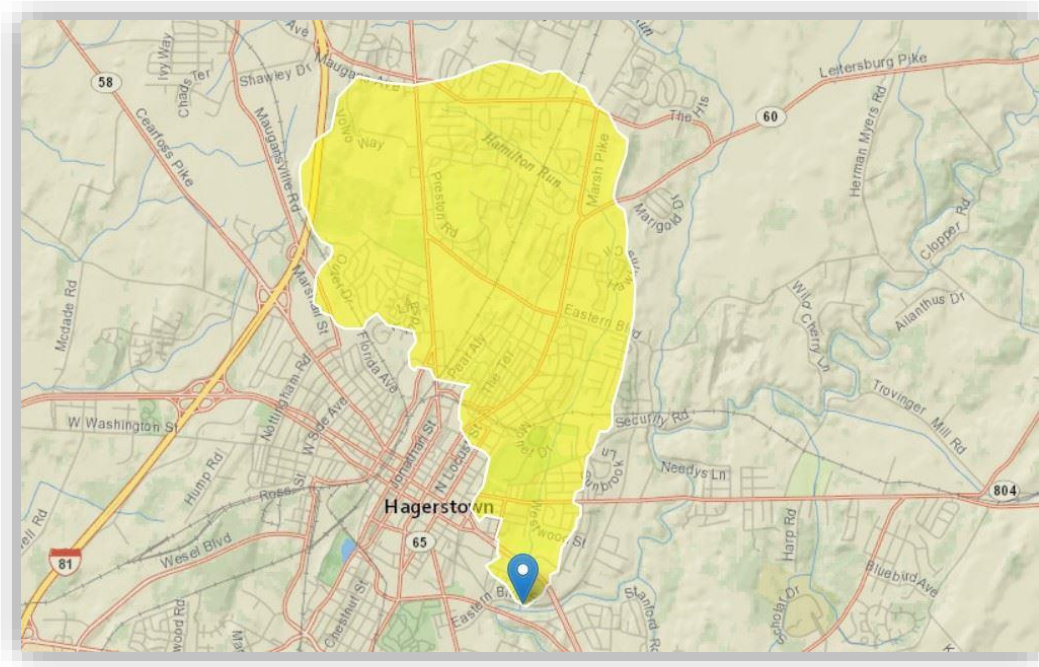


HAMILTON RUN WATER QUALITY & CLIMATE RESILIENCY PORTFOLIO



March 2024

Prepared by:



HAMILTON RUN WATER QUALITY & CLIMATE RESILIENCY PORTFOLIO

Financial Acknowledgment & Disclaimer

This project has been funded wholly or in part by the United States Environmental Protection Agency under assistance agreement CB96358501 to the Maryland Department of Natural Resources. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does the EPA endorse trade names or recommend the use of commercial products mentioned in this document.

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1. INTRODUCTION

A key tenant of [Maryland's Phase III Watershed Implementation Plan \(WIP\) to Restore the Chesapeake Bay](#) by 2025 is to engage with local communities and implement community-scale projects. Towards these ends, Maryland Environmental Service (MES) worked with the Maryland Department of Natural Resources (DNR) to develop a Water Quality and Climate Resiliency Portfolio for two targeted resiliency areas (TRAs), one on the Eastern Shore and one on the Western Shore. This initiative developed a list of potential projects utilizing community input, available datasets, and site assessments. The chosen projects within the portfolio will help restore local waters while also improving climate resilience. This work directly supports WIP implementation by creating pipelines of vetted projects that have community buy-in. Having a pipeline of identified projects better prepares Maryland and its communities to build climate resilience by taking advantage of existing and emerging funding opportunities that promote the

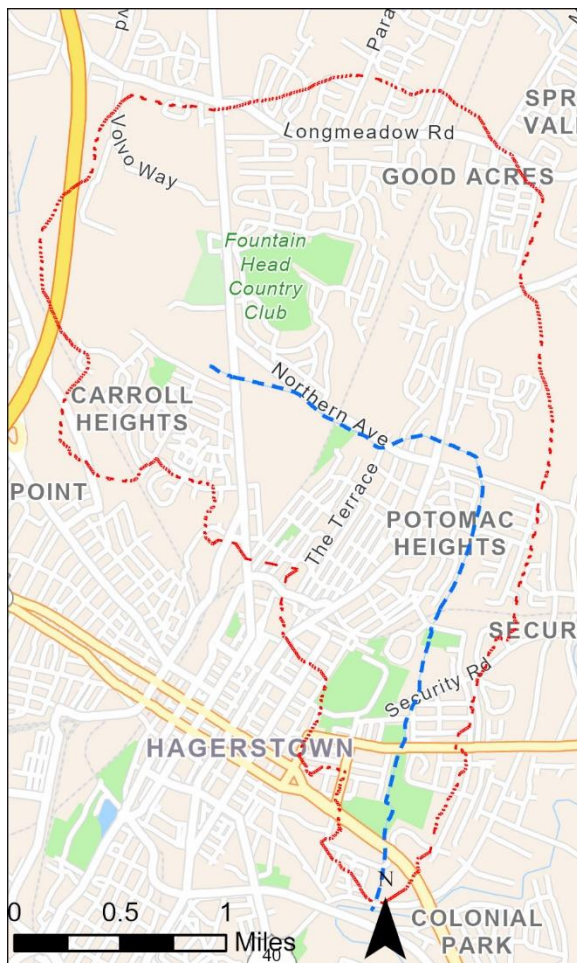


Figure 1: Hamilton Run Watershed Map

use of natural infrastructure. This report will discuss the methodology for identifying and prioritizing projects, results from community outreach and modeling efforts, and the resulting project portfolio in the Western Shore TRA; the Hamilton Run Watershed (Figure 1).

Hamilton Run is a Use IV stream that runs through the City of Hagerstown. Use IV streams are recreational trout waters, meaning they may be stocked with trout. The City of Hagerstown is a heavily urban historic town located in Washington County on the western shore. The City holds its own NPDES MS4 Permit, meaning that it is responsible for managing its own stormwater runoff and implementing projects to treat 20% of the untreated impervious area under the current permit term. To aid in meeting restoration requirements, the City has implemented a utility tax that charges property owners a fee based on the amount of impervious area they have on the property. This fee is used to leverage resources and implement new projects for pollutant load reductions.

2. PORTFOLIO DEVELOPMENT

There were five (5) key phases to the development of the Water Quality and Climate Resiliency Portfolio: (1) identifying targeted resiliency areas (TRAs) at county and community scales, (2) engagement with local government and communities to identify priority project areas within the TRAs, (3) hydrologic and hydraulic (H&H) modeling to evaluate existing and future flooding conditions, (4) feasibility assessment and concept development for proposed projects, and (5) development of a model to evaluate project co-benefits for prioritization of recommended implementation.

2.1 TARGETED RESILIENCY AREAS IDENTIFICATION PROCESS

Targeted Resiliency Areas (TRAs) are focus areas for action based on a landscape-scale, science-based targeted framework. They were developed to assist in creating the Comprehensive Water Quality and Climate Resiliency Portfolio (Portfolio). The portfolios identify a suite of restoration and conservation projects to optimize resiliency benefits and leverage important habitat, water quality, and greenhouse gas mitigation gains. The portfolios deliver multiple environmental, economic, and societal benefits. The TRAs were identified by the DNR Chesapeake and Coastal Service using three factors:

- DNR Priority Assets: Areas significant for ecological value and importance to natural-resource based economies.
- Climate Change Impact Areas: Coastal and inland areas vulnerable climate change impacts related to sea level rise, storm events and subsequent flooding.
- Natural and Nature Based Features (NNBF) Restoration and Conservation Opportunities: Aquatic and terrestrial areas suitable for NNBF restoration and unprotected rural resource lands.

These factors were mapped, combined, and prioritized at a small (12-digit) watershed scale to identify candidate watersheds in need of targeted resiliency that were co-located with disadvantaged communities.

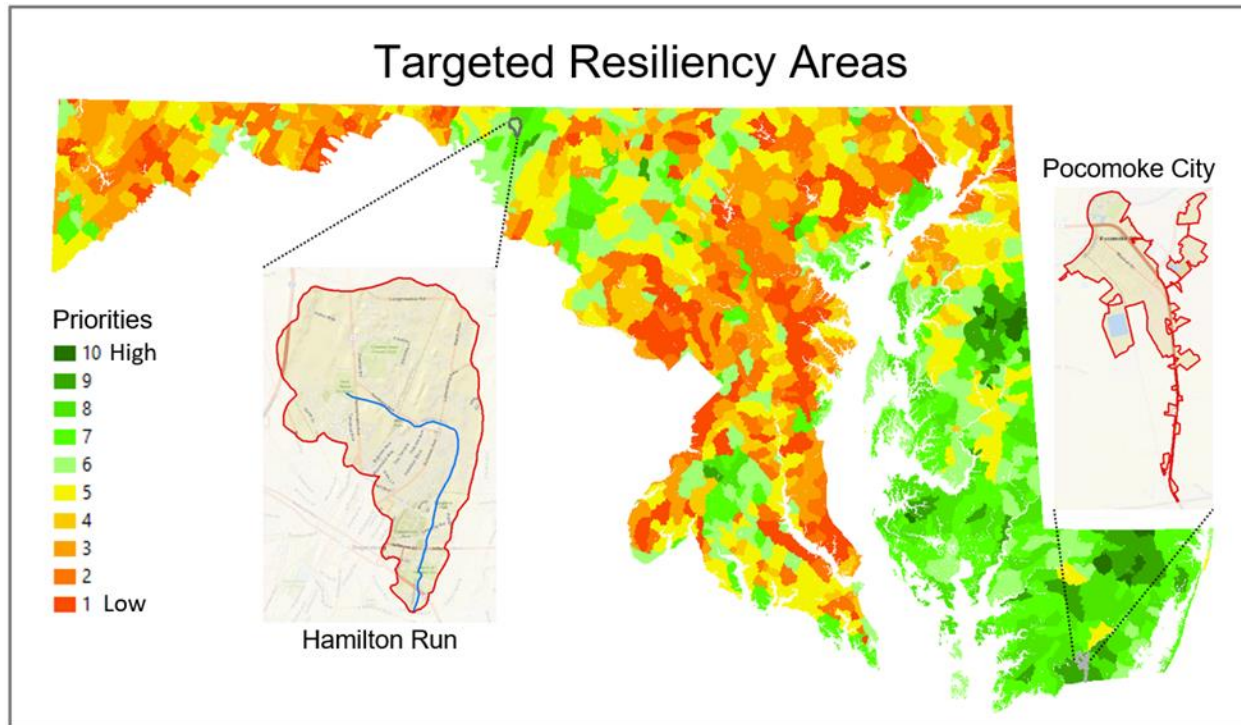


Figure 2: Targeted Resiliency Areas

DNR selected several candidate TRAs on the eastern shore for coastal flooding impacts and on the western shore for inland flooding impacts based on high scoring areas. Consultation with local governments was pursued to identify final TRAs based on interest in assistance, local knowledge of flooding issues, and previous and planned restoration, conservation, and mitigation projects. Hamilton Run in Hagerstown and Pocomoke City were selected as the two TRAs for study (Figure 2).

2.2 COMMUNITY OUTREACH

Community outreach was a critical component in the Portfolio to provide a list of projects that brought solutions to problems experienced by locals as well as preserving resources important to the community. Community buy-in is critical for the successful implementation of projects within the portfolio. Therefore, feedback from community outreach significantly influenced the focus areas for projects chosen for the Portfolio. To aid in these efforts, MES procured Smith Planning & Design to facilitate meetings, prepare materials, and build a distribution list of local businesses, contacts, and organizations. A total of three (3) outreach initiatives were completed to collect input from the local communities on flooding issues and to initiate relationships between the community and project team. This included a 1) listening session, 2) public survey and 3) planning project meeting. This section provides a summary of the results of each initiative, with detailed write-ups included within Appendix C.

2.2.1 LISTENING SESSION

On June 27, 2023, a listening session was held at Northern Middle School in Hagerstown, MD. The purpose of this meeting was to introduce the community to the initiative for developing the Portfolio and provide an opportunity for the community to voice their concerns pertaining to flooding. Advertisement for the event included distribution of resident letters and project briefing sheets via mail, email and posted on the City of Hagerstown website and social media. Distribution included area businesses, churches, City of Hagerstown and Washington County staff and key elected officials. Also included in the distribution were various media outlets. Copies of distribution materials are provided in Appendix C.

During the meetings, maps of the TRA boundary were provided and attendees were instructed to identify locations with flooding issues, as well as locations of opportunities for potential restoration projects. Attendees at the meeting included representatives from the project planning team, City of Hagerstown staff and three (3) Hagerstown residents. Discussions highlighted the American Legion (Northern Avenue), Medway Road, East Magnolia Avenue, and Longmeadow Shopping Center as areas frequently experiencing flooding impacts. Concerns were also expressed on the overall undersized stormwater BMPs throughout the City. These are small ESD practices that are overwhelmed and release uncontrolled flows during large rain events. Additionally, multiple reports of erosion along Hamilton Run were discussed, including Medway Road and Foxleigh Meadows.

2.2.2 PUBLIC SURVEY

Following the listening session, a public survey was distributed to gather additional public comment. The public survey was developed in ArcGIS Survey123 and allowed users to map locations of repetitive flood or water issues, as well as areas of importance as defined by the survey participants. The public survey was promoted via three (3) methods: 1) Electronic distribution of survey materials through targeted emails, 2) postcard mailers to local businesses, community groups, organizations, and departments, and 3) a targeted Facebook advertising campaign. A total of 12 survey responses were received.

Similar to discussions held at the listening session, reports of repetitive flooding were received for Northern Avenue and Medway Road, as shown in Figure 3. Reports also identified flooding for Rest Haven Cemetery, Fountain Head Plaza and the Greens at Hamilton Run.

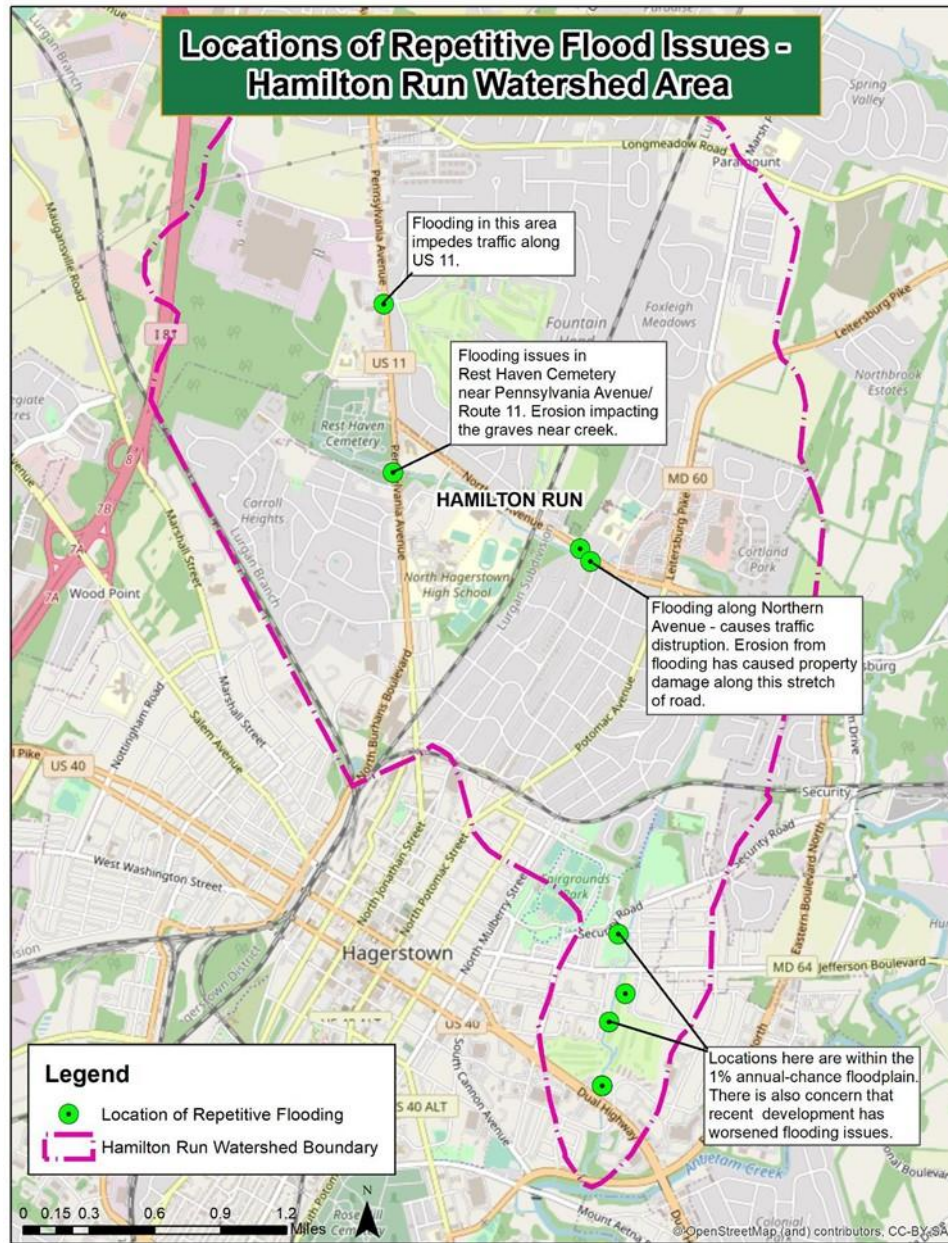


Figure 3: Map of Survey Responses for Repetitive Flooding Locations in Hamilton Run Watershed

Figure 4 shows areas of importance, which included recreational facilities such as Pangborn Park, the Greens at Hamilton Run, and Mills Park. Overlap between areas of importance and repetitive flooding are observed within the Greens at Hamilton Run and along Northern Avenue.

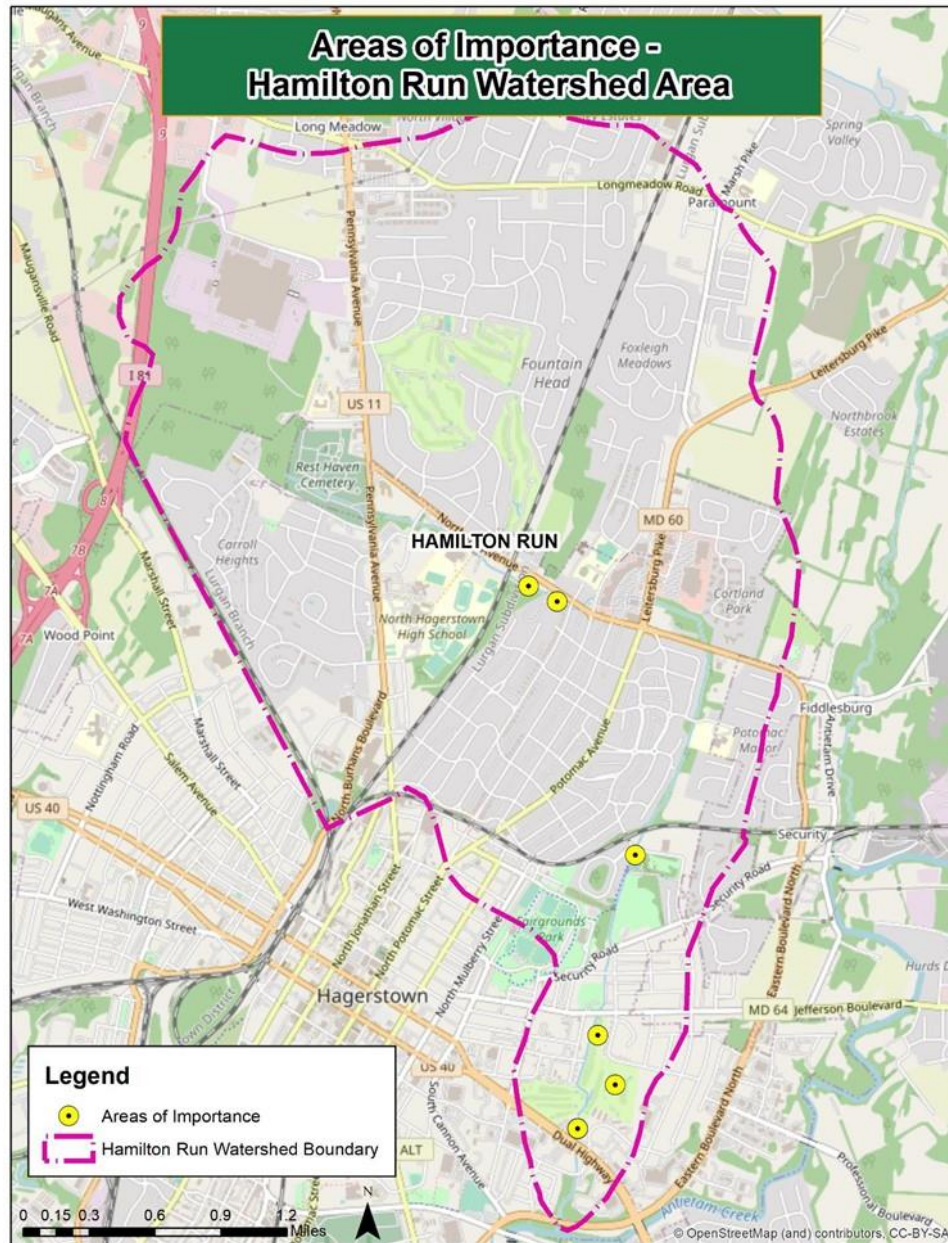


Figure 4: Map of Survey Responses for Areas of Importance in Hamilton Run Watershed

2.2.3 PLANNING PROJECT MEETING

On November 14, 2023, a second public meeting was held at the American Legion, Morris Frock Post 42 in Hagerstown, MD. This meeting was attended by 12 participants including representatives from DNR, MES, MDE, and the City of Hagerstown. Meeting invitations were distributed via mail and email. Distribution included area businesses, churches, City of Hagerstown and Washington County staff and key elected officials. Also included in the distribution were various media outlets such as radio and tv stations. Facebook ads ran the week

prior to the meeting date. Additionally, public meeting information was posted on the City of Hagerstown website, social media, and the cable news channel.

The purpose of this meeting was to discuss results from the listening session and public survey and how these data were utilized for identifying potential projects. Furthermore, results from the hydrologic & hydraulic (H&H) analysis were presented, and how repetitive flood locations may be impacted by future conditions due to increased precipitation. Proposed projects highlighted during this meeting were Northern Avenue, Pangborn Park, and the Greens at Hamilton Run.

Community members provided feedback and questions pertaining to the highlighted projects. Attendees informed the project team that the vacant lot on Northern Avenue was recently purchased to become a truck driving school, but some stormwater management would be provided as part of this project. Furthermore, a constructed wetland was identified at the Fountaindale Elementary School adjacent to the identified location as a potential project, as well as a reforestation project near the Health Department. This feedback was used to modify proposed projects within the portfolio to account for this new information.

Discussions were also held regarding impacts on flooding from Fountain Head Plaza and proposed new development northwest of Rest Haven Cemetery. Residents expressed that flooding within the cemetery increased after the Fountain Head Plaza construction, which has led to flooding impacts downstream. There are concerns that the new development will increase these impacts, as residents who reviewed the design plans mentioned stormwater runoff from offsite would be diverted around the development rather than treated as part of the project.

2.3 H&H ANALYSIS

Projects included within the Portfolio were evaluated not only on how they provide solutions to current flooding but also how they will better assist communities in building climate change resiliency. Michael Baker International was procured by MES to complete an H&H analysis for both current and future conditions. The current conditions modeling was used to investigate flooding reports received from community outreach efforts to determine potential causes of the reported flooding. This information would be leveraged in the development of proposed projects described in Section 3.2. Additionally, the model outputs were reviewed to identify any additional areas at risk to flooding not identified from flooding reports that may be considered for a project focus area. However, priority was placed on focus areas both at risk to flooding according to the model and received reports of flooding from the community outreach. The future conditions models were used to evaluate how flood risk may increase in the future in identified project focus areas, or if any new locations may become at risk with future increases in precipitation.

The 10-year, 25-year, 50-year and 100-year 24-hour storms were modeled utilizing current rainfall data from [NOAA Atlas 14 and the low emissions future \(Low RCP 4.5 Median Change Factor\)](#) for 2050 and 2080 precipitation projections, as shown in Table 1. The detailed modeling approach and outputs are provided in Appendix D.

Table 1: Hagerstown Current & Future Precipitation

Return Period	24 hr Precipitation (inch)	Change Factor (predicted rain depth/current rain depth)
10 yr - Current	4.1	
10yr + 2050 Prediction	4.55	1.11
10yr + 2080 Prediction	4.67	1.14
25yr - Current	4.95	
25yr + 2050 Prediction	5.54	1.12
25yr + 2080 Prediction	5.84	1.18
50yr - Current	5.68	
50yr + 2050 Prediction	6.36	1.12
50yr + 2080 Prediction	6.76	1.19
100yr - Current	6.49	
100yr + 2050 Prediction	7.2	1.11
100yr + 2080 Prediction	7.33	1.13

Figure 5 shows the results of the H&H analysis were consistent with the reports of flooding being experienced by the local communities received from the public survey and meetings. Rest Haven Cemetery, Northern Avenue from the American Legion to Longmeadow Shopping Center, and properties at Medway Road show inundation for the current 10-year storm, indicating these locations will experience more frequent flooding. Another area observed to be at risk to flooding for the 10-year storm not reported within the public survey was East Magnolia Avenue.

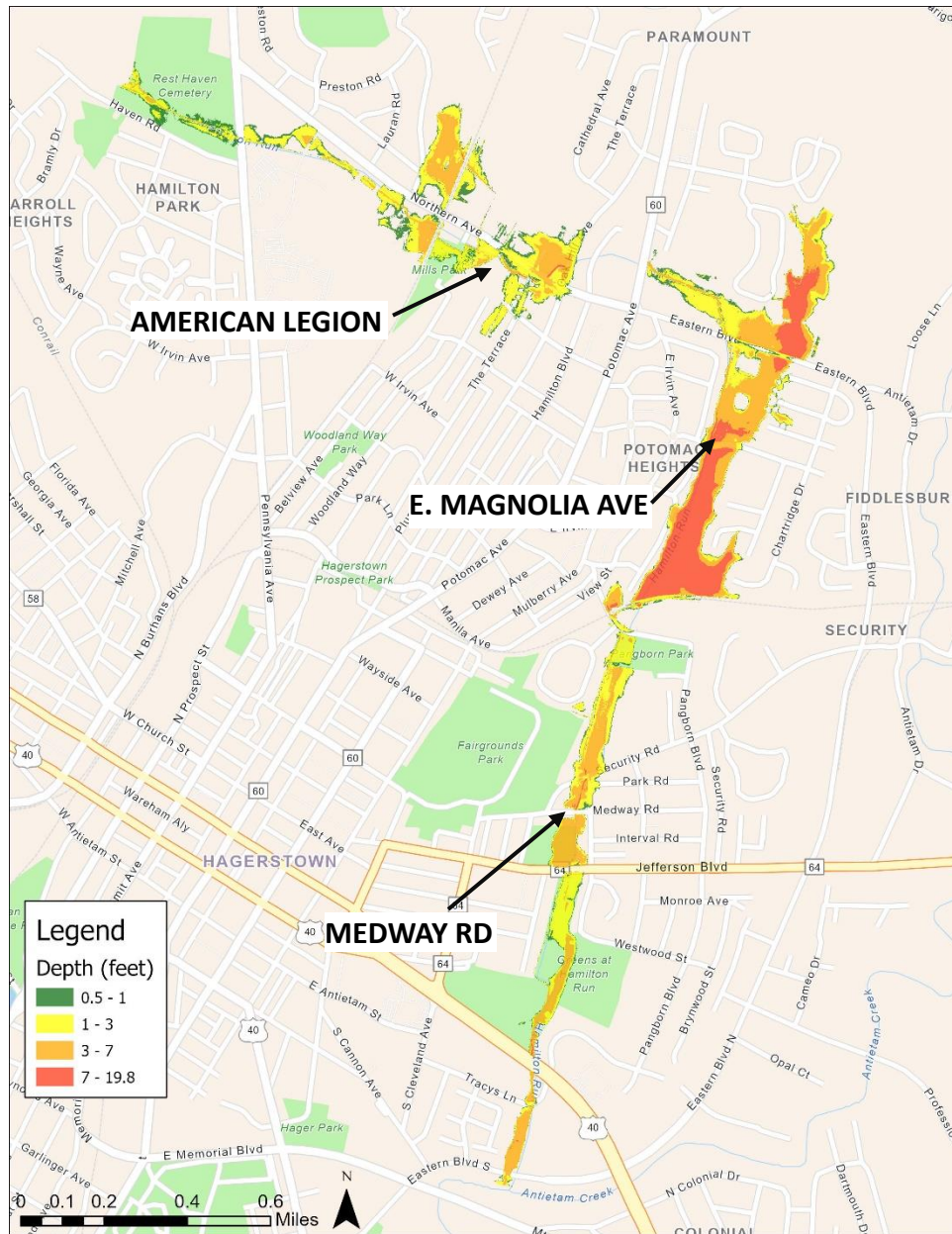


Figure 5: Current 10-year Storm Inundation Hamilton Run

Figure 6 shows that these impacts increase in severity for the 100-year storm, with inundation expanding further along Northern Avenue, within Rest Haven Cemetery, and residential properties adjacent to Medway Road.

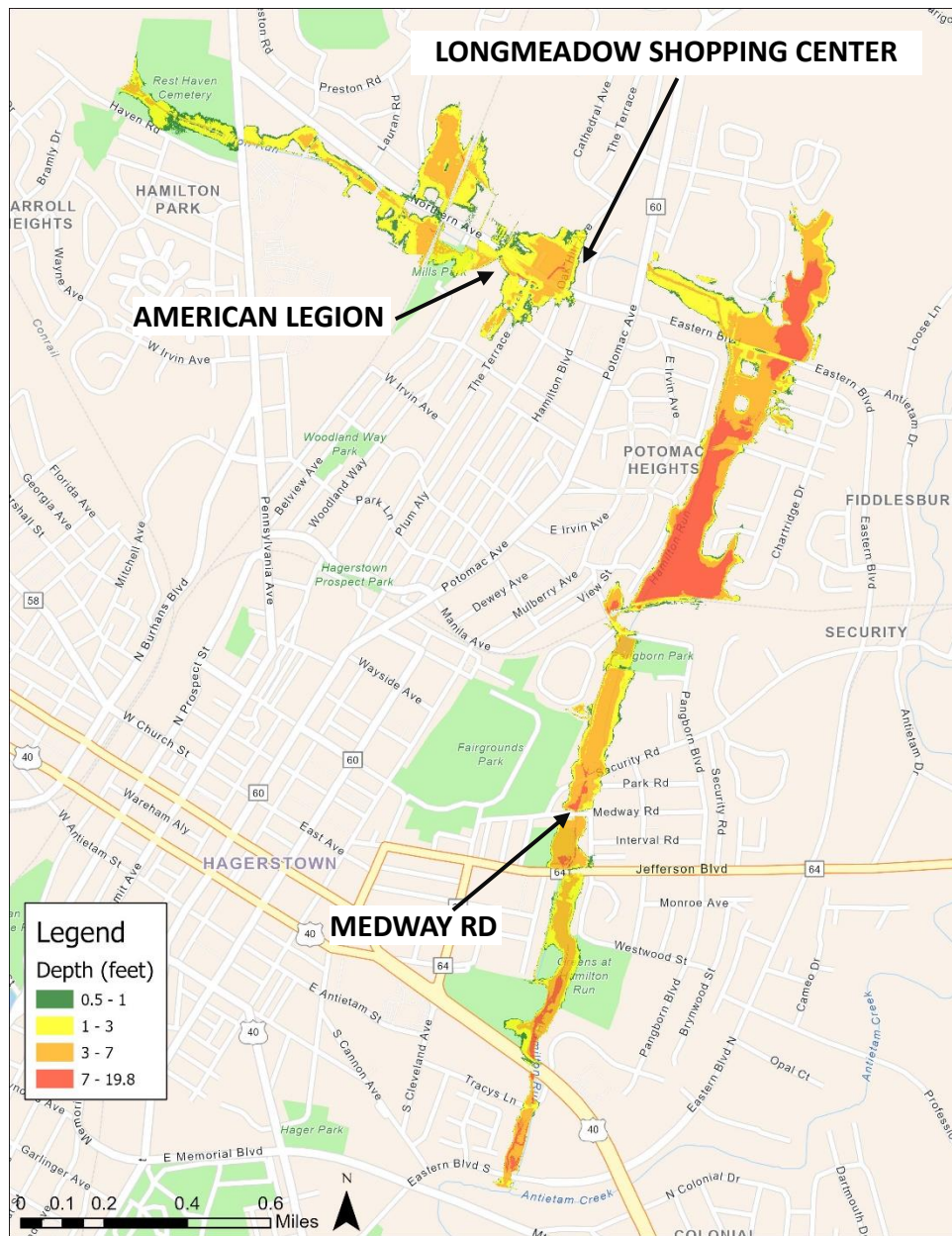


Figure 6: Current 100-year Storm Inundation Hamilton Run

Backwater impacts from culverts are observed along the full length of Hamilton Run. This is when the sizing of a culvert is receiving flow beyond its design capacity and causes ponding on the upstream end of the pipe. Culverts are required by state regulations to convey the 10-year 24 - hour storm, but depending on local regulations they may not be required to convey larger storm events such as the 100-year storm. For this reason, culverts exhibiting backwater effects for the 10-year storm are more alarming than culverts only exhibiting backwater effects for the 100-year storm. Backwater effects of particular concern are observed along Northern Avenue upstream of the Longmeadow Shopping Center. At this juncture Hamilton Run is diverted into an undersized box culvert running under the shopping center, resulting in the culvert backwatering as shown in

Figures 5 and 6. The inundation boundary also suggests additional culverts along Hamilton Run upstream of the shopping center, such as at the Terrace, American Legion entrance, and train tracks, may also be undersized, contributing to the severity of the observed trends. The increased inundation depths and expanded boundaries on the upstream end of the culverts under Magnolia Avenue and Medway Road indicate these culverts may also be undersized.

Much of the city was developed prior to stormwater management controls which began in the 1980s. This means many areas do not have adequate stormwater management for the runoff generated from current storm events over the dense urban landscape of Hagerstown. These unmanaged flows contribute to the backwater flooding at culverts previously described. Furthermore, this lack of stormwater management has resulted in the declined ecological health of Hamilton Run and increased flooding risk within the watershed.

The future conditions analysis showed an increase in depth of inundation for each storm event, but there were minimal changes in the inundation boundary, indicating there are no new properties at risk to flooding. Figure 7 shows the inundation for the 2080 100-year storm.

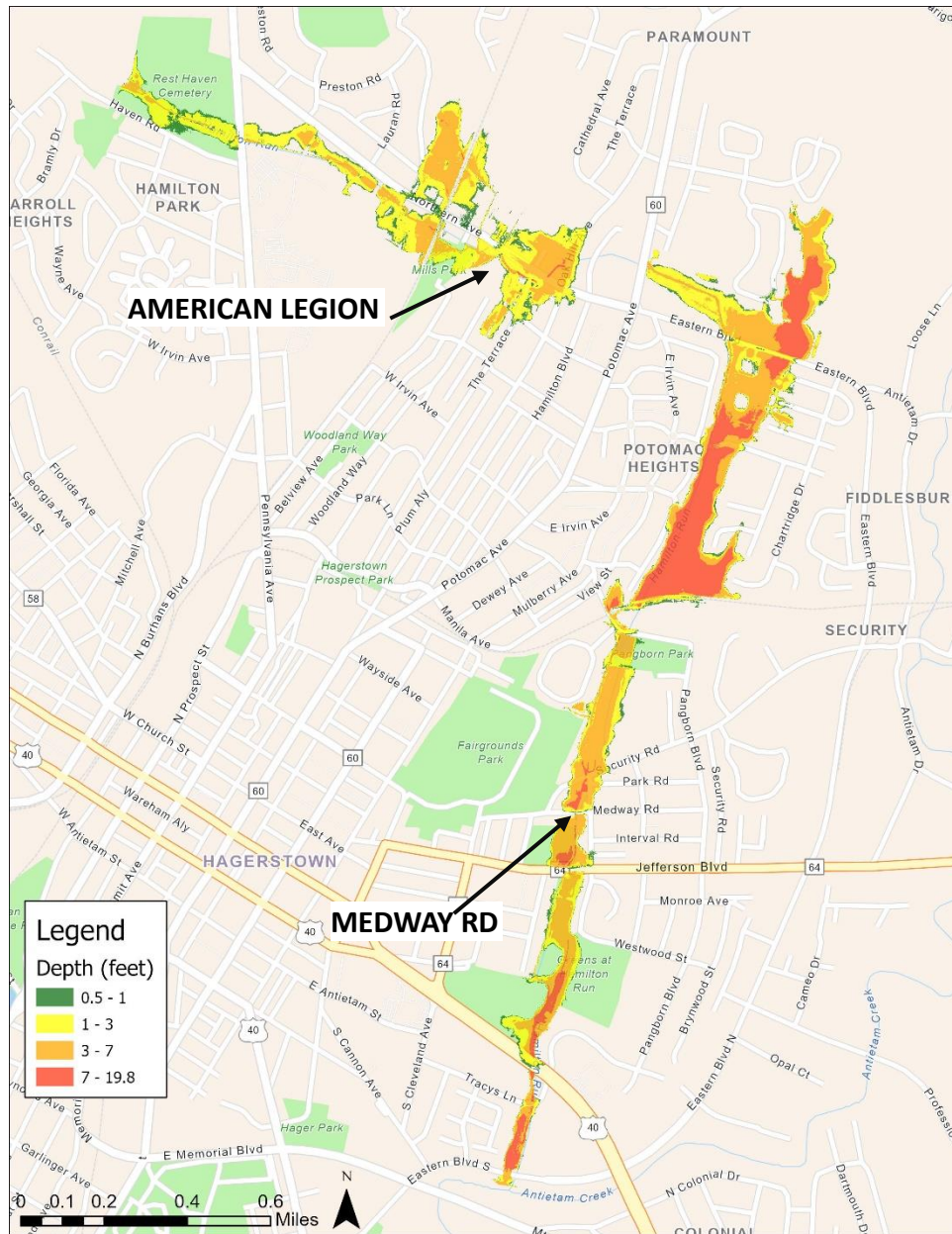


Figure 7: 2080 100-year Storm Inundation Hamilton Run

While no new properties were identified as at risk to future climate change induced flooding, project planning within the Hamilton Run watershed should continue to incorporate increased retention to help manage increased flooding volumes within current at-risk locations. Furthermore, continued evaluation of existing stormwater infrastructure will be vital as infrastructure continues to age.

The future conditions models were also used to conduct a floodplain storage analysis along Hamilton Run described in Appendix D. Multiple publicly owned properties were identified along the south side of Northern Avenue including the Fountaindale Elementary School, Northern

Middle School and Washington County Highway Maintenance Yard. A vacant lot that was formerly Gold's Gym on the north side of Northern Avenue was also identified as publicly owned land. Two retention basins were modeled, one at Northern Middle School/Highway Maintenance Yard and second at the vacant lot, to evaluate downstream flooding impacts with increased upstream retention on these properties. Increased retention from a proposed wetland at Pangborn Park was also modeled. The model determined the increased retention at Northern Middle School/Highway Maintenance Yard and Pangborn Park had greater reductions in the downstream flood depth compared to the vacant lot, likely due to closer proximity to the floodplain. However, the greatest reductions were observed when all three retention locations were included together within the model. The results of this model were used to support focus areas for proposed projects. However, as noted in Section 2.2.3, several of the publicly owned locations along Northern Avenue were determined to have previously completed or in progress projects, reducing the land available for retention facilities.

2.4 FEASIBILITY ASSESSMENT & CONCEPT DESIGN

The results of the community outreach and H&H analysis were used to identify focus areas for potential projects for flood mitigation. Previously completed studies were also reviewed for evaluation of recommended projects and integration into the Portfolio. All potential focus areas from the community outreach, H&H and previous studies were compiled into a list as shown in Table 1 of Appendix E. These focus areas were then narrowed down to a smaller set of projects that would undergo feasibility assessment and be evaluated within the co-benefits model described in Appendix E. Focus areas were removed from the project list due to criteria such as there were no readily available spaces for a potential project, no reports of flooding from the community, or the proposed project has already been moved forward toward implementation. The proposed projects within the refined list were then evaluated to ensure they were feasible.

Project recommendations and feasibility assessment were completed utilizing a combination of site visits, desktop analysis through GIS and field survey. The feasibility assessment reviewed which potential practices would be suitable for the proposed location considering topography, soils, and available space. For flood mitigation focus areas, recommended practices would need to be suitable for the experienced flooding. Co-benefits were also considered when selecting potential practices for a project. This means, when possible, practices were chosen that would offer flood mitigation but would also provide other benefits such as water quality improvements, restoration of natural habitats or improved green spaces for the community. This coincides with the overall goals of this initiative in promoting green, nature-based solutions for improving water quality and building climate resiliency. Any challenges the project may face were also evaluated, including land ownership, legal such as forest conservation easements, or physical constraints that would impair successful construction.

The refined list of projects were also evaluated within the co-benefits model, discussed in Appendix E, for prioritization of recommended project implementation. The top projects identified as the most feasibly successful and as a high priority for both DNR and the communities were moved forward to a concept design. The remaining projects will be used as a list of projects to be leveraged with different project funding sources at a different time. For Hamilton Run, a concept design was developed for a submerged gravel wetland located at the Washington County Maintenance Yard. Section 3 of this study provides a narrative of the practices utilized within the recommended projects and a summary of the feasibility assessment for recommended projects.

2.5 CO-BENEFITS MODEL

MES staff created a co-benefits model for the Hamilton Run TRA. The model utilizes a scoring system for a designated list of factors against which projects were evaluated based on their provided co-benefits. The methodology for scoring/ranking the resiliency projects was developed during the project based on input from the project partners and is provided in Appendix E. In the Hamilton Run TRA, this includes MES, MD DNR, Washington County, and the City of Hagerstown, as well as other partners identified during the project as having a vital role. Benefits were defined during the project by the project team and included factors such as a project's ability to benefit socially vulnerable populations, increase community resilience, advance program priorities, support partnership priorities (including other state agencies and multi-agency groups), reduce risk to critical infrastructure, increase overall community preparedness, and have the potential for carbon offset.

Each project was classified by the types of practices to be implemented. Some projects incorporated a single practice while others included multiple practices. For example, a project might include a stream restoration and a culvert redesign. A finite list of practices was evaluated, which is provided in Appendix E.

Each practice type was first compared to each benefit factor to create a scaled qualitative impact multiplier to represent how strongly a practice advances a specific factor. Then, each practice-factor combination underwent a qualification test based on details of the proposed projects. Certain practice-factor combinations would only be applicable for project ranking if the project met certain criteria, such as if the project is located within a certain distance to specific natural resources or communities. These components were then used to calculate an overall score. These scores were standardized into ranges for prioritization of high, medium, and low priority. Projects were compared only to other projects within the same TRA. The detailed modeling approach and outputs are provided in Appendix E. The resulting prioritization of the project portfolio from this matrix for Hamilton Run is provided in Table 2 below.

Table 2: Hamilton Run Portfolio Prioritization

Project ID	Project	Priority
29	Pangborn Townhomes Wetland Complex	High
22	Corridor of open field	High
10	Rest Haven Cemetery	High
24	Washington County Highway Maintenance Yard	Medium
16	Fountaindale Elementary School	Medium
8	Potomac Heights School/Magnolia culvert crossing	Medium
3	The Greens at Hamilton Run Stream Restoration	Low
13	Potomac Heights development	Low
20	Hamilton Run before the Greens	Low

3. WATER QUALITY AND CLIMATE RESILIENCY PORTFOLIO

The goal of the Portfolio is to aid the TRA communities in streamlining projects into implementation by providing a sound assessment to be used for both planning decisions and pursuing project funding. The projects described within have been evaluated based on feasibility, cost effectiveness, environmental and social co-benefits, as well as support from the local community. The portfolio is comprised of a list of projects developed from the findings of this initiative, as well as recommended projects from the 2017 Hamilton Run Watershed Characterization and Action Planⁱ that have not yet been implemented. Most of the projects described within this section were evaluated using the co-benefits model described in Section

2.5 and Appendix E for prioritization. However, some projects were not included in the model due to factors described within the respective narratives below. Although these projects were not included in the co-benefits model, they were included within the portfolio narrative to provide additional potential solutions to experienced flooding within the TRA and summary of any current efforts in progress for flooding mitigation or water quality improvements. Figure 8 shows the locations of the eleven (11) projects described within the Hamilton Run Portfolio.

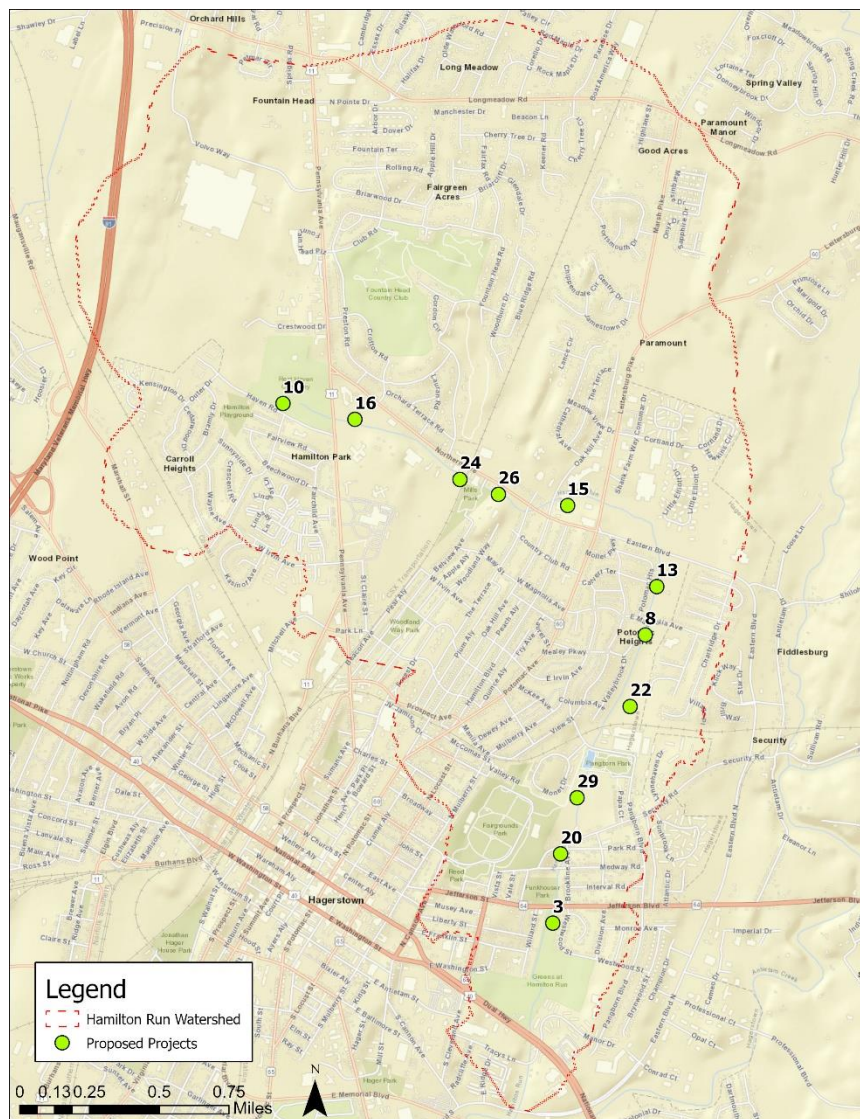
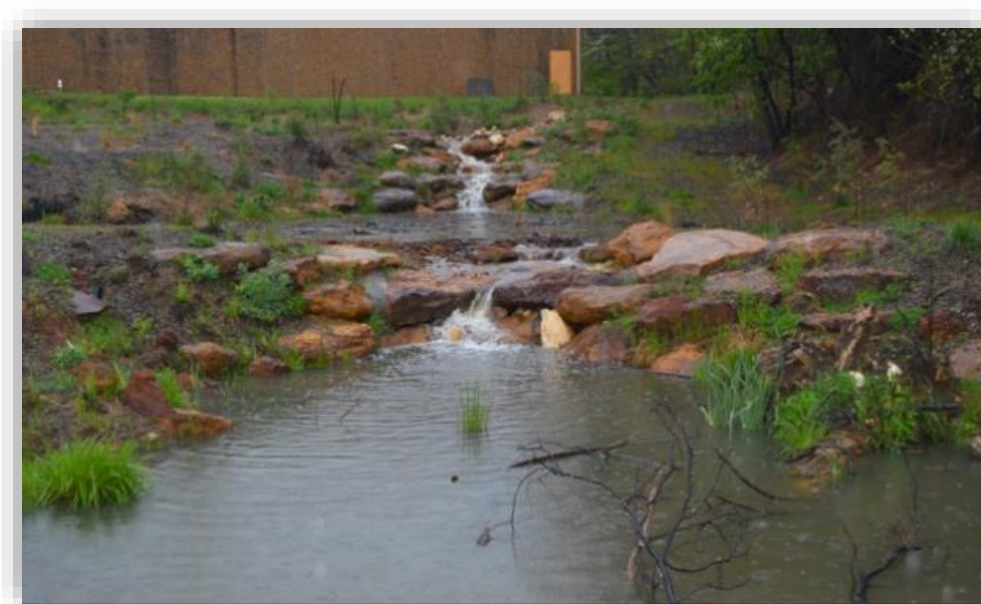


Figure 8: Hamilton Run Portfolio Locations Map

3.1 PRACTICE DESCRIPTIONS

STREAM RESTORATION AND REGENERATIVE STORMWATER CONVEYANCE (RSC)ⁱⁱ

Stream Restoration is a widely used practice to restore streams to their desired quality and functionality. One main goal is to reduce the velocity of flows and the frequency of erosion due to increased runoff from urban development. Increasing the sinuosity of the stream and adding protective layers to the stream are common solutions to these problems. There are many different stream restoration techniques ranging from Natural Channel Design to legacy sediment removal, and Regenerative Stormwater Conveyance (RSC). The appropriate technique depends on site specific conditions and the cause(s) of degradation from the stream's natural condition. For example, in ephemeral or intermittent channels the RSC methodology can be highly effective at treating runoff by conveying stormwater through a series of steps and pools. RSC structures allow for large amounts of water to flow without causing sediment depositions downstream because erosion is mitigated by the boulders and rocks weirs as well as pools which slow velocity. Furthermore, the pools aid in stormwater runoff treatment by allowing time for materials to settle and water to infiltrate into the ground. RSC structures utilize the natural and unique features of the area within the structure to reconnect the floodplain to the stream. Ideally stream restorations of any technique will successfully divert stormwater water from the channel onto the floodplain to mitigate downstream peak flows and enhance water quality treatment.



Source: https://dnr.maryland.gov/ccs/Documents/RSC_Training/RSC-Guidance.pdf

ENVIRONMENTAL SITE DESIGN (ESD)

ESD practices include many smaller-scale best management practices (BMPs) that are effective at providing water quality treatment benefits as well as controlling the flow direction of runoff. ESD is intended to mimic the natural hydrology of a landscape through the utilization of a series of small-scale practices in contrast to traditional stormwater management which typically relies on large treatment facilities (e.g., dry pond, wet pond, etc.). Example ESD practices include grass swales and bioswales which function similarly to RSC systems in that they filter and convey water through an open channel. Swales are often a cheaper practice to implement due to minimal grading, landscaping, and structural requirements. Rain gardens and micro-biorententions are small infiltration practices comprised of special media and native plantings. These offer temporary storage and treatment of stormwater runoff. These practices offer flexibility due to their small size, which is advantageous for urban environments. They also offer beautified green aesthetics to landscaping.



WETLAND CREATION/RESTORATION

Areas that have existing wetlands can be expanded to supply natural water storage through sinuous reaches, pools and vegetation. This storage helps mitigate riverine flooding from high tide, sea level rise, or from heavy stormwater events. Dense amounts of vegetation will provide filtration of pollutants while preventing excess runoff from inundating adjacent properties. Wetlands can be implemented in open space as well as additions to existing wetlands or wooded areas. These practices offer numerous co-benefits, with increased green aesthetics, habitat, and sustained base flow to streams.



Source: <https://www.chesapeakebay.net/issues/whats-at-risk/wetlands>

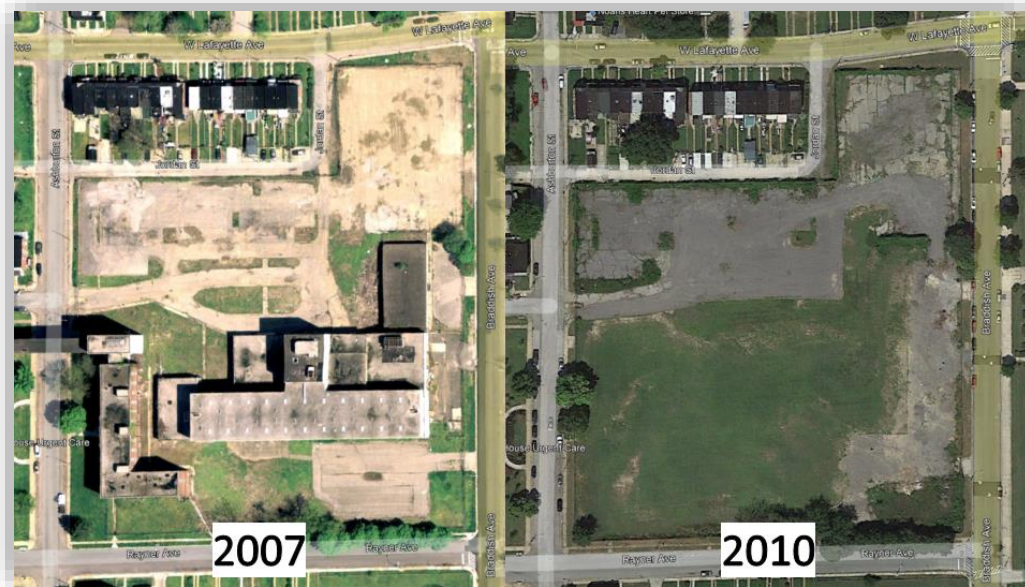
RETENTION/DETENTION PONDS

This SWM practice is historically successful in providing water quantity storage capacity. They have evolved to provide water quality treatment through designed features such as forebays and permanent pools to facilitate settling of materials at the base of the pond. These practices are advantageous for providing treatment for large amounts of impervious areas. However, initial costs for pond design and installation can be high. Ponds also require a maintenance plan to ensure sustainable maintenance throughout the life of the facility, as failing ponds have the potential for increasing flooding risk due to decreased storage capacity or dam failure. Properly maintained retention ponds can provide a unique space filled with a variety of wildlife.



IMPERVIOUS REMOVAL

Impervious land does not allow for natural grass and ground to absorb pollutants before reaching a drain system or the stream channel. Instead, stormwater collects pollutants as it runs across impervious surfaces and introduces these pollutants to local waterways if unmanaged. Additionally, impervious land on a slope that receives rainfall will convey that runoff to an adjacent area instead of storing it, increasing flooding. Impervious land also increases the velocity of stormwater runoff leading to increased erosion within streams and along roadways. Converting impervious land to pervious restores the natural hydrology and facilitates stormwater infiltration within soils. This provides not only more water quality treatment and storage but also more natural grass and green features throughout the landscape. These benefits can be increased through planting of trees or meadows in these areas. Furthermore, for jurisdictions with a Municipal Separate Storm Sewer System (MS4) Permit, impervious to pervious conversion qualify as an alternative BMP and would grant 0.75 acres of equivalent impervious treatment credit for every acre of impervious removed and planted with trees.



CULVERT/STORM DRAIN RETROFIT

Culverts that are undersized can have difficulty transporting the necessary water downstream to avoid backwatering. This can also have the effect of increasing downstream channel erosion due to the culvert discharging at higher than ideal velocity. Backwatering is when water pools on the upstream end of a culvert due to the inflow volumetric flow rate exceeding the designed capacity for the culvert. When this occurs, one of the few solutions available is to increase the size of the culvert itself to allow for such throughput. Stormwater networks that allow for underground conveyance are necessary in areas that experience flooding but have too much development in the above-ground areas. Often stormwater networks for older developments are not equipped to handle the flows received from increased impervious areas and precipitation amounts. If retention within impacted areas is not feasible to combat resulting flooding, modification to the storm drain network may be necessary to convey the water to a more manageable location. Culvert and storm drain retrofits are expensive to implement due to high-cost materials and the need to excavate and remove the existing infrastructure. This can cause additional impacts by requiring high traveled roadways to be closed for extended periods for construction. Furthermore, older infrastructure may be located under homes and businesses due to lack of regulations preventing such placement at the time. This poses additional risks to these buildings. While these retrofits may be necessary, they provide minimal environmental co-benefits.



3.2 PROPOSED PROJECTS

LONGMEADOW CULVERT (PROJECT ID: 15)

As discussed in Section 2, the H&H analysis revealed significant backwater flooding is being caused by the culvert running under Longmeadow Shopping Center. This is a 9 ft x 15 ft box culvert that diverts Hamilton Run under the shopping center then daylights on the east side of Potomac Avenue as shown in Figure 9. The observed flooding indicates this culvert is undersized for the capacity of flow it is receiving. Much of Northern Avenue does not have stormwater management that would meet current regulations, which allows large volumes of runoff to flow directly into Hamilton Run. Drainage from Northern Avenue feeds into the portion of Hamilton Run upstream from the shopping center. The culvert running under the shopping center is unable to properly convey these unmanaged flows during large storm events, resulting in flooding along Northern Avenue.



Figure 9: Approximate Location Longmeadow Culvert

A retrofit of the culvert to increase the size would allow for increased capacity for conveyance during storm events. However, the feasibility of this retrofit is very low. The culvert runs directly under business buildings creating an increased risk to these structures and occupants during construction. If a collapse were to occur, all lands and structures directly above the collapse would be impacted. Furthermore, the retrofit would be extremely expensive. Not only would the buildings need to be accounted for, but a significant amount of pavement would need to be



Figure 10: Existing Longmeadow Box Culvert

removed within the lot as well. This would also cause significant disruption to the businesses within the shopping center, reducing available parking and access for the community.

Furthermore, increasing conveyance through the culvert would be introducing increased flows downstream. A thorough H&H analysis would be necessary to fully evaluate the potential downstream impacts. While the culvert retrofit may reduce flooding impacts

upstream, it could potentially introduce new flooding risk downstream. This may result in the need for new projects downstream to account for these increased flows.

Due to the reasons described above, the project has a very low priority for implementation. Therefore, this project did not progress to evaluation within the co-benefits model. The alternative strategy for mitigating flooding from backwater from the culvert would be to implement projects along Northern Avenue to increase retention prior to the undersized culvert. Increased retention will reduce flows to the culvert, reducing the backwater impacts.

FOUNTAINDALE ELEMENTARY SCHOOL (PROJECT ID: 16)

Fountaindale Elementary School is located directly adjacent to Hamilton Run. The open grass spaces adjacent to the stream are in low lying elevations and have been reported to experience inundation during large rain events. The area west of the lot is utilized for playground space. East of this area, south and southeast of the lot, appears to be unutilized and viable space for a potential project as shown in Figure 11. There is a significant riparian buffer throughout this stream segment, but there is also room for a wetland complex or a storage basin within this space adjacent to the channel. This facility would aid in the management of flooding of the school property during storm events but would also provide water quality treatment for the school. Runoff from the 0.52 acre lot to the north currently runs directly into the stream. The proposed facility could provide treatment for the full first 1" of runoff for the lot, qualifying for restoration credit toward Hagerstown's MS4 restoration goal.



Figure 11: Proposed Location Fountaindale Wetland

Additional treatment could potentially be provided for the school building as well. The facility would need to be designed in a manner that could sustain prolonged periods of ponding due to lying within the floodplain. H&H analysis, including dam breach analysis, would need to be completed to evaluate potential impacts of this modification within the floodplain. The segment of the stream running along the elementary school property could also be converted into a step pool stream to allow for more storage in pools in between riffle or weir structures.

This project would offer the opportunity to further engage students in environmental topics. For Earth Day, students currently traverse the stream in waders to collect trash, as well as conduct weeding and plantings of the existing constructed wetlands east of the proposed project location. The constructed wetlands currently provide retention for floodwaters from the stream. Students could be informed on the importance of stormwater management and its potential impacts and how the new facility aids in flood management. Additional lessons or plantings could be integrated into Earth Day activities to keep students engaged with the new facility.

Increasing stormwater retention along Northern Avenue will help mitigate flooding. However, Northern Avenue has limited space for implementing projects due to its dense urban layout. Utilizing available open space on public lands is ideal due to increased ease of acquiring land. This area at Fountaindale Elementary School is one of the only open spaces available on public land which justifies its use for a runoff storage project.

WASHINGTON COUNTY HIGHWAY MAINTENANCE YARD (PROJECT ID: 24)

Hamilton Run runs along the front of the Washington County Highway Maintenance Yard behind several businesses. There is minimal space between the business parking lots and the maintenance yard, providing no floodplain for water to go when the stream reaches bankfull. Additionally, there is currently no stormwater management within this area for either quality or quantity control. Therefore, runoff from this impervious area is untreated and flows directly to Hamilton Run. The H&H analysis shows inundation for the 10-year storm, indicating this area is at risk for more frequent flooding. This risk is attributed to the placement of Hamilton Run in proximity to the property and lack of stormwater management.

The maintenance yard acts as storage for necessities for highway maintenance. This includes Washington County maintenance vehicles, equipment, and materials such as snow melt. This provides additional pollutant loads to the runoff entering Hamilton Run from the property during storm events. Furthermore, flood risk to the property brings concerns of inundating hazardous materials that may be stored on the property that could be introduced into the environment during a large storm event, or increased monetary loss may be experienced from damaged vehicles and equipment.

Two opportunities have been identified on the property. First, a portion of the east end of the maintenance yard's lot could be repurposed for installation of a BMP. The BMP type would have to be suitable for Type D hydrologic soils and withstand frequent inundation due to proximity to the stream. A submerged gravel wetland is recommended for this location. Submerged gravel wetlands are small-scale practices that utilize wetland plants and rocks to filter stormwater runoff. Runoff first enters the wetland areas then into the submerged gravel where pollutant removal is achieved through biological uptake from algae and bacteria growing within the rocks. These practices require a high groundwater table which is achieved within Type D soils and a minimum drainage area of one (1) acre. The proposed facility would receive approximately 1.5 acres of mostly impervious runoff from the maintenance yard lot. As demonstrated in Figure 12, a facility with a surface area of approximately 5,600 square feet and surface ponding depth of 1.5 feet would achieve full treatment for the first 1" of runoff. Wetland plant species chosen for the facility would need to withstand ponding at this depth and greater.

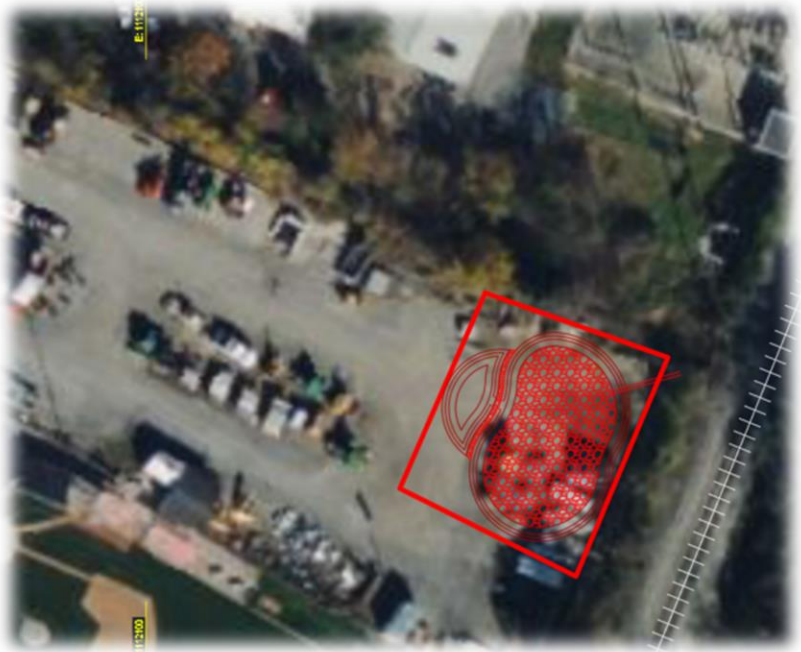


Figure 12: Proposed Location Maintenance Yard SGW

To implement this proposed 5,600 square foot stormwater facility, an approximately 75'x75' square area or a 100'x90' rectangular area along the far east side of the parking lot would need to be repurposed and converted from parking. Currently the maintenance yard has approximately 160,000 square feet of parking area, so while this project may require some reconfigurations of the traffic and parking areas, this proposed project would only reduce the maintenance yard's total parking area by less than 6%.

The second opportunity in this location would be the installation of a small wetland at the front of the property. Currently this location is a large open mowed lawn that Hamilton Run passes through. Currently this location is a large open barbered lawn that Hamilton Run passes through. This space could be utilized for a constructed wetland to increase floodplain storage for Hamilton Run compared to the existing grass. Additional wetlands or meadows could be installed on the south side of the stream to further increase floodplain storage capacity. While the constructed wetlands would aid in



Figure 13: Proposed Location Maintenance Yard Wetland

quantity management of flood water from the stream during large storm events, the wetlands would also provide water quality benefits. As flood water enters the wetlands, pollutants are removed as water flows and infiltrates through the dense vegetation. Furthermore, Figure 14 shows approximately 0.60 acres of impervious stormwater runoff currently flows through the open lawn prior to entering Hamilton Run. This drainage area includes 0.57 acres from Northern Avenue, and 0.03 acres from the maintenance yard driveway. As the runoff sheet flows across the constructed wetlands, additional pollutants would be



Figure 14: Northern Avenue Drainage to Proposed Wetland

removed prior to discharging to Hamilton Run. This project is directly in front of the only street view to the Washington County Highway Department building. Therefore, wetlands planting rather than tree planting in this area will preserve this view while offering increased floodplain benefit. Choice of planting will also reduce required maintenance requiring minimal to no mowing compared to the existing grass. Furthermore, the placement of the wetland could act as a demonstration project for the community, showcasing how natural solutions can be utilized on public lands to reduce flood risk, improve local water quality, and provide increased environmental benefits of improved floodplains and habitat creation.

Since both of the proposed projects fall within the effective 100-year floodplain, an H&H analysis will be necessary to ensure that neither project will cause an increase in flood elevation. The projects do not alter the current flow path of water. Rather the existing grades are utilized to capture this previously untreated runoff to reduce pollutant loads and the velocity at which flows are entering Hamilton Run. Therefore, it is expected that the projects would not alter current flood elevations. Furthermore, additional permitting and approval will be necessary for construction within the floodplain.

AMERICAN LEGION AND MILLS PARK RESTORATION (PROJECT ID: 26)

This stream segment exhibits the highest rate of bank erosion along Hamilton Run. Within the reach is a retaining wall currently held by old telephone posts across the banks, as shown in Figure 15. This is a use class IV stream, providing a good opportunity for stream restoration to mitigate flooding, promote ecological uplift, and restore hydrologic conditions. The City of Hagerstown recently received funding for the design of a stream restoration project beginning at the train tracks west of the American Legion property and extending to where the stream is diverted to the culvert running under Longmeadow Shopping Center. The project will restore the eroded banks along the stream, as well as investigate the culverts within this reach. As part of this analysis, culvert sizing will be evaluated to determine if culvert size could be increased without increasing flooding downstream. Most of the property



Figure 15: Failing Retaining Wall

for this section of Hamilton Run is owned by the Morris Frock Post 42 American Legion. A culvert runs under the driveway leading to the American Legion which becomes inundated during large rain events, disrupting access to the property. The American Legion has shown support for projects that will aid in mitigating the flooding impacts to their property through participation in community meetings. While the project does not focus on increasing flood retention, improved conveyance may help mitigate flooding due to backwater from undersized culverts. Additionally, although it is not under consideration for the current stream restoration design, there is open land on either side of the stream that could be utilized for water storage. However, the land that is utilized under Mills Park may be a challenge to acquire for restoration. This project was not evaluated within the co-benefits model as efforts for implementation are in progress. Following design completion, construction will be completed in phases as funding is available to the City.

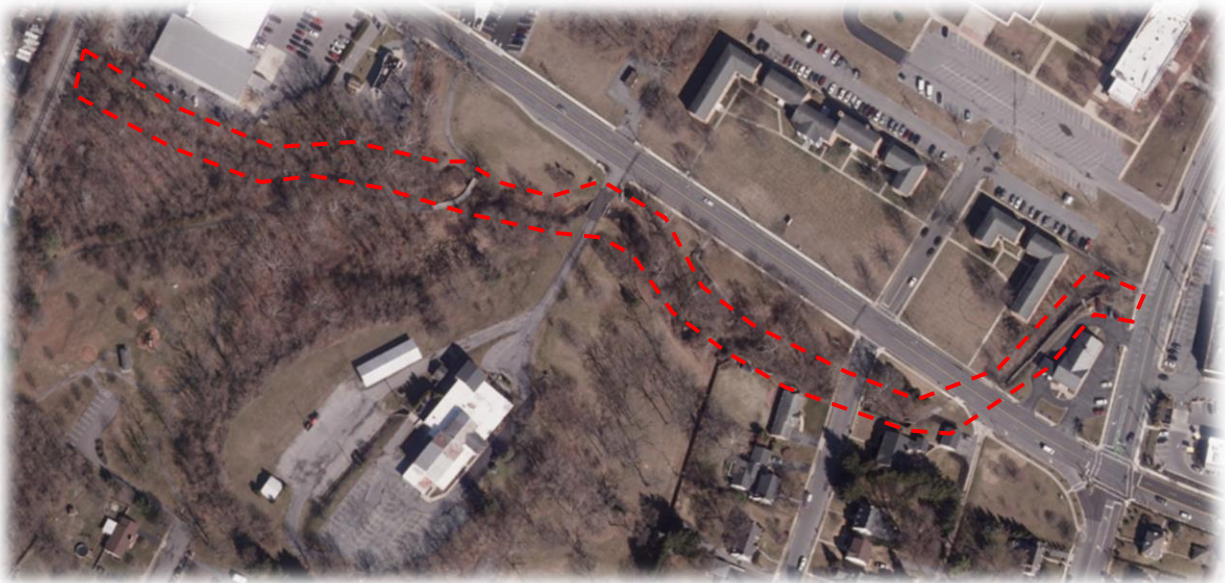


Figure 16: Location of Hamilton Run Northern Avenue Stream Restoration

POTOMAC HEIGHTS ELEMENTARY SCHOOL- MAGNOLIA CULVERT (PROJECT ID: 8)

Flooding events located along Hamilton Run have been recorded at the East Magnolia Avenue culvert crossing. Results from the H&H analysis indicate that the culvert is likely undersized, contributing to the localized flooding. Furthermore, the culvert is at the low point of East Magnolia Avenue, with multiple inlets located at the culvert. Therefore, the culvert must convey stream flows as well as receive stormwater runoff during storm events. This culvert requires redesign and emplacement to properly convey flooding events.



Figure 17: Street View of Magnolia Culvert

Additionally, approximately 26,000 square feet of wetland complex could be created at the downstream end of the culvert to provide more retention throughout this area as shown in Figure 18. This would aid in reducing flows being received downstream. Reallocation of land used by the school may be required to provide room for construction. Furthermore, this project would likely

require partial removal of the existing forests in this location. Forested lands provide significant benefits in increased runoff infiltration and carbon sequestration. A benefits analysis should be conducted to thoroughly understand if the provided benefits of the project would outweigh the tree removal. Proper H&H analysis must be conducted in this area before undergoing a contract for work because downstream impacts could also outweigh the benefits of reducing backwatering.



Figure 18: Proposed Location Potomac Heights Elementary Wetland

POTOMAC HEIGHTS DEVELOPMENT

is severe erosion present along Hamilton Run across from the property located by the intersection of Potomac Heights and Calvert Terrace. As noted in the community listening session held in June 2023, erosion of the streambanks is causing tree roots to be exposed and resulting in trees falling across Hamilton Run and onto adjacent properties. The 2017 Hamilton Run Action Plan recommended this location for a stream restoration (Figure 19). This project would grade back and realign the stream banks, increase channel sinuosity, and properly dissipate energy within the channel to limit future potential for recurring bank erosion. This would reduce sediment load reduction and provide some increased runoff retention. However, this project may be difficult to implement due to the site being both located on and surrounded by private property. Houses line the west side of this stream reach, limiting the extent available for increasing stream sinuosity. Additionally, property owners would experience changes in the 100-year floodplain and their permission would be necessary for project implementation. This stretch of Hamilton Run is within a forest conservation easement which will require additional coordination and approval for the project. Trees are often removed during construction of stream restoration projects, but usually replaced with new plantings following project completion. A Forest Conservation Plan may be needed to demonstrate how trees within the easement will be preserved during and after construction. This project would feed into the East Magnolia Avenue culvert. Therefore, it would be ideal for these two projects to be within the same design to provide optimal uplift and ensure the projects work cohesively together.



Figure 19: Potomac Heights Concept Plan

CORRIDOR OF OPEN FIELD

This section of Hamilton Run separates the backyards of private homes and a large parcel of land occupied by Potomac Heights Elementary School. There is a corridor of approximately four and a half acres that could be used to build a large wetland BMP complex, as proposed within the 2017 Action Plan report (Figure 20).



Figure 20: Corridor of Open Field Concept Plan

the downstream end of the proposed project, but indicated the impacts of this line would be minimal due to the location within the extents of the proposed project.

Local property owners along Valleybrook Drive have complained about flooding. The increased sinuosity and pooling along this proposed channel would allow for more storage capacity during high-rainfall storm events. The realignment of the channel would shift the western side of the floodplain away from the properties. Furthermore, the wetland complex would provide improved water quality from filtration provided by the wetlands and increased aquatic habitat. In practice, this project is highly feasible for introducing healthy wetlands and lower velocities in the channel. However, the feasibility of this project depends on the property owner, which is unknown according to SDAT Data. The 2017 Hamilton Run Action Plan also noted the existence of a sewer line that runs near the train tracks on

PANGBORN PARK

Hamilton Run flows through a large parcel of open land south of Pangborn Park. This land is privately owned and has been under discussion for a townhome development. Approximately 8



Figure 21: Pangborn Park Concept Plan

acres of the west side of the parcel cannot be used for the development because it is within the floodplain. This segment of Hamilton Run is relatively straight and according to the 2017 Hamilton Run Action Plan does not have many eroding banks. Although the stream is in fair condition in this location (limited erosion), there is opportunity for improved ecological uplift through implementation of a wetland complex.

As part of the 2017 Hamilton Run Action Plan, a concept plan was developed for the proposed wetland complex as shown in Figure 21. The project would increase the sinuosity of the stream, creating a more natural stream channel. Meandering streams also feature a lower slope channel compared to straighter streams, reducing water velocity and bank erosion. The project would also include constructed wetlands within the open areas along either side of the stream that would provide additional storage capacity within the floodplain. Medway Road is approximately 750 feet south of the proposed project location. As discussed in Section 2, properties on either side of Medway Road extending south to Jefferson Street experience

flooding from Hamilton Run. Increasing storage capacity upstream and slowing flow velocities may help mitigate flooding experienced at Medway Road.

The wetland complex would provide water quality benefits as well. During a storm event flood waters from the stream will flow into the wetlands where nutrients will be removed prior to discharging back into Hamilton Run. The constructed wetlands will also provide habitat for a variety of aquatic and other wildlife.

The proposed project could also provide additional recreational use to the land. The 2017 Hamilton Run Action Plan concept design included a pedestrian walking trail through the complex connecting Pangborn Park to the existing North End Walk, which runs from the Hagerstown Fairgrounds Park to Pangborn Park. The trail would also be accessible to the new residential development once constructed. The trail further connects the surrounding communities to a variety of recreational resources while increasing green space for the communities to enjoy. The trail could also incorporate educational signage about the wetland and Hamilton Run for additional community outreach.

The Pangborn Park wetland complex has a higher priority compared to the other retention locations identified along the section of Hamilton Run downstream of the Longmeadow Shopping. Each property is privately owned, but this property is currently planned for development. Since the land is planned to be repurposed, and the developer cannot build within the identified project location, this poses an opportunity for the City to modify this land as part of the development project. Furthermore, this project offers increased community access to recreational resources through the proposed walking trails to connect the surrounding neighborhoods.

HAMILTON RUN BEFORE THE GREENS (MEDWAY ROAD)

Flooding and erosion have been reported by the community for the reach of Hamilton Run extending from Medway Road to Jefferson Street. The H&H analysis also identified this area as at risk of flooding, with potential backwater flooding observed at the culvert running under Medway Road. This section of Hamilton Run is very constrained with properties lining both banks. This results in no floodplain for floodwater to go during large storm events. Furthermore, the straight narrow channel has higher susceptibility to erosion from higher velocity flows.

The stream banks were previously stabilized with gabion baskets, but these have started to fail. Due to the adjacent properties, there are significant limits on restoration projects within this reach. To increase capacity and decrease velocities, regenerative stormwater conveyance (RSC) could be utilized within this area. The pools allow for increased storage capacity within the channel, and the weirs help to reduce flow velocity. The RSC would restore the eroded banks and provide additional improved water quality to the stream. Furthermore, the stream restoration may provide some flood reduction, but will not fully mitigate the flooding within this area.

Another identified opportunity within this area is a constructed wetland within a small vacant lot on Security Road shown in Figure 23. The lot is owned by the property owner to the west at 655



Figure 22: Proposed Reach of Hamilton Run for Restoration



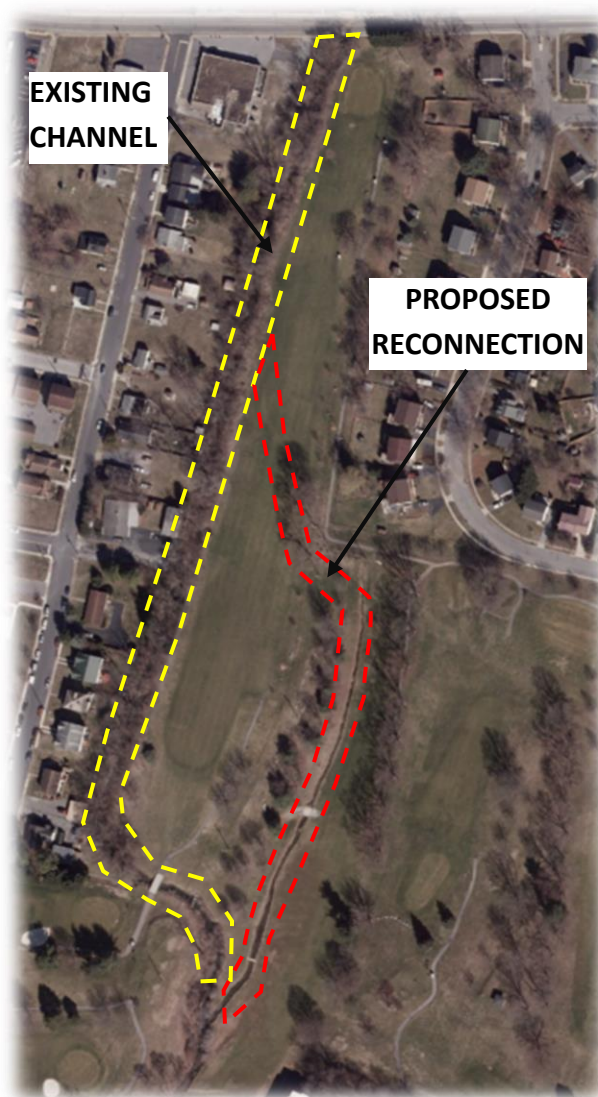
Figure 23: Proposed Medway Road Retention

Security Road. The property is split by Hamilton Run, and although the lawn appears to be regularly maintained, it does not appear to be utilized by the property owner. The property could be acquired by the City to construct a wetland complex. A meander from the stream could be diverted through the property with wetland on either bank for floodplain storage. This would provide some increased storage capacity upstream to Medway Road, reducing the volume and rate of flow to the confined channel. Because the project falls within the regulated floodplain, additional permitting will be required and an H&H analysis will be necessary to evaluate potential changes to the flood

elevation in this area. Adjacent property owners would have to be informed of all potential impacts. This location is unique in that it naturally sits at a lower elevation compared to the surrounding homes, which would aid in protecting against potential changes to the floodplain. The project area is relatively small, but if implemented with additional projects upstream such as Pangborn Park or Potomac Heights, collectively these projects will aid in protecting the downstream properties along Medway Road.

GREENS AT HAMILTON RUN

Hamilton Run flows through the Greens at Hamilton Run golf course at the downstream portion of the watershed approximately 3,000 linear feet upstream of where Hamilton Run feeds into Antietam Creek. As a result of the



development in Hagerstown, this reach of Hamilton Run has been diverted from its natural valley and currently runs along the west side of the golf course behind the residential properties on Willard Street (Figure 24). Remnants of the original stream channel are present through the golf course which meets Hamilton Run south of the golf course. These changes to Hamilton Run have led to increased erosion and flooding and a reduction in the health of the stream.

In 2017, a design was completed by Frederick, Seibert & Associates, Inc. to return Hamilton Run to its natural valley through the golf course. The goal of the project is to improve the health of this reach of Hamilton Run through nutrient and sediment load reductions. While this project offers significant water quality and ecological benefits, the stream restoration will not provide significant flood mitigation. However, some flood reduction may be observed from the improved stream hydrology. Over the course of this initiative, this project was progressed through implementation and is currently under construction.

Figure 24: The Greens at Hamilton Run Stream Channel

REST HAVEN CEMETERY

Rest Haven Cemetery is located at the headwaters of Hamilton Run. Springs on the property feed into the stream. As development has increased over time on the surrounding properties, runoff draining to the property has increased, resulting in more frequent flooding. The cemetery owners have particularly expressed concern following the commercial development directly north of the cemetery, including Fountain Head Plaza. Much of the commercial development was completed prior to the 2000's, with stormwater management that was designed to older standards. This means these older facilities may not be designed to manage the full first 1" of stormwater runoff. Furthermore, several facilities appear to be dry detention basins, which provide no water quality benefits. The unmanaged runoff from these facilities then enters the headwaters of Hamilton Run located within the cemetery. The reach of Hamilton Run running through the cemetery is directed through a culvert under Pennsylvania Avenue. Increased runoff after development to this area requires the culvert to convey additional flows, which it may not be designed to handle. Thus, the cemetery has experienced increased flooding on the property. This reach is also experiencing erosion along the banks, resulting in loss of land as the banks encroach on existing graves.



Figure 25: Fountainhead Plaza & Proposed Rest Haven Stream Restoration

This reach of Hamilton Run is currently under consideration for stream restoration and the Washington County Soil and Conservation District is actively pursuing funding for design. The project would include removing the existing pond and restoring the natural meander to the stream. Increased sinuosity will provide some additional retention as well as promote reduced velocities, preserving banks from erosion. This will help protect the cemetery land, preventing displacement of grave sites.

The stream restoration and mitigation of flooding within Rest Haven will also require a stormwater management evaluation for the commercial properties to the north to have a full understanding of how that hydrology would impact the restoration. This evaluation should identify opportunities for potential retrofits to increase the stormwater management, both quantity and quality, upstream of the cemetery. A retrofit opportunity could include a conversion of existing dry detention facilities to wet ponds with increased storage capacity if conditions allow. The dense impervious parking lots could also be segmented with micro-bioretention islands, reducing overall impervious acreage, and providing additional quality treatment. As opposed to most of the other projects provided within this portfolio narrative, this project lies within Washington County jurisdiction and would require coordination on the county level rather than with the City of Hagerstown.

3.3 PERMITTING

Permit requirements can cause significant time delays if not appropriately considered in scheduling during project implementation. Certain approvals must be obtained to move forward in construction. Below is a summary of permits and regulations that may be applicable to projects recommended within the Portfolio. This is not a comprehensive list of state and local regulations, it is advisable to consult with the Maryland Department of the Environment (MDE) and local authorities early in the planning process for project specific requirements. This will ensure that a project complies with all relevant regulations to minimize unexpected obstacles throughout the review process that may impact the overall success of the project.

1. NPDES MS4 Permit ([Link](#)): This permit manages and controls projects that utilize municipal separate storm sewer systems. These systems are designed to collect and convey stormwater from urban and suburban areas, including streets, parking lots, and other impervious surfaces, to prevent flooding and protect water quality. Most proposed practices fall under the MS4 Permit. These projects would have to be reported appropriately to MDE and could provide beneficial credit towards restoration goals.
2. Erosion and sediment control plan approval is required for any construction work that disturbs 5,000 square feet or more of soil, or results in the excavation of 100 cubic yards or more of soil. Review for state or federal properties is submitted to Maryland

Department of the Environment ([Link](#)), otherwise approval is received by the County ([Link](#)) in which the project is located.

3. Stormwater management plan approval is required for any new development project that disturbs 5,000 square feet or more of land. Plan review for state or federal properties is submitted to Maryland Department of the Environment ([Link](#)), otherwise approval is received by the County in which the project is located ([Link](#)).
4. Nontidal Wetland and Waterway Permit ([Link](#)): This is a Joint Federal/State Permit Application (JPA) that regulates activities in nontidal wetlands, waterways, floodplains and their adjacent buffer areas. Nontidal wetlands are areas that are not directly influenced by tidal waters but still provide important ecological and water quality benefits. The Non-tidal Wetlands and Waterways Permit may be required for a range of activities, including but not limited to: filling, grading, excavating, construction, dredging, or damming. A Dam Safety Permit is also obtained under the Nontidal Wetlands and Waterways Permit for construction of non-small pond dams regardless of proximity to wetlands and waterways. Small pond approval may be obtained from the local [Soil Conservation District](#) or [MDE designee](#).
5. Forest Conservation Act ([Link](#)): Any activity requiring a subdivision, grading or sediment control plan for a project of 40,000 square feet or more must submit a Forest Stand Delineation (FSD) and a Forest Conservation Plan (FCP) for review and approval. The FSD proves mapping of existing forest cover and environmental features. The FCP provides a narrative of how these identified resources will be protected during and after development and whether replanting trees will be required. Plans are submitted based on county region.

A list of the proposed projects with their expected required permits and applicable regulations is provided within Table 3.

Table 3: Hamilton Run Portfolio Permit Requirements Summary

PROJECT	REQUIRED PERMIT				
	NPDES MS4 Permit	Erosion and sediment control Permit	Stormwater management plan approval	Nontidal Wetland and Waterway Permit	Forest Conservation Act
Longmeadow Culvert		✓	✓	✓	
Fountaindale Elementary School	✓	✓	✓	✓	
Washington County Highway Maintenance Yard	✓	✓	✓	✓	
American Legion	✓	✓	✓	✓	✓
Potomac Heights School/Magnolia culvert crossing	✓	✓	✓	✓	
Potomac Heights development	✓	✓	✓	✓	✓
Corridor of open field	✓	✓	✓	✓	✓
Pangborn Townhomes Wetland Complex	✓	✓	✓	✓	✓
Hamilton Run before the Greens	✓	✓	✓	✓	
The Greens at Hamilton Run Stream Restoration	✓	✓	✓	✓	✓
Rest Haven Cemetery	✓	✓	✓	✓	

A higher number of required permits may make projects more difficult to achieve, but this should not deter the City from pursuing these projects. However, this should be accounted for in project budgets and scheduling and may result in delayed implementation due to scheduling needs.

3.4 FUNDING OPPORTUNITIES

Five funding opportunities were identified that would be the most likely to provide financial support for the feasible projects in the portfolio. Funding type and source were also considered in the selection of the funding opportunities to provide a variety of options to the TRA. This includes both Federal and State funded grants, as well as a loan program. A description of each of the funding sources, specifically with the relevant qualities that would qualify the resiliency projects for their funding opportunities, is found below. This list of funding sources does not fully encompass the vast funding opportunities that are available for such projects as described in this portfolio. Many of the agencies described within have additional funding opportunities that could be investigated and pursued for implementation of water quality and climate resiliency projects. Furthermore, additional partnerships may be pursued for support in project implementation, such as partnering with the Department of Transportation (DoT) for projects along State Highway Administration (SHA) maintained roadways.

DHS - FEMA - MDEM BUILDING RESILIENT INFRASTRUCTURE AND COMMUNITIES (BRIC)

The Building Resilient Infrastructure and Communities (BRIC) program makes federal funds available to states, U.S. territories, Indian tribal governments, and local communities for pre-

disaster mitigation activities. The guiding principles of the program are to **(1)** support state and local governments, tribes, and territories through capability and capacity-building to enable them to identify mitigation actions and implement projects that reduce risks posed by natural hazards; **(2)** encourage and enable innovation while allowing flexibility, consistency, and effectiveness; **(3)** promote partnerships and enable high-impact investments to reduce risk from natural hazards with a focus on critical services and facilities, public infrastructure, public safety, public health, and communities; **(4)** provide a significant opportunity to reduce future losses and minimize impacts on the Disaster Relief Fund; and **(5)** support the adoption and enforcement of building codes, standards, and policies that will protect the health, safety, and general welfare of the public, take into account future conditions, and have long-lasting impacts on community risk reduction, including for critical services and facilities and for future disaster costs.

Generally, all of the recommended projects within the Portfolio were chosen with the intention of hazard and flood mitigation. Thus, these projects would be eligible for BRIC funding. However, for smaller practices, it is recommended that multiple projects that would provide cohesive flood reduction along Hamilton Run be included within a single application. BRIC is a competitive program and to receive funding there needs to be a notable risk reduction which may not be achievable with small, stand-alone projects.

MD DNR CHESAPEAKE & COASTAL GRANTS GATEWAY

Grants Gateway provides a one-stop location for partners seeking technical and financial support for projects that help foster healthy ecosystems, communities, and economies. Proposals must fit into one or more of the identified Grants Gateway Outcomes. Each Outcome has specific eligibility requirements and selection criteria. Project Outcomes are as follows: **Outcome 1** - Accelerate recovery and restoration of natural resources by implementing nonpoint source pollution reduction projects. **Outcome 2** - Enhance capacity to understand and effectively plan to address flood risks associated with a changing climate. **Outcome 3** - Utilize natural and nature-based infrastructure to enhance community resilience to climate change. **Outcome 4** - Improve student ability to benefit Chesapeake and Coastal ecosystems through professional development, curriculum expansion, outdoor learning, and stewardship. **Outcome 5** - Foster sustainable development and use of Maryland waterways with projects that benefit the general boating public. Eligible applicants include academic institutions, local government, nonprofit organizations, and nongovernmental organizations.

The Hamilton Run Portfolio prioritized green infrastructure projects that aim to reduce flood risks along Northern Avenue until Antietam Creek, except for two projects. The only projects that prioritize grey infrastructure are the culvert retrofit for Longmeadow Shopping Center and East Magnolia Avenue. Therefore, these projects would likely not qualify for the Grants Gateway funding opportunities. East Magnolia Avenue may qualify if completed in conjunction with the

wetland complex on the elementary school property. This is a highly sought after grant program, therefore, projects may need to apply with leveraged funding to be most competitive.

MDE WATER INFRASTRUCTURE FINANCING ADMINISTRATION WATER QUALITY REVOLVING LOAN FUND (WQRLF)

The Water Quality Revolving Loan Program (WQRLF) provides low-interest loans to local governments to finance a wide variety of projects to protect or improve the quality of Maryland's water resources. Eligible projects may include wastewater treatment plant upgrades, nonpoint source pollution control projects, watershed restoration projects, and other water quality and public health improvement projects.

The Water Quality Revolving Loan Fund (WQRLF) supports projects that improve water quality, watershed health, and flood mitigation. All the projects in the Portfolio support these benefits in some way except for the Longmeadow Shopping Center culvert retrofit. The culvert retrofit has minimal co-benefits for water quality, thus reducing opportunities for sourced funding.

CHESAPEAKE BAY TRUST (CBT) GREEN STREETS, GREEN JOBS, GREEN TOWNS (G3) GRANT PROGRAM

Grant funding can be applied for anywhere in the Chesapeake Bay Watershed. Program goals include reduction of stormwater runoff, increase, expansion upon the number of green spaces in urban areas, improvement of the health of local streams and the Chesapeake Bay, and enhancement of the quality of life and community livability. Funding is available for conceptual plans, engineered designs, implementation of projects, greening communities and urban vacant lots, and white papers.

