BUFFERS, WATERWAYS, OR THE 100-YEAR FLOODPLAIN.
2. PLACE MATERIALS IN A LOCATION AND MANNER WHICH DOES NOT ADVERSELY IMPACT SURFACE OR SUBSURFACE WATER FLOW INTO OR OUT OF NONTIDAL WETLANDS, NONTIDAL WETLAND BUFFERS, WATERWAYS, OR THE 100-YEAR FLOODPLAIN.
3. DO NOT USE THE EXCAVATED MATERIAL AS BACKFILL IF IT CONTAINS WASTE METAL PRODUCTS, UNSIGHTLY DEBRIS, TOXIC MATERIAL, OR ANY OTHER DELETERIOUS SUBSTANCE. IF ADDITIONAL BACKFILL IS REQUIRED, USE CLEAN MATERIALS FREE OF WASTE METAL PRODUCTS, UNSIGHTLY DEBRIS, TOXIC MATERIAL, OR ANY OTHER DELETERIOUS SUBSTANCE.
4. PLACE HEAVY EQUIPMENT ON MATS OR SUITABLY OPERATE THE EQUIPMENT TO PREVENT DAMAGE TO NONTIDAL WETLANDS, NONTIDAL WETLAND BUFFERS, WATERWAYS, OR THE 100-YEAR FLOODPLAIN.
5. REPAIR AND MAINTAIN ANY SERVICEABLE STRUCTURE OR FILL SO THERE IS NO PERMANENT LOSS OF NONTIDAL WETLANDS, NONTIDAL WETLAND BUFFERS, OR WATERWAYS, OR PERMANENT MODIFICATION OF THE 100-YEAR FLOODPLAIN IN EXCESS OF THAT LOST UNDER THE ORIGINALLY AUTHORIZED STRUCTURE OR FILL.
6. RECTIFY ANY NONTIDAL WETLANDS, WETLAND BUFFERS, WATERWAYS, OR 100-YEAR FLOODPLAIN TEMPORARILY IMPACTED BY ANY CONSTRUCTION.
7. ALL STABILIZATION IN THE NONTIDAL WETLAND AND NONTIDAL WETLAND BUFFER SHALL CONSIST OF THE FOLLOWING SPECIES:

   ANNUAL RYEGRASS (LOLIUM MULTIFLORUM), MILLET (SETARIA ITALICA), BARLEY (HORDEUM SP.), OATS (UNIOLA SP.) AND/OR ~~RYE (SECALE CEREALE)~~. THESE SPECIES WILL ALLOW FOR THE STABILIZATION OF THE SITE WHILE ALSO ALLOWING FOR THE VOLUNTARY REVEGETATION OF NATURAL WETLAND SPECIES. OTHER NON-PERSISTENT VEGETATION MAY BE ACCEPTABLE, BUT MUST BE APPROVED BY THE NONTIDAL WETLANDS AND WATERWAYS DIVISION. KENTUCKY 31 FESCUE SHALL NOT BE UTILIZED IN WETLAND OR BUFFER AREAS. THE AREA SHOULD BE SEEDED AND MULCHED TO REDUCE EROSION AFTER CONSTRUCTION ACTIVITIES HAVE BEEN COMPLETED.
8. AFTER INSTALLATION HAS BEEN COMPLETED, MAKE POST CONSTRUCTION GRADES AND ELEVATIONS THE SAME AS THE ORIGINAL GRADES AND ELEVATIONS IN TEMPORARILY IMPACTED AREAS.
9. TO PROTECT AQUATIC SPECIES, IN-STREAM WORK IS PROHIBITED AS DETERMINED BY THE CLASSIFICATION OF THE STREAM:
   A. USE I WATERS (WITHOUT YELLOW PERCH): IN-STREAM WORK SHALL NOT BE CONDUCTED DURING THE PERIOD MARCH 1 THROUGH JUNE 15, INCLUSIVE DURING ANY YEAR.
   B. USE I WATERS (WITH YELLOW PERCH): IN-STREAM WORK SHALL NOT BE CONDUCTED DURING THE PERIOD FEBRUARY 15 THROUGH JUNE 15, INCLUSIVE DURING ANY YEAR.
   C. USE III WATERS: IN-STREAM WORK SHALL NOT BE CONDUCTED DURING THE PERIOD OCTOBER 1 THORUGH APRIL 30, INCLUSIVE, DURING ANY YEAR.
   D. USE IV WATERS: IN-STREAM WORK SHALL NOT BE CONDUCTED DURING THE PERIOD MARCH 1 THROUGH MAY 31, INCLUSIVE, DURING ANY YEAR.
10. STORMWATER RUNOFF FROM IMPERVIOUS SURFACES SHALL BE CONTROLLED TO PREVENT THE WASHING OF DEBRIS INTO THE WATERWAY.
11. CULVERTS SHALL BE CONSTRUCTED AND ANY RIPRAP PLACED SO AS NOT TO OBSTRUCT THE MOVEMENT OF AQUATIC SPECIES, UNLESS THE PURPOSE OF THE ACTIVITY IS TO IMPOUND WATER.

WETLAND CONSTRUCTION NOTES:

NOTE: SEE ESC PLANS FOR THE COMPLETE SEQUENCE OF CONSTRUCTION.

- ALL WETLAND CONSTRUCTION MUST BE COMPLETED "IN THE DRY."
- ALL UPSTREAM STORMWATER INFLOWS MUST BE DISCONNECTED.
- THE EXISTING CLAY BOTTOM OF POND SHALL BE RIPPED TO THE DEPTH NECESSARY TO RESTORE FREE GROUNDWATER MOVEMENT; THE WETLAND DESIGNER SHALL APPROVE PRIOR TO FILLING WITHIN THE PROPOSED WETLAND.
- FILL POND BOTTOM WITH SOIL SALVAGED FROM ON SITE TO ACHIEVE SUBGRADE ELEVATIONS 6" BELOW FINAL GRADE ELEVATION IN THE WETLAND PLANTING ZONES. ALL OTHER AREAS TO BE FILLED/EXCAVATED AND GRADED TO FINAL ELEVATIONS.
- ASBUILT OF THE WETLAND CELLS SHALL BE BASED ON THE SUBGRADE ELEVATION. ONCE THE FINAL SUBGRADE HAS BEEN APPROVED BY THE WETLAND DESIGNER FINAL SURFACE PREPARATION MAY BEGIN.
- 6" OF CLASS A TOPSOIL SHALL BE SPREAD ACROSS THE WETLAND PLANTING ZONES TO ACHIEVE FINAL GRADE. ONLY LOW-GROUND PRESSURE EQUIPMENT TO BE USED TO SPREAD TOPSOIL.
- SPREAD ORGANIC COMPOST ON SURFACE OF WETLAND CELL AT A QUANTITY OF 60 CY PER ACRE, AND INCORPORATE INTO THE SOIL TO A MINIMUM DEPTH OF 8" BY DISKING OR RIPPING, USING ONLY LOW GROUND PRESSURE EQUIPMENT.
- THE SPREADING OF THE TOP SOIL & DISKING OF THE ORGANIC COMPOST SHALL CREATE THE MICROTOPOGRAPHY WITHIN THE WETLAND CELL.
- PLACE LARGE WOODY DEBRIS IN THE WETLAND CELL AS SHOWN IN THE DESIGN PLANS.
- IF CONSTRUCTION IS COMPLETED OUTSIDE OF THE RECOMMENDED PLANTING SEASON, ALL AREAS OF DISTURBED SOIL ARE TO BE SEEDED WITH TEMPORARY SEED MIXES SPECIFIED IN THE PLANTING PLANS. NO SEEDING OF THE PERMANENT WETLAND SEED MIX OR PLANTING OF THE WETLAND PLANTS SHALL BE CONDUCTED UNTIL THE APPROPRIATE SEASON, AS APPROVED BY THE WETLAND DESIGNER.
- WETLAND PLANTING AND PERMANENT SEEDING NOTES AND DETAILS ARE INCLUDED IN THE DESIGN PLANS.

PERFORM STREAM RESTORATION OPERATION:

NOTE:SEE ESC PLANS FOR THE COMPLETE SEQUENCE OF CONSTRUCTION.

- ALL STREAM CONSTRUCTION MUST BE COMPLETED "IN THE DRY,"
- WHEN POSSIBLE NEW SEGMENTS OF CHANNEL SHALL BE CONSTRUCTED OFF-LINE AND STREAM FLOW MAINTAINED IN THE ORIGINAL STREAM CHANNEL WHILE THE PROPOSED CHANNEL IS BEING CONSTRUCTED. THE PROPOSED STREAM CHANNEL MUST BE GRADED, SEEDED AND MATTED TO CONTROL EROSION PRIOR TO INTRODUCTION OF FLOW INTO THE PROPOSED CHANNEL.
- TOP SOIL SHOULD BE SALVAGED AND STOCKPILED AS POSSIBLE FOR REUSE ACROSS THE DISTURBED STREAM BANKS & RIPARIAN AREAS.
- INSTALLATION OF STRUCTURES (LOG OR ROCK): USING LOGS (SALVAGED FROM SITE CLEARING IF AVAILABLE) OR ROCKS INSTALL THE STRUCTURES PER THE PLANS, ENSURING THAT THE TOP OF THE LOG/HEADER ROCK EXPOSED IN THE CHANNEL IS EVEN WITH THE INVERT OF THE STREAM CHANNEL.
- ONLY AFTER THE ENTIRE STREAM CHANNEL (OR SECTION) HAS BEEN CONSTRUCTED AND STABILIZED, AND ALL TIE-INS COMPLETED MAY THE PROPOSED CHANNEL BE OPENED TO STREAM FLOW.
- FLOODPLAIN GRADING CAN HAPPEN CONCURRENTLY WITH STREAM CHANNEL CONSTRUCTION OR BE STAGGERED.

CONSTRUCTION NOTES:

1. ALL EXISTING UNDERGROUND UTILITIES SHALL BE PHYSICALLY LOCATED BY THE CONTRACTOR PRIOR TO THE BEGINNING OF ANY CONSTRUCTION IN THE VICINITY OF THESE UTILITIES. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH UTILITY COMPANIES FOR THE RELOCATION OF SERVICES/UTILITIES IF REQUIRED.
2. THE DEVELOPER IS RESPONSIBLE FOR ANY DAMAGE TO EXISTING ROADS AND UTILITIES WHICH OCCUR AS A RESULT OF PROJECT CONSTRUCTION WITHIN OR CONTIGUOUS TO EXISTING RIGHT-OF-WAY.
3. STREET SURFACES SHALL BE MAINTAINED IN A CLEANED CONDITION, MUD AND DUST FREE AT ALL TIMES. ADEQUATE MEANS SHALL BE PROVIDED TO CLEAN TRUCKS AND OTHER EQUIPMENT USING THE COMPLETED STREETS.
4. ALL MATERIALS AND CONSTRUCTION WITHIN THE MDSHA RIGHT-OF-WAY WILL CONFORM TO CURRENT SPECIFICATIONS AND STANDARDS OF THE MARYLAND STATE HIGHWAY ADMINISTRATION.
5. LAND CONSERVATION NOTES:
   A.) STABILIZATION PRACTICES ON ALL PROJECTS MUST BE IN COMPLIANCE WITH THE REQUIREMENTS OF COMAR 26.17.1.08 g REGULATIONS BY JANUARY 9, 2013, REGARDLESS OF WHEN AN EROSION AND SEDIMENT CONTROL PLAN WAS APPROVED.
   B.) FOLLOWING INITIAL SOIL DISTURBANCE OR RE-DISTURBANCE, PERMANENT OR TEMPORARY STABILIZATION MUST BE COMPLETED WITHIN: THREE (3) CALENDAR DAYS AS TO THE SURFACE OF ALL PERIMETER DIKES, SWALES, DITCHES, PERIMETER SLOPES, AND ALL SLOPES STEEPER THAN 3 HORIZONTAL TO 1 VERTICAL (3:1), AND SEVEN (7) CALENDAR DAYS AS TO ALL OTHER DISTURBED OR GRADED AREAS ON THE PROJECT SITE NOT UNDER ACTIVE GRADING.
6. ALL FILL, BASE AND SUBBASE MATERIAL SHALL BE COMPACTED WITH TRACKED OR MECHANICAL EQUIPMENT TO THE ENGINEERS APPROVAL.
7. THE MARYLAND DEPARTMENT OF THE ENVIRONMENT (MDE), IN ACCORDANCE WITH THE CLEAN WATER ACT AS AMENDED AND PURSUANT TO THE STATE WATER CONTROL LAW AND REGULATIONS, REQUIRES CONSTRUCTION SITE OPERATORS SECURE, OR WILL SECURE, BY INDICATING PROOF OF APPLICATION, A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT FOR STORMWATER DISCHARGES FROM CONSTRUCTION ACTIVITIES. CONSTRUCTION ACTIVITIES INCLUDE, CLEARING, GRADING AND EXCAVATING WHICH RESULTS IN LAND DISTURBANCE EQUAL TO OR GREATER THAN ONE (1) ACRE. IN ORDER TO ENSURE COMPLIANCE WITH THE MDE PERMITTING REQUIREMENT, ALL APPLICATIONS FOR GRADING PERMITS WITHIN MONTGOMERY COUNTY, SUBJECT TO CRITERIA AS PREVIOUSLY DESCRIBED, SHALL BE REQUIRED TO PROVIDE RECEIPT OF PROOF THAT CONSTRUCTION SITE OPERATORS HAVE SECURED OR WILL SECURE A NPDES CONSTRUCTION PERMIT PRIOR TO THE ISSUANCE OF THE GRADING PERMIT.
8. THE APPROVAL OF THESE PLANS SHALL IN NO WAY RELIEVE THE OWNER OF COMPLYING WITH OTHER APPLICABLE LOCAL, STATE AND FEDERAL REQUIREMENTS.
9. EMERGENCY VEHICLE ACCESS SHALL BE PROVIDED DURING ALL PHASES OF CONSTRUCTION.

NOTICE REQUIRED:

CONTRACTORS SHALL NOTIFY OPERATORS WHO MAINTAIN UNDERGROUND UTILITY LINES IN THE AREA OF PROPOSED EXCAVATION AND/OR BLASTING AT LEAST TWO (2) WORKING DAYS, BUT NOT MORE THAN TEN (10) WORKING DAYS PRIOR TO COMMENCEMENT OF EXCAVATION OR DEMOLITION. NAMES AND TELEPHONE NUMBERS OF THE OPERATORS OF UNDERGROUND UTILITY LINES APPEAR BELOW. THESE NUMBERS SHALL ALSO BE USED TO SERVE IN AN EMERGENCY CONDITION.

PEPCO 202-833-7500
WASHINGTON GAS 703-750-1400
WASHINGTON SUBURBAN SANITARY COMMISSION 301-206-4001
MISS UTILITY 811 OR 800-552-7001

EMERGENCY

POLICE: 911 OR 301-258-6400
FIRE & RESCUE: 911 OR 240-773-4708

GENERAL NOTES:

1. THE PURPOSE OF THIS PROJECT IS TO CREATE A PERMITTEE RESPONSIBLE COMPENSATORY BANK FOR THE I-270/495 EXPANSION.
2. THE PROPERTY SHOWN HEREON IS RECORDED IN THE NAME OF:

PARCEL NUMBER	OWNER
00772244	USL2 MR MONT VILLAGE BUSINESS TR
00775420	POTOMAC ELECTRIC POWER CO
00775407	POTOMAC ELECTRIC POWER CO

3. ACCORDING TO MONTGOMERY COUNTY ASSESSMENTS, THE PARCELS TOTAL IS 128.39 ACRES.
4. THIS PROPERTY IS CURRENTLY ZONED RESIDENTIAL TOWNHOUSE LOW DENSITY (TLD), COMMERCIAL RESIDENTIAL NEIGHBORHOOD (CRN) OR RESIDENTIAL-200 (R-200).
5. THE BOUNDARY INFORMATION SHOWN HEREON WAS PREPARED WITHOUT THE BENEFIT OF A TITLE SEARCH OR PROPERTY BOUNDARY SURVEY, BASED ON AVAILABLE ONLINE GIS DATA.
6. THE PROPOSED USE OF THE PROPERTY FORESTED OPEN SPACE/MITIGATION.
7. TOPOGRAPHIC INFORMATION SHOWN HEREON WAS ACQUIRED BY AMT ENGINEERING. CONTOUR INTERVAL IS 1 FOOT. SEE SURVEY NOTES.
8. SOILS INFORMATION IS BASED ON THE USDA WEB SOIL SURVEYS DATABASE CURRENT DATA FOR MONTGOMERY COUNTY.
9. THE PROPERTY SHOWN HEREON IS WITHIN A 100-YEAR FLOODPLAIN; FEMA ZONE AE.
10. THE PROPERTY SHOWN HEREON HAS NO ARCHEOLOGICAL OR HISTORIC FEATURES AS INCLUDED IN THE STATE OR NATIONAL REGISTER OF HISTORIC PLACES.
11. ALL CONSTRUCTION SHALL CONFORM TO CURRENT MONTGOMERY COUNTY AND MARYLAND STATE HIGHWAY ADMINISTRATION STANDARDS AND SPECIFICATIONS OR APPROVED MODIFICATIONS.
12. SEDIMENT AND EROSION CONTROL WILL BE PROVIDED IN ACCORDANCE WITH THE 2011 MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL.
13. THE WETLAND DELINEATION SHOWN HEREON WAS PERFORMED BY RES IN SEPTEMBER 2020.
14. ALL WETLAND DELINEATIONS, PERMITS AND MITIGATION PLANS SHALL BE OBTAINED AND EVIDENCE OF SUCH BE PROVIDED TO THE COUNTY PRIOR TO LAND DISTURBANCE.
15. THESE STREAMS ARE DESIGNATED USE CLASS IP (WATER CONTACT RECREATION, PROTECTION OF AQUATIC LIFE, AND PUBLIC WATER SUPPLY) WATERS (WITHOUT YELLOW PERCH): IN-STREAM WORK SHALL NOT BE CONDUCTED DURING THE PERIOD MARCH 1 THROUGH JUNE 15, INCLUSIVE DURING ANY YEAR.

SURVEY NOTES:

1. HORIZONTAL DATUM: MARYLAND STATE PLANE NAD 83/2011
2. VERTICAL DATUM: NAVD 88 BASED ON RTK GPS OBSERVATIONS.
3. NO UNDERGROUND UTILITY DESIGNATION PROCEDURES WERE PERFORMED. UTILITIES SHOWN ARE FROM VISIBLE SURFACE EVIDENCE AND AVAILABLE RECORDS. SEWER INVERTS LABELED (DATR) ARE FROM WSSC RECORDS CONVERTED TO NAVD88 WITH AVERAGED RATE AND SHOULD BE CONSIDERED APPROXIMATE.
4. NO PROPERTY OR BOUNDARY SURVEY PROCEDURES WERE PERFORMED AS PART OF THIS SURVEY.

BENCHMARK DATA

NO	ELEV	DESCRIPTION
1	378.41	X-CUT ON SEWER MANHOLE RIM
2	372.11	MAG-NAIL IN POWER POLE
3	368.51	SQUARE CUT ON CORNER OF CONCRETE STEP
4	363.74	MAG-NAIL IN RETAINING WALL SUPPORT POLE
5	356.59	X-CUT ON SEWER MANHOLE RIM
6	351.32	SQUARE CUT ON CORNER OF CONCRETE EBOX PEDESTAL
7	352.28	X-CUT ON SEWER MANHOLE RIM
8	361.62	X-CUT ON SEWER MANHOLE RIM
9	365.67	X-CUT ON SEWER MANHOLE RIM

TRAVERSE DATA

NO	NORTHING	EASTING	ELEV	DESCRIPTION
1	549612.8806	1256904.0739	371.55	REBAR & CAP
2	549911.6583	1256877.3961	369.15	REBAR & CAP
3	550185.5116	1256545.3493	368.74	REBAR & CAP
4	550194.5612	1256244.7026	368.13	REBAR & CAP
5	550385.9432	1255901.0124	364.51	REBAR & CAP
6	550518.4884	1255106.4533	358.29	MAG-NAIL
7	550750.7908	1254861.5025	357.77	REBAR & CAP
8	550700.2689	1254462.5964	357.82	REBAR & CAP
9	550943.2640	1254205.0051	354.21	REBAR & CAP
10	551145.2060	1254008.3981	353.40	REBAR & CAP
11	551011.3964	1253706.0437	351.66	REBAR & CAP
12	551030.2872	1254946.3786	360.33	REBAR & CAP
301	549375.3780	1257258.6468	373.65	REBAR & CAP
302	549389.6357	1257027.6904	376.40	REBAR & CAP
303	550381.6582	1255510.6750	363.73	REBAR & CAP
304	550527.3286	1255303.3564	362.62	REBAR & CAP
305	551124.9972	1253417.3228	348.69	REBAR & CAP
306	550991.0591	1252983.5044	349.90	REBAR & CAP

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

NOTES

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#:52852
EXP. DATE:6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1
2

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	2 OF 51

MAP UNIT SYMBOL	MAP UNIT NAME	HYDROLOGIC SOIL GROUP	HYDRIC SOIL?
1B	GAILA SILT LOAM, 3 TO 8 PERCENT SLOPES	B	NO
1C	GAILA SILT LOAM, 8 TO 15 PERCENT SLOPES	B	NO
2B	GLENELG SILT LOAM, 3 TO 8 PERCENT SLOPES	B	NO
2C	GLENELG SILT LOAM, 8 TO 15 PERCENT SLOPES	B	NO
4B	ELIOAK SILT LOAM, 3 TO 8 PERCENT SLOPES	C	NO
5B	GLENVILLE SILT LOAM, 3 TO 8 PERCENT SLOPES	C/D	NO
6A	BAILE SILT LOAM, 0 TO 3 PERCENT SLOPES	C/D	YES
16C	BRINKLOW-BLOCKTOWN CHANNERY SILT LOAMS, 8 TO 15 PERCENT SLOPES	C	NO
16D	BRINKLOW-BLOCKTOWN CHANNERY SILT LOAMS, 15 TO 25 PERCENT SLOPES	C	NO
24D	MONTALTO SILT LOAM 15 TO 25 PERCENT SLOPES, VERY STONY	C	NO
37B	TRAVILAH SILT LOAM, 3 TO 8 PERCENT SLOPES	C/D	NO
54A	HATBORO SILT LOAM, 0 TO 3 PERCENT SLOPES, FREQUENTLY FLOODED	B/D	YES
65B	WHEATON SILT LOAM, 0 TO 8 PERCENT SLOPES	B	NO
66UB	WHEATON-URBAN LAND COMPLEX, 0 TO 8 PERCENT SLOPES	B	NO
66UC	WHEATON-URBAN LAND COMPLEX, 8 TO 15 PERCENT SLOPES	B	NO
67UB	URBAN LAND-WHEATON COMPLEX, 0 TO 8 PERCENT SLOPES	D	NO
116D	BLOCKTOWN CHANNERY SILT LOAM, 15 TO 25 PERCENT SLOPES, VERY ROCKY	D	NO
116E	BLOCKTOWN CHANNERY SILT LOAM, 25 TO 45 PERCENT SLOPES, VERY ROCKY	D	NO
400	URBAN LAND	D	NO

NOTES:
1. TOPOGRAPHY SHOWN IS BASED ON GIS, CONTOUR INTERVAL 5'.
2. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.
3. SEE DESIGN REPORT FOR HYDROLOGY CALCULATIONS.

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

STREAM RESTORATION
DRAINAGE AREA MAP

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#: 52652
EXP. DATE: 6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	3 OF 51

GRAPHIC SCALE: 1" = 700'
0 700' 1400' 2100'

LEGEND:
- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. SOILS BOUNDARY
- EX. DRAINAGE DIVIDE
- EX. SUB DRAINAGE DIVIDE
- EX. POND
- EX. STREAM

DA 1
DA 2
DA 3
DA 4A
DA 4B
DA 5
DA 6
DA 7
DA 8
DA 9

DETAILS SHOWN ON SHEET 3B

MAP UNIT SYMBOL	MAP UNIT NAME	HYDROLOGIC SOIL GROUP	HYDRIC SOIL?
1B	GAILA SILT LOAM, 3 TO 8 PERCENT SLOPES	B	NO
1C	GAILA SILT LOAM, 8 TO 15 PERCENT SLOPES	B	NO
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2C	GLENELG SILT LOAM, 8 TO 15 PERCENT SLOPES	B	NO
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5B	GLENVILLE SILT LOAM, 3 TO 8 PERCENT SLOPES	C/D	NO
6A	BAILE SILT LOAM, 0 TO 3 PERCENT SLOPES	C/D	YES
16C	BRINKLOW-BLOCKTOWN CHANNERY SILT LOAMS, 8 TO 15 PERCENT SLOPES	C	NO
16D	BRINKLOW-BLOCKTOWN CHANNERY SILT LOAMS, 15 TO 25 PERCENT SLOPES	C	NO
24D	MONTALTO SILT LOAM 15 TO 25 PERCENT SLOPES, VERY STONY	C	NO
37B	TRAVILAH SILT LOAM, 3 TO 8 PERCENT SLOPES	C/D	NO
54A	HATBORO SILT LOAM, 0 TO 3 PERCENT SLOPES, FREQUENTLY FLOODED	B/D	YES
65B	WHEATON SILT LOAM, 0 TO 8 PERCENT SLOPES	B	NO
66UB	WHEATON-URBAN LAND COMPLEX, 0 TO 8 PERCENT SLOPES	B	NO
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res
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WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

H&H DRAINAGE AREA MAP

MONTGOMERY COUNTY, MARYLAND

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LICENSE#:52652
EXP. DATE:6/14/2022

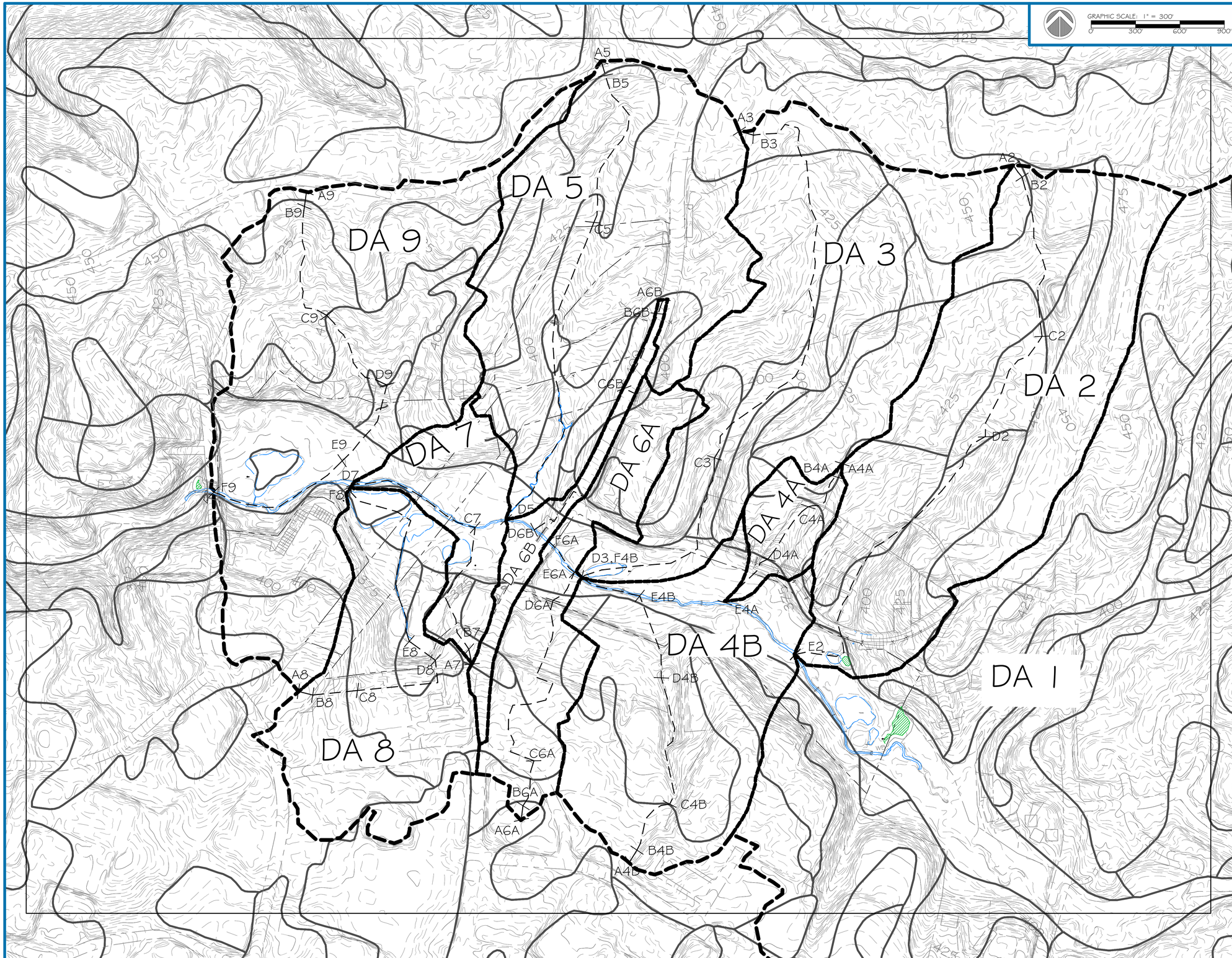
NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	3A OF 51



LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. SOILS BOUNDARY
- EX. DRAINAGE DIVIDE
- EX. SUB DRAINAGE DIVIDE
- TC FLOW PATH
- EX. POND
- EX. STREAM

MAP UNIT SYMBOL	MAP UNIT NAME	HYDROLOGIC SOIL GROUP	HYDRIC SOIL?
1B	GAILA SILT LOAM, 3 TO 8 PERCENT SLOPES	B	NO
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16D	BRINKLOW-BLOCKTOWN CHANNERY SILT LOAMS, 15 TO 25 PERCENT SLOPES	C	NO
24D	MONTALTO SILT LOAM 15 TO 25 PERCENT SLOPES, VERY STONY	C	NO
37B	TRAVILAH SILT LOAM, 3 TO 8 PERCENT SLOPES	C/D	NO
54A	HATBORO SILT LOAM, 0 TO 3 PERCENT SLOPES, FREQUENTLY FLOODED	B/D	YES
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NOTES:
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3. SEE DESIGN REPORT FOR HYDROLOGY CALCULATIONS.

res
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P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

H&H DETAIL MAP

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
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LICENSE#: 52852
EXP. DATE: 6/14/2022

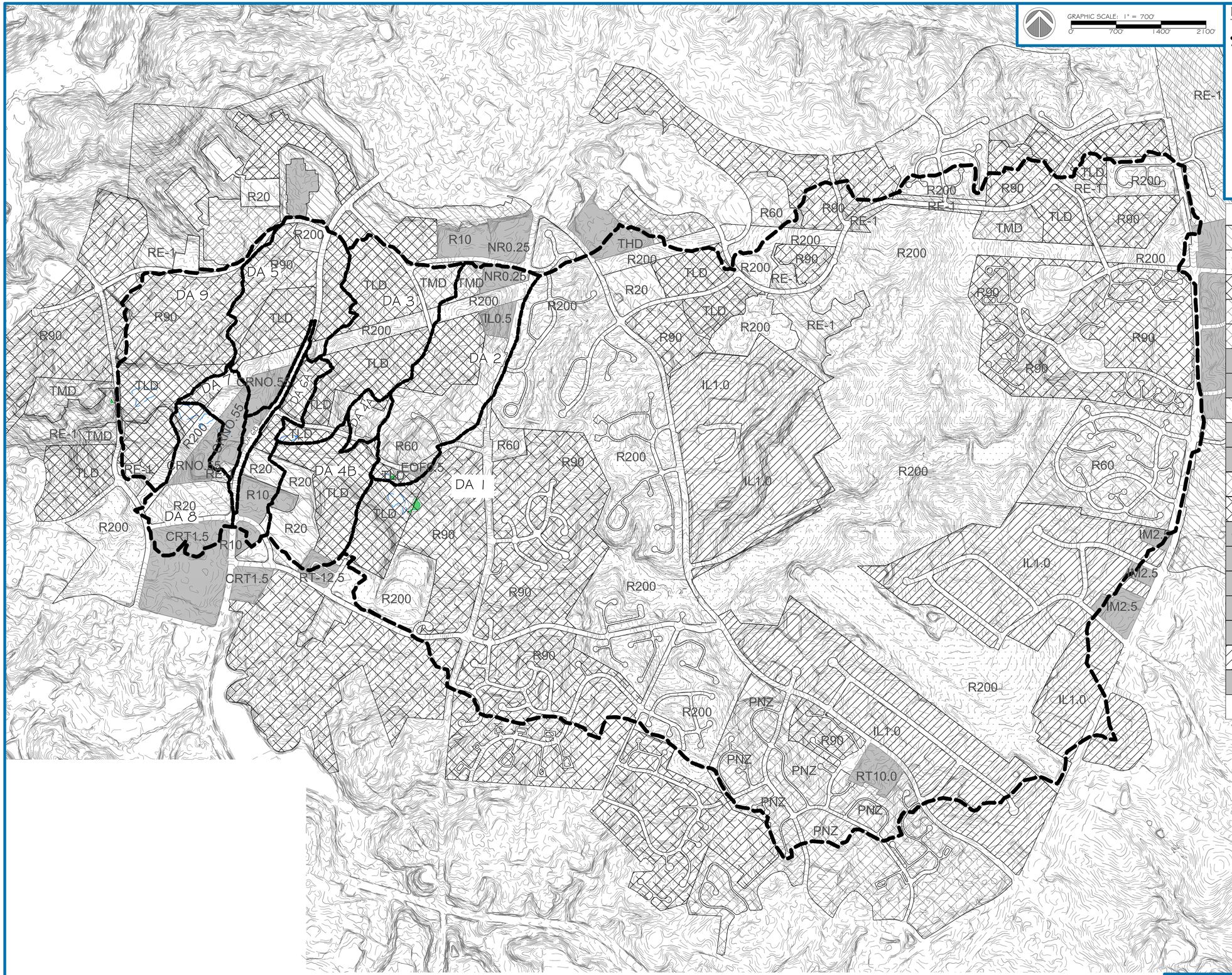
NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	3B OF 51



ZONING CLASSIFICATION

RE-1	SINGLE-FAMILY	MINIMUM LOT AREA: 40,000 SF
R-200	SINGLE-FAMILY	MINIMUM LOT AREA: 20,000 SF
R-90	SINGLE-FAMILY	MINIMUM LOT AREA: 9,000 SF
R-60	SINGLE-FAMILY	MINIMUM LOT AREA: 6,000 SF
PNZ	SINGLE-FAMILY	AVERAGE LOT AREA: 9,000 SF
RT-12.5	TOWNHOUSE	MINIMUM TRACT AREA: 20,000 SF 12.5 DWELLING UNITS/ACRE
RT-10.0	TOWNHOUSE	10.0 DWELLING UNITS/ACRE
R-20	MULTIPLE-FAMILY	MINIMUM LOT AREA: 16,000 SF 2,000 SF/DWELLING
R-10	MULTIPLE-FAMILY	MINIMUM LOT AREA: 20,000 SF 1,000 SF/DWELLING
THD	TOWNHOUSE	HIGH DENSITY TOWNHOUSE
TMD	TOWNHOUSE	MEDIUM DENSITY TOWNHOUSE
TLD	TOWNHOUSE	LOW DENSITY TOWNHOUSE
CRNO.55	COMMERCIAL	COMMERCIAL/RESIDENTIAL NEIGHBORHOOD
CRT1.5	COMMERCIAL	COMMERCIAL/RESIDENTIAL TOWN
NRO.25	COMMERCIAL	NEIGHBORHOOD RETAIL
EOFO.5	COMMERCIAL	EMPLOYMENT OFFICE
ILO.5	INDUSTRIAL	LIGHT INDUSTRIAL
IL1.0	INDUSTRIAL	LIGHT INDUSTRIAL
IM2.5	INDUSTRIAL	MEDIUM INDUSTRIAL
-------	STREETS, ROADS, & CULDESACS	IMPERVIOUS COVER

NOTES:
1. TOPOGRAPHY SHOWN IS BASED ON GIS, CONTOUR INTERVAL 5'.
2. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.
3. SEE DESIGN REPORT FOR HYDROLOGY CALCULATIONS.

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4644 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

ZONING MAP

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#: 52852
EXP. DATE: 6/14/2022

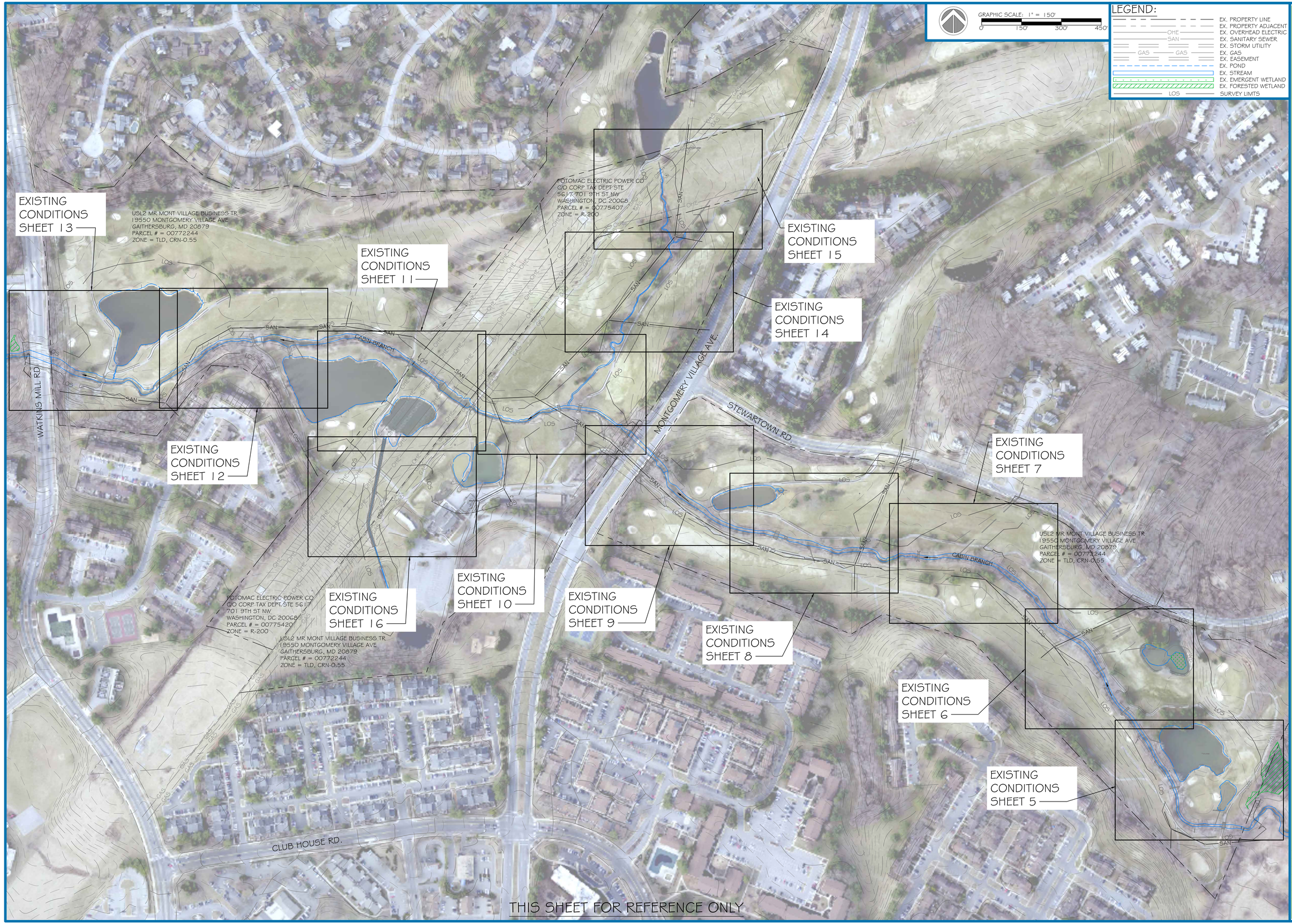
NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	3C OF 51



res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

EXISTING CONDITIONS KEY SHEET

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#: 52852
EXP. DATE: 6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	4 OF 51

MATCHLINE SHEET 6

GRAPHIC SCALE: 1" = 20'
0 20' 40' 60'

LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. SOILS BOUNDARY
- EX. ROAD CENTERLINE
- EX. EASEMENT
- EX. OVERHEAD ELECTRIC
- EX. SANITARY SEWER
- EX. STORM UTILITY
- EX. GAS
- EX. BUILDING
- EX. CURB
- EX. 100 YR WSE
- EX. 25' WETLAND BUFFER
- EX. STREAM THALWEG
- EX. POND
- EX. STREAM
- EX. EMERGENT WETLAND
- EX. FORESTED WETLAND
- EX. RIP RAP
- EX. CONCRETE SWALE
- EX. GROUNDWATER MONITORING WELL
- EX. DECIDUOUS TREE
- EX. EVERGREEN TREE
- EX. SPECIMEN TREE - REMOVE
- EX. SPECIMEN TREE W/ ORANGE SAFETY FENCE - SAVE
- SURVEY LIMITS
- LIMITS OF DISTURBANCE

24" CMP
371.33TW
INV=368.15
INV=368.77
CABIN BRANCH
RCP
INV=368.80
POPLAR
24"
POPLAR
SYCAMORE
24"
TRV 302
371.47WSE
4" PVC
INV=371.72
TRV 301
WOOD BRIDGE
3" PVC
INV=372.59
4" PVC
INV=372.49
ASPHALT TRAIL
373.38TW
373.29WSE
INV=371.10
18" SEWER
ASPHALT
4" PVC
INV=372.40
4" PVC
INV=372.51
4" PVC
INV=372.44
12" CMP
INV=369.75
18" RCP
INV=366.8
BRIDGE
CABIN BRANCH
MW
24" MULBERRY
24" SYCAMORE
MARYLAND NATIONAL CAPITAL
SILVER SPRING, MD 20907
PARCEL # = 02424097
ACRES = 15.38
ZONE = R-90
SEWER MANHOLE
TOP=378.64
INV IN(a)=364.65(DATR)
INV IN(b)=369.30(DATR)
INV OUT=364.65(DATR)
BM#1
18" SEWER
16D
54A

NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

EX. CONDITIONS REACH 1

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#: 52852
EXP. DATE: 6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV.3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	5 OF 51

MATCHLINE SHEET 7

MATCHLINE SHEET 5

GRAPHIC SCALE: 1" = 20'
0 20' 40' 60'

LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. SOILS BOUNDARY
- EX. ROAD CENTERLINE
- EX. EASEMENT
- EX. OVERHEAD ELECTRIC
- EX. SANITARY SEWER
- EX. STORM UTILITY
- EX. GAS
- EX. BUILDING
- EX. CURB
- EX. 100 YR WSE
- EX. 25' WETLAND BUFFER
- EX. STREAM THALWEG
- EX. POND
- EX. STREAM
- EX. EMERGENT WETLAND
- EX. FORESTED WETLAND
- EX. RIP RAP
- EX. CONCRETE SWALE
- EX. GROUNDWATER MONITORING WELL
- EX. DECIDUOUS TREE
- EX. EVERGREEN TREE
- EX. SPECIMEN TREE - REMOVE
- EX. SPECIMEN TREE W/ ORANGE SAFETY FENCE - SAVE
- SURVEY LIMITS
- LIMITS OF DISTURBANCE

21" SEWER

8" SEWER

18" SEWER

8" SEWER

SEWER MANHOLE
TOP=368.70
~~INV IN(a)=363.04(DATR)~~
INV IN(b)=359.79(DATR)
INV IN(c)=360.48(DATR)
INV OUT=359.58(DATR)

DRAINAGE MANHOLE
TOP=373.66
INV IN=368.16
INV OUT(a)=366.06
INV OUT(b)=366.16

CATCH BASIN
TOP=368.30
C/L INV=365.56

GRATE INLET
TOP=368.95
C/L INV=365.08

CABIN BRANCH

10" PVC
INV=366.14

4" PVC
INV=364.93

42"X24" CMP(2)

TRV 2

15" CMP
INV=364.32
INV=364.37
INV=363.79

24" WALNUT

INDOD BRIDGE

CABIN BRANCH

4" PVC
INV=369.82

2" MAPLE

3" PVC
INV=367.35

TRV 1

24" PINE

371.87TW
INV=369.70

370.13TW
INV=366.76
×367.46WSE

USL2 MR MONT VILLAGE BU
19550 MONTGOMERY VILLA
GAITHERSBURG, MD 20879
PARCEL # = 00772244
ZONE = TLD, CRN-0.55

USL2 MR MONT VILLAGE BUSINESS TR
19550 MONTGOMERY VILLAGE AVE
GAITHERSBURG, MD 20879
PARCEL # = 00772244
ZONE = TLD, CRN-0.55

ASPHALT TRAIL

NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

EX. CONDITIONS REACH 1

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#: 52852
EXP. DATE: 6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
X

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV.3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BWJC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	6 OF 51

GRAPHIC SCALE: 1" = 20'
0 20' 40' 60'

LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. SOILS BOUNDARY
- EX. ROAD CENTERLINE
- EX. EASEMENT
- OHE — EX. OVERHEAD ELECTRIC
- SAN — EX. SANITARY SEWER
- EX. STORM UTILITY
- GAS GAS — EX. GAS
- EX. BUILDING
- EX. CURB
- EX. 100 YR WSE
- WB — EX. 25' WETLAND BUFFER
- EX. STREAM THALWEG
- EX. POND
- EX. STREAM
- EX. EMERGENT WETLAND
- EX. FORESTED WETLAND
- EX. RIP RAP
- EX. CONCRETE SWALE
- MW — EX. GROUNDWATER MONITORING WELL
- EX. DECIDUOUS TREE
- EX. EVERGREEN TREE
- EX. SPECIMEN TREE - REMOVE
- EX. SPECIMEN TREE W/ ORANGE SAFETY FENCE - SAVE
- LOS — SURVEY LIMITS
- LOD — LIMITS OF DISTURBANCE

MATCHLINE SHEET 8

US12 MR MONT VILLAGE BUSINESS TR
19550 MONTGOMERY VILLAGE AVE
GAITHERSBURG, MD 20879
PARCEL # = 00772244
ZONE = TLD, CRN-0.55

30" SYCAMORE(NO TAG)

24" MAPLE

WOOD BRIDGE

CABIN BRANCH

ASPHALT TRAIL

363.36TW

4" PVC
INV=360.59
INV=363.71

24" RCP

24" OAK

4" PVC (2)
INV=362.33
INV=362.73

TRV 4

TRV 3

BM#3

21" SEWER

SEWER MANHOLE
TOP=369.41
INV IN=357.73(DATR)
INV OUT=357.73(DATR)

3" PVC
INV=365.14

US12 MR MONT VILLAGE BUSINESS TR
19550 MONTGOMERY VILLAGE AVE
GAITHERSBURG, MD 20879
PARCEL # = 00772244
ZONE = TLD, CRN-0.55

ASPHALT

54A

16D

MATCHLINE SHEET 6

NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY 4 LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

EX. CONDITIONS REACH 1

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#: 52852
EXP. DATE: 6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV.3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	7 OF 51

GRAPHIC SCALE: 1" = 20'
0 20' 40' 60'

LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. SOILS BOUNDARY
- EX. ROAD CENTERLINE
- EX. EASEMENT
- OHE — EX. OVERHEAD ELECTRIC
- SAN — EX. SANITARY SEWER
- EX. STORM UTILITY
- GAS — GAS — EX. GAS
- EX. BUILDING
- EX. CURB
- EX. 100 YR WSE
- WB — EX. 25' WETLAND BUFFER
- EX. STREAM THALWEG
- EX. POND
- EX. STREAM
- EX. EMERGENT WETLAND
- EX. FORESTED WETLAND
- EX. RIP RAP
- EX. CONCRETE SWALE
- MW — EX. GROUNDWATER MONITORING WELL
- EX. DECIDUOUS TREE
- EX. EVERGREEN TREE
- EX. SPECIMEN TREE - REMOVE
- EX. SPECIMEN TREE W/ ORANGE SAFETY FENCE - SAVE
- LOS — SURVEY LIMITS
- LOD — LIMITS OF DISTURBANCE

USL2 MR MONT VILLAGE BUSINESS TR
19550 MONTGOMERY VILLAGE AVE
GAITHERSBURG, MD 20879
PARCEL # = 00772244
ZONE = TLD, CRN-0.55

15" TO 21" CMP (PIPE NOT EXPOSED)
INV=356.23

2" PVC
INV=358.73

ASPHALT TRAIL

TRV 303

TRV 5

COOLER BOX

MW

CABIN BRANCH

WOOD BRIDGE

CONCRETE BRIDGE

ASPHALT

21" SEWER

15034067M
SEWER MANHOLE
TOP=362.65
INV IN=353.16(DATR)
INV OUT=353.16(DATR)

*PIPE EXPOSED AND BROKEN HERE

33" CMP
INV=358.80

96" CONC
INV=358.76

30" RCP
INV=358.54

383.00 LF

10" SEWER

15034068U
SEWER MANHOLE
TOP=365.91
INV IN(a)=355.41
INV IN(b)=354.77(DATR)
INV IN(c)=355.67(DATR)
INV OUT=354.77(DATR)

8" SEWER

66UC

MATCHLINE SHEET 9

MATCHLINE SHEET 7

NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

EX. CONDITIONS
REACH 1 & TRIBUTARY 4

MONTGOMERY COUNTY, MARYLAND

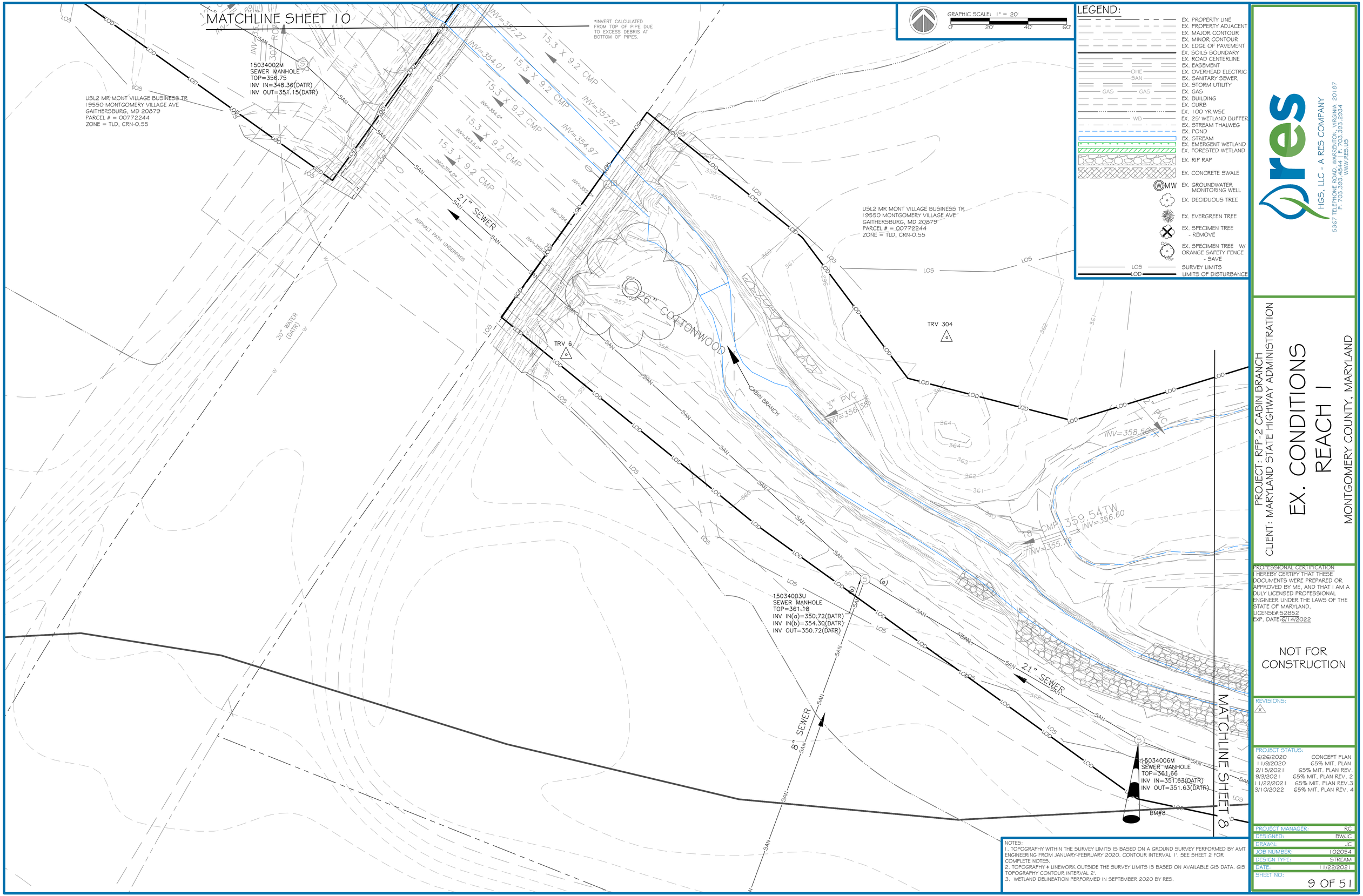
PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#: 52852
EXP. DATE: 6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:	
6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV.3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	8 OF 51



NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.

res
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P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

EX. CONDITIONS
REACH 1

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#: 52852
EXP. DATE: 6/14/2022

