PRELIMINARY ENGINEERING REPORT

FOR THE

CITY OF CUMBERLAND
ALLEGANY COUNTY, MARYLAND

RIVER PARK & NORTH BRANCH POTOMAC INDUSTRIAL DAM REMOVAL

CEC PROJECT #328-386

DECEMBER 2024

Recreation Engineering & Planning

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1. INTRODUCTION

A. Project Background

The River Park at Canal Place embodies a long-held vision for transforming Cumberland and Allegany County into a hub for outdoor enthusiasts. This initiative aims to unlock the recreational potential of the Potomac River, drawing inspiration from the success of Cumberland's Great Allegheny Passage and C&O Canal Towpath Trail (Towpath).
At its core, the project seeks to create a family-friendly river park, converting the previously perceived obstacle of what is known locally as the “Blue Bridge Dam” (Potomac Industrial Dam) into an opportunity. The removal of part of the dam allows for innovative river features catering to various skill levels and to promote fish passage upstream of the dam for the first time since its construction in the 1950s. Complementing the in-water features are streamside amenities, including boat access points, spectator seating, and paved trails connecting key areas. The river park project is strategically positioned near a designated parking area, facilitating easy access beneath Interstate 68. This strategic location not only promotes accessibility but also fosters greater integration with nearby businesses and local accommodations. The trails play a crucial role, weaving a Greater Cumberland trail network along both Maryland and West Virginia riverbanks. With connections to the Towpath, a river trestle, and the Knobley Tunnel, these trails offer diverse recreational opportunities. Building upon existing assets like Canal Place, Cumberland's infrastructure, and local businesses, the river park extends services, creating a dynamic space for recreation and supporting related businesses. This report delves into the detailed analysis and feasibility aspects, envisioning a future where the River Park at Canal Place is a thriving symbol of community vibrancy and natural beauty.

B. Project Scope

To further completion of the project, Recreation Engineering and Planning (REP) and Civil and Environmental Consultants, Inc. (CEC) were tasked with creating a 30% Preliminary Engineering Report (PER) and revised masterplan that will be necessary to determine and redefine the locations of the water feature drops and related land-based trails connections. To generate the 30% report and design, the following items are necessary:

1. Existing site topographic base mapping, bathymetry upstream of dam, 3D modeling of dam and other in-water man-made features.
2. Hydrology Analysis

3. Hydraulic Model Review
4. Floodplain Feasibility Analysis
5. Pertinent project site and surround area connections data
6. Meetings/Coordination with United States Army Corps of Engineers (USACE), City of Cumberland, Canal Place, and Allegany County

2. SITE ANALYSIS

A. Existing Site Photographs

Existing Avirett Street Levee
Proposed river park launch point & trailhead.

View of Ridgeley Flood control wall and Bridge Street Crossing.
Proposed trail intersection with Bridge Street.

Existing floodwall and dam on river left (Maryland).
Proposed location of trail underpass adjacent to water feature drop.

Existing Interstate 68 Bridge parking lots on Greene Street.
Proposed area of shared use parking for the river park.

Existing Riverside Park includes National Road 0-mile marker, George Washington's Headquarters. Proposed location of parking lot access for take-out location for river park and better access to the Riverside Park.

Existing Pedestrian Bridge with stairs and ADA access from Station to Riverside Park. Proposed connection point to Chesapeake & Ohio Bike Trail.

Existing flood wall River Left (Maryland side) downstream of railroad trestle. Proposed area for overlook and stair access to river trails.

Existing overlook connected to the C&O Bike Trail. Proposed ADA access ramp to riverside trails.

Existing gravel access to overhead electric lines on WV-28 Veteran's Memorial Highway. Proposed asphalt turnaround with parking for downstream of river park boat launch points and access to the trail network from the Ridgeley, WV side of the North Branch of the Potomac River.

Existing shared use gravel parking area adjacent to WV-28. Proposed shared use parking for use for downstream of river park boat launch points and access to the trail network from the Ridgeley, WV side of the North Branch of the Potomac River.

B. Site Opportunities & Constraints

1. Opportunities

a. Economic Development

The incorporation of new biking and hiking trails, fishing habitats, and river features, and observation areas within the project area is a significant expansion of recreational opportunities, reunifying both cities (Cumberland, Maryland and Ridgeley, West Virginia) through their use of the river, providing an easy escape to the natural environment within the confines of an up-and-coming city built upon the rich history of its past is a one-of-a-kind opportunity for the region that will produce continued economic growth and development for the City of Cumberland and Ridgeley. The WVU Research Corporation's River Park Visitor Profile and Tourism Economic Impact Study estimates that an additional 1 million visitors will be brought to the region with the implementation of the river park. See Appendix A for the full report.

b. Historic and Tourism

Building on the existing success of the C&O Canal Towpath National Historic Park, the National Road, and the Downtown Cumberland Historic district, the River Park at Canal Place is strategically positioned to draw from the rich historical tapestry of the region, offering visitors a distinctive and educational experience. The project's adjacency to key attractions, including the Great Allegheny Passage (GAP) Trail, Chesapeake and Ohio Canal Trail, Knobley Tunnel, Western Maryland Scenic Railroad, Canal Place businesses and event space, and the historic canal, creates a compelling foundation for recreational and tourism development.

c. Innovative River Features

The proposed river park which includes concrete and boulder features to create a unique manmade structure that offers a distinctive recreational experience that attracts a broad spectrum of users from novices to advanced enthusiasts. Proposed trails that connect to the surrounding trail system and the City of Cumberland that bring observers right next to the water feature drops action or allow passive seating areas on nearby hillsides provide ample interaction points further tying the city back to the Potomac River.

d. Trail Network Integration

The comprehensive trail network provides opportunities for exploration, connecting to existing trails like the Towpath and GAP Trail and introducing users to unique features such as the river park area, Knobley Tunnel, and railroad trestle. The trail networks will create a series of loops of varying length for users to create their own trail network that best fits their timeframe for a quick or longer ride, while enjoying different views for the extent of their ride back to their starting point.

e. Adaptive Reuse of Dam
Turning the dam obstruction into a recreational opportunity exemplifies adaptive reuse. Although removed, the river park water feature drops will continue to play a crucial role in the success of the Canal Re-watering Project by maintaining the water intake volume and depth necessary for the canal. Additionally, the integration of fish passage routes through the water feature drops will grant various fish species access upstream for the first time since the dam's construction in the 1950s.

2. Constraints

a. Sediment Contamination
Historical studies indicate sediment contamination, specifically dioxins, behind the dam, necessitating careful consideration and involvement of regulatory authorities like Maryland Department of the Environment (MDE).

b. Infrastructure Adaptation
The proposed changes to the dam and adjacent areas necessitate careful planning to ensure the integration of new and existing infrastructure, including existing Combined Sewer Overflows (CSO), proposed extension and capacity of CSO to the North Branch of the Potomac River, and other potential interactions that may come from project construction.

c. Site Morphology
The elevation changes and natural morphology of the site need to be considered in the design process to ensure the safety and accessibility of the proposed features including the connection to upland and riverside ADA accessibility options and trail designs.

d. Regulatory Approvals
The project requires compliance with various regulatory requirements, including permits, zoning regulations, and legal considerations, which may pose challenges in terms of timelines and a lengthy approval process for construction.

e. Historic Preservation
Balancing the need for progress with the preservation of historic sites and structures requires a nuanced approach to ensure the cultural integrity of the region is maintained or accentuated.

f. Public Safety
The inclusion of in-water features, particularly river park features, necessitates careful design to ensure public safety, especially for users with varying skill levels.

C. Hydrology

The availability and timing of flow is one of the most important factors in the performance and function of a river park, and a key factor in design. The North Branch of the Potomac River in Cumberland is a relatively large river with discharges that vary dramatically throughout the year. The character of the park will change with various flows, but generally there is adequate flow to provide for quality river recreation features throughout the year. Many popular river parks have similar flow regimes, designed to function down to 300 cubic feet per second (cfs) or even less. These same features can be designed to also function well at higher flows with increased performance for advanced paddlers and surfers.

River discharge data was downloaded from the publicly available USGS gage station 01603000, North Branch Potomac River Near Cumberland MD, located near the Canal Parkway bridge a little over 2 miles downstream of the project site. At the downstream end of the project area is the confluence with Wills Creek, which contributes significant flow to the river. Discharge data from Wills Creek was downloaded from USGS gage station 01601500. To estimate the flow in the North Branch Potomac upstream of the confluence, flow data from Wills Creek was subtracted from the North Branch Potomac gage data to create a time series of flow data for the North Branch Potomac upstream of Wills Creek.

For the purposes of this study, REP analyzed the average daily discharge for 30 full calendar years, 1993 through 2022 (Figure C-1). This provides a relatively large sample of data from the modern watershed. Older discharge data may not accurately reflect current watershed dynamics due to development, increase in impervious surface area, and other factors.

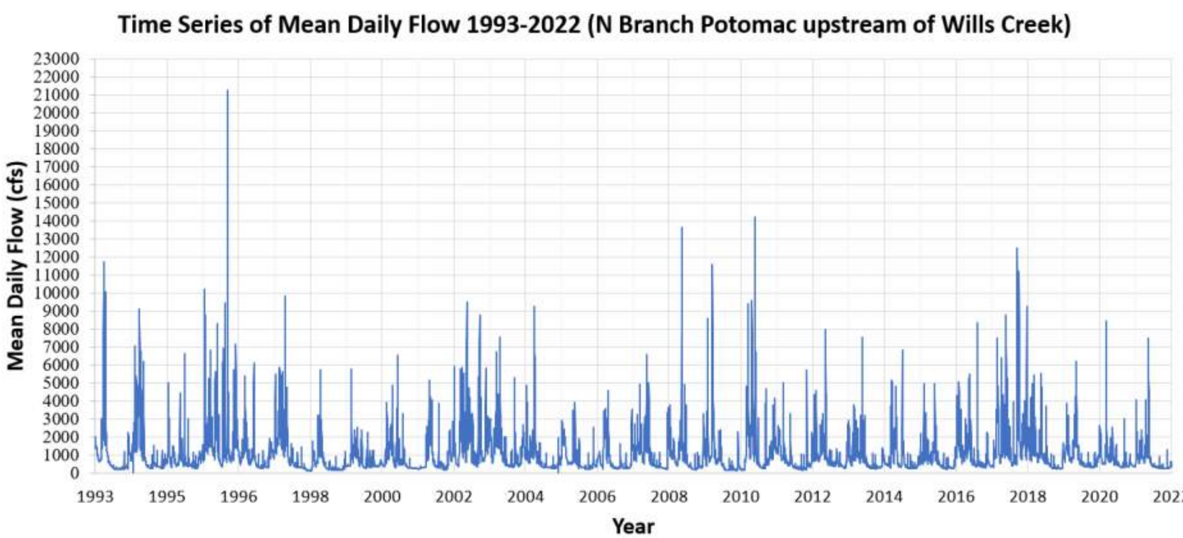

Fig. C-1: *Mean daily flow time series for the 30 calendar years analyzed (1993-2022) for the North Branch Potomac upstream of Wills Creek. The river typically flows between 300 and 3,000 cfs, though high flow events have occurred ranging from over 10,000 cfs to over 20,000 cfs.*

Flows in the river can vary dramatically from year to year, depending on precipitation and snowmelt. Generally, flows are higher in the winter and spring months (January –

May) and lower in the summer and fall (July – October). However, high flows can occur at any time of the year as evidenced by the highest flow recorded on September 7, 1996. On that date, the flow peaked at 21,230 cfs, the highest flow calculated for the North Branch of the Potomac upstream of the confluence with Wills Creek.

Exceedance probabilities offer a valuable method for determining typical flows and were computed for every calendar month. The 75% exceedance probability (lower quartile flow) represents the flow that surpasses 75% of the recorded daily flows in that month. Similarly, the 50% exceedance probability (median flow) is the flow eclipsed by 50% of the recorded daily flows, while the 25% exceedance probability (upper quartile flow) denotes the flow exceeded by 25% of the recorded daily flows in that month.

The accompanying plot (Figure C-2) illustrates these flows for each month, connecting the median flow with a blue line and shading the area between the upper and lower quartile flows in light blue. This shaded region encapsulates the middle 50% of recorded flows for each month, offering a reliable indicator of the typical flow range anticipated throughout the year.

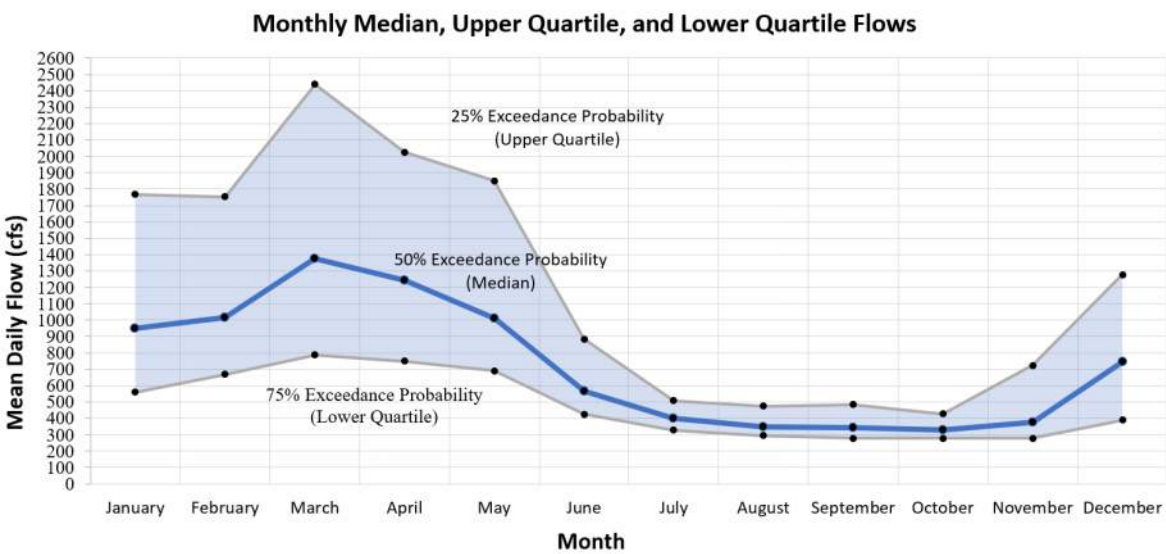

Fig. C-2: *Monthly median, upper quartile, and lower quartile daily flows calculated for each month of the year based on mean daily flow data from 1993-2022, based on the calculated flows in the North Branch Potomac River upstream of the confluence with Wills Creek.*

The median flows for February through May are all above 1,000 cfs, while the median flows for July through November are all below 400 cfs. A table summarizing the monthly statistics developed is shown on the following page. The month where the minimum daily flow was recorded is January (20 cfs), although this month has also recorded high flows up to 10,200 cfs. This demonstrates the annual variability in flows depending on the storm cycles that move through the watershed.

Table 1. Monthly statistics calculated from mean daily flow data from 1993-2022 for the North Branch Potomac River upstream of the confluence with Wills Creek

Month	Exceedance Probability			Minimum	Maximum
	50% (Median)	25% (Upper Quartile)	75% (Lower Quartile)		
January	951	1768	560	20	10200
February	1016	1755	668	187	7510
March	1378	2440	789	283	11610
April	1245	2025	749	383	11750
May	1012	1851	691	324	14190
June	565	884	424	237	6850
July	398	507	329	173	8377
August	350	475	295	175	9464
September	345	485	279	161	21230
October	331	428	278	172	5740
November	376	723	279	50	5810
December	746	1278	390	140	9260

Numerous established river parks with comparable flow patterns have achieved success. Leveraging the expected flow conditions, the proposed enhancements for river recreation can be tailored to perform effectively throughout a significant portion of the average year. In the winter and spring, characterized by higher flows, the project can be configured to offer accessible features suitable for everyone from beginners to advanced paddlers. As the flow decreases in the summer and early fall, the river features may be less enticing for advanced users, but the same structures can be designed to accommodate tubing, boat passage, and novice water-based activities. Riverside recreation, encompassing activities such as fishing, strolling, picnicking, biking, splashing, and wading, will be available year-round. The project is intended to facilitate fish passage at all expected flows while creating a habitat for aquatic species.

D. Floodplain Feasibility Analysis

The analysis found that the proposed improvements for the river park are feasible from a floodplain impact perspective at the 30% design stage. Preliminary hydraulic evaluations indicate that structures and dam modifications can likely be placed within the project area without causing adverse impacts to the floodplains of the North Branch Potomac River and Wills Creek. The need for careful design to comply with regulatory requirements is prudent as the project lies within a USACE Flood Risk Management area. While the current analysis provides essential guidance for design development, additional, more detailed studies—such as a no-rise certification and hydraulic analysis—will be required in future design phases to meet permitting and compliance standards. See Appendix B for the full Floodplain Feasibility Analysis report.

E. Dam Structural Analysis

Based on a review of the available record drawings (See Appendix C for drawings and figures), the Blue Bridge and dam were designed and built independently. The construction drawings do not indicate a positive connection between the two structures (e.g., steel dowels or other reinforcing steel configurations). Instead, the two structures were to be separated by an expansion joint (filled with ¾” pre-molded expansion joint material). A 9” wide, vertically oriented water stop was also included at the joint to minimize water infiltration through the joint.

Although it is not possible to verify that the design of the piers and abutments accounted for the location of the dam “infill” for any lateral stability without reviewing the original calculations (which are not available), given the construction means and the intentional expansion joint between the structures, it is unlikely that it was considered. In order to construct the abutments and pier as designed, it would have been necessary to have constructed these structures prior to placement of the dam concrete. As such, the design would have been considered a period of time prior to and during the construction of the dam that those structures would have been without the lateral support of the dam or the bridge superstructure.

Therefore, it is our opinion that the removal of portions of the dam will not adversely affect the performance of the bridge piers and abutments. Removal of the concrete near the interface between the structures to remain should be demolished with means that will ensure that incidental impacts will not occur (e.g., cutting rather than hammering). Given that the concrete in the dam appears to have been designed with some reinforcing steel, cutting of the concrete is the recommended approach.

Since the available record drawings are labeled to be “as built”, the discovery of connection between the dam and the pier or abutments is not anticipated. Nondestructive test methods (e.g., x-ray or ground penetrating radar) can be used prior to demolition to ensure such connections were not included. However, it is unlikely that such undocumented changes would have occurred in this case.

F. Aquatic Species

The Potomac Industrial Dam has a profound impact on historic migration corridors and spawning habitat. Dams and other manmade barriers have resulted in stream fragmentation limiting movement of resident fish and migrations of catadromous (migrate down rivers to the sea to spawn) and anadromous (migrate upstream of a river to spawn) species, including the American eel, to their historical spawning and nursery habitat. In turn, the dam likely limits the abundance and diversity of mussel species in the impounded zone behind the dam due to a lack of fish host and habitat impairments.

The Maryland Department of Natural Resources (MDNR) indicated that it has been assumed that mussels have long been extirpated or, if extant, few species remain, and they persist in very low numbers in the North Branch Potomac River (McCann, 2021).

The Potomac Industrial Dam has been identified as a high priority blockage for resident fish species and a moderate priority blockage for catadromous and anadromous species. Though there are six downstream barriers from the Potomac Industrial Dam, with one having a fish ladder and another being notched, the American eel has been documented downstream of the Potomac Industrial Dam but not upstream. According to the MDNR, the section of the North Branch Potomac River from Westernport downstream to Pinto remains cold and suitable for trout management (MDNR, n.d.). The impounded zone behind the Potomac Industrial Dam is likely impeding the trout population in this reach.

G. Construction Feasibility

In-river construction presents a set of unique challenges. Based on extensive experience designing and overseeing many similar river projects throughout the country, the design team believes the proposed project is constructable in a manner that can minimize the impact to the river. Detailed phasing and water control plans will be developed in future project phases and will change as the design progresses, but the overall approach will include:

1. Placement of temporary cofferdams to isolate work areas. The existing dam may be used temporarily as a cofferdam. Pump water to dewater the work area.

2. Allow space for river flow to pass around the isolated construction areas. Working in a single channel river such as this, the drop structures will need to be constructed in phases, with a portion constructed in the dry and then the river "flipped" with flow passing over the recently constructed portion while the rest of the structure work area is dewatered.

3. Turbidity curtains, care of water area, and other best management practices (BMPs) designed to limit excess turbidity in the river.

H. Sedimentation Analysis

The Potomac Industrial Dam has interrupted the North Branch Potomac River's natural sediment transport process resulting in sediment accumulation in the impounded zone behind the dam. Princeton Hydro estimated the impoundment to be approximately 1.9 miles long with an estimated accumulated sediment volume of 142,000 cubic yards (Wildman, 2010, reported in Van Ryswick and Sylvia 2015). The dam was constructed to supply water to local industry; however, this past industrial activity created concerns regarding the chemical and physical properties of the accumulated sediment, leading stakeholders to sample and analyze the sediment for contaminants.

As part of a feasibility study for removal of the Potomac Industrial Dam, Princeton Hydro collected three surficial sediment samples within the impounded zone behind the dam in 2009. The results of these sediment samples showed the presence of low levels of dioxin and dioxin-like compounds in surficial sediments in the impoundment. Due to the results of this study, American Rivers contracted the Maryland Geological Survey (MGS) to perform a more detailed sediment study within the impounded zone of the dam to determine the physical and chemical properties of the sediment and the areal extent and depth of dioxins and metals in the sediment (Van Ryswick and Sylvia 2015). MGS collected 10 sediment core samples, ranging from 1 to 3.4 meters deep, from the upstream impoundment area. Various depth intervals were analyzed for grain size, elemental concentration, extractable metals, and dioxins.

The following summarizes the findings of the study:

1. Upper sediments that accumulated after construction of the dam predominantly consist of gravelly sands. Fine muddy sand and mud sediments have accumulated in low energy areas close to the shore and along river left just above the dam. Gravel and cobbles increase in the deeper sediments, indicative of the pre-dam high energy streambed.

2. Total elemental concentrations in the sediments are within the ranges of other dam impoundment sediments from similar settings.

3. Toxicity characteristic leaching procedure (TCLP) analyses for extractable hazardous metals were run on the finer sediments at various intervals in the cores indicative of post-dam deposition. MGS found that the TCLP metals concentrations were either below the detection limit or well below hazardous metal threshold concentrations; therefore, MGS concluded that there were no concerns associated with TCLP metals in the sediments within the impounded zone.

4. The sediments were analyzed for a suite of dioxin compounds. Since the toxicity of individual dioxins varies by orders of magnitude but have a similar mode of action, the concentration and toxicity of individual dioxins were standardized to the most toxic dioxin, 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and presented as the Toxicity Equivalent (TEQ) dioxin concentration. Dioxins were found in all the sediment samples, with lower concentrations in coarser sand and gravelly sand sediments and higher concentrations in finer grained mud and organic sediments. Dioxin levels generally decreased in the pre-dam sediments dominated by gravelly sands and cobbles. Dioxins concentrations were generally lower farther upriver from the dam except in Core 8, which was taken in a finer sediment accumulated near the river right bank edge.

5. The TEQ dioxin concentrations in the sand and gravelly sand samples were below or just above the level of low risk to sensitive mammalian wildlife. The TEQ dioxin concentrations were highest in the very muddy sediments of Core 2 along the left bank just above the dam, where two samples contained TEQ values above the EPA level of high risk for sensitive avian wildlife.

I. Canal Water Intake Analysis

The existing canal water intake system is a necessary component of the Canal Rewatering Project. Currently, the first 0.25 miles of the proposed 1.20-mile canal reconstruction has been completed. The water intake system as constructed was designed to meet the rewatering requirements of the 1.20 miles of canal reconstruction. As the project stands as of this report, the required water for rewatering the canal is only needed as makeup water for water lost out of the canal. The capacity required for the total 1.20 miles is 8 cubic feet per second or approximately 3,600 gallons per minute.

There is an intake screen structure located in the reservoir formed by the Corps Dam at an elevation of 606.25 feet mean sea level (MSL). The water flows via gravity through a 24-inch water line into a sluice gate to the wet well of the pumping station. Two 75 HP submersible pumps move water through two 10-inch discharge pipes, below the pedestrian bridge to the canal turning basin. A float switch cluster is located near the canal in a stilling structure that controls the pumps by allowing them to come on and off at various water levels.

When the dam is removed, the water level at the existing intake location may fall below required levels. Modifications/relocations will need to be made to the intake to ensure proper water levels when the Canal Project extends to the proposed 1.20 miles. The design options are shown in the preliminary design section of this document.

J. Combined Sewer Outfall (CSO) Outlet Structure

The proposed future construction of an upgraded larger CSO structure (a part of the Canal Re-watering Project) downstream of the proposed river park has been coordinated with the design and intent of this 30% Preliminary Engineering Report, however continued coordination will be necessary as both projects mature towards construction.

K. Upland Analysis

1. Parking

Avirett Avenue – Approximately 47 shared-use parking spaces are in an asphalted and striped lot adjacent to the Apothecarium Dispensary of Cumberland and approximately seven residential houses. The parking area is not metered. The small area can access downtown Cumberland via Avirett Avenue which turns into S Johnson Street and intersects with Greene Street, a major connecting road to downtown Cumberland.

Greene Street Interstate 68 Bridge Underpass – Below the Interstate 68 Bridge (Cross Town Bridge), includes three distinct asphalt paved parking lots between S Johnson Street and Bridge Street Intersections. Parking areas nearest to the S Johnson Street intersection and Bridge Street intersection are shared use parking for businesses on both sides of Greene Street. The middle parking lot is a metered public parking lot (Parking Lot #3) and is the designated parking lot for the National Road Monument and George Washington Headquarters.

South Mechanic Street – Two asphalt public parking lots with striping serve the public. One adjacent to the Western Maryland Scenic Railroad Station/ and Canal Place and one below the Interstate 68 bridge at the intersection of Howard Street and South Mechanic Street. Both parking lots serve as overnight/long-term parking for users of the GAP and C&O Trail systems as well as parking for the Shops at Canal Place and Canal

Place Festival Grounds. It also serves as additional parking for the Historic city center and greater downtown area.

Route 28 (Veterans Memorial Highway), WV- Blocker Street Utility Road
At the end of Blocker Street located near the railroad trestle serves as an existing access point.

Route 28 (Veterans Memorial Highway), WV – A gravel overflow area serves as additional overflow parking directly across from a small business plaza currently housing Chef Paul’s Kitchen & Catering, My Place, and J&B’s Quick Stop Drive Thru. Adjacent to the overflow parking area is a car dealership, Nelson Auto Sales. The gravel lot can hold approximately 20-25 vehicles.

2. River Access

There are multiple launch ramps for boating along the North Branch of the Potomac River upstream and downstream from the industrial dam. Unfortunately, the inability to pass through Cumberland’s industrial dam has been a stumbling block for long distance river trails. With the removal of the industrial dam, a user could now paddle from Jennings Randolph Lake near Westernport, Maryland 147 miles to Sharpsburg, Maryland. Providing an expanded user group to lodge and board in Cumberland as they make their excursion down the Potomac River Water Trail.

Regional Water Access:

Allegany County Fairgrounds Boat Ramp (Existing)
Location: Lat: 39.607549 Long: -78.803939
Miles to downstream launch/take-out point: 2.70 miles
↓
Upper Potomac Industrial Park Boat Launch (Existing)
Location: Lat: 39.634237 Long; -78.797227
Miles to downstream launch/take-out point: 2.15 miles
↓
River Park Launch (Proposed)
Location: Lat: 39.647570 Long: -78.768506
Miles to downstream launch/take-out point: 0.30 miles
↓
River Park Take-out (Proposed)
Location: Lat: 39.648074 Long: -78.764786
Miles to downstream launch/take-out point: 0.20 miles
↓
Canal Place Stage Launch (Proposed)
Location: Lat: 39.645972 Long: -78.764318
Miles to downstream launch/take-out point: 2.72 miles
↓

Mason recreation Boat Ramp (Existing)
Location: Lat: 39.619571 Long: -78.762443

3. ADA Accessibility

ADA accessibility from the railroad station to Howard Street is carefully planned for seamless inclusivity. Originating at the ADA parking lots near the GAP/C&O Trailhead Junction, a wide ADA ramp encircles the Canal Place Festival Grounds, extending to a pedestrian bridge over the canal and an overlook along the Chesapeake and Ohio Towpath. Access to Riverside Park is facilitated by an ADA ramp from the south side of the Railroad Station building, connecting to the train station platform. The platform features an ADA crosswalk for safe passage over train tracks, leading to an additional ADA ramp connected to the pedestrian bridge. This strategic design ensures uninterrupted and barrier-free access, prioritizing the diverse mobility needs of individuals from Howard Street to the railroad station and to future planning endeavors along the North Branch of the Potomac.

4. Trail Connections

The junction of the Great Allegheny Passage (GAP) Trail and Chesapeake and Ohio Canal (C&O) Towpath Trail National Historic Park in Cumberland, Maryland, serves as a pivotal point for economic development. This convergence transforms Cumberland into a thriving tourist hub, attracting outdoor enthusiasts and bikers. The city strategically provides amenities such as bike rentals, accommodations, and restaurants to cater to trail users, fostering business growth. Cumberland's historical significance is heightened as it marks the transition from the industrial C&O Canal to the scenic GAP Trail. The economic impact is evident in increased patronage for local businesses, job creation, community engagement, and infrastructure investment. Overall, the trail junction enhances Cumberland's appeal, showcasing a successful model of economic development driven by outdoor recreation and cultural exploration.

3. PRELIMINARY DESIGN IMPLEMENTATION

A. River Park Design

A whitewater park on the Arkansas River in Salida, CO. The park is utilized by a wide range of people and abilities and has been credited with driving significant economic growth.

2. **IN-WATER DESIGN -** In the proposed river recreation park's water design, the intricacies of each in-stream recreational drop structure are meticulously planned to offer a dynamic and engaging experience for a broad spectrum of users. The natural stone boulders, with a minimum diameter of 3 feet, are strategically arranged and anchored to the riverbed where necessary, ensuring stability during varying flow rates. The variability in dry drop (1.5 to 3 feet) caters to users of different skill levels, making the park accessible to both beginners and advanced enthusiasts. The upstream-most drop structure, designed to mirror the water surface elevation of the existing dam,

A beginner kayaker descends a recreational drop structure in San Marcos, Texas designed by REP. These structures perform together with, and are anchored to a defunct mill dam, a common site scenario and opportunity for river recreation.

A casual river surf scene at a dam modification project in Dayton, Ohio. This surf structure shown is anchored directly to a defunct low-head dam.

serves as a key element in maintaining consistency and preserving the impoundment created by the Industrial Dam. The incorporation of fish passage channels at each drop structure demonstrates a commitment to ecological considerations. The un-grouted natural stone channels, specifically designed for low-flow conditions, aim to facilitate the movement of target fish species across the park. The pools between the drop structures not only provide a visually appealing cascade effect but also ensure a well-thought-out recovery time, contributing to the safety and enjoyment of users. The stone bank terracing further enhances the aesthetics of the water design, creating areas of focus for spectators and users alike.

Stone terracing and river access at a dam modification project in Calgary, Alberta.

3. **Riverside Design -** The riverside design of the park intricately weaves together accessibility, safety, and environmental sensitivity. The ADA accessible trails, constructed with durable riverside concrete, offer users the opportunity to traverse the length of the project seamlessly. The deliberate positioning of the trails close to the river's edge provides not only scenic views but also enhances user experience, allowing them to feel connected to the water throughout their journey. Trail underpasses at the existing "Blue Bridge" roadway bridge ensure a continuous and uninterrupted path for users.

The flood-resistant design of the trails acknowledges the dynamic nature of the river, accommodating potential inundation during high flows. Multiple ADA accessible river access points, strategically placed upstream and downstream, serve as pivotal entry and exit points for various water activities, fostering a sense of convenience and inclusivity. Stone river access steps, seamlessly integrated into the stone bank terracing, add an aesthetic touch while providing functional access to the water's edge. The emphasis on preserving existing infrastructure not only ensures continuity with the surrounding environment but also minimizes the project's ecological footprint. This comprehensive riverside design is a testament to the project's commitment to creating a harmonious and sustainable river recreation park.

B. Upland Design

All the site areas outside of the immediate water course are included in the upland design. Proposed structure and design elements including parking facilities, trail heads, trails, seating areas, viewing areas, historical features, fishing access and connections to existing infrastructure are a part of this section.

3. **<u>Loop Trail System -</u>** Expanding on the achievements of the C&O Canal and the Great Allegheny Passage Trail Systems, the proposed upland trail network aims to establish connections with national, regional, and local trail systems. Nationally, it integrates with the C&O and Great Allegheny Passage trail systems, while regionally, it connects to Carpendale, WV, the presently closed Knobley Tunnel, and potential future rails to trails connections. At the local level, the 1.9-mile Maryland loop trail offers wetland paths and fishing access points along the river. The system includes larger loop trails with smaller loops, providing diverse experiences and scenic views. This integrated trail system is designed to facilitate the reconnection of cities with their waterfronts, a prospect not realized for generations. See Appendix D for overview map of trails.

4. <u>Parking -</u> There are four proposed parking facilities providing river and trail access. They are integrated into the city's fabric and are multi-use facilities.

<u>Greene Street Interstate 68 Bridge Underpass</u> – Below the Interstate 68 Bridge (Cross Town Bridge), includes three distinct asphalt paved parking lots between S Johnson Street and Bridge Street Intersections. Parking areas nearest to the S Johnson Street intersection and Bridge Street intersection are shared use parking for businesses on both sides of Greene Street. The middle parking lot is a metered public parking lot (Parking Lot #3) and is the designated parking lot for the National Road Monument and George Washington Headquarters.

<u>South Mechanic Street</u> – Two asphalt public parking lots with striping serve the public. One adjacent to the Western Maryland Railway Station/ and Canal Place and one below the Interstate 68 bridge at the intersection of Howard Street and South Mechanic Street. Both parking lots serve as overnight/long-term parking for users of the GAP and C&O Trail systems as well as parking for the Shops at Canal Place and Canal Place Festival Grounds. It also serves as additional parking for the Historic city center and greater downtown area.

<u>Blocker Street</u> – The existing use of this connection to the levee is for utility and emergency access. Located on the Ridgeley, WV side of the river, this existing access point could be expanded and developed into a 7-space trail head providing parking, ADA accessibility to the river, and maintaining its existing use as a utility and emergency access corridor

<u>WV-28 Shared use river access point</u> - This existing gravel lot off WV-28 along the levee in Ridgeley, WV can provide river access to boaters and ADA access to hikers and fishermen.

5. River Left North Branch of Potomac River Design Features

River Park Launch Trailhead - Includes the Avirett Avenue parking facility, trail linkages and boater access to the river park launch area. This trail head provides access to the top of the levee trail, the river side trail, and the boat launch area.

Top of the Levee Trail - This trail follows the existing levee creating a strong connection along the entire length of the river park linking the launch area and the takeout area with multiple access points into the city and down to the riverfront. The trail offers outstanding views of the river, city, and surrounding countryside. In addition, the trail is almost entirely ADA compliant.

Riverside Trail - The riverside trail system provides direct access to the riverfront linking the beach, viewing, and seating areas along the riverfront. There are three access points down to the riverfront, however the middle access point allows for ADA accessibility to the riverfront.

Connections to Existing Pedestrian Systems - Where the top of the levee trail crosses the blue bridge, there is a proposed crosswalk providing a strong sidewalk connection into the city.

Blue Bridge Underpass - As the riverside trail passes under the blue bridge, an outstanding environment is created. Focused on the largest drop in the water park and bringing the trail close to the rushing water, letting bystanders experience the sound and feel the rushing water in close connection to river enthusiasts.

Terraced Rock Seating Area - Located in a natural bowl focused on the last two water feature drops in the water park, this feature provides the ideal viewing area of the park.

River Park Take Out Area - The takeout is located at the end of the river park, providing a calm area to take out. It also provides access along the levee wall to the top of the levee trail, providing direct access to the launch area and connections into town via the pedestrian bridge to Canal Place or road connections via Greene Street.

Proposed Observation Platform and Stairway - The proposed viewing platform will be located on an existing foundation structure and will provide panoramic views of the river, city and countryside while the stairway will also provide access to the riverfront.

Proposed ADA Ramp for River Access - Located adjacent to the existing observation platform this ramp will provide water access.

Waterfront Trail - The waterfront trail provides ADA access to beaches, hiking, and fishing opportunities along the calmer portion of the river.

Creating Fishing Opportunities Around River Deflectors - Along the waterfront trail access, fishing areas are created in and around the diversion structures, providing great eddies and low current for fish to congregate as they move up and downstream.

Connection to the Maryland Loop Trail - This 1.9-mile trail explores wetlands and river environments down river and be able to loop back to the beginning of the trail.

6. River Right North Branch of Potomac River Design Features

Proposed expansion of the waterfront trail upriver to Carpendale, WV, includes a trail connection in Ridgeley, WV at the Blue Bridge. This involves establishing a crosswalk and sidewalk connections to link the town with the riverfront. Specific features of the plan include:

Blue Bridge Underpass on WV Side - Details regarding the underpass at the Blue Bridge on the West Virginia side.

Trestle Bridge Underpass - The walkway provides trail users with access to the upstream and downstream of the river park without the interaction of pedestrians and the active railroad line. Occasionally, a user may be fortunate enough to be below the trestle when a train rumbles across overhead.

Emergency Access ADA Parking and Access - A secondary location for users to park and access the riverfront trails from WV-28 and used for emergency access as needed.

Boat Launch Access on WV-28 - The inclusion of a boat launch access point from WV-28 will provide water enthusiasts to access the calmer portions of the river and allow a gentle ½ day float trip to the Mason Recreation Boat Ramp.

Waterfront Trail - The main waterfront trail facilitates activities such as viewing, hiking, fishing, and access to beaches along the waterfront.

Connection to Trestle Loop Trail Downriver - Establishing a connection to the Trestle Loop Trail downstream.

C. Water Intake Design Options

The following options to be examined prior to the dam's removal:

1. A slip stream constructed on the side of the river below trail surface to provide necessary depth to cover the intake screen.

2. Intake screen to be relocated upstream before the first water feature drop, anchored into the designs of the feature's wingwalls.

3. Water intake location to remain in place, but installation of a smaller pipeline within the 24-inch pipeline to be pumped rather than gravity fed.

D. Sediment Dredging/Passive Release Design Options

1. **Sediment Dredging Option -** Following permit approvals, the first step of project implementation will be to mobilize equipment for the installation of MDE-approved erosion and sediment control measures and best management practices. Existing high value natural resources located in the work area will be demarcated to avoid unanticipated disturbances. Given the setting of the Bank, multiple ingress and egress locations exist that could be utilized to mobilize equipment. A mobile dredger will be brought in to begin the process of excavating deposited sediment from the reservoir behind the dam to prevent the release of contaminated sediment to the downstream channel. The removal of accumulated sediment will be planned and executed with approaches that will mitigate deleterious effects on aquatic life. The dredging program including the type of dredge, rating of pumps, location, and depth from which the sediment is to be removed, will need to be determined. It is anticipated that the dredging activity will generate approximately 142,000 cubic yards of waste requiring disposal. The disposal of the dredged material will be conducted in compliance with federal, state, and local government laws and regulations.

2. **Passive Sediment Release Option -** To avoid undue harm during dam removal, deconstruction will be undertaken in careful steps to not only avoid downstream degradation but also to maintain public safety and the structural integrity of the Blue Bridge, which is co-located with the dam. Though it has been determined that the bridge and dam are not structurally connected, the decommissioning will be completed in coordination with the State Highways Administration.

The project will involve dam removal to allow certain structures to remain in place, without reservoir impoundment or hazards to the Blue Bridge or recreational boaters. The dam will be removed as stated in the design section of this document, while leaving the center pier for the bridge in place. The pier will be stabilized, along with the streambed within the footprint of the former dam, to provide a suitable hydraulic section for velocity control and fish passage.

Removing the dam will generate short-term, temporary geomorphic disturbances during the passive release of the remaining sediments from the impoundment. Shifts in patterns of sediment movement can be a prominent ecological response to dam removal and these changes in transport control the process of channel evolution, which can also have important consequences for biogeochemical cycling. Additional modeling will need to be completed to determine the channel evolution and associated rates of sediment delivery.

WLS reviewed the Bloede Dam Biogeochemical Impacts Analysis Report (Boynton, et. al., 2014), which assessed phosphorus inputs to the ecosystem associated with sediment release from removal of the Bloede Dam. This analysis assessed how particulate phosphorus would interact with the estuarine segments of the Patapsco River, with the most basic distinction being between inputs of total particulate phosphorus and inputs of particulate phosphorus forms that could be converted into forms that could grow algae. The analysis concluded that there would be a reasonable expectation that release of sediment from the Bloede Dam could result in 1) the deposition of inorganic phosphorus in sediments of the tidal Patapsco River and that 2) under saline, and especially low oxygen conditions, a portion of that phosphorus could become bio-available for the growth of algae (Boynton, et. al., 2014). However, it is important to note that these release rates were related to the area of deposition; if the area of deposition of fine-grained material were spread out over the whole tidal Patapsco, then the releases would be aerially moderate. Ultimately the study concluded that a significant phosphorus release was not anticipated. Based on this study and the anticipated removal of sediment from the impounded zone behind the dam, WLS would anticipate the same discountable phosphorus release associated with the Potomac Industrial Dam.