Many projects along Hamilton Run can apply for the G3 grant program. The culvert crossing on East Magnolia Avenue floods the road leading to the elementary school which impacts people living in the downtown area of Hagerstown. The Washington County Highway Maintenance Yard currently has no water quality treatment area available and is located along Northern Avenue. Furthermore, the wetland on the front of the property would improve floodplain management and could act as a demonstration project for the community. This project is the best candidate for Hamilton Run for the G3 grant because of its proximity to urban Hagerstown.

CHESAPEAKE BAY TRUST (CBT) WATERSHED ASSISTANCE GRANT PROGRAM

This program provides support for watershed restoration project designs and permitting and for watershed planning and programmatic development. The goal of the projects funded through this opportunity will be to improve water quality in the Maryland portion of the Chesapeake Bay watershed, the Maryland portion of the Youghiogheny watershed, and the Maryland Coastal

Bays. Eligible applicants are nonprofits and local governments. This grant program welcomes applications for projects in the state of Maryland. Applicants can request funds from two project types. Type 1 is for project design. Generally, requests are up to \$100,000 for the design of stormwater best management practices, and \$150,000 for the design of stream restoration practices. Type 2 is for watershed planning and program development which generally caps at \$75,000.

All stream restoration projects, and practices that improve water quality that classify as BMPs may apply to the Watershed Assistance Grant Program. Only two (2) projects in the portfolio for Hamilton Run do not provide a water quality benefit which is the culvert retrofit for Longmeadow Shopping Center and on East Magnolia Avenue. Therefore, these projects would likely not qualify for the grant. East Magnolia Avenue may qualify if completed in conjunction with the wetland complex on the elementary school property. The remainder of the projects can apply to the grant program, so long as they demonstrate their quality benefit and must be classified as a BMP to qualify for the grant.

PORTFOLIO FUNDING ELIGIBILITY

Table 4 identifies which projects from the Hamilton Run Portfolio would qualify for each of the five funding sources.

Table 4: Hamilton Run Portfolio Eligible Funding Summary

PROJECT	FUNDING SOURCE				
	DHS - FEMA - MDEM Building Resilient Infrastructure and Communities (BRIC)	DNR Chesapeake & Coastal Grants Gateway	MDE Water Quality Revolving Loan Program	Chesapeake Bay Trust (CBT) Green Streets, Green Jobs, Green Towns (G3) Grant Program	Chesapeake Bay Trust (CBT) Watershed Assistance Grant Program
Longmeadow Culvert	✓				
Fountaindale Elementary School	✓	✓	✓	✓	✓
Washington County Highway Maintenance Yard	✓	✓	✓	✓	✓
American Legion	✓	✓	✓	✓	✓
Potomac Heights School/Magnolia culvert crossing	✓		✓	✓	
Potomac Heights development	✓	✓	✓		✓
Corridor of open field	✓	✓	✓	✓	✓
Pangborn Townhomes Wetland Complex	✓	✓	✓		✓
Hamilton Run before the Greens	✓	✓	✓	✓	✓
The Greens at Hamilton Run Stream Restoration	✓	✓	✓	✓	✓
Rest Haven Cemetery	✓	✓	✓	✓	✓

4. SUMMARY AND RECOMMENDATIONS

The Portfolio was developed as a planning resource for the TRAs to assist with prioritization for implementing projects that will improve water quality and build climate change resiliency within their communities. Table 5 provides a summary and rankings of the proposed projects within the Hamilton Run TRA.

Table 5: Hamilton Run Portfolio Summary

Project ID	Project	Practice(s)	Resiliency Score	Top Benefits	Cost Estimate	Priority	Comments
29	Pangborn Townhomes Wetland Complex	Stream Restoration, Wetland Creation/Restoration	High	Protects important ecosystems, restores local waters, supports local priorities	\$1,000,000 - \$1,250,000	High	Privately owned property
22	Corridor of open field	Stream Restoration, Wetland Creation/Restoration	High	Protects important ecosystems, restores local waters, offsets carbon	\$1,750,000 - \$2,000,000	High	Privately owned property
10	Rest Haven Cemetery	Stormwater Basin/ Stream Restoration	High	Contributes to aquatic life and biotically important areas, restores local waters, supports local priorities	\$1,000,000 - \$1,250,000	High	County jurisdiction. Requires additional stormwater analysis of upstream development
24	Washington County Highway Maintenance Yard	Environmental Site Design	Medium	Restores local waters, protects local and state protected lands including recreational value, supports local priorities	\$175,000 – \$225,000	Medium	Requires coordination with the county, not the city
16	Fountaindale Elementary School	Stormwater Basin, Wetland Creation/Restoration	Medium	Restores local waters, contributes to aquatic life and biotically important areas, supports local priorities	\$325,000 - \$400,000	Medium	Wetlands already exist here, but more retention is available
8	Potomac Heights School/Magnolia culvert crossing	Wetland Creation/Restoration , Culvert Redesign	Medium	Contributes to aquatic life and biotically important areas, supports local priorities, contributes to aquatic life and biotically important areas, protects local and state protected lands including recreational value	\$450,000 - \$550,000	Medium	Busy roadway will be impacted
3	The Greens at Hamilton Run Stream Restoration	Stream Restoration	Medium	Restores local waters, contributes to aquatic life and biotically important areas, protects local and state protected lands including recreational value	\$1,250,000 – \$1,500,000	Low	Under construction
13	Potomac Heights development	Stream Restoration	Medium	Restores local waters, contributes to aquatic life and biotically important areas, offsets carbon	\$700,000 - \$850,000	Low	Within forest conservation easement
20	Hamilton Run before the Greens	Stream Restoration	Low	contributes to aquatic life and biotically important areas, restores local waters, addresses socially vulnerable populations	\$750,000 - \$900,000	Low	Limited space for floodplain

Pangborn Townhomes Wetland Complex was the highest-ranking project due to the multiple provided benefits, such as protecting important ecosystems and restoring local waters, while also supporting local priorities. This project will aid in resiliency due to increasing floodplain storage, thus reducing flows downstream contributing to flooding. The greatest flooding experienced downstream of Pangborn Wetland Complex are the properties along Hamilton Run between Security Road and Jefferson Street. Implementing projects in series of Pangborn Wetland Complex upstream from these properties, including the Corridor of Open Field, Potomac Heights Development, Potomac Heights School, and Hamilton Run before the Greens, will maximize the flood reduction benefits.

ⁱ (2017). Hamilton Run Watershed Characterization and Action Plan Report.

<https://www.hagerstownmd.org/DocumentCenter/View/5998/Hamilton-Run-Action-Plan-May-30-17>

ⁱⁱ Maryland Department of Natural Resources. Regenerative Storm Conveyance Construction Guidance.

https://dnr.maryland.gov/ccs/Documents/RSC_Training/RSC-Guidance.pdf. Retrieved: September 2023.

APPENDIX A: QUALITY ASSURANCE PROJECT PLAN (QAPP)



R3_QA@epa.gov



Quality Document Status Memo

DATE	April 21, 2023		
SUBJECT	EPA Region 3 Review of Quality Assurance Document— Document Title: Water Quality and Climate Resiliency Portfolio EPA QA Document Control #: DCN 230087.1 Document Date: 4/21/2023 Document Type: Quality Assurance Project Plan (QAPP) If other, specify: Click or tap here to enter text.		
FROM EPA Delegated Approving Official (DAO)	Name: Durga Ghosh Division: CBPO Phone: 410-267-5750; E-mail: dghosh@chesapeakebay.net	DAO Signature	 04/21/2023
Additional Reviewer	☒ N/A Name Division: Choose an item. Phone; E-mail	Additional Reviewer Signature	
CC	Verena Joerger Regional Quality Assurance Manager EPA Region 3, LSASD, ASQAB	THRU EPA Project Officer or equivalent	☐ N/A Name: Holly Waldman Division: CBPO
TO	Name: Theresa Foye Organization: Maryland Environmental Services		

Thank you for submitting your quality assurance document for review. The status of your document is indicated on the following page, along with next steps and comments, if applicable. The document was reviewed for compliance to the requirements outlined in:

- ☐ EPA QA/R-2, EPA Requirements for QMPs [EPA/240/B-01/002, March 2001]
- ☒ EPA QA/R-5, EPA Requirements for QAPPs [EPA/240/B-01/003, March 2001]
- ☐ Uniform Federal Policy (UFP) for QAPPs
[Intergovernmental Data Quality Task Force, Part 1: UFP-QAPP Manual, March 2005]
- ☐ Other: Click or tap here to enter text.

If you have any questions regarding this review, contact me, the delegated approving official, as listed above. For general Region 3 quality-related questions, email the Region 3 Quality Assurance cadre at R3_QA@epa.gov.

Note: This action represents EPA's determination that the document(s) under review comply with applicable requirements of the EPA Region 3 Quality Management Plan [https://www.epa.gov/sites/production/files/2020-06/documents/r3qmp-final-r3-signatures-2020.pdf] and other applicable requirements in EPA quality regulations and policies [https://www.epa.gov/quality]. This action does not represent EPA's verification of technical or programmatic accuracy or completeness of document(s) under review, and is **not** intended to constitute EPA direction of work by contractors, grantees or subgrantees, or other non-EPA parties.

Document Review Status

Document Status	Next Steps
☒ Approved <i>addressed key requirements satisfactorily.</i>	- The document is valid for: ☒ 5 years ☐ Term of project, i.e., 1-2 years ☐ Other: Click or tap here to enter text. but should be reviewed annually, and if any significant changes to quality management or data collection practices, a resubmission is required of the revised document for review and subsequent approval.

Comments

☒ Not Applicable

General

Specific by Document Section

Document Section	Page #	EPA Comments

Summary:

Maryland Environmental Service will conduct work in conformance with the quality assurance program described in this QAPP. This approval action does not represent EPA's verification of the accuracy or completeness of document(s) under review. It is not intended to constitute EPA direction of work by contractors, grantees or subgrantees, or other non-EPA parties.

Quality Assurance Project Plan

for

Water Quality and Climate Resiliency Portfolio

Prepared by:

MARYLAND ENVIRONMENTAL SERVICE
259 NAJOLES ROAD
MILLERSVILLE, MD 21108

Prepared for:

US EPA Region 3
Four Penn Center
1600 John F. Kennedy Blvd.
Philadelphia, PA 19103-2029

1/10/2023

Revised: 02/03/2023

Revised: 04/10/2023

This quality assurance project plan (QAPP) has been prepared according to guidance provided in the following documents to ensure that environmental and related data collected, compiled, and/or generated for this project are complete, accurate, and of the type, quantity, and quality required for their intended use:

- *QAPP Requirements for Secondary Data Research Projects*. U.S. Environmental Protection Agency, Office of Research and Development, National Risk Management Research Laboratory, Cincinnati, OH, Washington, DC, 1999.
- *EPA Requirements for Quality Assurance Project Plans* (EPA QA/R-5, EPA/240/B-01/003). U.S. Environmental Protection Agency, Office of Environmental Information, Washington DC, March 2001a (Reissued May 2006).

- *Guidance for Quality Assurance Project Plans* (EPA QA/G-5, EPA 240/R-02/009). U.S. Environmental Protection Agency, Office of Environmental Information, Washington, DC, 2002.

Maryland Environmental Service will conduct work in conformance with the quality assurance program described in this QAPP.

A. Program Management

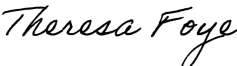
A1. Approval Sheet

Concurrence

Preparer/Author

Name: Doug Mace Title: Associate Engineer Organization: Maryland Environmental Service	Signature:  Date: 4/10/2023
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Management/Supervisor

Name: Theresa Foye Title: GIS Section Chief Organization: Maryland Environmental Service	Signature:  Date: 4/10/2023
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Quality Assurance Officer

Name: Barka T-W Shimelis Title: Lead GIS Specialist Organization: Maryland Environmental Service	Signature:  Date: 4/10/2023
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EPA Region 3

Name: Holly Waldman Title: Project Officer Organization: EPA	Signature: Holly Waldman Date: 04/21/2023
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Approval EPA Region 3

Name: Durga Ghosh Title: QA Coordinator Chesapeake Bay Program Organization: USGS	Signature: <i>Durga Ghosh</i> Date: <i>04/21/2023</i>
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Note: This approval action represents EPA's determination that the document(s) under review comply with applicable requirements of the EPA Region 3 Quality Management Plan [<https://www.epa.gov/sites/production/files/2020-06/documents/r3qmp-final-r3-signatures-2020.pdf>] and other applicable requirements in EPA quality regulations and policies [<https://www.epa.gov/quality>]. This approval action does **not** represent EPA's verification of the accuracy or completeness of document(s) under review, and is **not** intended to constitute EPA direction of work by contractors, grantees or subgrantees, or other non-EPA parties.

Document Revision History

QAPP Submittal	Summary of Edits Received/ Changes Made
QAPP Original Submittal (01/10/2023)	Original submittal
QAPP First Revision (02/02/2023)	Added clarification on data precision and accuracy; clarification on use of MyCoast; clarification on data validation and generation of reports; clarification on suitability of datasets with respect to project objectives
QAPP Second Revision (04/10/2023)	Addressed issues throughout document which were highlighted in EPA's review, dated 03/17/2023. Substantial additions related to data quality and criteria used for inclusion in analyses.

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ACRONYMS AND ABBREVIATIONS

D/O	Designer/Originator
DNR	Department of Natural Resources
FGDC	Federal Geographic Data Committee (FGDC)
GIS	Geographic Information System
PLS	Professional Licensed Surveyor
MES	Maryland Environmental Service
M-NCPPC	The Maryland-National Capital Park and Planning Commission
NGS	National Geodetic Survey
PM	Project Manager
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
SHA	State Highway Administration
TRA	Targeted Resiliency Area
WIP	Watershed Implementation Plan

1. Project Purpose, Objective, Organization, and Responsibilities

This section provides information regarding the purpose and objectives of the Water Quality and Climate Resiliency Portfolio (WQCRP) project as well as project organization and management. It outlines each task associated with the scope of work for the project, detailing what types of information will be gathered, and how that information will be utilized.

1.1 Project Purpose

Maryland Environmental Service (MES) is working with the Maryland Department of Natural Resources (DNR) to develop a Water Quality and Climate Resiliency Portfolio. The Water Quality and Climate Change Resiliency Portfolio initiative will develop projects with community support that will help to restore local waters while also improving climate resilience. This effort reduces the risks posed by a changing climate to the commercial economies and recreational opportunities essential to Maryland's working coast. Having a pipeline of identified projects better prepares Maryland and its communities to build climate resilience by taking advantage of existing and emerging funding opportunities that promote the use of natural infrastructure.

1.2 Project Objectives

A key tenant of Maryland's Phase III Watershed Implementation Plan (WIP) to Restore Chesapeake Bay by 2025 is to engage with local communities and implement community-scale projects. The Water Quality and Climate Change Resiliency Portfolio initiative will develop projects with community support that will help to restore local waters while also improving climate resilience. This work directly supports WIP implementation by creating pipelines of vetted projects that have community buy-in. The Maryland Department of Natural Resources (DNR) is leading this effort and has outlined three key phases to the development of the Portfolio: (1) identifying targeted resiliency areas (TRAs) at county and community scales, (2) working with partners to deliver technical assistance and identify priority projects within the TRAs, and (3) developing long term implementation and funding strategies (leveraging local, state, and federal resources).

1.3 Project Task Descriptions

Task 1 Refinement of Existing TRA Model: MES staff will refine the two identified TRAs, Hamilton Run and Pocomoke, by incorporating additional locally provided datasets. The datasets will be leveraged from the community engagement and outreach that is to occur in Task 2 (see below). In addition to locally provided datasets, the models will be enhanced with additional authoritative datasets as they become available, such as updated flood data, riverine Climate Ready Action Boundary (CRAB) (with additional elevation parameters), local Hazard Mitigation Plans, comprehensive plans, urban and nuisance flood plans and incorporating those datasets into the existing models with targeted parcels as potential project sites. The resulting refined models and boundaries will be used to develop a GIS-based restoration and conservation strategic plan for each TRA.

Task 2 Community Engagement & Outreach: MES will work closely with DNR to engage local community governments and partners for involvement within the two identified TRAs. This work will include (but is not limited to) the following:

- Identifying and reaching out to all potential interested partners (Smith Planning & Design). Attendance at in person or virtual meetings (planned at 6) with the communities and DNR (Smith Planning & Design). Smith Planning & Design has been procured as a subcontractor for Michael Baker through MES' shortlist. Smith Planning & Design was selected because they have extensive experience in planning and community outreach. They will be spearheading the community outreach portion of this project. MES and DNR will facilitate coordination between Smith Planning & Design and the local governments within each TRA to identify best methods for engagement of the local communities, such as meeting locations, platforms, and invitation distributions. Smith Planning & Design will also work with local governments to identify potential groups within each TRA that may act as a trusted voice on behalf of the community. These partners will further assist with the community engagement/coordination by offering additional insight into best methods for local engagement beyond information provided by the local governments. The goal of the community outreach meetings is to document the local flooding concerns, their high priority areas, collect locally developed data pertaining to flooding, and inform the community of potential projects and how their input has been incorporated into the development of this project portfolio.
- Collecting sources of local data (Smith Planning & Design and Michael Baker International).
- Determining local level assets and critical infrastructure that may be being impacted. Critical infrastructure will include roads, culverts, bridges, sewer treatment facilities, water treatment and distribution facilities, power distribution facilities, hospitals, municipal and police buildings, and other infrastructure determined during the project to be important to the community. These areas will be mapped using authoritative mapping sources such as the USGS. Infrastructure locations will be confirmed by city and county staff for both TRAs.
- Identifying potential projects for the portfolio by
 - Assembling a listing of potential projects that have been identified by local authorities and planning documents. Local authorities to be included in creating the potential projects listing include staff from both Hagerstown and Pocomoke City, as well as Washington and Worcester County. Planning documents could include WIPs, hazard mitigation plans, small watershed action plans, comprehensive plans, etc.)
 - Conducting vulnerability assessments and identifying potential projects to address areas at high risk. Hydraulic and hydrologic (H&H) modeling is planned. Michael Baker International was selected for the H&H because the firm has extensive experience with H&H modeling and stormwater issues. For example, Michael Baker International is currently working with the city of Virginia Beach to address flooding and stormwater issues. They are redesigning a public golf course to function as a series of connected stormwater ponds along with passive and active recreation opportunities. The H&H modeling will map those areas that are currently flooded regularly. The H&H modeling is expected to include 'bathtub' modeling, where the spatial extent of flooding under increased storm events can be mapped. Those areas that are not currently flooded but likely to become flooded in the future will be identified by the bathtub model. Using GIS,

critical infrastructure (defined above) that will be exposed to worsening flooding will be mapped.

- Completing cost/benefit assessments for each potential project, in which costs are estimated for planning, design and implementation and benefits include resiliency, water quality, carbon mitigation and habitat.
- Evaluating unawarded grant projects that were previously applied for by the community of interest.

Task 3 Site Assessments & Feasibility Analysis: The identified potential projects will be assessed and prioritized for quantifiable impacts to include (but not necessarily be limited to), social vulnerability, results of existing vulnerability assessments, community preparedness, restoration and conservation program priorities, partnership priorities (including other state agencies and multi-agency groups), critical infrastructure, and potential for carbon offset.

Michael Baker has been procured to provide support services for Hydrologic & Hydraulic modeling. These models will utilize current and the most recent NOAA projected precipitation data to identify vulnerable areas within each TRA. These vulnerable areas will be overlayed with additional existing data sources, such as EJ indexes, utility data, parcel data and existing building locations to quantify the severity of impacts within each vulnerable area. Sources of all acquired datasets shall be documented. This impacts analysis and vulnerability assessment will be used in conjunction with local concerns and the GIS-based suitability analysis to identify potential projects to move forward to a feasibility study. The feasibility study will be used for prioritization of these potential projects.

In the GIS-based suitability analysis, the potential projects will be scored and ranked. The methodology for scoring/ranking the resiliency projects will be developed during the project based on input by the project partners. In the Pocomoke TRA this will include MES, MD DNR, Worcester County, and Pocomoke City, as well as other partners identified during the project as having an important role. In Hagerstown TRA, project partners will include MES, MD DNR, Washington County, and the City of Hagerstown.

The scoring system for the GIS-based suitability analysis has not yet been determined. It will be created during the project duration based on input from DNR and the TRA partners. It will be designed so that all feasible projects will be evaluated. Those that have the greatest benefit and incur the least costs will receive the highest score. Benefits will be defined during the project by the project team and could include projects that benefit socially vulnerable populations, projects that increase community resiliency, projects that address restoration and conservation program priorities, partnership priorities (including other state agencies and multi-agency groups), projects that reduce risk to critical infrastructure, projects that increase overall community preparedness, and projects that have potential for carbon offset. Project benefits will be approximated using the factors selected by the project partners using a variety of databases and GIS layers. Sources to approximate benefit will be evaluated against the project goals prior to use. They will be evaluated to ensure they meet the goals of the project. As data sources for approximating benefits are identified, they will be added to this QAPP and resubmitted to EPA for approval. Similarly, costs for the various projects will be estimated. Sources to aid in estimating costs will be appropriate to the project goal, that of providing focus to DNR and the community partners on

which portfolio projects to begin promoting and researching. As sources for estimating costs are identified and deemed appropriate to the project goals, they will be added to this QAPP and resubmitted to EPA for approval.

The scoring system will adhere to accepted standards for GIS-based suitability analysis. Suitability analyses are designed to answer, ‘where is the best location for a given activity’. They do not yield objective precise values, such as parts per million of sediment that a stream monitoring program might produce. During the project, the partners will determine which factors the projects will be evaluated on, what proxy datasets might be used to measure those factors, and how the factors will be scaled to enable comparing one factor to another. The team plans to evaluate a finite list of project types, such as tree plantings, stream restoration or culvert redesign. The team plans to create a system of scores for each project type. For example, a stream restoration longer than 500 feet might receive a 5, a stream restoration longer than 100 feet but shorter than 500 feet might receive a 3. Similarly other types of projects will be assigned scores. The scores will vary in both direction and values permitted (the higher the score the better, and all scores vary from 0 to 5, for example). Some factors may be weighted to emphasize their importance to the project. For example, reducing flooding might be weighted more heavily than increasing fish passage. The matrix will then allow the project team to sum up all the scores for each project to be evaluated.

The GIS suitability analysis will be very different than a scientific model, such as a study of the biochemical components. All data sources will be evaluated to ensure they are of sufficient quality to serve the project goals. See Quality Objectives and Criteria, below, for a detailed discussion about the analysis and the data sources

As part of process of creating the portfolio, all projects will be evaluated to ensure they are feasible. The feasibility study will be performed by MES staff to incorporate all the project's relevant factors – including economic, technical, legal, and scheduling considerations – to ascertain the likelihood of completing the project successfully. Those projects that are identified as feasibly successful and a high priority for DNR and the communities will be moved forward to a concept design and the remaining projects will be used as a portfolio of projects to be leveraged with different project funding sources at a different time. Survey work will be conducted at potential project sites, under the guidance of a Professional Licensed Surveyor and stamped, if necessary. Examples of surveying support will be determined by a licensed Professional Engineer, and are to include but not limited to the following:

- Topographic Survey
- Boundary Survey
- Stakeout Survey
- Utilization of Unmanned Aerial Systems
- Utilities identification

Task 4 Concept Design of Projects: Green and gray nature-based solutions identified as ‘viable’ in Task 3, will move to a design phase. MES TES staff will advance projects to a concept design deliverable and provide design plans to DNR for future funding and implementation project funded phases. In addition, projects will be designed in sequence to minimize costs to the communities and maximize benefits to the extent practicable in addressing resiliency, water quality, carbon mitigation,

habitat, and other priorities identified by outreach efforts. Activities may include, but are not limited to:

- Concept sketches and drawings
- Topographic study
- Updated hydrology modeling for proposed project in a TRA
- Geology/geotechnical/soil reports
- Detailed survey support services
- Right of way access agreements/public land ownership

Conceptual designs will be created using a variety of resources including GPS units, engineering survey equipment and aerial imagery that is sufficiently precise to serve as base mapping. All data collected will be saved to MES servers and will be saved along with other project files for the period required by the grant.

All work performed under this task will be under the guidance of a Professional Engineer. It is understood that concept design plans will not require engineering stamping and are not considered permit ready projects.

Task 5 Portfolio Narrative Development: MES technical staff will develop a report to be made available for various audiences (communities, government agencies, technical service providers, funders, etc.). This document will identify the implementation of recommendations and identify which projects should be implemented first or in concert with other projects to maximize benefits and cost efficiencies, where possible. This narrative developed will also include recommendations on additional financing options based on existing local, state and federal funding initiatives, partner priorities and other potential funding mechanisms. If possible, the MES technical team will also develop an online dashboard to include the display of project types, locations, potential funding vehicles and partnerships that the communities can work towards completing.

1.4 Responsibilities of Project Participants

The project organization chart, presented as Figure 1, includes relationships and lines of communication among all participants and data users. The responsibilities of those persons are described below.

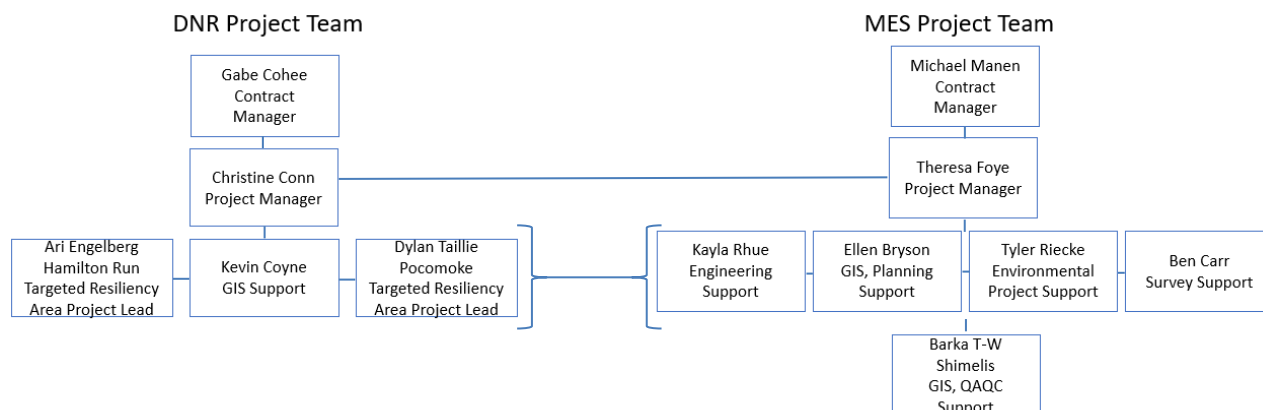


Figure 1 – Project Organization Chart

MES will send biweekly status meeting minutes and project correspondences as needed. Quarterly progress reports will be submitted to CBIG Grant Manager Gabe Cohee through the CCS federal funding grants management portal (https://webportalapp.com/sp/home/md_dnr_federal_funding). Each report will document progress toward the achievement of stated goals, objectives, and milestones during each quarter and semi-annual time frame. A description of activities will be reported for each objective. These reports will also describe difficulties encountered for each activity, any changes in expected deliverable dates, budget changes, or changes in staffing. Each report shall also include an upload of all written deliverables developed during the reporting period.

2. Data Acquisition and Analysis

This section discusses the sources from which data will be collected and methodology with which data will be acquired and used throughout the project.

2.1 Preliminary Site Assessment Methodology

Data will be acquired and utilized in a desktop analysis in the Hamilton Run watershed and Pocomoke City region from known authoritative data sources. The full and complete listing of data sources to be applied is not yet decided. It could include sources such as USGS, FEMA, EPA's Chesapeake Bay program, Maryland Department of Emergency Management, and others. The precision and accuracy of available data varies based on the data source. The minimum acceptable precision is at least 30 meters. Metadata will be included for all data that is utilized.

Scientific data, such as water sampling, will not be collected as part of this grant.

This grant will generate a listing of potential climate resiliency projects including for example, stream restoration, tree plantings, land acquisition, and other mitigation projects. The project locations will be identified anecdotally by our partners (e.g., the culvert at the intersection of First and Main), using GIS and authoritative studies and reports (e.g., the Hamilton Run Watershed Characterization and Action Plan Report) and possibly from H&H modeling to be completed. This mapping of potential projects does

not require high precision since the potential projects will not be designed but only identified for further evaluation. Once mapped, they will be evaluated against how well they meet criteria established by the grant partners, such as demographic characteristics of the neighborhood, how well the project protects critical environmental resources, the degree of community support for the project and many other criteria. The data sources for these criteria are included below.

Certain projects will undergo conceptual design. If any conceptual or designs are created for any of the identified projects, those plans and designs will rely on much more precise data, such as Trimble GPS and hydrologic & hydraulic modeling. The only field data to be gathered for the conceptual design will be surveyed data collected by high-precision GPS units. The GPS units will collect x-y location values for features and z-data representing elevation. All data will be downloaded from the GPS units and saved on MES servers for the duration of the project. Once the project is completed, all survey and GPS data will be made available to EPA and DNR.

Examples of publicly available GIS data and tools to be used might include but are not limited to:

- Chesapeake Bay Program Data Catalog
- Maryland National Flood Hazard Layer
- Mdfloodmaps.net
- MyCoast.org (Application)
- USGS: Floodplain and Channel Evolution Tool (FACET)
- FEMA Flood Maps
- Chesapeake Conservancy High Resolution Land Cover project
- Chesapeake Conservancy Enhanced Flow Path datasets
- MDEM Flood Risk Application
- Maryland Coast Smart- Climate Ready Action Boundary (CRAB) Inundated Zones data product
- Chesapeake Assessment Scenario Tool (CAST)
- Chesapeake Bay Program
- Historic Trends Scenario 2025

MyCoast.org relies on public input. MyCoast.org data will be used only anecdotally for this project. MyCoast data will not be used in any scoring of potential projects. No project will be recommended only because it appears on MyCoast.org. All other data sources will be evaluated during the project to ensure that the data source is appropriate to answer the project's fundamental question. See Quality Objectives and Criteria below for more information.

Property Ownership - Ownership of individual property parcels will determine the need for notifications and/or permissions during the field assessment. Property ownership will also be a factor in determining maintenance responsibility of infrastructure, potential costs of property acquisition in any remediation recommendation, and additional permitting requirements such as work on land owned by M-NCPPC. Additional sources of information may include deeds and easements recorded and retrieved from MDLANDREC.NET.

Authoritative Datasets- All data to be collected will contain proper metadata. Metadata will be evaluated to ensure data quality and appropriateness to the project. These datasets include but are not limited to:

- Flood Maps
- Climate Ready Action Boundary
- Parcel Data
- US Census Data
- Underserved Communities

Local Datasets- Spatial and non-spatial data collected during the creation of reports and studies, including but are not limited to:

- Comprehensive Plans
- Urban Plans
- Hydrologic Studies
- Watershed Characterization Plans
- Stormwater Systems
- Stream Layers
- Land Use
- Temperature Monitoring Data

Surveyed Data- All survey work that is performed during this project will be conducted under the guidance of a Professional Licensed Surveyor (PLS) and stamped, if necessary. This includes topographic survey, boundary survey, stakeout survey, use of unnamed aerial systems (drone) and utility identification. Equipment to be utilized, will be determined by the PLS assigned to the deliverable, and will consist of any of the following:

- Trimble R8 Real-Time Kinematic (RTK (GPS))
- Trimble S6 Robotic Total Station
- Nikon Total Station and Traverse

Community Engagement- An outreach survey may be developed using ESRI Survey123 software to collect sources of data, local assets, cost benefit, and critical infrastructure.

The updated Targeted Resiliency Area model will contain metadata in accordance with Federal Geospatial Data Committee (FGDC) standards.

2.2 Field Data Collection Methodology

Field visits of identified project areas will occur as needed. Field reconnaissance may include photo documentation of project sites and potential GPS data collection. All GPS data will be collected using a Trimble handheld GPS unit, with a published datasheet horizontal and vertical accuracy of 10cm + 1ppm. This task assumes that no post-processing will be performed for enhancing positional accuracy. However, MES will utilize a vertical referencing station and verify positional accuracy before collecting GPS data by referencing published (National Geodetic Survey (NGS), County or Maryland State Highway Administration (SHA)) Horizontal/Vertical Control in the area. FGDC metadata standards will be used in the creation of metadata for all collected data.

3. Quality Objectives and Criteria

QA Assessment and Response Actions

QA Assessment and Response Actions is a process that involves the following steps:

- A qualified person is tasked to create a work product. That person is the Designer/Originator (D/O);
- The D/O performs self-checks on their work for accuracy and completeness as it is produced;
- A second qualified person is tasked to QC check the work for accuracy and completeness and returns suggested corrections to the D/O of the work product;
- The D/O backchecks the corrections and coordinates with the person who provided them until they reach agreement on the changes to be implemented;
- A record of the suggested and implemented changes are kept on file as evidence that the QC check was performed;
- A final quality assurance (QA) review of the product is conducted prior to submission to the client. This review may be performed by the PM or by a third person depending on project complexity. The QA review will assure that the QC process has been completed and the scope of work has been fulfilled; and
- Finally, an audit of the files is made to ensure the QC/QA process was completed prior to signing and sealing documents and making final submission to a client.

Prior to starting design work, the PM will develop a plan for how QC/QA will be accomplished on each of their projects, taking into consideration the complexity of the project and availability of qualified staff to perform the QC/QA. The PM's role will be to:

- Document their QC/QA plan in writing;
- Follow their QC/QA plan;
- Modify their QC/QA plan as needed through the life of the project; and
- Keep a record that the QC/QA activities were completed.

In documenting their QC/QA plan, the PM will identify potential QC checkers for each element in their scope of work as well as QA reviewers for each plan submittal. Identification of the pool of qualified checkers and reviewers early in the project is important in order to schedule their time and availability when needed, especially when specialized expertise is required. Planning and scheduling ahead is important so the QC checks are performed as the work is produced. Monitoring and modifying the QC/QA plan throughout the life of the project is essential to ensure thorough and timely checks and reviews are performed and the project stays on track.

Quality Objectives, Criteria and Potential Decision Errors

The goal of this grant project is to create a portfolio of potential projects, such as tree plantings, stream buffer restoration, culvert upgrades, wetland restoration, and so on, that would increase the community's resiliency to increased flooding and climate change effects. This portfolio will focus future attention by DNR, other MD State Agencies, and the TRA communities themselves on those resiliency projects that are feasible, and which provide the greatest resiliency and community benefits at the least cost.

None of the projects included in the portfolio will move immediately toward construction upon completion of this grant project. Rather the portfolio will be used by DNR and the two TRA communities to begin promoting the top scoring projects from the portfolio. This promotion could entail conducting further research, identifying funding support, assessing neighbors' sentiments toward the potential project, finding partners with whom to undertake the projects, and so on. In every instance, the potential projects will be further evaluated to ensure feasibility, benefit and cost prior to purchase or construction.

Since this project is a planning effort, the data quality objectives for this project are to support planning and prioritization efforts only. No sampling data will be collected. No regulations will be promulgated from this grant. No funding will be awarded based solely on the portfolio listing. No tax abatements will be granted and no properties will be acquired based solely on the portfolio listing. Because any potential project would undergo further research before the communities and DNR fully commit, the standards for data collection and use are much lower than they would be for immediate implementation and construction of such projects. Nevertheless, using data improperly, using incomplete datasets, or making faulty assumptions from data will impact the quality of the portfolio.

As datasets are selected and applied, each will be evaluated to ensure it meets project needs in the four following areas:

- **Accuracy:** any input datasets must accurately reflect what they purport to map and will be positionally accurate. For example, if a stormwater basin map is used, all stormwater basins should appear on the map.
- **Precision:** any input datasets will attain a precision of at least 30-meter resolution (if raster data) and 1:24,000 for vector data. These precision parameters are sufficient for a planning and prioritization project.
- **Currency:** Spatial datasets to be employed should be relatively up-to-date. For example, if parcels mapping is employed, the dataset should have been updated within the previous twelve months, or more recently. Again, the framework is decided upon, spatial datasets will be selected, and will be evaluated to ensure they are up-to-date.
- **Completeness:** Information to be relied upon must be reliable and complete. Completeness of datasets will be ensured by relying on authoritative sources. For example, if stormwater basins are mapped, the source of the data should come from an agency or department deeply involved in stormwater management, such as a municipal engineer. If a statewide green infrastructure layer is applied, staff will ensure that both TRAs were considered in the analysis.

As data sources are identified during the Water Quality and Climate Resiliency Portfolio Project, they will be evaluated in accordance with the above criteria. This QAPP will be updated and re-submitted to EPA for approval.

Quality Objectives and Criteria for Task 1: Refinement of Existing TRA Model

The goal of Task 1 is to create a strategic plan for restoration and conservation activities in the two TRA

communities (Pocomoke City area and Hamilton Run watershed, Hagerstown. This strategic plan will take the form of a portfolio of resiliency projects which DNR and the two TRA communities can use to focus additional work after the project is completed.

Three fundamental efforts will be used to refine the model and develop the portfolio: 1) creation of a listing of flooding hotspots and potential resiliency projects; 2) assessment of each project to ensure feasibility, and 3) creation of a framework for ranking and scoring the projects. Each of these efforts have slightly different purposes and will involve different levels of data quality. Each of these tasks is discussed in detail below.

Quality Objectives and Criteria for Task 2: Community Engagement and Outreach

This task will help inform the two TRA communities about the project. It will also help inform maps of flooding hotspots in both TRAs. Flooding hotspots include geographic locations that experience regular flooding. “Regular flooding” is not defined precisely but represents flooding that occurs often enough to impact community members by preventing travel, leading to flooding on their lawns, as well as more catastrophic flooding that threatens life and property. Hotspot locations will be mapped by textual identification, such as road segments, road intersections, or local landmarks, such as “Cypress Park.”

Data quality risks associated with this task include 1) missing flooding hotspots, 2) mapping areas as flooding hotspots that are not in fact flooded, 3) inconsistency in the intensity of flooding reported by different people, and 4) insufficient knowledge on the part of the reporter as to how frequently the flooding occurs. Because this information is not being collected in a systematic way, no scoring or ranking will be made based solely on community input of flooding hotspots. The location of flooding hotspots will be confirmed by other geospatial data sources. Possible sources for confirming flooding hotspots include the USGS Flood Plain and Channel Evaluation Tool (FACET) and/or H&H modeling. These data sources are currently not defined, however as they are identified, this QAPP will be updated and resubmitted to EPA for approval.

Quality Objectives and Criteria for Task 3: Site Assessment and Feasibility Analysis

The identified potential projects will be assessed and prioritized for quantifiable impacts which may include (but not necessarily be limited to), social vulnerability, results of existing vulnerability assessments, community preparedness, restoration and conservation program priorities, partnership priorities (including other state agencies and multi-agency groups), critical infrastructure, and potential for carbon offset. Identified projects will also have a feasibility study performed by MES engineering staff to incorporate all the project's relevant factors – including economic, technical, legal, and scheduling considerations – to ascertain the likelihood of completing the project successfully.

Creating the framework for evaluating and scoring or ranking the portfolio projects stands at the heart of this project. The framework will be developed during the project and will be created cooperatively by DNR staff, MES staff, and representatives from local governments for the two TRA communities. How potential projects are to be evaluated for their feasibility, resiliency, and potential costs will be defined as the project progresses. Furthermore, input spatial data for the framework will be identified as needed

as the prioritization schema is developed throughout the project. As the project team decides which geospatial datasets will be used, each dataset will be assessed to ensure it meets the data quality criteria outlined above, including accuracy, precision, currency, and completeness. One approach for ensuring accuracy and completeness will be to rely on authoritative sources of information. For example, for Hagerstown's stormwater system, the source of the data will be the City of Hagerstown Engineering Department. This Department is responsible for maintaining and monitoring the storm draining network map. It is almost certain that the Department maintains the most accurate and complete system map. Similarly, as additional data sources are identified, the project team will reach out to EPA and update the quality objectives for each new data layer to be employed.

Quality Objectives and Criteria for Task 4: Concept Design of Selected Projects

During this task, MES staff will create conceptual designs for one or several of the resiliency projects identified in Task 1 through Task 3 above. This task may rely on data sources presented above, for which data quality and criteria were discussed. If additional data sources beyond those discussed above are utilized, they will be evaluated as to their accuracy, precision, currency, and completeness. If new data sources are to be utilized, MES will submit an update to the QAPP with a detailed discussion of how the data are appropriate to the task.

The concept plans created during this task will not be considered permit ready. They are intended to be used by DNR and the TRA partners after this project's completion to move forward. Follow up steps could include that of finding funding, identifying partners, laying out next steps.

Quality Objectives and Criteria for Task 5: Portfolio Narrative Development

Task 5 will not involve the use of any spatial data or information that has not already been evaluated in Tasks 1 through 4 above.

Non-direct Measurements

Non-direct datasets will be relied upon for this project. As discussed above, the datasets will be decided during the project when the team decides what factors to use for the ranking and scoring. These datasets are likely to include authoritative GIS datasets created by the federal government and the state of Maryland. As they are selected, they will be evaluated using the acceptance criteria above. MES will update and revise this QAPP as data layers are evaluated, including a discussion of how the data are appropriate to the task. The QAPP will be re-submitted to EPA for approval, as the datasets are identified.

Data Management

All data collected or generated during this project will be saved on MES servers. These servers are securely managed using state-of-art data systems such as SharePoint and OneDrive. Files are regularly backed up to ensure data preservation, availability, and data integrity. Currently access is provided to all MES staff and members of the DNR team. Selective folders are shared with partners from the

community, for example, the Hagerstown City Engineer, to allow for uploading of background files. Upon project completion all data shall be exported and copied to DNR servers for its use and distribution in accordance with its policies.

APPENDIX B: SITE VISIT

Hamilton Run Site Visit

On December 12th, 2022, staff members from Maryland Department of Natural Resources (DNR), Maryland Environmental Service (MES), Washington County, and the City of Hagerstown conducted site visits along Hamilton Run. The purpose of the site visits was for the project team to observe existing conditions for locations experiencing flooding, stream degradation, and potential projects. The sites were chosen by staff from the County and City who led the project team during the visit. Figure 1 shows each of the locations visited and a summary for each is provided below.

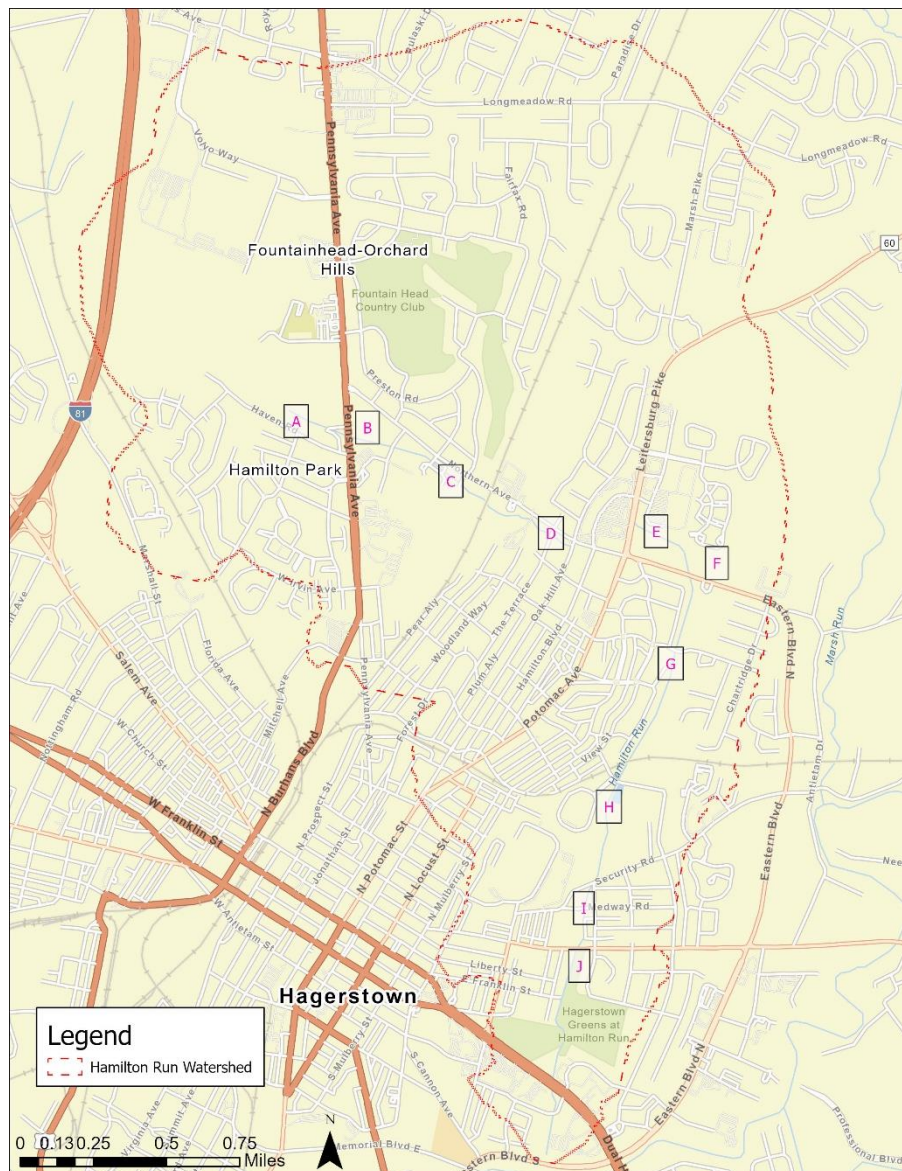


Figure 1: Hamilton Run TRA Site Visit Locations Map

A. REST HAVEN CEMETERY

Rest Haven Cemetery is located at the headwaters of Hamilton Run. Springs on the property feed into the stream. As development has increased over time on the surrounding properties, runoff draining to the property has increased, resulting in more frequent flooding. The cemetery owners have particularly expressed concern following the commercial development directly north of the cemetery, including Fountain Head Plaza. Further development is proposed upstream of the cemetery posing additional concern. Proposed projects discussed included a stream restoration to remove the pond and restore natural meander of the stream.



Figure 2: Rest Haven Cemetery Pond

B. FOUNTAINDALE ELEMENTARY SCHOOL

Fountaindale Elementary School is located directly adjacent to Hamilton Run. The open grass spaces adjacent to the stream are in low lying elevations and experience flooding during large rain events. A small dam was observed at the downstream end of the stream reach which was noted to have been installed for irrigation purposes.



Figure 3: Concrete Irrigation Dam (left) and Culvert under Fountaindale Way (right)

C. NORTHERN MIDDLE/WASHINGTON COUNTY MAINTENANCE YARD

Northern Middle and Washington County Maintenance Yard are adjacent properties. Hamilton Run runs along the front of both properties. Culverts running through the center of the Northern Middle School parking lot were observed to be much larger than the culverts on the maintenance yard. The culverts at the maintenance yard were noted to be undersized, but replacement would impact operations of the maintenance yard. The County expressed interest in relocation of the maintenance yard but currently is not feasible.



Figure 4: Culvert Leaving Northern Middle School (left) and Culvert under Railroad East of Maintenance Yard (right)

D. MILLS PARK/ THE TERRACE

This stream segment is noted as exhibiting the highest rate of bank erosion along Hamilton Run. Headcuts were observed of up to 4 feet. Within this reach is a privately owned retaining wall currently held by old telephone posts across the banks, as shown in Figure 5. Culverts were noted to be undersized resulting in flooding. However, the restricted flows downstream help reduce further degradation of the banks. It was discussed Ecotone was completing the design and permitting for a stream restoration along this reach, with construction to be completed in phases. The design will also evaluate retrofitting the culverts, ensuring there will be no downstream impacts if culvert sizes are increased.



Figure 5: Failing Retaining Wall Supported by Telephone Poles

E. LONGMEADOW SHOPPING CENTER CULVERT

This site was at the downstream end of the box culvert running under the Longmeadow Shopping Center. The culvert was built in the 1950's and is undersized for the current flows it receives. This creates backwatering on the upstream end of the culvert, contributing to the flooding experienced on Northern Avenue.



Figure 6: Longmeadow Shopping Center Culvert

F. CORTLAND MANOR DAM

The dam is constructed within a tributary feeding into Hamilton Run. It was thought flows from the tributary may have contributed to flooding. However, upstream of the dam is typically dry. This led to discussions on karst soils in the area, which may contribute to no water ponding upstream of the dam.

G. POTOMAC HEIGHTS SCHOOL/MAGNOLIA CULVERT CROSSING

Flooding concern was expressed for properties south of this location. The culvert under the railroad on the south end of the property currently acts as a dam to restrict discharges downstream. However, flooding issues were noted to persist.

H. PANGBORN PARK

Pangborn Park is located downstream from Potomac Heights. Recent projects within the area included reconstruction of the lake walls and restoring 400 feet of stream floodplain storage by the lake and the lake house. An additional project has been proposed just downstream of the lake to utilize a large available space for a forested wetland. The goal of the project would be to increase floodplain storage to help mitigate flooding to the downstream community.

I. MEDWAY ROAD EROSION

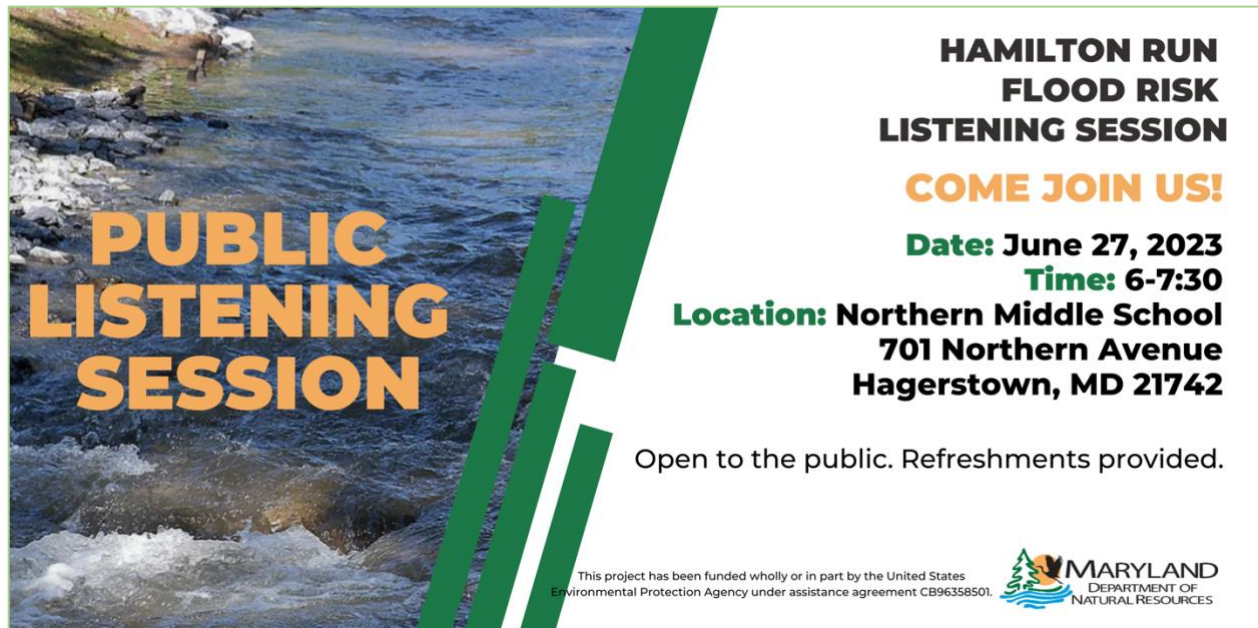
This segment of Hamilton Run runs within a restricted area between residential properties and a park. There is no floodplain for water to go when the stream becomes bank full resulting in flooding to the adjacent properties. A previous mitigation project included stabilizing the banks with gabion baskets, but these are starting to fail. The gabion baskets are starting to fall into the stream, and concern was expressed that this could cause more problems than if the original project had not been conducted.

J. GREENS AT HAMILTON RUN GOLF COURSE

A stream restoration is currently underway for this location. The design includes realigning Hamilton Run with its natural channel within the reach running through the golf course. The project was noted to be moving forward to construction.

APPENDIX C: COMMUNITY OUTREACH

APPENDIX C.1: LISTENING SESSION



Dear Resident,

We are excited to share information with you about the opportunities for implementing flood risk reduction projects in your community. Hamilton Run has been identified as an area of interest, and this planning initiative seeks to develop projects with community support that reduces flood risk.

In addition to providing information on this planning project, this letter serves to invite you to an upcoming listening session. The session will provide you with an opportunity to discuss local issues as well as opportunities for project development. As we are in the initial phase of this planning project, we would like to hear from residents and incorporate your ideas throughout the planning process. This information will help the Maryland Department of Natural Resources find solutions to reduce flood impacts. Please consider joining us for this important session.

HAMILTON RUN FLOOD RISK LISTENING SESSION

Date: Tuesday, June 27, 2023
Time: 6-7:30 PM
Location: Northern Middle School Auditorium, 701 Northern Avenue,
Hagerstown, MD

We look forward to meeting with you at the listening session!



HAMILTON RUN FLOOD RISK

PUBLIC LISTENING SESSION

This project has been funded wholly or in part by the United States Environmental Protection Agency under assistance agreement CB96358501.



The public is invited to attend a listening session on June 27th, 2023, in the Northern Middle School auditorium. The session will provide an opportunity to discuss flood risk associated with Hamilton Run. We are in the initial phase of this planning project and look forward to listening, learning, and working together to ensure your ideas are being incorporated throughout the planning process. This information will help the Maryland Department of Natural Resources find solutions to reduce flood impacts. Please consider joining us for this important session.

**WE LOOK FORWARD TO MEETING WITH YOU AT THE
LISTENING SESSION!**

Date: June 27, 2023

Time: 6:00-7:30 PM

Location:

Northern Middle
School Auditorium
701 Northern Ave.
Hagerstown, MD



Flood risk reduction focuses on decreasing the consequences of floods through measures within vulnerable areas.

Natural hazard risk reduction measures save \$6 on average for every \$1 spent.

Hamilton Run TRA					
Government Contacts					
Name	Agency/Organization	Email	Phone	Address	Notes
Mayor Tekesha Martinez	City of Hagerstown, Mayor	tmartinez@hagerstownmd.org			
Kristin B. Aleshire	City Councilmember	kaleshire@hagerstownmd.org			
Robert E. Bruchey, II	City Councilmember	rbruchey@hagerstownmd.org	(301) 766-4175	One East Franklin Street, Second Floor, City Hall, Hagerstown, MD 21740	
Tiara Burnett	City Councilmember	tburnett@hagerstownmd.org			
Shelley McIntire	City Councilmember	smcintire@hagerstownmd.org			
Matthew J. Schindler	City Councilmember	mschindler@hagerstownmd.org			
	City Community Engagement Office	events@hagerstownmd.org			
Wes Decker	Communications Office	wdecker@hagerstownmd.org	301-739-8577 ext. 819	1 E. Franklin St., #208	
Jim Bender	City Engineer	jbender@hagerstownmd.org	(301) 739-8577 Ext. 125	One E. Franklin Street, Rm 301, Hagerstown, MD 21740	
Kathleen Maher	City Planning & Zoning Department, Director	kmaher@hagerstownmd.org			
Stephen Bockmiller	City Planning & Zoning Department, Development Planner/Zoning Administrator	sbockmiller@hagerstownmd.org	(301) 739-8577 Ext. 138	One E. Franklin St. 3rd Floor Hagerstown, MD 21740	
Steve Lohr, Hagerstown Fire Chief	City Fire Department		(301) 790-2476	25 Church Street, Hagerstown, MD 21740	
	MD Dept. of Social Services	https://dhs.maryland.gov/local-offices/washington-county/	(240) 420-2100	122 N Potomac St, Hagerstown, MD 21740	
Mark Haddock	Hagerstown Parks and Recreation	http://www.hagerstownmd.org/parksandrec	(301) 739-8577 ext 169	351 N Cleveland Ave, Hagerstown, MD 21740	mhaddock@hagerstownmd.org

Media Outlets					
Name	Agency/Organization	Email/Website	Phone	Address	Notes
	Hub City Now Antietam Broadband 25	https://www.hagerstownmd.org/1596/Hub-City-Now-Antietam-Broadband-25			
	City of Hagerstown YouTube Channel	https://www.youtube.com/channel/UCgWC6TILUWbRV9MaDGRq8Bw			@CityofHagerstown
Larry Veihmeyer, Advertising	WARK (98.9 FM/AM 1490 Hagerstown)	lveihmeyer@manningmediainc.com	(301) 620-7700		
Larry Veihmeyer, Local Sales Manager	106.9 The Eagle	lveihmeyer@manningmediainc.com	(301) 733-4500	880 Commonwealth Avenue, Hagerstown, Maryland 21740	
Susan Simonson	Antietam-Conococheague Watershed Alliance (ACWA)	info@acwamaryland.org			

Local Organizations and Nonprofits					
Name	Agency/Organization	Email/Website	Phone	Address	Notes
Dennis Holovach	St Catherine Orthodox Church	https://www.saintcatherineorthodoxchurch.org/	(315) 559-5675	988%Qngjwy-%Xy1%Mf1jwxyt a1%RI%76<95	djholovach@gmail.com
	Otterbein UM Church	https://www.otterumc.org/	(301) 739-9386	65=%J%KwFspqna%Xy1%Mf1jwxyt a1%RI%76<95	
	Hagerstown Church of the Brethren	https://www.hagerstowncob.org/	(301) 733-3565	6:%X%Rzqgjjww-%Xy1%Mf1jwxyt a1%RI%76<95	
	Trinity Evangelical Lutheran Church	http://www.tlchag.org/	(301) 733-2878	15 Randolph Ave, Hagerstown, MD 21740	
	Zion Reformed UM Church	https://zionreformed.church/	(301) 739-7244	756%\$Utytrf%h%Xy1%Mf1jwxyt a1%RI%76<95	donrucc@myactv.net
Shannen Banzhoff, Social Media Director	Washington County Playhouse Dinner Theater	http://www.washingtoncountypplayhouse.com/	(301) 739-7469	44 N Potomac St Rear, Hagerstown, MD 21740	shannenbanzhoff.weebly.com
	Ebenezer AME Church		(240) 347-4951	26 Bethel St, Hagerstown, MD 21740	
	People Gospel Tabernacle	http://www.peoplesgospeltabernacle.com/	(301) 491-0638	543 Security Rd, Hagerstown, MD 21740	pgt.hagerstown.md@gmail.com
	First Christian Church	http://www.fcchagerstown.com/	(301) 733-0144	1345 Potomac Ave, Hagerstown, MD 21742	
Kathy Sebrosky, Administrative Assistant	St. Ann Roman Catholic Church	http://stannchurch.com/	(301) 733-0410 ext 108	1525 Oak Hill Ave, Hagerstown, MD 21742	ksebrosky@stannchurch.com
	YMCA	http://ymcaghagerstown.org/	(301) 739-3990	1100 Eastern Blvd N, Hagerstown, MD 21742	
	American Legion	http://www.morrisfrockpost42.org/	(301) 733-7676	405 Northern Ave, Hagerstown, MD 21742	morrisfrock@gmail.com
	Haven Lutheran Church	https://www.havenlc.org/	(301) 733-5056	1035 Haven Rd, Hagerstown, MD 21742	
	Senior Activities Center	https://www.wccoaging.org/senior-center	(301) 790-0275	535 E Franklin St, Hagerstown, MD 21740	info@wccoaging.org

Hamilton Run Targeted Resiliency Area Public Listening Session

June 27, 2023, 6:00 – 7:30 PM

Hamilton Run was identified as a Targeted Resiliency Area (TRA) by the Maryland Department of Natural Resources. A public listening session was scheduled to discuss local issues and capture input on community values and opportunities for large-scale nature-based projects. The following participants were in attendance:

- Christine Conn, MD Department of Natural Resources – Chesapeake and Coastal Service
- Ari Engelberg, MD Department of Natural Resources – Chesapeake and Coastal Service
- Jim Bender, City of Hagerstown
- Wes Decker, City of Hagerstown
- Dennis Nave, Hagerstown Resident
- David Trostle, Hagerstown Resident
- Tom Borum, Hagerstown Resident
- Steve Cohen, DCNewsNow
- Dave Guignet, Maryland Department of Environment
- Kayla Rhue, Maryland Environmental Services
- Ginny Smith, Smith Planning and Design
- Michele King, Smith Planning and Design

Resident letters and project briefing sheets were distributed on June 8th via mail and email. Distribution included area businesses, churches, City of Hagerstown and Washington County staff and key elected officials. Also included in the distribution were various media outlets such as radio and tv stations.

In addition, listening session information was posted on the City of Hagerstown website, social media, and the cable news channel.

Agenda

- Introductions
- Targeted Resiliency Area Overview
- Listening Session
- Next Steps

Targeted Resiliency Area Overview

Christine Conn explained to participants that Hamilton Run was chosen as a Targeted Resiliency Area (TRA) based on a statewide assessment. While flooding is a focus, other issues such as water quality and erosion will be included. The goal is to gather information to develop natural based projects within this targeted area, however, other project types identified as part of this planning process will be shared with partnering state and federal agencies as well as non-profit groups.

Hamilton Run Targeted Resiliency Area Public Listening Session

June 27, 2023, 6:00 - 7:30 PM

Identified projects will be prioritized using community input and knowledge. One project will be selected for design/build and funneled through the Grants Gateway. Other identified projects will be compiled into a project portfolio. The MD Coastal Commission will assist in determining proper funding sources and funding combinations, if necessary.

Listening Session

During the listening session, participants were asked to provide issues and opportunities. Community input and knowledge on issues and opportunities will assist with project prioritization. Issues and opportunities denoted with a number, i.e., #1, have been mapped and are presented on pages 6 and 7. Issues are denoted with red dots, while opportunities are denoted with green dots shown on the maps. Each numbered issue and opportunity corresponds to the numbered issues and opportunities on the maps.

To start the session, the public was asked what they liked about their community. The following responses were provided:

- Moderate Climate
- Location and proximity to major metropolitan areas.
- The community has a rural character but is not far from major cities.

ISSUES

- The area is considered a hub city and contains lots of warehouses. Many warehouses are unoccupied and many more are being built. How will these facilities impact flooding issues in the future?
- An engineer from Volvo indicated the need to lower berm as required by MDE because of hazardous dam rating. An increase in flow is anticipated to Hamilton Run near Rest Haven Cemetery. This will likely be exacerbated by planned development in upstream forested area.
- Stormwater BMPs placed throughout watershed do not have capacity to handle intense storms. These are small, distributed ESD practices that get overwhelmed and release uncontrolled stormwater flows. Where this water goes should be assessed. Larger SWM facilities, like detention ponds, may be a better approach, but Karst topography needs to be considered. Liners are typically recommended in situations like this.
- **#1 - Potomac Heights Development**
 - Severe erosion issues along Hamilton Run across from the property located by the intersection of Potomac Heights and Calvert Terrace.
 - After the Douglas A. Fiery Funeral Home was constructed, erosion issues began to occur. Fill dirt was brought in prior to the construction of the funeral home.
 - Erosion of the bank is causing tree roots to be exposed and resulting in trees falling across Hamilton Run and into adjacent properties.

Hamilton Run Targeted Resiliency Area

Public Listening Session

June 27, 2023, 6:00 - 7:30 PM

○ #2 – Hazardous Materials Site

- A hazardous materials (HazMat) site is located less than 1 mile from the headwaters of Hamilton Run, near the Rest Haven Cemetery.
- This is an EPA Superfund site known as Central Chemical, a pesticide manufacturer in the 1950's and 1960's.
- Characterization and clean-up of the site has been ongoing for more than 20 years, and there have been numerous rounds of groundwater sampling, dye tracing exercises, etc.
- DDT and other chemicals were identified in the groundwater 2-3 miles from a HazMat site.
- Karst soils make it difficult to determine where the contaminated groundwater flows.
- No aquatic life can be found in Hamilton Run around this area.
- Jeff Harp, Maryland Department of Environment, indicated toxicity testing will be performed at this site.
- Geese/duck waste might also be contributing to the decline in aquatic life.

○ #3 – American Legion

- Flooding occurs regularly at this location during heavy rain events. During a previous rain event, over 3 feet of floodwater was recorded at this site.
- A grant to increase the size of the bridge located along American Legion Avenue has been awarded.



- The culvert will be funded by the City. Washington County Conservation District (WCCD) consultant is performing field surveys and gathering data for design; between the design effort and the required permitting effort, it will be the fall of 2024 (at the earliest) before actual construction would begin.

○ #4 – Odor near Burger King

- The area around Burger King floods and there is a persistent odor in the area.

○ #5 – Medway Road

- Stream channel runs through residential properties and backyards.
- Flood controls such as concrete walls and gabions have been installed to prevent erosion, however, these structures are beginning to give way.
- Houses in this area are probably elevated, however yards are in the floodplain.

Hamilton Run Targeted Resiliency Area Public Listening Session

June 27, 2023, 6:00 - 7:30 PM



- A development is planned upstream between Point and Pangborn parks.
- **#6 – East Magnolia Avenue**
 - Multiple culvert crossings that are undersized.
 - The culverts are located by the Potomac Heights Elementary School.
 - Flooding events at this location impacts access to the school.
 - MDE and the City of Hagerstown indicated they are working on a 319 grant to increase the size of some culverts; however downstream impacts have not been determined.
 - The City and the Washington County Conservation District (WCCD) are partnering on a stream restoration project along Hamilton Run. On behalf of the City, WCCD submitted a Section 319 grant application to the State, and the City has been notified that the application was accepted and awarded funds. Those grant funds, along with funds from the City’s Stormwater Protection Fund, will be used to complete the project.
 - A safety hazard for school buses is a concern since they drive through flooded roads.



- **#7 – Foxleigh Meadows**
 - Ephemeral stream located in this development.
 - This stream is normally dry, however, during severe storm events, flooding occurs.

Hamilton Run Targeted Resiliency Area Public Listening Session

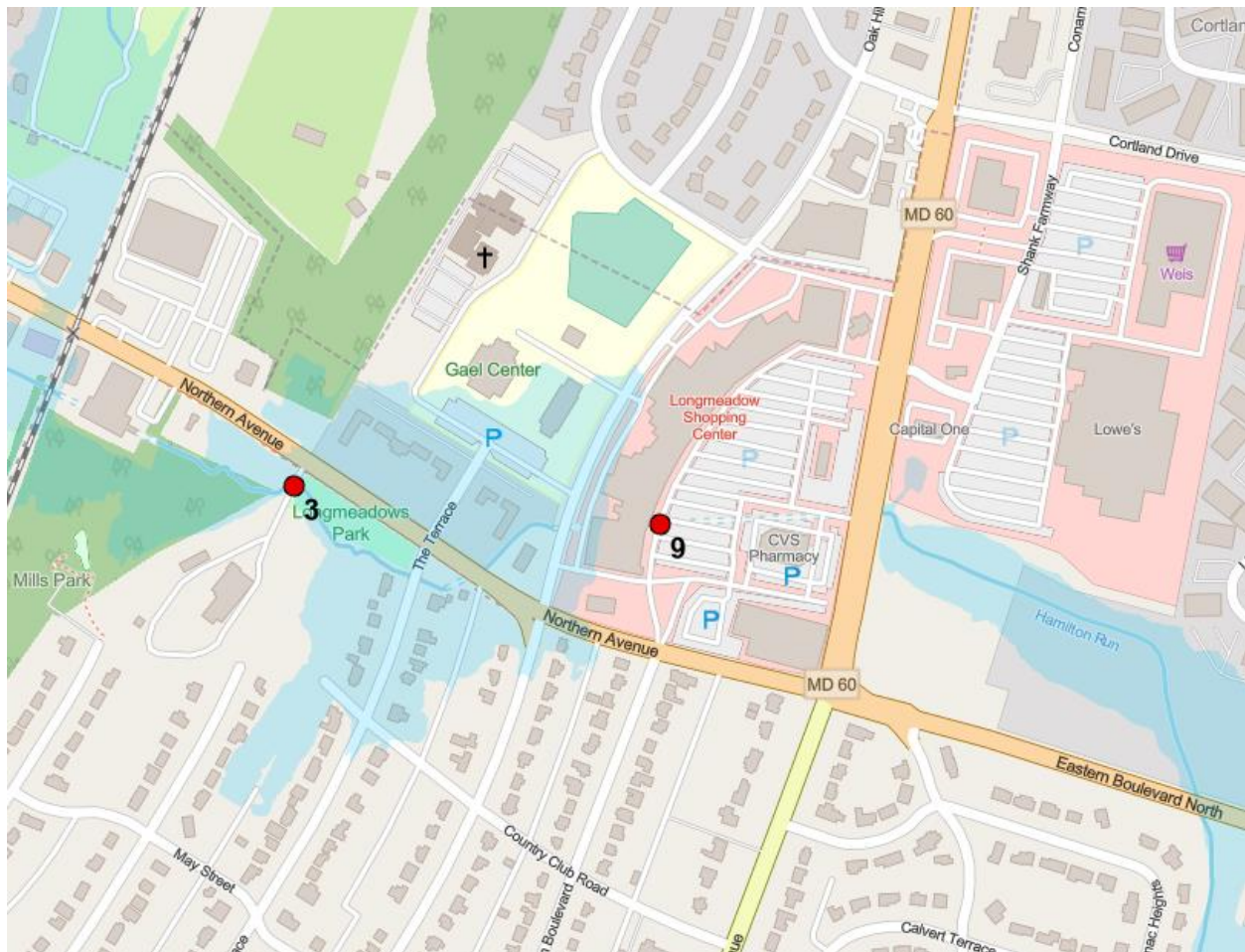
June 27, 2023, 6:00 - 7:30 PM

- **#8 – CSX Railroad**

- An undersized culvert is located under the railroad tracks.
- This culvert controls flooding downstream but does cause backwater.
- Opportunity – potential forest project on privately owned property.
- There is a potential for a green classroom at this site.

- **#9 – Longmeadow Shopping Center**

- The Longmeadow Shopping Center down the street from the legion has experienced flooding. Flooding in this area is caused by stormwater management issues. Debris fall collecting in drainage areas, causing flooding around shopping center. Hamilton Run is diverted under this shopping center.
- The SWM issues cause significant flooding to Northern Avenue.
- Image provided below.



Hamilton Run Targeted Resiliency Area

Public Listening Session

June 27, 2023, 6:00 - 7:30 PM

Culvert Summary

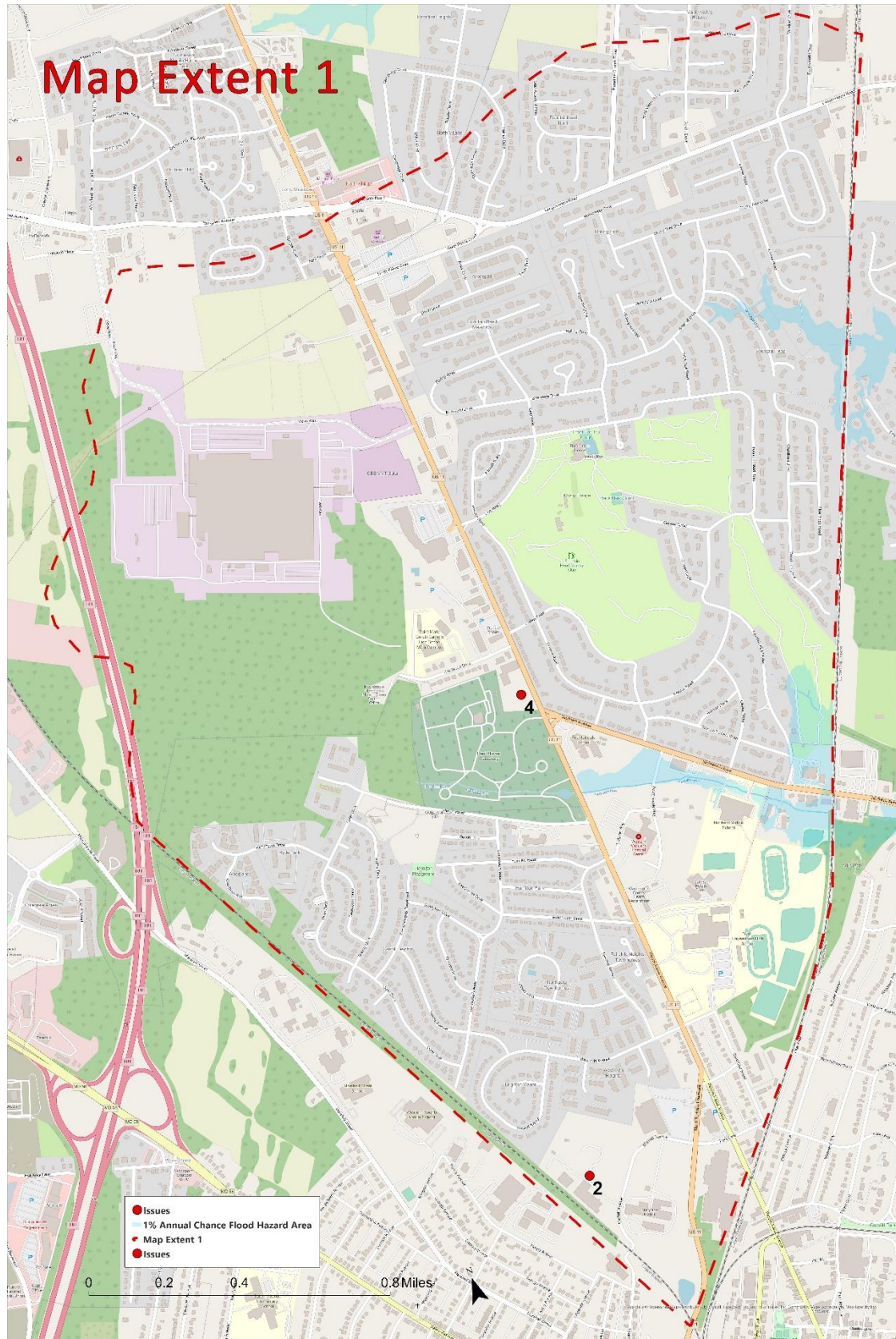
The existing culvert at the American Legion, the culverts at Magnolia Avenue, and the culvert under the CSX railroad line just north of Pangborn Park are all undersized, and larger storm events either inundate them and cause flooding, or they form a “dam” that backs water up and inundates property. The issue is that making any of these culverts much larger would help to solve that immediate problem, but would also send higher peak flows downstream, and possibly create new flooding problems for properties that are fairly safe right now. Both the City and MDE are aware of the perils of changing hydraulic conditions in an existing, developed environment. The culvert at the American Legion may be enlarged a bit without causing problems, however the other two locations are more challenging.

OPPORTUNITIES

- **#1 – Tree Planting**
 - Eight acres of floodplain in this area cannot be developed and is used as field/pasture.
 - The property is under private ownership, but there is a chance that the City could secure an easement from the property owner to do riparian tree planting.
- **#2 – Culvert Upgrade**
 - Opportunity to increase the size of the culvert on East Magnolia Avenue. A study will need to be completed to determine downstream impacts.
- **#3 – Potential Wetland Park**
 - **This is a top project site.**
 - This area may serve as a potential site for a wetland park/open space. This will provide connectivity to the other parks.
 - This project would provide more benefit to Issue #5 just downstream.

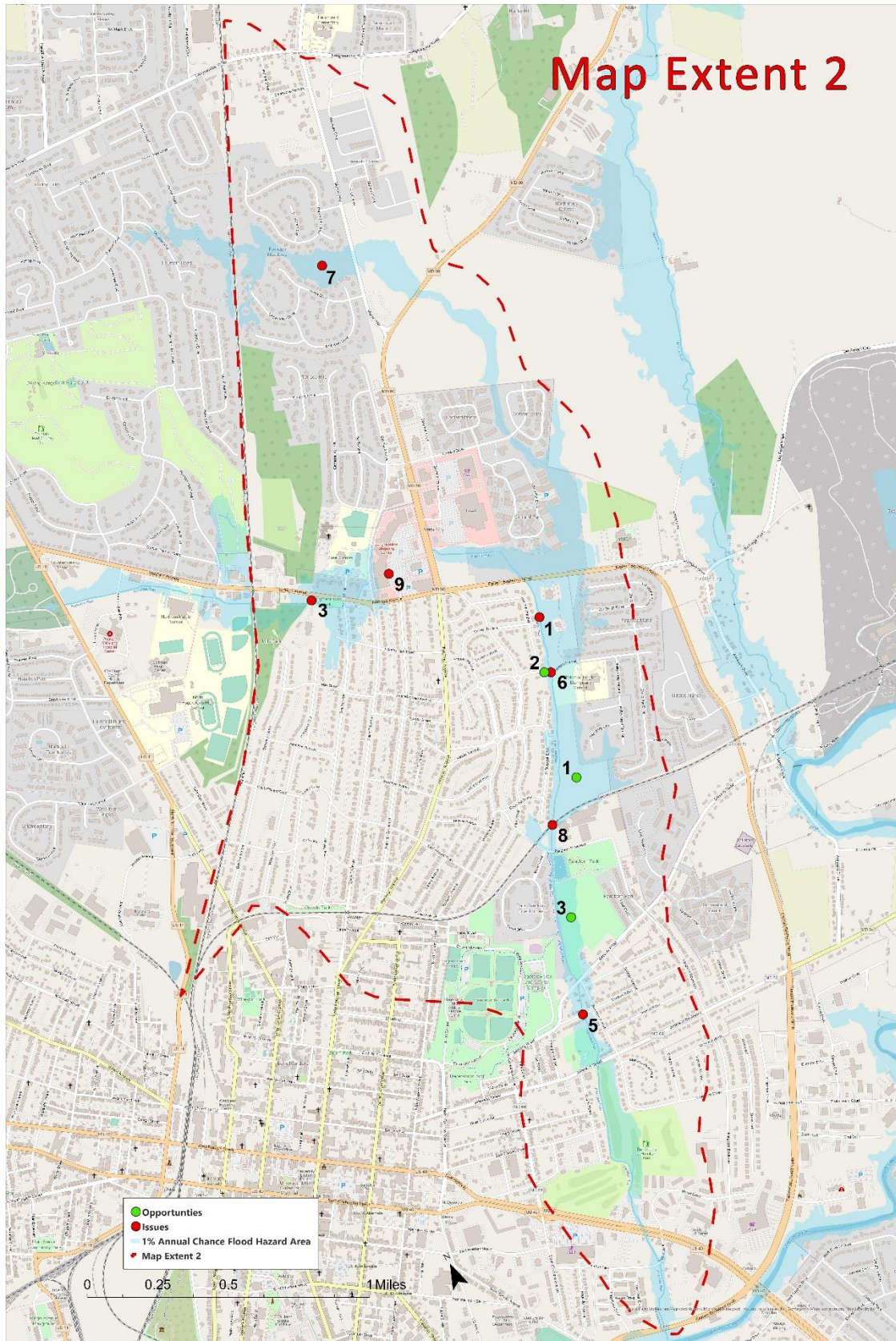
Hamilton Run Targeted Resiliency Area Public Listening Session

June 27, 2023, 6:00 - 7:30 PM



Hamilton Run Targeted Resiliency Area Public Listening Session

June 27, 2023, 6:00 - 7:30 PM



Hamilton Run Targeted Resiliency Area Public Listening Session

June 27, 2023, 6:00 - 7:30 PM

Next Steps

- Information from Listening Session will be incorporated into the project prioritization and design selection process.
- A follow-up community meeting will be held in the Fall of 2023 to discuss the results of this planning initiative.

APPENDIX C.2: PUBLIC SURVEY



**WE ARE SEEKING
YOUR INPUT ON
FLOOD ISSUES IN
HAMILTON RUN!**

Click the link or scan below to take the survey.



<https://arcg.is/01WCHX>

Hamilton Run TRA					
Government Contacts					
Name	Agency/Organization	Email	Phone	Address	Notes
Mayor Tekesha Martinez	City of Hagerstown, Mayor	tmartinez@hagerstownmd.org			
Kristin B. Aleshire	City Councilmember	kaleshire@hagerstownmd.org			
Robert E. Bruchey, II	City Councilmember	rbruchey@hagerstownmd.org	(301) 766-4175	One East Franklin Street, Second Floor, City Hall, Hagerstown, MD 21740	
Tiara Burnett	City Councilmember	tburnett@hagerstownmd.org			
Shelley McIntire	City Councilmember	smcintire@hagerstownmd.org			
Matthew J. Schindler	City Councilmember	mschindler@hagerstownmd.org			
	City Community Engagement Office	events@hagerstownmd.org			
Wes Decker	Communications Office	wdecker@hagerstownmd.org	301-739-8577 ext. 819	1 E. Franklin St., #208	
Jim Bender	City Engineer	jbender@hagerstownmd.org	(301) 739-8577 Ext. 125	One E. Franklin Street, Rm 301, Hagerstown, MD 21740	
Kathleen Maher	City Planning & Zoning Department, Director	kmaher@hagerstownmd.org			
Stephen Bockmiller	City Planning & Zoning Department, Development Planner/Zoning Administrator	sbockmiller@hagerstownmd.org	(301) 739-8577 Ext. 138	One E. Franklin St. 3rd Floor Hagerstown, MD 21740	
Steve Lohr, Hagerstown Fire Chief	City Fire Department		(301) 790-2476	25 Church Street, Hagerstown, MD 21740	
	MD Dept. of Social Services	https://dhs.maryland.gov/local-offices/washington-county/	(240) 420-2100	122 N Potomac St, Hagerstown, MD 21740	
Mark Haddock	Hagerstown Parks and Recreation	http://www.hagerstownmd.org/parksandrec	(301) 739-8577 ext 169	351 N Cleveland Ave, Hagerstown, MD 21740	mhaddock@hagerstownmd.org

Media Outlets					
Name	Agency/Organization	Email/Website	Phone	Address	Notes
	Hub City Now Antietam Broadband 25	https://www.hagerstownmd.org/1596/Hub-City-Now-Antietam-Broadband-25			
	City of Hagerstown YouTube Channel	https://www.youtube.com/channel/UCgWC6TILUWbV9MaDGRq8Bw			@CityofHagerstown
Larry Veihmeyer, Advertising	WARK (98.9 FM/AM 1490 Hagerstown)	lveihmeyer@manningmediainc.com	(301) 620-7700		
Larry Veihmeyer, Local Sales Manager	106.9 The Eagle	lveihmeyer@manningmediainc.com	(301) 733-4500	880 Commonwealth Avenue, Hagerstown, Maryland 21740	
Susan Simonson	Antietam-Conococheague Watershed Alliance (ACWA)	info@acwamaryland.org			

Local Organizations and Nonprofits					
Name	Agency/Organization	Email/Website	Phone	Address	Notes
Dennis Holovach	St Catherine Orthodox Church	https://www.saintcatherineorthodoxchurch.org/	(315) 559-5675	988%Qngjwy-%Xy1%Mf1jwxyt a1%RI%76<95	djholovach@gmail.com
	Otterbein UM Church	https://www.otterumc.org/	(301) 739-9386	65=%J%KwFspqna%Xy1%Mf1jwxyt a1%RI%76<95	
	Hagerstown Church of the Brethren	https://www.hagerstowncob.org/	(301) 733-3565	6:%X%Rzqgjww-%Xy1%Mf1jwxyt a1%RI%76<95	
	Trinity Evangelical Lutheran Church	http://www.tlchag.org/	(301) 733-2878	15 Randolph Ave, Hagerstown, MD 21740	
	Zion Reformed UM Church	https://zionreformed.church/	(301) 739-7244	756%\$Utyttrfh%Xy1%Mf1jwxyt a1%RI%76<95	donrucc@myactv.net
Shannen Banzhoff, Social Media Director	Washington County Playhouse Dinner Theater	http://www.washingtoncountypplayhouse.com/	(301) 739-7469	44 N Potomac St Rear, Hagerstown, MD 21740	shannenbanzhoff.weebly.com
	Ebenezer AME Church		(240) 347-4951	26 Bethel St, Hagerstown, MD 21740	
	People Gospel Tabernacle	http://www.peoplesgospeltabernacle.com/	(301) 491-0638	543 Security Rd, Hagerstown, MD 21740	pgt.hagerstown.md@gmail.com
	First Christian Church	http://www.fcchagerstown.com/	(301) 733-0144	1345 Potomac Ave, Hagerstown, MD 21742	
Kathy Sebrosky, Administrative Assistant	St. Ann Roman Catholic Church	http://stannchurch.com/	(301) 733-0410 ext 108	1525 Oak Hill Ave, Hagerstown, MD 21742	ksebrosky@stannchurch.com
	YMCA	http://ymcaghagerstown.org/	(301) 739-3990	1100 Eastern Blvd N, Hagerstown, MD 21742	
	American Legion	http://www.morrisfrockpost42.org/	(301) 733-7676	405 Northern Ave, Hagerstown, MD 21742	morrisfrock@gmail.com
	Haven Lutheran Church	https://www.havenlc.org/	(301) 733-5056	1035 Haven Rd, Hagerstown, MD 21742	
	Senior Activities Center	https://www.wccoaging.org/senior-center	(301) 790-0275	535 E Franklin St, Hagerstown, MD 21740	info@wccoaging.org

Hamilton Run Watershed Area Public Survey Final Results Report

INTRODUCTION

The Hamilton Run Watershed Area was identified as a Targeted Resilience Area (TRA) by the Maryland Department of Natural Resources (DNR). An in-person public listening session was held on June 27, 2023, to discuss local topics as it relates to areas of flooding concern. Following this listening session, a public survey was developed in ArcGIS Survey123 to gather additional public comment. The purpose of collecting feedback from the listening sessions and public survey is to identify and prioritize large-scale nature-based projects to alleviate flooding and water issues.

The public survey was developed in ArcGIS Survey123 and allowed users to map points of interest as part of some of their responses. The survey consisted of the following questions:

Tell Us About Yourself

1. Do you live in the Hamilton Run Watershed Area? (map below for reference)
 - a. Yes
 - b. No
2. Do you work in the Hamilton Run Watershed?
 - a. Yes
 - b. No
3. Do you spend time recreating or attending events in the Hamilton Run Watershed Area?
 - a. Yes
 - b. No
4. How old are you?

a. Under 18	e. 45 to 54
b. 18 to 24	f. 55 to 64
c. 25 to 34	g. 65 or older
d. 35 to 44	

Location of Repetitive Flood or Water Issues

5. What type(s) of flood or water issues occur in Hamilton Run (select all that apply)?
 - ☐ Damage to Property (e.g., homes, buildings, roads)
 - ☐ Transportation Delays
 - ☐ Stormwater Management Issues
 - ☐ Disruptions to Critical Infrastructure (e.g., power, water, or gas outages)
 - ☐ Pollution of Drinking Water
 - ☐ Environmental Degradation (e.g., erosion)
 - ☐ Disruptions to Events or Scheduled Activities
 - ☐ Other
6. Do you know of any areas in Hamilton Run that experience repetitive flooding or water issues?
 - a. Yes

Hamilton Run Watershed Area Public Survey Final Results Report

- b. No
- 7. If yes, please utilize the map below to indicate a location in Hamilton Run that experiences flooding or water issues.
- 8. Please describe the flooding or water issue you identified on the previous map.

Areas of Importance

- 9. Utilizing the map below, please locate areas in the Hamilton Run Watershed that are significant to you (e.g., a park or recreational or cultural resource).
- 10. Please describe the area of importance you identified on the map above.

PROMOTING THE PUBLIC SURVEY

The public survey was promoted via three methods: (1) Electronic distribution of survey materials, (2) postcard mailers to local businesses, community groups, organizations, and departments, and (3) targeted Facebook advertising campaign.

Method #1

A contact listing was developed and maintained for outreach in the Hamilton Run area. The contact listing included government contacts, media outlets, local organizations and nonprofits, and businesses. Ready-made survey materials (social media image, link, and QR code) were provided to contacts via email the week of September 17, 2023. Contacts were introduced to the survey, its purpose, and asked to share the provided survey



materials on social media. In total, 24 contacts were directly contacted via email with this survey information.

Method #2

Postcards were developed and mailed for contacts where a physical address was available. In some cases, contacts received both an email and a postcard. Postcards (pictured left) were mailed to contacts on September 21st. In total, 40 postcards were mailed to businesses, organizations, media outlets, and government contacts in the Hamilton Run Area.



This image was provided to project contacts to share on social media. This image was also modified to be used in the targeted Facebook ad campaign.

Hamilton Run Watershed Area Public Survey Final Results Report

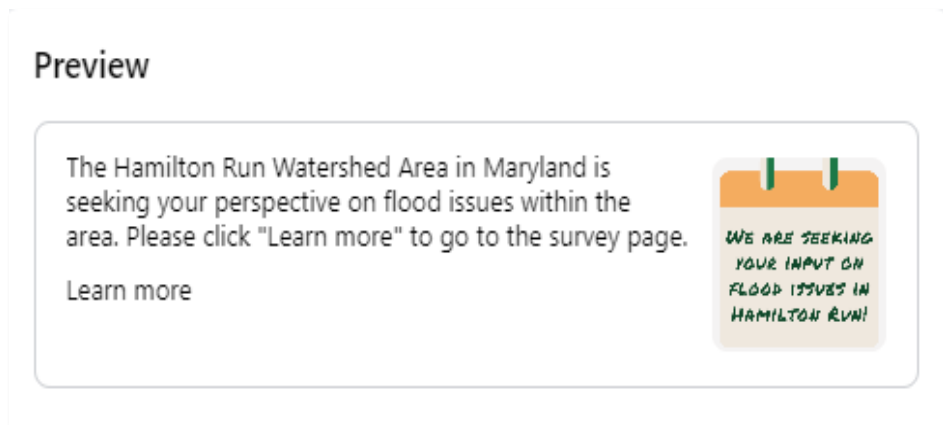
Method #3

The public survey was promoted on Facebook via two (2) targeted advertisement campaigns. The campaigns targeted all groups of people within a 10 mile radius of Hagerstown, Maryland, which included the Hamilton Run area.

Link clicks: The number of clicks on links within the ad that led to the public survey.

Reach: The number of accounts that saw the ad at least once.

The first ad campaign ran from September 25 to September 30, 2023. The first campaign had a reach of 1,908 people and generated 54 link clicks. The second campaign ran from October 2 to October 7, 2023. This campaign had a reach of 414 people and generated 12 link clicks. For both ad campaigns, the vast majority of the audience lived in Maryland and was 55 years of age or older.



An example of one type of ad a Facebook user might see during the ad campaigns. Ads appeared on the mobile app feed, Instagram stories, Facebook reels, and Instagram feed.

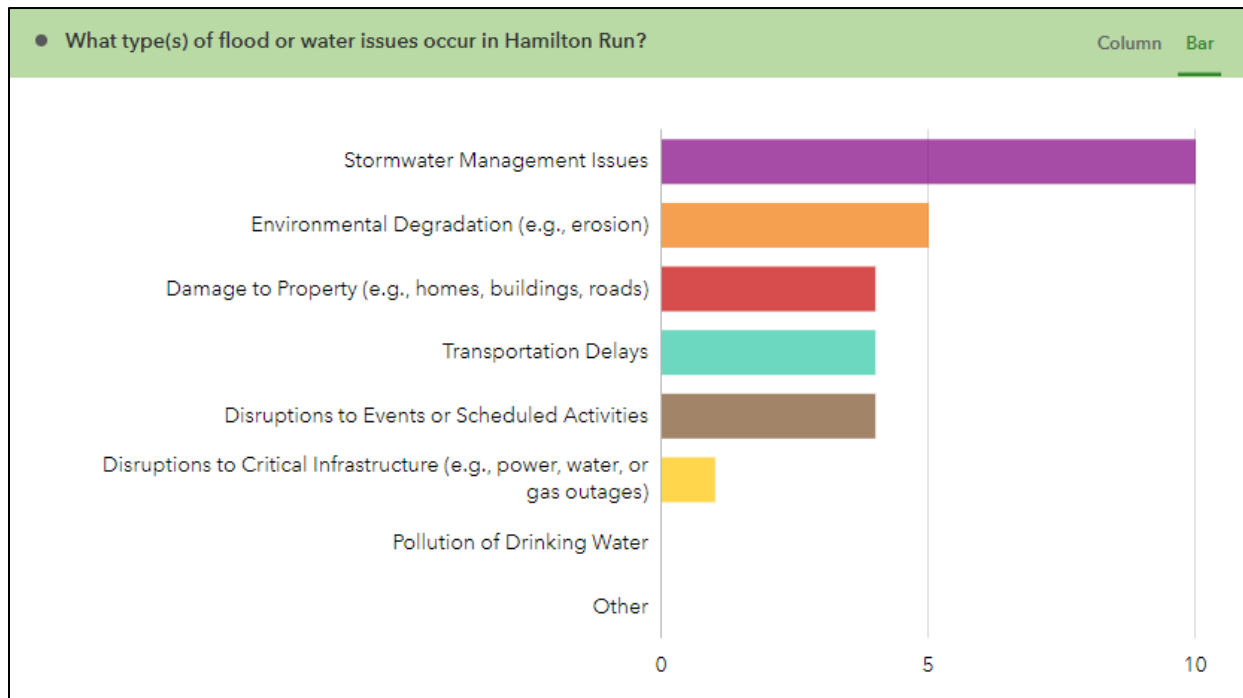
PUBLIC SURVEY RESULTS

There were twelve (12) responses to the public Hamilton Run TRA Survey. Results indicate the following:

- 42% of respondents live in the Hamilton Run.
- 75% of respondents do not work in Hamilton Run.
 - 16.8% indicate they work in Hamilton Run, and one respondent skipped the question.
- The majority (82%) of respondents spend time recreating or attending events in Hamilton Run.
- Most of the survey respondents are 65 years of age or older (41.7%).
- 58% of respondents (or 7 of 12) indicated that they know of areas in Hamilton Run that experience repetitive flooding or water issues.