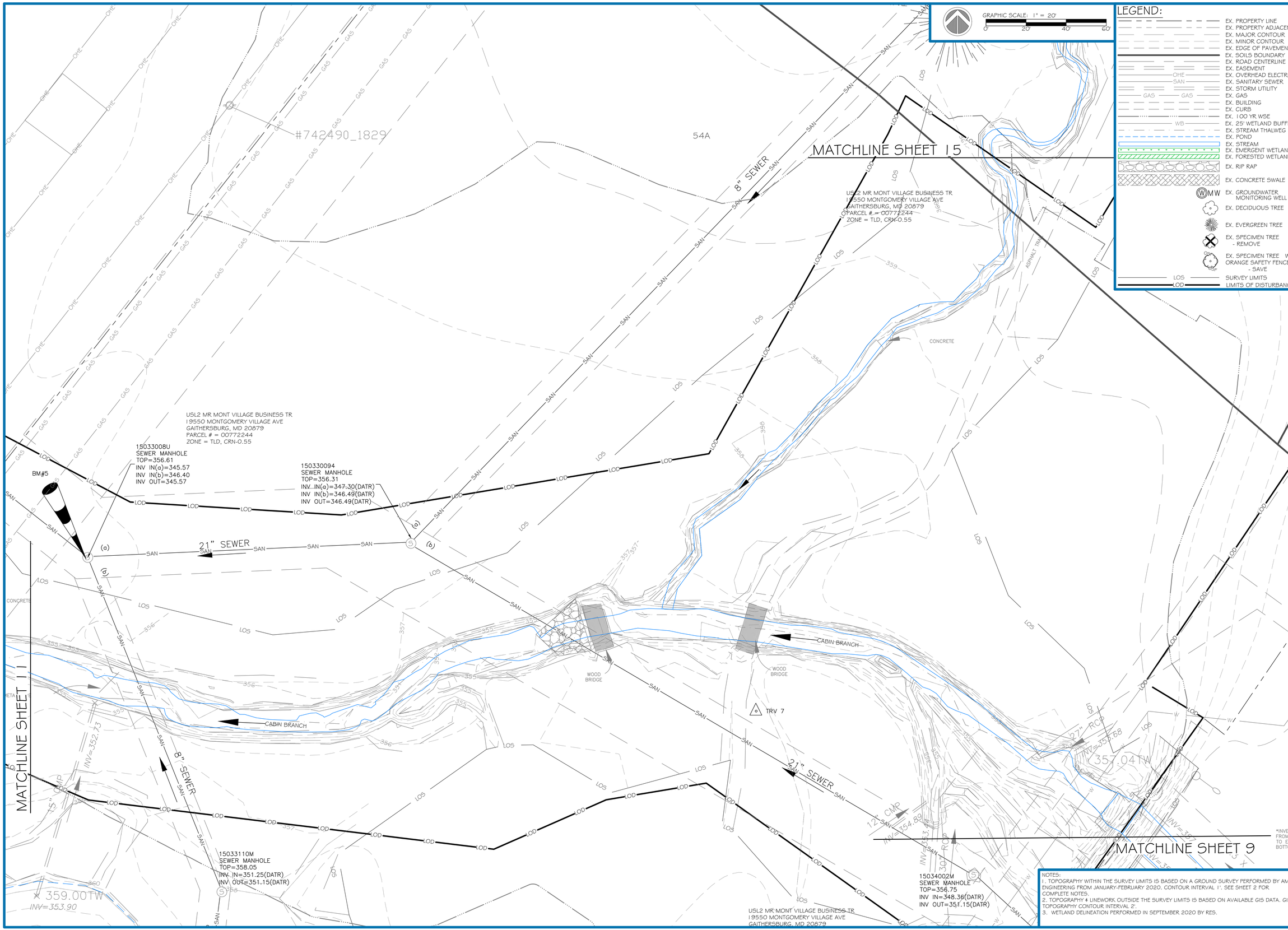
NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV.3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	9 OF 51



NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.

res
HGS, LLC - A RES COMPANY
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P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

EX. CONDITIONS
REACH 2 & TRIBUTARY 4

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#:52852
EXP. DATE:6/14/2022

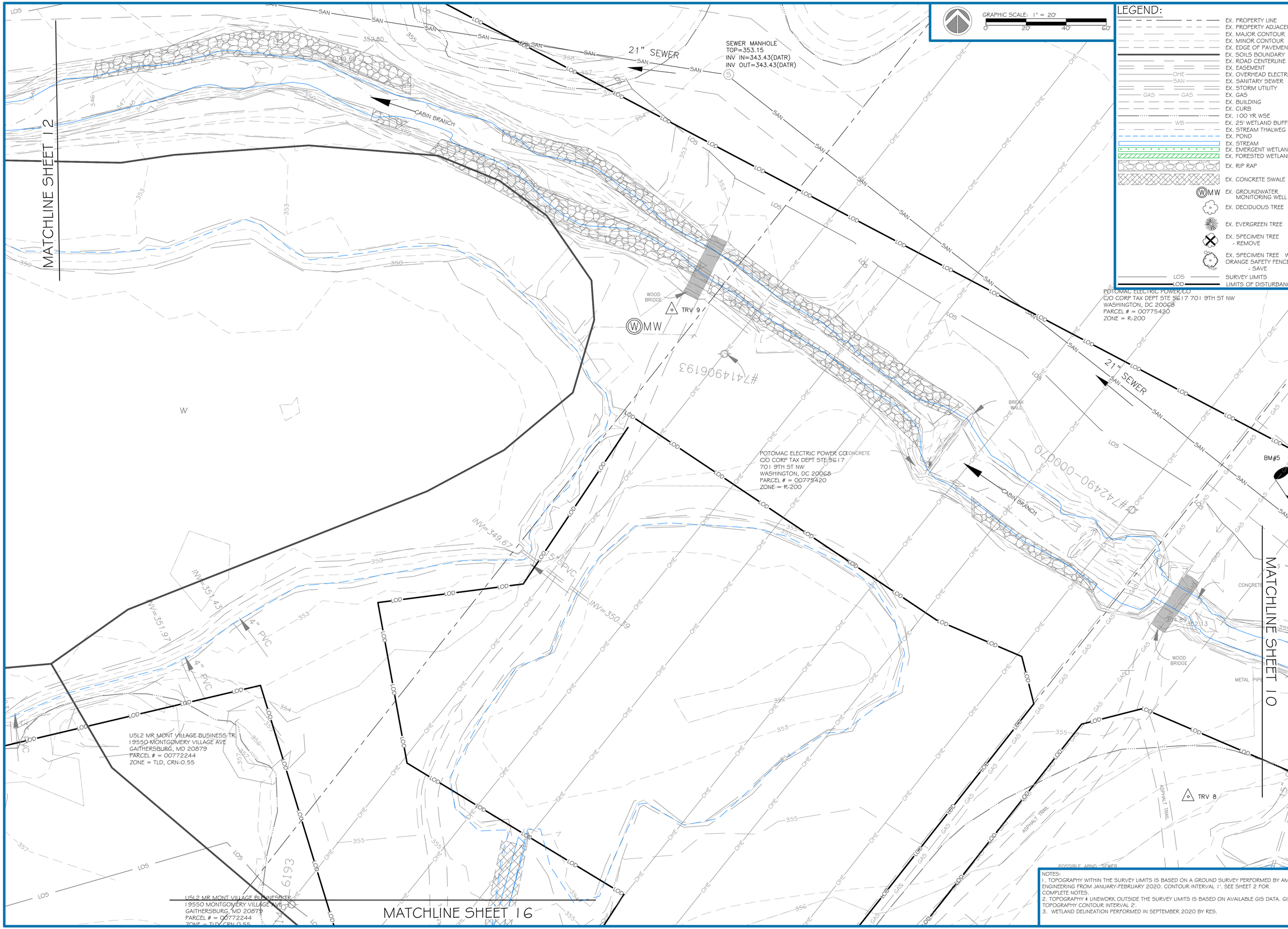
NOT FOR CONSTRUCTION

REVISIONS:

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV.3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	10 OF 51



NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

EX. CONDITIONS REACH 2

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
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LICENSE#:52852
EXP. DATE:6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV.3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	11 OF 51

GRAPHIC SCALE: 1" = 20'
0' 20' 40' 60'

LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. SOILS BOUNDARY
- EX. ROAD CENTERLINE
- EX. EASEMENT
- EX. OVERHEAD ELECTRIC
- EX. SANITARY SEWER
- EX. STORM UTILITY
- EX. GAS
- EX. BUILDING
- EX. CURB
- EX. 100 YR WSE
- EX. 25' WETLAND BUFFER
- EX. STREAM THALWEG
- EX. POND
- EX. STREAM
- EX. EMERGENT WETLAND
- EX. FORESTED WETLAND
- EX. RIP RAP
- EX. CONCRETE SWALE
- EX. GROUNDWATER MONITORING WELL
- EX. DECIDUOUS TREE
- EX. EVERGREEN TREE
- EX. SPECIMEN TREE - REMOVE
- EX. SPECIMEN TREE W/ ORANGE SAFETY FENCE - SAVE
- SURVEY LIMITS
- LIMITS OF DISTURBANCE

MATCHLINE SHEET 13

MATCHLINE SHEET 11

USL2 MR MONT VILLAGE BUSINESS TR
19550 MONTGOMERY VILLAGE AVE
GAITHERSBURG, MD 20879
PARCEL # = 00772244
ZONE = TLD, CRN-0.55

USL2 MR MONT VILLAG
19550 MONTGOMERY
GAITHERSBURG, MD.2
PARCEL # = 0077224
ZONE = TLD, CRN-0.5

USL2 MR MONT VILLAGE BUSINESS TR
19550 MONTGOMERY VILLAGE AVE
GAITHERSBURG, MD 20879
PARCEL # = 00772244
ZONE = TLD, CRN-0.55

FLORES JOSE P & R A
19642 CLUB LAKE RD
GAITHERSBURG, MD 20879
PARCEL # = 01513928
ACRES = 0.05
ZONE = TMD

DIGGS/AUSTIN
19644 CLUB LAKE RD

TRV 305

TRV 11

SEWER MANHOLE
TOP=348.96
INV IN=339.57(DATR)
INV OUT=339.57(DATR)

SEWER MANHOLE
TOP=348.90
INV IN=338.74(DATR)
INV OUT=338.74(DATR)

21" SEWER

4" PVC

CABIN BRANCH

WOOD BRIDGE

24" RCP

24" CMP

15" CMP

10" CONC.

4" CI

33" CMP

ASPHALT TRAIL

EXPOSED PRIVATE WATER LINE

CONCRETE

COMBINE SHEET 13

INV=345.78
INV=345.58
INV=346.03
INV=344.99
INV=347.17
INV=347.12
INV=350.46
INV=351.0

351.46TW

356.31

24" POPLAR

29" TASHMO TAG)

TTONWOOD(NO TAG)

6GUC

TFP=353.3

NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RESJOS

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

EX. CONDITIONS REACH 2

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#:52652
EXP. DATE:6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:	
6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV.3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	12 OF 51

GRAPHIC SCALE: 1" = 20'
0' 20' 40' 60'

LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. SOILS BOUNDARY
- EX. ROAD CENTERLINE
- EX. EASEMENT
- OHE — EX. OVERHEAD ELECTRIC
- SAN — EX. SANITARY SEWER
- EX. STORM UTILITY
- GAS — GAS — EX. GAS
- EX. BUILDING
- EX. CURB
- EX. 100 YR WSE
- WB — EX. 25' WETLAND BUFFER
- EX. STREAM THALWEG
- EX. POND
- EX. STREAM
- EX. EMERGENT WETLAND
- EX. FORESTED WETLAND
- EX. RIP RAP
- EX. CONCRETE SWALE
- MW — EX. GROUNDWATER MONITORING WELL
- EX. DECIDUOUS TREE
- EX. EVERGREEN TREE
- EX. SPECIMEN TREE - REMOVE
- EX. SPECIMEN TREE W/ ORANGE SAFETY FENCE - SAVE
- LOS — SURVEY LIMITS
- LOD — LIMITS OF DISTURBANCE

3" PVC
INV=346.28

345.95
347.78

MW

W

TRV 306

U5L2 MR MONT VILLAGE BUSINESS TR
19550 MONTGOMERY VILLAGE AVE
GAITHERSBURG, MD 20879
PARCEL # = 00772244
ZONE = TLD, CRN-0.55

4" PVC
INV=345.43

SEWER MAN
TOP=348.9
INV IN=338
INV OUT=3

ASPHALT TRAIL

24" CMP

WATKINS MILL RD

LOCUST

116D

66UC

CABIN BRANCH

EXPOSED BRIDGE SUPPORTS

ASPHALT

21" SEWER

SEWER MANHOLE
TOP=349.37
INV IN=335.49(DATR)
INV OUT=335.49(DATR)

21" SEWER

MATCHLINE SHEET 12

NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

EX. CONDITIONS REACH 2

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE#:52852
EXP. DATE: 6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV.3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	13 OF 51

GRAPHIC SCALE: 1" = 150'
0' 150' 300' 450'

LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. OVERHEAD ELECTRIC
- EX. SANITARY SEWER
- EX. STORM UTILITY
- EX. GAS
- EX. POND
- EX. STREAM
- EX. WETLAND
- SURVEY LIMITS
- PR. CONSERVATION EASEMENT
- PR. BANKFULL
- PR. STREAM RESTORATION (EXCLUDED)
- PR. STREAM RESTORATION
- PR. STREAM RESTORATION (PEPCO)
- PR. FORESTED WETLAND RESTORATION
- PR. WETLAND ENHANCEMENT
- PR. WETLAND BUFFER ENHANCEMENT
- PR. RIPARIAN BUFFER (35' BUFFER)
- PR. RIPARIAN BUFFER ENHANCEMENT
- PR. FOREST CONSERVATION EASEMENT (BY OTHERS)

CREDIT SUMMARY

ACTIVITY	LINEAR FEET (LF) ACREAGE (AC)	CREDIT RATIO	CREDIT	STREAM GAINS (FUNCTIONAL FEET)
STREAM RESTORATION	7,173 LF	1:1	7,173	5,598
STREAM RESTORATION (PEPCO PROPERTY)	810 LF	1:1	810	476
WETLAND RESTORATION (PFO)	4.37	1:1	4.37	-
WETLAND ENHANCEMENT	0.03	4:1	0.01	-
WETLAND BUFFER ENHANCEMENT	2.48 AC	15:1	0.17	-
TOTAL WETLAND CREDIT			4.55	-
RIPARIAN BUFFER (35 FOOT BUFFER)	8.27 AC	-	-	-
RIPARIAN BUFFER ENHANCEMENT	0.93 AC	15:1	0.06	-

PFO WETLAND 5
1.16 ACRES

REACH 2
1,856 LF RESTORED

TRIBUTARY 4
813 LF RESTORED

PFO WETLAND 3
0.40 ACRES

PFO WETLAND 2
0.18 ACRES RESTORED
0.06 ACRES ENHANCEMENT

TRIBUTARY 3
724 LF RESTORED

TRIBUTARY 2
421 LF RESTORED

TRIBUTARY 1
497 LF RESTORED

PFO WETLAND 4
1.53 ACRES

TRIBUTARY 5
39 LF RESTORED

REACH 1
2,825 LF RESTORED

PFO WETLAND 1
1.11 AC

WATKINS MILL RD

MONTGOMERY VILLAGE AVE.

STEWARTOWN RD.

CLUB HOUSE RD.

US12 MR MONT VILLAGE BUSINESS TR
19550 MONTGOMERY VILLAGE AVE
GAITHERSBURG, MD 20879
PARCEL # = 00772244
ZONE = TLD, CRN-0.55

POTOMAC ELECTRIC POWER CO
C/O CORP TAX DEPT STE 56|7
701 9TH ST NW
WASHINGTON, DC 20068
PARCEL # = 00775407
ZONE = R-200

POTOMAC ELECTRIC POWER CO
C/O CORP TAX DEPT STE 56|7
701 9TH ST NW
WASHINGTON, DC 20068
PARCEL # = 00775420
ZONE = R-200

THIS SHEET FOR REFERENCE ONLY

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4644 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

MITIGATION MASTER PLAN

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
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LICENSE#: 52852
EXP. DATE: 6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	17 OF 51

GRAPHIC SCALE: 1" = 20'
0 20' 40' 60'

LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. SOILS BOUNDARY
- EX. ROAD CENTERLINE
- EX. EASEMENT
- EX. OVERHEAD ELECTRIC
- EX. SANITARY SEWER
- EX. STORM UTILITY
- EX. GAS
- EX. BUILDING
- EX. CURB
- EX. 100 YR WSE
- EX. 25' WETLAND BUFFER
- EX. STREAM THALWEG
- EX. POND
- EX. STREAM
- EX. EMERGENT WETLAND
- EX. FORESTED WETLAND
- EX. RIP RAP
- EX. CONCRETE SWALE
- EX. GROUNDWATER MONITORING WELL
- EX. DECIDUOUS TREE
- EX. EVERGREEN TREE
- EX. SPECIMEN TREE - REMOVE
- EX. SPECIMEN TREE W/ ORANGE SAFETY FENCE - SAVE
- SURVEY LIMITS
- LIMITS OF DISTURBANCE

SEWER MANHOLE
TOP=369.38
INV IN=362.23
INV OUT=362.13

MATCHLINE SHEET 14

24" PINE

28" SPRUCE(NO TAG)

EXPOSED PRIVATE WATER LINE

27" PINE

8" SEWER

15034257U
SEWER MANHOLE
TOP=362.21
INV IN(a)=354.71
INV IN(b)=354.71
INV OUT=354.61

WOOD BRIDGE

24" PINE

8" SEWER

15034258M
SEWER MANHOLE
TOP=379.50
INV IN=368.85(DATR)
INV OUT=368.85(DATR)

8" SEWER

US12 MR MONT VILLAGE BUSINESS TR
19550 MONTGOMERY VILLAGE AVE
GAITHERSBURG, MD 20879
PARCEL # = 00772244
ZONE = TLD, CRN-0.55

MATCHLINE SHEET 13

8" SEWER

US12 MR MONT VILLAGE BUSINESS TR
19550 MONTGOMERY VILLAGE AVE
GAITHERSBURG, MD 20879
PARCEL # = 00772244

NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

EX. CONDITIONS TRIBUTARY 4

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#: 52852
EXP. DATE: 6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV.3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	15 OF 51

MATCHLINE SHEET 11

GRAPHIC SCALE: 1" = 20'
0 20' 40' 60'

LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. SOILS BOUNDARY
- EX. ROAD CENTERLINE
- EX. EASEMENT
- EX. OVERHEAD ELECTRIC
- EX. SANITARY SEWER
- EX. STORM UTILITY
- EX. GAS
- EX. BUILDING
- EX. CURB
- EX. 100 YR WSE
- EX. 25' WETLAND BUFFER
- EX. STREAM THALWEG
- EX. POND
- EX. STREAM
- EX. EMERGENT WETLAND
- EX. FORESTED WETLAND
- EX. RIP RAP
- EX. CONCRETE SWALE
- EX. GROUNDWATER MONITORING WELL
- EX. DECIDUOUS TREE
- EX. EVERGREEN TREE
- EX. SPECIMEN TREE - REMOVE
- EX. SPECIMEN TREE W/ ORANGE SAFETY FENCE - SAVE
- SURVEY LIMITS
- LIMITS OF DISTURBANCE

U5L2 MR MONT VILLAGE BUSINESS TR
19550 MONTGOMERY VILLAGE AVE
GAITHERSBURG, MD 20879
PARCEL # = 00772244
ZONE = TLD, CRN-0.55

POTOMAC ELECTRIC POWER CO
C/O CORP TAX DEPT STE 5617
701 9TH ST NW
WASHINGTON, DC 20068
PARCEL # = 00775420
ZONE = R-200

#741489_5193
#741489_8284
#741489_4674
#741489_6359

ASPHALT TRAIL
WOOD BRIDGE
OVERHEAD TRANSMISSION LINE
26" SPRUCE
CONC.
ASPHALT
CONCRETE
GA
STORM DRAIN INLET
TOP=363.52
INV OUT=361.35
TRASH CATCH
INV=364.31
36" RCP
*12" PIPE INSERTED INTO 24" PIPE HERE

NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

EX. CONDITIONS TRIBUTARY 5

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#:52852
EXP. DATE:6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV.3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	16 OF 51

GRAPHIC SCALE: 1" = 150'
0 150' 300' 450'

LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. OVERHEAD ELECTRIC
- EX. SANITARY SEWER
- EX. STORM UTILITY
- EX. GAS
- EX. POND
- EX. STREAM
- EX. WETLAND
- SURVEY LIMITS
- PR. CONSERVATION EASEMENT
- PR. BANKFULL
- PR. STREAM RESTORATION (EXCLUDED)
- PR. STREAM RESTORATION
- PR. STREAM RESTORATION (PEPCO)
- PR. FORESTED WETLAND RESTORATION
- PR. WETLAND ENHANCEMENT
- PR. WETLAND BUFFER ENHANCEMENT
- PR. RIPARIAN BUFFER (35' BUFFER)
- PR. RIPARIAN BUFFER ENHANCEMENT
- PR. FOREST CONSERVATION EASEMENT (BY OTHERS)

CREDIT SUMMARY

ACTIVITY	LINEAR FEET (LF) ACREAGE (AC)	CREDIT RATIO	CREDIT	STREAM GAINS (FUNCTIONAL FEET)
STREAM RESTORATION	7,173 LF	1:1	7,173	5,598
STREAM RESTORATION (PEPCO PROPERTY)	810 LF	1:1	810	476
WETLAND RESTORATION (PFO)	4.37	1:1	4.37	-
WETLAND ENHANCEMENT	0.03	4:1	0.01	-
WETLAND BUFFER ENHANCEMENT	2.48 AC	15:1	0.17	-
TOTAL WETLAND CREDIT			4.55	-
RIPARIAN BUFFER (35 FOOT BUFFER)	8.27 AC	-	-	-
RIPARIAN BUFFER ENHANCEMENT	0.83 AC	15:1	0.06	-

USL2 MR MONT VILLAGE BUSINESS TR
19550 MONTGOMERY VILLAGE AVE
GAITHERSBURG, MD 20879
PARCEL # = 00772244
ZONE = TLD, CRN-0.55

PFO WETLAND 5
1.16 ACRES

REACH 2
1,856 LF RESTORED

POTOMAC ELECTRIC POWER CO
C/O CORP TAX DEPT STE 5617
701 9TH ST NW
WASHINGTON, DC 20068
PARCEL # = 00775407
ZONE = R-200

TRIBUTARY 4
813 LF RESTORED

PFO WETLAND 3
0.40 ACRES

PFO WETLAND 2
0.18 ACRES RESTORED
0.03 ACRES ENHANCEMENT

TRIBUTARY 3
724 LF RESTORED

TRIBUTARY 2
421 LF RESTORED

TRIBUTARY 1
497 LF RESTORED

PFO WETLAND 4
1.53 ACRES

TRIBUTARY 5
39 LF RESTORED

POTOMAC ELECTRIC POWER CO
C/O CORP TAX DEPT STE 5617
701 9TH ST NW
WASHINGTON, DC 20068
PARCEL # = 00775420
ZONE = R-200

USL2 MR MONT VILLAGE BUSINESS TR
19550 MONTGOMERY VILLAGE AVE
GAITHERSBURG, MD 20879
PARCEL # = 00772244
ZONE = TLD, CRN-0.55

REACH 1
2,825 LF RESTORED

USL2 MR MONT VILLAGE BUSINESS TR
19550 MONTGOMERY VILLAGE AVE
GAITHERSBURG, MD 20879
PARCEL # = 00772244
ZONE = TLD, CRN-0.55

PFO WETLAND 1
1.11 AC

WATKINS MILL RD.
MONTGOMERY VILLAGE AVE.
STEWARTOWN RD.
CLUB HOUSE RD.

THIS SHEET FOR REFERENCE ONLY

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

MITIGATION MASTER PLAN

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#: 52852
EXP. DATE: 6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	17 OF 51

GRAPHIC SCALE: 1" = 150'
0 150' 300' 450'

LEGEND:
- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. OVERHEAD ELECTRIC
- EX. SANITARY SEWER
- EX. STORM UTILITY
- EX. GAS
- EX. EASEMENT
- EX. POND
- EX. STREAM
- EX. EMERGENT WETLAND
- EX. FORESTED WETLAND
- SURVEY LIMITS
- PR. BANKFULL
- PR. FORESTED WETLAND

TRIBUTARY 4/4-1 SHEET 34

POTOMAC ELECTRIC POWER CO
C/O CORP TAX DEPT STE
5G/7 701 9TH ST NW
WASHINGTON, DC 20068
PARCEL # = 00775407
ZONE = R-200

USL2 MR MONT VILLAGE BUSINESS TR
19550 MONTGOMERY VILLAGE AVE
GAITHERSBURG, MD 20879
PARCEL # = 00772244
ZONE = TLD, CRN-0.55

WETLAND 5 SHEET 42

REACH 2 SHEET 27

TRIBUTARY 4 SHEET 35

TRIBUTARY 4 SHEET 36

WETLAND 3 SHEET 40

TRIBUTARY 3 SHEET 33

TRIBUTARY 3/3-1 SHEET 32

TRIBUTARY 2 SHEET 31

REACH 2 SHEET 29

REACH 2 SHEET 28

WETLAND 4 SHEET 41

REACH 2 SHEET 26

REACH 2 SHEET 25

TRIBUTARY 1/1-1 SHEET 30

TRIBUTARY 5 SHEET 37

REACH 1 SHEET 24

WETLAND 2 SHEET 39

POTOMAC ELECTRIC POWER CO
C/O CORP TAX DEPT STE 5G/7
701 9TH ST NW
WASHINGTON, DC 20068
PARCEL # = 00775420
ZONE = R-200

USL2 MR MONT VILLAGE BUSINESS TR
19550 MONTGOMERY VILLAGE AVE
GAITHERSBURG, MD 20879
PARCEL # = 00772244
ZONE = TLD, CRN-0.55

REACH 1 SHEET 23

REACH 1 SHEET 22

REACH 1 SHEET 21

WETLAND 1 SHEET 38

REACH 1 SHEET 20

REACH 1 SHEET 19

MONTGOMERY VILLAGE AVE.
STEWARTOWN RD.
WATKINS MILL RD.
CLUB HOUSE RD.
CABIN BRANCH

THIS SHEET FOR REFERENCE ONLY

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

DESIGN KEY SHEET

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION
MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#: 52852
EXP. DATE: 6/14/2022

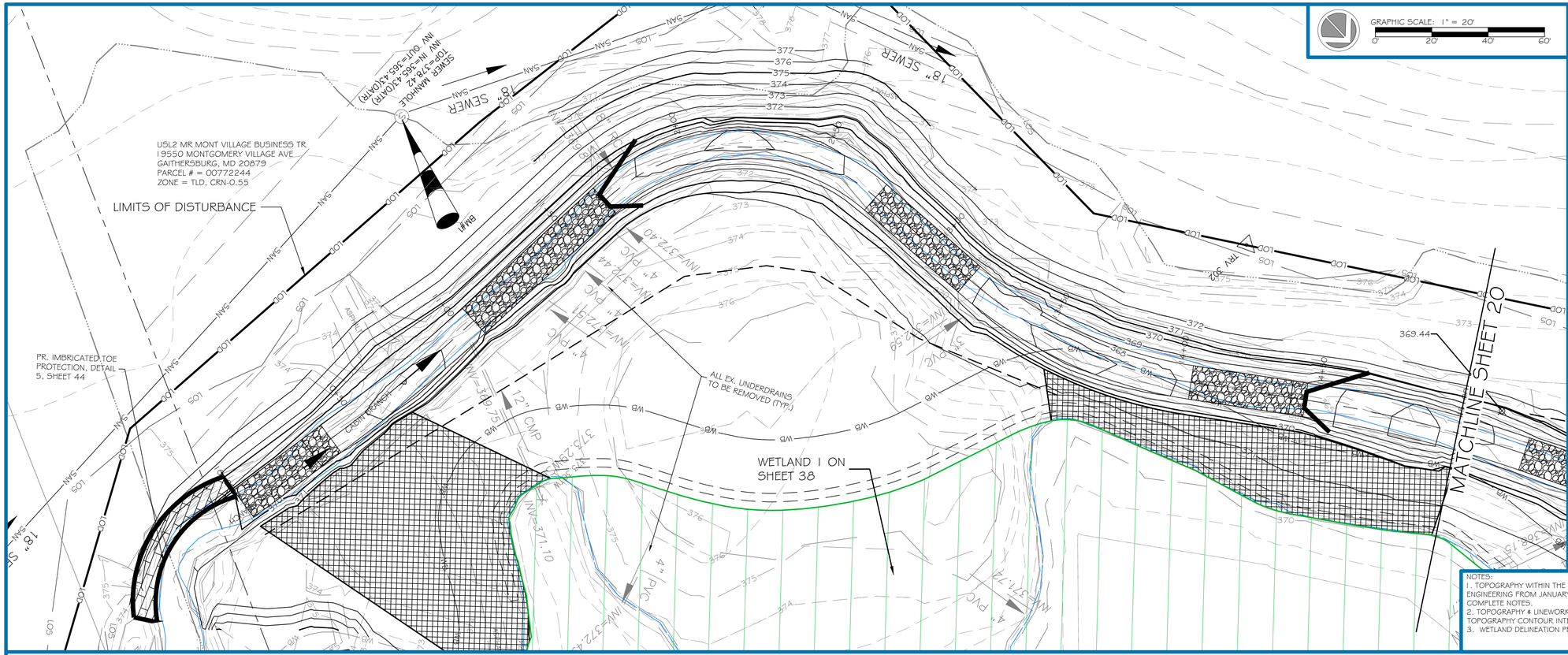
NOT FOR CONSTRUCTION

REVISIONS:
1

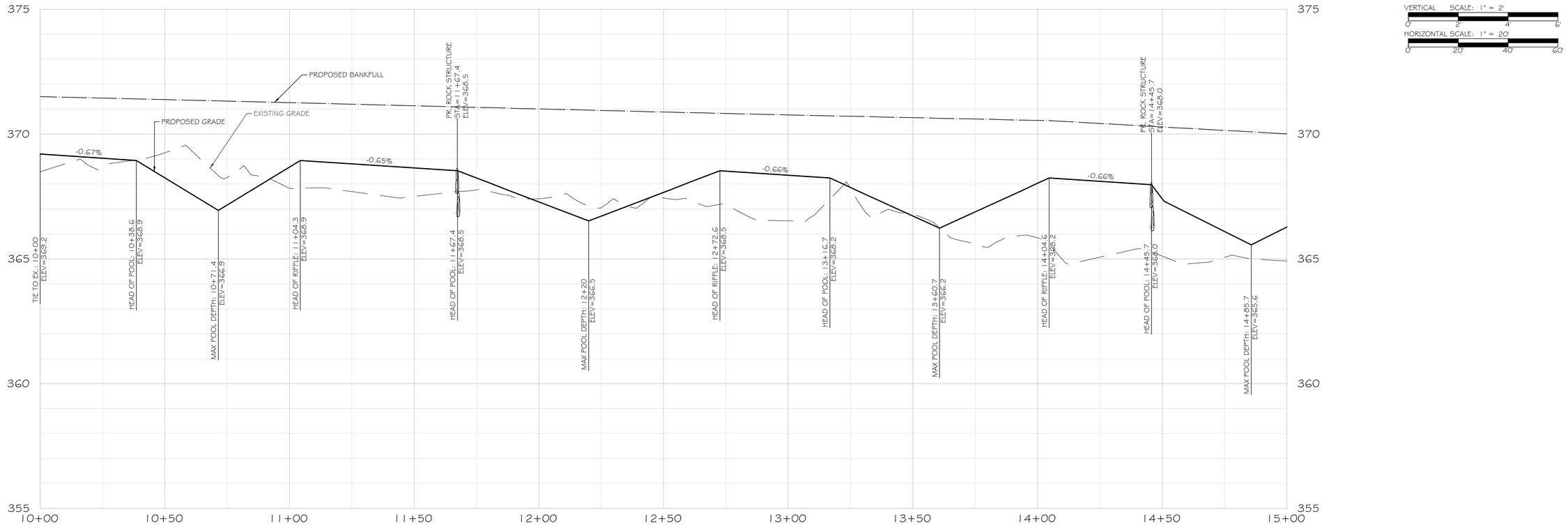
PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	18 OF 51



NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.



CABIN BRANCH REACH 1 PROFILE

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & PROFILE
REACH 1

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#: 52652
EXP. DATE: 6/14/2022

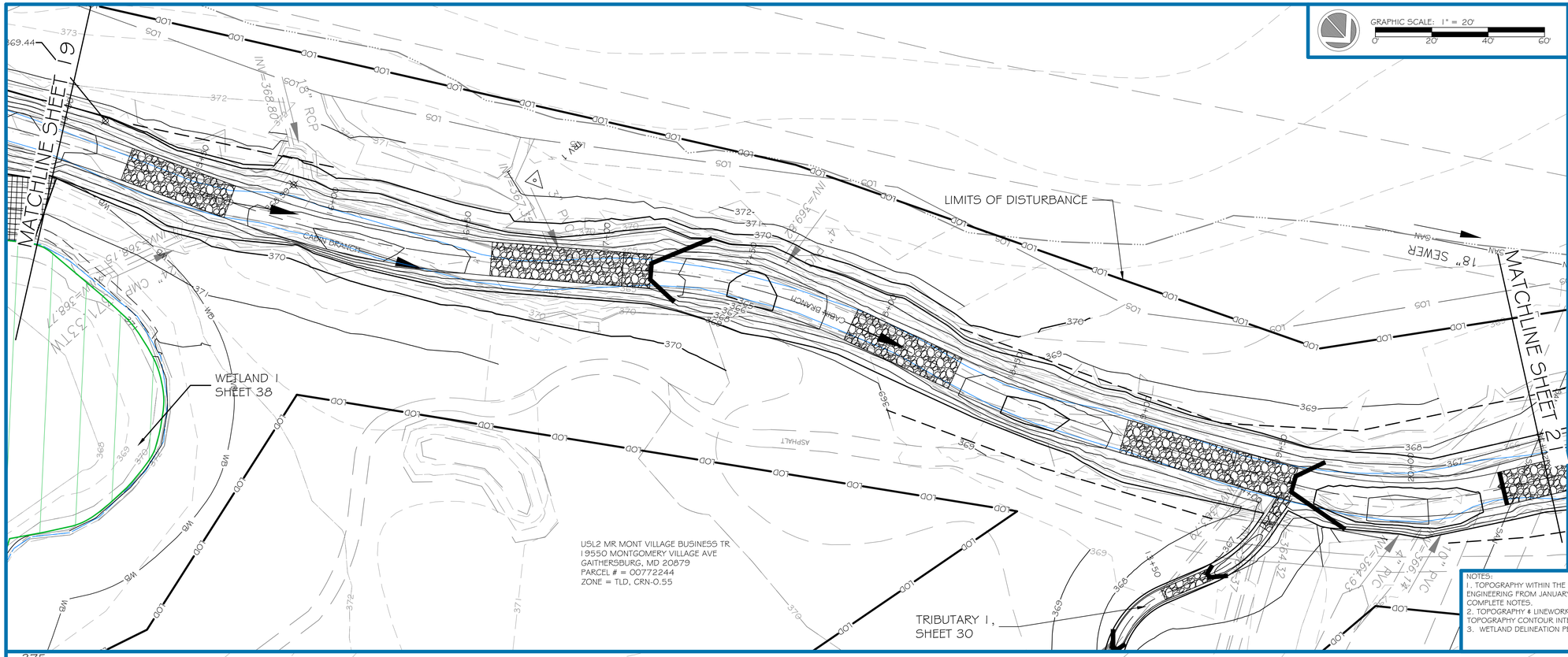
NOT FOR CONSTRUCTION

REVISIONS:
1
2

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	19 OF 51



GRAPHIC SCALE: 1" = 20'
0' 20' 40' 60'

LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. ROAD CENTERLINE
- EX. EASEMENT
- EX. OVERHEAD ELECTRIC
- EX. SANITARY SEWER
- EX. STORM UTILITY
- EX. GAS
- EX. BUILDING
- EX. CURB
- EX. FLOODPLAIN
- EX. STREAM THALWEG
- EX. POND
- EX. STREAM
- EX. WETLAND
- EX. CONCRETE SWALE
- SURVEY LIMITS
- PR. LIMITS OF DISTURBANCE
- PR. MAJOR CONTOUR
- PR. MINOR CONTOUR
- PR. FLOODPLAIN GRADING LIMITS
- PR. FORESTED WETLAND
- PR. WETLAND ENHANCEMENT
- PR. BANKFULL
- PR. STREAM CENTERLINE
- PR. BERM
- PR. WETLAND INLET/OUTLET
- PR. RIP RAP
- PR. RIFFLE
- PR. ROCK OFFSET CROSS-VANE
- PR. ROCK SILL
- DETAIL CALLOUT (DETAIL # / SHEET #)

PROFILE LEGEND:

- EX. GRADE
- PR. GRADE
- PR. BANKFULL

NOTES:
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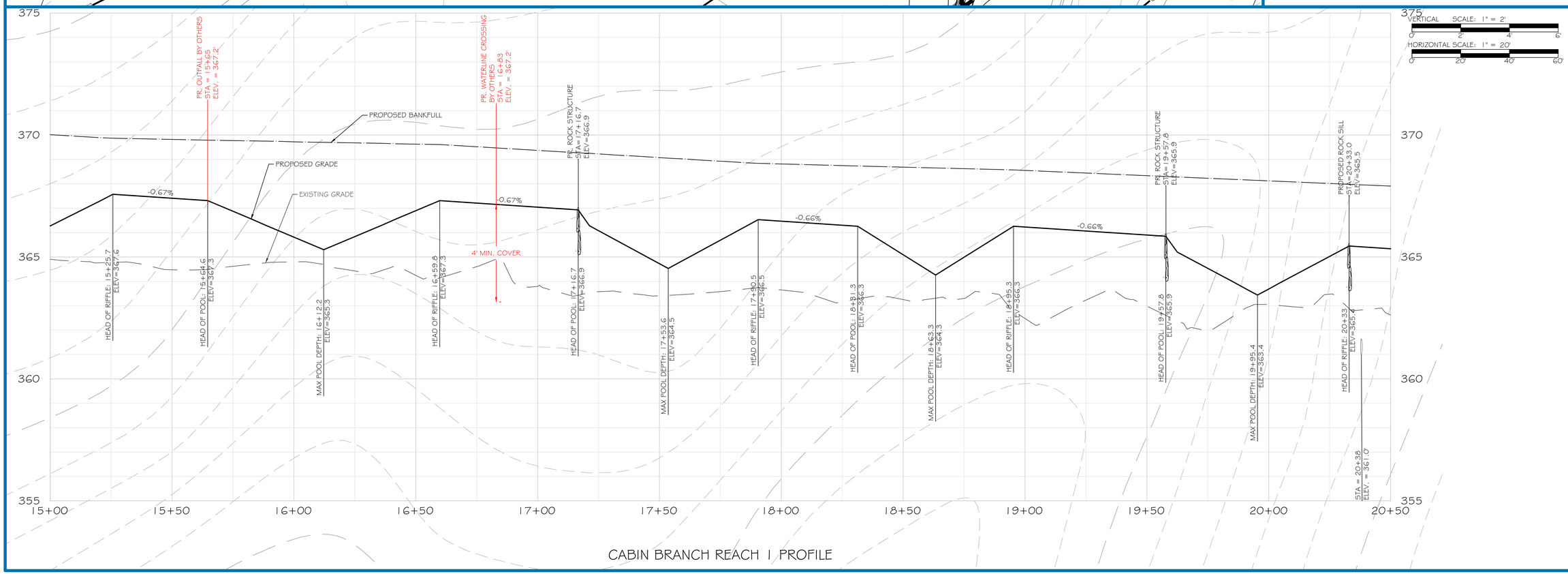

CABIN BRANCH REACH 1 PROFILE

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & PROFILE REACH 1

MONTGOMERY COUNTY, MARYLAND

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REVISIONS:
1
2

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
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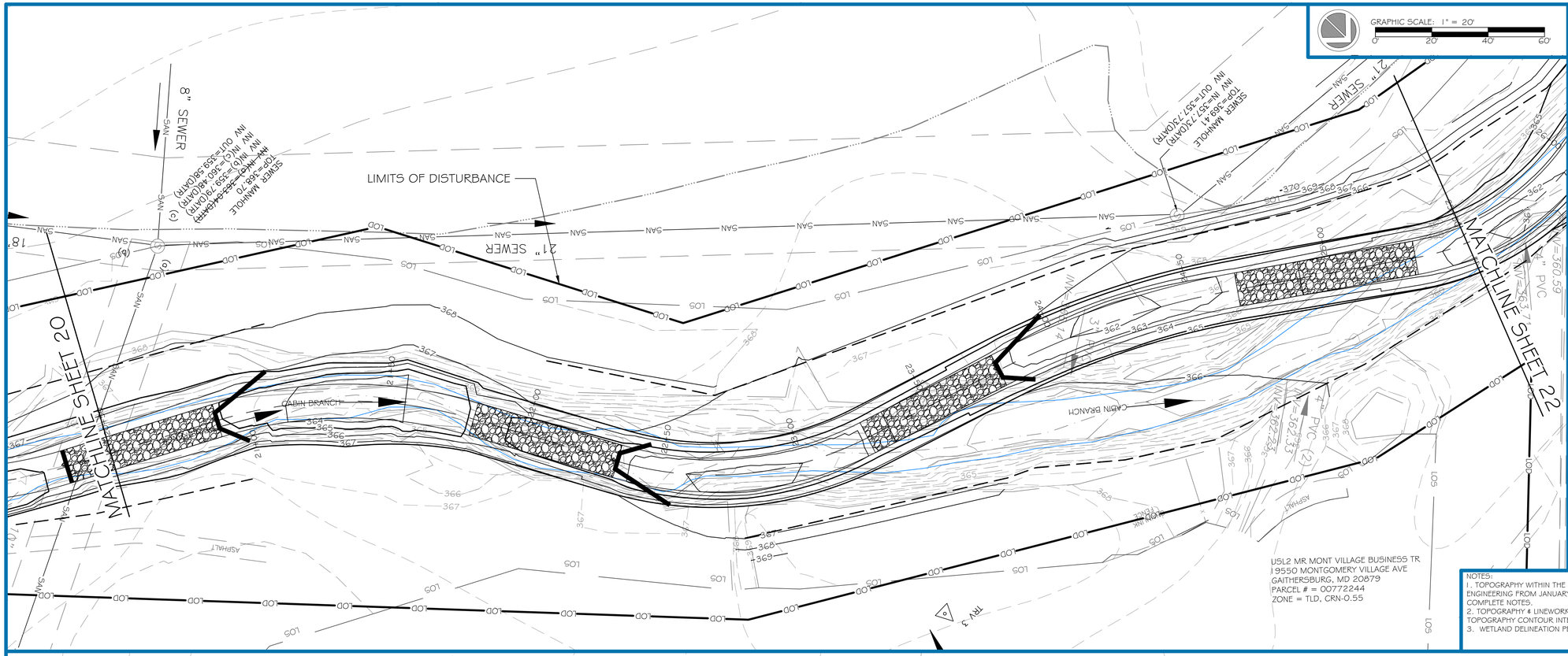
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	20 OF 51



LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. ROAD CENTERLINE
- EX. EASEMENT
- OHE — EX. OVERHEAD ELECTRIC
- SAN — EX. SANITARY SEWER
- EX. STORM UTILITY
- GAS — EX. GAS
- EX. BUILDING
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- EX. STREAM THALWEG
- EX. POND
- EX. STREAM
- EX. WETLAND
- EX. CONCRETE SWALE
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- LOD — PR. LIMITS OF DISTURBANCE
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PROFILE LEGEND:

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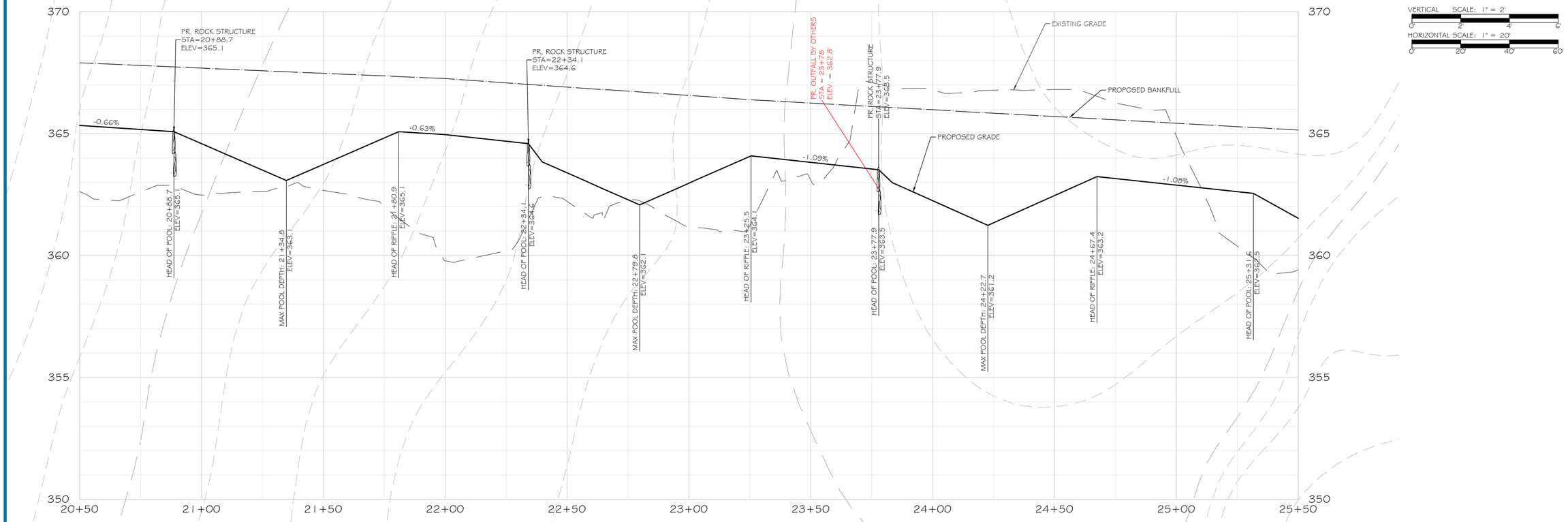

CABIN BRANCH REACH 1 PROFILE

RES
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4644 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & PROFILE
REACH 1

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
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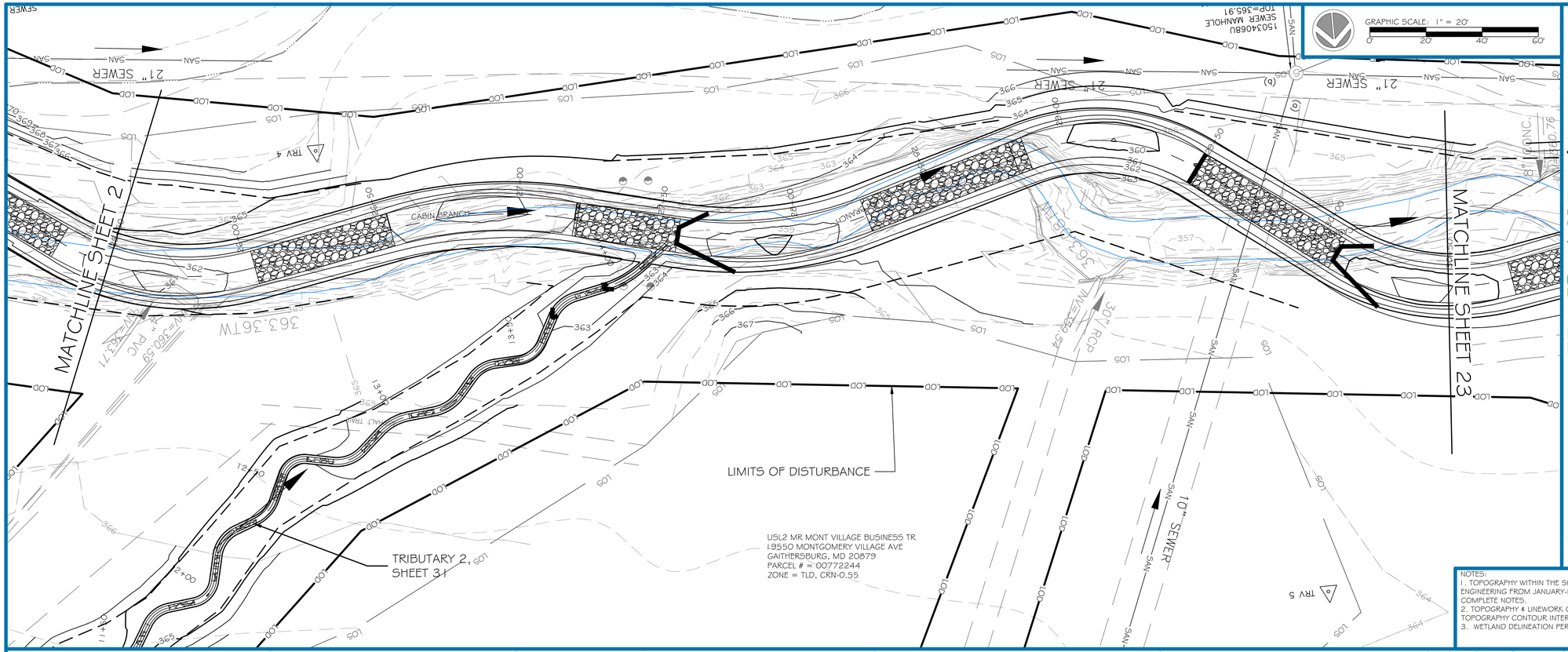
LICENSE#:52652
EXP. DATE:6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1
2

PROJECT STATUS:	
6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	21 OF 51





CABIN BRANCH REACH 1 PROFILE

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4644 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & PROFILE
REACH 1

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
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LICENSE#: 52652
EXP. DATE: 6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
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2
3

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
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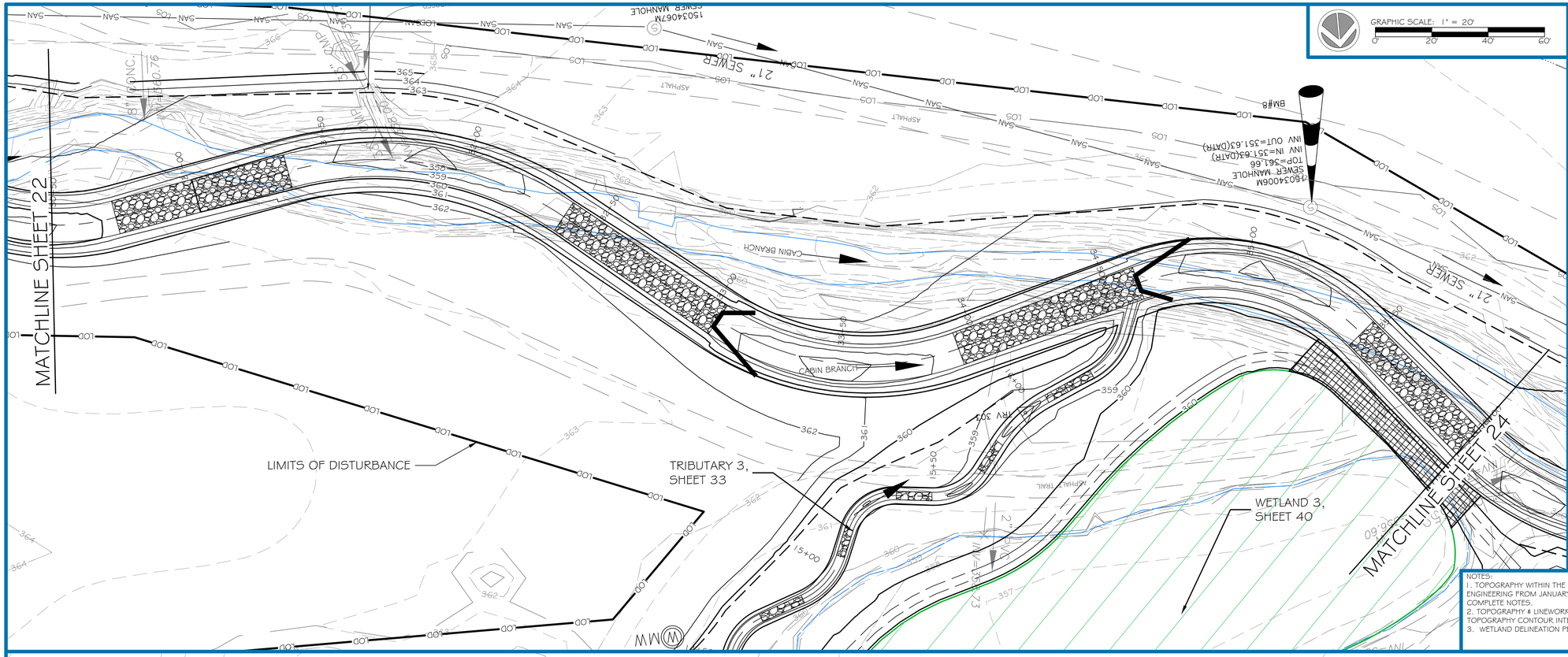
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	22 OF 51



LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. ROAD CENTERLINE
- EX. EASEMENT
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- SAN — EX. SANITARY SEWER
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- EX. WETLAND
- EX. CONCRETE SWALE
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- LOD — PR. LIMITS OF DISTURBANCE
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- PR. ROCK SILL
- DETAIL CALLOUT (DETAIL # / SHEET #)

PROFILE LEGEND:

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- PR. GRADE
- PR. BANKFULL

NOTES:
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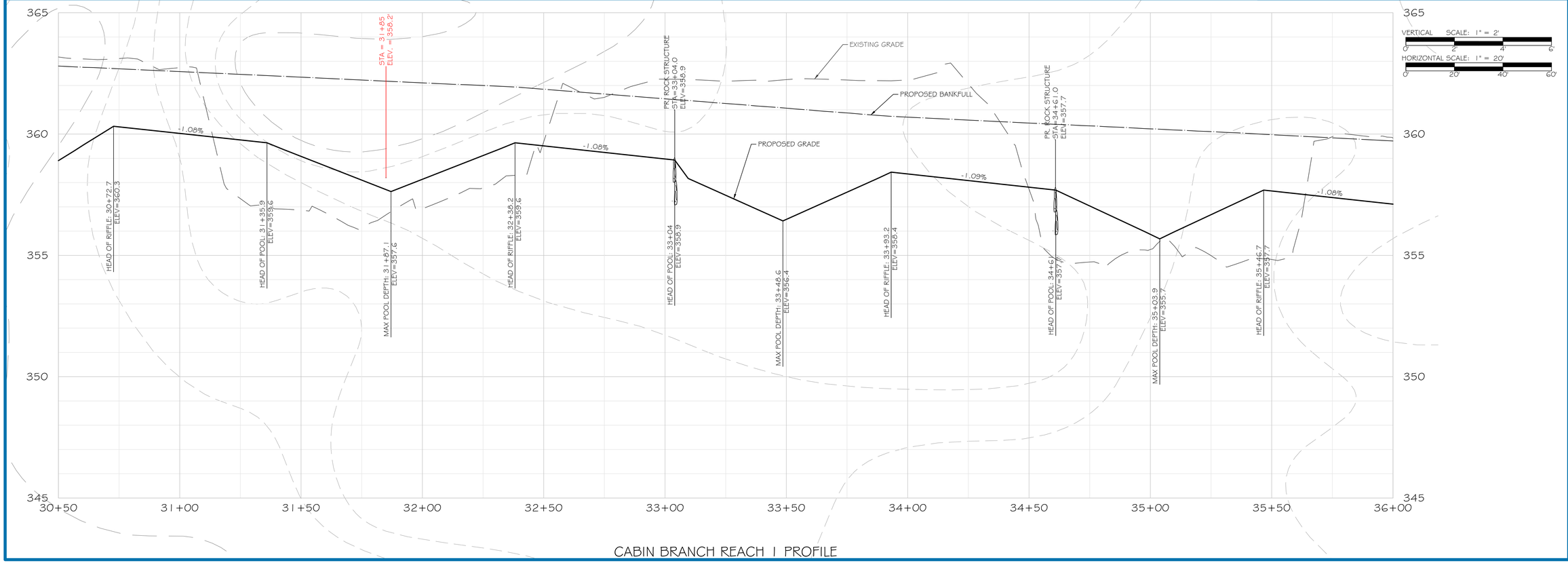
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.