Low-head dams not only affect the downstream sediment supply and biogeochemical cycling processes, but they also have potential implications associated with flooding. These effects associated with the removal of a low-head dam can include both direct effects associated with changes in riverine hydrology and indirect effects related to potential changes in river morphology. The Potomac Industrial Dam does not provide a flood control function and the deleterious effects of its removal on flooding will likely be minimal. The accumulated sediment in the impounded zone decreases the reservoirs' ability to store floodwater and its removal is anticipated to result in reduced flood elevations upstream due to the loss of backwater effects. Indirect effects of low-head dam removal are generally associated with changes in river morphology, which could result in increased flood elevations associated with a sediment release that exceeds the channel's conveyance capacity.

4. CONCLUSION & NEXT PHASES

Based on the assessment described in this report, a river recreation park at the site of the Industrial Dam is feasible from a technical perspective as shown in the 30% Floodplain Feasibility Analysis Report.

To progress into the detailed design phase, additional data will need to be collected including additional topographic and bathymetric survey, water level logger installation and data analysis, and a sediment assessment. It is recommended that this additional data collection is scheduled in late summer / fall 2024 while flows in the river are low.

Below is a summary of the next technical steps required to bring the design through 60% design and regulatory permit application submittals:

1. Topographical Survey - Additional surveying including a detailed bathymetric survey will be necessary beyond what has been collected to date.

2. Water Level Loggers - Installation of water level loggers at multiple locations in the project vicinity to record water surface elevations. It is important that this task occurs during low flows prior to the next high flow season, as the water surface elevation data collected is needed for the full range of flows from low to high. This data is used for calibration of the design hydraulic model and needs to be collected prior to detailed design hydraulic modeling.

3. Sediment Assessment - An assessment of the impounded sediment upstream of the dam will be necessary to advance the design. The sediment assessment would entail rod probing to refusal throughout the sediment assessment area to estimate sediment depths, sediment type, and underlying material characteristics. Sediment sampling for contaminants can occur during the same investigation.

4. 60% Design Plans - Advance the preliminary design plans to 60%. The 60% plans will include sufficient detail to be used for permit applications. The plans will include detailed cross sections and profiles, materials, construction access / dewatering details, etc. Development of the 60% design plans will run concurrently with hydraulic modeling tasks, stakeholder meetings, etc. Upon completion of the 60% design plans, the consultant is to provide an updated opinion of probable cost estimate for the project.

5. Floodplain Impact Hydraulic Modeling - Floodplain hydraulic analysis of project elements in the 60% design, building upon the floodplain feasibility analysis. Develop a floodplain impact report detailing the hydraulic analysis performed, and any floodplain impacts as a result of the proposed project. If the proposed design meets the requirements for no-rise certification, one will be provided. It will be necessary to develop proposed conditions hydraulic model and analyze the 1% annual exceedance probability discharge (100-yr flood) water surface elevations for existing and proposed conditions, and associated change. The design team will make grading changes or geometry modifications if there are adverse impacts to the floodplain due to the proposed improvements. The goal is to design the project to meet no-rise requirements, and it is anticipated that several design iterations will be required.

6. Flood Control Impact Hydraulic Modeling - The HEC-RAS model will be used to determine if there will be any effects on the adjacent USACE Flood Control Project. The design team will make grading changes or geometry modifications if there are adverse flood control impacts due to the proposed improvements. Close coordination with USACE will be necessary. The model results will be used for USACE Section 408 permitting.

7. Design Hydraulic Modeling - Advance the hydraulic model to be used for design support purposes. Analyze hydraulics and various design geometries to optimize the design for design flows. The design process will include iterations using the hydraulic model and the developed design surfaces to optimize the recreational channel features at all anticipated flows, inform material selection and embedment depths, etc. Water surface elevation data for a range of flows from low to high will need to be collected from the installed water level loggers prior to this task.

8. Permitting Agency Engagement, Coordination, and Meetings - The client and design team will need to engage with the various required regulatory agencies and meet with representatives throughout the 60% design process in order to work toward completing permit applications and supporting information. Anticipated required regulatory agencies include but are not limited to:
   - City of Cumberland, MD
   - City of Ridgeley, WV
   - United States Army Corps of Engineers
   - National Park Service
   - Maryland Department of the Environment
   - United States Wildlife and Fisheries
   - Maryland Department of Transportation State Highway Administration (MDOT SHA)
   - Maryland Historical Trust

9. Permit Applications - Preparation and submittal of necessary major permit applications to the various regulatory entities governing the work involved in this project. Necessary information includes quantities, areas of impact, design plans, required hydraulic modeling reports, etc.

10. Additional Work Items: Further phases of work include additional regulatory permitting effort required after initial application submittals, final design, bid documents development, the bid phase, and the construction phase.

5. COST ESTIMATE

Conceptual Level Preliminary Estimate of Probable Costs 12-Jan-24						
On-Grade Trail - Concrete Surface						
DESCRIPTION	**QTY**	**UNIT**	**UNIT PRICE**			**COST**
Trail A - 0.6 Miles (MD Side)	2800	SY	$150	$/	SY	$420,000
Ramp 1 (Near Overlook)	400	SY	$150	$/	SY	$60,000
Ramp 1 Landscape Wall	2100	SF	$125	$/	SF	$262,500
Ramp 2 (Near Dam)	260	SY	$150	$/	SY	$39,000
Ramp 2 Landscape Wall	1330	SF	$125	$/	SF	$166,250
Railing	160	LF	$125	$/	LF	$20,000
Steps	20	SY	$200	$/	SY	$4,000
Path From Pedestrian Bridge to Overlook	110	SY	$150	$/	SY	$16,500
Small Pedestrian Bridge	1	LS	$65,000	$/	LS	$65,000
					SUBTOTAL	*$1,053,250*
Event Terrace Area						
DESCRIPTION	**QTY**	**UNIT**	**UNIT PRICE**			**COST**
Concrete Sidewalk	3100	SY	$150	$/	SY	$465,000
Unclassified Excavation	1	LS	$150,000	$/	LS	$150,000
					SUBTOTAL	*$615,000*
Parking Lot						
DESCRIPTION	**QTY**	**UNIT**	**UNIT PRICE**			**COST**
Asphalt Surface	3900	SY	$60	$/	SY	$234,000
Concrete Sidewalk	320	SY	$150	$/	SY	$48,000
Concrete Curbing	500	LF	$75	$/	LF	$37,500
Storm System	1	LS	$180,000	$/	LS	$180,000
					SUBTOTAL	*$319,500*
Dam Modification, River Structures & River Access						
DESCRIPTION	**QTY**	**UNIT**	**UNIT PRICE**			**COST**
Water Control & Dewatering	1	LS	$800,000	$/	LS	$800,000
Dam Structure Demo & Removal	1800	CY	$200	$/	CY	$360,000
Embankment (Fill) for River Structures and Pools	42000	CY	$30	$/	CY	$1,260,000
Steel Sheet Pile	32000	SF	$90	$/	SF	$2,880,000
Structural Concrete Slabs at River Structures	400	CY	$380	$/	CY	$152,000
Structural Concrete Walls at River Structures	150	CY	$380	$/	CY	$57,000
Grouted Boulders at River Structures	6500	CY	$320	$/	CY	$2,080,000
Grouted Boulder Bank Terracing & Toe Boulders	5900	CY	$320	$/	CY	$1,888,000
Grouted Boulder Current Deflectors	450	CY	$320	$/	CY	$144,000
Ungrouted Riprap (6") Bedding Under Structures	6700	CY	$120	$/	CY	$804,000
Ungrouted Riprap (18") Scour Protection	6300	CY	$150	$/	CY	$945,000
River Boulders	42	EA	$1,600	$/	EA	$67,200

Access Steps	80	SY	$1,000	$/	SY	$80,000
Miscellaneous Equipment Hours	300	HR	$300	$/	HR	$90,000
Mobilization/Demobilization	1	LS	$400,000	$/	LS	$400,000
					SUBTOTAL	*$12,007,200*
Riverside Trails & ADA Access Paths						
DESCRIPTION	**QTY**	**UNIT**	**UNIT PRICE**			**COST**
Riprap Removal	2100	CY	$80	$/	CY	$168,000
Trail Grading	2200	CY	$30	$/	CY	$66,000
6" Reinforced Concrete Paths	4500	SY	$150	$/	SY	$675,000
Trail Subgrade	1500	CY	$120	$/	CY	$180,000
Ungrouted Boulder Terracing (Upland)	1200	CY	$250	$/	CY	$300,000
					SUBTOTAL	*$1,389,000*
On-Grade Trail - (West Virginia Side)						
DESCRIPTION	**QTY**	**UNIT**	**UNIT PRICE**			**COST**
Trail B - 0.6 Miles (WV Side Lower, Conc.)	2000	SY	$150	$/	SY	$300,000
Trail C - 1.4 Miles (WV Side Upper, Asphalt)	6700	SY	$60	$/	SY	$402,000
					SUBTOTAL	*$702,000*
Miscellaneous Items						
DESCRIPTION	**QTY**	**UNIT**	**UNIT PRICE**			**COST**
Beach Put Ins / Take Outs	4	EA	$35,000	$/	EA	$140,000
Overlooks C&O Trail	300	SY	$150	$/	SY	$45,000
Signal Adjustment	1	LS	$300,000	$/	LS	$300,000
Relocation of George Washington's Headquarters	1	LS	$100,000	$/	LS	$100,000
Sidewalk Demolition	350	SY	$40	$/	SY	$14,000
Grading (Overexcavation of On-Grade Trails)	12000	CY	$30	$/	CY	$360,000
Box Culvert (10' x 4')	300	LF	$2,000	$/	LF	$600,000
Water Intake Modification	1	EA	$1,000,000	$/	EA	$1,000,000
Contaminated Sediment Removal/Disposal	1	EA	$1,250,000	$/	EA	$1,250,000
					SUBTOTAL	*$3,809,000*
					TOTAL	$19,894,950
					CONTINGENCY 25%	$4,973,738
					Engineering Design, Permitting & Construction Inspection	$3,581,091
					PRELIMINARY GRAND TOTAL	**$28,449,779**
					SAY	**$28,500,000**

NOTES

1. Estimates are for planning/budgetary purposes only. Budgets must be updated at each major milestone of the design phases of the project.
2. This is a planning-level construction cost estimate based on a conceptual plan dated 12/18/2023. No detailed design plans have been created at this time.

Appendix A

River Park Visitor Profile and Tourism Economic Impact Study
West Virginia University Research Corporation

River Park Visitor Profile and Tourism Economic Impact Study

Prepared by:

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02/02/2024

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EXECUTIVE SUMMARY

This visitor profile and economic impact study for the River Park was conducted via the online survey platform--Prolific with a total of 4,877 participants from eight targeted states, namely Kentucky (KY), Maryland (MD), New York (NY), Ohio (OH), Pennsylvania (PA), Virginia (VA), Washington DC, and West Virginia (WV). These participants took part in the initial survey. Subsequently, 382 respondents who reported having visited Cumberland, MD in the previous 12 months were selected to participate in a comprehensive follow-up survey. This two-tiered approach ensured a broad yet detailed understanding of visitor demographics, behaviors, and the economic contributions stemming from visits to the area, specifically in relation to the River Park.

The primary objective of this study is to assess the projected increase in visits and the corresponding economic effects resulting from the proposed development of the River Park. The analysis estimates that the construction of the park is likely to boost visits by 1,053,053 (with a 70% probability), generating a direct economic impact of $219,931,773, supporting 2,412 jobs. Furthermore, the overall economic impact is anticipated to reach $307,335,643, supporting 2,901 jobs. This underscores the significant potential of the River Park to drive economic growth and job creation in the area, highlighting its value not just as a recreational asset but also as a catalyst for local economic development. The study also estimated the total number of visits to Cumberland and to Allegany County as a whole in the past 12 months, which are 988,095 and 1,294,109, respectively.

In terms of visitor profiles, the study found that four states—Maryland, Pennsylvania, New York, and Virginia—combined accounted for the majority of the respondents (78.9%), with Maryland contributing the largest portion of the sample at 22.7%, followed by Pennsylvania (21.3%), New York (18.8%), and Virginia (16.1%). Summer is the season most respondents reported visiting the city, with 56.9% of responses, followed by spring at 39.7% and fall at 28.7%, while winter was reported as the least visited season, at 22.3%. Rocky Gap State Park was the most popular attraction in the area. Nearly half (47.6%) of respondents reported having visited the park.

The average number of visits in the previous 12 months is 2.28 times, and the average group size is 3.2. In addition, over two-thirds of respondents reported staying overnight during their most recent trip to the city (67.9%), while 32.1% of respondents were day-trippers. The average number of nights stayed is 3.5.

Nearly 90% of respondents will speak positively about the city, 85% will recommend the city to family and others, and 80% intend to revisit within the following 12 months. When asked about the likelihood of recommending the proposed River Park to others, the average likelihood is 76.5%.

1. Introduction

The World Tourism Organization estimates that international tourism arrivals reached 1.4 billion in 2018 with total tourism receipts being $US 1.7 trillion for the same year (WTO, 2019). Ceballos-Lascurain cites a WTO estimate that nature-based tourism generates 7% of international tourism expenditure (Lindberg et al., 1997). A study undertaken for the World Resources Institute found that this type of tourism is increasing at an annual rate of between 10% and 30% (Reingold, 1993). The term nature-based tourism is generally applied to tourism activities depending on the use of natural resources which remain in a relatively undeveloped state, including scenery, topography, waterways, vegetation, wildlife, and cultural heritage (Ceballos-Lascurain, 1996). A recent study by the Bureau of Economic Analysis of the U.S. Department of Commerce (Headwaters Economics, 2021) revealed that in 2020, outdoor recreation, even hit hard by the Covid-19 pandemic, still contributed $374 billion or 1.8% to the nation's GDP, about three times the amount of oil and gas development (Headwaters Economics, 2021). This so-called "recreation economy" has been recognized as one of USDA's top priorities in the Memorandum of Understanding (MOU) signed in 2022 by the USDA Rural Development, Forest Service, and National Institute of Food and Agriculture (NIFA).

Cumberland, MD, as one of the important nature-based tourism destinations in the Appalachian region, is well known for its natural and cultural assets. To add to its existing tourism attractions, a River Park at Canal Place was proposed to be constructed. The park includes property in both Maryland and West Virginia. It encompasses approximately 2 miles along the Potomac River, including the adjacent shorelines up to the top of the US Army Corps of Engineers (USACE) levee. This 2-mile stretch is located approximately 0.5 miles upstream of the Blue Bridge and extends 1.5 miles downstream to the Carpendale Trestle (Figure 1).

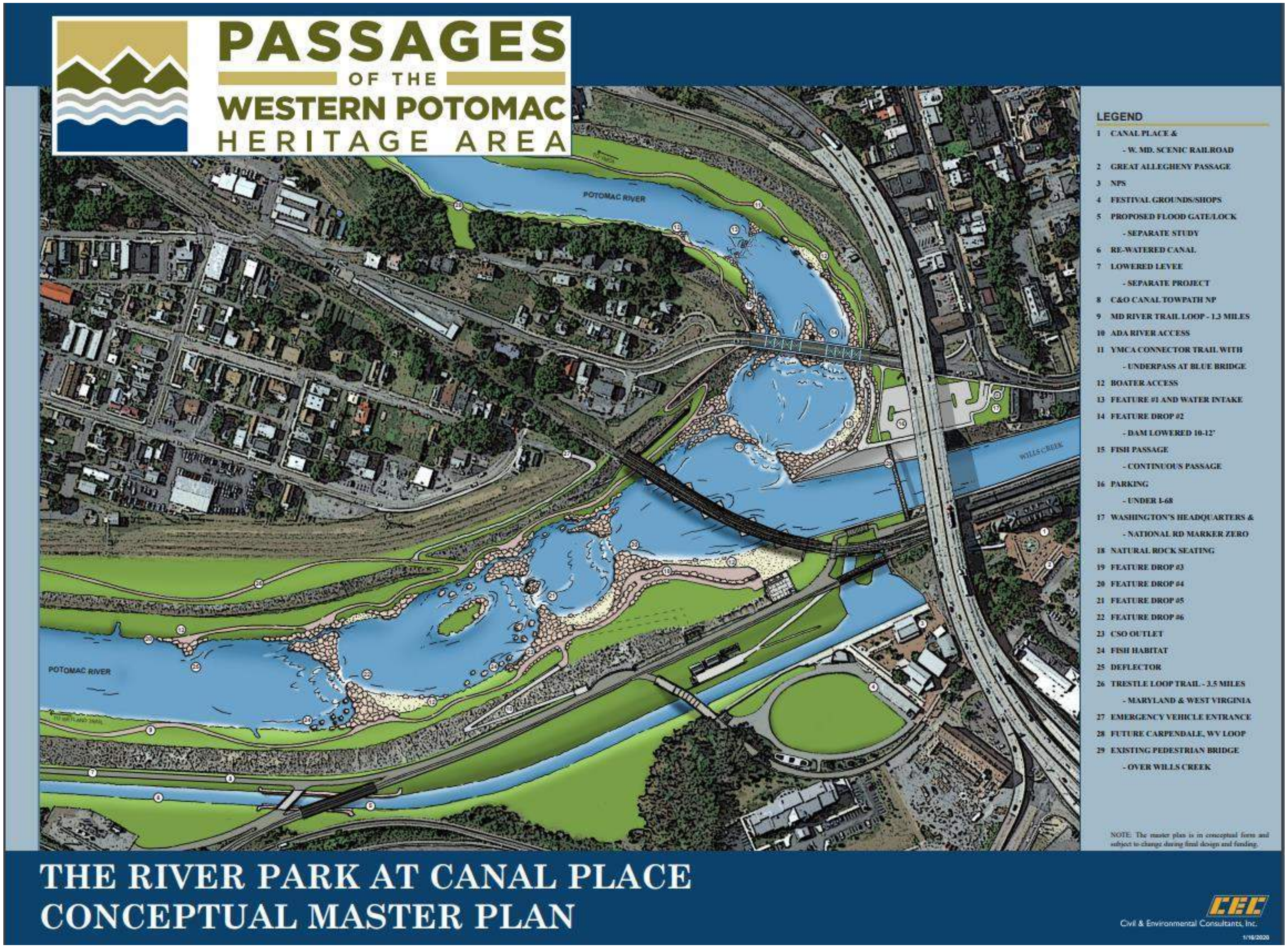


Figure 1. The conceptual master plan of the River Park

Adjacent to River Park, numerous historic properties, including the C&O Canal Towpath National Historic Park and the National Road, offer cultural significance. Additionally, tourism opportunities abound with the presence of the Great Allegheny Passage trail and the Western Potomac Scenic Railroad.

As a dedicated advocate for the conservation and sustainable management of natural resources, The Canal Place Preservation & Development Authority (CPPDA) is keenly interested in understanding how the park contributes to the local and regional economy. To this end, the Recreation, Parks, and Tourism Resources Program (RPTR) at West Virginia University (WVU) was contracted to conduct a market survey that examines the visitor economic impact of the River Park.

2. Methods

In this study, we implemented a structured methodology to assess visitor profiles and tourism economic impacts associated with the River Park. Our approach encompassed three key stages:

1) Onsite Surveys in Cumberland, MD: These surveys were conducted to identify the primary tourism markets for Cumberland and to test the effectiveness of the questionnaire designed for subsequent online surveys.
2) Initial Online Survey: This preliminary survey aimed to identify individuals who had visited any location in Allegany County, MD, during the specified period (December 1, 2022, to November 30, 2023). The survey distinguished between those who had and had not visited the area.
3) Comprehensive Online Survey for Past Visitors: Targeting only individuals who had visited Cumberland, MD, in the preceding 12 months, this detailed survey sought to gather in-depth data on visitor profiles and spending patterns.

The primary objective of the initial online survey was to estimate the total number of visits to both Allegany County and Cumberland, specifically highlighting any increase in visits attributable to the River Park's construction. The comprehensive survey aimed to collect detailed information on visitor spending. These data points were then utilized to calculate the overall economic impact resulting from the development of the River Park. The combination of both onsite surveys and online surveys has also been used in other studies (e.g., Kyle et al., 2022).

2.1. Questionnaire

The questionnaire for the initial survey and the questionnaire for the full-length survey are included as Appendix A and Appendix B. The full-length survey questionnaire consisted of five sections, including: 1) background information, 2) trip characteristics, 3) perceptions of the River Park, 4) Spending in Cumberland, MD, and 5) socio-demographics. The questionnaire was built into Qualtrics and reviewed and approved by West Virginia University IRB.

2.2. Data collection and data analysis

The questionnaire was built in Qualtrics and integrated into Prolific which was used as the survey platform for this study. Based on the onsite surveys, previous studies in the area, and personal communications with Ashli Workman, Director of Tourism of Allegany County, the target states for Cumberland included Kentucky (KY), Maryland (MD), New York (NY), Ohio (OH), Pennsylvania (PA), Virginia (VA), Washington DC, and West Virginia (VA), with a total of 8,701 eligible participants. Specifically, for the initial survey, the purpose of the survey was described as follows:

> The purpose of this short screening survey is to identify who have or have not visited any places in Allegany County, Maryland, from December 1, 2022 to November 30, 2023. Only those who have visited the country during the past 12 months will be invited again to participate in the follow-up full-length survey.

This initial short survey takes approximately 1 to 2 minutes to complete and pays $1.00.

For the follow-up full length survey, the following description was used:

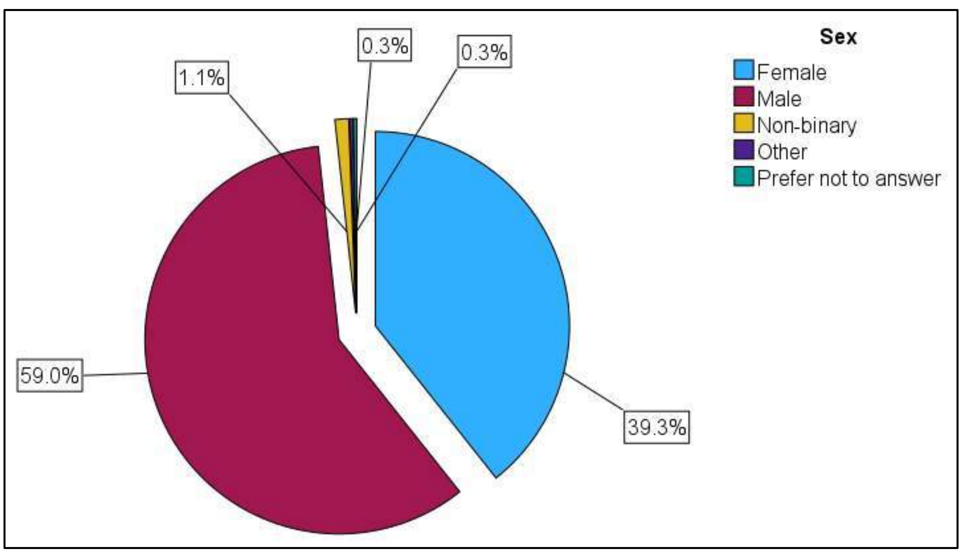
> You recently participated in a short screening survey on "River Park Visitor Profile and Tourism Economic Impact Study." You are invited again to participate in the second survey that targets those who met the screening criteria: at least 18 years old and have travelled at least once to Cumberland, Maryland in the past 12 months (December 1, 2022 - November 30, 2023).
>
> This study is being conducted by the Canal Place Preservation & Development Authority (CPPDA), Maryland with assistance from West Virginia University. It takes approximately 5 minutes and pays $3.00.

The initial survey started on December 20, 2023 and ended January 10, 2024, with 4,877 respondents. Of this number, 477 valid respondents who reported having visited Cumberland in the past 12 months were then invited again to participate in the full-length survey, which started on December 21 and ended on January 10, 2024. Of the 477 participants invited, 382 responded, resulting in a response rate of 80.1%. Of the 382 respondents, 23 were removed due to systematic incomplete responses, resulting in 359 valid responses for further analysis.

3. Results

3.1. Demographics

Of the 365 valid respondents, over half of them were males (59.0%) while females accounted for 39.3%. In addition, a small percent of respondents identified themselves as non-



binary (1.1%) while 0.3% preferred not to answer (Figure 2).

Most respondents were young, with 71.2% of them ranging between 18 and 44 years old (14.8% for age 18-24, 34.5% for age 25-34, and 22.2% for age 35-44, respectively) (Figure 3). Respondents between 45 and 64 years old accounted for 27.9% while a small percent of respondents aged 65 and over (0.3%). In addition, 0.3% of respondents preferred not to tell.

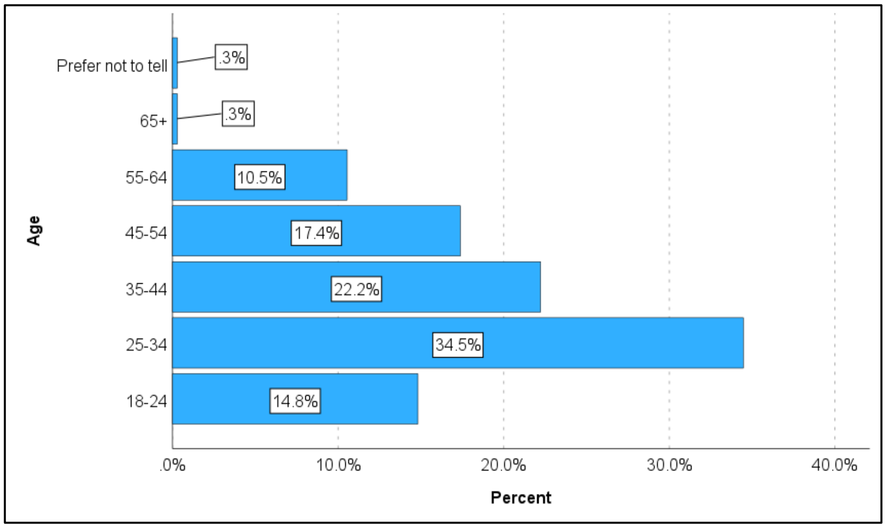


Figure 3. Respondents by age

Figures 4 and 5 present respondents by education and income, respectively. As shown, most respondents were well educated and affluent. Specifically, 88.9% had some college level education (24.5%) or college degree (40.2% undergraduate or post-secondary degree and 24.2% graduate school degree). In

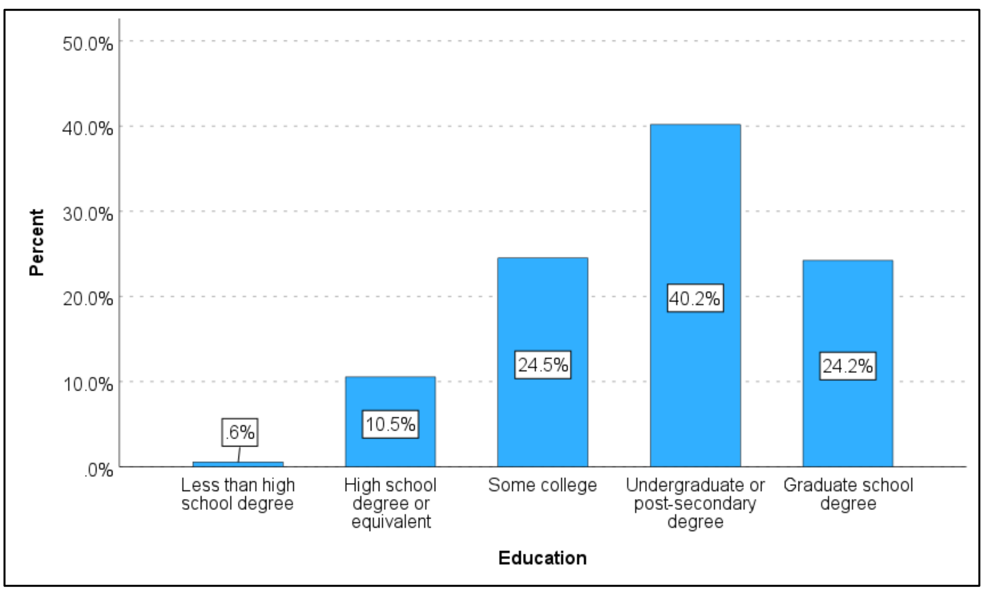


Figure 4. Respondents by education

addition, 10.5% had a high school degree or equivalent while a small percent of respondents (0.6%) had a less than high school degree.

In terms of household income before taxes, half of the respondents (50.1%) reported a household income below $80,000 (22.5%, 14.2%, 9.1%, and 4.3% had an income between $60,001 and $80,000; between $40,001 and $60,000; between $20,001 and $40,000, and less than $20,000, respectively). The rest of 49.9% reported an income of $80,001 or above (16.2%, 18.8%, and 7.4% reported a household income between $80,001 and $100,000, between $100,001 and $150,000, and between $150,001 and $200,000, respectively).

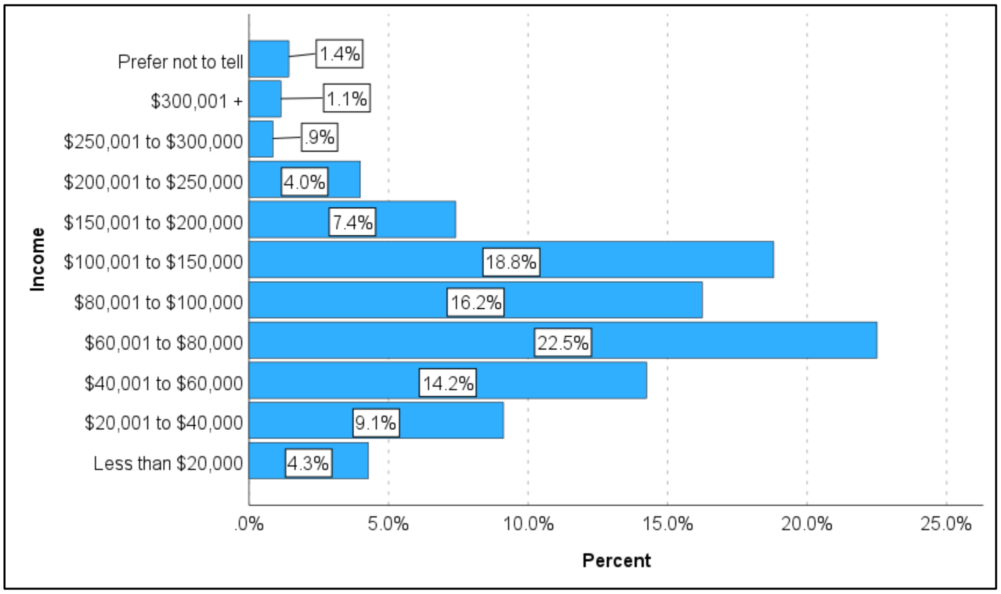


Figure 5. Respondents by income

3.2. Trip characteristics

Seasons in which respondents visited Cumberland, MD

Participants were asked to indicate the seasons in which they visited Cumberland, MD in the previous 12 months (December 1, 2022 – November 30, 2023). Results are presented in Table 1. As shown in the Table, summer is the season most respondents reported visiting the city

(56.9%), followed by spring (39.7%) and fall (28.7%), while winter was reported as the least visited season (22.3%).

Table 1. Seasons in which respondents visited Cumberland, MD

Seasons visited	Responses		Percent of cases
	N	(%)	(%)
Winter	79	15.1	22.3
Spring	141	26.9	39.7
Summer	202	38.5	56.9
Fall	102	19.5	28.7
Total	524	100.0	147.6

Note: This is a multiple-response question where percent of response is the percentage of each response out of the total number of responses with a sum total of percent of response being 100 while percent of cases refers to the percent of respondents who visited the city during a given season.

Origin of respondents by state

Figure 6 presents the origin of respondents by state (without sampling adjustment). Of the eight targeted states, four states (Maryland, Pennsylvania, New York, and Virginia) combined accounted for most of the respondents

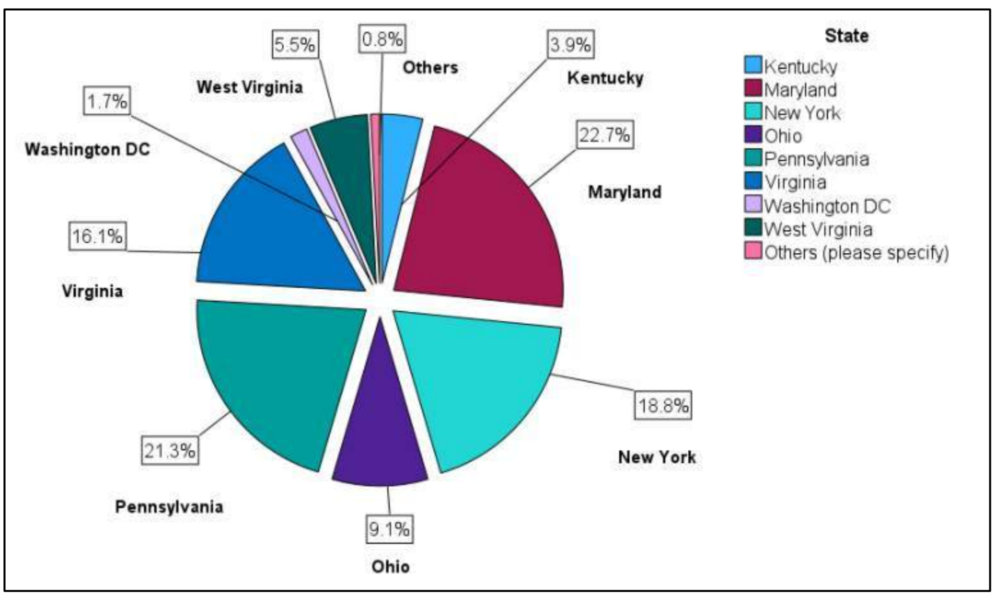


Figure 6. Origin of respondents by state

(78.9%), with 22.7% of respondents being from Maryland, the largest portion of the sample, followed by Pennsylvania (21.3%), New York (18.8%) and Virginia (16.1%). It is worth noting that the percentage for each state should not be used as a proxy for market segments for the area because the survey participants were intentionally limited to the eight targeted states.

Places visited

Table 2 presents places in Cumberland that respondents have visited during the previous 12 months. Rocky Gap State Park was the most popular attraction in the area. Nearly half (47.6%) of respondents reported having visited the park. The second most popular place is Allegany Museum (31.8%), followed by Cumberland Visitor Center (27.8%) and C&O Canal National Historical Park (22.3%). The least visited places/events include National RD Marker Zero (2.6%), Emmanuel Episcopal Church (4.6%), and DelFest (7.2%).

Table 2. Places visited.

Places visited	Responses		Percent of cases*
	N	(%)	(%)
Rocky Gap State Park**	166	17.5	47.6
Allegany Museum	111	11.7	31.8
Cumberland Visitor Center	97	10.2	27.8
C&O Canal National Historical Park	78	8.2	22.3
Western Maryland Scenic Railroad	76	8	21.8
Western Maryland Rail Trail	73	7.7	20.9
Rocky Gap Casino Resort	67	7.1	19.2
Great Allegheny Passage	61	6.4	17.5
C&O Canal Towpath	53	5.6	15.2
Paw Paw Tunnel	52	5.5	14.9
Washington's Headquarters	41	4.3	11.7
DelFest	25	2.6	7.2
Emmanuel Episcopal Church	16	1.7	4.6
National RD Marker Zero	9	0.9	2.6
Others	23	2.4	6.6
	948	100.0	271.6

Note: This is a multiple-response question where percent of response is the percentage of each response out of the total number of responses with a sum total of percent of response being 100 while percent of cases refers to the percent of respondents who visited a given place.

*Ordered by percent of cases from the largest to the smallest.

** When the frequency is analyzed specifically for the park, the valid response rate is 46.2%, accounting for missing data. This valid response rate is utilized to estimate the total number of visits to the city.

Activities

Respondents were asked to indicate activities they participated in during all trips to Cumberland in the past 12 months. As shown in Table 3, the top three most popular activities are hiking/walking (62.6%), dinning locally (49.4%), and sightseeing (44.3%), followed by shopping (39.7%), history/cultural interest (38.6%), photography (38.3%), and scenic driving (36.3%). The least popular activities include hunting (2%), rail biking (2.6%), interpretive programs/exhibits (4.6%), and mountain biking (4.9%).

Table 3. Activities that respondents reported having participated in.

	Responses		**Percent of cases***
Places visited	N	(%)	**(%)**
Hiking/walking	219	11.9	62.6
Dining locally	173	9.4	49.4
Sightseeing	155	8.4	44.3
Shopping	139	7.6	39.7
History/cultural interest	135	7.3	38.6
Photography	134	7.3	38.3
Scenic driving	127	6.9	36.3
Visit to a museum or attraction	125	6.8	35.7
Birding	89	4.8	25.4
Cycling/biking	68	3.7	19.4
Picnicking/cooking-out	53	2.9	15.1
Dog walking	48	2.6	13.7
Fishing	41	2.2	11.7
Special events	39	2.1	11.1
Climbing	38	2.1	10.9
Scenic railroad trail ride	38	2.1	10.9
Playground	34	1.8	9.7
Visit to winery, brewery, distillery	34	1.8	9.7
Visit to an art gallery	32	1.7	9.1
Canoeing/kayaking/rafting	30	1.6	8.6
Swimming	22	1.2	6.3
Mountain biking	17	0.9	4.9
Interpretive programs/exhibits	16	0.9	4.6
Rail biking	9	0.5	2.6
Hunting	7	0.4	2.0
Other	17	0.9	4.9
Total	1839	100	525.4

Note: This is a multiple-response question where percent of response is the percentage of each response out of the total number of responses with a sum total of percent of response being 100 while percent of cases refers to the percent of respondents who visited a given place.

*Ordered by percentage of cases from the largest to the smallest.

Travel purposes

In terms of travel purposes (note; respondents were allowed to choose multiple purposes), most respondents (79.8%) traveled to city for leisure/holiday/vacation, followed by visiting friends and/or relatives (49.1%), and business (8.0%). There were a small number of respondents (2.8%) who reported having visited the area for other reasons.

Table 4. Travel purposes.

Reasons for visiting the area	Responses		Percent of Cases
	N	(%)	(%)
Leisure	281	57.1	79.8
VRF	173	35.2	49.1
Business	28	5.7	8.0
Other	10	2.0	2.8
Total	492	100.0	139.8

Frequency of visits and group size

Respondents were asked to report how many times they have visited the city in the past 12 months. The average number of visits in the previous 12 months is 2.28 times. Responses were also asked to report their group size, which is 3.2 on average, ranging between 1 and 20.

Overnight stay

Over two thirds of respondents reported staying overnight during their most recent trip to the city (67.9%) while 32.1% of respondents were day trippers. The average number of nights is 3.5, ranging from 1 to 25.

Table 5 presents responses on where respondents have stayed during their most recent trip to the city (note; as with their responses on travel purposes, respondents were also allowed to choose multiple lodging types). As shown, most stayed in hotels/motels/inns (45.6%), followed by friends and/or relatives (32.2%), Airbnb (30.5%), camping/tents (8.8%), Bed & Breakfast (7.9%), and rented houses/apartments (6.3%). A small number of respondents stayed in RV (2.1%) and second homes (1.3%).

Table 5. Respondents by lodging types.

	Responses		Percent of cases*
Lodging	N	(%)	**(%)**
Hotel/motel/inn	109	33.7	45.6
Friends and/or relatives	77	23.8	32.2
Airbnb	73	22.6	30.5
Camping/tent	21	6.5	8.8
Bed & Breakfast	19	5.9	7.9
Rented house/apartment/VRBO	15	4.6	6.3
RV	5	1.5	2.1
Second home	3	0.9	1.3
Other	1	0.3	0.4
Total	323	100.0	135.1

*Ordered by percentage of cases from the largest to the smallest.

Travel composition

Figure 7 presents participants' travel composition during their most recent trip to the city. As shown, over half of the respondents reported being with relatives/family, followed by with friends (25.6%), and both friends and relatives/family (13.6%), while 6.0% of them travelled alone.

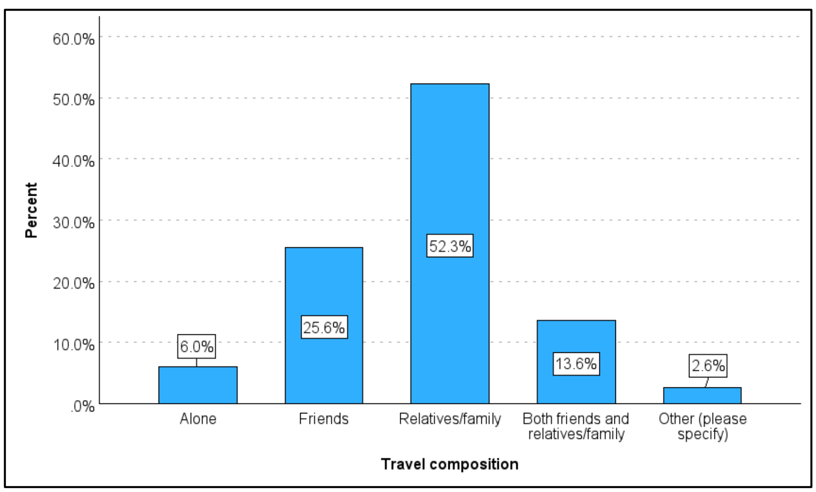


Figure 7. Travel composition

Recommendation

Respondents were asked to indicate to what extent recommendations from others influenced their current visit to the city on a scale of 0 to 100, where 0 implies no influence and 100 signifies complete influence. It was found that 7.5% of respondents reported a score of 0, indicating no influence, while 2.9% reported a score of 100, indicating complete influence. In addition, 54.4% of respondents reported a score less than 50, while 31.5% of respondents reported a score greater than 70. The average score is 48.43 (Figure 8).