Hamilton Run Watershed Area Public Survey Final Results Report

When asked what types of flood or water issues occur in Hamilton Run, the top responses were: Stormwater Management Issues and Environmental Degradation (e.g., erosion).



Stormwater management issues (10 responses) and environmental degradation (5 responses) were identified by respondents as the most common types of flood issues in Hamilton Run. Property damage, transportation delays, and disruption of events were tied with 4 responses each.

Locations of Repetitive Flood or Water Issues

The following locations (**mapped on page 5**) were identified as areas of concern by those who took the survey:

- Flooding started along Northern Avenue after Lowe's and Weis was built.
- Flood waters impact Northern Avenue and disrupt traffic. Erosion from flooding has caused issues for several properties along Hamilton Run river in this area.
- The drainage area contributing to Hamilton Run causes flooding issues in Rest Haven Cemetery near Pennsylvania Avenue/Route 11. They have issues with erosion and flooding affecting the grave sites near the creek. The water backs up at the culverts at route 11 and floods out the road.

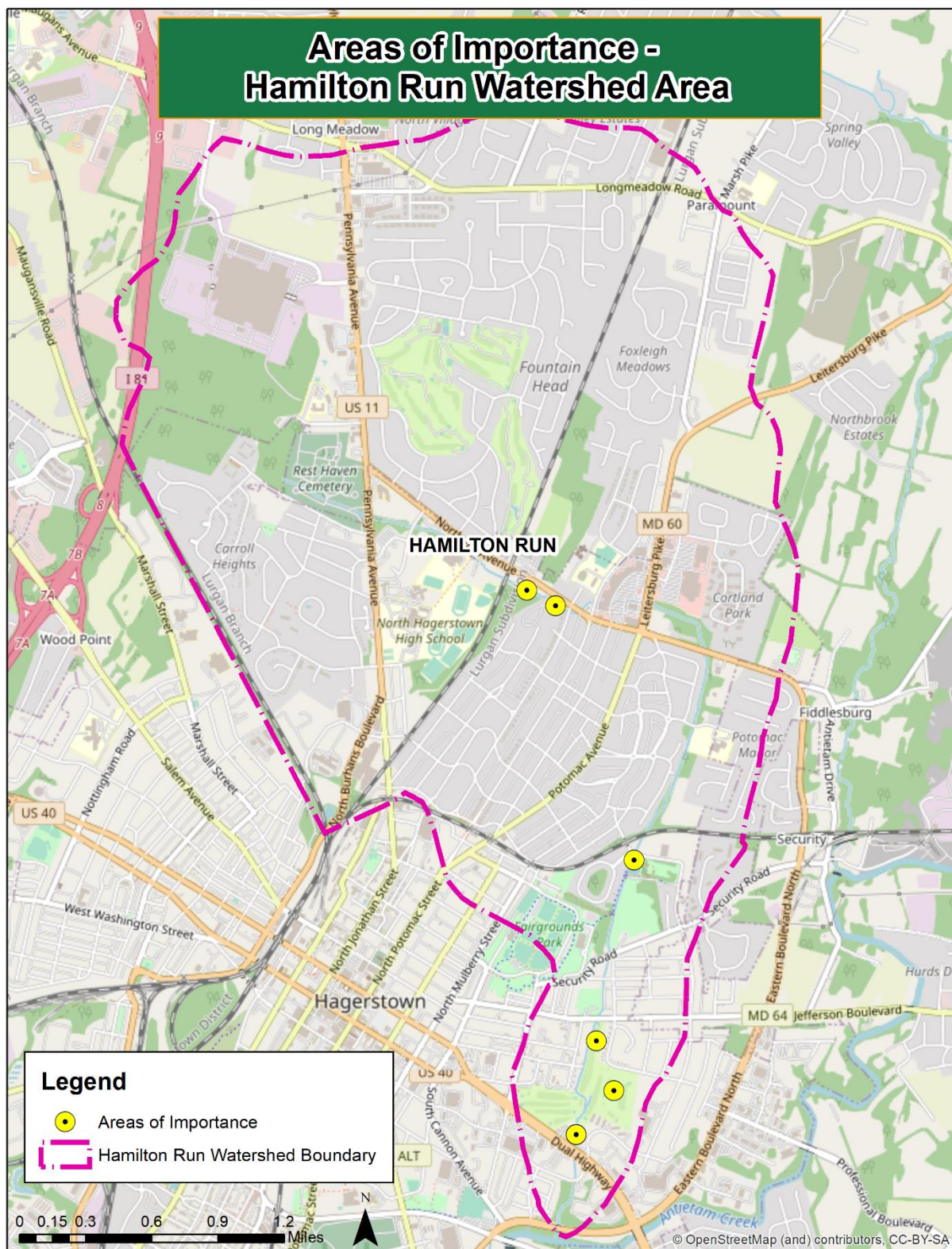
Areas of Importance

The following locations (**mapped on page 6**) were identified as areas of importance to the community:

- Pangborn Park (walking trail us sometimes flooded)
- Greens at Hamilton Run (outdoor activities, running and walking)

Hamilton Run Watershed Area Public Survey Final Results Report

Areas of importance are mapped below.



APPENDIX C.3: PLANNING PROJECT PUBLIC MEETING

YOU'RE INVITED

HAMILTON RUN FLOOD RISK PUBLIC MEETING

Date: November 14, 2023

Time: 6:00-7:30 PM

Location: American Legion

Morris Frock Post 42

405 Northern Ave, Hagerstown, MD 21742



This project has been funded wholly or in part by the United States Environmental Protection Agency under assistance agreement CB96358501.



OPEN PUBLIC SESSION TO DISCUSS:

- FLOOD RISK REDUCTION
- PROJECT IDEAS

Hamilton Run TRA					
Government Contacts					
Name	Agency/Organization	Email	Phone	Address	Notes
Mayor Tekesha Martinez	City of Hagerstown, Mayor	tmartinez@hagerstownmd.org	(301) 766-4175	One East Franklin Street, Second Floor, City Hall, Hagerstown, MD 21740	Sent group email September 17. Sent group email on 10/31 (meeting #2). Postcard mailed (9/21). Postcard mailed (10/31).
Kristin B. Aleshire	City Councilmember	kaleshire@hagerstownmd.org			
Robert E. Bruchey, II	City Councilmember	rbruchey@hagerstownmd.org			
Tiara Burnett	City Councilmember	tburnett@hagerstownmd.org			
Shelley McIntire	City Councilmember	smcintire@hagerstownmd.org			
Matthew J. Schindler	City Councilmember	mschindler@hagerstownmd.org			
	City Community Engagement Office	events@hagerstownmd.org			
Wes Decker	Communications Office	wdecker@hagerstownmd.org	(301) 739-8577 ext. 819	1 E. Franklin St., #208	
Jim Bender	City Engineer	jbender@hagerstownmd.org	(301) 739-8577 Ext. 125	One E. Franklin Street, Rm 301, Hagerstown, MD 21740	
Kathleen Maher	City Planning & Zoning Department, Director	kmaher@hagerstownmd.org	(301) 739-8577 Ext. 138	One E. Franklin St. 3rd Floor Hagerstown, MD 21740	
Stephen Bockmiller	City Planning & Zoning Department, Development Planner/Zoning Administrator	sbockmiller@hagerstownmd.org			
Steve Lohr, Hagerstown Fire Chief	City Fire Department		(301) 790-2476	25 Church Street, Hagerstown, MD 21740	
	MD Dept. of Social Services	https://dhs.maryland.gov/local-offices/	(240) 420-2100	122 N Potomac St, Hagerstown, MD 21740	
Mark Haddock	Hagerstown Parks and Recreation	mhaddock@hagerstownmd.org	(301) 739-8577 ext 169	351 N Cleveland Ave, Hagerstown, MD 21740	
Alex Reed	WC Watershed Specialist	areed@washco-md.net	P: 240-313-2677	16232 Elliott Parkway	
Tom Brown	WC Emergency Manager	cbrown@washco-md.net		100 W. Washington Street	
	WC Public Relations & Marketing	pr@washco-md.net	240-313-2380	Hagerstown, MD 21740	
Denise D. Price	WC Soil Conservation District	Dee@conservationplace.com		1260 Maryland Ave, Hagerstown, MD 21740	
Media Outlets					
Name	Agency/Organization	Email/Website	Phone	Address	Notes
	Hub City Now Antietam Broadband 25	pr@washco-md.net	(301) 620-7700	880 Commonwealth Avenue, Hagerstown, Maryland 21740	Sent group email on September 17. Sent group email on 10/31 (meeting #2)
Larry Veihmeyer, Advertising	City of Hagerstown YouTube Channel	pr@washco-md.net			
Larry Veihmeyer, Local Sales Manager	WARK (98.9 FM/AM 1490 Hagerstown)	lveihmeyer@manningmediainc.com	(301) 733-4500		Sent group email on September 17. Sent email on 10/31 (meeting #2) Postcard Mailed (9/21). Postcard mailed (10/31).
Susan Simonson	Antietam-Conococheague Watershed Alliance (ACWA)	info@acwamaryland.org			
Local Organizations and Nonprofits					
Name	Agency/Organization	Email/Website	Phone	Address	Notes
Dennis Holovach	St. Catherine Orthodox Church	djholovach@gmail.com	(315) 559-5675	433 Liberty St, Hagerstown, MD 21740	Sent email on September 17. Sent email on 10/31 (meeting #2) Postcard Mailed (9/21). Postcard mailed (10/31).
	Otterbein UM Church	https://www.otterumc.org/	(301) 739-9386	108 E Franklin St, Hagerstown, MD 21740	Postcard Mailed (9/21). Postcard mailed (10/31).
	Hagerstown Church of the Brethern	https://www.hagerstowncob.org/	(301) 733-3565	15 S Mulberry St, Hagerstown, MD 21740	Postcard Mailed (9/21). Postcard mailed (10/31).
	Trinity Evangelical Lutheran Church	http://www.tlchag.org/	(301) 733-2878	15 Randolph Ave, Hagerstown, MD 21740	Postcard Mailed (9/21). Postcard mailed (10/31).
	Zion Reformed UM Church	zionrucc@myactv.net	(301) 739-7244	201 N Potomac St, Hagerstown, MD 21740	Sent email on September 17. Sent email on 10/31 (meeting #2) Postcard Mailed (9/21). Postcard mailed (10/31).
Shannen Banzhoff, Social Media Director	Washington County Playhouse Dinner Theater	shannenbanzhoff.weebly.com	(301) 739-7469	44 N Potomac St Rear, Hagerstown, MD 21740	Postcard Mailed (9/21). Postcard mailed (10/31).
	Ebenezer AME Church		(240) 347-4951	26 Bethel St, Hagerstown, MD 21740	Postcard Mailed (9/21). Postcard mailed (10/31).
	People Gospel Tabernacle	pgt.hagerstown.md@gmail.com	(301) 491-0638	543 Security Rd, Hagerstown, MD 21740	Sent email on September 17. Sent email on 10/31 (meeting #2) Postcard Mailed (9/21). Postcard mailed (10/31).
	First Christian Church	http://www.fcchagerstown.com/	(301) 733-0144	1345 Potomac Ave, Hagerstown, MD 21742	Postcard Mailed (9/21). Postcard mailed (10/31).
Kathy Sebrosky, Administrative Assistant	St. Ann Roman Catholic Church	ksebrosky@stannchurch.com	(301) 733-0410 ext 108	1525 Oak Hill Ave, Hagerstown, MD 21742	Sent email on September 17. Sent email on 10/31 (meeting #2) Postcard Mailed (9/21). Postcard mailed (10/31).
	YMCA	http://ymcahagerstown.org/	(301) 739-3990	1100 Eastern Blvd N, Hagerstown, MD 21742	Postcard Mailed (9/21). Postcard mailed (10/31).
Dennis A. Nave	American Legion	morrisfrock@gmail.com	(301) 733-7676	405 Northern Ave, Hagerstown, MD 21742	Sent email on September 17. Sent email on 10/31 (meeting #2) Postcard Mailed (9/21). Postcard mailed (10/31).
	Haven Lutheran Church	https://www.havenlc.org/	(301) 733-5056	1035 Haven Rd, Hagerstown, MD 21742	Postcard Mailed (9/21). Postcard mailed (10/31).
	Senior Activites Center	info@wccoaging.org	(301) 790-0275	535 E Franklin St, Hagerstown, MD 21740	Sent email on September 17. Sent email on 10/31 (meeting #2) Postcard Mailed (9/21). Postcard mailed (10/31).

<https://dhs.maryland.gov/local-offices/w> Washinton County Chamber of Commerce

<https://www.hagerstown.org/>

(301) 739-2015

[1 South Potomac St., Hagerstown, MD 21740](#)

Postcard Mailed (9/21). Postcard mailed (10/31).

Businesses					
Name	Agency/Organization	Email/Website	Phone	Address	Notes
	Long Meadow Shopping Center			1537 Potomac Ave, Hagerstown, MD 21742	Postcard Mailed (9/21). Postcard mailed (10/31).
	Fulton Bank	https://www.fultonbank.com/	(301) 791-8529	1585 Potomac Ave, Hagerstown, MD 21742	
	CNB Bank	https://www.cnb.bank/	(301) 797-5015	1591 Potomac Ave, Hagerstown, MD 21742	
	CVS		(301) 733-8515	1503 Potomac Ave, Hagerstown, MD 21742	
	Rooster Moon Coffeehouse	http://www.roostermooncoffeehouse.com/	(301) 790-5040	1551 Potomac Ave, Hagerstown, MD 21742	
	Weis Markets	https://www.weismarkets.com/stores#	(301) 665-9485	12817 Shank Farm Way, Hagerstown, MD 21742	
	Free Range Cafe	http://www.freerangecafe.com/	(240) 513-6070	520 Northern Ave, Hagerstown, MD 21742	
	Fountain Head Country Club	http://www.fhcc1924.com/	(301) 739-6933	13316 Fountain Head Rd, Hagerstown, MD 21742	
	Middletown Valley Bank	http://www.mvbbank.com/	(240) 850-3990	13418 Marsh Pike, Hagerstown, MD 21742	
	Sheetz		(301) 393-8397	18717 Longmeadow Rd, Hagerstown, MD 21742	
	Central Dawgma & The Dawg Wash	http://www.centraldawgma.com/	(301) 665-9090	13402 Pennsylvania Ave, Hagerstown, MD 21742	
	M&T Bank		(301) 745-5361	13409 Pennsylvania Ave, Hagerstown, MD 21742	
	Finders Keepers Fine Consignments		(301) 790-2300	19021 Longmeadow Rd, Hagerstown, MD 21742	
	Silhouette Salon		(301) 797-8105	13228 Marsh Pike, Hagerstown, MD 21742	
	Beautiful Nails	https://beautifulnailshagerstown.com/	(240) 452-1818	19405 Emerald Square Suite 1300, Hagerstown, MD 21742	
	Lowe's Home Improvement		(240) 313-7129	12809 Shank Farm Way, Hagerstown, MD 21740	

Hamilton Run Targeted Resiliency Area Flood Risk Reduction Public Meeting

November 14, 2023, 6:00 - 7:30 PM

Hamilton Run was identified as a Targeted Resiliency Area (TRA) by the Maryland Department of Natural Resources. As a follow-up to both the public listening session held in June and the online public survey conducted September through October, a public meeting was held in November. This public meeting was held at the American Legion, Morris Frock Post 42. The American Legion is located along Hamilton Run and is one of several locations identified as experiencing flood related issues. The following participants were in attendance:

- Christine Conn, MD Department of Natural Resources – Chesapeake and Coastal Service
- Jim Bender, City of Hagerstown
- Dennis Nave, Hagerstown Resident
- Eric Brown, Hagerstown Business Owner, Rest Haven Funeral Home, and Cemetery
- W. Barnhart, Hagerstown Resident
- J. Rathvon, Hagerstown Resident
- Kayla Rhue, Maryland Environmental Services
- Sean Kelley, Maryland Environmental Services
- Ginny Smith, Smith Planning and Design
- Michele King, Smith Planning and Design

Meeting invitations were distributed via mail and email. Distribution included area businesses, churches, City of Hagerstown and Washington County staff and key elected officials. Also included in the distribution were various media outlets such as radio and tv stations. Finally, Facebook Ads ran the week prior to the meeting date.

In addition, public meeting information was posted on the City of Hagerstown website, social media, and the cable news channel.

Agenda

- Introductions
- Targeted Resiliency Area Overview
- Planning Projects Highlights & Discussion
- Next Steps

Targeted Resiliency Area Overview

Christine Conn explained to participants that Hamilton Run was chosen as a Targeted Resiliency Area (TRA) based on a statewide assessment. While flooding is a focus, other issues such as water quality and erosion will be included. The goal is to gather information to develop nature-based flood risk reduction projects within this targeted area, however, other project types identified as part of this planning process will be shared with partnering state and federal agencies as well as non-profit groups.

Hamilton Run Targeted Resiliency Area Flood Risk Reduction Public Meeting

November 14, 2023, 6:00 - 7:30 PM

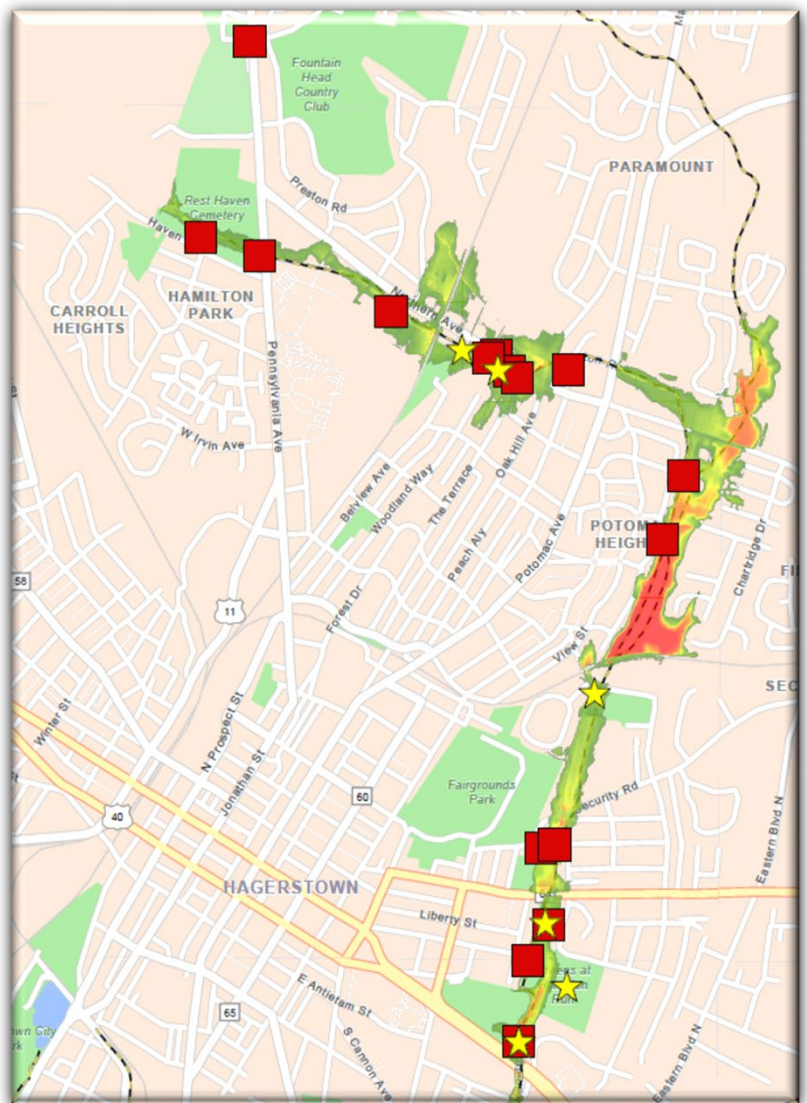
Identified projects will be prioritized using community input and knowledge. Project(s) will be selected and funneled through the Grants Gateway. Other identified projects will be compiled into a project portfolio. The MD Coastal Commission will assist in determining proper funding sources and funding combinations, if necessary.

MyCoast Maryland was included within the opening slides. Information on the flood documentation tool, access, and usage was discussed. Directions on how to download the app was presented and participants were encouraged to download the app and ask any questions that they may have during the session.

Planning Projects & Highlights

Kayla Rhue, MES, opened this portion of the meeting by providing information on the online public survey conducted September through October 2023. Survey results were shared with meeting attendees. Results contained repetitive flood reports which included: Northern Avenue, Rest Haven Cemetery, and Greens at Hamilton Golf Course. Areas of importance were also identified and included: Northern Avenue, Greens at Hamilton Golf Course, and Pangborn Park. Ms. Rhue explained that information from both the listening session and the public survey were reviewed and integrated into this planning project.

Both current and future conditions for various storm events were discussed. This information was used to further identify locations at-risk to flooding and to identify potential causes of flooding as well as solutions. For instance, the Northern Avenue area, flooding



Hamilton Run Targeted Resiliency Area Flood Risk Reduction Public Meeting

November 14, 2023, 6:00 - 7:30 PM

observed upstream of Longmeadow Shopping Center and the culvert running under the shopping center causes backwater effect upstream. Then downstream of the Longmeadow Shopping Center there is potential backwater effect at culvert crossings contributing to flooding. In addition, there is a disconnection from the original stream at the Greens at Hamilton.

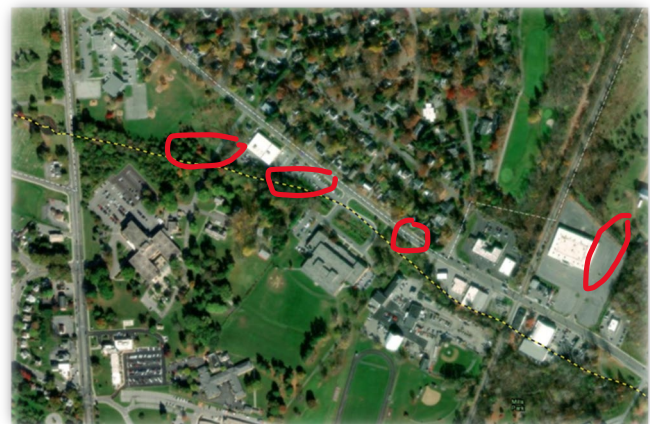
In consideration of community feedback and the H&H study conducted by contractor, a variety of focus areas and projects were identified. Evaluation of these projects and future projects identified include multiple factors, such as:

- Protects Valuable Resources
- Provides Water Quality Improvement
- Feasibility
- Cost Effectiveness/Available Funding

Participant Comments

○ Northern Avenue

- Flooding on Northern Avenue north of Bulldog Avenue because of Fountainhead development. Area across from County Building will be 3-4 inches deep when Hamilton Run has not reached bankfull. The water has nowhere to go due to lack of stormwater drains/system in this area. Old development did not include stormwater management.
- Participants expressed concern over new development, as well. They indicated some of the stormwater is accounted for, but not all. Several participants thought that a stormwater pond will be installed in the area, but they wondered if this pond would pick up stormwater from the Hamilton Heights development.
- It was reported that the school project was installed.
- The red circles identified on the presentation slides for Northern Avenue are on public property. One is already an engineered wetland, area by Health Department is a tree planting site and rain garden, while the third has recently been purchased as a truck driving school.



Hamilton Run Targeted Resiliency Area Flood Risk Reduction Public Meeting

November 14, 2023, 6:00 - 7:30 PM

- Participants asked if this planning effort was aligned with the 2017 Action Plan, and Ms. Rhue indicated, “yes.”
- **Pangborn Park Area**
 - The City indicated that they would approach property owner – Security Road. The property owner has proposed building townhouses on the site. The City may propose to acquire or obtain a permanent easement at the back of the property. At that point, proposed water retention solutions could be further analyzed, such as the wetland and forested area, this may assist with MS4 permit. Additionally, a walking trail, connecting to existing trails, may be included.
- **The Greens at Hamilton Run**
 - The City recently awarded bid for stream restoration design project at this location. Project schedule is November 2023 through March 2024. Currently exists as a straight channel, proposed design would realign channel to more natural, historic condition.



Next Steps

- Finalize the development of the Project Portfolio.
- Identify potential funding eligibility.
- Phase II: Design
 - Move high priority projects towards implementation.
 - Apply for funding to begin design.
 - Continue community engagement.

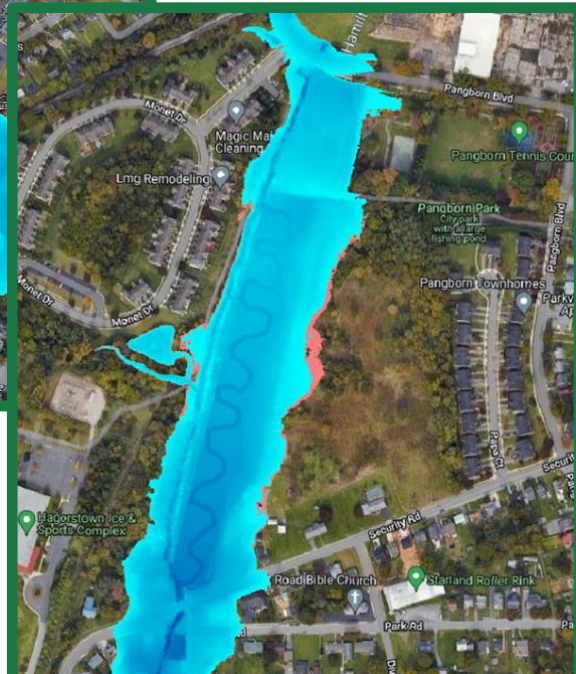
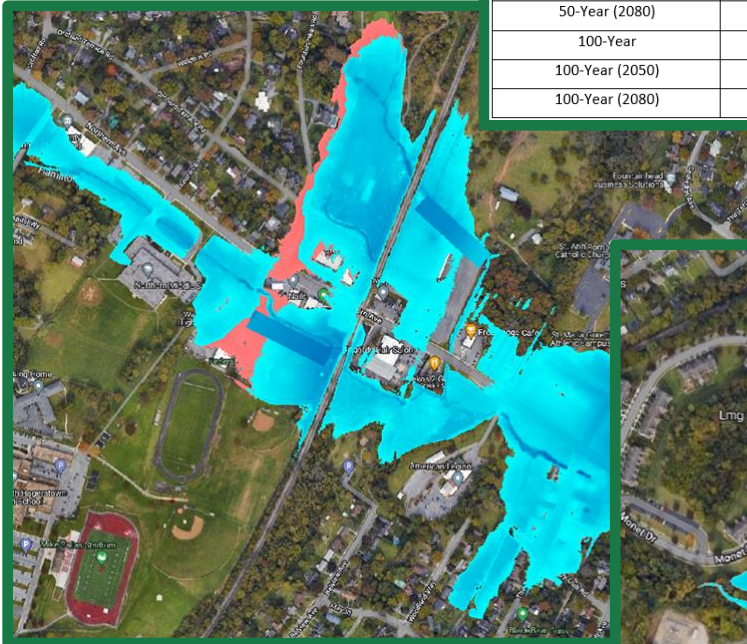
APPENDIX D: HYDROLOGIC & HYDRAULIC MODEL

WATER QUALITY & CLIMATE CHANGE RESILIENCY PORTFOLIO SUPPORT

Task 1 – Hydrologic & Hydraulic (H&H) Analysis Hamilton Run, Hagerstown

Table 2: Precipitation Volume

Scenario	Precipitation (in.)	Change Factor
10-Year	4.1	-
10-Year (2050)	4.55	1.11
10-Year (2080)	4.67	1.14
25-Year	4.95	-
25-Year (2050)	5.54	1.12
25-Year (2080)	5.84	1.18
50-Year	5.68	-
50-Year (2050)	6.36	1.12
50-Year (2080)	6.76	1.19
100-Year	6.49	-
100-Year (2050)	7.20	1.11
100-Year (2080)	7.33	1.13



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INTRODUCTION

DNR Water Quality and Climate Resiliency Portfolio

The Water Quality and Climate Change Resiliency Portfolio (Portfolio) will build upon an existing state GIS (Geographic Information System) model that identifies Targeted Resilience Areas (TRAs) with opportunities for implementation of green and gray infrastructure approaches that will optimize resiliency benefits and corresponding potential financing opportunities. The Portfolio initiative will develop projects with community support that will help to restore local waters while improving climate resilience. This work directly supports the implementation of the Maryland's Phase III Watershed Implementation Plan to Restore Chesapeake Bay by 2025 (WIP) by creating a pipeline of vetted projects that have community buy-in.

The Maryland Department of Natural Resources (DNR) is leading this effort and has outlined three key phases to the development of the Portfolio: (1) identify TRAs at county and community scales, (2) working with partners to deliver technical assistance and identify priority projects within the TRAs, and (3) develop long term implementation and funding strategies.

As part of phase 2 TRA flood models have been created by incorporating available data leveraged from web-based sources, local datasets and information gathered during community engagement efforts. This involved a thorough review of current design and regulatory resources to gain team knowledge and thorough understanding of the context that is needed to develop implementable flood mitigation solutions.

Current and future climate condition for 2050 and 2080 with storm events were developed as part of this analysis. Current and future land use conditions were also analyzed to understand the impact of development within the watershed. The result is a GIS-based output developed from a Hydrologic and Hydraulic (H&H) model of Hamilton Run for peak flood discharges during a 10-, 25-, 50-, and 100-year, 24-hour storm events for current conditions, and future conditions anticipated in 2050 and 2080.

Target Resilience Area – Hamilton Run

The Hamilton Run watershed has a mix of residential and commercial development, light industrial development, transitional agricultural lands, and undeveloped property, predominantly located in the northwestern part of the watershed. However, within the limits of Hagerstown, much of the Hamilton Run watershed is built-out, which may make it more difficult to change or influence land use patterns. There are still pockets of privately-owned, undeveloped land within the limits of Hagerstown and throughout the watershed that could be targeted for opportunities to implement green and gray infrastructure improvements that will optimize water quantity and quality.

Hamilton Run is a perennial stream that flows through the City of Hagerstown where there are significant areas of impervious land cover without stormwater management controls. As a result, Hamilton Run receives a significant amount of urban runoff during storm events, which has adversely impacted water quality, accelerated bank erosion, and led to channel straightening and channel incision.

Urban environments with large areas of untreated surface runoff leads to stream instability. In an attempt to adjust to new environmental conditions, channels typically evolve into more incised, straightened channels through stream bed and bank erosion. Erosion from stream beds and banks lead to increased

sediment and nutrient loads downstream. In addition, runoff from impervious surface can include oils from roads, debris and other pollutants that lead to decreased water quality.

Hagerstown is also experiencing flooding outside mapped floodplains with increasing frequency, due to a variety of issues related to development: increased impervious surface, disruption of natural watershed flows and functions, undersized and aged stormwater infrastructure, and changing weather patterns which exacerbate the inadequacies of older stormwater systems and the fragmented watersheds. Flooding reflects decades of development that has outstripped the capacity of stormwater infrastructure and disrupted the natural flow and discharge of watersheds. Additionally, many stormwater systems are beyond their expected useful life and in need of repair and replacement. These challenges are compounded by what is becoming the new normal: an increase in the frequency and intensity of storms

The frequency and intensity of storms is increasing due to the changing climate that will continue to exacerbate the flood issues within the Hamilton Run watershed. The stormwater infrastructure in this areas is aging and was not designed to convey the amount of runoff that is currently occurring and amounts that are predicted to occur in the future. As urbanization and the amount of impervious surface increase the capacity of the existing systems to convey runoff will be reduced. Localized flooding and impaired water quality within the watershed are related to untreated stormwater. Without stormwater Best Management Practices (BPM) or green infrastructure in place to reduce the depth of floodwater and improve water quality, Hamilton Run will continue to experience flooding and degraded water quality and habitat in the affected tributaries.

Future Development

There are two large undeveloped areas located along Hamilton Run. The first is a section of Hamilton Run that is partially forested, vacant land and is currently comprised of land zoned for high density residential development, professional office-mixed, as well as some areas set aside for forest conservation easements associated with the Cortland Apartments. Remaining land in this area is in the Hamilton Run floodplain.

The second area is located at the headwaters of Hamilton Run west of its beginning in Rest Haven Cemetery, at the end of Haven Rd. This area is zoned for high density residential development and industrial-general. It is currently connected to a larger forested segment that extends outside the City limits into Washington County, but is still within the Hamilton Run watershed.

Ongoing Projects

The Hamilton Run Watershed Characterization and Action Plan documents existing corridor conditions of Hamilton Run and identifies areas where stream restoration and BMPs could provide ecological improvements and reduce sediment and nutrient loads. This data was then used to develop the watershed action plan that recommends and prioritizes cost effective restoration solutions. Concept level plans were developed for the three highest priority restoration projects and recommendations regarding land use and management practices were developed. The Hamilton Run Watershed Characterization and Action Plan was developed to provide information that will aid the City in submitting proposals required to secure funding for implementing priority stream restoration projects and will help the City meet TMDL and impervious acre treatment requirements as part of their NPDES MS4 permits.

METHODOLOGY

Flooding is observed along numerous locations on Hamilton Run. In all cases it is limited to the area designated by the 1% floodplain and has not seriously impacted adjacent properties during past flood events. The Maryland Department of Natural Resources, in collaboration with the City of Hagerstown hosted a public listening session on Tuesday, June 27, 2023. This event focused on addressing flood risk concerns associated with Hamilton Run, aiming to find effective solutions to reduce flood impacts and ensure the safety of the local community. Using community feedback that was obtained during the listening session and online public outreach efforts H&H studies were completed for two priority locations.

Both the City and Washington County own and/or maintain a number of properties in the Hamilton Run watershed, ranging from parks and recreation facilities, schools, municipal buildings, highway maintenance facilities, and a nine-hole golf course. To address water quality and quantity concerns it is recommended that the City, in partnership with the County, develop plan to utilize these properties when considering location of future floodplain management facilities.

Two locations within the Hamilton Run study area were selected to conduct H&H studies to determine discharge values and to model four, 24-hour storm events. The models were completed for existing and future conditions, with consideration for anticipated changes in rainfall intensities.

Northern Avenue

Runoff flow that is generated from the area upstream of the of the Longmeadow Shopping Center is piped under the Shopping Center and parking lot West of Oak Hill Avenue and is discharged on the East side of Leitersburg Pike. The areas upstream of the Shopping Center that are impacted by backup stormwater include numerous residential and commercial properties, Washington County Highway Department, Northern Middle School, Washington County Planning and Zoning building, and Fontaindale Elementary School.

Pangborn Park

The second location was selected to provide technical support for a project (Project Area 8) that was prioritized in the Hamilton Run Watershed Characterization and Action Plan. This location of Hamilton Run splits the Pangborn Park. The Action Plan recommended restoration of eroding banks that are confined due to limitations from the pond and a paved walking path and reroute Pangborn Park Pond return water flows from its current location into the proposed wetland BMP.

The Hamilton / Marsh Run Stormwater Improvement Phase I report described a primary flow constraint at the railroad crossing over Hamilton Run upstream from Pangborn Lake. The culvert at this location is undersized for flood flows and during large storm events the culvert and railroad crossing functionally act as a dam that holds back flood flows. The report describes five houses that are significantly impacted by flooding during storm events from this impoundment. The constriction limits flood flows to Hamilton Run downstream of the railroad crossing and has influenced channel dimensions.

FUTURE CONDITIONS 2050 & 2080

A concept-level hydrologic and hydraulic (H&H) study was performed to estimate flood flows and flood depths along Hamilton Run under current conditions and under each of the mitigation scenarios for the 2050, and 2080 scenarios. Drainage areas were developed for each site. Soil information was obtained using Natural Resources Conservation Service (NRCS) Web Soils Survey and land use information was obtained from the National Land Cover Database (NLCD) land use layer. Drainage area, soils, and land use information can be found in Appendix D.1.

Hydrology

The watershed was subdivided into 4 separate subcatchments to estimate the peak flow runoff values. The contributing drainage areas, time of concentration, and curve numbers were developed using the available terrain data, land cover, and NRCS soil data. Table 1 summarizes the input data used to develop the hydrologic model.

Table 1: Hydrologic Input

Area	Drainage Area (ac)	% Impervious	Curve Number	Time of Concentration (hrs)
DA 1	942.4	48	78	1.63
DA 2	743.6	39	78	1.88
DA 3	874.3	43	76	4.48
DA 4	1102.45	34	72	3.30

The NRCS hydrologic method (via Hydrographs 2004) was used to estimate peak flows for the 10, 25, 50, 100, in accordance with Technical Release No. 55 (TR-55) standards for estimating runoff. Twelve storm events were investigated as part of this analysis. These events include the 10-, 25-, 50, and 100-year 24-hour storm frequency, and the future projected rainfall for each event for the years 2050 and 2080. Current rainfall data was obtained using National Oceanic and Atmospheric (NOAA) Atlas 14 for Washington County. Future rainfall conditions were obtained using the RAND Corporation climate projections for Washington County, which incorporate regional atmospheric and topographic variability. Low air emission scenarios were used (RCP 4.5). Table 2 summarizes the total precipitation for each event.

Table 2: Precipitation Volume

Scenario	Precipitation (In.)	Change Factor
10-Year	4.1	-
10-Year (2050)	4.55	1.11
10-Year (2080)	4.67	1.14
25-Year	4.95	-
25-Year (2050)	5.54	1.12
25-Year (2080)	5.84	1.18

Scenario	Precipitation (In.)	Change Factor
50-Year	5.68	-
50-Year (2050)	6.36	1.12
50-Year (2080)	6.76	1.19
100-Year	6.49	-
100-Year (2050)	7.20	1.11
100-Year (2080)	7.33	1.13

Peak flows were developed using Hydrographs 2004. Three flow change locations were used within the hydraulic model. Tables 3a-3c summarizes the peak runoff rates used for the hydraulic model.

Table 3a: Peak Flows

River Station: 21056			
Return Period	Current	2050	2080
10	543	633	658
25	715	840	904
50	870	1017	1104
100	1045	1201	1230

Table 3b: Peak Flows

River Station: 17400			
Return Period	Current	2050	2080
10	980	1137	1180
25	1280	1495	1606
50	1547	1800	1951
100	1849	2118	2168

Table 3c: Peak Flows

River Station: 11933			
Return Period	Current	2050	2080
10	1878	2176	2256
25	2446	2854	3064
50	2952	3433	3719
100	3526	4037	4131

Hydrologic backup is available in Appendix D.2.

Hydraulics

The existing hydraulic computations and mitigation alternatives were performed using a 1-D steady state HEC-RAS (Version 6.3.1) analysis. HEC-RAS is a standard step backwater hydraulic model that utilizes site specific geometric cross section data of the stream and floodplain to establish the stream hydraulics. Steady state 1-D models utilize a standard step backwater approach to calculating resulting water surface elevation (WSEL) from downstream to upstream. This method does not calculate downstream impacts resulting from upstream mitigation. A Routing analysis was done with HEC-RAS to evaluate the potential

downstream impacts from the proposed mitigation measures evaluated in this study. The existing Federal Emergency Management Agency (FEMA) model was obtained for Hamilton Run and extended to include the entire project's limits. A total of four proposed scenarios were analyzed in addition to the existing conditions within the model and are summarized in Table 4.

Table 4: Summary of Modeled Scenarios

Scenario	Description
Existing Conditions	Existing conditions of Hamilton Run
Scenario 1	Storage facility near Northern Ave near the Northern Middle School sports facilities.
Scenario 2	Storage facility in the parking lot of the privately owned gym on the corner of the transit rail and Northern Ave on the north side of Northern Ave.
Scenario 3	Wetland storage area near Pangborn Park directly adjacent to Hamilton Run
Scenario 4	Combination of proposed scenarios 1-3

The three mitigation scenarios modeled are based on a floodplain storage analysis. Hydrographs 2004 was used to perform a routing analysis for each storage facility scenario. The size of each mitigation alternative was approximated based on the available land area. An iterative approach was used to divert flow from Hamilton Run to size each storage facility and overflow control device for each storm event, including the future 2050 and 2080 events. Table 5 summarizes the facility type, the percentage of the watershed that is diverted to each storage facility, and the estimated available storage volume.

Table 5: Storage Facility Treatment

Scenario	Facility Type	Percent of Drainage Area Treated	Storage Volume (ft ³)
1	Basin	3% of DA2	207,200
2	Basin	3% of DA2	207,200
3	Wetland	1% of Entire Watershed	295,500

The routing analysis resulted in an approximate 1% reduction in peak flows for each scenario for each alternative and a 2% reduction in flows for Scenario 4 with the combination of all three mitigation measures. Table 6 shows the reduction in WSEL for the 10-year and 100-year events for current and future 2080 conditions for Scenarios 1, 2, 3, and 4 at the proposed mitigation measure from the existing conditions. Results of the maximum reduction in WSEL for the 100-year event in 2080 for Scenarios 1, 2, and 3, are illustrated in Figure 5a, and Figure 5b (Appendix D.1).

Table 6a: Maximum Reduction in WSEL for Each Scenario Along Hamilton Run

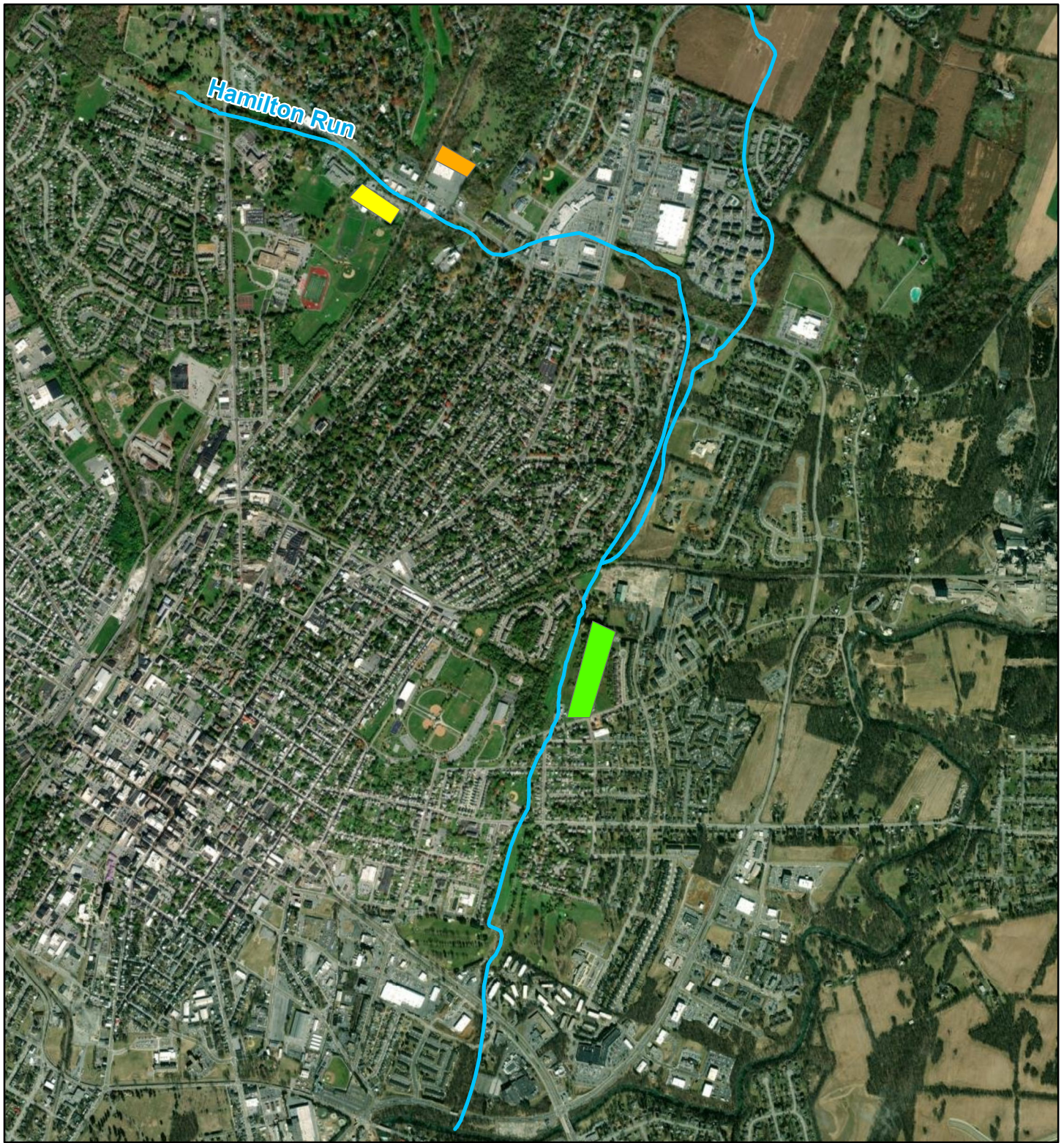
Scenario (HEC-RAS Stream Station)	10 Year (ft)	10 Year (2080) (ft)	100 Year (ft)	100 Year (2080) (ft)
Scenario 1 (Sta. 16949)	0.4	0.1	1.4	1.4
Scenario 2 (Sta. 16219)	0	0	0	0
Scenario 3 (Sta. 7071)	0.8	0.9	0.8	0.6
Scenario 4 (Sta. 7071/16949)	0.8/0.4	0.8/0.1	0.8/1.4	0.5/1.4

RESULTS

The H&H analysis indicates notable changes for Scenarios 1, 3, and 4. Based on the modeling results, Scenario 2, which investigated a basin near the privately owned gym near Northern Avenue, will not have large impacts on Hamilton Run. This is likely due to the placement of the basin being located away from the main reach of Hamilton Run. The velocities are close to zero on the outer edge of the floodplain, which contributes to the low changes noted in water surface elevation as this area is mostly ineffective flow and not contributing to the main channel. This basin is closer to the Tributary to Hamilton Run, which was not included in the model during this study. This location may be further investigated during the next phase of this project to evaluate the basin's efficacy along the Tributary and the resulting impact on Hamilton Run. Scenario 1, which investigated the basin near the Northern Middle School indicates a reduction of almost 1.5' in WSEL for the larger storms, which will improve the flooding along Northern Avenue near the middle school and the Washington County Highway Department. Additionally, this basin will mitigate the backwater from Longmeadow Shopping Center that is impacting commercial and residential properties that are located just upstream of the Shopping Center. The investigation under Scenario 3 indicates a WSEL reduction of almost 1' near the proposed wetland. The combination of all three Scenarios as modeled in Scenario 4 shows the largest reduction WSEL and contributing flows for Hamilton Run. The basin near Northern Middle School and the wetland near Pangborn Park are contributing the most attenuation for this alternative at both the upstream and downstream ends of Hamilton Run.

Appendix D.1

Figures



Legend

-  Stream
-  Basin (Gym) near Northern Avenue
-  Basin (School) near Northern Avenue
-  Wetland near Pangborn Park



0 875 1,750 3,500
Feet

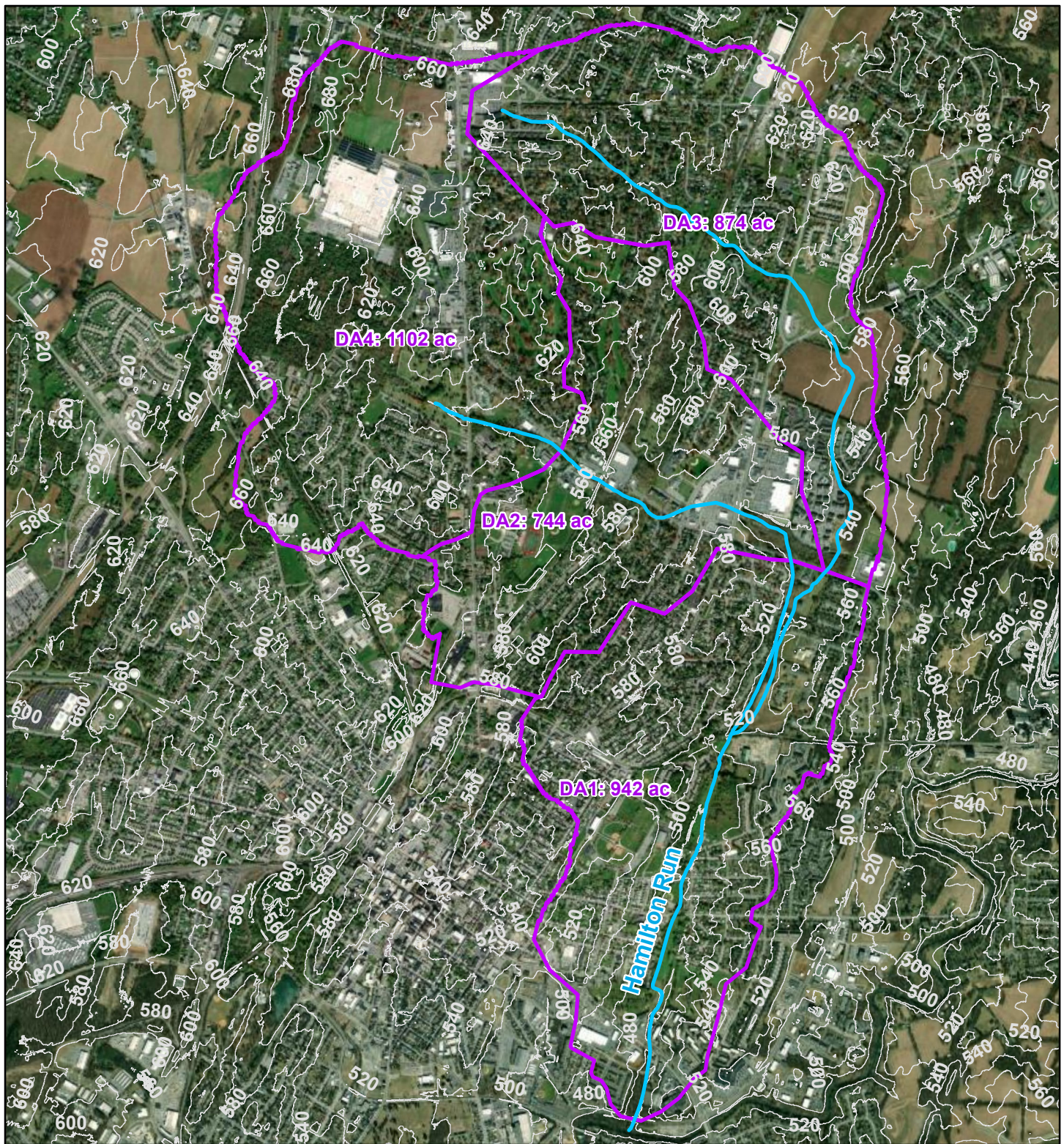
Figure 1
Project Location

Water Quality and Climate
Change Resiliency Portfolio

Hamilton Run
Hagerstown, MD



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Legend

- Streams
- Drainage Areas
- Contours



0 1,250 2,500 5,000 Feet

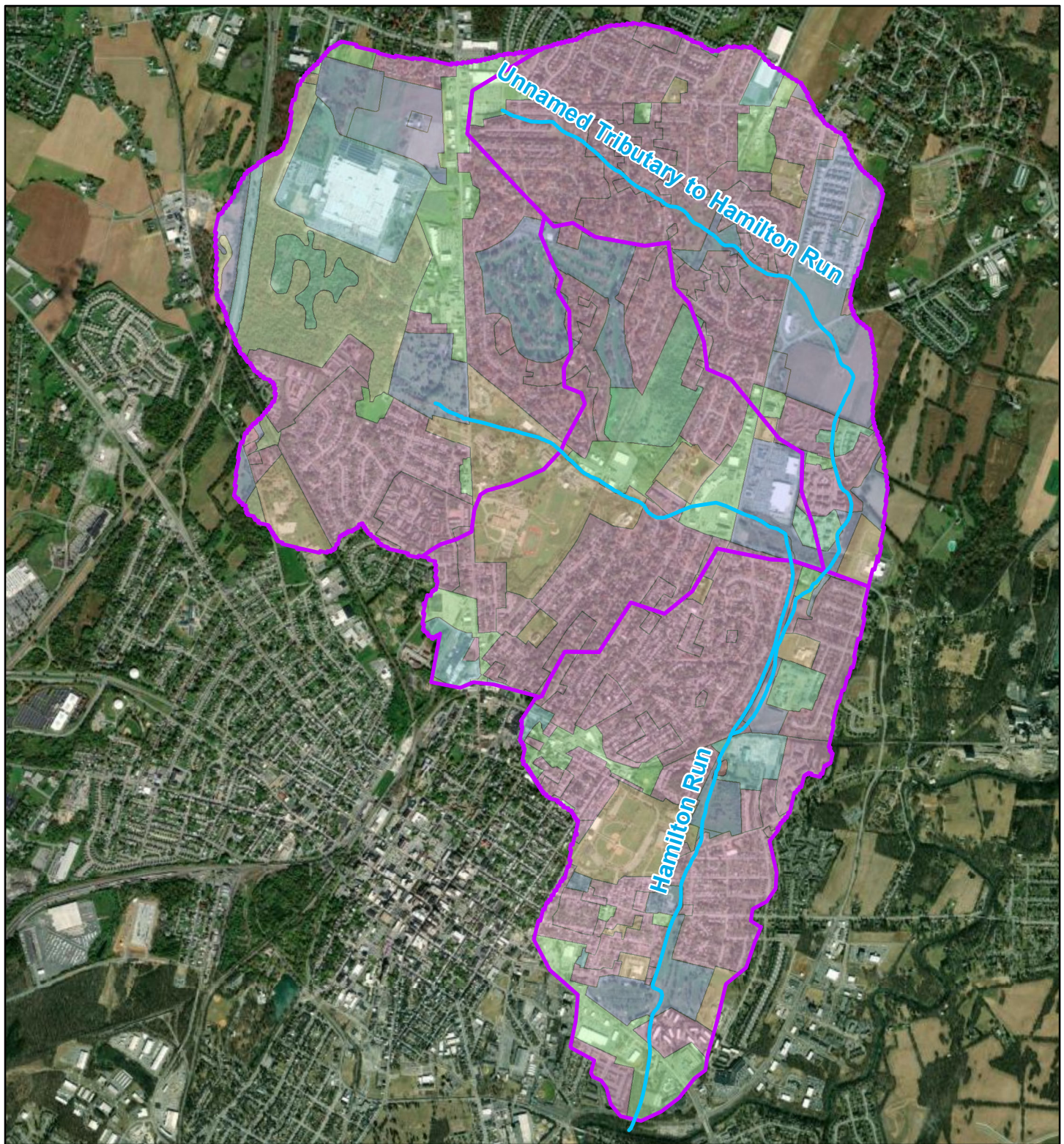
Figure 2
Drainage Area Map

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Change Resiliency Portfolio



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Legend

- | | | |
|--|---|--|
|  Streams |  Residential |  Agricultural |
|  Drainage Area |  Commercial |  Forest |
| |  Industrial |  Undeveloped |
| |  Altered Lands |  Water |



0 1,250 2,500 5,000
Feet

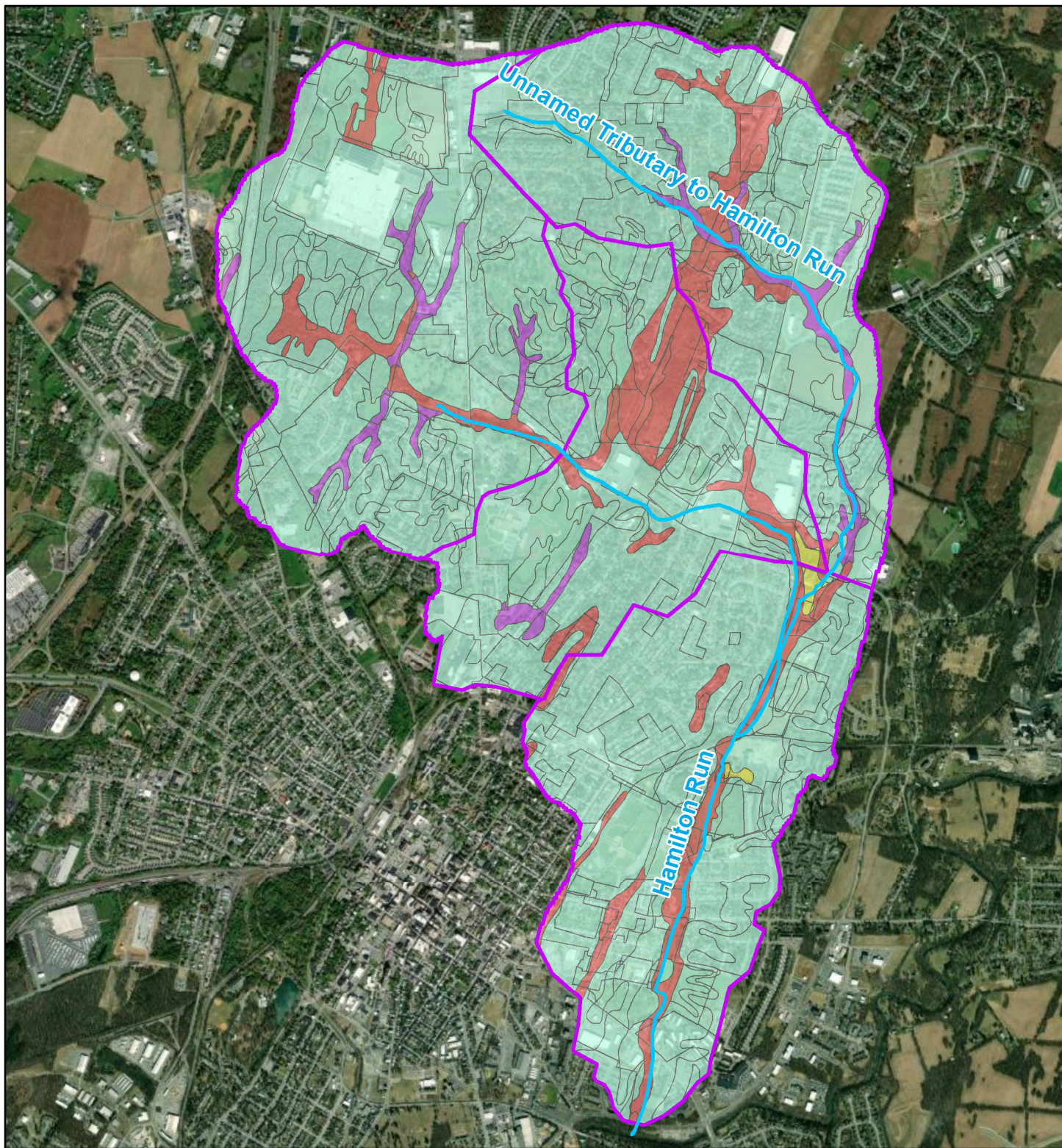
Figure 3
Landuse Map

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Change Resiliency Portfolio



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Legend

- Streams
- Drainage Area

Hydrologic Soil Group

- A
- B
- C
- D



0 1,250 2,500 5,000 Feet

Figure 4
Soil Map

Water Quality and Climate
Change Resiliency Portfolio



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Legend

- | | | | |
|--|-------------------------------------|---|---------------------|
|  | Basin (Gym) Near Northern Avenue |  | Proposed Floodplain |
|  | Basin (School) Near Northern Avenue |  | Existing Floodplain |



0 345 690 1,380 Feet

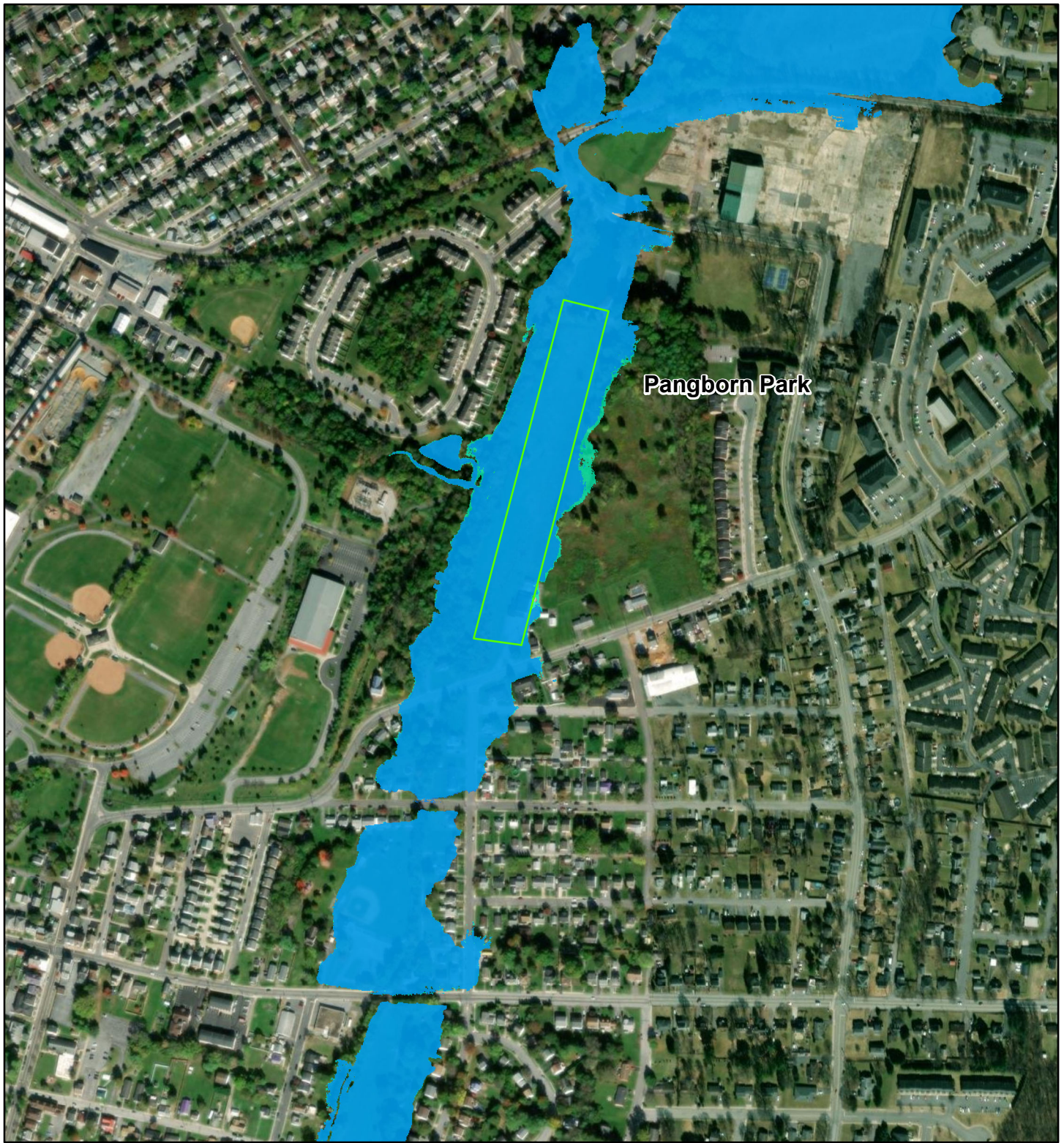
Figure 5a
Floodplain Map
(Northern Avenue)

Water Quality and Climate
Change Resiliency Portfolio



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Legend

-  Wetland Near Pangborn Park
-  Proposed Floodplain
-  Existing Floodplain



0 250 500 1,000 Feet

Figure 5b
Floodplain Map
(Pangborn Park)

Water Quality and Climate
Change Resiliency Portfolio



Hamilton Run
Hagerstown, MD



Appendix D.2

Hydrologic Backup

Time of Concentration Calculations

Computed By: **HL** Date: **12/21/23**
Checked By: **EDC** Date: **12/21/23**

DA 1

Sheet Flow:

Surface Description (Table 15-1)
Manning's Roughness coeff., n
Flow Length, L (Table 15-2) (≤ 100)
Two-yr, 24-hr rainfall, P_2
Land Slope, s
 $T_t = (0.007 * (n * L)^{0.8}) / (P_2^{0.5} * s^{0.4})$

Short Grass
0.15 (see Table 15-1)
92 ft
2.83 inches NOAA ATLAS 14
0.011 ft/ft
0.21 hr = 12.4 min

Shallow Concentrated Flow:

Surface Description (Figure 15-4)
Flow Length, L
Watercourse slope, s
Average Velocity, V (Figure 15-4)
 $T_t = L / (3600 * V)$

Smooth/Grass
1977 ft
0.032 ft/ft
1.25 ft/s
0.44 hr = 26.4 min

Channel Flow:

Cross Sectional Flow Area, a
Wetted Perimeter, P_w
Hydraulic radius, $r = a / P_w$
Channel Slope, s
Manning's Roughness coeff., n
 $V = 1.49 * r^{2/3} * s^{1/2} / n$
Flow Length, L
 $T_t = L / (3600 * V)$

37.4 sq ft
25 ft
1.47 ft
0.005 ft/ft
0.05
2.79 ft/s
9920 ft
0.99 hr 59.2 min

Total Watershed or subarea T_c	1.63 hr =	98.0 min
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Table 15-1 Manning's roughness coefficients for sheet flow (flow depth generally ≤ 0.1 ft)

Surface description	n^1
Smooth surface (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover $\leq 20\%$	0.06
Residue cover $> 20\%$	0.17
Grass:	
Short-grass prairie	0.15
Dense grasses ²	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods: ³	
Light underbrush	0.40
Dense underbrush	0.80

- 1 The Manning's n values are a composite of information compiled by Engman (1986).
- 2 Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
- 3 When selecting n , consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

Table 15-2 Maximum sheet flow lengths using the McCuen-Spiess limitation criterion

Cover type	n values	Slope (ft/ft)	Length (ft)
Range	0.13	0.01	77
Grass	0.41	0.01	24
Woods	0.80	0.01	12.5
Range	0.13	0.05	172
Grass	0.41	0.05	55
Woods	0.80	0.05	28

Time of Concentration Calculations

Computed By: **HL** Date: **12/21/23**
Checked By: **EDC** Date: **12/21/23**

DA 2

Sheet Flow:

Surface Description (Table 15-1)
Manning's Roughness coeff., n
Flow Length, L (Table 15-2) (≤ 100)
Two-yr, 24-hr rainfall, P_2
Land Slope, s
 $T_t = (0.007 * (n * L)^{0.8}) / (P_2^{0.5} * s^{0.4})$

Smooth
0.011 (see Table 15-1)
93 ft
2.83 inches NOAA ATLAS 14
0.140 ft/ft
0.01 hr = 0.6 min

Shallow Concentrated Flow:

Surface Description (Figure 15-4)
Flow Length, L
Watercourse slope, s
Average Velocity, V (Figure 15-4)
 $T_t = L / (3600 * V)$

Smooth/Grass
4232 ft
0.018 ft/ft
0.98 ft/s
1.20 hr = 72.0 min

Channel Flow:

Cross Sectional Flow Area, a
Wetted Perimeter, P_w
Hydraulic radius, $r = a / P_w$
Channel Slope, s
Manning's Roughness coeff., n
 $V = 1.49 * r^{2/3} * s^{1/2} / n$
Flow Length, L
 $T_t = L / (3600 * V)$

37.4 sq ft
25 ft
1.47 ft
0.004 ft/ft
0.05
2.42 ft/s
5853 ft
0.67 hr 40.3 min

Total Watershed or subarea T_c	1.88 hr =	112.9 min
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Table 15-1 Manning's roughness coefficients for sheet flow (flow depth generally ≤ 0.1 ft)

Surface description	n^1
Smooth surface (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover $\leq 20\%$	0.06
Residue cover $> 20\%$	0.17
Grass:	
Short-grass prairie	0.15
Dense grasses ²	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods: ³	
Light underbrush	0.40
Dense underbrush	0.80

- 1 The Manning's n values are a composite of information compiled by Engman (1986).
- 2 Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
- 3 When selecting n , consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

Table 15-2 Maximum sheet flow lengths using the McCuen-Spiess limitation criterion

Cover type	n values	Slope (ft/ft)	Length (ft)
Range	0.13	0.01	77
Grass	0.41	0.01	24
Woods	0.80	0.01	12.5
Range	0.13	0.05	172
Grass	0.41	0.05	55
Woods	0.80	0.05	28

Time of Concentration Calculations

Computed By: **HL** Date: **12/21/23**
Checked By: **EDC** Date: **12/21/23**

DA 3

Sheet Flow:

Surface Description (Table 15-1)
Manning's Roughness coeff., n
Flow Length, L (Table 15-2) (≤ 100)
Two-yr, 24-hr rainfall, P_2
Land Slope, s
 $T_t = (0.007 * (n * L)^{0.8}) / (P_2^{0.5} * s^{0.4})$

Smooth
0.011 (see Table 15-1)
97 ft
2.83 inches NOAA ATLAS 14
0.002 ft/ft
0.05 hr = 3.2 min

Shallow Concentrated Flow:

Surface Description (Figure 15-4)
Flow Length, L
Watercourse slope, s
Average Velocity, V (Figure 15-4)
 $T_t = L / (3600 * V)$

Smooth/Grass
10411 ft
0.010 ft/ft
0.7 ft/s
4.13 hr = 247.9 min

Channel Flow:

Cross Sectional Flow Area, a
Wetted Perimeter, P_w
Hydraulic radius, $r = a / P_w$
Channel Slope, s
Manning's Roughness coeff., n
 $V = 1.49 * r^{2/3} * s^{1/2} / n$
Flow Length, L
 $T_t = L / (3600 * V)$

37.4 sq ft
25 ft
1.47 ft
0.005 ft/ft
0.05
2.69 ft/s
2909 ft
0.30 hr 18.0 min

Total Watershed or subarea T_c	4.48 hr =	269.1 min
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Table 15-1 Manning's roughness coefficients for sheet flow (flow depth generally ≤ 0.1 ft)

Surface description	n^1
Smooth surface (concrete, asphalt, gravel, or bare soil).....	0.011
Fallow (no residue).....	0.05
Cultivated soils:	
Residue cover $\leq 20\%$	0.06
Residue cover $> 20\%$	0.17
Grass:	
Short-grass prairie.....	0.15
Dense grasses ²	0.24
Bermudagrass.....	0.41
Range (natural).....	0.13
Woods: ³	
Light underbrush.....	0.40
Dense underbrush.....	0.80

- 1 The Manning's n values are a composite of information compiled by Engman (1986).
- 2 Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
- 3 When selecting n , consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

Table 15-2 Maximum sheet flow lengths using the McCuen-Spiess limitation criterion

Cover type	n values	Slope (ft/ft)	Length (ft)
Range	0.13	0.01	77
Grass	0.41	0.01	24
Woods	0.80	0.01	12.5
Range	0.13	0.05	172
Grass	0.41	0.05	55
Woods	0.80	0.05	28

Time of Concentration Calculations

Computed By: **HL** Date: **12/21/23**
Checked By: **EDC** Date: **12/21/23**

DA 4

Sheet Flow:

Surface Description (Table 15-1)
Manning's Roughness coeff., n
Flow Length, L (Table 15-2) (≤ 100)
Two-yr, 24-hr rainfall, P_2
Land Slope, s
 $T_t = (0.007 * (n * L)^{0.8}) / (P_2^{0.5} * s^{0.4})$

Short Grass
0.15 (see Table 15-1)
94 ft
2.83 inches NOAA ATLAS 14
0.003 ft/ft
0.35 hr = 20.9 min

Shallow Concentrated Flow:

Surface Description (Figure 15-4)
Flow Length, L
Watercourse slope, s
Average Velocity, V (Figure 15-4)
 $T_t = L / (3600 * V)$

Smooth/Grass
7775 ft
0.014 ft/ft
0.826 ft/s
2.61 hr = 156.9 min

Channel Flow:

Cross Sectional Flow Area, a
Wetted Perimeter, P_w
Hydraulic radius, $r = a / P_w$
Channel Slope, s
Manning's Roughness coeff., n
 $V = 1.49 * r^{2/3} * s^{1/2} / n$
Flow Length, L
 $T_t = L / (3600 * V)$

37.4 sq ft
25 ft
1.47 ft
0.005 ft/ft
0.05
2.80 ft/s
3423 ft
0.34 hr 20.4 min

Total Watershed or subarea T_c	3.30 hr =	198.2 min
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Table 15-1 Manning's roughness coefficients for sheet flow (flow depth generally ≤ 0.1 ft)

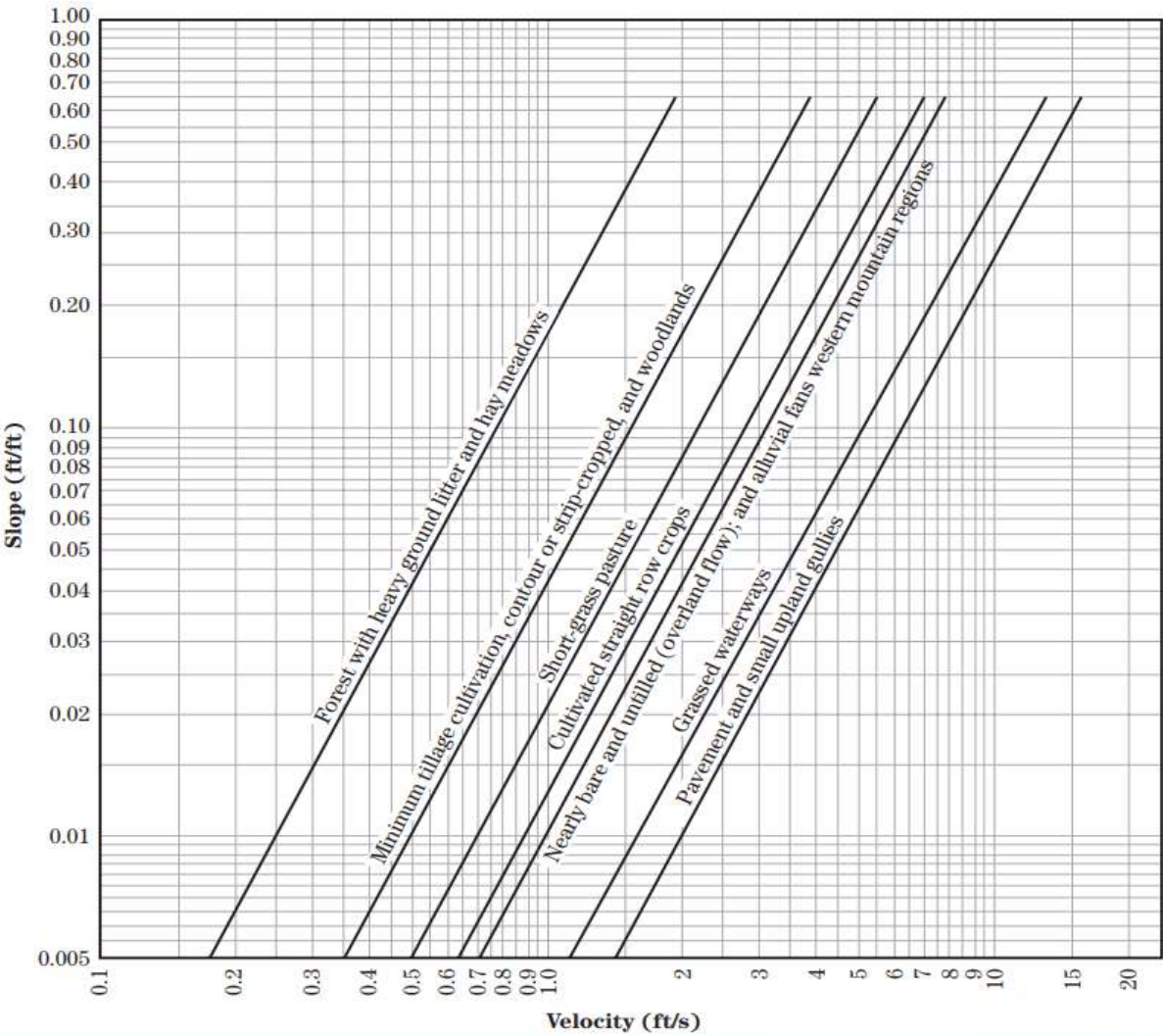
Surface description	n^1
Smooth surface (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover $\leq 20\%$	0.06
Residue cover $> 20\%$	0.17
Grass:	
Short-grass prairie	0.15
Dense grasses ²	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods: ³	
Light underbrush	0.40
Dense underbrush	0.80

- 1 The Manning's n values are a composite of information compiled by Engman (1986).
- 2 Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
- 3 When selecting n , consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

Table 15-2 Maximum sheet flow lengths using the McCuen-Spiess limitation criterion

Cover type	n values	Slope (ft/ft)	Length (ft)
Range	0.13	0.01	77
Grass	0.41	0.01	24
Woods	0.80	0.01	12.5
Range	0.13	0.05	172
Grass	0.41	0.05	55
Woods	0.80	0.05	28

Figure 15-4 Velocity versus slope for shallow concentrated flow

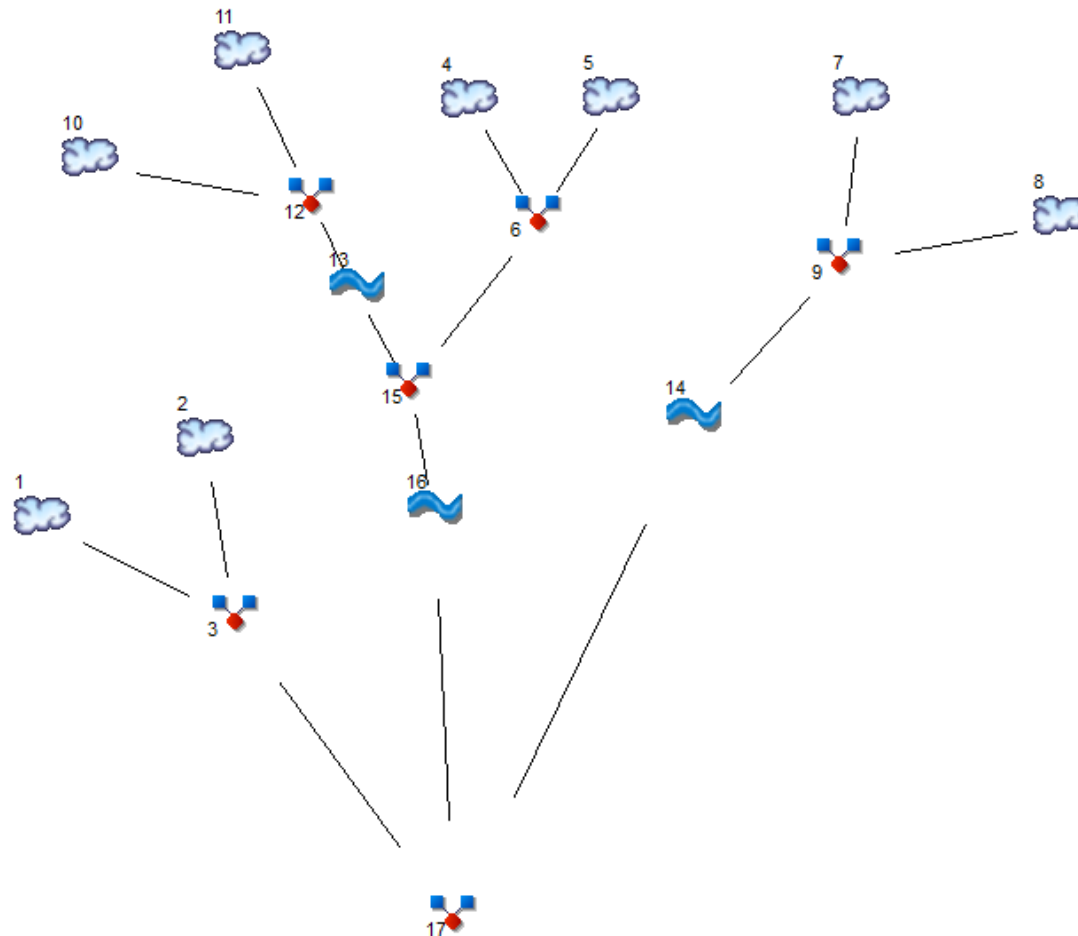


DRAINAGE AREA 1								
LANDUSE	DESCRIPTION	Curve Number (HSG A)	Area (ac)	Curve Number (HSG B)	Area (ac)	Curve Number (HSG D)	Area (ac)	COMPOSITE CN
11	RESIDENTIAL, SINGLE UNIT, LOW DENSITY,20%	54	-	70	4.834	85	5.174	78
12	RESIDENTIAL, SINGLE UNIT, MEDIUM DENSITY,25%	61	0.070	75	206.988	87	15.103	76
13	RESIDENTIAL, HIGH DENSITY OR MULTIPLE DWELLING	77	-	85	42.593	92	4.009	86
14	COMMERCIAL/SERVICES	89	2.860	92	11.687	95	2.246	92
15	INDUSTRIAL	81	0.603	88	10.424	93	0.747	88
16	ALTERED LANDS	77	-	86	64.750	94	6.968	87
18	OTHER AGRICULTURE	39	-	61	52.188	80	21.859	67
21	CROPLAND AND PASTURELAND	49	0.085	69	0.614	84	0.504	74
22	CROPLAND AND PASTURELAND	49	0.284	69	7.932	84	5.654	75
41	DECIDUOUS FOREST (10-50% CROWN CLOSURE)	36	-	60	0.050	79	0.042	69
73	UPLAND RIGHTS-OF-WAY UNDEVELOPED	72	-	82	14.103	89	0.178	82
191	RESIDENTIAL, SINGLE UNIT, LOW DENSITY	51	0.837	68		84	3.155	77
Total (ac)		486.50						
Pervious CN		78						

DRAINAGE AREA 2										
LANDUSE	DESCRIPTION	Curve Number (HSG A)	Area (ac)	Curve Number (HSG B)	Area (ac)	Curve Number (HSG C)	Area (ac)	Curve Number (HSG D)	Area (ac)	COMPOSITE CN
11	RESIDENTIAL, SINGLE UNIT, LOW DENSITY,20%	54	-	70	27.773	80	-	85	10.070	74
12	RESIDENTIAL, SINGLE UNIT, MEDIUM DENSITY,25%	61	-	75	117.198	83	3.368	87	16.285	77
13	RESIDENTIAL, HIGH DENSITY OR MULTIPLE DWELLING	77	-	85	14.455	90	2.738	92	-	86
14	COMMERCIAL/SERVICES	89	-	92	15.969	94	-	95	4.806	93
15	INDUSTRIAL	81	-	88	13.867	91	-	93	-	88
16	ALTERED LANDS	77	-	86	95.487	91	2.112	94	4.281	86
18	OTHER AGRICULTURE	39	-	61	43.719	74	-	80	2.142	62
21	CROPLAND AND PASTURELAND	49	0.956	69	6.391	79	-	84	3.033	72
22	CROPLAND AND PASTURELAND	49	-	69	10.185	79	-	84	4.046	73
41	DECIDUOUS FOREST (10-50% CROWN CLOSURE)	36	-	60	6.657	73	-	79	47.961	77
73	UPLAND RIGHTS-OF-WAY UNDEVELOPED	72	0.041	82	0.533	87	-	89	0.490	85
Total (ac)		454.56								
Pervious CN		78								

DRAINAGE AREA 3								
LANDUSE	DESCRIPTION	Curve Number (HSG B)	Area (ac)	Curve Number (HSG C)	Area (ac)	Curve Number (HSG D)	Area (ac)	COMPOSITE CN
11	RESIDENTIAL, SINGLE UNIT, LOW DENSITY,20%	70	56.440	80	6.764	85	18.364	74
12	RESIDENTIAL, SINGLE UNIT, MEDIUM DENSITY,25%	75	183.463	83	2.790	87	14.204	76
13	RESIDENTIAL, HIGH DENSITY OR MULTIPLE DWELLING	85	13.389	90	1.324	92	-	85
14	COMMERCIAL/SERVICES	92	9.036	94	0.033	95	7.450	93
15	INDUSTRIAL	88	5.576	91	-	93	1.655	89
16	ALTERED LANDS	86	21.400	91	0.879	94	1.588	87
18	OTHER AGRICULTURE	61	0.333	74	-	80	-	61
21	CROPLAND AND PASTURELAND	69	115.315	79	14.970	84	0.409	70
22	CROPLAND AND PASTURELAND	69	7.380	79	3.270	84	7.502	77
41	DECIDUOUS FOREST (10-50% CROWN CLOSURE)	60	1.602	73	-	79	-	60
44	DECIDUOUS BRUSH/SHRUBLAND	56	0.109	70	-	77	0.532	73
73	UPLAND RIGHTS-OF-WAY UNDEVELOPED	82	4.221	87	0.440	89	0.316	83
192	MIXED FOREST (>50% DECIDUOUS WITH 10-50% CROWN CLOSURE)	60	0.044	73	-	79	-	60
242	CONFINED FEEDING OPERATIONS	74	1.190	82	0.349	86	-	76
Total (ac)		502.34						
Pervious CN		76						

DRAINAGE AREA 4								
LANDUSE	DESCRIPTION	Curve Number (HSG B)	Area (ac)	Curve Number (HSG C)	Area (ac)	Curve Number (HSG D)	Area (ac)	COMPOSITE CN
11	RESIDENTIAL, SINGLE UNIT, LOW DENSITY,20%	70	11.632	80	0.454	85	-	70
12	RESIDENTIAL, SINGLE UNIT, MEDIUM DENSITY,25%	75	121.209	83	8.347	87	1.744	76
13	RESIDENTIAL, HIGH DENSITY OR MULTIPLE DWELLING	85	38.270	90	-	92	2.586	85
14	COMMERCIAL/SERVICES	92	26.657	94	3.824	95	1.007	92
15	INDUSTRIAL	88	21.504	91	0.716	93	0.229	88
16	ALTERED LANDS	86	68.691	91	0.410	94	8.809	87
18	OTHER AGRICULTURE	61	93.452	74	7.120	80	8.678	63
21	CROPLAND AND PASTURELAND	69	60.628	79	2.680	84	4.842	70
22	CROPLAND AND PASTURELAND	69	21.754	79	-	84	5.467	72
41	DECIDUOUS FOREST (10-50% CROWN CLOSURE)	60	143.328	73	7.245	79	89.097	63
44	DECIDUOUS BRUSH/SHRUBLAND	56	26.282	70	-	77	0.974	57
191	RESIDENTIAL, SINGLE UNIT, LOW DENSITY	68	3.293	79	-	84	-	68
242	CONFINED FEEDING OPERATIONS	74	1.421	82	-	86	-	74
Total (ac)		729.30						
Pervious CN		72						



Legend

Hyd.	Origin	Description
1	SCS Runoff	DA1 Imp
2	SCS Runoff	DA1 Perv
3	Combine	DA1 Combine
4	SCS Runoff	DA2 Imp
5	SCS Runoff	DA2 Perv
6	Combine	DA2 Combine
7	SCS Runoff	DA3 Imp
8	SCS Runoff	DA3 Perv
9	Combine	DA3 Combine
10	SCS Runoff	DA4 Imp
11	SCS Runoff	DA4 Perv
12	Combine	DA4 Combine
13	Reach	DA4+Lag
14	Reach	DA3 + Lag
15	Combine	DA4+DA2+Lag
16	Reach	DA4+DA2+Lag
17	Combine	Outfall

Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	630.81	5	770.00	6,397,429				DA1 Imp	
2	SCS Runoff	361.72	5	775.00	3,477,143				DA1 Perv	
3	Combine	991.46	5	770.00	9,874,567	1, 2			DA1 Combine	
4	SCS Runoff	356.34	5	780.00	4,018,308				DA2 Imp	
5	SCS Runoff	300.18	5	785.00	3,219,658				DA2 Perv	
6	Combine	655.34	5	780.00	7,237,966	4, 5			DA2 Combine	
7	SCS Runoff	248.28	5	870.00	5,198,566				DA3 Imp	
8	SCS Runoff	157.80	5	880.00	3,295,349				DA3 Perv	
9	Combine	405.47	5	875.00	8,493,909	7, 8			DA3 Combine	
10	SCS Runoff	309.02	5	830.00	5,232,980				DA4 Imp	
11	SCS Runoff	234.59	5	835.00	4,050,287				DA4 Perv	
12	Combine	542.34	5	835.00	9,283,272	10, 11			DA4 Combine	
13	Reach	529.82	5	850.00	9,283,260	12			DA4+Lag	
14	Reach	383.80	5	910.00	8,493,896	9			DA3 + Lag	
15	Combine	979.81	5	805.00	16,521,230	6, 13			DA4+DA2+Lag	
16	Reach	956.96	5	835.00	16,521,220	15			DA4+DA2+Lag	
17	Combine	1877.87	5	800.00	34,889,680	3, 14, 16			Outfall	
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Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	764.22	5	770.00	7,801,709				DA1 Imp	
2	SCS Runoff	496.61	5	770.00	4,718,816				DA1 Perv	
3	Combine	1260.83	5	770.00	12,520,530	1, 2			DA1 Combine	
4	SCS Runoff	431.73	5	780.00	4,900,353				DA2 Imp	
5	SCS Runoff	412.37	5	785.00	4,369,387				DA2 Perv	
6	Combine	843.66	5	780.00	9,269,741	4, 5			DA2 Combine	
7	SCS Runoff	301.04	5	870.00	6,339,687				DA3 Imp	
8	SCS Runoff	221.50	5	875.00	4,527,650				DA3 Perv	
9	Combine	521.79	5	875.00	10,867,340	7, 8			DA3 Combine	
10	SCS Runoff	374.56	5	830.00	6,381,658				DA4 Imp	
11	SCS Runoff	341.99	5	835.00	5,714,443				DA4 Perv	
12	Combine	714.98	5	835.00	12,096,100	10, 11			DA4 Combine	
13	Reach	700.79	5	850.00	12,096,090	12			DA4+Lag	
14	Reach	496.77	5	905.00	10,867,330	9			DA3 + Lag	
15	Combine	1279.86	5	810.00	21,365,830	6, 13			DA4+DA2+Lag	
16	Reach	1256.24	5	835.00	21,365,820	15			DA4+DA2+Lag	
17	Combine	2445.88	5	795.00	44,753,670	3, 14, 16			Outfall	
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Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	878.58	5	770.00	9,008,393				DA1 Imp	
2	SCS Runoff	617.39	5	770.00	5,829,819				DA1 Perv	
3	Combine	1495.97	5	770.00	14,838,220	1, 2			DA1 Combine	
4	SCS Runoff	496.36	5	780.00	5,658,287				DA2 Imp	
5	SCS Runoff	512.28	5	780.00	5,398,119				DA2 Perv	
6	Combine	1008.64	5	780.00	11,056,410	4, 5			DA2 Combine	
7	SCS Runoff	346.26	5	870.00	7,320,244				DA3 Imp	
8	SCS Runoff	278.86	5	875.00	5,637,333				DA3 Perv	
9	Combine	624.23	5	875.00	12,957,570	7, 8			DA3 Combine	
10	SCS Runoff	430.74	5	830.00	7,368,704				DA4 Imp	
11	SCS Runoff	440.30	5	835.00	7,233,962				DA4 Perv	
12	Combine	869.21	5	835.00	14,602,670	10, 11			DA4 Combine	
13	Reach	853.42	5	850.00	14,602,660	12			DA4+Lag	
14	Reach	596.77	5	905.00	12,957,560	9			DA3 + Lag	
15	Combine	1546.48	5	810.00	25,659,070	6, 13			DA4+DA2+Lag	
16	Reach	1521.93	5	835.00	25,659,060	15			DA4+DA2+Lag	
17	Combine	2951.71	5	795.00	53,454,840	3, 14, 16			Outfall	
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Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	1005.31	5	770.00	10,347,730				DA1 Imp	
2	SCS Runoff	754.20	5	770.00	7,097,623				DA1 Perv	
3	Combine	1759.51	5	770.00	17,445,350	1, 2			DA1 Combine	
4	SCS Runoff	567.98	5	780.00	6,499,546				DA2 Imp	
5	SCS Runoff	626.00	5	780.00	6,572,046				DA2 Perv	
6	Combine	1193.98	5	780.00	13,071,590	4, 5			DA2 Combine	
7	SCS Runoff	396.35	5	870.00	8,408,590				DA3 Imp	
8	SCS Runoff	344.37	5	875.00	6,909,439				DA3 Perv	
9	Combine	739.70	5	875.00	15,318,020	7, 8			DA3 Combine	
10	SCS Runoff	492.98	5	830.00	8,464,257				DA4 Imp	
11	SCS Runoff	553.83	5	835.00	8,993,374				DA4 Perv	
12	Combine	1044.70	5	835.00	17,457,620	10, 11			DA4 Combine	
13	Reach	1027.95	5	845.00	17,457,630	12			DA4+Lag	
14	Reach	709.46	5	905.00	15,318,010	9			DA3 + Lag	
15	Combine	1848.91	5	810.00	30,529,220	6, 13			DA4+DA2+Lag	
16	Reach	1823.54	5	830.00	30,529,200	15			DA4+DA2+Lag	
17	Combine	3525.79	5	795.00	63,292,590	3, 14, 16			Outfall	
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Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	701.48	5	770.00	7,140,765				DA1 Imp	
2	SCS Runoff	432.36	5	775.00	4,126,387				DA1 Perv	
3	Combine	1133.34	5	770.00	11,267,150	1, 2			DA1 Combine	
4	SCS Runoff	396.27	5	780.00	4,485,207				DA2 Imp	
5	SCS Runoff	358.96	5	785.00	3,820,825				DA2 Perv	
6	Combine	754.42	5	780.00	8,306,032	4, 5			DA2 Combine	
7	SCS Runoff	276.23	5	870.00	5,802,602				DA3 Imp	
8	SCS Runoff	191.02	5	875.00	3,938,451				DA3 Perv	
9	Combine	466.57	5	875.00	9,741,052	7, 8			DA3 Combine	
10	SCS Runoff	343.74	5	830.00	5,841,020				DA4 Imp	
11	SCS Runoff	290.31	5	835.00	4,915,150				DA4 Perv	
12	Combine	632.62	5	835.00	10,756,170	10, 11			DA4 Combine	
13	Reach	619.24	5	850.00	10,756,160	12			DA4+Lag	
14	Reach	443.11	5	910.00	9,741,038	9			DA3 + Lag	
15	Combine	1137.00	5	810.00	19,062,190	6, 13			DA4+DA2+Lag	
16	Reach	1113.77	5	835.00	19,062,190	15			DA4+DA2+Lag	
17	Combine	2175.51	5	800.00	40,070,370	3, 14, 16			Outfall	
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Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	856.66	5	770.00	8,776,925				DA1 Imp	
2	SCS Runoff	594.01	5	770.00	5,614,146				DA1 Perv	
3	Combine	1450.67	5	770.00	14,391,060	1, 2			DA1 Combine	
4	SCS Runoff	483.97	5	780.00	5,512,899				DA2 Imp	
5	SCS Runoff	492.85	5	780.00	5,198,412				DA2 Perv	
6	Combine	976.82	5	780.00	10,711,310	4, 5			DA2 Combine	
7	SCS Runoff	337.59	5	870.00	7,132,151				DA3 Imp	
8	SCS Runoff	267.71	5	875.00	5,421,495				DA3 Perv	
9	Combine	604.44	5	875.00	12,553,650	7, 8			DA3 Combine	
10	SCS Runoff	419.97	5	830.00	7,179,367				DA4 Imp	
11	SCS Runoff	421.10	5	835.00	6,937,133				DA4 Perv	
12	Combine	839.30	5	835.00	14,116,500	10, 11			DA4 Combine	
13	Reach	823.83	5	850.00	14,116,500	12			DA4+Lag	
14	Reach	577.46	5	905.00	12,553,630	9			DA3 + Lag	
15	Combine	1494.85	5	810.00	24,827,800	6, 13			DA4+DA2+Lag	
16	Reach	1470.49	5	835.00	24,827,800	15			DA4+DA2+Lag	
17	Combine	2853.73	5	795.00	51,772,500	3, 14, 16			Outfall	
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Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	984.98	5	770.00	10,132,720				DA1 Imp	
2	SCS Runoff	732.09	5	770.00	6,892,082				DA1 Perv	
3	Combine	1717.07	5	770.00	17,024,800	1, 2			DA1 Combine	
4	SCS Runoff	556.49	5	780.00	6,364,494				DA2 Imp	
5	SCS Runoff	607.62	5	780.00	6,381,719				DA2 Perv	
6	Combine	1164.11	5	780.00	12,746,210	4, 5			DA2 Combine	
7	SCS Runoff	388.32	5	870.00	8,233,873				DA3 Imp	
8	SCS Runoff	333.75	5	875.00	6,702,835				DA3 Perv	
9	Combine	721.06	5	875.00	14,936,710	7, 8			DA3 Combine	
10	SCS Runoff	483.00	5	830.00	8,288,384				DA4 Imp	
11	SCS Runoff	535.35	5	835.00	8,706,572				DA4 Perv	
12	Combine	1016.29	5	835.00	16,994,960	10, 11			DA4 Combine	
13	Reach	999.63	5	845.00	16,994,950	12			DA4+Lag	
14	Reach	691.28	5	905.00	14,936,690	9			DA3 + Lag	
15	Combine	1800.00	5	810.00	29,741,160	6, 13			DA4+DA2+Lag	
16	Reach	1774.65	5	830.00	29,741,150	15			DA4+DA2+Lag	
17	Combine	3432.92	5	795.00	61,702,660	3, 14, 16			Outfall	
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Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	1116.29	5	770.00	11,521,960				DA1 Imp	
2	SCS Runoff	875.72	5	770.00	8,232,066				DA1 Perv	
3	Combine	1992.01	5	770.00	19,754,020	1, 2			DA1 Combine	
4	SCS Runoff	630.70	5	780.00	7,237,090				DA2 Imp	
5	SCS Runoff	727.04	5	780.00	7,622,477				DA2 Perv	
6	Combine	1357.73	5	780.00	14,859,570	4, 5			DA2 Combine	
7	SCS Runoff	440.22	5	870.00	9,362,771				DA3 Imp	
8	SCS Runoff	402.95	5	875.00	8,051,645				DA3 Perv	
9	Combine	842.01	5	875.00	17,414,420	7, 8			DA3 Combine	
10	SCS Runoff	547.49	5	830.00	9,424,760				DA4 Imp	
11	SCS Runoff	656.17	5	835.00	10,585,200				DA4 Perv	
12	Combine	1201.30	5	835.00	20,009,960	10, 11			DA4 Combine	
13	Reach	1183.99	5	845.00	20,009,950	12			DA4+Lag	
14	Reach	809.83	5	900.00	17,414,400	9			DA3 + Lag	
15	Combine	2118.09	5	805.00	34,869,540	6, 13			DA4+DA2+Lag	
16	Reach	2092.47	5	830.00	34,869,500	15			DA4+DA2+Lag	
17	Combine	4037.00	5	795.00	72,037,920	3, 14, 16			Outfall	
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Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	720.31	5	770.00	7,339,050				DA1 Imp	
2	SCS Runoff	451.49	5	775.00	4,302,720				DA1 Perv	
3	Combine	1171.47	5	770.00	11,641,770	1, 2			DA1 Combine	
4	SCS Runoff	406.91	5	780.00	4,609,753				DA2 Imp	
5	SCS Runoff	374.88	5	785.00	3,984,100				DA2 Perv	
6	Combine	781.08	5	780.00	8,593,850	4, 5			DA2 Combine	
7	SCS Runoff	283.68	5	870.00	5,963,728				DA3 Imp	
8	SCS Runoff	200.08	5	875.00	4,113,611				DA3 Perv	
9	Combine	483.05	5	875.00	10,077,340	7, 8			DA3 Combine	
10	SCS Runoff	352.99	5	830.00	6,003,210				DA4 Imp	
11	SCS Runoff	305.62	5	835.00	5,152,132				DA4 Perv	
12	Combine	657.14	5	835.00	11,155,350	10, 11			DA4 Combine	
13	Reach	643.52	5	850.00	11,155,330	12			DA4+Lag	
14	Reach	459.12	5	910.00	10,077,320	9			DA3 + Lag	
15	Combine	1179.58	5	810.00	19,749,190	6, 13			DA4+DA2+Lag	
16	Reach	1156.24	5	835.00	19,749,170	15			DA4+DA2+Lag	
17	Combine	2256.10	5	800.00	41,468,260	3, 14, 16			Outfall	
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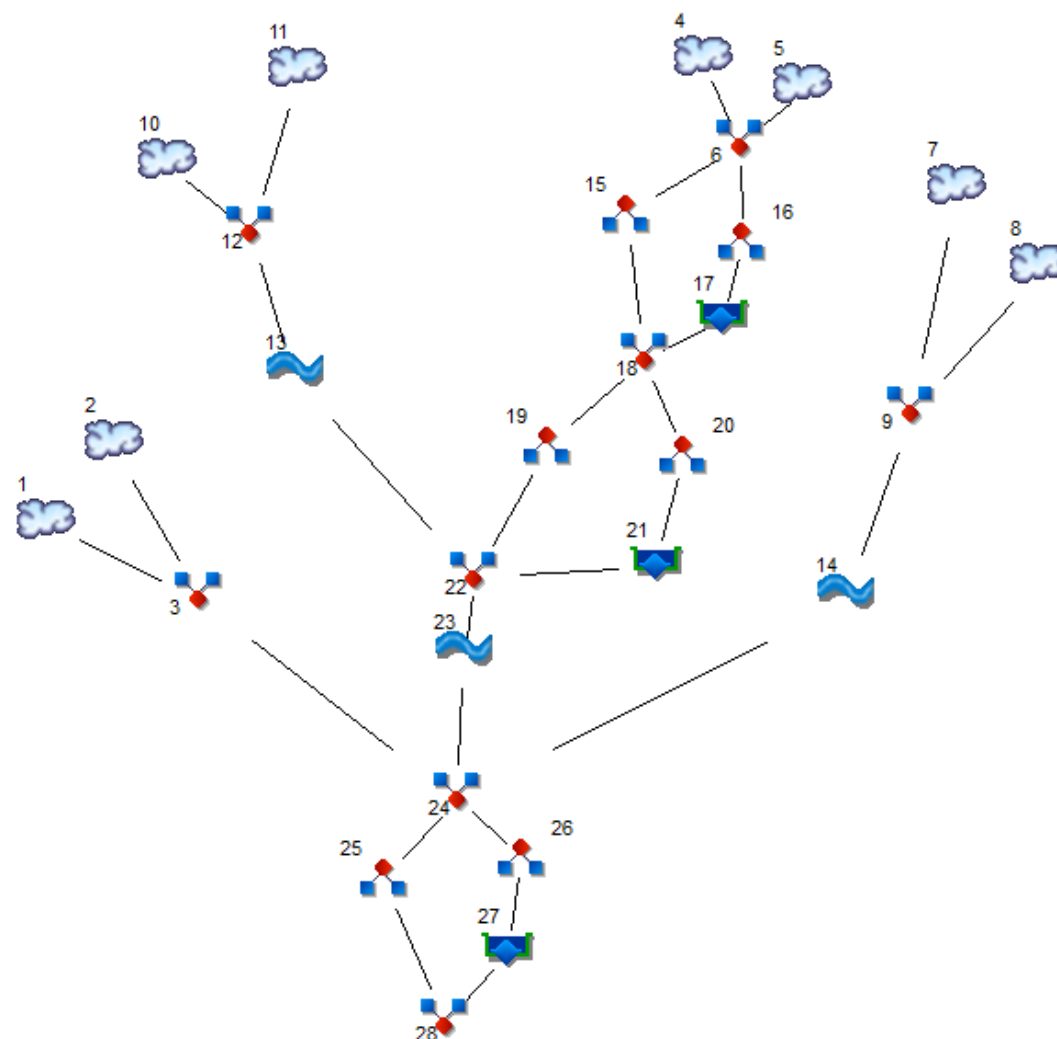
Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	903.62	5	770.00	9,272,945				DA1 Imp	
2	SCS Runoff	644.22	5	770.00	6,077,645				DA1 Perv	
3	Combine	1547.84	5	770.00	15,350,590	1, 2			DA1 Combine	
4	SCS Runoff	510.51	5	780.00	5,824,458				DA2 Imp	
5	SCS Runoff	534.58	5	780.00	5,627,587				DA2 Perv	
6	Combine	1045.09	5	780.00	11,452,060	4, 5			DA2 Combine	
7	SCS Runoff	356.16	5	870.00	7,535,216				DA3 Imp	
8	SCS Runoff	291.66	5	875.00	5,885,563				DA3 Perv	
9	Combine	646.91	5	875.00	13,420,790	7, 8			DA3 Combine	
10	SCS Runoff	443.04	5	830.00	7,585,104				DA4 Imp	
11	SCS Runoff	462.40	5	835.00	7,575,977				DA4 Perv	
12	Combine	903.56	5	835.00	15,161,080	10, 11			DA4 Combine	
13	Reach	887.39	5	850.00	15,161,070	12			DA4+Lag	
14	Reach	618.91	5	905.00	13,420,770	9			DA3 + Lag	
15	Combine	1605.74	5	810.00	26,613,110	6, 13			DA4+DA2+Lag	
16	Reach	1580.95	5	835.00	26,613,100	15			DA4+DA2+Lag	
17	Combine	3064.18	5	795.00	55,384,480	3, 14, 16			Outfall	
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Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	1047.53	5	770.00	10,794,280				DA1 Imp	
2	SCS Runoff	800.27	5	770.00	7,526,796				DA1 Perv	
3	Combine	1847.79	5	770.00	18,321,070	1, 2			DA1 Combine	
4	SCS Runoff	591.83	5	780.00	6,780,025				DA2 Imp	
5	SCS Runoff	664.30	5	780.00	6,969,437				DA2 Perv	
6	Combine	1256.14	5	780.00	13,749,460	4, 5			DA2 Combine	
7	SCS Runoff	413.04	5	870.00	8,771,452				DA3 Imp	
8	SCS Runoff	366.54	5	875.00	7,341,147				DA3 Perv	
9	Combine	778.50	5	875.00	16,112,600	7, 8			DA3 Combine	
10	SCS Runoff	513.72	5	830.00	8,829,531				DA4 Imp	
11	SCS Runoff	592.48	5	835.00	9,593,857				DA4 Perv	
12	Combine	1103.99	5	835.00	18,423,390	10, 11			DA4 Combine	
13	Reach	1087.03	5	845.00	18,423,390	12			DA4+Lag	
14	Reach	747.50	5	900.00	16,112,600	9			DA3 + Lag	
15	Combine	1950.87	5	810.00	32,172,830	6, 13			DA4+DA2+Lag	
16	Reach	1925.45	5	830.00	32,172,830	15			DA4+DA2+Lag	
17	Combine	3719.44	5	795.00	66,606,470	3, 14, 16			Outfall	
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Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	1136.61	5	770.00	11,736,950				DA1 Imp	
2	SCS Runoff	898.09	5	770.00	8,441,711				DA1 Perv	
3	Combine	2034.69	5	770.00	20,178,660	1, 2			DA1 Combine	
4	SCS Runoff	642.17	5	780.00	7,372,131				DA2 Imp	
5	SCS Runoff	745.64	5	780.00	7,816,602				DA2 Perv	
6	Combine	1387.81	5	780.00	15,188,730	4, 5			DA2 Combine	
7	SCS Runoff	448.24	5	870.00	9,537,475				DA3 Imp	
8	SCS Runoff	413.77	5	875.00	8,263,064				DA3 Perv	
9	Combine	860.83	5	875.00	17,800,530	7, 8			DA3 Combine	
10	SCS Runoff	557.47	5	830.00	9,600,611				DA4 Imp	
11	SCS Runoff	675.14	5	835.00	10,880,890				DA4 Perv	
12	Combine	1230.20	5	835.00	20,481,500	10, 11			DA4 Combine	
13	Reach	1212.79	5	845.00	20,481,510	12			DA4+Lag	
14	Reach	828.31	5	900.00	17,800,530	9			DA3 + Lag	
15	Combine	2167.71	5	805.00	35,670,240	6, 13			DA4+DA2+Lag	
16	Reach	2142.02	5	830.00	35,670,240	15			DA4+DA2+Lag	
17	Combine	4131.24	5	795.00	73,649,380	3, 14, 16			Outfall	
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Legend

Hyd.	Origin	Description
1	SCS Runoff	DA1 Imp
2	SCS Runoff	DA1 Perv
3	Combine	DA1 Combine
4	SCS Runoff	DA2 Imp
5	SCS Runoff	DA2 Perv
6	Combine	DA2 Combine
7	SCS Runoff	DA3 Imp
8	SCS Runoff	DA3 Perv
9	Combine	DA3 Combine
10	SCS Runoff	DA4 Imp
11	SCS Runoff	DA4 Perv
12	Combine	DA4 Combine
13	Reach	DA4+Lag
14	Reach	DA3 + Lag
15	Diversion1	Stream
16	Diversion2	Divert to Basin
17	Reservoir	School Basin
18	Combine	Basin + Stream
19	Diversion1	Stream
20	Diversion2	Divert to Basin
21	Reservoir	Gym Pond
22	Combine	<no description>
23	Reach	DA4+DA2+Lag
24	Combine	Outfall
25	Diversion1	Stream
26	Diversion2	Divert to Wetland
27	Reservoir	Wetland
28	Combine	Outfall



Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	630.81	5	770.00	6,397,429				DA1 Imp	
2	SCS Runoff	361.72	5	775.00	3,477,143				DA1 Perv	
3	Combine	991.46	5	770.00	9,874,567	1, 2			DA1 Combine	
4	SCS Runoff	356.34	5	780.00	4,018,308				DA2 Imp	
5	SCS Runoff	300.18	5	785.00	3,219,658				DA2 Perv	
6	Combine	655.34	5	780.00	7,237,966	4, 5			DA2 Combine	
7	SCS Runoff	248.28	5	870.00	5,198,566				DA3 Imp	
8	SCS Runoff	157.80	5	880.00	3,295,349				DA3 Perv	
9	Combine	405.47	5	875.00	8,493,909	7, 8			DA3 Combine	
10	SCS Runoff	309.02	5	830.00	5,232,980				DA4 Imp	
11	SCS Runoff	234.59	5	835.00	4,050,287				DA4 Perv	
12	Combine	542.34	5	835.00	9,283,272	10, 11			DA4 Combine	
13	Reach	529.82	5	850.00	9,283,260	12			DA4+Lag	
14	Reach	383.80	5	910.00	8,493,896	9			DA3 + Lag	
15	Diversion1	635.68	5	780.00	7,020,829	6			Stream	
16	Diversion2	19.66	5	780.00	217,139	6			Divert to Basin	
17	Reservoir	4.43	5	895.00	217,134	16	558.28	111,536	School Basin	
18	Combine	637.93	5	780.00	7,237,962	15, 17			Basin + Stream	
19	Diversion1	618.79	5	780.00	7,020,828	18			Stream	
20	Diversion2	19.14	5	780.00	217,139	18			Divert to Basin	
21	Reservoir	4.18	5	895.00	217,134	20	558.24	109,241	Gym Pond	
22	Combine	952.31	5	815.00	16,521,220	13, 19, 21			<no description>	
23	Reach	931.99	5	840.00	16,521,180	22			DA4+DA2+Lag	
24	Combine	1845.83	5	800.00	34,889,660	3, 14, 23			Outfall	
25	Diversion1	1827.37	5	800.00	34,540,760	24			Stream	
26	Diversion2	18.46	5	800.00	348,896	24			Divert to Wetland	
27	Reservoir	10.35	5	940.00	348,875	26	557.87	120,295	Wetland	
28	Combine	1832.87	5	800.00	34,889,570	25, 27			Outfall	
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Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	764.22	5	770.00	7,801,709				DA1 Imp	
2	SCS Runoff	496.61	5	770.00	4,718,816				DA1 Perv	
3	Combine	1260.83	5	770.00	12,520,530	1, 2			DA1 Combine	
4	SCS Runoff	431.73	5	780.00	4,900,353				DA2 Imp	
5	SCS Runoff	412.37	5	785.00	4,369,387				DA2 Perv	
6	Combine	843.66	5	780.00	9,269,741	4, 5			DA2 Combine	
7	SCS Runoff	301.04	5	870.00	6,339,687				DA3 Imp	
8	SCS Runoff	221.50	5	875.00	4,527,650				DA3 Perv	
9	Combine	521.79	5	875.00	10,867,340	7, 8			DA3 Combine	
10	SCS Runoff	374.56	5	830.00	6,381,658				DA4 Imp	
11	SCS Runoff	341.99	5	835.00	5,714,443				DA4 Perv	
12	Combine	714.98	5	835.00	12,096,100	10, 11			DA4 Combine	
13	Reach	700.79	5	850.00	12,096,090	12			DA4+Lag	
14	Reach	496.77	5	905.00	10,867,330	9			DA3 + Lag	
15	Diversion1	818.35	5	780.00	8,991,651	6			Stream	
16	Diversion2	25.31	5	780.00	278,092	6			Divert to Basin	
17	Reservoir	8.07	5	880.00	278,088	16	558.77	137,545	School Basin	
18	Combine	820.97	5	780.00	9,269,729	15, 17			Basin + Stream	
19	Diversion1	796.34	5	780.00	8,991,648	18			Stream	
20	Diversion2	24.63	5	780.00	278,092	18			Divert to Basin	
21	Reservoir	7.80	5	880.00	278,088	20	558.73	135,173	Gym Pond	
22	Combine	1244.83	5	815.00	21,365,830	13, 19, 21			<no description>	
23	Reach	1224.65	5	840.00	21,365,800	22			DA4+DA2+Lag	
24	Combine	2403.72	5	795.00	44,753,620	3, 14, 23			Outfall	
25	Diversion1	2379.68	5	795.00	44,306,110	24			Stream	
26	Diversion2	24.04	5	795.00	447,536	24			Divert to Wetland	
27	Reservoir	13.37	5	940.00	447,514	26	558.12	152,832	Wetland	
28	Combine	2387.16	5	800.00	44,753,540	25, 27			Outfall	
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Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	878.58	5	770.00	9,008,393				DA1 Imp	
2	SCS Runoff	617.39	5	770.00	5,829,819				DA1 Perv	
3	Combine	1495.97	5	770.00	14,838,220	1, 2			DA1 Combine	
4	SCS Runoff	496.36	5	780.00	5,658,287				DA2 Imp	
5	SCS Runoff	512.28	5	780.00	5,398,119				DA2 Perv	
6	Combine	1008.64	5	780.00	11,056,410	4, 5			DA2 Combine	
7	SCS Runoff	346.26	5	870.00	7,320,244				DA3 Imp	
8	SCS Runoff	278.86	5	875.00	5,637,333				DA3 Perv	
9	Combine	624.23	5	875.00	12,957,570	7, 8			DA3 Combine	
10	SCS Runoff	430.74	5	830.00	7,368,704				DA4 Imp	
11	SCS Runoff	440.30	5	835.00	7,233,962				DA4 Perv	
12	Combine	869.21	5	835.00	14,602,670	10, 11			DA4 Combine	
13	Reach	853.42	5	850.00	14,602,660	12			DA4+Lag	
14	Reach	596.77	5	905.00	12,957,560	9			DA3 + Lag	
15	Diversion1	978.38	5	780.00	10,724,710	6			Stream	
16	Diversion2	30.26	5	780.00	331,692	6			Divert to Basin	
17	Reservoir	11.35	5	870.00	331,687	16	559.14	157,871	School Basin	
18	Combine	981.35	5	780.00	11,056,400	15, 17			Basin + Stream	
19	Diversion1	951.91	5	780.00	10,724,720	18			Stream	
20	Diversion2	29.44	5	780.00	331,692	18			Divert to Basin	
21	Reservoir	11.90	5	870.00	331,688	20	559.07	154,080	Gym Pond	
22	Combine	1508.77	5	815.00	25,659,070	13, 19, 21			<no description>	
23	Reach	1487.57	5	835.00	25,659,020	22			DA4+DA2+Lag	
24	Combine	2900.66	5	795.00	53,454,800	3, 14, 23			Outfall	
25	Diversion1	2871.65	5	795.00	52,920,280	24			Stream	
26	Diversion2	29.01	5	795.00	534,548	24			Divert to Wetland	
27	Reservoir	14.99	5	950.00	534,526	26	558.33	186,601	Wetland	
28	Combine	2880.56	5	795.00	53,454,670	25, 27			Outfall	
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Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	1005.31	5	770.00	10,347,730				DA1 Imp	
2	SCS Runoff	754.20	5	770.00	7,097,623				DA1 Perv	
3	Combine	1759.51	5	770.00	17,445,350	1, 2			DA1 Combine	
4	SCS Runoff	567.98	5	780.00	6,499,546				DA2 Imp	
5	SCS Runoff	626.00	5	780.00	6,572,046				DA2 Perv	
6	Combine	1193.98	5	780.00	13,071,590	4, 5			DA2 Combine	
7	SCS Runoff	396.35	5	870.00	8,408,590				DA3 Imp	
8	SCS Runoff	344.37	5	875.00	6,909,439				DA3 Perv	
9	Combine	739.70	5	875.00	15,318,020	7, 8			DA3 Combine	
10	SCS Runoff	492.98	5	830.00	8,464,257				DA4 Imp	
11	SCS Runoff	553.83	5	835.00	8,993,374				DA4 Perv	
12	Combine	1044.70	5	835.00	17,457,620	10, 11			DA4 Combine	
13	Reach	1027.95	5	845.00	17,457,630	12			DA4+Lag	
14	Reach	709.46	5	905.00	15,318,010	9			DA3 + Lag	
15	Diversion1	1158.16	5	780.00	12,679,430	6			Stream	
16	Diversion2	35.82	5	780.00	392,147	6			Divert to Basin	
17	Reservoir	12.84	5	875.00	392,143	16	559.60	183,689	School Basin	
18	Combine	1161.42	5	780.00	13,071,580	15, 17			Basin + Stream	
19	Diversion1	1126.57	5	780.00	12,679,440	18			Stream	
20	Diversion2	34.84	5	780.00	392,147	18			Divert to Basin	
21	Reservoir	16.12	5	860.00	392,143	20	559.37	170,816	Gym Pond	
22	Combine	1809.83	5	820.00	30,529,200	13, 19, 21			<no description>	
23	Reach	1788.43	5	835.00	30,529,200	22			DA4+DA2+Lag	
24	Combine	3465.65	5	795.00	63,292,520	3, 14, 23			Outfall	
25	Diversion1	3430.99	5	795.00	62,659,640	24			Stream	
26	Diversion2	34.66	5	795.00	632,925	24			Divert to Wetland	
27	Reservoir	15.78	5	975.00	632,903	26	558.63	236,111	Wetland	
28	Combine	3442.02	5	795.00	63,292,440	25, 27			Outfall	
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Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	701.48	5	770.00	7,140,765				DA1 Imp	
2	SCS Runoff	432.36	5	775.00	4,126,387				DA1 Perv	
3	Combine	1133.34	5	770.00	11,267,150	1, 2			DA1 Combine	
4	SCS Runoff	396.27	5	780.00	4,485,207				DA2 Imp	
5	SCS Runoff	358.96	5	785.00	3,820,825				DA2 Perv	
6	Combine	754.42	5	780.00	8,306,032	4, 5			DA2 Combine	
7	SCS Runoff	276.23	5	870.00	5,802,602				DA3 Imp	
8	SCS Runoff	191.02	5	875.00	3,938,451				DA3 Perv	
9	Combine	466.57	5	875.00	9,741,052	7, 8			DA3 Combine	
10	SCS Runoff	343.74	5	830.00	5,841,020				DA4 Imp	
11	SCS Runoff	290.31	5	835.00	4,915,150				DA4 Perv	
12	Combine	632.62	5	835.00	10,756,170	10, 11			DA4 Combine	
13	Reach	619.24	5	850.00	10,756,160	12			DA4+Lag	
14	Reach	443.11	5	910.00	9,741,038	9			DA3 + Lag	
15	Diversion1	731.78	5	780.00	8,056,849	6			Stream	
16	Diversion2	22.63	5	780.00	249,181	6			Divert to Basin	
17	Reservoir	6.33	5	885.00	249,176	16	558.55	125,873	School Basin	
18	Combine	734.18	5	780.00	8,306,028	15, 17			Basin + Stream	
19	Diversion1	712.16	5	780.00	8,056,845	18			Stream	
20	Diversion2	22.03	5	780.00	249,181	18			Divert to Basin	
21	Reservoir	6.00	5	885.00	249,176	20	558.51	123,640	Gym Pond	
22	Combine	1105.07	5	815.00	19,062,180	13, 19, 21			<no description>	
23	Reach	1084.69	5	840.00	19,062,140	22			DA4+DA2+Lag	
24	Combine	2138.07	5	800.00	40,070,340	3, 14, 23			Outfall	
25	Diversion1	2116.69	5	800.00	39,669,610	24			Stream	
26	Diversion2	21.38	5	800.00	400,703	24			Divert to Wetland	
27	Reservoir	12.01	5	940.00	400,681	26	558.02	136,851	Wetland	
28	Combine	2123.29	5	800.00	40,070,230	25, 27			Outfall	
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Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	856.66	5	770.00	8,776,925				DA1 Imp	
2	SCS Runoff	594.01	5	770.00	5,614,146				DA1 Perv	
3	Combine	1450.67	5	770.00	14,391,060	1, 2			DA1 Combine	
4	SCS Runoff	483.97	5	780.00	5,512,899				DA2 Imp	
5	SCS Runoff	492.85	5	780.00	5,198,412				DA2 Perv	
6	Combine	976.82	5	780.00	10,711,310	4, 5			DA2 Combine	
7	SCS Runoff	337.59	5	870.00	7,132,151				DA3 Imp	
8	SCS Runoff	267.71	5	875.00	5,421,495				DA3 Perv	
9	Combine	604.44	5	875.00	12,553,650	7, 8			DA3 Combine	
10	SCS Runoff	419.97	5	830.00	7,179,367				DA4 Imp	
11	SCS Runoff	421.10	5	835.00	6,937,133				DA4 Perv	
12	Combine	839.30	5	835.00	14,116,500	10, 11			DA4 Combine	
13	Reach	823.83	5	850.00	14,116,500	12			DA4+Lag	
14	Reach	577.46	5	905.00	12,553,630	9			DA3 + Lag	
15	Diversion1	947.52	5	780.00	10,389,970	6			Stream	
16	Diversion2	29.30	5	780.00	321,339	6			Divert to Basin	
17	Reservoir	11.41	5	870.00	321,335	16	559.05	153,045	School Basin	
18	Combine	950.43	5	780.00	10,711,310	15, 17			Basin + Stream	
19	Diversion1	921.92	5	780.00	10,389,970	18			Stream	
20	Diversion2	28.51	5	780.00	321,339	18			Divert to Basin	
21	Reservoir	10.59	5	875.00	321,335	20	559.02	151,086	Gym Pond	
22	Combine	1457.50	5	815.00	24,827,790	13, 19, 21			<no description>	
23	Reach	1436.47	5	840.00	24,827,770	22			DA4+DA2+Lag	
24	Combine	2804.39	5	795.00	51,772,440	3, 14, 23			Outfall	
25	Diversion1	2776.35	5	795.00	51,254,740	24			Stream	
26	Diversion2	28.04	5	795.00	517,724	24			Divert to Wetland	
27	Reservoir	14.83	5	950.00	517,703	26	558.28	179,119	Wetland	
28	Combine	2784.90	5	795.00	51,772,340	25, 27			Outfall	
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Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	984.98	5	770.00	10,132,720				DA1 Imp	
2	SCS Runoff	732.09	5	770.00	6,892,082				DA1 Perv	
3	Combine	1717.07	5	770.00	17,024,800	1, 2			DA1 Combine	
4	SCS Runoff	556.49	5	780.00	6,364,494				DA2 Imp	
5	SCS Runoff	607.62	5	780.00	6,381,719				DA2 Perv	
6	Combine	1164.11	5	780.00	12,746,210	4, 5			DA2 Combine	
7	SCS Runoff	388.32	5	870.00	8,233,873				DA3 Imp	
8	SCS Runoff	333.75	5	875.00	6,702,835				DA3 Perv	
9	Combine	721.06	5	875.00	14,936,710	7, 8			DA3 Combine	
10	SCS Runoff	483.00	5	830.00	8,288,384				DA4 Imp	
11	SCS Runoff	535.35	5	835.00	8,706,572				DA4 Perv	
12	Combine	1016.29	5	835.00	16,994,960	10, 11			DA4 Combine	
13	Reach	999.63	5	845.00	16,994,950	12			DA4+Lag	
14	Reach	691.28	5	905.00	14,936,690	9			DA3 + Lag	
15	Diversion1	1129.19	5	780.00	12,363,820	6			Stream	
16	Diversion2	34.92	5	780.00	382,386	6			Divert to Basin	
17	Reservoir	16.07	5	860.00	382,382	16	559.36	170,119	School Basin	
18	Combine	1132.39	5	780.00	12,746,200	15, 17			Basin + Stream	
19	Diversion1	1098.42	5	780.00	12,363,810	18			Stream	
20	Diversion2	33.97	5	780.00	382,386	18			Divert to Basin	
21	Reservoir	15.86	5	860.00	382,382	20	559.32	167,809	Gym Pond	
22	Combine	1761.46	5	820.00	29,741,170	13, 19, 21			<no description>	
23	Reach	1741.05	5	835.00	29,741,130	22			DA4+DA2+Lag	
24	Combine	3374.13	5	795.00	61,702,630	3, 14, 23			Outfall	
25	Diversion1	3340.39	5	795.00	61,085,560	24			Stream	
26	Diversion2	33.74	5	795.00	617,026	24			Divert to Wetland	
27	Reservoir	15.66	5	970.00	617,004	26	558.58	227,740	Wetland	
28	Combine	3351.08	5	795.00	61,702,530	25, 27			Outfall	
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Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	1116.29	5	770.00	11,521,960				DA1 Imp	
2	SCS Runoff	875.72	5	770.00	8,232,066				DA1 Perv	
3	Combine	1992.01	5	770.00	19,754,020	1, 2			DA1 Combine	
4	SCS Runoff	630.70	5	780.00	7,237,090				DA2 Imp	
5	SCS Runoff	727.04	5	780.00	7,622,477				DA2 Perv	
6	Combine	1357.73	5	780.00	14,859,570	4, 5			DA2 Combine	
7	SCS Runoff	440.22	5	870.00	9,362,771				DA3 Imp	
8	SCS Runoff	402.95	5	875.00	8,051,645				DA3 Perv	
9	Combine	842.01	5	875.00	17,414,420	7, 8			DA3 Combine	
10	SCS Runoff	547.49	5	830.00	9,424,760				DA4 Imp	
11	SCS Runoff	656.17	5	835.00	10,585,200				DA4 Perv	
12	Combine	1201.30	5	835.00	20,009,960	10, 11			DA4 Combine	
13	Reach	1183.99	5	845.00	20,009,950	12			DA4+Lag	
14	Reach	809.83	5	900.00	17,414,400	9			DA3 + Lag	
15	Diversion1	1317.00	5	780.00	14,413,780	6			Stream	
16	Diversion2	40.73	5	780.00	445,787	6			Divert to Basin	
17	Reservoir	17.51	5	865.00	445,782	16	559.80	195,331	School Basin	
18	Combine	1321.69	5	780.00	14,859,560	15, 17			Basin + Stream	
19	Diversion1	1282.04	5	780.00	14,413,780	18			Stream	
20	Diversion2	39.65	5	780.00	445,787	18			Divert to Basin	
21	Reservoir	17.34	5	865.00	445,782	20	559.74	191,864	Gym Pond	
22	Combine	2081.30	5	815.00	34,869,490	13, 19, 21			<no description>	
23	Reach	2056.99	5	835.00	34,869,470	22			DA4+DA2+Lag	
24	Combine	3970.51	5	795.00	72,037,900	3, 14, 23			Outfall	
25	Diversion1	3930.81	5	795.00	71,317,540	24			Stream	
26	Diversion2	39.71	5	795.00	720,379	24			Divert to Wetland	
27	Reservoir	16.43	5	990.00	720,357	26	558.93	284,921	Wetland	
28	Combine	3943.47	5	795.00	72,037,660	25, 27			Outfall	
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Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	720.31	5	770.00	7,339,050				DA1 Imp	
2	SCS Runoff	451.49	5	775.00	4,302,720				DA1 Perv	
3	Combine	1171.47	5	770.00	11,641,770	1, 2			DA1 Combine	
4	SCS Runoff	406.91	5	780.00	4,609,753				DA2 Imp	
5	SCS Runoff	374.88	5	785.00	3,984,100				DA2 Perv	
6	Combine	781.08	5	780.00	8,593,850	4, 5			DA2 Combine	
7	SCS Runoff	283.68	5	870.00	5,963,728				DA3 Imp	
8	SCS Runoff	200.08	5	875.00	4,113,611				DA3 Perv	
9	Combine	483.05	5	875.00	10,077,340	7, 8			DA3 Combine	
10	SCS Runoff	352.99	5	830.00	6,003,210				DA4 Imp	
11	SCS Runoff	305.62	5	835.00	5,152,132				DA4 Perv	
12	Combine	657.14	5	835.00	11,155,350	10, 11			DA4 Combine	
13	Reach	643.52	5	850.00	11,155,330	12			DA4+Lag	
14	Reach	459.12	5	910.00	10,077,320	9			DA3 + Lag	
15	Diversion1	757.65	5	780.00	8,336,035	6			Stream	
16	Diversion2	23.43	5	780.00	257,815	6			Divert to Basin	
17	Reservoir	6.87	5	880.00	257,811	16	558.62	129,401	School Basin	
18	Combine	760.11	5	780.00	8,593,841	15, 17			Basin + Stream	
19	Diversion1	737.31	5	780.00	8,336,029	18			Stream	
20	Diversion2	22.80	5	780.00	257,815	18			Divert to Basin	
21	Reservoir	6.53	5	885.00	257,811	20	558.58	127,193	Gym Pond	
22	Combine	1146.47	5	815.00	19,749,180	13, 19, 21			<no description>	
23	Reach	1126.30	5	840.00	19,749,140	22			DA4+DA2+Lag	
24	Combine	2217.20	5	800.00	41,468,240	3, 14, 23			Outfall	
25	Diversion1	2195.03	5	800.00	41,053,560	24			Stream	
26	Diversion2	22.17	5	800.00	414,682	24			Divert to Wetland	
27	Reservoir	12.41	5	940.00	414,660	26	558.05	141,565	Wetland	
28	Combine	2201.93	5	800.00	41,468,140	25, 27			Outfall	
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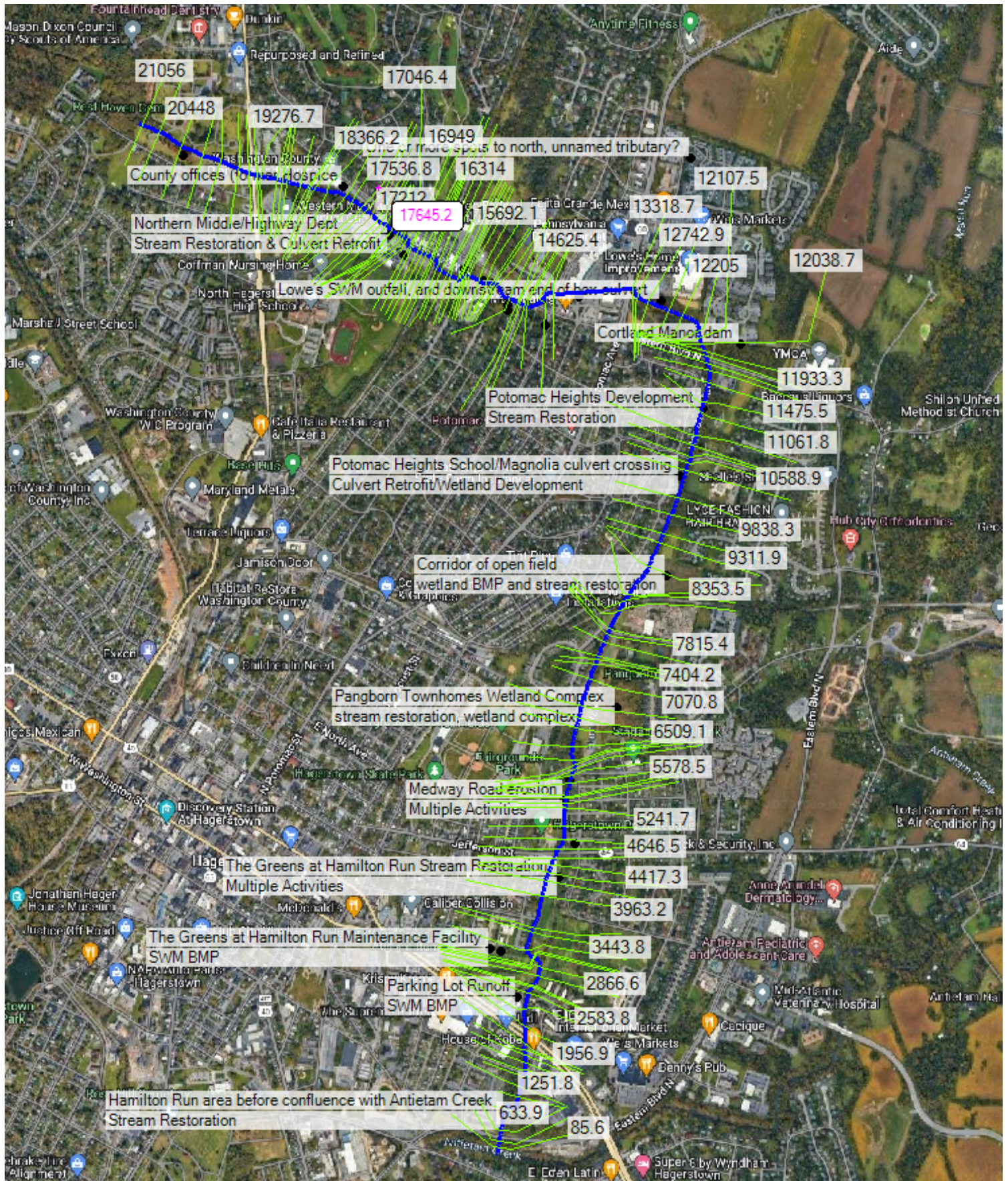
Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	903.62	5	770.00	9,272,945				DA1 Imp	
2	SCS Runoff	644.22	5	770.00	6,077,645				DA1 Perv	
3	Combine	1547.84	5	770.00	15,350,590	1, 2			DA1 Combine	
4	SCS Runoff	510.51	5	780.00	5,824,458				DA2 Imp	
5	SCS Runoff	534.58	5	780.00	5,627,587				DA2 Perv	
6	Combine	1045.09	5	780.00	11,452,060	4, 5			DA2 Combine	
7	SCS Runoff	356.16	5	870.00	7,535,216				DA3 Imp	
8	SCS Runoff	291.66	5	875.00	5,885,563				DA3 Perv	
9	Combine	646.91	5	875.00	13,420,790	7, 8			DA3 Combine	
10	SCS Runoff	443.04	5	830.00	7,585,104				DA4 Imp	
11	SCS Runoff	462.40	5	835.00	7,575,977				DA4 Perv	
12	Combine	903.56	5	835.00	15,161,080	10, 11			DA4 Combine	
13	Reach	887.39	5	850.00	15,161,070	12			DA4+Lag	
14	Reach	618.91	5	905.00	13,420,770	9			DA3 + Lag	
15	Diversion1	1013.74	5	780.00	11,108,490	6			Stream	
16	Diversion2	31.35	5	780.00	343,561	6			Divert to Basin	
17	Reservoir	13.87	5	865.00	343,557	16	559.16	158,830	School Basin	
18	Combine	1016.77	5	780.00	11,452,040	15, 17			Basin + Stream	
19	Diversion1	986.26	5	780.00	11,108,490	18			Stream	
20	Diversion2	30.50	5	780.00	343,561	18			Divert to Basin	
21	Reservoir	13.23	5	865.00	343,557	20	559.13	157,203	Gym Pond	
22	Combine	1567.68	5	815.00	26,613,110	13, 19, 21			<no description>	
23	Reach	1546.41	5	835.00	26,613,080	22			DA4+DA2+Lag	
24	Combine	3011.19	5	795.00	55,384,380	3, 14, 23			Outfall	
25	Diversion1	2981.07	5	795.00	54,830,580	24			Stream	
26	Diversion2	30.11	5	795.00	553,844	24			Divert to Wetland	
27	Reservoir	15.16	5	955.00	553,822	26	558.39	195,704	Wetland	
28	Combine	2990.40	5	795.00	55,384,350	25, 27			Outfall	
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Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	1047.53	5	770.00	10,794,280				DA1 Imp	
2	SCS Runoff	800.27	5	770.00	7,526,796				DA1 Perv	
3	Combine	1847.79	5	770.00	18,321,070	1, 2			DA1 Combine	
4	SCS Runoff	591.83	5	780.00	6,780,025				DA2 Imp	
5	SCS Runoff	664.30	5	780.00	6,969,437				DA2 Perv	
6	Combine	1256.14	5	780.00	13,749,460	4, 5			DA2 Combine	
7	SCS Runoff	413.04	5	870.00	8,771,452				DA3 Imp	
8	SCS Runoff	366.54	5	875.00	7,341,147				DA3 Perv	
9	Combine	778.50	5	875.00	16,112,600	7, 8			DA3 Combine	
10	SCS Runoff	513.72	5	830.00	8,829,531				DA4 Imp	
11	SCS Runoff	592.48	5	835.00	9,593,857				DA4 Perv	
12	Combine	1103.99	5	835.00	18,423,390	10, 11			DA4 Combine	
13	Reach	1087.03	5	845.00	18,423,390	12			DA4+Lag	
14	Reach	747.50	5	900.00	16,112,600	9			DA3 + Lag	
15	Diversion1	1218.45	5	780.00	13,336,980	6			Stream	
16	Diversion2	37.68	5	780.00	412,484	6			Divert to Basin	
17	Reservoir	16.80	5	860.00	412,480	16	559.55	181,305	School Basin	
18	Combine	1222.10	5	780.00	13,749,460	15, 17			Basin + Stream	
19	Diversion1	1185.44	5	780.00	13,336,980	18			Stream	
20	Diversion2	36.66	5	780.00	412,483	18			Divert to Basin	
21	Reservoir	16.63	5	865.00	412,479	20	559.50	178,434	Gym Pond	
22	Combine	1915.05	5	820.00	32,172,820	13, 19, 21			<no description>	
23	Reach	1892.04	5	835.00	32,172,790	22			DA4+DA2+Lag	
24	Combine	3656.85	5	795.00	66,606,420	3, 14, 23			Outfall	
25	Diversion1	3620.29	5	795.00	65,940,390	24			Stream	
26	Diversion2	36.57	5	795.00	666,064	24			Divert to Wetland	
27	Reservoir	16.04	5	980.00	666,042	26	558.75	254,316	Wetland	
28	Combine	3632.02	5	795.00	66,606,370	25, 27			Outfall	
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Hyd. No.	Hydrograph type	Peak flow	Time interval	Time to peak	Volume	Inflow hyd(s)	Maximum elevation	Maximum storage	Hydrograph description	
	(origin)	(cfs)	(min)	(min)	(cuft)		(ft)	(cuft)		
1	SCS Runoff	1136.61	5	770.00	11,736,950				DA1 Imp	
2	SCS Runoff	898.09	5	770.00	8,441,711				DA1 Perv	
3	Combine	2034.69	5	770.00	20,178,660	1, 2			DA1 Combine	
4	SCS Runoff	642.17	5	780.00	7,372,131				DA2 Imp	
5	SCS Runoff	745.64	5	780.00	7,816,602				DA2 Perv	
6	Combine	1387.81	5	780.00	15,188,730	4, 5			DA2 Combine	
7	SCS Runoff	448.24	5	870.00	9,537,475				DA3 Imp	
8	SCS Runoff	413.77	5	875.00	8,263,064				DA3 Perv	
9	Combine	860.83	5	875.00	17,800,530	7, 8			DA3 Combine	
10	SCS Runoff	557.47	5	830.00	9,600,611				DA4 Imp	
11	SCS Runoff	675.14	5	835.00	10,880,890				DA4 Perv	
12	Combine	1230.20	5	835.00	20,481,500	10, 11			DA4 Combine	
13	Reach	1212.79	5	845.00	20,481,510	12			DA4+Lag	
14	Reach	828.31	5	900.00	17,800,530	9			DA3 + Lag	
15	Diversion1	1346.18	5	780.00	14,733,070	6			Stream	
16	Diversion2	41.63	5	780.00	455,661	6			Diver to Basin	
17	Reservoir	17.71	5	865.00	455,657	16	559.87	199,673	School Basin	
18	Combine	1351.23	5	780.00	15,188,720	15, 17			Basin + Stream	
19	Diversion1	1310.70	5	780.00	14,733,060	18			Stream	
20	Diversion2	40.54	5	780.00	455,662	18			Diver to Basin	
21	Reservoir	17.54	5	865.00	455,657	20	559.81	196,106	Gym Pond	
22	Combine	2129.92	5	815.00	35,670,220	13, 19, 21			<no description>	
23	Reach	2105.68	5	835.00	35,670,180	22			DA4+DA2+Lag	
24	Combine	4063.66	5	795.00	73,649,400	3, 14, 23			Outfall	
25	Diversion1	4023.03	5	795.00	72,912,920	24			Stream	
26	Diversion2	40.64	5	795.00	736,493	24			Diver to Wetland	
27	Reservoir	16.51	5	990.00	736,472	26	558.99	294,301	Wetland	
28	Combine	4035.97	5	795.00	73,649,210	25, 27			Outfall	
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Appendix D.3

Hydraulic Backup



Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	21056	10yr	Existing	543	583.87	587.46	587.46	588.53	0.015491	9.03	83.27	56.23	0.95	
Main	21056	10yr	Proposed	543	583.87	587.46	587.46	588.53	0.015491	9.03	83.27	56.23	0.95	0
Main	21056	10yr+2050	Existing	633	583.87	587.85	587.85	588.8	0.012144	8.72	109.24	72.87	0.86	
Main	21056	10yr+2050	Proposed	633	583.87	587.85	587.85	588.8	0.012144	8.72	109.24	72.87	0.86	0
Main	21056	10yr+2080	Existing	658	583.87	587.92	587.92	588.87	0.011925	8.77	114.69	76.73	0.86	
Main	21056	10yr+2080	Proposed	658	583.87	587.92	587.92	588.87	0.011925	8.77	114.69	76.73	0.86	0
Main	21056	25yr	Existing	715	583.87	588.08	588.08	589.03	0.011351	8.84	127.73	86.45	0.84	
Main	21056	25yr	Proposed	715	583.87	588.08	588.08	589.03	0.011351	8.84	127.73	86.45	0.84	0
Main	21056	25yr+2050	Existing	840	583.87	588.67	588.67	589.28	0.006923	7.67	215.54	211.31	0.67	
Main	21056	25yr+2050	Proposed	840	583.87	588.67	588.67	589.28	0.006923	7.67	215.54	211.31	0.67	0
Main	21056	25yr+2080	Existing	904	583.87	588.78	588.78	589.4	0.006863	7.78	241.18	239.39	0.67	
Main	21056	25yr+2080	Proposed	904	583.87	588.78	588.78	589.4	0.006863	7.78	241.18	239.39	0.67	0
Main	21056	50yr	Existing	870	583.87	588.67	588.67	589.33	0.007458	7.96	215	211.05	0.7	
Main	21056	50yr	Proposed	870	583.87	588.67	588.67	589.33	0.007458	7.96	215	211.05	0.7	0
Main	21056	50yr+2050	Existing	1017	583.87	588.95	588.95	589.53	0.006541	7.8	283.91	258.47	0.66	
Main	21056	50yr+2050	Proposed	1017	583.87	588.95	588.95	589.53	0.006541	7.8	283.91	258.47	0.66	0
Main	21056	50yr+2080	Existing	1104	583.87	589.03	589.03	589.63	0.006767	8.03	305.39	273.79	0.68	
Main	21056	50yr+2080	Proposed	1104	583.87	589.03	589.03	589.63	0.006767	8.03	305.39	273.79	0.68	0
Main	21056	100yr	Existing	1045	583.87	588.97	588.97	589.56	0.006716	7.93	288.6	262.91	0.67	
Main	21056	100yr	Proposed	1045	583.87	588.97	588.97	589.56	0.006716	7.93	288.6	262.91	0.67	0
Main	21056	100yr+2050	Existing	1201	583.87	589.13	589.13	589.72	0.006794	8.17	333.5	289.85	0.68	
Main	21056	100yr+2050	Proposed	1201	583.87	589.13	589.13	589.72	0.006794	8.17	333.5	289.85	0.68	0
Main	21056	100yr+2080	Existing	1230	583.87	589.16	589.16	589.75	0.006805	8.21	341.63	293.54	0.68	
Main	21056	100yr+2080	Proposed	1230	583.87	589.16	589.16	589.75	0.006805	8.21	341.63	293.54	0.68	0
Main	20804	10yr	Existing	543	582.45	585.73		585.88	0.003043	3.66	195.92	112.71	0.41	
Main	20804	10yr	Proposed	543	582.45	585.73		585.88	0.003043	3.66	195.92	112.71	0.41	0
Main	20804	10yr+2050	Existing	633	582.45	585.88		586.05	0.003324	3.98	214.33	131.91	0.44	
Main	20804	10yr+2050	Proposed	633	582.45	585.88		586.05	0.003324	3.98	214.33	131.91	0.44	0
Main	20804	10yr+2080	Existing	658	582.45	585.92		586.1	0.003389	4.06	219.82	138.29	0.44	
Main	20804	10yr+2080	Proposed	658	582.45	585.92		586.1	0.003389	4.06	219.82	138.29	0.44	0
Main	20804	25yr	Existing	715	582.45	586.01		586.19	0.003551	4.25	232.23	152.14	0.45	
Main	20804	25yr	Proposed	715	582.45	586.01		586.19	0.003551	4.25	232.23	152.14	0.45	0
Main	20804	25yr+2050	Existing	840	582.45	586.19		586.4	0.00389	4.65	264.93	199.5	0.48	
Main	20804	25yr+2050	Proposed	840	582.45	586.19		586.4	0.00389	4.65	264.93	199.5	0.48	0
Main	20804	25yr+2080	Existing	904	582.45	586.28		586.49	0.004013	4.81	282.05	210.75	0.49	
Main	20804	25yr+2080	Proposed	904	582.45	586.28		586.49	0.004013	4.81	282.05	210.75	0.49	0
Main	20804	50yr	Existing	870	582.45	586.23		586.44	0.003949	4.72	272.86	206.04	0.48	
Main	20804	50yr	Proposed	870	582.45	586.23		586.44	0.003949	4.72	272.86	206.04	0.48	0
Main	20804	50yr+2050	Existing	1017	582.45	586.42		586.65	0.004152	5.05	313.34	224.92	0.5	
Main	20804	50yr+2050	Proposed	1017	582.45	586.42		586.65	0.004152	5.05	313.34	224.92	0.5	0
Main	20804	50yr+2080	Existing	1104	582.45	586.53		586.76	0.004218	5.2	337.48	232.23	0.51	
Main	20804	50yr+2080	Proposed	1104	582.45	586.53		586.76	0.004218	5.2	337.48	232.23	0.51	0
Main	20804	100yr	Existing	1045	582.45	586.46		586.68	0.004161	5.09	321.7	227.48	0.5	
Main	20804	100yr	Proposed	1045	582.45	586.46		586.68	0.004161	5.09	321.7	227.48	0.5	0
Main	20804	100yr+2050	Existing	1201	582.45	586.63		586.87	0.004313	5.37	362.75	241.13	0.52	
Main	20804	100yr+2050	Proposed	1201	582.45	586.63		586.87	0.004313	5.37	362.75	241.13	0.52	0
Main	20804	100yr+2080	Existing	1230	582.45	586.67		586.91	0.004341	5.42	370.42	244.31	0.52	
Main	20804	100yr+2080	Proposed	1230	582.45	586.67		586.91	0.004341	5.42	370.42	244.31	0.52	0
Main	20448	10yr	Existing	543	580.71	584.85		584.94	0.00222	3.4	348.17	332.74	0.36	
Main	20448	10yr	Proposed	543	580.71	584.85		584.94	0.00222	3.4	348.17	332.74	0.36	0
Main	20448	10yr+2050	Existing	633	580.71	585		585.09	0.002155	3.46	396.73	337.33	0.36	
Main	20448	10yr+2050	Proposed	633	580.71	585		585.09	0.002155	3.46	396.73	337.33	0.36	0
Main	20448	10yr+2080	Existing	658	580.71	585.03		585.12	0.002154	3.49	409.14	339.3	0.36	
Main	20448	10yr+2080	Proposed	658	580.71	585.03		585.12	0.002154	3.49	409.14	339.3	0.36	0
Main	20448	25yr	Existing	715	580.71	585.13		585.22	0.002047	3.48	443.72	341.99	0.35	
Main	20448	25yr	Proposed	715	580.71	585.13		585.22	0.002047	3.48	443.72	341.99	0.35	0
Main	20448	25yr+2050	Existing	840	580.71	585.28		585.37	0.002108	3.65	493.88	345.64	0.36	
Main	20448	25yr+2050	Proposed	840	580.71	585.28		585.37	0.002108	3.65	493.88	345.64	0.36	0
Main	20448	25yr+2080	Existing	904	580.71	585.37		585.46	0.002077	3.68	523.52	347.71	0.36	
Main	20448	25yr+2080	Proposed	904	580.71	585.37		585.46	0.002077	3.68	523.52	347.71	0.36	0
Main	20448	50yr	Existing	870	580.71	585.32		585.42	0.002077	3.65	509.28	346.72	0.36	
Main	20448	50yr	Proposed	870	580.71	585.32		585.42	0.002077	3.65	509.28	346.72	0.36	0
Main	20448	50yr+2050	Existing	1017	580.71	585.48		585.58	0.002124	3.81	565.33	351.3	0.36	
Main	20448	50yr+2050	Proposed	1017	580.71	585.48		585.58	0.002124	3.81	565.33	351.3	0.36	0
Main	20448	50yr+2080	Existing	1104	580.71	585.57		585.67	0.002178	3.92	593.82	353.34	0.37	
Main	20448	50yr+2080	Proposed	1104	580.71	585.57		585.67	0.002178	3.92	593.82	353.34	0.37	0
Main	20448	100yr	Existing	1045	580.71	585.51		585.61	0.002156	3.86	573.25	351.87	0.37	
Main	20448	100yr	Proposed	1045	580.71	585.51		585.61	0.002156	3.86	573.25	351.87	0.37	0
Main	20448	100yr+2050	Existing	1201	580.71	585.66		585.77	0.002192	4.01	628.21	355.33	0.37	
Main	20448	100yr+2050	Proposed	1201	580.71	585.66		585.77	0.002192	4.01	628.21	355.33	0.37	0
Main	20448	100yr+2080	Existing	1230	580.71	585.69		585.79	0.0022	4.03	637.74	355.82	0.37	
Main	20448	100yr+2080	Proposed	1230	580.71	585.69		585.79	0.0022	4.03	637.74	355.82	0.37	0
Main	20131	10yr	Existing	543	578.95	583.36	583.29	583.77	0.006896	5.78	160.83	189.71	0.62	
Main	20131	10yr	Proposed	543	578.95	583.36	583.29	583.77	0.006896	5.78	160.83	189.71	0.62	0
Main	20131	10yr+2050	Existing	633	578.95	583.5	583.34	583.92	0.007044	6.04	190.58	240.78	0.64	
Main	20131	10yr+2050	Proposed	633	578.95	583.5	583.34	583.92	0.007044	6.04	190.58	240.78	0.64	0
Main	20131	10yr+2080	Existing	658	578.95	583.53	583.46	583.96	0.007052	6.09	199.36	258.22	0.64	
Main	20131	10yr+2080	Proposed	658	578.95	583.53	583.46	583.96	0.007052	6.09	199.36	258.22	0.64	0
Main	20131	25yr	Existing	715	578.95	583.61	583.6	584.07	0.007444	6.37	220.5	286.94	0.66	
Main	20131	25yr	Proposed	715	578.95	583.61	583.6	584.07	0.007444	6.37	220.5	286.94	0.66	0
Main	20131	25yr+2050	Existing	840	578.95	583.78	583.78	584.22	0.007064	6.45	272.77	312.99	0.65	
Main	20131	25yr+2050	Proposed	840	578.95	583.78	583.78	584.22	0.007064	6.45	272.77	312.99	0.65	0
Main	20131	25yr+2080	Existing	904	578.95	583.81	583.81	584.28	0.007634	6.75	282.03	313.75	0.67	
Main	20131	25yr+2080	Proposed	904	578.95	583.81	583.81	584.28	0.007634	6.75	282.03	313.75	0.67	0
Main	20131	50yr	Existing	870	578.95	583.79	583.79	584.25	0.007467	6.64	274.74	313.15	0.66	
Main	20131	50yr	Proposed	870	578.95	583.79	583.79	5						

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	19868	50yr+2050	Existing	1017	578.35	582.17		582.44	0.006762	5.95	345.29	280.14	0.63	
Main	19868	50yr+2050	Proposed	1017	578.35	582.17		582.44	0.006762	5.95	345.29	280.14	0.63	0
Main	19868	50yr+2080	Existing	1104	578.35	582.26		582.53	0.006636	6.01	369.75	288.02	0.63	
Main	19868	50yr+2080	Proposed	1104	578.35	582.26		582.53	0.006636	6.01	369.75	288.02	0.63	0
Main	19868	100yr	Existing	1045	578.35	582.2		582.47	0.006718	5.97	353.22	281.46	0.63	
Main	19868	100yr	Proposed	1045	578.35	582.2		582.47	0.006718	5.97	353.22	281.46	0.63	0
Main	19868	100yr+2050	Existing	1201	578.35	582.35		582.62	0.006463	6.07	398.13	291.22	0.62	
Main	19868	100yr+2050	Proposed	1201	578.35	582.35		582.62	0.006463	6.07	398.13	291.22	0.62	0
Main	19868	100yr+2080	Existing	1230	578.35	582.38		582.65	0.006413	6.08	406.14	292.04	0.62	
Main	19868	100yr+2080	Proposed	1230	578.35	582.38		582.65	0.006413	6.08	406.14	292.04	0.62	0
Main	19602	10yr	Existing	543	578.29	580.4		580.5	0.003716	3.46	284.89	274.43	0.44	
Main	19602	10yr	Proposed	543	578.29	580.4		580.5	0.003716	3.46	284.89	274.43	0.44	0
Main	19602	10yr+2050	Existing	633	578.29	580.53		580.63	0.003679	3.59	320.63	285.98	0.45	
Main	19602	10yr+2050	Proposed	633	578.29	580.53		580.63	0.003679	3.59	320.63	285.98	0.45	0
Main	19602	10yr+2080	Existing	658	578.29	580.56		580.66	0.00374	3.65	327.61	287.22	0.45	
Main	19602	10yr+2080	Proposed	658	578.29	580.56		580.66	0.00374	3.65	327.61	287.22	0.45	0
Main	19602	25yr	Existing	715	578.29	580.61		580.72	0.003839	3.77	344.14	290.15	0.46	
Main	19602	25yr	Proposed	715	578.29	580.61		580.72	0.003839	3.77	344.14	290.15	0.46	0
Main	19602	25yr+2050	Existing	840	578.29	580.75		580.87	0.003907	3.97	384.65	300.98	0.47	
Main	19602	25yr+2050	Proposed	840	578.29	580.75		580.87	0.003907	3.97	384.65	300.98	0.47	0
Main	19602	25yr+2080	Existing	904	578.29	580.81		580.93	0.004037	4.1	401.57	306.48	0.48	
Main	19602	25yr+2080	Proposed	904	578.29	580.8		580.93	0.004052	4.1	401.05	306.43	0.48	-0.01
Main	19602	50yr	Existing	870	578.29	580.78		580.9	0.003941	4.02	394.14	304.96	0.47	
Main	19602	50yr	Proposed	870	578.29	580.78		580.9	0.003941	4.02	394.14	304.96	0.47	0
Main	19602	50yr+2050	Existing	1017	578.29	580.93		581.06	0.003915	4.18	439.36	310.15	0.47	
Main	19602	50yr+2050	Proposed	1017	578.29	580.93		581.06	0.003915	4.18	439.36	310.15	0.47	0
Main	19602	50yr+2080	Existing	1104	578.29	581.01		581.14	0.003989	4.31	463.73	317.02	0.48	
Main	19602	50yr+2080	Proposed	1104	578.29	581.01		581.14	0.003989	4.31	463.73	317.02	0.48	0
Main	19602	100yr	Existing	1045	578.29	580.95		581.08	0.003971	4.23	445.34	310.73	0.48	
Main	19602	100yr	Proposed	1045	578.29	580.95		581.08	0.003971	4.23	445.34	310.73	0.48	0
Main	19602	100yr+2050	Existing	1201	578.29	581.05		581.2	0.004337	4.54	477.88	319.76	0.5	
Main	19602	100yr+2050	Proposed	1201	578.29	581.05		581.2	0.004337	4.54	477.88	319.76	0.5	0
Main	19602	100yr+2080	Existing	1230	578.29	581.07		581.22	0.00441	4.6	483.15	320.78	0.51	
Main	19602	100yr+2080	Proposed	1230	578.29	581.07		581.22	0.00441	4.6	483.15	320.78	0.51	0
Main	19454	10yr	Existing	543	576.17	579.34	579.34	579.69	0.008135	5.53	185.44	286.69	0.66	
Main	19454	10yr	Proposed	543	576.17	579.34	579.34	579.69	0.008135	5.53	185.44	286.69	0.66	0
Main	19454	10yr+2050	Existing	633	576.17	579.43	579.43	579.81	0.008673	5.86	210.88	303.36	0.69	
Main	19454	10yr+2050	Proposed	633	576.17	579.43	579.43	579.81	0.008673	5.86	210.88	303.36	0.69	0
Main	19454	10yr+2080	Existing	658	576.17	579.46	579.46	579.83	0.008521	5.86	220.8	306.89	0.68	
Main	19454	10yr+2080	Proposed	658	576.17	579.46	579.46	579.83	0.008521	5.86	220.8	306.89	0.68	0
Main	19454	25yr	Existing	715	576.17	579.53	579.53	579.89	0.008392	5.92	240.01	311.32	0.68	
Main	19454	25yr	Proposed	715	576.17	579.53	579.53	579.89	0.008392	5.92	240.01	311.32	0.68	0
Main	19454	25yr+2050	Existing	840	576.17	579.62	579.62	580	0.008928	6.27	269.4	318.7	0.71	
Main	19454	25yr+2050	Proposed	840	576.17	579.62	579.62	580	0.008928	6.27	269.4	318.7	0.71	0
Main	19454	25yr+2080	Existing	904	576.17	579.68	579.68	580.06	0.00873	6.3	289.24	325.59	0.7	
Main	19454	25yr+2080	Proposed	904	576.17	579.68	579.68	580.06	0.008657	6.28	290.25	325.82	0.7	0
Main	19454	50yr	Existing	870	576.17	579.64	579.64	580.03	0.00901	6.34	276.42	320.86	0.71	
Main	19454	50yr	Proposed	870	576.17	579.64	579.64	580.03	0.00901	6.34	276.42	320.86	0.71	0
Main	19454	50yr+2050	Existing	1017	576.17	579.72	579.72	580.15	0.009971	6.81	301.79	328.36	0.75	
Main	19454	50yr+2050	Proposed	1017	576.17	579.72	579.72	580.15	0.009971	6.81	301.79	328.36	0.75	0
Main	19454	50yr+2080	Existing	1104	576.17	579.78	579.78	580.22	0.01025	7	320.61	332.24	0.77	
Main	19454	50yr+2080	Proposed	1104	576.17	579.78	579.78	580.22	0.01025	7	320.61	332.24	0.77	0
Main	19454	100yr	Existing	1045	576.17	579.74	579.74	580.17	0.009824	6.8	310.47	330.26	0.75	
Main	19454	100yr	Proposed	1045	576.17	579.74	579.74	580.17	0.009824	6.8	310.47	330.26	0.75	0
Main	19454	100yr+2050	Existing	1201	576.17	579.9	579.9	580.29	0.008933	6.74	361.42	336.24	0.72	
Main	19454	100yr+2050	Proposed	1201	576.17	579.9	579.9	580.29	0.008933	6.74	361.42	336.24	0.72	0
Main	19454	100yr+2080	Existing	1230	576.17	579.94	579.94	580.31	0.008529	6.65	374.7	337.6	0.71	
Main	19454	100yr+2080	Proposed	1230	576.17	579.94	579.94	580.31	0.008529	6.65	374.7	337.6	0.71	0
Main	19336.9	10yr	Existing	543	576.03	578.81	577.89	578.88	0.001543	2.63	306.16	199.42	0.3	
Main	19336.9	10yr	Proposed	543	576.03	578.81	577.89	578.88	0.001543	2.63	306.15	199.41	0.3	0
Main	19336.9	10yr+2050	Existing	633	576.03	578.95	577.97	579.02	0.001627	2.8	333.72	202.21	0.31	
Main	19336.9	10yr+2050	Proposed	633	576.03	578.95	577.97	579.02	0.001627	2.8	333.72	202.21	0.31	0
Main	19336.9	10yr+2080	Existing	658	576.03	578.98	578	579.06	0.001648	2.85	341.04	202.94	0.31	
Main	19336.9	10yr+2080	Proposed	658	576.03	578.98	578	579.06	0.001648	2.85	341.04	202.94	0.31	0
Main	19336.9	25yr	Existing	715	576.03	579.07	578.05	579.15	0.001685	2.94	358.09	204.63	0.32	
Main	19336.9	25yr	Proposed	715	576.03	579.07	578.05	579.15	0.001686	2.94	358.05	204.62	0.32	0
Main	19336.9	25yr+2050	Existing	840	576.03	579.23	578.15	579.32	0.00178	3.15	392.23	208.45	0.33	
Main	19336.9	25yr+2050	Proposed	840	576.03	579.23	578.15	579.32	0.00178	3.15	392.23	208.45	0.33	0
Main	19336.9	25yr+2080	Existing	904	576.03	579.31	578.2	579.41	0.001823	3.24	409.19	210.5	0.33	
Main	19336.9	25yr+2080	Proposed	904	576.03	579.31	578.2	579.41	0.001823	3.24	409.21	210.51	0.33	0
Main	19336.9	50yr	Existing	870	576.03	579.27	578.17	579.37	0.001798	3.19	400.42	209.44	0.33	
Main	19336.9	50yr	Proposed	870	576.03	579.27	578.17	579.37	0.001798	3.19	400.41	209.44	0.33	0
Main	19336.9	50yr+2050	Existing	1017	576.03	579.46	578.28	579.56	0.00189	3.41	439.51	215.87	0.34	
Main	19336.9	50yr+2050	Proposed	1017	576.03	579.46	578.28	579.56	0.00189	3.41	439.48	215.87	0.34	0
Main	19336.9	50yr+2080	Existing	1104	576.03	579.55	578.34	579.67	0.001953	3.54	460.66	219.43	0.35	
Main	19336.9	50yr+2080	Proposed	1104	576.03	579.55	578.34	579.67	0.001953	3.54	460.63	219.43	0.35	0
Main	19336.9	100yr	Existing	1045	576.03	579.49	578.3	579.6	0.001913	3.45	446.41	217.33	0.34	
Main	19336.9	100yr	Proposed	1045	576.03	579.49	578.3	579.6	0.001913	3.45	446.4	217.33	0.34	0
Main	19336.9	100yr+2050	Existing	1201	576.03	579.65	578.38	579.77	0.002023	3.67	482.78	226.4	0.36	
Main	19336.9	100yr+2050	Proposed	1201	576.03	579.65	578.38	579.77	0.002023	3.67	482.78	226.4	0.36	0
Main	19336.9	100yr+2080	Existing	1230	576.03	579.68	578.41	579.81	0.00204	3.71	489.55	231.89	0.36	
Main	19336.9	100yr+2080	Proposed	1230	576.03	579.68	578.41	579.81	0.00204	3.71	489.55	231.89	0.36	0
Main	19276.7	10yr	Existing	543	575.93	578.72	578.24	578.77	0.001784	2.45	324.46	239.5	0.31	
Main	19276.7	10yr	Proposed	543	575.93	578.72	578.24	578.77	0.001784	2.45	324.46	239.5	0.31	0
Main	19276.7	10yr+2050	Existing	633	575.93	578.86</								

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	19065.8	10yr+2050	Proposed	633	576.59	577.89		578.1	0.012696	4.25	174.33	161.84	0.74	0
Main	19065.8	10yr+2080	Existing	658	576.59	577.92		578.13	0.012562	4.29	179.77	163.6	0.74	
Main	19065.8	10yr+2080	Proposed	658	576.59	577.92		578.13	0.012598	4.29	179.59	163.54	0.74	0
Main	19065.8	25yr	Existing	715	576.59	577.99		578.21	0.0123	4.42	191.71	167.23	0.74	
Main	19065.8	25yr	Proposed	715	576.59	577.99		578.21	0.01235	4.42	191.45	167.15	0.74	0
Main	19065.8	25yr+2050	Existing	840	576.59	578.14		578.38	0.011945	4.73	217.14	176.2	0.74	
Main	19065.8	25yr+2050	Proposed	840	576.59	578.14		578.38	0.011956	4.73	217.08	176.18	0.74	0
Main	19065.8	25yr+2080	Existing	904	576.59	578.21		578.46	0.011723	4.86	229.77	179.5	0.74	
Main	19065.8	25yr+2080	Proposed	904	576.59	578.21		578.46	0.011841	4.87	228.98	179.29	0.74	0
Main	19065.8	50yr	Existing	870	576.59	578.18		578.42	0.011806	4.79	223.28	177.79	0.74	
Main	19065.8	50yr	Proposed	870	576.59	578.17		578.42	0.01194	4.8	222.42	177.57	0.74	-0.01
Main	19065.8	50yr+2050	Existing	1017	576.59	578.33		578.59	0.011407	5.07	251.48	185.23	0.74	
Main	19065.8	50yr+2050	Proposed	1017	576.59	578.33		578.59	0.011393	5.07	251.58	185.25	0.74	0
Main	19065.8	50yr+2080	Existing	1104	576.59	578.41		578.69	0.011346	5.24	266.21	188.69	0.74	
Main	19065.8	50yr+2080	Proposed	1104	576.59	578.41		578.69	0.011269	5.23	266.82	188.84	0.74	0
Main	19065.8	100yr	Existing	1045	576.59	578.36		578.62	0.011376	5.12	256.33	186.38	0.74	
Main	19065.8	100yr	Proposed	1045	576.59	578.36		578.63	0.011356	5.12	256.48	186.41	0.74	0
Main	19065.8	100yr+2050	Existing	1201	576.59	578.49		578.78	0.01137	5.42	281.45	192.62	0.75	
Main	19065.8	100yr+2050	Proposed	1201	576.59	578.49		578.78	0.01137	5.42	281.45	192.62	0.75	0
Main	19065.8	100yr+2080	Existing	1230	576.59	578.52		578.82	0.011265	5.46	286.84	195.43	0.75	
Main	19065.8	100yr+2080	Proposed	1230	576.59	578.51		578.81	0.011348	5.47	286.13	195.06	0.75	-0.01
Main	18990	10yr	Existing	543	575.77	576.73		576.94	0.01306	3.04	145.88	130.36	0.68	
Main	18990	10yr	Proposed	543	575.77	576.74		576.95	0.012838	3.02	146.87	130.87	0.68	0.01
Main	18990	10yr+2050	Existing	633	575.77	576.85		577.09	0.013908	3.35	162.46	141.89	0.71	
Main	18990	10yr+2050	Proposed	633	575.77	576.85		577.09	0.013959	3.35	162.21	141.74	0.71	0
Main	18990	10yr+2080	Existing	658	575.77	576.88		577.12	0.014144	3.4	166.62	144.46	0.72	
Main	18990	10yr+2080	Proposed	658	575.77	576.89		577.13	0.013975	3.39	167.46	144.98	0.72	0.01
Main	18990	25yr	Existing	715	575.77	576.93		577.19	0.014848	3.54	174.07	147.68	0.74	
Main	18990	25yr	Proposed	715	575.77	576.94		577.2	0.014633	3.52	174.99	148.02	0.74	0.01
Main	18990	25yr+2050	Existing	840	575.77	577.05		577.35	0.015548	3.76	192.92	155.49	0.77	
Main	18990	25yr+2050	Proposed	840	575.77	577.06		577.35	0.015502	3.75	193.15	155.61	0.77	0.01
Main	18990	25yr+2080	Existing	904	575.77	577.12		577.43	0.015926	3.88	202.75	160.63	0.78	
Main	18990	25yr+2080	Proposed	904	575.77	577.13		577.44	0.015394	3.83	205.62	162.22	0.77	0.01
Main	18990	50yr	Existing	870	575.77	577.08		577.38	0.015863	3.83	196.84	157.5	0.78	
Main	18990	50yr	Proposed	870	575.77	577.1		577.39	0.015279	3.78	199.81	159.01	0.76	0.02
Main	18990	50yr+2050	Existing	1017	575.77	577.25		577.57	0.016294	4.08	224.28	176.17	0.8	
Main	18990	50yr+2050	Proposed	1017	575.77	577.24		577.56	0.016387	4.09	223.64	175.65	0.8	-0.01
Main	18990	50yr+2080	Existing	1104	575.77	577.33		577.66	0.016389	4.29	238.92	183.05	0.81	
Main	18990	50yr+2080	Proposed	1104	575.77	577.32		577.65	0.016753	4.31	236.97	182.33	0.82	-0.01
Main	18990	100yr	Existing	1045	575.77	577.27		577.6	0.016355	4.16	229.12	178.82	0.8	
Main	18990	100yr	Proposed	1045	575.77	577.27		577.59	0.016453	4.16	228.56	178.55	0.8	0
Main	18990	100yr+2050	Existing	1201	575.77	577.41		577.76	0.016358	4.49	254.25	188.12	0.82	
Main	18990	100yr+2050	Proposed	1201	575.77	577.41		577.76	0.016358	4.49	254.25	188.12	0.82	0
Main	18990	100yr+2080	Existing	1230	575.77	577.42		577.78	0.016878	4.58	255.72	188.51	0.83	
Main	18990	100yr+2080	Proposed	1230	575.77	577.43		577.78	0.016486	4.55	257.84	189.08	0.82	0.01
Main	18912.4	10yr	Existing	543	574.67	575.51		575.75	0.018226	3.79	139.68	152.03	0.82	
Main	18912.4	10yr	Proposed	543	574.67	575.5		575.74	0.018856	3.83	138.15	151.71	0.84	-0.01
Main	18912.4	10yr+2050	Existing	633	574.67	575.65		575.89	0.01708	4.15	161.48	165.27	0.82	
Main	18912.4	10yr+2050	Proposed	633	574.67	575.66		575.89	0.016798	4.14	162.36	165.47	0.82	0.01
Main	18912.4	10yr+2080	Existing	658	574.67	575.68		575.93	0.016708	4.22	166.81	166.45	0.82	
Main	18912.4	10yr+2080	Proposed	658	574.67	575.67		575.92	0.017228	4.25	165.15	166.08	0.83	-0.01
Main	18912.4	25yr	Existing	715	574.67	575.78		576.02	0.015126	4.3	181.99	169.74	0.79	
Main	18912.4	25yr	Proposed	715	574.67	575.75		576	0.016136	4.37	178.16	168.91	0.81	-0.03
Main	18912.4	25yr+2050	Existing	840	574.67	575.9		576.17	0.014788	4.63	203.36	173.24	0.8	
Main	18912.4	25yr+2050	Proposed	840	574.67	575.9		576.17	0.014889	4.64	202.91	173.17	0.8	0
Main	18912.4	25yr+2080	Existing	904	574.67	575.96		576.24	0.014548	4.77	214.35	174.93	0.8	
Main	18912.4	25yr+2080	Proposed	904	574.67	575.94		576.23	0.015587	4.86	209.63	174.21	0.83	-0.02
Main	18912.4	50yr	Existing	870	574.67	575.94		576.21	0.014389	4.67	209.85	174.24	0.79	
Main	18912.4	50yr	Proposed	870	574.67	575.91		576.19	0.015609	4.77	204.42	173.4	0.82	-0.03
Main	18912.4	50yr+2050	Existing	1017	574.67	576.06		576.36	0.014569	5.06	231.59	178.24	0.81	
Main	18912.4	50yr+2050	Proposed	1017	574.67	576.07		576.37	0.014303	5.03	233.03	178.55	0.81	0.01
Main	18912.4	50yr+2080	Existing	1104	574.67	576.14		576.46	0.014432	5.25	245.52	181.2	0.82	
Main	18912.4	50yr+2080	Proposed	1104	574.67	576.16		576.47	0.01362	5.16	250.25	182.02	0.8	0.02
Main	18912.4	100yr	Existing	1045	574.67	576.09		576.39	0.014471	5.11	236.39	179.27	0.81	
Main	18912.4	100yr	Proposed	1045	574.67	576.1		576.4	0.014217	5.09	237.8	179.57	0.81	0.01
Main	18912.4	100yr+2050	Existing	1201	574.67	576.21		576.55	0.014712	5.48	257.9	183.31	0.83	
Main	18912.4	100yr+2050	Proposed	1201	574.67	576.21		576.55	0.014712	5.48	257.9	183.31	0.83	0
Main	18912.4	100yr+2080	Existing	1230	574.67	576.27		576.6	0.013402	5.4	270.2	185.37	0.8	
Main	18912.4	100yr+2080	Proposed	1230	574.67	576.24		576.58	0.014378	5.51	263.99	184.34	0.83	-0.03
Main	18730	10yr	Existing	543	572.5	573.4		573.54	0.008486	1.95	180.36	158.67	0.51	
Main	18730	10yr	Proposed	543	572.5	573.42		573.55	0.00817	1.93	182.87	159.64	0.5	0.02
Main	18730	10yr+2050	Existing	633	572.5	573.5		573.66	0.009065	2.16	196.98	165.16	0.54	
Main	18730	10yr+2050	Proposed	633	572.5	573.49		573.66	0.009274	2.17	195.35	164.55	0.54	-0.01
Main	18730	10yr+2080	Existing	658	572.5	573.53		573.69	0.009269	2.22	200.98	166.64	0.55	
Main	18730	10yr+2080	Proposed	658	572.5	573.55		573.71	0.008773	2.2	205.06	168.14	0.53	0.02
Main	18730	25yr	Existing	715	572.5	573.55		573.74	0.010364	2.39	205.02	168.12	0.58	
Main	18730	25yr	Proposed	715	572.5	573.59		573.77	0.009479	2.34	212	170.97	0.56	0.04
Main	18730	25yr+2050	Existing	840	572.5	573.72		573.92	0.010254	2.62	235.2	184.55	0.59	
Main	18730	25yr+2050	Proposed	840	572.5	573.73		573.93	0.010147	2.6	236.17	185.03	0.59	0.01
Main	18730	25yr+2080	Existing	904	572.5	573.79		574	0.010367	2.65	248.08	190.71	0.6	
Main	18730	25yr+2080	Proposed	904	572.5	573.84		574.04	0.009341	2.58	258.18	194.92	0.57	0.05
Main	18730	50yr	Existing	870	572.5	573.74		573.95	0.010619	2.66	238.48	186.16	0.6	
Main	18730	50yr	Proposed	870	572.5	573.8		573.99	0.00939	2.53	250.24	191.67	0.57	0.06
Main	18730	50yr+2050	Existing	1017	572.5	573.92		574.13	0.010197	2.78	272.61	199.91	0.6	
Main	18730	50yr+2050	Proposed	1017	572.5	573.9		574.12	0.010502	2.81	269.67	198.91	0.61	-0.02
Main	18730	50yr+2080	Existing	1104	572.5	574		574.22	0.010287	2.89	288.5	205.07	0.61	
Main	18730	50yr+2												

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)	
Main	18624	50yr+2080	Proposed	1104	571.03	573.99	573.99	571.91	574.01	0.000373	0.85	985.45	367.95	0.13	-0.04
Main	18624	100yr	Existing	1045	571.03	573.98	573.98	571.91	574	0.000339	0.81	980.8	367.58	0.12	
Main	18624	100yr	Proposed	1045	571.03	573.97	573.97	571.91	573.98	0.000345	0.81	975.87	367.2	0.12	-0.01
Main	18624	100yr+2050	Existing	1201	571.03	574.14	574.14	571.91	574.16	0.000374	0.87	1040.04	372.22	0.13	
Main	18624	100yr+2050	Proposed	1201	571.03	574.14	574.14	571.91	574.16	0.000374	0.87	1040.04	372.22	0.13	0
Main	18624	100yr+2080	Existing	1230	571.03	574.09	574.09	571.91	574.12	0.000412	0.9	1023.58	370.94	0.14	
Main	18624	100yr+2080	Proposed	1230	571.03	574.15	574.15	571.91	574.17	0.000389	0.89	1042.7	372.43	0.13	0.06
Main	18591	10yr	Existing	543	571	573.44	573.44	571.91	573.45	0.000147	0.59	810.14	324.73	0.08	
Main	18591	10yr	Proposed	543	571	573.45	573.45	571.91	573.46	0.000145	0.59	814.24	325.26	0.08	0.01
Main	18591	10yr+2050	Existing	633	571	573.54	573.54	571.91	573.55	0.000178	0.67	843.97	329.25	0.09	
Main	18591	10yr+2050	Proposed	633	571	573.53	573.53	571.91	573.54	0.00018	0.67	841.08	328.81	0.09	-0.01
Main	18591	10yr+2080	Existing	658	571	573.57	573.57	571.91	573.58	0.000187	0.69	852.13	330.46	0.09	
Main	18591	10yr+2080	Proposed	658	571	573.59	573.59	571.91	573.6	0.000183	0.68	859.34	331.52	0.09	0.02
Main	18591	25yr	Existing	715	571	573.6	573.6	571.91	573.61	0.000214	0.74	861.57	331.85	0.1	
Main	18591	25yr	Proposed	715	571	573.63	573.63	571.91	573.64	0.000206	0.73	873.24	333.55	0.1	0.03
Main	18591	25yr+2050	Existing	840	571	573.76	573.76	571.91	573.77	0.000248	0.8	916.74	340.42	0.11	
Main	18591	25yr+2050	Proposed	840	571	573.77	573.77	571.91	573.78	0.000247	0.8	918.36	340.67	0.11	0.01
Main	18591	25yr+2080	Existing	904	571	573.83	573.83	571.91	573.84	0.000271	0.85	939.92	359.07	0.11	
Main	18591	25yr+2080	Proposed	904	571	573.87	573.87	571.91	573.89	0.000271	0.87	957.22	362.39	0.11	0.04
Main	18591	50yr	Existing	870	571	573.78	573.78	571.91	573.79	0.000261	0.82	923.03	343.57	0.11	
Main	18591	50yr	Proposed	870	571	573.84	573.84	571.91	573.85	0.000249	0.82	942.58	360.83	0.11	0.06
Main	18591	50yr+2050	Existing	1017	571	573.94	573.94	571.91	573.96	0.000315	0.96	982.62	363.19	0.12	
Main	18591	50yr+2050	Proposed	1017	571	573.93	573.93	571.91	573.95	0.00032	0.96	977.7	363.04	0.13	-0.01
Main	18591	50yr+2080	Existing	1104	571	574.02	574.02	571.91	574.04	0.000339	1.02	1010.87	365.17	0.13	
Main	18591	50yr+2080	Proposed	1104	571	573.98	573.98	571.91	574	0.000356	1.04	995.24	363.59	0.13	-0.04
Main	18591	100yr	Existing	1045	571	573.97	573.97	571.91	573.99	0.000324	0.98	991.05	363.46	0.13	
Main	18591	100yr	Proposed	1045	571	573.95	573.95	571.91	573.97	0.000329	0.99	986.1	363.3	0.13	-0.02
Main	18591	100yr+2050	Existing	1201	571	574.13	574.13	571.91	574.15	0.000355	1.09	1049.37	371.43	0.13	
Main	18591	100yr+2050	Proposed	1201	571	574.13	574.13	571.91	574.15	0.000355	1.09	1049.37	371.43	0.13	0
Main	18591	100yr+2080	Existing	1230	571	574.08	574.08	571.91	574.1	0.000393	1.13	1032.53	368.71	0.14	
Main	18591	100yr+2080	Proposed	1230	571	574.13	574.13	571.91	574.16	0.00037	1.11	1051.86	371.83	0.14	0.05
Main	18562.12		Culvert												
Main	18533.2	10yr	Existing	543	571	572	572	571.03	572.02	0.000691	0.81	437.62	224.39	0.16	
Main	18533.2	10yr	Proposed	543	571	572	572	571.03	572.02	0.000692	0.81	437.41	224.36	0.16	0
Main	18533.2	10yr+2050	Existing	633	571	572.17	572.17	571.03	572.19	0.000736	0.91	475.11	229.29	0.17	
Main	18533.2	10yr+2050	Proposed	633	571	572.17	572.17	571.03	572.19	0.000735	0.91	475.3	229.31	0.17	0
Main	18533.2	10yr+2080	Existing	658	571	572.21	572.21	571.03	572.24	0.000745	0.94	485.49	230.6	0.17	
Main	18533.2	10yr+2080	Proposed	658	571	572.21	572.21	571.03	572.24	0.000745	0.94	485.61	230.62	0.17	0
Main	18533.2	25yr	Existing	715	571	572.31	572.31	571.03	572.34	0.000768	1	508.31	233.45	0.18	
Main	18533.2	25yr	Proposed	715	571	572.31	572.31	571.03	572.34	0.000766	1	508.71	233.5	0.18	0
Main	18533.2	25yr+2050	Existing	840	571	572.51	572.51	571.03	572.55	0.000812	1.13	555.58	238.46	0.19	
Main	18533.2	25yr+2050	Proposed	840	571	572.51	572.51	571.03	572.55	0.000812	1.13	555.7	238.47	0.19	0
Main	18533.2	25yr+2080	Existing	904	571	572.61	572.61	571.03	572.65	0.000831	1.19	579.28	240.93	0.19	
Main	18533.2	25yr+2080	Proposed	904	571	572.61	572.61	571.03	572.65	0.00083	1.19	579.39	240.94	0.19	0
Main	18533.2	50yr	Existing	870	571	572.56	572.56	571.03	572.59	0.000821	1.16	566.82	239.63	0.19	
Main	18533.2	50yr	Proposed	870	571	572.56	572.56	571.03	572.59	0.000821	1.16	566.85	239.64	0.19	0
Main	18533.2	50yr+2050	Existing	1017	571	572.78	572.78	571.03	572.82	0.00086	1.29	620.04	245.3	0.2	
Main	18533.2	50yr+2050	Proposed	1017	571	572.78	572.78	571.03	572.82	0.000859	1.29	620.19	245.31	0.2	0
Main	18533.2	50yr+2080	Existing	1104	571	572.9	572.9	571.03	572.94	0.00088	1.37	650.64	248.75	0.2	
Main	18533.2	50yr+2080	Proposed	1104	571	572.9	572.9	571.03	572.94	0.00088	1.37	650.65	248.75	0.2	0
Main	18533.2	100yr	Existing	1045	571	572.82	572.82	571.03	572.86	0.000866	1.32	629.94	246.39	0.2	
Main	18533.2	100yr	Proposed	1045	571	572.82	572.82	571.03	572.86	0.000866	1.32	630.01	246.4	0.2	0
Main	18533.2	100yr+2050	Existing	1201	571	573.03	573.03	571.03	573.08	0.0009	1.44	684.12	252.68	0.2	
Main	18533.2	100yr+2050	Proposed	1201	571	573.03	573.03	571.03	573.08	0.0009	1.44	684.12	252.68	0.2	0
Main	18533.2	100yr+2080	Existing	1230	571	573.07	573.07	571.03	573.12	0.000906	1.46	694.01	253.99	0.21	
Main	18533.2	100yr+2080	Proposed	1230	571	573.07	573.07	571.03	573.12	0.000906	1.46	694.03	253.99	0.21	0
Main	18366.2	10yr	Existing	543	569.57	571.37	571.37	571.63	571.63	0.015999	4.13	131.05	113.67	0.77	
Main	18366.2	10yr	Proposed	543	569.57	571.36	571.36	571.63	571.63	0.016191	4.15	130.56	113.62	0.77	-0.01
Main	18366.2	10yr+2050	Existing	633	569.57	571.48	571.48	571.78	571.78	0.016139	4.32	144.03	115.1	0.78	
Main	18366.2	10yr+2050	Proposed	633	569.57	571.49	571.49	571.78	571.78	0.015957	4.3	144.55	115.16	0.78	0.01
Main	18366.2	10yr+2080	Existing	658	569.57	571.51	571.51	571.82	571.82	0.016165	4.37	147.55	115.48	0.78	
Main	18366.2	10yr+2080	Proposed	658	569.57	571.51	571.51	571.82	571.82	0.016023	4.36	147.96	115.53	0.78	0
Main	18366.2	25yr	Existing	715	569.57	571.57	571.57	571.9	571.9	0.016563	4.51	154.35	116.23	0.8	
Main	18366.2	25yr	Proposed	715	569.57	571.58	571.58	571.91	571.91	0.016136	4.47	155.65	116.37	0.79	0.01
Main	18366.2	25yr+2050	Existing	840	569.57	571.66	571.66	572.07	572.07	0.01846	4.91	165.26	117.42	0.85	
Main	18366.2	25yr+2050	Proposed	840	569.57	571.67	571.67	572.07	572.07	0.018202	4.89	166	117.51	0.84	0.01
Main	18366.2	25yr+2080	Existing	904	569.57	571.72	571.72	572.15	572.15	0.018892	5.06	171.93	118.15	0.86	
Main	18366.2	25yr+2080	Proposed	904	569.57	571.73	571.73	572.15	572.15	0.01863	5.03	172.7	118.24	0.85	0.01
Main	18366.2	50yr	Existing	870	569.57	571.69	571.69	572.11	572.11	0.018547	4.97	168.75	117.81	0.85	
Main	18366.2	50yr	Proposed	870	569.57	571.7	571.7	572.11	572.11	0.018456	4.96	169.02	117.83	0.85	0.01
Main	18366.2	50yr+2050	Existing	1017	569.57	571.8	571.8	572.29	572.29	0.020362	5.38	181.02	119.14	0.9	
Main	18366.2	50yr+2050	Proposed	1017	569.57	571.81	571.81	572.29	572.29	0.019932	5.34	182.26	119.27	0.89	0.01
Main	18366.2	50yr+2080	Existing	1104	569.57	571.86	571.86	572.39	572.39	0.020995	5.57	188.96	119.99	0.92	
Main	18366.2	50yr+2080	Proposed	1104	569.57	571.87	571.87	572.4	572.4	0.020558	5.53	190.24	120.13	0.91	0.01
Main	18366.2	100yr	Existing	1045	569.57	571.82	571.82	572.32	572.32	0.020683	5.45	183.28	119.38	0.91	
Main	18366.2	100yr	Proposed	1045	569.57	571.83	571.83	572.33	572.33	0.020154	5.4	184.81	119.55	0.9	0.01
Main	18366.2	100yr+2050	Existing	1201	569.57	571.95	571.95	572.51	572.51	0.02108	5.72	199.23	121.1	0.92	
Main	18366.2	100yr+2050	Proposed	1201	569.57	571.95	571.95	572.52	572.52	0.020827	5.69	200.01			