CABIN BRANCH REACH 1 PROFILE

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4644 F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & PROFILE
REACH 1

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
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LICENSE#:52852
EXP. DATE:6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
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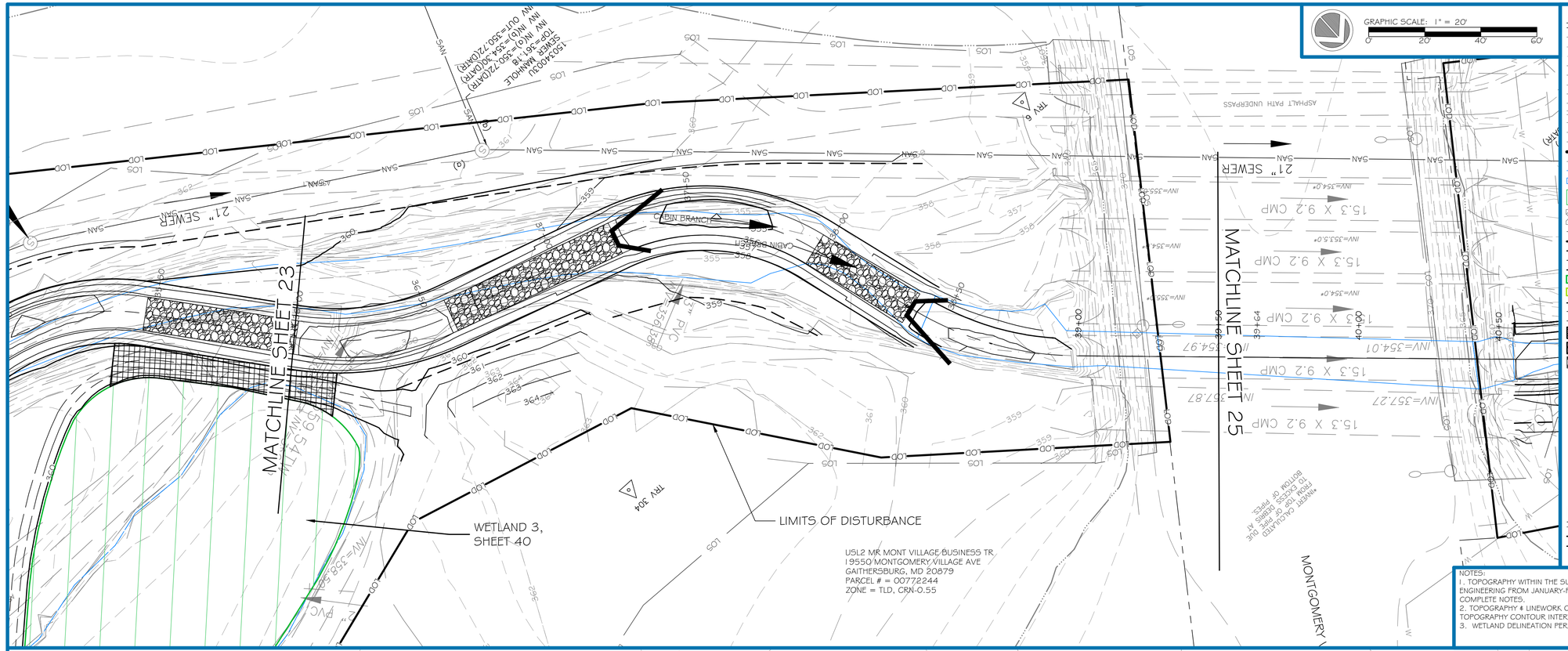
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BWJC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	23 OF 51



GRAPHIC SCALE: 1" = 20'
0' 20' 40' 60'

LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
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- OHE — EX. OVERHEAD ELECTRIC
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PROFILE LEGEND:

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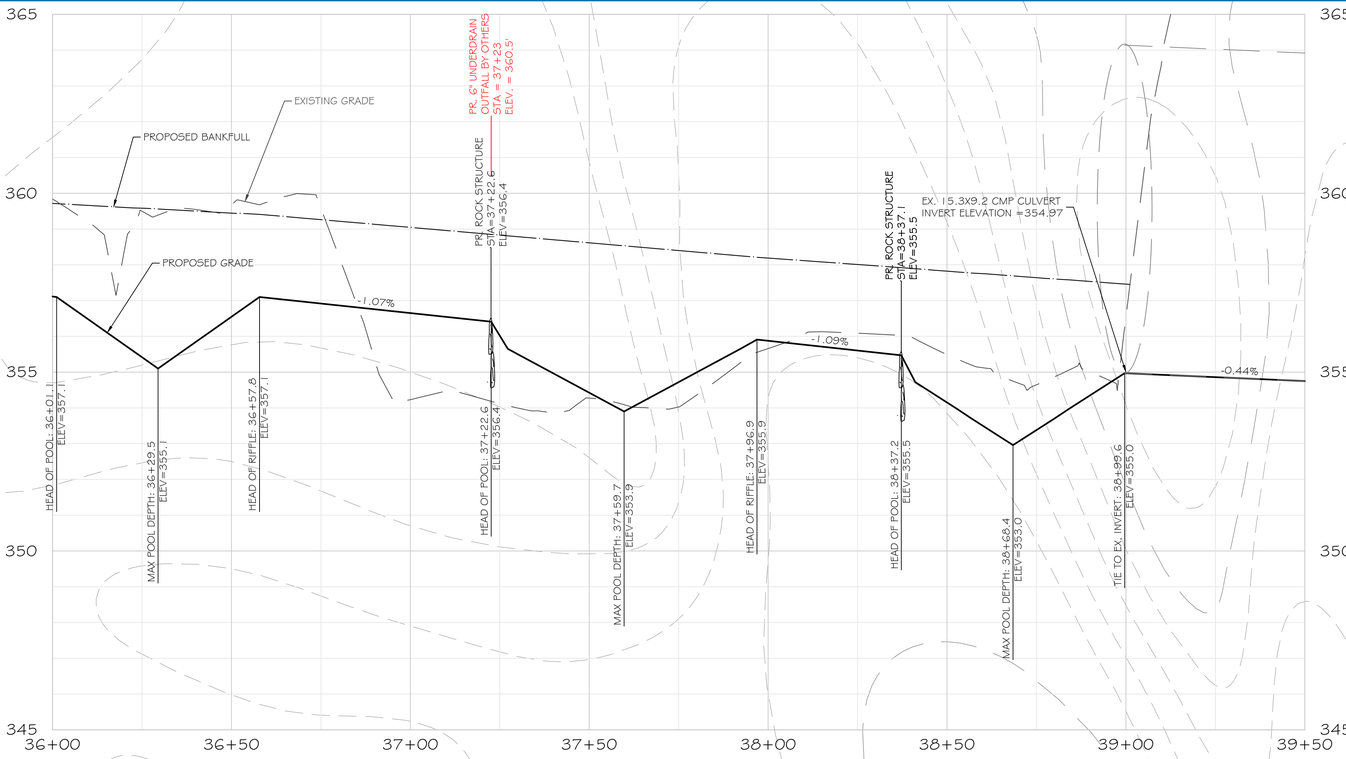

VERTICAL SCALE: 1" = 2'
0' 2' 4' 6'
HORIZONTAL SCALE: 1" = 20'
0' 20' 40' 60'

CABIN BRANCH REACH 1 PROFILE

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & PROFILE
REACH 1
MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
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LICENSE#: 52852
EXP. DATE: 6/14/2022

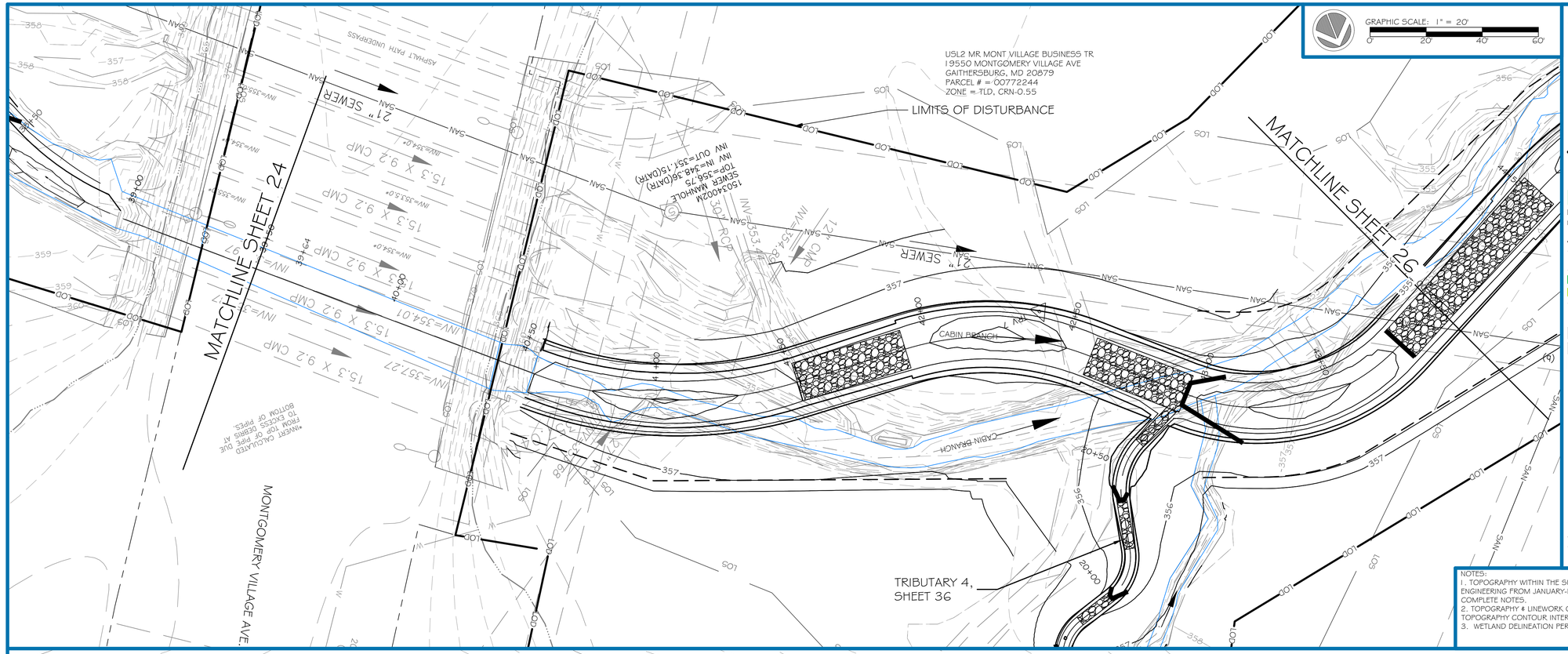
NOT FOR CONSTRUCTION

REVISIONS:
1
2

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	24 OF 51



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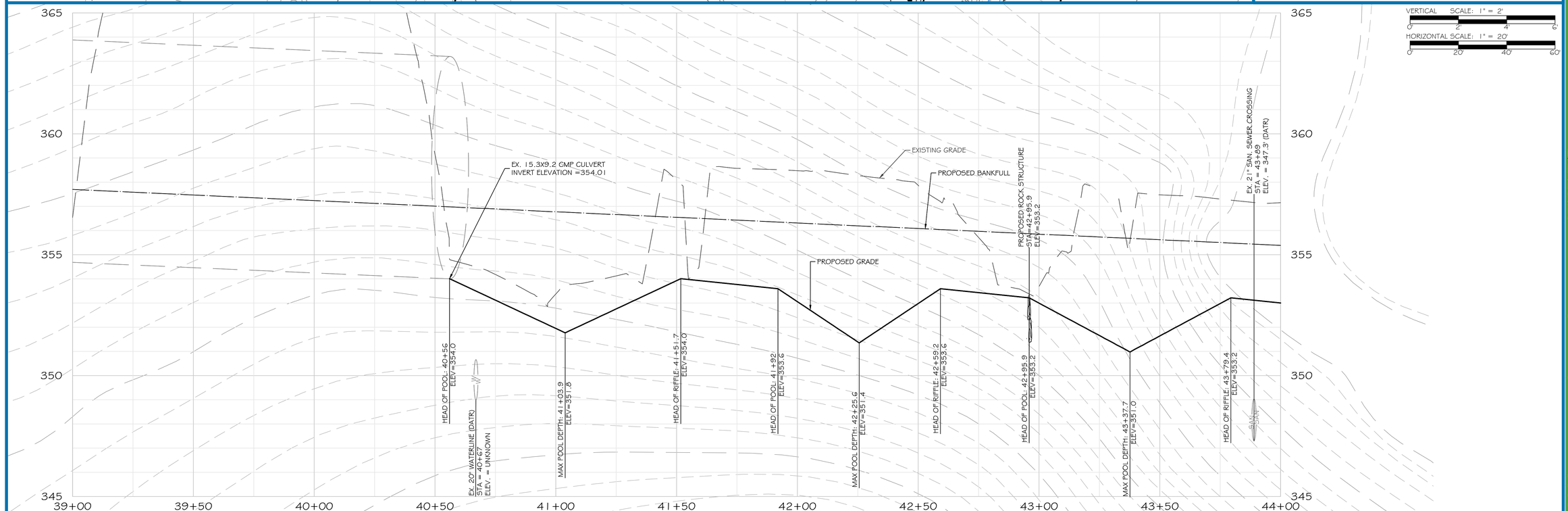

CABIN BRANCH REACH 2 PROFILE

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & PROFILE
REACH 2

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
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LICENSE#:52852
EXP. DATE:6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
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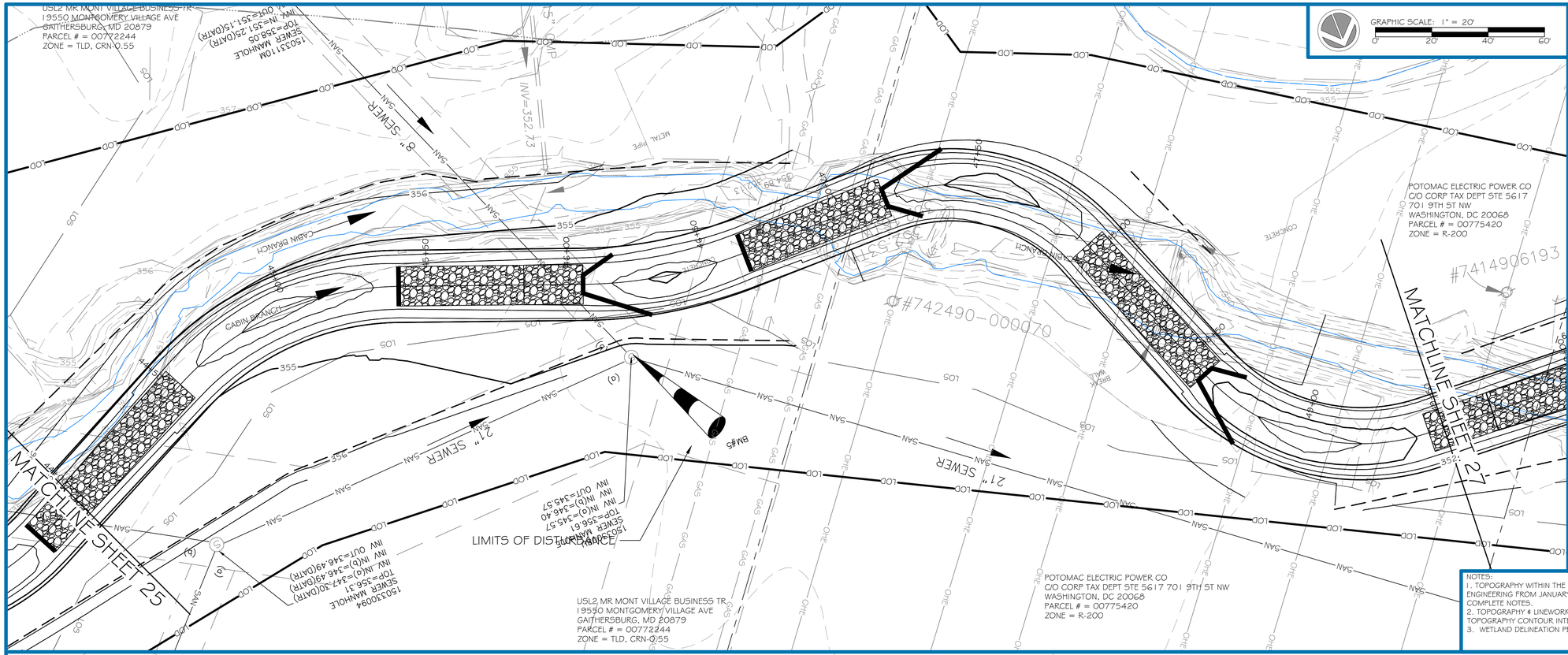
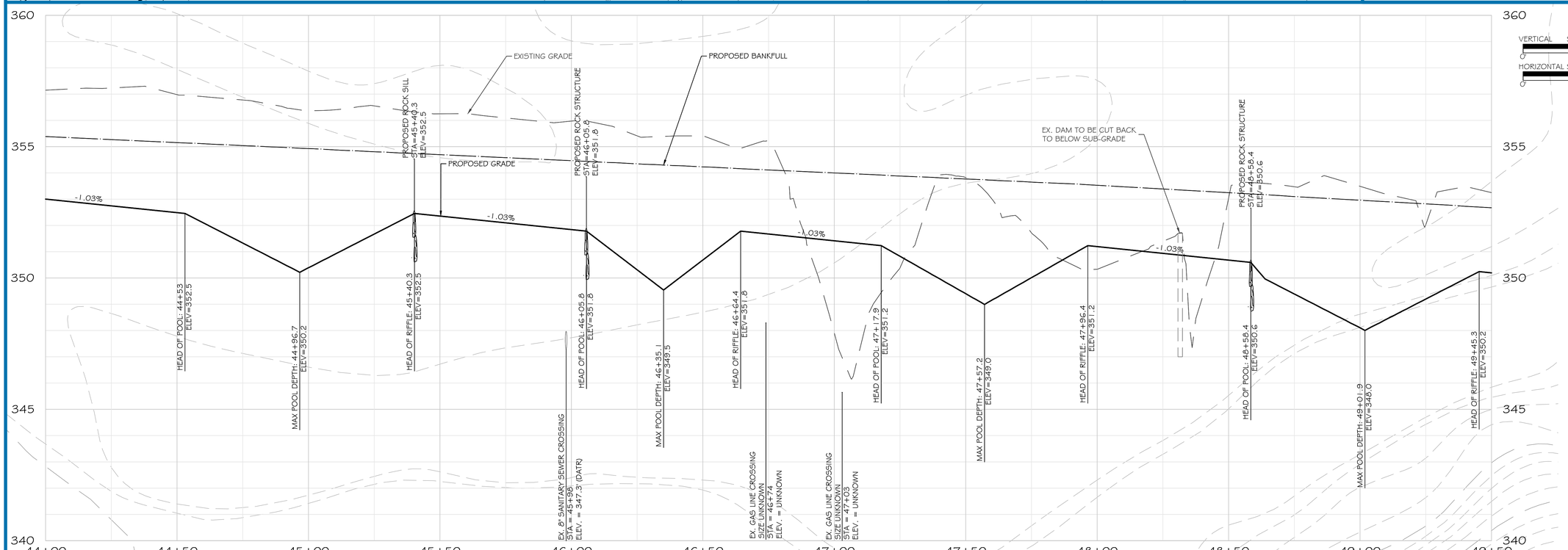
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	25 OF 51





CABIN BRANCH REACH 2 PROFILE

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & PROFILE
REACH 2

MONTGOMERY COUNTY, MARYLAND

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REVISIONS:
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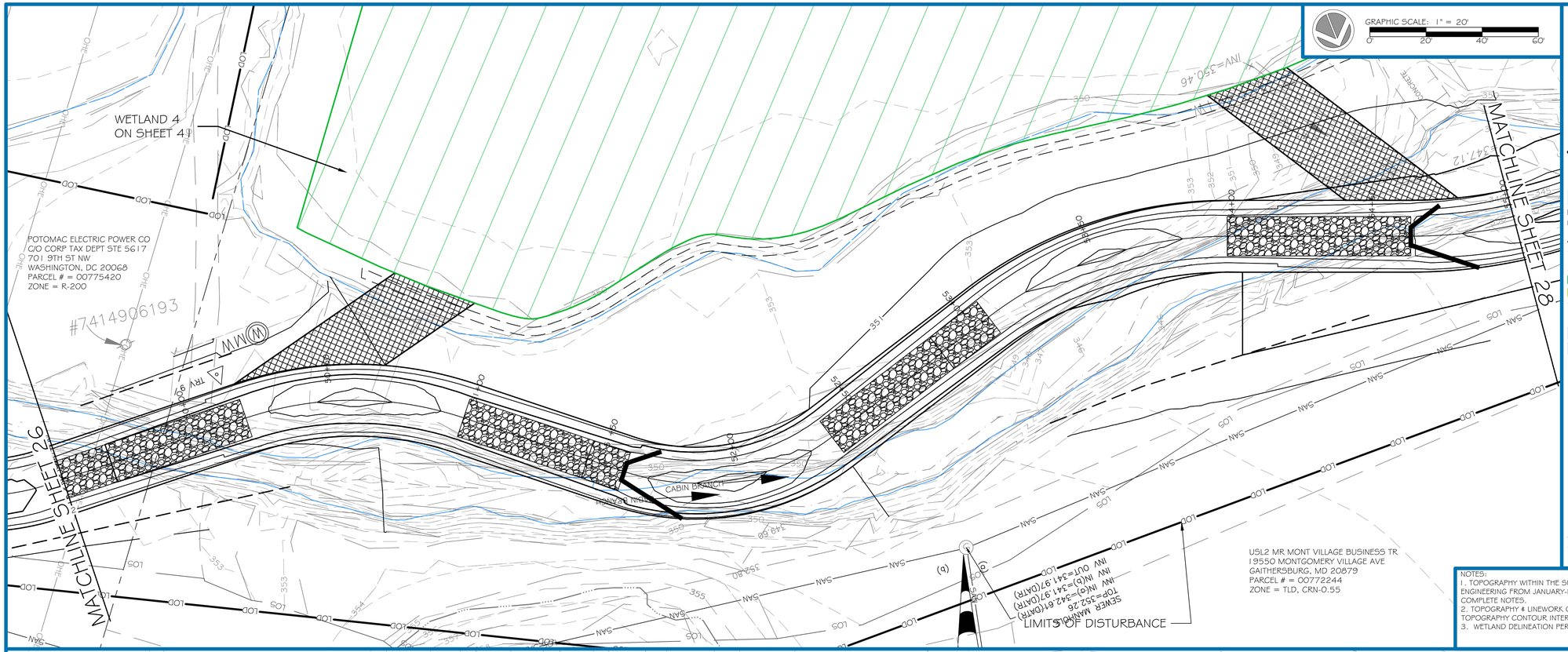
PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	26 OF 51



NOTES:
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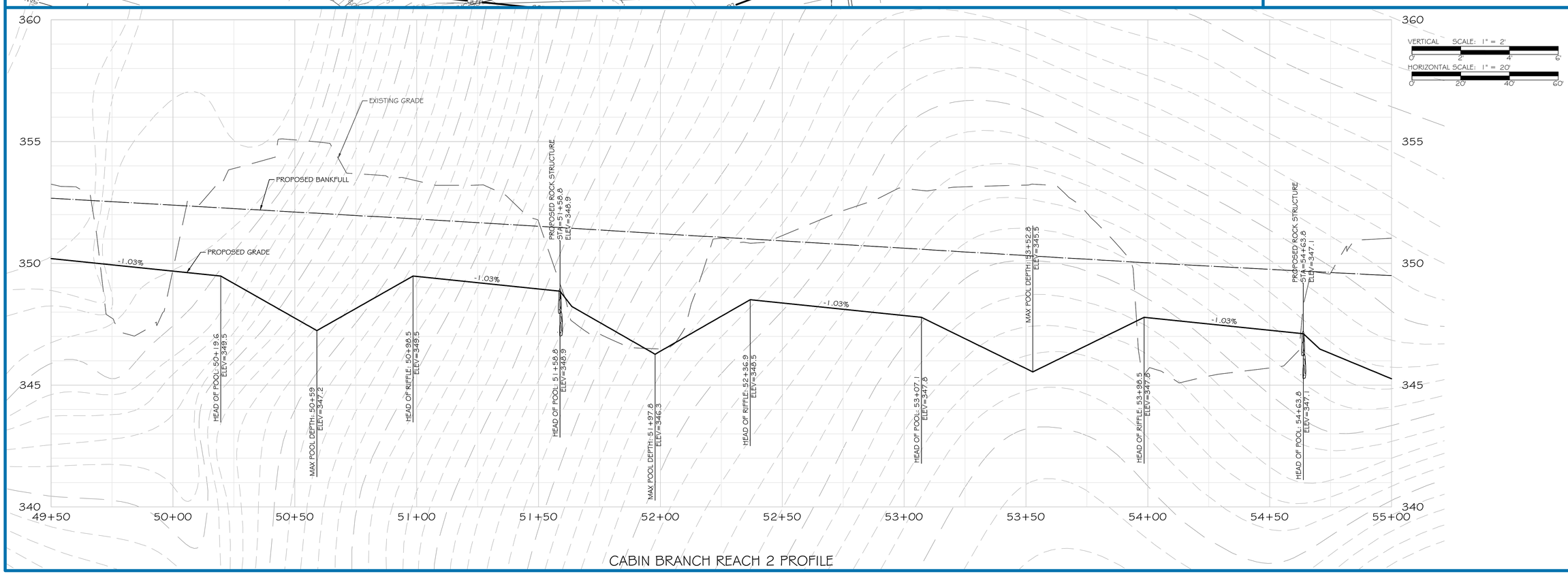
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.



CABIN BRANCH REACH 2 PROFILE

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & PROFILE
REACH 2
MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#: 52852
EXP. DATE: 6/14/2022

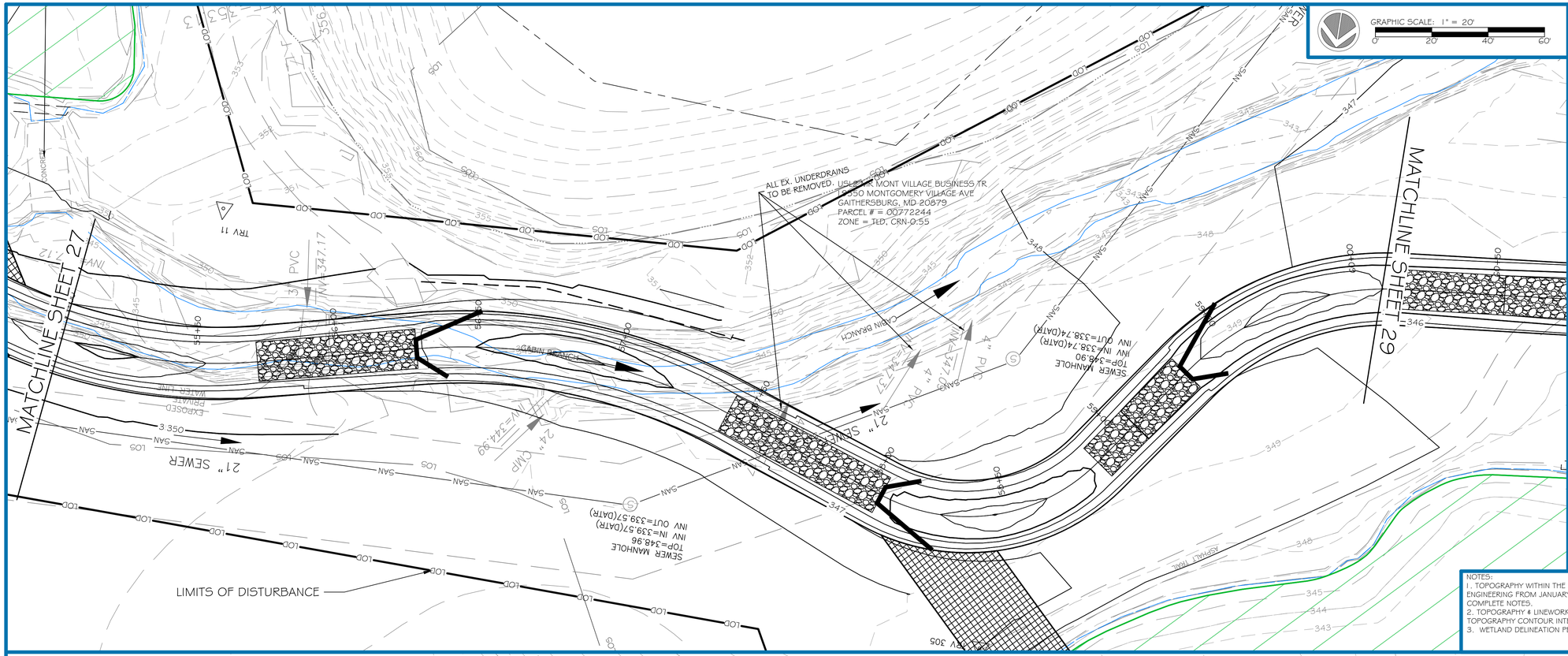
NOT FOR CONSTRUCTION

REVISIONS:
1
2

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	27 OF 51



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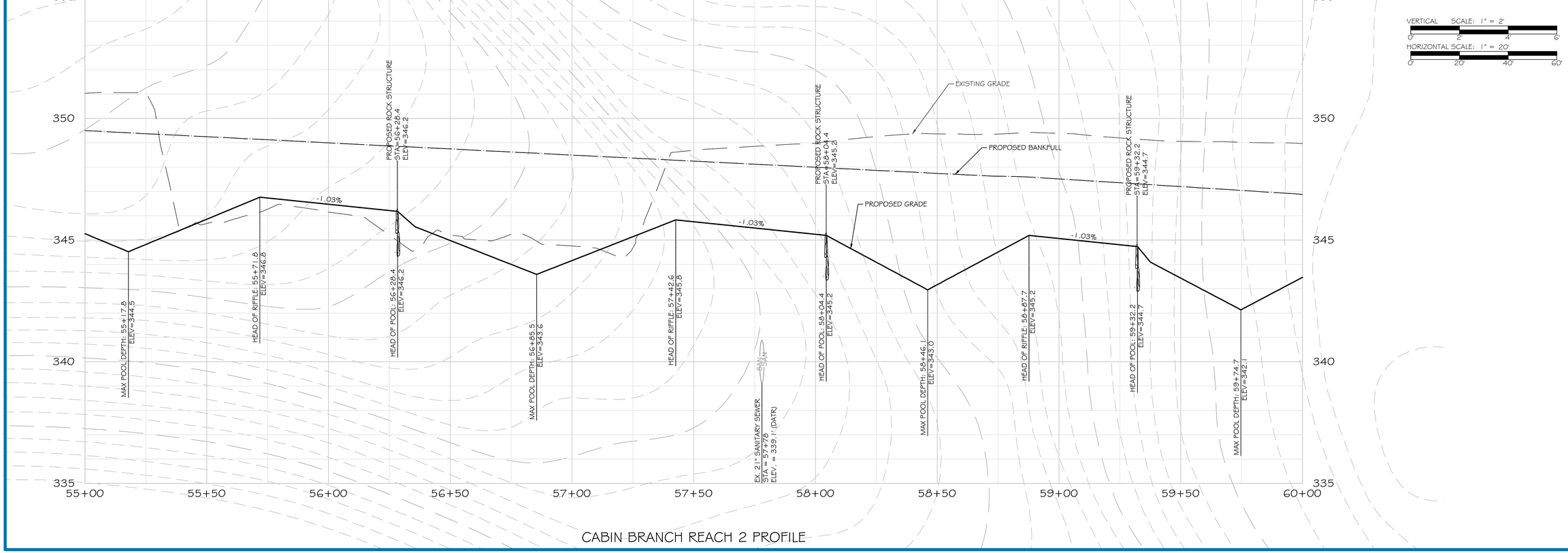
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.



CABIN BRANCH REACH 2 PROFILE

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & PROFILE
REACH 2
MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
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LICENSE#: 52852
EXP. DATE: 6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

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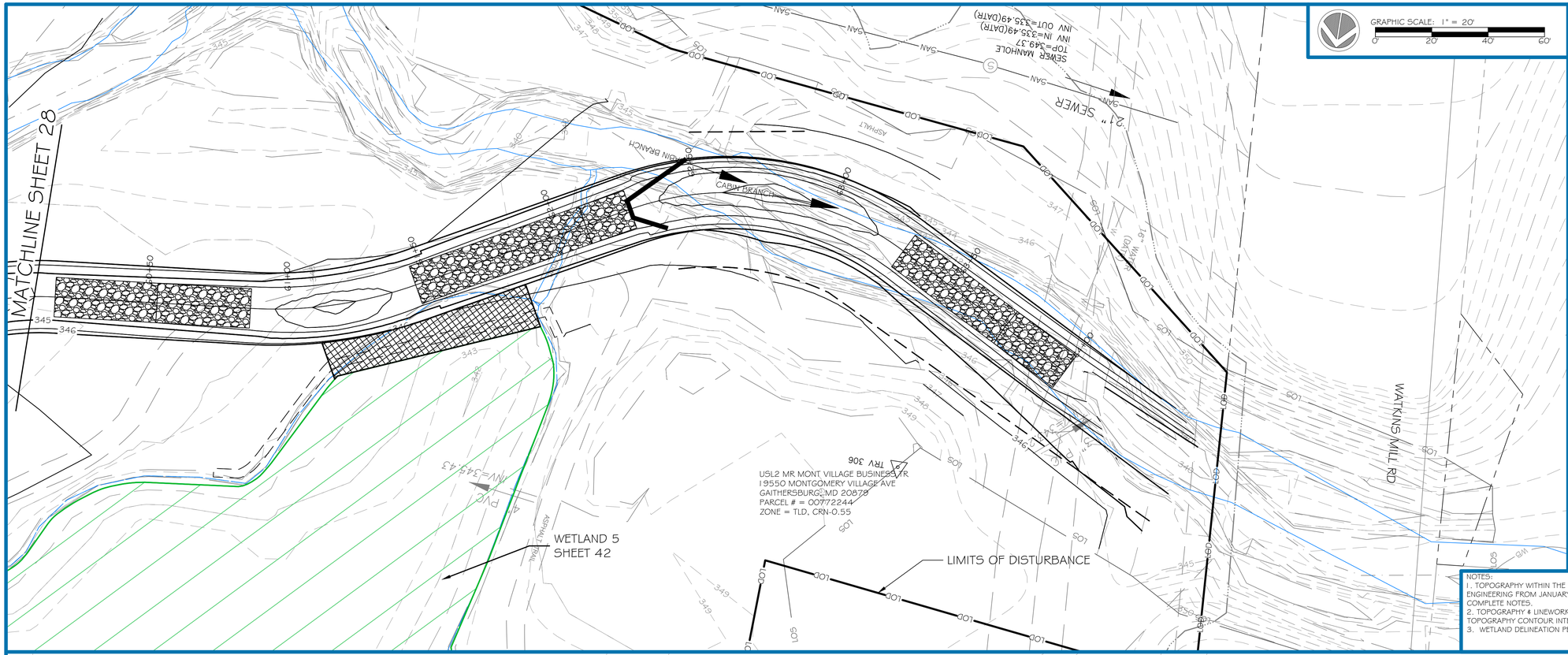
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	28 OF 51



CABIN BRANCH REACH 2 PROFILE

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4644 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & PROFILE
REACH 2

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
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LICENSE#:52852
EXP. DATE:6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
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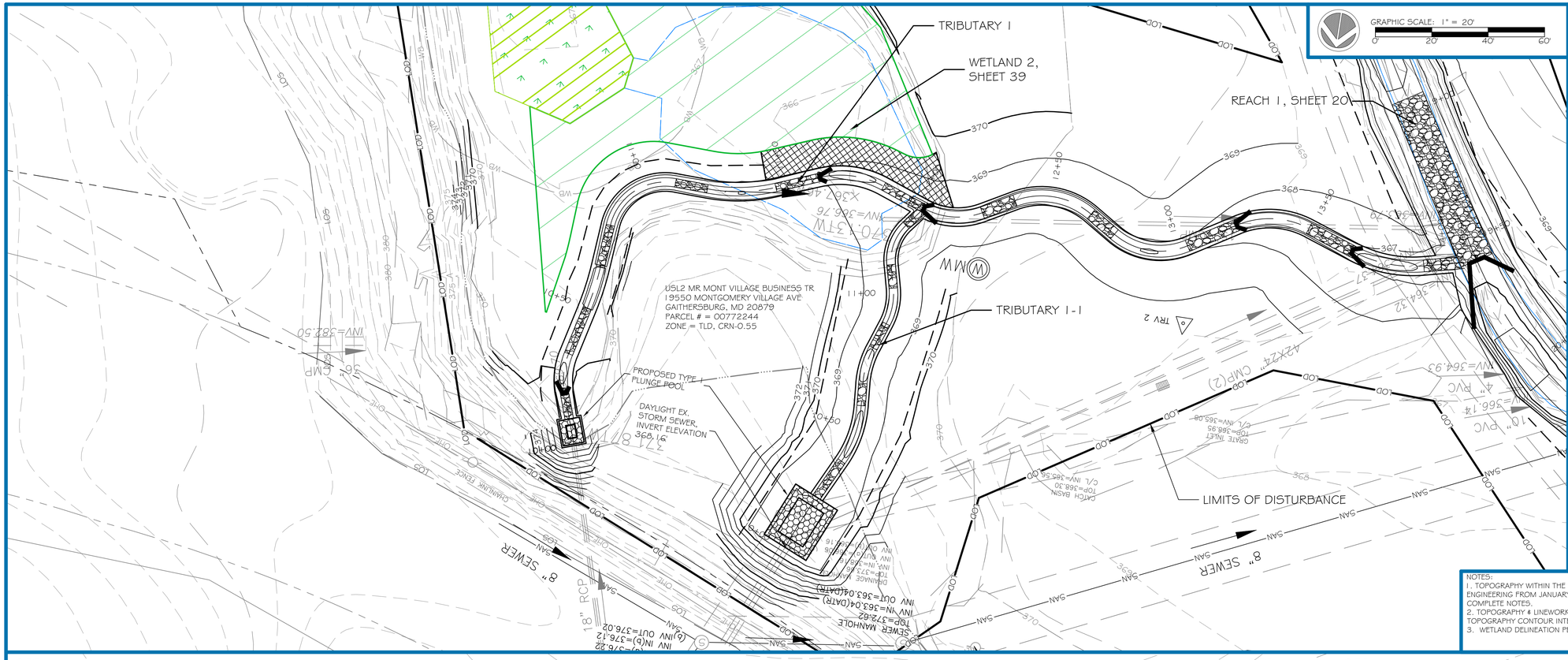
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021

SHEET NO:
29 OF 51



LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. ROAD CENTERLINE
- EX. EASEMENT
- OHE — EX. OVERHEAD ELECTRIC
- SAN — EX. SANITARY SEWER
- EX. STORM UTILITY
- GAS — EX. GAS
- EX. BUILDING
- EX. CURB
- EX. FLOODPLAIN
- EX. STREAM THALWEG
- EX. POND
- EX. STREAM
- EX. WETLAND
- EX. CONCRETE SWALE
- LOS — SURVEY LIMITS
- LOD — PR. LIMITS OF DISTURBANCE
- PR. MAJOR CONTOUR
- PR. MINOR CONTOUR
- PR. FLOODPLAIN GRADING LIMITS
- PR. FORESTED WETLAND
- PR. WETLAND ENHANCEMENT
- PR. BANKFULL
- PR. STREAM CENTERLINE
- PR. BERM
- PR. WETLAND INLET/OUTLET
- PR. RIP RAP
- PR. RIFFLE
- PR. ROCK OFFSET CROSS-VANE
- PR. ROCK SILL
- DETAIL # / SHEET # — DETAIL CALLOUT

PROFILE LEGEND:

- EX. GRADE
- PR. GRADE
- PR. BANKFULL

NOTES:
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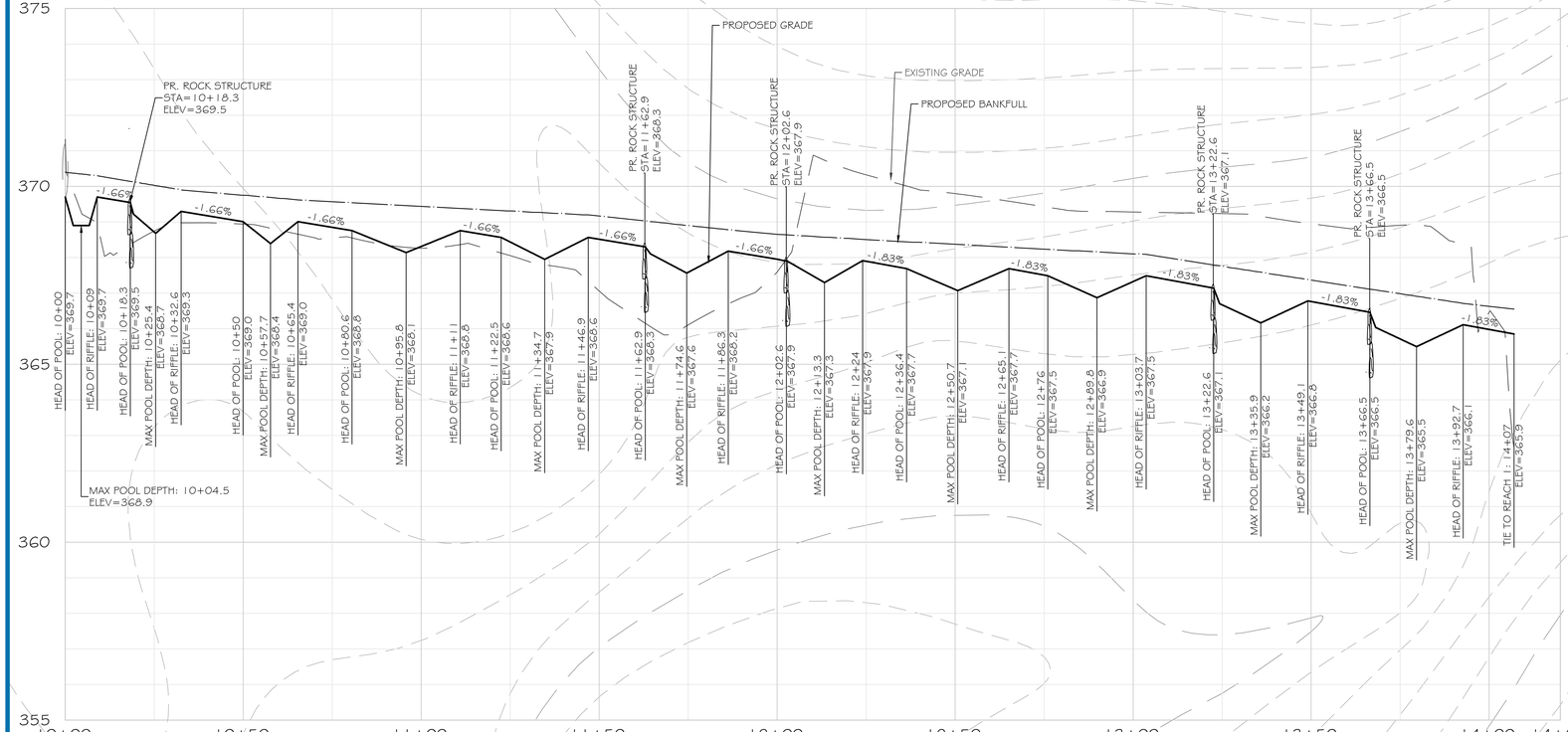
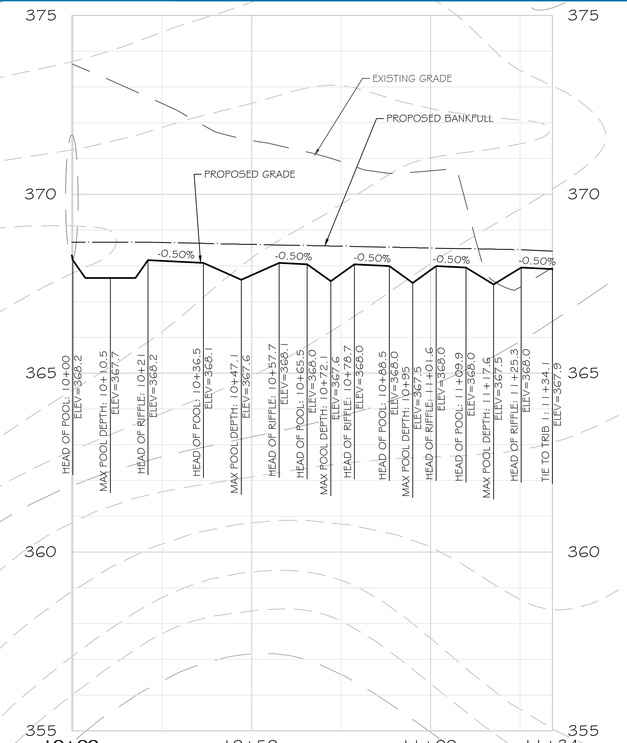
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.