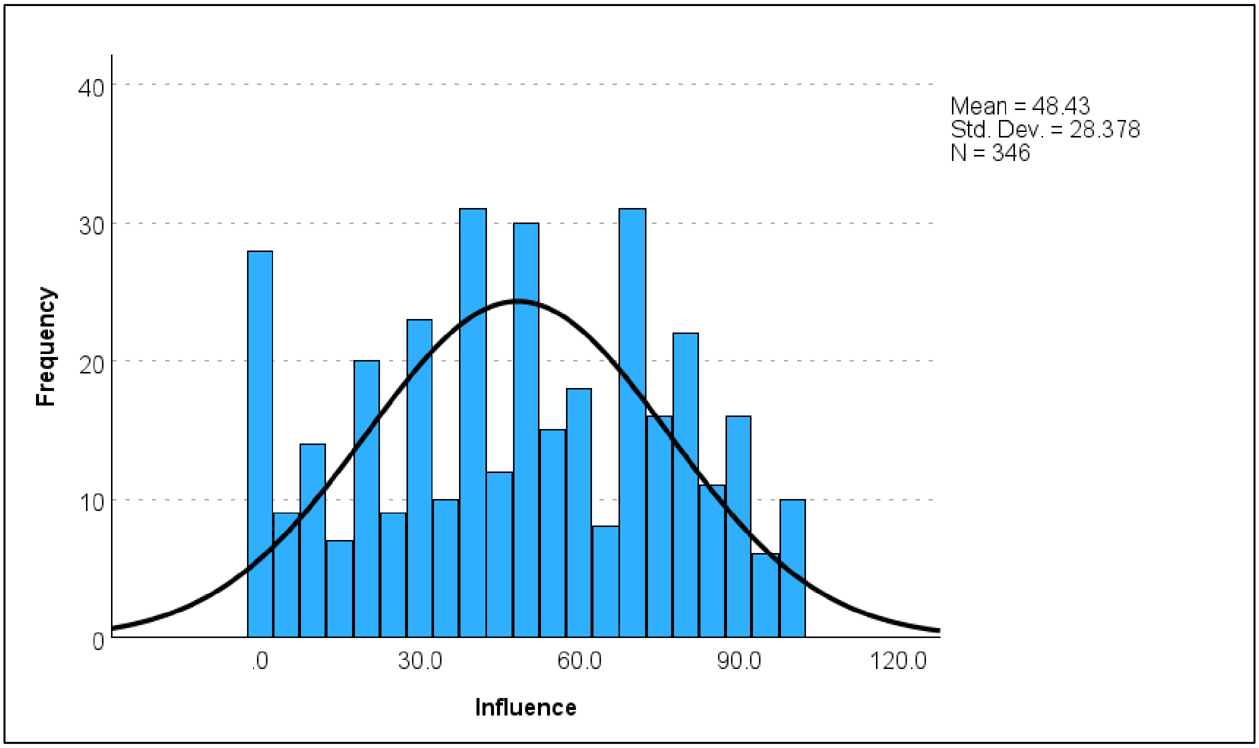


Figure 8. Histogram of recommendation influence

Destination loyalty

Four items were used to measure respondents' destination loyalty to the city (Yuan et al., 2021). Results are presented in Table 6. Nearly 90% of respondents will speak positively about the city, 85% will recommend the city to family/others, and 80% will revisit again in the following 12 months. Relatively, a smaller percentage of respondents (60.3%) will share their experience on social media. When asked how likely they will recommend the proposed River Park to others, the average likelihood is 76.5%.

Table 6. Destination loyalty.

Item	Very Unlikely (%)	Unlikely (%)	Neutral (%)	Likely (%)	Very Likely (%)	Likely + Very Likely
Will recommend to family/others	0.6	3.1	11.4	39.9	45.0	84.9
Will speak positively about the city	0.3	0.6	11.1	37.5	50.6	88.1
Will share my experience on social media	10.5	12.5	16.8	31.3	29.0	60.3
Will revisit again in the following 12 months	1.7	4.8	13.9	41.8	37.8	79.6

River Park activities

Participants were asked to indicate how likely they will participate in an activity related to the park if they plan to revisit Cumberland in the next 12 months on a scale of 0 to 100, where 0 implies not likely at all and 100 indicates very likely. The mean scores are presented in Table 7. The most popular activity is taking photos (78.5), followed by sightseeing (77.7), and using land based accompanying trails (67.1), while kayaking/rafting is the least popular activity (40.6).

Table 7. River Park activities that respondent may participate in.

	Minimum	Maximum	Mean	Std. Deviation
Kayaking/rafting	0	100.0	40.6	34.7
Spectating	0	100.0	63.3	28.5
Sightseeing	0	100.0	77.7	24.0
Taking photos	0	100.0	78.5	26.7
Using land based accompanying trails	0	100.0	67.1	28.1

3.3. Economic impact analysis

3.3.1 Estimates of total visits for Cumberland, Allegany County, and River Park

To estimate the total number of visits to Cumberland, we employed a methodology that leverages a benchmark figure from a well-attended local attraction. Specifically, we used the 2023 visitation figure for Rocky Gap State Park, which stood at 913,000, as provided by Ashli Workman, the Director of Tourism for Allegany County, through personal communications. This number served as a reference point for our calculations. By analyzing survey responses, we found that 46.2% of respondents indicated they had visited the park, with an average of two visits per respondent. Based on these data, we extrapolated the total visitation figures for Cumberland as follows:

$$\text{Total visits for Cumberland} = 913000/.462/2 = 988{,}095$$

From the initial survey, 30.97% of respondents reported having visited Allegany County, but not Cumberland, based on this information, the total number of visits for the county would be:

$$\text{Total visits for Allegany County} = 988{,}095 + 988{,}095 * .3097 = 1{,}294{,}109$$

The estimation of additional visits attributed to the construction of the River Park is calculated by the following formulas:

$$\text{sampled visits to Allegany /sampled non visits to Allegany} = 1156/3713 = 0.31133854$$

$$\text{Total non-visits} = 1{,}294{,}109/0.31133854 = 4{,}156{,}597.506$$

Total additional visits = total non-visits *[highly possible visits sampled/highly impossible visits sampled] = 4,156,597.506 * [871 /3438] = 4,156,597.506 *0.253344968=1,053,053

The total of 1,053,053 visits was calculated based on respondents who had not visited Allegany County in the past year but reported a 70% probability of visiting the park after its construction. The average score (70-100%) is 81.1%. Below is the question used in the survey:

If you currently have no plans or are unsure about visiting the county in the next 12 months, please consider this scenario: River Park will be open to the public after its construction within this timeframe. How likely are you to visit the park? Is it likely to be a primary draw for you, or just one among several attractions in the county? Adjust the slider below on a scale from 0 (River Park is not a factor in visiting the county) to 100 (River Park is the primary reason for visiting the county) (Tyrrell & Johnston, 2001; Yuan et al., 2018).

0 10 20 30 40 50 60 70 80 90 100

3.3.2 Visitor spending of the River Park

Table 8 presents the trip spending per person for those who visited Cumberland in the previous year. On average, each visitor spent $84.5 on lodging, $83.8 per trip on restaurants and bars, $55 on shopping, $34.0 on groceries, $33.4 on gas, automobile service, repair, and $32.4 on admission/fees.

Table 8. Trip spending per person.

	Min.	Max.	Mean	Std. Deviation
Gas, automobile service, repair	0	200.0	33.4	31.19
Lodging (hotel, motel, condos, etc.)	0	1200.0	84.5	140.76
Restaurants and bars s (food & beverages, etc.)	0	750.0	83.8	94.79
Groceries take-out food/drinks, sundries	0	400.0	34.0	49.18
Shopping (souvenirs, gifts, clothing, etc.)	0	500.0	55.1	76.66
Outdoor recreation equipment purchase or rental (skiing, biking, etc.)	0	365.0	27.8	54.85
Admissions and fees (seasonal pass, tickets for train rides, events, theaters, activities, etc.)	0	350.0	32.4	47.83
Others	0	350.0	14.5	38.56

Table 9 presents the total spending and adjusted total spending associated with the River Park. As shown, the total spending is estimated to be $384,890,871.5. As aforementioned, for those who did not visit Allegany County in the past year, the average likelihood of visiting the county due to the construction of the River Park is 81.1%. Accordingly, the adjusted total spending associated with the park is 384,890,871.5*81.1% = $312,146,496.8.

Table 9. Total spending by additional visitors who are attracted to visit the park.

	Total	Adjusted total*
Gas, automobile service, repair	35,171,970.2	28,524,467.8
Lodging (hotel, motel, condos, etc.)	88,982,978.5	72,165,195.6
Restaurants and bars s (food & beverages,	88,245,841.4	71,567,377.4
etc.)	35,803,802	29,036,883.4
Groceries take-out food/drinks, sundries	58,023,220.3	47,056,831.7
Shopping (souvenirs, gifts, clothing, etc.)	29,274,873.4	23,741,922.3
Outdoor recreation equipment purchase or rental (skiing, biking, etc.)	34,118,917.2	27,670,441.9
Others	15,269,268.5	12,383,376.8
Total	384,890,871.5	312,146,496.8

*Adjusted by the average of 81.1%.

3.3.3 Economic impact estimates of the River Park

The economic impact estimates for the River Park are presented in Table 10. The direct impact of the park is $219,931,773, supporting 2,412 jobs. The total economic impact is estimated to be $307,335,643, supporting 2,901 jobs.

Table 10. River Park economic impact estimates

	Direct Impact	Indirect & Induced Impacts	Total Economic Impact
Output (Sales)	$219,931,773	$87,403,869	$307,335,643
Employment	2,412	489	2,901
Labor Income	$70,759,040	$23,031,809	$93,790,849.11
State & Local Taxes	--	--	$41,691,786.25

*The direct impact is less than the estimated $312,146,497 due to the application of retail margins. Tax impact includes sales, personal income, property, and corporation net income taxes.

4. Conclusions

This study introduces an innovative methodology for estimating the increase in visitor numbers attributable to the development of the River Park. Based on a survey of 4,877 participants, the research team was able to predict a significant rise in visitation numbers. It is projected that the construction of the park would result in an additional 1,053,053 visits. This increase is not only a testament to the park's potential to attract visitors but also signifies its role in contributing to local and regional economies. The economic implications of these additional visits are substantial. The study estimates a total economic impact of $307,335,643, reflecting the direct, indirect, and induced effects generated by the increased visitation. The total economic impact would support 2,901 jobs.

It should be noted that this study, while comprehensive in its estimation of visitation and economic impacts, does not account for several other significant benefits associated with the construction of the River Park. Among these, the potential increase in property values and the attraction of new residents to the area are particularly noteworthy. Research has consistently shown that proximity to well-maintained green spaces can substantially elevate property values. For instance, the value for homes with a nearby park can increase between 8% to 20% (Playworld, 2021). Moreover, urban green spaces/parks are known to attract individuals and families seeking a higher quality of life, leading to population growth and demographic shifts that can have lasting positive effects on local communities.

During the onsite survey, feedback from participants highlighted the appeal of the River Park and its surrounding amenities as a catalyst for relocation. Specifically, one respondent from North Carolina and another from Michigan shared their interest in moving to the area, underscoring the park's potential to attract new residents. This anecdotal evidence suggests that the River Park, along with other local attractions, is perceived as a significant factor in individuals' decisions to relocate, reflecting the broader trend of green spaces enhancing the attractiveness of urban areas.

However, the quantification of these benefits requires a different methodological approach, often involving long-term real estate market analysis and demographic studies. This aspect falls outside the scope of the current study but represents an important area for future research. Understanding the full spectrum of benefits, including changes in property values and population dynamics, is crucial for a holistic assessment of the impact of urban parks like River Park. Further exploration into these areas could provide valuable insights for urban planners, real estate developers, and policymakers. It would help in crafting strategies that maximize the benefits of such projects, not only in terms of direct economic impact and visitor numbers but also in enhancing the overall attractiveness and livability of urban areas.

In conclusion, the River Park project stands as a significant contributor to the local economy and community well-being. The anticipated increase in visits and the associated economic impact highlight the importance of the park in promoting environmental sustainability, recreational opportunities, and economic vitality. This study underscores the need for strategic planning and investment in public amenities that enhance the quality of urban life and contribute to the long-term sustainability of the city.

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Appendix A: Survey questionnaire (initial survey)

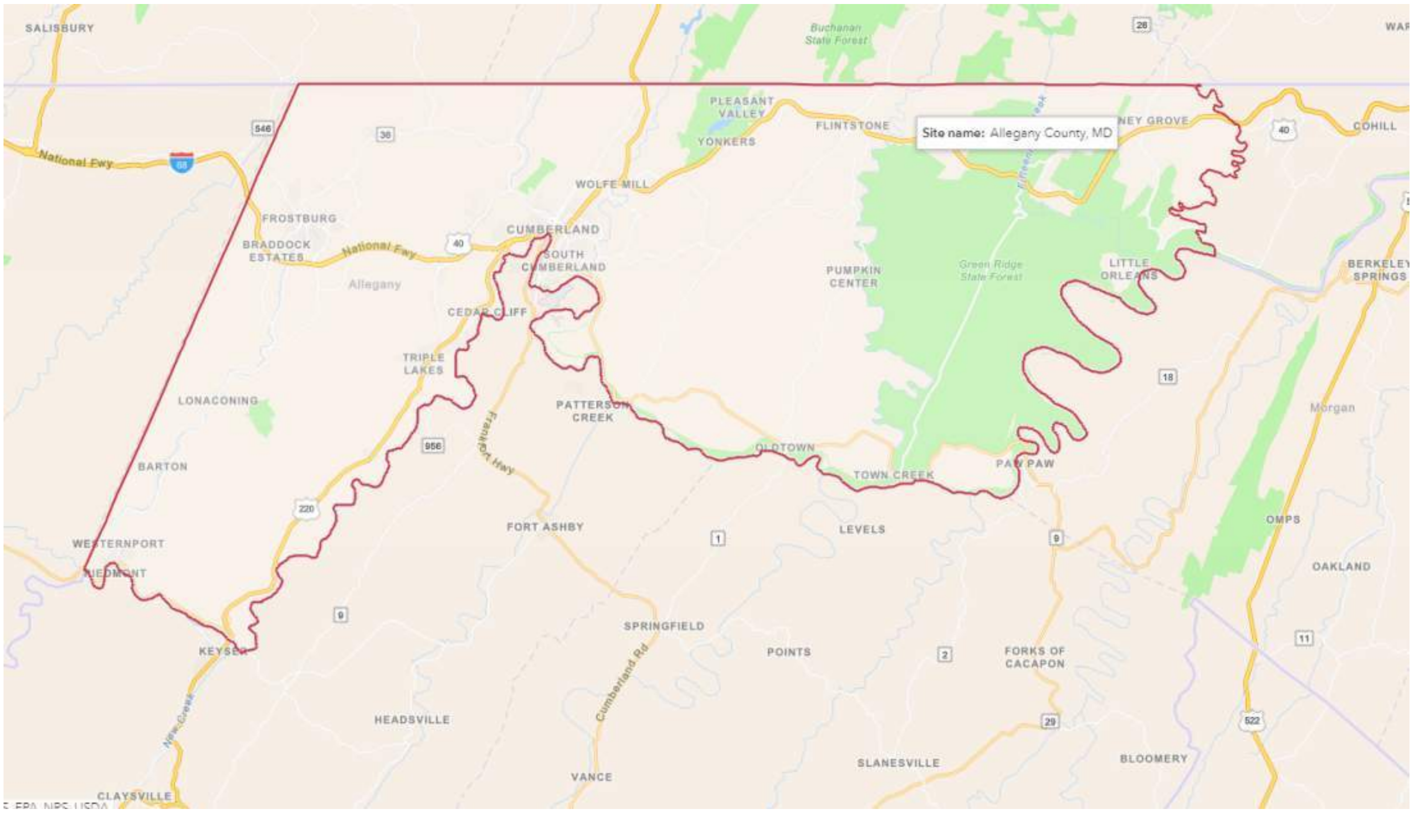
Appendix B: Survey questionnaire (full-length survey)

eligibility

The purpose of this short screening survey is to identify who have or have not visited any places in Allegany County, Maryland, from **December 1, 2022 to November 30, 2023**.

This short survey may take about 1 to 2 minutes to complete. **You will be offered $1.00 for completing this screening survey.** Thanks.

1. Below is a map (which is not interactive) that shows the Allegany County, Maryland. Please answer the next question to indicate if have visited any places in the county for leisure/recreation/vacation, visiting friends and/or relatives/family, business or other purposes in the past 12 months, from **December 1, 2022 to November 30, 2023.**



2. Have you visited Allegany County, Maryland during the previous 12 months (**from Dec. 1, 2022 to Nov. 30, 2023**)?

- ◯ Yes
- ◯ No

3. What factors impacted your decision to visit Allegany County, Maryland for your most recent trip? (Check all that apply)

- ☐ Leisure/recreation/vacation
- ☐ Visiting friends and/or relatives/family
- ☐ Business

☐ Other (Please specify)

4. Are you planning to visit Allegany County in the next 12 months?

◯ Yes
◯ No
◯ Not sure yet

5. As you may know, the River Park at Canal Place is going to be constructed in downtown Cumberland, MD. Below is a map that shows the conceptual plan of the River Park. The proposed features of the River Park include:

-Whitewater kayaking, rafting
-3.2 mile river loop trail and trail connections -Multiple water accesses/spectating areas
-Tri-state overlook -New and improved parking areas
-Fish passage accessibility
-Murals

The following question is related to this proposed River Park.

If you currently have no plans or are unsure about visiting the county in the next 12 months, please consider this scenario: River Park will be open to the public after its construction within this timeframe. How likely are you to visit the park? Is it likely to be a primary draw for you, or just one among several attractions in the county? Adjust the slider below on a scale from 0 (River Park is not a factor in visiting the county) to 100 (River Park is the primary reason for visiting the county).

0 10 20 30 40 50 60 70 80 90 100

5. Are you planning to visit Allegany County in the next 12 months?

- Yes
- No
- Not sure yet

5. As you may know, the River Park at Canal Place is going to be constructed in downtown Cumberland, MD. Below is a map that shows the conceptual plan of the River Park. The proposed features of the River Park include:

-Whitewater kayaking, rafting
-3.2 mile river loop trail and trail connections
-Multiple water accesses/spectating areas
-Tri-state overlook
-New and improved parking areas
-Fish passage accessibility
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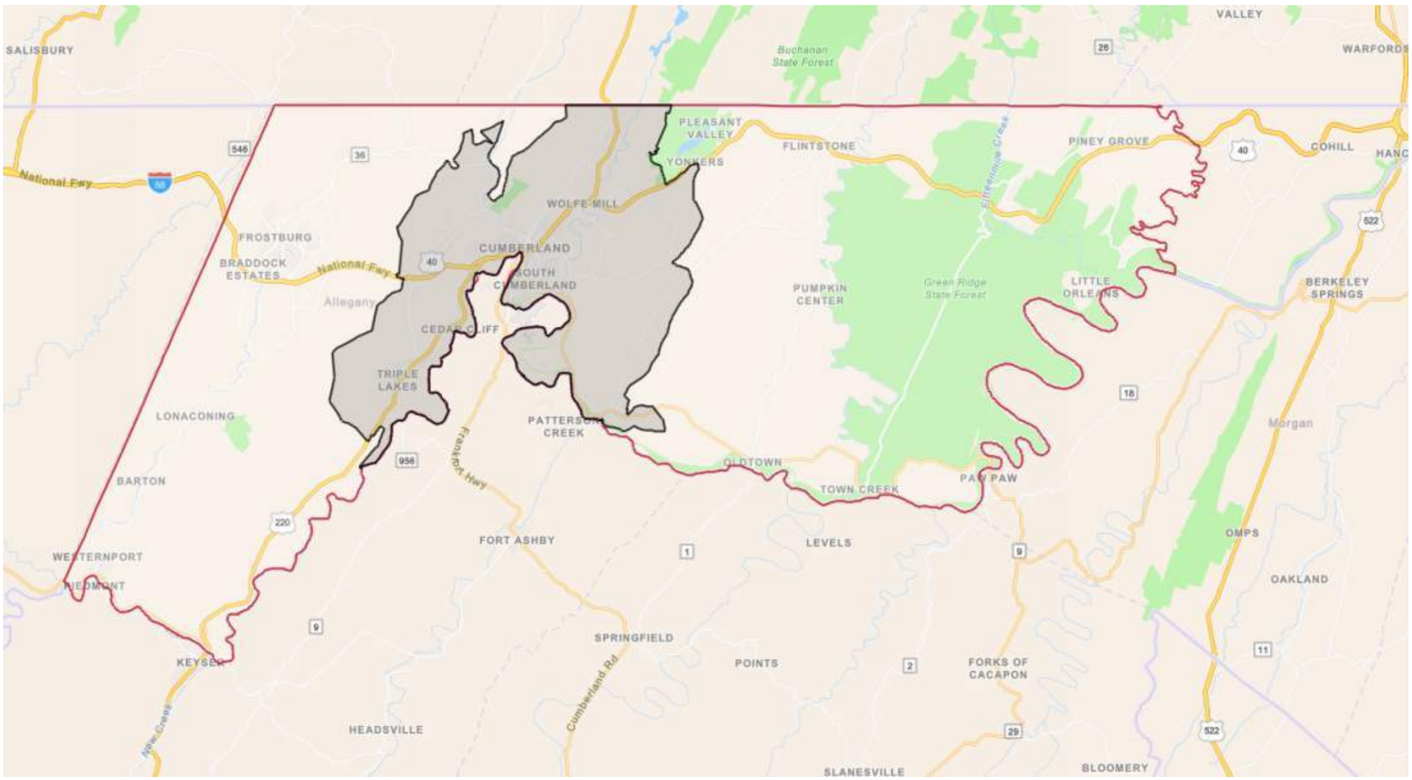
0 10 20 30 40 50 60 70 80 90 100

6. The shaded area below refers to Cumberland in Allegany County, MD. Cumberland is famous for the Western Maryland Scenic Railroad, C&O Canal National Historical Park, National Road, George Washington's Headquarters, Rocky Gap State Park, Allegany Museum, The Great Allegheny Passage, and more.



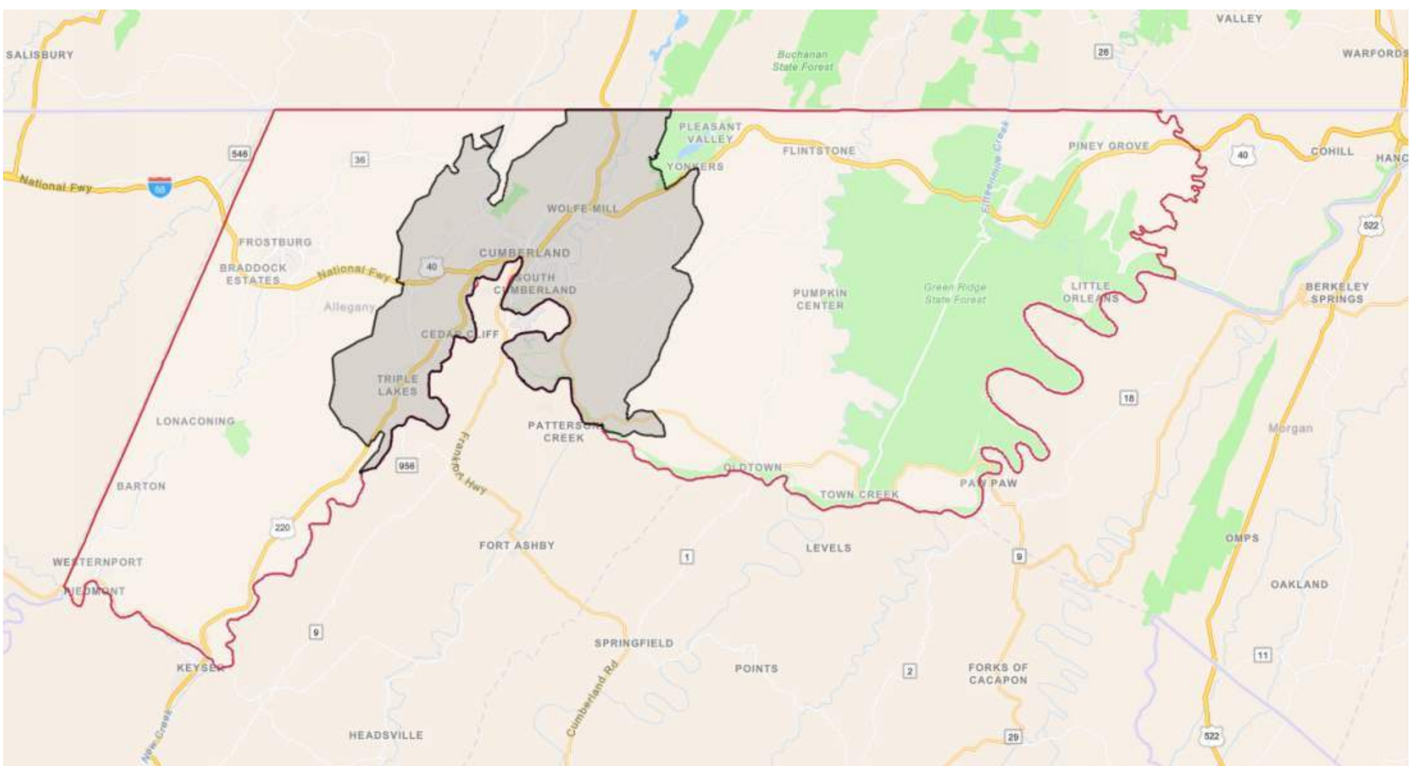
Have you visited Cumberland, MD during the previous 12 months (**from Dec. 1, 2022 to Nov 30, 2023**)?

◯ Yes
◯ No

7. What factors impacted your decision to visit Cumberland, Maryland for your most recent trip? (Check all that apply)

- ☐ Leisure/recreation/vacation
- ☐ Visit friends and/or relatives/family
- ☐ Business
- ☐ Other (please specify)

6. The shaded area below refers to Cumberland in Allegany County, MD. Cumberland is famous for the Western Maryland Scenic Railroad, C&O Canal National Historical Park, National Road, George Washington's Headquarters, Rocky Gap State Park, Allegany Museum, The Great Allegheny Passage, and more.



Have you visited Cumberland, MD during the previous 12 months (**from Dec. 1, 2022 to Nov 30, 2023**)?

- ◯ Yes
- ◯ No

7. What factors impacted your decision to visit Cumberland, Maryland for your most recent trip? (Check all that apply)

- ☐ Leisure/recreation/vacation
- ☐ Visit friends and/or relatives/family
- ☐ Business
- ☐ Other (please specify)

8. Are you planning to visit Cumberland in the next 12 months?

- ◯ Yes
- ◯ No
- ◯ Not sure yet

For those who are not planning to visit Cumberland

9. As you may know, the River Park at Canal Place is going to be constructed in downtown Cumberland, MD. Below is a map that shows the conceptual plan of the River Park. The proposed features of the River Park include:

-Whitewater kayaking, rafting
-3.2 mile river loop trail and trail connections
-Multiple water accesses/spectating areas
-Tri-state overlook
-New and improved parking areas
-Fish passage accessibility
-Murals

The following question is related to this proposed River Park.

If you currently have no plans or are unsure about visiting Cumberland in the next 12 months, please consider this scenario: River Park will be open to the public after its construction within this timeframe. How likely are you to visit the park? Is it likely to be a primary draw for you, or just one among several attractions in Cumberland? Adjust the slider below on a scale from 0 (River Park is not a factor in visiting Cumberland) to 100 (River Park is the primary reason for visiting Cumberland).

0 10 20 30 40 50 60 70 80 90 100

Cover Letter

Cover Letter

Dear Participant:

You recently participated in a short screening survey for a project titled 'River Park Visitor Profile and Tourism Economic Impact Study' in Cumberland, Maryland. You are invited again to participate in this follow-up survey that only targets those who met the screening criteria: at least 18 years old and have visited at least once to Cumberland, MD in the previous 12 months (from **December 1, 2022** to **November 30, 2023**).

This project is being conducted by the **Canal Place Preservation and Development Authority (CPPDA)** with support from a WVU team led by Dr. Jinyang Deng, a professor with WVU's School of Natural Resources. Your participation in this project is greatly appreciated and will take approximately 5 minutes. You will be offered $3 as a gesture of thanks for completing this survey.

The purpose of this study is to know about the tourism market for Cumberland and to estimate the economic impacts of a River Park to be constructed in the area. Your participation in this survey is voluntary and you can quit at any time. However, you can help us very much by taking a few minutes to respond. You do not have to answer all of the questions, but any information you provide will contribute to the project’s success.

All information collected will be kept strictly confidential. Information you provide is anonymous and only summaries will be reported in which an individual’s answers will not be identified.

This survey was reviewed and approved by WVU Institutional Review Board (IRB) and **a WVU IRB acknowledgement is on file**. If you have any further questions, please feel free to contact Dr. Jinyang Deng (304-293-6818) and/or by email (jinyang.deng@mail.wvu.edu). Your contribution to this study is greatly appreciated and will be a great benefit to the city of Cumberland, MD.

Sincerely,

Dr. Jinyang Deng
West Virginia University

Consent

1. You will be offered $3 for completing this survey. If you agree to participate in this survey, please check "Yes" below:

- ◯ Yes
- ◯ No

Background Information

Section 1: Background Information

2. Please check the seasons in which you visited Cumberland, MD in the previous 12 months (**December. 1, 2022 - November 30, 2023**) (check all that apply)

- ☐ **Winter**: December 1, 2022 - February 28, 2023
- ☐ **Spring**: March 1, 2023 - May 31, 2023

- ☐ **Summer**: June 1, 2023 - August 31, 2023
- ☐ **Fall**: September 1, 2023 - November 30, 2023

3. What state do you currently reside in?

- ○ Kentucky
- ○ Maryland
- ○ New York
- ○ Ohio
- ○ Pennsylvania
- ○ Virginia
- ○ Washington DC
- ○ West Virginia
- ○ Other (please specify)

4. Please choose from the following list of places you have visited in Cumberland in the previous 12 months (click to choose all that apply). If the places you visited are not on the list, please write down in the blank space provided.

- ☐ Allegany Museum
- ☐ C&O Canal National Historical Park and Visitors Museum
- ☐ C&O Canal Towpath
- ☐ Cumberland Visitor Center (located in the Western Maryland Railway station)
- ☐ Paw Paw Tunnel
- ☐ Rocky Gap Casino Resort
- ☐ Rocky State Park
- ☐ Washington’s Headquarters

- ☐ DelFest
- ☐ Emmanuel Episcopal Church
- ☐ Great Allegheny Passage
- ☐ National RD Marker Zero
- ☐ Western Maryland Rail Trail
- ☐ Western Maryland Scenic Railroad
- ☐ **Others (please specify)** ________

5. What activities did you participate in **during all trips** to Cumberland in the past 12 months (**from December 1, 2022 to November 30, 2023**)? (check all that apply)

- ☐ Birding/wildlife viewing
- ☐ Canoeing/kayaking/rafting
- ☐ Climbing
- ☐ Cycling/biking
- ☐ Dining locally
- ☐ Dog walking
- ☐ Fishing
- ☐ Hiking/walking
- ☐ History/cultural interest
- ☐ Hunting
- ☐ Interpretive programs/exhibits
- ☐ Mountain biking
- ☐ Photography
- ☐ Picnicking/cooking-out
- ☐ Playground

- ☐ Rail biking
- ☐ Scenic driving
- ☐ Scenic railroad train ride
- ☐ Shopping
- ☐ Sightseeing
- ☐ Special events
- ☐ Swimming
- ☐ Visit to a museum or attraction
- ☐ Visit to an art gallery
- ☐ Visit to winery, brewery, distillery
- ☐ Other (please specify)

Section 2: Trip Characteristics

Section 2: Trip Characteristics

7. Please check where appropriate to indicate your reason(s) for visiting Cumberland **during your most recent visit**.

- ☐ Leisure/holiday/vacation
- ☐ Visiting friends and/or relatives/family
- ☐ Business
- ☐ Others (please specify)

8. **Including your most recent visit**, how many times have you visited Cumberland in the previous 12 months (**December 1. 2022-November 30, 2023)**? (Numbers only).

9. **Including yourself**, how many people were traveling with you **during your most recent trip** to the city? (number only)

10. Have you stayed overnight during your most recent trip to the city?

- Yes
- No

11. During your most recent trip to the city, how many nights have you stayed in the city? (number only)

12. Please indicate your main type(s) of accommodation that you stayed at during your most recent trip to the city.

- ☐ Airbnb
- ☐ Bed & Breakfast
- ☐ Camping/tent
- ☐ Friends and/or relatives
- ☐ Hotel/motel/inn
- ☐ Rented house/apartment/VRBO
- ☐ RV
- ☐ Second home
- ☐ Timeshare
- ☐ Other (please specify)

13. During your most recent trip to the city, please indicate your travel composition:

- ○ Alone
- ○ Friends
- ○ Relatives/family
- ○ Both friends and relatives/family

○ Other (please specify)

14. Please move the slider below to indicate how much of your current visit to the city is influenced by recommendations from others.

0 10 20 30 40 50 60 70 80 90 100

15. Please indicate how likely you will recommend Cumberland to others?

	Very Unlikely	Unlikely	Neutral	Likely	Very Likely
1. Will recommend to family/others	○	○	○	○	○
2. Will speak positively about the city	○	○	○	○	○
3. Will share my experience on social media	○	○	○	○	○

16. Please indicate how likely you will revisit Cumberland in the

following 12 months?

	Very Unlikely	Unlikely	Neutral	Likely	Very Likely
1. Will revisit again in the following 12 months	◯	◯	◯	◯	◯

17. As you may know, the River Park at Canal Place is going to be constructed in downtown Cumberland, MD. Below is a map that shows the conceptual plan of the River Park. The proposed features of the River Park include:

-Whitewater kayaking, rafting
-3.2 mile river loop trail and trail connections -Multiple water accesses/spectating areas
-Tri-state overlook -New and improved parking areas
-Fish passage accessibility
-Murals

The following questions are related to this proposed River Park.

18. If you plan to revisit Cumberland, how likely will you participate in the following activities related to the River Park?

	0	10	20	30	40	50	60	70	80	90	100	
Kayaking/rafting												
Spectating												
Sightseeing												
Taking photos												

	0	10	20	30	40	50	60	70	80	90	100
Using land based accompanying trails											

19. Please move the slider below to indicate how likely you will recommend the proposed River Park to others.

0 10 20 30 40 50 60 70 80 90 100

SECTION 3: Perceptions of the River Park

Section 3: Perceptions of the River Park

20. As you may know, the River Park at Canal Place is going to be constructed in downtown Cumberland, MD. Below is a map that shows the conceptual plan of the River Park. The proposed features of the River Park include:

- -Whitewater kayaking, rafting
- -3.2 mile river loop trail and trail connections
- -Multiple water accesses/spectating areas
- -Tri-state overlook
- -New and improved parking areas

-Fish passage accessibility

-Murals

The following questions are related to this proposed River Park.

If you currently have no plans or are unsure about visiting Cumberland in the next 12 months, please consider this scenario: River Park will be open to the public after its construction within this timeframe. How likely are you to visit the park? Is it likely to be a primary draw for you, or just one among several attractions in the city? Adjust the slider below on a scale from 0 (River Park is not a factor in visiting Cumberland) to 100 (River Park is the primary reason for visiting Cumberland).

0	10	20	30	40	50	60	70	80	90	100

21. If you plan to visit Cumberland again, how likely will you participate in the following activities related to the River Park?

	0	10	20	30	40	50	60	70	80	90	100
Kayaking/rafting											
Spectating											
Sightseeing											
Taking photos											
Using land based accompanying trails											

22. Please move the slider below to indicate how likely you will recommend the proposed River Park to others.

0	10	20	30	40	50	60	70	80	90	100

SECTION 4: Your Spending in the Cumberland

Section 4: Your Spending in Cumberland, MD

23. To better understand the economic impact of tourism to the city, we are interested in finding out the approximate amount of money you have spent in the city (please give your best estimate of dollars spent for **the entire group during the most recent trip in the city. If you are not sure the total for the entire group, you can simply multiply your spending by the number of the group to get the total spending for the entire group**).

* Gasoline, automobile service, repair

* Lodging (hotel, motel, condos, etc.)

* Restaurants and bars (food & beverages, etc.)

* Groceries, take-out food/drinks, sundries

* Shopping (souvenirs, gifts, clothing, etc.)

* Outdoor recreation equipment purchase or rental (skiing, biking, etc.)

* Admissions and fees (seasonal pass, tickets for train rides, events, theaters, activities,

etc.)

* Others [ ]

SECTION 5: Socio-demographics

Section 5: Socio-demographics

24. Gender (person who fills this questionaire)

- ○ Female
- ○ Male
- ○ Non-binary
- ○ Other
- ○ Prefer not to answer

25. Including yourself, how many females and males in your group for your most recent trip to the city?

Females [ ]

Males [ ]

Non-binary	
Other	
Prefer not to answer	

26. What is your age?

- ◯ 18-24
- ◯ 25-34
- ◯ 35-44
- ◯ 45-54
- ◯ 55-64
- ◯ 65+
- ◯ Prefer not to tell

27. What is the highest level of education you have completed?

- ◯ Less than high school degree
- ◯ High school degree or equivalent
- ◯ Some college
- ◯ Undergraduate or post-secondary degree
- ◯ Graduate school degree

28. What was your approximate household income from all sources, before taxes, in **2022**?

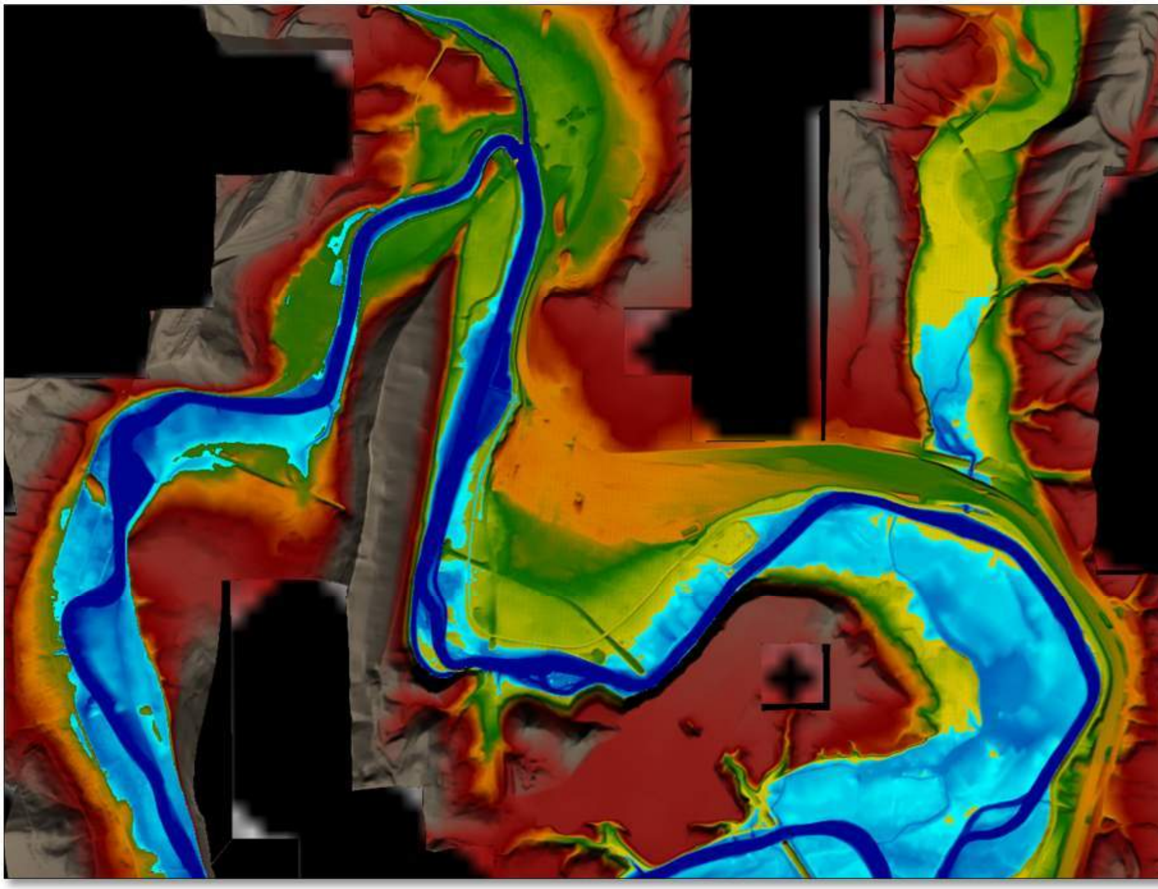
- Less than $20,000
- $20,001 to $40,000
- $40,001 to $60,000
- $60,001 to $80,000
- $80,001 to $100,000
- $100,001 to $150,000
- $150,001 to $200,000
- $200,001 to $250,000
- $250,001 to $300,000
- $300,001 +
- Prefer not to tell

29. What is your zip code

30. Do you have any other comments on your experience in the city?

Appendix B

Floodplain Feasibility Study
Recreation Engineering & Planning



Floodplain Feasibility Analysis
River Park at Canal Place – Cumberland, MD

PREPARED FOR: City of Cumberland
57 N Liberty St, Cumberland, MD 21502

PREPARED BY:
Recreation Engineering & Planning Inc.
485 Arapahoe Ave, Boulder, CO 80302

Recreation Engineering & Planning

DATE: December 6, 2024

Table of Contents

Introduction

The purpose of this report is to describe the hydraulic analysis performed to assess floodplain impacts for proposed improvements associated with the River Park at Canal Place in Cumberland, MD. Recreation Engineering and Planning (REP) is contracted with Civil and Environmental Consultants, Inc. (CEC) to develop 30% design plans for the in-stream recreation related features at the park. This analysis investigated the feasibility level floodplain impacts due to the proposed project, at the 30% design stage.