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	17972.8	10yr+2080	Existing	658	564.77	568.27		568.57	0.004392	5.08	206.23	129.81	0.52	
Main	17972.8	10yr+2080	Proposed	658	564.77	568.24		568.55	0.004583	5.16	202.38	127.95	0.53	-0.03
Main	17972.8	25yr	Existing	715	564.77	568.49		568.77	0.003877	5.01	236.1	145.09	0.49	
Main	17972.8	25yr	Proposed	715	564.77	568.46		568.75	0.003989	5.05	232.1	140.08	0.5	-0.03
Main	17972.8	25yr+2050	Existing	840	564.77	568.88		569.16	0.003462	5.11	299.62	172.02	0.48	
Main	17972.8	25yr+2050	Proposed	840	564.77	568.86		569.15	0.003553	5.16	296.18	171.11	0.48	-0.02
Main	17972.8	25yr+2080	Existing	904	564.77	569.05		569.32	0.003253	5.11	329.21	180.58	0.46	
Main	17972.8	25yr+2080	Proposed	904	564.77	569.03		569.31	0.003311	5.14	326.74	180.1	0.47	-0.02
Main	17972.8	50yr	Existing	870	564.77	568.96		569.24	0.003349	5.1	313.94	176.11	0.47	
Main	17972.8	50yr	Proposed	870	564.77	568.94		569.22	0.00344	5.15	310.11	174.87	0.48	-0.02
Main	17972.8	50yr+2050	Existing	1017	564.77	569.37		569.62	0.002741	4.95	389.79	190.79	0.43	
Main	17972.8	50yr+2050	Proposed	1017	564.77	569.35		569.6	0.002832	5.01	384.6	189.93	0.44	-0.02
Main	17972.8	50yr+2080	Existing	1104	564.77	569.6		569.83	0.002497	4.9	434.29	200.69	0.42	
Main	17972.8	50yr+2080	Proposed	1104	564.77	569.57		569.81	0.002581	4.96	428.31	199.39	0.42	-0.03
Main	17972.8	100yr	Existing	1045	564.77	569.45		569.69	0.002654	4.93	404.3	194.08	0.43	
Main	17972.8	100yr	Proposed	1045	564.77	569.41		569.66	0.002763	5.01	397.53	192.55	0.43	-0.04
Main	17972.8	100yr+2050	Existing	1201	564.77	569.8		570.02	0.002399	4.95	474.14	210.51	0.41	
Main	17972.8	100yr+2050	Proposed	1201	564.77	569.78		570.01	0.002437	4.98	470.94	209.53	0.41	-0.02
Main	17972.8	100yr+2080	Existing	1230	564.77	569.84		570.07	0.002405	4.99	482.99	212.14	0.41	
Main	17972.8	100yr+2080	Proposed	1230	564.77	569.83		570.06	0.002438	5.01	480.42	211.83	0.41	-0.01
Main	17807.2	10yr	Existing	543	560	567.76	562.07	567.81	0.000206	1.77	355.21	180.1	0.12	
Main	17807.2	10yr	Proposed	543	560	567.72	562.07	567.77	0.000212	1.79	348.37	178.04	0.12	-0.04
Main	17807.2	10yr+2050	Existing	633	560	568.19	562.3	568.24	0.000207	1.85	451.59	235.64	0.12	
Main	17807.2	10yr+2050	Proposed	633	560	568.16	562.3	568.21	0.000211	1.86	444.72	233.65	0.12	-0.03
Main	17807.2	10yr+2080	Existing	658	560	568.3	562.35	568.35	0.000207	1.86	477.26	243.8	0.12	
Main	17807.2	10yr+2080	Proposed	658	560	568.27	562.35	568.32	0.000211	1.88	470.49	241.29	0.12	-0.03
Main	17807.2	25yr	Existing	715	560	568.51	562.48	568.56	0.000208	1.91	531.35	259.62	0.12	
Main	17807.2	25yr	Proposed	715	560	568.49	562.48	568.54	0.000213	1.92	524.13	258.26	0.12	-0.02
Main	17807.2	25yr+2050	Existing	840	560	568.9	562.76	568.95	0.000213	1.99	635.98	280.24	0.12	
Main	17807.2	25yr+2050	Proposed	840	560	568.88	562.76	568.94	0.000216	2.01	630.7	277.87	0.13	-0.02
Main	17807.2	25yr+2080	Existing	904	560	569.07	562.89	569.12	0.000219	2.05	683.14	299.53	0.13	
Main	17807.2	25yr+2080	Proposed	904	560	569.05	562.89	569.11	0.000221	2.05	679.3	297.93	0.13	-0.02
Main	17807.2	50yr	Existing	870	560	568.98	562.82	569.04	0.000215	2.02	658.76	289.24	0.13	
Main	17807.2	50yr	Proposed	870	560	568.96	562.82	569.02	0.000219	2.03	652.75	287.11	0.13	-0.02
Main	17807.2	50yr+2050	Existing	1017	560	569.38	563.12	569.43	0.00022	2.11	781.18	319.19	0.13	
Main	17807.2	50yr+2050	Proposed	1017	560	569.35	563.12	569.41	0.000225	2.12	772.72	318.19	0.13	-0.03
Main	17807.2	50yr+2080	Existing	1104	560	569.6	563.29	569.66	0.000218	2.13	853.68	327	0.13	
Main	17807.2	50yr+2080	Proposed	1104	560	569.57	563.29	569.63	0.000223	2.15	844.06	326.19	0.13	-0.03
Main	17807.2	100yr	Existing	1045	560	569.45	563.17	569.51	0.000219	2.11	805.04	321.97	0.13	
Main	17807.2	100yr	Proposed	1045	560	569.42	563.17	569.47	0.000225	2.14	793.99	320.69	0.13	-0.03
Main	17807.2	100yr+2050	Existing	1201	560	569.8	563.47	569.85	0.000222	2.18	917.18	332.27	0.13	
Main	17807.2	100yr+2050	Proposed	1201	560	569.78	563.47	569.84	0.000225	2.19	912.15	331.86	0.13	-0.02
Main	17807.2	100yr+2080	Existing	1230	560	569.84	563.52	569.89	0.000226	2.21	930.89	333.4	0.13	
Main	17807.2	100yr+2080	Proposed	1230	560	569.83	563.52	569.88	0.000228	2.22	926.95	333.08	0.13	-0.01
Main	17778.79		Culvert											
Main	17741.4	10yr	Existing	543	560	567.35	562.14	567.41	0.00025	1.91	289.23	79.96	0.13	
Main	17741.4	10yr	Proposed	543	560	567.31	562.14	567.36	0.000256	1.92	287.11	77.03	0.13	-0.04
Main	17741.4	10yr+2050	Existing	633	560	567.7	562.36	567.77	0.000276	2.08	334.71	125.21	0.14	
Main	17741.4	10yr+2050	Proposed	633	560	567.67	562.36	567.73	0.000286	2.11	318.95	109.21	0.14	-0.03
Main	17741.4	10yr+2080	Existing	658	560	567.81	562.42	567.88	0.000281	2.11	348.8	138.63	0.14	
Main	17741.4	10yr+2080	Proposed	658	560	567.77	562.42	567.84	0.000287	2.13	343.43	134.98	0.14	-0.04
Main	17741.4	25yr	Existing	715	560	568.04	562.55	568.11	0.000289	2.2	383.66	160.15	0.15	
Main	17741.4	25yr	Proposed	715	560	568	562.55	568.07	0.000297	2.22	376.87	158.98	0.15	-0.04
Main	17741.4	25yr+2050	Existing	840	560	568.58	562.82	568.66	0.000281	2.27	484.58	207.82	0.15	
Main	17741.4	25yr+2050	Proposed	840	560	568.54	562.82	568.62	0.000288	2.29	476.33	205.37	0.15	-0.04
Main	17741.4	25yr+2080	Existing	904	560	568.86	562.96	568.94	0.000269	2.28	546.56	235.88	0.14	
Main	17741.4	25yr+2080	Proposed	904	560	568.82	562.96	568.9	0.000277	2.3	537.06	231.78	0.14	-0.04
Main	17741.4	50yr	Existing	870	560	568.72	562.89	568.79	0.000275	2.28	512.77	217.62	0.14	
Main	17741.4	50yr	Proposed	870	560	568.67	562.89	568.75	0.000284	2.3	503.14	213.33	0.15	-0.05
Main	17741.4	50yr+2050	Existing	1017	560	569.31	563.17	569.38	0.000252	2.29	657.26	261.72	0.14	
Main	17741.4	50yr+2050	Proposed	1017	560	569.28	563.17	569.35	0.000257	2.31	649.75	260.55	0.14	-0.03
Main	17741.4	50yr+2080	Existing	1104	560	569.54	563.36	569.61	0.000253	2.33	718.96	271.23	0.14	
Main	17741.4	50yr+2080	Proposed	1104	560	569.52	563.36	569.59	0.000258	2.35	712.14	270.16	0.14	-0.02
Main	17741.4	100yr	Existing	1045	560	569.39	563.25	569.46	0.000252	2.3	678.04	264.95	0.14	
Main	17741.4	100yr	Proposed	1045	560	569.36	563.25	569.43	0.000256	2.32	671.76	263.98	0.14	-0.03
Main	17741.4	100yr+2050	Existing	1201	560	569.74	563.54	569.81	0.000261	2.41	774.53	280.15	0.14	
Main	17741.4	100yr+2050	Proposed	1201	560	569.73	563.54	569.8	0.000264	2.42	770.62	279.63	0.14	-0.01
Main	17741.4	100yr+2080	Existing	1230	560	569.79	563.59	569.86	0.000265	2.44	787.17	281.76	0.14	
Main	17741.4	100yr+2080	Proposed	1230	560	569.77	563.59	569.85	0.000268	2.44	783.79	281.33	0.15	-0.02
Main	17645.2	10yr	Existing	543	561.29	567.26		567.36	0.000758	2.73	260.57	100.52	0.23	
Main	17645.2	10yr	Proposed	543	561.29	567.21		567.31	0.000793	2.77	255.86	99.69	0.23	-0.05
Main	17645.2	10yr+2050	Existing	633	561.29	567.61		567.72	0.000761	2.88	298.88	119.35	0.23	
Main	17645.2	10yr+2050	Proposed	633	561.29	567.57		567.68	0.000789	2.91	294.1	117.62	0.23	-0.04
Main	17645.2	10yr+2080	Existing	658	561.29	567.72		567.83	0.000745	2.89	312.01	122.66	0.23	
Main	17645.2	10yr+2080	Proposed	658	561.29	567.68		567.79	0.000774	2.93	306.75	121.26	0.23	-0.04
Main	17645.2	25yr	Existing	715	561.29	567.96		568.06	0.000724	2.94	342.23	135.02	0.23	
Main	17645.2	25yr	Proposed	715	561.29	567.91		568.02	0.000752	2.98	336.09	132.48	0.23	-0.05
Main	17645.2	25yr+2050	Existing	840	561.29	568.51		568.61	0.000647	2.97	428.5	169.56	0.22	
Main	17645.2	25yr+2050	Proposed	840	561.29	568.46		568.57	0.000673	3.01	421.14	168.29	0.22	-0.05
Main	17645.2	25yr+2080	Existing	904	561.29	568.8		568.89	0.000578	2.9	479.15	177.92	0.21	
Main	17645.2	25yr+2080	Proposed	904	561.29	568.76		568.85	0.000601	2.94	471.44	176.68	0.21	-0.04
Main	17645.2	50yr	Existing	870	561.29	568.65		568.74	0.000613	2.94	452.2	173.55	0.21	
Main	17645.2	50yr	Proposed	870	561.29	568.6		568.7	0.00064	2.98	443.84	172.17	0.22	-0.05
Main	17645.2	50yr+2050	Existing	1017	561.29	569.25		569.34	0.0005					

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	17536.8	50yr+2080	Existing	1104	560.6	569.4	564.09	569.51	0.00043	2.93	554.44	186.19	0.18	
Main	17536.8	50yr+2080	Proposed	1104	560.6	569.37	564.09	569.49	0.000437	2.94	549.38	184.81	0.18	-0.03
Main	17536.8	100yr	Existing	1045	560.6	569.25	563.95	569.36	0.00042	2.86	527.48	179.59	0.18	
Main	17536.8	100yr	Proposed	1045	560.6	569.22	563.95	569.34	0.000427	2.87	522.88	178.67	0.18	-0.03
Main	17536.8	100yr+2050	Existing	1201	560.6	569.59	564.29	569.71	0.000463	3.09	590.64	206.74	0.19	
Main	17536.8	100yr+2050	Proposed	1201	560.6	569.57	564.29	569.7	0.000466	3.09	587.66	204.02	0.19	-0.02
Main	17536.8	100yr+2080	Existing	1230	560.6	569.63	564.37	569.75	0.000476	3.14	599	210.94	0.19	
Main	17536.8	100yr+2080	Proposed	1230	560.6	569.61	564.37	569.74	0.000479	3.14	596.27	209.75	0.19	-0.02
Main	17508.52		Culvert											
Main	17468.3	10yr	Existing	543	560.6	566.82	562.71	566.91	0.000458	2.42	225.91	69.99	0.18	
Main	17468.3	10yr	Proposed	543	560.6	566.78	562.71	566.87	0.000471	2.44	224.07	69.05	0.18	-0.04
Main	17468.3	10yr+2050	Existing	633	560.6	567.02	562.93	567.12	0.000516	2.62	275.05	80.39	0.19	
Main	17468.3	10yr+2050	Proposed	633	560.6	566.98	562.93	567.08	0.000528	2.64	271.9	77.21	0.19	-0.04
Main	17468.3	10yr+2080	Existing	658	560.6	567.08	563	567.19	0.000538	2.7	279.95	84.63	0.19	
Main	17468.3	10yr+2080	Proposed	658	560.6	567.03	563	567.15	0.000552	2.72	276.39	81.72	0.2	-0.05
Main	17468.3	25yr	Existing	715	560.6	567.19	563.13	567.32	0.000592	2.87	290.08	90.37	0.2	
Main	17468.3	25yr	Proposed	715	560.6	567.15	563.13	567.27	0.000608	2.89	286.11	88.22	0.21	-0.04
Main	17468.3	25yr+2050	Existing	840	560.6	567.43	563.41	567.58	0.000707	3.21	311.98	97.45	0.22	
Main	17468.3	25yr+2050	Proposed	840	560.6	567.38	563.41	567.54	0.000725	3.24	307.99	96.26	0.23	-0.05
Main	17468.3	25yr+2080	Existing	904	560.6	567.53	563.53	567.7	0.000768	3.38	322.41	100.65	0.23	
Main	17468.3	25yr+2080	Proposed	904	560.6	567.49	563.53	567.66	0.000787	3.41	318.27	99.29	0.24	-0.04
Main	17468.3	50yr	Existing	870	560.6	567.48	563.47	567.64	0.000734	3.29	317.11	98.96	0.23	
Main	17468.3	50yr	Proposed	870	560.6	567.43	563.47	567.59	0.000756	3.32	312.59	97.63	0.23	-0.05
Main	17468.3	50yr+2050	Existing	1017	560.6	567.7	563.77	567.9	0.000878	3.68	340.09	108.72	0.25	
Main	17468.3	50yr+2050	Proposed	1017	560.6	567.66	563.77	567.86	0.000901	3.71	335.43	106.17	0.25	-0.04
Main	17468.3	50yr+2080	Existing	1104	560.6	567.84	563.94	568.06	0.000949	3.88	356.38	115.84	0.26	
Main	17468.3	50yr+2080	Proposed	1104	560.6	567.79	563.94	568.01	0.000983	3.93	349.65	113.96	0.27	-0.05
Main	17468.3	100yr	Existing	1045	560.6	567.74	563.82	567.94	0.000906	3.75	344.51	111.7	0.25	
Main	17468.3	100yr	Proposed	1045	560.6	567.7	563.82	567.91	0.000927	3.78	340.07	108.7	0.26	-0.04
Main	17468.3	100yr+2050	Existing	1201	560.6	567.97	564.12	568.21	0.001041	4.11	371.13	119.97	0.27	
Main	17468.3	100yr+2050	Proposed	1201	560.6	567.94	564.12	568.18	0.001061	4.14	367.46	118.91	0.28	-0.03
Main	17468.3	100yr+2080	Existing	1230	560.6	568.01	564.16	568.26	0.001067	4.18	375.89	121.33	0.28	
Main	17468.3	100yr+2080	Proposed	1230	560.6	567.97	564.16	568.22	0.001092	4.21	371.09	119.96	0.28	-0.04
Main	17400.8	10yr	Existing	980	562.21	566.59		566.79	0.003641	5.14	351.91	177.71	0.48	
Main	17400.8	10yr	Proposed	952	562.21	566.55		566.75	0.003639	5.09	344.5	176.39	0.48	-0.04
Main	17400.8	10yr+2050	Existing	1137	562.21	566.76		566.98	0.003948	5.52	381.99	183.92	0.51	
Main	17400.8	10yr+2050	Proposed	1105	562.21	566.73		566.95	0.00387	5.43	376.67	182.83	0.5	-0.03
Main	17400.8	10yr+2080	Existing	1180	562.21	566.82		567.05	0.003976	5.59	392.67	187.15	0.51	
Main	17400.8	10yr+2080	Proposed	1146	562.21	566.79		567.01	0.003876	5.49	387.12	185.16	0.5	-0.03
Main	17400.8	25yr	Existing	1280	562.21	566.92		567.17	0.004173	5.84	412.16	193.84	0.52	
Main	17400.8	25yr	Proposed	1245	562.21	566.89		567.13	0.004096	5.75	405.9	191.81	0.52	-0.03
Main	17400.8	25yr+2050	Existing	1495	562.21	567.14		567.42	0.004339	6.18	457.05	202.57	0.54	
Main	17400.8	25yr+2050	Proposed	1458	562.21	567.12		567.38	0.004276	6.11	451.07	201.63	0.54	-0.02
Main	17400.8	25yr+2080	Existing	1606	562.21	567.25		567.53	0.00443	6.35	477.98	205.47	0.55	
Main	17400.8	25yr+2080	Proposed	1568	562.21	567.22		567.5	0.004383	6.28	471.66	204.78	0.54	-0.03
Main	17400.8	50yr	Existing	1547	562.21	567.2		567.47	0.00437	6.26	467.53	204.21	0.54	
Main	17400.8	50yr	Proposed	1509	562.21	567.16		567.43	0.004342	6.2	460.08	203.05	0.54	-0.04
Main	17400.8	50yr+2050	Existing	1800	562.21	567.42		567.72	0.004545	6.61	513.2	208.63	0.56	
Main	17400.8	50yr+2050	Proposed	1761	562.21	567.38		567.68	0.00453	6.56	505.95	207.98	0.56	-0.04
Main	17400.8	50yr+2080	Existing	1951	562.21	567.58		567.89	0.004468	6.71	546.32	211.55	0.56	
Main	17400.8	50yr+2080	Proposed	1915	562.21	567.51		567.83	0.004611	6.75	533.32	210.41	0.57	-0.07
Main	17400.8	100yr	Existing	1849	562.21	567.46		567.77	0.00458	6.67	521.57	209.37	0.56	
Main	17400.8	100yr	Proposed	1809	562.21	567.43		567.73	0.004532	6.61	515.52	208.83	0.56	-0.03
Main	17400.8	100yr+2050	Existing	2118	562.21	567.7		568.03	0.004604	6.93	572.64	213.84	0.57	
Main	17400.8	100yr+2050	Proposed	2081	562.21	567.68		568	0.004523	6.85	569.13	213.54	0.56	-0.02
Main	17400.8	100yr+2080	Existing	2168	562.21	567.74		568.07	0.004615	6.98	581.51	214.55	0.57	
Main	17400.8	100yr+2080	Proposed	2130	562.21	567.71		568.04	0.004592	6.94	575.43	214.08	0.57	-0.03
Main	17302.2	10yr	Existing	980	560.85	566.4	565.36	566.54	0.001617	3.97	465.39	378.66	0.32	
Main	17302.2	10yr	Proposed	952	560.85	566.36	565.34	566.49	0.001609	3.94	456.52	377.83	0.32	-0.04
Main	17302.2	10yr+2050	Existing	1137	560.85	566.54	565.51	566.7	0.00182	4.3	496.38	381.58	0.34	
Main	17302.2	10yr+2050	Proposed	1105	560.85	566.52	565.48	566.67	0.001768	4.23	491.38	381.11	0.34	-0.02
Main	17302.2	10yr+2080	Existing	1180	560.85	566.6	565.54	566.76	0.00183	4.35	508.72	382.73	0.35	
Main	17302.2	10yr+2080	Proposed	1146	560.85	566.58	565.51	566.73	0.001775	4.27	503.59	382.25	0.34	-0.02
Main	17302.2	25yr	Existing	1280	560.85	566.69	565.62	566.86	0.001934	4.52	528.46	384.7	0.36	
Main	17302.2	25yr	Proposed	1245	560.85	566.66	565.59	566.83	0.00189	4.45	522.46	384.05	0.35	-0.03
Main	17302.2	25yr+2050	Existing	1495	560.85	566.9	565.77	567.09	0.002084	4.83	574.31	389.64	0.37	
Main	17302.2	25yr+2050	Proposed	1458	560.85	566.88	565.74	567.06	0.002035	4.75	569.03	389.06	0.37	-0.02
Main	17302.2	25yr+2080	Existing	1606	560.85	567	565.84.8							

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	17212	10yr	Proposed	952	560.83	566.14	565.07	566.3	0.001866	4.09	404.02	315.55	0.35	-0.04
Main	17212	10yr+2050	Existing	1137	560.83	566.29	565.27	566.48	0.002235	4.57	434.33	340.5	0.39	
Main	17212	10yr+2050	Proposed	1105	560.83	566.27	565.23	566.46	0.002151	4.48	431	338.74	0.38	-0.02
Main	17212	10yr+2080	Existing	1180	560.83	566.34	565.31	566.54	0.00229	4.67	445.35	350.34	0.39	
Main	17212	10yr+2080	Proposed	1146	560.83	566.32	565.27	566.51	0.002194	4.56	441.62	346.8	0.39	-0.02
Main	17212	25yr	Existing	1280	560.83	566.4	565.37	566.63	0.002535	4.96	460.5	376.44	0.42	
Main	17212	25yr	Proposed	1245	560.83	566.38	565.36	566.6	0.002429	4.84	456.08	366.7	0.41	-0.02
Main	17212	25yr+2050	Existing	1495	560.83	566.54	565.59	566.82	0.003051	5.56	495.57	400.21	0.46	
Main	17212	25yr+2050	Proposed	1458	560.83	566.53	565.56	566.8	0.002953	5.45	491.95	396.59	0.45	-0.01
Main	17212	25yr+2080	Existing	1606	560.83	566.61	565.68	566.9	0.003255	5.79	512.32	432.16	0.48	
Main	17212	25yr+2080	Proposed	1568	560.83	566.59	565.65	566.88	0.003156	5.69	508.61	423.41	0.47	-0.02
Main	17212	50yr	Existing	1547	560.83	566.59	565.64	566.87	0.003097	5.63	506.9	419.35	0.46	
Main	17212	50yr	Proposed	1509	560.83	566.56	565.6	566.83	0.003058	5.57	498.99	406.76	0.46	-0.03
Main	17212	50yr+2050	Existing	1800	560.83	566.73	565.83	567.06	0.003553	6.16	544.41	496.12	0.5	
Main	17212	50yr+2050	Proposed	1761	560.83	566.7	565.8	567.03	0.003493	6.09	538	482.33	0.49	-0.03
Main	17212	50yr+2080	Existing	1951	560.83	566.81	565.93	567.19	0.004042	6.64	566.76	529.09	0.53	
Main	17212	50yr+2080	Proposed	1915	560.83	566.79	565.89	567.14	0.003756	6.38	561.01	523.79	0.51	-0.02
Main	17212	100yr	Existing	1849	560.83	566.75	565.86	567.09	0.003632	6.25	552.02	509.82	0.51	
Main	17212	100yr	Proposed	1809	560.83	566.74	565.83	567.07	0.003539	6.16	547.74	502.1	0.5	-0.01
Main	17212	100yr+2050	Existing	2118	560.83	566.89	566.02	567.3	0.004332	6.95	588.87	533.05	0.55	
Main	17212	100yr+2050	Proposed	2081	560.83	566.86	566	567.27	0.004292	6.9	582.55	531.67	0.55	-0.03
Main	17212	100yr+2080	Existing	2168	560.83	566.92	566.05	567.34	0.004379	7.02	598.92	537	0.56	
Main	17212	100yr+2080	Proposed	2130	560.83	566.9	566.03	567.31	0.004309	6.95	593.51	534.88	0.55	-0.02
Main	17146.8	10yr	Existing	980	559.74	566.09	565.35	566.22	0.001305	3.89	475.81	583.78	0.29	
Main	17146.8	10yr	Proposed	952	559.74	566.05	565.31	566.18	0.001336	3.92	462.34	582.07	0.3	-0.04
Main	17146.8	10yr+2050	Existing	1137	559.74	566.19	565.55	566.34	0.001445	4.14	509.07	588.01	0.31	
Main	17146.8	10yr+2050	Proposed	1105	559.74	566.18	565.46	566.32	0.001398	4.07	504.86	587.48	0.3	-0.01
Main	17146.8	10yr+2080	Existing	1180	559.74	566.25	565.58	566.4	0.001402	4.11	527.58	592	0.3	
Main	17146.8	10yr+2080	Proposed	1146	559.74	566.23	565.56	566.38	0.001359	4.04	522.72	590.87	0.3	-0.02
Main	17146.8	25yr	Existing	1280	559.74	566.31	565.69	566.47	0.001467	4.24	548.79	595.92	0.31	
Main	17146.8	25yr	Proposed	1245	559.74	566.29	565.66	566.45	0.001433	4.18	543.01	595.13	0.31	-0.02
Main	17146.8	25yr+2050	Existing	1495	559.74	566.46	565.8	566.63	0.001559	4.44	596.53	608.38	0.32	
Main	17146.8	25yr+2050	Proposed	1458	559.74	566.44	565.78	566.61	0.001513	4.37	592.58	607.14	0.32	-0.02
Main	17146.8	25yr+2080	Existing	1606	559.74	566.52	565.86	566.7	0.00162	4.56	617.97	615.07	0.33	
Main	17146.8	25yr+2080	Proposed	1568	559.74	566.51	565.84	566.69	0.001574	4.49	613.94	613.81	0.32	-0.01
Main	17146.8	50yr	Existing	1547	559.74	566.5	565.83	566.68	0.001545	4.44	612.25	613.29	0.32	
Main	17146.8	50yr	Proposed	1509	559.74	566.47	565.81	566.64	0.001551	4.43	601.41	609.91	0.32	-0.03
Main	17146.8	50yr+2050	Existing	1800	559.74	566.64	565.93	566.84	0.001677	4.7	659.44	633.08	0.34	
Main	17146.8	50yr+2050	Proposed	1761	559.74	566.61	565.91	566.81	0.001667	4.67	651.18	629.39	0.34	-0.03
Main	17146.8	50yr+2080	Existing	1951	559.74	566.71	565.91	566.94	0.001835	4.95	685.73	649.38	0.35	
Main	17146.8	50yr+2080	Proposed	1915	559.74	566.7	565.92	566.91	0.001735	4.81	679.97	642.84	0.34	-0.01
Main	17146.8	100yr	Existing	1849	559.74	566.66	565.94	566.87	0.001696	4.74	669.03	637.62	0.34	
Main	17146.8	100yr	Proposed	1809	559.74	566.65	565.93	566.85	0.001659	4.68	664.18	635.28	0.33	-0.01
Main	17146.8	100yr+2050	Existing	2118	559.74	566.79	566.14	567.03	0.00192	5.11	713.31	652.59	0.36	
Main	17146.8	100yr+2050	Proposed	2081	559.74	566.76	566.13	567.01	0.001921	5.1	704.97	651.8	0.36	-0.03
Main	17146.8	100yr+2080	Existing	2168	559.74	566.82	566.17	567.07	0.001897	5.1	727.34	653.93	0.36	
Main	17146.8	100yr+2080	Proposed	2130	559.74	566.81	566.14	567.05	0.001885	5.07	720.33	653.26	0.36	-0.01
Main	17124.4		Culvert											
Main	17102.2	10yr	Existing	980	559.74	565.26	565.26	565.86	0.004924	6.72	234.54	526.08	0.57	
Main	17102.2	10yr	Proposed	952	559.74	564.26	564.26	565.8	0.015431	10	97.59	60.2	0.96	-1
Main	17102.2	10yr+2050	Existing	1137	559.74	565.47	565.47	566.04	0.004719	6.79	292.53	551.44	0.56	
Main	17102.2	10yr+2050	Proposed	1105	559.74	565.43	565.43	566	0.00478	6.8	280.96	550.12	0.56	-0.04
Main	17102.2	10yr+2080	Existing	1180	559.74	565.51	565.51	566.08	0.00477	6.87	303.14	552.68	0.56	
Main	17102.2	10yr+2080	Proposed	1146	559.74	565.48	565.48	566.04	0.004702	6.79	295.77	551.81	0.56	-0.03
Main	17102.2	25yr	Existing	1280	559.74	565.59	565.59	566.17	0.004904	7.05	325.89	555.4	0.57	
Main	17102.2	25yr	Proposed	1245	559.74	565.56	565.56	566.14	0.004885	7	317.16	554.33	0.57	-0.03
Main	17102.2	25yr+2050	Existing	1495	559.74	565.76	565.76	566.35	0.005153	7.39	371.23	564.9	0.59	
Main	17102.2	25yr+2050	Proposed	1458	559.74	565.73	565.73	566.32	0.005124	7.34	363.35	561.6	0.59	-0.03
Main	17102.2	25yr+2080	Existing	1606	559.74	565.82	565.82	566.44	0.005351	7.6	390.12	573.95	0.6	
Main	17102.2	25yr+2080	Proposed	1568	559.74	565.8	565.8	566.41	0.005305	7.54	383.04	571.33	0.6	-0.02
Main	17102.2	50yr	Existing	1547	559.74	565.79	565.79	566.39	0.005203	7.46	381.69	570.66	0.59	
Main	17102.2	50yr	Proposed	1509	559.74	565.76	565.76	566.36	0.005239	7.45	371.59	565.13	0.6	-0.03
Main	17102.2	50yr+2050	Existing	1800	559.74	565.93	565.93	566.58	0.005697	7.96	420.92	581.11	0.63	
Main	17102.2	50yr+2050	Proposed	1761	559.74	565.91	565.91	566.55	0.005656	7.9	413.94	579.98	0.62	-0.02
Main	17102.2	50yr+2080	Existing	1951	559.74	566.01	566.01	566.69	0.005947	8.22	443.94	584.81	0.64	
Main	17102.2	50yr+2080	Proposed	1915	559.74	565.98	565.98	566.67	0.005963	8.2	436.07	583.55	0.64	-0.03
Main	17102.2	100yr	Existing	1849	559.74	565.96	565.96	566.62	0.005768	8.04	428.91	582.4	0.63	
Main	17102.2	100yr	Proposed	1809	559.74	565.94	565.94	566.59	0.005714	7.97	422.27	581.33	0.63	-0.02
Main	17102.2	100yr+2050	Existing	2118	559.74	566.11	566.11	566.8	0.006125	8.44	470.95	588.7	0.65	
Main	17102.2	100yr+2050	Proposed	2081	559.74	566.09	566.09	566.78	0.00609	8.39	464.95	587.86	0.65	-0.02
Main	17102.2	100yr+2080	Existing	2168	559.74	566.13	566.13	566.84	0.006224	8.53	477.22	589.57	0.66	
Main	17102.2	100yr+2080	Proposed	2130	559.74	566.12	566.12	566.81	0.006074	8.42	474.96	589.25	0.65	-0.01
Main	17046.4	10yr	Existing	980	558.38	564.23	564.23	564.94	0.007882	7.72	210.24	455.68	0.7	
Main	17046.4	10yr	Proposed	952	558.38	561.65	558.23	561.7	0.003001	0.97	541.9	124.91	0.12	-2.58
Main	17046.4	10yr+2050	Existing	1137	558.38	564.48	564.48	565.13	0.007201	7.7	257.43	543.83	0.67	
Main	17046.4	10yr+2050	Proposed	1105	558.38	561.8	558.38	561.86	0.003667	1.09	559.94	125.62	0.13	-2.68
Main	17046.4	10yr+2080	Existing	1180	558.38	564.48	564.48	565.18	0.007722	7.98	258.04	545	0.7	
Main	17046.4	10yr+2080	Proposed	1146	558.38	561.85	558.42	561.92	0.003381	1.12	566.38	125.87	0.14	-2.63
Main	17046.4	25yr	Existing	1280	558.38	564.59	564.59	565.3	0.007779	8.14	280.23	609.88	0.7	
Main	17046.4	25yr	Proposed	1245	558.38	561.89	558.51	561.96	0.004388	1.21	571.07	126.05	0.15	-2.7
Main	17046.4	25yr+2050	Existing	1495	558.38	564.77	564.77	565.52	0.00819	8.59	321.19	711.7	0.72	
Main	17046.4	25yr+2050	Proposed	1458	558.38	562.04	558.7	562.14	0.005041	1.39	590.49	126.85	0.16	-2

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	16949	50yr	Proposed	1509	556.68	562.01	558.23	562.09	0.000431	1.68	691.19	1372.98	0.16	-1.26
Main	16949	50yr+2050	Existing	1800	556.68	563.5	563.5	564.03	0.004839	6.89	487.35	1808.85	0.57	
Main	16949	50yr+2050	Proposed	1761	556.68	562.12	558.42	562.22	0.000548	1.92	706.75	1377.66	0.18	-1.38
Main	16949	50yr+2080	Existing	1951	556.68	563.59	563.59	564.12	0.004899	7.02	526.87	1828.12	0.57	
Main	16949	50yr+2080	Proposed	1915	556.68	562.18	558.54	562.3	0.000626	2.07	714.97	1382.18	0.2	-1.41
Main	16949	100yr	Existing	1849	556.68	563.53	563.53	564.06	0.004859	6.93	500.17	1818.46	0.57	
Main	16949	100yr	Proposed	1809	556.68	562.09	558.46	562.2	0.000589	1.98	702.53	1376.39	0.19	-1.44
Main	16949	100yr+2050	Existing	2118	556.68	563.65	563.65	564.21	0.005181	7.29	555.86	1835.76	0.59	
Main	16949	100yr+2050	Proposed	2081	556.68	562.25	558.65	562.38	0.000711	2.22	724.14	1387.54	0.21	-1.4
Main	16949	100yr+2080	Existing	2168	556.68	563.67	563.67	564.24	0.005242	7.35	565.67	1842.29	0.6	
Main	16949	100yr+2080	Proposed	2130	556.68	562.25	558.68	562.38	0.000745	2.27	724.12	1387.53	0.21	-1.42
Main	16913	10yr	Existing	980	557.82	562.08	562.08	562.54	0.006583	6.25	281.15	1596.67	0.63	
Main	16913	10yr	Proposed	952	556.07	561.62	557.47	561.66	0.000205	1.78	658.94	1195.45	0.13	-0.46
Main	16913	10yr+2050	Existing	1137	557.82	562.29	562.29	562.66	0.005452	5.94	375.92	1640.77	0.58	
Main	16913	10yr+2050	Proposed	1105	556.07	561.76	557.63	561.81	0.000252	2	688.27	1291.94	0.15	-0.53
Main	16913	10yr+2080	Existing	1180	557.82	562.32	562.32	562.69	0.005516	6.01	387.46	1643.87	0.58	
Main	16913	10yr+2080	Proposed	1146	556.07	561.81	557.67	561.86	0.000263	2.06	701.8	1364.06	0.15	-0.51
Main	16913	25yr	Existing	1280	557.82	562.37	562.37	562.75	0.005647	6.15	414.78	1653.98	0.59	
Main	16913	25yr	Proposed	1245	556.07	561.84	557.76	561.9	0.000303	2.22	711.52	1399.67	0.16	-0.53
Main	16913	25yr+2050	Existing	1495	557.82	562.47	562.47	562.87	0.006093	6.51	460.59	1662.87	0.62	
Main	16913	25yr+2050	Proposed	1458	556.07	561.99	557.96	562.06	0.000373	2.5	762.09	1541.31	0.18	-0.48
Main	16913	25yr+2080	Existing	1606	557.82	562.52	562.52	562.93	0.006315	6.69	482.45	1667.43	0.63	
Main	16913	25yr+2080	Proposed	1568	556.07	562.01	558.06	562.08	0.000428	2.69	766.55	1550	0.19	-0.51
Main	16913	50yr	Existing	1547	557.82	562.49	562.49	562.9	0.006267	6.63	468.72	1664.41	0.63	
Main	16913	50yr	Proposed	1509	556.07	561.99	558	562.07	0.0004	2.59	762.16	1541.42	0.19	-0.5
Main	16913	50yr+2050	Existing	1800	557.82	562.59	562.59	563.03	0.006707	6.99	517.83	1675.43	0.65	
Main	16913	50yr+2050	Proposed	1761	556.07	562.11	558.22	562.2	0.000502	2.94	808.52	1608.23	0.21	-0.48
Main	16913	50yr+2080	Existing	1951	557.82	562.64	562.64	563.1	0.007017	7.22	543.45	1681.11	0.67	
Main	16913	50yr+2080	Proposed	1915	556.07	562.17	558.35	562.27	0.000567	3.15	835.36	1625.1	0.22	-0.47
Main	16913	100yr	Existing	1849	557.82	562.61	562.61	563.05	0.006727	7.03	528.97	1677.99	0.66	
Main	16913	100yr	Proposed	1809	556.07	562.07	558.26	562.17	0.000542	3.05	794.2	1593.32	0.22	-0.54
Main	16913	100yr+2050	Existing	2118	557.82	562.7	562.7	563.18	0.007288	7.44	572.45	1687.55	0.68	
Main	16913	100yr+2050	Proposed	2081	556.07	562.23	558.47	562.34	0.000636	3.36	865.48	1633.66	0.24	-0.47
Main	16913	100yr+2080	Existing	2168	557.82	562.71	562.71	563.2	0.007493	7.56	576.88	1688.58	0.69	
Main	16913	100yr+2080	Proposed	2130	556.07	562.23	558.5	562.35	0.000667	3.44	865.17	1633.57	0.24	-0.48
Main	16837.3	10yr	Existing	980	556.25	561.65	560.8	561.74	0.000795	3.78	700.09	1226.74	0.31	
Main	16837.3	10yr	Proposed	952	556.25	561.63	556.92	561.64	0.000089	1.24	1117.09	1224.36	0.1	-0.02
Main	16837.3	10yr+2050	Existing	1137	556.25	561.8	560.94	561.9	0.000829	3.94	775.63	1251.85	0.32	
Main	16837.3	10yr+2050	Proposed	1105	556.25	561.77	557.05	561.79	0.000106	1.38	1187.02	1247.45	0.11	-0.03
Main	16837.3	10yr+2080	Existing	1180	556.25	561.81	560.94	561.92	0.000876	4.06	781.42	1253.85	0.33	
Main	16837.3	10yr+2080	Proposed	1146	556.25	561.82	557.1	561.84	0.00011	1.41	1212.73	1256.3	0.11	0.01
Main	16837.3	25yr	Existing	1280	556.25	561.92	561.05	562.03	0.000858	4.08	839.66	1275.97	0.33	
Main	16837.3	25yr	Proposed	1245	556.25	561.86	557.18	561.87	0.000126	1.52	1229.83	1262.16	0.12	-0.06
Main	16837.3	25yr+2050	Existing	1495	556.25	561.98	561.19	562.11	0.001071	4.59	868.08	1290.53	0.37	
Main	16837.3	25yr+2050	Proposed	1458	556.25	562.01	557.35	562.03	0.000153	1.71	1306.85	1297.6	0.14	0.03
Main	16837.3	25yr+2080	Existing	1606	556.25	562.01	561.25	562.15	0.001174	4.83	885.13	1298.49	0.38	
Main	16837.3	25yr+2080	Proposed	1568	556.25	562.02	557.44	562.05	0.000175	1.83	1313.77	1300.13	0.14	0.01
Main	16837.3	50yr	Existing	1547	556.25	562.02	561.23	562.15	0.001077	4.63	889.04	1299.92	0.37	
Main	16837.3	50yr	Proposed	1509	556.25	562.01	557.4	562.03	0.000163	1.77	1307.39	1297.8	0.14	-0.01
Main	16837.3	50yr+2050	Existing	1800	556.25	562.07	561.35	562.23	0.001344	5.21	916.32	1309.89	0.41	
Main	16837.3	50yr+2050	Proposed	1761	556.25	562.12	557.6	562.15	0.000202	2	1367.11	1336.51	0.16	0.05
Main	16837.3	50yr+2080	Existing	1951	556.25	562.15	561.4	562.32	0.001404	5.38	957.18	1350.81	0.42	
Main	16837.3	50yr+2080	Proposed	1915	556.25	562.18	557.71	562.22	0.000228	2.14	1399.01	1361.96	0.17	0.03
Main	16837.3	100yr	Existing	1849	556.25	562.12	561.38	562.28	0.001326	5.2	939.66	1332.14	0.41	
Main	16837.3	100yr	Proposed	1809	556.25	562.09	557.63	562.12	0.000219	2.07	1350.71	1316.52	0.16	-0.03
Main	16837.3	100yr+2050	Existing	2118	556.25	562.24	561.57	562.42	0.001443	5.52	1006.59	1391.68	0.43	
Main	16837.3	100yr+2050	Proposed	2081	556.25	562.25	557.81	562.29	0.000255	2.28	1434.33	1394.85	0.18	0.01
Main	16837.3	100yr+2080	Existing	2168	556.25	562.26	561.4	562.44	0.001474	5.59	1016.11	1399.59	0.43	
Main	16837.3	100yr+2080	Proposed	2130	556.25	562.25	557.87	562.29	0.000267	2.33	1434.36	1394.87	0.18	-0.01
Main	16732.4	10yr	Existing	980	555.81	561.67	559.43	561.69	0.000216	2.12	1247.29	1268.98	0.17	
Main	16732.4	10yr	Proposed	952	555.81	561.63	556.4	561.64	0.000069	1.19	1532.16	1262.92	0.09	-0.04
Main	16732.4	10yr+2050	Existing	1137	555.81	561.82	559.56	561.84	0.000244	2.3	1322.84	1317.04	0.18	
Main	16732.4	10yr+2050	Proposed	1105	555.81	561.77	556.53	561.78	0.000082	1.32	1603.39	1300.53	0.1	-0.05
Main	16732.4	10yr+2080	Existing	1180	555.81	561.83	559.61	561.86	0.000259	2.37	1329.05	1321.72	0.18	
Main	16732.4	10yr+2080	Proposed	1146	555.81	561.82	556.57	561.83	0.000084	1.35	1629.32	1318.36	0.1	-0.01
Main	16732.4	25yr	Existing	1280	555.81	561.94	559.68	561.97	0.000269	2.45	1386.9	1376.15	0.19	
Main	16732.4	25yr	Proposed	1245	555.81	561.85	556.66	561.86	0.000096	1.45	1646.41	1330.57	0.11	-0.09
Main	16732.4	25yr+2050	Existing	1495	555.81	562	559.71	562.04	0.000344	2.79	1417.79	1398.85	0.21	
Main	16732.4	25yr+2050	Proposed	1458	555.81	562	556.84	562.02	0.000116	1.62	1725.32	1400.31	0.12	0
Main	16732.4	25yr+2080	Existing	1606	555.81	562.03	559.94	562.07	0.000383	2.96	1436.01	1412.31	0.22	
Main	16732.4	25yr+2080	Proposed	1568	555.81	562.01	556.93	562.03	0.000133	1.74	1732.16	1405.59	0.13	-0.02
Main	16732.4	50yr	Existing	1547	555.81	562.04	559.91	562.08	0.000353	2.84	1439.15	1415.12	0.22	
Main	16732.4	50yr	Proposed	1509	555.81	562	556.88	562.02	0.000124	1.68	1725.68	1400.59	0.13	-0.04
Main	16732.4	50yr+2050	Existing	1800	555.81	562.09	559.95	562.14	0.000451	3.24	1469.24	1426.45	0.24	
Main	16732.4	50yr+2050	Proposed	1761	555.81	562.12	557.09	562.14	0.000154	1.89	1787.97	1431.09	0.14	0.03
Main	16732.4	50yr+2080	Existing	1951	555.81	562.17	559.95	562.22	0.000489	3.4	1511.4	1440.66	0.26	
Main	16732.4	50yr+2080	Proposed	1915	555.81	562.18	557.2	562.2	0.000173	2.02	1821.41	1442.17	0.15	0.01
Main	16732.4	100yr	Existing	1849	555.81	562.13	559.95	562.19	0.000455	3.27	1492.9	1434.37	0.25	
Main	16732.4	100yr	Proposed	1809	555.81	562.08	557.13	562.11	0.000167	1.96	1770.34	1425.18	0.15	-0.05
Main	16732.4	100yr+2050	Existing	2118	555.81	562.26	560.27	562.32	0.000525	3.56	1562.78	1460.18	0.27	
Main	16732.4</													

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	16595.2	10yr+2050	Existing	1137	554.57	561.82	557.34	561.82	0.000044	1.16	2318.47	1439.4	0.08	
Main	16595.2	10yr+2050	Proposed	1105	554.57	561.77	555.64	561.77	0.000021	0.81	2500.31	1436.24	0.06	-0.05
Main	16595.2	10yr+2080	Existing	1180	554.57	561.83	557.34	561.84	0.000047	1.2	2325.52	1440.17	0.08	
Main	16595.2	10yr+2080	Proposed	1146	554.57	561.82	555.67	561.82	0.000022	0.83	2529.83	1439.46	0.06	-0.01
Main	16595.2	25yr	Existing	1280	554.57	561.94	557.34	561.95	0.000051	1.27	2389.53	1447.15	0.09	
Main	16595.2	25yr	Proposed	1245	554.57	561.85	555.75	561.86	0.000026	0.9	2549.05	1441.56	0.06	-0.09
Main	16595.2	25yr+2050	Existing	1495	554.57	562	557.67	562.01	0.000066	1.46	2423.06	1455.34	0.1	
Main	16595.2	25yr+2050	Proposed	1458	554.57	562	555.91	562.01	0.000032	1.02	2635.58	1455.82	0.07	0
Main	16595.2	25yr+2080	Existing	1606	554.57	562.03	557.69	562.04	0.000075	1.55	2442.57	1461.99	0.1	
Main	16595.2	25yr+2080	Proposed	1568	554.57	562.01	555.99	562.02	0.000037	1.1	2642.85	1458.04	0.07	-0.02
Main	16595.2	50yr	Existing	1547	554.57	562.04	557.67	562.05	0.000069	1.5	2445.85	1463.21	0.1	
Main	16595.2	50yr	Proposed	1509	554.57	562	555.94	562.01	0.000035	1.06	2635.98	1455.93	0.07	-0.04
Main	16595.2	50yr+2050	Existing	1800	554.57	562.09	557.78	562.11	0.00009	1.72	2477.79	1472.07	0.11	
Main	16595.2	50yr+2050	Proposed	1761	554.57	562.11	556.21	562.12	0.000044	1.21	2702.08	1474.28	0.08	0.02
Main	16595.2	50yr+2080	Existing	1951	554.57	562.17	557.84	562.18	0.0001	1.83	2522.26	1479.35	0.12	
Main	16595.2	50yr+2080	Proposed	1915	554.57	562.17	556.35	562.18	0.000051	1.3	2737.3	1479.83	0.09	0
Main	16595.2	100yr	Existing	1849	554.57	562.13	557.8	562.15	0.000092	1.74	2502.77	1476.17	0.12	
Main	16595.2	100yr	Proposed	1809	554.57	562.08	556.26	562.09	0.000048	1.25	2683.33	1471.2	0.08	-0.05
Main	16595.2	100yr+2050	Existing	2118	554.57	562.26	557.91	562.28	0.000111	1.94	2575.49	1483.58	0.13	
Main	16595.2	100yr+2050	Proposed	2081	554.57	562.24	556.5	562.25	0.000057	1.39	2776.26	1482.84	0.09	-0.02
Main	16595.2	100yr+2080	Existing	2168	554.57	562.27	557.93	562.29	0.000115	1.98	2585.84	1484.34	0.13	
Main	16595.2	100yr+2080	Proposed	2130	554.57	562.24	556.51	562.25	0.00006	1.42	2775.97	1482.81	0.09	-0.03
Main	16557.1	10yr	Existing	980	552.8	561.67	557.57	561.67	0.000024	0.84	2311.9	1716.64	0.06	
Main	16557.1	10yr	Proposed	952	552.8	561.63	557.54	561.63	0.000023	0.82	2288.85	1714.5	0.06	-0.04
Main	16557.1	10yr+2050	Existing	1137	552.8	561.82	557.83	561.82	0.000029	0.94	2391.12	1733.23	0.06	
Main	16557.1	10yr+2050	Proposed	1105	552.8	561.77	557.77	561.77	0.000028	0.92	2363.46	1728.6	0.06	-0.05
Main	16557.1	10yr+2080	Existing	1180	552.8	561.83	557.9	561.83	0.000031	0.97	2397.62	1734.6	0.06	
Main	16557.1	10yr+2080	Proposed	1146	552.8	561.82	557.84	561.82	0.000029	0.95	2390.63	1733.13	0.06	-0.01
Main	16557.1	25yr	Existing	1280	552.8	561.94	558.06	561.95	0.000034	1.03	2456.56	1747	0.07	
Main	16557.1	25yr	Proposed	1245	552.8	561.85	558	561.86	0.000034	1.02	2408.17	1736.82	0.07	-0.09
Main	16557.1	25yr+2050	Existing	1495	552.8	562	558.36	562.01	0.000045	1.19	2487.32	1752.6	0.08	
Main	16557.1	25yr+2050	Proposed	1458	552.8	562	558.31	562.01	0.000042	1.16	2487.48	1752.62	0.08	0
Main	16557.1	25yr+2080	Existing	1606	552.8	562.04	558.52	562.04	0.000014	0.67	7012.9	1758.49	0.04	
Main	16557.1	25yr+2080	Proposed	1568	552.8	562.02	558.46	562.02	0.000014	0.66	6977.64	1754.35	0.04	-0.02
Main	16557.1	50yr	Existing	1547	552.8	562.04	558.43	562.04	0.000013	0.65	7022.25	1759.76	0.04	
Main	16557.1	50yr	Proposed	1509	552.8	562	558.38	562.01	0.000045	1.2	2487.68	1752.66	0.08	-0.04
Main	16557.1	50yr+2050	Existing	1800	552.8	562.1	558.78	562.1	0.000017	0.74	7120.88	1766.5	0.05	
Main	16557.1	50yr+2050	Proposed	1761	552.8	562.12	558.72	562.12	0.000016	0.72	7157.12	1767.71	0.05	0.02
Main	16557.1	50yr+2080	Existing	1951	552.8	562.17	558.97	562.18	0.000019	0.79	7255.93	1770.81	0.05	
Main	16557.1	50yr+2080	Proposed	1915	552.8	562.18	558.93	562.18	0.000018	0.77	7263.71	1771.04	0.05	0.01
Main	16557.1	100yr	Existing	1849	552.8	562.14	558.82	562.14	0.000017	0.75	7196.52	1769.01	0.05	
Main	16557.1	100yr	Proposed	1809	552.8	562.09	558.78	562.09	0.000017	0.75	7100.94	1765.84	0.05	-0.05
Main	16557.1	100yr+2050	Existing	2118	552.8	562.26	559.18	562.27	0.000021	0.83	7416.77	1780.37	0.05	
Main	16557.1	100yr+2050	Proposed	2081	552.8	562.24	559.13	562.25	0.00002	0.82	7381.33	1774.41	0.05	-0.02
Main	16557.1	100yr+2080	Existing	2168	552.8	562.28	559.23	562.28	0.000022	0.85	7448.29	1781.18	0.05	
Main	16557.1	100yr+2080	Proposed	2130	552.8	562.24	559.18	562.25	0.000021	0.84	7380.9	1774.4	0.05	-0.04
Main	16490.34	Culvert												
Main	16383.2	10yr	Existing	980	552.8	556.91	556.38	557.15	0.005644	5.96	476.68	1026.31	0.56	
Main	16383.2	10yr	Proposed	952	552.8	556.87	556.38	557.1	0.00614	5.99	459.02	1030.35	0.57	-0.04
Main	16383.2	10yr+2050	Existing	1137	552.8	557.11	556.59	557.35	0.005494	6.1	536.23	1087.26	0.55	
Main	16383.2	10yr+2050	Proposed	1105	552.8	557.09	556.51	557.31	0.005711	6.02	524.12	1098.18	0.56	-0.02
Main	16383.2	10yr+2080	Existing	1180	552.8	557.16	556.61	557.4	0.005476	6.15	551.34	1104.86	0.55	
Main	16383.2	10yr+2080	Proposed	1146	552.8	557.13	556.53	557.36	0.005682	6.06	538.72	1110.31	0.56	-0.03
Main	16383.2	25yr	Existing	1280	552.8	557.29	556.67	557.52	0.005378	6.22	588.06	1133.74	0.55	
Main	16383.2	25yr	Proposed	1245	552.8	557.25	556.56	557.47	0.005617	6.15	573.3	1122.99	0.56	-0.04
Main	16383.2	25yr+2050	Existing	1495	552.8	557.53	556.83	557.76	0.005244	6.39	662.02	1192.45	0.55	
Main	16383.2	25yr+2050	Proposed	1458	552.8	557.49	556.55	557.72	0.005472	6.33	647.16	1188.7	0.55	-0.04
Main	16383.2	25yr+2080	Existing	1606	552.8	557.65	556.92	557.88	0.005188	6.48	698.7	1233.72	0.55	
Main	16383.2	25yr+2080	Proposed	1568	552.8	557.62	556.9	557.84	0.005383	6.4	685.19	1217.63	0.55	-0.03
Main	16383.2	50yr	Existing	1547	552.8	557.59	556.88	557.82	0.005223	6.44	679.06	1214.52	0.55	
Main	16383.2	50yr	Proposed	1509	552.8	557.55	556.86	557.78	0.005414	6.36	665.75	1208.59	0.55	-0.04
Main	16383.2	50yr+2050	Existing	1800	552.8	557.86	557.02	558.1	0.005032	6.59	764.49	1279.77	0.55	
Main	16383.2	50yr+2050	Proposed	1761	552.8	557.83	557	558.06	0.005166	6.49	753.46	1264.98	0.55	-0.03
Main	16383.2	50yr+2080	Existing	1951	552.8	558.01	557.1	558.25	0.004991	6.7	810.65	1307.68	0.55	
Main	16383.2	50yr+2080	Proposed	1915	552.8	557.99	557.08	558.22	0.005118	6.61	801.05	1314.65	0.55	-0.02
Main	16383.2	100yr	Existing	1849	552.8	557.91	557.04	558.15	0.005022	6.63	779.41	1291.14	0.55	
Main	16383.2	100yr	Proposed	1809	552.8	557.88	557.03	558.11	0.005153	6.53	768.27	1278.98	0.55	-0.03
Main	16383.2	100yr+2050	Existing	2118	552.8	558.17	557.19	558.42	0.004962	6.84	861.74	1332.78	0.55	
Main	16383.2	100yr+2050	Proposed	2081	552.8	558.15	557.17	558.38	0.005043	6.71	852.3	1335.61	0.55	-0.02
Main	16383.2	100yr+2080	Existing	2168	552.8	558.22	557.21	558.47	0.005064	6.95	876.79	1347.13	0.55	
Main	16383.2	100yr+2080	Proposed	2130	552.8	558.19	557.2	558.42	0.005024	6.74	867.42	1346.17	0.55	-0.03
Main	16314	10yr	Existing	980	553.19	556.53	555.62	556.69	0.006428	5.01	466.05	1000.14	0.59	
Main	16314	10yr	Proposed	952	553.19	556.49	555.61	556.63	0.006087	4.81	452.21	992.57	0.58	-0.04
Main	16314	10yr+2050	Existing	1137	553.19	556.74	555.72	556.91	0.006216	5.23	525.69	1049.77	0.59	
Main	16314	10yr+2050	Proposed	1105	553.19	556.69	555.72	556.86	0.006383	5.23	511.18	1042.45	0.6	-0.05
Main	16314	10yr+2080	Existing	1180	553.19	556.79	555.72	556.96	0.006137	5.27	541.35	1062.29	0.59	
Main	16314	10yr+2080	Proposed	1146	553.19	556.74	555.73	556.91	0.00629	5.27	526.5	1051.27	0.6	-0.05
Main	16314	25yr	Existing	1280	553.19	556.92	555.85	557.09	0.006072	5.41	578.43	1095.37	0.59	
Main	16314	25yr	Proposed	1245	553.19	556.87	555.84	557.04	0.006071	5.35	563.11	1082.53	0.59	-0.05
Main	16314	25yr+2050	Existing	1495	553.19	557.17	555.91	557.36	0.005811	5.64	657.69	1157.64	0.59	
Main	16314	25yr+2050	Proposed	1458	553.19	557.12	555.9	557.3	0.005805	5.57	641.38			

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	16219	50yr+2050	Existing	1800	551.75	557.03	555.85	557.26	0.00409	6.23	765.15	1106.73	0.53	
Main	16219	50yr+2050	Proposed	1761	551.76	556.99	555.83	557.22	0.004103	6.19	752.54	1103.76	0.53	-0.04
Main	16219	50yr+2080	Existing	1951	551.75	557.19	555.95	557.43	0.004116	6.4	813.41	1134.36	0.53	
Main	16219	50yr+2080	Proposed	1915	551.76	557.15	555.92	557.39	0.004121	6.37	802.03	1131	0.53	-0.04
Main	16219	100yr	Existing	1849	551.75	557.08	555.88	557.32	0.004084	6.28	780.82	1113.46	0.53	
Main	16219	100yr	Proposed	1809	551.76	557.04	555.86	557.27	0.004094	6.24	768.09	1108.69	0.53	-0.04
Main	16219	100yr+2050	Existing	2118	551.75	557.36	556.07	557.61	0.004092	6.55	868.61	1156.06	0.53	
Main	16219	100yr+2050	Proposed	2081	551.76	557.32	556.02	557.57	0.004112	6.52	855.5	1149.5	0.53	-0.04
Main	16219	100yr+2080	Existing	2168	551.75	557.41	556.09	557.66	0.004088	6.59	885.23	1164.84	0.53	
Main	16219	100yr+2080	Proposed	2130	551.76	557.37	556.07	557.63	0.004097	6.56	872.65	1158.9	0.53	-0.04
Main	16168	10yr	Existing	980	550.78	555.07	555.07	555.77	0.016418	8.91	250.39	254.12	0.97	
Main	16168	10yr	Proposed	952	550.78	555.21	555.05	555.76	0.01227	7.97	272.63	344.88	0.84	0.14
Main	16168	10yr+2050	Existing	1137	550.78	555.22	555.22	555.99	0.017236	9.46	274.17	308.99	1	
Main	16168	10yr+2050	Proposed	1105	550.78	555.31	555.2	555.96	0.014153	8.76	288.44	383.16	0.91	0.09
Main	16168	10yr+2080	Existing	1180	550.78	555.28	555.28	556.05	0.017034	9.53	282.87	336.29	1	
Main	16168	10yr+2080	Proposed	1146	550.78	555.34	555.23	556.01	0.014501	8.93	293.57	405.91	0.92	0.06
Main	16168	25yr	Existing	1280	550.78	555.36	555.36	556.18	0.017545	9.86	296.85	394.49	1.02	
Main	16168	25yr	Proposed	1245	550.78	555.43	555.33	556.14	0.015095	9.28	307.26	472.36	0.95	0.07
Main	16168	25yr+2050	Existing	1495	550.78	555.55	555.55	556.45	0.018243	10.48	327.69	571.51	1.05	
Main	16168	25yr+2050	Proposed	1458	550.78	555.61	555.52	556.41	0.015898	9.92	338.26	600.12	0.98	0.06
Main	16168	25yr+2080	Existing	1606	550.78	555.64	555.64	556.58	0.018457	10.76	343.75	606.76	1.06	
Main	16168	25yr+2080	Proposed	1568	550.78	555.7	555.61	556.54	0.016198	10.2	354.25	625.22	1	0.06
Main	16168	50yr	Existing	1547	550.78	555.6	555.6	556.51	0.018216	10.58	336.13	595.05	1.05	
Main	16168	50yr	Proposed	1509	550.78	555.65	555.56	556.47	0.016092	10.06	345.31	608.92	0.99	0.05
Main	16168	50yr+2050	Existing	1800	550.78	555.8	555.8	556.8	0.018818	11.21	370.94	642.03	1.08	
Main	16168	50yr+2050	Proposed	1761	550.78	555.77	555.77	556.76	0.018818	11.14	365.05	636.2	1.08	-0.03
Main	16168	50yr+2080	Existing	1951	550.78	555.93	555.93	556.96	0.018862	11.51	393.1	687.2	1.09	
Main	16168	50yr+2080	Proposed	1915	550.78	555.89	555.89	556.93	0.01908	11.49	386.15	682.07	1.09	-0.04
Main	16168	100yr	Existing	1849	550.78	555.84	555.84	556.85	0.018879	11.32	377.85	657.14	1.08	
Main	16168	100yr	Proposed	1809	550.78	555.8	555.8	556.81	0.018939	11.26	371.42	643.04	1.08	-0.04
Main	16168	100yr+2050	Existing	2118	550.78	556.05	556.05	557.14	0.019081	11.85	415.65	700.59	1.1	
Main	16168	100yr+2050	Proposed	2081	550.78	556.03	556.03	557.1	0.0189	11.75	411.76	698.82	1.09	-0.02
Main	16168	100yr+2080	Existing	2168	550.78	556.09	556.09	557.19	0.019114	11.94	422.55	745.91	1.1	
Main	16168	100yr+2080	Proposed	2130	550.78	556.06	556.06	557.15	0.019228	11.9	416.2	700.88	1.1	-0.03
Main	16066	4 10yr	Existing	980	549.25	553.86	553.86	554.35	0.008331	7.13	274.88	316.93	0.7	
Main	16066	4 10yr	Proposed	952	549.25	553.92	553.92	554.61	0.010257	8.01	290.87	396.49	0.78	0.06
Main	16066	4 10yr+2050	Existing	1137	549.25	553.89	553.89	554.51	0.010453	8.05	284.33	321.64	0.79	
Main	16066	4 10yr+2050	Proposed	1105	549.25	554.17	554.17	554.81	0.009196	7.97	363.46	465.82	0.75	0.28
Main	16066	4 10yr+2080	Existing	1180	549.25	553.89	553.89	554.55	0.011258	8.35	284.33	321.64	0.82	
Main	16066	4 10yr+2080	Proposed	1146	549.25	554.24	554.24	554.86	0.008869	7.94	384.44	520.59	0.74	0.35
Main	16066	4 25yr	Existing	1280	549.25	554.14	554.14	554.64	0.008433	7.6	354.77	373.36	0.72	
Main	16066	4 25yr	Proposed	1245	549.25	554.34	554.34	554.96	0.008823	8.06	415.02	619.47	0.74	0.2
Main	16066	4 25yr+2050	Existing	1495	549.25	554.3	554.3	554.82	0.008659	7.92	400.32	487.55	0.73	
Main	16066	4 25yr+2050	Proposed	1458	549.25	554.52	554.52	555.16	0.009136	8.46	473.05	800.44	0.76	0.22
Main	16066	4 25yr+2080	Existing	1606	549.25	554.35	554.35	554.89	0.008988	8.15	417.13	558.46	0.75	
Main	16066	4 25yr+2080	Proposed	1568	549.25	554.59	554.59	555.26	0.009434	8.71	501.24	863.51	0.77	0.24
Main	16066	4 50yr	Existing	1547	549.25	554.32	554.32	554.85	0.008893	8.06	406.87	510.81	0.74	
Main	16066	4 50yr	Proposed	1509	549.25	554.56	554.56	555.21	0.009219	8.56	487.52	825.51	0.77	0.24
Main	16066	4 50yr+2050	Existing	1800	549.25	554.43	554.43	555.02	0.009793	8.63	440.99	641.83	0.78	
Main	16066	4 50yr+2050	Proposed	1761	549.25	554.82	554.82	554.87	0.006634	2.34	1289.45	1161.69	0.2	0.39
Main	16066	4 50yr+2080	Existing	1951	549.25	554.52	554.52	555.11	0.00976	8.75	473.55	736.99	0.79	
Main	16066	4 50yr+2080	Proposed	1915	549.25	554.82	554.82	554.88	0.00075	2.55	1289.38	1161.57	0.22	0.3
Main	16066	4 100yr	Existing	1849	549.25	554.47	554.47	555.05	0.009591	8.6	455.05	694.8	0.78	
Main	16066	4 100yr	Proposed	1809	549.25	554.82	554.82	554.87	0.000669	2.41	1289.45	1161.69	0.21	0.35
Main	16066	4 100yr+2050	Existing	2118	549.25	554.6	554.6	555.21	0.009976	8.97	505.71	809.48	0.8	
Main	16066	4 100yr+2050	Proposed	2081	549.25	554.82	554.82	554.89	0.000886	2.77	1289.38	1161.57	0.24	0.22
Main	16066	4 100yr+2080	Existing	2168	549.25	554.62	554.62	555.24	0.010147	9.08	512.89	819.18	0.8	
Main	16066	4 100yr+2080	Proposed	2130	549.25	554.82	554.82	554.89	0.000928	2.84	1289.38	1161.57	0.25	0.2
Main	15991	10yr	Existing	980	548.31	552.64	552.34	552.9	0.007808	6.17	431.63	397.42	0.66	
Main	15991	10yr	Proposed	952	548.32	552.61	552.31	552.87	0.007774	6.12	423.46	461.42	0.66	-0.03
Main	15991	10yr+2050	Existing	1137	548.31	552.79	552.44	553.07	0.007895	6.44	477.45	404.73	0.67	
Main	15991	10yr+2050	Proposed	1105	548.32	552.77	552.43	553.04	0.007722	6.34	471.82	468.05	0.66	-0.02
Main	15991	10yr+2080	Existing	1180	548.31	552.83	552.48	553.11	0.007908	6.5	489.62	406.59	0.67	
Main	15991	10yr+2080	Proposed	1146	548.32	552.8	552.45	553.08	0.007892	6.45	480.25	469.42	0.67	-0.03
Main	15991	25yr	Existing	1280	548.31	552.92	552.53	553.21	0.007953	6.66	516.9	412.06	0.68	
Main	15991	25yr	Proposed	1245	548.32	552.89	552.51	553.17	0.007935	6.6	507.59	474.12	0.68	-0.03
Main	15991	25yr+2050	Existing	1495	548.31	553.11	552.65	553.41	0.008016	6.96	573.52	426.44	0.69	
Main	15991	25yr+2050	Proposed	1458	548.32	553.08	552.63	553.38	0.008	6.9	564.2	486.27	0.69	-0.03
Main	15991	25yr+2080	Existing	1606	548.31	553.2	552.73	553.51	0.00804	7.1	602.13	434.42	0.69	
Main	15991	25yr+2080	Proposed	1568	548.32	553.17	552.7	553.47	0.008027	7.04	592.72	497.41	0.69	-0.03
Main	15991	50yr	Existing	1547	548.31	553.15	552.69	553.46	0.008027	7.02	587	430.23	0.69	
Main	15991	50yr	Proposed	1509	548.32	553.12	552.66	553.42	0.008013	6.97	573.81	492.8	0.69	-0.03
Main	15991	50yr+2050	Existing	1800	548.31	553.35	552.83	553.67	0.008077	7.33	651.1	458.15	0.7	
Main	15991	50yr+2050	Proposed	1761	548.32	553.32	552.79	553.64	0.008062	7.28	641.81	518.53	0.7	-0.03
Main	15991	50yr+2080	Existing	1951	548.31	553.47	552.91	553.8	0.008094	7.5	688.45	465.55	0.7	
Main	15991	50yr+2080	Proposed	1915	548.32	553.44	552.89	553.77	0.008077	7.46	680.28	527.9	0.7	-0.03
Main	15991	100yr	Existing	1849	548.31	553.39	552.86	553.72	0.008071	7.38	663.65	461.29	0.7	
Main	15991	100yr	Proposed	1809	548.32	553.36	552.84	553.68	0.008059	7.33	654.14	522.97	0.7	-0.03
Main	15991	100yr+2050	Existing	2118	548.31	553.59	552.99	553.93	0.008102	7.68	729.07	472.55	0.71	
Main	15991	100yr+2050	Proposed	2081	548.32	553.56	552.97	553.9	0.008077	7.63	721.1	534.2	0.7	-0.03
Main	15991	100yr+2080	Existing	2168	548.31	553.62	553.02	553.97	0.008111	7.73	740.8	474.56	0.71	
Main	15991	100yr+2080	Proposed	2130	548.32	553.6	553	553.94						

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	15908	10yr+2050	Proposed	1105	548.08	552.27	551.92	552.5	0.007093	5.68	501.16	577.71	0.63	0.02
Main	15908	10yr+2080	Existing	1180	548.08	552.29	551.95	552.54	0.007762	5.97	508.4	589.96	0.66	
Main	15908	10yr+2080	Proposed	1146	548.08	552.26	551.93	552.5	0.007821	5.95	496.84	573.87	0.66	-0.03
Main	15908	25yr	Existing	1280	548.08	552.39	552.01	552.64	0.007674	6.05	539.94	623.38	0.66	
Main	15908	25yr	Proposed	1245	548.08	552.35	551.99	552.6	0.007728	6.03	528.44	612.13	0.66	-0.04
Main	15908	25yr+2050	Existing	1495	548.08	552.58	552.12	552.84	0.007509	6.22	604.74	667.55	0.66	
Main	15908	25yr+2050	Proposed	1458	548.08	552.55	552.11	552.8	0.007524	6.19	594.17	659.23	0.66	-0.03
Main	15908	25yr+2080	Existing	1606	548.08	552.68	552.18	552.93	0.007445	6.31	636.52	687.65	0.66	
Main	15908	25yr+2080	Proposed	1568	548.08	552.65	552.17	552.9	0.007463	6.28	625.83	681.57	0.66	-0.03
Main	15908	50yr	Existing	1547	548.08	552.63	552.15	552.88	0.007474	6.26	619.85	679.19	0.66	
Main	15908	50yr	Proposed	1509	548.08	552.6	552.13	552.85	0.007489	6.23	609.13	672.59	0.66	-0.03
Main	15908	50yr+2050	Existing	1800	548.08	552.83	552.28	553.1	0.007404	6.5	687.48	711.27	0.66	
Main	15908	50yr+2050	Proposed	1761	548.08	552.8	552.26	553.06	0.007402	6.46	677.76	705.99	0.66	-0.03
Main	15908	50yr+2080	Existing	1951	548.08	552.94	552.34	553.22	0.007378	6.65	725.4	731.58	0.66	
Main	15908	50yr+2080	Proposed	1915	548.08	552.92	552.33	553.19	0.007364	6.61	717.08	726.12	0.66	-0.02
Main	15908	100yr	Existing	1849	548.08	552.87	552.3	553.14	0.007364	6.54	700.88	719.01	0.66	
Main	15908	100yr	Proposed	1809	548.08	552.84	552.28	553.11	0.007366	6.5	690.89	713.34	0.66	-0.03
Main	15908	100yr+2050	Existing	2118	548.08	553.07	552.42	553.35	0.007329	6.8	766.83	750.37	0.67	
Main	15908	100yr+2050	Proposed	2081	548.08	553.04	552.41	553.32	0.007306	6.76	758.89	748.29	0.66	-0.03
Main	15908	100yr+2080	Existing	2168	548.08	553.1	552.44	553.39	0.007336	6.85	778.3	753.35	0.67	
Main	15908	100yr+2080	Proposed	2130	548.08	553.08	552.42	553.36	0.007312	6.81	770.24	751.27	0.67	-0.02
Main	15859.1	10yr	Existing	980	547.68	551.27	551.27	551.79	0.01341	7.88	324.21	286.85	0.87	
Main	15859.1	10yr	Proposed	952	547.68	551.25	551.25	551.76	0.013299	7.8	317.8	286.12	0.86	-0.02
Main	15859.1	10yr+2050	Existing	1137	547.68	551.43	551.43	551.97	0.013462	8.21	366.51	289.01	0.88	
Main	15859.1	10yr+2050	Proposed	1105	547.68	551.27	551.27	551.94	0.017049	8.88	324.21	286.85	0.88	-0.16
Main	15859.1	10yr+2080	Existing	1180	547.68	551.45	551.45	552.01	0.013745	8.35	373.86	289.24	0.89	
Main	15859.1	10yr+2080	Proposed	1146	547.68	551.43	551.43	551.98	0.013527	8.24	368	289.06	0.88	-0.02
Main	15859.1	25yr	Existing	1280	547.68	551.52	551.52	552.1	0.014109	8.6	393.13	289.84	0.9	
Main	15859.1	25yr	Proposed	1245	547.68	551.5	551.5	552.07	0.013882	8.49	387.52	289.67	0.89	-0.02
Main	15859.1	25yr+2050	Existing	1495	547.68	551.66	551.66	552.29	0.015002	9.15	430.25	291	0.94	
Main	15859.1	25yr+2050	Proposed	1458	547.68	551.64	551.64	552.26	0.014904	9.07	423.57	290.79	0.93	-0.02
Main	15859.1	25yr+2080	Existing	1606	547.68	551.72	551.72	552.38	0.015449	9.42	448.11	291.93	0.96	
Main	15859.1	25yr+2080	Proposed	1568	547.68	551.7	551.7	552.35	0.015312	9.33	441.93	291.37	0.95	-0.02
Main	15859.1	50yr	Existing	1547	547.68	551.69	551.69	552.34	0.015235	9.28	438.49	291.26	0.95	
Main	15859.1	50yr	Proposed	1509	547.68	551.67	551.67	552.3	0.015123	9.2	431.89	291.05	0.94	-0.02
Main	15859.1	50yr+2050	Existing	1800	547.68	551.84	551.84	552.54	0.015948	9.82	480.3	321	0.98	
Main	15859.1	50yr+2050	Proposed	1761	547.68	551.82	551.82	552.51	0.015897	9.75	473.49	311.96	0.97	-0.02
Main	15859.1	50yr+2080	Existing	1951	547.68	551.93	551.93	552.65	0.01636	10.12	503.63	336.34	0.99	
Main	15859.1	50yr+2080	Proposed	1915	547.68	551.9	551.9	552.63	0.016385	10.08	496.86	329.96	0.99	-0.03
Main	15859.1	100yr	Existing	1849	547.68	551.86	551.86	552.58	0.016279	9.96	485.92	324.48	0.99	
Main	15859.1	100yr	Proposed	1809	547.68	551.84	551.84	552.55	0.016198	9.89	479.36	319.61	0.98	-0.02
Main	15859.1	100yr+2050	Existing	2118	547.68	552.01	552.01	552.78	0.016978	10.49	526.36	357.79	1.02	
Main	15859.1	100yr+2050	Proposed	2081	547.68	551.98	551.98	552.75	0.017066	10.46	519.05	349.88	1.02	-0.03
Main	15859.1	100yr+2080	Existing	2168	547.68	552.04	552.04	552.81	0.01702	10.56	534.46	365.89	1.02	
Main	15859.1	100yr+2080	Proposed	2130	547.68	552.01	552.01	552.79	0.017117	10.53	526.94	358.48	1.02	-0.03
Main	15692.1	10yr	Existing	980	547.65	550.74	548.76	550.78	0.001127	2.33	759.47	346.81	0.25	
Main	15692.1	10yr	Proposed	952	547.65	550.71	548.73	550.74	0.001116	2.3	748.09	345.58	0.25	-0.03
Main	15692.1	10yr+2050	Existing	1137	547.65	550.92	548.91	550.95	0.001209	2.52	815.26	352.9	0.27	
Main	15692.1	10yr+2050	Proposed	1105	547.65	550.89	548.85	550.92	0.001186	2.48	805.7	351.77	0.26	-0.03
Main	15692.1	10yr+2080	Existing	1180	547.65	550.96	548.95	551	0.001231	2.57	829.68	354.61	0.27	
Main	15692.1	10yr+2080	Proposed	1146	547.65	550.93	548.91	550.96	0.001212	2.53	818.68	353.31	0.27	-0.03
Main	15692.1	25yr	Existing	1280	547.65	551.05	549	551.09	0.001297	2.69	858.76	358.06	0.28	
Main	15692.1	25yr	Proposed	1245	547.65	551.02	548.99	551.06	0.00127	2.65	849.49	356.96	0.27	-0.03
Main	15692.1	25yr+2050	Existing	1495	547.65	551.26	549.17	551.31	0.001383	2.91	927.01	369.31	0.29	
Main	15692.1	25yr+2050	Proposed	1458	547.65	551.23	549.14	551.27	0.001362	2.87	917.11	368.16	0.29	-0.03
Main	15692.1	25yr+2080	Existing	1606	547.65	551.35	549.23	551.37	0.001437	3.03	957.72	372.89	0.3	
Main	15692.1	25yr+2080	Proposed	1568	547.65	551.32	549.21	551.37	0.001418	2.99	947.53	371.71	0.29	-0.03
Main	15692.1	50yr	Existing	1547	547.65	551.3	549.2	551.35	0.001409	2.97	941.48	371	0.29	
Main	15692.1	50yr	Proposed	1509	547.65	551.27	549.17	551.32	0.001389	2.93	931.16	369.8	0.29	-0.03
Main	15692.1	50yr+2050	Existing	1800	547.65	551.5	549.33	551.56	0.001542	3.23	1005.85	380.25	0.31	
Main	15692.1	50yr+2050	Proposed	1761	547.65	551.47	549.3	551.52	0.001522	3.19	996.15	378.72	0.31	-0.03
Main	15692.1	50yr+2080	Existing	1951	547.65	551.61	549.4	551.67	0.001612	3.37	1042.83	387.17	0.32	
Main	15692.1	50yr+2080	Proposed	1915	547.65	551.58	549.39	551.65	0.001595	3.34	1034.37	385.67	0.32	-0.03
Main	15692.1	100yr	Existing	1849	547.65	551.53	549.35	551.59	0.001565	3.28	1018.03	382.55	0.31	
Main	15692.1	100yr	Proposed	1809	547.65	551.5	549.33	551.56	0.001545	3.24	1008.32	380.69	0.31	-0.03
Main	15692.1	100yr+2050	Existing	2118	547.65	551.73	549.47	551.8	0.001682	3.53	1082.62	394.93	0.33	
Main	15692.1	100yr+2050	Proposed	2081	547.65	551.7	549.45	551.77	0.00167	3.5	1073.32	392.05	0.33	-0.03
Main	15692.1	100yr+2080	Existing	2168	547.65	551.77	549.5	551.84	0.001697	3.57	1095.42	398.92	0.33	
Main	15692.1	100yr+2080	Proposed	2130	547.65	551.74	549.47	551.81	0.001688	3.54	1085.4	395.8	0.33	-0.03
Main	15578.6	10yr	Existing	980	547.25	550.49	549.36	550.6	0.002176	3.4	411.92	437.31	0.36	
Main	15578.6	10yr	Proposed	952	547.25	550.46	549.33	550.56	0.002153	3.36	405.57	426.87	0.36	-0.03
Main	15578.6	10yr+2050	Existing	1137	547.25	550.64	549.47	550.76	0.002375	3.68	441.46	441.41	0.38	
Main	15578.6	10yr+2050	Proposed	1105	547.25	550.62	549.45	550.73	0.002314	3.61	436.95	440.79	0.37	-0.02
Main	15578.6	10yr+2080	Existing	1180	547.25	550.68	549.5	550.8	0.00243	3.75	449.01	443.99	0.38	
Main	15578.6	10yr+2080	Proposed	1146	547.25	550.65	549.48	550.77	0.002381	3.69	443.38	441.68	0.38	-0.03
Main	15578.6	25yr	Existing	1280	547.25	550.74	549.57	550.88	0.002607	3.94	463.22	452.75	0.4	
Main	15578.6	25yr	Proposed	1245	547.25	550.72	549.54	550.85	0.002534	3.87	458.99	450.86	0.39	-0.02
Main	15578.6	25yr+2050	Existing	1495	547.25	550.9	549.69	551.07	0.003092	4.44	498.62	469.16	0.44	
Main	15578.6	25yr+2050	Proposed	1458	547.25	550.88	549.68	551.04	0.003027	4.38	493.5	467.97	0.43	-0.02
Main	15578.6	25yr+2080	Existing	1606	547.25	550.98	549.77	551.15	0.003252	4.63	515.46	473.09	0.45	
Main	15578.6	25yr+2080	Proposed	1568	547.25	550.95	549.74	551.13	0.003194	4.56	509.96	471.78	0.45	-0.03
Main	15578.6	50												

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	15484.8	50yr+2080	Proposed	1915	545	550.32	550.32	550.81	0.007001	8.14	503.97	417.27	0.67	-0.01
Main	15484.8	100yr	Existing	1849	545	550.29	550.29	550.78	0.006854	8.02	493.51	414.81	0.66	
Main	15484.8	1809r	Proposed	1809	545	550.27	550.27	550.76	0.006805	7.97	485.78	412.99	0.66	-0.02
Main	15484.8	100yr+2050	Existing	2118	545	550.39	550.39	550.91	0.007454	8.48	534.78	432.96	0.69	
Main	15484.8	100yr+2050	Proposed	2081	545	550.38	550.38	550.89	0.007298	8.39	531.57	430.25	0.68	-0.01
Main	15484.8	100yr+2080	Existing	2168	545	550.4	550.4	550.94	0.007707	8.64	537.86	435.54	0.7	
Main	15484.8	100yr+2080	Proposed	2130	545	550.39	550.39	550.92	0.007482	8.5	536.53	434.42	0.69	-0.01
Main	15459.57		Culvert											
Main	15436.7	10yr	Existing	980	545	549.34	549.34	549.69	0.005617	6.46	346.63	411.08	0.59	
Main	15436.7	10yr	Proposed	952	545	549.32	549.32	549.67	0.005599	6.43	338.06	408.33	0.59	-0.02
Main	15436.7	10yr+2050	Existing	1137	545	549.5	549.5	549.83	0.005534	6.59	414.39	456.35	0.59	
Main	15436.7	10yr+2050	Proposed	1105	545	549.37	549.37	549.77	0.006594	7.04	359.34	415.41	0.64	-0.13
Main	15436.7	10yr+2080	Existing	1180	545	549.42	549.42	549.82	0.006755	7.18	377.56	432.02	0.65	
Main	15436.7	10yr+2080	Proposed	1146	545	549.51	549.51	549.84	0.005504	6.58	417.95	456.59	0.59	0.09
Main	15436.7	25yr	Existing	1280	545	549.46	549.46	549.89	0.007278	7.5	394.5	453.27	0.68	
Main	15436.7	25yr	Proposed	1245	545	549.42	549.42	549.87	0.007451	7.54	379.14	432.74	0.68	-0.04
Main	15436.7	25yr+2050	Existing	1495	545	549.65	549.65	550.02	0.006491	7.32	482.74	460.77	0.64	
Main	15436.7	25yr+2050	Proposed	1458	545	549.64	549.64	550	0.006373	7.24	476.89	460.4	0.64	-0.01
Main	15436.7	25yr+2080	Existing	1606	545	549.69	549.69	550.08	0.006807	7.54	500.85	462.34	0.66	
Main	15436.7	25yr+2080	Proposed	1568	545	549.67	549.67	550.06	0.006699	7.47	494.73	461.75	0.65	-0.02
Main	15436.7	50yr	Existing	1547	545	549.45	549.45	550.09	0.01073	9.1	392.71	451.62	0.82	
Main	15436.7	50yr	Proposed	1509	545	549.65	549.65	550.03	0.006535	7.35	484.96	460.92	0.65	0.2
Main	15436.7	50yr+2050	Existing	1800	545	549.76	549.75	550.17	0.007182	7.84	535.2	465.63	0.68	
Main	15436.7	50yr+2050	Proposed	1761	545	549.74	549.74	550.15	0.00716	7.81	527.02	464.85	0.68	-0.02
Main	15436.7	50yr+2080	Existing	1951	545	549.86	549.81	550.24	0.006996	7.7	583.56	470.51	0.66	
Main	15436.7	50yr+2080	Proposed	1915	545	549.81	549.8	550.22	0.007226	7.93	559.36	467.95	0.68	-0.05
Main	15436.7	100yr	Existing	1849	545	549.77	549.77	550.19	0.007351	7.95	541.37	466.22	0.69	
Main	15436.7	100yr	Proposed	1809	545	549.79	549.76	550.17	0.006827	7.68	547.55	466.81	0.66	0.02
Main	15436.7	100yr+2050	Existing	2118	545	549.95	549.87	550.32	0.006632	7.76	622.21	474.52	0.66	
Main	15436.7	100yr+2050	Proposed	2081	545	549.94	549.85	550.3	0.006513	7.68	618.33	474.12	0.65	-0.01
Main	15436.7	100yr+2080	Existing	2168	545	550.01	549.87	550.35	0.006044	7.49	654.7	477.84	0.63	
Main	15436.7	100yr+2080	Proposed	2130	545	549.97	549.86	550.33	0.006365	7.63	634.27	475.76	0.65	-0.04
Main	15397.3	10yr	Existing	980	544.46	548.96		549.1	0.002667	4.28	474.82	462.35	0.41	
Main	15397.3	10yr	Proposed	952	544.46	548.86		549.03	0.003072	4.51	432.49	442.04	0.44	-0.1
Main	15397.3	10yr+2050	Existing	1137	544.46	549.23		549.34	0.002078	3.98	606.3	517.57	0.37	
Main	15397.3	10yr+2050	Proposed	1105	544.46	549.14		549.27	0.002273	4.1	564.53	492.78	0.38	-0.09
Main	15397.3	10yr+2080	Existing	1180	544.46	549.27		549.38	0.002057	3.99	627.72	523.39	0.37	
Main	15397.3	10yr+2080	Proposed	1146	544.46	549.22		549.33	0.002161	4.05	600.5	515.91	0.37	-0.05
Main	15397.3	25yr	Existing	1280	544.46	549.37		549.48	0.001959	3.96	681.97	533.86	0.36	
Main	15397.3	25yr	Proposed	1245	544.46	549.31		549.43	0.002084	4.05	651.47	528.23	0.37	-0.06
Main	15397.3	25yr+2050	Existing	1495	544.46	549.54		549.63	0.001957	4.07	771.09	546.76	0.36	
Main	15397.3	25yr+2050	Proposed	1458	544.46	549.53		549.64	0.001872	3.98	769.46	546.67	0.35	-0.01
Main	15397.3	25yr+2080	Existing	1606	544.46	549.62		549.73	0.001899	4.07	820.16	549.33	0.36	
Main	15397.3	25yr+2080	Proposed	1568	544.46	549.59		549.7	0.001925	4.08	802.51	548.41	0.36	-0.03
Main	15397.3	50yr	Existing	1547	544.46	549.55		549.66	0.002033	4.16	779.5	547.2	0.37	
Main	15397.3	50yr	Proposed	1509	544.46	549.52		549.64	0.002049	4.16	763.49	546.36	0.37	-0.03
Main	15397.3	50yr+2050	Existing	1800	544.46	549.79		549.89	0.001772	4.04	909.9	553.46	0.35	
Main	15397.3	50yr+2050	Proposed	1761	544.46	549.74		549.84	0.001859	4.1	881.49	552.22	0.35	-0.05
Main	15397.3	50yr+2080	Existing	1951	544.46	549.88		549.98	0.001783	4.11	959.96	555.79	0.35	
Main	15397.3	50yr+2080	Proposed	1915	544.46	549.83		549.94	0.001853	4.16	935.19	554.62	0.36	-0.05
Main	15397.3	100yr	Existing	1849	544.46	549.8		549.91	0.00183	4.11	916.69	553.75	0.35	
Main	15397.3	100yr	Proposed	1809	544.46	549.81		549.91	0.001723	4	922.1	554.01	0.34	0.01
Main	15397.3	100yr+2050	Existing	2118	544.46	549.95		550.06	0.001861	4.25	1001.05	557.79	0.36	
Main	15397.3	100yr+2050	Proposed	2081	544.46	549.94		550.05	0.001818	4.19	996.86	557.54	0.35	-0.01
Main	15397.3	100yr+2080	Existing	2168	544.46	550.01		550.12	0.001765	4.17	1035.9	559.85	0.35	
Main	15397.3	100yr+2080	Proposed	2130	544.46	549.97		550.08	0.001813	4.21	1013.92	558.55	0.35	-0.04
Main	15129.3	10yr	Existing	980	542.64	548.69	547.11	548.75	0.000686	2.83	747.76	823.15	0.22	
Main	15129.3	10yr	Proposed	952	542.64	548.58	547.02	548.65	0.000726	2.87	692.74	767.45	0.23	-0.11
Main	15129.3	10yr+2050	Existing	1137	542.64	549.01	547.46	549.07	0.000552	2.65	927.05	857.39	0.2	
Main	15129.3	10yr+2050	Proposed	1105	542.64	548.9	547.42	548.96	0.000614	2.75	867.07	846.3	0.21	-0.11
Main	15129.3	10yr+2080	Existing	1180	542.64	549.05	547.5	549.1	0.000562	2.68	948.32	861.38	0.2	
Main	15129.3	10yr+2080	Proposed	1146	542.64	548.99	547.47	549.05	0.000579	2.7	914.69	855.04	0.21	-0.06
Main	15129.3	25yr	Existing	1280	542.64	549.15	547.62	549.2	0.000571	2.74	1005.6	872.08	0.21	
Main	15129.3	25yr	Proposed	1245	542.64	549.08	547.58	549.14	0.000596	2.77	966.85	864.68	0.21	-0.07
Main	15129.3	25yr+2050	Existing	1495	542.64	549.29	547.87	549.35	0.000641	2.95	1087.85	889.51	0.22	
Main	15129.3	25yr+2050	Proposed	1458	542.64	549.3	547.86	549.36	0.000599	2.86	1095.32	890.86	0.21	0.01
Main	15129.3	25yr+2080	Existing	1606	542.64	549.38	547.94	549.44	0.000657	3.01	1138.97	896.68	0.22	
Main	15129.3	25yr+2080	Proposed	1568	542.64	549.34	547.89	549.41	0.000655	3	1119.82	894.41	0.22	-0.04
Main	15129.3	50yr	Existing	1547	542.64	549.29	547.89	549.35	0.00068	3.05	1086.87	886.34	0.23	
Main	15129.3	50yr	Proposed	1509	542.64	549.26	547.88	549.33	0.000668	3.03	1071.08	880.48	0.22	-0.03
Main	15129.3	50yr+2050	Existing	1800	542.64	549.54	548.11	549.6	0.000663	3.09	1238.32	910.41	0.22	
Main	15129.3	50yr+2050	Proposed	1761	542.64	549.48	548.08	549.55	0.000684	3.11	1201.95	903.94	0.23	-0.06
Main	15129.3	50yr+2080	Existing	1951	542.64	549.62	548.18	549.69	0.000708	3.22	1285.85	915.7	0.23	
Main	15129.3	50yr+2080	Proposed	1915	542.64	549.56	548.17	549.64	0.000728	3.24	1253.39	913.08	0.23	-0.06
Main	15129.3	100yr	Existing	1849	542.64	549.54	548.14	549.61	0.000699	3.17	1238.55	910.45	0.23	
Main	15129.3	100yr	Proposed	1809	542.64	549.57	548.13	549.63	0.000646	3.06	1255.91	913.52	0.22	0.03
Main	15129.3	100yr+2050	Existing	2118	542.64	549.67	548.22	549.74	0.00078	3.4	1317.03	917.1	0.24	
Main	15129.3	100yr+2050	Proposed	2081	542.64	549.67	548.22	549.74	0.00075	3.33	1318.54	917.16	0.24	0
Main	15129.3	100yr+2080	Existing	2168	542.64	549.74	548.3	549.82	0.000739	3.33	1364.67	919.1	0.24	
Main	15129.3	100yr+2080	Proposed	2130	542.64	549.7	548.22	549.77	0.000756	3.36	1336.62	917.92	0.24	-0.04
Main	14993.2	10yr	Existing	980	541.09	548.69	546.66	548.7	0.000151	1.33	1386.23	908.11	0.1	
Main	14993.2	10yr	Proposed	952	541.09	548.58	546.64	548.59	0.000164	1.37	1322.76	896.7	0.11	-0.11
Main	14993.2	10yr+2050	Existing	1137	541.09	549.01	546.78	549.02	0.000139	1.32	1571.62	925.7	0.1	