TRIB 1 PROFILE



TRIB 1-1 PROFILE

VERTICAL SCALE: 1" = 2'
0' 2' 4' 6'
HORIZONTAL SCALE: 1" = 20'
0' 20' 40' 60'

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & PROFILE
TRIBUTARY 1 & TRIBUTARY 1-1

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#:52652
EXP. DATE:6/14/2022

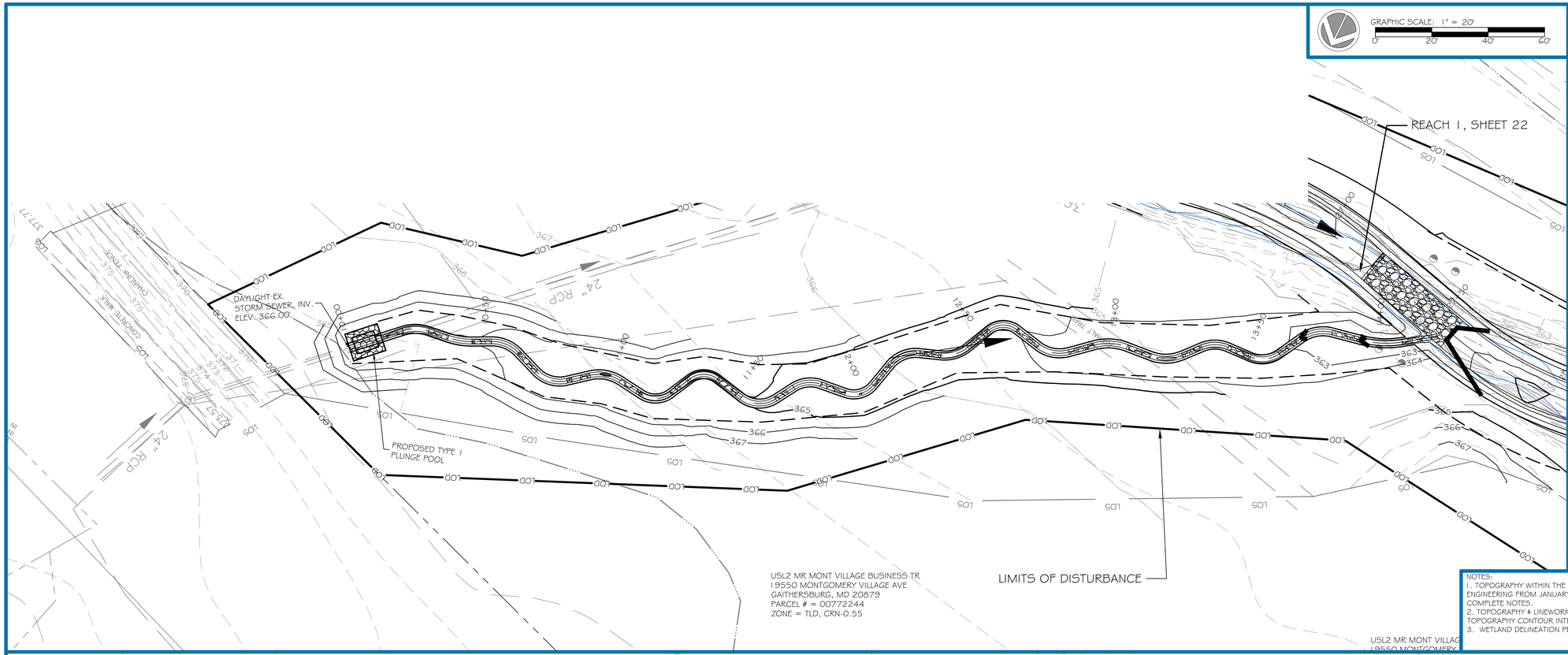
NOT FOR CONSTRUCTION

REVISIONS:
2

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	30 OF 51



NOTES:
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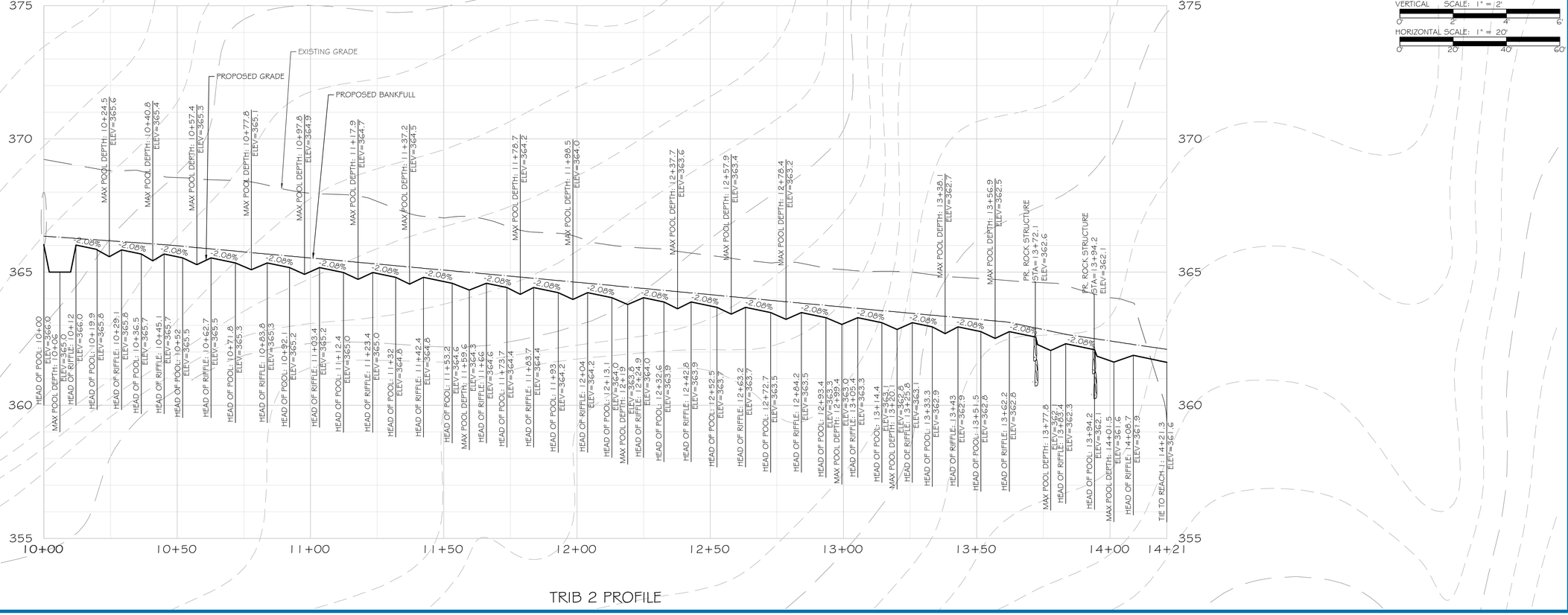
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.



res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & PROFILE
TRIBUTARY 2
MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
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LICENSE#:52852
EXP. DATE:6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:	
6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV. 1
9/3/2021	65% MIT. PLAN REV. 2
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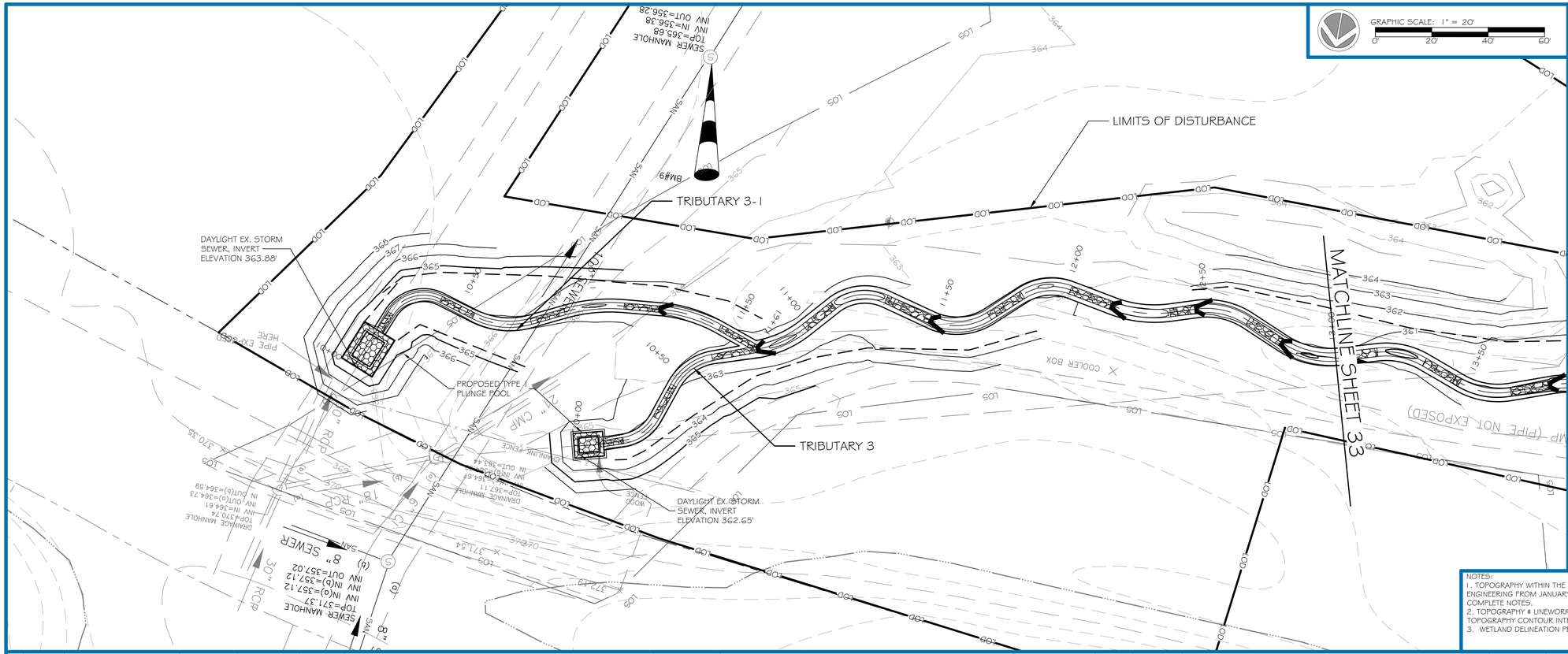
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	31 OF 51



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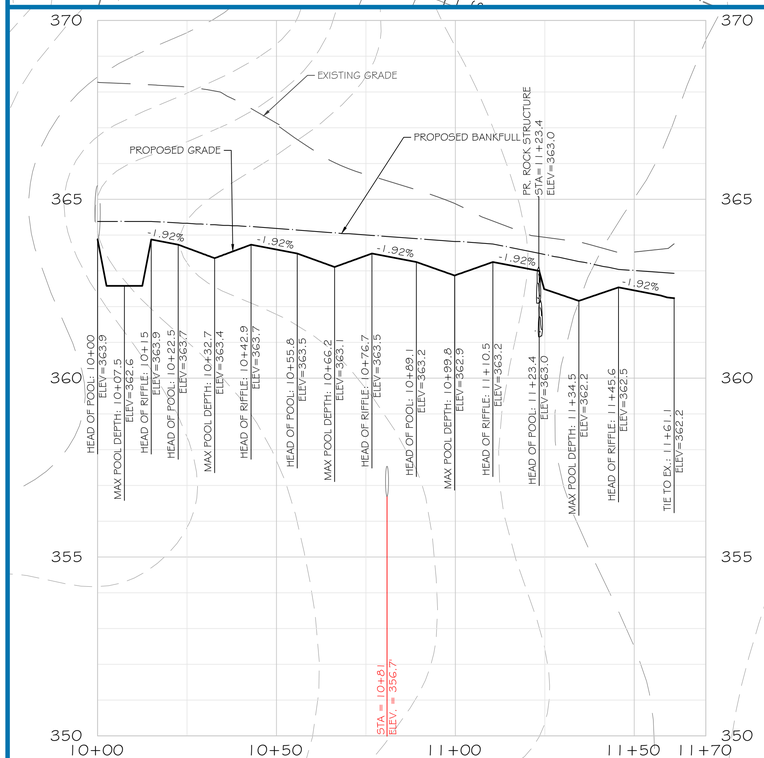
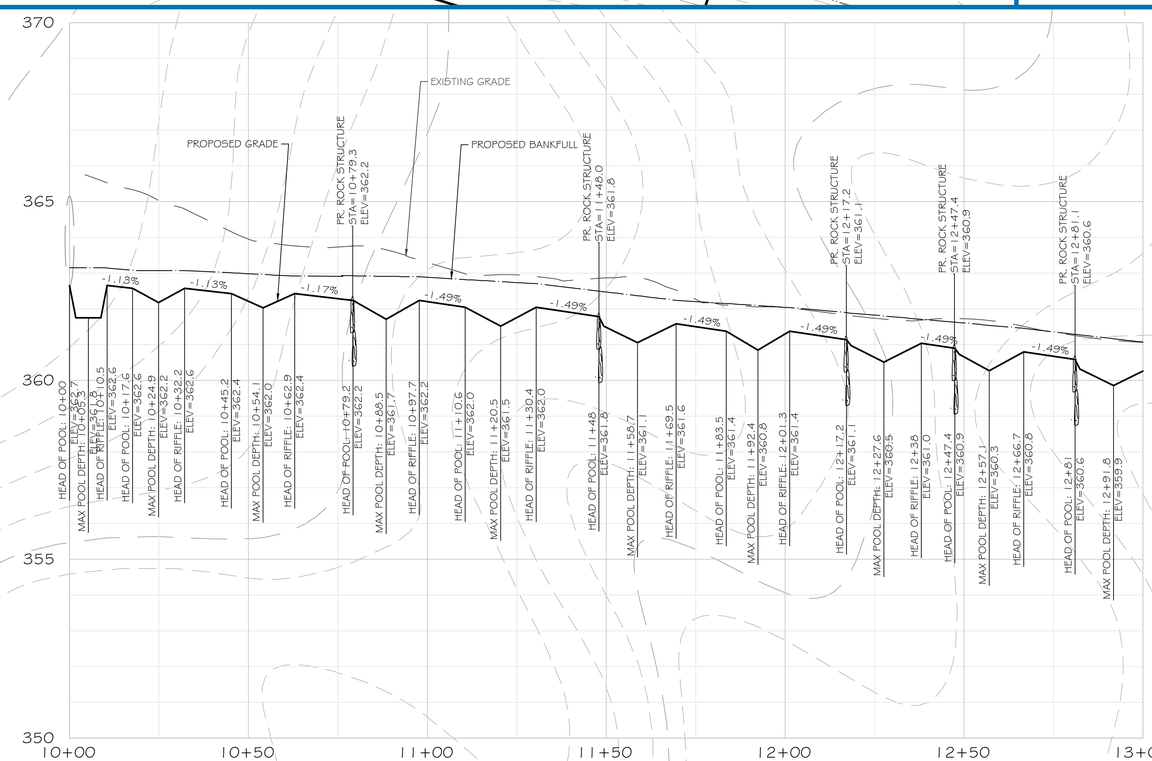
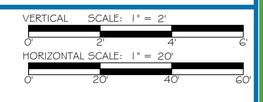


TRIB 3-1 PROFILE



TRIB 3 PROFILE



res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & PROFILE
TRIBUTARY 3 & TRIBUTARY 3-1

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
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LICENSE#: 52852
EXP. DATE: 6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
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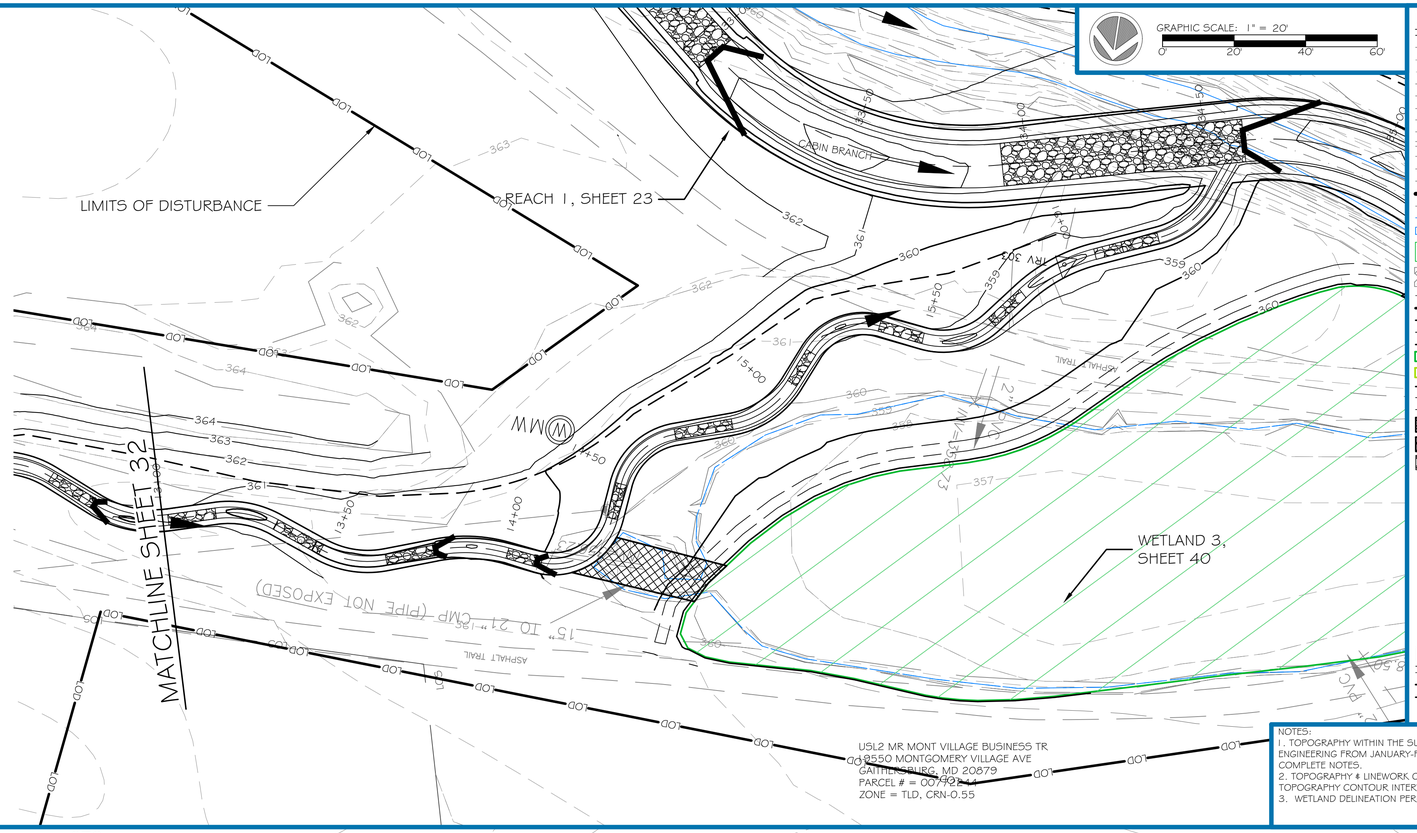
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	32 OF 51



GRAPHIC SCALE: 1" = 20'
0' 20' 40' 60'

LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. ROAD CENTERLINE
- EX. EASEMENT
- OHE — EX. OVERHEAD ELECTRIC
- SAN — EX. SANITARY SEWER
- EX. STORM UTILITY
- GAS — EX. GAS
- EX. BUILDING
- EX. CURB
- EX. FLOODPLAIN
- EX. STREAM THALWEG
- EX. POND
- EX. STREAM
- EX. WETLAND
- EX. CONCRETE SWALE
- LOS — SURVEY LIMITS
- LOD — PR. LIMITS OF DISTURBANCE
- PR. MAJOR CONTOUR
- PR. MINOR CONTOUR
- PR. FLOODPLAIN GRADING LIMITS
- PR. FORESTED WETLAND
- PR. WETLAND ENHANCEMENT
- PR. BANKFULL
- PR. STREAM CENTERLINE
- PR. BERM
- PR. WETLAND INLET/OUTLET
- PR. RIP RAP
- PR. RIFFLE
- PR. ROCK OFFSET CROSS-VANE
- PR. ROCK SILL
- DETAIL # / SHEET # — DETAIL CALLOUT

PROFILE LEGEND:

- EX. GRADE
- PR. GRADE
- PR. BANKFULL

NOTES:
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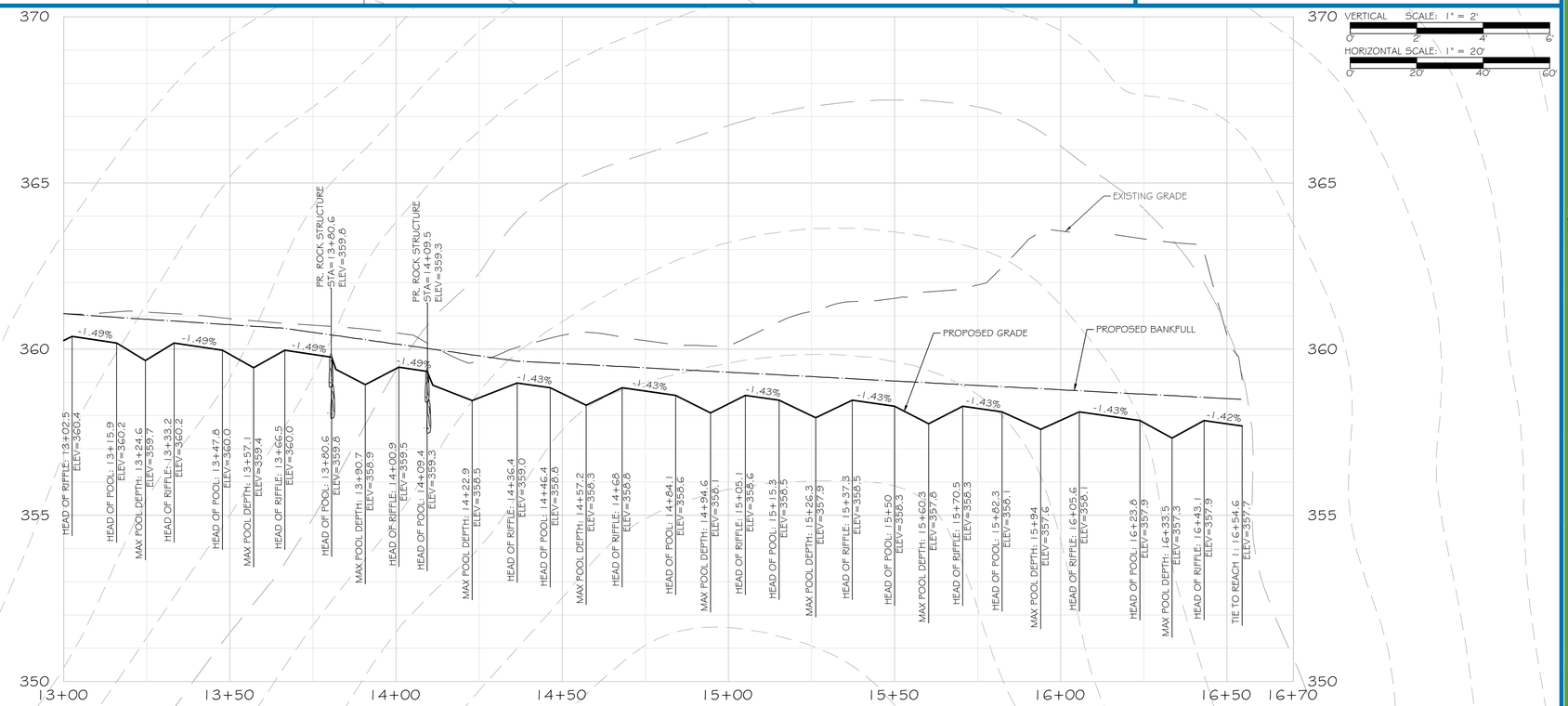

TRIB 3 PROFILE

RES
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & PROFILE
TRIBUTARY 3

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
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LICENSE#: 52852
EXP. DATE: 6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
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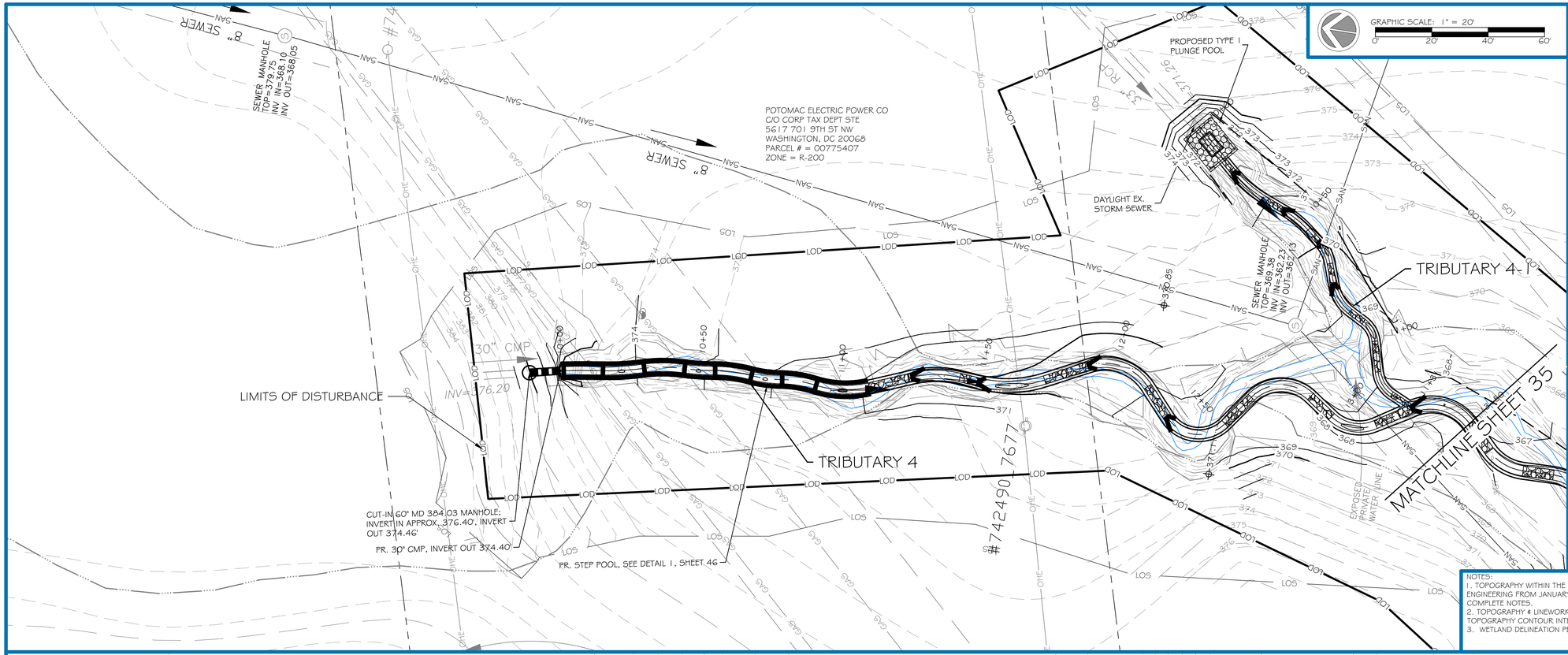
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	33 OF 51



LEGEND:

- EX. PROPERTY LINE
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- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. ROAD CENTERLINE
- EX. EASEMENT
- EX. OVERHEAD ELECTRIC
- EX. SANITARY SEWER
- EX. STORM UTILITY
- EX. GAS
- EX. BUILDING
- EX. CURB
- EX. FLOODPLAIN
- EX. STREAM THALWEG
- EX. POND
- EX. STREAM
- EX. WETLAND
- EX. CONCRETE SWALE
- SURVEY LIMITS
- PR. LIMITS OF DISTURBANCE
- PR. MAJOR CONTOUR
- PR. MINOR CONTOUR
- PR. FLOODPLAIN GRADING LIMITS
- PR. FORESTED WETLAND
- PR. WETLAND ENHANCEMENT
- PR. BANKFULL
- PR. STREAM CENTERLINE
- PR. BERM
- PR. WETLAND INLET/OUTLET
- PR. RIP RAP
- PR. RIFFLE
- PR. ROCK OFFSET CROSS-VANE
- PR. ROCK SILL
- DETAIL CALLOUT (DETAIL # / SHEET #)

PROFILE LEGEND:

- EX. GRADE
- PR. GRADE
- PR. BANKFULL

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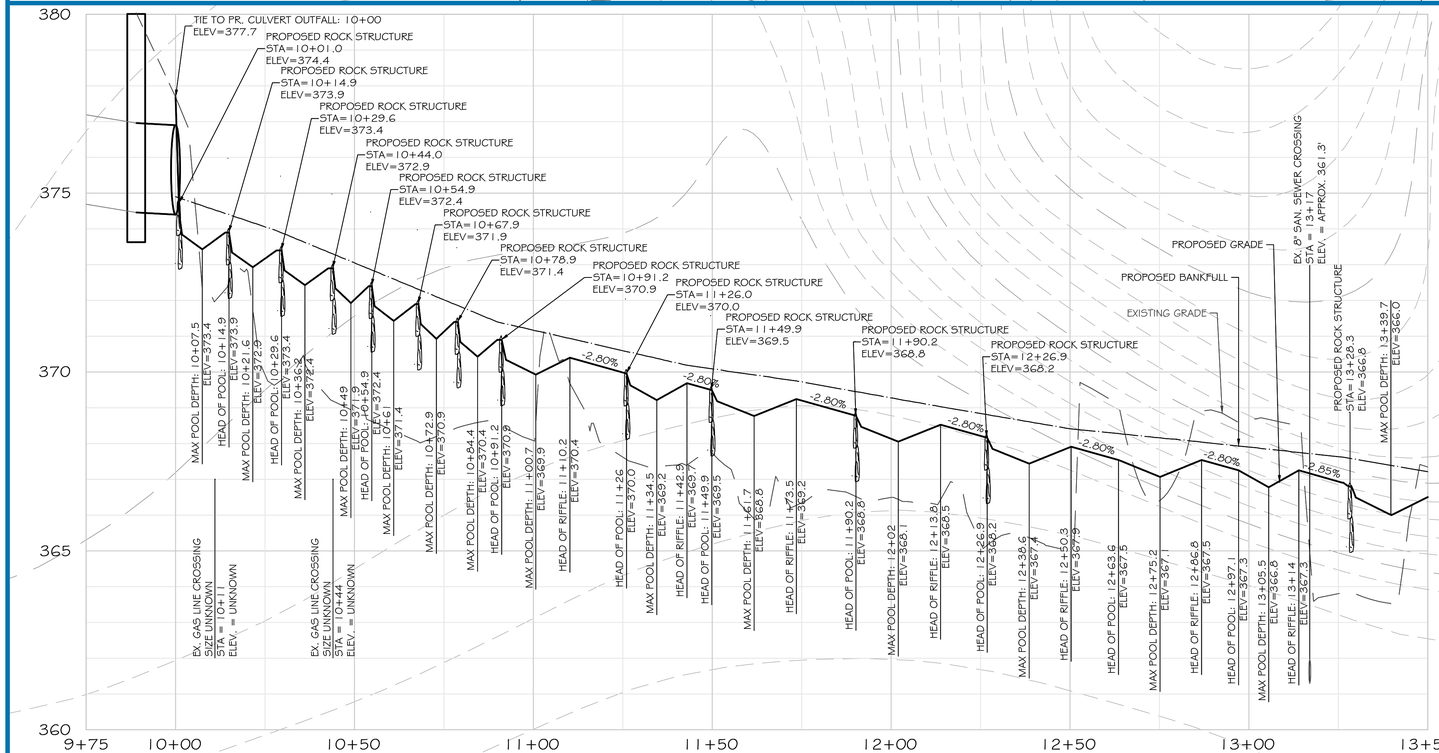
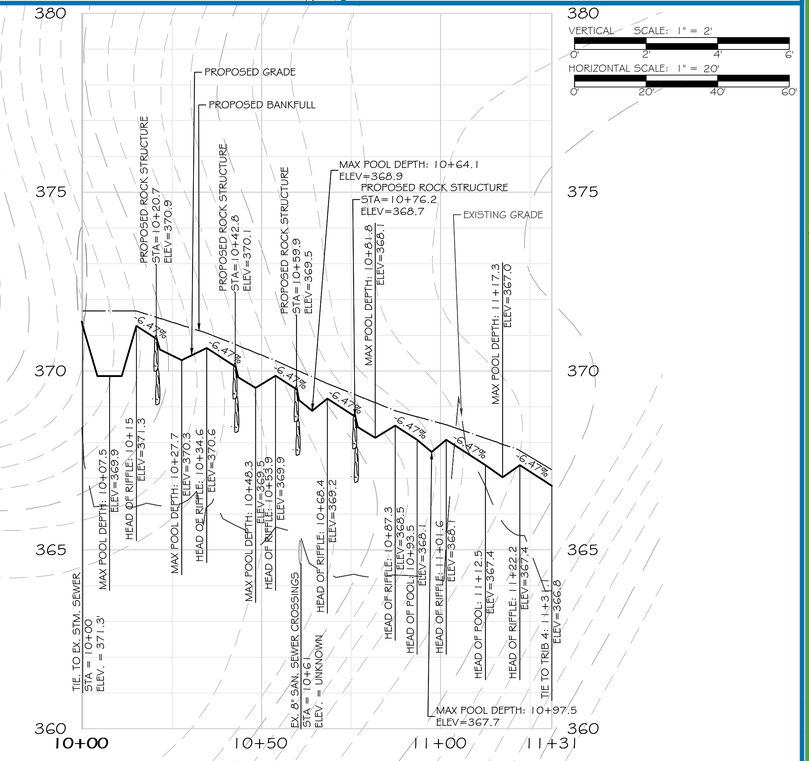
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.



TRIB 4 PROFILE



TRIB 4-1 PROFILE

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & PROFILE
TRIBUTARY 4 & TRIBUTARY 4-1

MONTGOMERY COUNTY, MARYLAND

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROFESSIONAL CERTIFICATION
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LICENSE#: 52852
EXP. DATE: 6/14/2022

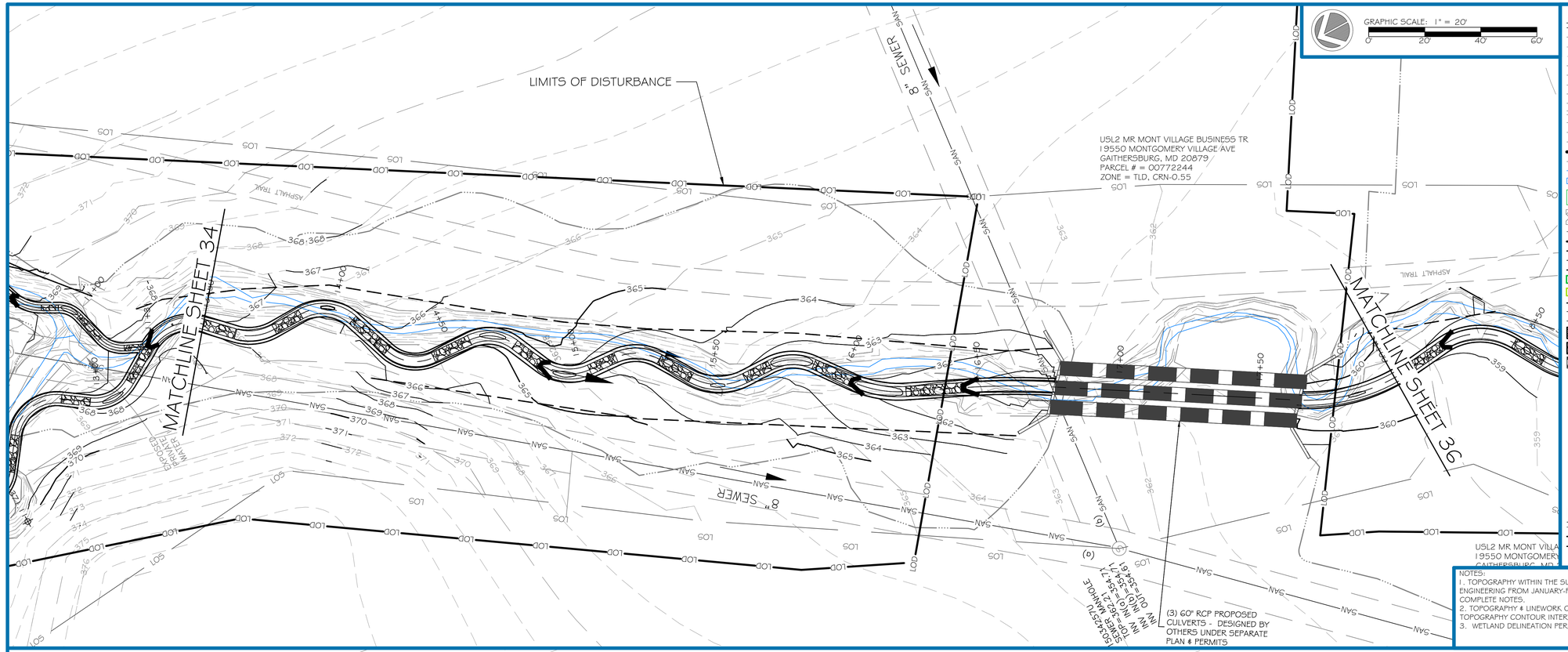
NOT FOR CONSTRUCTION

REVISIONS:
1 X

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BWJ/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	34 OF 51



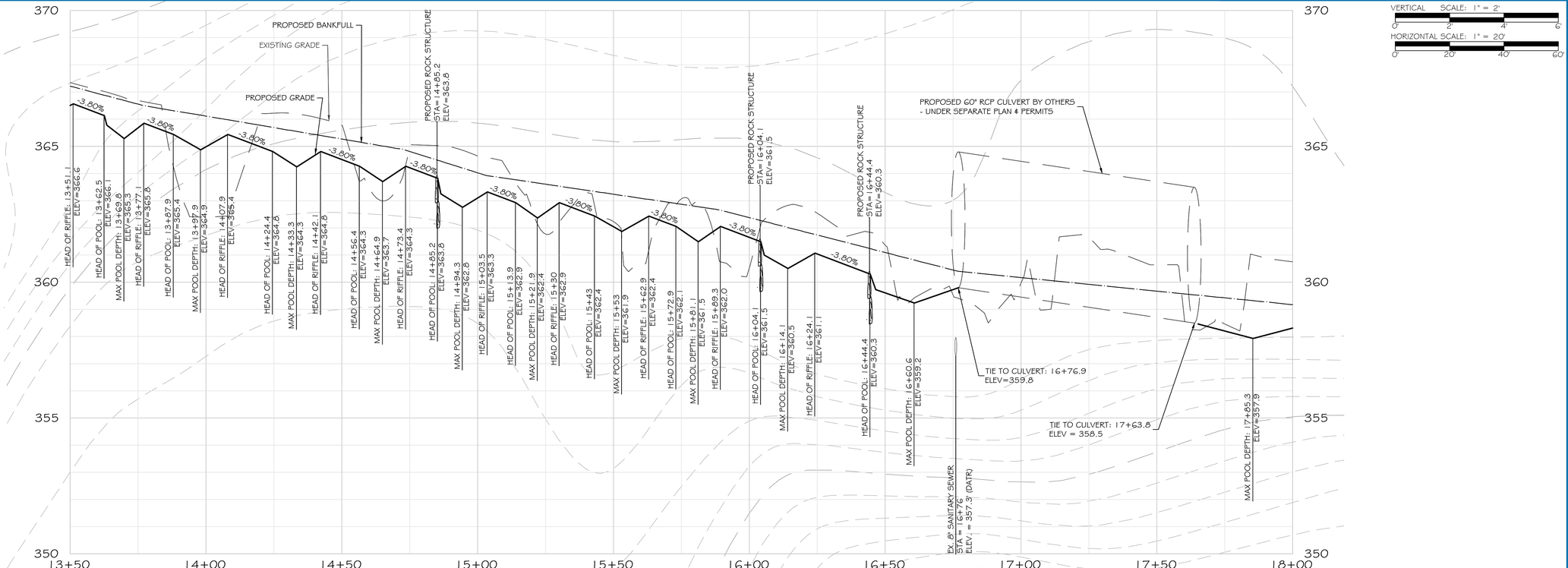
LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. ROAD CENTERLINE
- EX. EASEMENT
- OHE — EX. OVERHEAD ELECTRIC
- SAN — EX. SANITARY SEWER
- EX. STORM UTILITY
- GAS — EX. GAS
- EX. BUILDING
- EX. CURB
- EX. FLOODPLAIN
- EX. STREAM THALWEG
- EX. POND
- EX. STREAM
- EX. WETLAND
- EX. CONCRETE SWALE
- LOS — SURVEY LIMITS
- LOD — PR. LIMITS OF DISTURBANCE
- PR. MAJOR CONTOUR
- PR. MINOR CONTOUR
- PR. FLOODPLAIN GRADING LIMITS
- PR. FORESTED WETLAND
- PR. WETLAND ENHANCEMENT
- PR. BANKFULL
- PR. STREAM CENTERLINE
- PR. BERM
- PR. WETLAND INLET/OUTLET
- PR. RIP RAP
- PR. RIFFLE
- PR. ROCK OFFSET CROSS-VANE
- PR. ROCK SILL
- DETAIL CALLOUT (DETAIL # / SHEET #)

PROFILE LEGEND:

- EX. GRADE
- PR. GRADE
- PR. BANKFULL

NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.



TRIB 4 PROFILE

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & PROFILE
TRIBUTARY 4

MONTGOMERY COUNTY, MARYLAND

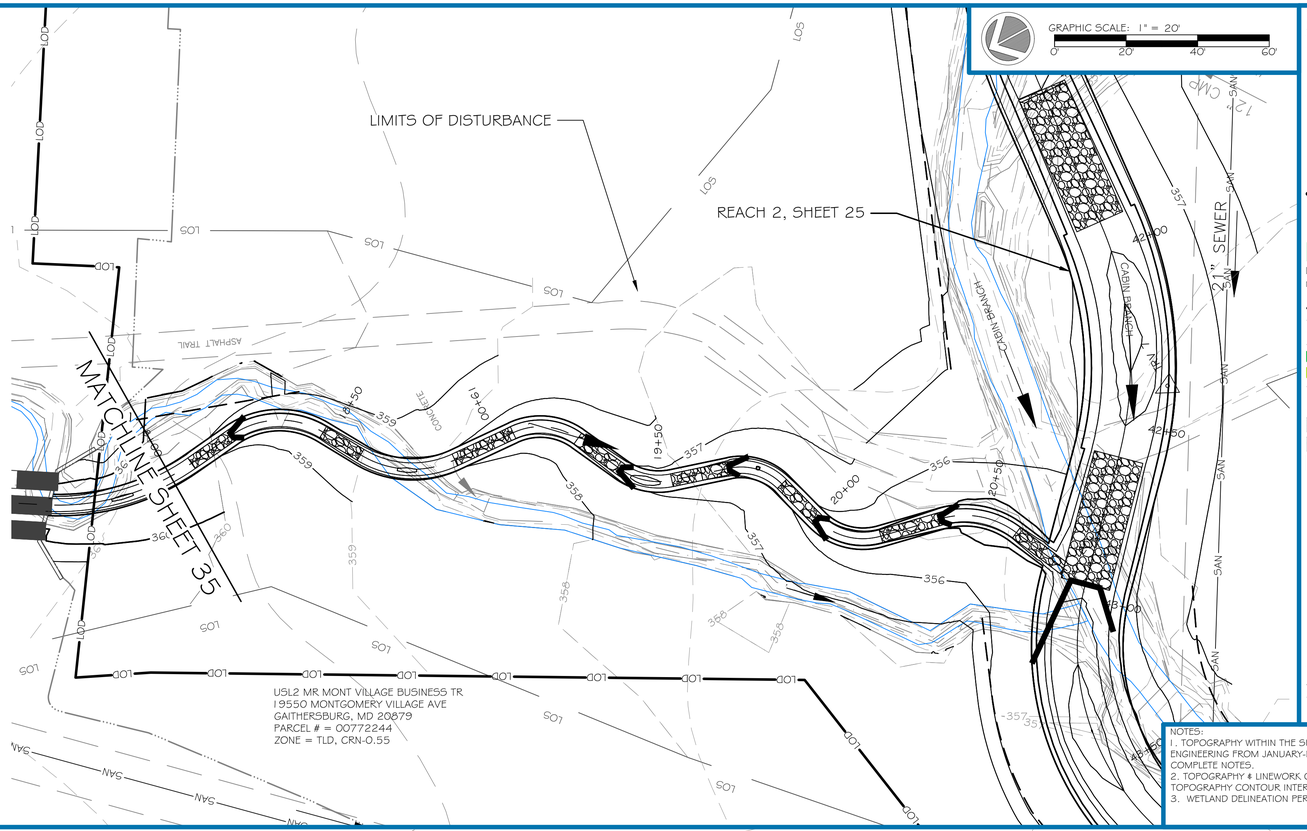
PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#:52652
EXP. DATE:6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:	
6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	35 OF 51



GRAPHIC SCALE: 1" = 20'
0' 20' 40' 60'

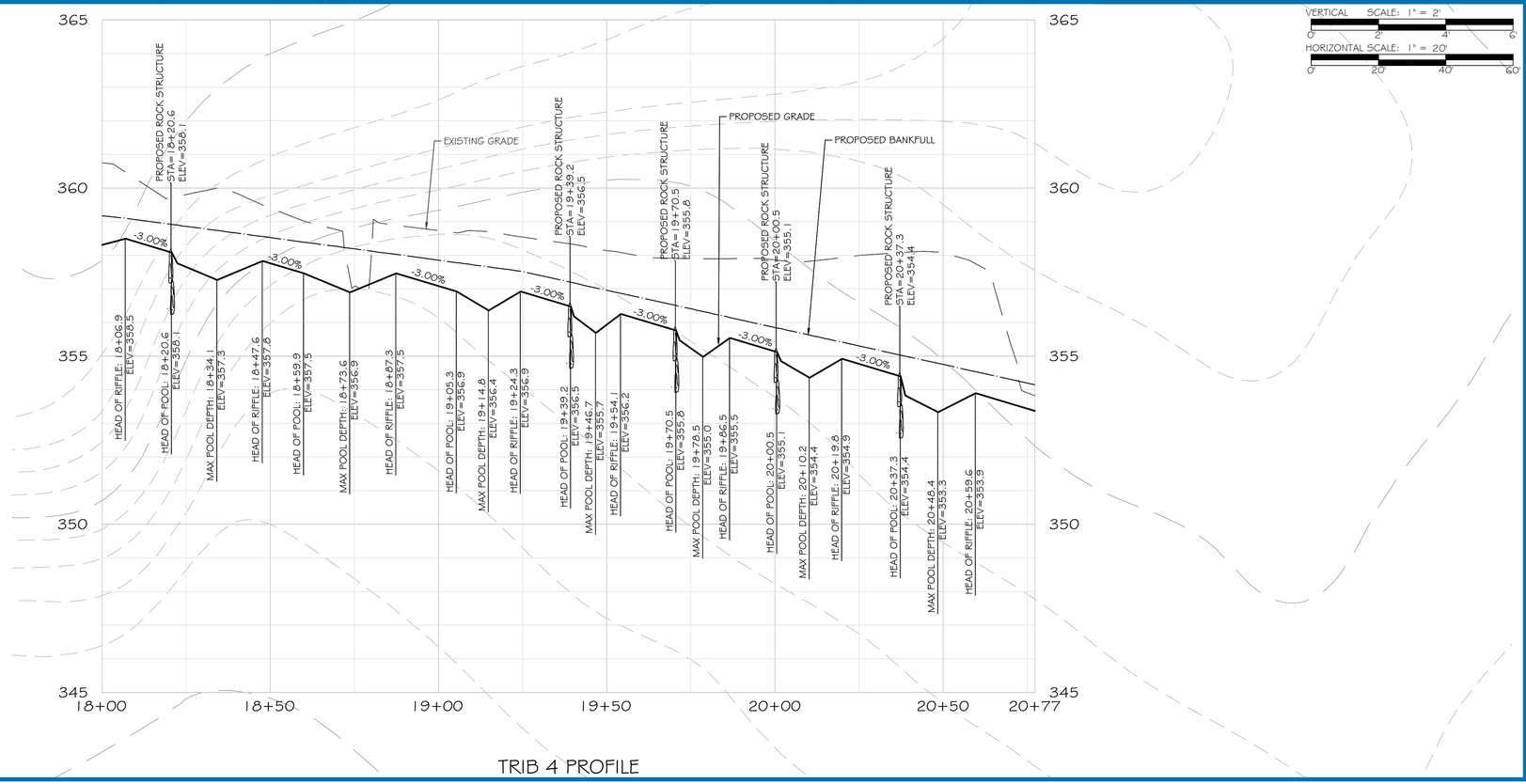
LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. ROAD CENTERLINE
- EX. EASEMENT
- OHE — EX. OVERHEAD ELECTRIC
- SAN — EX. SANITARY SEWER
- EX. STORM UTILITY
- GAS — EX. GAS
- EX. BUILDING
- EX. CURB
- EX. FLOODPLAIN
- EX. STREAM THALWEG
- EX. POND
- EX. STREAM
- EX. WETLAND
- EX. CONCRETE SWALE
- LOS — SURVEY LIMITS
- LOD — PR. LIMITS OF DISTURBANCE
- PR. MAJOR CONTOUR
- PR. MINOR CONTOUR
- PR. FLOODPLAIN GRADING LIMITS
- PR. FORESTED WETLAND
- PR. WETLAND ENHANCEMENT
- PR. BANKFULL
- PR. STREAM CENTERLINE
- PR. BERM
- PR. WETLAND INLET/OUTLET
- PR. RIP RAP
- PR. RIFFLE
- PR. ROCK OFFSET CROSS-VANE
- PR. ROCK SILL
- DETAIL CALLOUT (DETAIL # / SHEET #)

PROFILE LEGEND:

- EX. GRADE
- PR. GRADE
- PR. BANKFULL

NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.



TRIB 4 PROFILE

VERTICAL SCALE: 1" = 2'
0' 2' 4' 6'
HORIZONTAL SCALE: 1" = 20'
0' 20' 40' 60'

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & PROFILE
TRIBUTARY 4

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#:52852
EXP. DATE:6/14/2022

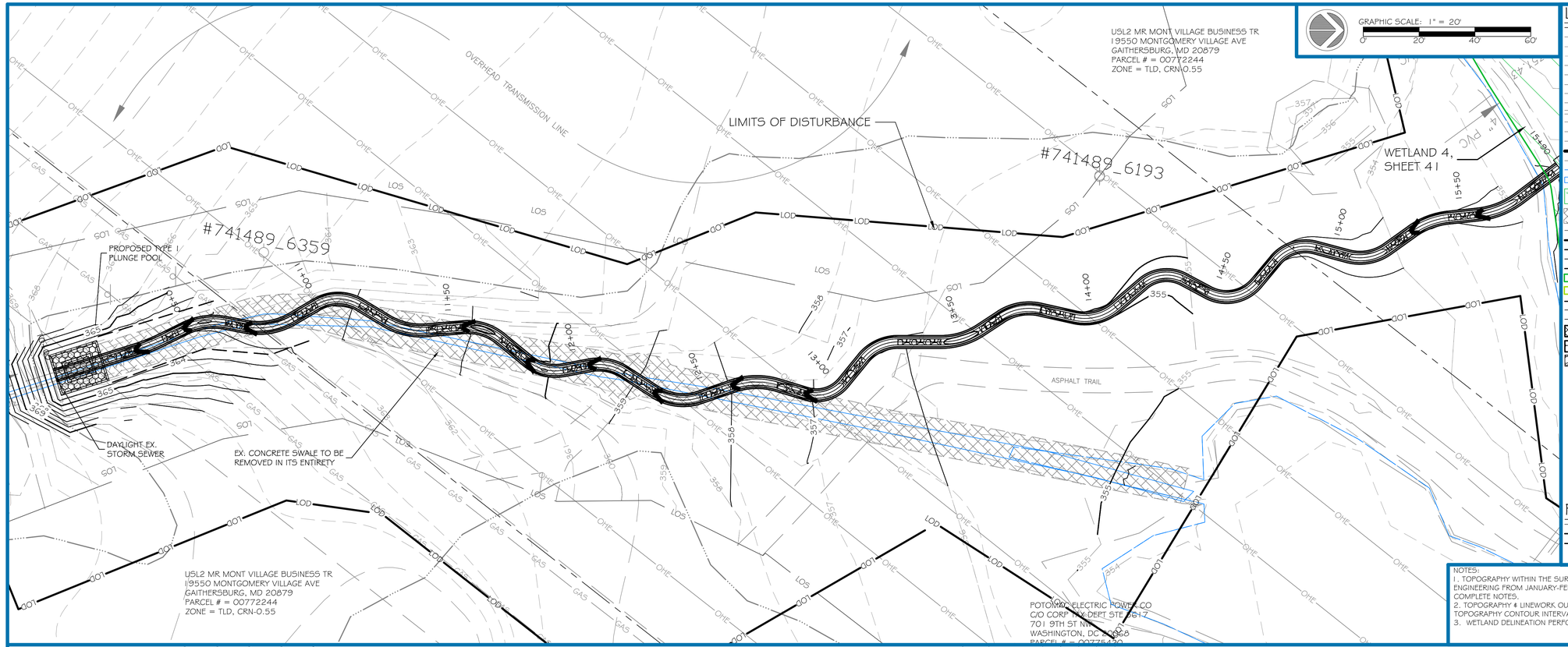
NOT FOR CONSTRUCTION

REVISIONS:
1

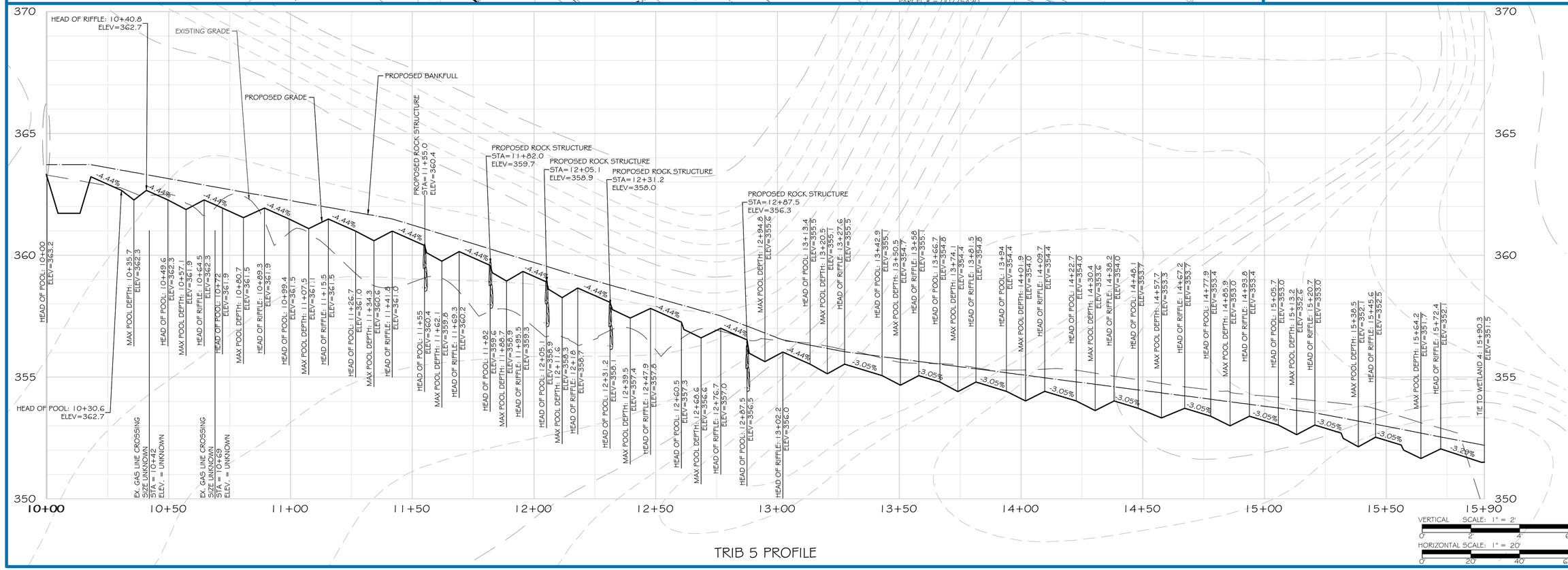
PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	36 OF 51



NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.



TRIB 5 PROFILE

VERTICAL SCALE: 1" = 2'
0 2' 4' 6'
HORIZONTAL SCALE: 1" = 20'
0 20' 40' 60'

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & PROFILE
TRIBUTARY 5

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE#: 52852
EXP. DATE: 6/14/2022

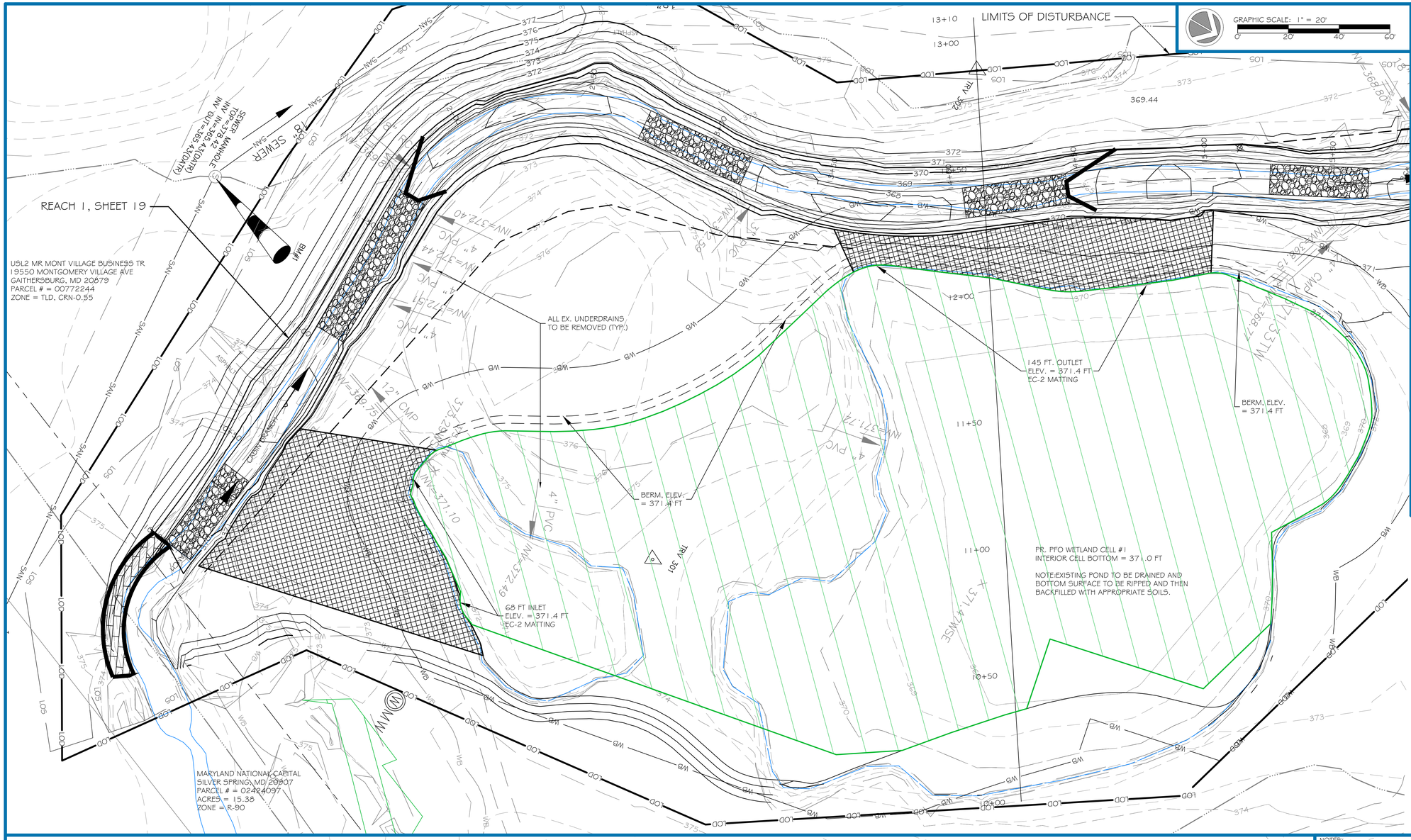
NOT FOR CONSTRUCTION

REVISIONS:
X

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BWJ/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	37 OF 51



LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. ROAD CENTERLINE
- EX. EASEMENT
- OHE — EX. OVERHEAD ELECTRIC
- SAN — EX. SANITARY SEWER
- EX. STORM UTILITY
- GAS — EX. GAS
- EX. BUILDING
- EX. CURB
- EX. FLOODPLAIN
- EX. STREAM THALWEG
- EX. POND
- EX. STREAM
- EX. WETLAND
- EX. CONCRETE SWALE
- LOS — SURVEY LIMITS
- LOD — PR. LIMITS OF DISTURBANCE
- PR. MAJOR CONTOUR
- PR. MINOR CONTOUR
- PR. FLOODPLAIN GRADING LIMITS
- PR. FORESTED WETLAND
- PR. WETLAND ENHANCEMENT
- PR. BANKFULL
- PR. STREAM CENTERLINE
- PR. BERM
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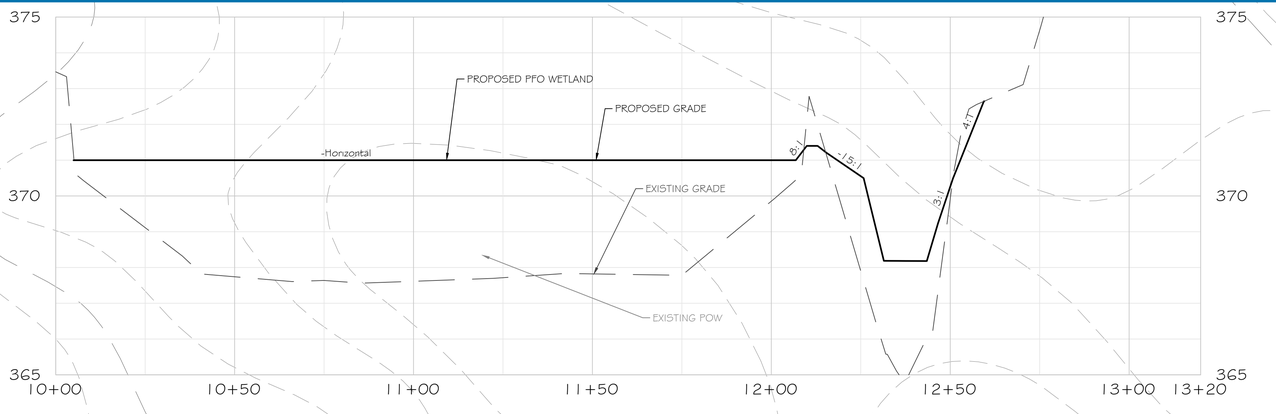
- PR. ROCK OFFSET CROSS-VANE
- PR. ROCK SILL
- DETAIL CALLOUT (DETAIL # / SHEET #)

PROFILE LEGEND:

- EX. GRADE
- PR. GRADE
- PR. BANKFULL



WETLAND CELL #1 SECTION

PROFILE DOES NOT REFLECT MICROTOPOGRAPHY, MICROTOPOGRAPHY TO BE CREATED IN THE FIELD.

NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.

VERTICAL SCALE: 1" = 2'
0' 2' 4' 6'
HORIZONTAL SCALE: 1" = 20'
0' 20' 40' 60'

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & SECTION
WETLAND CELL #1

MONTGOMERY COUNTY, MARYLAND

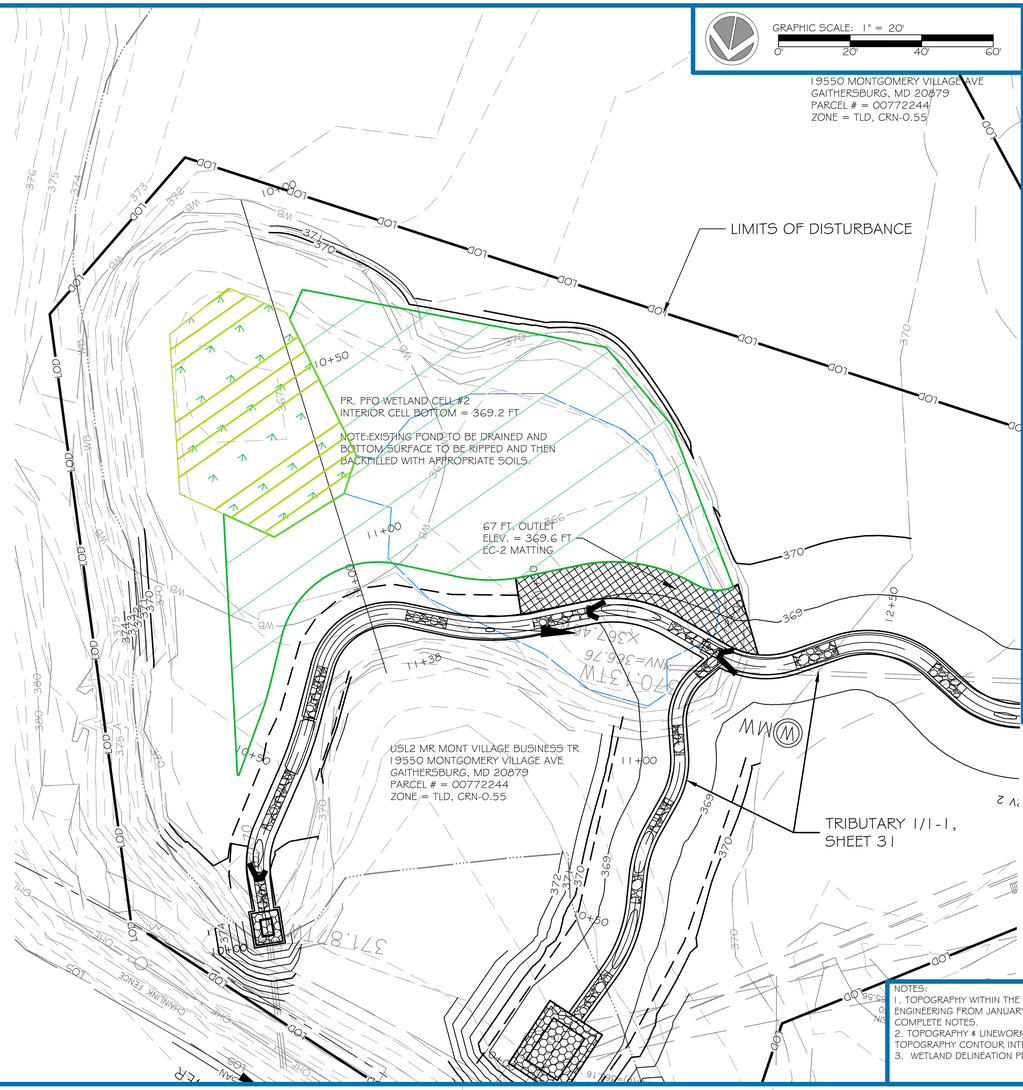
PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#:52652
EXP. DATE:6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

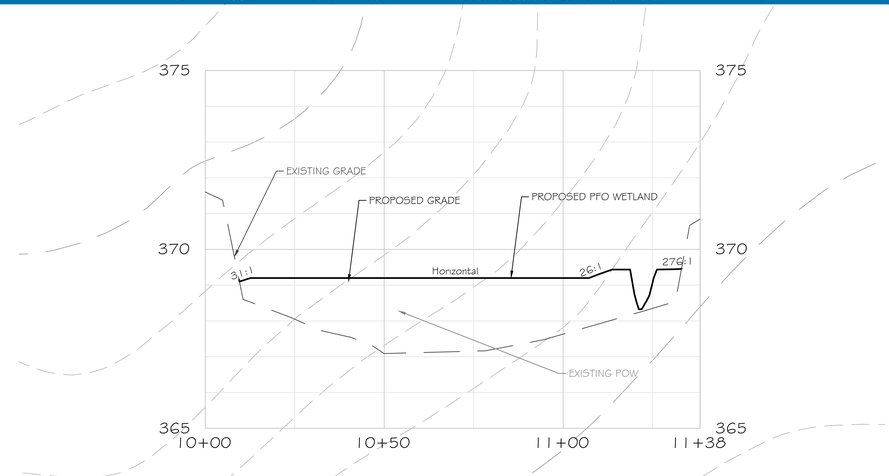
PROJECT STATUS:	
6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	38 OF 51



NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.

VERTICAL SCALE: 1" = 2'
0' 2' 4' 6'
HORIZONTAL SCALE: 1" = 20'
0' 20' 40' 60'



WETLAND CELL #2 SECTION

PROFILE DOES NOT REFLECT MICROTOPOGRAPHY, MICROTOPOGRAPHY TO BE CREATED IN THE FIELD.

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & SECTION
WETLAND CELL #2

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#:52852
EXP. DATE:6/14/2022

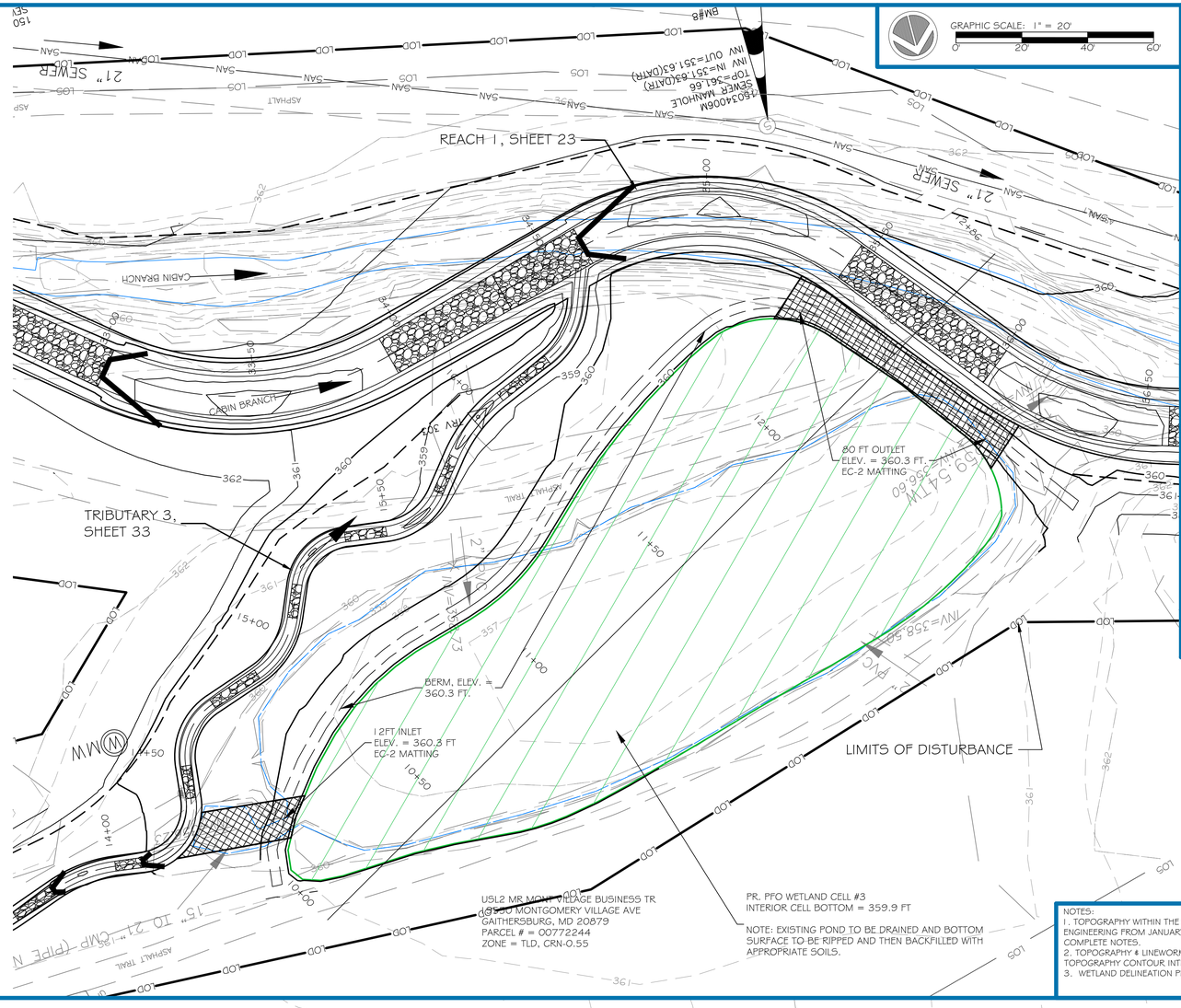
NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	39 OF 51



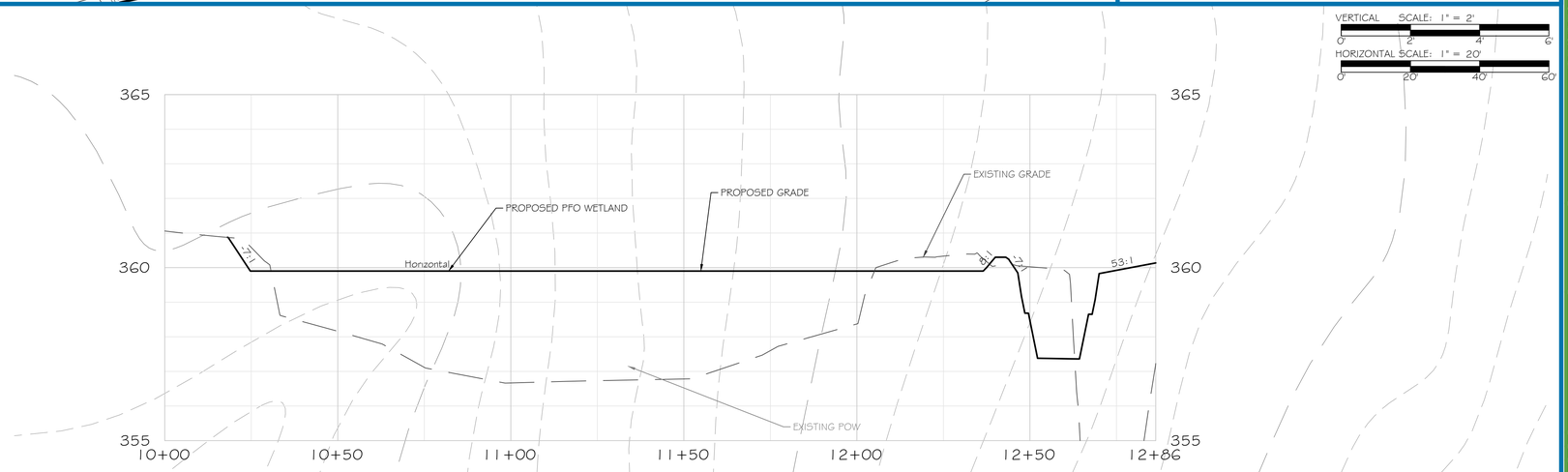
LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. ROAD CENTERLINE
- EX. EASEMENT
- OHE — EX. OVERHEAD ELECTRIC
- SAN — EX. SANITARY SEWER
- EX. STORM UTILITY
- GAS — EX. GAS
- EX. BUILDING
- EX. CURB
- EX. FLOODPLAIN
- EX. STREAM THALWEG
- EX. POND
- EX. STREAM
- EX. WETLAND
- EX. CONCRETE SWALE
- LOS — SURVEY LIMITS
- LOD — PR. LIMITS OF DISTURBANCE
- PR. MAJOR CONTOUR
- PR. MINOR CONTOUR
- PR. FLOODPLAIN GRADING LIMITS
- PR. FORESTED WETLAND
- PR. WETLAND ENHANCEMENT
- PR. BANKFULL
- PR. STREAM CENTERLINE
- PR. BERM
- PR. WETLAND INLET/OUTLET
- PR. RIP RAP
- PR. RIFFLE
- PR. ROCK OFFSET CROSS-VANE
- PR. ROCK SILL
- DETAIL CALLOUT (DETAIL # / SHEET #)

PROFILE LEGEND:

- EX. GRADE
- PR. GRADE
- PR. BANKFULL

NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.



WETLAND CELL #3 SECTION

PROFILE DOES NOT REFLECT MICROTOPOGRAPHY, MICROTOPOGRAPHY TO BE CREATED IN THE FIELD.

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & SECTION
WETLAND CELL #3

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND,
LICENSE#: 52852
EXP. DATE: 6/14/2022

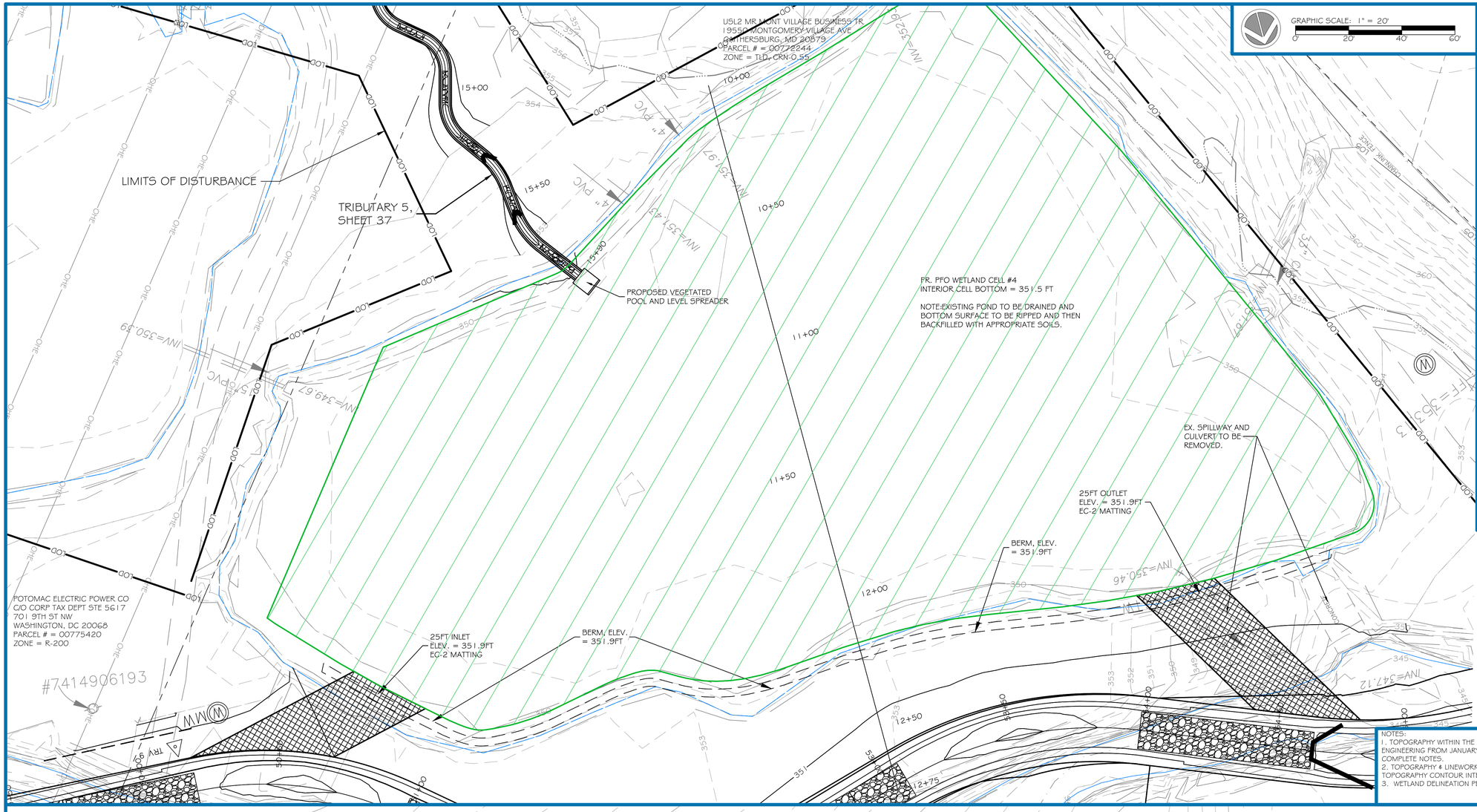
NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

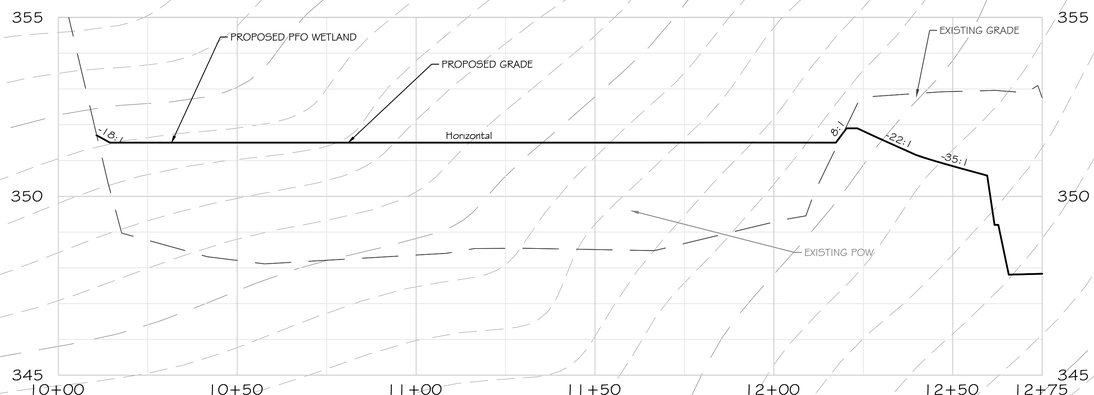
6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	40 OF 51



NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.

VERTICAL SCALE: 1" = 2'
0 2' 4' 6'
HORIZONTAL SCALE: 1" = 20'
0 20' 40' 60'



WETLAND CELL #4 SECTION

PROFILE DOES NOT REFLECT MICROTOPOGRAPHY, MICROTOPOGRAPHY TO BE CREATED IN THE FIELD.

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & SECTION
WETLAND CELL #4

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#: 52852
EXP. DATE: 6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BWJC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	41 OF 51



LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. ROAD CENTERLINE
- EX. EASEMENT
- OHE — EX. OVERHEAD ELECTRIC
- SAN — EX. SANITARY SEWER
- EX. STORM UTILITY
- GAS — EX. GAS
- EX. BUILDING
- EX. CURB
- EX. FLOODPLAIN
- EX. STREAM THALWEG
- EX. POND
- EX. STREAM
- EX. WETLAND
- EX. CONCRETE SWALE
- LOS — SURVEY LIMITS
- LOD — PR. LIMITS OF DISTURBANCE
- PR. MAJOR CONTOUR
- PR. MINOR CONTOUR
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- PR. FORESTED WETLAND
- PR. WETLAND ENHANCEMENT
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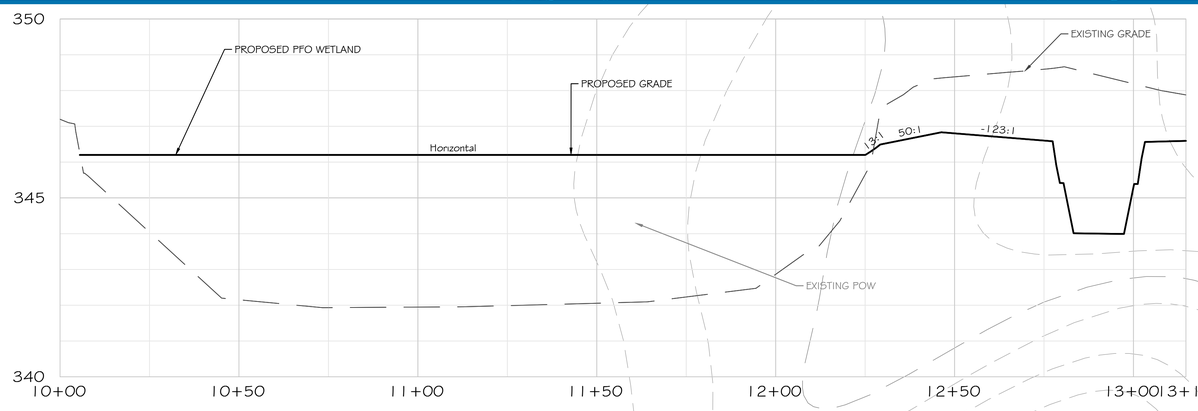
- PR. RIP RAP
- PR. RIFFLE
- PR. ROCK OFFSET CROSS-VANE
- PR. ROCK SILL
- DETAIL # / SHEET # — DETAIL CALLOUT

PROFILE LEGEND:

- EX. GRADE
- PR. GRADE
- PR. BANKFULL



WETLAND CELL #5 SECTION

NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.

VERTICAL SCALE: 1" = 2'
0' 2' 4' 6'
HORIZONTAL SCALE: 1" = 20'
0' 20' 40' 60'

PROFILE DOES NOT REFLECT MICROTOPOGRAPHY, MICROTOPOGRAPHY TO BE CREATED IN THE FIELD.

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HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLAN & SECTION
WETLAND CELL #5
MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#:52852
EXP. DATE:6/14/2022

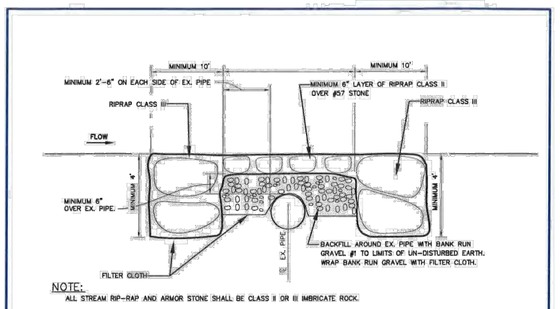
NOT FOR CONSTRUCTION

REVISIONS:
X

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	42 OF 51

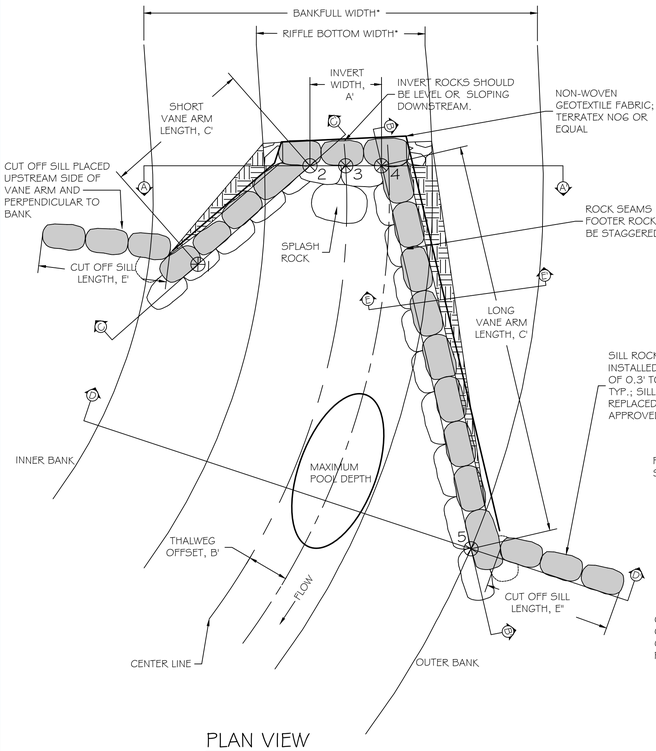


NOTE:
ALL STREAM RIP-RAP AND ARMOR STONE SHALL BE CLASS II OR III IMBRICATE ROCK.

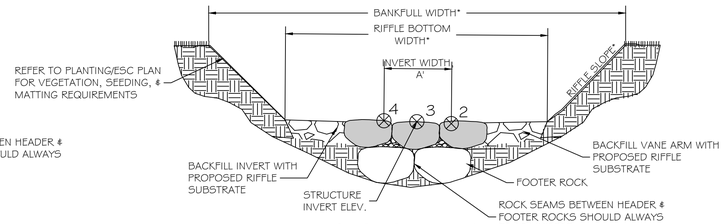
PIPE PROTECTION DETAIL

WASHINGTON SUBURBAN SANITARY COMMISSION	APPROVED: 5/16/11 Chief Engineer	STANDARD DETAIL: STREAM BANK PROTECTION AT EXIST. UTILITY STREAM CROSSING	SC 3.2

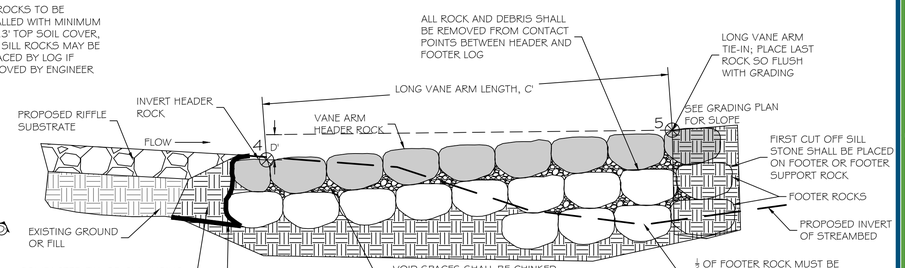
SC32



PLAN VIEW
NOT TO SCALE



SECTION A - A'
NOT TO SCALE



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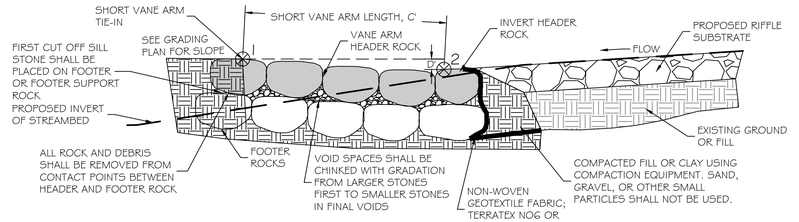
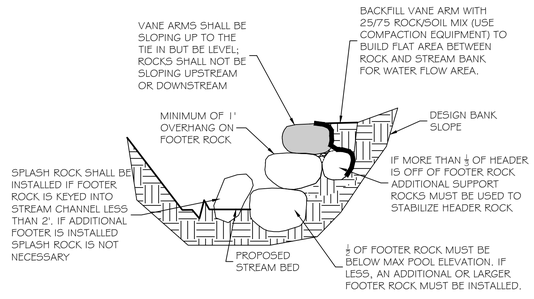


SECTION C - C'
NOT TO SCALE



SECTION E - E'
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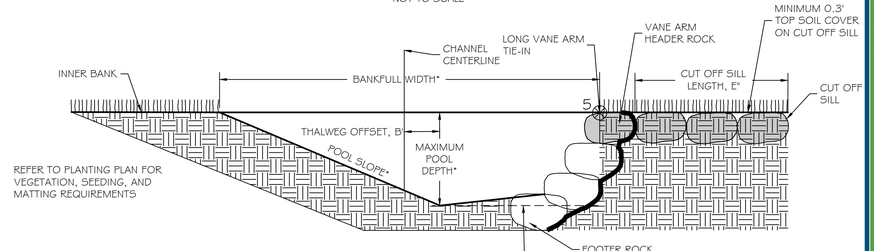
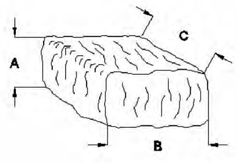


SECTION D - D'
NOT TO SCALE

ROCK CROSS-VANE STRUCTURE TABLE													
REACH	STRUCTURE #	STATION	INVERT WIDTH, A'	INVERT ELEV.	THALWEG OFFSET, B'	VANE ARM LENGTH, C'		VANE ARM TIE-IN HEIGHT, D'		CUT OFF SILL LENGTH, E'	ROCK HEIGHT (A)	ROCK DEPTH (B)	ROCK LENGTH (C)
						LONG	SHORT	LONG	SHORT				



1 OFFSET CROSS VANE/STEP POOL
NOT TO SCALE

LEGEND
- STAKEOUT
- HEADER ROCK
- FOOTER ROCK
- GEOTEXTILE FABRIC
- CHINKING MATERIAL
- FOOTER SUPPORT ROCK

*NOTE: SEE CROSS-SECTION GEOMETRY TABLE FOR CHANNEL DIMENSIONS AND SLOPES.

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PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

TYPICAL STREAM DETAILS

MONTGOMERY COUNTY, MARYLAND

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REVISIONS:
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PROJECT STATUS:

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9/3/2021	65% MIT. PLAN REV. 2
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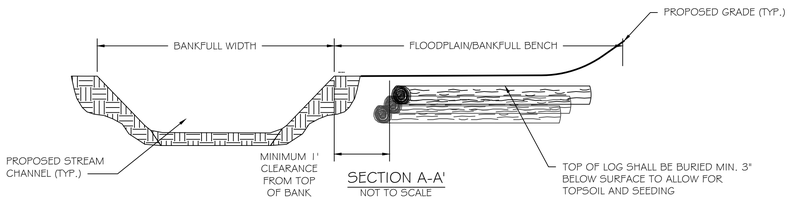
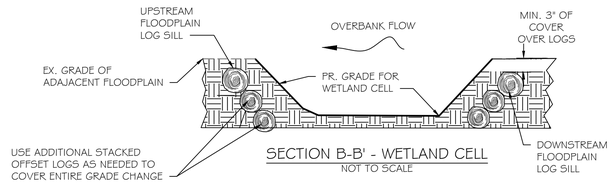
3/10/2022	65% MIT. PLAN REV. 4

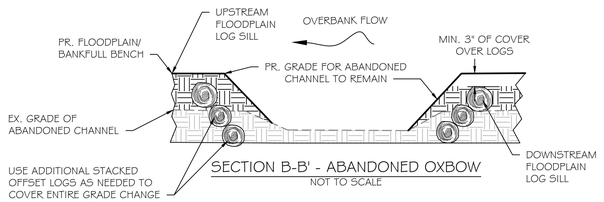
PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	43 OF 51



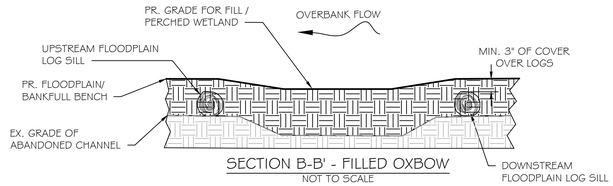
SECTION A-A'
NOT TO SCALE



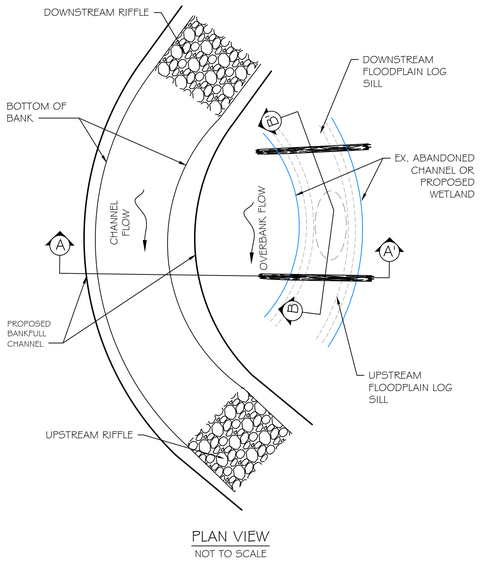
SECTION B-B' - WETLAND CELL
NOT TO SCALE



SECTION B-B' - ABANDONED OXBOW
NOT TO SCALE



SECTION B-B' - FILLED OXBOW
NOT TO SCALE

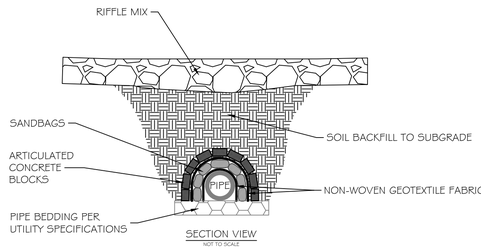


PLAN VIEW
NOT TO SCALE

WILL BE ADDED DURING FINAL PLAN DEVELOPMENT

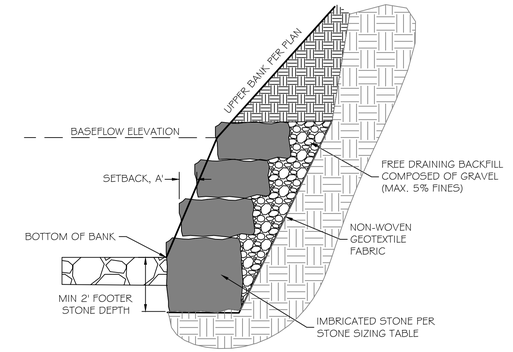
1 FLOODPLAIN LOG SILL
NOT TO SCALE

NOTES:
1. BURIED LOGS MAY BE PLACED IN SINGLE OR MULTIPLE CONFIGURATIONS BASED ON SITE CONDITIONS, DESIGN CONSIDERATIONS, AND/OR AVAILABLE MATERIAL.
2. A LONGER SILL MAY BE ACHIEVED, WHERE A SINGLE LOG OF SUFFICIENT LENGTH NOT BE AVAILABLE, BY OVERLAPPING PARALLEL LOGS BY A MINIMUM OF 2 FEET.
3. LOGS SHOULD BE PLACED PERPENDICULAR TO PROJECTED OVERBANK FLOWPATHS.
4. WHERE MULTIPLE BURIED LOGS ARE UTILIZED, THE LOGS SHOULD MAKE SECURE CONTACT WITH ONE ANOTHER.
5. REFER TO PLANTING AND/OR ESC PLAN FOR VEGETATION, SEEDING, AND MATTING REQUIREMENTS

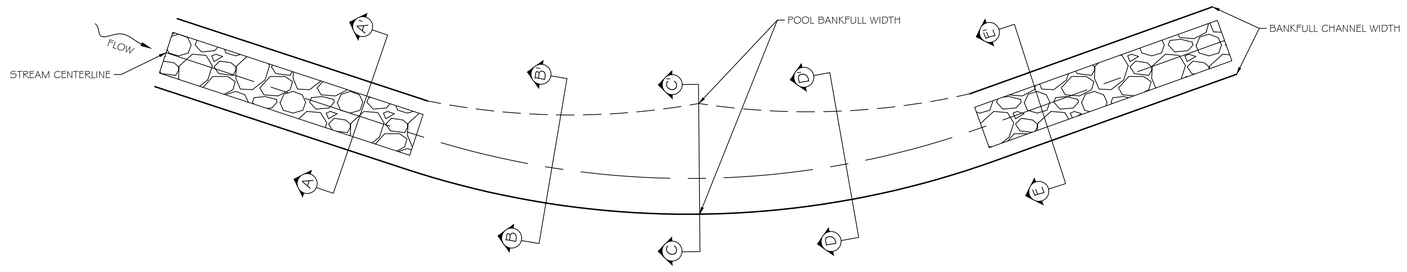


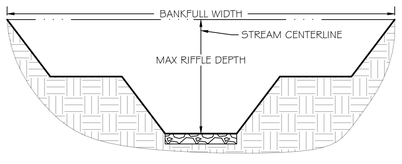
SECTION VIEW
NOT TO SCALE

3 ACB PIPE PROTECTION

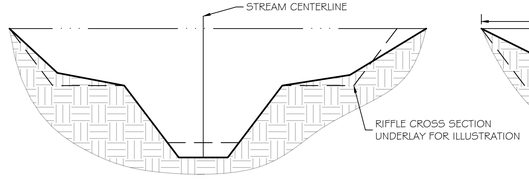


4 IMBRICATED STONE TOE
NOT TO SCALE

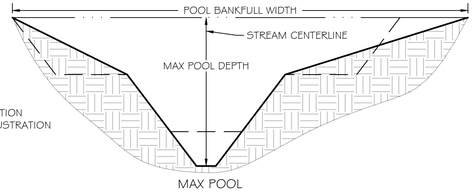




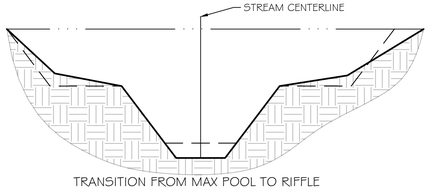
RIFFLE WITH INNER BERM
SECTION A - A'
NOT TO SCALE



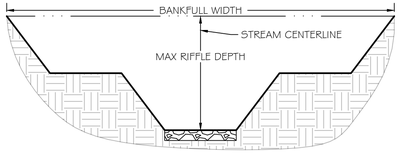
TRANSITION FROM RIFFLE TO MAX POOL
SECTION B - B'
NOT TO SCALE



MAX POOL
SECTION C - C'
NOT TO SCALE

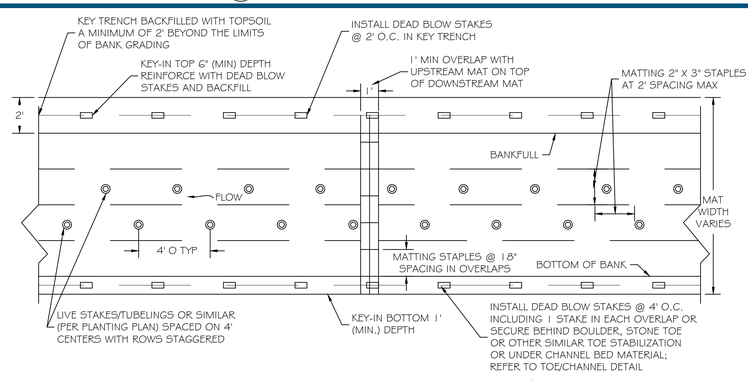


TRANSITION FROM MAX POOL TO RIFFLE
SECTION D - D'
NOT TO SCALE

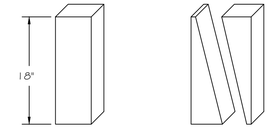


RIFFLE WITH INNER BERM
SECTION E - E'
NOT TO SCALE

2 INNER BERM TO POOL TRANSITION
NOT TO SCALE



5 COIR FIBER MATTING DETAIL IN-CHANNEL INSTALLATION
NOT TO SCALE



SAW A 2X4 DIAGONALLY TO PRODUCE (2) DEAD BLOW STAKES

6 DEAD BLOW STAKE
NOT TO SCALE

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PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

TYPICAL STREAM DETAILS

MONTGOMERY COUNTY, MARYLAND

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NOT FOR CONSTRUCTION

REVISIONS:
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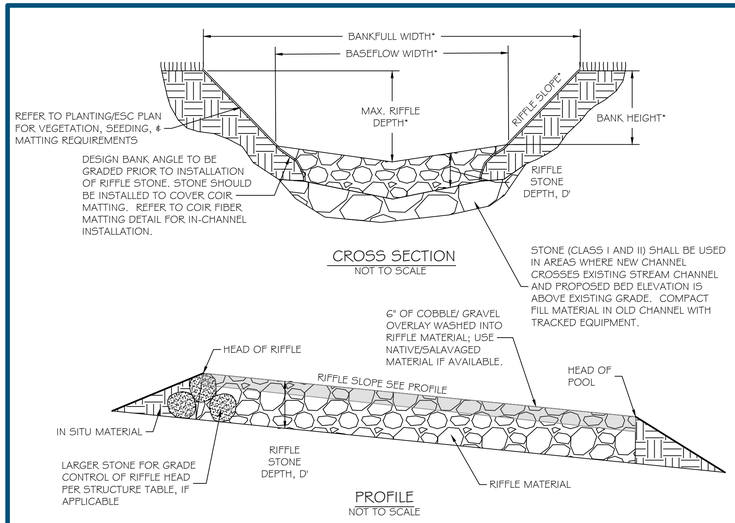
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	44 OF 51



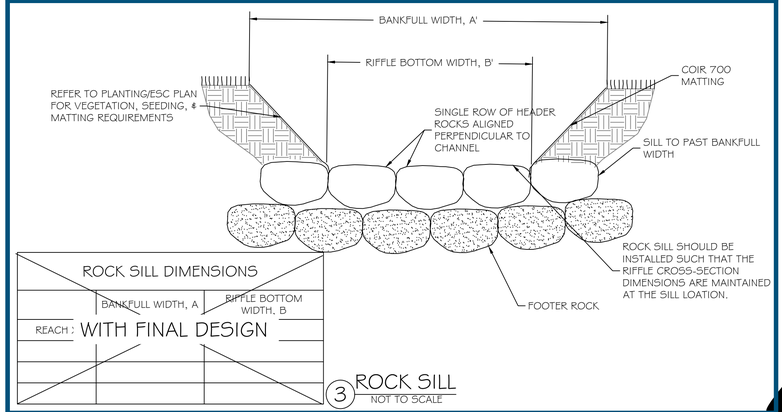
STRUCTURE TABLE		
REAC	RIFFLE STONE DEPTH, D	MIN. GRADE CONTROL STONE SIZE (L, W, H)
WITH FINAL DESIGN		

RIFFLE MIX 1		
MATERIAL	SIZE (D50)	PERCENT
ROCK	.2"	15
ROCK	1.5"	40
ROCK	5"	40
ROCK	8.5"	10
SOIL/SAND		

RIFFLE MIX 2		
MATERIAL	SIZE (D50)	PERCENT
ROCK	.2"	15
ROCK	1.5"	40
ROCK	3"	40
ROCK	6"	10
SOIL/SAND		

1 CONSTRUCTED RIFFLE
NOT TO SCALE

*NOTE: SEE CROSS-SECTION GEOMETRY TABLE FOR CHANNEL DIMENSIONS AND SLOPES.



ROCK SILL DIMENSIONS		
REACH :	BANKFULL WIDTH, A	RIFFLE BOTTOM WIDTH, B
WITH FINAL DESIGN		

3 ROCK SILL
NOT TO SCALE

Xref:

WITH FINAL DESIGN

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DRAWN:	JC
JOB NUMBER:	102054
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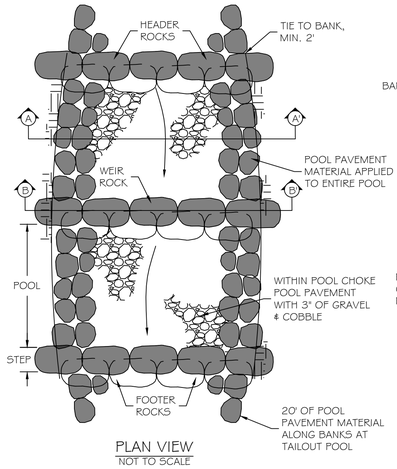
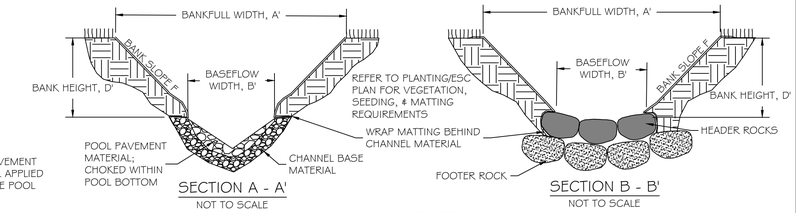
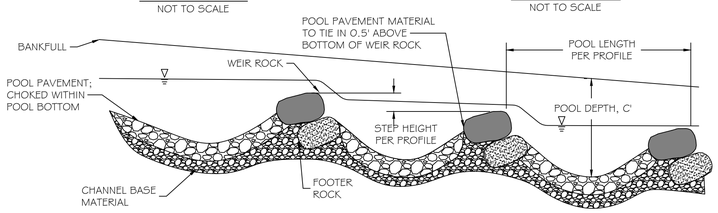


PLAN VIEW
NOT TO SCALE



SECTION A - A'
NOT TO SCALE

SECTION B - B'
NOT TO SCALE



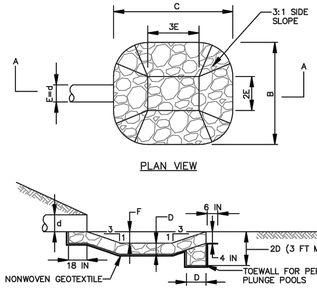
PROFILE VIEW
NOT TO SCALE

STEP POOL CROSS-SECTION GEOMETRY				
REACH	STATION	A-POOL BKF WIDTH (FT)	B-POOL BOTTOM WIDTH (FT)	C-MAX POOL DEPTH (FT)
T4A	10+00-11+10	5.0	0.5	1.00

1 STEP POOL
NOT TO SCALE

DETAIL D-4-2 PLUNGE POOL

STANDARD SYMBOL: PP



PLAN VIEW

SECTION A-A

CONSTRUCTION SPECIFICATIONS

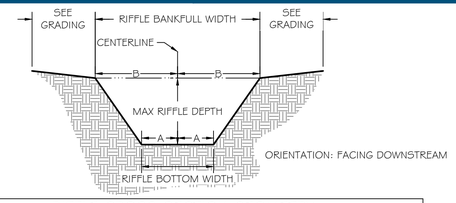
1. USE SPECIFIED CLASS OF RIPRAP.
2. USE NONWOVEN GEOTEXTILE AS SPECIFIED IN SECTION H-1 MATERIALS, AND PROTECT FROM PUNCHING, CUTTING, OR TEARING. REPAIR ANY DAMAGE OTHER THAN AN OCCASIONAL SMALL HOLE BY PLACING ANOTHER PIECE OF GEOTEXTILE OVER THE DAMAGED PART OR BY COMPLETELY REPLACING THE GEOTEXTILE. PROVIDE A MINIMUM OF ONE FOOT OVERLAP FOR ALL REPAIRS AND FOR JOINING TWO PIECES OF GEOTEXTILE.
3. PREPARE THE SUBGRADE FOR THE PLUNGE POOL TO THE REQUIRED LINES AND GRADES. COMPACT ANY FILL REQUIRED IN THE SUBGRADE TO A DENSITY OF APPROXIMATELY THAT OF THE SURROUNDING UNDISTURBED MATERIAL.
4. EMBED THE GEOTEXTILE A MINIMUM OF 4 INCHES AND EXTEND THE GEOTEXTILE A MINIMUM OF 6 INCHES BEYOND THE EDGE OF THE SCOUR HOLE.
5. STONE FOR THE PLUNGE POOL MAY BE PLACED BY EQUIPMENT. CONSTRUCT TO THE FULL COURSE THICKNESS IN ONE OPERATION AND IN SUCH A MANNER AS TO AVOID DISPLACEMENT OF UNDERLYING MATERIALS. DELIVER AND PLACE THE STONE FOR THE PLUNGE POOL IN A MANNER THAT WILL ENSURE THAT IT IS REASONABLY HOMOGENEOUS WITH THE SMALLER STONES AND SPALLS FILLING THE VOIDS BETWEEN THE LARGER STONES. PLACE STONE FOR THE PLUNGE POOL IN A MANNER TO PREVENT DAMAGE TO THE GEOTEXTILE. HAND PLACE TO THE EXTENT NECESSARY.
6. AT THE PLUNGE POOL OUTLET, PLACE THE STONE SO THAT IT MEETS THE EXISTING GRADE.
7. MAINTAIN LINE, GRADE, AND CROSS SECTION. KEEP OUTLET FREE OF EROSION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS. AFTER HIGH FLOWS INSPECT FOR SCOUR AND DISLODGED RIPRAP. MAKE NECESSARY REPAIRS IMMEDIATELY.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE | 2011 | MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

Type 1 Plunge Pool

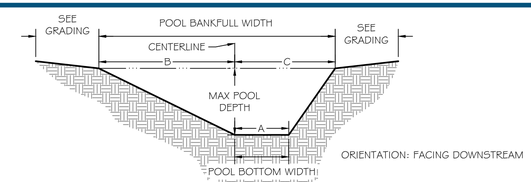
Tributary	TW (ft)	Plunge Pool Width, B, (ft)	Plunge Pool Length, C, (ft)	Min. D50- Type 1 (ft)	Min. D50- Type 1 (in)	Stone Size (Refer Table H.2)	Rip Rap Depth- Type 1 (2xD50) (in)	Plunge Pool Bottom Length (ft)	Plunge Pool Bottom Width (ft)	Plunge Pool Depth-F (ft)
T1-1	2.8	17.5	21.0	0.9	11.3	Class II	32	10.5	7.0	1.8
T1A	1.2	7.5	9.0	0.1	1.2	Number 1	5	4.5	3.0	0.8
T2	1.6	10.0	12.0	0.3	4.0	Rip Rap	11	6.0	4.0	1.0
T3A	1.4	8.8	10.5	0.1	1.2	Number 1	5	5.3	3.5	0.9
T3-1	2	12.5	15.0	0.3	3.9	Rip Rap	11	7.5	5.0	1.3
T4-1	2.2	13.8	16.5	0.5	5.6	Class I	19	8.3	5.5	1.4
T5	2.4	15.0	18.0	0.5	5.6	Class I	19	9.0	6.0	1.5



RIFFLE CROSS-SECTION GEOMETRY								
REACH	STATION	A-CENTERLINE OFFSET TO BOTTOM OF BANK (FT)	RIFFLE BOTTOM WIDTH (FT)	MAX RIFFLE DEPTH* (FT)	B-CENTERLINE OFFSET TO TOP OF BANK (FT)	RIFFLE BANKFULL WIDTH (FT)	RIFFLE STONE DEPTH (FT)
T1A	10+00-12+02	2.1	4.2	0.6	3.3	6.6	
T1B	12+02-14+07	2.1	4.2	0.6	3.3	6.6	
T1-1	10+00-11+34	1.5	3	0.5	2.5	5	
T2	10+00-14+21	0.85	1.7	0.35	1.6	3.2	
T3A	10+00-10+79	1.1	2.2	0.5	2.3	4.6	
T3B	10+79-16+55	1.5	3	0.66	3.1	6.2	
T3-1	10+00-11+61	1.1	2.2	0.5	2.3	4.6	
T4A	11+10-13+28	1.5	3	0.5	2.5	5	
T4B	13+28-20+77	1.8	3.6	0.6	1.8	3.6	
T4-1	10+00-11+31	1	2	0.42	1.9	3.8	
T5	10+00-15+90	1.1	2.2	0.5	2.3	4.6	

*REACH PROFILE DATA SHALL BE USED TO DETERMINE DEPTH AT SPECIFIC STATIONS.