The proposed project is located within a U.S. Army Corps of Engineers (USACE) Flood Risk Management project protecting Cumberland, MD and Ridgeley, WV against flood discharges, and within the regulated floodway of the North Branch Potomac River. The proposed project will need to be designed to have no adverse impact on the floodplains of the North Branch Potomac River and Wills Creek. At the preliminary design level, a feasibility level hydraulic analysis is necessary to determine from a floodplain perspective where proposed structures may be located and extent of proposed dam lowering. This report does not include a formal no-rise analysis or hydraulic analysis sufficient for USACE 408 permit review or floodplain permitting. The purpose of this analysis is solely to assess the floodplain impact feasibility of locations, geometry and elevations for proposed improvements included in the 30% design. Further hydraulic analysis and no-rise certification will be performed at a further design phase.

Figure 1. Looking upstream at the confluence, North Branch Potomac River on the left, Wills Creek on the right.

Hydraulic Modeling Software

The modeling described in this analysis was performed using software developed by the USACE Hydrologic Engineering Center (HEC) for riverine hydraulic modeling: River Analysis System (HEC-RAS). HEC-RAS is capable of one and two-dimensional flow calculations and various sediment transport computations. All models developed for this analysis were updated and run with HEC-RAS version 6.6.

USACE CWMS Hydraulic Model

The proposed project is located within a USACE Flood Risk Management project and will be subject to USACE 408 review. To assess flood risk, the most current hydraulic models of the North Branch Potomac River and Wills Creek were requested from the USACE. A Freedom of Information Act (FOIA) request letter was filed with the USACE Baltimore District on November 9, 2023 requesting the hydraulic models and associated documentation. In response to the FOIA request, REP received a report describing hydraulic model developed on July 26, 2024 and received the HEC-RAS model files on August 7, 2024, with various additional modeling support files following.

The hydraulic model provided by the USACE to REP is described in the report "Potomac River Watershed Corps Water Management System Report", dated March 2019. This model is the Corps Water Management System (CWMS) model for the Potomac River Watershed and includes the North Branch of the Potomac River from Jennings Randolph Dam to the confluence with the South Branch of the Potomac River and Wills Creek from the USGS Wills Creek gage to the confluence with the North Branch of the Potomac River. The provided model also includes other rivers and tributaries within the Potomac River watershed to downstream of the confluence with the Anacostia River in Washington, D.C.

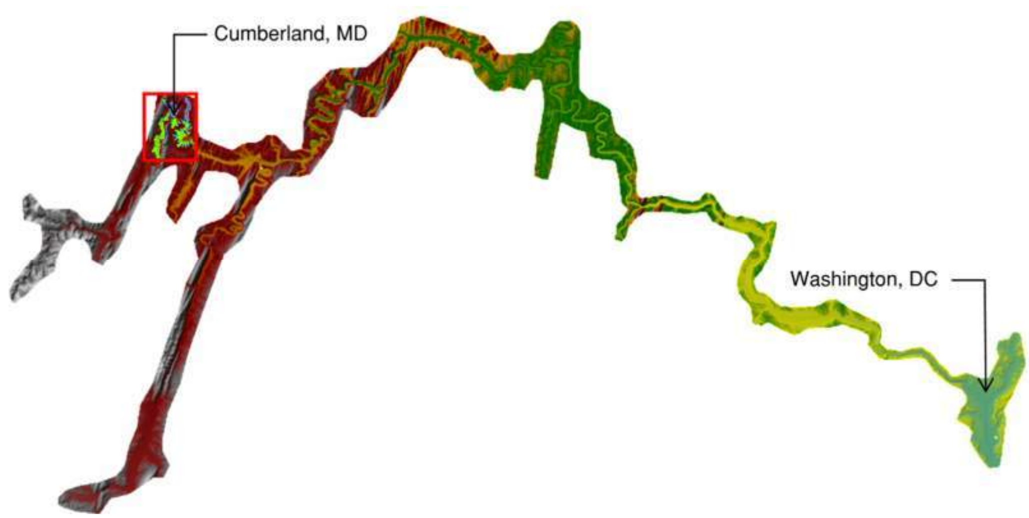


Figure 2. CWMS Potomac River Watershed model terrain extents. River reaches relevant for this study outlined in red.

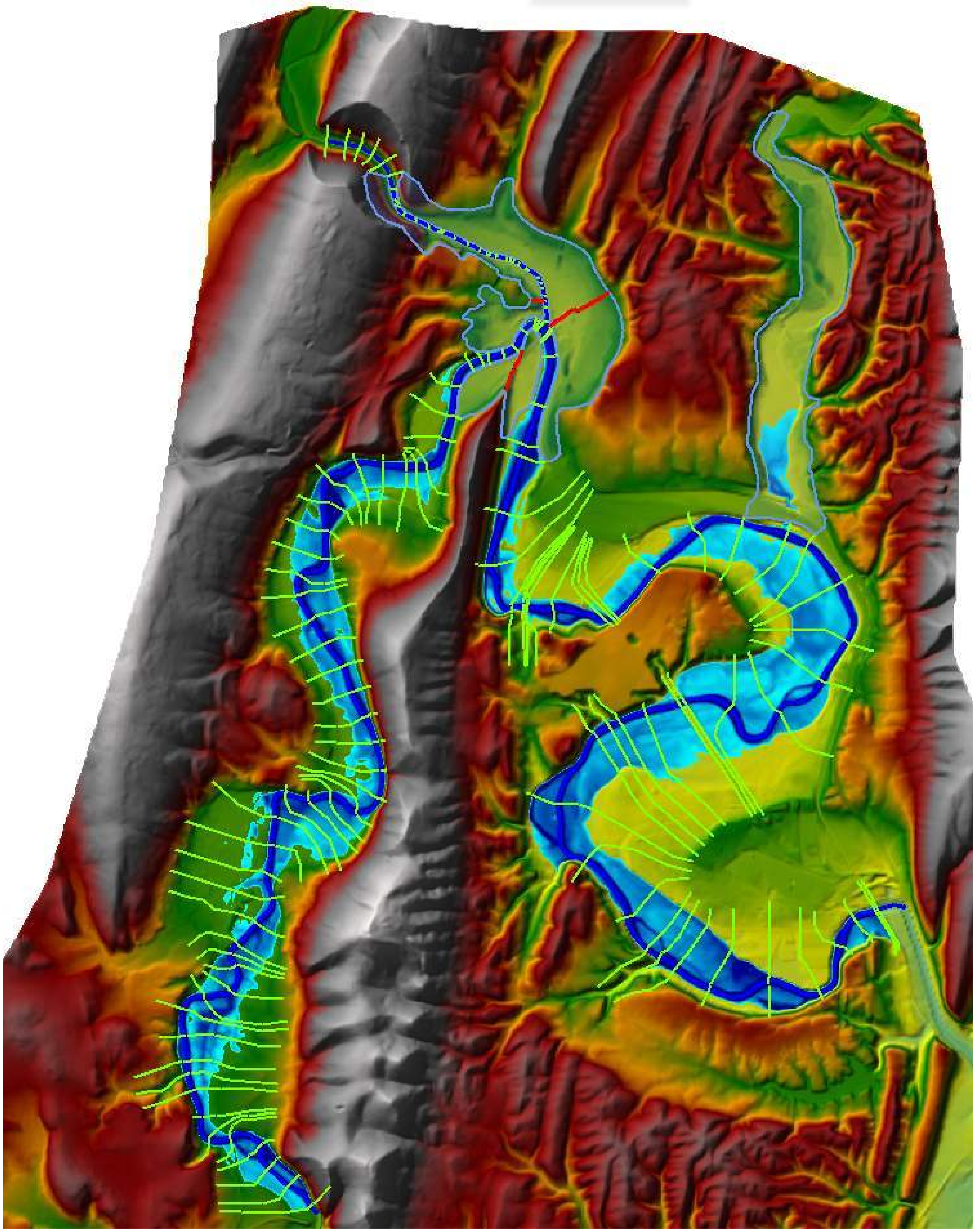


Figure 3. Trimmed model extents with terrain, river reaches, cross-sections, and storage areas shown. North Branch Potomac River extents include from river station 334.617 (upstream) to river station 314.22 (downstream). Area shown here outlined in red in Figure 2.

REP trimmed the CWMS model to the relevant reaches for the proposed project. River stationing of the North Branch Potomac River is in river miles from the confluence with the Chesapeake Bay. River stationing of Wills Creek is in river miles from the confluence with the North Branch Potomac River. At the upstream end, the North Branch Potomac River was trimmed at cross-section 334.617 (near the West Portal Moberly Tunnel), and at the downstream end at cross-section 314.22 (railroad bridge near Irons Mountain Campsite), resulting in 20.4 river miles. The full reach of Wills Creek from the CWMS model was left unchanged, from cross-section 0.205 near the confluence to cross-section 2.340 at the USGS Wills Creek gage station. Levees, inline structures, bridges, storage areas and connections were left unchanged from the CWMS model.

Effective FIS and FIRM

The effective Flood Insurance Study (FIS) for this reach of the North Branch Potomac River and Wills Creek is dated April 3, 2020. The Flood Insurance Rate Map (FIRM) panel for the project area has the same effective date and is attached to this report.

The peak discharges for the North Branch Potomac River and Wills Creek from the FIS are summarized in Table 1 below. The 1% annual chance discharge is often referred to as the "100-yr flood", the 0.2% annual chance discharge is often referred to as the "500-yr flood", etc.

For the purposes of this study, the 1% annual chance peak discharge or 100-yr flood was investigated for the North Branch Potomac River. For the downstream boundary condition, the 1% annual chance flood water surface elevation was used from the FIS flood profiles, 581.8.

TABLE 1.
FIS ANNUAL CHANCE PEAK DISCHARGES (CUBIC FEET PER SECOND)

	10% Annual Chance (10-yr)	2% Annual Chance (50-yr)	1% Annual Chance (100-yr)	0.2% Annual Chance (500-yr)
North Branch Potomac River At Cumberland, MD Gaging Station	*	*	51,000	*
Wills Creek At Confluence with North Branch Potomac River	14,700	28,000	36,100	62,300

Existing Conditions Model

Within the project area, twenty-three new cross-sections were added to the North Branch Potomac River to better define the area of proposed improvements. Cross-section geometry was cut from the existing terrain. Bank stations and roughness values were kept consistent with CWMS cross-sections in the vicinity (Manning's n 0.035 in channel, 0.065 in overbank). Total reach lengths were kept the same. The existing dam is modeled as an inline structure.

Figure 4. Existing conditions model geometry with additional cross-sections within the project area.

Proposed Conditions Model

Cross-section geometry within the project reach was updated to reflect the proposed river structures, grading and dam modifications consistent with the 30% design plans developed for the River Park at Canal Place. The in-line structure representing the existing dam was replaced by two proposed conditions cross-sections. A cross-section was located at every drop crest, exit, and pool. Roughness values were left unchanged and total reach length was kept the same.

Results

The existing conditions and proposed conditions models were run with the 1% annual chance peak discharge from the effective FIS and resulting water surface elevations were compared. Feasibility level floodplain impacts were investigated, to ensure the proposed project can meet one of the primary project goals of not increasing flood risk. Water surface elevation profiles for the 1% annual chance peak discharge (51,000 cfs) are shown in Figure 5 for the proposed conditions model as compared to the existing conditions model. Water surface elevations at each cross-section are given in the table on the following page.

Based on this preliminary analysis, the drop structures can be designed to match or slightly lower flood event water surface elevations upstream of the first drop structure. Flood elevation would decrease as compared to existing conditions through the project area to below the existing dam. Flood elevations downstream of the project would remain unchanged. The results of this analysis indicate the project can be designed to meet floodway no-rise requirements. Further design, analysis, and hydraulic modeling will be necessary for complying with regulatory floodplain / floodway requirements and providing a no-rise certification.

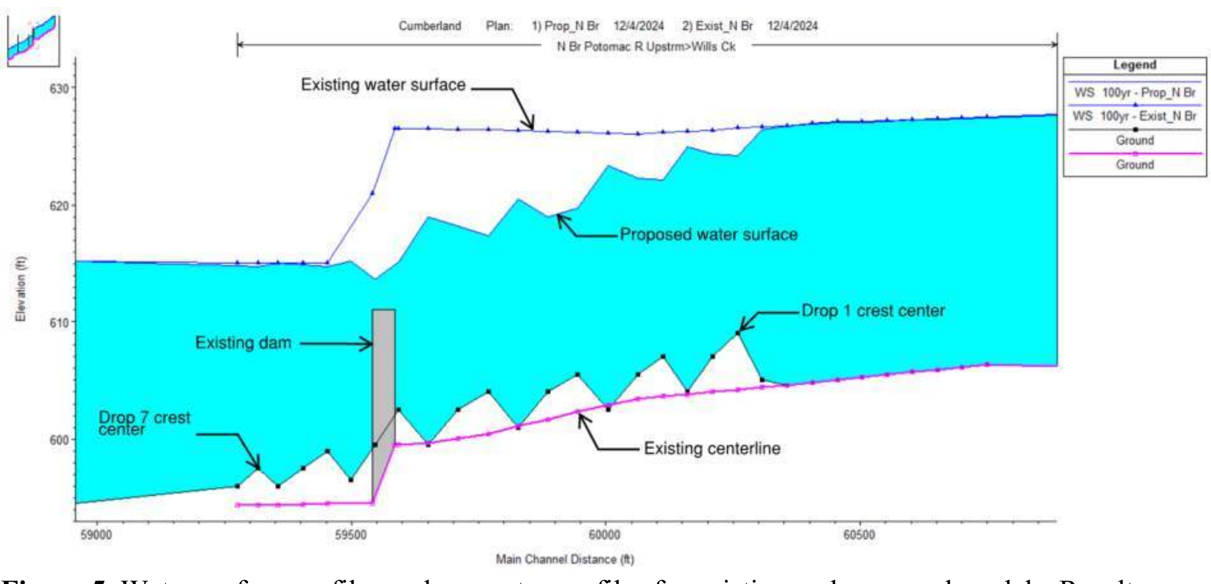


Figure 5. Water surface profiles and geometry profiles for existing and proposed models. Results show no increase in water surface elevation at any cross-section.

North Branch Potomac River 100-yr Flood WSE Comparison Table

		Data from existing model	Data from proposed model	Calculated Difference
1	2	3	4	4 - 3
River	Cross-section RS	Existing Conditions WSE (100-yr)	Proposed Conditions WSE (100-yr)	Proposed - Existing
N Branch Potomac	330.631	644.22	644.22	0.00
N Branch Potomac	330.481	644.1	644.1	0.00
N Branch Potomac	330.26	642.85	642.85	0.00
N Branch Potomac	330.072	641.41	641.41	0.00
N Branch Potomac	329.881	640.22	640.21	-0.01
N Branch Potomac	329.687	638.02	638.02	0.00
N Branch Potomac	329.502	638.47	638.46	-0.01
N Branch Potomac	329.312	637.86	637.85	-0.01
N Branch Potomac	329.124	637.07	637.07	0.00
N Branch Potomac	328.934	636.61	636.6	-0.01
N Branch Potomac	328.745	636.19	636.18	-0.01
N Branch Potomac	328.555	635.85	635.84	-0.01
N Branch Potomac	328.417	635.61	635.6	-0.01
N Branch Potomac	328.178	634.9	634.89	-0.01
N Branch Potomac	327.986	634.49	634.48	-0.01
N Branch Potomac	327.797	634.56	634.54	-0.02
N Branch Potomac	327.608	634.15	634.13	-0.02
N Branch Potomac	327.377	633.36	633.34	-0.02
N Branch Potomac	327.199	632.72	632.7	-0.02
N Branch Potomac	327.038	632.53	632.51	-0.02
N Branch Potomac	326.97	632.45	632.42	-0.03
N Branch Potomac	326.905	632.33	632.31	-0.02
N Branch Potomac	326.661	631.46	631.43	-0.03
N Branch Potomac	326.479	630.88	630.85	-0.03
N Branch Potomac	326.274	630.35	630.32	-0.03
N Branch Potomac	326.091	629.15	629.11	-0.04
N Branch Potomac	326.009	628.79	628.75	-0.04
N Branch Potomac	325.958	628.73	628.69	-0.04
N Branch Potomac	325.857	628.21	628.17	-0.04
N Branch Potomac	325.764	627.51	627.46	-0.05
N Branch Potomac	325.75	627.41	627.35	-0.06
N Branch Potomac	325.74	627.33	627.28	-0.05
N Branch Potomac	325.73	627.29	627.23	-0.06
N Branch Potomac	325.72	627.19	627.14	-0.05
N Branch Potomac	325.71	627.13	627.07	-0.06
N Branch Potomac	325.7	627.08	627.02	-0.06
N Branch Potomac	325.69	626.95	626.89	-0.06
N Branch Potomac	325.68	626.76	626.7	-0.06
N Branch Potomac	325.67	626.69	626.43	-0.26
N Branch Potomac	325.66	626.57	624.17	-2.40
N Branch Potomac	325.65	626.36	624.38	-1.98
N Branch Potomac	325.64	626.25	624.95	-1.30
N Branch Potomac	325.63	626.22	622.16	-4.06
N Branch Potomac	325.621	626.06	622.31	-3.75
N Branch Potomac	325.61	626.12	623.35	-2.77
N Branch Potomac	325.6	626.17	619.72	-6.45
N Branch Potomac	325.59	626.28	619	-7.28
N Branch Potomac	325.58	626.37	620.55	-5.82
N Branch Potomac	325.57	626.42	617.35	-9.07
N Branch Potomac	325.55	626.45	618.23	-8.22
N Branch Potomac	325.54	626.46	619.02	-7.44
N Branch Potomac	325.532	626.5	615.19	-11.31
N Branch Potomac	325.527*	Inl Struct	-	-
N Branch Potomac	325.52**	-	613.73	-
N Branch Potomac	325.51**	-	615.23	-
N Branch Potomac	325.506	615.09	614.74	-0.35
N Branch Potomac	325.5	615.09	614.95	-0.14
N Branch Potomac	325.487	615.1	615.1	0.00
N Branch Potomac	325.48	615.09	614.76	-0.33
N Branch Potomac	325.47	615.07	614.88	-0.19
N Branch Potomac	325.412	615.26	615.26	0.00
N Branch Potomac	325.408	615.23	615.23	0.00
N Branch Potomac	325.4	Allegheny RR Bridge	Bridge	-
N Branch Potomac	325.394	615.13	615.13	0.00

*Only in existing model

**Only in proposed model

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations (BFEs) shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Lambert Conformal Conic State Plane Maryland Zone 1900. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at https://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242** or visit its website at https://www.ngs.noaa.gov/.

Base map source: Base map information shown on this FIRM was provided in digital format. Road centerline and political boundary files were provided by the GIS Division of Allegany County Government.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles for North Branch Potomac and Potomac Rivers in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

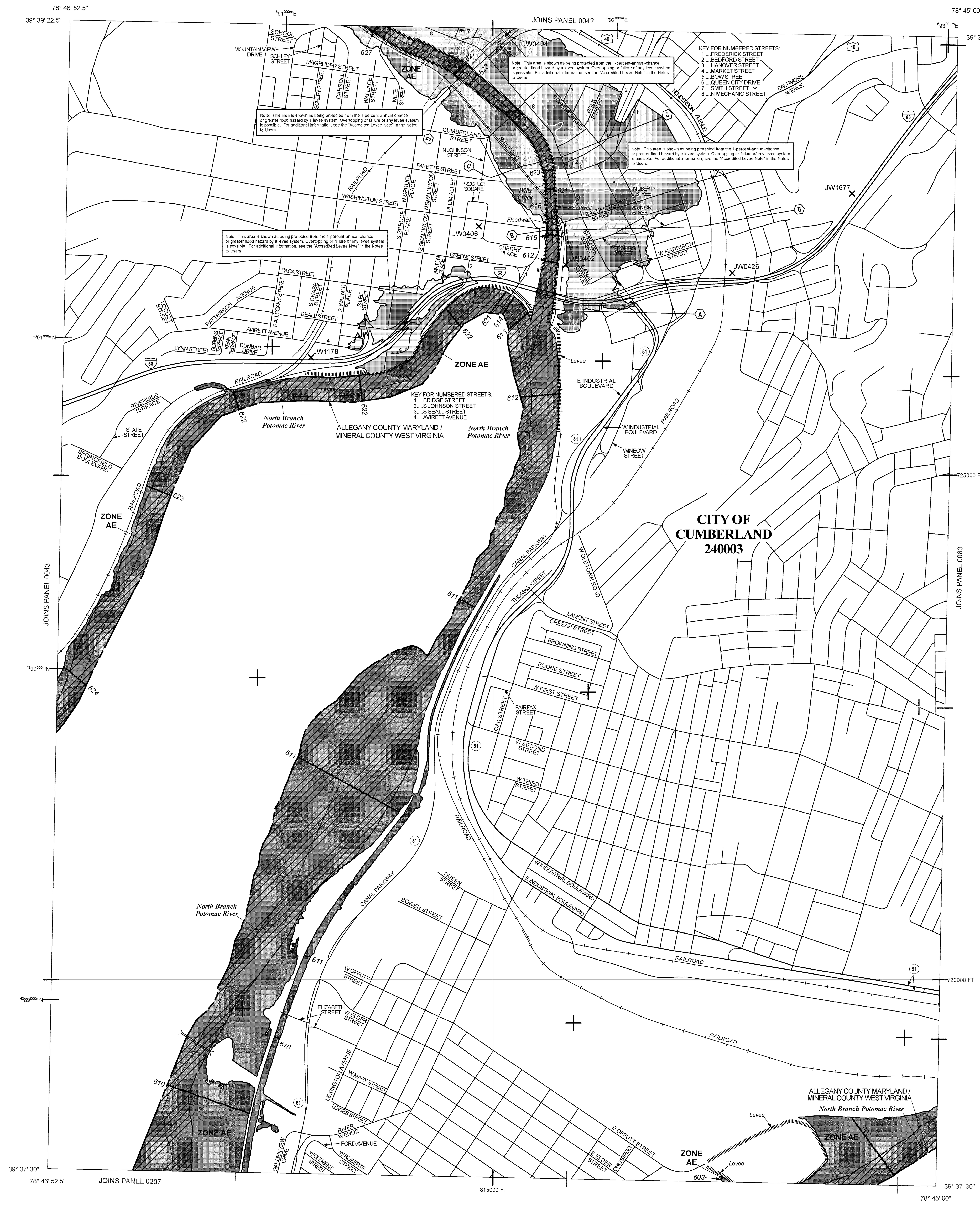
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Information eXchange** at 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Information eXchange may also be reached by Fax at 1-800-358-9620 and its website at https://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at https://www.fema.gov/national-flood-insurance-program.

ACCREDITED LEVEE NOTES TO USERS:
Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance-level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at https://www.fema.gov/national-flood-insurance-program.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAS)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary
0.2% annual chance floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

	Bridge
	Footbridge
	Culvert
A — A	Cross section line
23 - - - 23	Transect line
87°07'45", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4123000MN	1000-meter Universal Transverse Mercator grid values, zone 17 North
600000 FT	5000-foot grid ticks: Maryland State Plane coordinate system (FIPSZONE 1900), Lambert Conformal Conic projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5	River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
APRIL 3, 2020

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0044E

FIRM
FLOOD INSURANCE RATE MAP

ALLEGANY COUNTY, MARYLAND
AND INCORPORATED AREAS

PANEL 44 OF 370

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CUMBERLAND, CITY OF	240003	0044	E

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

MAP NUMBER
24001C0044E

EFFECTIVE DATE
APRIL 3, 2020

Federal Emergency Management Agency

HEC-RAS Profile: 100yr

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Upstrm>Wills Ck	334.617	100yr	Exist_N Br	51000.00	634.78	659.65		661.92	0.001398	12.34	4836.63	889.50	0.46
Upstrm>Wills Ck	334.617	100yr	Prop_N Br	51000.00	634.78	659.65		661.92	0.001398	12.34	4836.63	889.50	0.46
Upstrm>Wills Ck	334.411	100yr	Exist_N Br	51000.00	632.79	659.44		660.20	0.001053	7.30	8631.67	984.11	0.36
Upstrm>Wills Ck	334.411	100yr	Prop_N Br	51000.00	632.79	659.44		660.20	0.001053	7.30	8631.67	984.11	0.36
Upstrm>Wills Ck	334.228	100yr	Exist_N Br	51000.00	631.63	658.72		659.31	0.000745	6.63	10374.88	1241.87	0.31
Upstrm>Wills Ck	334.228	100yr	Prop_N Br	51000.00	631.63	658.72		659.31	0.000745	6.63	10374.88	1241.87	0.31
Upstrm>Wills Ck	334.046	100yr	Exist_N Br	51000.00	628.79	658.35		658.80	0.000358	7.06	15731.18	1567.42	0.24
Upstrm>Wills Ck	334.046	100yr	Prop_N Br	51000.00	628.79	658.35		658.80	0.000358	7.06	15731.18	1567.42	0.24
Upstrm>Wills Ck	333.813	100yr	Exist_N Br	51000.00	628.45	656.24		658.01	0.001242	10.89	5188.12	638.54	0.42
Upstrm>Wills Ck	333.813	100yr	Prop_N Br	51000.00	628.45	656.24		658.01	0.001242	10.89	5188.12	638.54	0.42
Upstrm>Wills Ck	333.669	100yr	Exist_N Br	51000.00	626.60	656.19		657.21	0.000582	9.24	9103.12	645.91	0.31
Upstrm>Wills Ck	333.669	100yr	Prop_N Br	51000.00	626.60	656.19		657.21	0.000582	9.24	9103.12	645.91	0.31
Upstrm>Wills Ck	333.48	100yr	Exist_N Br	51000.00	626.50	654.57		656.46	0.000976	11.57	5953.79	437.33	0.40
Upstrm>Wills Ck	333.48	100yr	Prop_N Br	51000.00	626.50	654.57		656.46	0.000976	11.57	5953.76	437.33	0.40
Upstrm>Wills Ck	333.29	100yr	Exist_N Br	51000.00	626.50	654.24		655.48	0.000642	9.01	6138.53	685.18	0.32
Upstrm>Wills Ck	333.29	100yr	Prop_N Br	51000.00	626.50	654.24		655.48	0.000642	9.01	6138.49	685.18	0.32
Upstrm>Wills Ck	333.173	100yr	Exist_N Br	51000.00	626.34	653.74		655.06	0.000672	9.44	6772.77	1496.53	0.33
Upstrm>Wills Ck	333.173	100yr	Prop_N Br	51000.00	626.34	653.74		655.06	0.000672	9.44	6772.72	1496.52	0.33
Upstrm>Wills Ck	333.084	100yr	Exist_N Br	51000.00	625.53	653.68		654.58	0.000884	7.95	9032.45	1460.25	0.35
Upstrm>Wills Ck	333.084	100yr	Prop_N Br	51000.00	625.53	653.68		654.58	0.000884	7.95	9032.27	1460.24	0.35
Upstrm>Wills Ck	332.915	100yr	Exist_N Br	51000.00	624.84	652.63		653.74	0.000935	8.77	8432.20	2068.26	0.36
Upstrm>Wills Ck	332.915	100yr	Prop_N Br	51000.00	624.84	652.63		653.74	0.000935	8.77	8431.97	2068.25	0.36
Upstrm>Wills Ck	332.722	100yr	Exist_N Br	51000.00	626.52	651.24	640.14	652.77	0.000935	10.15	7581.35	2376.23	0.37
Upstrm>Wills Ck	332.722	100yr	Prop_N Br	51000.00	626.52	651.24	640.14	652.77	0.000935	10.15	7581.06	2376.23	0.37
Upstrm>Wills Ck	332.533	100yr	Exist_N Br	51000.00	625.43	651.09		651.88	0.000602	8.12	12353.08	2052.56	0.30
Upstrm>Wills Ck	332.533	100yr	Prop_N Br	51000.00	625.43	651.09		651.88	0.000602	8.12	12352.86	2052.54	0.30
Upstrm>Wills Ck	332.343	100yr	Exist_N Br	51000.00	623.30	650.62		651.31	0.000531	7.72	12636.12	1558.89	0.29
Upstrm>Wills Ck	332.343	100yr	Prop_N Br	51000.00	623.30	650.62		651.31	0.000531	7.72	12635.74	1558.88	0.29
Upstrm>Wills Ck	332.154	100yr	Exist_N Br	51000.00	623.30	650.36	644.35	650.83	0.000447	7.33	16357.32	1835.70	0.26
Upstrm>Wills Ck	332.154	100yr	Prop_N Br	51000.00	623.30	650.36	644.35	650.83	0.000447	7.33	16356.99	1835.69	0.26
Upstrm>Wills Ck	332.061	100yr	Exist_N Br	51000.00	623.37	650.11		650.63	0.000395	6.87	14797.84	1648.49	0.25
Upstrm>Wills Ck	332.061	100yr	Prop_N Br	51000.00	623.37	650.11		650.63	0.000395	6.87	14797.53	1648.48	0.25
Upstrm>Wills Ck	331.964	100yr	Exist_N Br	51000.00	623.31	649.55		650.38	0.000651	8.92	11840.92	1270.23	0.32
Upstrm>Wills Ck	331.964	100yr	Prop_N Br	51000.00	623.31	649.55		650.38	0.000651	8.92	11840.61	1270.22	0.32
Upstrm>Wills Ck	331.775	100yr	Exist_N Br	51000.00	624.02	648.50		649.61	0.000882	9.58	9140.14	1138.72	0.36
Upstrm>Wills Ck	331.775	100yr	Prop_N Br	51000.00	624.02	648.50		649.61	0.000882	9.58	9139.77	1138.66	0.36
Upstrm>Wills Ck	331.574	100yr	Exist_N Br	51000.00	623.30	646.20		648.30	0.001546	12.34	5627.24	782.64	0.48
Upstrm>Wills Ck	331.574	100yr	Prop_N Br	51000.00	623.30	646.20		648.30	0.001546	12.34	5626.97	782.52	0.48
Upstrm>Wills Ck	331.396	100yr	Exist_N Br	51000.00	619.67	645.81		647.09	0.000740	9.35	7207.39	1070.51	0.34
Upstrm>Wills Ck	331.396	100yr	Prop_N Br	51000.00	619.67	645.81		647.09	0.000740	9.35	7206.92	1070.25	0.34
Upstrm>Wills Ck	331.207	100yr	Exist_N Br	51000.00	618.39	645.39		646.34	0.000571	8.45	9285.83	1197.51	0.30
Upstrm>Wills Ck	331.207	100yr	Prop_N Br	51000.00	618.39	645.39		646.34	0.000571	8.45	9285.29	1197.39	0.30
Upstrm>Wills Ck	331.017	100yr	Exist_N Br	51000.00	618.40	645.03	633.37	645.76	0.000497	7.64	13136.68	2702.15	0.28
Upstrm>Wills Ck	331.017	100yr	Prop_N Br	51000.00	618.40	645.03	633.37	645.75	0.000497	7.64	13134.96	2702.12	0.28
Upstrm>Wills Ck	330.793	100yr	Exist_N Br	51000.00	619.59	644.87	636.57	645.22	0.000438	7.38	21838.39	3167.42	0.26
Upstrm>Wills Ck	330.793	100yr	Prop_N Br	51000.00	619.59	644.87	636.57	645.22	0.000438	7.38	21835.88	3167.41	0.26
Upstrm>Wills Ck	330.631	100yr	Exist_N Br	51000.00	619.07	644.22	638.30	644.87	0.000588	8.61	16029.90	2369.19	0.31
Upstrm>Wills Ck	330.631	100yr	Prop_N Br	51000.00	619.07	644.22	638.30	644.87	0.000588	8.62	16027.29	2369.13	0.31
Upstrm>Wills Ck	330.481	100yr	Exist_N Br	51000.00	617.86	644.10	634.75	644.49	0.000378	6.71	17883.41	1987.06	0.24
Upstrm>Wills Ck	330.481	100yr	Prop_N Br	51000.00	617.86	644.10	634.75	644.49	0.000378	6.71	17881.23	1987.05	0.24
Upstrm>Wills Ck	330.26	100yr	Exist_N Br	51000.00	616.63	642.85	632.90	643.94	0.000764	9.39	9410.07	1049.03	0.35
Upstrm>Wills Ck	330.26	100yr	Prop_N Br	51000.00	616.63	642.85	632.90	643.94	0.000764	9.39	9408.47	1049.01	0.35
Upstrm>Wills Ck	330.072	100yr	Exist_N Br	51000.00	615.80	641.41	633.08	643.01	0.001348	11.15	6467.89	1101.89	0.44
Upstrm>Wills Ck	330.072	100yr	Prop_N Br	51000.00	615.80	641.41	633.08	643.01	0.001348	11.16	6466.81	1101.77	0.44
Upstrm>Wills Ck	329.881	100yr	Exist_N Br	51000.00	614.80	640.22	631.69	641.88	0.001153	11.15	6592.83	839.34	0.42
Upstrm>Wills Ck	329.881	100yr	Prop_N Br	51000.00	614.80	640.21	631.69	641.88	0.001154	11.15	6591.23	839.10	0.42
Upstrm>Wills Ck	329.687	100yr	Exist_N Br	51000.00	614.30	638.02	630.26	640.48	0.001468	13.11	4911.87	840.65	0.48
Upstrm>Wills Ck	329.687	100yr	Prop_N Br	51000.00	614.30	638.02	630.26	640.48	0.001469	13.11	4910.46	840.49	0.48
Upstrm>Wills Ck	329.502	100yr	Exist_N Br	51000.00	613.53	638.47	626.25	639.23	0.000487	7.73	10013.03	778.23	0.28
Upstrm>Wills Ck	329.502	100yr	Prop_N Br	51000.00	613.53	638.46	626.25	639.23	0.000488	7.73	10009.71	778.20	0.28
Upstrm>Wills Ck	329.312	100yr	Exist_N Br	51000.00	612.15	637.86	629.11	638.66	0.000664	8.55	11210.50	1193.41	0.32
Upstrm>Wills Ck	329.312	100yr	Prop_N Br	51000.00	612.15	637.85	629.11	638.65	0.000665	8.56	11204.16	1193.25	0.32

HEC-RAS Profile: 100yr (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Upstrm>Wills Ck	329.124	100yr	Exist_N Br	51000.00	611.56	637.07		637.99	0.000672	9.30	11677.68	1318.29	0.33
Upstrm>Wills Ck	329.124	100yr	Prop_N Br	51000.00	611.56	637.07		637.98	0.000673	9.31	11668.42	1318.22	0.33
Upstrm>Wills Ck	328.934	100yr	Exist_N Br	51000.00	611.20	636.61	628.17	637.32	0.000559	8.44	12709.46	1611.26	0.30
Upstrm>Wills Ck	328.934	100yr	Prop_N Br	51000.00	611.20	636.60	628.17	637.32	0.000560	8.45	12699.39	1610.71	0.30
Upstrm>Wills Ck	328.745	100yr	Exist_N Br	51000.00	611.00	636.19	625.96	636.78	0.000466	7.38	14323.26	1674.42	0.27
Upstrm>Wills Ck	328.745	100yr	Prop_N Br	51000.00	611.00	636.18	625.96	636.77	0.000467	7.38	14308.35	1674.15	0.27
Upstrm>Wills Ck	328.555	100yr	Exist_N Br	51000.00	610.50	635.85		636.33	0.000412	7.09	15276.61	1484.29	0.26
Upstrm>Wills Ck	328.555	100yr	Prop_N Br	51000.00	610.50	635.84		636.32	0.000413	7.09	15262.02	1484.20	0.26
Upstrm>Wills Ck	328.417	100yr	Exist_N Br	51000.00	609.50	635.61	627.83	636.10	0.000441	7.42	15422.01	1699.31	0.26
Upstrm>Wills Ck	328.417	100yr	Prop_N Br	51000.00	609.50	635.60	627.83	636.09	0.000442	7.43	15405.57	1697.52	0.26
Upstrm>Wills Ck	328.178	100yr	Exist_N Br	51000.00	606.50	634.90	622.40	635.58	0.000448	7.74	13221.63	1470.83	0.27
Upstrm>Wills Ck	328.178	100yr	Prop_N Br	51000.00	606.50	634.89	622.40	635.57	0.000449	7.75	13202.51	1470.74	0.27
Upstrm>Wills Ck	327.986	100yr	Exist_N Br	51000.00	606.40	634.49	620.73	635.16	0.000401	7.56	12487.49	1361.45	0.26
Upstrm>Wills Ck	327.986	100yr	Prop_N Br	51000.00	606.40	634.48	620.73	635.15	0.000403	7.56	12470.63	1360.87	0.26
Upstrm>Wills Ck	327.797	100yr	Exist_N Br	51000.00	606.20	634.56		634.74	0.000216	5.44	20707.97	1426.59	0.18
Upstrm>Wills Ck	327.797	100yr	Prop_N Br	51000.00	606.20	634.54		634.73	0.000216	5.45	20688.12	1426.43	0.18
Upstrm>Wills Ck	327.608	100yr	Exist_N Br	51000.00	604.90	634.15		634.51	0.000263	6.12	18061.92	1704.81	0.21
Upstrm>Wills Ck	327.608	100yr	Prop_N Br	51000.00	604.90	634.13		634.50	0.000263	6.13	18035.70	1704.51	0.21
Upstrm>Wills Ck	327.377	100yr	Exist_N Br	51000.00	604.70	633.36	622.33	634.10	0.000517	8.00	11724.40	1437.86	0.28
Upstrm>Wills Ck	327.377	100yr	Prop_N Br	51000.00	604.70	633.34	622.33	634.08	0.000519	8.01	11703.07	1436.34	0.28
Upstrm>Wills Ck	327.199	100yr	Exist_N Br	51000.00	604.60	632.72	620.57	633.61	0.000557	8.56	10233.46	1069.88	0.30
Upstrm>Wills Ck	327.199	100yr	Prop_N Br	51000.00	604.60	632.70	620.57	633.59	0.000559	8.57	10214.84	1065.57	0.30
Upstrm>Wills Ck	327.038	100yr	Exist_N Br	51000.00	604.50	632.53	616.81	633.17	0.000336	6.74	10562.83	936.24	0.23
Upstrm>Wills Ck	327.038	100yr	Prop_N Br	51000.00	604.50	632.51	616.81	633.16	0.000337	6.75	10543.13	935.25	0.23
Upstrm>Wills Ck	326.97	100yr	Exist_N Br	51000.00	604.30	632.45	616.58	633.05	0.000309	6.46	11052.34	1416.56	0.22
Upstrm>Wills Ck	326.97	100yr	Prop_N Br	51000.00	604.30	632.42	616.58	633.03	0.000310	6.47	11021.95	1404.30	0.22
Upstrm>Wills Ck	326.905	100yr	Exist_N Br	51000.00	604.10	632.33	616.34	632.94	0.000320	6.65	11086.59	1213.46	0.23
Upstrm>Wills Ck	326.905	100yr	Prop_N Br	51000.00	604.10	632.31	616.34	632.92	0.000321	6.66	11063.38	1201.54	0.23
Upstrm>Wills Ck	326.661	100yr	Exist_N Br	51000.00	603.90	631.46	617.23	632.41	0.000490	8.10	7673.67	459.83	0.28
Upstrm>Wills Ck	326.661	100yr	Prop_N Br	51000.00	603.90	631.43	617.23	632.39	0.000491	8.11	7662.36	459.66	0.28
Upstrm>Wills Ck	326.479	100yr	Exist_N Br	51000.00	603.80	630.88	617.08	631.95	0.000545	8.52	6862.51	341.73	0.30
Upstrm>Wills Ck	326.479	100yr	Prop_N Br	51000.00	603.80	630.85	617.08	631.92	0.000547	8.53	6853.52	341.59	0.30
Upstrm>Wills Ck	326.478			Lat Struct									
Upstrm>Wills Ck	326.274	100yr	Exist_N Br	51000.00	604.72	630.35	616.80	631.35	0.000530	8.21	7033.14	474.87	0.29
Upstrm>Wills Ck	326.274	100yr	Prop_N Br	51000.00	604.72	630.32	616.80	631.32	0.000532	8.22	7022.81	470.36	0.29
Upstrm>Wills Ck	326.091	100yr	Exist_N Br	51000.00	606.19	629.15		630.60	0.001077	10.06	6093.82	416.93	0.40
Upstrm>Wills Ck	326.091	100yr	Prop_N Br	51000.00	606.19	629.11		630.57	0.001084	10.08	6078.48	416.72	0.40
Upstrm>Wills Ck	326.009	100yr	Exist_N Br	51000.00	606.25	628.79		630.12	0.000962	9.43	6090.53	442.90	0.38
Upstrm>Wills Ck	326.009	100yr	Prop_N Br	51000.00	606.25	628.75		630.08	0.000969	9.46	6072.92	442.51	0.38
Upstrm>Wills Ck	326.008			Lat Struct									
Upstrm>Wills Ck	325.958	100yr	Exist_N Br	51000.00	606.14	628.73		629.83	0.000735	8.54	6540.55	392.58	0.33
Upstrm>Wills Ck	325.958	100yr	Prop_N Br	51000.00	606.14	628.69		629.79	0.000740	8.56	6524.74	392.32	0.33
Upstrm>Wills Ck	325.857	100yr	Exist_N Br	51000.00	606.00	628.21		629.40	0.000838	8.80	6047.95	350.88	0.35
Upstrm>Wills Ck	325.857	100yr	Prop_N Br	51000.00	606.00	628.17		629.36	0.000844	8.82	6032.38	350.62	0.35
Upstrm>Wills Ck	325.764	100yr	Exist_N Br	51000.00	606.31	627.51		628.89	0.001190	9.53	5616.86	360.18	0.41
Upstrm>Wills Ck	325.764	100yr	Prop_N Br	51000.00	606.31	627.46		628.85	0.001203	9.56	5597.98	359.98	0.41
Upstrm>Wills Ck	325.75	100yr	Exist_N Br	51000.00	606.10	627.41		628.83	0.001207	9.65	5538.09	367.10	0.41
Upstrm>Wills Ck	325.75	100yr	Prop_N Br	51000.00	606.10	627.35		628.79	0.001220	9.68	5518.40	366.97	0.41
Upstrm>Wills Ck	325.74	100yr	Exist_N Br	51000.00	605.91	627.33		628.77	0.001207	9.70	5553.08	374.85	0.41
Upstrm>Wills Ck	325.74	100yr	Prop_N Br	51000.00	605.91	627.28		628.73	0.001221	9.73	5532.61	374.72	0.41
Upstrm>Wills Ck	325.73	100yr	Exist_N Br	51000.00	605.70	627.29		628.71	0.001181	9.67	5641.10	382.13	0.41
Upstrm>Wills Ck	325.73	100yr	Prop_N Br	51000.00	605.70	627.23		628.66	0.001194	9.70	5620.00	382.01	0.41
Upstrm>Wills Ck	325.72	100yr	Exist_N Br	51000.00	605.47	627.19		628.65	0.001201	9.76	5567.63	373.91	0.41
Upstrm>Wills Ck	325.72	100yr	Prop_N Br	51000.00	605.47	627.14		628.60	0.001214	9.80	5546.63	373.80	0.41
Upstrm>Wills Ck	325.71	100yr	Exist_N Br	51000.00	605.25	627.13		628.59	0.001168	9.76	5533.02	364.30	0.41
Upstrm>Wills Ck	325.71	100yr	Prop_N Br	51000.00	605.25	627.07		628.54	0.001181	9.80	5512.39	364.23	0.41
Upstrm>Wills Ck	325.70	100yr	Exist_N Br	51000.00	605.03	627.08		628.53	0.001154	9.73	5508.48	359.07	0.41
Upstrm>Wills Ck	325.70	100yr	Prop_N Br	51000.00	605.03	627.02		628.48	0.001166	9.77	5488.00	358.80	0.41
Upstrm>Wills Ck	325.69	100yr	Exist_N Br	51000.00	604.81	626.95		628.47	0.001209	9.90	5311.97	347.65	0.41
Upstrm>Wills Ck	325.69	100yr	Prop_N Br	51000.00	604.81	626.89		628.42	0.001222	9.93	5291.67	347.41	0.42
Upstrm>Wills Ck	325.68	100yr	Exist_N Br	51000.00	604.60	626.76		628.39	0.001298	10.25	5030.05	303.39	0.43
Upstrm>Wills Ck	325.68	100yr	Prop_N Br	51000.00	604.60	626.70		628.34	0.001312	10.29	5011.95	303.01	0.43