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	14965.7	10yr+2080	Existing	1180	540.25	549.04	546.17	549.05	0.000069	0.98	2082.25	1071.86	0.07	
Main	14965.7	10yr+2080	Proposed	1146	540.25	548.99	546.13	548.99	0.000069	0.97	2045.19	1062.71	0.07	-0.05
Main	14965.7	25yr	Existing	1280	540.25	549.14	546.21	549.15	0.000074	1.03	2145.18	1089.87	0.07	
Main	14965.7	25yr	Proposed	1245	540.25	549.08	546.2	549.08	0.000074	1.02	2102.46	1077.02	0.07	-0.06
Main	14965.7	25yr+2050	Existing	1495	540.25	549.28	546.28	549.29	0.000089	1.14	2233.79	1134.77	0.07	
Main	14965.7	25yr+2050	Proposed	1458	540.25	549.29	546.31	549.3	0.000083	1.11	2242.3	1137.15	0.07	0.01
Main	14965.7	25yr+2080	Existing	1606	540.25	549.36	546.41	549.37	0.000095	1.19	2288.71	1141.32	0.08	
Main	14965.7	25yr+2080	Proposed	1568	540.25	549.33	546.3	549.34	0.000093	1.17	2268.19	1139.86	0.08	-0.03
Main	14965.7	50yr	Existing	1547	540.25	549.28	546.31	549.29	0.000095	1.18	2232.55	1133.79	0.08	
Main	14965.7	50yr	Proposed	1509	540.25	549.25	546.28	549.26	0.000093	1.16	2215.62	1118.29	0.08	-0.03
Main	14965.7	50yr+2050	Existing	1800	540.25	549.53	546.54	549.54	0.000104	1.26	2394.92	1159.42	0.08	
Main	14965.7	50yr+2050	Proposed	1761	540.25	549.47	546.53	549.48	0.000105	1.26	2355.86	1149.43	0.08	-0.06
Main	14965.7	50yr+2080	Existing	1951	540.25	549.6	546.59	549.61	0.000115	1.34	2444.54	1177.41	0.09	
Main	14965.7	50yr+2080	Proposed	1915	540.25	549.55	546.57	549.56	0.000116	1.33	2410.01	1162.47	0.09	-0.05
Main	14965.7	100yr	Existing	1849	540.25	549.53	546.55	549.54	0.00011	1.3	2394.64	1159.36	0.08	
Main	14965.7	100yr	Proposed	1809	540.25	549.55	546.43	549.56	0.000103	1.26	2413.84	1163.24	0.08	0.02
Main	14965.7	100yr+2050	Existing	2118	540.25	549.65	546.64	549.66	0.000131	1.43	2476.11	1195.66	0.09	
Main	14965.7	100yr+2050	Proposed	2081	540.25	549.65	546.63	549.66	0.000126	1.4	2478.13	1196.72	0.09	0
Main	14965.7	100yr+2080	Existing	2168	540.25	549.73	546.65	549.74	0.000129	1.43	2526.87	1216.84	0.09	
Main	14965.7	100yr+2080	Proposed	2130	540.25	549.68	546.64	549.69	0.000129	1.42	2497.04	1207.41	0.09	-0.05
Main	14923.7	Culvert												
Main	14888.5	10yr	Existing	980	540.25	548.67	545.8	548.68	0.000057	0.88	1967.56	1215.74	0.06	
Main	14888.5	10yr	Proposed	952	540.25	548.57	545.78	548.57	0.00006	0.89	1898.41	1155.34	0.06	-0.1
Main	14888.5	10yr+2050	Existing	1137	540.25	548.98	545.91	548.98	0.000056	0.9	2168.56	1349.09	0.06	
Main	14888.5	10yr+2050	Proposed	1105	540.25	548.89	545.91	548.89	0.000058	0.91	2107.87	1336.87	0.06	-0.09
Main	14888.5	10yr+2080	Existing	1180	540.25	549.03	545.93	549.04	0.000058	0.92	2204.13	1351.75	0.06	
Main	14888.5	10yr+2080	Proposed	1146	540.25	548.97	545.91	548.98	0.000058	0.91	2163.81	1348.74	0.06	-0.06
Main	14888.5	25yr	Existing	1280	540.25	549.14	545.96	549.14	0.000062	0.96	2272.78	1363.54	0.07	
Main	14888.5	25yr	Proposed	1245	540.25	549.05	545.96	549.05	0.000063	0.96	2213.17	1352.43	0.07	-0.09
Main	14888.5	25yr+2050	Existing	1495	540.25	549.27	546.12	549.28	0.000075	1.07	2361.12	1379.27	0.07	
Main	14888.5	25yr+2050	Proposed	1458	540.25	549.25	546.1	549.26	0.000072	1.05	2349.55	1377.62	0.07	-0.02
Main	14888.5	25yr+2080	Existing	1606	540.25	549.36	546.14	549.37	0.00008	1.11	2420.05	1391.26	0.07	
Main	14888.5	25yr+2080	Proposed	1568	540.25	549.31	546.13	549.32	0.000079	1.1	2387.29	1383.06	0.07	-0.05
Main	14888.5	50yr	Existing	1547	540.25	549.27	546.14	549.27	0.00008	1.11	2356.42	1378.6	0.07	
Main	14888.5	50yr	Proposed	1509	540.25	549.25	546.13	549.26	0.000077	1.08	2347.06	1377.27	0.07	-0.02
Main	14888.5	50yr+2050	Existing	1800	540.25	549.51	546.24	549.52	0.000088	1.19	2516.31	1420.2	0.08	
Main	14888.5	50yr+2050	Proposed	1761	540.25	549.46	546.22	549.47	0.000088	1.18	2484.52	1412.34	0.08	-0.05
Main	14888.5	50yr+2080	Existing	1951	540.25	549.58	546.3	549.59	0.000097	1.25	2566.59	1422.97	0.08	
Main	14888.5	50yr+2080	Proposed	1915	540.25	549.54	546.29	549.55	0.000097	1.25	2538.62	1421.43	0.08	-0.04
Main	14888.5	100yr	Existing	1849	540.25	549.52	546.27	549.53	0.000092	1.21	2526.4	1420.75	0.08	
Main	14888.5	100yr	Proposed	1809	540.25	549.5	546.26	549.51	0.00009	1.19	2511.93	1419.96	0.08	-0.02
Main	14888.5	100yr+2050	Existing	2118	540.25	549.65	546.36	549.66	0.000109	1.33	2610.36	1425.31	0.09	
Main	14888.5	100yr+2050	Proposed	2081	540.25	549.64	546.34	549.65	0.000106	1.31	2602.97	1424.93	0.09	-0.01
Main	14888.5	100yr+2080	Existing	2168	540.25	549.72	546.36	549.73	0.000108	1.34	2654.3	1426.82	0.09	
Main	14888.5	100yr+2080	Proposed	2130	540.25	549.67	546.35	549.68	0.000108	1.33	2621.38	1425.77	0.09	-0.05
Main	14851.2	10yr	Existing	980	539.5	548.67	545.44	548.68	0.000047	0.87	2089.82	1144.67	0.05	
Main	14851.2	10yr	Proposed	952	539.5	548.57	545.44	548.57	0.00005	0.89	2019.52	1126.03	0.06	-0.1
Main	14851.2	10yr+2050	Existing	1137	539.5	548.98	545.77	548.98	0.000048	0.9	2291.7	1173.84	0.06	
Main	14851.2	10yr+2050	Proposed	1105	539.5	548.89	545.73	548.89	0.000049	0.9	2230.86	1163.81	0.06	-0.09
Main	14851.2	10yr+2080	Existing	1180	539.5	549.03	545.79	549.04	0.000049	0.91	2327.3	1181.03	0.06	
Main	14851.2	10yr+2080	Proposed	1146	539.5	548.97	545.77	548.98	0.000049	0.91	2286.87	1172.81	0.06	-0.06
Main	14851.2	25yr	Existing	1280	539.5	549.14	545.85	549.14	0.000053	0.95	2395.99	1191.1	0.06	
Main	14851.2	25yr	Proposed	1245	539.5	549.05	545.84	549.05	0.000054	0.96	2336.28	1182.51	0.06	-0.09
Main	14851.2	25yr+2050	Existing	1495	539.5	549.27	545.95	549.28	0.000064	1.06	2484.21	1227.45	0.06	
Main	14851.2	25yr+2050	Proposed	1458	539.5	549.25	545.93	549.26	0.000062	1.04	2472.69	1217.61	0.06	-0.02
Main	14851.2	25yr+2080	Existing	1606	539.5	549.36	545.96	549.37	0.000069	1.11	2543.15	1253.88	0.07	
Main	14851.2	25yr+2080	Proposed	1568	539.5	549.31	545.95	549.32	0.000068	1.1	2510.34	1243.79	0.07	-0.05
Main	14851.2	50yr	Existing	1547	539.5	549.26	545.97	549.27	0.000069	1.1	2479.42	1225.15	0.07	
Main	14851.2	50yr	Proposed	1509	539.5	549.25	545.95	549.26	0.000066	1.08	2470.03	1214.06	0.07	-0.01
Main	14851.2	50yr+2050	Existing	1800	539.5	549.51	546.13	549.51	0.000077	1.18	2639.39	1286.08	0.07	
Main	14851.2	50yr+2050	Proposed	1761	539.5	549.46	546.11	549.47	0.000076	1.18	2607.58	1283.77	0.07	-0.05
Main	14851.2	50yr+2080	Existing	1951	539.5	549.58	546.18	549.59	0.000085	1.25	2689.6	1289.72	0.07	
Main	14851.2	50yr+2080	Proposed	1915	539.5	549.54	546.16	549.55	0.000084	1.25	2661.57	1287.69	0.07	-0.04
Main	14851.2	100yr	Existing	1849	539.5	549.52	546.14	549.53	0.00008	1.21	2649.45	1286.81	0.07	
Main	14851.2	100yr	Proposed	1809	539.5	549.5	546.14	549.51	0.000078	1.19	2634.96	1285.75	0.07	-0.02
Main	14851.2	100yr+2050	Existing	2118	539.5	549.65	546.24	549.66	0.000095	1.33	2733.2	1293.22	0.08	
Main	14851.2	100yr+2050	Proposed	2081	539.5	549.64	546.22	549.65	0.000092	1.31	2725.87	1292.61	0.08	-0.01
Main	14851.2	100yr+2080	Existing	2168	539.5	549.71	546.25	549.72	0.000094	1.34	2777.21	1296.89	0.08	
Main	14851.2	100yr+2080	Proposed	2130	539.5	549.66	546.24	549.67	0.000095	1.33	2744.23	1294.14	0.08	-0.05
Main	14709.95	Culvert												
Main	14625.4	10yr	Existing	980	538.8	548.67	544.31	548.67	0.000029	0.77	2300.61	736.21	0.05	
Main	14625.4	10yr	Proposed	952	538.8	548.56	544.27	548.56	0.00003	0.78	2237.92	735.36	0.05	-0.11
Main	14625.4	10yr+2050	Existing	1137	538.8	548.95	544.47	548.96	0.000032	0.82	2471.19	750.27	0.05	
Main	14625.4	10yr+2050	Proposed	1105	538.8	548.87	544.45	548.88	0.000032	0.82	2423.05	747.77	0.05	-0.08
Main	14625.4	10yr+2080	Existing	1180	538.8	549.03	544.51	549.03	0.000032	0.84	2513.33	751.68	0.05	
Main	14625.4	10yr+2080	Proposed	1146	538.8	548.95	544.47	548.95	0.000032	0.83	2466.98	750.06	0.05	-0.08
Main	14625.4	25yr	Existing	1280	538.8	549.11	544.61	549.11	0.000036	0.88	2562.98	753.47	0.05	
Main	14625.4	25yr	Proposed	1245	538.8	549.02	544.58	549.02	0.000036	0.88	2509.18	751.55	0.05	-0.09
Main	14625.4	25yr+2050	Existing	1495	538.8	549.25	544.77	549.26	0.000044	0.99	2648.44	756.55	0.06	
Main	14625.4	25yr+2050	Proposed	1458	538.8	549.25	544.75	549.26	0.000042	0.97	2646.21	756.47	0.06	0
Main	14625.4	25yr+2080	Existing											

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main		14415 50yr+2050	Existing	1800	537.55	549.44	544.07	549.45	0.000067	1.3	2537.51	968.81	0.07	
Main		14415 50yr+2050	Proposed	1761	537.55	549.42	544	549.43	0.000065	1.28	2526.04	967.3	0.07	-0.02
Main		14415 50yr+2080	Existing	1951	537.55	549.54	544.29	549.55	0.000073	1.37	2595.91	973.06	0.08	
Main		14415 50yr+2080	Proposed	1915	537.55	549.49	544.23	549.5	0.000073	1.36	2565.91	970.91	0.08	-0.05
Main		14415 100yr	Existing	1849	537.55	549.47	544.14	549.48	0.000069	1.32	2553.99	970.03	0.08	
Main		14415 100yr	Proposed	1809	537.55	549.43	544.09	549.45	0.000067	1.31	2534.92	968.62	0.07	-0.04
Main		14415 100yr+2050	Existing	2118	537.55	549.58	544.58	549.6	0.000083	1.47	2622.2	974.95	0.08	
Main		14415 100yr+2050	Proposed	2081	537.55	549.6	544.51	549.61	0.00008	1.44	2628.7	975.42	0.08	0.02
Main		14415 100yr+2080	Existing	2168	537.55	549.68	544.64	549.7	0.000082	1.46	2679.04	979.05	0.08	
Main		14415 100yr+2080	Proposed	2130	537.55	549.62	544.59	549.63	0.000082	1.46	2643.17	976.46	0.08	-0.06
Main	13766.61	Culvert												
Main		13318.7 10yr	Existing	980	530.04	535.54	532.98	535.71	0.001145	3.31	296.43	219.43	0.28	
Main		13318.7 10yr	Proposed	952	530.04	535.58	532.95	535.74	0.001046	3.18	299.36	220.4	0.27	0.04
Main		13318.7 10yr+2050	Existing	1137	530.04	535.84	533.2	536.04	0.001233	3.59	316.97	225.03	0.29	
Main		13318.7 10yr+2050	Proposed	1105	530.04	535.78	533.15	535.97	0.001216	3.53	312.93	224.3	0.29	-0.06
Main		13318.7 10yr+2080	Existing	1180	530.04	535.92	533.24	536.12	0.001257	3.66	322.26	225.99	0.3	
Main		13318.7 10yr+2080	Proposed	1146	530.04	535.85	533.2	536.06	0.001238	3.6	318.09	225.23	0.3	-0.07
Main		13318.7 25yr	Existing	1280	530.04	536.05	533.35	536.29	0.001342	3.86	331.81	227.72	0.31	
Main		13318.7 25yr	Proposed	1245	530.04	535.99	533.33	536.21	0.001332	3.81	327.08	226.86	0.31	-0.06
Main		13318.7 25yr+2050	Existing	1495	530.04	536.24	533.62	536.53	0.001612	4.34	344.7	229.9	0.34	
Main		13318.7 25yr+2050	Proposed	1458	530.04	536.22	533.58	536.5	0.001558	4.25	343.02	228.68	0.34	-0.02
Main		13318.7 25yr+2080	Existing	1606	530.04	536.35	533.75	536.67	0.001734	4.56	352.03	230.86	0.36	
Main		13318.7 25yr+2080	Proposed	1568	530.04	536.31	533.71	536.63	0.001691	4.48	349.65	230.55	0.35	-0.04
Main		13318.7 50yr	Existing	1547	530.04	536.29	533.69	536.6	0.001668	4.44	348.28	230.37	0.35	
Main		13318.7 50yr	Proposed	1509	530.04	536.25	533.64	536.55	0.001628	4.37	345.59	230.02	0.34	-0.04
Main		13318.7 50yr+2050	Existing	1800	530.04	536.69	533.96	536.82	0.00084	3.32	791.19	233.96	0.25	
Main		13318.7 50yr+2050	Proposed	1761	530.04	536.65	533.92	536.78	0.000833	3.28	781.08	233.57	0.25	-0.04
Main		13318.7 50yr+2080	Existing	1951	530.04	536.84	534.13	536.97	0.000882	3.46	824.28	235.22	0.26	
Main		13318.7 50yr+2080	Proposed	1915	530.04	536.8	534.1	536.94	0.000873	3.42	816.36	234.92	0.26	-0.04
Main		13318.7 100yr	Existing	1849	530.04	536.74	534.02	536.87	0.000855	3.36	801.58	234.36	0.25	
Main		13318.7 100yr	Proposed	1809	530.04	536.7	533.98	536.83	0.000842	3.32	793.57	234.05	0.25	-0.04
Main		13318.7 100yr+2050	Existing	2118	530.04	537	534.31	537.14	0.000917	3.59	862.63	236.73	0.26	
Main		13318.7 100yr+2050	Proposed	2081	530.04	536.96	534.27	537.1	0.000912	3.57	853.58	236.36	0.26	-0.04
Main		13318.7 100yr+2080	Existing	2168	530.04	537.06	534.35	537.21	0.00092	3.62	876.52	237.34	0.26	
Main		13318.7 100yr+2080	Proposed	2130	530.04	537.01	534.31	537.16	0.000917	3.6	866.42	236.88	0.26	-0.05
Main		13211.5 10yr	Existing	980	529.5	534.42	533.72	535.26	0.006676	7.94	190.9	135.37	0.68	
Main		13211.5 10yr	Proposed	952	529.5	534.36	533.7	535.28	0.007134	8.13	150.33	132.4	0.7	-0.06
Main		13211.5 10yr+2050	Existing	1137	529.5	534.56	534.01	535.54	0.007653	8.68	209.72	142.39	0.73	
Main		13211.5 10yr+2050	Proposed	1105	529.5	534.53	534.01	535.48	0.007456	8.53	206.03	141.09	0.72	-0.03
Main		13211.5 10yr+2080	Existing	1180	529.5	534.6	534.06	535.61	0.007906	8.87	214.76	144.21	0.74	
Main		13211.5 10yr+2080	Proposed	1146	529.5	534.57	534.01	535.55	0.007707	8.72	210.77	142.78	0.73	-0.03
Main		13211.5 25yr	Existing	1280	529.5	534.73	534.73	535.76	0.007903	9.05	235.21	151.59	0.74	
Main		13211.5 25yr	Proposed	1245	529.5	534.73	534.73	535.7	0.007513	8.82	234.52	151.14	0.73	0
Main		13211.5 25yr+2050	Existing	1495	529.5	535.2	535.2	536.06	0.006378	8.67	316.12	204.2	0.68	
Main		13211.5 25yr+2050	Proposed	1458	529.5	535.13	535.13	536.01	0.0066	8.74	302.57	199.18	0.69	-0.07
Main		13211.5 25yr+2080	Existing	1606	529.5	535.3	535.3	536.18	0.006498	8.87	336.44	210.03	0.69	
Main		13211.5 25yr+2080	Proposed	1568	529.5	535.27	535.27	536.14	0.006473	8.81	329.16	207.96	0.69	-0.03
Main		13211.5 50yr	Existing	1547	529.5	535.25	535.25	536.12	0.006452	8.77	325.29	206.86	0.69	
Main		13211.5 50yr	Proposed	1509	529.5	535.21	535.21	536.07	0.006374	8.68	319.22	205.12	0.68	-0.04
Main		13211.5 50yr+2050	Existing	1800	529.5	535.47	535.47	536.39	0.006755	9.24	369.19	219.85	0.71	
Main		13211.5 50yr+2050	Proposed	1761	529.5	535.44	535.44	536.35	0.006667	9.14	363.67	218.09	0.7	-0.03
Main		13211.5 50yr+2080	Existing	1951	529.5	535.62	535.62	536.53	0.0067	9.37	400.22	228.64	0.71	
Main		13211.5 50yr+2080	Proposed	1915	529.5	535.59	535.59	536.5	0.00669	9.33	393.56	226.91	0.71	-0.03
Main		13211.5 100yr	Existing	1849	529.5	535.53	535.53	536.44	0.006673	9.25	381.14	223.55	0.7	
Main		13211.5 100yr	Proposed	1809	529.5	535.47	535.47	536.39	0.006783	9.26	370.24	220.19	0.71	-0.06
Main		13211.5 100yr+2050	Existing	2118	529.5	535.73	535.73	536.69	0.006988	9.7	423.6	235.91	0.72	
Main		13211.5 100yr+2050	Proposed	2081	529.5	535.71	535.71	536.66	0.006864	9.59	420.23	234.87	0.72	-0.02
Main		13211.5 100yr+2080	Existing	2168	529.5	535.73	535.73	536.73	0.007285	9.91	424.63	236.4	0.74	
Main		13211.5 100yr+2080	Proposed	2130	529.5	535.72	535.72	536.7	0.0071	9.77	422.71	235.64	0.73	-0.01
Main		13051.8 10yr	Existing	980	529.65	533.93		534.26	0.004346	5.63	322.81	235.5	0.53	
Main		13051.8 10yr	Proposed	952	529.65	533.9		534.23	0.00434	5.59	315.12	234.9	0.53	-0.03
Main		13051.8 10yr+2050	Existing	1137	529.65	534.13		534.45	0.004212	5.74	369.83	239.14	0.52	
Main		13051.8 10yr+2050	Proposed	1105	529.65	534.09		534.42	0.004234	5.72	360.6	238.43	0.53	-0.04
Main		13051.8 10yr+2080	Existing	1180	529.65	534.18		534.5	0.004201	5.79	381.49	240.04	0.53	
Main		13051.8 10yr+2080	Proposed	1146	529.65	534.14		534.46	0.004208	5.75	372.36	239.34	0.52	-0.04
Main		13051.8 25yr	Existing	1280	529.65	534.28		534.61	0.004195	5.89	407.41	242.55	0.53	
Main		13051.8 25yr	Proposed	1245	529.65	534.25		534.58	0.004195	5.85	398.42	241.5	0.53	-0.03
Main		13051.8 25yr+2050	Existing	1495	529.65	534.52		534.85	0.004132	6.08	464.39	251	0.53	
Main		13051.8 25yr+2050	Proposed	1458	529.65	534.47		534.81	0.004148	6.05	454.15	248.81	0.53	-0.05
Main		13051.8 25yr+2080	Existing	1606	529.65	534.63		534.97	0.004118	6.18	492.33	255.38	0.53	
Main		13051.8 25yr+2080	Proposed	1568	529.65	534.59		534.93	0.004106	6.13	483.67	254.17	0.53	-0.04
Main		13051.8 50yr	Existing	1547	529.65	534.57		534.91	0.004099	6.11	478.88	253.49	0.53	
Main		13051.8 50yr	Proposed	1509	529.65	534.53		534.87	0.004126	6.09	468.22	251.82	0.53	-0.04
Main		13051.8 50yr+2050	Existing	1800	529.65	534.79		535.15	0.004178	6.38	535.78	262.36	0.54	
Main		13051.8 50yr+2050	Proposed	1761	529.65	534.76		535.11	0.004166	6.34	527.14	260.84	0.54	-0.03
Main		13051.8 50yr+2080	Existing	1951	529.65	534.92		535.28	0.00421	6.53	568.73	266.91	0.54	
Main		13051.8 50yr+2080	Proposed	1915	529.65	534.89		535.25	0.004204	6.5	560.94	265.91	0.54	-0.03
Main		13051.8 100yr	Existing	1849	529.65	534.83		535.19	0.00419	6.43	546.61	264.08	0.54	
Main		13051.8 100yr	Proposed	1809	529.65	534.8		535.16	0.00418	6.39	537.8	262.72	0.54	-0.03
Main		13051.8 100yr+2050	Existing	2118	529.65	535.05		535.42	0.004233	6.67	604	270.62	0.55	
Main		13051.8 100yr+2050	Proposed	2081	529.65	535.02		535.39	0.004232	6.64	596.2	269.99	0.55	-0.03
Main		13051.8 100yr+2080	Existing	2168	529.65	535.09		535.46	0.004232	6.71	614.62	271.46	0.55	
Main		13051.8 100yr+2080	Proposed	2130	529.65</									

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	12537.3	10yr	Proposed	952	527.58	532.45	531.6	532.59	0.001619	3.81	476.08	358.64	0.33	-0.04
Main	12537.3	10yr+2050	Existing	1137	527.58	532.67	531.76	532.82	0.001696	4.03	540.21	370.22	0.34	
Main	12537.3	10yr+2050	Proposed	1105	527.58	532.63	531.73	532.78	0.001684	4	529.39	368.32	0.33	-0.04
Main	12537.3	10yr+2080	Existing	1180	527.58	532.72	531.79	532.86	0.001719	4.09	553.49	372.53	0.34	
Main	12537.3	10yr+2080	Proposed	1146	527.58	532.68	531.77	532.83	0.001694	4.04	543.86	370.85	0.34	-0.04
Main	12537.3	25yr	Existing	1280	527.58	532.84	531.84	532.99	0.001726	4.17	589.6	377.42	0.34	
Main	12537.3	25yr	Proposed	1245	527.58	532.79	531.84	532.94	0.001732	4.15	576.02	375.72	0.34	-0.05
Main	12537.3	25yr+2050	Existing	1495	527.58	533.03	532.03	533.19	0.001854	4.44	647.22	384.25	0.36	
Main	12537.3	25yr+2050	Proposed	1458	527.58	532.99	532	533.15	0.001842	4.4	636.42	383.12	0.35	-0.04
Main	12537.3	25yr+2080	Existing	1606	527.58	533.13	532.12	533.3	0.001893	4.55	678.44	387.58	0.36	
Main	12537.3	25yr+2080	Proposed	1568	527.58	533.1	532.09	533.27	0.001869	4.5	669.27	386.56	0.36	-0.03
Main	12537.3	50yr	Existing	1547	527.58	533.07	532.07	533.24	0.001878	4.49	661.17	385.71	0.36	
Main	12537.3	50yr	Proposed	1509	527.58	533.04	532.05	533.21	0.001859	4.45	651.12	384.66	0.36	-0.03
Main	12537.3	50yr+2050	Existing	1800	527.58	533.29	532.23	533.48	0.001956	4.72	730.94	393.18	0.37	
Main	12537.3	50yr+2050	Proposed	1761	527.58	533.26	532.21	533.44	0.001951	4.7	719.54	391.93	0.37	-0.03
Main	12537.3	50yr+2080	Existing	1951	527.58	533.41	532.32	533.6	0.002018	4.87	767.98	397.64	0.38	
Main	12537.3	50yr+2080	Proposed	1915	527.58	533.38	532.3	533.57	0.002006	4.84	758.95	396.55	0.37	-0.03
Main	12537.3	100yr	Existing	1849	527.58	533.33	532.26	533.52	0.001975	4.77	743.27	394.67	0.37	
Main	12537.3	100yr	Proposed	1809	527.58	533.3	532.23	533.48	0.001958	4.73	733.46	393.48	0.37	-0.03
Main	12537.3	100yr+2050	Existing	2118	527.58	533.54	532.41	533.74	0.002068	5.01	809.47	401.8	0.38	
Main	12537.3	100yr+2050	Proposed	2081	527.58	533.52	532.38	533.71	0.002048	4.97	801.77	401.34	0.38	-0.02
Main	12537.3	100yr+2080	Existing	2168	527.58	533.59	532.43	533.79	0.002061	5.03	824.45	402.69	0.38	
Main	12537.3	100yr+2080	Proposed	2130	527.58	533.56	532.41	533.75	0.00206	5.01	813.92	402.06	0.38	-0.03
Main	12205	10yr	Existing	980	527.58	531.95	531.17	532.05	0.001781	3.57	585.44	378.63	0.34	
Main	12205	10yr	Proposed	952	527.58	531.91	531.14	532.01	0.001796	3.55	569.94	374.9	0.34	-0.04
Main	12205	10yr+2050	Existing	1137	527.58	532.11	531.28	532.21	0.001855	3.75	646.31	388.46	0.35	
Main	12205	10yr+2050	Proposed	1105	527.58	532.07	531.26	532.18	0.001844	3.72	633.5	385.92	0.34	-0.04
Main	12205	10yr+2080	Existing	1180	527.58	532.14	531.31	532.25	0.001898	3.82	659.49	391.18	0.35	
Main	12205	10yr+2080	Proposed	1146	527.58	532.12	531.28	532.23	0.001842	3.75	652.15	389.67	0.34	-0.02
Main	12205	25yr	Existing	1280	527.58	532.26	531.36	532.37	0.001879	3.88	708.32	405.71	0.35	
Main	12205	25yr	Proposed	1245	527.58	532.22	531.34	532.33	0.001891	3.86	689.05	397.59	0.35	-0.04
Main	12205	25yr+2050	Existing	1495	527.58	532.39	531.49	532.52	0.002122	4.22	760.85	413.68	0.37	
Main	12205	25yr+2050	Proposed	1458	527.58	532.36	531.46	532.49	0.002119	4.19	747.19	411.97	0.37	-0.03
Main	12205	25yr+2080	Existing	1606	527.58	532.48	531.54	532.61	0.00215	4.31	798.84	418.86	0.38	
Main	12205	25yr+2080	Proposed	1568	527.58	532.47	531.52	532.59	0.002098	4.25	791.69	417.57	0.37	-0.01
Main	12205	50yr	Existing	1547	527.58	532.43	531.52	532.56	0.002157	4.28	775.8	415.55	0.38	
Main	12205	50yr	Proposed	1509	527.58	532.4	531.48	532.53	0.002128	4.23	765.42	414.26	0.38	-0.03
Main	12205	50yr+2050	Existing	1800	527.58	532.63	531.64	532.77	0.002205	4.47	862.75	429.29	0.39	
Main	12205	50yr+2050	Proposed	1761	527.58	532.59	531.61	532.73	0.002225	4.46	845.87	426.92	0.39	-0.04
Main	12205	50yr+2080	Existing	1951	527.58	532.73	531.69	532.87	0.002284	4.62	903.66	434.29	0.39	
Main	12205	50yr+2080	Proposed	1915	527.58	532.7	531.69	532.85	0.002274	4.59	892.79	433.03	0.39	-0.03
Main	12205	100yr	Existing	1849	527.58	532.67	531.66	532.81	0.002229	4.52	876.56	431.22	0.39	
Main	12205	100yr	Proposed	1809	527.58	532.64	531.63	532.78	0.002203	4.48	866.21	429.78	0.39	-0.03
Main	12205	100yr+2050	Existing	2118	527.58	532.85	531.76	533	0.002312	4.73	955.42	440.27	0.4	
Main	12205	100yr+2050	Proposed	2081	527.58	532.83	531.74	532.98	0.002272	4.68	949.19	439.55	0.39	-0.02
Main	12205	100yr+2080	Existing	2168	527.58	532.9	531.78	533.05	0.002288	4.75	978.27	446.66	0.4	
Main	12205	100yr+2080	Proposed	2130	527.58	532.87	531.77	533.02	0.002292	4.73	963.52	442.72	0.4	-0.03
Main	12107.5	10yr	Existing	980	527.56	531.84	530.79	531.9	0.001191	2.91	673.95	411.48	0.27	
Main	12107.5	10yr	Proposed	952	527.56	531.79	530.78	531.85	0.001205	2.9	656.52	409.04	0.28	-0.05
Main	12107.5	10yr+2050	Existing	1137	527.56	531.99	530.9	532.05	0.001262	3.08	737.32	420.75	0.28	
Main	12107.5	10yr+2050	Proposed	1105	527.56	531.96	530.87	532.02	0.001252	3.05	723.77	418.68	0.28	-0.03
Main	12107.5	10yr+2080	Existing	1180	527.56	532.02	530.92	532.09	0.001298	3.14	750.12	422.7	0.29	
Main	12107.5	10yr+2080	Proposed	1146	527.56	532	530.89	532.07	0.001251	3.08	744.06	421.78	0.28	-0.02
Main	12107.5	25yr	Existing	1280	527.56	532.14	530.96	532.21	0.001269	3.18	803.91	431.05	0.29	
Main	12107.5	25yr	Proposed	1245	527.56	532.09	530.95	532.16	0.001291	3.18	782.32	427.56	0.29	-0.05
Main	12107.5	25yr+2050	Existing	1495	527.56	532.25	531.07	532.33	0.001488	3.5	850.65	438.65	0.31	
Main	12107.5	25yr+2050	Proposed	1458	527.56	532.22	531.06	532.3	0.001481	3.48	836.47	436.45	0.31	-0.03
Main	12107.5	25yr+2080	Existing	1606	527.56	532.34	531.15	532.43	0.001517	3.59	889.75	443.1	0.32	
Main	12107.5	25yr+2080	Proposed	1568	527.56	532.33	531.13	532.41	0.001472	3.53	884.08	442.47	0.31	-0.01
Main	12107.5	50yr	Existing	1547	527.56	532.28	531.07	532.37	0.001521	3.56	865.17	440.36	0.32	
Main	12107.5	50yr	Proposed	1509	527.56	532.26	531.07	532.35	0.001494	3.52	855.26	439.26	0.31	-0.02
Main	12107.5	50yr+2050	Existing	1800	527.56	532.48	531.24	532.58	0.001608	3.78	953.83	459.16	0.33	
Main	12107.5	50yr+2050	Proposed	1761	527.56	532.44	531.21	532.54	0.00163	3.78	934.78	457.66	0.33	-0.04
Main	12107.5	50yr+2080	Existing	1951	527.56	532.57	531.3	532.67	0.001674	3.92	994.7	461.87	0.34	
Main	12107.5	50yr+2080	Proposed	1915	527.56	532.55	531.28	532.65	0.001667	3.89	983.4	461.13	0.34	-0.02
Main	12107.5	100yr	Existing	1849	527.56	532.51	531.26	532.61	0.001627	3.83	967.8	460.11	0.33	
Main	12107.5	100yr	Proposed	1809	527.56	532.49	531.24	532.59	0.001605	3.79	957.67	459.45	0.33	-0.02
Main	12107.5	100yr+2050	Existing	2118	527.56	532.69	531.37	532.79	0.001693	4.01	1048.83	465.37	0.34	
Main	12107.5	100yr+2050	Proposed	2081	527.56	532.68	531.34	532.78	0.001657	3.96	1043.78	465.04	0.34	-0.01
Main	12107.5	100yr+2080	Existing	2168	527.56	532.74	531.38	532.85	0.001653	4	1074.75	467.04	0.34	
Main	12107.5	100yr+2080	Proposed	2130	527.56	532.71	531.37	532.81	0.001667	3.99	1058.58	466	0.34	-0.03
Main	12038.7	10yr	Existing	980	527.54	531.85	529.35	531.86	0.000147	1.07	1586.45	1024.52	0.1	
Main	12038.7	10yr	Proposed	952	527.54	531.81	529.34	531.82	0.000146	1.05	1560.75	1019.85	0.1	-0.04
Main	12038.7	10yr+2050	Existing	1137	527.54	532	529.41	532.01	0.000166	1.16	1680.68	1038.29	0.1	
Main	12038.7	10yr+2050	Proposed	1105	527.54	531.97	529.4	531.98	0.000163	1.15	1660.6	1036.36	0.1	-0.03
Main	12038.7	10yr+2080	Existing	1180	527.54	532.03	529.43	532.04	0.000173	1.19	1699.73	1040.11	0.11	
Main	12038.7	10yr+2080	Proposed	1146	527.54	532.02	529.42	532.03	0.000166	1.17	1690.47	1039.23	0.1	-0.01
Main	12038.7	25yr	Existing	1280	527.54	532.16	529.47	532.17	0.000177	1.23	1777.84	1048.34	0.11	
Main	12038.7	25yr	Proposed	1245	527.54	532.11	529.46	532.12	0.000177	1.22	1746.69	1044.94	0.11	-0.05
Main	12038.7	25yr+2050	Existing	1495	527.54	532.27	529.54	532.28	0.000215	1.38	1846.92	1056.03	0.12	
Main	12038.7	25yr+2050	Proposed	1458	527.54	532.24	529.52	532.25	0.000212	1.37	1826.57	1053.77	0.12	-0.03
Main	1													

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	11933.3	50yr+2050	Proposed	3351	527.54	532.44	532.44	528.62	532.45	0.000214	1.46	3398.05	1248.26	0.12 -0.04
Main	11933.3	50yr+2080	Existing	3719	527.54	532.56	528.71	532.58	0.00024	1.57	3500.1	1251.31	0.13	
Main	11933.3	50yr+2080	Proposed	3632	527.54	532.54	528.7	532.56	0.000233	1.54	3481.23	1250.76	0.13	-0.02
Main	11933.3	100yr	Existing	3526	527.54	532.51	528.68	532.52	0.000225	1.51	3454.35	1249.95	0.13	
Main	11933.3	100yr	Proposed	3442	527.54	532.49	528.65	532.5	0.000218	1.48	3437.32	1249.44	0.12	-0.02
Main	11933.3	100yr+2050	Existing	4037	527.54	532.68	528.77	532.7	0.00026	1.66	3591.82	1254.07	0.14	
Main	11933.3	100yr+2050	Proposed	3943	527.54	532.67	528.75	532.69	0.00025	1.63	3583.82	1253.82	0.13	-0.01
Main	11933.3	100yr+2080	Existing	4131	527.54	532.73	528.79	532.75	0.000261	1.68	3635.84	1255.44	0.14	
Main	11933.3	100yr+2080	Proposed	4036	527.54	532.7	528.77	532.72	0.000256	1.65	3608.86	1254.6	0.13	-0.03
Main	11850.9	10yr	Existing	1878	525	531.82	530.1	531.83	0.000131	1.32	2613.69	1107.9	0.09	
Main	11850.9	10yr	Proposed	1833	525	531.78	530.1	531.79	0.00013	1.31	2583.83	1107.16	0.09	-0.04
Main	11850.9	10yr+2050	Existing	2176	525	531.97	530.11	531.98	0.000155	1.46	2719.21	1110.51	0.1	
Main	11850.9	10yr+2050	Proposed	2123	525	531.94	530.11	531.95	0.000152	1.44	2696.55	1109.95	0.1	-0.03
Main	11850.9	10yr+2080	Existing	2256	525	532.02	530.11	532.02	0.000026	0.6	5792.4	1111.3	0.04	
Main	11850.9	10yr+2080	Proposed	2202	525	531.99	530.11	532	0.000157	1.47	2730.22	1110.78	0.1	-0.03
Main	11850.9	25yr	Existing	2446	525	532.14	530.11	532.15	0.000028	0.63	5930.92	1113.73	0.04	
Main	11850.9	25yr	Proposed	2387	525	532.09	530.11	532.1	0.000028	0.62	5875.48	1112.72	0.04	-0.05
Main	11850.9	25yr+2050	Existing	2854	525	532.25	530.11	532.25	0.000036	0.72	6048.84	1115.87	0.05	
Main	11850.9	25yr+2050	Proposed	2784	525	532.22	530.11	532.22	0.000035	0.71	6013.23	1115.22	0.05	-0.03
Main	11850.9	25yr+2080	Existing	3064	525	532.34	530.11	532.34	0.00004	0.76	6146.17	1117.63	0.05	
Main	11850.9	25yr+2080	Proposed	2990	525	532.32	530.11	532.33	0.000038	0.75	6132.26	1117.38	0.05	-0.02
Main	11850.9	50yr	Existing	2952	525	532.28	530.11	532.28	0.000038	0.74	6085.02	1116.52	0.05	
Main	11850.9	50yr	Proposed	2880	525	532.26	530.11	532.26	0.000037	0.73	6060.35	1116.08	0.05	-0.02
Main	11850.9	50yr+2050	Existing	3433	525	532.48	530.11	532.48	0.000046	0.83	6303.32	1120.26	0.06	
Main	11850.9	50yr+2050	Proposed	3351	525	532.44	530.11	532.44	0.000045	0.82	6257.87	1119.55	0.05	-0.04
Main	11850.9	50yr+2080	Existing	3719	525	532.56	530.11	532.57	0.000051	0.89	6400.35	1121.77	0.06	
Main	11850.9	50yr+2080	Proposed	3632	525	532.54	530.11	532.54	0.000049	0.87	6374.06	1121.36	0.06	-0.02
Main	11850.9	100yr	Existing	3526	525	532.51	530.11	532.51	0.000047	0.85	6336.56	1120.78	0.06	
Main	11850.9	100yr	Proposed	3442	525	532.48	530.11	532.49	0.000046	0.83	6312.76	1120.41	0.06	-0.03
Main	11850.9	100yr+2050	Existing	4037	525	532.68	530.11	532.68	0.000057	0.94	6528.49	1123.76	0.06	
Main	11850.9	100yr+2050	Proposed	3943	525	532.67	530.11	532.67	0.000054	0.92	6517.38	1123.59	0.06	-0.01
Main	11850.9	100yr+2080	Existing	4131	525	532.73	530.11	532.74	0.000057	0.95	6590.05	1124.72	0.06	
Main	11850.9	100yr+2080	Proposed	4036	525	532.7	530.11	532.7	0.000056	0.94	6552.3	1124.13	0.06	-0.03
Main	11804.22	Culvert												
Main	11742.3	10yr	Existing	1878	525	530.88	529.01	530.91	0.000502	2.03	1702.39	873.37	0.17	
Main	11742.3	10yr	Proposed	1833	525	530.83	529.01	530.85	0.000515	2.04	1663.47	872.4	0.17	-0.05
Main	11742.3	10yr+2050	Existing	2176	525	531.3	529.01	531.32	0.000414	1.95	1984.96	880.25	0.15	
Main	11742.3	10yr+2050	Proposed	2123	525	531.22	529.01	531.24	0.00043	1.97	1930.48	878.26	0.16	-0.08
Main	11742.3	10yr+2080	Existing	2256	525	531.43	529.01	531.45	0.000389	1.92	2070.78	889.82	0.15	
Main	11742.3	10yr+2080	Proposed	2202	525	531.34	529.01	531.36	0.000406	1.94	2012.37	881.68	0.15	-0.09
Main	11742.3	25yr	Existing	2446	525	531.75	529.01	531.77	0.00033	1.84	2291.59	900.62	0.14	
Main	11742.3	25yr	Proposed	2387	525	531.65	529.01	531.67	0.000348	1.87	2221.2	898.2	0.14	-0.1
Main	11742.3	25yr+2050	Existing	2854	525	531.52	529.01	531.55	0.000568	2.35	2130.12	894.89	0.18	
Main	11742.3	25yr+2050	Proposed	2784	525	531.47	529.01	531.5	0.000566	2.33	2099.63	893.06	0.18	-0.05
Main	11742.3	25yr+2080	Existing	3064	525	531.66	529.01	531.69	0.000568	2.39	2227.19	898.39	0.18	
Main	11742.3	25yr+2080	Proposed	2990	525	531.61	529.01	531.65	0.000566	2.37	2195.61	897.41	0.18	-0.05
Main	11742.3	50yr	Existing	2952	525	531.59	529.01	531.62	0.000565	2.36	2179.92	896.92	0.18	
Main	11742.3	50yr	Proposed	2880	525	531.54	529.01	531.57	0.000567	2.35	2143.68	895.71	0.18	-0.05
Main	11742.3	50yr+2050	Existing	3433	525	531.89	529.01	531.93	0.000571	2.47	2386.61	903.93	0.18	
Main	11742.3	50yr+2050	Proposed	3351	525	531.84	529.01	531.88	0.000572	2.45	2350.35	902.67	0.18	-0.05
Main	11742.3	50yr+2080	Existing	3719	525	532.06	529.12	532.07	0.000172	1.38	4085.93	907.27	0.1	
Main	11742.3	50yr+2080	Proposed	3632	525	532	529.08	532.01	0.000171	1.37	4032.52	906.12	0.1	-0.06
Main	11742.3	100yr	Existing	3526	525	531.95	529.03	531.99	0.000572	2.49	2425.57	905.11	0.18	
Main	11742.3	100yr	Proposed	3442	525	531.9	529.01	531.93	0.000572	2.47	2389.69	904.03	0.18	-0.05
Main	11742.3	100yr+2050	Existing	4037	525	532.26	529.16	532.27	0.000176	1.43	4265.7	912.85	0.1	
Main	11742.3	100yr+2050	Proposed	3943	525	532.21	529.16	532.23	0.000173	1.41	4224.12	911.22	0.1	-0.05
Main	11742.3	100yr+2080	Existing	4131	525	532.32	529.16	532.34	0.000176	1.44	4326.12	915.2	0.1	
Main	11742.3	100yr+2080	Proposed	4036	525	532.26	529.16	532.27	0.000176	1.43	4265.76	912.85	0.1	-0.06
Main	11652.6	10yr	Existing	1878	524.2	530.67	529.22	530.8	0.002037	4.47	896.44	820.26	0.36	
Main	11652.6	10yr	Proposed	1833	524.2	530.61	529.21	530.74	0.002137	4.54	867.5	818.84	0.37	-0.06
Main	11652.6	10yr+2050	Existing	2176	524.2	531.14	529.43	531.24	0.001481	4.06	1101.24	833.57	0.31	
Main	11652.6	10yr+2050	Proposed	2123	524.2	531.05	529.37	531.15	0.001571	4.14	1062.11	829.87	0.32	-0.09
Main	11652.6	10yr+2080	Existing	2256	524.2	531.28	529.46	531.37	0.001353	3.95	1162.8	839.47	0.3	
Main	11652.6	10yr+2080	Proposed	2202	524.2	531.18	529.44	531.28	0.001438	4.03	1120.93	835.54	0.31	-0.1
Main	11652.6	25yr	Existing	2446	524.2	531.63	529.52	531.71	0.001082	3.69	1320.52	858.63	0.27	
Main	11652.6	25yr	Proposed	2387	524.2	531.52	529.49	531.6	0.001159	3.77	1270.48	849.83	0.28	-0.11
Main	11652.6	25yr+2050	Existing	2854	524.2	531.28	529.74	531.43	0.002165	5	1162.74	839.47	0.38	
Main	11652.6	25yr+2050	Proposed	2784	524.2	531.23	529.74	531.38	0.002168	4.98	1143.08	837.63	0.38	-0.05
Main	11652.6	25yr+2080	Existing	3064	524.2	531.42	529.65	531.57	0.002121	5.04	1227.29	844.86	0.38	
Main	11652.6	25yr+2080	Proposed	2990	524.2	531.38	529.65	531.52	0.002126	5.01	1206.71	843.5	0.38	-0.04
Main	11652.6	50yr	Existing	2952	524.2	531.35	529.74	531.5	0.002125	5	1196.62	842.63	0.38	
Main	11652.6	50yr	Proposed	2880	524.2	531.3	529.74	531.45	0.002153	5	1172.05	840.34	0.38	-0.05
Main	11652.6	50yr+2050	Existing	3433	524.2	531.65	529.74	531.81	0.002073	5.12	1332.47	859.34	0.38	
Main	11652.6	50yr+2050	Proposed	3351	524.2	531.6	529.65	531.75	0.002089	5.11	1308.28	857.9	0.38	-0.05
Main	11652.6	50yr+2080	Existing	3719	524.2	531.84	529.79	531.99	0.002018	5.16	1416.83	864.84	0.38	
Main	11652.6	50yr+2080	Proposed	3632	524.2	531.78	529.79	531.93	0.002048	5.16	1388.2	862.83	0.38	-0.06
Main	11652.6	100yr	Existing	3526	524.2	531.71	529.74	531.86	0.002064	5.14	1358.14	860.87	0.38	
Main	11652.6	100yr	Proposed	3442	524.2	531.66	529.74	531.81	0.002075	5.12	1334.38	859.46	0.38	-0.05
Main	11652.6	100yr+2050	Existing	4037	524.2	532.03	530.51	532.19	0.001974	5.22	1506.06	870.54	0.37	
Main	11652.6	100yr+2050	Proposed	3943	524.2	531.99	530.48	532.15	0.001959	5.17	1486.69	869.23	0.37	-0.04
Main	11652.6	100yr+2080	Existing	4131	524.2	532.1	530.53	532.26	0.001944	5.21	1536.9	872.94	0.37	
Main	11652.6	100yr+2080	Proposed	403										

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	11207.8	10yr+2050	Existing	2176	521.09	527.04		527.05	0.000263	1.59	2563.3	705.37	0.13	
Main	11207.8	10yr+2050	Proposed	2123	521.09	527.01		527.02	0.000257	1.56	2542.9	704.92	0.13	-0.03
Main	11207.8	10yr+2080	Existing	2256	521.09	527.08		527.09	0.000273	1.63	2592.63	706.01	0.14	
Main	11207.8	10yr+2080	Proposed	2202	521.09	527.05		527.06	0.000266	1.6	2571.82	705.56	0.13	-0.03
Main	11207.8	25yr	Existing	2446	521.09	527.17		527.19	0.000295	1.72	2659.66	707.47	0.14	
Main	11207.8	25yr	Proposed	2387	521.09	527.14		527.15	0.00029	1.7	2635.45	706.94	0.14	-0.03
Main	11207.8	25yr+2050	Existing	2854	521.09	527.38		527.4	0.000339	1.9	2805.77	710.65	0.15	
Main	11207.8	25yr+2050	Proposed	2784	521.09	527.34		527.36	0.000332	1.87	2780.23	710.09	0.15	-0.04
Main	11207.8	25yr+2080	Existing	3064	521.09	527.49		527.51	0.000358	1.98	2885.44	712	0.16	
Main	11207.8	25yr+2080	Proposed	2990	521.09	527.45		527.47	0.000351	1.95	2859.2	711.56	0.16	-0.04
Main	11207.8	50yr	Existing	2952	521.09	527.44		527.46	0.000346	1.93	2847.25	711.36	0.16	
Main	11207.8	50yr	Proposed	2880	521.09	527.41		527.42	0.000338	1.9	2825.51	710.99	0.15	-0.03
Main	11207.8	50yr+2050	Existing	3433	521.09	527.62		527.64	0.000407	2.15	2974.92	713.51	0.17	
Main	11207.8	50yr+2050	Proposed	3351	521.09	527.62		527.64	0.000387	2.1	2976.58	713.54	0.17	0
Main	11207.8	50yr+2080	Existing	3719	521.09	527.8		527.82	0.000417	2.23	3105.25	715.7	0.17	
Main	11207.8	50yr+2080	Proposed	3632	521.09	527.75		527.78	0.000412	2.2	3071.62	715.13	0.17	-0.05
Main	11207.8	100yr	Existing	3526	521.09	527.7		527.73	0.000402	2.16	3037.03	714.55	0.17	
Main	11207.8	100yr	Proposed	3442	521.09	527.66		527.68	0.000396	2.13	3006.68	714.04	0.17	-0.04
Main	11207.8	100yr+2050	Existing	4037	521.09	527.94		527.97	0.000443	2.34	3208.64	717.43	0.18	
Main	11207.8	100yr+2050	Proposed	3943	521.09	527.9		527.93	0.000434	2.3	3180.23	716.96	0.18	-0.04
Main	11207.8	100yr+2080	Existing	4131	521.09	527.98		528.01	0.00045	2.37	3238.25	717.93	0.18	
Main	11207.8	100yr+2080	Proposed	4036	521.09	527.91		527.94	0.000454	2.36	3183.03	717	0.18	-0.07
Main	11061.8	10yr	Existing	1878	520.93	526.82	522.58	526.84	0.000232	1.58	2051.2	714.3	0.13	
Main	11061.8	10yr	Proposed	1833	520.93	526.79	522.57	526.8	0.000226	1.55	2036.14	711.85	0.13	-0.03
Main	11061.8	10yr+2050	Existing	2176	520.93	526.99	522.69	527.01	0.000279	1.77	2129.8	727.53	0.14	
Main	11061.8	10yr+2050	Proposed	2123	520.93	526.96	522.67	526.98	0.00027	1.74	2116.91	725.27	0.14	-0.03
Main	11061.8	10yr+2080	Existing	2256	520.93	527.03	522.71	527.05	0.000293	1.82	2148.35	730.79	0.14	
Main	11061.8	10yr+2080	Proposed	2202	520.93	527	522.69	527.02	0.000284	1.79	2135.13	728.47	0.14	-0.03
Main	11061.8	25yr	Existing	2446	520.93	527.12	522.79	527.14	0.000325	1.95	2190.71	748.86	0.15	
Main	11061.8	25yr	Proposed	2387	520.93	527.09	522.77	527.11	0.000316	1.91	2175.16	735.82	0.15	-0.03
Main	11061.8	25yr+2050	Existing	2854	520.93	527.31	522.93	527.34	0.000392	2.19	2283.93	782.91	0.17	
Main	11061.8	25yr+2050	Proposed	2784	520.93	527.28	522.89	527.31	0.000381	2.15	2267.5	780.45	0.17	-0.03
Main	11061.8	25yr+2080	Existing	3064	520.93	527.42	522.99	527.45	0.000424	2.31	2335.56	790.9	0.18	
Main	11061.8	25yr+2080	Proposed	2990	520.93	527.39	522.96	527.42	0.000412	2.27	2318.6	788.26	0.17	-0.03
Main	11061.8	50yr	Existing	2952	520.93	527.37	522.94	527.4	0.000406	2.24	2311.06	787.08	0.17	
Main	11061.8	50yr	Proposed	2880	520.93	527.34	522.93	527.37	0.000393	2.2	2297.29	784.92	0.17	-0.03
Main	11061.8	50yr+2050	Existing	3433	520.93	527.54	523.1	527.57	0.000498	2.54	2391.04	799.96	0.19	
Main	11061.8	50yr+2050	Proposed	3351	520.93	527.54	523.08	527.58	0.000473	2.47	2394.14	800.49	0.19	0
Main	11061.8	50yr+2080	Existing	3719	520.93	527.71	523.19	527.75	0.000527	2.67	2478.59	814.85	0.2	
Main	11061.8	50yr+2080	Proposed	3632	520.93	527.67	523.16	527.71	0.000516	2.62	2456.24	811.01	0.19	-0.04
Main	11061.8	100yr	Existing	3526	520.93	527.62	523.14	527.66	0.000499	2.57	2433.66	807.2	0.19	
Main	11061.8	100yr	Proposed	3442	520.93	527.58	523.11	527.62	0.000487	2.52	2413.7	803.81	0.19	-0.04
Main	11061.8	100yr+2050	Existing	4037	520.93	527.85	523.33	527.9	0.000575	2.83	2546.77	825.9	0.21	
Main	11061.8	100yr+2050	Proposed	3943	520.93	527.81	523.31	527.86	0.00056	2.78	2528.14	822.99	0.2	-0.04
Main	11061.8	100yr+2080	Existing	4131	520.93	527.89	523.36	527.94	0.000589	2.88	2566.33	828.98	0.21	
Main	11061.8	100yr+2080	Proposed	4036	520.93	527.81	523.32	527.86	0.000587	2.85	2527.99	822.97	0.21	-0.08
Main	10733.8	10yr	Existing	1878	517.3	526.79		526.79	0.000076	1.24	3283.95	585.37	0.08	
Main	10733.8	10yr	Proposed	1833	517.3	526.76		526.76	0.000073	1.22	3265.45	584.95	0.08	-0.03
Main	10733.8	10yr+2050	Existing	2176	517.3	526.95		526.96	0.000093	1.4	3378.41	587.5	0.09	
Main	10733.8	10yr+2050	Proposed	2123	517.3	526.92		526.93	0.00009	1.37	3363.06	587.16	0.08	-0.03
Main	10733.8	10yr+2080	Existing	2256	517.3	526.99		526.99	0.000098	1.44	3400.36	588	0.09	
Main	10733.8	10yr+2080	Proposed	2202	517.3	526.96		526.97	0.000095	1.41	3384.65	587.65	0.09	-0.03
Main	10733.8	25yr	Existing	2446	517.3	527.07		527.08	0.00011	1.53	3450.11	589.09	0.09	
Main	10733.8	25yr	Proposed	2387	517.3	527.04		527.05	0.000107	1.51	3431.6	588.69	0.09	-0.03
Main	10733.8	25yr+2050	Existing	2854	517.3	527.25		527.27	0.000136	1.73	3558.96	591.72	0.1	
Main	10733.8	25yr+2050	Proposed	2784	517.3	527.22		527.23	0.000132	1.7	3539.79	591.2	0.1	-0.03
Main	10733.8	25yr+2080	Existing	3064	517.3	527.36		527.37	0.000149	1.83	3619.22	593.36	0.11	
Main	10733.8	25yr+2080	Proposed	2990	517.3	527.32		527.34	0.000145	1.79	3599.56	592.83	0.11	-0.04
Main	10733.8	50yr	Existing	2952	517.3	527.31		527.32	0.000142	1.77	3590.99	592.6	0.11	
Main	10733.8	50yr	Proposed	2880	517.3	527.28		527.3	0.000137	1.74	3575.29	592.17	0.1	-0.03
Main	10733.8	50yr+2050	Existing	3433	517.3	527.46		527.48	0.000178	2.01	3679.67	595	0.12	
Main	10733.8	50yr+2050	Proposed	3351	517.3	527.47		527.49	0.000169	1.96	3685.85	595.17	0.12	0.01
Main	10733.8	50yr+2080	Existing	3719	517.3	527.63		527.65	0.000192	2.11	3782.54	597.79	0.12	
Main	10733.8	50yr+2080	Proposed	3632	517.3	527.59		527.61	0.000187	2.08	3756.72	597.09	0.12	-0.04
Main	10733.8	100yr	Existing	3526	517.3	527.54		527.56	0.00018	2.03	3731.12	596.4	0.12	
Main	10733.8	100yr	Proposed	3442	517.3	527.51		527.52	0.000175	2	3708.16	595.78	0.12	-0.03
Main	10733.8	100yr+2050	Existing	4037	517.3	527.76		527.78	0.000212	2.24	3859.47	599.52	0.13	
Main	10733.8	100yr+2050	Proposed	3943	517.3	527.7								

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	10426.1	50yr+2080	Existing	3719	516.2	527.54	522.93	527.59	0.000294	2.98	3009.83	565.7	0.16	
Main	10426.1	50yr+2080	Proposed	3632	516.2	527.5	522.88	527.54	0.000286	2.93	2986.66	564.15	0.16	-0.04
Main	10426.1	100yr	Existing	3526	516.2	527.46	522.56	527.5	0.000276	2.87	2964.27	562.84	0.16	
Main	10426.1	100yr	Proposed	3442	516.2	527.43	522.78	527.47	0.000268	2.82	2943.99	561.66	0.15	-0.03
Main	10426.1	100yr+2050	Existing	4037	516.2	527.66	523.07	527.71	0.000326	3.16	3077.81	577.87	0.17	
Main	10426.1	100yr+2050	Proposed	3943	516.2	527.63	523.04	527.68	0.000316	3.1	3059.48	574.57	0.17	-0.03
Main	10426.1	100yr+2080	Existing	4131	516.2	527.7	523.13	527.75	0.000335	3.21	3097.23	581.07	0.17	
Main	10426.1	100yr+2080	Proposed	4036	516.2	527.62	523.07	527.67	0.000332	3.18	3054.02	573.59	0.17	-0.08
Main	10374.02	Culvert												
Main	10330.4	10yr	Existing	1878	515.35	526.75	520.41	526.76	0.000043	1.15	3153.33	471.54	0.06	
Main	10330.4	10yr	Proposed	1833	515.35	526.72	520.4	526.73	0.000041	1.13	3138.95	470.61	0.06	-0.03
Main	10330.4	10yr+2050	Existing	2176	515.35	526.9	520.55	526.91	0.000054	1.3	3223.16	484	0.07	
Main	10330.4	10yr+2050	Proposed	2123	515.35	526.88	520.53	526.89	0.000052	1.28	3211.48	477.26	0.07	-0.02
Main	10330.4	10yr+2080	Existing	2256	515.35	526.94	520.59	526.95	0.000057	1.35	3239.98	492.62	0.07	
Main	10330.4	10yr+2080	Proposed	2202	515.35	526.91	520.56	526.92	0.000055	1.32	3227.81	486.67	0.07	-0.03
Main	10330.4	25yr	Existing	2446	515.35	527.03	520.67	527.04	0.000065	1.44	3284.93	504.46	0.08	
Main	10330.4	25yr	Proposed	2387	515.35	527	520.64	527.01	0.000063	1.41	3269.95	499.55	0.08	-0.03
Main	10330.4	25yr+2050	Existing	2854	515.35	527.2	520.82	527.21	0.000088	1.69	3372.94	514.25	0.09	
Main	10330.4	25yr+2050	Proposed	2784	515.35	527.17	520.8	527.18	0.000085	1.66	3357.39	513.3	0.09	-0.03
Main	10330.4	25yr+2080	Existing	3064	515.35	527.29	520.9	527.31	0.000098	1.79	3420.06	517.1	0.09	
Main	10330.4	25yr+2080	Proposed	2990	515.35	527.26	520.86	527.28	0.000094	1.76	3404.16	516.14	0.09	-0.03
Main	10330.4	50yr	Existing	2952	515.35	527.25	520.85	527.27	0.000092	1.74	3399.47	515.85	0.09	
Main	10330.4	50yr	Proposed	2880	515.35	527.23	520.83	527.24	0.000089	1.7	3387.01	515.1	0.09	-0.02
Main	10330.4	50yr+2050	Existing	3433	515.35	527.38	521.03	527.4	0.000119	1.98	3465.44	520.01	0.1	
Main	10330.4	50yr+2050	Proposed	3351	515.35	527.39	520.99	527.41	0.000112	1.93	3473.03	520.51	0.1	0.01
Main	10330.4	50yr+2080	Existing	3719	515.35	527.54	521.12	527.56	0.00013	2.1	3551.2	525.4	0.11	
Main	10330.4	50yr+2080	Proposed	3632	515.35	527.5	521.08	527.52	0.000126	2.06	3530	524.07	0.11	-0.04
Main	10330.4	100yr	Existing	3526	515.35	527.46	521.05	527.48	0.000121	2.01	3509.49	522.88	0.11	
Main	10330.4	100yr	Proposed	3442	515.35	527.43	521.03	527.45	0.000117	1.98	3490.87	521.67	0.1	-0.03
Main	10330.4	100yr+2050	Existing	4037	515.35	527.66	521.21	527.68	0.000147	2.25	3612.9	530.34	0.12	
Main	10330.4	100yr+2050	Proposed	3943	515.35	527.63	521.18	527.65	0.000142	2.2	3596.31	529.02	0.11	-0.03
Main	10330.4	100yr+2080	Existing	4131	515.35	527.69	521.24	527.72	0.000152	2.29	3630.31	532.13	0.12	
Main	10330.4	100yr+2080	Proposed	4036	515.35	527.62	521.21	527.64	0.000149	2.26	3591.28	528.62	0.12	-0.07
Main	10229.4	10yr	Existing	1878	515.09	526.74	526.75	526.76	0.000082	1.54	2388.28	377.99	0.09	
Main	10229.4	10yr	Proposed	1833	515.09	526.71	526.72	526.73	0.000079	1.51	2376.96	377.55	0.08	-0.03
Main	10229.4	10yr+2050	Existing	2176	515.09	526.88	526.9	526.91	0.000103	1.74	2442.32	380.06	0.1	
Main	10229.4	10yr+2050	Proposed	2123	515.09	526.86	526.88	526.89	0.000099	1.7	2433.42	379.72	0.09	-0.02
Main	10229.4	10yr+2080	Existing	2256	515.09	526.91	526.93	526.94	0.000109	1.79	2454.93	380.54	0.1	
Main	10229.4	10yr+2080	Proposed	2202	515.09	526.89	526.91	526.91	0.000105	1.76	2445.83	380.19	0.1	-0.02
Main	10229.4	25yr	Existing	2446	515.09	527	527.02	527.03	0.000123	1.91	2488.17	381.81	0.1	
Main	10229.4	25yr	Proposed	2387	515.09	526.97	526.99	527.01	0.000119	1.88	2477.15	381.39	0.1	-0.03
Main	10229.4	25yr+2050	Existing	2854	515.09	527.17	527.2	527.21	0.000156	2.18	2551.52	384.63	0.12	
Main	10229.4	25yr+2050	Proposed	2784	515.09	527.14	527.17	527.18	0.00015	2.13	2540.33	384.06	0.12	-0.03
Main	10229.4	25yr+2080	Existing	3064	515.09	527.25	527.29	527.29	0.000173	2.3	2585.26	386.33	0.12	
Main	10229.4	25yr+2080	Proposed	2990	515.09	527.22	527.26	527.26	0.000167	2.26	2573.92	385.76	0.12	-0.03
Main	10229.4	50yr	Existing	2952	515.09	527.22	527.25	527.25	0.000163	2.23	2570.7	385.6	0.12	
Main	10229.4	50yr	Proposed	2880	515.09	527.19	527.22	527.22	0.000157	2.19	2561.92	385.16	0.12	-0.03
Main	10229.4	50yr+2050	Existing	3433	515.09	527.33	527.38	527.38	0.000209	2.55	2616.07	387.88	0.14	
Main	10229.4	50yr+2050	Proposed	3351	515.09	527.35	527.39	527.39	0.000198	2.48	2622.63	388.21	0.13	0.02
Main	10229.4	50yr+2080	Existing	3719	515.09	527.49	527.54	527.54	0.00023	2.7	2678.36	397.55	0.14	
Main	10229.4	50yr+2080	Proposed	3632	515.09	527.45	527.5	527.5	0.000223	2.65	2662.99	395.62	0.14	-0.04
Main	10229.4	100yr	Existing	3526	515.09	527.42	527.46	527.46	0.000213	2.59	2648.48	391	0.14	
Main	10229.4	100yr	Proposed	3442	515.09	527.38	527.42	527.42	0.000206	2.54	2635.27	388.85	0.14	-0.04
Main	10229.4	100yr+2050	Existing	4037	515.09	527.6	527.66	527.66	0.000259	2.89	2722.4	401.2	0.15	
Main	10229.4	100yr+2050	Proposed	3943	515.09	527.57	527.63	527.63	0.000251	2.83	2710.65	400.61	0.15	-0.03
Main	10229.4	100yr+2080	Existing	4131	515.09	527.63	527.69	527.69	0.000268	2.94	2734.77	401.82	0.16	
Main	10229.4	100yr+2080	Proposed	4036	515.09	527.56	527.62	527.62	0.000264	2.9	2705.69	400.35	0.15	-0.07
Main	9838.3	10yr	Existing	1878	513.11	526.72	526.73	526.73	0.000043	1.23	3002.41	370.56	0.06	
Main	9838.3	10yr	Proposed	1833	513.11	526.69	526.7	526.71	0.000041	1.2	2991.56	370	0.06	-0.03
Main	9838.3	10yr+2050	Existing	2176	513.11	526.86	526.87	526.88	0.000054	1.4	3053.6	373.21	0.07	
Main	9838.3	10yr+2050	Proposed	2123	513.11	526.83	526.85	526.85	0.000052	1.37	3045.2	372.78	0.07	-0.03
Main	9838.3	10yr+2080	Existing	2256	513.11	526.89	526.9	526.91	0.000058	1.45	3065.45	373.82	0.07	
Main	9838.3	10yr+2080	Proposed	2202	513.11	526.87	526.88	526.88	0.000056	1.42	3056.86	373.38	0.07	-0.02
Main	9838.3	25yr	Existing	2446	513.11	526.97	526.99	527.01	0.000066	1.55	3096.85	375.44	0.08	
Main	9838.3	25yr	Proposed	2387	513.11	526.95	526.96	526.96	0.000064	1.52	3086.4	374.9	0.08	-0.02
Main	9838.3	25yr+2050	Existing	2854	513.11	527.13	527.15	527.15	0.000085	1.78	3156.23	378.47	0.09	
Main	9838.3	25yr+2050	Proposed	2784	513.11	527.1	527.12	527.12	0.000082	1.74	3145.73	377.93	0.09	-0.03
Main	9838.3	25yr+2080	Existing	3064	513.11	527.21	527.24	527.24	0.000096	1.89	3187.81	380.19	0.09	
Main	9838.3	25yr+2080	Proposed	2990	513.11	527.19	527.21	527.21	0.000092	1.85	3177.23	379.61	0.09	-0.02
Main	9838.3	50yr	Existing	2952	513.11	527.18	527.2	527.2	0.00009	1.83	3174.39	379.45	0.09	
Main	9838.3	50yr	Proposed	2880	513.11	527.16	527.18	527.18	0.000086	1.79	3166.35	379	0.09	-0.02
Main	9838.3	50yr+2050	Existing	3433	513.11	527.28	527.31	527.31	0.000117	2.1	3214.77	381.39	0.11	
Main	9838.3	50yr+2050	Proposed	3351	513.11	527.3	527.33	527.33	0.000111	2.05	3222.2	381.72	0.1	0.02
Main	9838.3	50yr+2080	Existing	3719	513.11	527.44	527.47	527.47	0.000131	2.24	3273.56	383.99	0.11	
Main	9838.3	50yr+2080	Proposed	3632	513.11	527.4	527.43	527.43	0.000126	2.2	3259.39	383.36	0.11	-0.04
Main	9838.3	100yr	Existing	3526	513.11	527.37	527.39	527.39	0.00012	2.14	3246.16	382.78	0.11	
Main	9838.3	100yr	Proposed	3442	513.11	527.33	527.36	527.36	0.000116	2.1	3233.85	382.24	0.1	-0.04
Main	9838.3	100yr+2050	Existing	4037	513.11	527.54	527.58	527.58	0.000149	2.4	3313.16	385.73	0.12	
Main	9838.3	100yr+2050	Proposed	3943	513.11	527.51	527.55	527.55	0.000143	2.36	3302.74	385.27	0.12	-0.03
Main	9838.3	100yr+2080	Existing	4131	513.11	527.57	527.61	527.61	0.000154	2.45	3324.19	386.22	0.12	
Main	9838.3	100yr+2080	Proposed	4036	513.11	527.5	527.53	527.53	0.000151	2.41	3296.72</			

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	9311.9	10yr+2050	Proposed	2123	510.2	526.83	513.69	526.83	0.000011	0.72	5330.71	591.92	0.03	-0.02
Main	9311.9	10yr+2080	Existing	2256	510.2	526.88	513.74	526.88	0.000012	0.77	5357.64	593.85	0.04	
Main	9311.9	10yr+2080	Proposed	2202	510.2	526.86	513.72	526.86	0.000012	0.75	5346.2	593.03	0.03	-0.02
Main	9311.9	25yr	Existing	2446	510.2	526.96	513.84	526.97	0.000014	0.83	5399.29	597.18	0.04	
Main	9311.9	25yr	Proposed	2387	510.2	526.93	513.8	526.94	0.000013	0.81	5385.41	595.86	0.04	-0.03
Main	9311.9	25yr+2050	Existing	2854	510.2	527.12	513.98	527.12	0.000018	0.95	5477.68	605.05	0.04	
Main	9311.9	25yr+2050	Proposed	2784	510.2	527.09	513.98	527.09	0.000017	0.93	5463.79	603.66	0.04	-0.03
Main	9311.9	25yr+2080	Existing	3064	510.2	527.2	514.09	527.2	0.000021	1.02	5519.36	609.19	0.05	
Main	9311.9	25yr+2080	Proposed	2990	510.2	527.17	514.05	527.18	0.00002	0.99	5505.45	607.82	0.04	-0.03
Main	9311.9	50yr	Existing	2952	510.2	527.16	514.04	527.17	0.000019	0.98	5501.79	607.46	0.04	
Main	9311.9	50yr	Proposed	2880	510.2	527.14	514.02	527.15	0.000018	0.96	5491.24	606.4	0.04	-0.02
Main	9311.9	50yr+2050	Existing	3433	510.2	527.26	514.2	527.27	0.000025	1.13	5553.74	612.56	0.05	
Main	9311.9	50yr+2050	Proposed	3351	510.2	527.29	514.2	527.29	0.000024	1.11	5564.35	613.65	0.05	0.03
Main	9311.9	50yr+2080	Existing	3719	510.2	527.42	514.32	527.42	0.000029	1.21	5631.75	620.54	0.05	
Main	9311.9	50yr+2080	Proposed	3632	510.2	527.38	514.3	527.39	0.000028	1.19	5613.09	618.64	0.05	-0.04
Main	9311.9	100yr	Existing	3526	510.2	527.35	514.26	527.35	0.000026	1.16	5595.78	616.87	0.05	
Main	9311.9	100yr	Proposed	3442	510.2	527.31	514.22	527.32	0.000025	1.13	5579.6	615.21	0.05	-0.04
Main	9311.9	100yr+2050	Existing	4037	510.2	527.52	514.4	527.53	0.000033	1.31	5683.43	625.67	0.06	
Main	9311.9	100yr+2050	Proposed	3943	510.2	527.49	514.37	527.5	0.000032	1.28	5669.92	624.41	0.06	-0.03
Main	9311.9	100yr+2080	Existing	4131	510.2	527.54	514.43	527.55	0.000035	1.34	5697.82	627.01	0.06	
Main	9311.9	100yr+2080	Proposed	4036	510.2	527.47	514.4	527.48	0.000034	1.31	5661.14	623.53	0.06	-0.07
Main	9172	10yr	Existing	1878	510.07	526.71	512.92	526.71	0.000007	0.62	5277.85	649.97	0.03	
Main	9172	10yr	Proposed	1833	510.07	526.68	512.9	526.69	0.000007	0.61	5265.85	647.36	0.03	-0.03
Main	9172	10yr+2050	Existing	2176	510.07	526.85	513.04	526.85	0.00001	0.71	5334.06	660.68	0.03	
Main	9172	10yr+2050	Proposed	2123	510.07	526.83	513.02	526.83	0.000009	0.7	5324.83	658.94	0.03	-0.02
Main	9172	10yr+2080	Existing	2256	510.07	526.88	513.07	526.88	0.00001	0.74	5347.02	662.58	0.03	
Main	9172	10yr+2080	Proposed	2202	510.07	526.86	513.05	526.86	0.00001	0.72	5337.62	661.24	0.03	-0.02
Main	9172	25yr	Existing	2446	510.07	526.96	513.15	526.96	0.000012	0.8	5381.43	669.42	0.04	
Main	9172	25yr	Proposed	2387	510.07	526.93	513.12	526.94	0.000011	0.78	5369.98	667.13	0.03	-0.03
Main	9172	25yr+2050	Existing	2854	510.07	527.11	513.3	527.12	0.000016	0.93	5446.4	683.78	0.04	
Main	9172	25yr+2050	Proposed	2784	510.07	527.09	513.28	527.09	0.000015	0.9	5434.87	680.99	0.04	-0.02
Main	9172	25yr+2080	Existing	3064	510.07	527.2	513.38	527.2	0.000018	0.99	5481.54	702.75	0.04	
Main	9172	25yr+2080	Proposed	2990	510.07	527.17	513.36	527.17	0.000017	0.97	5469.7	697.79	0.04	-0.03
Main	9172	50yr	Existing	2952	510.07	527.16	513.33	527.17	0.000017	0.96	5466.59	695.79	0.04	
Main	9172	50yr	Proposed	2880	510.07	527.14	513.31	527.15	0.000016	0.93	5457.73	686.81	0.04	-0.02
Main	9172	50yr+2050	Existing	3433	510.07	527.26	513.5	527.27	0.000022	1.11	5510.87	709.92	0.05	
Main	9172	50yr+2050	Proposed	3351	510.07	527.28	513.49	527.29	0.000021	1.08	5520.09	712.17	0.05	0.02
Main	9172	50yr+2080	Existing	3719	510.07	527.41	513.61	527.42	0.000026	1.19	5578.4	731.26	0.05	
Main	9172	50yr+2080	Proposed	3632	510.07	527.38	513.59	527.38	0.000025	1.17	5562.1	722.92	0.05	-0.03
Main	9172	100yr	Existing	3526	510.07	527.34	513.54	527.35	0.000023	1.13	5547.17	718.58	0.05	
Main	9172	100yr	Proposed	3442	510.07	527.31	513.51	527.32	0.000022	1.11	5533.21	715.31	0.05	-0.03
Main	9172	100yr+2050	Existing	4037	510.07	527.51	513.73	527.52	0.00003	1.29	5624.22	748.45	0.06	
Main	9172	100yr+2050	Proposed	3943	510.07	527.49	513.68	527.49	0.000028	1.26	5612.13	744.55	0.05	-0.02
Main	9172	100yr+2080	Existing	4131	510.07	527.54	513.74	527.55	0.000031	1.32	5637.13	752.52	0.06	
Main	9172	100yr+2080	Proposed	4036	510.07	527.47	513.72	527.48	0.00003	1.29	5604.22	741.74	0.06	-0.07
Main	8825.9	10yr	Existing	1878	509.17	526.71	511.6	526.71	0.000003	0.38	8062.29	894.94	0.02	
Main	8825.9	10yr	Proposed	1833	509.17	526.68	511.59	526.68	0.000002	0.37	8046.7	894.67	0.02	-0.03
Main	8825.9	10yr+2050	Existing	2176	509.17	526.85	511.71	526.85	0.000003	0.44	8134.95	896.21	0.02	
Main	8825.9	10yr+2050	Proposed	2123	509.17	526.82	511.7	526.83	0.000003	0.43	8123.04	896.01	0.02	-0.03
Main	8825.9	10yr+2080	Existing	2256	509.17	526.88	511.73	526.88	0.000003	0.45	8151.63	896.51	0.02	
Main	8825.9	10yr+2080	Proposed	2202	509.17	526.86	511.72	526.86	0.000003	0.44	8139.55	896.29	0.02	-0.02
Main	8825.9	25yr	Existing	2446	509.17	526.96	511.78	526.96	0.000004	0.49	8195.8	897.28	0.02	
Main	8825.9	25yr	Proposed	2387	509.17	526.93	511.77	526.93	0.000004	0.48	8181.12	897.02	0.02	-0.03
Main	8825.9	25yr+2050	Existing	2854	509.17	527.11	511.93	527.12	0.000005	0.57	8278.4	898.87	0.02	
Main	8825.9	25yr+2050	Proposed	2784	509.17	527.09	511.91	527.09	0.000005	0.55	8263.81	898.59	0.02	-0.02
Main	8825.9	25yr+2080	Existing	3064	509.17	527.19	511.99	527.2	0.000006	0.6	8322.05	899.72	0.03	
Main	8825.9	25yr+2080	Proposed	2990	509.17	527.17	511.96	527.17	0.000006	0.59	8307.55	899.44	0.03	-0.02
Main	8825.9	50yr	Existing	2952	509.17	527.16	511.95	527.16	0.000006	0.58	8303.71	899.37	0.02	
Main	8825.9	50yr	Proposed	2880	509.17	527.14	511.93	527.14	0.000005	0.57	8292.66	899.15	0.02	-0.02
Main	8825.9	50yr+2050	Existing	3433	509.17	527.26	512.07	527.26	0.000007	0.67	8357.69	900.42	0.03	
Main	8825.9	50yr+2050	Proposed	3351	509.17	527.28	512.05	527.28	0.000007	0.66	8368.94	900.63	0.03	0.02
Main	8825.9	50yr+2080	Existing	3719	509.17	527.41	512.13	527.41	0.000008	0.72	8438.9	902	0.03	
Main	8825.9	50yr+2080	Proposed	3632	509.17	527.38	512.12	527.38	0.000008	0.71	8419.52	901.62	0.03	-0.03
Main	8825.9	100yr	Existing	3526	509.17	527.34	512.09	527.34	0.000008	0.69	8401.6	901.27	0.03	
Main	8825.9	100yr	Proposed	3442	509.17	527.31	512.07	527.31	0.000007	0.67	8384.79	900.94	0.03	-0.03
Main	8825.9	100yr+2050	Existing	4037	509.17	527.51	512.21	527.52	0.000005	0.55	12829.84	903.07	0.02	
Main	8825.9	100yr+2050	Proposed	3943	509.17	527.48	512.19	527.49	0.000009	0.76	8478.33	902.76	0.03	-0.03
Main	8825.9	100yr+2080	Existing	4131	509.17	527.54	512.23	527.54	0.000005	0.56	12854.76	903.36	0.02	
Main	8825.9	100yr+2080	Proposed	4036	509.17	527.47	512.21	527.47	0.00001	0.78	8469.08	902.58	0.03	-0.07
Main	8353.5	10yr	Existing	1878	508.05	526.71	510.87	526.71	0.000004	0.49	8214.43	1107.45	0.02	
Main	8353.5	10yr	Proposed	1833	508.05	526.68	510.85	526.68	0.000004	0.48	8198.28	1107.03	0.02	-0.03
Main	8353.5	10yr+2050	Existing	2176	508.05	526.84	511	526.85	0.000005	0.56	8289.66	1109.37	0.02	
Main	8353.5	10yr+2050	Proposed	2123	508.05	526.82	510.97	526.82	0.000005	0.55	8277.31	1109.06	0.02	-0.02
Main	8353.5	10yr+2080	Existing	2256	508.05	526.88	511.03	526.88	0.000005	0.58	8306.86	1109.81	0.02	
Main	8353.5	10yr+2080	Proposed	2202	508.05	526.85	511	526.85	0.000005	0.57	8294.36	1109.5	0.02	-0.03
Main	8353.5	25yr	Existing	2446	508.05	526.96	511.09	526.96	0.000006	0.63	8352.62	1110.99	0.03	
Main	8353.5	25yr	Proposed	2387	508.05	526.93	511.07	526.93	0.000006	0.61	8337.42	1110.6	0.03	-0.03
Main	8353.5	25yr+2050	Existing	2854	508.05	527.11	511.24	527.11	0.000008	0.73	8438.11	1113.32	0.03	
Main	8353.5	25yr+2050	Proposed	2784	508.05	527.08	511.21	527.09	0.000008	0.71	8423.01	1112.91	0.03	-0.03
Main	8353.5	25yr+2080	Existing	3064	508.05	527.19	511.31	527.19	0.000009	0.77	8483.37	1114.55	0.03	
Main	8353.5	25yr+2080	Proposed	2990	508.05	527.16	511.29	527.17	0.000009	0.76	8468.32	1114.14	0.03	-0.03
Main	8353.5													

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	8243.8	50yr+2080	Proposed	3632	506.35	527.37	514.29	527.37	0.000005	0.6	9802.86	1723.14	0.02	-0.04
Main	8243.8	100yr	Existing	3526	506.35	527.34	514.2	527.34	0.000005	0.58	9780.75	1720.91	0.02	
Main	8243.8	100yr	Proposed	3442	506.35	527.31	514.11	527.31	0.000005	0.57	9760	1718.72	0.02	-0.03
Main	8243.8	100yr+2050	Existing	4037	506.35	527.51	514.64	527.51	0.000007	0.66	9896.26	1730.98	0.03	
Main	8243.8	100yr+2050	Proposed	3943	506.35	527.48	514.56	527.48	0.000006	0.64	9875.54	1729.27	0.03	-0.03
Main	8243.8	100yr+2080	Existing	4131	506.35	527.54	514.72	527.54	0.000007	0.67	9914.65	1732.49	0.03	
Main	8243.8	100yr+2080	Proposed	4036	506.35	527.46	514.64	527.46	0.000007	0.66	9863.8	1728.3	0.03	-0.08
Main	8157.422		Culvert											
Main	8080.6	10yr	Existing	1878	506.35	526.55		526.66	0.000228	2.79	1069.59	1096.88	0.13	
Main	8080.6	10yr	Proposed	1833	506.35	526.57		526.68	0.000215	2.72	1085.97	1104.3	0.12	0.02
Main	8080.6	10yr+2050	Existing	2176	506.35	526.68		526.82	0.000294	3.19	1156.34	1137.14	0.14	
Main	8080.6	10yr+2050	Proposed	2123	506.35	526.66		526.8	0.000281	3.12	1146.19	1132.02	0.14	-0.02
Main	8080.6	10yr+2080	Existing	2256	506.35	526.69		526.85	0.000313	3.29	1169.64	1143.14	0.15	
Main	8080.6	10yr+2080	Proposed	2202	506.35	526.68		526.83	0.0003	3.22	1159.56	1138.76	0.14	-0.01
Main	8080.6	25yr	Existing	2446	506.35	526.75		526.93	0.00036	3.54	1207.03	1156.4	0.16	
Main	8080.6	25yr	Proposed	2387	506.35	526.73		526.91	0.000345	3.47	1194.19	1151.58	0.15	-0.02
Main	8080.6	25yr+2050	Existing	2854	506.35	526.84		527.08	0.000472	4.07	1271.18	1180.44	0.18	
Main	8080.6	25yr+2050	Proposed	2784	506.35	526.83		527.06	0.000452	3.98	1260.3	1176.9	0.18	-0.01
Main	8080.6	25yr+2080	Existing	3064	506.35	526.89		527.16	0.000533	4.33	1302.96	1191.67	0.19	
Main	8080.6	25yr+2080	Proposed	2990	506.35	526.87		527.13	0.000511	4.24	1293.14	1187.28	0.19	-0.02
Main	8080.6	50yr	Existing	2952	506.35	526.87		527.13	0.000498	4.19	1293.35	1187.35	0.19	
Main	8080.6	50yr	Proposed	2880	506.35	526.87		527.11	0.000476	4.09	1288.14	1185.73	0.18	0
Main	8080.6	50yr+2050	Existing	3433	506.35	526.89		527.23	0.000668	4.85	1307.83	1194.67	0.22	
Main	8080.6	50yr+2050	Proposed	3351	506.35	526.94		527.25	0.000627	4.71	1337.81	1204.02	0.21	0.05
Main	8080.6	50yr+2080	Existing	3719	506.35	526.99		527.37	0.000755	5.18	1375.51	1209.82	0.23	
Main	8080.6	50yr+2080	Proposed	3632	506.35	526.98		527.34	0.000724	5.07	1366.06	1208.37	0.22	-0.01
Main	8080.6	100yr	Existing	3526	506.35	526.96		527.31	0.000686	4.93	1357.91	1207.12	0.22	
Main	8080.6	100yr	Proposed	3442	506.35	526.95		527.28	0.000659	4.83	1346.04	1205.29	0.21	-0.01
Main	8080.6	100yr+2050	Existing	4037	506.35	527.04		527.48	0.000868	5.57	1414.2	1215.82	0.25	
Main	8080.6	100yr+2050	Proposed	3943	506.35	527.03		527.45	0.000832	5.45	1405.84	1214.47	0.24	-0.01
Main	8080.6	100yr+2080	Existing	4131	506.35	527.05		527.51	0.000906	5.69	1419.1	1216.61	0.25	
Main	8080.6	100yr+2080	Proposed	4036	506.35	526.98		527.43	0.000891	5.63	1370.7	1209.08	0.25	-0.07
Main	8079.2	10yr	Existing	1878	506.35	526.55	513.11	526.66	0.000248	2.78	1038.57	1106.61	0.13	
Main	8079.2	10yr	Proposed	1833	506.35	526.57	512.99	526.68	0.000234	2.7	1055.02	1114.55	0.12	0.02
Main	8079.2	10yr+2050	Existing	2176	506.35	526.68	513.66	526.82	0.000317	3.15	1126.43	1145.09	0.14	
Main	8079.2	10yr+2050	Proposed	2123	506.35	526.66	513.56	526.8	0.000303	3.08	1116.19	1141.21	0.14	-0.02
Main	8079.2	10yr+2080	Existing	2256	506.35	526.7	513.79	526.85	0.000337	3.26	1139.84	1150.17	0.15	
Main	8079.2	10yr+2080	Proposed	2202	506.35	526.68	513.7	526.83	0.000324	3.19	1129.67	1146.32	0.15	-0.02
Main	8079.2	25yr	Existing	2446	506.35	526.75	514.13	526.93	0.000388	3.5	1177.8	1172.84	0.16	
Main	8079.2	25yr	Proposed	2387	506.35	526.73	514.03	526.9	0.000373	3.43	1164.74	1168.14	0.16	-0.02
Main	8079.2	25yr+2050	Existing	2854	506.35	526.84	514.82	527.08	0.00051	4.03	1242.64	1194.51	0.18	
Main	8079.2	25yr+2050	Proposed	2784	506.35	526.83	514.71	527.05	0.000487	3.93	1232.03	1191.5	0.18	-0.01
Main	8079.2	25yr+2080	Existing	3064	506.35	526.89	515.14	527.15	0.000576	4.29	1274.84	1201.07	0.19	
Main	8079.2	25yr+2080	Proposed	2990	506.35	526.87	515.04	527.13	0.000552	4.2	1264.92	1199.05	0.19	-0.02
Main	8079.2	50yr	Existing	2952	506.35	526.87	514.97	527.12	0.000538	4.14	1265.09	1199.08	0.19	
Main	8079.2	50yr	Proposed	2880	506.35	526.87	514.86	527.1	0.000514	4.05	1259.8	1198.01	0.18	0
Main	8079.2	50yr+2050	Existing	3433	506.35	526.89	515.72	527.23	0.000721	4.8	1279.95	1202.11	0.22	
Main	8079.2	50yr+2050	Proposed	3351	506.35	526.94	515.59	527.25	0.000673	4.65	1310.68	1208	0.21	0.05
Main	8079.2	50yr+2080	Existing	3719	506.35	526.99	516.14	527.37	0.000809	5.11	1348.73	1213.17	0.23	
Main	8079.2	50yr+2080	Proposed	3632	506.35	526.98	516.01	527.34	0.000777	5	1339.19	1211.87	0.23	-0.01
Main	8079.2	100yr	Existing	3526	506.35	526.97	515.85	527.31	0.000736	4.87	1330.96	1210.76	0.22	
Main	8079.2	100yr	Proposed	3442	506.35	526.95	515.72	527.28	0.000707	4.77	1319	1209.13	0.22	-0.02
Main	8079.2	100yr+2050	Existing	4037	506.35	527.05	516.59	527.48	0.00093	5.49	1387.73	1218.58	0.25	
Main	8079.2	100yr+2050	Proposed	3943	506.35	527.03	516.46	527.45	0.000892	5.37	1379.28	1217.42	0.24	-0.02
Main	8079.2	100yr+2080	Existing	4131	506.35	527.05	516.7	527.5	0.00097	5.61	1392.76	1219.26	0.25	
Main	8079.2	100yr+2080	Proposed	4036	506.35	526.99	516.59	527.43	0.000956	5.55	1344.26	1212.56	0.25	-0.06
Main	7932.964		Culvert											
Main	7815.4	10yr	Existing	1878	505.2	513.25	511.36	514.14	0.004329	8.13	435.24	387.28	0.53	
Main	7815.4	10yr	Proposed	1833	505.2	513.24	511.3	514.09	0.004154	7.96	433.11	387.13	0.52	-0.01
Main	7815.4	10yr+2050	Existing	2176	505.2	513.34	513.09	514.45	0.005445	9.19	454.73	388.64	0.6	
Main	7815.4	10yr+2050	Proposed	2123	505.2	513.34	513.02	514.4	0.005176	8.96	455.13	388.66	0.58	0
Main	7815.4	10yr+2080	Existing	2256	505.2	513.34	513.17	514.54	0.00585	9.53	454.89	388.65	0.62	
Main	7815.4	10yr+2080	Proposed	2202	505.2	513.33	513.12	514.48	0.005587	9.31	454.13	388.6	0.61	-0.01
Main	7815.4	25yr	Existing	2446	505.2	513.39	513.39	514.75	0.006622	10.18	466.24	389.43	0.66	
Main	7815.4	25yr	Proposed	2387	505.2	513.34	513.34	514.68	0.006539	10.08	455.33	388.68	0.66	-0.05
Main	7815.4	25yr+2050	Existing	2854	505.2	513.78	513.78	515.17	0.006691	10.6	558.64	394.53	0.67	
Main	7815.4	25yr+2050	Proposed	2784	505.2	513.72	513.72	515.1	0.00666	10.52	554.38	393.76	0.67	-0.06
Main	7815.4	25yr+2080	Existing	3064	505.2	513.94	513.94	515.37	0.006836	10.86	597.65	396.62	0.69	
Main	7815.4	25yr+2080	Proposed	2990	505.2	513.88	513.88	515.3	0.006814	10.79	582.74	395.82	0.68	-0.06
Main	7815.4	50yr	Existing	2952	505.2	513.86	513.86	515.27	0.006774	10.73	576.39	395.48	0.68	
Main	7815.4	50yr	Proposed	2880	505.2	513.8	513.8	515.2	0.006702	10.63	563.94	394.81	0.67	-0.06
Main	7815.4	50yr+2050	Existing	3433	505.2	514.23	514.23	515.7	0.007016	11.27	665.24	400.22	0.69	
Main	7815.4	50yr+2050	Proposed	3351	505.2	514.15	514.15	515.63	0.007033	11.21	647.91	399.3	0.69	-0.08
Main	7815.4	50yr+2080	Existing	3719	505.2	514.38	514.38	515.94	0.007423	11.73	701.9	403.18	0.72	
Main	7815.4	50yr+2080	Proposed	3632	505.2	514.32	514.32	515.87	0.007362	11.63	687.78	401.67	0.71	-0.06
Main	7815.4	100yr	Existing	3526	505.2	514.29	514.29	515.78	0.007078	11.37	680.7	401.03	0.7	
Main	7815.4	100yr	Proposed	3442	505.2	514.23	514.23	515.71	0.007017	11.27	667.01	400.31	0.69	-0.06
Main	7815.4	100yr+2050	Existing	4037	505.2	514.53	514.53	516.21	0.007909	12.25	739.43	407.66	0.74	
Main	7815.4	100yr+2050	Proposed	3943	505.2	514.5	514.5	516.13	0.007699	12.06	731.59	406.34	0.73	-0.03
Main	7815.4	100yr+2080	Existing	4131	505.2	514.6	514.6	516.29	0.007934	12.34	756.32	410.53	0.74	
Main	7815.4	100yr+2080	Proposed	4036	505.2	514.53	514.53	516.21	0.007895	12.24	739.91	407.74	0.74	-0.07
Main	7814.4	10yr	Existing	1878	505.8	513.49	512.73	513.9	0.002503	5.99	508.58	392.43	0.42	
Main	7814.4	10yr	Proposed	1833	505.8	513.46	512.67	513.86	0.002438	5.9	503.5	392.16	0.41	