RIFFLE CROSS-SECTION GEOMETRY
NOT TO SCALE



POOL CROSS-SECTION GEOMETRY							
REACH	STATION	A-CENTERLINE OFFSET TO BOTTOM OF OUTER BANK (FT)	POOL BOTTOM WIDTH (FT)	MAX POOL DEPTH (FT)	B-CENTERLINE OFFSET TO TOP OF INNER BANK (FT)	C-CENTERLINE OFFSET TO TOP OF OUTER BANK (FT)	POOL BANKFULL WIDTH (FT)
T1A	10+00-12+02	0.9	0.9	1.20	4.6	3.3	7.9
T1B	12+02-14+07	0.9	0.9	1.20	4.6	3.3	7.9
T1-1	10+00-11+34	0.5	0.5	1.00	3.5	2.5	6.0
T2	10+00-14+21	0.4	0.4	0.60	2.3	1.6	3.9
T3A	10+00-10+79	0.5	0.5	0.90	3.2	2.3	5.5
T3B	10+79-16+55	0.5	0.5	1.00	3.5	2.5	6.0
T3-1	10+00-11+61	0.5	0.5	0.90	3.2	2.3	5.5
T4A	11+10-13+28	0.5	0.5	1.00	3.5	2.5	6.0
T4B	13+28-20+77	0.6	0.6	1.20	4.2	3.0	7.2
T4-1	10+00-11+31	0.3	0.3	0.80	2.7	1.9	4.6
T5	10+00-15+90	0.5	0.5	0.90	3.2	2.3	5.5

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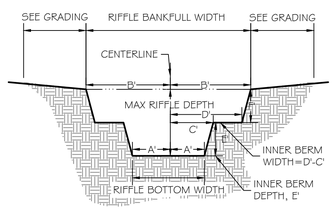
POOL CROSS-SECTION GEOMETRY
NOT TO SCALE



RIFFLE (W/ INNER BERM) CROSS-SECTION GEOMETRY										
REACH	STATION	A-CENTERLINE OFFSET TO BOTTOM OF BANK (FT)	RIFFLE BOTTOM WIDTH (FT)	MAX RIFFLE DEPTH* (FT)	B-CENTERLINE OFFSET TO TOP OF BANK (FT)	RIFFLE BANKFULL WIDTH (FT)	C-CENTERLINE OFFSET TO INSIDE OF BERM (FT)	D-CENTERLINE OFFSET TO OUTSIDE OF BERM (FT)	E-HEIGHT TO BERM FROM RIFFLE BOTTOM (FT)	F-HEIGHT TO TOP OF BANK FROM BERM (FT)	G-RIFFLE STONE DEPTH (FT)
1	10+00-39+00	6	12	2.3	11.6	23.2	8.6	9.6	1.3	1	
2	40+56-64+00	7	14	2.4	12.8	25.6	9.8	10.8	1.4	1	

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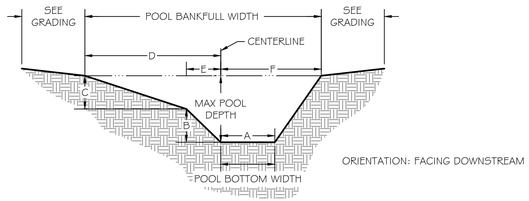
RIFFLE (W/ INNER BERM) CROSS-SECTION GEOMETRY
NOT TO SCALE



POOL (POINT BAR) CROSS-SECTION GEOMETRY									
REACH	STATION	A-CENTERLINE OFFSET TO BOTTOM OF BANK (FT)	POOL BOTTOM WIDTH (FT)	B-HEIGHT TO POINT BAR FROM POOL BOTTOM (FT)	C-HEIGHT TO TOP OF INNER BANK FROM POINT BAR (FT)	MAX POOL DEPTH (FT)	D-CENTERLINE OFFSET TO TOP OF INNER BANK (FT)	E-CENTERLINE OFFSET TO POINT BAR (FT)	F-CENTERLINE OFFSET TO TOP OF OUTER BANK (FT)	POOL BKF WIDTH (FT)
1	10+00-39+00	3.0	3.0	3.3	1.0	4.3	16.3	9.6	11.6	27.9
2	40+56-64+00	3.6	3.6	3.6	1.0	4.6	17.9	10.8	12.8	30.7

*REACH PROFILE DATA SHALL BE USED TO DETERMINE DEPTH AT SPECIFIC STATIONS.

POOL (POINT BAR) CROSS-SECTION GEOMETRY
NOT TO SCALE

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

TYPICAL STREAM DETAILS

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE#: 52852 EXP. DATE: 6/14/2022

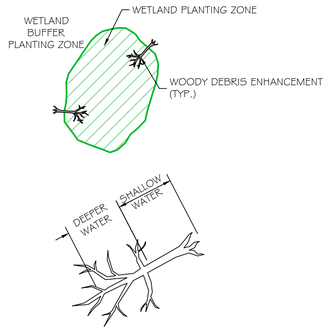
NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BWJC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	46 OF 51



③ LARGE WOODY DEBRIS ENHANCEMENT AREA

NOT TO SCALE

LARGE WOODY DEBRIS PLACEMENT NOTES:

1. LARGE WOODY DEBRIS SHALL BE USED FOR ENHANCEMENT OF HABITAT WITHIN THE WETLAND CELLS. THE WOODY DEBRIS WILL PROVIDE SUNNING AREAS FOR REPTILES AND AMPHIBIANS, LOAFING SITES FOR WATERFOWL AND WADING BIRDS, ADDITIONAL VERTICAL AND HORIZONTAL HABITAT, AND SUBSTRATE FOR INVERTEBRATES.
2. LARGE WOODY DEBRIS ENHANCEMENTS SHALL CONSIST OF CLEARED OR CUT TREES TAKEN FROM AREAS ON SITE THAT HAVE TO BE CLEARED FOR CONSTRUCTION. TREES USED FOR LARGE WOODY DEBRIS ENHANCEMENT SHALL HAVE A TRUNK DIAMETER OF 6" OR LARGER, AND THE MAIN PART OF THE TRUNK SHALL BE AT LEAST 12 FEET LONG. WOODY DEBRIS WITH ROOT BALLS ATTACHED ARE PREFERRED, HOWEVER SAW-CUT TREES ARE ACCEPTABLE.
3. LARGE WOODY DEBRIS PLACEMENT
   a. WHEN PLACED, THE MAIN TRUNK OF THE TREE SHALL POINT INWARDS FROM THE CELL PERIMETER, SO THAT WITH CHANGING WATER LEVELS, THE TREE WILL PROVIDE LOAFING AREAS FOR WILDLIFE MOST OF THE TIME.
   b. THE ROOT WAD OR TRUNK BASE SHOULD ORIGINATE ON THE WETLAND BUFFER EDGE AND THE TRUNK SHOULD BE POINTED TOWARDS THE CENTER OF THE CELL.
   c. DEPENDING ON THE SIZE OF THE WETLAND CELL, MULTIPLE PIECES OF LARGE WOODY DEBRIS WILL BE REQUIRED. FOR THE TWO CELLS SIZED BETWEEN 0.25 AND 0.5 ACRES, TWO PIECES OF LARGE WOODY DEBRIS WILL BE PLACED IN EACH CELL. FOR THE THREE CELLS SIZED GREATER THAN 1 ACRE, THREE PIECES OF LARGE WOODY DEBRIS WILL BE PLACED IN EACH CELL.

UPLAND TREE PLANTING

ACRES 0.24
PLANTS PER ACRE 750
TOTAL PLANTS 185

SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS	SIZE	STOCK	%	QUANTITY
CANOPY (80%)						
Linodendron tulipifera	Tulptree	FACU	8-12"	Bareroot	15%	25
Quercus rubra	Northern red oak	FACU	8-12"	Bareroot	12%	20
Platanus occidentalis	Sycamore	FACW	8-12"	Bareroot	10%	20
Carya glabra	Pignut hickory	FACU	8-12"	Bareroot	10%	20
Robinia pseudoacacia	Black locust	FACU	8-12"	Bareroot	10%	20
Liquidambar styraciflua	Sweetgum	FAC	8-12"	Bareroot	5%	10
Quercus alba	White oak	FACU	8-12"	Bareroot	5%	10
Acer negundo	Boxelder	FAC	8-12"	Bareroot	5%	10
Acer rubrum	Red maple	FAC	8-12"	Bareroot	5%	10
UNDERSTORY/SHRUB (20%)						
Prunus serotina	Black cherry	FACU	8-12"	Bareroot	10%	20
Cercis canadensis	Eastern redbud	UPL	8-12"	Bareroot	7%	10
Prunus amencana	Amencan plum	FACU	8-12"	Bareroot	7%	10
					100%	185

WETLAND TREE PLANTING

ACRES 4.40
PLANTS PER ACRE 750
TOTAL PLANTS 3,300

SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS	SIZE	STOCK	%	QUANTITY
CANOPY (80%)						
Acer negundo	Boxelder	FAC	8-12"	Bareroot	15%	495
Acer rubrum	Red maple	FAC	8-12"	Bareroot	15%	495
Platanus occidentalis	Sycamore	FACW	8-12"	Bareroot	15%	495
Betula nigra	River birch	FACW	8-12"	Bareroot	10%	330
Quercus paluslris	Pin Oak	FACW	8-12"	Bareroot	10%	330
Populus deltoides	Eastern cottonwood	FAC	8-12"	Bareroot	10%	330
Acer saccahnnum	Silver maple	FAC	8-12"	Bareroot	5%	165
UNDERSTORY/SHRUB (20%)						
Cephalanthus occidentalis	Buttonbush	OBL	8-12"	Bareroot	10%	330
Salix nigra	Black willow	OBL	8-12"	Bareroot	10%	330
					100%	3,300

RIPARIAN TREE PLANTING

ACRES 15.68
PLANTS PER ACRE 750
TOTAL PLANTS 11,770

SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS	SIZE	STOCK	%	QUANTITY
CANOPY (75%)						
Platanus occidentalis	Sycamore	FACW	8-12"	Bareroot	20%	2,350
Acer negundo	Boxelder	FAC	8-12"	Bareroot	15%	1,765
Acer rubrum	Red maple	FAC	8-12"	Bareroot	10%	1,175
Nyssa sylvatica	Black gum	FAC	8-12"	Bareroot	10%	1,175
Quercus phellos	Willow oak	FACW	8-12"	Bareroot	10%	1,175
Betula nigra	River birch	FACW	8-12"	Bareroot	5%	590
Liquidambar styraciflua	Sweetgum	FAC	8-12"	Bareroot	5%	590
Quercus rubra	Northern red oak	FACU	8-12"	Bareroot	5%	590
Quercus paluslris	Pin Oak	FACW	8-12"	Bareroot	5%	590
UNDERSTORY/SHRUB (25%)						
Cornus amomum	Silky dogwood	FACW	8-12"	Bareroot	5%	590
Lindera benzoin	Spicebush	FACW	8-12"	Bareroot	5%	590
Viburnum dentatum	Southern arrowwood	FACW	8-12"	Bareroot	5%	590
					100%	11,770

UPLAND PLANTING SEED MIX

ACRES 0.72
POUNDS PER ACRE 14
TOTAL POUND 10

SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS	%
Grasses (80%)			
Elymus virginicus	Virginia Wildrye	FACW	25.0%
Schizachynum scopanum	Little Bluestem	FACU	25.0%
Tndens flavus	Purpletop	FACU	13.0%
Chasmanthium latifolium	River Oats	FACU	10.0%
Andropogon virginicus	Broomsedge	FACU	5.0%
Agrostis perennans	Autumn Bentgrass	FACU	2.0%
Forbs/Legumes (20%)			
Chamaecnsta fasciculata	Partndge Pea	FACU	8.5%
Senna hebecarpa	Wild Senna	FAC	3.5%
Baptisia australis	Blue False Indigo	FACU	3.0%
Asclepas synaca	Common Milkweed	FACU	2.0%
Rudbeckia hirta	Blackeyed Susan	FACU	1.3%
Aster pilosus	Heath Aster	FAC	0.5%
Helenium autumnale	Common Sneezeweed	FACW	0.5%
Solidago nemoralis	Gray Goldenrod	NI	0.5%
Pycnanthemum tenuifolium	Narrowleaf Mountainmint	FACW	0.2%
			100.0%

WETLAND SEED MIX

ACRES 4.40
POUNDS PER ACRE 5
TOTAL POUNDS 22

SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS	%
Grasses/Sedges (80%)			
Elymus virginicus	Virginia Wildrye	FACW	29.6%
Carex lunda	Lund Sedge	OBL	20.0%
Carex frankii	Frank's Sedge	OBL	20.0%
Carex scopana	Blunt Broom Sedge	FACW	5.0%
Carex vulpinoidea	Fox Sedge	OBL	5.0%
Scirpus cyperinus	Woolgrass	FACW	0.2%
Juncus effusus	Soft Rush	FACW	0.2%
Forbs (20%)			
Helianthus angustifolius	Narrowleaf Sunflower	FACW	5.5%
Asclepas incarnata	Swamp Milkweed	OBL	5.0%
Vernonia noveboracensis	New York Ironweed	FAC	4.0%
Verbena hastata	Blue Vervain	FACW	2.0%
Aster novae-angliae	New England Aster	FACW	2.0%
Solidago rugosa	Wrinkleleaf Goldenrod	FAC	1.0%
Ludwigia alternifolia	Seedbox	FACW	0.3%
Mimulus ringens	Square Stemmed Monkeyflower	OBL	0.2%
			100.0%

RIPARIAN/STREAM BANK SEED MIX

ACRES 23.34
POUNDS PER ACRE 15
TOTAL POUNDS 350

SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS	%
Grasses (80%)			
Chasmanthium latifolium	River Oats	FACU	25.0%
Elymus virginicus	Virginia Wildrye	FACW	25.0%
Schizachynum scopanum	Little Bluestem	FACU	10.0%
Panicum virgatum	Switchgrass	FAC	9.0%
Panicum rigidulum	Redtop Panicgrass	FACW	5.0%
Tndens flavus	Purpletop	FACU	5.0%
Agrostis perennans	Autumn Bentgrass	FACU	0.5%
Juncus tenuis	Path Rush	FAC	0.5%
Forbs (20%)			
Chamaecnsta fasciculata	Partndge Pea	FACU	5.0%
Asclepas incarnata	Swamp Milkweed	OBL	3.0%
Senna hebecarpa	Wild Senna	FAC	3.0%
Vernonia noveboracensis	New York Ironweed	FAC	2.5%
Helianthus angustifolius	Narrowleaf Sunflower	FACW	2.5%
Aster novae-angliae	New England Aster	FACW	2.0%
Helenium autumnale	Common Sneezeweed	FACW	1.5%
Eupatonum perfoliatum	Boneset	FACW	0.5%
			100.0%

PLANTING NOTES:

1. PLANTS AND SEEDS SHALL BE OBTAINED FROM A COMMERCIAL SUPPLIER. THE CONTRACTOR SHALL MAKE ARRANGEMENTS WITH RELIABLE SOURCES TO ENSURE THAT AN ADEQUATE SUPPLY OF THE REQUIRED PLANT AND SEED MATERIALS IS AVAILABLE.
2. IN THE EVENT THAT A PLANT OR SEED SPECIFIED IS NOT COMMERCIALLY AVAILABLE, THE CONTRACTOR MAY REQUEST A SUBSTITUTION IN WRITING. ALL REQUESTS FOR SUBSTITUTIONS SHALL BE MADE AT LEAST 1 MONTH PRIOR TO INSTALLATION AND BE APPROVED BY THE ENGINEER OR THEIR ASSIGNED.
3. ALL PLANT MATERIALS RECEIVED FROM COMMERCIAL SUPPLIERS SHALL CONFORM TO THE CURRENT ISSUE OF THE AMERICAN STANDARD FOR NURSERY STOCK, PUBLISHED BY THE AMERICAN ASSOCIATIONS OF NURSERYMEN.
4. THE CONTRACTOR IS RESPONSIBLE FOR INSTALLING ALL PLANT MATERIAL IN THE APPROPRIATE SEASON FOR EACH TYPE OF STOCK. THE PLANTING SEASON FOR CONTAINER TREES, SHRUBS, TUBELINGS,BAREROOTS, CONTAINER SEEDLINGS, AND LIVE STAKES SHALL BE FROM NOVEMBER 1 THROUGH DECEMBER 15, AND FEBRUARY 15 THROUGH APRIL 1. LIVE STAKES AND BAREROOT TREES AND SHRUBS MUST BE INSTALLED IN THE DORMANT SEASON. ADJUSTMENTS TO THE PLANTING SEASONS MAY BE MADE BY THE ENGINEER BASED ON SEASONAL AND SITE CONDITIONS.
5. ALL PLANT MATERIAL SHALL BE UNIFORMLY SHAPED AND HAVE A VIGOROUS ROOT SYSTEM. THE PLANT MATERIAL SHALL BE HEALTHY, AND FREE OF DEFECTS, DECAY, ABRASIONS OF THE BARK, PLANT DISEASE, INSECT PEST EGGS, AND ALL FORMS OF INFESTATIONS. THE PLANT MATERIALS MUST BE FRESH AND FREE OF TRANSPLANT SHOCK OR VISIBLE WILT. UNHEALTHY PLANT STOCK ARE UNACCEPTABLE AND WILL BE REJECTED.
6. ALL CONTAINER GROWN STOCK, INCLUDING PLUGS, SHALL HAVE BEEN PROPAGATED FOR A SUFFICIENT TIME FOR THE ROOTS TO HAVE DEVELOPED SUFFICIENTLY TO HOLD THE SOILS TOGETHER WHEN REMOVED FROM THE CONTAINER. CONTAINER STOCK WITH POORLY DEVELOPED ROOTS ARE UNACCEPTABLE AND WILL BE REJECTED.
7. NO SEEDING OR PLANTING SHALL OCCUR WHEN THE SOIL IS FROZEN OR THE SITE IS FLOODED.
8. THE CONTRACTOR SHALL NOTIFY THE ENGINEER A MINIMUM OF 48 HOURS PRIOR TO THE COMMENCING OF PLANTING OR SEEDING OPERATIONS.
9. THE FINAL LOCATION OF PLANT MATERIAL, AS WELL AS LOCATION OF PLANTING ZONES, WILL BE SUBJECT TO THE APPROVAL OF THE ENGINEER. THE CONTRACTOR WILL BE RESPONSIBLE FOR THE REPLANTING OR RESEEDING ANY PLANT MATERIAL INSTALLED WITHOUT APPROVAL OF THE ENGINEER.
10. SPACING OF BAREROOT TREES WILL BE 7' ON-CENTER.
11. THE PLANTING DENSITY IS DESIGNED FOR TYPICAL DIE-OFF AND HERBIVORY, IF EXCESSIVE DIE-OFF OR HERBIVORY IS NOTED DURING MONITORING, REPLANTING OF AFFECTED AREAS WILL BE REQUIRED.
12. THE BORDERS OF THE CONSERVATION AREA WILL BE MARKED WITH A METAL POST & SIGN A MINIMUM OF EVERY 50' DESIGNATING THE CONSERVATION AREAS.

STREAM BANK PLANTING

(BELOW TOP OF BANK)
LINEAR FEET OF BANK 17,506.0
PLANTS PER LINEAR FOOT 0.4
TOTAL PLANTS 7,000

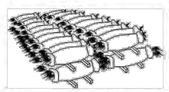
SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS	SIZE	STOCK	%	QUANTITY
Salix nigra	Black Willow	OBL	2-3'	Livestakes	30%	2,100
Cornus amomum	Silky dogwood	FACW	2-3'	Livestakes	25%	1,750
Alnus semulata	Smooth Alder	FACW	8-12"	Bareroot	20%	1,400
Cephalanthus occidentalis	Buttonbush	OBL	8-12? 2-3'	Bareroot/ Livestakes	15%	1,050
Platanus occidentalis	Sycamore	FACW	8-12"	Bareroot	10%	700
					100%	7,000

FIELD STABILIZATION MIX / PERMANENT SEEDING SUMMARY

Hardiness Zone (from Figure B.3): 6a
Seed Mixture (from Table B.3): 1

No.	Species	Application Rate (lb/ac)	Seeding Dates	Seeding Depths	Fertilizer Rate (10-20-20) N	P_2O_5	K_2O	Lime Rate
1	Switch Grass (*Panicum virgatum*)	10	March 1 to May 15, August 15 to October 15	1/4-1/2 in	45 pounds per acre (1.0 lb/ 1000 sf)	90 lb/ac (2 lb/ 1000 sf)	90 lb/ac (2 lb/ 1000 sf)	2 tons/ ac (90 lb/ 1000 sf)
	Creeping Red Fescue (*Festuca rubra var. rubra*)	15	March 1 to May 15, August 15 to October 15	1/4-1/2 in				
	Partridge Pea (*Chamaecnsta fasciculata*)	4	March 1 to May 15, August 15 to October 15	1/4-1/2 in				

PLANTING BARE-ROOTED SEEDLINGS



CARE OF SEEDLINGS UNTIL PLANTED

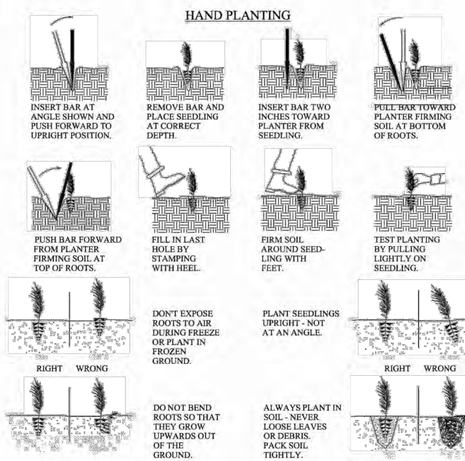
SEEDLINGS SHOULD BE PLANTED IMMEDIATELY. IF IT IS NECESSARY TO STORE MOSS PACKED SEEDLINGS FOR MORE THAN 2 WEEKS, ONE PINT OF WATER PER PKG. SHOULD BE ADDED. IF CLAY-TREATED, DO NOT ADD WATER TO PKG. PACKAGES MUST BE SEPERATED TO PROVIDE VENTILATION TO PREVENT "HEATING". SEPARATE PACKAGES WITH WOOD STRIPS AND STORE OUT OF THE WIND IN A SHADED, COOL (NOT FREEZING) LOCATION.

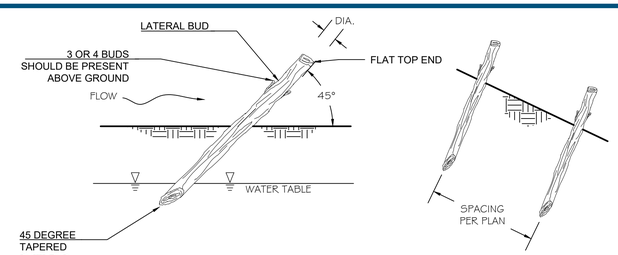


CARE OF SEEDLINGS DURING PLANTING

WHEN PLANTING, ROOTS MUST BE KEPT MOIST UNTIL TREES ARE IN THE GROUND. DO NOT CARRY SEEDLINGS IN YOUR HAND EXPOSED TO THE AIR AND SUN. KEEP MOSS-PACKED SEEDLINGS IN A CONTAINER PACKED WITH WET MOSS OR FILLED WITH THICK MUDDY WATER. COVER CLAY-TREATED SEEDLINGS WITH WET BURLAP ONLY.

HAND PLANTING

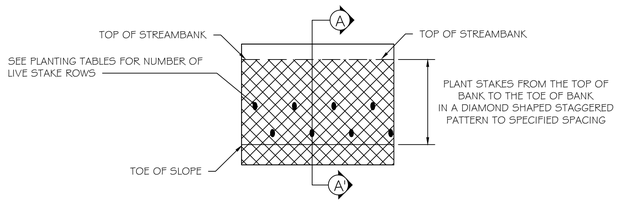




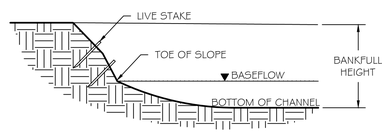
NOTES:
1. DO NOT INSTALL LIVE STAKES THAT HAVE BEEN SPLIT.
2. LIVE STAKES MUST BE INSTALLED WITH BUDS POINTING UPWARDS.
3. LIVE STAKES SHOULD BE 1 TO 2 INCHES IN DIAMETER.
4. LIVE STAKES SHOULD BE LONG ENOUGH TO REACH BELOW THE GROUNDWATER TABLE (2 TO 3 FEET IN LENGTH).
5. LIVE STAKES SHOULD BE INSTALLED LEAVING 4 TO 8 INCHES ABOVE GROUND.
6. LIVE STAKES SHOULD BE INSERTED AT A 45° ANGLE TO THE BANK AND POINTED DOWNSTREAM.

① LIVE STAKE INSTALLATION

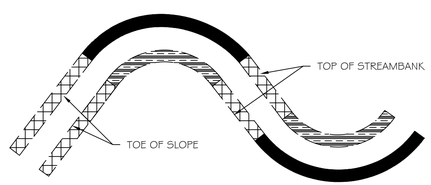
NOT TO SCALE



PLAN VIEW



SECTION A-A'



LIVE STAKE SPACING PLAN VIEW

INNER BEND SPACING PER PLANTING TABLE
RIFFLE SPACING PER PLANTING TABLE
OUTER BEND SPACING PER PLANTING TABLE

② LIVE STAKE LAYOUT

NOT TO SCALE

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLANTING NOTES & DETAILS

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#:52652
EXP. DATE:6/14/2022

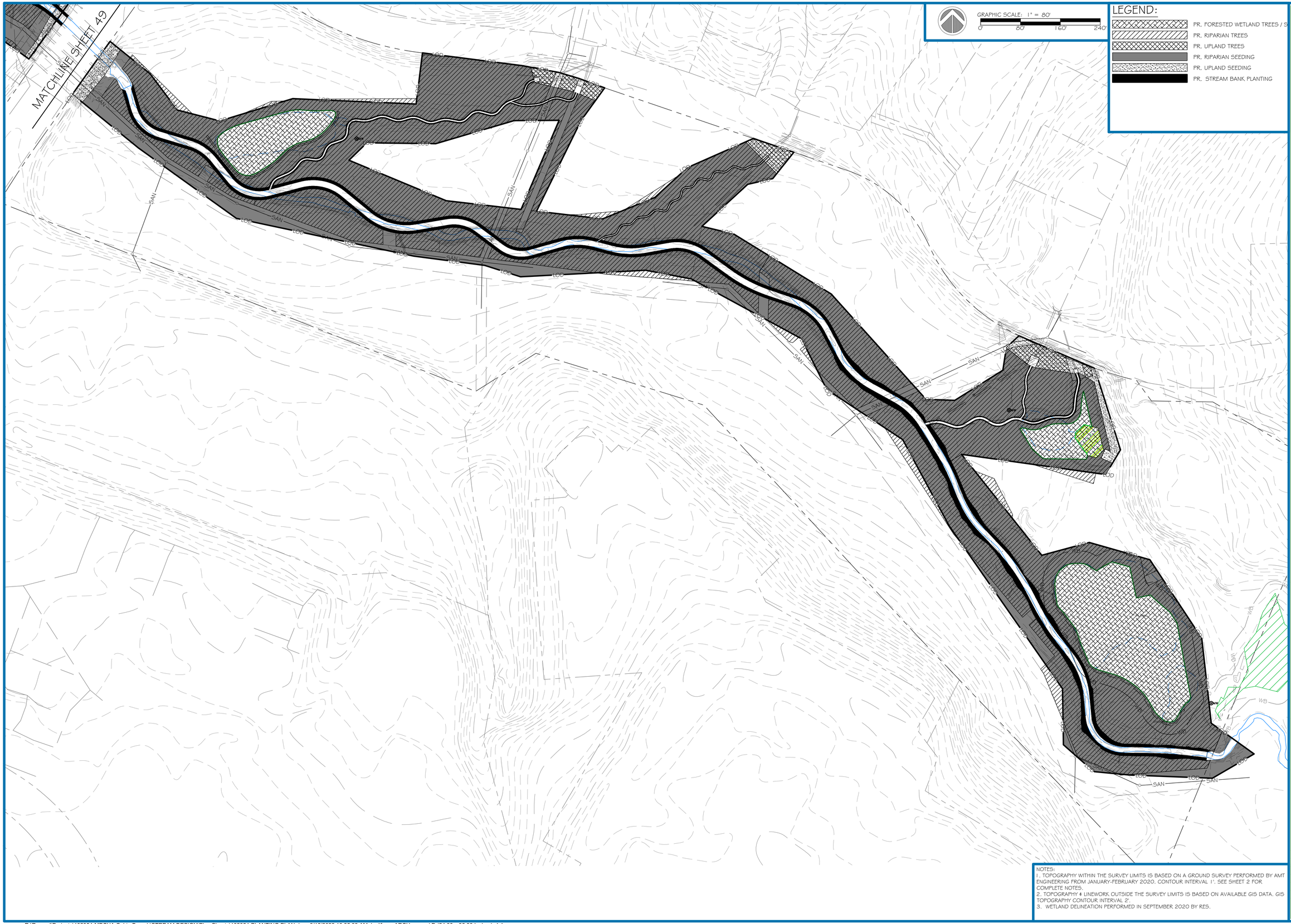
NOT FOR CONSTRUCTION

REVISIONS:
2

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RG
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	47 OF 51



NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
3. WETLAND DELINEATION PERFORMED IN SEPTEMBER 2020 BY RES.

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PLANTING PLAN

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION
MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#: 52852
EXP. DATE: 6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
X

PROJECT STATUS:	
6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV.3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	48 OF 51

R:\Rescad\Projects\102054-MDSHA Cabin Branch\STREAM DESIGN\Plan Sheets\102054-PLANTING PLAN.dwg, 3/15/2022 10:35:39 AM, bwilfong, ARCH expand D (24.00 x 36.00 Inches), 1:1

GRAPHIC SCALE: 1" = 80'

0' 80' 160' 240'

LEGEND:

- PR. FORESTED WETLAND TREES / S
- PR. RIPARIAN TREES
- PR. UPLAND TREES
- PR. RIPARIAN SEEDING
- PR. UPLAND SEEDING
- PR. STREAM BANK PLANTING

MATCHLINE SHEET 48

NOTES:
1. TOPOGRAPHY WITHIN THE SURVEY LIMITS IS BASED ON A GROUND SURVEY PERFORMED BY AMT ENGINEERING FROM JANUARY-FEBRUARY 2020. CONTOUR INTERVAL 1'. SEE SHEET 2 FOR COMPLETE NOTES.
2. TOPOGRAPHY & LINEWORK OUTSIDE THE SURVEY LIMITS IS BASED ON AVAILABLE GIS DATA. GIS TOPOGRAPHY CONTOUR INTERVAL 2'.
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WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

PLANTING PLAN

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#: 52852
EXP. DATE: 6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV.3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BWJC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	49 OF 51

MONITORING PLAN & REPORTS

AS-BUILT REPORT

An as-built report shall be submitted within 60 days of completion of mitigation activities. The as-built report shall include comparisons of the design plan to the as-built plan, using the following components:

- Plan view maps of the constructed wetlands, streams, and adjacent buffers that depict the Boundaries, as-built topography, all mitigation activities (including buffer activities), and the locations of all monitoring stations (photo stations, anticipated vegetation sampling plots, wetland monitoring wells, stream gages, cross-sections, longitudinal profiles, pattern and bank vegetation monitoring stations, etc.).
- As-built longitudinal profiles of stream reaches taken from permanent locations and overlaid with and compared to design longitudinal profiles.
- As-built cross-sections of stream reaches taken at permanent locations; overlaid with and compared to design cross-sections.
- Photographs of the completed construction taken at permanent photo stations.
- Summary of stream geomorphologic data presented in a side-by-side comparison of the design and as-built channels.
- Planting composition, overall locations, and densities.
- Revised credit totals and individual mitigation activities. Explain any differences in credits totals from design to as-built plans.

SUCCESS CRITERIA

Streams

- Hydrology: Visually classify stream flow (perennial, intermittent, ephemeral) during the first and final monitoring years. Stream flow is to meet or exceed baseline flow.
- Lateral Stability: The following parameters shall be used to evaluate lateral stability:
  a) The Bankfull stream Cross-Sectional Area shall not increase or decrease by an amount greater than 25% of the as-built stream cross-sectional area.
  b) The numbers of live stakes and woody stems of native tree and shrub species providing bank stabilization from the top of bank to the toe of slope shall be at least 1 living stem per 50 square feet per stream edge along the bank by the end of the first growing season following planting and maintained each monitoring year until canopy coverage is 30% for any identified reach. Canopy coverage shall be at least 30% each monitoring year thereafter. Data shall be collected adjacent to each cross-section.
- Vertical Stability: A longitudinal profile survey shall demonstrate <0.5' thalweg change from as-built riffle elevations.
- Bedform Diversity: The D50 size particle remains within the as-built size class (silt, sand, gravel, cobble, or boulder), or the D50 size particle remains within its design size class (silt, sand, gravel, cobble, or boulder).
- Habitat Assessment: (For perennial streams only) Using A *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers* (RBP assessment), the Total Score of the Habitat Assessment for each reach shall be 100 or greater at Year 1, and each monitoring year thereafter the Total Score shall be equal to or greater than the previous monitoring year's Total Score.
- Structure Stability: Visual observations/photographs and written narrative shall demonstrate:
  a) Absence of collapsed structure or repositioned header rocks.
  b) Absence of under cutting, washing around, or erosion of the bank or streambed associated with any instream structure that could lead to a collapsed structure or repositioned head rock.
  c) All structures are exposed, unless they are specified as buried rock or log sill structures.

Wetlands

- Wetland Vegetation Dominance: Wetland vegetation dominance, defined as a vegetation community where more than 50% of all dominant plant species across all strata are rated obligate ("OBL"), facultative wet ("FACW"), or facultative ("FAC"), using the vegetation sampling procedures as described in the appropriate regional supplement to the Corps of Engineers Wetland Delineation Manual, must be achieved
- Areal Cover Vegetative Standards: The minimum areal cover shall be vegetated by native (FAC or wetter) species annually as described below:
  a) Year 1: a minimum of 50%
  b) Year 2: a minimum of 60%
  c) Year 3: a minimum of 70%
  d) Year 5: a minimum of 85%

  Additionally, volunteer species should support functions consistent with the project design goals.
- Non-Native and Invasive Species: No more than 10% of relative plant cover over the entire mitigation site shall be made up by non-native or invasive species, with no individual colony greater than or equal to 5% of relative plant cover. No more than 5% of relative plant cover over the entire site shall be made up of *Phragmites australis*, *Persicaria perfoliata*, or *Lythrum salicaria*. Invasive species are identified on the 2010 National Park Service/U.S. Fish and Wildlife Service document *Plant Invaders of Mid Atlantic Natural Areas* and the Maryland Invasive Species Council *Invasive Species of Concern in Maryland*. *Phalaris arundinacea* and *Typha spp.* may also be considered as invasive species by MDE and the Corps. Native status will be based on the Natural Resources Conservation Service Plants Database.
- Wetland Species Richness: For scrub/shrub wetlands, establish a minimum of three species of native wetland shrubs (FAC or wetter) with no more than 75% relative cover of one species, over the entire mitigation site. For forested wetlands, establish a minimum of three species of native wetland trees and two species of native wetland shrubs (FAC or wetter) with no more than 75% relative cover of one species, over the entire mitigation site. Loblolly pine cannot be more than 35% relative cover
- Wetland Vegetation Density for PSS and PFO: For scrub-shrub or forested wetlands, native wetland (FAC or wetter) plant density of at least 435 living trees/shrubs per acre with a minimum height of 10 inches shall be achieved by the end of the first year a monitoring report is required and maintained each monitoring year thereafter through the end of the monitoring period.
- Wetland Vegetation Cover for PFO: For forested wetlands, average tree height of tallest five native wetland (FAC or wetter) trees within each sample plot shall be
  a) ≥3' in height at year three.
  b) ≥5' at year five and each monitoring year thereafter.

  Additionally, planted trees/shrubs shall have a minimum height of 10 inches by the end of the first year. Canopy cover of native wetland (FAC or wetter) trees and shrubs must be at least 30% by the end of the monitoring period.
- Wetland Hydrology: Wetland hydrology, defined as 14 consecutive days of ponding, or a water table 12 inches or less below the soil surface, during the growing season at a minimum frequency of 5 years in 10 (50 percent or higher probability). For the purpose of this determination, the growing season should be based on median dates (i.e., 50 percent probability) of 28ºF air temperatures in spring and fall, based on the long-term data for the nearest appropriate weather station, as recorded in the WETS tables available from the NRCS (https://www.wcc.nrcs.usda.gov/climate/navigate_wets.html), or as specified in the appropriate regional supplement to the Corps of Engineers Wetland Delineation Manual.
- Wetland Soils: The entire wetland restoration or creation area must meet the Hydric Soil Technical Standard (Technical Note 11) developed by the National Technical Committee for Hydric Soils for saturated conditions and anaerobic conditions:
  a) Free water must exist within 10 inches (25 cm) of the ground surface for at least 14 consecutive days; and
  b) Anaerobic conditions must exist within 10 inches (25 cm) of the ground surface for at least 14 consecutive days. Anaerobic conditions may be determined by one of the following methods, as detailed in the Hydric Soil Technical Standard:
     (1) Positive reaction to alpha-alpha dipyridyl, determined as least weekly.
     (2) Reduction of iron determined with IRIS devices (tubes or films) installed for 30 days.
     (3) Measurement of redox potential (Eh) using platinum electrodes, determined at least weekly.

Buffer Area(s)

- Areal Cover Vegetative Standards: The minimum areal cover shall be vegetated by native species annually as described below:
  a) Year 1: a minimum of 50%
  b) Year 2: a minimum of 60%
  c) Year 3: a minimum of 70%
  d) Year 5: a minimum of 85%

  Additionally, volunteer species should support functions consistent with the project design goals.
- Non-Native and Invasive Species: No more than 10% of relative plant cover over the entire mitigation site shall be made up by non-native or invasive species, with no individual colony greater than or equal to 5% of relative plant cover. No more than 5% of relative plant cover over the entire site shall be made up of *Pueraria montana*, *Phragmites australis*, *Persicaria perfoliata*, or *Lythrum salicaria*. Invasive species are identified on the 2010 National Park Service/U.S. Fish and Wildlife Service document *Plant Invaders of Mid Atlantic Natural Areas* and the Maryland Invasive Species Council Invasive Species of Concern in Maryland. Native status will be based on the Natural Resources Conservation Service Plants Database.
  Vegetation Density: Native plant density of at least 435 living trees/shrubs per acre shall be achieved by the end of the first year and maintained each monitoring year thereafter. Additionally, planted trees/shrubs shall have a minimum height of 10 inches by the end of the first year.

MONITORING PROVISIONS

- The monitoring period begins the year the mitigation planting occurs, unless planting occurs after April 15, in which case the monitoring period will not begin until the following year. For each monitoring report, vegetative monitoring shall be conducted between May 1 and September 30.
- The permittee must prepare an invasive species eradication and maintenance plan to remove non-native invasive plant species within the project site if annual site visits document their presence. The plan must be submitted to the Corps for approval along with the annual monitoring report.
- Site visits shall preferably occur doing a period with normal precipitation and groundwater levels.
- Monitoring must be conducted a minimum of once per year during years that monitoring reports are required.

Streams

Stream restoration shall be monitored for five (5) out of ten (10) years; with reports at Years 1 (As-built), 3, 5. 7, and 10.

- Riffle Cross-Sections: Two (2) riffle cross sections (per stream) will be monitored.
- Longitudinal Profiles (thalweg): The Year 1 (As-built) longitudinal surveyor may include thalweg, bankfull, and potential top of bank and toe of slope depending on the designed channels cross section. Longitudinal profiles with be shown in a graphical display that overlays previous profiles in annual reports. Subsequent years longitudinal profiles will include only the thalweg.
- Habitat Assessment: Stream habitat will be monitored by using an assessment method such as EPA's Rapid Bioassessment Protocol (RBP) high gradient stream habitat form in pre-construction. Results of stream habitat assessments will be shown for all monitoring years at the time the report is submitted, including a preconstruction monitoring report.
- Biological Sampling: Sampling results for macroinvertebrates will be provided, including a figure indicating how each metric is trending considering pre-construction values. Biological samples will occur once during the monitoring period at representative reaches of stream and will be sampled during the same time of year as preconstruction samples.
- Photographs: Site conditions will be documented with established, fixed photo stations along the entire length of each stream restoration project area. Photographs will focus on vegetation, wetlands as applicable, and stream conditions. Photographs will also include each grade control structure (upstream and downstream) and cross sections (upstream and downstream).
- The stream project will be evaluated at least twice during the active monitoring period using the Maryland Stream Mitigation Framework calculator.
- The permittee must notify and provide to the Corps, a detailed description and construction plans for any necessary corrective measures, including maintenance and repair, or alteration in any way, of the permitted stream restoration 15 days prior to performance of such corrective measures for review and approval.
- If the project is determined to be stable at the end of Year 5 and meets all final year performance standards for two consecutive years, the permittee may request an exemption from additional stream monitoring requirements.

Stream reaches will be reevaluated with the MSMF Stream Calculator during monitoring years 3, 5, 7, and 10. Notes will be made in the calculation runs on earlier years (3, 5, 7) where further improvements are expected to occur and with any remedial actions needed to maintain the project and vegetation.

Wetlands

- Vegetation: Ten (10) vegetation plots (with an established minimum of 400 square feet in size for woody stem counts from which a minimum of nine (9) square feet will be evaluated for herbaceous vegetation), will be established across the site. The vegetation data shall include:
  a) Vegetative species identification
  b) Estimate of actual and relative percent cover by plant species, in order of dominance across all strata for each plot, shown in a table
  c) Number of woody plant stems (total and #/acre)
  d) The percentage of dominant species FAC or wetter
  e) Estimate of percent survival by planted woody species
  f) A non-native/invasive species assessment including percent cover
- For scrub-shrub or forested wetlands, measure the height of the tallest five trees within each sample plot in each monitoring year. In the final year of monitoring, measure canopy cover.
- Data should be summarized for each plot, by field/cell, and for the entire site.
- Hydrology: Five (5) groundwater monitoring wells will be established according to the 2005 Corps document entitled *Technical Standard for Water-Table Monitoring of Potential Wetland Sites ERDC TN-WRAP-05-02.* Hydrology data shall include*:*
  a) Monitoring data for surface water and groundwater, including hydrograph of measured depth to water table, after calibrating for above-ground height of well. Data should be included for each well separately.
  b) Discuss how precipitation during this monitoring year compares with historical precipitation data for that location.
  c) Summarize results of the hydrology monitoring for each well, by field/cell, and for the entire site, including if each meets/does not meet
  d) Additionally, estimate the percent of the site that is inundated or saturated to the surface on the dates of the site visits.
- Soils: Monitoring data (soil profile with photos) to determine if hydric soils are actively developing. Data should be included for each sample location. This must include evidence that saturated and anaerobic soil conditions are being met, as measured by alpha-alpha dipyridyl, IRIS devices (tubes or films), or platinum electrodes.
- Delineation of Aquatic Resources: At the final year of the monitoring period, the wetland boundary area as shown on the approved mitigation plan, shall be delineated using the wetland criteria outlined in the Corps of Engineers Wetlands Delineation Manual (1987) and appropriate regional supplement(s). Delineated wetlands shall be broken into projected vegetative type (e.g., emergent, scrub-shrub, forested) based on species present and density. In addition, all special aquatic sites, other waters, such as lakes and ponds, and all streams, within the approved mitigation site shall be identified and delineated. The delineated aquatic resource mitigation areas as verified by the MDE and/or Corps shall be consistent with the approved mitigation plan and contain at least as much wetland acreage and waterway linear feet as required in the permit. Deep water habitats and unvegetated areas that do not meet wetland criteria shall not be included in area measurements.
- Wetland function assessment: An assessment of the specific wetland functions and values being provided should be conducted during the first and final years of the monitoring period. The Corps New England District document entitled *Wetland Functions and Values: A Descriptive Approach*, or equivalent, shall be used for each wetland cell/area.

Buffer Area(s)

- Vegetation: Fifteen (15) vegetation plots (with an established minimum of 400 square feet in size for woody stem counts from which a minimum of nine (9) square feet will be evaluated for herbaceous vegetation), will be established across the site. The vegetation data shall include:
  a) Vegetative species identification
  b) Percent ground cover assessment for each species, across all strata for each plot, shown in a table
  c) Number of woody plant stems (total and #/acre)
  d) Estimate of percent survival by planted woody species
- A non-native/invasive species assessment including percent Estimate percent cover by plant species across all strata for each plot. For each species listed in the table include native/non-native status.
- For scrub-shrub or forested buffers, estimate the percent survival of planted trees and number of native trees/shrubs per acre.
- Data should be summarized for each plot, by field/cell, and for the entire site.

MONITORING REPORTS

Monitoring reports will be submitted to Agencies by December 31st each reporting year following construction. The following information must be included with the monitoring report:

- Monitoring and Performance Standards: Summary table comparing the required performance standards to the conditions and status of the developing mitigation site must be completed and attached to the beginning of the Monitoring Report. The table will list the monitoring requirements and performance standards and evaluate whether the compensatory mitigation project site, including each area (plot, well, field or cell as appropriate), is successfully achieving the approved performance standards or trending towards success.
- Project Overview / Background Data:
  - Title page indicating the permit name, permit tracking number (Corps permit number and MDE NT number), mitigation site name (if applicable), phase (if applicable), monitoring year, and preparer identification (name, address, phone number, and email address).
  - Written description of the location, any identifiable landmarks of the mitigation site, including information to locate the site perimeter(s), and coordinates of the mitigation site (expressed as latitude and longitude).
  - Date(s) of site inspections.
  - A brief paragraph describing the goals and objectives of the mitigation site, including the authorized impact acreage and type of aquatic resource impacted, proposed mitigation acreage and aquatic resource type approved as part of the Phase II Wetland Mitigation Plan or Permit. Include the dates the mitigation construction was started and the planting was completed.
  - A brief narrative description of the mitigation site addressing its position in the landscape, adjacent waterbodies, and adjacent land use.
  - Describe methods used to evaluate performance standards. Plot locations should be clearly identified on the appropriate maps.
  - A short statement on whether the performance standards are being met.
  - A narrative description of existing mitigation site conditions and functions and how the mitigation site has or has not achieved the goals, objectives and performance standards established for the project.
  - Dates of any recent corrective or maintenance activities conducted since the previous report submission.
  - Specific recommendations for any additional corrective or remedial actions.
  - Estimate the percent of the mitigation site that is establishing into wetland and the type of wetland system (ex: forested, scrub-shrub, emergent). If this differs from what was planned, show the boundaries of the actual wetland area/types on the plans or maps.
  - Estimate the percent of the mitigation site buffer that is establishing into forested buffer. If this differs from what was planned, show the boundaries of the actual forested buffer area on the plans or maps.
  - Discussion of growing season and how it was determined for this site.
- Summary data: Summary data should be provided to substantiate the success and/or potential challenges associated with the compensatory mitigation project. Refer to Section IV below for monitoring report measurements to include for the overall site.
- Photographs: Take one set of photographs from
  a) Established photographic points
  b) Vegetation plots (each cardinal direction)
  c) In-stream structures (upstream and downstream)
  d) Cross-sections (upstream and downstream)

  Photos are to be taken between May 1 and September 30 of each monitoring year (pictures should be taken at the same time of year when possible). Photo location points should be identified on the appropriate maps and labeled with the direction in which the photo was taken.
- Maps and Plans: Maps should be provided to show the location of the compensatory mitigation site relative to other landscape features, habitat types, locations of photographic reference points, transects, sampling data points (e.g., vegetation plots, wells, soil samples, etc.), and/or other features pertinent to the mitigation plan. GPS coordinates should be shown on the plans for each photographic reference point and sample plot. In addition, the submitted maps and plans should clearly delineate the mitigation site perimeter(s), which will assist the project managers in locating the mitigation area(s) during subsequent site inspections. Each map or diagram should be formatted to print on a standard 8.5 by 11-inch piece of paper and include a legend and the location of any photos submitted for review. As-built plans should be included if they were not already submitted to MDE and the Corps.
- Conclusions: A general statement shall be included that describes the conditions of the compensatory mitigation project. If performance standards are not being met, a brief explanation of the difficulties and potential remedial actions proposed by the Permittee, including a timetable, must be provided. MDE and the Corps will ultimately determine if the mitigation site is successful for a given monitoring period.

INVASIVE SPECIES MANAGEMENT

The sponsor will manage all invasive species as necessary to achieve compliance with the Non-Native and Invasive Species Success Criteria outlined above. Invasive species will be identified using the 2010 National Park Service/U.S. Fish and Wildlife Service document *Plant Invaders of Mid Atlantic Natural Areas* and the Maryland Invasive Species Council Invasive Species of Concern in Maryland.

In the event that effective control on the site is no longer practicable (such as if the watershed or drainage area in which the site is located is determined to be infested with these species), is unreasonably expensive, or is more likely to harm surrounding native vegetation than help it, appropriate management reductions may be submitted to the Corps and MDE for approval.

All herbicide application will be carried out under the supervision of a Maryland Licensed Pesticide Applicator and in accordance with labeling and EPA requirements. It is expected that most treatments, if necessary, will be conducted using spot sprayers; however, other suitable means of application may be employed as/where necessary. Treatment shall be focused on areas of known infestation reported in the annual Monitoring Reports. Exact treatment methods and timing shall be determined by species.

Once the forest canopy is established, invasive species should pose a minimal threat to the site's integrity. After canopy closure, invasive species issues should only occur in areas that undergo some type of disturbance. In the event of a forest canopy disturbance, the disturbed area should be closely monitored for invasive species prevalence.

res
HGS, LLC - A RES COMPANY
5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4644 F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION

MONITORING PLAN

MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#: 52852
EXP. DATE: 6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1 X

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
2/15/2021	65% MIT. PLAN REV.
9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	50 OF 51

GRAPHIC SCALE: 1" = 150'
0' 150' 300' 450'

LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. OVERHEAD ELECTRIC
- EX. SANITARY SEWER
- EX. STORM UTILITY
- EX. GAS
- EX. POND
- EX. STREAM
- EX. WETLAND
- SURVEY LIMITS
- PR. CONSERVATION EASEMENT
- PR. BANKFULL
- PR. FORESTED WETLAND RESTORATION
- PR. WETLAND ENHANCEMENT
- PR. WETLAND BUFFER ENHANCEMENT
- PR. RIPARIAN BUFFER (35' BUFFER)
- PR. RIPARIAN BUFFER ENHANCEMENT
- # PHOTOSTATION
- # MONITORING WELL
- # MONITORING CROSS-SECTION
- # UPLAND VEGETATION PLOT
- # WETLAND VEGETATION PLOT

PFO WETLAND 5
1.16 ACRES

REACH 2
1,856 LF RESTORED

TRIBUTARY 4
813 LF RESTORED

PFO WETLAND 3
0.40 ACRES

PFO WETLAND 2
0.18 ACRES RESTORED
0.03 ACRES ENHANCEMENT

TRIBUTARY 3
724 LF RESTORED

TRIBUTARY 2
421 LF RESTORED

TRIBUTARY 1
497 LF RESTORED

PFO WETLAND 4
1.53 ACRES

TRIBUTARY 5
39 LF RESTORED

REACH 1
2,825 LF RESTORED

PFO WETLAND
1.11 AC

WATKINS MILL RD.

MONTGOMERY VILLAGE AVE.

STEWARTOWN RD.

CLUB HOUSE RD.

USL2 MR MONT VILLAGE BUSINESS TR
19550 MONTGOMERY VILLAGE AVE
GAITHERSBURG, MD 20879
PARCEL # = 00772244
ZONE = TLD, CRN-0.55

POTOMAC ELECTRIC POWER CO
C/O CORP TAX DEPT STE 561
701 9TH ST NW
WASHINGTON, DC 20068
PARCEL # = 00775407
ZONE = R-200

POTOMAC ELECTRIC POWER CO
C/O CORP TAX DEPT STE 561
701 9TH ST NW
WASHINGTON, DC 20068
PARCEL # = 00775420
ZONE = R-200

THIS SHEET FOR REFERENCE ONLY

res
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5367 TELEPHONE ROAD, WARRENTON, VIRGINIA 20187
P: 703.393.4844 | F: 703.393.2934
WWW.RES.US

MONITORING PLAN

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION
MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
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LICENSE#: 52852
EXP. DATE: 6/14/2022

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REVISIONS:

PROJECT STATUS:

6/26/2020	CONCEPT PLAN
11/9/2020	65% MIT. PLAN
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9/3/2021	65% MIT. PLAN REV. 2
11/22/2021	65% MIT. PLAN REV. 3
3/10/2022	65% MIT. PLAN REV. 4

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	11/22/2021
SHEET NO:	51 OF 51

Appendix B: Option Agreement with Green Bloom MV Park LLC and Green Bloom MV Development, LLC

DRAFT

SHA 63.30-10(02/01/95)
Office of Real Estate

Permanent Easement Option Contract
with the
State Highway Administration
of the
Maryland Department of Transportation

R/W Contract No.
AZ0485172-0002
Item No.

THIS OPTION, granted this of in the year **20** ,

BY:
Name:
Green Bloom MV Park, LLC

Address:
19550 Montgomery Village Avenue
Gaithersburg, MD 20886

and the Mortgagees, Trustees and/or Lien Holders listed in the PAYEE CLAUSE who will be contacted by the STATE HIGHWAY ADMINISTRATION for the purpose of agreeing to release the land, easements and/or rights hereinafter described from the operation and effect of any mortgage and/or lien which they may hold upon the property of the above mentioned persons, it being understood and agreed that they retain their rights as mortgagees and/or lienors in and to the remainder of the land of the above mentioned persons not hereby agreed to be conveyed.

All as the parties of the first part, hereinafter called the GRANTORS, to **HGS, LLC, a Virginia limited liability company ("HGS")** on behalf of the STATE OF MARYLAND, party of the second part, hereinafter called the GRANTEE.

A. **WHEREAS,** the said GRANTEE proposes to lay out, open, establish, construct, extend, widen, straighten, grade and improve as a part of the State Highway System of Maryland, a highway and/or bridge, together with the appurtenances thereto belonging, shown on the plans designated as Construction Contract No. **AZ0485172-B** for the improvements to **Cabin Branch Phase I Stream Mitigation** in **Montgomery** County.

B. **WITNESSETH,** that in consideration of the mutual benefits, inuring to each of the parties hereto and the covenants and agreements between them, incorporated herein, beneficial to each of the parties to this agreement, the said GRANTORS do hereby give and grant to the GRANTEE, its successors and assigns, the exclusive right and option to purchase for a period of twelve (12) months from the date hereof, for the sum of **One Hundred Ninety-eight Thousand Eight Hundred Fifty and No/100** Dollars **($198,850.00**) all of the following described land, easements, rights, privileges and controls.

C. **ALL THE EASEMENTS, RIGHTS, PRIVILEGES AND CONTROLS,** as shown and/or indicated, on the **attached preliminary plat** all of which plat are made a part hereof, and which are duly recorded, or intended to be recorded among the Land Records of the aforesaid County.