HEC-RAS Profile: 100yr (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Upstrm>Wills Ck	325.67	100yr	Exist_N Br	51000.00	604.40	626.69		628.33	0.001334	10.26	4972.10	286.34	0.43
Upstrm>Wills Ck	325.67	100yr	Prop_N Br	51000.00	605.00	626.43		628.25	0.001603	10.84	4703.25	285.30	0.47
Upstrm>Wills Ck	325.66	100yr	Exist_N Br	51000.00	604.19	626.57		628.26	0.001352	10.41	4902.42	279.35	0.44
Upstrm>Wills Ck	325.66	100yr	Prop_N Br	51000.00	609.00	624.17		627.93	0.005019	15.55	3279.00	270.38	0.79
Upstrm>Wills Ck	325.65	100yr	Exist_N Br	51000.00	604.01	626.36		628.17	0.001475	10.80	4724.48	271.73	0.45
Upstrm>Wills Ck	325.65	100yr	Prop_N Br	51000.00	607.00	624.38		627.55	0.003671	14.27	3574.41	264.30	0.68
Upstrm>Wills Ck	325.64	100yr	Exist_N Br	51000.00	603.82	626.25		628.10	0.001476	10.91	4684.69	269.80	0.46
Upstrm>Wills Ck	325.64	100yr	Prop_N Br	51000.00	604.00	624.95		627.12	0.001902	11.82	4319.63	265.42	0.51
Upstrm>Wills Ck	325.63	100yr	Exist_N Br	51000.00	603.62	626.22		628.01	0.001447	10.73	4755.69	273.04	0.45
Upstrm>Wills Ck	325.63	100yr	Prop_N Br	51000.00	607.00	622.16		626.73	0.006515	17.14	2975.41	258.17	0.89
Upstrm>Wills Ck	325.621	100yr	Exist_N Br	51000.00	603.45	626.06		627.93	0.001393	11.04	4789.01	276.98	0.45
Upstrm>Wills Ck	325.621	100yr	Prop_N Br	51000.00	605.50	622.31		626.28	0.004666	16.03	3261.85	263.13	0.77
Upstrm>Wills Ck	325.62			Lat Struct									
Upstrm>Wills Ck	325.61	100yr	Exist_N Br	51000.00	602.90	626.12		627.79	0.001231	10.42	5062.59	289.90	0.42
Upstrm>Wills Ck	325.61	100yr	Prop_N Br	51000.00	602.50	623.35		625.59	0.001936	12.05	4335.72	280.83	0.52
Upstrm>Wills Ck	325.60	100yr	Exist_N Br	51000.00	602.32	626.17		627.67	0.001059	9.94	5419.31	305.00	0.39
Upstrm>Wills Ck	325.60	100yr	Prop_N Br	51000.00	605.50	619.72	619.72	625.08	0.007976	18.63	2817.56	279.96	0.98
Upstrm>Wills Ck	325.59	100yr	Exist_N Br	51000.00	601.68	626.28		627.54	0.000854	9.12	5880.01	316.75	0.35
Upstrm>Wills Ck	325.59	100yr	Prop_N Br	51000.00	604.00	619.00	618.05	623.50	0.006298	17.07	3054.14	286.16	0.88
Upstrm>Wills Ck	325.58	100yr	Exist_N Br	51000.00	601.13	626.37		627.44	0.000683	8.34	6348.60	328.90	0.32
Upstrm>Wills Ck	325.58	100yr	Prop_N Br	51000.00	601.00	620.55		622.58	0.001834	11.43	4533.63	305.78	0.50
Upstrm>Wills Ck	325.57	100yr	Exist_N Br	51000.00	600.46	626.42		627.36	0.000584	7.80	6689.07	333.48	0.30
Upstrm>Wills Ck	325.57	100yr	Prop_N Br	51000.00	604.00	617.35	616.91	622.11	0.007496	17.50	2913.47	273.18	0.94
Upstrm>Wills Ck	325.55	100yr	Exist_N Br	51000.00	600.08	626.45		627.30	0.000495	7.42	7023.54	346.25	0.27
Upstrm>Wills Ck	325.55	100yr	Prop_N Br	51000.00	602.50	618.23		621.29	0.003878	14.04	3632.93	287.91	0.70
Upstrm>Wills Ck	325.54	100yr	Exist_N Br	51000.00	599.66	626.46		627.26	0.000489	7.16	7156.80	341.88	0.27
Upstrm>Wills Ck	325.54	100yr	Prop_N Br	51000.00	599.50	619.02		620.75	0.001562	10.57	4825.97	297.37	0.46
Upstrm>Wills Ck	325.532	100yr	Exist_N Br	51000.00	599.50	626.50	610.80	627.21	0.000409	6.72	7584.43	332.60	0.25
Upstrm>Wills Ck	325.532	100yr	Prop_N Br	51000.00	602.50	615.19	615.19	620.24	0.009637	18.03	2829.16	281.97	1.00
Upstrm>Wills Ck	325.527			Inl Struct									
Upstrm>Wills Ck	325.52	100yr	Prop_N Br	51000.00	599.50	613.73	612.52	617.79	0.006802	16.17	3153.92	281.85	0.85
Upstrm>Wills Ck	325.51	100yr	Prop_N Br	51000.00	596.50	615.23		616.95	0.001605	10.52	4846.60	305.57	0.47
Upstrm>Wills Ck	325.506	100yr	Exist_N Br	51000.00	594.50	615.09		616.30	0.001015	8.85	5762.54	335.85	0.38
Upstrm>Wills Ck	325.506	100yr	Prop_N Br	51000.00	599.00	614.74		616.83	0.002487	11.59	4400.72	334.62	0.56
Upstrm>Wills Ck	325.50	100yr	Exist_N Br	51000.00	594.44	615.09		616.23	0.000910	8.58	5967.40	350.58	0.36
Upstrm>Wills Ck	325.50	100yr	Prop_N Br	51000.00	597.50	614.95		616.59	0.001682	10.29	4976.37	350.03	0.47
Upstrm>Wills Ck	325.487	100yr	Exist_N Br	51000.00	594.40	615.10		616.17	0.000866	8.27	6167.00	353.67	0.35
Upstrm>Wills Ck	325.487	100yr	Prop_N Br	51000.00	596.00	615.10		616.43	0.001239	9.24	5521.88	353.67	0.41
Upstrm>Wills Ck	325.48	100yr	Exist_N Br	51000.00	594.38	615.09		616.13	0.000759	8.18	6310.31	353.32	0.33
Upstrm>Wills Ck	325.48	100yr	Prop_N Br	51000.00	597.50	614.76		616.35	0.001551	10.11	5109.10	352.48	0.46
Upstrm>Wills Ck	325.47	100yr	Exist_N Br	51000.00	594.38	615.07		616.09	0.000799	8.08	6328.84	355.68	0.33
Upstrm>Wills Ck	325.47	100yr	Prop_N Br	51000.00	596.00	614.88		616.22	0.001269	9.27	5521.22	355.24	0.41
Wils Ck>downstrm	325.412	100yr	Exist_N Br	51000.00	594.30	615.26		615.74	0.000327	5.58	9461.62	521.00	0.22
Wils Ck>downstrm	325.412	100yr	Prop_N Br	51000.00	594.30	615.26		615.74	0.000327	5.58	9461.62	521.00	0.22
Wils Ck>downstrm	325.411			Lat Struct									
Wils Ck>downstrm	325.41			Lat Struct									
Wils Ck>downstrm	325.408	100yr	Exist_N Br	51000.00	594.30	615.23	603.00	615.73	0.000345	5.70	9274.91	520.32	0.23
Wils Ck>downstrm	325.408	100yr	Prop_N Br	51000.00	594.30	615.23	603.00	615.73	0.000345	5.70	9274.91	520.32	0.23
Wils Ck>downstrm	325.4 Allegheny RR 2			Bridge									
Wils Ck>downstrm	325.394	100yr	Exist_N Br	51000.00	594.00	615.13		615.70	0.000420	6.14	8685.01	515.64	0.25
Wils Ck>downstrm	325.394	100yr	Prop_N Br	51000.00	594.00	615.13		615.70	0.000420	6.14	8685.01	515.64	0.25
Wils Ck>downstrm	325.269 Wills CF	100yr	Exist_N Br	51000.00	591.50	614.48		615.36	0.000559	7.64	7418.23	441.75	0.29
Wils Ck>downstrm	325.269 Wills CF	100yr	Prop_N Br	51000.00	591.50	614.48		615.36	0.000559	7.64	7418.23	441.75	0.29
Wils Ck>downstrm	324.925	100yr	Exist_N Br	51000.00	590.50	612.86		614.09	0.000835	9.33	6731.44	430.93	0.36
Wils Ck>downstrm	324.925	100yr	Prop_N Br	51000.00	590.50	612.86		614.09	0.000835	9.33	6731.44	430.93	0.36
Wils Ck>downstrm	324.643	100yr	Exist_N Br	51000.00	589.80	612.73	601.16	613.13	0.000312	5.84	13716.31	1021.58	0.22
Wils Ck>downstrm	324.643	100yr	Prop_N Br	51000.00	589.80	612.73	601.16	613.13	0.000312	5.84	13716.31	1021.58	0.22
Wils Ck>downstrm	324.562	100yr	Exist_N Br	51000.00	589.60	612.66	601.72	612.98	0.000268	5.40	15164.59	1136.32	0.20
Wils Ck>downstrm	324.562	100yr	Prop_N Br	51000.00	589.60	612.66	601.72	612.98	0.000268	5.40	15164.59	1136.32	0.20

HEC-RAS Profile: 100yr (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Wils Ck>downstrm	324.165	100yr	Exist_N Br	51000.00	587.50	611.54	599.08	612.23	0.000447	7.13	9678.55	896.93	0.26
Wils Ck>downstrm	324.165	100yr	Prop_N Br	51000.00	587.50	611.54	599.08	612.23	0.000447	7.13	9678.55	896.93	0.26
Wils Ck>downstrm	323.789	100yr	Exist_N Br	51000.00	585.60	611.05	597.35	611.42	0.000304	5.23	13178.61	1297.00	0.21
Wils Ck>downstrm	323.789	100yr	Prop_N Br	51000.00	585.60	611.05	597.35	611.42	0.000304	5.23	13178.61	1297.00	0.21
Wils Ck>downstrm	323.414	100yr	Exist_N Br	51000.00	584.80	607.40	602.27	610.01	0.002114	13.52	5037.57	702.60	0.54
Wils Ck>downstrm	323.414	100yr	Prop_N Br	51000.00	584.80	607.40	602.27	610.01	0.002114	13.52	5037.57	702.60	0.54
Wils Ck>downstrm	323.335	100yr	Exist_N Br	51000.00	584.60	608.18	597.03	609.09	0.000622	7.89	7370.22	798.11	0.31
Wils Ck>downstrm	323.335	100yr	Prop_N Br	51000.00	584.60	608.18	597.03	609.09	0.000622	7.89	7370.22	798.11	0.31
Wils Ck>downstrm	323.322 MD 61 Ford Ave			Bridge									
Wils Ck>downstrm	323.312	100yr	Exist_N Br	51000.00	584.58	607.93	597.42	608.99	0.000737	8.47	6851.21	537.99	0.33
Wils Ck>downstrm	323.312	100yr	Prop_N Br	51000.00	584.58	607.93	597.42	608.99	0.000737	8.47	6851.21	537.99	0.33
Wils Ck>downstrm	323.307 USGS Cumberland	100yr	Exist_N Br	51000.00	584.57	607.89		608.97	0.000748	8.58	6908.07	756.26	0.34
Wils Ck>downstrm	323.307 USGS Cumberland	100yr	Prop_N Br	51000.00	584.57	607.89		608.97	0.000748	8.58	6908.07	756.26	0.34
Wils Ck>downstrm	323.134	100yr	Exist_N Br	51000.00	584.00	608.07		608.35	0.000257	4.71	13981.74	910.59	0.19
Wils Ck>downstrm	323.134	100yr	Prop_N Br	51000.00	584.00	608.07		608.35	0.000257	4.71	13981.74	910.59	0.19
Wils Ck>downstrm	322.762	100yr	Exist_N Br	51000.00	581.50	607.19	594.49	607.75	0.000372	6.40	11450.15	997.92	0.24
Wils Ck>downstrm	322.762	100yr	Prop_N Br	51000.00	581.50	607.19	594.49	607.75	0.000372	6.40	11450.15	997.92	0.24
Wils Ck>downstrm	322.715	100yr	Exist_N Br	51000.00	581.20	605.76	596.45	607.48	0.001082	10.79	5386.81	322.74	0.41
Wils Ck>downstrm	322.715	100yr	Prop_N Br	51000.00	581.20	605.76	596.45	607.48	0.001082	10.79	5386.81	322.74	0.41
Wils Ck>downstrm	322.691	100yr	Exist_N Br	51000.00	581.10	605.80	596.31	607.27	0.000952	10.26	7353.48	954.43	0.38
Wils Ck>downstrm	322.691	100yr	Prop_N Br	51000.00	581.10	605.80	596.31	607.27	0.000952	10.26	7353.48	954.43	0.38
Wils Ck>downstrm	322.273	100yr	Exist_N Br	51000.00	578.50	603.94	592.87	605.24	0.000853	9.37	6846.46	810.09	0.35
Wils Ck>downstrm	322.273	100yr	Prop_N Br	51000.00	578.50	603.94	592.87	605.24	0.000853	9.37	6846.46	810.09	0.35
Wils Ck>downstrm	321.894	100yr	Exist_N Br	51000.00	577.50	603.01	589.70	603.85	0.000477	7.77	10201.98	1276.24	0.28
Wils Ck>downstrm	321.894	100yr	Prop_N Br	51000.00	577.50	603.01	589.70	603.85	0.000477	7.77	10201.98	1276.24	0.28
Wils Ck>downstrm	321.517	100yr	Exist_N Br	51000.00	575.50	600.78	591.90	602.49	0.001241	11.22	7903.12	1544.10	0.42
Wils Ck>downstrm	321.517	100yr	Prop_N Br	51000.00	575.50	600.78	591.90	602.49	0.001241	11.22	7903.12	1544.10	0.42
Wils Ck>downstrm	321.516			Lat Struct									
Wils Ck>downstrm	321.205 Evitts CF	100yr	Exist_N Br	51000.00	576.50	600.76	588.26	601.16	0.000345	5.59	15424.83	2257.79	0.22
Wils Ck>downstrm	321.205 Evitts CF	100yr	Prop_N Br	51000.00	576.50	600.76	588.26	601.16	0.000345	5.59	15424.83	2257.79	0.22
Wils Ck>downstrm	321.053	100yr	Exist_N Br	51000.00	577.00	600.12	590.46	600.75	0.000616	7.33	13851.66	2367.83	0.30
Wils Ck>downstrm	321.053	100yr	Prop_N Br	51000.00	577.00	600.12	590.46	600.75	0.000616	7.33	13851.66	2367.83	0.30
Wils Ck>downstrm	320.717	100yr	Exist_N Br	51000.00	576.00	599.49	589.47	599.97	0.000437	6.81	16307.87	2204.41	0.26
Wils Ck>downstrm	320.717	100yr	Prop_N Br	51000.00	576.00	599.49	589.47	599.97	0.000437	6.81	16307.87	2204.41	0.26
Wils Ck>downstrm	320.297	100yr	Exist_N Br	51000.00	574.70	598.71	593.68	599.20	0.000508	7.53	16958.52	2207.25	0.28
Wils Ck>downstrm	320.297	100yr	Prop_N Br	51000.00	574.70	598.71	593.68	599.20	0.000508	7.53	16958.52	2207.25	0.28
Wils Ck>downstrm	319.984	100yr	Exist_N Br	51000.00	574.00	597.67		598.42	0.000524	7.75	13215.95	2383.19	0.28
Wils Ck>downstrm	319.984	100yr	Prop_N Br	51000.00	574.00	597.67		598.42	0.000524	7.75	13215.95	2383.19	0.28
Wils Ck>downstrm	319.597	100yr	Exist_N Br	51000.00	573.50	596.39	593.25	597.14	0.000862	9.41	15590.92	3068.61	0.36
Wils Ck>downstrm	319.597	100yr	Prop_N Br	51000.00	573.50	596.39	593.25	597.14	0.000862	9.41	15590.92	3068.61	0.36
Wils Ck>downstrm	319.056	100yr	Exist_N Br	51000.00	572.50	595.48		595.86	0.000293	5.31	16073.58	3747.10	0.21
Wils Ck>downstrm	319.056	100yr	Prop_N Br	51000.00	572.50	595.48		595.86	0.000293	5.31	16073.58	3747.10	0.21
Wils Ck>downstrm	318.722	100yr	Exist_N Br	51000.00	570.90	592.68	586.20	594.72	0.001581	12.63	5931.41	2148.09	0.49
Wils Ck>downstrm	318.722	100yr	Prop_N Br	51000.00	570.90	592.68	586.20	594.72	0.001581	12.63	5931.41	2148.09	0.49
Wils Ck>downstrm	318.709 RR Bridge 5			Bridge									
Wils Ck>downstrm	318.685	100yr	Exist_N Br	51000.00	570.80	592.64		594.30	0.001121	10.73	6061.40	2842.12	0.41
Wils Ck>downstrm	318.685	100yr	Prop_N Br	51000.00	570.80	592.64		594.30	0.001121	10.73	6061.40	2842.12	0.41
Wils Ck>downstrm	318.451	100yr	Exist_N Br	51000.00	570.70	592.32		593.02	0.000556	7.71	12851.46	2925.65	0.29
Wils Ck>downstrm	318.451	100yr	Prop_N Br	51000.00	570.70	592.32		593.02	0.000556	7.71	12851.46	2925.65	0.29
Wils Ck>downstrm	318.263	100yr	Exist_N Br	51000.00	570.50	592.00	587.02	592.47	0.000493	7.25	16639.39	2093.93	0.28
Wils Ck>downstrm	318.263	100yr	Prop_N Br	51000.00	570.50	592.00	587.02	592.47	0.000493	7.25	16639.39	2093.93	0.28
Wils Ck>downstrm	318.19	100yr	Exist_N Br	51000.00	570.30	591.98	580.71	592.26	0.000311	5.80	18917.22	2375.22	0.22
Wils Ck>downstrm	318.19	100yr	Prop_N Br	51000.00	570.30	591.98	580.71	592.26	0.000311	5.80	18917.22	2375.22	0.22
Wils Ck>downstrm	318.076	100yr	Exist_N Br	51000.00	569.80	591.44	581.90	592.00	0.000498	7.19	14102.65	1713.28	0.28
Wils Ck>downstrm	318.076	100yr	Prop_N Br	51000.00	569.80	591.44	581.90	592.00	0.000498	7.19	14102.65	1713.28	0.28
Wils Ck>downstrm	317.535	100yr	Exist_N Br	51000.00	568.50	590.80	582.80	590.97	0.000261	5.13	23304.00	2191.70	0.20
Wils Ck>downstrm	317.535	100yr	Prop_N Br	51000.00	568.50	590.80	582.80	590.97	0.000261	5.13	23304.00	2191.70	0.20
Wils Ck>downstrm	317.049	100yr	Exist_N Br	51000.00	569.50	588.09	583.17	589.50	0.001605	11.64	7672.73	787.33	0.48
Wils Ck>downstrm	317.049	100yr	Prop_N Br	51000.00	569.50	588.09	583.17	589.50	0.001605	11.64	7672.73	787.33	0.48
Wils Ck>downstrm	316.569	100yr	Exist_N Br	51000.00	565.00	587.22		587.59	0.000339	5.82	15768.66	1591.26	0.23
Wils Ck>downstrm	316.569	100yr	Prop_N Br	51000.00	565.00	587.22		587.59	0.000339	5.82	15768.66	1591.26	0.23

HEC-RAS Profile: 100yr (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Wils Ck>downstrm	316.3	100yr	Exist_N Br	51000.00	561.50	586.61	577.60	587.06	0.000450	6.97	16878.42	2066.71	0.26
Wils Ck>downstrm	316.3	100yr	Prop_N Br	51000.00	561.50	586.61	577.60	587.06	0.000450	6.97	16878.42	2066.71	0.26
Wils Ck>downstrm	316.196	100yr	Exist_N Br	51000.00	561.00	586.65	573.75	586.84	0.000182	4.80	23930.59	2795.77	0.17
Wils Ck>downstrm	316.196	100yr	Prop_N Br	51000.00	561.00	586.65	573.75	586.84	0.000182	4.80	23930.59	2795.77	0.17
Wils Ck>downstrm	316.064	100yr	Exist_N Br	51000.00	560.80	586.39	574.30	586.68	0.000263	5.86	20265.34	2066.45	0.21
Wils Ck>downstrm	316.064	100yr	Prop_N Br	51000.00	560.80	586.39	574.30	586.68	0.000263	5.86	20265.34	2066.45	0.21
Wils Ck>downstrm	315.799	100yr	Exist_N Br	51000.00	560.50	586.12	576.07	586.34	0.000223	4.94	20698.51	1757.76	0.19
Wils Ck>downstrm	315.799	100yr	Prop_N Br	51000.00	560.50	586.12	576.07	586.34	0.000223	4.94	20698.51	1757.76	0.19
Wils Ck>downstrm	315.353	100yr	Exist_N Br	51000.00	559.50	585.62	571.40	585.89	0.000193	5.16	18238.11	1286.75	0.18
Wils Ck>downstrm	315.353	100yr	Prop_N Br	51000.00	559.50	585.62	571.40	585.89	0.000193	5.16	18238.11	1286.75	0.18
Wils Ck>downstrm	314.987	100yr	Exist_N Br	51000.00	559.00	583.51		585.07	0.000933	10.04	5224.33	262.86	0.38
Wils Ck>downstrm	314.987	100yr	Prop_N Br	51000.00	559.00	583.51		585.07	0.000933	10.04	5224.33	262.86	0.38
Wils Ck>downstrm	314.612	100yr	Exist_N Br	51000.00	558.00	582.87		583.56	0.000488	7.19	9057.61	608.92	0.27
Wils Ck>downstrm	314.612	100yr	Prop_N Br	51000.00	558.00	582.87		583.56	0.000488	7.19	9057.61	608.92	0.27
Wils Ck>downstrm	314.396	100yr	Exist_N Br	51000.00	556.50	582.25	570.40	583.00	0.000489	7.94	11068.11	966.70	0.28
Wils Ck>downstrm	314.396	100yr	Prop_N Br	51000.00	556.50	582.25	570.40	583.00	0.000489	7.94	11068.11	966.70	0.28
Wils Ck>downstrm	314.243	100yr	Exist_N Br	51000.00	554.50	581.70	568.72	582.57	0.000525	7.78	7570.93	1517.29	0.29
Wils Ck>downstrm	314.243	100yr	Prop_N Br	51000.00	554.50	581.70	568.72	582.57	0.000525	7.78	7570.93	1517.29	0.29
Wils Ck>downstrm	314.231 RR Bridge 6			Bridge									
Wils Ck>downstrm	314.22	100yr	Exist_N Br	51000.00	554.40	581.80	565.99	582.45	0.000342	6.69	8644.21	427.45	0.24
Wils Ck>downstrm	314.22	100yr	Prop_N Br	51000.00	554.40	581.80	565.99	582.45	0.000342	6.69	8644.21	427.45	0.24

CITY OF CUMBERLAND

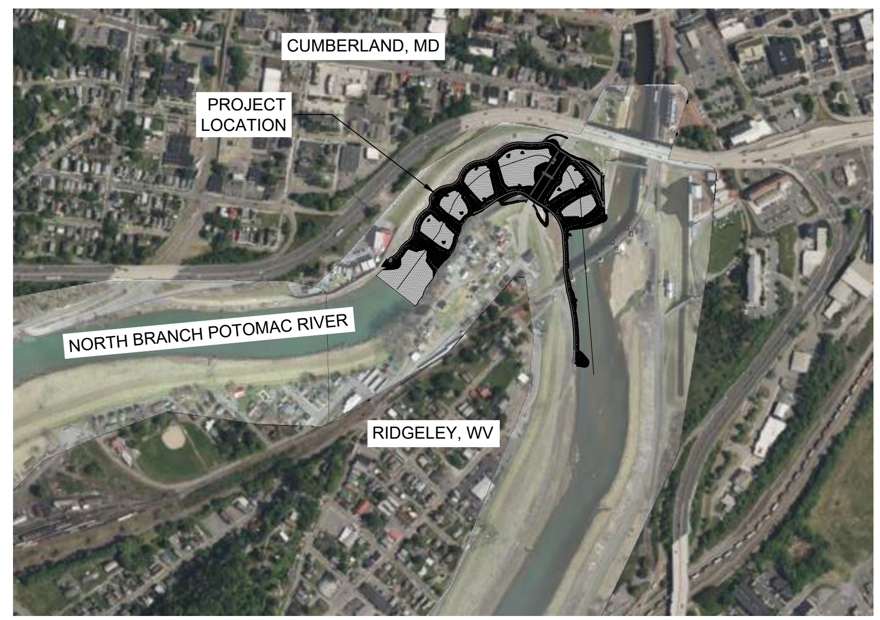
RIVER PARK AT CANAL PLACE

30% DESIGN

DECEMBER 6, 2024

PROJECT LOCATION:

LATITUDE: 39° 38' 55.1" N
LONGITUDE: 78° 45' 57.1" W



VICINITY MAP

SCALE: 1"=500' (FOR 22X34" SHEETS)

N

SHEET INDEX:

LEGEND:

- EXISTING GRADE CONTOURS
- RIVER CENTERLINE (THALWEG)
- BOULDERS AND TERRACING
- RIPRAP ARMORING
- CONCRETE

ABBREVIATIONS:

AVG	AVERAGE
APPROX.	APPROXIMATE
ASTM	AMERICAN SOCIETY OF TESTING AND MATERIALS
BLDG	BUILDING
BM	BENCHMARK
CONC	CONCRETE
DIA	DIAMETER
DTL	DETAIL
DS	DOWNSTREAM
E	EAST
ELEV	ELEVATION
EXIST	EXISTING
FT	FEET
HDPE	HIGH DENSITY POLYETHYLENE
IN	INCHES
MAX	MAXIMUM
MIN	MINIMUM
N	NORTH
NTS	NOT TO SCALE
OC	ON CENTER
OHWM	ORDINARY HIGH WATER MARK
SHT	SHEET
STA	STATION
STD	STANDARD
STRM	STORM
TYP	TYPICAL

X / X — DETAIL OR SECTION NUMBER; SHEET ON WHICH DETAIL OR SECTION IS SHOWN

PROJECT OWNER:

CITY OF CUMBERLAND
CITY OF CUMBERLAND
57 N. LIBERTY ST
CUMBERLAND, MD 21502

Recreation Engineering & Planning

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DRAFT

PROJECT OWNER:
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RIVER PARK AT CANAL PLACE
NORTH BRANCH POTOMAC RIVER — CUMBERLAND, MD

PRELIMINARY - NOT FOR CONSTRUCTION

COVER & TOC

REVISIONS:

NO.	DATE

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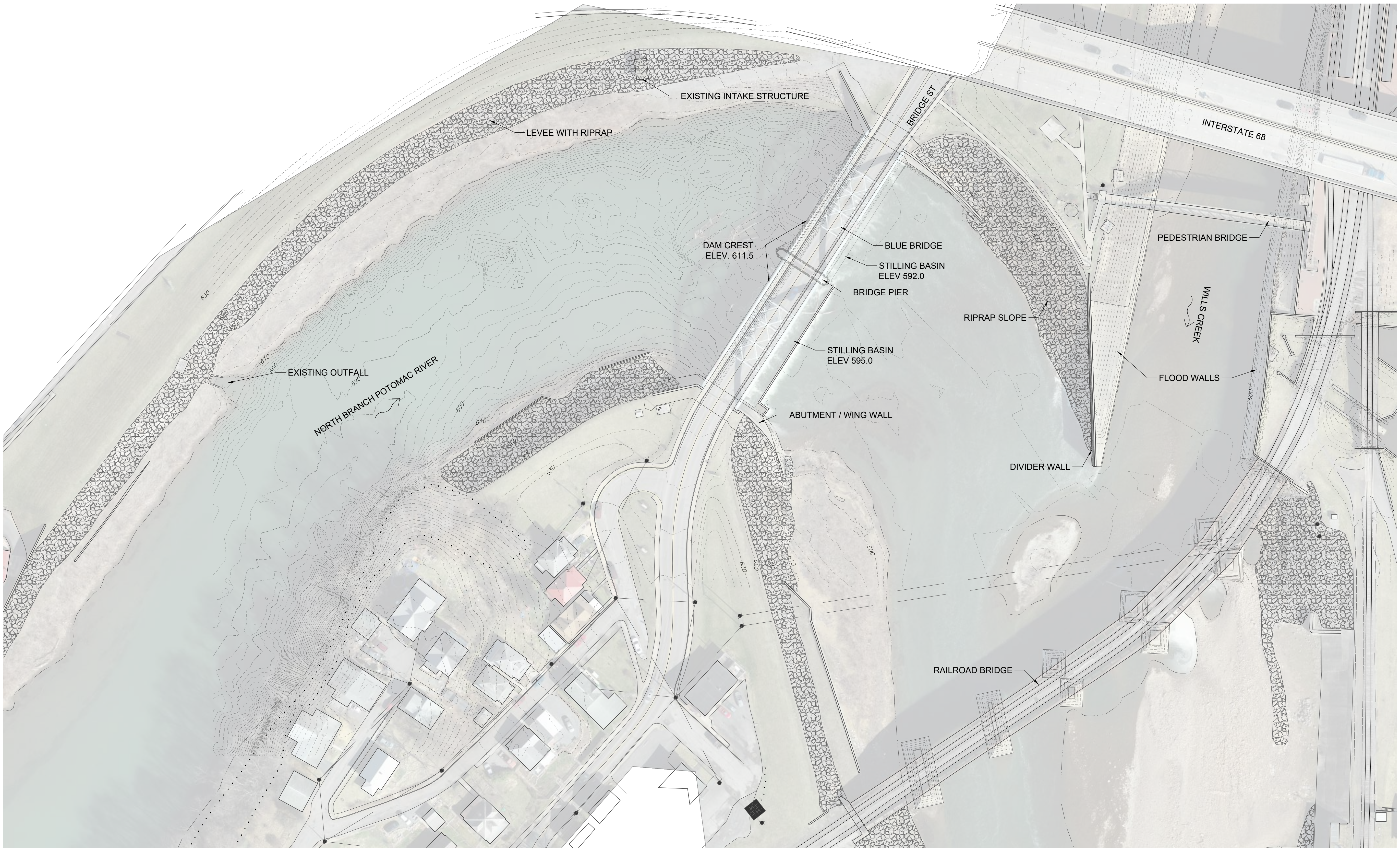
CHECKED: ----
PLOT DATE: 12/6/2024

DRAWING NO.