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)	
Main	7732.9	10yr	Existing	1878	505.8	509.46	509.44	510.48	0.015931	9.98	260.63	126.68	0.98		
Main	7732.9	10yr	Proposed	1833	505.8	509.43	509.41	510.43	0.015859	9.89	256.44	125.78	0.98	-0.03	
Main	7732.9	10yr+2050	Existing	2176	505.8	509.68	509.68	510.8	0.016108	10.49	289.47	132.71	1		
Main	7732.9	10yr+2050	Proposed	2123	505.8	509.64	509.64	510.74	0.016136	10.42	284.03	131.59	1	-0.04	
Main	7732.9	10yr+2080	Existing	2256	505.8	509.72	509.71	510.88	0.016524	10.71	294.6	134.35	1.01		
Main	7732.9	10yr+2080	Proposed	2202	505.8	509.69	509.69	510.82	0.016279	10.57	290.89	133	1	-0.03	
Main	7732.9	25yr	Existing	2446	505.8	509.9	509.9	511.07	0.015818	10.82	318.72	142.64	1		
Main	7732.9	25yr	Proposed	2387	505.8	509.85	509.85	511.01	0.015847	10.75	312.58	140.92	1	-0.05	
Main	7732.9	25yr+2050	Existing	2854	505.8	510.27	510.27	511.45	0.014291	10.98	377.41	184.81	0.96		
Main	7732.9	25yr+2050	Proposed	2784	505.8	510.22	510.22	511.39	0.014398	10.92	368.04	177.28	0.97	-0.05	
Main	7732.9	25yr+2080	Existing	3064	505.8	510.5	510.5	511.62	0.012982	10.85	427.37	235.71	0.93		
Main	7732.9	25yr+2080	Proposed	2990	505.8	510.34	510.34	511.56	0.014535	11.21	392.35	216.85	0.98	-0.16	
Main	7732.9	50yr	Existing	2952	505.8	510.29	510.29	511.53	0.014928	11.26	381.8	193.4	0.99		
Main	7732.9	50yr	Proposed	2880	505.8	510.14	510.14	511.46	0.016564	11.57	355.86	163.02	1.03	-0.15	
Main	7732.9	50yr+2050	Existing	3433	505.8	510.93	510.93	511.87	0.010166	10.24	549.86	305.14	0.83		
Main	7732.9	50yr+2050	Proposed	3351	505.8	510.88	510.88	511.83	0.010219	10.2	536.17	303.37	0.84	-0.05	
Main	7732.9	50yr+2080	Existing	3719	505.8	511.05	511.05	512.03	0.01028	10.49	589	311.06	0.84		
Main	7732.9	50yr+2080	Proposed	3632	505.8	511.02	511.02	511.98	0.010247	10.41	577.23	309.26	0.84	-0.03	
Main	7732.9	100yr	Existing	3526	505.8	510.97	510.97	511.92	0.010145	10.3	564.26	307.27	0.84		
Main	7732.9	100yr	Proposed	3442	505.8	510.94	510.94	511.88	0.010117	10.23	552.45	305.48	0.83	-0.03	
Main	7732.9	100yr+2050	Existing	4037	505.8	511.3	511.3	512.21	0.009482	10.42	668.3	326.96	0.82		
Main	7732.9	100yr+2050	Proposed	3943	505.8	511.17	511.17	512.14	0.010147	10.58	624.18	315.13	0.84	-0.13	
Main	7732.9	100yr+2080	Existing	4131	505.8	511.2	511.2	512.23	0.01069	10.91	635.5	316.32	0.86		
Main	7732.9	100yr+2080	Proposed	4036	505.8	511.21	511.21	512.18	0.010158	10.64	636.74	316.45	0.84	0.01	
Main	7617.3	10yr	Existing	1878	504.12	509.16	509.35	500.3241	5.07	616.42	239.41	0.46			
Main	7617.3	10yr	Proposed	1833	504.12	509.12	509.32	500.3211	5.02	608.29	238.3	0.45		-0.04	
Main	7617.3	10yr+2050	Existing	2176	504.12	509.37	509.59	500.3427	5.41	668.53	245.65	0.47			
Main	7617.3	10yr+2050	Proposed	2123	504.12	509.34	509.55	500.3394	5.35	659.47	244.77	0.47		-0.03	
Main	7617.3	10yr+2080	Existing	2256	504.12	509.43	509.66	500.3477	5.5	681.96	246.98	0.48			
Main	7617.3	10yr+2080	Proposed	2202	504.12	509.39	509.62	500.3443	5.44	672.95	246.09	0.48		-0.04	
Main	7617.3	25yr	Existing	2446	504.12	509.55	509.8	500.3588	5.7	713.37	250.04	0.49			
Main	7617.3	25yr	Proposed	2387	504.12	509.52	509.76	500.3555	5.64	703.7	249.1	0.49		-0.03	
Main	7617.3	25yr+2050	Existing	2854	504.12	509.81	510.09	500.3818	6.11	777.44	258.87	0.51			
Main	7617.3	25yr+2050	Proposed	2784	504.12	509.77	510.04	500.3777	6.04	766.64	255.93	0.51		-0.04	
Main	7617.3	25yr+2080	Existing	3064	504.12	509.93	510.23	500.393	6.31	809.52	264.7	0.52			
Main	7617.3	25yr+2080	Proposed	2990	504.12	509.89	510.18	500.3892	6.24	798.31	263.03	0.52		-0.04	
Main	7617.3	50yr	Existing	2952	504.12	509.86	510.15	500.3871	6.21	792.53	262.16	0.51			
Main	7617.3	50yr	Proposed	2880	504.12	509.82	510.1	500.3833	6.14	781.43	259.95	0.51		-0.04	
Main	7617.3	50yr+2050	Existing	3433	504.12	510.13	510.46	500.4114	6.65	864.23	271.87	0.54			
Main	7617.3	50yr+2050	Proposed	3351	504.12	510.09	510.41	500.4075	6.58	852.22	270.6	0.53		-0.04	
Main	7617.3	50yr+2080	Existing	3719	504.12	510.28	510.63	500.4241	6.89	905.57	276.23	0.55			
Main	7617.3	50yr+2080	Proposed	3632	504.12	510.24	510.58	500.402	6.82	893.4	274.95	0.54		-0.04	
Main	7617.3	100yr	Existing	3526	504.12	510.18	510.52	500.4158	6.73	877.69	273.3	0.54			
Main	7617.3	100yr	Proposed	3442	504.12	510.14	510.47	500.4118	6.66	865.53	272.01	0.54		-0.04	
Main	7617.3	100yr+2050	Existing	4037	504.12	510.45	510.84	500.4544	7.3	953.95	292.67	0.57			
Main	7617.3	100yr+2050	Proposed	3943	504.12	510.41	510.78	500.4481	7.2	940.56	289.84	0.56		-0.04	
Main	7617.3	100yr+2080	Existing	4131	504.12	510.5	510.89	500.4595	7.38	968.78	295.99	0.57			
Main	7617.3	100yr+2080	Proposed	4036	504.12	510.45	510.84	500.4544	7.29	953.81	292.64	0.57		-0.05	
Main	7404.2	10yr	Existing	1878	501.71	508.27	508.57	500.4136	6.6	608.32	306.31	0.51			
Main	7404.2	10yr	Proposed	1833	501.71	508.24	508.54	500.4086	6.54	600.47	306.03	0.51		-0.03	
Main	7404.2	10yr+2050	Existing	2176	501.71	508.43	508.75	500.4466	7	657.16	308.08	0.53			
Main	7404.2	10yr+2050	Proposed	2123	501.71	508.4	508.72	500.4398	6.92	649.34	307.8	0.53		-0.03	
Main	7404.2	10yr+2080	Existing	2256	501.71	508.45	508.79	500.4655	7.16	664.32	308.34	0.55			
Main	7404.2	10yr+2080	Proposed	2202	501.71	508.44	508.77	500.4491	7.03	661.4	308.23	0.54		-0.01	
Main	7404.2	25yr	Existing	2446	501.71	508.56	508.92	500.4719	7.32	699.62	309.61	0.55			
Main	7404.2	25yr	Proposed	2387	501.71	508.53	508.88	500.4714	7.28	688.07	309.2	0.55		-0.03	
Main	7404.2	25yr+2050	Existing	2854	501.71	508.74	509.13	500.5186	7.83	753.56	311.54	0.58			
Main	7404.2	25yr+2050	Proposed	2784	501.71	508.71	509.1	500.5101	7.74	744.96	311.24	0.58		-0.03	
Main	7404.2	25yr+2080	Existing	3064	501.71	508.85	509.25	500.5252	7.98	787.65	312.55	0.59			
Main	7404.2	25yr+2080	Proposed	2990	501.71	508.82	509.21	500.5189	7.9	777.84	312.26	0.58		-0.03	
Main	7404.2	50yr	Existing	2952	501.71	508.8	509.19	500.5155	7.86	772.76	312.11	0.58			
Main	7404.2	50yr	Proposed	2880	501.71	508.75	509.15	500.5214	7.86	756.83	311.64	0.58		-0.05	
Main	7404.2	50yr+2050	Existing	3433	501.71	509	509.44	500.5543	8.35	835.52	313.95	0.61			
Main	7404.2	50yr+2050	Proposed	3351	501.71	508.97	509.4	500.5482	8.27	825.01	313.65	0.6		-0.03	
Main	7404.2	50yr+2080	Existing	3719	501.71	509.09	509.56	500.5877	8.68	864.7	314.8	0.63			
Main	7404.2	50yr+2080	Proposed	3632	501.71	509.08	509.53	500.569	8.53	860.35	314.68	0.62		-0.01	
Main	7404.2	100yr	Existing	3526	501.71	509.04	509.48	500.5612	8.43	847.22	314.29	0.61			
Main	7404.2	100yr	Proposed	3442	501.71	509	509.44	500.555	8.35	836.65	313.99	0.61		-0.04	
Main	7404.2	100yr+2050	Existing	4037	501.71	509.23	509.72	500.5993	8.9	907.91	316.11	0.63			
Main	7404.2	100yr+2050	Proposed	3943	501.71	509.18	509.67	500.5992	8.86	893.62	315.65	0.63		-0.05	
Main	7404.2	100yr+2080	Existing	4131	501.71	509.25	509.76	500.6134	9.03	914.91	316.37	0.64			
Main	7404.2	100yr+2080	Proposed	4036	501.71	509.23	509.72	500.5992	8.9	907.78	316.11	0.63		-0.02	
Main	7358.3	10yr	Existing	1878	501.47	507.69	507.69	508.28	0.008141	8.66	484.39	341.14	0.72		
Main	7358.3	10yr	Proposed	1833	501.47	507.67	507.67	508.25	0.008041	8.58	477.55	340.88	0.71		-0.02
Main	7358.3	10yr+2050	Existing	2176	501.47	507.81	507.81	508.45	0.008757	9.15	527.7	342.96	0.75		
Main	7358.3	10yr+2050	Proposed	2123	501.47	507.79	507.79	508.42	0.008643	9.06	520.42	342.63	0.74		-0.02
Main	7358.3	10yr+2080	Existing	2256	501.47	507.89	507.89	508.49	0.008265	8.98	554.38	344.17	0.73		
Main	7358.3	10yr+2080	Proposed	2202	501.47	507.82	507.82	508.46	0.008815	9.19	531.16	343.11	0.75		-0.07
Main	7358.3	25yr	Existing	2446	501.47	507.92	507.92	508.59	0.009307	9.57	563.41	344.58	0.77		
Main	7358.3	25yr	Proposed	2387	501.47	507.92	507.92	508.56	0.008862	9.34	563.44	344.58	0.76		0
Main	7358.3	25yr+2050	Existing	2854	501.47	508.11	508.11	508.79	0.009404	9.87	629.12	347.54	0.78		
Main	7358.3	25yr+2050	Proposed	2784	501.47	508.07	508.07	508.76	0.009416	9.83	617.51	347.02	0.78		-0.04
Main	7358.3	25yr+2080	Existing	3064	501.47	508.14	508.14	508.89	0.010272	10.37	641.57	348.09	0.82		</

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main		7288 50yr+2050	Existing	3433	501.1	507.06	507.06	507.75	0.011015	10.1	729.15	406.78	0.86	
Main		7288 50yr+2050	Proposed	3351	501.1	507.02	507.02	507.72	0.01111	10.09	714.36	405.68	0.86	-0.04
Main		7288 50yr+2080	Existing	3719	501.1	507.14	507.14	507.87	0.011409	10.41	762.55	409.26	0.87	
Main		7288 50yr+2080	Proposed	3632	501.1	507.11	507.11	507.83	0.011414	10.36	749.62	408.31	0.87	-0.03
Main		7288 100yr	Existing	3526	501.1	507.08	507.08	507.79	0.011214	10.23	738.52	407.48	0.86	
Main		7288 100yr	Proposed	3442	501.1	507.06	507.06	507.76	0.011051	10.12	729.66	406.82	0.86	-0.02
Main		7288 100yr+2050	Existing	4037	501.1	507.23	507.23	507.99	0.011792	10.72	798.97	411.95	0.89	
Main		7288 100yr+2050	Proposed	3943	501.1	507.2	507.2	507.95	0.011801	10.68	785.49	410.96	0.89	-0.03
Main		7288 100yr+2080	Existing	4131	501.1	507.26	507.26	508.02	0.011866	10.8	810.35	412.79	0.89	
Main		7288 100yr+2080	Proposed	4036	501.1	507.23	507.23	507.99	0.011791	10.72	798.86	411.94	0.89	-0.03
Main		7070.8 10yr	Existing	1878	500.62	504.47		504.59	0.003342	3.87	718.9	311.16	0.43	
Main		7070.8 10yr	Proposed	1833	500.62	503.63		503.82	0.004309	3.57	533.07	294.05	0.46	-0.84
Main		7070.8 10yr+2050	Existing	2176	500.62	504.71		504.84	0.003281	4.07	794.07	316.02	0.43	
Main		7070.8 10yr+2050	Proposed	2123	500.62	503.88		504.07	0.004042	3.68	606.01	303.63	0.46	-0.83
Main		7070.8 10yr+2080	Existing	2256	500.62	504.78		504.9	0.003277	4.13	813.68	318.08	0.43	
Main		7070.8 10yr+2080	Proposed	2202	500.62	503.94		504.13	0.003965	3.7	625.47	304.76	0.45	-0.84
Main		7070.8 25yr	Existing	2446	500.62	504.94		505.07	0.003204	4.24	865.49	323.6	0.43	
Main		7070.8 25yr	Proposed	2387	500.62	504.09		504.28	0.003808	3.74	669.8	306.86	0.45	-0.85
Main		7070.8 25yr+2050	Existing	2854	500.62	505.22		505.37	0.003184	4.49	958.06	329.85	0.44	
Main		7070.8 25yr+2050	Proposed	2784	500.62	504.38		504.59	0.003523	3.87	761.86	310.48	0.44	-0.84
Main		7070.8 25yr+2080	Existing	3064	500.62	505.38		505.54	0.003087	4.57	1011.8	332.24	0.44	
Main		7070.8 25yr+2080	Proposed	2990	500.62	504.53		504.74	0.003423	3.96	806.17	312.04	0.44	-0.85
Main		7070.8 50yr	Existing	2952	500.62	505.29		505.45	0.003146	4.53	982.38	330.93	0.44	
Main		7070.8 50yr	Proposed	2880	500.62	504.45		504.66	0.003477	3.92	782.41	311.2	0.44	-0.84
Main		7070.8 50yr+2050	Existing	3433	500.62	505.64		505.81	0.002994	4.72	1098.24	336.2	0.43	
Main		7070.8 50yr+2050	Proposed	3351	500.62	504.79		505.01	0.003207	4.1	890.52	319.13	0.43	-0.85
Main		7070.8 50yr+2080	Existing	3719	500.62	505.83		506.01	0.002934	4.84	1163.25	339.3	0.43	
Main		7070.8 50yr+2080	Proposed	3632	500.62	505.03		505.25	0.002974	4.17	967.81	328.91	0.42	-0.8
Main		7070.8 100yr	Existing	3526	500.62	505.7		505.87	0.002972	4.76	1119.74	337.22	0.43	
Main		7070.8 100yr	Proposed	3442	500.62	504.87		505.09	0.003137	4.13	914.04	321.59	0.43	-0.83
Main		7070.8 100yr+2050	Existing	4037	500.62	505.79		506	0.003582	5.31	1150.13	338.67	0.48	
Main		7070.8 100yr+2050	Proposed	3943	500.62	505.32		505.54	0.002631	4.16	1064.37	332.52	0.4	-0.47
Main		7070.8 100yr+2080	Existing	4131	500.62	505.84		506.06	0.003583	5.35	1167.16	339.48	0.48	
Main		7070.8 100yr+2080	Proposed	4036	500.62	505.3		505.53	0.002813	4.29	1057.16	332.25	0.41	-0.54
Main		6684.3 10yr	Existing	1878	498.12	503.15	501.76	503.27	0.003497	3.75	701.6	443.33	0.43	
Main		6684.3 10yr	Proposed	1833	498.12	502.6	501.08	502.74	0.001922	2.85	630.95	391.69	0.32	-0.55
Main		6684.3 10yr+2050	Existing	2176	498.12	503.43	501.88	503.56	0.003389	3.96	790.62	466.22	0.43	
Main		6684.3 10yr+2050	Proposed	2123	498.12	502.89	501.25	503.03	0.00189	2.78	706.36	406.78	0.31	-0.54
Main		6684.3 10yr+2080	Existing	2256	498.12	503.5	501.92	503.63	0.003339	4	814.13	470.08	0.43	
Main		6684.3 10yr+2080	Proposed	2202	498.12	502.96	501.29	503.1	0.00188	2.77	726.98	411.73	0.31	-0.54
Main		6684.3 25yr	Existing	2446	498.12	503.67	502.02	503.8	0.003368	4.19	871.26	493.29	0.43	
Main		6684.3 25yr	Proposed	2387	498.12	503.13	501.38	503.27	0.001862	2.76	775.14	433.56	0.31	-0.54
Main		6684.3 25yr+2050	Existing	2854	498.12	504	502.21	504.15	0.003153	4.35	997.01	537.99	0.43	
Main		6684.3 25yr+2050	Proposed	2784	498.12	503.47	501.57	503.63	0.001813	2.93	884.43	463.7	0.31	-0.53
Main		6684.3 25yr+2080	Existing	3064	498.12	504.18	502.23	504.33	0.003169	4.52	1069.65	565.44	0.43	
Main		6684.3 25yr+2080	Proposed	2990	498.12	503.65	501.66	503.8	0.001757	3.01	941.77	481.38	0.31	-0.53
Main		6684.3 50yr	Existing	2952	498.12	504.08	502.25	504.23	0.003148	4.42	1029.93	550.05	0.43	
Main		6684.3 50yr	Proposed	2880	498.12	503.55	501.61	503.71	0.001787	2.97	910.7	467.29	0.31	-0.53
Main		6684.3 50yr+2050	Existing	3433	498.12	504.51	502.42	504.66	0.002907	4.61	1216.63	622.71	0.42	
Main		6684.3 50yr+2050	Proposed	3351	498.12	503.99	501.81	504.14	0.001606	3.1	1069.42	529.88	0.3	-0.52
Main		6684.3 50yr+2080	Existing	3719	498.12	504.8	502.52	504.94	0.002544	4.53	1350.14	656.69	0.4	
Main		6684.3 50yr+2080	Proposed	3632	498.12	504.31	501.92	504.46	0.001434	3.12	1202.62	581.47	0.29	-0.49
Main		6684.3 100yr	Existing	3526	498.12	504.61	502.46	504.75	0.002802	4.6	1258.73	637.92	0.41	
Main		6684.3 100yr	Proposed	3442	498.12	504.09	501.85	504.24	0.001563	3.12	1107.42	545.9	0.3	-0.52
Main		6684.3 100yr+2050	Existing	4037	498.12	505.02	502.65	505.1	0.001523	3.63	1938.09	665.69	0.31	
Main		6684.3 100yr+2050	Proposed	3943	498.12	504.73	502.05	504.86	0.001192	3.06	1389.96	621.23	0.27	-0.29
Main		6684.3 100yr+2080	Existing	4131	498.12	505.08	502.67	505.16	0.001501	3.64	1978.15	666.96	0.31	
Main		6684.3 100yr+2080	Proposed	4036	498.12	504.63	502.09	504.78	0.001353	3.21	1346.63	614.48	0.29	-0.45
Main		6509.1 10yr	Existing	1878	497.16	502.67		502.77	0.002301	3.36	781.44	293.01	0.35	
Main		6509.1 10yr	Proposed	1833	497.16	502.25		502.35	0.00242	3.1	757.52	284.99	0.35	-0.42
Main		6509.1 10yr+2050	Existing	2176	497.16	502.97		503.07	0.002228	3.54	869.2	299.93	0.35	
Main		6509.1 10yr+2050	Proposed	2123	497.16	502.55		502.65	0.002339	3.27	841.37	290.77	0.35	-0.42
Main		6509.1 10yr+2080	Existing	2256	497.16	503.04		503.15	0.002207	3.58	892.41	301.52	0.35	
Main		6509.1 10yr+2080	Proposed	2202	497.16	502.62		502.73	0.002321	3.32	863.86	292.66	0.35	-0.42
Main		6509.1 25yr	Existing	2446	497.16	503.22		503.33	0.002176	3.68	944.6	306.59	0.35	
Main		6509.1 25yr	Proposed	2387	497.16	502.79		502.9	0.002296	3.44	913.93	296.82	0.35	-0.43
Main		6509.1 25yr+2050	Existing	2854	497.16	503.57		503.69	0.002111	3.88	1055.95	324.75	0.36	
Main		6509.1 25yr+2050	Proposed	2784	497.16	503.15		503.27	0.002226	3.65	1020.12	304.34	0.36	-0.42
Main		6509.1 25yr+2080	Existing	3064	497.16	503.75		503.88	0.002062	3.96	1116	330.99	0.35	
Main		6509.1 25yr+2080	Proposed	2990	497.16	503.33		503.45	0.00218	3.75	1075.71	315.08	0.36	-0.42
Main		6509.1 50yr	Existing	2952	497.16	503.65		503.78	0.002089	3.92	1083.79	327.71	0.35	
Main		6509.1 50yr	Proposed	2880	497.16	503.23		503.35	0.002205	3.7	1045.7	305.74	0.36	-0.42
Main		6509.1 50yr+2050	Existing	3433	497.16	504.12		504.25	0.001898	4.03	1239.32	341.77	0.34	
Main		6509.1 50yr+2050	Proposed	3351	497.16	503.69		503.82	0.001993	3.84	1195.52	330.26	0.35	-0.43
Main		6509.1 50yr+2080	Existing	3719	497.16	504.45		504.58	0.001724	4.04	1352.56	350.65	0.33	
Main		6509.1 50yr+2080	Proposed	3632	497.16	504.05		504.17	0.001774	3.84	1313.85	342.45	0.33	-0.4
Main		6509.1 100yr	Existing	3526	497.16	504.22		504.35	0.001842	4.04	1274.95	344.64	0.34	
Main		6509.1 100yr	Proposed	3442	497.16	503.8		503.93	0.00193	3.84	1229.92	333.59	0.34	-0.42
Main		6509.1 100yr+2050	Existing	4037	497.16	504.68		504.81	0.001715	4.16	1433.9	356.69	0.33	
Main		6509.1 100yr+2050	Proposed	3943	497.16	504.5		504.62	0.001506	3.79	1470.94	354.24	0.31	-0.18
Main		6509.1 100yr+2080	Existing	4131	497.16	504.73		504.87	0.001722	4.2	1455.13	358.37	0.34	
Main		6509.1 100yr+2080	Proposed	4036	497.16	504.37		504.51	0.001716	3.97	1427.05	350.22	0.33	-0.36
Main		6370.8 10yr	Existing	1878	496.98	502.46	500.8	502.52	0.001273	2.76	991.29	357.82	0.27</	

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main		6111.5 10yr+2050	Proposed	2123	495.02	502.33	500.11	502.39	0.000353	2.06	1151.5	275.19	0.15	-0.11
Main		6111.5 10yr+2080	Existing	2256	495.02	502.51	500.11	502.61	0.001049	3.63	1044.79	275.52	0.27	
Main		6111.5 10yr+2080	Proposed	2202	495.02	502.41	500.11	502.46	0.000361	2.1	1172.1	275.65	0.16	-0.1
Main		6111.5 25yr	Existing	2446	495.02	502.68	500.11	502.78	0.00108	3.75	1091.18	276.55	0.27	
Main		6111.5 25yr	Proposed	2387	495.02	502.57	500.11	502.63	0.00038	2.2	1217.32	276.64	0.16	-0.11
Main		6111.5 25yr+2050	Existing	2854	495.02	503.03	500.3	503.14	0.001135	4	1188.08	278.67	0.28	
Main		6111.5 25yr+2050	Proposed	2784	495.02	502.91	500.11	502.99	0.000415	2.38	1312.07	278.61	0.17	-0.12
Main		6111.5 25yr+2080	Existing	3064	495.02	503.22	500.47	503.34	0.001149	4.1	1239.87	279.8	0.28	
Main		6111.5 25yr+2080	Proposed	2990	495.02	503.09	500.11	503.17	0.000429	2.47	1361.72	279.33	0.17	-0.13
Main		6111.5 50yr	Existing	2952	495.02	503.12	500.35	503.23	0.001143	4.05	1212.04	279.2	0.28	
Main		6111.5 50yr	Proposed	2880	495.02	502.99	500.11	503.07	0.000422	2.43	1334.97	278.94	0.17	-0.13
Main		6111.5 50yr+2050	Existing	3433	495.02	503.61	500.61	503.74	0.001107	4.19	1351.61	281.55	0.28	
Main		6111.5 50yr+2050	Proposed	3351	495.02	503.46	500.11	503.55	0.000432	2.58	1466.48	280.84	0.18	-0.15
Main		6111.5 50yr+2080	Existing	3719	495.02	503.98	500.72	504.11	0.001035	4.19	1455.1	283.12	0.27	
Main		6111.5 50yr+2080	Proposed	3632	495.02	503.83	500.11	503.92	0.000414	2.61	1569.64	282.27	0.17	-0.15
Main		6111.5 100yr	Existing	3526	495.02	503.73	500.65	503.86	0.001084	4.19	1384.4	282.05	0.28	
Main		6111.5 100yr	Proposed	3442	495.02	503.57	500.11	503.66	0.000429	2.59	1496.5	281.27	0.18	-0.16
Main		6111.5 100yr+2050	Existing	4037	495.02	504.2	500.84	504.34	0.001071	4.35	1517.65	284.06	0.28	
Main		6111.5 100yr+2050	Proposed	3943	495.02	504.3	500.11	504.39	0.000382	2.62	1703.4	283.84	0.17	0.1
Main		6111.5 100yr+2080	Existing	4131	495.02	504.25	500.87	504.39	0.001088	4.41	1532.77	284.29	0.28	
Main		6111.5 100yr+2080	Proposed	4036	495.02	504.15	500.11	504.25	0.000432	2.75	1660.57	283.34	0.18	-0.1
Main		5920.3 10yr	Existing	1878	494.5	502.06		502.1	0.000432	2.62	1459.54	413.65	0.18	
Main		5920.3 10yr	Proposed	1833	494.5	502.02		502.05	0.000167	1.69	1634.99	415.8	0.11	-0.04
Main		5920.3 10yr+2050	Existing	2176	494.5	502.34		502.39	0.000463	2.79	1575.45	419.18	0.19	
Main		5920.3 10yr+2050	Proposed	2123	494.5	502.3		502.33	0.000186	1.83	1752.04	426.06	0.12	-0.04
Main		5920.3 10yr+2080	Existing	2256	494.5	502.42		502.46	0.000469	2.83	1608.02	427.01	0.19	
Main		5920.3 10yr+2080	Proposed	2202	494.5	502.38		502.41	0.000191	1.87	1784	433.01	0.12	-0.04
Main		5920.3 25yr	Existing	2446	494.5	502.58		502.63	0.000498	2.96	1679.15	439.65	0.2	
Main		5920.3 25yr	Proposed	2387	494.5	502.54		502.57	0.000205	1.96	1854.66	437.38	0.13	-0.04
Main		5920.3 25yr+2050	Existing	2854	494.5	502.93		502.99	0.000524	3.13	1833.31	446.7	0.2	
Main		5920.3 25yr+2050	Proposed	2784	494.5	502.88		502.92	0.000226	2.12	2004.76	444.13	0.14	-0.05
Main		5920.3 25yr+2080	Existing	3064	494.5	503.12		503.17	0.000529	3.2	1916.89	449.22	0.21	
Main		5920.3 25yr+2080	Proposed	2990	494.5	503.06		503.1	0.000234	2.2	2084.07	446.99	0.14	-0.06
Main		5920.3 50yr	Existing	2952	494.5	503.02		503.07	0.000527	3.17	1871.88	447.87	0.2	
Main		5920.3 50yr	Proposed	2880	494.5	502.96		503	0.00023	2.16	2041.29	445.45	0.14	-0.06
Main		5920.3 50yr+2050	Existing	3433	494.5	503.52		503.58	0.000506	3.24	2100.84	454.53	0.2	
Main		5920.3 50yr+2050	Proposed	3351	494.5	503.43		503.48	0.000237	2.28	2253.23	451.65	0.14	-0.09
Main		5920.3 50yr+2080	Existing	3719	494.5	503.9		503.96	0.000469	3.22	2273.21	459.25	0.2	
Main		5920.3 50yr+2080	Proposed	3632	494.5	503.8		503.85	0.000228	2.31	2421.28	456.65	0.14	-0.1
Main		5920.3 100yr	Existing	3526	494.5	503.64		503.7	0.000494	3.23	2155.39	456.03	0.2	
Main		5920.3 100yr	Proposed	3442	494.5	503.54		503.59	0.000236	2.3	2301.98	452.91	0.14	-0.1
Main		5920.3 100yr+2050	Existing	4037	494.5	504.12		504.18	0.000485	3.33	2374.68	462.37	0.2	
Main		5920.3 100yr+2050	Proposed	3943	494.5	504.28		504.32	0.000211	2.3	2640.88	463.17	0.14	0.16
Main		5920.3 100yr+2080	Existing	4131	494.5	504.17		504.24	0.000492	3.37	2399	463.15	0.2	
Main		5920.3 100yr+2080	Proposed	4036	494.5	504.13		504.17	0.000239	2.42	2569.35	460.9	0.14	-0.04
Main		5840.6 10yr	Existing	1878	494.43	502.02	499.07	502.07	0.000395	2.55	1512.51	454.31	0.17	
Main		5840.6 10yr	Proposed	1833	494.43	501.97	499.07	502.02	0.00039	2.52	1491.98	452.99	0.17	-0.05
Main		5840.6 10yr+2050	Existing	2176	494.43	502.29	499.43	502.35	0.000425	2.72	1638.56	461.06	0.18	
Main		5840.6 10yr+2050	Proposed	2123	494.43	502.25	499.4	502.3	0.000419	2.69	1617.97	459.97	0.18	-0.04
Main		5840.6 10yr+2080	Existing	2256	494.43	502.37	499.48	502.43	0.00043	2.76	1673.95	462.92	0.18	
Main		5840.6 10yr+2080	Proposed	2202	494.43	502.32	499.43	502.38	0.000425	2.73	1652.16	461.77	0.18	-0.05
Main		5840.6 25yr	Existing	2446	494.43	502.53	499.6	502.59	0.000447	2.86	1749.69	467.58	0.19	
Main		5840.6 25yr	Proposed	2387	494.43	502.48	499.51	502.54	0.000442	2.82	1726.54	465.68	0.19	-0.05
Main		5840.6 25yr+2050	Existing	2854	494.43	502.88	499.72	502.94	0.000476	3.04	1912.96	477.98	0.2	
Main		5840.6 25yr+2050	Proposed	2784	494.43	502.82	499.72	502.88	0.000472	3.01	1885.64	476.67	0.19	-0.06
Main		5840.6 25yr+2080	Existing	3064	494.43	503.06	500.02	503.13	0.000482	3.11	2002.36	481.48	0.2	
Main		5840.6 25yr+2080	Proposed	2990	494.43	503	499.99	503.06	0.00048	3.08	1970.49	480.34	0.2	-0.06
Main		5840.6 50yr	Existing	2952	494.43	502.96	499.98	503.03	0.000479	3.07	1954.17	479.75	0.2	
Main		5840.6 50yr	Proposed	2880	494.43	502.9	499.95	502.97	0.000476	3.05	1924.64	478.54	0.2	-0.06
Main		5840.6 50yr+2050	Existing	3433	494.43	503.47	500.18	503.54	0.000461	3.15	2201.18	489.36	0.2	
Main		5840.6 50yr+2050	Proposed	3351	494.43	503.38	500.15	503.44	0.000467	3.14	2153.65	486.64	0.2	-0.09
Main		5840.6 50yr+2080	Existing	3719	494.43	503.85	500.29	503.92	0.000432	3.14	2390.03	503.69	0.19	
Main		5840.6 50yr+2080	Proposed	3632	494.43	503.75	500.25	503.82	0.000438	3.14	2337.92	499.99	0.19	-0.1
Main		5840.6 100yr	Existing	3526	494.43	503.6	500.22	503.66	0.000452	3.15	2260.54	493.44	0.19	
Main		5840.6 100yr	Proposed	3442	494.43	503.49	500.18	503.55	0.00046	3.15	2206.73	489.73	0.19	-0.11
Main		5840.6 100yr+2050	Existing	4037	494.43	504.07	500.4	504.14	0.000445	3.24	2500.85	506.47	0.19	
Main		5840.6 100yr+2050	Proposed	3943	494.43	504.24	500.37	504.3	0.000386	3.06	2582.87	508.43	0.18	0.17
Main		5840.6 100yr+2080	Existing	4131	494.43	504.13	500.43	504.2	0.000452	3.28	2527.19	507.1	0.2	
Main		5840.6 100yr+2080	Proposed	4036	494.43	504.07	500.4	504.14	0.000445	3.24	2500.5	506.46	0.19	-0.06
Main	5808.252	Bridge												
Main		5774 10yr	Existing	1878	493.62	501.94		502	0.000395	2.63	1313.59	466.66	0.18	
Main		5774 10yr	Proposed	1833	493.62	501.9		501.95	0.000393	2.62	1292.39	465.4	0.18	-0.04
Main		5774 10yr+2050	Existing	2176	493.62	502.22		502.28	0.000418	2.78	1445.41	491.66	0.18	
Main		5774 10yr+2050	Proposed	2123	493.62	502.17		502.23	0.000414	2.76	1423.59	486.42	0.18	-0.05
Main		5774 10yr+2080	Existing	2256	493.62	502.29		502.36	0.000425	2.82	1482.91	499.49	0.18	
Main		5774 10yr+2080	Proposed	2202	493.62	502.25		502.31	0.000417	2.78	1460.29	495.19	0.18	-0.04
Main		5774 25yr	Existing	2446	493.62	502.46		502.52	0.000432	2.89	1565.22	504.71	0.19	
Main		5774 25yr	Proposed	2387	493.62	502.41		502.47	0.00043	2.87	1540.05	503.12	0.19	-0.05
Main		5774 25yr+2050	Existing	2854	493.62	502.8		502.87	0.000446	3.02	1744.18	527.6	0.19	
Main		5774 25yr+2050	Proposed	2784	493.62	502.75		502.81	0.000444	3	1713.88	524.28	0.19	-0.05
Main		5774 25yr+2080	Existing	3064	493.62	502.99		503.06	0.000444	3.07	1844.67	539.32	0.19	
Main		5774 25yr+2080	Proposed	2990	493.62	502.93		503	0.000445	3.05	1808.74	534.6	0.19	-0.06
Main		5774 50yr	Existing	2952	493.62	502.89		502.96	0.000445	3.05	1790.32	532.62	0.19	
Main		5774 50yr	Proposed	2880</										

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	5703.9	50yr+2050	Proposed	3351	493.34	503.2	500.46	503.32	0.000712	4.1	1394.01	304.16	0.24	-0.1
Main	5703.9	50yr+2080	Existing	3719	493.34	503.69	500.63	503.81	0.00065	4.06	1546.09	312.61	0.24	
Main	5703.9	50yr+2080	Proposed	3632	493.34	503.59	500.58	503.71	0.00066	4.06	1513	310.79	0.24	-0.1
Main	5703.9	100yr	Existing	3526	493.34	503.42	500.54	503.55	0.000685	4.09	1462.88	308.02	0.24	
Main	5703.9	100yr	Proposed	3442	493.34	503.31	500.5	503.44	0.0007	4.1	1428.11	306.08	0.24	-0.11
Main	5703.9	100yr+2050	Existing	4037	493.34	503.9	500.77	504.03	0.000682	4.23	1612.38	318.75	0.24	
Main	5703.9	100yr+2050	Proposed	3943	493.34	504.09	500.74	504.2	0.000589	3.98	1671.54	323.68	0.23	0.19
Main	5703.9	100yr+2080	Existing	4131	493.34	503.95	500.8	504.09	0.000697	4.28	1627.77	320.34	0.25	
Main	5703.9	100yr+2080	Proposed	4036	493.34	503.9	500.78	504.03	0.000682	4.23	1612.16	318.73	0.24	-0.05
Main	5578.5	10yr	Existing	1878	493.2	501.69		501.85	0.001167	4.55	844.6	280.76	0.3	
Main	5578.5	10yr	Proposed	1833	493.2	501.65		501.81	0.001151	4.5	833.03	279.64	0.3	-0.04
Main	5578.5	10yr+2050	Existing	2176	493.2	501.93		502.12	0.001284	4.88	914.26	287.41	0.32	
Main	5578.5	10yr+2050	Proposed	2123	493.2	501.89		502.07	0.001261	4.82	903.13	286.36	0.31	-0.04
Main	5578.5	10yr+2080	Existing	2256	493.2	502		502.19	0.001306	4.95	934.58	289.36	0.32	
Main	5578.5	10yr+2080	Proposed	2202	493.2	501.96		502.15	0.001285	4.9	922.76	288.21	0.32	-0.04
Main	5578.5	25yr	Existing	2446	493.2	502.15		502.35	0.00137	5.14	977.31	293.15	0.33	
Main	5578.5	25yr	Proposed	2387	493.2	502.11		502.3	0.001351	5.08	964.23	292.05	0.33	-0.04
Main	5578.5	25yr+2050	Existing	2854	493.2	502.47		502.68	0.00147	5.47	1071.53	300.66	0.34	
Main	5578.5	25yr+2050	Proposed	2784	493.2	502.41		502.63	0.001455	5.42	1055.66	299.48	0.34	-0.06
Main	5578.5	25yr+2080	Existing	3064	493.2	502.65		502.87	0.001488	5.59	1126.15	304.81	0.35	
Main	5578.5	25yr+2080	Proposed	2990	493.2	502.58		502.8	0.001484	5.55	1106.5	303.31	0.34	-0.07
Main	5578.5	50yr	Existing	2952	493.2	502.55		502.77	0.001481	5.53	1096.46	302.54	0.34	
Main	5578.5	50yr	Proposed	2880	493.2	502.49		502.71	0.001471	5.48	1078.76	301.19	0.34	-0.06
Main	5578.5	50yr+2050	Existing	3433	493.2	503.08		503.29	0.001393	5.59	1259.67	315.2	0.34	
Main	5578.5	50yr+2050	Proposed	3351	493.2	502.97		503.19	0.001422	5.61	1226.73	312.62	0.34	-0.11
Main	5578.5	50yr+2080	Existing	3719	493.2	503.49		503.7	0.001254	5.48	1392.73	325.72	0.32	
Main	5578.5	50yr+2080	Proposed	3632	493.2	503.38		503.59	0.001281	5.49	1356.91	322.68	0.33	-0.11
Main	5578.5	100yr	Existing	3526	493.2	503.21		503.42	0.001348	5.56	1301.54	318.42	0.33	
Main	5578.5	100yr	Proposed	3442	493.2	503.09		503.31	0.001389	5.59	1263.56	315.51	0.34	-0.12
Main	5578.5	100yr+2050	Existing	4037	493.2	503.7		503.91	0.001313	5.69	1458.73	332.16	0.33	
Main	5578.5	100yr+2050	Proposed	3943	493.2	503.91		504.1	0.001111	5.32	1531.46	340.87	0.31	0.21
Main	5578.5	100yr+2080	Existing	4131	493.2	503.74		503.96	0.001341	5.77	1473.22	333.85	0.33	
Main	5578.5	100yr+2080	Proposed	4036	493.2	503.69		503.91	0.001312	5.69	1458.51	332.14	0.33	-0.05
Main	5410.7	10yr	Existing	1878	490.97	501.61		501.71	0.000498	3.46	1001.3	271.48	0.2	
Main	5410.7	10yr	Proposed	1833	490.97	501.57		501.67	0.000485	3.4	990.79	271.33	0.2	-0.04
Main	5410.7	10yr+2050	Existing	2176	490.97	501.84		501.96	0.000586	3.81	1063.16	273.13	0.22	
Main	5410.7	10yr+2050	Proposed	2123	490.97	501.8		501.92	0.000569	3.75	1053.48	272.81	0.21	-0.04
Main	5410.7	10yr+2080	Existing	2256	490.97	501.9		502.03	0.000606	3.89	1081.23	273.73	0.22	
Main	5410.7	10yr+2080	Proposed	2202	490.97	501.86		501.99	0.00059	3.83	1070.92	273.39	0.22	-0.04
Main	5410.7	25yr	Existing	2446	490.97	502.04		502.17	0.00066	4.1	1118.57	274.97	0.23	
Main	5410.7	25yr	Proposed	2387	490.97	502		502.13	0.000644	4.04	1107.09	274.59	0.23	-0.04
Main	5410.7	25yr+2050	Existing	2854	490.97	502.33		502.49	0.000764	4.5	1200.32	279.4	0.25	
Main	5410.7	25yr+2050	Proposed	2784	490.97	502.28		502.44	0.000746	4.43	1186.61	278.28	0.25	-0.05
Main	5410.7	25yr+2080	Existing	3064	490.97	502.51		502.68	0.000803	4.67	1248.62	283.32	0.26	
Main	5410.7	25yr+2080	Proposed	2990	490.97	502.44		502.61	0.00079	4.61	1231.18	281.91	0.26	-0.07
Main	5410.7	50yr	Existing	2952	490.97	502.41		502.58	0.000783	4.58	1222.28	281.19	0.25	
Main	5410.7	50yr	Proposed	2880	490.97	502.36		502.52	0.000768	4.52	1206.77	279.93	0.25	-0.05
Main	5410.7	50yr+2050	Existing	3433	490.97	502.93		503.11	0.000807	4.81	1371.66	293.45	0.26	
Main	5410.7	50yr+2050	Proposed	3351	490.97	502.83		503	0.000811	4.79	1341.07	290.66	0.26	-0.1
Main	5410.7	50yr+2080	Existing	3719	490.97	503.35		503.52	0.000768	4.81	1498.65	310.59	0.26	
Main	5410.7	50yr+2080	Proposed	3632	490.97	503.24		503.41	0.000773	4.8	1464.5	304.92	0.26	-0.11
Main	5410.7	100yr	Existing	3526	490.97	503.07		503.24	0.000796	4.81	1411.17	297.81	0.26	
Main	5410.7	100yr	Proposed	3442	490.97	502.94		503.12	0.000806	4.81	1375.32	293.81	0.26	-0.13
Main	5410.7	100yr+2050	Existing	4037	490.97	503.54		503.73	0.000825	5.05	1558.66	321.44	0.27	
Main	5410.7	100yr+2050	Proposed	3943	490.97	503.78		503.94	0.000702	4.72	1636.96	331.43	0.25	0.24
Main	5410.7	100yr+2080	Existing	4131	490.97	503.58		503.77	0.000848	5.13	1571.3	323.45	0.27	
Main	5410.7	100yr+2080	Proposed	4036	490.97	503.54		503.73	0.000825	5.05	1558.45	321.4	0.27	-0.04
Main	5372.1	10yr	Existing	1878	490	501.13	496.13	501.58	0.001361	5.5	461.96	281.29	0.32	
Main	5372.1	10yr	Proposed	1833	490	501.11	496.06	501.54	0.001314	5.4	455.96	272.03	0.31	-0.02
Main	5372.1	10yr+2050	Existing	2176	490	501.23	496.68	501.79	0.001719	6.22	489.82	303.56	0.36	
Main	5372.1	10yr+2050	Proposed	2123	490	501.22	496.59	501.76	0.001645	6.08	487.55	302.44	0.35	-0.01
Main	5372.1	10yr+2080	Existing	2256	490	501.26	496.8	501.85	0.001807	6.4	500.18	308.64	0.37	
Main	5372.1	10yr+2080	Proposed	2202	490	501.25	496.74	501.82	0.001733	6.26	497.14	307.16	0.36	-0.01
Main	5372.1	25yr	Existing	2446	490	501.3	497.14	501.97	0.002074	6.87	511.15	313.69	0.39	
Main	5372.1	25yr	Proposed	2387	490	501.29	497.05	501.94	0.001987	6.72	508.44	312.63	0.38	-0.01
Main	5372.1	25yr+2050	Existing	2854	490	501.3	497.79	502.22	0.002814	8	512.71	314.95	0.46	
Main	5372.1	25yr+2050	Proposed	2784	490	501.32	497.67	502.18	0.002642	7.77	519	320.49	0.44	0.02
Main	5372.1	25yr+2080	Existing	3064	490	501.26	498.1	502.35	0.003333	8.69	500.09	308.59	0.5	
Main	5372.1	25yr+2080	Proposed	2990	490	501.3	497.89	502.31	0.003096	8.39	511.56	313.84	0.48	0.04
Main	5372.1	50yr	Existing	2952	490	501.3	497.92	502.28	0.00302	8.29	511.24	313.72	0.47	
Main	5372.1	50yr	Proposed	2880	490	501.32	497.83	502.24	0.002837	8.04	517.47	319.7	0.46	0.02
Main	5372.1	50yr+2050	Existing	3433	490	500.82	498.58	502.57	0.005459	10.77	379.53	205.59	0.63	
Main	5372.1	50yr+2050	Proposed	3351	490	500.94	498.49	502.52	0.004873	10.26	401.26	222.16	0.6	0.12
Main	5372.1	50yr+2080	Existing	3719	490	500.28	498.99	502.76	0.008213	12.68	305.48	76.68	0.77	
Main	5372.1	50yr+2080	Proposed	3632	490	500.43	498.87	502.71	0.007404	12.17	319.93	127.58	0.73	0.15
Main	5372.1	100yr	Existing	3526	490	500.65	498.71	502.63	0.00628	11.4	351.4	178.16	0.68	
Main	5372.1	100yr	Proposed	3442	490	500.81	498.61	502.58	0.005526	10.82	377.26	204.17	0.64	0.16
Main	5372.1	100yr+2050	Existing	4037	490	503.25	501.87	503.63	0.001314	6.19	1253.29	425.6	0.32	
Main	5372.1	100yr+2050	Proposed	3943	490	499.77	499.27	502.96	0.011455	14.36	279.47	43.67	0.9	-3.48
Main	5372.1	100yr+2080	Existing	4131	490	503.28	501.94	503.67	0.001342	6.27	1268.53	427.16	0.33	
Main	5372.1	100yr+2080	Proposed	4036	490	503.25	501.87	503.63	0.001314	6.19	1252.98	425.56	0.32	-0.03
Main	5335.655		Bridge											
Main	5299.7	10yr	Existing	1878	490	497.17	496	497.46	0.002391	5.35	494.9	137.6	0.39	
Main	5299.7	10yr	Proposed	1833	490	497.13	496	497.41	0.002356	5.29	489.44	137.54	0.39	-0.04
Main	5299.7	10yr+2050	Existing	2176	490	497.41	496.01	497.74						

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)	
Main	5241.7	10yr+2050	Existing	2176	489.84	497.4	494.93	497.55	0.00117	4.04	759.73	177.58	0.29		
Main	5241.7	10yr+2050	Proposed	2123	489.84	497.36	494.89	497.5	0.001148	3.99	752.08	177.35	0.29	-0.04	
Main	5241.7	10yr+2080	Existing	2256	489.84	497.47	494.97	497.63	0.001194	4.12	772.7	177.97	0.3		
Main	5241.7	10yr+2080	Proposed	2202	489.84	497.42	494.94	497.58	0.001177	4.07	764.2	177.71	0.29	-0.05	
Main	5241.7	25yr	Existing	2446	489.84	497.6	495.07	497.77	0.001286	4.33	795.26	178.64	0.31		
Main	5241.7	25yr	Proposed	2387	489.84	497.56	495.03	497.72	0.001261	4.27	787.55	178.41	0.3	-0.04	
Main	5241.7	25yr+2050	Existing	2854	489.84	497.87	495.28	498.08	0.001461	4.76	844.58	180.46	0.33		
Main	5241.7	25yr+2050	Proposed	2784	489.84	497.82	495.25	498.02	0.001435	4.69	835.63	180.04	0.33	-0.05	
Main	5241.7	25yr+2080	Existing	3064	489.84	497.99	495.39	498.21	0.00157	4.99	864.92	181.41	0.34		
Main	5241.7	25yr+2080	Proposed	2990	489.84	497.94	495.36	498.16	0.001534	4.91	857.35	181.06	0.34	-0.05	
Main	5241.7	50yr	Existing	2952	489.84	497.92	495.33	498.13	0.001522	4.88	852.28	180.82	0.34		
Main	5241.7	50yr	Proposed	2880	489.84	497.88	495.3	498.09	0.001485	4.8	845	180.48	0.33	-0.04	
Main	5241.7	50yr+2050	Existing	3433	489.84	498.21	495.56	498.47	0.001721	5.34	905.59	183.3	0.36		
Main	5241.7	50yr+2050	Proposed	3351	489.84	498.15	495.53	498.41	0.001695	5.27	895.41	182.83	0.36	-0.06	
Main	5241.7	50yr+2080	Existing	3719	489.84	498.34	495.71	498.63	0.001864	5.63	930.65	184.98	0.38		
Main	5241.7	50yr+2080	Proposed	3632	489.84	498.31	495.67	498.59	0.001816	5.54	923.83	184.27	0.37	-0.03	
Main	5241.7	100yr	Existing	3526	489.84	498.25	495.62	498.52	0.001771	5.44	913.3	183.66	0.37		
Main	5241.7	100yr	Proposed	3442	489.84	498.21	495.58	498.47	0.001729	5.35	905.68	183.3	0.36	-0.04	
Main	5241.7	100yr+2050	Existing	4037	489.84	498.47	495.85	498.83	0.002238	6.25	958.39	355.29	0.42		
Main	5241.7	100yr+2050	Proposed	3943	489.84	498.44	495.81	498.78	0.002184	6.15	949.81	354.49	0.41	-0.03	
Main	5241.7	100yr+2080	Existing	4131	489.84	498.52	495.9	498.88	0.002271	6.32	970.46	356.37	0.42		
Main	5241.7	100yr+2080	Proposed	4036	489.84	498.47	495.86	498.82	0.00224	6.25	957.98	355.25	0.42	-0.05	
Main	4984.3	10yr	Existing	1878	489.6	497.07	497.11	0.000397	2.36	1341.73	319.27	0.17			
Main	4984.3	10yr	Proposed	1833	489.6	497.03	497.07	0.000389	2.32	1329.48	318.8	0.16	-0.04		
Main	4984.3	10yr+2050	Existing	2176	489.6	497.29	497.34	0.000455	2.58	1413.74	322.44	0.18			
Main	4984.3	10yr+2050	Proposed	2123	489.6	497.25	497.3	0.000446	2.55	1400.32	321.84	0.18	-0.04		
Main	4984.3	10yr+2080	Existing	2256	489.6	497.37	497.41	0.000466	2.63	1436.88	323.47	0.18			
Main	4984.3	10yr+2080	Proposed	2202	489.6	497.32	497.36	0.000458	2.6	1421.77	322.8	0.18	-0.05		
Main	4984.3	25yr	Existing	2446	489.6	497.49	497.54	0.000505	2.77	1475.68	325.04	0.19			
Main	4984.3	25yr	Proposed	2387	489.6	497.44	497.49	0.000494	2.73	1462.21	324.5	0.19	-0.05		
Main	4984.3	25yr+2050	Existing	2854	489.6	497.75	497.81	0.00058	3.05	1561.74	328.88	0.2			
Main	4984.3	25yr+2050	Proposed	2784	489.6	497.7	497.76	0.000569	3.01	1545.95	327.98	0.2	-0.05		
Main	4984.3	25yr+2080	Existing	3064	489.6	497.85	497.92	0.000628	3.2	1596.18	330.83	0.21			
Main	4984.3	25yr+2080	Proposed	2990	489.6	497.81	497.88	0.000612	3.15	1583.19	330.1	0.21	-0.04		
Main	4984.3	50yr	Existing	2952	489.6	497.79	497.85	0.000607	3.13	1574.15	329.58	0.21			
Main	4984.3	50yr	Proposed	2880	489.6	497.75	497.81	0.000591	3.08	1561.75	328.88	0.21	-0.04		
Main	4984.3	50yr+2050	Existing	3433	489.6	498.07	498.15	0.000694	3.44	1667.4	334.71	0.22			
Main	4984.3	50yr+2050	Proposed	3351	489.6	498.01	498.09	0.000683	3.39	1649.14	333.82	0.22	-0.06		
Main	4984.3	50yr+2080	Existing	3719	489.6	498.19	498.28	0.000755	3.63	1709.99	336.62	0.23			
Main	4984.3	50yr+2080	Proposed	3632	489.6	498.16	498.25	0.000734	3.57	1698.66	336.11	0.23	-0.03		
Main	4984.3	100yr	Existing	3526	489.6	498.11	498.19	0.000715	3.5	1680.31	335.29	0.23			
Main	4984.3	100yr	Proposed	3442	489.6	498.07	498.15	0.000697	3.45	1667.29	334.7	0.22	-0.04		
Main	4984.3	100yr+2050	Existing	4037	489.6	498.32	498.42	0.000827	3.84	1752.64	338.53	0.25			
Main	4984.3	100yr+2050	Proposed	3943	489.6	498.29	498.38	0.000803	3.77	1741.76	338.04	0.24	-0.03		
Main	4984.3	100yr+2080	Existing	4131	489.6	498.37	498.47	0.000842	3.89	1769.09	339.26	0.25			
Main	4984.3	100yr+2080	Proposed	4036	489.6	498.32	498.42	0.000827	3.84	1752.02	338.5	0.25	-0.05		
Main	4801.5	10yr	Existing	1878	489.54	497.06	492.52	497.07	0.000095	1.2	2148.3	460.52	0.08		
Main	4801.5	10yr	Proposed	1833	489.54	497.02	492.49	497.03	0.000093	1.18	2131.74	459.72	0.08	-0.04	
Main	4801.5	10yr+2050	Existing	2176	489.54	497.28	492.62	497.29	0.000112	1.32	2245.21	465.16	0.09		
Main	4801.5	10yr+2050	Proposed	2123	489.54	497.24	492.62	497.25	0.000109	1.3	2227.16	464.3	0.09	-0.04	
Main	4801.5	10yr+2080	Existing	2256	489.54	497.35	492.62	497.37	0.000115	1.35	2276.35	469.54	0.09		
Main	4801.5	10yr+2080	Proposed	2202	489.54	497.3	492.63	497.32	0.000113	1.33	2256.01	465.67	0.09	-0.05	
Main	4801.5	25yr	Existing	2446	489.54	497.47	492.71	497.49	0.000126	1.43	2328.15	500.4	0.1		
Main	4801.5	25yr	Proposed	2387	489.54	497.43	492.68	497.44	0.000123	1.41	2310.12	495.56	0.1	-0.04	
Main	4801.5	25yr+2050	Existing	2854	489.54	497.73	492.85	497.75	0.000148	1.6	2442.89	528.9	0.11		
Main	4801.5	25yr+2050	Proposed	2784	489.54	497.68	492.82	497.7	0.000145	1.57	2421.83	526.91	0.11	-0.05	
Main	4801.5	25yr+2080	Existing	3064	489.54	497.83	492.92	497.86	0.000162	1.68	2488.41	533.2	0.11		
Main	4801.5	25yr+2080	Proposed	2990	489.54	497.79	492.9	497.82	0.000157	1.65	2471.21	531.57	0.11	-0.04	
Main	4801.5	50yr	Existing	2952	489.54	497.77	492.88	497.79	0.000156	1.64	2459.16	530.44	0.11		
Main	4801.5	50yr	Proposed	2880	489.54	497.73	492.86	497.75	0.000151	1.61	2442.73	528.88	0.11	-0.04	
Main	4801.5	50yr+2050	Existing	3433	489.54	498.04	493.03	498.07	0.000181	1.82	2582.7	541.75	0.12		
Main	4801.5	50yr+2050	Proposed	3351	489.54	497.99	493.02	498.02	0.000178	1.79	2558.5	539.35	0.12	-0.05	
Main	4801.5	50yr+2080	Existing	3719	489.54	498.17	493.12	498.2	0.000199	1.93	2638.54	547.37	0.13		
Main	4801.5	50yr+2080	Proposed	3632	489.54	498.14	493.09	498.17	0.000193	1.89	2623.75	546.08	0.12	-0.03	
Main	4801.5	100yr	Existing	3526	489.54	498.08	493.06	498.11	0.000187	1.86	2599.61	543.53	0.12		
Main	4801.5	100yr	Proposed	3442	489.54	498.04	493.03	498.07	0.000182	1.82	2582.51	541.73	0.12	-0.04	
Main	4801.5	100yr+2050	Existing	4037	489.54	498.29	493.19	498.33	0.00022	2.05	2694.15	551.59	0.13		
Main	4801.5	100yr+2050	Proposed	3943	489.54	498.26	493.18	498.3	0.000213	2.01	2680.07	550.5	0.13	-0.03	
Main	4801.5	100yr+2080	Existing	4131	489.54	498.34	493.22	498.38	0.000225	2.08	2715.77	553.63	0.13		
Main	4801.5	100yr+2080	Proposed	4036	489.54	498.29	493.19	498.33	0.00022	2.05	2693.33	551.52	0.13	-0.05	
Main	4646.5	10yr	Existing	1878	488.7	497.01	493.38	497.04	0.000224	2	1482.73	395.15	0.13		
Main	4646.5	10yr	Proposed	1833	488.7	496.97	493.34	497	0.000219	1.97	1468.2	390.93	0.13	-0.04	
Main	4646.5	10yr+2050	Existing	2176	488.7	497.22	493.65	497.26	0.000259	2.19	1568.97	408.62	0.14		
Main	4646.5	10yr+2050	Proposed	2123	488.7	497.18	493.6	497.22	0.000254	2.16	1552.67	406.22	0.14	-0.04	
Main	4646.5	10yr+2080	Existing	2256	488.7	497.29	493.74	497.33	0.000266	2.23	1597.62	412.99	0.14		
Main	4646.5	10yr+2080	Proposed	2202	488.7	497.25	493.68	497.29	0.000261	2.2	1578.92	410.14	0.14	-0.04	
Main	4646.5	25yr	Existing	2446	488.7	497.41	493.91	497.45	0.00029	2.36	1644.62	418.84	0.15		
Main	4646.5	25yr	Proposed	2387	488.7	497.37	493.85	497.41	0.000284	2.32	1628.02	417.77	0.15	-0.04	
Main	4646.5	25yr+2050	Existing	2854	488.7	497.66	494.26	497.71	0.000336	2.59	1750.24	425.43	0.16		
Main	4646.5	25yr+2050	Proposed	2784	488.7	497.61	494.2	497.66	0.000329	2.55	1730.66	424.31	0.16	-0.05	
Main	4646.5	25yr+2080	Existing	3064	488.7	497.75	494.43	497.81	0.000364	2.72	1791.32	427.76	0.17		
Main	4646.5	25yr+2080	Proposed	2990	488.7	497.72									

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	4510.8	50yr+2050	Existing	3433	488.6	492.5	492.5	492.99	0.010087	7.95	665.9	255.54	0.78	
Main	4510.8	50yr+2050	Proposed	3351	488.6	492.46	492.95	492.95	0.010107	7.89	655.48	255.17	0.78	-0.04
Main	4510.8	50yr+2080	Existing	3719	488.6	492.64	493.16	491.007	0.010007	8.14	701.93	256.83	0.79	
Main	4510.8	50yr+2080	Proposed	3632	488.6	492.6	493.11	491.0043	0.010043	8.09	690.8	256.43	0.79	-0.04
Main	4510.8	100yr	Existing	3526	488.6	492.54	493.05	491.0066	0.010066	8.01	677.59	255.96	0.79	
Main	4510.8	100yr	Proposed	3442	488.6	492.5	493	491.0085	0.010085	7.95	667.03	255.58	0.78	-0.04
Main	4510.8	100yr+2050	Existing	4037	488.6	492.79	493.34	490.9946	0.009946	8.36	740.47	258.2	0.79	
Main	4510.8	100yr+2050	Proposed	3943	488.6	492.75	493.29	490.9964	0.009964	8.3	729.18	257.8	0.79	-0.04
Main	4510.8	100yr+2080	Existing	4131	488.6	492.83	493.39	490.9929	0.009929	8.42	751.68	258.6	0.79	
Main	4510.8	100yr+2080	Proposed	4036	488.6	492.79	493.34	490.9946	0.009946	8.36	740.35	258.2	0.79	-0.04
Main	4417.3	10yr	Existing	1878	487.91	490.95	490.35	491.14	0.006436	4.73	566.55	279.31	0.58	
Main	4417.3	10yr	Proposed	1833	487.91	490.92	490.35	491.1	0.006439	4.69	558.07	279.09	0.58	-0.03
Main	4417.3	10yr+2050	Existing	2176	487.91	491.15	490.35	491.35	0.006413	4.95	621.01	280.72	0.58	
Main	4417.3	10yr+2050	Proposed	2123	487.91	491.11	490.35	491.31	0.006417	4.91	611.54	280.47	0.58	-0.04
Main	4417.3	10yr+2080	Existing	2256	487.91	491.2	490.35	491.41	0.006409	5.01	635.12	281.08	0.59	
Main	4417.3	10yr+2080	Proposed	2202	487.91	491.17	490.35	491.37	0.006411	4.97	625.62	280.84	0.58	-0.03
Main	4417.3	25yr	Existing	2446	487.91	491.32	490.35	491.54	0.006396	5.15	667.89	282	0.59	
Main	4417.3	25yr	Proposed	2387	487.91	491.28	490.35	491.5	0.006401	5.1	657.86	281.67	0.59	-0.04
Main	4417.3	25yr+2050	Existing	2854	487.91	491.56	490.41	491.8	0.006344	5.47	735.89	284.21	0.6	
Main	4417.3	25yr+2050	Proposed	2784	487.91	491.52	490.38	491.76	0.006348	5.41	724.62	283.85	0.59	-0.04
Main	4417.3	25yr+2080	Existing	3064	487.91	491.67	490.49	491.93	0.00633	5.62	769.22	285.29	0.6	
Main	4417.3	25yr+2080	Proposed	2990	487.91	491.63	490.46	491.89	0.006335	5.57	757.56	284.91	0.6	-0.04
Main	4417.3	50yr	Existing	2952	487.91	491.61	490.45	491.86	0.006337	5.54	751.54	284.72	0.6	
Main	4417.3	50yr	Proposed	2880	487.91	491.57	490.42	491.82	0.006342	5.49	740.06	284.35	0.6	-0.04
Main	4417.3	50yr+2050	Existing	3433	487.91	491.87	490.63	492.15	0.006303	5.88	825.92	286.97	0.61	
Main	4417.3	50yr+2050	Proposed	3351	487.91	491.83	490.6	492.11	0.006308	5.82	813.58	286.65	0.6	-0.04
Main	4417.3	50yr+2080	Existing	3719	487.91	492.02	490.73	492.32	0.006294	6.07	867.83	288.05	0.61	
Main	4417.3	50yr+2080	Proposed	3632	487.91	491.97	490.7	492.27	0.006296	6.01	855.24	287.72	0.61	-0.05
Main	4417.3	100yr	Existing	3526	487.91	491.92	490.66	492.21	0.006299	5.94	839.71	287.32	0.61	
Main	4417.3	100yr	Proposed	3442	487.91	491.88	490.63	492.16	0.006303	5.89	827.25	287	0.61	-0.04
Main	4417.3	100yr+2050	Existing	4037	487.91	492.17	490.83	492.49	0.006287	6.27	913.01	289.2	0.61	
Main	4417.3	100yr+2050	Proposed	3943	487.91	492.13	490.81	492.44	0.006289	6.21	899.77	288.86	0.61	-0.04
Main	4417.3	100yr+2080	Existing	4131	487.91	492.22	490.87	492.55	0.006284	6.33	926.14	289.54	0.62	
Main	4417.3	100yr+2080	Proposed	4036	487.91	492.17	490.84	492.49	0.006287	6.27	912.86	289.2	0.61	-0.05
Main	4303	10yr	Existing	1878	486.26	489.98	490.25	490.192	0.009192	6.48	489.29	255.58	0.64	
Main	4303	10yr	Proposed	1833	486.26	489.95	490.22	490.231	0.009231	6.45	481.03	254.95	0.64	-0.03
Main	4303	10yr+2050	Existing	2176	486.26	490.19	490.48	490.8967	0.008967	6.68	542.5	259.59	0.64	
Main	4303	10yr+2050	Proposed	2123	486.26	490.16	490.44	490.8997	0.008997	6.64	533.37	258.93	0.64	-0.03
Main	4303	10yr+2080	Existing	2256	486.26	490.24	490.54	490.8922	0.008922	6.73	556.11	260.45	0.64	
Main	4303	10yr+2080	Proposed	2202	486.26	490.21	490.5	490.8952	0.008952	6.69	546.94	259.87	0.64	-0.03
Main	4303	25yr	Existing	2446	486.26	490.37	490.67	490.8811	0.008811	6.85	588.12	262.45	0.64	
Main	4303	25yr	Proposed	2387	486.26	490.33	490.63	490.8847	0.008847	6.81	578.21	261.83	0.64	-0.04
Main	4303	25yr+2050	Existing	2854	486.26	490.62	490.95	490.8576	0.008576	7.08	655.19	266.59	0.64	
Main	4303	25yr+2050	Proposed	2784	486.26	490.58	490.91	490.8861	0.008861	7.04	643.97	265.9	0.64	-0.04
Main	4303	25yr+2080	Existing	3064	486.26	490.74	491.09	490.8848	0.008848	7.19	688.41	268.62	0.64	
Main	4303	25yr+2080	Proposed	2990	486.26	490.7	491.04	490.88512	0.008512	7.15	676.82	267.91	0.64	-0.04
Main	4303	50yr	Existing	2952	486.26	490.68	491.02	490.8531	0.008531	7.13	670.78	267.55	0.64	
Main	4303	50yr	Proposed	2880	486.26	490.63	490.97	490.8564	0.008564	7.09	659.34	266.85	0.64	-0.05
Main	4303	50yr+2050	Existing	3433	486.26	490.95	491.32	490.8373	0.008373	7.39	744.01	271.98	0.64	
Main	4303	50yr+2050	Proposed	3351	486.26	490.9	491.27	490.8382	0.008382	7.34	732.18	271.27	0.64	-0.05
Main	4303	50yr+2080	Existing	3719	486.26	491.1	491.49	490.8312	0.008312	7.54	784.77	273.8	0.64	
Main	4303	50yr+2080	Proposed	3632	486.26	491.05	491.44	490.8329	0.008329	7.5	772.57	273.31	0.64	-0.05
Main	4303	100yr	Existing	3526	486.26	491	491.37	490.8359	0.008359	7.44	757.3	272.69	0.64	
Main	4303	100yr	Proposed	3442	486.26	490.95	491.32	490.8372	0.008372	7.4	745.31	272.06	0.64	-0.05
Main	4303	100yr+2050	Existing	4037	486.26	491.26	491.67	490.8254	0.008254	7.7	828.62	275.65	0.65	
Main	4303	100yr+2050	Proposed	3943	486.26	491.21	491.61	490.8271	0.008271	7.66	815.76	275.05	0.65	-0.05
Main	4303	100yr+2080	Existing	4131	486.26	491.3	491.72	490.8238	0.008238	7.75	841.38	276.39	0.65	
Main	4303	100yr+2080	Proposed	4036	486.26	491.26	491.66	490.8254	0.008254	7.7	828.48	275.65	0.65	-0.04
Main	4186.1	10yr	Existing	1878	484.71	489.18	489.38	489.959	0.005959	5.3	559.35	256.95	0.54	
Main	4186.1	10yr	Proposed	1833	484.71	489.14	489.34	489.962	0.005962	5.28	550.48	256.38	0.54	-0.04
Main	4186.1	10yr+2050	Existing	2176	484.71	489.38	489.6	490.6074	0.006074	5.47	611.99	260.28	0.55	
Main	4186.1	10yr+2050	Proposed	2123	484.71	489.35	489.56	490.6059	0.006059	5.44	602.7	259.69	0.55	-0.03
Main	4186.1	10yr+2080	Existing	2256	484.71	489.44	489.66	490.6092	0.006092	5.51	626.01	261.16	0.55	
Main	4186.1	10yr+2080	Proposed	2202	484.71	489.4	489.62	490.6068	0.006068	5.49	616.56	260.57	0.55	-0.04
Main	4186.1	25yr	Existing	2446	484.71	489.57	489.8	490.6091	0.006091	5.59	660.16	273.36	0.55	
Main	4186.1	25yr	Proposed	2387	484.71	489.52	489.76	490.6061	0.006061	5.57	649.18	268.35	0.55	-0.05
Main	4186.1	25yr+2050	Existing	2854	484.71	489.84	490.09	490.6044	0.006044	5.51	739.89	300.06	0.55	
Main	4186.1	25yr+2050	Proposed	2784	484.71	489.8	490.04	490.60643	0.0060643	5.54	726.47	296.78	0.55	-0.04
Main	4186.1	25yr+2080	Existing	3064	484.71	489.97	490.23	490.60624	0.0060624	5.45	780.86	309.75	0.55	
Main	4186.1	25yr+2080	Proposed	2990	484.71	489.93	490.18	490.60531	0.0060531	5.47	766.44	306.38	0.55	-0.04
Main	4186.1	50yr	Existing	2952	484.71	489.9	490.16	490.60638	0.0060638	5.48	758.9	304.6	0.55	
Main	4186.1	50yr	Proposed	2880	484.71	489.86	490.11	490.60643	0.0060643	5.51	744.89	301.26	0.55	-0.04
Main	4186.1	50yr+2050	Existing	3433	484.71	490.2	490.47	490.5965	0.005965	5.47	851.05	327.57	0.55	
Main	4186.1	50yr+2050	Proposed	3351	484.71	490.15	490.42	490.5983	0.005983	5.42	836.01	324.37	0.55	-0.05
Main	4186.1	50yr+2080	Existing	3719	484.71	490.36	490.64	490.5868	0.005868	5.62	905.39	337.55	0.55	
Main	4186.1	50yr+2080	Proposed	3632	484.71	490.31	490.59	490.5896	0.005896	5.57	889	335.49	0.55	-0.05
Main	4186.1	100yr	Existing	3526	484.71	490.25	490.52	490.5945	0.005945	5.52	868.14	331.16	0.55	
Main	4186.1	100yr	Proposed	3442	484.71	490.2	490.47	490.5963	0.005963	5.47	852.7	327.92	0.55	-0.05
Main	4186.1	100yr+2050	Existing	4037	484.71	490.53	490.83	490.5766	0.005766	5.77	964.97	343.84	0.55	
Main	4186.1	100yr+2050	Proposed	3943	484.71	490.48	490.78	490.5797	0.005797	5.72	947.4	341.87	0.55	-0.05
Main	4186.1	100yr+2080	Existing	4131	484.71	490.58	4							

	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	3517.2	10yr+2050	Proposed	2123	480.34	485.78		485.99	0.003877	5.15	608.42	192.55	0.44	-0.05
Main	3517.2	10yr+2080	Existing	2256	480.34	485.91		486.13	0.003973	5.27	634.48	198.75	0.45	
Main	3517.2	10yr+2080	Proposed	2202	480.34	485.86		486.07	0.003938	5.23	623.94	196.41	0.44	-0.05
Main	3517.2	25yr	Existing	2446	480.34	486.11		486.34	0.004203	5.52	674.88	215.01	0.46	
Main	3517.2	25yr	Proposed	2387	480.34	486.04		486.27	0.004058	5.39	661.28	205.81	0.45	-0.07
Main	3517.2	25yr+2050	Existing	2854	480.34	486.55		486.79	0.004204	5.71	774.81	240.86	0.46	
Main	3517.2	25yr+2050	Proposed	2784	480.34	486.47		486.71	0.004285	5.73	755.18	238.17	0.47	-0.08
Main	3517.2	25yr+2080	Existing	3064	480.34	486.84		487.07	0.003835	5.58	845.64	250.37	0.44	
Main	3517.2	25yr+2080	Proposed	2990	480.34	486.75		486.99	0.0039	5.59	825.17	247.68	0.44	-0.09
Main	3517.2	50yr	Existing	2952	480.34	486.67		486.91	0.004076	5.68	803.86	244.8	0.45	
Main	3517.2	50yr	Proposed	2880	480.34	486.58		486.82	0.004178	5.71	781.93	241.83	0.46	-0.09
Main	3517.2	50yr+2050	Existing	3433	480.34	487.2		487.43	0.003582	5.53	938.2	271.56	0.43	
Main	3517.2	50yr+2050	Proposed	3351	480.34	487.12		487.35	0.003627	5.53	917.9	263.26	0.43	-0.08
Main	3517.2	50yr+2080	Existing	3719	480.34	487.47		487.7	0.003402	5.42	1014.49	291.76	0.42	
Main	3517.2	50yr+2080	Proposed	3632	480.34	487.38		487.62	0.003459	5.47	990.32	286.6	0.42	-0.09
Main	3517.2	100yr	Existing	3526	480.34	487.28		487.52	0.003522	5.52	962.38	280.21	0.42	
Main	3517.2	100yr	Proposed	3442	480.34	487.21		487.44	0.003576	5.53	940.62	272.59	0.43	-0.07
Main	3517.2	100yr+2050	Existing	4037	480.34	487.76		487.99	0.003215	5.26	1102.64	305.83	0.41	
Main	3517.2	100yr+2050	Proposed	3943	480.34	487.68		487.9	0.003269	5.3	1076.52	302.11	0.41	-0.08
Main	3517.2	100yr+2080	Existing	4131	480.34	487.84		488.07	0.003168	5.24	1127.69	310.2	0.41	
Main	3517.2	100yr+2080	Proposed	4036	480.34	487.76		487.99	0.003216	5.26	1102.39	305.8	0.41	-0.08
Main	3443.8	10yr	Existing	1878	479.47	485.19		485.41	0.004801	5.44	546.24	209.57	0.48	
Main	3443.8	10yr	Proposed	1833	479.47	485.14		485.36	0.004828	5.43	535.96	208.45	0.48	-0.05
Main	3443.8	10yr+2050	Existing	2176	479.47	485.51		485.73	0.004631	5.49	613.68	216.85	0.47	
Main	3443.8	10yr+2050	Proposed	2123	479.47	485.45		485.68	0.004674	5.49	601.42	215.77	0.48	-0.06
Main	3443.8	10yr+2080	Existing	2256	479.47	485.59		485.82	0.004583	5.5	631.41	218.4	0.47	
Main	3443.8	10yr+2080	Proposed	2202	479.47	485.54		485.76	0.004617	5.49	619.37	217.35	0.47	-0.05
Main	3443.8	25yr	Existing	2446	479.47	485.79		486.02	0.004449	5.5	675.94	223.37	0.47	
Main	3443.8	25yr	Proposed	2387	479.47	485.73		485.96	0.004488	5.5	661.77	221.45	0.47	-0.06
Main	3443.8	25yr+2050	Existing	2854	479.47	486.26		486.49	0.004009	5.41	782.71	234.65	0.45	
Main	3443.8	25yr+2050	Proposed	2784	479.47	486.17		486.4	0.004121	5.45	761.78	232.69	0.45	-0.09
Main	3443.8	25yr+2080	Existing	3064	479.47	486.58		486.8	0.003506	5.18	859.33	239.65	0.42	
Main	3443.8	25yr+2080	Proposed	2990	479.47	486.49		486.71	0.003596	5.21	838.25	238.46	0.42	-0.09
Main	3443.8	50yr	Existing	2952	479.47	486.39		486.61	0.003829	5.34	813.83	237.06	0.44	
Main	3443.8	50yr	Proposed	2880	479.47	486.29		486.52	0.003973	5.4	790.23	235.36	0.44	-0.1
Main	3443.8	50yr+2050	Existing	3433	479.47	486.96		487.18	0.003255	5.13	950.8	244.76	0.4	
Main	3443.8	50yr+2050	Proposed	3351	479.47	486.88		487.1	0.003296	5.13	931.61	243.7	0.41	-0.08
Main	3443.8	50yr+2080	Existing	3719	479.47	487.24		487.46	0.003105	5.11	1019.25	248.51	0.4	
Main	3443.8	50yr+2080	Proposed	3632	479.47	487.15		487.37	0.003154	5.11	997.97	247.35	0.4	-0.09
Main	3443.8	100yr	Existing	3526	479.47	487.05		487.27	0.003205	5.12	973.07	245.99	0.4	
Main	3443.8	100yr	Proposed	3442	479.47	486.97		487.19	0.003249	5.13	953.07	244.88	0.4	-0.08
Main	3443.8	100yr+2050	Existing	4037	479.47	487.54		487.76	0.002956	5.08	1094.77	252.45	0.39	
Main	3443.8	100yr+2050	Proposed	3943	479.47	487.45		487.67	0.002999	5.08	1072.65	251.4	0.39	-0.09
Main	3443.8	100yr+2080	Existing	4131	479.47	487.62		487.84	0.002923	5.08	1115.76	253.39	0.39	
Main	3443.8	100yr+2080	Proposed	4036	479.47	487.54		487.76	0.002957	5.08	1094.57	252.44	0.39	-0.08
Main	3189.9	10yr	Existing	1878	479.05	483.77		484.05	0.005926	5.81	466.73	164.61	0.55	
Main	3189.9	10yr	Proposed	1833	479.05	483.72		483.99	0.005973	5.8	457.3	163.28	0.55	-0.05
Main	3189.9	10yr+2050	Existing	2176	479.05	484.17		484.46	0.005437	5.82	534.36	172.57	0.53	
Main	3189.9	10yr+2050	Proposed	2123	479.05	484.1		484.39	0.005523	5.82	522.47	171.46	0.53	-0.07
Main	3189.9	10yr+2080	Existing	2256	479.05	484.28		484.56	0.005315	5.81	552.23	174.23	0.52	
Main	3189.9	10yr+2080	Proposed	2202	479.05	484.21		484.49	0.005407	5.82	539.81	173.08	0.52	-0.07
Main	3189.9	25yr	Existing	2446	479.05	484.54		484.82	0.004997	5.78	598.43	179.63	0.51	
Main	3189.9	25yr	Proposed	2387	479.05	484.46		484.74	0.005082	5.79	584.15	177.77	0.51	-0.08
Main	3189.9	25yr+2050	Existing	2854	479.05	485.12		485.4	0.004564	5.79	712.53	205.98	0.49	
Main	3189.9	25yr+2050	Proposed	2784	479.05	484.97		485.26	0.004876	5.91	681.75	201.43	0.5	-0.15
Main	3189.9	25yr+2080	Existing	3064	479.05	485.52		485.78	0.004526	5.94	805.78	253.09	0.49	
Main	3189.9	25yr+2080	Proposed	2990	479.05	485.39		485.66	0.004742	6.02	772.62	244.88	0.5	-0.13
Main	3189.9	50yr	Existing	2952	479.05	485.32		485.58	0.004275	5.69	756.27	237.01	0.47	
Main	3189.9	50yr	Proposed	2880	479.05	485.17		485.44	0.004483	5.76	722.68	209	0.48	-0.15
Main	3189.9	50yr+2050	Existing	3433	479.05	486.08		486.31	0.003596	5.5	951.36	269.51	0.44	
Main	3189.9	50yr+2050	Proposed	3351	479.05	485.97		486.2	0.003747	5.57	922.43	267.33	0.45	-0.11
Main	3189.9	50yr+2080	Existing	3719	479.05	486.44		486.66	0.003156	5.29	1051.39	277.4	0.41	
Main	3189.9	50yr+2080	Proposed	3632	479.05	486.33		486.55	0.003279	5.34	1021.01	274.59	0.42	-0.11
Main	3189.9	100yr	Existing	3526	479.05	486.2		486.42	0.003432	5.42	984.81	272.01	0.43	
Main	3189.9	100yr	Proposed	3442	479.05	486.09		486.32	0.003576	5.49	954.97	269.78	0.44	-0.11
Main	3189.9	100yr+2050	Existing	4037	479.05	486.82		487.03	0.002799	5.17	1168.7	337.85	0.39	
Main	3189.9	100yr+2050	Proposed	3943	479.05	486.71		486.92	0.002896	5.2	1132.54	330.03	0.4	-0.11
Main	3189.9	100yr+2080	Existing	4131	479.05	486.92		487.12	0.002724	5.15	1202.28	341.15	0.39	
Main	3189.9	100yr+2080	Proposed	4036	479.05	486.82		487.02	0.0028	5.17	1168.41	337.82	0.39	-0.1
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Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	3033.7	50yr+2050	Proposed	3351	480.98	485.73	481.83	485.81	0.001136	3.32	1568.86	416.1	0.28	-0.12
Main	3033.7	50yr+2080	Existing	3719	480.98	486.24	481.99	486.31	0.000932	3.23	1780.21	420.02	0.26	
Main	3033.7	50yr+2080	Proposed	3632	480.98	486.12	481.94	486.2	0.000972	3.24	1731.45	419.05	0.26	-0.12
Main	3033.7	100yr	Existing	3526	480.98	485.98	481.9	486.06	0.001023	3.26	1672.75	417.97	0.27	
Main	3033.7	100yr	Proposed	3442	480.98	485.86	481.85	485.94	0.001074	3.29	1623.45	417.08	0.27	-0.12
Main	3033.7	100yr+2050	Existing	4037	480.98	486.63	482.11	486.71	0.000827	3.2	1947.51	434.5	0.24	
Main	3033.7	100yr+2050	Proposed	3943	480.98	486.52	482.07	486.59	0.000855	3.2	1898.61	430.5	0.25	-0.11
Main	3033.7	100yr+2080	Existing	4131	480.98	486.74	482.16	486.81	0.000806	3.2	1992.99	437.92	0.24	
Main	3033.7	100yr+2080	Proposed	4036	480.98	486.63	482.11	486.7	0.000828	3.2	1947.14	434.47	0.24	-0.11
Main	2866.6	10yr	Existing	1878	476.4	482.84	480.69	482.99	0.002224	4.17	649.55	189.11	0.37	
Main	2866.6	10yr	Proposed	1833	476.4	482.77	480.64	482.92	0.002246	4.16	636.46	187.9	0.37	-0.07
Main	2866.6	10yr+2050	Existing	2176	476.4	483.29	480.89	483.44	0.002136	4.31	735.48	200.56	0.36	
Main	2866.6	10yr+2050	Proposed	2123	476.4	483.2	480.85	483.36	0.002159	4.29	718.83	198.13	0.36	-0.09
Main	2866.6	10yr+2080	Existing	2256	476.4	483.41	480.94	483.57	0.002099	4.33	760.42	203.73	0.36	
Main	2866.6	10yr+2080	Proposed	2202	476.4	483.32	480.91	483.48	0.00213	4.32	742.7	201.48	0.36	-0.09
Main	2866.6	25yr	Existing	2446	476.4	483.73	481.06	483.89	0.001967	4.37	826.54	212.27	0.35	
Main	2866.6	25yr	Proposed	2387	476.4	483.63	481.02	483.79	0.002013	4.36	806.12	210.37	0.36	-0.1
Main	2866.6	25yr+2050	Existing	2854	476.4	484.45	481.29	484.6	0.001609	4.34	985.47	225.61	0.33	
Main	2866.6	25yr+2050	Proposed	2784	476.4	484.27	481.25	484.43	0.001739	4.41	945.2	223.65	0.34	-0.18
Main	2866.6	25yr+2080	Existing	3064	476.4	484.95	481.4	485.09	0.001317	4.16	1099.72	229.06	0.3	
Main	2866.6	25yr+2080	Proposed	2990	476.4	484.78	481.36	484.93	0.001403	4.22	1061.17	228.08	0.31	-0.17
Main	2866.6	50yr	Existing	2952	476.4	484.7	481.34	484.84	0.001445	4.24	1041.71	227.58	0.31	
Main	2866.6	50yr	Proposed	2880	476.4	484.51	481.3	484.66	0.001571	4.32	999.31	226.28	0.32	-0.19
Main	2866.6	50yr+2050	Existing	3433	476.4	485.59	481.6	485.73	0.001113	4.1	1247.51	232.75	0.28	
Main	2866.6	50yr+2050	Proposed	3351	476.4	485.47	481.55	485.61	0.00114	4.09	1219.23	232.05	0.28	-0.12
Main	2866.6	50yr+2080	Existing	3719	476.4	485.99	481.74	486.13	0.001042	4.12	1341.6	235.24	0.27	
Main	2866.6	50yr+2080	Proposed	3632	476.4	485.87	481.69	486.01	0.001061	4.11	1313.5	234.43	0.28	-0.12
Main	2866.6	100yr	Existing	3526	476.4	485.73	481.64	485.87	0.001084	4.1	1279.72	233.54	0.28	
Main	2866.6	100yr	Proposed	3442	476.4	485.61	481.6	485.74	0.001109	4.1	1251.09	232.84	0.28	-0.12
Main	2866.6	100yr+2050	Existing	4037	476.4	486.39	481.88	486.53	0.000995	4.18	1436.11	237.91	0.27	
Main	2866.6	100yr+2050	Proposed	3943	476.4	486.28	481.84	486.42	0.001007	4.16	1408.89	237.14	0.27	-0.11
Main	2866.6	100yr+2080	Existing	4131	476.4	486.5	481.93	486.64	0.000988	4.2	1461.06	238.61	0.27	
Main	2866.6	100yr+2080	Proposed	4036	476.4	486.39	481.89	486.53	0.000995	4.18	1435.91	237.91	0.27	-0.11
Main	2736.7	107r	Existing	1878	475.97	482.39	480.82	482.66	0.0028	5.77	562.45	179.38	0.45	
Main	2736.7	10yr	Proposed	1833	475.97	482.32	480.79	482.59	0.002782	5.7	550.72	175.17	0.44	-0.07
Main	2736.7	10yr+2050	Existing	2176	475.97	482.87	481.03	483.13	0.002505	5.79	650.46	188.2	0.43	
Main	2736.7	10yr+2050	Proposed	2123	475.97	482.77	480.99	483.04	0.002572	5.8	633.17	186.59	0.43	-0.1
Main	2736.7	10yr+2080	Existing	2256	475.97	483	481.08	483.27	0.00241	5.77	676.24	190.31	0.42	
Main	2736.7	10yr+2080	Proposed	2202	475.97	482.91	481.05	483.17	0.002486	5.79	657.68	188.76	0.43	-0.09
Main	2736.7	25yr	Existing	2446	475.97	483.36	481.2	483.61	0.002153	5.67	744.91	196.07	0.4	
Main	2736.7	25yr	Proposed	2387	475.97	483.25	481.16	483.5	0.002224	5.7	723.89	194.33	0.41	-0.11
Main	2736.7	25yr+2050	Existing	2854	475.97	484.15	481.45	484.38	0.001715	5.49	905.24	209.79	0.37	
Main	2736.7	25yr+2050	Proposed	2784	475.97	483.95	481.41	484.19	0.001852	5.59	863.27	205.64	0.38	-0.2
Main	2736.7	25yr+2080	Existing	3064	475.97	484.7	481.58	484.91	0.001425	5.26	1023.91	220.62	0.34	
Main	2736.7	25yr+2080	Proposed	2990	475.97	484.52	481.54	484.73	0.001508	5.33	983.92	217.05	0.35	-0.18
Main	2736.7	50yr	Existing	2952	475.97	484.43	481.51	484.64	0.001553	5.36	963.78	215.33	0.35	
Main	2736.7	50yr	Proposed	2880	475.97	484.22	481.47	484.44	0.001676	5.46	919.52	211.24	0.36	-0.21
Main	2736.7	50yr+2050	Existing	3433	475.97	485.37	481.79	485.57	0.001245	5.21	1177.02	235.18	0.32	
Main	2736.7	50yr+2050	Proposed	3351	475.97	485.25	481.74	485.44	0.00127	5.21	1147.51	232.96	0.32	-0.12
Main	2736.7	50yr+2080	Existing	3719	475.97	485.79	481.9	485.98	0.001169	5.22	1276.11	241.52	0.31	
Main	2736.7	50yr+2080	Proposed	3632	475.97	485.66	481.84	485.86	0.001191	5.22	1246.38	239.85	0.32	-0.13
Main	2736.7	100yr	Existing	3526	475.97	485.52	481.79	485.71	0.001217	5.21	1210.82	237.7	0.32	
Main	2736.7	100yr	Proposed	3442	475.97	485.39	481.78	485.58	0.00124	5.21	1180.81	235.46	0.32	-0.13
Main	2736.7	100yr+2050	Existing	4037	475.97	486.2	482.08	486.39	0.001117	5.26	1375.94	247.36	0.31	
Main	2736.7	100yr+2050	Proposed	3943	475.97	486.08	482.03	486.27	0.001129	5.24	1347.2	245.45	0.31	-0.12
Main	2736.7	100yr+2080	Existing	4131	475.97	486.3	482.08	486.5	0.001112	5.29	1402.19	249.1	0.31	
Main	2736.7	100yr+2080	Proposed	4036	475.97	486.2	482.08	486.39	0.001117	5.26	1375.74	247.35	0.31	-0.1
Main	2583.8	10yr	Existing	1878	475.34	482.15	479.56	482.36	0.001223	4.28	657.23	194.31	0.3	
Main	2583.8	10yr	Proposed	1833	475.34	482.08	479.52	482.29	0.001228	4.25	644.08	192.86	0.3	-0.07
Main	2583.8	10yr+2050	Existing	2176	475.34	482.65	479.68	482.86	0.001136	4.34	756.79	203.03	0.3	
Main	2583.8	10yr+2050	Proposed	2123	475.34	482.55	479.68	482.76	0.001159	4.34	737.05	201.48	0.3	-0.1
Main	2583.8	10yr+2080	Existing	2256	475.34	482.79	480.43	483.01	0.001106	4.34	786.06	205.12	0.29	
Main	2583.8	10yr+2080	Proposed	2202	475.34	482.69	480.37	482.91	0.001132	4.35	764.82	203.66	0.29	-0.1
Main	2583.8	25yr	Existing	2446	475.34	483.17	480.6	483.37	0.001012	4.3	864.2	210.31	0.28	
Main	2583.8	25yr	Proposed	2387	475.34	483.05	480.54	483.26	0.001037	4.31	840.45	208.74	0.28	-0.12
Main	2583.8	25yr+2050	Existing	2854	475.34	484	480.88	484.18	0.000831	4.19	1042.97	219.78	0.26	
Main	2583.8	25yr+2050	Proposed	2784	475.34	483.78	480.85	483.98	0.000896	4.28	995.87	217.48	0.27	-0.22
Main	2583.8	25yr+2080	Existing	3064	475.34	484.57	481.03	484.74	0.000697	4.02	1171.78	225.81	0.24	
Main	2583.8	25yr+2080	Proposed	2990	475.34	484.38	480.98	484.56	0.000735	4.07	1128.99	223.85	0.25	-0.19
Main	2583.8	50yr	Existing	2952	475.34	484.29	480.95	484.46	0.000755	4.09	1107.24	222.83	0.25	
Main	2583.8	50yr	Proposed	2880	475.34	484.07	480.91	484.25	0.000812	4.17	1058.73	220.53	0.26	-0.22
Main	2583.8	50yr+2050	Existing	3433	475.34	485.26	481.26	485.42	0.000619	3.99	1329.15	232.64	0.23	
Main	2583.8	50yr+2050	Proposed	3351	475.34	485.13	481.22	485.29	0.000628	3.98	1299.51	231.37	0.23	-0.13
Main	2583.8	50yr+2080	Existing	3719	475.34	485.68	481.41	485.84	0.000597	4.03	1427.68	236.66	0.23	
Main	2583.8	50yr+2080	Proposed	3632	475.34	485.56	481.39	485.72	0.000603	4.02	1398.24	235.47	0.23	-0.12
Main	2583.8	100yr	Existing	3526	475.34	485.41	481.32	485.56	0.00061	4	1362.96	234.03	0.23	
Main	2583.8	100yr	Proposed	3442	475.34	485.28	481.27	485.44	0.000618	3.99	1332.98	232.8	0.23	-0.13
Main	2583.8	100yr+2050	Existing	4037	475.34	486.09	481.6	486.26	0.000585	4.1	1525.76	240.6	0.23	
Main	2583.8	100yr+2050	Proposed	3943	475.34	485.98	481.55	486.14	0.000588	4.08	1497.63	239.48	0.23	-0.11
Main	2583.8	100yr+2080	Existing	4131	475.34	486.2	481.63	486.36	0.000585	4.13	1551.26	241.61	0.23	
Main	2583.8	100yr+2080	Proposed	4036	475.34	486.09	481.6	486.25	0.000585	4.1	1525.56	240.59	0.23	-0.11
Main	2572.486		Bridge											