D. TEMPORARY CONSTRUCTION EASEMENT: TOGETHER with the temporary right during the period of construction to use the area of land shown on the **attached preliminary plat** for the purpose of **construction access, stockpiling materials and haul roads.**

E. **IT IS FURTHER AGREED** that the GRANTORS will **N/A.**

F. **IT IS FURTHER AGREED** that the GRANTEE will **N/A.**

G. **IT IS FURTHER AGREED** that the deed or deeds or other instruments of conveyance executed by the GRANTORS conveying to the GRANTEE all of the land, premises, easements, rights and privileges described in this option must contain covenants (running with and binding the remaining property of the GRANTORS, and binding the GRANTORS, their heirs, successors and assigns) that will perpetuate all of the rights and privileges

agreed to be conveyed to the GRANTEE under the provisions of this option. The terms and conditions of this contract shall survive the execution and delivery of the deed and shall not become merged therein.

H. **IT IS FURTHER AGREED** that the GRANTORS herein do hereby authorize and designate

Name:	Address:
Green Bloom MV Park, LLC	**c/o Monument Realty LLC** **750 17th Street NW Ste. 110** **Washington, DC 20006**

as their specified Agent or the individual Grantor to receive, on their behalf, the official notice of the acceptance of this option by the GRANTEE, said notice to be forwarded by mail to said specified Agent or Grantor. The said GRANTORS do hereby further authorize the GRANTEE, its members, officers, agents or employees to enter in and upon the hereinbefore described premises and proceed with the construction of the said state roads and/or bridge and their appurtenances, immediately upon the mailing by the GRANTEE to said Agent or Grantor, by mail, of the said notice of the acceptance of this option. The taking possession of said land and premises by the GRANTEE, however, shall not be construed as a waiver of any objection to title.

I. **IT IS FURTHER AGREED** that upon acceptance of this option by the GRANTEE, said GRANTORS will, upon demand, convey unto the State of Maryland, to the use of the State Highway Administration of the Department of Transportation (or to such person or persons as may be designated by the GRANTEE), by a special warranty deed, or deeds, a good and marketable fee simple title, the same to be delivered to the office of the GRANTEE at Baltimore, Maryland, or to a duly appointed agent acting for the GRANTEE in this particular instance, within thirty (30) days from the date of said demand, to be made in writing within three (3) months from the date of the acceptance of this option; provided that, GRANTORS and GRANTEE further agree each to employ their best efforts to conform with said time periods except, however, that no cause of action shall lie for the failure of such best efforts to so conform. The deed or deeds, and other instruments of conveyance must meet with the approval of the Office of Counsel of the State Highway Administration and shall contain the covenants set forth in this option.

J. **PAYEE CLAUSE:** Payment shall be made for the land rights herein agreed to be conveyed, upon receipt of the approvals mentioned in this option, by check, from the Treasurer of the State of Maryland, said checks, except as herein otherwise provided, to be made payable to **Green Bloom MV Park, LLC** its heirs and assigns.

K. **IT IS FURTHER AGREED** that the contents of this option and the acceptance thereof, comprise the entire contract and that no verbal representations made before or after the signing hereof, or anything not herein written, shall vary the terms of this option, and that the payment of **One Hundred Ninety-eight Thousand Eight Hundred Fifty and No/100** dollars **($198,850.00)** by the GRANTEE shall constitute full and final payment for the acquisition of the property described in this option, and any damages to the remainder thereof, if any.

Relocation Assistance payments and services, if any, are in addition to, and are not included, as any part of this option contract.

IN WITNESS WHEREOF THE GRANTORS have hereunto set their hands and seals.
SIGNED, SEALED AND DELIVERED IN THE PRESENCE OF:

FOR: Green Bloom MV Park, LLC, a Delaware limited liability company

By: Monument Realty LLC, its authorized agent

WITNESS Valerie Mnayazij _____ _____ **(SEAL)**
BY: F. Russell Hines, Authorized Signatory

HGS, LLC

WITNESS _____ _____ **(SEAL)**
BY: Ben Eubanks, General Manager

STATE OF ~~Maryland~~ District of Columbia ~~COUNTY OF~~

I hereby certify that, before me, the subscriber, a NOTARY PUBLIC of the ~~STATE OF~~ District of Columbia, in and for County personally appeared F. Russell Hines and each severally acknowledged the aforegoing option to be his respective act.

AS WITNESS MY HAND AND NOTARY SEAL, this 5th of October in the year 2020

NOTARY PUBLIC Emily M. Lilly

NOTARY SEAL

EMILY M. LILLY
COMMISSION EXPIRES
NOTARY
PUBLIC
11-14-2024
DISTRICT OF COLUMBIA

My Commission expires 11/14/2024

IN WITNESS WHEREOF THE GRANTORS have hereunto set their hands and seals.
SIGNED, SEALED AND DELIVERED IN THE PRESENCE OF:

FOR: Green Bloom MV Park, LLC

WITNESS _____ _____**(SEAL)**
BY: F. Russell Hines, President

HGS, LLC

WITNESS _____ _____**(SEAL)**
BY: Ben Eubanks, General Manager

STATE OF **Maryland** COUNTY OF

I hereby certify that, before me, the subscriber, a NOTARY PUBLIC of the STATE OF Virginia, in and for City of Richmond County personally appeared BEN EUBANKS and each severally acknowledged the aforegoing option to be his respective act.

AS WITNESS MY HAND AND NOTARY SEAL, this 28th of September in the year 2020

NOTARY PUBLIC Ronda LaFern Gooden

NOTARY SEAL

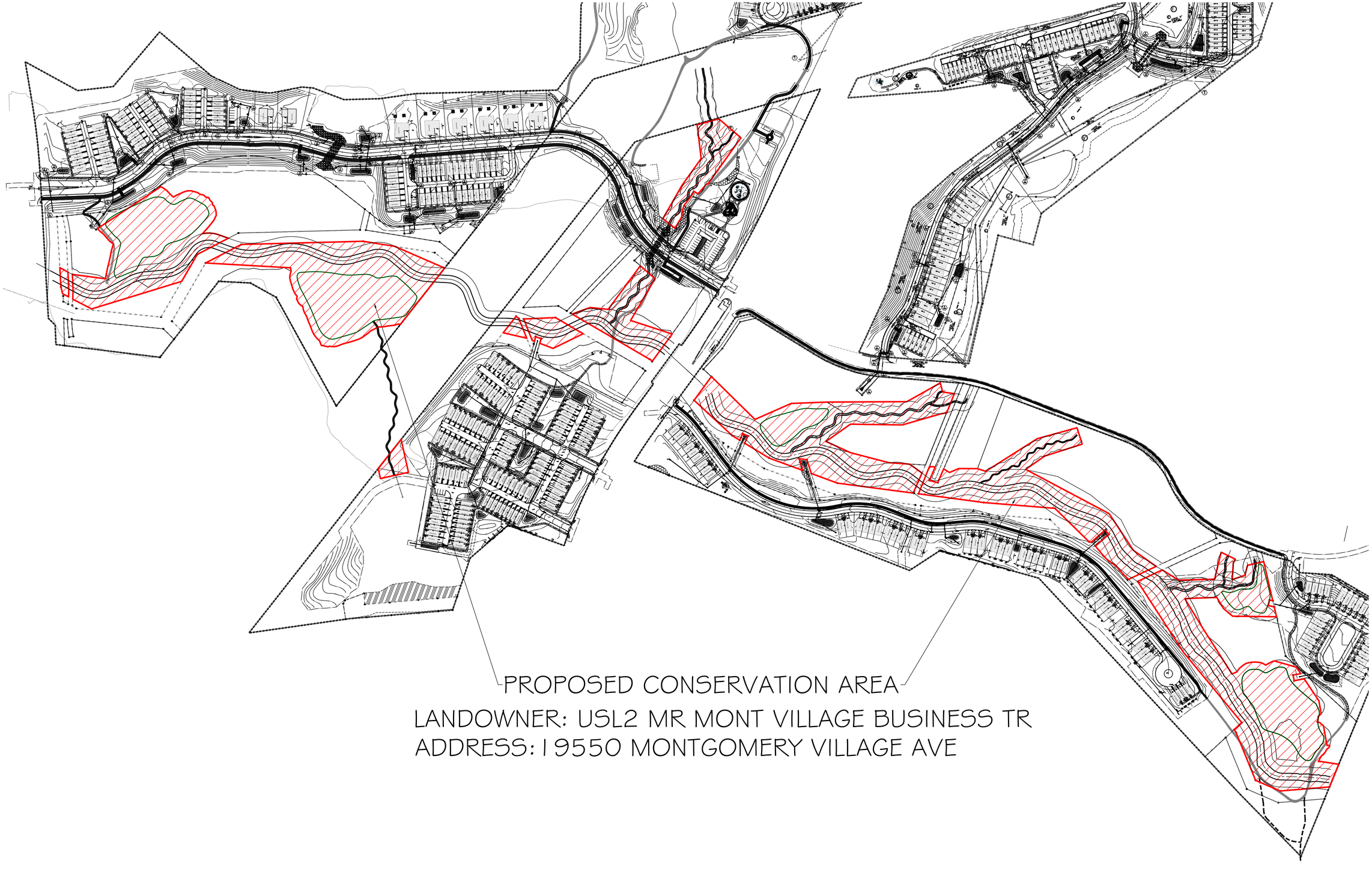
RONDA LaFERN GOODEN
NOTARY PUBLIC
REG. # 7747374
MY COMMISSION EXPIRES
10/31/2021
COMMONWEALTH OF VIRGINIA

My Commission expires 10/31/2021

The aforegoing option is hereby accepted this of in the year .

STATE HIGHWAY ADMINISTRATION
of the
DEPARTMENT OF TRANSPORTATION OF MARYLAND

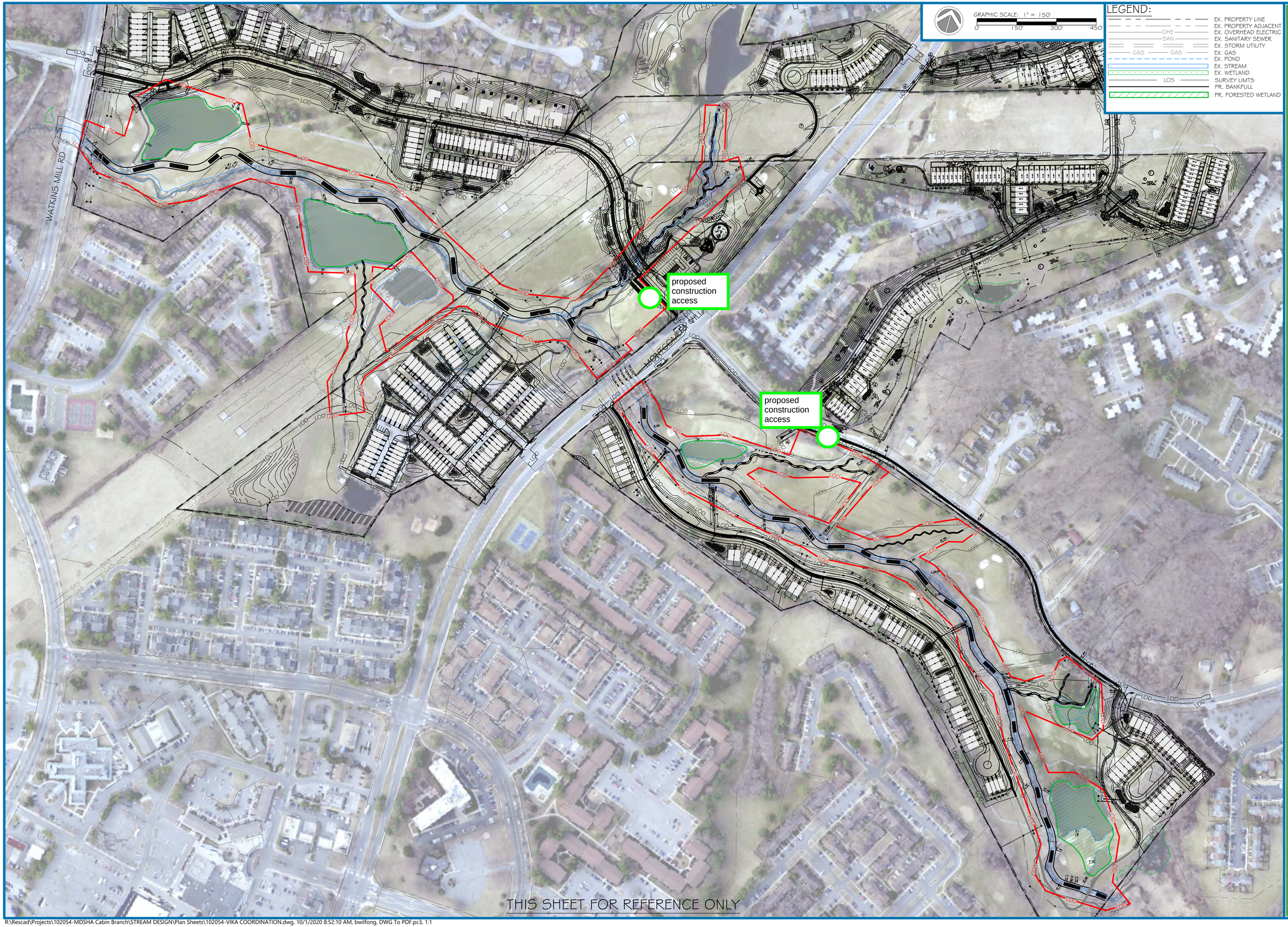
by: _____



PROPOSED CONSERVATION AREA

LANDOWNER: USL2 MR MONT VILLAGE BUSINESS TR

ADDRESS: 19550 MONTGOMERY VILLAGE AVE



THIS SHEET FOR REFERENCE ONLY

res
HGS, LLC - A RES COMPANY
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P: 703.393.4644 | F: 703.393.2934
WWW.RES.US

PROJECT: RFP-2 CABIN BRANCH
CLIENT: MARYLAND STATE HIGHWAY ADMINISTRATION
MONTGOMERY COUNTY, MARYLAND

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE#:52852
EXP. DATE:6/14/2022

NOT FOR CONSTRUCTION

REVISIONS:
1

PROJECT STATUS:	
6/26/2020	CONCEPT PLAN
9/25/2020	65% MIT. PLAN

PROJECT MANAGER:	RC
DESIGNED:	BW/JC
DRAWN:	JC
JOB NUMBER:	102054
DESIGN TYPE:	STREAM
DATE:	9/25/2020
SHEET NO:	4 OF 48

Appendix C: Cabin Branch Function Based Rapid Stream Assessment

DRAFT

FINAL DRAFT
FUNCTION-BASED RAPID STREAM ASSESSMENT METHODOLOGY

METHODOLOGY SEQUENCE

A report has been completed that provides detailed guidance on how this assessment is to be conducted (Starr et al, 2015). It can be located on the USFWS Chesapeake Bay Field Office website under Stream Restoration Protocol Publications. The methodology report in written based on the sequence in how the assessment should be conducted, as much as possible. However, there are some sections in the report that are out of sequence based on where that information is recorded on the data sheets. Therefore, this section lists the order of how the assessment should be conducted. The following is the rapid function-based assessment stepwise procedure:

1. Office Pre Site Visit Tasks
2. Rapid Watershed Assessment Form
3. Rapid Assessment Summary Form – Bankfull Determination
4. Rapid Assessment Summary Form – Rosgen Classification
5. Existing and Proposed Function-based Rapid Reach Level Stream Assessment Form – Only the existing conditions
6. Rapid Assessment Summary Form - Overall Existing Function-based Rapid Stream Assessment
7. Rapid Assessment Summary Form – Channel Evolution Trend
8. Rapid Assessment Summary Form - Restoration Potential
9. Existing and Proposed Function-based Rapid Reach Level Stream Assessment Form - proposed conditions
10. Rapid Assessment Summary Form – Overall Proposed Function-based Rapid Stream Assessment
11. Overall Project Evaluation

EXISTING and PROPOSED REACH LEVEL STREAM FUNCTION-BASED RAPID ASSESSMENT FIELD DATA SHEET

Watershed:	Middle Potomac - Catoctin	Rater(s):	RC/BW
Stream:	Cabin Branch	Date:	3/10/2022
Reach Length:	5008 linear feet	Latitude:	39.177353
Photo(s):	See Attached	Longitude:	-77.199137
Reach ID:	Cabin Branch	**Reach Score/Reach Total**	**Ex. 60/170 Prop.: 134/170**
			Quality: Ex: 0.35 Prop:0.79

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category: Functioning	Functioning-at-Risk	Not Functioning
Runoff	**Stream Function Pyramid Level 1 Hydrology**			
	1. Concentrated Flow	No potential for concentrated flow/impairments from adjacent land use	Some potential for concentrated flow/impairments to reach restoration site, however, measures are in place to protect resources	Potential for concentrated flow/impairments to reach restoration site and no treatments are in place
	Existing Condition	10 9 8	7 6 5 4	**3** 2 1
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	2. Flashiness	Non-flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover less than 6%	Semi-flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover 7 - 15%	Flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover greater than 15%
	Existing Condition	10 9 8	7 6 5 **4**	3 2 1
	Proposed Condition	10 9 8	7 **6** 5 4	3 2 1
	Stream Function Pyramid Level 1 Hydrology Overall EXISTING Condition		**F FAR NF**	**Score:7**
	Stream Function Pyramid Level 1 Hydrology Overall PROPOSED Condition		**F FAR NF**	**Score:14**
Floodplain Connectivity (Vertical Stability)	**Stream Function Pyramid Level 2 Hydraulics**			
	3. Bank Height Ratio (BHR)	<1.20	1.21 - 1.50	>1.50
	Existing Condition	10 9 8	7 6 5 4	3 **2** 1
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
	4a. Entrenchment (Meandering streams in alluvial valleys or Rosgen C, E, DA Streams)	>2.2	2.1 - 1.4	<1.4
	Existing Condition	10 9 8	7 6 **5** 4	3 2 1
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
	4b. Entrenchment (Non meandering streams in colluvial valleys or Rosgen B Streams)	>1.4	1.3 - 1.1	<1.1
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	5. Floodplain Drainage	no concentrated flow; runoff is primarily sheet flow; hillslopes < 10%; hillslopes >200 ft from stream; ponding or wetland areas and litter or debris jams are well represented	runoff is equally sheet and concentrated flow (minor gully and rill erosion occurring); hillslopes 10 - 40%; hillslopes 50 - 200 ft from stream; ponding or wetland areas and litter or debris jams are minimally represented	concentrated flows present (extensive gully and rill erosion); hillslopes >40%; hillslopes <50 ft from stream; ponding or wetland areas and litter or debris jams are not well represented or absent
	Existing Condition	10 9 8	7 6 5 4	**3** 2 1
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
	6. Vertical Stability Extent	Stable	Localized Instability	Widespread Instability
	Existing Condition	10 9 8	7 6 5 **4**	3 2 1
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
	Stream Function Pyramid Level 2 Hydraulics Overall EXISTING Condition		**F FAR NF**	**Score:14**
	Stream Function Pyramid Level 2 Hydraulics Overall PROPOSED Condition		**F FAR NF**	**Score:36**

Reach ID:	Cabin Branch	Reach Score/Reach Total Ex. 60/170 Prop.: 134/170	Quality: Ex: 0.35 Prop:0.79

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category: Functioning	Functioning-at-Risk	Not Functioning
Stream Function Pyramid Level 3 Geomorphology				
Riparian Vegetation (Score = Average of Left and Right bank, max score of 10)	7. Riparian Vegetation Zone (EPA, 1999, modified)	Riparian zone extends to a width of >100 feet; good vegetation community diversity and density; human activities do not impact zone; invasive species not present or sparse	Riparian zone extends to a width of 25-100 feet; species composition is dominated by 2 or 3 species; human activities greatly impact zone; invasive species well represented and alter the community	Riparian zone extends to a width of <25 feet; little or no riparian vegetation due to human activities; majority of vegetation is invasive
	Left Bank Existing	10 9 8	7 6 5 4	3 **2** 1
	Left Bank Proposed	10 **9** 8	7 6 5 4	3 2 1
	Right Bank Existing	10 9 8	7 6 5 4	3 **2** 1
	Right Bank Proposed	10 **9** 8	7 6 5 4	3 2 1
Lateral Stability (Score =Average of Left and right bank, max score of 10)	8. Dominant Bank Erosion Rate Potential	Dominate bank erosion rate potential is low or BEHI/NBS Rating: L/VL, L/L, L/M, L/H, L/VH, M/VL	Dominate bank erosion rate potential is moderate or BEHI/NBS Rating: M/L, M/M, M/H, L/Ex, H/L, M/VH, M/Ex, H/L, H/M, VH/VL, Ex/VL	Dominate bank erosion rate potential is high or BEHI/NBS Rating: H/H, H/Ex, VH/H, Ex/M, Ex/H, Ex/VH, VH/VH, Ex/Ex
	Existing Condition (Right bank)	10 9 8	7 6 5 **4**	3 2 1
	Proposed Condition (Right Bank)	10 **9** 8	7 6 5 4	3 2 1
	Existing Condition (Left bank)	10 9 8	7 6 5 **4**	3 2 1
	Proposed Condition (Left Bank)	10 **9** 8	7 6 5 4	3 2 1
	9. Lateral Stability Extent	Stable	Localized Instability	Widespread Instability
	Existing Condition	10 9 8	7 6 5 4	**3** 2 1
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
Bedform Diversity (Do not complete if stream is ephemeral)	10. Shelter for Fish and Macroinvertebrates (EPA 1999)	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, rubble, gravel, cobble and large rocks, or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient)	20-70% mix of stable habitat; suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale)	Less than 20% mix of stable habitat; lack of habitat availability less than desirables obvious; substrate unstable or lacking
	Existing Condition	10 9 8	7 6 5 **4**	3 2 1
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	11a. Pool-to-Pool Spacing Ratio (Watersheds < 10 mi^2)	4.0 - 5.0	3.0 - 4.0 ***or*** 5.0 - 7.0	< 3.0 ***or*** >7.0
	Existing Condition	10 9 8	7 6 5 4	**3** 2 1
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
	11b. Pool-to-Pool Spacing Ratio (Watersheds > 10 mi^2)	5.0 - 7.0	3.5 - 5.0 ***or*** 7.0 - 8.0	<3.5 ***or*** >8.0
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	12a. Pool Max Depth Ratio/Depth Variability (Gravel Bed Streams)	>1.5	1.2 - 1.5	<1.2
	Existing Condition	10 9 8	7 6 5 4	**3** 2 1
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
	12b. Pool Max Depth Ratio/Depth Variability (Sand Bed Streams)	>1.2	1.1 - 1.2	<1.1
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
Bedform Diversity (Do not complete if stream is ephemeral)	**Moderate Gradient Perennial Streams in Colluvial Valleys**			
	11. Pool-to-Pool Spacing Ratio (3-5% Slope)	2.0 - 4.0	4.0 - 6.0	>6.0
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	12. Pool Max Depth Ratio/Depth Variability	>1.5	1.2 - 1.5	<1.2
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1

Stream Function Pyramid Level 3 Geomorphology Overall EXISTING Condition F **FAR** NF **Score:17**

Stream Function Pyramid Level 3 Geomorphology Overall PROPOSED Condition **F** FAR NF **Score:53**

Reach ID:	Cabin Branch	Reach Score/Reach Total	Ex. 60/170 Prop.: 134/170	Quality: Ex: 0.35 Prop:0.79

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category: Functioning	Functioning-at-Risk	Not Functioning
Stream Function Pyramid Level 4 Physicochemical				
Water Quality and Nutrients (Do not complete if stream is ephemeral)	13. Water Appearance and Nutrient Enrichment (USDA 1999)	Very clear, or clear but tea-colored; objects visible at depth 3 to 6 ft (less if slightly colored); no oil sheen on surface; no noticeable film on submerged objects or rocks. Clear water along entire reach; diverse aquatic plant community includes low quantities of many species of macrophytes; little algal growth present	Frequent cloudiness especially after storm events; objects visible to depth 0.5 to 3.0 ft; may have slight green color; no oil sheen on water surface. Fairly clear or slightly greenish water along entire reach; moderate algal growth on stream substrate	Very turbid or muddy appearance most of the time; objects visible at depth< 0.5 ft; slow moving water maybe bright green; other obvious water pollutants; floating algal mats, surface scum, sheen or heavy coat of foam on surface; or strong odor of chemicals, oil, sewage, or other pollutants. Pea-green, gray, or brown water along entire reach; dense stands of macrophytes clogging stream; severe algal blooms creating thick algal
	Existing Condition	10 9 8	7 6 5 4	**3** 2 1
	Proposed Condition	10 9 8	7 6 **5** 4	3 2 1
	14. Detritus (Petersen, 1992)	Mainly consisting of leaves and wood without sediment covering it	Leaves and wood scarce; fine organic debris without sediment	Fine organic sediment - black in color and foul odor (anaerobic) or detritus absent
	Existing Condition	10 9 8	7 6 5 **4**	3 2 1
	Proposed Condition	10 9 8	7 **6** 5 4	3 2 1

Stream Function Pyramid Level 4 Physicochemical Overall EXISTING Condition F **FAR** **NF** **Score:7**

Stream Function Pyramid Level 4 Physicochemical Overall PROPOSED Condition F **FAR** NF **Score:11**

Biology (Do not complete if stream is ephemeral)				
Stream Function Pyramid Level 5 Biology				
	15. Macroinvertebrate	Abundant	Rare	Not present
	Existing Condition	10 9 8	7 6 **5** 4	3 2 1
	Proposed Condition	10 9 8	7 **6** 5 4	3 2 1
	16. Macroinvertebrate Tolerance	Abundant intolerant species	Limited intolerant species	Only tolerant species
	Existing Condition	10 9 8	7 6 **5** 4	3 2 1
	Proposed Condition	10 9 8	7 **6** 5 4	3 2 1
	17. Fish Presence	Abundant	Rare	Not present
	Existing Condition	10 9 8	7 6 **5** 4	3 2 1
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	If existing biology is FAR or NF, provide description of cause(s)			

Stream Function Pyramid Level 5 Biology Overall EXISTING Condition F **FAR** **NF** **Score: 15**

Stream Function Pyramid Level 5 Biology Overall PROPOSED Condition **F** **FAR** **NF** **Score: 20**

Reach ID:	Cabin Branch	Reach Score/Reach Total	Ex. 60/170 Prop.: 134/170	Quality: Ex: 0.35 Prop:0.79

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category		
		Functioning	Functioning-at-Risk	Not Functioning

Bankfull Determination and Rosgen Stream Classification

Rosgen Stream Type (Observation): EX - F PRO - C/Bc

Regional Curve (circle one): **Piedmont** Coastal Plain Allegheny Plateau/Ridge and Valley Urban Karst

DA (sqmi)	4.32		
BF Width (ft)	26.2-27.0	BF Area (sqft)	40.6-50.7
BF Depth (ft)	1.5-1.94	Percent Impervious (%)	21.3

Field Measurements

Parameter	Measurements and Ratios			
Water surface to geomorphic feature elevation difference	Existing Min:1.6, Max: 2.5, Avg.:2.0			
Riffle Mean Depth at Bankfull Stage (dbkf)	Existing Min:1.7, Max: 2.29, Avg.:2.09	Proposed: 1.73 & 1.84		
Riffle Width at Bankfull Stage (Wbkf)	Existing Min:17.1, Max:22.5, Avg.:20.2	Proposed: 23.2 & 25.6		
Riffle XS Area at Bankfull Stage (Abkf = dbkf*Wbkf)	Existing Min: 34.4, Max: 45.8, Avg.:40.3	Proposed: 40.18 & 41.12		
Floodprone Area Width (Wfpa) (Wfpa=Width at elevation determined by 2xDmax)	Existing Not calculated at all XS Minimum 28.23	Target: 92.8 & 102.4		
Entrenchment Ratio (ER) (ER=Wfpa/Wbkf)	Existing Min: 1.4, Max: 1.93 Avg: 1.6	Target 4.0		
Low Bank Height (LBH)	Existing Min: 4.09, Max: 5.52, Avg.:4.53	Proposed: 2.3 & 2.4		
Riffle Maximum Depth at Bankfull Stage (Dmax)	Existing Min: 1.95, Max: 3.35, Avg.:2.56	Proposed: 2.3 & 2.4		
Bank Height Ratio (BHR) (BHR=LBH/Dmax)	Existing Min: 1.46, Max: 2.24, Avg.:1.79	Proposed: 1.0		
BEHI/NBS Ratings and Lengths	H/M, H/L, M/M, M/L, L/L	L/L		
Pool to Pool Spacing (P-P)	Ranges from 47-168	Proposed: Min:104, Max:168, Avg.:136.6		
Pool to Pool Spacing Ratio (P-P Ratio) (P-P Ratio=P-P/Wbkf)	Range from 2.4-8.4	Proposed: Min:4.4, Max:7.0, Avg.:5.7		
Pool Maximum Depth at Bankfull Stage (Dmbkfp)	n/a	Proposed: 4.3 & 4.6		
Pool Depth Ratio (Dmbkfp Ratio) (Dmbkfp Ratio=Dmbkfp/dbkf)	n/a	Proposed: 2.5		
Macroinvertebrate Taxa Observed	n/a	n/a		

EXISTING and PROPOSED REACH LEVEL STREAM FUNCTION-BASED RAPID ASSESSMENT FIELD DATA SHEET

Watershed:	Middle Potomac - Catoctin	Rater(s):	RC/BW
Stream:	Un -Named Tributary to Cabin Branch	Date:	3/10/2022
Reach Length:	542 linear feet	Latitude:	39.177353
Photo(s):	See Attached	Longitude:	-77.199137
Reach ID:	Trib 1	**Reach Score/Reach Total**	**Ex. 24/170 Prop.: 136/170** **Quality: Ex: 0.14 Prop:0.8**

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category: Functioning	Functioning-at-Risk	Not Functioning
Runoff	**Stream Function Pyramid Level 1 Hydrology**			
	1. Concentrated Flow	No potential for concentrated flow/impairments from adjacent land use	Some potential for concentrated flow/impairments to reach restoration site, however, measures are in place to protect resources	Potential for concentrated flow/impairments to reach restoration site and no treatments are in place
	Existing Condition	10 9 8	7 6 5 4	3 **2** 1
	Proposed Condition	10 9 8	7 6 **5** 4	3 2 1
	2. Flashiness	Non-flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover less than 6%	Semi-flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover 7 - 15%	Flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover greater than 15%
	Existing Condition	10 9 8	7 6 5 4	**3** 2 1
	Proposed Condition	10 9 8	7 **6** 5 4	3 2 1
	Stream Function Pyramid Level 1 Hydrology Overall EXISTING Condition	**F FAR NF**		**Score:5**
	Stream Function Pyramid Level 1 Hydrology Overall PROPOSED Condition	**F FAR NF**		**Score:11**
Floodplain Connectivity (Vertical Stability)	**Stream Function Pyramid Level 2 Hydraulics**			
	3. Bank Height Ratio (BHR)	<1.20	1.21 - 1.50	>1.50
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
	4a. Entrenchment (Meandering streams in alluvial valleys or Rosgen C, E, DA Streams)	>2.2	2.1 - 1.4	<1.4
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
	4b. Entrenchment (Non meandering streams in colluvial valleys or Rosgen B Streams)	>1.4	1.3 - 1.1	<1.1
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	5. Floodplain Drainage	no concentrated flow; runoff is primarily sheet flow; hillslopes < 10%; hillslopes >200 ft from stream; ponding or wetland areas and litter or debris jams are well represented	runoff is equally sheet and concentrated flow (minor gully and rill erosion occurring); hillslopes 10 - 40%; hillslopes 50 - 200 ft from stream; ponding or wetland areas and litter or debris jams are minimally represented	concentrated flows present (extensive gully and rill erosion); hillslopes >40%; hillslopes <50 ft from stream; ponding or wetland areas and litter or debris jams are not well represented or absent
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
	6. Vertical Stability Extent	Stable	Localized Instability	Widespread Instability
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	Stream Function Pyramid Level 2 Hydraulics Overall EXISTING Condition	**F FAR NF**		**Score:4**
	Stream Function Pyramid Level 2 Hydraulics Overall PROPOSED Condition	**F FAR NF**		**Score:26**

Reach ID:	Trib 1	Reach Score/Reach Total Ex. 24/170 Prop.: 136/170	Quality: Ex: 0.14 Prop:0.8

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category		
		Functioning	Functioning-at-Risk	Not Functioning
Stream Function Pyramid Level 3 Geomorphology				
Riparian Vegetation (Score = Average of Left and Right bank, max score of 10)	7. Riparian Vegetation Zone (EPA, 1999, modified)	Riparian zone extends to a width of >100 feet; good vegetation community diversity and density; human activities do not impact zone; invasive species not present or sparse	Riparian zone extends to a width of 25-100 feet; species composition is dominated by 2 or 3 species; human activities greatly impact zone; invasive species well represented and alter the community	Riparian zone extends to a width of <25 feet; little or no riparian vegetation due to human activities; majority of vegetation is invasive
	Left Bank Existing	10 9 8	7 6 5 4	**3** 2 1
	Left Bank Proposed	10 **9** 8	7 6 5 4	3 2 1
	Right Bank Existing	10 9 8	7 6 5 4	**3** 2 1
	Right Bank Proposed	10 **9** 8	7 6 5 4	3 2 1
Lateral Stability (Score =Average of Left and right bank, max score of 10)	8. Dominant Bank Erosion Rate Potential	Dominate bank erosion rate potential is low or BEHI/NBS Rating: L/VL, L/L, L/M, L/H, L/VH, M/VL	Dominate bank erosion rate potential is moderate or BEHI/NBS Rating: M/L, M/M, M/H, L/Ex, H/L, M/VH, M/Ex, H/L, H/M, VH/VL, Ex/VL	Dominate bank erosion rate potential is high or BEHI/NBS Rating: H/H, H/Ex, VH/H, Ex/M, Ex/H, Ex/VH, VH/VH, Ex/Ex
	Existing Condition (Right bank)	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition (Right Bank)	10 **9** 8	7 6 5 4	3 2 1
	Existing Condition (Left bank)	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition (Left Bank)	10 **9** 8	7 6 5 4	3 2 1
	9. Lateral Stability Extent	Stable	Localized Instability	Widespread Instability
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
Bedform Diversity (Do not complete if stream is ephemeral)	10. Shelter for Fish and Macroinvertebrates (EPA 1999)	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, rubble, gravel, cobble and large rocks, or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient)	20-70% mix of stable habitat; suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale)	Less than 20% mix of stable habitat; lack of habitat availability less than desirables obvious; substrate unstable or lacking
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	11a. Pool-to-Pool Spacing Ratio (Watersheds < 10 mi^2)	4.0 - 5.0	3.0 - 4.0 ***or*** 5.0 - 7.0	< 3.0 ***or*** >7.0
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	11b. Pool-to-Pool Spacing Ratio (Watersheds > 10 mi^2)	5.0 - 7.0	3.5 - 5.0 ***or*** 7.0 - 8.0	<3.5 ***or*** >8.0
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	12a. Pool Max Depth Ratio/Depth Variability (Gravel Bed Streams)	>1.5	1.2 - 1.5	<1.2
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	12b. Pool Max Depth Ratio/Depth Variability (Sand Bed Streams)	>1.2	1.1 - 1.2	<1.1
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
Moderate Gradient Perennial Streams in Colluvial Valleys				
Bedform Diversity (Do not complete if stream is ephemeral)	11. Pool-to-Pool Spacing Ratio (3-5% Slope)	2.0 - 4.0	4.0 - 6.0	>6.0
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	12. Pool Max Depth Ratio/Depth Variability	>1.5	1.2 - 1.5	<1.2
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1

Stream Function Pyramid Level 3 Geomorphology Overall EXISTING Condition F FAR NF Score:8

Stream Function Pyramid Level 3 Geomorphology Overall PROPOSED Condition F FAR NF Score:51

Reach ID:	Trib 1	Reach Score/Reach Total	Ex. 24/170 Prop.: 136/170	Quality: Ex: 0.14 Prop:0.8

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category: Functioning	Functioning-at-Risk	Not Functioning

Stream Function Pyramid Level 4 Physicochemical

Water Quality and Nutrients (Do not complete if stream is ephemeral)

13. Water Appearance and Nutrient Enrichment (USDA 1999)	Very clear, or clear but tea-colored; objects visible at depth 3 to 6 ft (less if slightly colored); no oil sheen on surface; no noticeable film on submerged objects or rocks. Clear water along entire reach; diverse aquatic plant community includes low quantities of many species of macrophytes; little algal growth present			Frequent cloudiness especially after storm events; objects visible to depth 0.5 to 3.0 ft; may have slight green color; no oil sheen on water surface. Fairly clear or slightly greenish water along entire reach; moderate algal growth on stream substrate				Very turbid or muddy appearance most of the time; objects visible at depth< 0.5 ft; slow moving water maybe bright green; other obvious water pollutants; floating algal mats, surface scum, sheen or heavy coat of foam on surface; or strong odor of chemicals, oil, sewage, or other pollutants. Pea-green, gray, or brown water along entire reach; dense stands of macrophytes clogging stream; severe algal blooms creating thick algal		
Existing Condition	10	9	8	7	6	5	4	**3**	2	1
Proposed Condition	10	9	**8**	7	6	5	4	3	2	1
14. Detritus (Petersen, 1992)	Mainly consisting of leaves and wood without sediment covering it			Leaves and wood scarce; fine organic debris without sediment				Fine organic sediment - black in color and foul odor (anaerobic) or detritus absent		
Existing Condition	10	9	8	7	6	5	4	3	2	**1**
Proposed Condition	10	9	**8**	7	6	5	4	3	2	1

Stream Function Pyramid Level 4 Physicochemical Overall EXISTING Condition F FAR **NF** **Score:4**

Stream Function Pyramid Level 4 Physicochemical Overall PROPOSED Condition **F** FAR NF **Score:16**

Stream Function Pyramid Level 5 Biology

Biology (Do not complete if stream is ephemeral)

15. Macroinvertebrate	Abundant			Rare				Not present		
Existing Condition	10	9	8	7	6	5	4	3	2	**1**
Proposed Condition	10	9	**8**	7	6	5	4	3	2	1
16. Macroinvertebrate Tolerance	Abundant intolerant species			Limited intolerant species				Only tolerant species		
Existing Condition	10	9	8	7	6	5	4	3	2	**1**
Proposed Condition	10	9	**8**	7	6	5	4	3	2	1
17. Fish Presence	Abundant			Rare				Not present		
Existing Condition	10	9	8	7	6	5	4	3	2	**1**
Proposed Condition	10	9	**8**	7	6	5	4	4	2	1
If existing biology is FAR or NF, provide description of cause(s)	Stream is currently piped.									

Stream Function Pyramid Level 5 Biology Overall EXISTING Condition F FAR **NF** **Score: 3**

Stream Function Pyramid Level 5 Biology Overall PROPOSED Condition **F** FAR NF **Score:24**

Reach ID:	Trib 1	Reach Score/Reach Total	Ex. 24/170 Prop.: 136/170	Quality: Ex: 0.14 Prop:0.8

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category		
		Functioning	Functioning-at-Risk	Not Functioning

Bankfull Determination and Rosgen Stream Classification

Rosgen Stream Type (Observation) EX - Stream is currently piped PRO - C

Regional Curve (circle one): **Piedmont** Coastal Plain Allegheny Plateau/Ridge and Valley Urban Karst

DA (sqmi)	0.15		
BF Width (ft)	5.6-7.1	BF Area (sqft)	2.7-4.4
BF Depth (ft)	0.48-0.62	Percent Impervious (%)	21.3

Field Measurements

Parameter	Measurements and Ratios			
Water surface to geomorphic feature elevation difference	Ex- Channel is piped Upstream Reference: 0.3-0.7; avg: 0.51			
Riffle Mean Depth at Bankfull Stage (dbkf)	Ex- Channel is piped Upstream Reference: 0.32-0.65; avg.: 0.54	Proposed: 0.39 & 0.49		
Riffle Width at Bankfull Stage (Wbkf)	Ex- Channel is piped Upstream Reference: 4.7-8.1; avg.: 6.48	Proposed: 5.0 & 6.6		
Riffle XS Area at Bankfull Stage (Abkf = dbkf*Wbkf)	Ex- Channel is piped Upstream Reference: 2.5-4.3; avg.: 3.40	Proposed: 1.95 & 3.24		
Floodprone Area Width (Wfpa) (Wfpa=Width at elevation determined by 2xDmax)	Ex- Channel is piped Upstream Reference: 6.0-9.1; avg.: 8.4	Target: 20 & 26.4		
Entrenchment Ratio (ER) (ER=Wfpa/Wbkf)	Ex- Channel is piped Upstream Reference: 1.12-1.45; avg.: 1.31	Target 4.0		
Low Bank Height (LBH)	Ex- Channel is piped Upstream Reference: 0.96-3.75; avg.: 2.51	Proposed: 2.3 & 2.4		
Riffle Maximum Depth at Bankfull Stage (Dmax)	Ex- Channel is piped Upstream Reference: 0.42-1.10; avg.: 0.82	Proposed: 0.5 & 0.6		
Bank Height Ratio (BHR) (BHR=LBH/Dmax)	Ex- Channel is piped Upstream Reference: 2.3-3.6; avg.: 2.9	Proposed: 1.0		
BEHI/NBS Ratings and Lengths	Ex- Channel is piped	L/L		
Pool to Pool Spacing (P-P)	Ex- Channel is piped	Proposed: Min: 21, Max: 46, Avg.: 34		
Pool to Pool Spacing Ratio (P-P Ratio) (P-P Ratio=P-P/Wbkf)	Ex- Channel is piped	Proposed: Min:3.2, Max:7.3, Avg.:5.6		
Pool Maximum Depth at Bankfull Stage (Dmbkfp)	Ex- Channel is piped	Proposed: 1.0 & 1.2		
Pool Depth Ratio (Dmbkfp Ratio) (Dmbkfp Ratio=Dmbkfp/dbkf)	Ex- Channel is piped	Proposed: 2.5		
Macroinvertebrate Taxa Observed	Ex- Channel is piped	n/a		

EXISTING and PROPOSED REACH LEVEL STREAM FUNCTION-BASED RAPID ASSESSMENT FIELD DATA SHEET

Watershed:	Middle Potomac - Catoctin	Rater(s):	RC/BW
Stream:	Un -Named Tributary to Cabin Branch	Date:	3/10/2022
Reach Length:	421 linear feet	Latitude:	39.177353
Photo(s):	See Attached	Longitude:	-77.199137
Reach ID:	Trib 2	**Reach Score/Reach Total**	**Ex. 24/170 Prop.: 136/170** **Quality: Ex: 0.14 Prop:0.8**

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category: Functioning	Functioning-at-Risk	Not Functioning
Runoff	**Stream Function Pyramid Level 1 Hydrology**			
	1. Concentrated Flow	No potential for concentrated flow/impairments from adjacent land use	Some potential for concentrated flow/impairments to reach restoration site, however, measures are in place to protect resources	Potential for concentrated flow/impairments to reach restoration site and no treatments are in place
	Existing Condition	10 9 8	7 6 5 4	3 **2** 1
	Proposed Condition	10 9 8	7 6 **5** 4	3 2 1
	2. Flashiness	Non-flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover less than 6%	Semi-flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover 7 - 15%	Flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover greater than 15%
	Existing Condition	10 9 8	7 6 5 4	**3** 2 1
	Proposed Condition	10 9 8	7 **6** 5 4	3 2 1
	Stream Function Pyramid Level 1 Hydrology Overall EXISTING Condition	**F FAR NF**		**Score:5**
	Stream Function Pyramid Level 1 Hydrology Overall PROPOSED Condition	**F FAR NF**		**Score:11**
Floodplain Connectivity (Vertical Stability)	**Stream Function Pyramid Level 2 Hydraulics**			
	3. Bank Height Ratio (BHR)	<1.20	1.21 - 1.50	>1.50
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
	4a. Entrenchment (Meandering streams in alluvial valleys or Rosgen C, E, DA Streams)	>2.2	2.1 - 1.4	<1.4
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
	4b. Entrenchment (Non meandering streams in colluvial valleys or Rosgen B Streams)	>1.4	1.3 - 1.1	<1.1
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	5. Floodplain Drainage	no concentrated flow; runoff is primarily sheet flow; hillslopes < 10%; hillslopes >200 ft from stream; ponding or wetland areas and litter or debris jams are well represented	runoff is equally sheet and concentrated flow (minor gully and rill erosion occurring); hillslopes 10 - 40%; hillslopes 50 - 200 ft from stream; ponding or wetland areas and litter or debris jams are minimally represented	concentrated flows present (extensive gully and rill erosion); hillslopes >40%; hillslopes <50 ft from stream; ponding or wetland areas and litter or debris jams are not well represented or absent
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
	6. Vertical Stability Extent	Stable	Localized Instability	Widespread Instability
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	Stream Function Pyramid Level 2 Hydraulics Overall EXISTING Condition	**F FAR NF**		**Score:4**
	Stream Function Pyramid Level 2 Hydraulics Overall PROPOSED Condition	**F FAR NF**		**Score:26**

Reach ID:	Trib 2	Reach Score/Reach Total Ex. 24/170 Prop.: 136/170	Quality: Ex: 0.14 Prop:0.8

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category: Functioning	Functioning-at-Risk	Not Functioning
Stream Function Pyramid Level 3 Geomorphology				
Riparian Vegetation (Score = Average of Left and Right bank, max score of 10)	7. Riparian Vegetation Zone (EPA, 1999, modified)	Riparian zone extends to a width of >100 feet; good vegetation community diversity and density; human activities do not impact zone; invasive species not present or sparse	Riparian zone extends to a width of 25-100 feet; species composition is dominated by 2 or 3 species; human activities greatly impact zone; invasive species well represented and alter the community	Riparian zone extends to a width of <25 feet; little or no riparian vegetation due to human activities; majority of vegetation is invasive
	Left Bank Existing	10 9 8	7 6 5 4	**3** 2 1
	Left Bank Proposed	10 **9** 8	7 6 5 4	3 2 1
	Right Bank Existing	10 9 8	7 6 5 4	**3** 2 1
	Right Bank Proposed	10 **9** 8	7 6 5 4	3 2 1
Lateral Stability (Score =Average of Left and right bank, max score of 10)	8. Dominant Bank Erosion Rate Potential	Dominate bank erosion rate potential is low or BEHI/NBS Rating: L/VL, L/L, L/M, L/H, L/VH, M/VL	Dominate bank erosion rate potential is moderate or BEHI/NBS Rating: M/L, M/M, M/H, L/Ex, H/L, M/VH, M/Ex, H/L, H/M, VH/VL, Ex/VL	Dominate bank erosion rate potential is high or BEHI/NBS Rating: H/H, H/Ex, VH/H, Ex/M, Ex/H, Ex/VH, VH/VH, Ex/Ex
	Existing Condition (Right bank)	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition (Right Bank)	10 **9** 8	7 6 5 4	3 2 1
	Existing Condition (Left bank)	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition (Left Bank)	10 **9** 8	7 6 5 4	3 2 1
	9. Lateral Stability Extent	Stable	Localized Instability	Widespread Instability
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
Bedform Diversity (Do not complete if stream is ephemeral)	10. Shelter for Fish and Macroinvertebrates (EPA 1999)	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, rubble, gravel, cobble and large rocks, or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient)	20-70% mix of stable habitat; suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale)	Less than 20% mix of stable habitat; lack of habitat availability less than desirables obvious; substrate unstable or lacking
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	11a. Pool-to-Pool Spacing Ratio (Watersheds < 10 mi^2)	4.0 - 5.0	3.0 - 4.0 ***or*** 5.0 - 7.0	< 3.0 ***or*** >7.0
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	11b. Pool-to-Pool Spacing Ratio (Watersheds > 10 mi^2)	5.0 - 7.0	3.5 - 5.0 ***or*** 7.0 - 8.0	<3.5 ***or*** >8.0
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	12a. Pool Max Depth Ratio/Depth Variability (Gravel Bed Streams)	>1.5	1.2 - 1.5	<1.2
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	12b. Pool Max Depth Ratio/Depth Variability (Sand Bed Streams)	>1.2	1.1 - 1.2	<1.1
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
Moderate Gradient Perennial Streams in Colluvial Valleys				
Bedform Diversity (Do not complete if stream is ephemeral)	11. Pool-to-Pool Spacing Ratio (3-5% Slope)	2.0 - 4.0	4.0 - 6.0	>6.0
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	12. Pool Max Depth Ratio/Depth Variability	>1.5	1.2 - 1.5	<1.2
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1

Stream Function Pyramid Level 3 Geomorphology Overall EXISTING Condition F FAR NF Score:8

Stream Function Pyramid Level 3 Geomorphology Overall PROPOSED Condition F FAR NF Score:51

Reach ID:	Trib 2	Reach Score/Reach Total Ex. 24/170 Prop.: 136/170	Quality: Ex: 0.14 Prop:0.8

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category: Functioning	Functioning-at-Risk	Not Functioning
Stream Function Pyramid Level 4 Physicochemical				
Water Quality and Nutrients (Do not complete if stream is ephemeral)	13. Water Appearance and Nutrient Enrichment (USDA 1999)	Very clear, or clear but tea-colored; objects visible at depth 3 to 6 ft (less if slightly colored); no oil sheen on surface; no noticeable film on submerged objects or rocks. Clear water along entire reach; diverse aquatic plant community includes low quantities of many species of macrophytes; little algal growth present	Frequent cloudiness especially after storm events; objects visible to depth 0.5 to 3.0 ft; may have slight green color; no oil sheen on water surface. Fairly clear or slightly greenish water along entire reach; moderate algal growth on stream substrate	Very turbid or muddy appearance most of the time; objects visible at depth< 0.5 ft; slow moving water maybe bright green; other obvious water pollutants; floating algal mats, surface scum, sheen or heavy coat of foam on surface; or strong odor of chemicals, oil, sewage, or other pollutants. Pea-green, gray, or brown water along entire reach; dense stands of macrophytes clogging stream; severe algal blooms creating thick algal
	Existing Condition	10 9 8	7 6 5 4	**3** 2 1
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	14. Detritus (Petersen, 1992)	Mainly consisting of leaves and wood without sediment covering it	Leaves and wood scarce; fine organic debris without sediment	Fine organic sediment - black in color and foul odor (anaerobic) or detritus absent
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1

Stream Function Pyramid Level 4 Physicochemical Overall EXISTING Condition F FAR **NF** **Score:4**

Stream Function Pyramid Level 4 Physicochemical Overall PROPOSED Condition **F** FAR NF **Score:16**

Stream Function Pyramid Level 5 Biology

Biology (Do not complete if stream is ephemeral)										
	15. Macroinvertebrate	Abundant			Rare				Not present	
	Existing Condition	10	9	8	7	6	5	4	3	2 **1**
	Proposed Condition	10	9	**8**	7	6	5	4	3	2 1
	16. Macroinvertebrate Tolerance	Abundant intolerant species			Limited intolerant species				Only tolerant species	
	Existing Condition	10	9	8	7	6	5	4	3	2 **1**
	Proposed Condition	10	9	**8**	7	6	5	4	3	2 1
	17. Fish Presence	Abundant			Rare				Not present	
	Existing Condition	10	9	8	7	6	5	4	3	2 **1**
	Proposed Condition	10	9	**8**	7	6	5	4	4	2 1
	If existing biology is FAR or NF, provide description of cause(s)	Stream is currently piped.								