01



EXISTING PLAN VIEW

N

SCALE BAR 1"=50'

50 0 50

CONTOUR INTERVAL 2FT

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RIVER PARK AT CANAL PLACE

NORTH BRANCH POTOMAC RIVER CUMBERLAND, MD

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EXISTING CONDITIONS 1

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PLOT DATE: 12/6/2024

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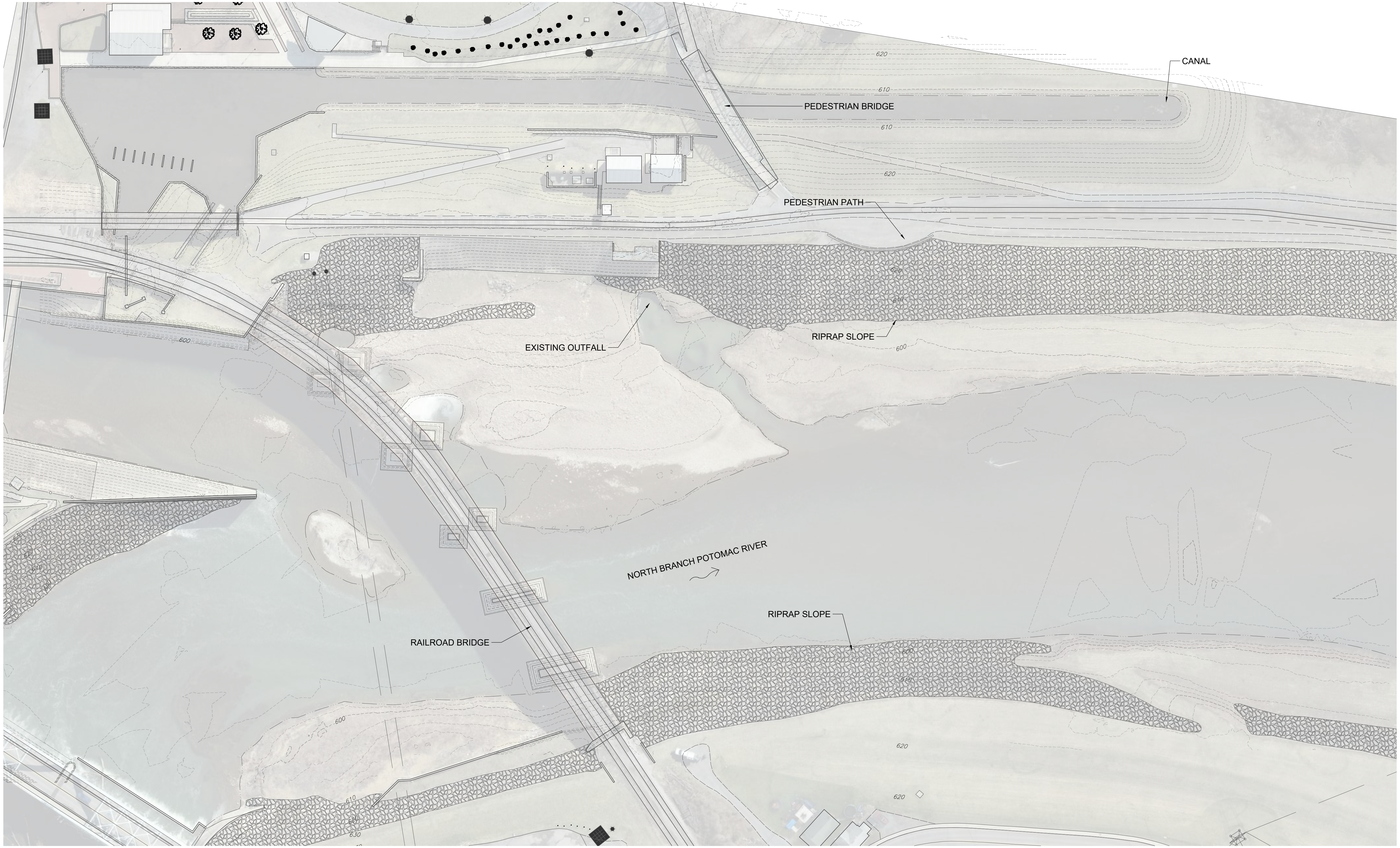
02

SHEET 02 OF 12



EXISTING PLAN VIEW

SCALE BAR 1"=50'
50 0 50
CONTOUR INTERVAL 2FT

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RIVER PARK AT CANAL PLACE
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EXISTING CONDITIONS 2

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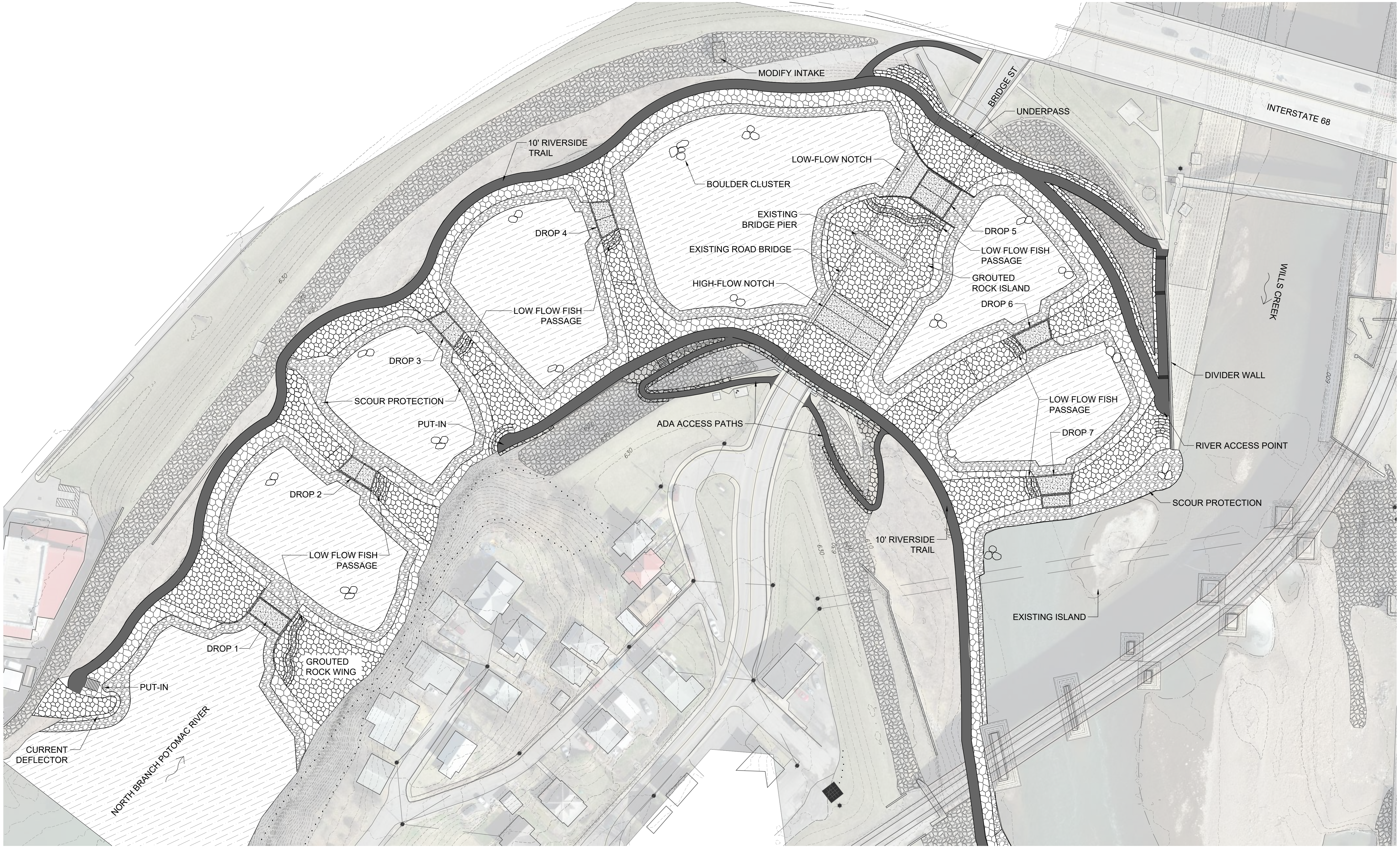
03



PROPOSED PLAN VIEW UPSTREAM

N

SCALE BAR 1"=50'
50 0 50
CONTOUR INTERVAL 2FT

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RIVER PARK AT CANAL PLACE
NORTH BRANCH POTOMAC RIVER CUMBERLAND, MD
PRELIMINARY - NOT FOR CONSTRUCTION
OVERALL PLAN 1

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PLOT DATE: 12/6/2024

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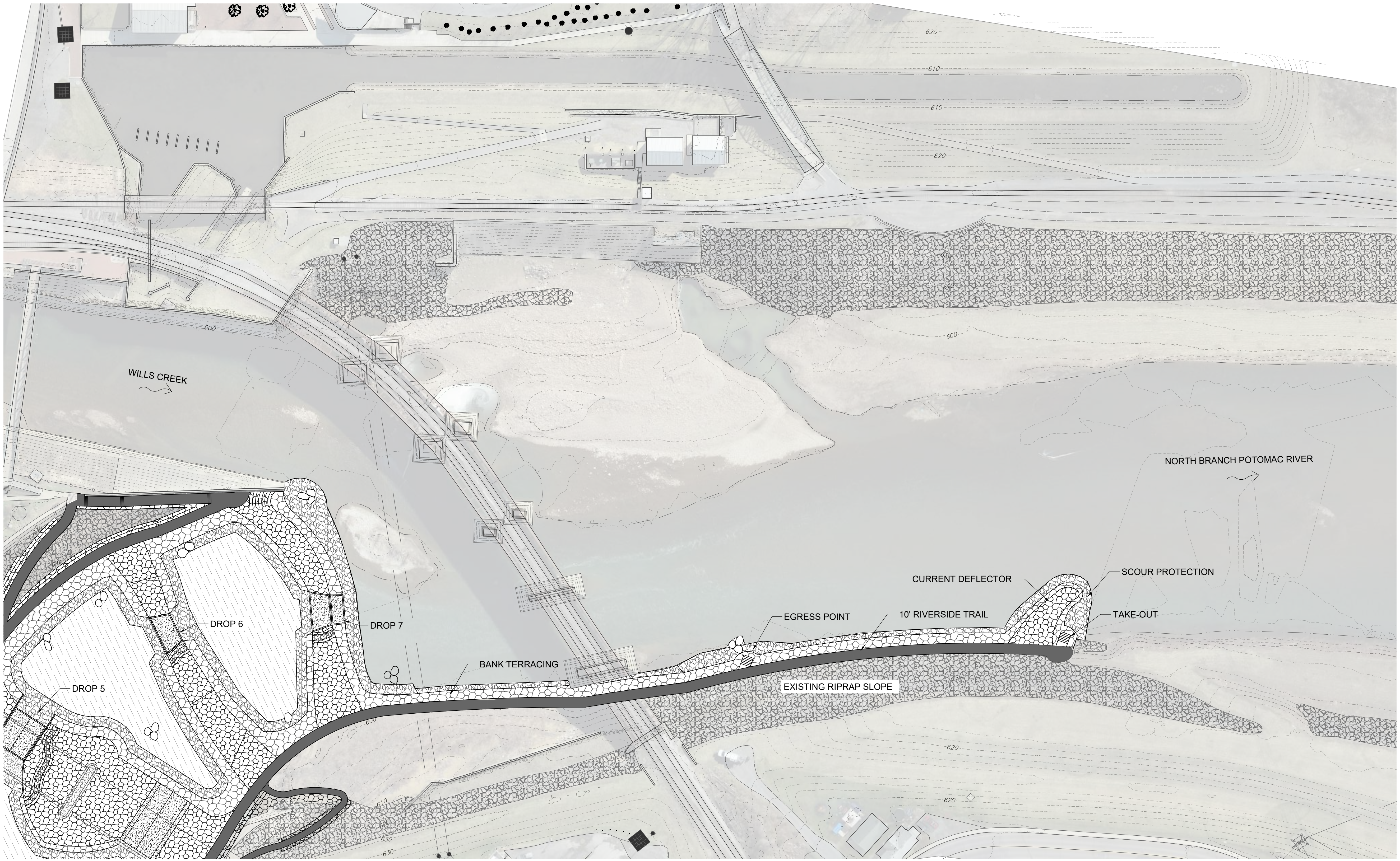
04

SHEET 04 OF 12



PROPOSED PLAN VIEW DOWNSTREAM

N

SCALE BAR 1"=50'
50 0 50
CONTOUR INTERVAL 2FT

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RIVER PARK AT CANAL PLACE
NORTH BRANCH POTOMAC RIVER CUMBERLAND, MD
PRELIMINARY - NOT FOR CONSTRUCTION
OVERALL PLAN 2

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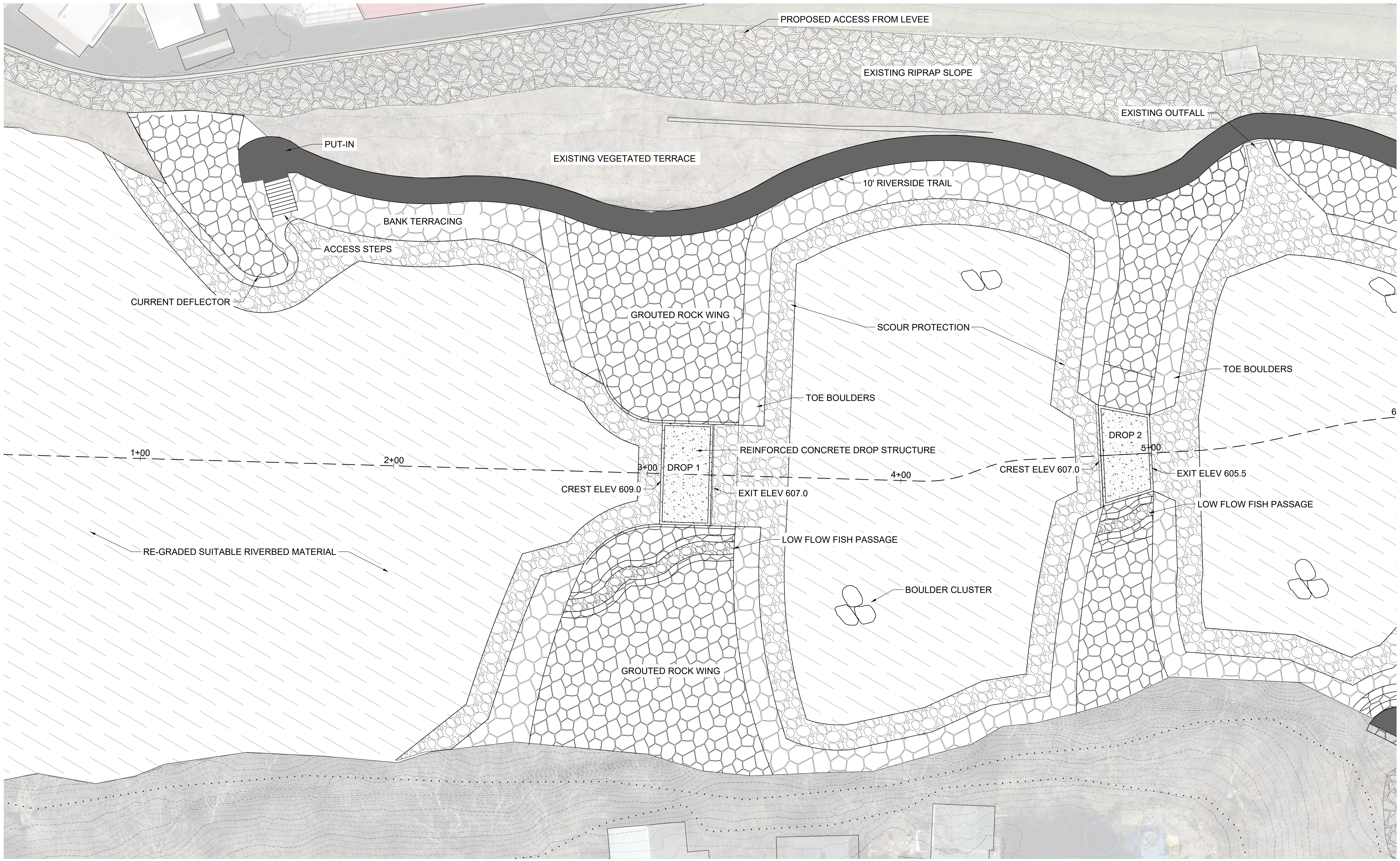
05

SHEET 05 OF 12



PROPOSED PLAN VIEW UPSTREAM

SCALE BAR 1"=20'

20 0 20

CONTOUR INTERVAL 2FT

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RIVER PARK AT CANAL PLACE

NORTH BRANCH POTOMAC RIVER — CUMBERLAND, MD

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UPSTREAM PLAN VIEW

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PLOT DATE: 12/6/2024

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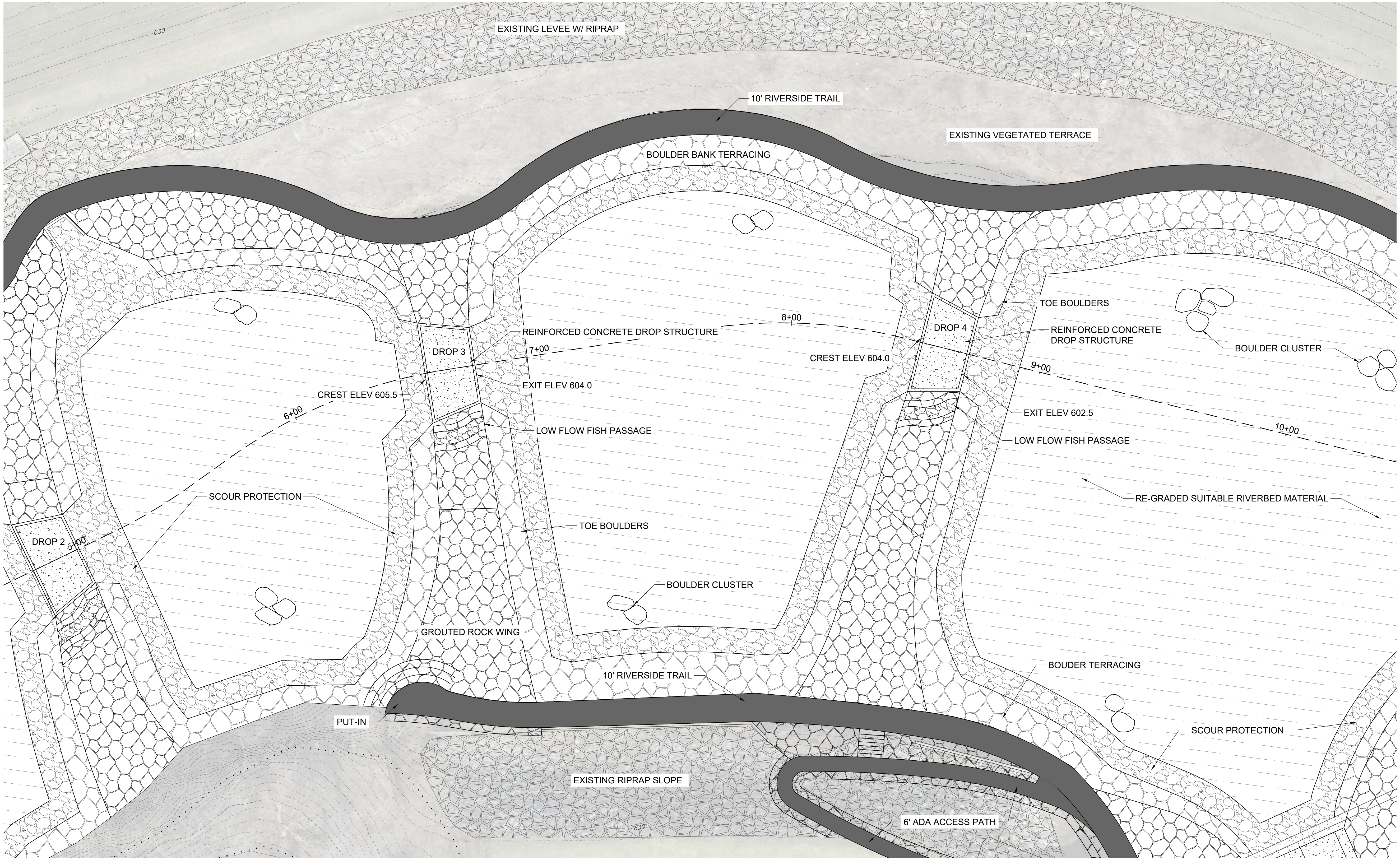
06



PROPOSED PLAN VIEW MID-SECTION

N

SCALE BAR 1"=20'

20 0 20

CONTOUR INTERVAL 2FT

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MID-SECTION PLAN VIEW

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PLOT DATE: 12/6/2024

DRAWING NO.

07

SHEET 07 OF 12

PROPOSED PLAN VIEW DAM MODIFICATION

N

SCALE BAR 1"=20'

20 0 20

CONTOUR INTERVAL 2FT

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RIVER PARK AT CANAL PLACE

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PRELIMINARY - NOT FOR CONSTRUCTION

DAM MOD PLAN VIEW

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PLOT DATE: 12/6/2024

DRAWING NO.

08

SHEET 08 OF 12

PROPOSED PLAN VIEW CONFLUENCE

N

SCALE BAR 1"=20'

20 0 20

CONTOUR INTERVAL 2FT

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RIVER PARK AT CANAL PLACE
NORTH BRANCH POTOMAC RIVER CUMBERLAND, MD
PRELIMINARY - NOT FOR CONSTRUCTION
CONFLUENCE PLAN VIEW

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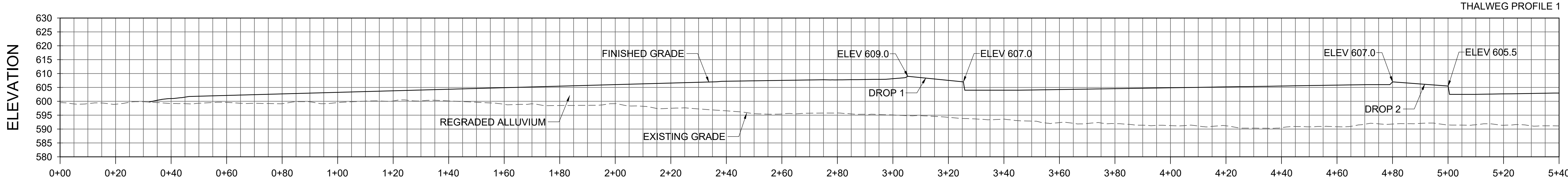
PLOT DATE: 12/6/2024

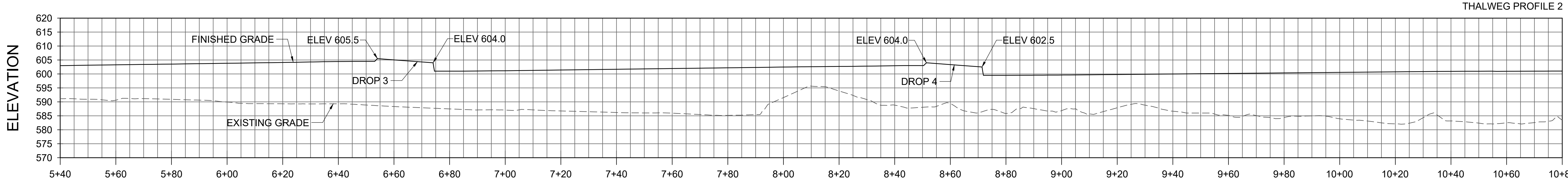
DRAWING NO.
09

SHEET 09 OF 12

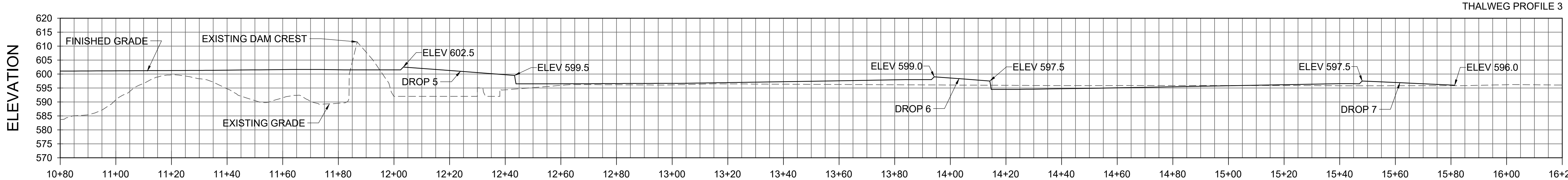
THALWEG PROFILE 1



THALWEG PROFILE 2



THALWEG PROFILE 3



THALWEG PROFILE

SCALE BAR 1"=20'
20 0 20

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PRELIMINARY - NOT FOR CONSTRUCTION
THALWEG PROFILE

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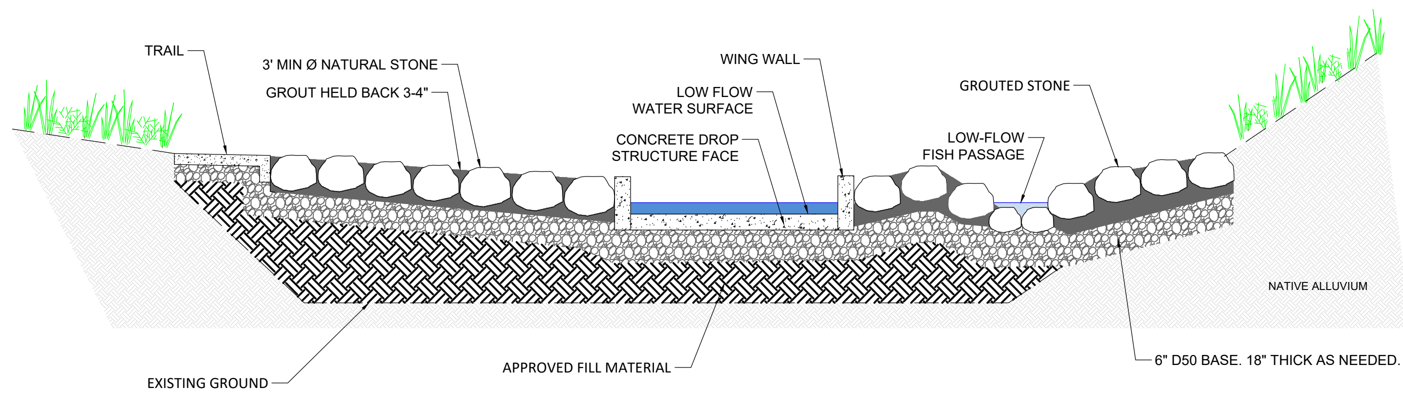
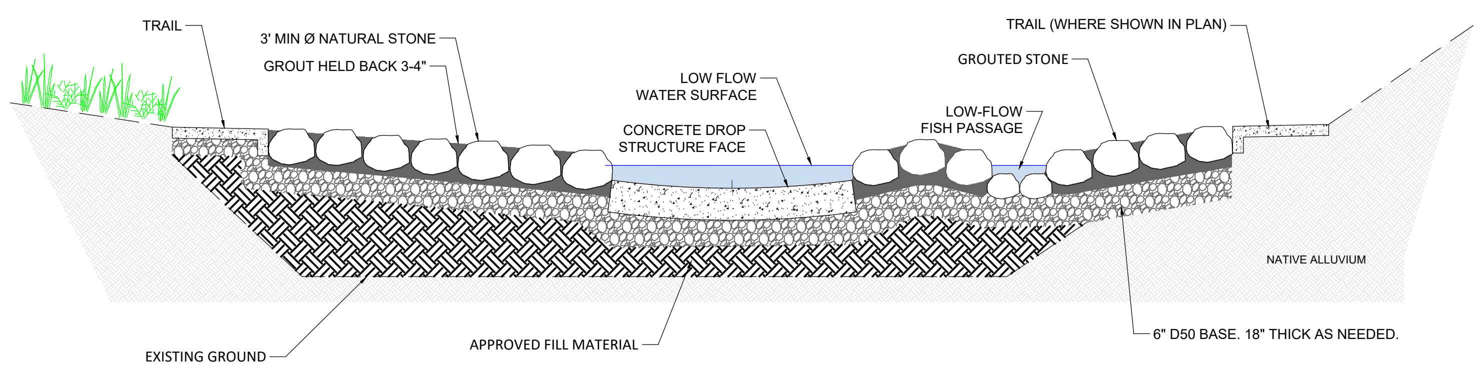
PLOT DATE: 12/6/2024

DRAWING NO.
10



DROP 1 CROSS SECTION - CONCEPT LEVEL
SCALE: NTS



DROP 2,3,4,6,7 TYPICAL CROSS SECTION - CONCEPT LEVEL
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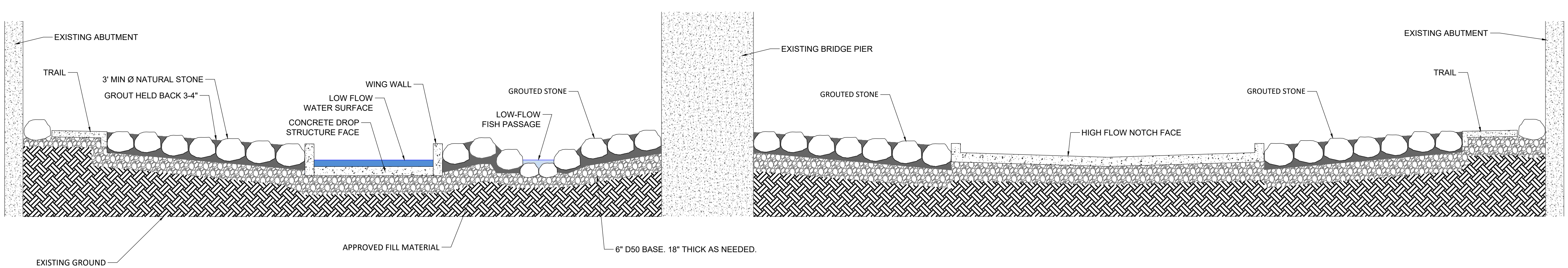

DROP 5 CROSS SECTION - CONCEPT LEVEL
SCALE: NTS

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57 N. LIBERTY ST
CUMBERLAND, MD 21502

RIVER PARK AT CANAL PLACE
NORTH BRANCH POTOMAC RIVER CUMBERLAND, MD
PRELIMINARY - NOT FOR CONSTRUCTION
TYPICAL SECTIONS

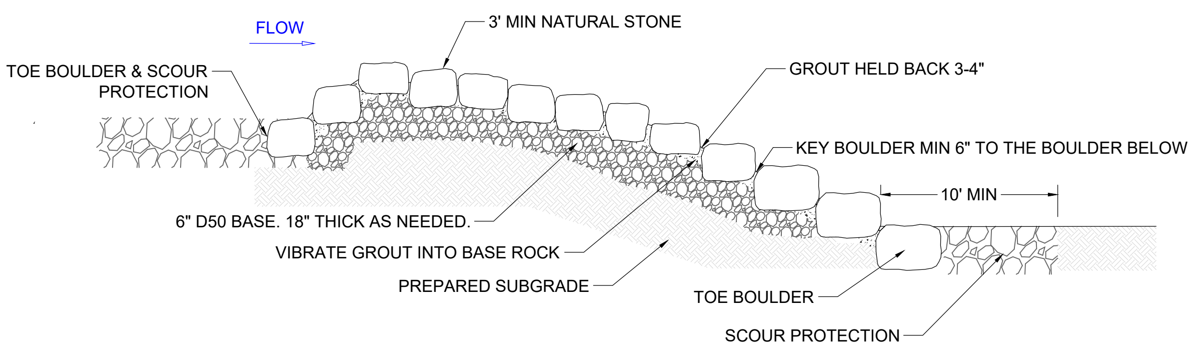
REVISIONS:

NO.	DATE
#	----
#	----
#	
#	
#	
#	
#	

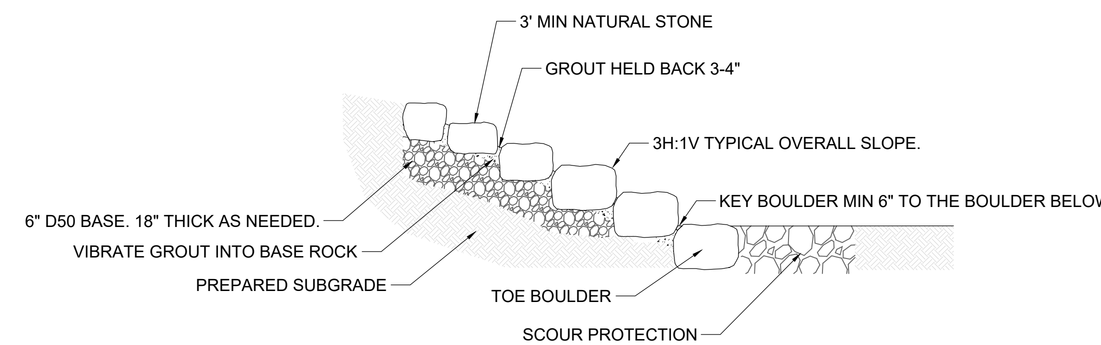
DESIGNED: ML DRAFTED: SL
CHECKED: ----
PLOT DATE: 12/6/2024

DRAWING NO.
11

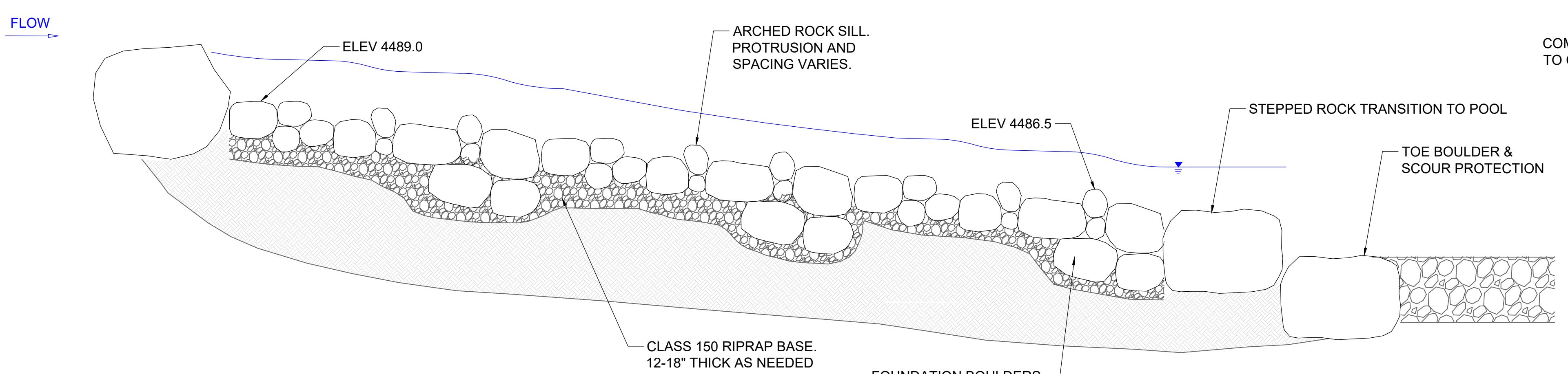
SHEET 11 OF 12



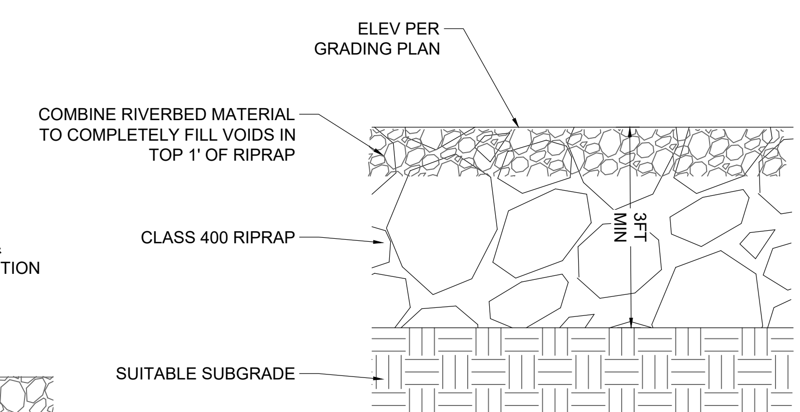
GROUTED ROCK WING PROFILE
SCALE: NTS



GROUTED BOULDER TERRACING DETAIL
SCALE: NTS



FISH PASSAGE PROFILE
NTS



SCOUR PROTECTION DETAIL
SCALE: NTS

Recreation Engineering & Planning
RECREATION ENGINEERING AND PLANNING
485 ARAPAHOE AVE.
BOULDER | CO | 80302
WWW.BOATERPARKS.COM

DRAFT

PROJECT OWNER:
CITY OF CUMBERLAND
57 N. LIBERTY ST
CUMBERLAND, MD 21502

RIVER PARK AT CANAL PLACE
NORTH BRANCH POTOMAC RIVER CUMBERLAND, MD
PRELIMINARY - NOT FOR CONSTRUCTION
TYPICAL DETAILS

REVISIONS:

NO.	DATE
#	----
#	----
#	
#	
#	
#	
#	

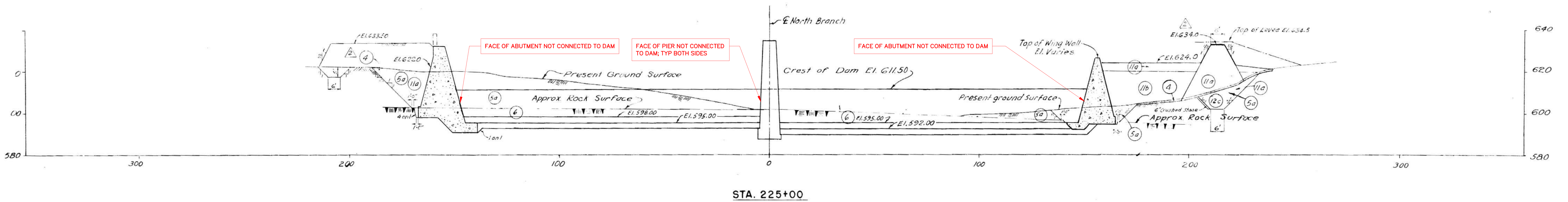
DESIGNED: ML DRAFTED: SL
CHECKED: ----
PLOT DATE: 12/6/2024

DRAWING NO.
12

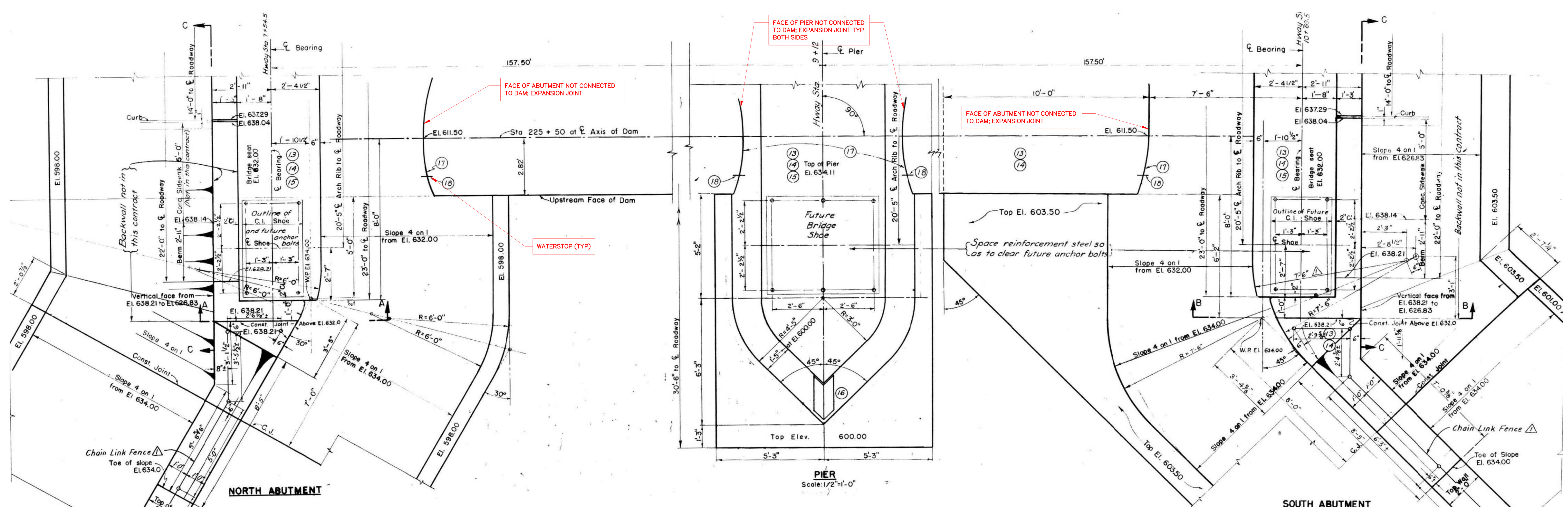
SHEET 12 OF 12

Appendix C

Dam Structural Analysis and Original Bridge & Dam Construction Documents



EXCERPT FROM "NORTH BRANCH POTOMAC RIVER INDUSTRIAL DAM SECTIONS 222+30 - 225+00" DRAWING NO. B-251-204.10; SHEET 10 OF 13; CORPS OF ENGINEERS, U.S. ARMY; 24 MARCH, 1954



EXCERPT FROM "NORTH BRANCH POTOMAC RIVER INDUSTRIAL DAM DETAILS OF BRIDGE ABUTMENTS" DRAWING NO. B-251-204.8; SHEET 8 OF 12; CORPS OF ENGINEERS, U.S. ARMY; 12 MARCH, 1953

POTOMAC RIVER BASIN

PLANS FOR

LOCAL FLOOD PROTECTION PROJECT
CUMBERLAND, MD. & RIDGELEY, W. VA.

NORTH BRANCH POTOMAC RIVER
INDUSTRIAL DAM

1952

AS BUILT DRAWINGS

CORPS OF ENGINEERS, U.S ARMY
OFFICE OF THE DISTRICT ENGINEER
WASHINGTON DISTRICT
WASHINGTON 25, D.C.

TO ACCOMPANY SPECIFICATION SERIAL NO. CIVENG 49-080-53-25
DATED 16 FEBRUARY 1953

B-251-204

NORTH BRANCH POTOMAC RIVER

INDUSTRIAL DAM

INDEX TO DRAWINGS

SHEET NO.	TITLE	DRAWING NO.
1	TOPOGRAPHY OF WILLS CREEK AND WEST CUMBERLAND AREAS	B-251-204.1
2	LOCATION OF SUBSURFACE EXPLORATION	B-251-204.2
3	SUBSURFACE EXPLORATIONS OVERBURDEN DRILLINGS	B-251-204.3
4	GENERAL PLAN	B-251-204.4
5	HYDROGRAPHS OF DAILY DISCHARGES	B-251-204.5
6	DETAILS OF NORTH ABUTMENT	B-251-204.6
7	DETAILS OF SOUTH ABUTMENT	B-251-204.7
8	DETAILS OF BRIDGE ABUTMENTS	B-251-204.8
9	FOUNDATION PLAN	B-251-204.9
10	SECTIONS 222+30 - 225+00	B-251-204.10
11	SECTIONS 225+00 - 227+80	B-251-204.11
12	ALIGNMENT PLAN	B-251-204.12
13	PIER ENCASEMENT	B-251-204.13

LEGEND

EXISTING		NEW
(with designations)	CONDUITS AND SEWERS	
	WATER LINE	
	GAS LINE	
	POWER LINE	
T T T	TELEPHONE LINE	
x x x	FENCE	
	EASEMENT LINE	
(in plan) (in section)	WORK	(in plan) (in section)
	FUTURE WORK	(with designation)
624	CONTOURS	624
	SHORE LINE	

GENERAL NOTES

1 *All cross sections are shown looking upstream.*

2 *Right or left banks and/or walls refer to banks or walls when looking downstream.*

3 *The relocation of water, gas, telephone power lines and services, where required, will be performed by others.*

4 *Payment lines for excavation and concrete will be as shown on the drawings or as directed by the contracting officer.*

5 *Circled numbers on sheets 1 thru 12 refer to item numbers under which payment will be made.*

6 *All work designated by light dashed lines not included in this contract.*

7 *All concrete work shall be constructed in alternate monoliths unless otherwise approved.*

8 *Horizontal construction joints in the spillway section to be as shown on the drawings.*

9 *Tolerances; Concrete spillway crest ± .005' in 20' horizontal.*
Top of walls ± 1/4" in 20' horizontal.
Spillway apron ± 1/4" in 20' horizontal.
Bridge seat and top of pier ± 1/4" in 20' horizontal.

10 *Concrete Finish; Class "B" finish to be used on all exposed concrete surfaces*
Class "D" finish to be used on concrete surfaces against which backfill will be placed.