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	2441.3	10yr+2050	Existing	2176	475.05	482.43		482.61	0.001419	4.55	881.47	215.78	0.33	
Main	2441.3	10yr+2050	Proposed	2123	475.05	482.32		482.51	0.001452	4.55	859.52	214.89	0.33	-0.11
Main	2441.3	10yr+2080	Existing	2256	475.05	482.58		482.76	0.001368	4.55	915.35	217.14	0.32	
Main	2441.3	10yr+2080	Proposed	2202	475.05	482.48		482.66	0.0014	4.55	892.97	216.24	0.33	-0.1
Main	2441.3	25yr	Existing	2446	475.05	482.97		483.15	0.001245	4.52	1000.17	220.17	0.31	
Main	2441.3	25yr	Proposed	2387	475.05	482.85		483.03	0.001279	4.53	974.36	219.37	0.32	-0.12
Main	2441.3	25yr+2050	Existing	2854	475.05	483.83		483.99	0.001017	4.44	1191.32	226.05	0.29	
Main	2441.3	25yr+2050	Proposed	2784	475.05	483.6		483.77	0.001099	4.52	1140.57	224.5	0.3	-0.23
Main	2441.3	25yr+2080	Existing	3064	475.05	484.42		484.57	0.000854	4.28	1326.89	229.89	0.27	
Main	2441.3	25yr+2080	Proposed	2990	475.05	484.23		484.38	0.000899	4.32	1282.47	228.75	0.27	-0.19
Main	2441.3	50yr	Existing	2952	475.05	484.13		484.28	0.000924	4.34	1259.4	228.11	0.28	
Main	2441.3	50yr	Proposed	2880	475.05	483.9		484.07	0.000993	4.41	1208.47	226.57	0.29	-0.23
Main	2441.3	50yr+2050	Existing	3433	475.05	485.13		485.28	0.000759	4.27	1491.51	234.06	0.26	
Main	2441.3	50yr+2050	Proposed	3351	475.05	485		485.15	0.000768	4.26	1461.39	233.3	0.26	-0.13
Main	2441.3	50yr+2080	Existing	3719	475.05	485.55		485.7	0.000737	4.34	1590.93	236.55	0.25	
Main	2441.3	50yr+2080	Proposed	3632	475.05	485.43		485.58	0.000743	4.32	1561.33	235.81	0.25	-0.12
Main	2441.3	100yr	Existing	3526	475.05	485.28		485.43	0.000749	4.29	1525.8	234.92	0.25	
Main	2441.3	100yr	Proposed	3442	475.05	485.15		485.3	0.000757	4.27	1495.43	234.16	0.26	-0.13
Main	2441.3	100yr+2050	Existing	4037	475.05	485.96		486.12	0.000727	4.45	1688.69	238.86	0.25	
Main	2441.3	100yr+2050	Proposed	3943	475.05	485.85		486	0.000729	4.41	1660.75	238.28	0.25	-0.11
Main	2441.3	100yr+2080	Existing	4131	475.05	486.07		486.23	0.000729	4.48	1713.82	239.41	0.25	
Main	2441.3	100yr+2080	Proposed	4036	475.05	485.96		486.12	0.000727	4.44	1688.49	238.86	0.25	-0.11
Main	2213.1	10yr	Existing	1878	473.01	481.03	478.76	481.6	0.002701	7.18	446.93	100.9	0.47	
Main	2213.1	10yr	Proposed	1833	473.01	480.97	478.7	481.53	0.002657	7.08	441.25	100.48	0.47	-0.06
Main	2213.1	10yr+2050	Existing	2176	473.01	481.48	479.1	482.12	0.002842	7.67	493.34	104.96	0.49	
Main	2213.1	10yr+2050	Proposed	2123	473.01	481.39	479.03	482.01	0.002833	7.59	483.46	103.59	0.48	-0.09
Main	2213.1	10yr+2080	Existing	2256	473.01	481.63	479.21	482.28	0.002846	7.77	509.08	107.2	0.49	
Main	2213.1	10yr+2080	Proposed	2202	473.01	481.53	479.13	482.17	0.00284	7.7	498.76	105.76	0.49	-0.1
Main	2213.1	25yr	Existing	2446	473.01	482.03	479.53	482.69	0.002734	7.87	553.92	117.16	0.48	
Main	2213.1	25yr	Proposed	2387	473.01	481.9	479.38	482.57	0.002793	7.87	538.93	111.16	0.49	-0.13
Main	2213.1	25yr+2050	Existing	2854	473.01	483.02	479.99	483.62	0.002249	7.7	686.5	155.67	0.45	
Main	2213.1	25yr+2050	Proposed	2784	473.01	482.72	479.91	483.36	0.002488	7.92	641.65	144.64	0.47	-0.3
Main	2213.1	25yr+2080	Existing	3064	473.01	483.76	480.22	484.26	0.0018	7.25	809.13	238.48	0.4	
Main	2213.1	25yr+2080	Proposed	2990	473.01	483.53	480.14	484.06	0.001918	7.37	767.52	164.86	0.42	-0.23
Main	2213.1	50yr	Existing	2952	473.01	483.4	480.1	483.95	0.001986	7.43	747.43	162.47	0.42	
Main	2213.1	50yr	Proposed	2880	473.01	483.12	480.02	483.7	0.002181	7.63	701.7	157.36	0.44	-0.28
Main	2213.1	50yr+2050	Existing	3433	473.01	484.6	480.53	485.02	0.001453	6.87	1069.64	458.43	0.37	
Main	2213.1	50yr+2050	Proposed	3351	473.01	484.44	480.45	484.88	0.001518	6.96	1015.6	425.58	0.38	-0.16
Main	2213.1	50yr+2080	Existing	3719	473.01	485.1	480.96	485.47	0.001262	6.6	1249.17	516.99	0.35	
Main	2213.1	50yr+2080	Proposed	3632	473.01	484.96	480.87	485.33	0.001315	6.68	1195.67	497.79	0.35	-0.14
Main	2213.1	100yr	Existing	3526	473.01	484.78	480.77	485.17	0.001379	6.77	1131.96	477.68	0.36	
Main	2213.1	100yr	Proposed	3442	473.01	484.62	480.57	485.04	0.001443	6.86	1076.99	460.84	0.37	-0.16
Main	2213.1	100yr+2050	Existing	4037	473.01	485.58	481.24	485.9	0.001125	6.41	1422.26	556.01	0.33	
Main	2213.1	100yr+2050	Proposed	3943	473.01	485.44	481.15	485.78	0.001159	6.45	1373.31	532.61	0.33	-0.14
Main	2213.1	100yr+2080	Existing	4131	473.01	485.69	481.33	486.01	0.001101	6.38	1466.05	567.95	0.33	
Main	2213.1	100yr+2080	Proposed	4036	473.01	485.58	481.24	485.9	0.001125	6.41	1421.95	555.94	0.33	-0.11
Main	1956.9	10yr	Existing	1878	472	480.85	476.04	481.08	0.000832	3.9	508.63	95.58	0.25	
Main	1956.9	10yr	Proposed	1833	472	480.79	475.98	481.02	0.000814	3.84	503.62	94.57	0.25	-0.06
Main	1956.9	10yr+2050	Existing	2176	472	481.29	476.44	481.56	0.000898	4.21	552.17	105.05	0.27	
Main	1956.9	10yr+2050	Proposed	2123	472	481.19	476.37	481.45	0.000896	4.17	542.58	102.93	0.27	-0.1
Main	1956.9	10yr+2080	Existing	2256	472	481.44	476.54	481.71	0.000897	4.26	567.36	108.24	0.27	
Main	1956.9	10yr+2080	Proposed	2202	472	481.34	476.47	481.61	0.000896	4.23	557.47	106.16	0.27	-0.1
Main	1956.9	25yr	Existing	2446	472	481.86	476.78	482.14	0.000868	4.34	609.39	131.06	0.27	
Main	1956.9	25yr	Proposed	2387	472	481.73	476.71	482	0.000879	4.32	595.84	126.56	0.27	-0.13
Main	1956.9	25yr+2050	Existing	2854	472	482.86	477.25	483.15	0.000765	4.4	713.57	200.23	0.25	
Main	1956.9	25yr+2050	Proposed	2784	472	482.56	477.17	482.85	0.000829	4.47	681.05	178.32	0.26	-0.3
Main	1956.9	25yr+2080	Existing	3064	472	483.65	477.48	483.88	0.000599	4.1	949.75	225.96	0.23	
Main	1956.9	25yr+2080	Proposed	2990	472	483.41	477.41	483.65	0.000638	4.17	896.15	218.7	0.23	-0.24
Main	1956.9	50yr	Existing	2952	472	483.28	477.36	483.53	0.000658	4.2	868.83	210.56	0.24	
Main	1956.9	50yr	Proposed	2880	472	482.98	477.28	483.25	0.000722	4.31	806.69	202.84	0.25	-0.3
Main	1956.9	50yr+2050	Existing	3433	472	484.5	477.88	484.71	0.000515	4.02	1156.74	264.85	0.21	
Main	1956.9	50yr+2050	Proposed	3351	472	484.34	477.8	484.56	0.000525	4.01	1116.62	256.03	0.22	-0.16
Main	1956.9	50yr+2080	Existing	3719	472	484.99	478.17	485.2	0.000491	4.04	1295.72	300.7	0.21	
Main	1956.9	50yr+2080	Proposed	3632	472	484.84	478.08	485.06	0.000499	4.03	1252.22	291.2	0.21	-0.15
Main	1956.9	100yr	Existing	3526	472	484.67	477.98	484.88	0.000503	4.01	1203.61	272.15	0.21	
Main	1956.9	100yr	Proposed	3442	472	484.52	477.88	484.73	0.000513	4.01	1162.3	265.44	0.21	-0.15
Main	1956.9	100yr+2050	Existing	4037	472	485.46	478.47	485.67	0.000473	4.07	1441.99	329.28	0.21	
Main	1956.9	100yr+2050	Proposed	3943	472	485.33	478.4	485.54	0.000476	4.05	1399.79	317.59	0.21	-0.13
Main	1956.9	100yr+2080	Existing	4131	472	485.57	478.57	485.79	0.000471	4.09	1480.38	335.58	0.21	
Main	1956.9	100yr+2080	Proposed	4036	472	485.46	478.47	485.67	0.000473	4.07	1441.72	329.24	0.21	-0.11
Main	1837.505		Bridge											
Main	1707.8	10yr	Existing	1878	472	478.26	475.84	478.88	0.0028	6.34	301.97	69.13	0.46	
Main	1707.8	10yr	Proposed	1833	472	478.16	475.78	478.77	0.002816	6.29	296.85	68.74	0.46	-0.1
Main	1707.8	10yr+2050	Existing	2176	472	478.88	476.21	479.56	0.002698	6.65	335.38	71.99	0.46	
Main	1707.8	10yr+2050	Proposed	2123	472	478.76	476.14	479.44	0.002721	6.6	329.31	71.46	0.46	-0.12
Main	1707.8	10yr+2080	Existing	2256	472	479.05	476.3	479.74	0.002663	6.72	344.49	72.79	0.46	
Main	1707.8	10yr+2080	Proposed	2202	472	478.93	476.24	479.62	0.002688	6.67	338.31	72.25	0.46	-0.12
Main	1707.8	25yr	Existing	2446	472	479.45	476.53	480.18	0.002574	6.86	366.35	74.71	0.45	
Main	1707.8	25yr	Proposed	2387	472	479.32	476.47	480.04	0.002603	6.82	359.51	74.11	0.45	-0.13
Main	1707.8	25yr+2050	Existing	2854	472	480.37	476.99	481.15	0.00233	7.08	416.2	79.91	0.44	
Main	1707.8	25yr+2050	Proposed	2784	472	480.21	476.91	480.97	0.002378	7.05	407.23	78.87	0.44	-0.16
Main	1707.8	25yr+2080	Existing	3064	472	480.88	477.22	481.66	0.002192	7.15	443.34	83.12	0.43	
Main	1707.8	25yr+2080	Proposed	2990	472	480.71	477.15	481.49	0.00223	7.12	434.37	82.02	0.43	-

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	1623.9	50yr+2050	Existing	3433	468.23	478.07	478.07	481.32	0.012562	14.56	243.17	39.47	0.94	
Main	1623.9	50yr+2050	Proposed	3351	468.23	477.88	477.88	481.16	0.013067	14.6	236.02	38.81	0.96	-0.19
Main	1623.9	50yr+2080	Existing	3719	468.23	478.49	478.49	481.85	0.012117	14.83	260.15	41.24	0.93	
Main	1623.9	50yr+2080	Proposed	3632	468.23	478.37	478.37	481.69	0.012209	14.74	255.23	40.75	0.94	-0.12
Main	1623.9	100yr	Existing	3526	468.23	478.21	478.21	481.49	0.012372	14.63	248.94	40.09	0.94	
Main	1623.9	100yr	Proposed	3442	468.23	478.06	478.06	481.33	0.012644	14.6	243.07	39.46	0.95	-0.15
Main	1623.9	100yr+2050	Existing	4037	468.23	478.9	478.9	482.41	0.011869	15.2	277.63	42.97	0.93	
Main	1623.9	100yr+2050	Proposed	3943	468.23	478.79	478.79	482.25	0.011916	15.08	272.64	42.48	0.93	-0.11
Main	1623.9	100yr+2080	Existing	4131	468.23	479.04	479.04	482.57	0.011738	15.27	283.35	43.52	0.93	
Main	1623.9	100yr+2080	Proposed	4036	468.23	478.9	478.9	482.41	0.0119	15.21	277.32	42.94	0.93	-0.14
Main	1555	10yr	Existing	1878	468.05	476.9	474.25	477.76	0.003743	7.44	254.81	42.23	0.51	
Main	1555	10yr	Proposed	1833	468.05	476.85	474.17	477.68	0.003657	7.32	252.67	42.06	0.5	-0.05
Main	1555	10yr+2050	Existing	2176	468.05	477.17	474.77	478.23	0.004413	8.29	266.07	43.14	0.55	
Main	1555	10yr+2050	Proposed	2123	468.05	477.12	474.68	478.15	0.004307	8.15	263.86	42.97	0.55	-0.05
Main	1555	10yr+2080	Existing	2256	468.05	477.23	474.89	478.36	0.004591	8.51	269.03	43.38	0.57	
Main	1555	10yr+2080	Proposed	2202	468.05	477.19	474.82	478.27	0.004476	8.37	266.93	43.21	0.56	-0.04
Main	1555	25yr	Existing	2446	468.05	477.37	475.22	478.64	0.005053	9.05	275.08	43.86	0.6	
Main	1555	25yr	Proposed	2387	468.05	477.33	475.11	478.56	0.004906	8.88	273.28	43.72	0.59	-0.04
Main	1555	25yr+2050	Existing	2854	468.05	477.62	475.83	479.23	0.006132	10.2	286.11	44.72	0.66	
Main	1555	25yr+2050	Proposed	2784	468.05	477.59	475.74	479.14	0.005925	9.99	284.6	44.6	0.65	-0.03
Main	1555	25yr+2080	Existing	3064	468.05	477.71	476.1	479.52	0.006792	10.82	290.04	45.02	0.7	
Main	1555	25yr+2080	Proposed	2990	468.05	477.68	475.82	479.42	0.006547	10.59	288.84	44.93	0.68	-0.03
Main	1555	50yr	Existing	2952	468.05	477.64	475.96	479.35	0.006521	10.53	286.69	44.77	0.68	
Main	1555	50yr	Proposed	2880	468.05	477.62	475.87	479.26	0.006254	10.29	285.95	44.71	0.67	-0.02
Main	1555	50yr+2050	Existing	3433	468.05	477.86	476.6	480.04	0.007979	11.88	296.79	45.54	0.76	
Main	1555	50yr+2050	Proposed	3351	468.05	477.82	476.49	479.92	0.007733	11.65	295.04	45.4	0.74	-0.04
Main	1555	50yr+2080	Existing	3719	468.05	477.95	478.97	480.45	0.00898	12.71	301.14	45.87	0.8	
Main	1555	50yr+2080	Proposed	3632	468.05	477.92	478.85	480.33	0.008687	12.46	299.65	45.75	0.79	-0.03
Main	1555	100yr	Existing	3526	468.05	477.9	476.72	480.18	0.008262	12.13	298.71	45.68	0.77	
Main	1555	100yr	Proposed	3442	468.05	477.88	476.61	480.06	0.00795	11.88	297.7	45.61	0.76	-0.02
Main	1555	100yr+2050	Existing	4037	468.05	478	477.36	480.91	0.01037	13.71	303.27	46.03	0.87	
Main	1555	100yr+2050	Proposed	3943	468.05	477.98	477.23	480.77	0.009967	13.42	302.47	45.97	0.85	-0.02
Main	1555	100yr+2080	Existing	4131	468.05	478.02	477.46	481.05	0.010782	14	304.02	46.08	0.88	
Main	1555	100yr+2080	Proposed	4036	468.05	478	477.36	480.91	0.010357	13.7	303.35	46.03	0.86	-0.02
Main	1451.8	10yr	Existing	1878	468.05	476.93	473.47	477.39	0.001703	5.48	372.24	68.65	0.36	
Main	1451.8	10yr	Proposed	1833	468.05	476.88	473.41	477.32	0.001667	5.39	368.46	68.35	0.36	-0.05
Main	1451.8	10yr+2050	Existing	2176	468.05	477.23	473.9	477.79	0.001982	6.07	392.66	70.29	0.39	
Main	1451.8	10yr+2050	Proposed	2123	468.05	477.17	473.82	477.71	0.00194	5.98	388.63	69.97	0.39	-0.06
Main	1451.8	10yr+2080	Existing	2256	468.05	477.31	474	477.89	0.002054	6.23	398.15	70.72	0.4	
Main	1451.8	10yr+2080	Proposed	2202	468.05	477.25	473.92	477.82	0.002008	6.13	394.27	70.41	0.4	-0.06
Main	1451.8	25yr	Existing	2446	468.05	477.47	474.24	478.13	0.002237	6.59	409.73	71.62	0.42	
Main	1451.8	25yr	Proposed	2387	468.05	477.42	474.16	478.06	0.002179	6.48	406.24	71.35	0.42	-0.05
Main	1451.8	25yr+2050	Existing	2854	468.05	477.78	474.74	478.6	0.002644	7.36	432.29	73.36	0.46	
Main	1451.8	25yr+2050	Proposed	2784	468.05	477.73	474.65	478.52	0.002568	7.23	428.97	73.1	0.45	-0.05
Main	1451.8	25yr+2080	Existing	3064	468.05	477.91	474.98	478.81	0.002883	7.77	441.53	74.09	0.48	
Main	1451.8	25yr+2080	Proposed	2990	468.05	477.86	474.89	478.74	0.002795	7.62	438.54	73.86	0.48	-0.05
Main	1451.8	50yr	Existing	2952	468.05	477.81	474.86	478.68	0.002793	7.58	434.41	73.53	0.47	
Main	1451.8	50yr	Proposed	2880	468.05	477.78	474.75	478.61	0.002692	7.43	432.3	73.36	0.47	-0.03
Main	1451.8	50yr+2050	Existing	3433	468.05	478.13	475.39	479.2	0.003276	8.44	458.69	75.43	0.52	
Main	1451.8	50yr+2050	Proposed	3351	468.05	478.08	475.3	479.11	0.0032	8.3	454.32	75.09	0.51	-0.05
Main	1451.8	50yr+2080	Existing	3719	468.05	478.31	475.71	479.51	0.003561	8.92	472.35	76.35	0.54	
Main	1451.8	50yr+2080	Proposed	3632	468.05	478.26	475.62	479.41	0.003482	8.78	467.89	76.06	0.53	-0.05
Main	1451.8	100yr	Existing	3526	468.05	478.21	475.5	479.31	0.003352	8.58	464.09	75.8	0.52	
Main	1451.8	100yr	Proposed	3442	468.05	478.16	475.41	479.23	0.003261	8.43	460.4	75.55	0.52	-0.05
Main	1451.8	100yr+2050	Existing	4037	468.05	478.47	476.05	479.82	0.00393	9.49	484.39	77.16	0.57	
Main	1451.8	100yr+2050	Proposed	3943	468.05	478.42	475.96	479.72	0.003832	9.33	480.34	76.89	0.56	-0.05
Main	1451.8	100yr+2080	Existing	4131	468.05	478.53	476.14	479.92	0.004024	9.64	488.58	77.44	0.58	
Main	1451.8	100yr+2080	Proposed	4036	468.05	478.47	476.05	479.82	0.003926	9.49	484.48	77.16	0.57	-0.06
Main	1353.7	10yr	Existing	1878	466.4	476.85	472.99	477.14	0.001664	5.17	641.94	185.73	0.29	
Main	1353.7	10yr	Proposed	1833	466.4	476.8	472.88	477.08	0.001642	5.12	631.37	184.23	0.29	-0.05
Main	1353.7	10yr+2050	Existing	2176	466.4	477.16	473.75	477.48	0.001858	5.58	699.76	195.39	0.31	
Main	1353.7	10yr+2050	Proposed	2123	466.4	477.1	473.65	477.42	0.001833	5.52	688.02	193.08	0.31	-0.06
Main	1353.7	10yr+2080	Existing	2256	466.4	477.24	473.91	477.57	0.001903	5.68	715.86	198.38	0.31	
Main	1353.7	10yr+2080	Proposed	2202	466.4	477.18	473.8	477.51	0.001876	5.62	704.4	196.3	0.31	-0.06
Main	1353.7	25yr	Existing	2446	466.4	477.41	474.38	477.77	0.00202	5.92	750.54	204.21	0.33	
Main	1353.7	25yr	Proposed	2387	466.4	477.36	474.14	477.71	0.001984	5.84	739.96	202.63	0.32	-0.05
Main	1353.7	25yr+2050	Existing	2854	466.4	477.75	474.38	478.15	0.002243	6.37	821.36	212.46	0.34	
Main	1353.7	25yr+2050	Proposed	2784	466.4	477.7	474.38	478.09	0.002201	6.29	810.69	211.6	0.34	-0.05
Main	1353.7	25yr+2080	Existing	3064	466.4	477.89	474.38	478.31	0.002372	6.61	851.77	214.71	0.36	
Main	1353.7	25yr+2080	Proposed	2990	466.4	477.85	474.38	478.26	0.002322	6.52	841.9	213.98	0.35	-0.04
Main	1353.7	50yr	Existing	2952	466.4	477.78	474.38	478.2	0.002354	6.54	828.18	212.97	0.35	
Main	1353.7	50yr	Proposed	2880	466.4	477.75	474.38	478.15	0.002284	6.43	821.44	212.46	0.35	-0.03
Main	1353.7	50yr+2050	Existing	3433	466.4	478.16	475.49	478.61	0.002542	6.96	909.68	218.95	0.37	
Main	1353.7	50yr+2050	Proposed	3351	466.4	478.09	475.49	478.54	0.002521	6.9	894.75	217.86	0.37	-0.07
Main	1353.7	50yr+2080	Existing	3719	466.4	478.38	475.7	478.85	0.00263	7.17	957.36	221.81	0.38	
Main	1353.7	50yr+2080	Proposed	3632	466.4	478.31	475.7	478.77	0.002613	7.12	941.72	220.91	0.38	-0.07
Main	1353.7	100yr	Existing	3526	466.4	478.25	475.62	478.7	0.002552	7.01	928.23	220.14	0.37	
Main	1353.7	100yr	Proposed	3442	466.4	478.19	475.49	478.64	0.002517	6.93	915.43	219.37	0.37	-0.05
Main	1353.7	100yr+2050	Existing	4037	466.4	478.57	476.49	479.07	0.002771	7.44	1001.23	224.36	0.39	
Main	1353.7	100yr+2050	Proposed	3943	466.4	478.51	476.16	479	0.002744	7.38	986.48	223.49	0.39	-0.06
Main	1353.7	100yr+2080	Existing	4131	466.4	478.64	476.55	479.15	0.002793	7.5	1016.57	225.26	0.39	
Main	1353.7	100yr+2080	Proposed	4036	466.4	478.58	476.49	479.07	0.002768	7.44	1001.53	224.38	0.39	-0.06
Main	1322													

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	1102.5	10yr	Proposed	1833	467.77	473.98		474.21	0.00257	5.44	639.96	168.65	0.42	-0.07
Main	1102.5	10yr+2050	Existing	2176	467.77	474.47		474.71	0.002529	5.73	722.18	172.38	0.42	
Main	1102.5	10yr+2050	Proposed	2123	467.77	474.39		474.63	0.002536	5.69	709.75	171.92	0.42	-0.08
Main	1102.5	10yr+2080	Existing	2256	467.77	474.57		474.82	0.002517	5.79	740.86	173.06	0.43	
Main	1102.5	10yr+2080	Proposed	2202	467.77	474.5		474.75	0.002525	5.75	728.3	172.6	0.42	-0.07
Main	1102.5	25yr	Existing	2446	467.77	474.83		475.08	0.00249	5.92	784.61	174.65	0.43	
Main	1102.5	25yr	Proposed	2387	467.77	474.75		475	0.002499	5.88	771.11	174.16	0.43	-0.08
Main	1102.5	25yr+2050	Existing	2854	467.77	475.35		475.63	0.002432	6.19	876.6	178.3	0.43	
Main	1102.5	25yr+2050	Proposed	2784	467.77	475.26		475.53	0.002442	6.15	860.96	177.39	0.43	-0.09
Main	1102.5	25yr+2080	Existing	3064	467.77	475.61		475.9	0.002402	6.31	923.42	180.99	0.43	
Main	1102.5	25yr+2080	Proposed	2990	467.77	475.52		475.8	0.002412	6.27	906.97	180.05	0.43	-0.09
Main	1102.5	50yr	Existing	2952	467.77	475.47		475.75	0.002418	6.25	898.45	179.56	0.43	
Main	1102.5	50yr	Proposed	2880	467.77	475.38		475.66	0.002428	6.2	882.38	178.63	0.43	-0.09
Main	1102.5	50yr+2050	Existing	3433	467.77	476.06		476.37	0.002345	6.51	1007.41	187.43	0.43	
Main	1102.5	50yr+2050	Proposed	3351	467.77	475.97		476.27	0.002354	6.47	989.01	185.29	0.43	-0.09
Main	1102.5	50yr+2080	Existing	3719	467.77	476.41		476.73	0.002299	6.65	1073.77	193.5	0.43	
Main	1102.5	50yr+2080	Proposed	3632	467.77	476.31		476.62	0.002312	6.61	1054.05	192.55	0.43	-0.1
Main	1102.5	100yr	Existing	3526	467.77	476.18		476.49	0.002329	6.56	1029.26	190.11	0.43	
Main	1102.5	100yr	Proposed	3442	467.77	476.08		476.38	0.002342	6.52	1009.73	187.71	0.43	-0.1
Main	1102.5	100yr+2050	Existing	4037	467.77	476.78		477.11	0.002249	6.79	1146.08	196.66	0.42	
Main	1102.5	100yr+2050	Proposed	3943	467.77	476.67		477	0.002265	6.75	1124.62	195.78	0.42	-0.11
Main	1102.5	100yr+2080	Existing	4131	467.77	476.89		477.22	0.002236	6.83	1166.81	197.5	0.42	
Main	1102.5	100yr+2080	Proposed	4036	467.77	476.78		477.11	0.002249	6.79	1145.8	196.65	0.42	-0.11
Main	962.9	10yr	Existing	1878	466.72	473.75		473.93	0.002228	4.94	698.02	170.67	0.39	
Main	962.9	10yr	Proposed	1833	466.72	473.68		473.86	0.002229	4.9	686.78	170.11	0.39	-0.07
Main	962.9	10yr+2050	Existing	2176	466.72	474.17		474.36	0.002211	5.19	770.42	173.29	0.39	
Main	962.9	10yr+2050	Proposed	2123	466.72	474.1		474.29	0.002215	5.15	757.77	172.91	0.39	-0.07
Main	962.9	10yr+2080	Existing	2256	466.72	474.28		474.48	0.002205	5.25	789.41	173.88	0.39	
Main	962.9	10yr+2080	Proposed	2202	466.72	474.21		474.4	0.002209	5.21	776.64	173.48	0.39	-0.07
Main	962.9	25yr	Existing	2446	466.72	474.54		474.74	0.002189	5.39	833.89	175.23	0.39	
Main	962.9	25yr	Proposed	2387	466.72	474.46		474.66	0.002194	5.35	820.16	174.81	0.39	-0.08
Main	962.9	25yr+2050	Existing	2854	466.72	475.06		475.29	0.002151	5.66	927.3	178.2	0.39	
Main	962.9	25yr+2050	Proposed	2784	466.72	474.98		475.2	0.002158	5.61	911.43	177.59	0.39	-0.08
Main	962.9	25yr+2080	Existing	3064	466.72	475.33		475.56	0.002129	5.78	974.67	180.03	0.39	
Main	962.9	25yr+2080	Proposed	2990	466.72	475.24		475.47	0.002136	5.74	958.07	179.37	0.39	-0.09
Main	962.9	50yr	Existing	2952	466.72	475.19		475.42	0.002141	5.72	949.44	179.04	0.39	
Main	962.9	50yr	Proposed	2880	466.72	475.1		475.32	0.002148	5.67	933.16	178.42	0.39	-0.09
Main	962.9	50yr+2050	Existing	3433	466.72	475.79		476.04	0.002084	5.98	1059.27	183.96	0.39	
Main	962.9	50yr+2050	Proposed	3351	466.72	475.69		475.94	0.002092	5.94	1040.85	183.12	0.39	-0.1
Main	962.9	50yr+2080	Existing	3719	466.72	476.15		476.41	0.002046	6.12	1124.84	186.95	0.39	
Main	962.9	50yr+2080	Proposed	3632	466.72	476.04		476.3	0.002054	6.08	1105.54	186.08	0.39	-0.11
Main	962.9	100yr	Existing	3526	466.72	475.91		476.17	0.002069	6.03	1081.07	184.96	0.39	
Main	962.9	100yr	Proposed	3442	466.72	475.81		476.06	0.002081	5.99	1061.61	184.07	0.39	-0.1
Main	962.9	100yr+2050	Existing	4037	466.72	476.52		476.8	0.002009	6.27	1195.73	190.35	0.39	
Main	962.9	100yr+2050	Proposed	3943	466.72	476.41		476.68	0.002021	6.23	1174.67	189.05	0.39	-0.11
Main	962.9	100yr+2080	Existing	4131	466.72	476.63		476.91	0.002002	6.31	1216.05	191.83	0.39	
Main	962.9	100yr+2080	Proposed	4036	466.72	476.52		476.79	0.00201	6.27	1195.45	190.33	0.39	-0.11
Main	633.9	10yr	Existing	1878	466.21	472.64		472.95	0.004	6.96	650.28	169.3	0.5	
Main	633.9	10yr	Proposed	1833	466.21	472.58		472.88	0.004014	6.92	638.75	168.86	0.5	-0.06
Main	633.9	10yr+2050	Existing	2176	466.21	473.08		473.4	0.003905	7.2	725.05	171.75	0.5	
Main	633.9	10yr+2050	Proposed	2123	466.21	473.01		473.33	0.003921	7.16	711.97	171.34	0.5	-0.07
Main	633.9	10yr+2080	Existing	2256	466.21	473.2		473.52	0.003879	7.26	744.77	172.37	0.5	
Main	633.9	10yr+2080	Proposed	2202	466.21	473.12		473.44	0.003896	7.22	731.53	171.95	0.5	-0.08
Main	633.9	25yr	Existing	2446	466.21	473.46		473.8	0.00382	7.4	790.95	173.8	0.49	
Main	633.9	25yr	Proposed	2387	466.21	473.38		473.71	0.003839	7.36	776.67	173.36	0.49	-0.08
Main	633.9	25yr+2050	Existing	2854	466.21	474.02		474.37	0.00369	7.66	888.51	176.79	0.49	
Main	633.9	25yr+2050	Proposed	2784	466.21	473.93		474.27	0.003713	7.61	871.87	176.29	0.49	-0.09
Main	633.9	25yr+2080	Existing	3064	466.21	474.3		474.65	0.003622	7.77	938.13	178.29	0.49	
Main	633.9	25yr+2080	Proposed	2990	466.21	474.2		474.55	0.003645	7.73	920.78	177.77	0.49	-0.1
Main	633.9	50yr	Existing	2952	466.21	474.15		474.5	0.003659	7.71	911.69	177.5	0.49	
Main	633.9	50yr	Proposed	2880	466.21	474.06		474.4	0.003683	7.67	894.62	176.98	0.49	-0.09
Main	633.9	50yr+2050	Existing	3433	466.21	474.79		475.16	0.003518	7.98	1026.34	182.38	0.49	
Main	633.9	50yr+2050	Proposed	3351	466.21	474.68		475.05	0.003536	7.93	1007.34	181.51	0.49	-0.11
Main	633.9	50yr+2080	Existing	3719	466.21	475.16		475.54	0.00343	8.11	1095.24	185.52	0.49	
Main	633.9	50yr+2080	Proposed	3632	466.21	475.06		475.43	0.003447	8.06	1075.35	184.62	0.49	-0.1
Main	633.9	100yr	Existing	3526	466.21	474.92		475.29	0.003482	8.02	1049.53	183.44	0.49	
Main	633.9	100yr	Proposed	3442	466.21	474.8		475.17	0.003511	7.98	1028.99	182.5	0.49	-0.12
Main	633.9	100yr+2050	Existing	4037	466.21	475.54		475.94	0.003423	8.34	1166.6	191	0.49	
Main	633.9	100yr+2050	Proposed	3943	466.21	475.43		475.82	0.003426	8.27	1145.26	189.26	0.49	-0.11
Main	633.9	100yr+2080	Existing	4131	466.21	475.65		476.05	0.003417	8.4	1187.31	192.29	0.49	
Main	633.9	100yr+2080	Proposed	4036	466.21	475.54		475.93	0.003424	8.34	1166.29	190.97	0.49	-0.11
Main	337.2	10yr	Existing	1878	466.04	472	469.18	472.14	0.001658	3.97	807.96	185.73	0.31	
Main	337.2	10yr	Proposed	1833	466.04	471.93	469.16	472.07	0.00166	3.93	795.21	185.34	0.31	-0.07
Main	337.2	10yr+2050	Existing	2176	466.04	472.44	469.4	472.61	0.001642	4.18	890.44	188.47	0.31	
Main	337.2	10yr+2050	Proposed	2123	466.04	472.37	469.37	472.53	0.001645	4.14	876.05	187.89	0.31	-0.07
Main	337.2	10yr+2080	Existing	2256	466.04	472.56	469.45	472.73	0.001637	4.23	912.18	189.35	0.31	
Main	337.2	10yr+2080	Proposed	2202	466.04	472.48	469.42	472.65	0.00164	4.2	897.62	188.76	0.31	-0.08
Main	337.2	25yr	Existing	2446	466.04	472.84	469.58	473.01	0.001624	4.35	962.95	191.4	0.31	
Main	337.2	25yr	Proposed	2387	466.04	472.75	469.54	472.92	0.001628	4.31	947.26	190.77	0.31	-0.09
Main	337.2	25yr+2050	Existing	2854	466.04	473.41	469.83	473.6	0.001589	4.58	1070.02	195.7	0.32	
Main	337.2	25yr+2050	Proposed	2784	466.04	473.31	469.79	473.5	0.001596	4.54	1051.76	194.97	0.32	-0.1
Main	337.2	25yr+2080	Existing	3064	466.04	473.7	469.94	473.9	0.001568	4.68	1124.34	198.26	0.32	
Main	337.2	25yr+2080	Proposed	2990	466.04	473.6	469.92	473.8	0.001575	4.64	1105.4	197.37	0.32	-0.1
Main	337.2	50yr	Existing	2952	466.04	473.55	469.89	473.74	0.001579	4.62	1095.4	196.9	0.32	
Main	337.2	50yr	Proposed	2880	466.04	473.45	469.85	473.64	0.001587	4.59	1076.7	196.02	0.32	-0.1
Main	33													

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Difference (ft)
Main	179.1 50yr	Proposed		2880	465.8	470.34	470.34	471.84	0.016689	10.56	368.2	186.9	0.94	-0.05
Main	179.1 50yr+2050	Existing		3433	465.8	470.72	470.72	472.39	0.016664	11.24	416.77	190.54	0.96	
Main	179.1 50yr+2050	Proposed		3351	465.8	470.67	470.67	472.31	0.01661	11.13	410.29	190.03	0.95	-0.05
Main	179.1 50yr+2080	Existing		3719	465.8	470.91	470.91	472.67	0.0167	11.57	440.15	192.37	0.96	
Main	179.1 50yr+2080	Proposed		3632	465.8	470.86	470.86	472.59	0.016606	11.45	433.87	191.88	0.96	-0.05
Main	179.1 100yr	Existing		3526	465.8	470.79	470.79	472.48	0.016622	11.34	424.94	191.18	0.96	
Main	179.1 100yr	Proposed		3442	465.8	470.73	470.73	472.4	0.016629	11.24	417.84	190.62	0.96	-0.06
Main	179.1 100yr+2050	Existing		4037	465.8	471.11	471.11	472.96	0.016644	11.9	466.12	194.26	0.97	
Main	179.1 100yr+2050	Proposed		3943	465.8	471.06	471.06	472.88	0.016558	11.79	459.49	193.78	0.96	-0.05
Main	179.1 100yr+2080	Existing		4131	465.8	471.17	471.17	473.05	0.016624	12	473.67	194.79	0.97	
Main	179.1 100yr+2080	Proposed		4036	465.8	471.11	471.11	472.96	0.016673	11.91	465.76	194.23	0.97	-0.06
Main	85.6 10yr	Existing		1878	463.48	469.17	468.43	469.7	0.003798	6.56	530.56	316.49	0.52	
Main	85.6 10yr	Proposed		1833	463.48	469.13	468.38	469.65	0.003801	6.52	516.65	310.56	0.52	-0.04
Main	85.6 10yr+2050	Existing		2176	463.48	469.46	468.58	470	0.003806	6.81	625.25	329.43	0.52	
Main	85.6 10yr+2050	Proposed		2123	463.48	469.41	468.58	469.95	0.0038	6.77	610.46	328.84	0.52	-0.05
Main	85.6 10yr+2080	Existing		2256	463.48	469.53	468.58	470.07	0.003805	6.87	648.08	330.34	0.52	
Main	85.6 10yr+2080	Proposed		2202	463.48	469.48	468.58	470.02	0.003806	6.83	632.72	329.73	0.52	-0.05
Main	85.6 25yr	Existing		2446	463.48	469.68	469	470.23	0.003801	7	700.65	332.43	0.52	
Main	85.6 25yr	Proposed		2387	463.48	469.64	468.96	470.18	0.003802	6.96	684.54	331.79	0.52	-0.04
Main	85.6 25yr+2050	Existing		2854	463.48	470.01	469.26	470.57	0.003806	7.28	809.56	341.93	0.53	
Main	85.6 25yr+2050	Proposed		2784	463.48	469.96	469.26	470.52	0.003801	7.23	791.76	340.38	0.53	-0.05
Main	85.6 25yr+2080	Existing		3064	463.48	470.16	469.26	470.73	0.003803	7.4	863.37	346.18	0.53	
Main	85.6 25yr+2080	Proposed		2990	463.48	470.11	469.26	470.68	0.003805	7.36	844.71	344.96	0.53	-0.05
Main	85.6 50yr	Existing		2952	463.48	470.08	469.26	470.65	0.003805	7.34	834.96	344.12	0.53	
Main	85.6 50yr	Proposed		2880	463.48	470.03	469.26	470.59	0.003806	7.29	816.35	342.51	0.53	-0.05
Main	85.6 50yr+2050	Existing		3433	463.48	470.42	469.26	471	0.003801	7.61	952.26	350.54	0.54	
Main	85.6 50yr+2050	Proposed		3351	463.48	470.36	469.26	470.94	0.003801	7.56	932.9	349.62	0.53	-0.06
Main	85.6 50yr+2080	Existing		3719	463.48	470.6	469.26	471.19	0.003807	7.76	1017.39	353.51	0.54	
Main	85.6 50yr+2080	Proposed		3632	463.48	470.55	469.26	471.13	0.0038	7.71	998.37	352.67	0.54	-0.05
Main	85.6 100yr	Existing		3526	463.48	470.48	469.26	471.06	0.003801	7.66	973.97	351.57	0.54	
Main	85.6 100yr	Proposed		3442	463.48	470.43	469.26	471	0.003801	7.61	954.37	350.64	0.54	-0.05
Main	85.6 100yr+2050	Existing		4037	463.48	470.81	469.26	471.4	0.003801	7.92	1088.72	356.65	0.54	
Main	85.6 100yr+2050	Proposed		3943	463.48	470.75	469.26	471.34	0.003803	7.87	1067.93	355.74	0.54	-0.06
Main	85.6 100yr+2080	Existing		4131	463.48	470.86	469.26	471.46	0.003801	7.96	1109.27	357.55	0.54	
Main	85.6 100yr+2080	Proposed		4036	463.48	470.8	469.26	471.4	0.003801	7.92	1088.5	356.64	0.54	-0.06

APPENDIX E: CO-BENEFITS MODEL

Analytic / Spatial Model for Prioritizing Projects

MODEL GOALS

The model developed for the Water Quality and Climate Resiliency Portfolio Project (Portfolio) needed to prioritize candidate locations where natural and nature-based feature (NNBF) projects would be desirable within two communities in Maryland. The two communities are the Hamilton Run watershed in Washington County, MD, and the Pocomoke area in Worcester and Somerset Counties, MD. NNBF projects can include restoration projects such as restoring a wetland complex, replacing lawn with meadow, planting trees, restoring a stream, or others. Selected gray infrastructure projects, such as a culvert replacement project, are also considered.

Candidate projects were assessed as to how much benefit they would confer on the two communities, as well as whether they were feasible. Benefits focused on improving both community's resilience to changes in the climate expected over the decades. Benefits were defined during the project by the project team and included factors such as protecting local waters, protecting habitats that are important for community resiliency, and protecting vulnerable populations. Feasibility includes issues such as: can land be acquired, would permits be relatively straightforward to acquire, and would the project achieve benefits without negatively impacting neighbors or communities.

The primary output of the model is a priority for pursuing each project. Priority can be high, medium, and low. Both the Hamilton Run and the Pocomoke are advised to pursue those projects receiving the highest priority first.

Although the model parameters are identical for both communities, at run time the model compares projects only to other projects in the same community.

The model incorporated a variety of spatial and non-spatial information. Examples of spatial information include data such as FEMA 100-year floodplains, Maryland's Stronghold Watersheds, DNR Targeted Ecological Areas, and more. As part of the Portfolio, services were obtained to develop hydrologic and hydraulic modeling for both communities. Locally relevant information was also gathered during the project. All sources of information utilized during the project are presented in Appendix E.1: Co-Benefits Model Sources of Information.

DNR had previously developed a GIS model to help determine which areas in Maryland would serve as the focus of this project, resulting in the selection of the Hamilton Run and Pocomoke communities. The existing TRA model was not refined during this project, however, many of the data layers that were used for that analysis will have value in mapping and scoring candidate project locations.

SOURCES FOR CANDIDATE PROJECT LOCATIONS

A list of focus areas for potential flood mitigation or water quality projects were assembled by referencing any of the following:

- Authoritative studies and plans, for example, the Hamilton Run Watershed Characterization and Action Plan.
- Locations indicated by community groups, local and county governments, by DNR, MDE, and other partner agencies for NNBF projects or gray infrastructure projects.
- Locations mentioned at community outreach meetings held in Pocomoke City and Hagerstown during the project.
- Locations identified as vulnerable to flooding by H&H modeling undertaken during this project.

This list totaled to 29 potential focus areas for the Hamilton Run TRA as shown in Table 1. Figure 1 displays the locations of these focus areas.

Table 1: Potential Project Focus Areas Hamilton Run

Project ID	Project	Source
1	Cortland Manor dam	site visit
2	County offices (former Hospice)	site visit
3	The Greens at Hamilton Run Stream Restoration	site visit
4	Lowe's SWM outfall, and downstream end of box culvert	site visit
5	Medway Road erosion	site visit
6	Northern Middle/Highway Dept	site visit
7	Unnamed tributary	site visit
8	Potomac Heights School/Magnolia culvert crossing	site visit
9	Railroad and tributary	site visit
10	Rest Haven Cemetery	site visit
11	Rotary Park/Mills Park	site visit
12	The Terrace and the Wall of Death	site visit
13	Potomac Heights development	Listening session notes
14	American Legion	Listening session notes
15	Longmeadow Shopping Center	Listening session notes
16	Fountaindale Elementary School	Survey and site visit
17	Hamilton Run area before confluence with Antietam Creek	2017 Ham Run Wtshd AP
18	Parking Lot Runoff	2017 Ham Run Wtshd AP
19	Swale Change	2017 Ham Run Wtshd AP
20	Hamilton Run before the Greens	2017 Ham Run Wtshd AP
21	The Greens at Hamilton Run Maintenance Facility	2017 Ham Run Wtshd AP
22	Corridor of open field	2017 Ham Run Wtshd AP
23	Forested area near Lowes	2017 Ham Run Wtshd AP

24	Washington County Highway Maintenance Yard	2017 Ham Run Wtshd AP
25	WCPS Middle School	2017 Ham Run Wtshd AP
26	American Legion and Mills Park Restoration, just upstream of American Legion Drive	2017 Ham Run Wtshd AP
27	Restoration south of the Greens	2017 Ham Run Wtshd AP
28	Step Pool Weir System at The Terrace	MES
29	Pangborn Townhomes Wetland Complex	MES/Listening Notes

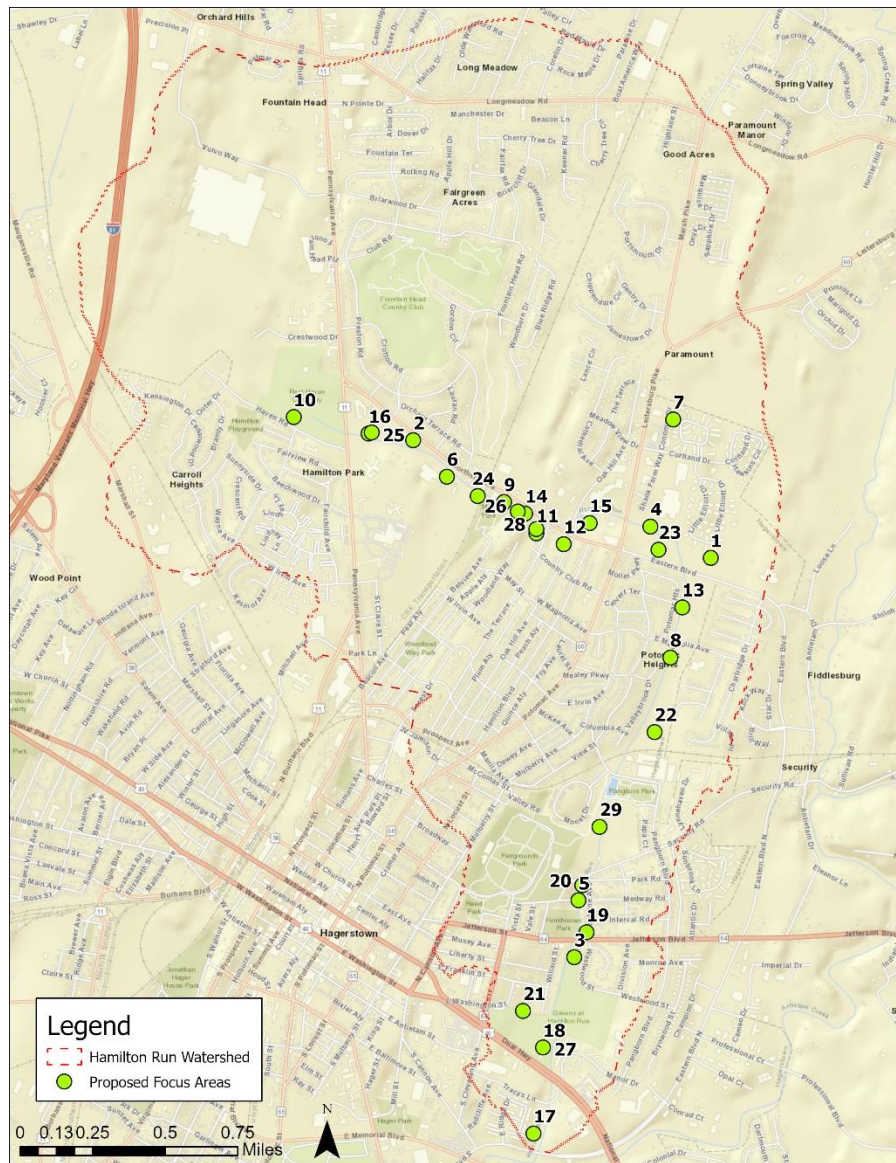


Figure 1: Potential Project Focus Areas Hamilton Run Locations Map

Focus areas were then removed from the project list due to criteria such as there were no readily available spaces for a potential project, no reports of flooding from the community, or the proposed project has already been moved forward toward implementation. The proposed projects within the refined list were then evaluated to ensure they were feasible. This feasibility

assessment reviewed what potential practices would be suitable for the proposed location, considering topography, soils, and available space. For flood mitigation focus areas, recommended practices would need to be suitable for the experienced flooding. Any challenges the project may face were also evaluated, including land ownership, legal such as permits and forest conservation easements, or physical constraints that would impair successful construction. The project list was also updated through the community outreach initiative described in Section 2.2 as additional information was received from the community pertaining to locations of proposed projects. Section 3 includes summaries of the feasibility assessments within the project narratives. Following the review described above, the project list for the Hamilton Run TRA was refined to 9 projects, shown in Table 2, which were integrated into the co-benefits model described below.

Table 2: Hamilton Run Proposed Projects

Project ID	Project	Practice(s)
29	Pangborn Townhomes Wetland Complex	Stream Restoration, Wetland Creation/Restoration
22	Corridor of open field	Stream Restoration, Wetland Creation/Restoration
24	Washington County Highway Maintenance Yard	Wetland Creation/Restoration
16	Fountaindale Elementary School	Stormwater Basin, Wetland Creation/Restoration
3	The Greens at Hamilton Run Stream Restoration	Stream Restoration
13	Potomac Heights development	Stream Restoration
8	Potomac Heights School/Magnolia culvert crossing	Wetland Creation/Restoration, Culvert Redesign
20	Hamilton Run before the Greens	Stream Restoration
10	Rest Haven Cemetery	Stormwater Basin

As previously mentioned, various practices were considered for each focus area to determine the most suitable for the project. For example, a project near Pangborn Townhomes in Hagerstown envisioned restoring about 125,000 square feet of wetland and restoring about 32,000 square feet of a stream. All projects included at least one practice; many included two practices; one project envisioned four practices. The foundation of the model was built upon the general benefits provided by each practice type. The details of the proposed projects, such as location and size of implemented practices, were then used to quantify the relevant co-benefits for each proposed project. The model then prioritized the projects by summing up the benefits achieved by all the practices envisioned. This methodology for prioritization is described further in the following section of this Appendix.

The specific practices envisioned for each project were obtained from the same information sources as listed above, such as a watershed study, design plan, or H&H modeling. The model considered the following practices:

1. Culvert redesign
2. Forest restoration, non-riparian
3. Forest restoration, riparian
4. Living shoreline creation
5. Meadow creation
6. Shoreline/marsh restoration
7. Environmental site design (ESD) such as swales & micro-bioretentions
8. Stormwater basins
9. Stream restoration
10. Wetland restoration or creation

DETAILS OF PRIORITIZATION MECHANISM

The model evaluated each of the projects by considering how well each project would provide the greatest benefit, while remaining feasible. Based on how many benefits were achieved by each project, projects were scored as having High, Medium, or Low priority.

The projects that achieved the most benefits as defined by the Team and outlined here were scored the highest priority. Again, the model evaluated each project only against other projects within the same community, that is Pocomoke region or the Hamilton Run watershed in Hagerstown.

Each project was scored based on multiple **benefits**, evaluating if and how much the project:

- addresses socially vulnerable populations.
- appears to be feasible according to economic, technical, legal (including permitting), and scheduling issues.
- can be completed within a reasonable environmental footprint and timeline.
- helps critical infrastructure and life support systems.
- leverages available funding (appears to meet eligibility guidelines for one of five selected funding programs).
- offsets carbon.
- appears solid and viable and funding for project was previously sought but it was wait-listed.
- protects habitats important for community resiliency.
- protects important ecosystems.
- protects important fisheries, contributes to aquatic life and biotically important areas.

- protects local and state protected lands including recreational value.
- restores local waters.
- supports local priorities, as indicated by studies, plans, reports, community meetings, and municipal offices.

To evaluate each project, the model used the following approach. For each project practice the model first calculated a subscore based on the practice area multiplied by an impact value.

Depending on the practice type, the practice area was either how much of the practice was envisioned on a project, for example, 2.5 acres of reforestation or 1.2 acres of stream restoration, or the drainage area treated by the practice. Therefore, the model incorporates the assumption that the more of a given practice or area treated, the better that project will be. A project with two acres of reforestation will confer more benefit than a project incorporating only half of an acre. To standardize the scoring, square feet were used as the standardized metric for the project area.

The **impact** component reflects the reality that some practices have a very strong and positive impact on the provided benefits such as water quality treatment, or runoff reduction. However, that same practice might advance other benefits by not much if at all. For example, a culvert upgrade will generally restore fish passage and will, therefore, have a very positive impact on the factor, 'protects aquatic life.' Culvert upgrades do not, however, offset much carbon. Here, the impact score would be 'little to none.' Culvert upgrades can be expensive and time consuming to complete, so evaluated against 'feasibility' they would score strongly negative.

Impact values are unitless and range from negative three (-3) to three (3). The impact value is interpreted as follows and shown in Table 3: strongly negative, moderately negative, slightly negative, little to none, slightly positive, moderately positive, or strongly positive.

Table 3: Impact Factor Scoring

Impact Meaning	Integer Value
strongly negative	-3
moderately negative	-2
slightly negative	-1
none	0
slightly positive	1
moderately positive	2
strongly positive	3

The resulting practice-factor impact values are provided in Table 4.

Table 4: Practice Factor Impact Values

Factor	Culvert redesign ...	Forest restoration non riparian	Living shoreline	Meadow creation	Shoreline/marsh restoration	Small stormwater BMPs	Stormwater basin restoration	Stream restoration	Wetland restoration
addresses socially vulnerable populations	1	1	1	1	1	1	0	1	1
appears to be feasible according to economic, technical, legal, and environmental footprint and timeline	-2	2	0	2	0	-1	0	-2	1
helps critical infrastructure and life support systems	3	3	2	0	2	0	0	2	2
leverages available funding (appears to meet eligibility guidelines)	3	3	2	2	1	0	0	0	3
offsets carbon	-1	3	1	1	1	1	1	2	3
project appears solid and viable and funding for project was secured	2	2	3	2	1	3	0	0	3
protects habitats important for community resiliency	1	1	2	1	3	1	3	2	3
protects important ecosystems	1	3	3	2	3	1	0	3	3
protects important fisheries, contributes to aquatic life and biodiversity	3	1	3	1	3	1	3	3	3
protects local and state protected lands including recreation	-1	1	1	1	1	0	1	1	2
restores local waters	1	3	3	2	3	2	3	3	3
supports local priorities, as indicated by studies, plans, reports, and other documents	2	1	2	2	1	2	1	0	2

As demonstrated in Table 4, the impact values are based solely on the general potential for a practice type to provide a specific benefit factor. These are qualitative values determined by the experience and observations of industry professionals, including GIS Specialists and Professional Engineers. This experience is supported by review of capital improvement projects, project grant applications, and previous studies completed by other groups and agencies. Some of these factors, such as cost and feasibility, were also evaluated in more detail based on the project specific parameters outside of this model.

The following are examples of how different impact factors may apply to different practices.

1. The practice of planting trees in the riparian buffer has a strongly positive impact on 'offsetting carbon.'
2. Replacing lawn with a meadow has little to no effect on 'helping protect critical infrastructure.' While meadows can certainly help retain sediments and protect local waters, they are not generally sufficient to help retain the flood waters that threaten local infrastructure.
3. Performing a stream restoration project has a strongly negative effect on 'environmental footprint and timeline.' Stream restoration projects generally include large amounts of earth disturbance and can take multiple years to complete.

One additional component is needed to complete the model. Some practices will provide benefits *only if they are situated or located properly or if they meet other qualifications*. An optional **qualification test** allows us to incorporate these details based on project specifics. Qualification tests could be spatial or non-spatial. For example, a stream restoration project will help ‘address socially vulnerable populations’ only if it is located sufficiently close to a socially vulnerable population. A culvert replacement project might help protect critical infrastructure only if it is upstream of that critical infrastructure. By contrast, any reforestation achieved will help ‘offset carbon’ no matter where it is located. No additional qualification test is needed for reforestation and offsetting carbon. Non-spatial tests were also possible. For example, candidate projects were evaluated individually as to their feasibility.

The amount of the practice, the impact value and criteria tests were utilized to mathematically score projects. *The projects with the most beneficial practices and the least amount of adverse practices, that meet any additional criteria needed, will receive the highest score.*

The model used mathematics and logic to calculate the subcomponent score for each practice employed on each project as follows: If the qualification test is passed, the subcomponent score will be the practice area multiplied by the impact score. If the qualification test is not passed, the subcomponent score will be 0.

Here is an example of how a single project would be scored. Imagine a project that includes three practices: a stream restoration, tree plantings in the riparian area, and converting mowed lawn to meadow. For simplicity only three benefit factors are shown. The actual model evaluated thirteen benefit factors. All values are hypothetical; this is not an actual project.

Table 5: Example Project Ranking

Project: Example 1					
Practice	Amount	Benefit factor	Impact	Passed	Subscore
stream restoration	5,000 sf	feasibility	-2	Passed	-10,000
		protects important ecosystems	3	Passed	15,000
		addresses socially vulnerable populations	1	Failed	0
reforestation, riparian	20,000 sf	feasibility	2	Passed	40,000
		protects important ecosystems	3	Passed	60,000
		addresses socially vulnerable populations	1	Failed	0
convert turf to meadow	50,000 sf	feasibility	2	Passed	100,000
		protects important ecosystems	1	Passed	50,000
		addresses socially vulnerable populations	1	Failed	0
Total “Points” for this Project					255,000

The points achieved by this project do not represent any absolute measure of the value of this project. The calculation of points is only used to compare this project to all other projects that were scored using the same system.

The model evaluated all the actual projects for both the Hamilton Run area and the Pocomoke area as shown above. Then all projects were compared to all other projects in the same area. Projects were then assigned to one of three priorities: High, Medium, or Low priority based on their rank in the listing of scores. The top third of the projects were assigned High Priority, the middle third were assigned Medium Priority, and the lowest third were assigned Low Priority. The prioritization of projects for Hamilton Run are shown in Table 6 below.

Table 6: Hamilton Run Portfolio Prioritization

Project ID	Project	Priority
29	Pangborn Townhomes Wetland Complex	High
22	Corridor of open field	High
10	Rest Haven Cemetery	High
24	Washington County Highway Maintenance Yard	Medium
16	Fountaindale Elementary School	Medium
8	Potomac Heights School/Magnolia culvert crossing	Medium
3	The Greens at Hamilton Run Stream Restoration	Low
13	Potomac Heights development	Low
20	Hamilton Run before the Greens	Low

APPENDIX E.1: CO-BENEFITS MODEL SOURCES OF INFORMATION

R1: Factors and Information Sources Applied

<u>Factor</u>	<u>Information Source</u>	<u>Citation</u>	<u>Description</u>
addresses socially vulnerable populations			
	Environmental Justice Scores (MDE)	Maryland Department of the Environment, Environmental Justice Scores (EJ), 2023.	This EJ Screening Tool shows underserved and over-burdened communities. Groups populations into percentiles. Colored according to 0-24.9, 25-49.9, etc. For our project, we considered anything over 50% as
	MBA Hydraulics and Hydrologic Studies, 2023	Michael Baker International, 2023.	Michael Baker Associations generated H&H studies for this project
	Microsoft AI Generated Building Footprints, 2014-2021	Maryland iMap, Maryland Building Footprints, 2018-2020.	Maryland has posted building footprints as a map service. This is same as the Microsoft building footprint. The data depend on the underlying imagery. In general, the data are from 2014 through 2021.
	National Flood Hazard Layer	Federal Emergency Management Agency, National Flood Hazard Layer, 2023.	1% and 0.2% annual flood chance area
appears to be feasible according to economic, technical, legal (including permitting), and scheduling issues			
	Maryland Environmental Services Staff Assessment, 2023	Maryland Environmental Service, 2023.	To evaluate projects, MES staff created rough estimates of how much projects would cost using staff planner and engineer expertise. MES evaluated estimated costs, checked it permitting was difficult, and land
environmental footprint and timeline			
	Maryland Environmental Services Staff Assessment, 2023	Maryland Environmental Service, 2023.	To evaluate projects, MES staff created rough estimates of how much projects would cost using staff planner and engineer expertise. MES evaluated estimated costs, checked it permitting was difficult, and land
leverages available funding (appears to meet eligibility guidelines for one of five selected funding programs)			
	Maryland Environmental Services Staff Assessment, 2023	Maryland Environmental Service, 2023.	To evaluate projects, MES staff created rough estimates of how much projects would cost using staff planner and engineer expertise. MES evaluated estimated costs, checked it permitting was difficult, and land
offsets carbon			

<u>Factor</u>	<u>Information Source</u>	<u>Citation</u>	<u>Description</u>
	Maryland DNR Ecosystem Services Carbon Sequestration Estimates	Maryland Department of Natural Resources, Ecosystem Services Carbon Sequestration Estimates, 2019.	Created by DNR, estimates mT per year removed. Valid for tree plantings and wetlands restoration only
project appears solid and viable and funding for project was previously sought but it was wait-listed			
	Maryland Environmental Services Staff Assessment, 2023	Maryland Environmental Service, 2023.	To evaluate projects, MES staff created rough estimates of how much projects would cost using staff planner and engineer expertise. MES evaluated estimated costs, checked if permitting was difficult, and land
protects important ecosystems			
	Biodiversity Conservation Network (BioNet), 2019	Maryland Department of Natural Resources, Biodiversity Conservation Network (BioNet), 2019.	Scores important areas across the state as Tier 1 through Tier 5. Not all areas of the state get a score, so even a Tier 5 is exemplary.
	Chesapeake and Atlantic Coastal Bays Trust Fund priorities, 2012	Maryland Department of Natural Resources, Chesapeake and Atlantic Coastal Bays Trust Fund, 2012.	Allows Maryland to accelerate Bay restoration by focusing limited financial resources on the most efficient, cost-effective non-point source pollution control projects
	Coastal Resiliency Assessment	Maryland Department of Natural Resources, Coastal Resiliency Assessment, 2023.	Landscape level spatial analysis and modeling effort. Identifies natural habitats that provide the greatest potential risk reduction for coastal communities.
	GreenPrint Conservation Benefit Assessment Wetland Adaptation Areas	Maryland Department of Natural Resources, GreenPrint Conservation Benefit Assessment Wetland Adaptation Areas, 2023.	Created via GreenPrint. Shows marsh migration areas, 2016

<u>Factor</u>	<u>Information Source</u>	<u>Citation</u>	<u>Description</u>
	Maryland DNR-Owned Public Lands and Protected Open Space	Maryland Department of Natural Resources, DNR-Owned Public Lands and Conservation Easements, 2017.	Includes owned and conservation easement protected lands. CREP, Forest Legacy, CRP, and other lands
	Targeted Ecological Areas	Maryland Department of Natural Resources, Targeted Ecological Areas (TEA), 2017.	High priority conservation areas designated by DNR
protects important fisheries, contributes to aquatic life and biotically important areas			
	Biodiversity Conservation Network (BioNet), 2019	Maryland Department of Natural Resources, Biodiversity Conservation Network (BioNet), 2019.	Scores important areas across the state as Tier 1 through Tier 5. Not all areas of the state get a score, so even a Tier 5 is exemplary.
	Forests of Recognized Importance	American Forest Foundation, Forests of Recognized Importance (FORI), 2015-2020 via 2024 American Tree Farm System	Forests of recognized Importance (FORI). This dataset created by Maryland Forest Service includes variety of areas, including buffers of Stronghold Watersheds, Trout bearing streams, streams feeding municipal
	GreenPrint Conservation Benefit Assessment Wetland Adaptation Areas	Maryland Department of Natural Resources, GreenPrint Conservation Benefit Assessment Wetland Adaptation Areas, 2023.	Created via GreenPrint. Shows marsh migration areas, 2016
	Targeted Ecological Areas	Maryland Department of Natural Resources, Targeted Ecological Areas (TEA), 2017.	High priority conservation areas designated by DNR
protects local and state protected lands including recreational value			
	Maryland DNR-Owned Public Lands and Protected Open Space	Maryland Department of Natural Resources, DNR-Owned Public Lands and Conservation Easements, 2017.	Includes owned and conservation easement protected lands. CREP, Forest Legacy, CRP, and other lands
restores local waters			

<u>Factor</u>	<u>Information Source</u>	<u>Citation</u>	<u>Description</u>
	EPA §303d Data	Environmental Protection Agency, 303(d) Listed Impaired Waters, 2023	This tool maps impaired and threatened waters that don't meet water quality standards
	Forests of Recognized Importance	American Forest Foundation, Forests of Recognized Importance (FORI), 2015-2020 via 2024 American Tree Farm System	Forests of recognized Importance (FORI). This dataset created by Maryland Forest Service includes variety of areas, including buffers of Stronghold Watersheds, Trout bearing streams, streams feeding municipal

APPENDIX E.2: HAMILTON RUN CO-BENEFITS MODEL PROJECT PORTFOLIO

Issue	No issues in the open field, and BANCS assessments show good quality stream in this area.		
Description	This section of Hamilton Run separates the backyards of private homes and a large parcel of land occupied by an elementary school that is part of Washington County Public Schools (WCPS). Along the left bank, on land owned by WCPS, there is a long corridor approximately four and a half acres in size of open field that could be used to build a large wetland BMP complex. Some floodplain retention was also included in the project model.		
Suggested by	2017 Ham Run Wtshd AP		
Project Impacts	WCPS property will be impacted by constructed.		
Practice(s) Envisioned	1	24,000 square_feet	Stream restoration, including FP reconnection
	2	125,000 square_feet	Wetland creation/restoration

Issue	This area experiences intermittent flooding. Lots of trees, some fallen over at culverts, downstream of cemetery pond which is to be removed.		
Description	BMPs designed to withstand sheetflow from the basketball courts to the north and the parking lot to the south would be desired, and reconnecting the floodplain to the stream in this area would allow for a strong ecosystem. Lots of room for floodplain width here. The wetland complex could be expanded.		
Suggested by	Survey Map and Kayla notes		
Project Impacts	Concrete dam floods the adjacent school property.		
Practice(s) Envisioned	1	30,000 sq_feet treat	Stormwater basin restoration/enhancement
	2	7,500 square_feet	Wetland creation/restoration

Issue	Riparian vegetation and in-stream habitat need improvement.		
Description	There are few eroding stream banks in these project reaches where bank restoration would have the potential to provide TMDL credits.		
Suggested by	2017 Ham Run Wtshd AP		
Project Impacts	Brookline Ave and Medway Rd properties will have floodplain adjustments.		
Practice(s) Envisioned	1	14,000 square_feet	Stream restoration, including FP reconnection

Issue	Private property owner Brook Meadow LLC may be difficult to work with		
Description	Open space adjacent to Hamilton Run and behind Pangborn Apartments where a Wetland Complex and RSC section of the stream could be developed to hold large amounts of stormwater.		
Suggested by	MES/Listening Notes		
Project Impacts	Potential floodplain change at Pangborn Apartments/property owners along Security Rd, wetland increases		
Practice(s) Envisioned	1	125,000 square_feet	Wetland creation/restoration
	2	32,000 square_feet	Stream restoration, including FP reconnection

Issue	Severe erosion issues along Hamilton Run across from the property located by the intersection of Potomac Heights and Calvert Terrace. Erosion of the bank is causing tree roots to be exposed and resulting in trees falling across Hamilton Run and into adjac		
Description	Hamilton Run stream restoration; most areas mentioned in this portfolio are along Hamilton run. Should attempt to increase water storage in the immediate area to withstand impacts upstream of the retrofit at the shopping center, while providing enough infrasturcture downstream to withstand impacts. Should also design to support natural features and utilize what little open space is available for green works.		
Suggested by	Listening session notes		
Project Impacts	Property owners will experience changes in the floodplain extents due to close proximity to residential property. Businesses and public roadways may require temporary closings or re-routing to complete project construction.		
Practice(s) Envisioned	1	32,000 square_feet	Stream restoration, including FP reconnection

Issue	Multiple culvert crossings that are undersized. Flooding events at this location impacts access to the school. A safety hazard for school buses is a concern since they drive through flooded roads.		
Description	Increase the size of the culverts running under E Magnolia Ave to allow for more throughput. Wetlands could also be added in this area for more retention.		
Suggested by	site visit		
Project Impacts	Construction may impact the bus routes and neighboring communities during construction.		
Practice(s) Envisioned	1	10,000 square_feet	Wetland creation/restoration
	2	21,780 sq_ft-feet	Culvert redesign and emplacement

Issue	Lack of room for tree planting. The current conditions bottleneck when a storm occurs, generating localized flooding. The swale next to the dry pond is severely eroded.		
Description	Headwaters at Hamilton Run. Large swale collecting all drainage going to cemetery. Dam to be breached is next to swale. Water will go to cemetery headwaters. Removing SW pond to restore meander in stream		
Suggested by	site visit		
Project Impacts	Rest Haven Cemetery construction, floodplain boundary changes, and SWM facility installation, possible		
Practice(s) Envisioned	1	20,650 square_feet	Stream restoration, including FP reconnection
	2	105,000 sq_feet treat	Stormwater basin restoration/enhancement

Issue	Unstable stream banks, frequent flooding of the fairway, poor bedform diversity, narrow riparian buffer, increased water temperatures		
Description	2017 Hamilton Run action plan included multiple activities, including stream restoration. There is currently a contract for this stream restoration. Stream runs along a golf course and has disconnected from the floodplain.		
Suggested by	site visit		
Project Impacts	The golf course could be impacted if the stream restoration is occurring during operations.		
Practice(s) Envisioned	1	40,000 square_feet	Stream restoration, including FP reconnection

Issue	Moderate bank erosion. No riparian buffer in some areas.		
Description	This reach of Hamilton Run flows between the Washington County Highway Maintenance Yard and several private commercial businesses. A stormwater treatment BMP could be installed on the downstream end of where Hamilton Run parallels the maintenance yard to provide runoff treatment from the maintenance yard parking lot. A Submerged Gravel Wetland has been proposed by MES.		
Suggested by	2017 Ham Run Wtshd AP		
Project Impacts	A home and LLC are on the property where the stream would require re-alignment to add sinuosity.		
Practice(s) Envisioned	1	65,340 sq_feet treat	Environmental Site Design (ESD)

APPENDIX F: CONCEPT PLAN

Hamilton Run Concept Plan

Projects moved forward to concept design were selected based on feedback from the community, provided benefits to both the environment and the community, and feasibility of implementation. Great consideration was taken into how the project would serve the needs of the community. The project selected for concept development within Hamilton Run was the Washington County Maintenance Yard.

The Washington County Maintenance Yard is located along Northern Avenue east of Northern Middle School. Northern Avenue is at high risk for flooding due to the proximity of properties to Hamilton Run reducing available floodplain storage, as well as old infrastructure not designed to convey present day discharges. The culvert running under Longmeadow Shopping Center demonstrates the most significant impacts, with significant backwater flooding as demonstrated in Section 2.3 of the Hamilton Run Water Quality and Climate Resiliency Portfolio narrative. The urban environment along Northern Avenue poses challenges for flood mitigation. The H&H analysis described in Section 2.3 determined if floodplain retention along Northern Avenue could be increased by 207,200 cubic feet, reductions over 1' could potentially be observed for the 100-year storm water surface elevation. Focus was placed on investigating available land on public properties as this makes it easier to implement stormwater projects since land does not need to be purchased from a private entity. Multiple publicly owned properties were identified along Northern Avenue within or adjacent to the floodplain for consideration of potential projects. However, as described in Section 2.2.3, several of these properties were determined to not be viable for projects following further community outreach. Focus was placed on the remaining public space. The Washington County Highway Maintenance Yard was chosen due to the greater potential for pollutant load reductions in comparison to other projects identified along Northern Avenue.

Hamilton Run runs along the front of the Washington County Maintenance Yard behind several businesses. There is minimal space between the business parking lots and the maintenance yard, providing no floodplain for water to go when the stream reaches bankfull, resulting in flooding to the property. Additionally, there is currently no stormwater management within this area for either quality or quantity control. Therefore, runoff from this impervious is untreated and flows directly to Hamilton Run. As described within Section 3.2 in the Hamilton Run Portfolio narrative, the use of the property creates additional concern for unmanaged runoff and flood risk.

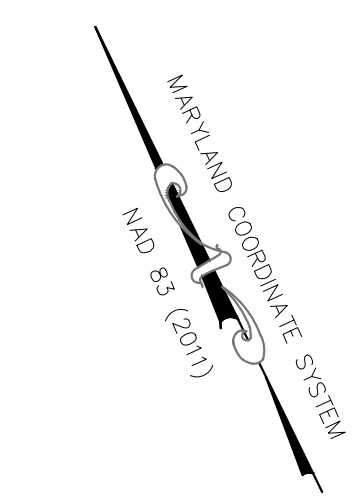
The proposed concept focuses on the implementation of a submerged gravel wetland on the east side of the maintenance yard lot. A submerged gravel wetland (SGW) is recommended due to the soil types in this area. The proposed SGW is sized to treat the first 1" of runoff for approximately 1.5 acres of the maintenance lot while also allowing 6" of freeboard. Native

wetland plantings should be chosen for the designed ponding depth. Planting recommendations are provided within the concept plan. Furthermore, the concept includes both a proposed plan view as well as typical profile for the SGW.

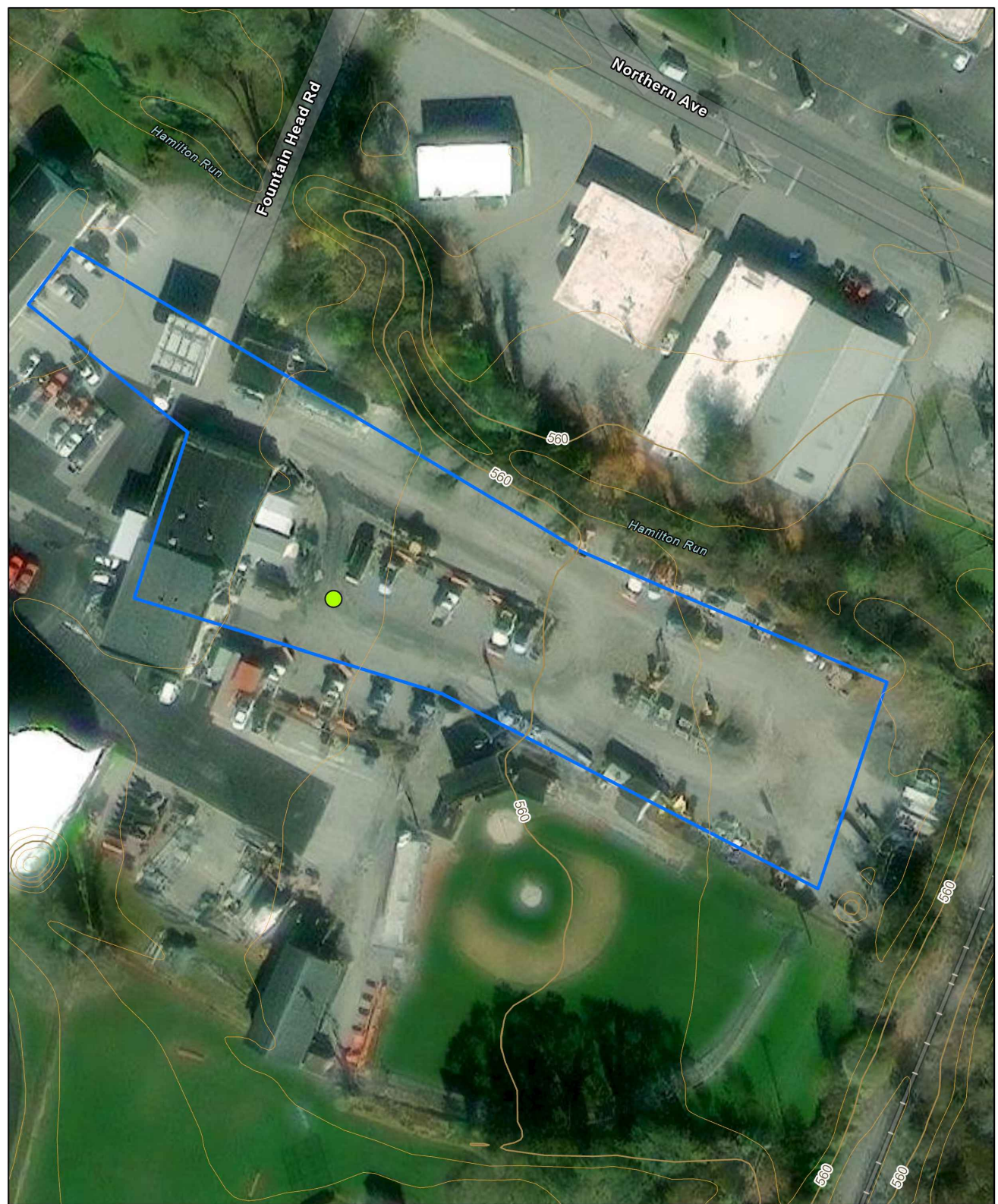
Section 3.3 and 3.4 of the Portfolio narrative provides a summary of possible permit requirements and funding opportunities for each project within the portfolio. Due to being located within the 100-year floodplain, disturbance area, and proposed practices, the project would require several permits. This may include an Erosion and Sediment Control Permit, stormwater management plan review by City of Hagerstown, and Nontidal Wetlands and Waterway Permit. It should be noted MDE guidance recommends avoiding constructing BMPs within the 100-year floodplain but does not prohibit such projects. Furthermore, neither Washington County nor the City of Hagerstown ordinances prohibit BMPs within the floodplain. The project would also be eligible for restoration credits under the NPDES MS4 Permit. Although the property is within the City of Hagerstown, it falls under Washington County's MS4 Permit. Depending on the status of the County's restoration progress, the City may be able to partner with the County in order to obtain the provided restoration credits from the project.

Five funding opportunities were considered when evaluating funding opportunities, including DHS - FEMA - MDEM Building Resilient Infrastructure and Communities (BRIC) Grant, MD DNR Chesapeake & Coastal Grants Gateway MDE Water Infrastructure Financing Administration Water Quality Revolving Loan Fund (WQRLF), Chesapeake Bay Trust (CBT) Green Streets, Green Jobs, Green Towns (G3) Grant Program, and Chesapeake Bay Trust (CBT) Watershed Assistance Grant Program. The proposed concept for the Washington County Highway Maintenance Yard may be eligible for each of the five funding opportunities. However, the project focuses on water quality and does not offer significant flood reduction, making the project noncompetitive for the BRIC grant. The addition of the wetland at the front of the property as described within Section 3.2 of the Portfolio narrative would increase the provided co-benefits of the proposed project. Thus, making the project more competitive for funding opportunities.

SAVED: 1/7/2024 9:45:12 AM C:\Users\jls\OneDrive\Documents\HAMILTON RUN SURVEY\CAD\PROJECTS\HAMILTON RUN MAINTENANCE YARD\WORKSHEET.DWG
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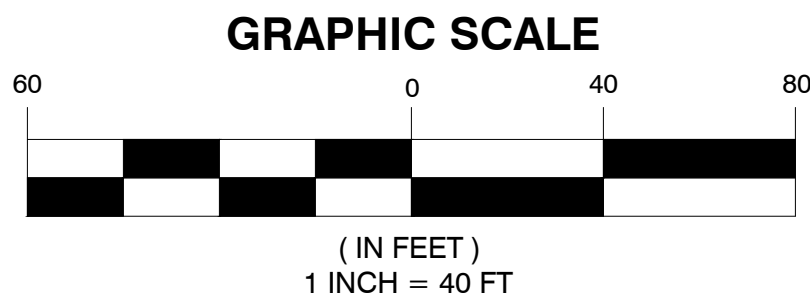
DRAINAGE AREA



0 40 80 160 Feet

GENERAL NOTES

- 1) PROPOSED CONTOUR INTERVALS ARE AT 0.5' (MINOR) & 2.0' (MAJOR).
- 2) HORIZONTAL DATUM: NORTH AMERICAN DATUM OF 1983 MARYLAND STATE PLANE (NAD83/1981).
- 3) VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
- 4) ELEVATIONS APPROXIMATED USING WASHINGTON COUNTY DEM PROVIDED BY MARYLAND IMAP.



REVISIONS

REVISIONS



SURVEYED BY: JBC, JLS

DRAWN BY: STK

CHECKED BY: JW

DATE: JANUARY 12, 2024

SITE LOCATION

HAMILTON RUN - MAINTENANCE YARD CONCEPT PLAN
HAGERSTOWN - WASHINGTON COUNTY - MARYLAND

TECHNICAL AND ENVIRONMENTAL SERVICES

259 Najoles Road - Millersville, Maryland 21108 - Office: 410-729-8200 - www.menv.com

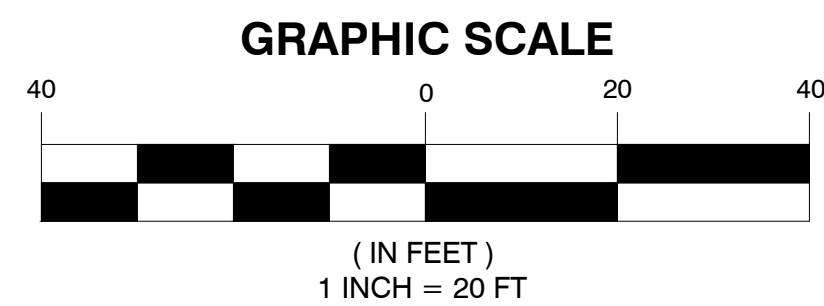
PROJECT NO.

SCALE: 1" = 40'

SHEET 1 OF 3

DRAWING NO.

DATE: 1/2/2024
FILE PATH: C:\USERS\JAMES\WORKING\PROJECTS\HAMILTON RUN\SURVEY\CAD\PROJECTS\HAMILTON RUN MAINTENANCE YARD WORKSHEET.DWG
SHEET: 2 OF 3
PROJECT: HAMILTON RUN MAINTENANCE YARD WORKSHEET.DWG



REVISIONS



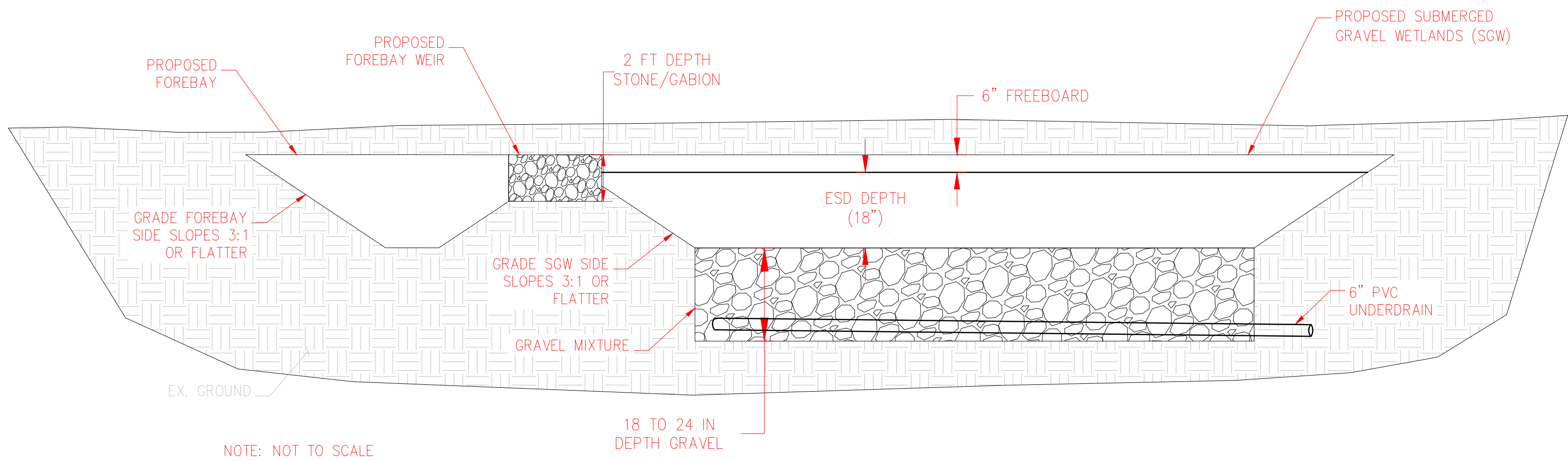
SURVEYED BY: JBC, JLS
DRAWN BY: STK
CHECKED BY: JW
DATE: JANUARY 12, 2024

PROPOSED SUBMERGED GRAVEL WETLAND
HAMILTON RUN - MAINTENANCE YARD CONCEPT PLAN
HAGERSTOWN - WASHINGTON COUNTY - MARYLAND
TECHNICAL AND ENVIRONMENTAL SERVICES
259 Najoles Road - Millersville, Maryland 21108 - Office: 410-729-8200 - www.menv.com

PROJECT NO.
SCALE: 1" = 20'
SHEET 2 OF 3
DRAWING NO.

GENERAL NOTES
1) PROPOSED CONTOUR INTERVALS ARE AT 0.5' (MINOR) & 2.0' (MAJOR).
2) HORIZONTAL DATUM: NORTH AMERICAN DATUM OF 1983 MARYLAND STATE PLANE (NAD83/1981).
3) VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
4) ELEVATIONS APPROXIMATED USING WASHINGTON COUNTY DEM PROVIDED BY MARYLAND IMAP.

SUBMERGED GRAVEL
WETLAND DETAILS



WETLAND PLANTS TABLE

Common Plant Name	Scientific Species	MDE Physiographic Region
Common Marsh-marigold	<i>Caltha palustris</i>	ARN
Broad Water-weed	<i>Elodea canadensis</i>	RPC
Pickereel Weed	<i>Pontederia cordata</i>	S
Broad-leaf Cattail	<i>Typha latifolia</i>	S

PLANTING NOTES
1) ALTERNATIVE SPECIES MAY BE USED FOR PLANTING SO LONG AS SPECIES ARE MARYLAND NATIVES AND CAN WITHSTAND A PONDING DEPTH OF 1 TO 2 FEET.

DATE: 1/12/2024
FILE PATH: C:\Users\james.van.der.kolk\OneDrive\Documents\Hamilton Run Survey\CAD\PROPOSED\HAMILTON RUN MAINTENANCE YARD WORKSHEET.DWG

REVISIONS		SURVEYED BY: JBC, JLS	PROPOSED SUBMERGED GRAVEL WETLAND DETAILS	PROJECT NO.
		DRAWN BY: STK	HAMILTON RUN - MAINTENANCE YARD CONCEPT PLAN	SCALE: NONE
		CHECKED BY: JW	HAGERSTOWN - WASHINGTON COUNTY - MARYLAND	SHEET 3 OF 3
		DATE: JANUARY 12, 2024	TECHNICAL AND ENVIRONMENTAL SERVICES	DRAWING NO.
			259 Najoles Road - Millersville, Maryland 21108 - Office: 410-729-8200 - www.menv.com	