Stream Function Pyramid Level 5 Biology Overall EXISTING Condition F FAR **NF** **Score: 3**

Stream Function Pyramid Level 5 Biology Overall PROPOSED Condition **F** FAR NF **Score:24**

Reach ID:	Trib 2	Reach Score/Reach Total	Ex. 24/170 Prop.: 136/170	Quality: Ex: 0.14 Prop:0.8

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category		
		Functioning	Functioning-at-Risk	Not Functioning

Bankfull Determination and Rosgen Stream Classification

Rosgen Stream Type (Observation) EX - Stream is currently piped PRO - C

Regional Curve (circle one): **Piedmont** Coastal Plain Allegheny Plateau/Ridge and Valley Urban Karst

DA (sqmi)	0.02		
BF Width (ft)	2.3-3.3	BF Area (sqft)	0.6-1.1
BF Depth (ft)	0.25-0.32	Percent Impervious (%)	21.3

Field Measurements

Parameter	Measurements and Ratios			
Water surface to geomorphic feature elevation difference	Ex- Channel is piped			
Riffle Mean Depth at Bankfull Stage (dbkf)	Ex- Channel is piped	Proposed: 0.24		
Riffle Width at Bankfull Stage (Wbkf)	Ex- Channel is piped	Proposed: 3.2		
Riffle XS Area at Bankfull Stage (Abkf = dbkf*Wbkf)	Ex- Channel is piped	Proposed: 0.78		
Floodprone Area Width (Wfpa) (Wfpa=Width at elevation determined by 2xDmax)	Ex- Channel is piped	Target: 12.8		
Entrenchment Ratio (ER) (ER=Wfpa/Wbkf)	Ex- Channel is piped	Target 4.0		
Low Bank Height (LBH)	Ex- Channel is piped	Proposed: 0.35		
Riffle Maximum Depth at Bankfull Stage (Dmax)	Ex- Channel is piped	Proposed: 0.35		
Bank Height Ratio (BHR) (BHR=LBH/Dmax)	Ex- Channel is piped	Proposed:1.0		
BEHI/NBS Ratings and Lengths	Ex- Channel is piped	L/L		
Pool to Pool Spacing (P-P)	Ex- Channel is piped	Proposed: Min: 16, Max: 24, Avg.: 20		
Pool to Pool Spacing Ratio (P-P Ratio) (P-P Ratio=P-P/Wbkf)	Ex- Channel is piped	Proposed: Min:5, Max:7.5, Avg.:6.3		
Pool Maximum Depth at Bankfull Stage (Dmbkfp)	Ex- Channel is piped	Proposed: 0.6		
Pool Depth Ratio (Dmbkfp Ratio) (Dmbkfp Ratio=Dmbkfp/dbkf)	Ex- Channel is piped	Proposed:2.5		
Macroinvertebrate Taxa Observed	Ex- Channel is piped	n/a		

EXISTING and PROPOSED REACH LEVEL STREAM FUNCTION-BASED RAPID ASSESSMENT FIELD DATA SHEET

Watershed:	Middle Potomac - Catoctin	Rater(s):	RC/BW
Stream:	Un -Named Tributary to Cabin Branch	Date:	3/10/2022
Reach Length:	8016 linear feet	Latitude:	39.177353
Photo(s):	See Attached	Longitude:	-77.199137
Reach ID:	Trib 3	**Reach Score/Reach Total**	**Ex. 24/170 Prop.: 136/170** **Quality: Ex: 0.14 Prop:0.8**

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category: Functioning	Functioning-at-Risk	Not Functioning
Runoff	**Stream Function Pyramid Level 1 Hydrology**			
	1. Concentrated Flow	No potential for concentrated flow/impairments from adjacent land use	Some potential for concentrated flow/impairments to reach restoration site, however, measures are in place to protect resources	Potential for concentrated flow/impairments to reach restoration site and no treatments are in place
	Existing Condition	10 9 8	7 6 5 4	3 **2** 1
	Proposed Condition	10 9 8	7 6 **5** 4	3 2 1
	2. Flashiness	Non-flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover less than 6%	Semi-flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover 7 - 15%	Flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover greater than 15%
	Existing Condition	10 9 8	7 6 5 4	**3** 2 1
	Proposed Condition	10 9 8	7 **6** 5 4	3 2 1
	Stream Function Pyramid Level 1 Hydrology Overall EXISTING Condition	**F FAR NF**		**Score:5**
	Stream Function Pyramid Level 1 Hydrology Overall PROPOSED Condition	**F FAR NF**		**Score:11**
Floodplain Connectivity (Vertical Stability)	**Stream Function Pyramid Level 2 Hydraulics**			
	3. Bank Height Ratio (BHR)	<1.20	1.21 - 1.50	>1.50
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
	4a. Entrenchment (Meandering streams in alluvial valleys or Rosgen C, E, DA Streams)	>2.2	2.1 - 1.4	<1.4
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
	4b. Entrenchment (Non meandering streams in colluvial valleys or Rosgen B Streams)	>1.4	1.3 - 1.1	<1.1
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	5. Floodplain Drainage	no concentrated flow; runoff is primarily sheet flow; hillslopes < 10%; hillslopes >200 ft from stream; ponding or wetland areas and litter or debris jams are well represented	runoff is equally sheet and concentrated flow (minor gully and rill erosion occurring); hillslopes 10 - 40%; hillslopes 50 - 200 ft from stream; ponding or wetland areas and litter or debris jams are minimally represented	concentrated flows present (extensive gully and rill erosion); hillslopes >40%; hillslopes <50 ft from stream; ponding or wetland areas and litter or debris jams are not well represented or absent
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
	6. Vertical Stability Extent	Stable	Localized Instability	Widespread Instability
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	Stream Function Pyramid Level 2 Hydraulics Overall EXISTING Condition	**F FAR NF**		**Score:4**
	Stream Function Pyramid Level 2 Hydraulics Overall PROPOSED Condition	**F FAR NF**		**Score:26**

Reach ID:	Trib 3	Reach Score/Reach Total Ex. 24/170 Prop.: 136/170	Quality: Ex: 0.14 Prop:0.8

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category: Functioning	Functioning-at-Risk	Not Functioning
Stream Function Pyramid Level 3 Geomorphology				
Riparian Vegetation (Score = Average of Left and Right bank, max score of 10)	7. Riparian Vegetation Zone (EPA, 1999, modified)	Riparian zone extends to a width of >100 feet; good vegetation community diversity and density; human activities do not impact zone; invasive species not present or sparse	Riparian zone extends to a width of 25-100 feet; species composition is dominated by 2 or 3 species; human activities greatly impact zone; invasive species well represented and alter the community	Riparian zone extends to a width of <25 feet; little or no riparian vegetation due to human activities; majority of vegetation is invasive
	Left Bank Existing	10 9 8	7 6 5 4	**3** 2 1
	Left Bank Proposed	10 **9** 8	7 6 5 4	3 2 1
	Right Bank Existing	10 9 8	7 6 5 4	**3** 2 1
	Right Bank Proposed	10 **9** 8	7 6 5 4	3 2 1
Lateral Stability (Score =Average of Left and right bank, max score of 10)	8. Dominant Bank Erosion Rate Potential	Dominate bank erosion rate potential is low or BEHI/NBS Rating: L/VL, L/L, L/M, L/H, L/VH, M/VL	Dominate bank erosion rate potential is moderate or BEHI/NBS Rating: M/L, M/M, M/H, L/Ex, H/L, M/VH, M/Ex, H/L, H/M, VH/VL, Ex/VL	Dominate bank erosion rate potential is high or BEHI/NBS Rating: H/H, H/Ex, VH/H, Ex/M, Ex/H, Ex/VH, VH/VH, Ex/Ex
	Existing Condition (Right bank)	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition (Right Bank)	10 **9** 8	7 6 5 4	3 2 1
	Existing Condition (Left bank)	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition (Left Bank)	10 **9** 8	7 6 5 4	3 2 1
	9. Lateral Stability Extent	Stable	Localized Instability	Widespread Instability
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
Bedform Diversity (Do not complete if stream is ephemeral)	10. Shelter for Fish and Macroinvertebrates (EPA 1999)	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, rubble, gravel, cobble and large rocks, or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient)	20-70% mix of stable habitat; suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale)	Less than 20% mix of stable habitat; lack of habitat availability less than desirables obvious; substrate unstable or lacking
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	11a. Pool-to-Pool Spacing Ratio (Watersheds < 10 mi^2)	4.0 - 5.0	3.0 - 4.0 ***or*** 5.0 - 7.0	< 3.0 ***or*** >7.0
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	11b. Pool-to-Pool Spacing Ratio (Watersheds > 10 mi^2)	5.0 - 7.0	3.5 - 5.0 ***or*** 7.0 - 8.0	<3.5 ***or*** >8.0
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	12a. Pool Max Depth Ratio/Depth Variability (Gravel Bed Streams)	>1.5	1.2 - 1.5	<1.2
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	12b. Pool Max Depth Ratio/Depth Variability (Sand Bed Streams)	>1.2	1.1 - 1.2	<1.1
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
Moderate Gradient Perennial Streams in Colluvial Valleys				
Bedform Diversity (Do not complete if stream is ephemeral)	11. Pool-to-Pool Spacing Ratio (3-5% Slope)	2.0 - 4.0	4.0 - 6.0	>6.0
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	12. Pool Max Depth Ratio/Depth Variability	>1.5	1.2 - 1.5	<1.2
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1

Stream Function Pyramid Level 3 Geomorphology Overall EXISTING Condition F FAR NF Score:8

Stream Function Pyramid Level 3 Geomorphology Overall PROPOSED Condition F FAR NF Score:51

Reach ID:	Trib 3	Reach Score/Reach Total	Ex. 24/170 Prop.: 136/170	Quality: Ex: 0.14 Prop:0.8

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category: Functioning	Functioning-at-Risk	Not Functioning

Stream Function Pyramid Level 4 Physicochemical

Water Quality and Nutrients (Do not complete if stream is ephemeral)

13. Water Appearance and Nutrient Enrichment (USDA 1999)	Very clear, or clear but tea-colored; objects visible at depth 3 to 6 ft (less if slightly colored); no oil sheen on surface; no noticeable film on submerged objects or rocks. Clear water along entire reach; diverse aquatic plant community includes low quantities of many species of macrophytes; little algal growth present			Frequent cloudiness especially after storm events; objects visible to depth 0.5 to 3.0 ft; may have slight green color; no oil sheen on water surface. Fairly clear or slightly greenish water along entire reach; moderate algal growth on stream substrate				Very turbid or muddy appearance most of the time; objects visible at depth< 0.5 ft; slow moving water maybe bright green; other obvious water pollutants; floating algal mats, surface scum, sheen or heavy coat of foam on surface; or strong odor of chemicals, oil, sewage, or other pollutants. Pea-green, gray, or brown water along entire reach; dense stands of macrophytes clogging stream; severe algal blooms creating thick algal		
Existing Condition	10	9	8	7	6	5	4	**3**	2	1
Proposed Condition	10	9	**8**	7	6	5	4	3	2	1
14. Detritus (Petersen, 1992)	Mainly consisting of leaves and wood without sediment covering it			Leaves and wood scarce; fine organic debris without sediment				Fine organic sediment - black in color and foul odor (anaerobic) or detritus absent		
Existing Condition	10	9	8	7	6	5	4	3	2	**1**
Proposed Condition	10	9	**8**	7	6	5	4	3	2	1

Stream Function Pyramid Level 4 Physicochemical Overall EXISTING Condition F FAR **NF** **Score:4**

Stream Function Pyramid Level 4 Physicochemical Overall PROPOSED Condition **F** FAR NF **Score:16**

Stream Function Pyramid Level 5 Biology

Biology (Do not complete if stream is ephemeral)

15. Macroinvertebrate	Abundant			Rare				Not present			
Existing Condition	10	9	8	7	6	5	4	3	2	**1**	
Proposed Condition	10	9	**8**	7	6	5	4	3	2	1	
16. Macroinvertebrate Tolerance	Abundant intolerant species			Limited intolerant species				Only tolerant species			
Existing Condition	10	9	8	7	6	5	4	3	2	**1**	
Proposed Condition	10	9	**8**	7	6	5	4	3	2	1	
17. Fish Presence	Abundant			Rare				Not present			
Existing Condition	10	9	8	7	6	5	4	3	2	**1**	
Proposed Condition	10	9	**8**	7	6	5	4	4	2	1	
If existing biology is FAR or NF, provide description of cause(s)	Stream is currently piped.										

Stream Function Pyramid Level 5 Biology Overall EXISTING Condition F FAR **NF** **Score: 3**

Stream Function Pyramid Level 5 Biology Overall PROPOSED Condition **F** FAR NF **Score:24**

Reach ID:	Trib 3	Reach Score/Reach Total	Ex. 24/170 Prop.: 136/170	Quality: Ex: 0.14 Prop:0.8

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category		
		Functioning	Functioning-at-Risk	Not Functioning

Bankfull Determination and Rosgen Stream Classification

Rosgen Stream Type (Observation) EX - Stream is currently piped PRO - C

Regional Curve (circle one): **Piedmont** Coastal Plain Allegheny Plateau/Ridge and Valley Urban Karst

DA (sqmi)	0.13		
BF Width (ft)	5.2-6.6	BF Area (sqft)	2.3-3.9
BF Depth (ft)	0.45-0.58	Percent Impervious (%)	21.3

Field Measurements

Parameter	Measurements and Ratios			
Water surface to geomorphic feature elevation difference	Ex- Channel is piped Upstream Reference: 0.57			
Riffle Mean Depth at Bankfull Stage (dbkf)	Ex- Channel is piped Upstream Reference: 0.5	Proposed: 0.36 & 0.48		
Riffle Width at Bankfull Stage (Wbkf)	Ex- Channel is piped Upstream Reference: 5.52	Proposed: 4.6 & 6.2		
Riffle XS Area at Bankfull Stage (Abkf = dbkf*Wbkf)	Ex- Channel is piped Upstream Reference: 2.8	Proposed: 1.65 & 2.97		
Floodprone Area Width (Wfpa) (Wfpa=Width at elevation determined by 2xDmax)	Ex- Channel is piped Upstream Reference: 5.9	Target: 18.4 & 24.8		
Entrenchment Ratio (ER) (ER=Wfpa/Wbkf)	Ex- Channel is piped Upstream Reference: 1.1	Target 4.0		
Low Bank Height (LBH)	Ex- Channel is piped Upstream Reference: 2.7	Proposed: 0.5 & 0.66		
Riffle Maximum Depth at Bankfull Stage (Dmax)	Ex- Channel is piped Upstream Reference: 0.7	Proposed: 0.5 & 0.66		
Bank Height Ratio (BHR) (BHR=LBH/Dmax)	Ex- Channel is piped Upstream Reference: 3.9	Proposed: 1.0		
BEHI/NBS Ratings and Lengths	Ex- Channel is piped	L/L		
Pool to Pool Spacing (P-P)	Ex- Channel is piped	Proposed: Min: 20, Max: 40, Avg.: 30		
Pool to Pool Spacing Ratio (P-P Ratio) (P-P Ratio=P-P/Wbkf)	Ex- Channel is piped	Proposed: Min:4.3, Max:8.3, Avg.:5.4		
Pool Maximum Depth at Bankfull Stage (Dmbkfp)	Ex- Channel is piped	Proposed: 0.9 & 1.2		
Pool Depth Ratio (Dmbkfp Ratio) (Dmbkfp Ratio=Dmbkfp/dbkf)	Ex- Channel is piped	Proposed: 2.5		
Macroinvertebrate Taxa Observed	Ex- Channel is piped	n/a		

EXISTING and PROPOSED REACH LEVEL STREAM FUNCTION-BASED RAPID ASSESSMENT FIELD DATA SHEET

Watershed:	Middle Potomac - Catoctin	Rater(s):	RC/BW
Stream:	Un -Named Tributary to Cabin Branch	Date:	3/10/2022
Reach Length:	1033 linear feet	Latitude:	39.177353
Photo(s):	See Attached	Longitude:	-77.199137
Reach ID:	Trib 4	**Reach Score/Reach Total**	**Ex. 66/170 Prop.: 136/170** **Quality: Ex: 0.39 Prop:0.8**

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category: Functioning	Functioning-at-Risk	Not Functioning
Runoff	**Stream Function Pyramid Level 1 Hydrology**			
	1. Concentrated Flow	No potential for concentrated flow/impairments from adjacent land use	Some potential for concentrated flow/impairments to reach restoration site, however, measures are in place to protect resources	Potential for concentrated flow/impairments to reach restoration site and no treatments are in place
	Existing Condition	10 9 8	7 6 5 **4**	3 2 1
	Proposed Condition	10 9 8	7 6 **5** 4	3 2 1
	2. Flashiness	Non-flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover less than 6%	Semi-flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover 7 - 15%	Flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover greater than 15%
	Existing Condition	10 9 8	7 6 **5** 4	3 2 1
	Proposed Condition	10 9 8	7 **6** 5 4	3 2 1
	Stream Function Pyramid Level 1 Hydrology Overall EXISTING Condition		**F FAR NF**	**Score:9**
	Stream Function Pyramid Level 1 Hydrology Overall PROPOSED Condition		**F FAR NF**	**Score:11**
Floodplain Connectivity (Vertical Stability)	**Stream Function Pyramid Level 2 Hydraulics**			
	3. Bank Height Ratio (BHR)	<1.20	1.21 - 1.50	>1.50
	Existing Condition	10 9 8	7 6 5 4	**3** 2 1
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
	4a. Entrenchment (Meandering streams in alluvial valleys or Rosgen C, E, DA Streams)	>2.2	2.1 - 1.4	<1.4
	Existing Condition	10 9 8	7 6 5 **4**	3 2 1
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
	4b. Entrenchment (Non meandering streams in colluvial valleys or Rosgen B Streams)	>1.4	1.3 - 1.1	<1.1
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	5. Floodplain Drainage	no concentrated flow; runoff is primarily sheet flow; hillslopes < 10%; hillslopes >200 ft from stream; ponding or wetland areas and litter or debris jams are well represented	runoff is equally sheet and concentrated flow (minor gully and rill erosion occurring); hillslopes 10 - 40%; hillslopes 50 - 200 ft from stream; ponding or wetland areas and litter or debris jams are minimally represented	concentrated flows present (extensive gully and rill erosion); hillslopes >40%; hillslopes <50 ft from stream; ponding or wetland areas and litter or debris jams are not well represented or absent
	Existing Condition	10 9 8	7 6 5 **4**	3 2 1
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	6. Vertical Stability Extent	Stable	Localized Instability	Widespread Instability
	Existing Condition	10 9 8	7 6 5 **4**	3 2 1
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	Stream Function Pyramid Level 2 Hydraulics Overall EXISTING Condition		**F FAR NF**	**Score:15**
	Stream Function Pyramid Level 2 Hydraulics Overall PROPOSED Condition		**F FAR NF**	**Score:34**

Reach ID:	Trib 4	Reach Score/Reach Total	Ex. 66/170 Prop.: 136/170	Quality: Ex: 0.39 Prop:0.8

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category: Functioning	Functioning-at-Risk	Not Functioning
Stream Function Pyramid Level 3 Geomorphology				
Riparian Vegetation (Score = Average of Left and Right bank, max score of 10)	7. Riparian Vegetation Zone (EPA, 1999, modified)	Riparian zone extends to a width of >100 feet; good vegetation community diversity and density; human activities do not impact zone; invasive species not present or sparse	Riparian zone extends to a width of 25-100 feet; species composition is dominated by 2 or 3 species; human activities greatly impact zone; invasive species well represented and alter the community	Riparian zone extends to a width of <25 feet; little or no riparian vegetation due to human activities; majority of vegetation is invasive
	Left Bank Existing	10 **9** 8	7 6 5 4	**3** 2 1
	Left Bank Proposed	10 9 8	7 6 5 4	3 2 1
	Right Bank Existing	10 9 8	7 6 5 4	**3** 2 1
	Right Bank Proposed	10 **9** 8	7 6 5 4	3 2 1
Lateral Stability (Score =Average of Left and right bank, max score of 10)	8. Dominant Bank Erosion Rate Potential	Dominate bank erosion rate potential is low or BEHI/NBS Rating: L/VL, L/L, L/M, L/H, L/VH, M/VL	Dominate bank erosion rate potential is moderate or BEHI/NBS Rating: M/L, M/M, M/H, L/Ex, H/L, M/VH, M/Ex, H/L, H/M, VH/VL, Ex/VL	Dominate bank erosion rate potential is high or BEHI/NBS Rating: H/H, H/Ex, VH/H, Ex/M, Ex/H, Ex/VH, VH/VH, Ex/Ex
	Existing Condition (Right bank)	10 9 8	7 6 5 **4**	3 2 1
	Proposed Condition (Right Bank)	10 **9** 8	7 6 5 4	3 2 1
	Existing Condition (Left bank)	10 9 8	7 6 5 **4**	3 2 1
	Proposed Condition (Left Bank)	10 **9** 8	7 6 5 4	3 2 1
	9. Lateral Stability Extent	Stable	Localized Instability	Widespread Instability
	Existing Condition	10 9 **8**	7 6 5 **4**	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
Bedform Diversity (Do not complete if stream is ephemeral)	10. Shelter for Fish and Macroinvertebrates (EPA 1999)	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, rubble, gravel, cobble and large rocks, or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient)	20-70% mix of stable habitat; suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale)	Less than 20% mix of stable habitat; lack of habitat availability less than desirables obvious; substrate unstable or lacking
	Existing Condition	10 9 8	7 6 5 **4**	3 2 1
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	11a. Pool-to-Pool Spacing Ratio (Watersheds < 10 mi^2)	4.0 - 5.0	3.0 - 4.0 ***or*** 5.0 - 7.0	< 3.0 ***or*** >7.0
	Existing Condition	10 9 8	7 6 5 **4**	3 2 1
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	11b. Pool-to-Pool Spacing Ratio (Watersheds > 10 mi^2)	5.0 - 7.0	3.5 - 5.0 ***or*** 7.0 - 8.0	<3.5 ***or*** >8.0
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	12a. Pool Max Depth Ratio/Depth Variability (Gravel Bed Streams)	>1.5	1.2 - 1.5	<1.2
	Existing Condition	10 9 8	7 6 5 4	**3** 2 1
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	12b. Pool Max Depth Ratio/Depth Variability (Sand Bed Streams)	>1.2	1.1 - 1.2	<1.1
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
Bedform Diversity (Do not complete if stream is ephemeral)	**Moderate Gradient Perennial Streams in Colluvial Valleys**			
	11. Pool-to-Pool Spacing Ratio (3-5% Slope)	2.0 - 4.0	4.0 - 6.0	>6.0
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	12. Pool Max Depth Ratio/Depth Variability	>1.5	1.2 - 1.5	<1.2
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1

Stream Function Pyramid Level 3 Geomorphology Overall EXISTING Condition F **FAR** NF **Score:22**

Stream Function Pyramid Level 3 Geomorphology Overall PROPOSED Condition **F** FAR NF **Score:51**

Reach ID:	Trib 4	Reach Score/Reach Total	Ex. 66/170 Prop.: 136/170	Quality: Ex: 0.39 Prop:0.8

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category: Functioning	Functioning-at-Risk	Not Functioning

Stream Function Pyramid Level 4 Physicochemical

Water Quality and Nutrients (Do not complete if stream is ephemeral)

13. Water Appearance and Nutrient Enrichment (USDA 1999)	Very clear, or clear but tea-colored; objects visible at depth 3 to 6 ft (less if slightly colored); no oil sheen on surface; no noticeable film on submerged objects or rocks. Clear water along entire reach; diverse aquatic plant community includes low quantities of many species of macrophytes; little algal growth present			Frequent cloudiness especially after storm events; objects visible to depth 0.5 to 3.0 ft; may have slight green color; no oil sheen on water surface. Fairly clear or slightly greenish water along entire reach; moderate algal growth on stream substrate				Very turbid or muddy appearance most of the time; objects visible at depth< 0.5 ft; slow moving water maybe bright green; other obvious water pollutants; floating algal mats, surface scum, sheen or heavy coat of foam on surface; or strong odor of chemicals, oil, sewage, or other pollutants. Pea-green, gray, or brown water along entire reach; dense stands of macrophytes clogging stream; severe algal blooms creating thick algal		
Existing Condition	10	9	8	7	6	5	**4**	3	2	1	
Proposed Condition	10	9	**8**	7	6	5	4	3	2	1	
14. Detritus (Petersen, 1992)	Mainly consisting of leaves and wood without sediment covering it			Leaves and wood scarce; fine organic debris without sediment				Fine organic sediment - black in color and foul odor (anaerobic) or detritus absent			
Existing Condition	10	9	8	7	6	5	**4**	3	2	1	
Proposed Condition	10	9	**8**	7	6	5	4	3	2	1	

Stream Function Pyramid Level 4 Physicochemical Overall EXISTING Condition F FAR NF **Score:8**

Stream Function Pyramid Level 4 Physicochemical Overall PROPOSED Condition F FAR NF **Score:16**

Stream Function Pyramid Level 5 Biology

Biology (Do not complete if stream is ephemeral)

15. Macroinvertebrate	Abundant			Rare				Not present			
Existing Condition	10	9	8	7	6	5	**4**	3	2	1	
Proposed Condition	10	9	**8**	7	6	5	4	3	2	1	
16. Macroinvertebrate Tolerance	Abundant intolerant species			Limited intolerant species				Only tolerant species			
Existing Condition	10	9	8	7	6	5	4	3	2	1	
Proposed Condition	10	9	**8**	7	6	5	**4**	3	2	1	
17. Fish Presence	Abundant			Rare				Not present			
Existing Condition	10	9	8	7	6	5	4	3	2	1	
Proposed Condition	10	9	**8**	7	6	5	**4**	3	2	1	
If existing biology is FAR or NF, provide description of cause(s)											

Stream Function Pyramid Level 5 Biology Overall EXISTING Condition F **FAR** NF **Score: 12**

Stream Function Pyramid Level 5 Biology Overall PROPOSED Condition **F** FAR NF **Score:24**

Reach ID:	Trib 4	Reach Score/Reach Total	Ex. 66/170 Prop.: 136/170	Quality: Ex: 0.39 Prop:0.8

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category		
		Functioning	Functioning-at-Risk	Not Functioning

Bankfull Determination and Rosgen Stream Classification

Rosgen Stream Type (Observation): EX - C/F PRO - C

Regional Curve (circle one): **Piedmont** Coastal Plain Allegheny Plateau/Ridge and Valley Urban Karst

DA (sqmi)	0.13		
BF Width (ft)	5.3-6.7	BF Area (sqft)	2.4-4.0
BF Depth (ft)	0.46-0.59	Percent Impervious (%)	21.3

Field Measurements

Parameter	Measurements and Ratios			
Water surface to geomorphic feature elevation difference	Existing Min:0.39, Max: 0.55, Avg.: 0.48			
Riffle Mean Depth at Bankfull Stage (dbkf)	Existing Min:0.44, Max: 0.55, Avg.: 0.48	Proposed: 0.31, 0.47 & 0.39		
Riffle Width at Bankfull Stage (Wbkf)	Existing Min:2.93, Max: 4.59, Avg.: 3.82	3.8, 5.0 & 6.0		
Riffle XS Area at Bankfull Stage (Abkf = dbkf*Wbkf)	Existing Min:1.53, Max: 2.18, Avg.: 1.83	Proposed: 1.18, 1.95 & 2.82		
Floodprone Area Width (Wfpa) (Wfpa=Width at elevation determined by 2xDmax)	Existing Min:4.44, Max: 7.80, Avg.: 5.56	Target: 8.4, 20 & 24		
Entrenchment Ratio (ER) (ER=Wfpa/Wbkf)	Existing Min:1.10, Max: 1.84, Avg.: 1.47	Target 2.2 / 4.0		
Low Bank Height (LBH)	Existing Min:1.0, Max: 1.95, Avg.: 1.29	Proposed: 0.42, 0.5 & 0.6		
Riffle Maximum Depth at Bankfull Stage (Dmax)	Existing Min:0.56, Max: 0.72, Avg.: 0.63	Proposed: 0.42, 0.5 & 0.6		
Bank Height Ratio (BHR) (BHR=LBH/Dmax)	Existing Min:1.38, Max:2.86, Avg.: 1.98	Proposed: 1.0		
BEHI/NBS Ratings and Lengths	H/M, H/L, M/M, M/L, L/L	L/L		
Pool to Pool Spacing (P-P)	Existing Avg.: 39.4	Proposed: Min: 12, Max: 49, Avg.: 25		
Pool to Pool Spacing Ratio (P-P Ratio) (P-P Ratio=P-P/Wbkf)	Existing Avg.: 10.32	Proposed: Min:2.3, Max:5.1, Avg.:5.0		
Pool Maximum Depth at Bankfull Stage (Dmbkfp)	Existing Avg.: 1.29	Proposed: 0.8, 1.0 & 1.2		
Pool Depth Ratio (Dmbkfp Ratio) (Dmbkfp Ratio=Dmbkfp/dbkf)	Existing Avg.: 2.7	Proposed: 2.5		
Macroinvertebrate Taxa Observed	n/a	n/a		

EXISTING and PROPOSED REACH LEVEL STREAM FUNCTION-BASED RAPID ASSESSMENT FIELD DATA SHEET

Watershed:	Middle Potomac - Catoctin	Rater(s):	RC/BW
Stream:	Un -Named Tributary to Cabin Branch	Date:	3/10/2022
Reach Length:	554 linear feet	Latitude:	39.177353
Photo(s):	See Attached	Longitude:	-77.199137
Reach ID:	Trib 5	**Reach Score/Reach Total**	**Ex. 24/170 Prop.: 136/170** **Quality: Ex: 0.14 Prop:0.8**

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category: Functioning	Functioning-at-Risk	Not Functioning
Runoff	**Stream Function Pyramid Level 1 Hydrology**			
	1. Concentrated Flow	No potential for concentrated flow/impairments from adjacent land use	Some potential for concentrated flow/impairments to reach restoration site, however, measures are in place to protect resources	Potential for concentrated flow/impairments to reach restoration site and no treatments are in place
	Existing Condition	10 9 8	7 6 5 4	3 **2** 1
	Proposed Condition	10 9 8	7 6 **5** 4	3 2 1
	2. Flashiness	Non-flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover less than 6%	Semi-flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover 7 - 15%	Flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover greater than 15%
	Existing Condition	10 9 8	7 6 5 4	**3** 2 1
	Proposed Condition	10 9 8	7 **6** 5 4	3 2 1
	Stream Function Pyramid Level 1 Hydrology Overall EXISTING Condition	**F FAR NF**		**Score:5**
	Stream Function Pyramid Level 1 Hydrology Overall PROPOSED Condition	**F FAR NF**		**Score:11**
Floodplain Connectivity (Vertical Stability)	**Stream Function Pyramid Level 2 Hydraulics**			
	3. Bank Height Ratio (BHR)	<1.20	1.21 - 1.50	>1.50
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
	4a. Entrenchment (Meandering streams in alluvial valleys or Rosgen C, E, DA Streams)	>2.2	2.1 - 1.4	<1.4
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
	4b. Entrenchment (Non meandering streams in colluvial valleys or Rosgen B Streams)	>1.4	1.3 - 1.1	<1.1
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	5. Floodplain Drainage	no concentrated flow; runoff is primarily sheet flow; hillslopes < 10%; hillslopes >200 ft from stream; ponding or wetland areas and litter or debris jams are well represented	runoff is equally sheet and concentrated flow (minor gully and rill erosion occurring); hillslopes 10 - 40%; hillslopes 50 - 200 ft from stream; ponding or wetland areas and litter or debris jams are minimally represented	concentrated flows present (extensive gully and rill erosion); hillslopes >40%; hillslopes <50 ft from stream; ponding or wetland areas and litter or debris jams are not well represented or absent
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
	6. Vertical Stability Extent	Stable	Localized Instability	Widespread Instability
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	Stream Function Pyramid Level 2 Hydraulics Overall EXISTING Condition	**F FAR NF**		**Score:4**
	Stream Function Pyramid Level 2 Hydraulics Overall PROPOSED Condition	**F FAR NF**		**Score:26**

Reach ID:	Trib 5	Reach Score/Reach Total Ex. 24/170 Prop.: 136/170	Quality: Ex: 0.14 Prop:0.8

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category: Functioning	Functioning-at-Risk	Not Functioning
Stream Function Pyramid Level 3 Geomorphology				
Riparian Vegetation (Score = Average of Left and Right bank, max score of 10)	7. Riparian Vegetation Zone (EPA, 1999, modified)	Riparian zone extends to a width of >100 feet; good vegetation community diversity and density; human activities do not impact zone; invasive species not present or sparse	Riparian zone extends to a width of 25-100 feet; species composition is dominated by 2 or 3 species; human activities greatly impact zone; invasive species well represented and alter the community	Riparian zone extends to a width of <25 feet; little or no riparian vegetation due to human activities; majority of vegetation is invasive
	Left Bank Existing	10 9 8	7 6 5 4	**3** 2 1
	Left Bank Proposed	10 **9** 8	7 6 5 4	3 2 1
	Right Bank Existing	10 9 8	7 6 5 4	**3** 2 1
	Right Bank Proposed	10 **9** 8	7 6 5 4	3 2 1
Lateral Stability (Score =Average of Left and right bank, max score of 10)	8. Dominant Bank Erosion Rate Potential	Dominate bank erosion rate potential is low or BEHI/NBS Rating: L/VL, L/L, L/M, L/H, L/VH, M/VL	Dominate bank erosion rate potential is moderate or BEHI/NBS Rating: M/L, M/M, M/H, L/Ex, H/L, M/VH, M/Ex, H/L, H/M, VH/VL, Ex/VL	Dominate bank erosion rate potential is high or BEHI/NBS Rating: H/H, H/Ex, VH/H, Ex/M, Ex/H, Ex/VH, VH/VH, Ex/Ex
	Existing Condition (Right bank)	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition (Right Bank)	10 **9** 8	7 6 5 4	3 2 1
	Existing Condition (Left bank)	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition (Left Bank)	10 **9** 8	7 6 5 4	3 2 1
	9. Lateral Stability Extent	Stable	Localized Instability	Widespread Instability
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 **9** 8	7 6 5 4	3 2 1
Bedform Diversity (Do not complete if stream is ephemeral)	10. Shelter for Fish and Macroinvertebrates (EPA 1999)	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, rubble, gravel, cobble and large rocks, or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient)	20-70% mix of stable habitat; suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale)	Less than 20% mix of stable habitat; lack of habitat availability less than desirables obvious; substrate unstable or lacking
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	11a. Pool-to-Pool Spacing Ratio (Watersheds < 10 mi^2)	4.0 - 5.0	3.0 - 4.0 ***or*** 5.0 - 7.0	< 3.0 ***or*** >7.0
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	11b. Pool-to-Pool Spacing Ratio (Watersheds > 10 mi^2)	5.0 - 7.0	3.5 - 5.0 ***or*** 7.0 - 8.0	<3.5 ***or*** >8.0
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	12a. Pool Max Depth Ratio/Depth Variability (Gravel Bed Streams)	>1.5	1.2 - 1.5	<1.2
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	12b. Pool Max Depth Ratio/Depth Variability (Sand Bed Streams)	>1.2	1.1 - 1.2	<1.1
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
Moderate Gradient Perennial Streams in Colluvial Valleys				
Bedform Diversity (Do not complete if stream is ephemeral)	11. Pool-to-Pool Spacing Ratio (3-5% Slope)	2.0 - 4.0	4.0 - 6.0	>6.0
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	12. Pool Max Depth Ratio/Depth Variability	>1.5	1.2 - 1.5	<1.2
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1

Stream Function Pyramid Level 3 Geomorphology Overall EXISTING Condition F FAR NF Score:8

Stream Function Pyramid Level 3 Geomorphology Overall PROPOSED Condition F FAR NF Score:51

Reach ID:	Trib 5	Reach Score/Reach Total Ex. 24/170 Prop.: 136/170	Quality: Ex: 0.14 Prop:0.8

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category: Functioning	Functioning-at-Risk	Not Functioning
Stream Function Pyramid Level 4 Physicochemical				
Water Quality and Nutrients (Do not complete if stream is ephemeral)	13. Water Appearance and Nutrient Enrichment (USDA 1999)	Very clear, or clear but tea-colored; objects visible at depth 3 to 6 ft (less if slightly colored); no oil sheen on surface; no noticeable film on submerged objects or rocks. Clear water along entire reach; diverse aquatic plant community includes low quantities of many species of macrophytes; little algal growth present	Frequent cloudiness especially after storm events; objects visible to depth 0.5 to 3.0 ft; may have slight green color; no oil sheen on water surface. Fairly clear or slightly greenish water along entire reach; moderate algal growth on stream substrate	Very turbid or muddy appearance most of the time; objects visible at depth< 0.5 ft; slow moving water maybe bright green; other obvious water pollutants; floating algal mats, surface scum, sheen or heavy coat of foam on surface; or strong odor of chemicals, oil, sewage, or other pollutants. Pea-green, gray, or brown water along entire reach; dense stands of macrophytes clogging stream; severe algal blooms creating thick algal
	Existing Condition	10 9 8	7 6 5 4	**3** 2 1
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	14. Detritus (Petersen, 1992)	Mainly consisting of leaves and wood without sediment covering it	Leaves and wood scarce; fine organic debris without sediment	Fine organic sediment - black in color and foul odor (anaerobic) or detritus absent
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1

Stream Function Pyramid Level 4 Physicochemical Overall EXISTING Condition F FAR **NF** **Score:4**

Stream Function Pyramid Level 4 Physicochemical Overall PROPOSED Condition **F** FAR NF **Score:16**

Biology (Do not complete if stream is ephemeral)				
Stream Function Pyramid Level 5 Biology				
	15. Macroinvertebrate	Abundant	Rare	Not present
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	16. Macroinvertebrate Tolerance	Abundant intolerant species	Limited intolerant species	Only tolerant species
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	3 2 1
	17. Fish Presence	Abundant	Rare	Not present
	Existing Condition	10 9 8	7 6 5 4	3 2 **1**
	Proposed Condition	10 9 **8**	7 6 5 4	4 2 1
	If existing biology is FAR or NF, provide description of cause(s)	Stream is currently a concrete channel.		

Stream Function Pyramid Level 5 Biology Overall EXISTING Condition **F** **FAR** **NF** **Score: 3**

Stream Function Pyramid Level 5 Biology Overall PROPOSED Condition **F** **FAR** **NF** **Score:24**

Reach ID:	Trib 5	Reach Score/Reach Total	Ex. 24/170 Prop.: 136/170	Quality: Ex: 0.14 Prop:0.8

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category		
		Functioning	Functioning-at-Risk	Not Functioning

Bankfull Determination and Rosgen Stream Classification

Rosgen Stream Type (Observation) EX - Stream is currently concrete channel PRO - C

Regional Curve (circle one): **Piedmont** Coastal Plain Allegheny Plateau/Ridge and Valley Urban Karst

DA (sqmi)	0.06		
BF Width (ft)	3.6-4.9	BF Area (sqft)	1.3-2.2
BF Depth (ft)	0.35-0.45	Percent Impervious (%)	21.3

Field Measurements

Parameter	Measurements and Ratios			
Water surface to geomorphic feature elevation difference	Ex- Channel is in concrete channel			
Riffle Mean Depth at Bankfull Stage (dbkf)	Ex- Channel is in concrete channel	Proposed: 0.36		
Riffle Width at Bankfull Stage (Wbkf)	Ex- Channel is in concrete channel	Proposed: 4.6		
Riffle XS Area at Bankfull Stage (Abkf = dbkf*Wbkf)	Ex- Channel is in concrete channel	Proposed: 1.65		
Floodprone Area Width (Wfpa) (Wfpa=Width at elevation determined by 2xDmax)	Ex- Channel is in concrete channel	Target: 18.4		
Entrenchment Ratio (ER) (ER=Wfpa/Wbkf)	Ex- Channel is in concrete channel	Target 4.0		
Low Bank Height (LBH)	Ex- Channel is in concrete channel	Proposed: 0.5		
Riffle Maximum Depth at Bankfull Stage (Dmax)	Ex- Channel is in concrete channel	Proposed: 0.5		
Bank Height Ratio (BHR) (BHR=LBH/Dmax)	Ex- Channel is in concrete channel	Proposed: 1.0		
BEHI/NBS Ratings and Lengths	Ex- Channel is in concrete channel	L/L		
Pool to Pool Spacing (P-P)	Ex- Channel is in concrete channel	Proposed: Min: 21, Max: 30, Avg.: 26		
Pool to Pool Spacing Ratio (P-P Ratio) (P-P Ratio=P-P/Wbkf)	Ex- Channel is in concrete channel	Proposed: Min:4.6, Max:6.5, Avg.:5.7		
Pool Maximum Depth at Bankfull Stage (Dmbkfp)	Ex- Channel is in concrete channel	Proposed: 0.9		
Pool Depth Ratio (Dmbkfp Ratio) (Dmbkfp Ratio=Dmbkfp/dbkf)	Ex- Channel is in concrete channel	Proposed: 2.5		
Macroinvertebrate Taxa Observed	Ex- Channel is in concrete channel	n/a		

Cabin Branch





Cabin Branch





Tributary 1, 2, and 3 (general riparian conditions)





Tributary 4





Tributary 5





Appendix D: Maryland Stream Mitigation Framework (MSMF) Stream Mitigation Calculator

DRAFT

STREAM MITIGATION CALCULATOR

BACKGROUND INFORMATION

Corps Project ID #:		Corps PM:	
Project Name:	RFP-2 Cabin Branch	Date:	3/10/2022
Lat/Long:	N 39D 10' 43", W 77D 12' 08"	Sponsor:	MDOT SHA
County:	Montgomery	Collaborators:	HGS, LLC/MLA

Total Stream Gains (Functional Feet): 5583

Reach Name	Physiographic Region	Evaluation	Activity	Resource Type	Length (Feet)	Stream Quality	Channel Thread	Drainage Area (sqmi)	Raw Reach Value (Functional Feet)	Raw Change in Value (Functional Feet)	Site Sensitivity	Site Protection	Buffer Adjustment	Buffer Area (Acres)	Buffer Quality	Stream Gains (Functional Feet)	REMARKS
Cabin Branch	Piedmont	Existing	Preliminary Resource Evaluation	Perennial Wadeable	4670	35%	Primary	4.33	2895	3653	1	Easement	Evaluation			4236	
							1	1.77			0.1	0.03	Existing Buffer	6.08	63%		
	Piedmont	Proposed	Restoration/Enhancement	Perennial Wadeable	4680	79%	Primary	4.33	6548		374	123	Proposed Buffer	6.08	94%		
							1	1.77					Functional Feet		86		
Tributary 1	Piedmont	Existing	Preliminary Resource Evaluation	Intermittent	0	14%	Primary	0.15	0	190	1	Easement	Evaluation			225	
							1	0.48			0.1	0.03	Existing Buffer	0.58	60%		
	Piedmont	Proposed	Restoration/Enhancement	Intermittent	497.5	80%	Primary	0.15	190		20	7	Proposed Buffer	0.58	94%		
							1	0.48					Functional Feet		9		
Tributary 2	Piedmont	Existing	Preliminary Resource Evaluation	Intermittent	0	14%	Primary	0.02	0	154	1	Easement	Evaluation			184	
							1	0.41			0.1	0.03	Existing Buffer	0.54	60%		
	Piedmont	Proposed	Restoration/Enhancement	Intermittent	471	80%	Primary	0.02	154		16	5	Proposed Buffer	0.54	94%		
							1	0.41					Functional Feet		8		
Tributary 3	Piedmont	Existing	Preliminary Resource Evaluation	Intermittent	0	14%	Primary	0.08	0	237	1	Easement	Evaluation			283	
							1	0.41			0.1	0.03	Existing Buffer	0.83	60%		
	Piedmont	Proposed	Restoration/Enhancement	Intermittent	723.6	80%	Primary	0.08	237		25	8	Proposed Buffer	0.83	94%		
							1	0.41					Functional Feet		13		
Tributary 4	Piedmont	Existing	Preliminary Resource Evaluation	Intermittent	713	39%	Primary	0.13	125	168	1	Easement	Evaluation			206	
							1	0.45			0.1	0.03	Existing Buffer	0.93	60%		
	Piedmont	Proposed	Restoration/Enhancement	Intermittent	812.6	80%	Primary	0.13	293		18	6	Proposed Buffer	0.93	94%		
							1	0.45					Functional Feet		14		
Tributary 5	Piedmont	Existing	Preliminary Resource Evaluation	Intermittent	0	14%	Primary	0.06	0	13	1	Easement	Evaluation			15	
							1	0.41			0.1	0.03	Existing Buffer	0.04	60%		
	Piedmont	Proposed	Restoration/Enhancement	Intermittent	38.6	80%	Primary	0.06	13		1	0	Proposed Buffer	0.04	94%		
							1	0.41					Functional Feet		1		
Cabin Branch (PEPCO)	Piedmont	Existing	Preliminary Resource Evaluation	Perennial Wadeable	252	35%	Primary	4.3	156	235	1	Improved Protection	Evaluation			256	
							1	1.77			0.1	-0.03	Existing Buffer	0.33	63%		
	Piedmont	Proposed	Restoration/Enhancement	Perennial Wadeable	280	79%	Primary	4.3	391		24	-8	Proposed Buffer	0.33	94%		
							1	1.77					Functional Feet		5		
Trib 4 (PEPCO)	Piedmont	Existing	Preliminary Resource Evaluation	Intermittent	122	39%	Primary	0.13	21	23	1	Improved Protection	Evaluation			27	
							1	0.45			0.1	-0.03	Existing Buffer	0.16	60%		
	Piedmont	Proposed	Restoration/Enhancement	Intermittent	123	80%	Primary	0.13	44		3	-1	Proposed Buffer	0.16	94%		
							1	0.45					Functional Feet		2		
Trib 5 (PEPCO)	Piedmont	Existing	Preliminary Resource Evaluation	Intermittent	0	14%	Primary	0.06	0	133	1	Improved Protection	Evaluation			150	
							1	0.41			0.1	-0.03	Existing Buffer	0.46	60%		
	Piedmont	Proposed	Restoration/Enhancement	Intermittent	407	80%	Primary	0.06	133		14	-5	Proposed Buffer	0.46	94%		
							1	0.41					Functional Feet		7		
	Not Selected	Existing	Preliminary Resource Evaluation	NA	0	0%	NA	0	0	0	0	Select From List	Evaluation			NA	
							0	FALSE			0	0	Existing Buffer				
	Not Selected	Proposed	NA	NA	0		NA	0	0		0	NA	Proposed Buffer				

Maryland Stream Mitigation Framework Version 1: Stream Buffer Quality Assessment

Project Name:	RFP-2 Cabin Branch	**SBAA (Acres):**	6.08
CSBA Name:	Cabin Branch	*Infrastructure Area (Acres):*	0
Assessor(s):	RC	*Wetland Area (Acres):*	0
Date:	3/10/2022	*Area Credited By Other Prog:*	0
Latitude(*dec. deg*):	39.177353	**CSBA (Acres):**	6.08
Longitude (*dec. deg*):	-77.199137	**Existing Buffer Quality (%)*:**	*62.9*
Corps Permit Number:		**Proposed Buffer Quality (%)*:**	*94.3*

General Notes: Cabin Branch riparian conditions are similar throughout the project site so were scored with a composite score for the entire reach.

General Instructions: Identify your ***Stream Buffer Assessment Area*** *(****SBAA****). The Stream Buffer Assessment Area is the area where the Stream Buffer Quality Assessment Metrics 1 and 2 will occur. The SBAA includes the project area (future conservation easement area) for a given stream reach and any inholdings (Easements/infrastructure, credited wetlands, etc between the SBAA boundary and the stream). The SBAA may not exceed 200 feet from the baseflow channel edge. To determine the* ***Credited Stream Buffer Area (CSBA)****, subtract the Infrastructure Area and Area Credited by other Programs (TMDL, Wetland Credits, Forest Conservation, etc.) from the SBAA. A CSBA should be selected where vegetation or topography changes significantly. Please use the Wetland Delineation Forms applying the appropriate regional supplement to determine the extent of wetlands in the SBAA and to collect vegetation data. In the metrics below, circle the most applicable metric for your assessed area. Please use the comments box below each metric for any discussion items. Mapping is required showing landscape and project context for the SBAA and CSBA. More information can be found in the* ***MSMF Version 1: Stream Buffer Assessment Detailed Instructions****.*
Highlighted cells above are MSMF V.1. Mitigation Calculator input values.

Metrics Applied to Stream Buffer Assessment Area (SBAA)

Metric 1: % SBAA as wetlands

Ranges	50%+	30-49%	15-30%	5-15%	0%
Existing	4	3	2	1	0
Proposed	4	3	2	1	0

Notes: Only POW within the existing buffer. Areas will be converted to PFO to increase wetlands within the buffer area.

Metric 2: % of SBAA as Utilities/Infrastructure

Ranges	0	1-5%	5-10%	10-15%	>15%
Existing	4	3	2	1	0
Proposed	4	3	2	1	0

Notes: All utilities have been removed from the credit calculations and buffer scores.

Metrics Applied to Credited Stream Buffer Area (CSBA)

Metric 3: Plant Species Richness in CSBA (MDWAM 2022)

Ranges	11+	9-10	6-8	2-5	2 or less

Existing	4	3	2	1	0
Proposed	4	3	2	1	0
Notes: Historic golf course with limited existing plant species.					
Metric 4: % Canopy Cover in the CSBA3 (VA Unified 2008)					
Ranges	>60%	30-60%	10%-29%	1-9%	0%
Existing	4	3	2	1	0
Proposed	4	3	2	1	0
Notes: Very limited existing trees on the site and are situated primarily along Cabin Branch and randomly throughout the historic fairways.					
Metric 5: # of Strata in CSBA1 (MDWAM 2022)					
Ranges	4+	3	2	1	0
Existing	4	3	2	1	0
Proposed	4	3	2	1	0
Notes:					
Metric 6: Total Cover of herbaceous, emergent, and submergent plants in CSBA1 (MDWAM 2022)					
Ranges	>75%	51-74%	26-50%	<25%	NA
Existing	4	3	2	1	0
Proposed	4	3	2	1	0
Notes: Since the golf course has been out of operation for several years there is very little bare areas outside of the eroding stream banks.					
Metric 7: Invasive Plant Species (Total Relative % Cover) in CSBA1 (MDWAM 2022)					
Ranges	<1%	1-10%	11-25%	26-50%	51-100%
Existing	4	3	2	1	0
Proposed	4	3	2	1	0
Notes: Typical invasive species found throughout the region. Due to the large watershed of Cabin Branch it will be very difficult to maintain invasive species cover below 1%.					
Metric 8: Mircotopgraphy and Woody Debris in CSBA 1,2 (MDWAM 2022 & MDE 2021)					
Description	Woody debris and topographic deviations widespread, covering >15% of the CSBA. Multiple types of woody debris (Snags, downed wood, etc)	Woody debris and topographic deviations common, covering 10-15% of CSBA. Woody debris may lack diversity.	Occasional woody debris and topographic deviations present (Covering 5-9% CSBA) and/or woody debris lacking diversity.	Woody debris and topographic deviations very limited (<5% CSBA coverage) and/or Either woody debris or topographic deviations absent or scarce.	Woody debris and deviations in topography very scarce or not present
Existing	4	3	2	1	0
Proposed	4	3	2	1	0
Notes: Limited diversity in the riparian condition due to the historic land use as a golf course and the area being maintained over those years.					
Metric 9: Height Above Nearest Drainage in CSBA4 (Nobre et al. 2011)					
Ranges	0-2 ft	2.1-3 ft	3.1-4 ft	4.1-6 ft	>6 ft
Existing	4	3	2	1	0
Proposed	4	3	2	1	0
Notes:					

Maryland Stream Mitigation Framework Version 1: Stream Buffer Quality Assessment

Project Name:	RFP-2 Cabin Branch	**SBAA (Acres):**	2.8
CSBA Name:	Tributaries	*Infrastructure Area (Acres):*	0
Assessor(s):	RC	*Wetland Area (Acres):*	0
Date:	3/10/2022	*Area Credited By Other Prog:*	0
Latitude(*dec. deg*):	39.177353	**CSBA (Acres):**	2.8
Longitude (*dec. deg*):	-77.199137	**Existing Buffer Quality (%)*:**	*60*
Corps Permit Number:		**Proposed Buffer Quality (%)*:**	*94.3*

General Notes: Tributaries are primarily piped so scored the surrounding buffer in the vicinity of the piped channel.

General Instructions: Identify your ***Stream Buffer Assessment Area*** *(* ***SBAA****). The Stream Buffer Assessment Area is the area where the Stream Buffer Quality Assessment Metrics 1 and 2 will occur. The SBAA includes the project area (future conservation easement area) for a given stream reach and any inholdings (Easements/infrastructure, credited wetlands, etc between the SBAA boundary and the stream). The SBAA may not exceed 200 feet from the baseflow channel edge. To determine the* ***Credited Stream Buffer Area (CSBA)****, subtract the Infrastructure Area and Area Credited by other Programs (TMDL, Wetland Credits, Forest Conservation, etc.) from the SBAA. A CSBA should be selected where vegetation or topography changes significantly. Please use the Wetland Delineation Forms applying the appropriate regional supplement to determine the extent of wetlands in the SBAA and to collect vegetation data. In the metrics below, circle the most applicable metric for your assessed area. Please use the comments box below each metric for any discussion items. Mapping is required showing landscape and project context for the SBAA and CSBA. More information can be found in the* ***MSMF Version 1: Stream Buffer Assessment Detailed Instructions****.*
Highlighted cells above are MSMF V.1. Mitigation Calculator input values.

Metrics Applied to Stream Buffer Assessment Area (SBAA)

Metric 1: % SBAA as wetlands

Ranges	50%+	30-49%	15-30%	5-15%	0%
Existing	4	3	2	1	0
Proposed	4	3	2	1	0

Notes:

Metric 2: % of SBAA as Utilities/Infrastructure

Ranges	0	1-5%	5-10%	10-15%	>15%
Existing	4	3	2	1	0
Proposed	4	3	2	1	0

Notes:

Metrics Applied to Credited Stream Buffer Area (CSBA)

Metric 3: Plant Species Richness in CSBA (MDWAM 2022)

Ranges	11+	9-10	6-8	2-5	2 or less

Existing	4	3	2	1	0
Proposed	4	3	2	1	0
Notes:					

Metric 4: % Canopy Cover in the CSBA3 (VA Unified 2008)					
Ranges	>60%	30-60%	10%-29%	1-9%	0%
Existing	4	3	2	1	0
Proposed	4	3	2	1	0
Notes:					

Metric 5: # of Strata in CSBA1 (MDWAM 2022)					
Ranges	4+	3	2	1	0
Existing	4	3	2	1	0
Proposed	4	3	2	1	0
Notes:					

Metric 6: Total Cover of herbaceous, emergent, and submergent plants in CSBA1 (MDWAM 2022)					
Ranges	>75%	51-74%	26-50%	<25%	NA
Existing	4	3	2	1	0
Proposed	4	3	2	1	0
Notes:					

Metric 7: Invasive Plant Species (Total Relative % Cover) in CSBA1 (MDWAM 2022)					
Ranges	<1%	1-10%	11-25%	26-50%	51-100%
Existing	4	3	2	1	0
Proposed	4	3	2	1	0
Notes:					

Metric 8: Mircotopgraphy and Woody Debris in CSBA 1,2 (MDWAM 2022 & MDE 2021)					
Description	Woody debris and topographic deviations widespread, covering >15% of the CSBA. Multiple types of woody debris (Snags, downed wood, etc)	Woody debris and topographic deviations common, covering 10-15% of CSBA. Woody debris may lack diversity.	Occasional woody debris and topographic deviations present (Covering 5-9% CSBA) and/or woody debris lacking diversity.	Woody debris and topographic deviations very limited (<5% CSBA coverage) and/or Either woody debris or topographic deviations absent or scarce.	Woody debris and deviations in topography very scarce or not present
Existing	4	3	2	1	0
Proposed	4	3	2	1	0
Notes:					

Metric 9: Height Above Nearest Drainage in CSBA4 (Nobre et al. 2011)					
Ranges	0-2 ft	2.1-3 ft	3.1-4 ft	4.1-6 ft	>6 ft
Existing	4	3	2	1	0
Proposed	4	3	2	1	0
Notes:					

Appendix E: Cabin Branch Land Use Vicinity Map

DRAFT

1 INCH = 500 FEET

0 500 1,000 1,500 FEET

LEGEND

- LIMITS OF DISTURBANCE

LAND COVER TYPE

- DECIDUOUS FOREST
- DEVELOPED, LOW INTENSITY
- DEVELOPED, OPEN SPACE
- OPEN WATER
- SHRUB/SCRUB

NOTES:
1. LAND USE DATA OBTAINED FROM USGS NLCD.

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PROJECT: CABIN BRANCH

LAND USE VICINITY MAP

MONTGOMERY COUNTY, MARYLAND

PROJECT MANAGER: RC
DRAWN: TB
JOB NUMBER: 102054
DATE: 01/29/2021
REVISIONS: NONE