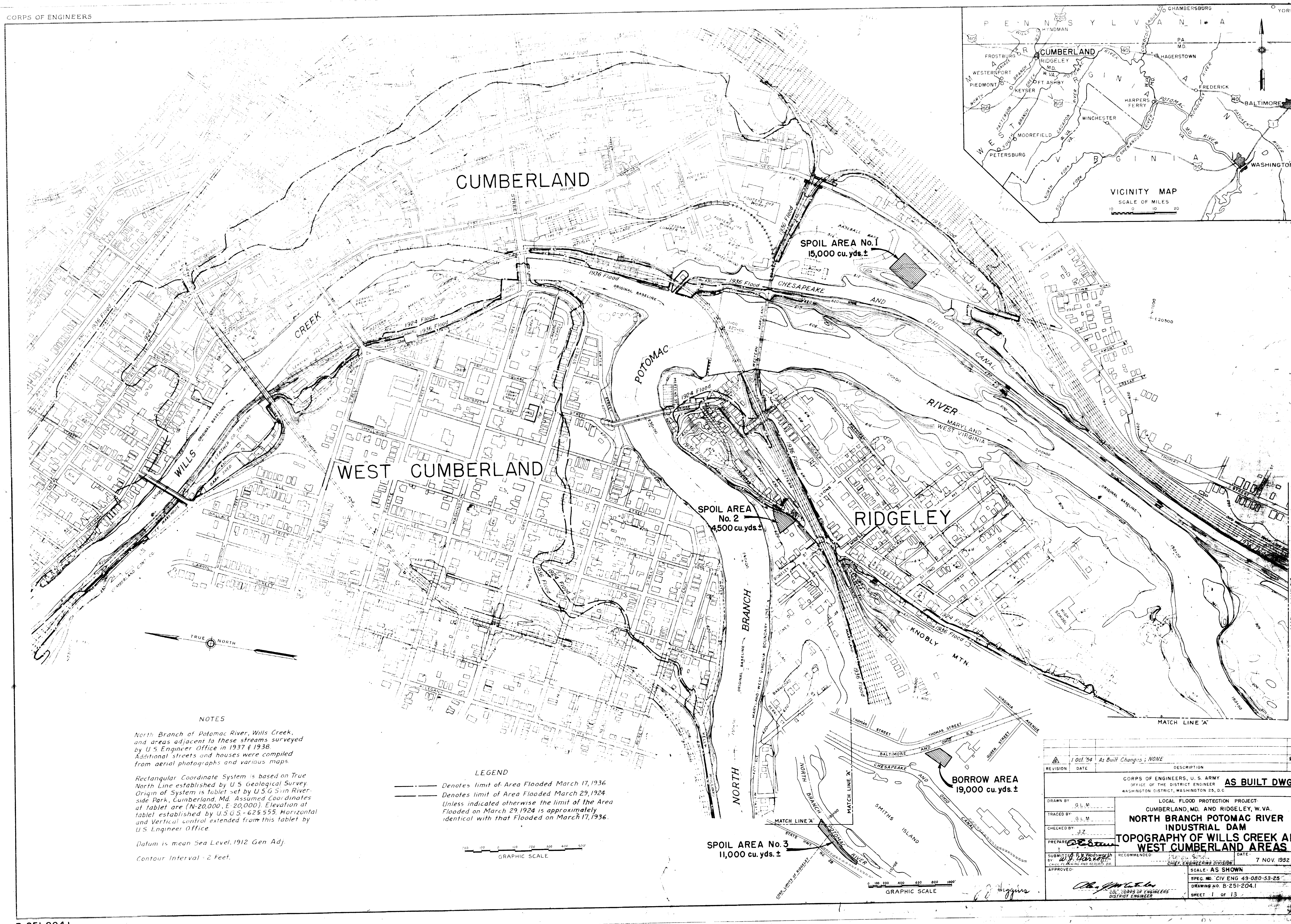
11 *For location of Exploratory Core Borings, see Sheet No. 9 "Plan of Industrial Dam."*

12 *Drilling holes in concrete and / or rock shall be at the location shown on the drawings or as directed by the contracting officer, and the number of drill holes may be increased or decreased as required.*

13 *For location of Borrow and Spoil Areas see Sheet No. 1.*

14 *Rock elevations and/or surfaces shown on the profiles and sections are approximate only, having been derived from rock elevations in the borings shown on other drawings. In consequence, rock surfaces and elevations between borings as shown on the drawings cannot be guaranteed.*

AS BUILT DRAWINGS



NOTES

North Branch of Potomac River, Wills Creek, and areas adjacent to these streams surveyed by U.S. Engineer Office in 1937 & 1938. Additional streets and houses were compiled from aerial photographs and various maps.

Rectangular Coordinate System is based on True North Line established by U.S. Geological Survey. Origin of System is tablet set by U.S.G.S. in Riverside Park, Cumberland, Md. Assumed Coordinates at tablet are (N-20,000, E-20,000). Elevation at tablet established by U.S.G.S. = 625.555. Horizontal and Vertical control extended from this tablet by U.S. Engineer Office.

Datum is mean Sea Level, 1912 Gen. Adj.

Contour Interval = 2 Feet.

LEGEND

—·— Denotes limit of Area Flooded March 17, 1936.

— — Denotes limit of Area Flooded March 29, 1924.

Unless indicated otherwise the limit of the Area Flooded on March 29, 1924 is approximately identical with that Flooded on March 17, 1936.

REVISION	DATE	DESCRIPTION	BY
4	1 Oct. '54	As Built Changes; NONE	W.D.P.

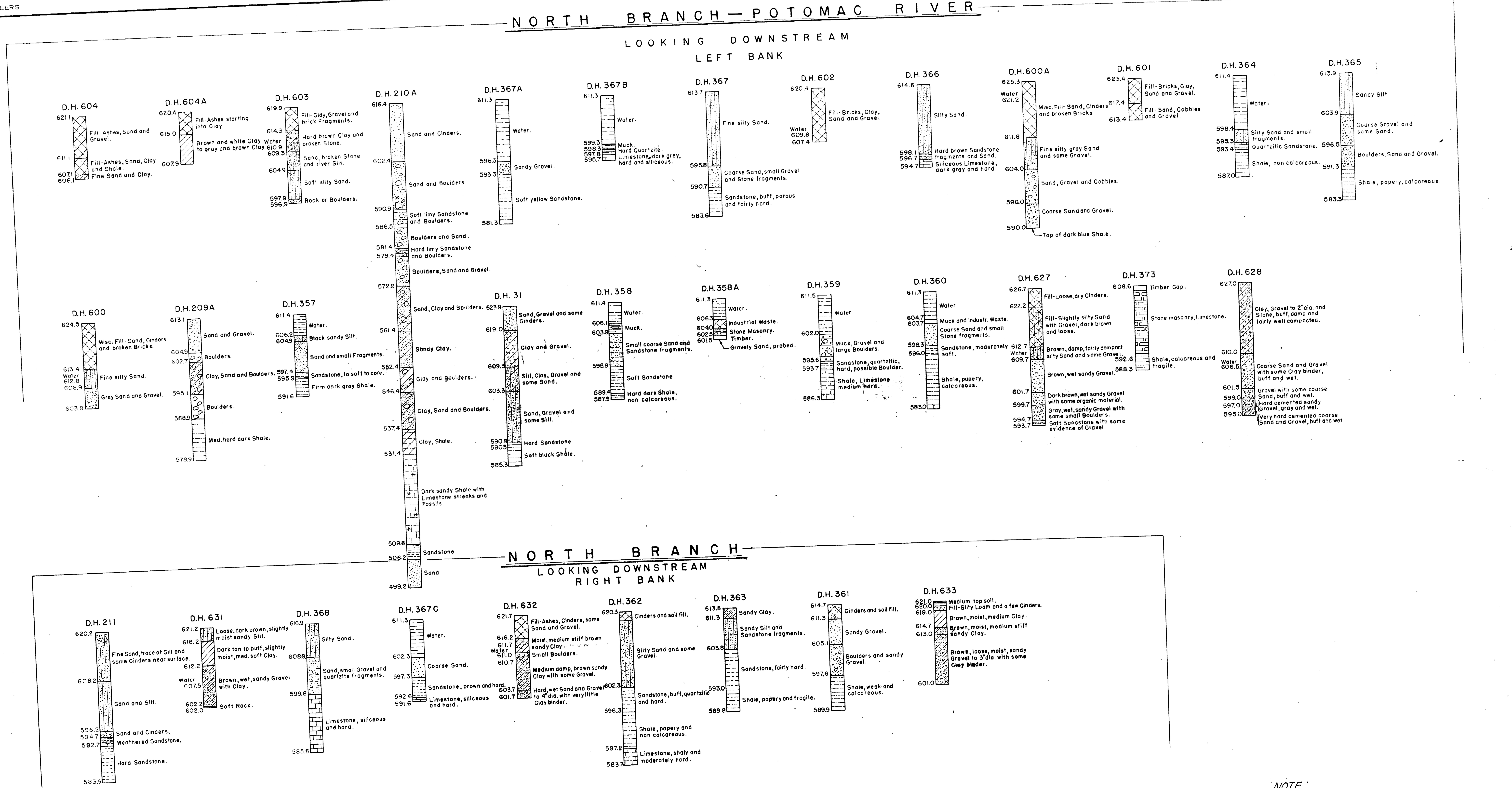
CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
WASHINGTON DISTRICT, WASHINGTON 25, D.C.

AS BUILT DWG.

LOCAL FLOOD PROTECTION PROJECT
CUMBERLAND, MD. AND RIDGELEY, W. VA.

NORTH BRANCH POTOMAC RIVER INDUSTRIAL DAM
TOPOGRAPHY OF WILLS CREEK AND WEST CUMBERLAND AREAS

DRAWN BY: G.L.M.
TRACED BY: G.L.M.
CHECKED BY: J.Z.
PREPARED: [signature]
SUBMITTED BY: R. W. Wadsworth / W. J. Yarnoff, CHIEF, PLANNING AND REPORTS BR.
RECOMMENDED: [signature] CHIEF, ENGINEERING DIVISION
DATE: 7 NOV. 1952
APPROVED: [signature] COL., CORPS OF ENGINEERS, DISTRICT ENGINEER
SCALE: AS SHOWN
SPEC. NO. CIV ENG 49-080-53-25
DRAWING NO. B-251-204.1
SHEET 1 OF 13



NOTE:
For location of Subsurface Explorations see Sheet No. 2.

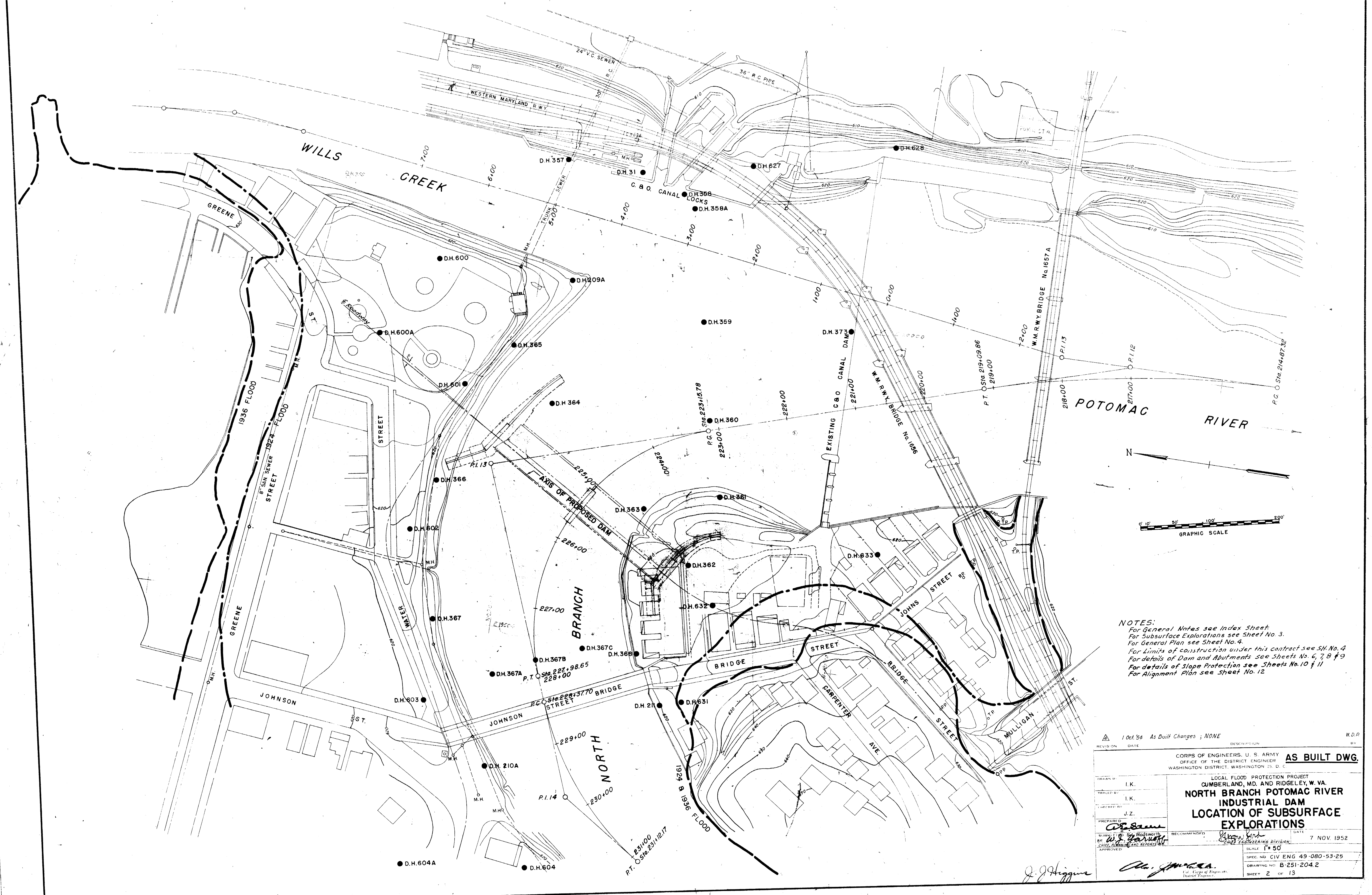
REVISION	DATE	DESCRIPTION	BY
A	1 Oct '54	As Built Changes; NONE	W.D.R.

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
WASHINGTON DISTRICT, WASHINGTON 25, D. C.

AS BUILT DWG.

LOCAL FLOOD PROTECTION PROJECT
CUMBERLAND, MD. AND RIDGELEY, W. VA.
NORTH BRANCH POTOMAC RIVER
INDUSTRIAL DAM
SUBSURFACE EXPLORATIONS
OVERBURDEN DRILLINGS

DRAWN BY: I.K. G.L.M.
TRACED BY: G.L.M. I.K.
CHECKED BY: J.Z.
PREPARED: [signature]
SUBMITTED: W. Wadsworth [signature] CHIEF, PLANNING AND REPORTS BR.
RECOMMENDED: [signature] CHIEF, ENGINEERING DIVISION
DATE: 7 NOV. 1952
APPROVED: [signature] Col., Corps of Engineers, District Engineer.
SCALE NONE
SPEC. NO. CIV ENG 49-080-53-25
DRAWING NO. B-251-204.3
SHEET 3 OF 13



NOTES:
For General Notes see Index Sheet.
For Subsurface Explorations see Sheet No. 3.
For General Plan see Sheet No. 4.
For Limits of construction under this contract see SH. No. 4
For details of Dam and Abutments see Sheets No. 6, 7, 8 & 9
For details of Slope Protection see Sheets No. 10 & 11
For Alignment Plan see Sheet No. 12

REVISION	DATE	DESCRIPTION	BY
1	1 Oct. '54	As Built Changes ; NONE	W.D.R.

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
WASHINGTON DISTRICT, WASHINGTON 25, D. C.

AS BUILT DWG.

LOCAL FLOOD PROTECTION PROJECT
CUMBERLAND, MD. AND RIDGELEY, W. VA.
NORTH BRANCH POTOMAC RIVER
INDUSTRIAL DAM
LOCATION OF SUBSURFACE EXPLORATIONS

DRAWN BY: I.K.
TRACED BY: I.K.
CHECKED BY: J.Z.
PREPARED: [signature]
SUBMITTED BY: W. J. Yarnoff, CHIEF, PLANNING AND REPORTS BR.
RECOMMENDED: [signature], CHIEF, ENGINEERING DIVISION
APPROVED: [signature], Col., Corps of Engineers, District Engineer
DATE: 7 NOV. 1952
SCALE: 1" = 50'
SPEC. NO. CIV ENG 49-080-53-25
DRAWING NO. B-251-204.2
SHEET 2 OF 13

J. J. Higgins

LEGEND

- ● D.H. 300 Denotes number and location of drill hole
- ■ A 400 " " " " " Auger
- ♦ T. P. 152 " " " " " test pit

NOTE

Drill holes in 300 series, Test Pit 1.– and all Auger borings made 1945

Drill holes in 600 series made 1949

Notes:

For legend and general notes see Index Sheet.
For subsurface explorations see sheet No. 3
For alignment plan see sheet No. 12
For details of dam and abutments see sheets No. 6, 7, 8 & 9
For details of slope protection see sheets No. 10 & 11
For limiting heights of levee work included in this contract see note sheets No. 10 and 11.
(3) For pier encasement of W. M. Rwy. bridge piers No. 1 & 2 see sheet No. 13

REVISION	DATE	DESCRIPTION	BY
4	1 Oct. '54	As Built Changes; approaches added, Temporary Fence relocated	W.D.P.
3	21 June '54	Pier encasement added to Piers No. 1 & 2 of W. M. Rwy. Bridge No. 1656	W.D.P.
2	24-Mar-54	Impervious Backfill Material added	W.D.P.
1	12 May '53	Street name Corr.	W.D.P.

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
WASHINGTON DISTRICT, WASHINGTON 25, D. C.

AS BUILT DWG.

LOCAL FLOOD PROTECTION PROJECT
CUMBERLAND, MD. AND RIDGELEY, W. VA.

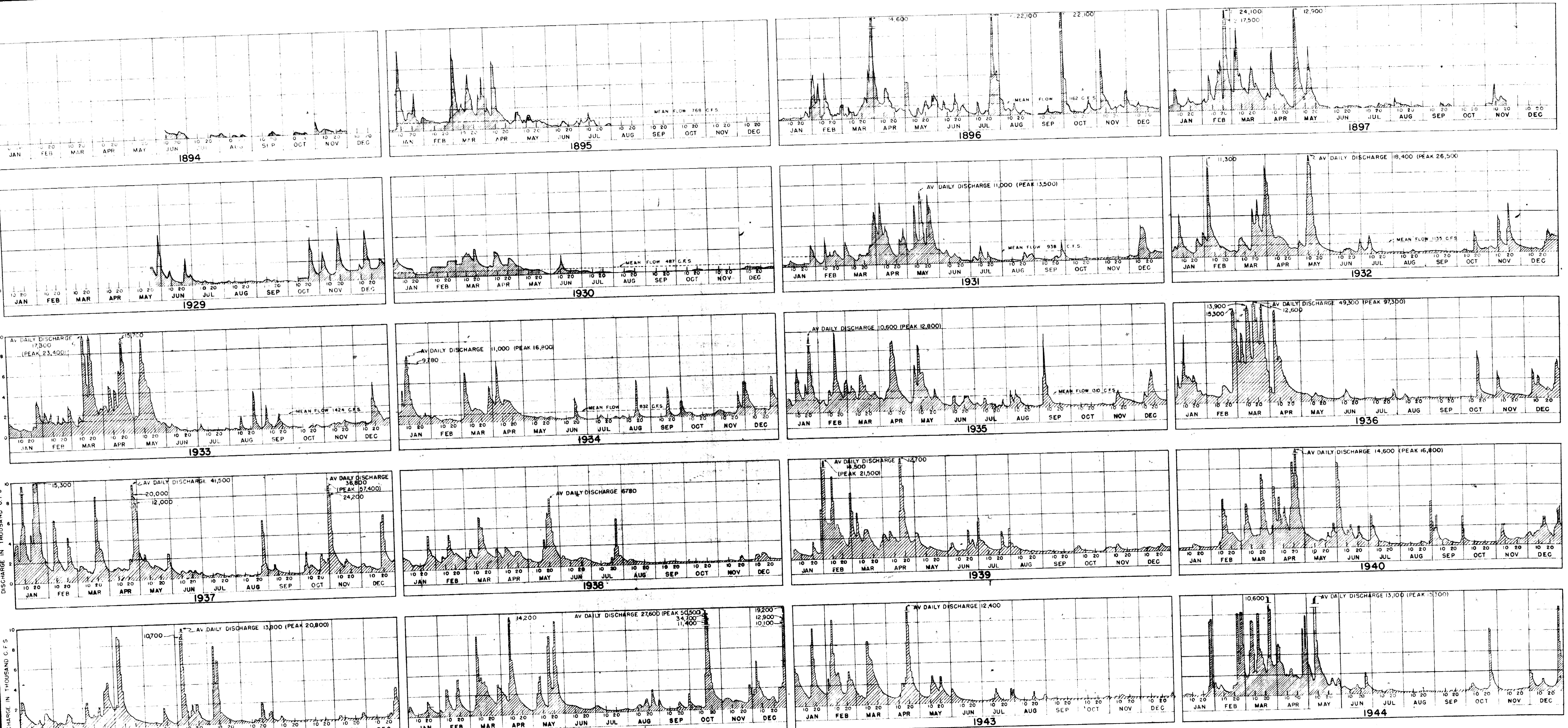
NORTH BRANCH–POTOMAC RIVER INDUSTRIAL DAM

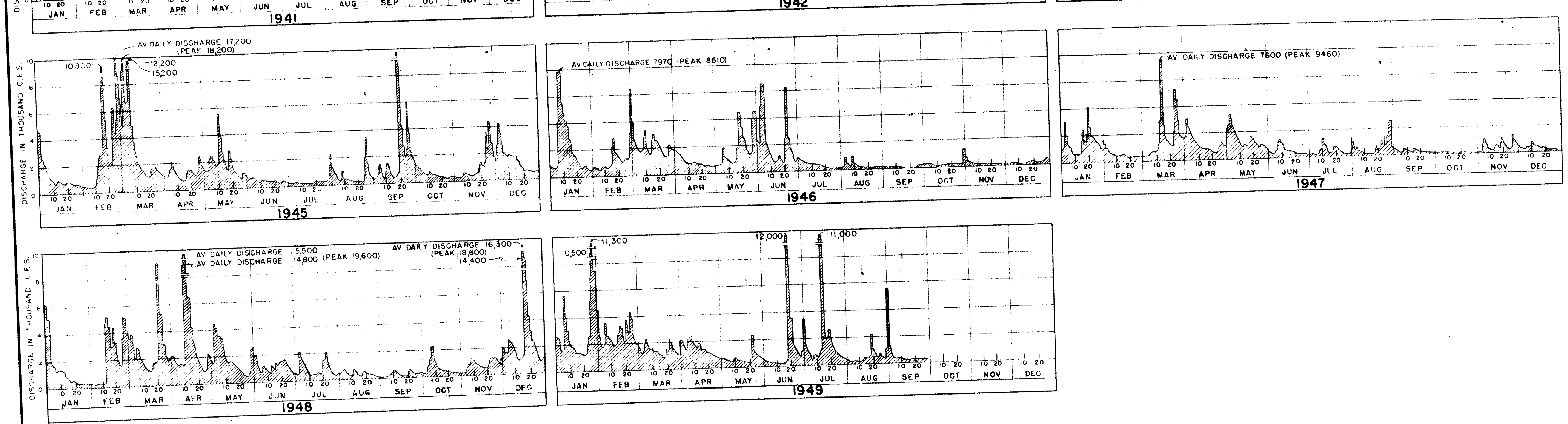
GENERAL PLAN

I.K.
TRACED BY: I.K. R.T.R.
CHECKED BY: J.Z.
PREPARED: [signature]
SUBMITTED BY: W. J. R. Wadsworth
CHIEF, PLANNING AND REPORTS
RECOMMENDED: [signature]
CHIEF, ENGINEERING DIVISION
APPROVED: [signature]
Col., Corps of Engineers, District Engineer

DATE: 7 NOV. 1952
SCALE: 1" = 50'
SPEC. NO. CIV ENG 49-080-53-25
DRAWING NO. B-251-204.4
SHEET 4 OF 13

B-251-204.4





NOTES:
Hydrographs are for U.S.G.S. gaging station at Wileys Ford Bridge 2 miles south of Cumberland, Allegany County, and 2 miles downstream from Wills Creek. Drainage Area = 875 square miles. Records availabe from June 1894 to November 1897 and May 1929 to September 1949. Values shown are average daily flows except as indicated by maximum discharge notes.

REVISION	DATE	DESCRIPTION	BY
4	1 Oct. '54	As Built Changes ; NONE	W.D.P.

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
WASHINGTON DISTRICT, WASHINGTON 25, D. C.

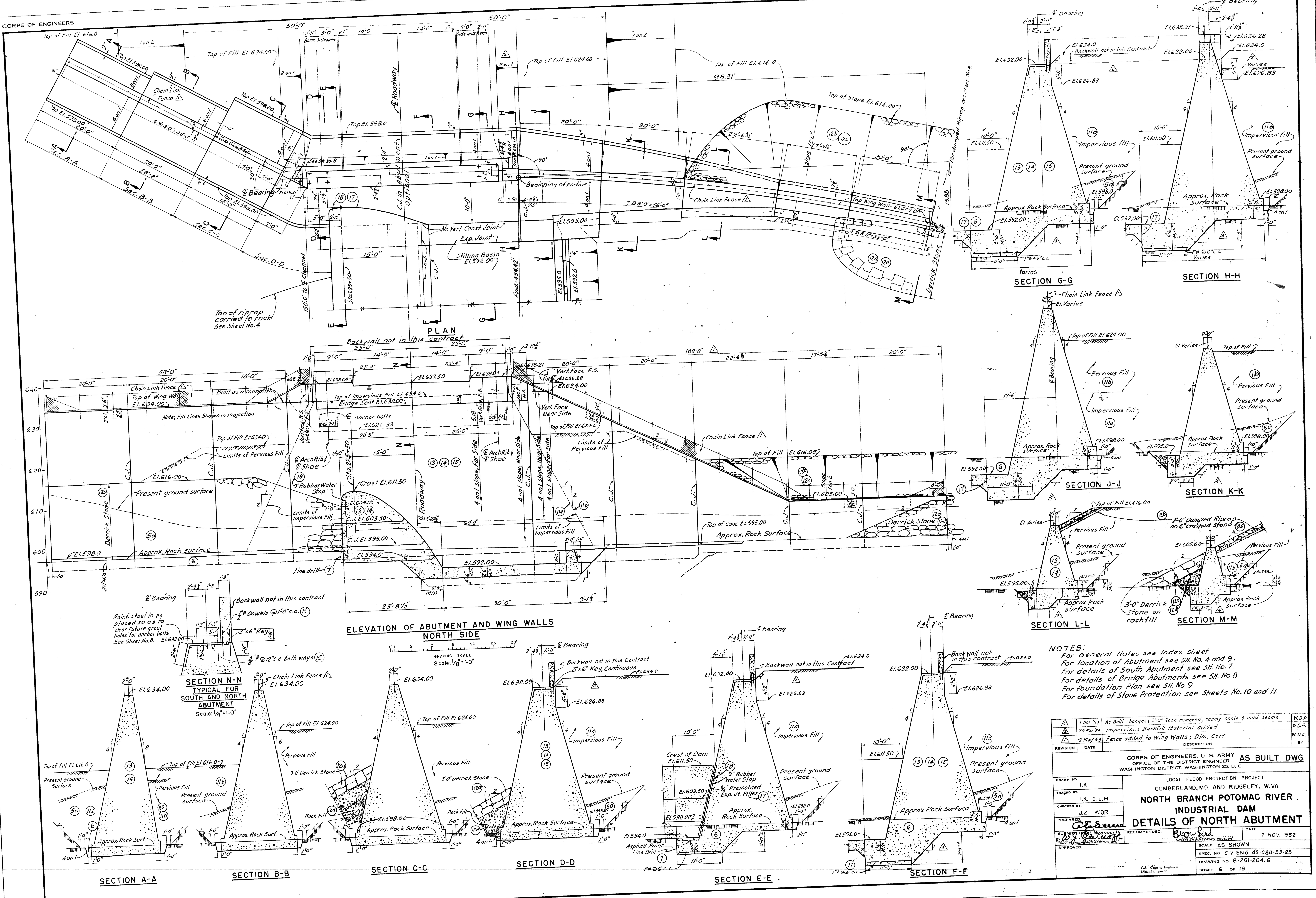
AS BUILT DWG.

DRAWN BY: R.T.R.
TRACED BY: R.T.R.
CHECKED BY: J.Z.
PREPARED: [signature]
SUBMITTED BY: R. J. Wadsworth / W. J. Yarnoff — CHIEF, PLANNING AND REPORTS BR.
RECOMMENDED: [signature] — CHIEF, ENGINEERING DIVISION
APPROVED: Col., Corps of Engineers, District Engineer

LOCAL FLOOD PROTECTION PROJECT
CUMBERLAND, MD. AND RIDGELEY, W. VA.

NORTH BRANCH POTOMAC RIVER
HYDROGRAPHS OF DAILY DISCHARGES

DATE: 7 NOV. 1952
SCALE: AS SHOWN
SPEC. NO. CIV ENG 49-080-53-25
DRAWING NO. B-251-204.5
SHEET 5 OF 13



NOTES:
For General Notes see Index Sheet.
For location of Abutment see SH. No. 4 and 9.
For details of South Abutment see SH. No. 7.
For details of Bridge Abutments see SH. No. 8.
For Foundation Plan see SH. No. 9.
For details of Stone Protection see Sheets No. 10 and 11.

REVISION	DATE	DESCRIPTION	BY
4	1 Oct. '54	As Built changes; 2'-0" Rock removed, seamy shale & mud seams	W.D.P.
3	24 Mar. '54	Impervious Backfill Material added	W.D.P.
2	12 May '53	Fence added to Wing Walls; Dim. Corr.	W.D.P.

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
WASHINGTON DISTRICT, WASHINGTON 25, D. C.

AS BUILT DWG.

LOCAL FLOOD PROTECTION PROJECT
CUMBERLAND, MD. AND RIDGELEY, W. VA.

NORTH BRANCH POTOMAC RIVER
INDUSTRIAL DAM
DETAILS OF NORTH ABUTMENT

DRAWN BY: I.K.
TRACED BY: I.K. G.L.M.
CHECKED BY: J.Z. W.D.P.
PREPARED:
SUBMITTED: Paul Wadsworth, Chief, ... and Reports Br.
RECOMMENDED: Chief, Engineering Division
APPROVED: Col., Corps of Engineers, District Engineer
DATE: 7 NOV. 1952
SCALE: AS SHOWN
SPEC. NO. CIV ENG 49-080-53-25
DRAWING NO. B-251-204.6
SHEET 6 OF 13

B-251-204.6

NOTES:

For General Notes see Index Sheet.
For location of Abutment see SH. No. 4 and 9.
For details of North Abutment see SH. No. 6.
For details of Bridge Abutments see SH. No. 8.
For foundation Plan see SH. No. 9.
For details of Stone Protection see Sheets No. 10 and 11.

Revision	Date	Description	By
3	1 Oct. '54	As Built Changes: NONE	W.D.P.
2	24 Mar. '54	Impervious Backfill Material added	W.D.P.
1	12 May '53	Fence added to Wing Walls	W.D.P.

AS BUILT DWG.

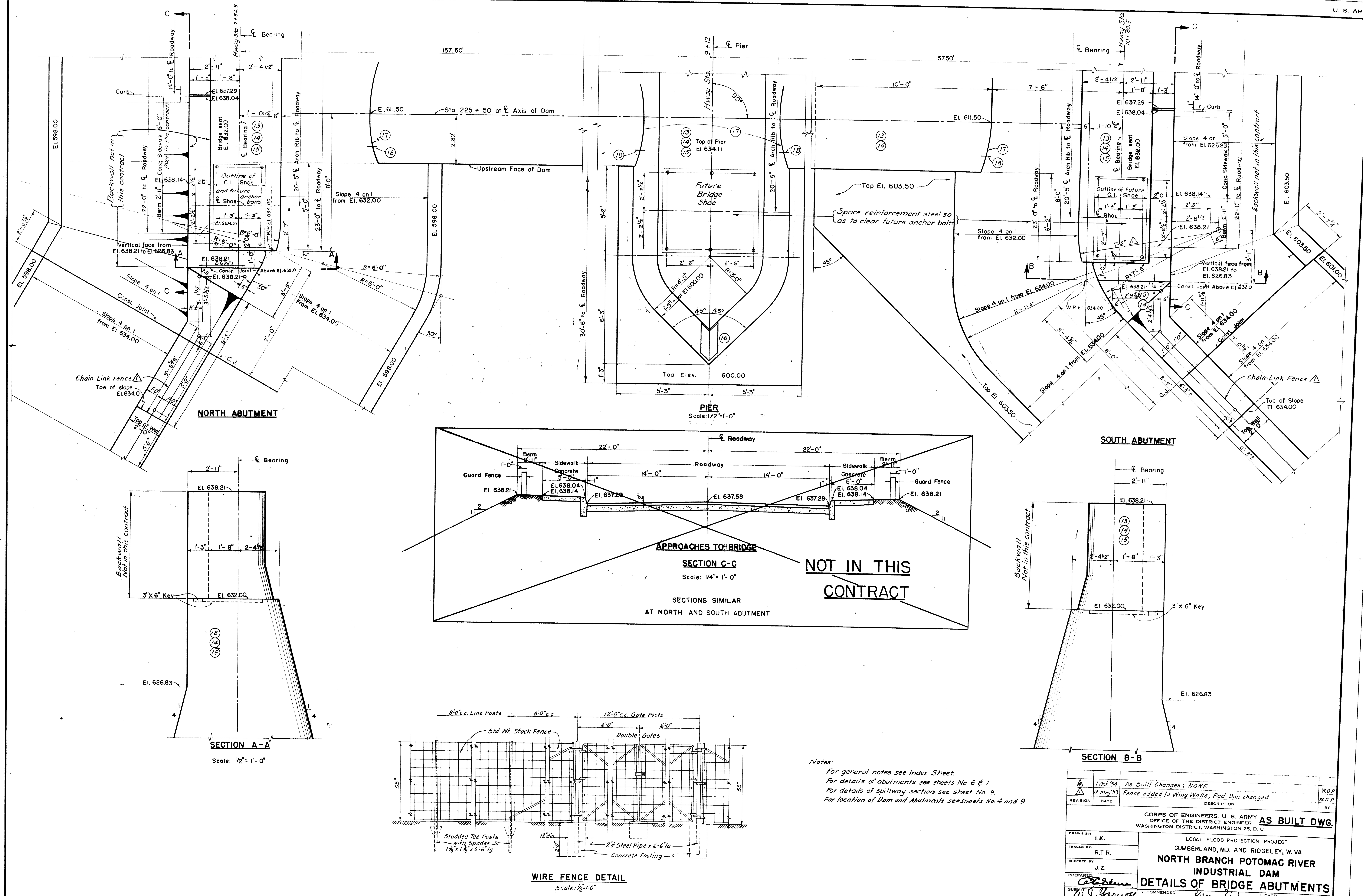
CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
WASHINGTON DISTRICT, WASHINGTON 25, D. C.

LOCAL FLOOD PROTECTION PROJECT
CUMBERLAND, MD. AND RIDGELEY, W. VA.

NORTH BRANCH POTOMAC RIVER
INDUSTRIAL DAM
DETAILS OF SOUTH ABUTMENT

Drawn by: I.K.
Traced by: I.K. G.L.M.
Checked by: J.Z. W.D.P.
Submitted: R. Wadsworth
Date: 7 NOV. 1952
Scale: AS SHOWN
Spec. No. CIV ENG 49-080-53-25
Drawing No. B-251-204.7
Sheet 7 of 13

CORPS OF ENGINEERS U. S. ARMY



Notes:

For general notes see Index Sheet.
For details of abutments see sheets No 6 & 7
For details of spillway sections see sheet No. 9.
For location of Dam and Abutments see sheets No. 4 and 9

REVISION	DATE	DESCRIPTION	BY
2	1 Oct '54	As Built Changes; NONE	W.D.P.
1	12 May '53	Fence added to Wing Walls; Rad. Dim. changed	W.D.P.

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
WASHINGTON DISTRICT, WASHINGTON 25, D. C.

AS BUILT DWG.

DRAWN BY: I.K.
TRACED BY: R.T.R.
CHECKED BY: J.Z.

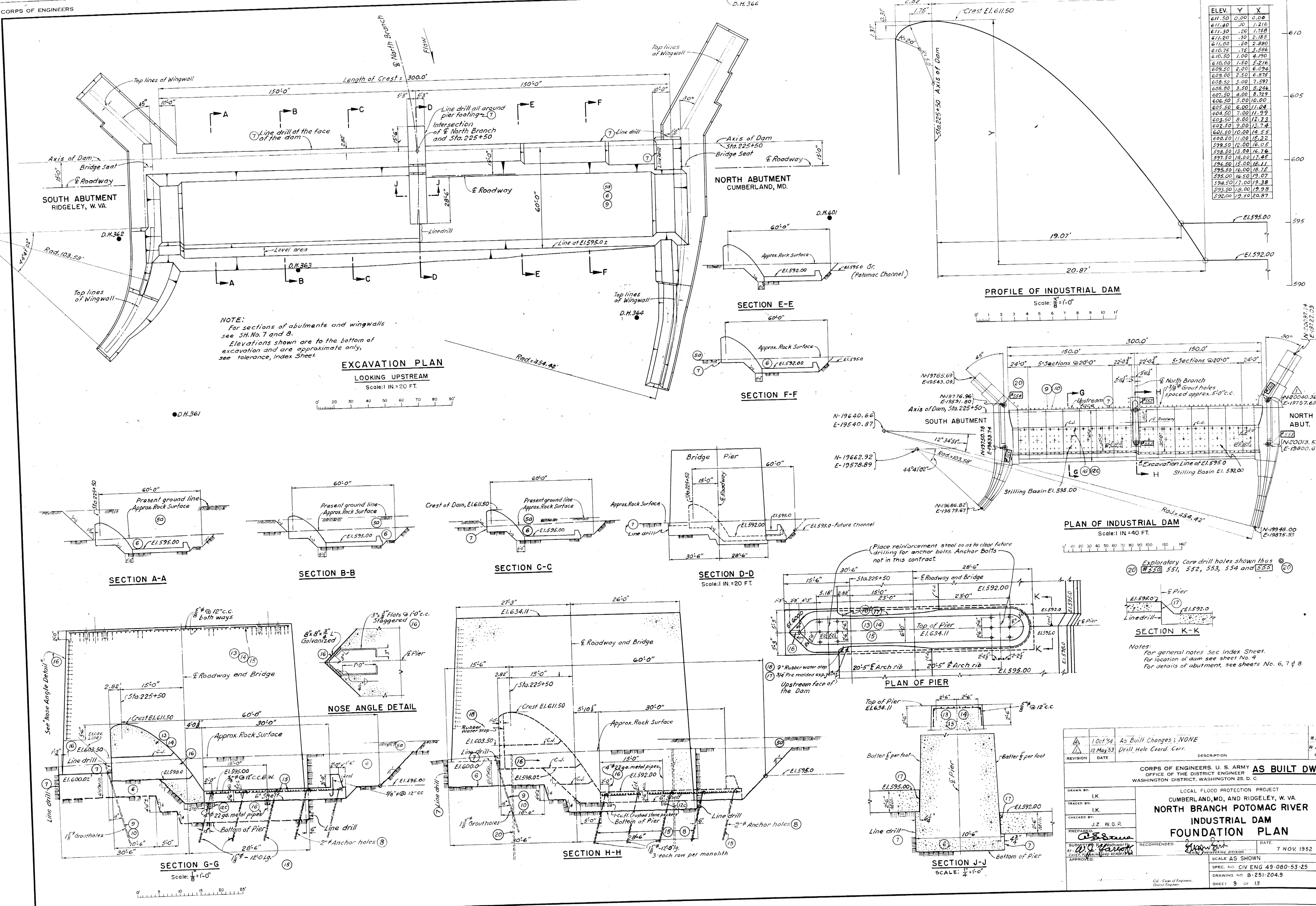
LOCAL FLOOD PROTECTION PROJECT
CUMBERLAND, MD. AND RIDGELEY, W. VA.

NORTH BRANCH POTOMAC RIVER INDUSTRIAL DAM
DETAILS OF BRIDGE ABUTMENTS

PREPARED: [signature]
SUBMITTED: W. J. Yarnoff [signature]
RECOMMENDED: [signature] CHIEF, ENGINEERING DIVISION
APPROVED: Col., Corps of Engineers, District Engineer

DATE: 7 NOV. 1952
SCALE: AS SHOWN
SPEC. NO. CIV ENG 49-080-53-25
DRAWING NO. B-251-204.8
SHEET 8 OF 12

B-251-204.8



ELEV.	Y	X
611.50	0.00	0.00
611.40	.10	1.216
611.30	.20	1.758
611.20	.30	2.185
611.00	.50	2.880
610.75	.75	3.586
610.50	1.00	4.190
610.00	1.50	5.216
609.50	2.00	6.094
609.00	2.50	6.875
608.50	3.00	7.597
608.00	3.50	8.246
607.50	4.00	8.729
606.50	5.00	10.00
605.50	6.00	11.04
604.50	7.00	11.99
603.50	8.00	12.73
602.50	9.00	13.74
601.50	10.00	14.55
600.50	11.00	15.32
599.50	12.00	16.05
598.50	13.00	16.76
597.50	14.00	17.45
596.50	15.00	18.11
595.50	16.00	18.75
595.00	16.50	19.07
594.50	17.00	19.38
593.50	18.00	19.98
592.00	19.50	20.87

REVISION	DATE	DESCRIPTION	BY
4	1 Oct. '54	As Built Changes; NONE	W.D.P.
1	12 May '53	Drill Hole Coord. Corr.	W.D.P.

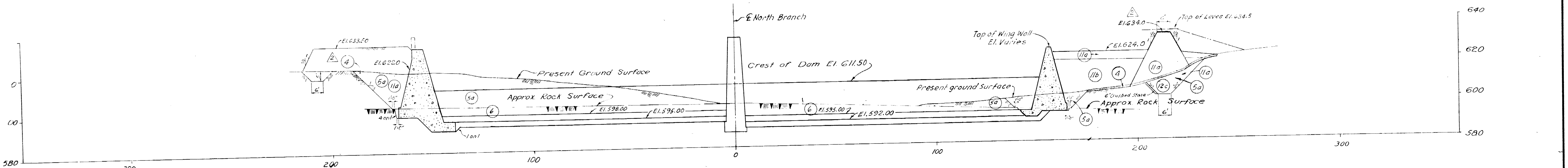
CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
WASHINGTON DISTRICT, WASHINGTON 25, D. C.

AS BUILT DWG.

LOCAL FLOOD PROTECTION PROJECT
CUMBERLAND, MD, AND RIDGELEY, W. VA.

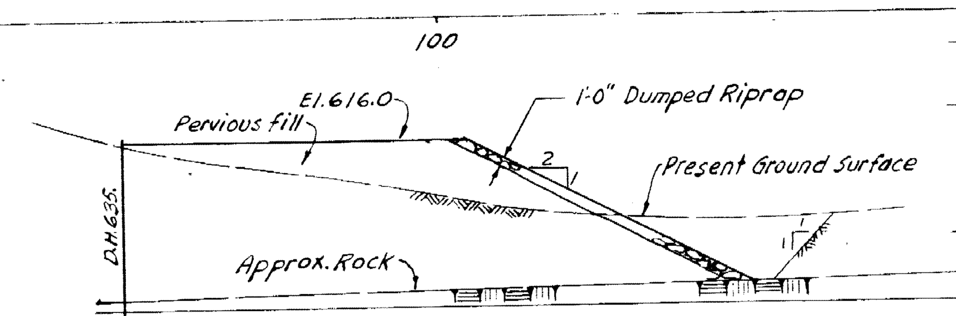
NORTH BRANCH POTOMAC RIVER INDUSTRIAL DAM FOUNDATION PLAN

DRAWN BY: I.K.
TRACED BY: I.K.
CHECKED BY: J.Z. W.D.P.
PREPARED: [signature]
SUBMITTED: R. L. Wadsworth BY: W. J. Yarcott
CHIEF, PLANNING AND REPORTS BR.
RECOMMENDED: [signature] CHIEF ENGINEERING DIVISION
APPROVED:
Col., Corps of Engineers, District Engineer.
DATE: 7 NOV. 1952
SCALE AS SHOWN
SPEC. NO. CIV ENG 49-080-53-25
DRAWING NO. B-251-204.9
SHEET 9 OF 13

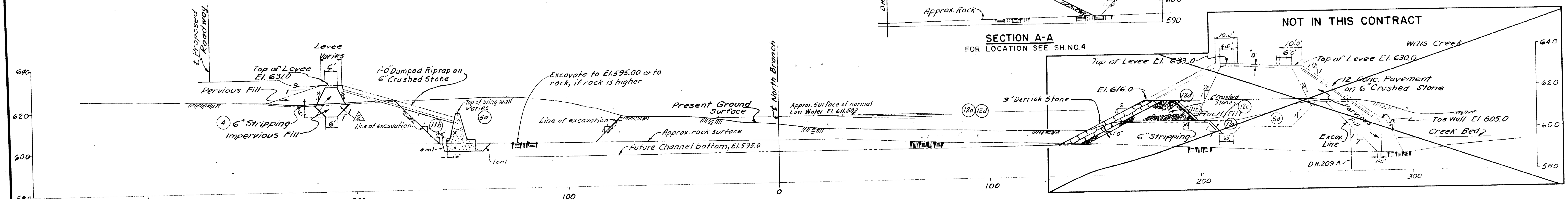


STA. 225+00

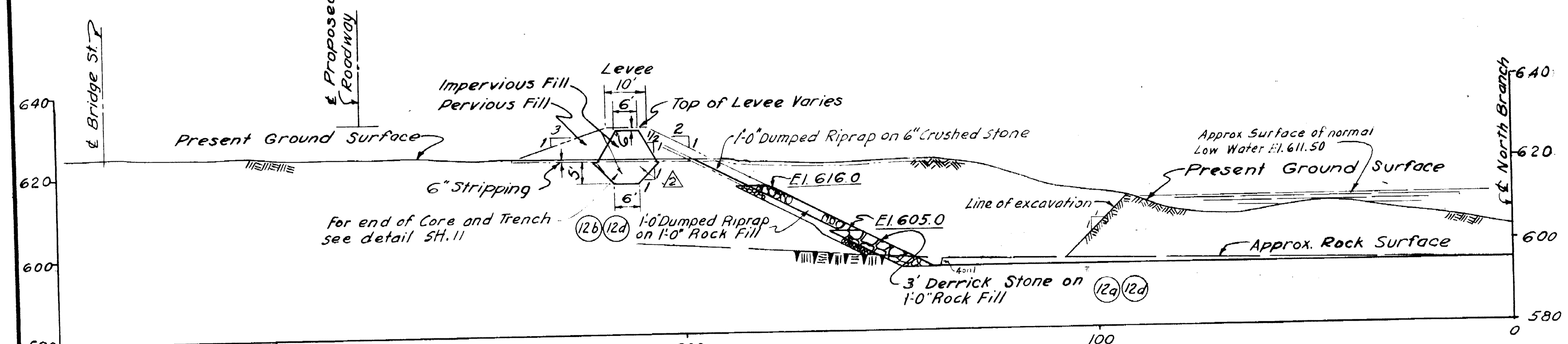
STA. 224+60



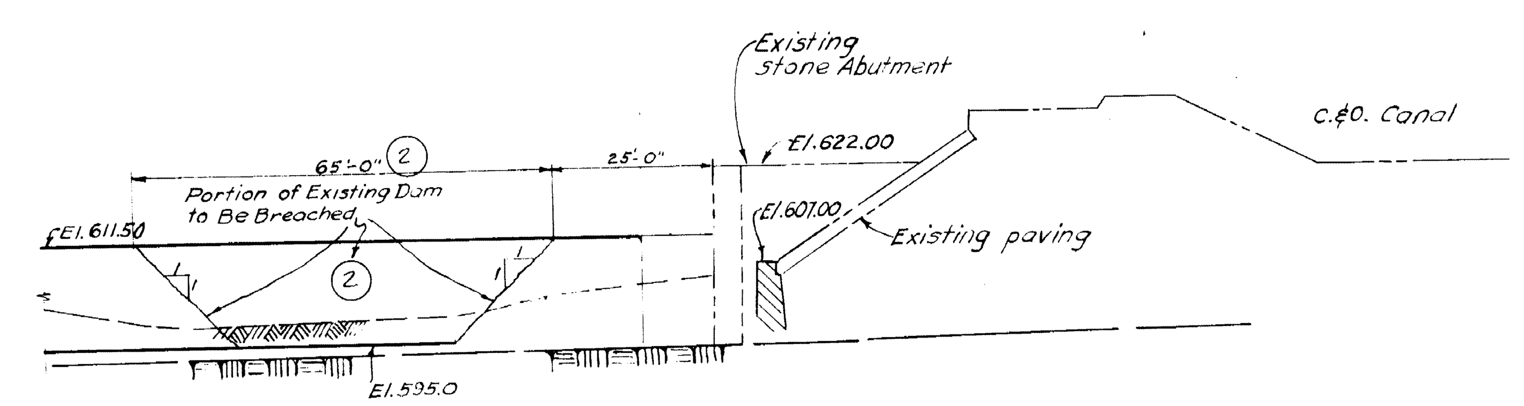
SECTION A-A
FOR LOCATION SEE SH. NO. 4



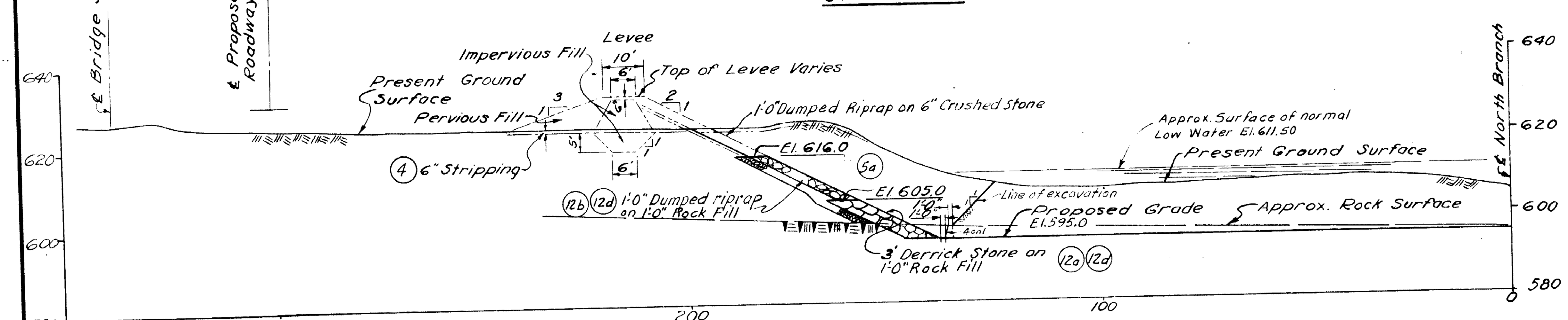
STA. 224+00



STA. 223+00



DETAIL OF C.&O. CANAL DAM



STA. 222+30

NOTES:
For General Notes see Index Sheet.
For location of sections see Sheet No. 4.
For additional sections see Sheet No. 11.
Levee sections shown in dashed lines are not included in this contract.
All Cross Sections taken looking up-stream

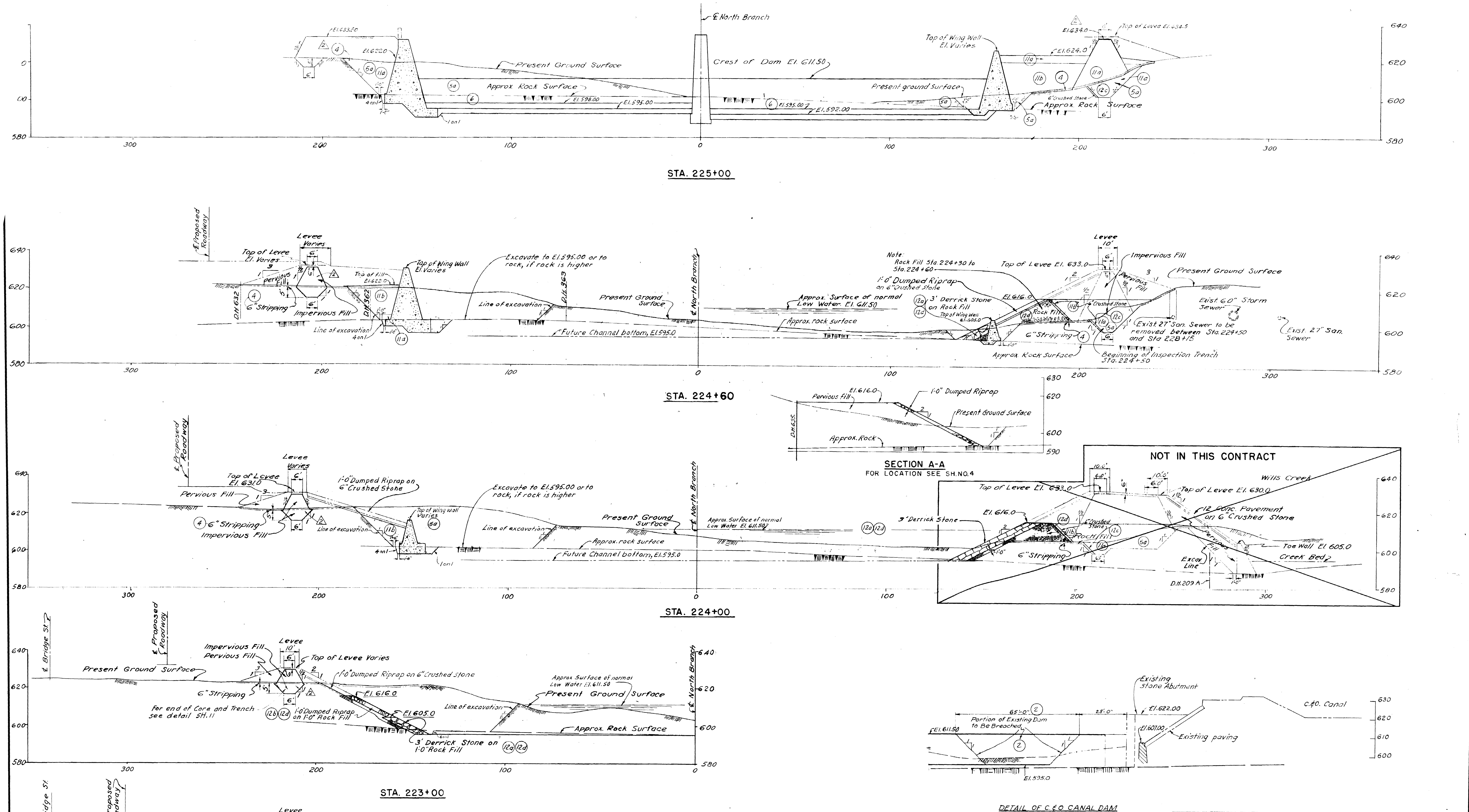
REVISION	DATE	DESCRIPTION	BY
2	1 Oct. '54	As Built Changes; NONE	W.D.H.
1	24 Mar. '54	Impervious Backfill Material added	W.D.P.

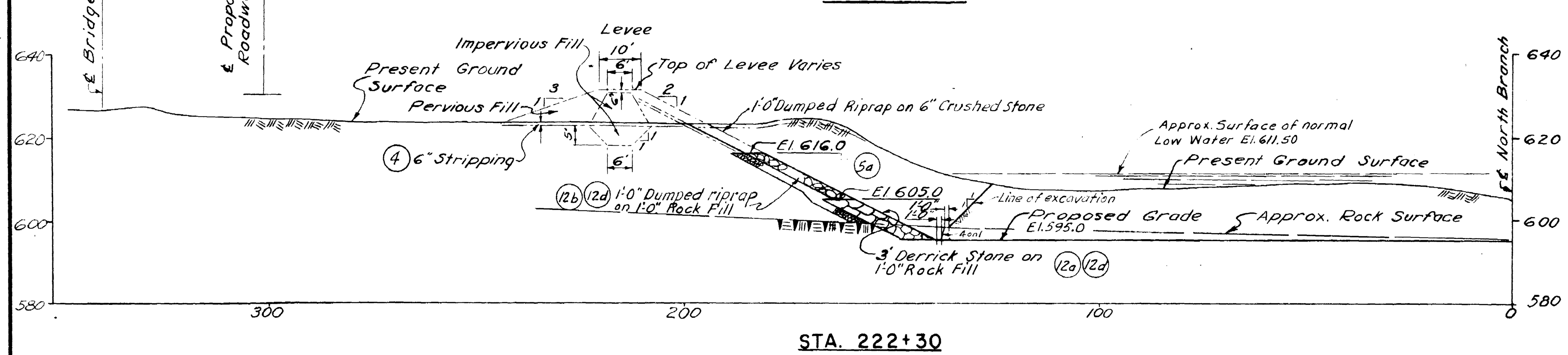
CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
WASHINGTON DISTRICT, WASHINGTON 25, D. C.

AS BUILT DWG.

LOCAL FLOOD PROTECTION PROJECT
CUMBERLAND, MD. AND RIDGELEY, W. VA.
NORTH BRANCH POTOMAC RIVER
INDUSTRIAL DAM
SECTIONS 222+30 — 225+00

DRAWN BY: I K
TRACED BY: I K
CHECKED BY: J.Z.
PREPARED: [signature]
SUBMITTED: R. A. Wadsworth
BY: [signature]
CHIEF, PLANNING AND REPORTS
APPROVED:
RECOMMENDED: [signature]
CHIEF, ENGINEERING DIVISION
Col., Corps of Engineers, District Engineer
DATE: 7 NOV. 1952
SCALE: 1" = 20'
SPEC. NO. CIV ENG 49-080-53-25
DRAWING NO. B-251-204.10
SHEET 10 OF 13





NOTES:
For General Notes see Index Sheet.
For location of sections see Sheet No. 4.
For additional sections see Sheet No. 11.
Levee sections shown in dashed lines are not included in this contract.
All Cross Sections taken looking up-stream

REVISION	DATE	DESCRIPTION	BY
2	1 Oct. '54	As Built Changes; NONE	W.D.P.
1	24 Mar. '54	Impervious Backfill Material added	W.D.P.

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
WASHINGTON DISTRICT, WASHINGTON 25, D. C.

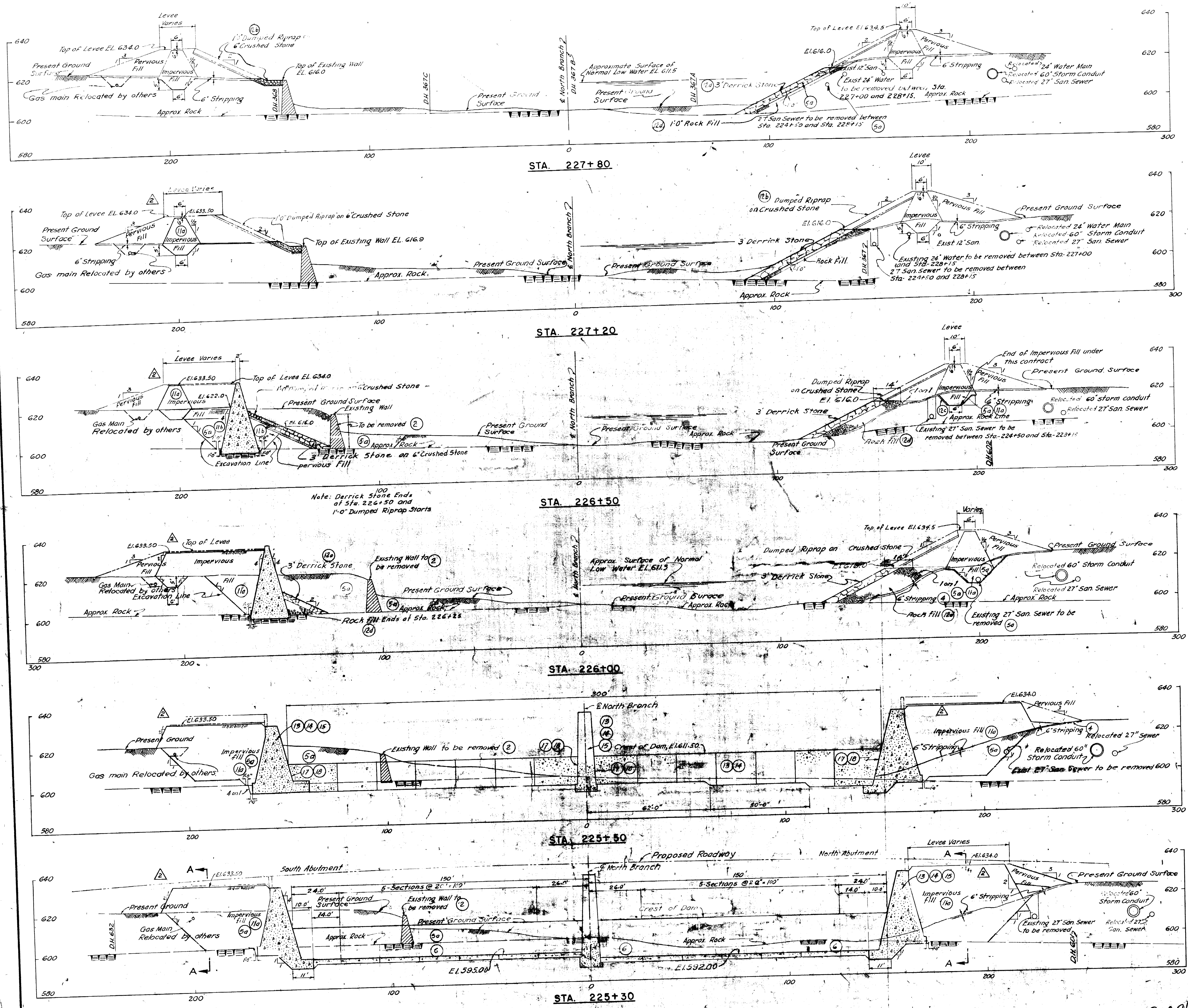
AS BUILT DWG.

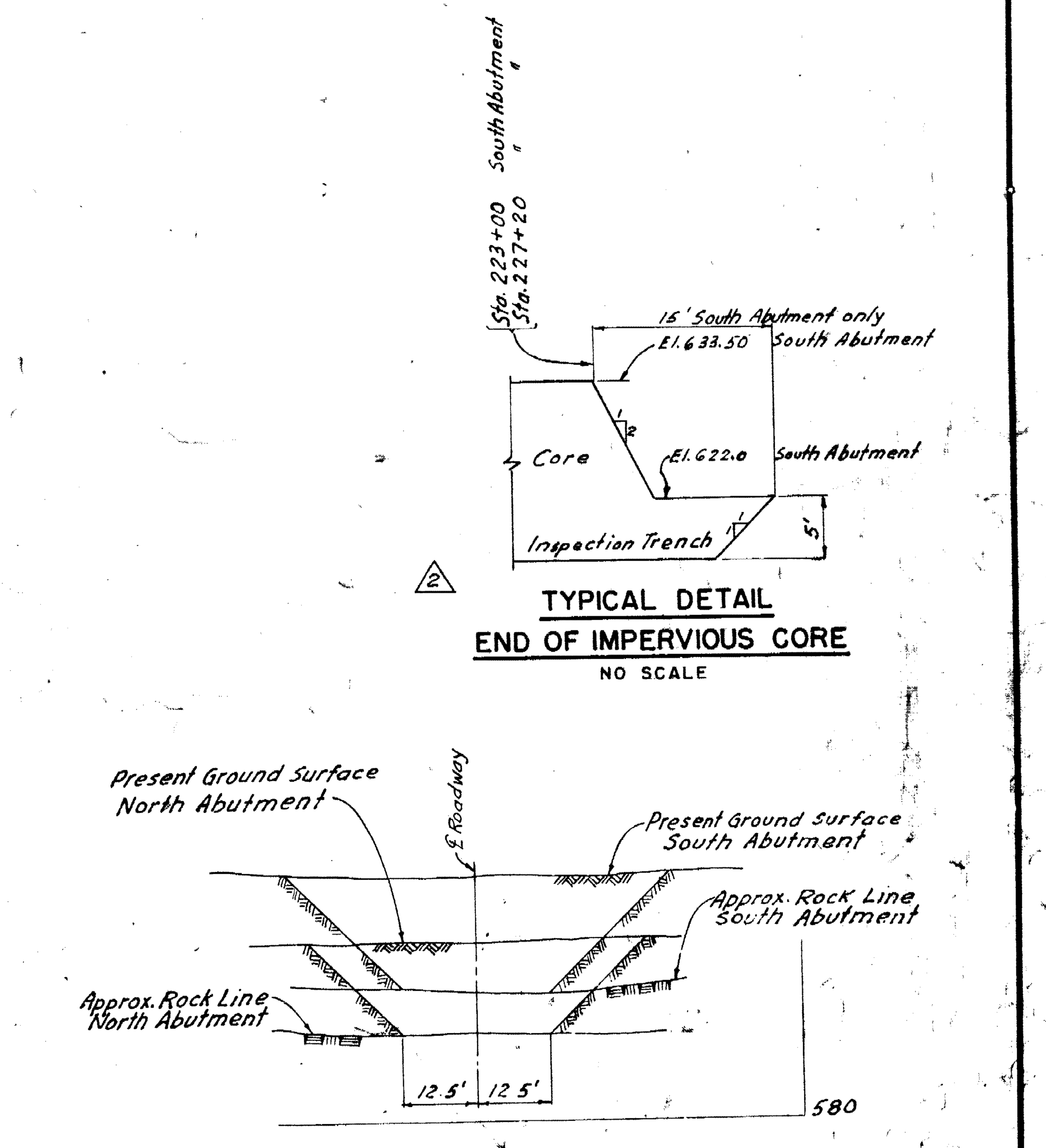
DRAWN BY: I K
TRACED BY: I K
CHECKED BY: J.Z
PREPARED:
SUBMITTED: R.A. Wadsworth
APPROVED:

LOCAL FLOOD PROTECTION PROJECT
CUMBERLAND, MD. AND RIDGELEY, W. VA.
NORTH BRANCH POTOMAC RIVER
INDUSTRIAL DAM
SECTIONS 222+30 — 225+00

DATE: 7 NOV. 1952
SCALE: 1" = 20'
SPEC. NO. CIV ENG 49-080-53-25
DRAWING NO. B-251-204.10
SHEET 10 OF 13

B-251-204.10





TYPICAL DETAIL
END OF IMPERVIOUS CORE
NO SCALE

SECTION A-A
CUT-OFF TRENCH

NOTES:
For General Notes see Index Sheet.
For location of sections see Sheet No. 4.
For additional sections see Sheet No. 10.
Levee Sections shown by dashed lines, are not included in this contract.
All Cross Sections taken looking up-stream

Revision	Date	Description	By
1	1 Oct '54	As Built Changes: NONE	W.D.P.
2	24 Mar '54	Impervious Backfill Material added	W.D.R.

AS BUILT DWG.

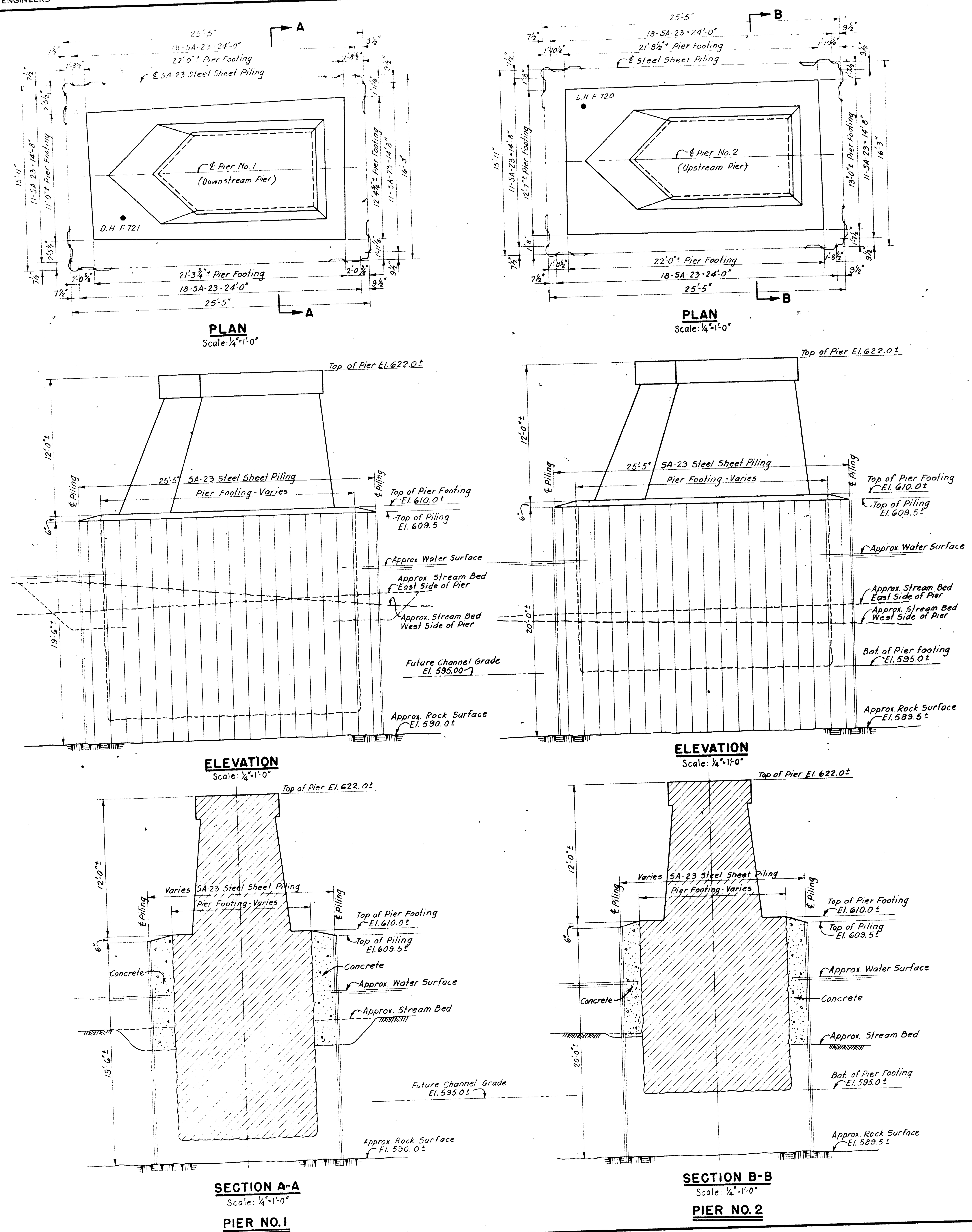
CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
WASHINGTON DISTRICT, WASHINGTON 25, D. C.

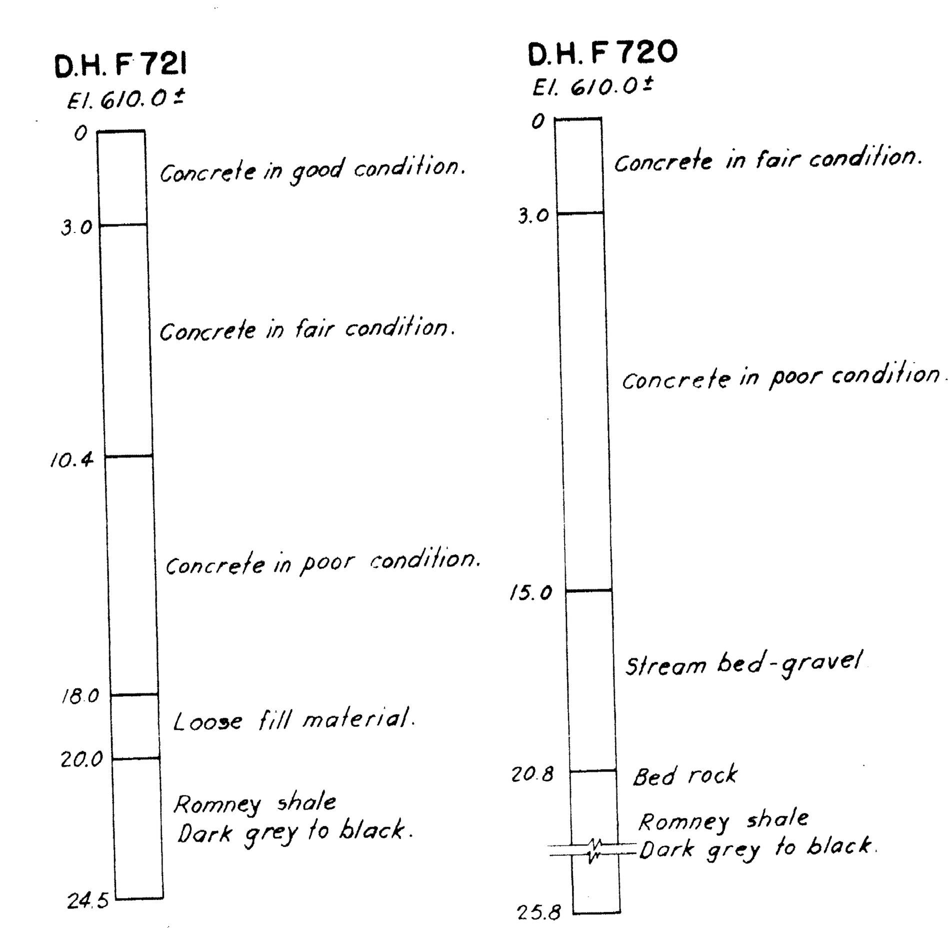
LOCAL FLOOD PROTECTION PROJECT
CUMBERLAND, MD. AND RIDGELEY, W. VA.
NORTH BRANCH POTOMAC RIVER
INDUSTRIAL DAM
SECTIONS 225+30 — 227+80

Drawn by: I.K.
Traced by: I.K.
Checked by: J.Z.
Date: 7 NOV. 1952
Scale: 1" = 20'
Spec. No. CIV ENG 49-080-53-25
Drawing No. B-251-204.11
Sheet 11 of 13

B-251-204.11


U.S. ARMY
WILLS CREEK
POTOMAC RIVER
NORTH BRANCH
EXISTING C&O CANAL DAM
C&O CANAL LOCKS
W.M.RWY. BRIDGE No. 1656
W.M.RWY BRIDGE No. 1657 A
Water Surface El. 611.5
BALL PARK
WASHINGTON STREET
BALTIMORE ST. BRIDGE
GREENE STREET
JOHNSON ST.
JOHNSON P.C. STREET BRIDGE
BRIDGE (Macomb) STREET
CARPENTER AVE.
JOHNS STREET (Gravel)
MULLIGAN ST.
PACA ST.
NOTES:
For General Notes see Index Sheet.
For limits of work see Sheet No. 4.
For details of Abutments see Sheets No. 6, 7 and 8.
For Cross Sections see Sheets No. 10 and 11.
1 Oct.'54 As Built Changes; NONE
24 Mar.'54 ℄ Levee W. Cumberland and E. Ridgeley added
12 May'53 Control Coord. and Street name Corr.
CORPS OF ENGINEERS, U.S. ARMY
OFFICE OF THE DISTRICT ENGINEER
WASHINGTON DISTRICT WASHINGTON 25, D.C.
AS BUILT DWG.
LOCAL FLOOD PROTECTION PROJECT
CUMBERLAND, MD. AND RIDGELEY, W. VA.
NORTH BRANCH POTOMAC RIVER
INDUSTRIAL DAM
ALIGNMENT PLAN
7 NOV. 1952
SCALE 1"=50'
CIV ENG 49-080-53-26
DRAWING NO. B-251-204.12
SHEET 12 OF 13
REVIEWED FOR SAFTEY BRANCH
SAFTEY ENGINEER
B-251-204.12





NOTES:

All timber and loose material on the face of the existing piers shall be removed in order to obtain bond between new and existing concrete as directed by the contracting officer.

DA-27 steel sheet piling may be substituted for SA-23 steel sheet piling on pier No. 2 as directed by the contracting officer.

Excavate stream bed material adjacent to pier above elevation 600 before driving steel sheet piling to insure the placement of concrete fill to elevation 600 or below.

Steel sheet piling shall be driven to lines as shown into soft rock or as directed by the contracting officer.

Stream bed material should be backfilled against the outside of steel sheet piling as necessary before placing concrete to maintain clearances and reduce spreading or as directed by the contracting officer.

For location of piers No. 1 & 2 and approximate location of temporary cofferdam see general plan sheet No. 4.

Approximate depths of pier footings and rock surface determined by core borings drilled thru each pier footing on 14 June 1954 for pier No. 2 and 16 June 1954 for pier No. 1.

REVISION	DATE	DESCRIPTION	BY
4	1 Oct '54	As Built Changes; NONE	W.D.P.
3	21 June '54	New Sheet	W.D.P.

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
WASHINGTON DISTRICT, WASHINGTON 25, D. C.

AS BUILT DWG.

DRAWN BY G.L.M.
TRACED BY M.M.H.
CHECKED BY W.D.P.
REVIEWED FOR SAFETY BRANCH: J. J. Higgins
PREPARED BY: W. D. Phillips, CHIEF, DESIGN-PLANS SECTION
SUBMITTED BY: R. C. Wadsworth, CHIEF, PLANNING & REPORTS BRANCH
RECOMMENDED: D. [signature]
APPROVED: Ray Adams, Col., Corps of Engineers, District Engineer.

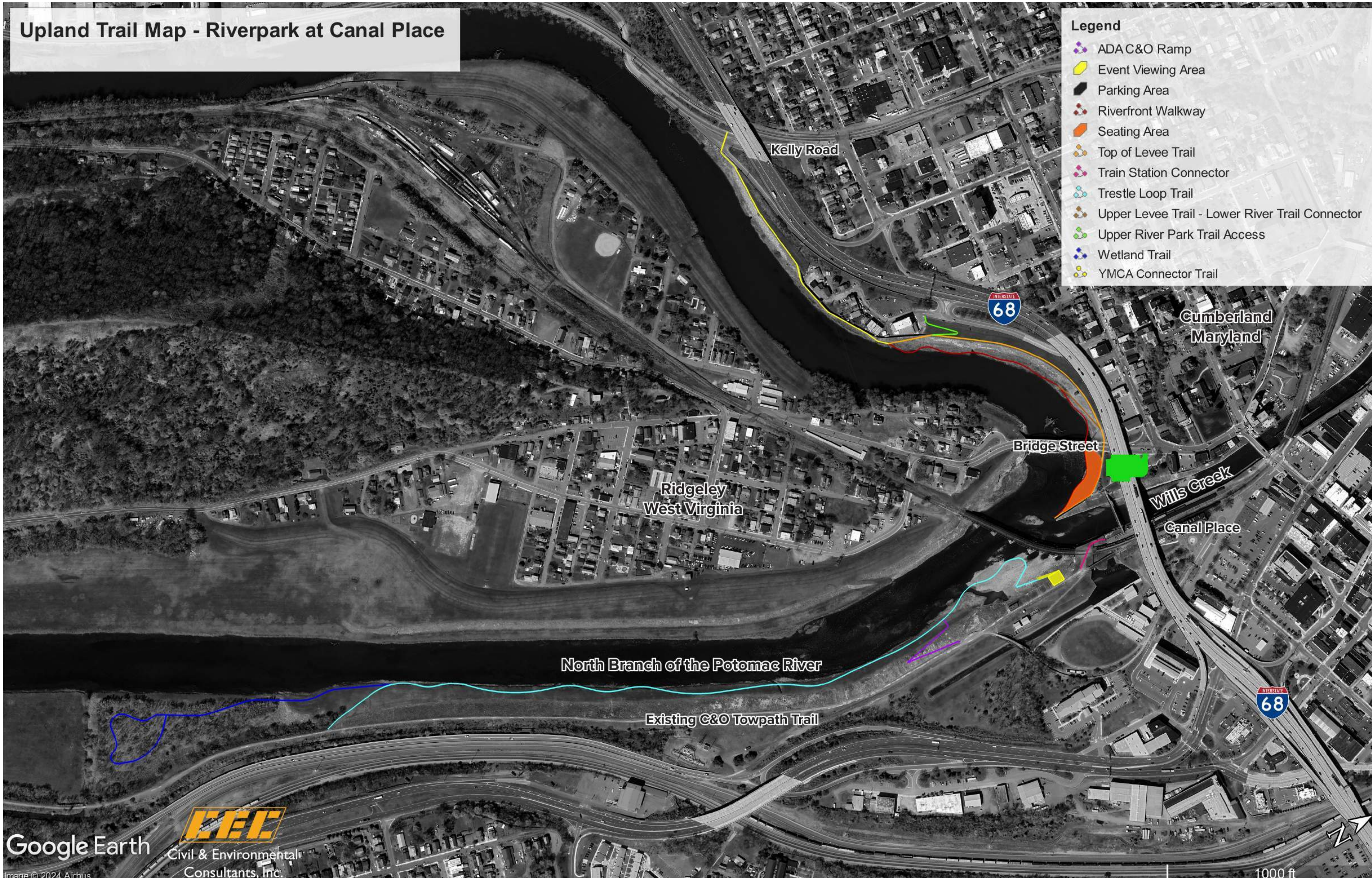
LOCAL FLOOD PROTECTION PROJECT
CUMBERLAND, MD. AND RIDGELEY, W. VA.
NORTH BRANCH POTOMAC RIVER
INDUSTRIAL DAM
PIER ENCASEMENT
PIERS NO. 1 & 2, W.M. RWY. BRIDGE NO. 1656

SCALE: ¼"=1'-0"
SPEC. NO.:
DATE: 21 JUNE 1954
DRAWING NO. B-251-204.13
SHEET 13 OF 13

Appendix D

Loop Trail Design Overview Map
Civil and Environmental Consultants, Inc.

Upland Trail Map - Riverpark at Canal Place



Appendix E

River Park at Canal Place Master Plan
Civil and Environmental Consultants, Inc.

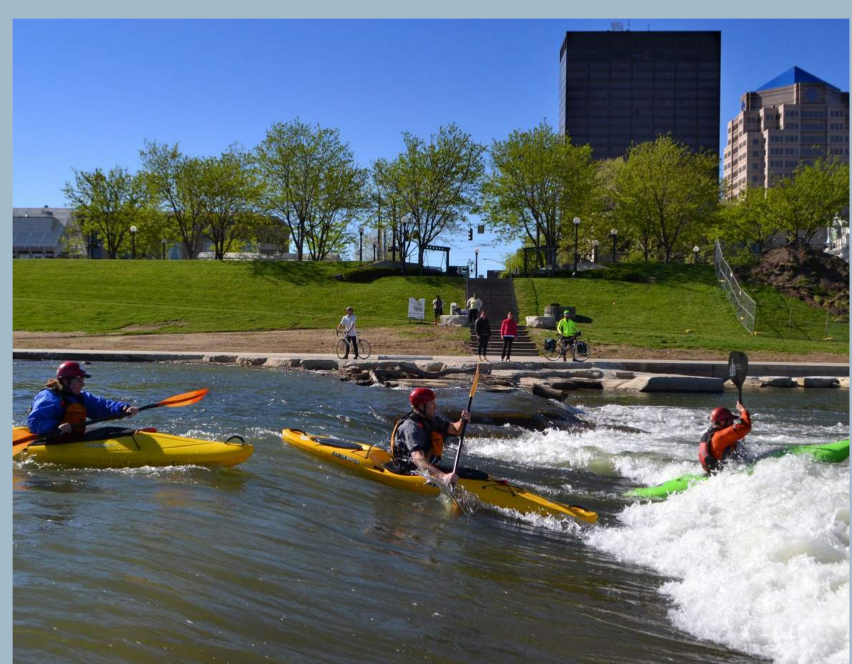
Canal Place
Preservation & Development Authority

PASSAGES OF THE WESTERN POTOMAC HERITAGE AREA

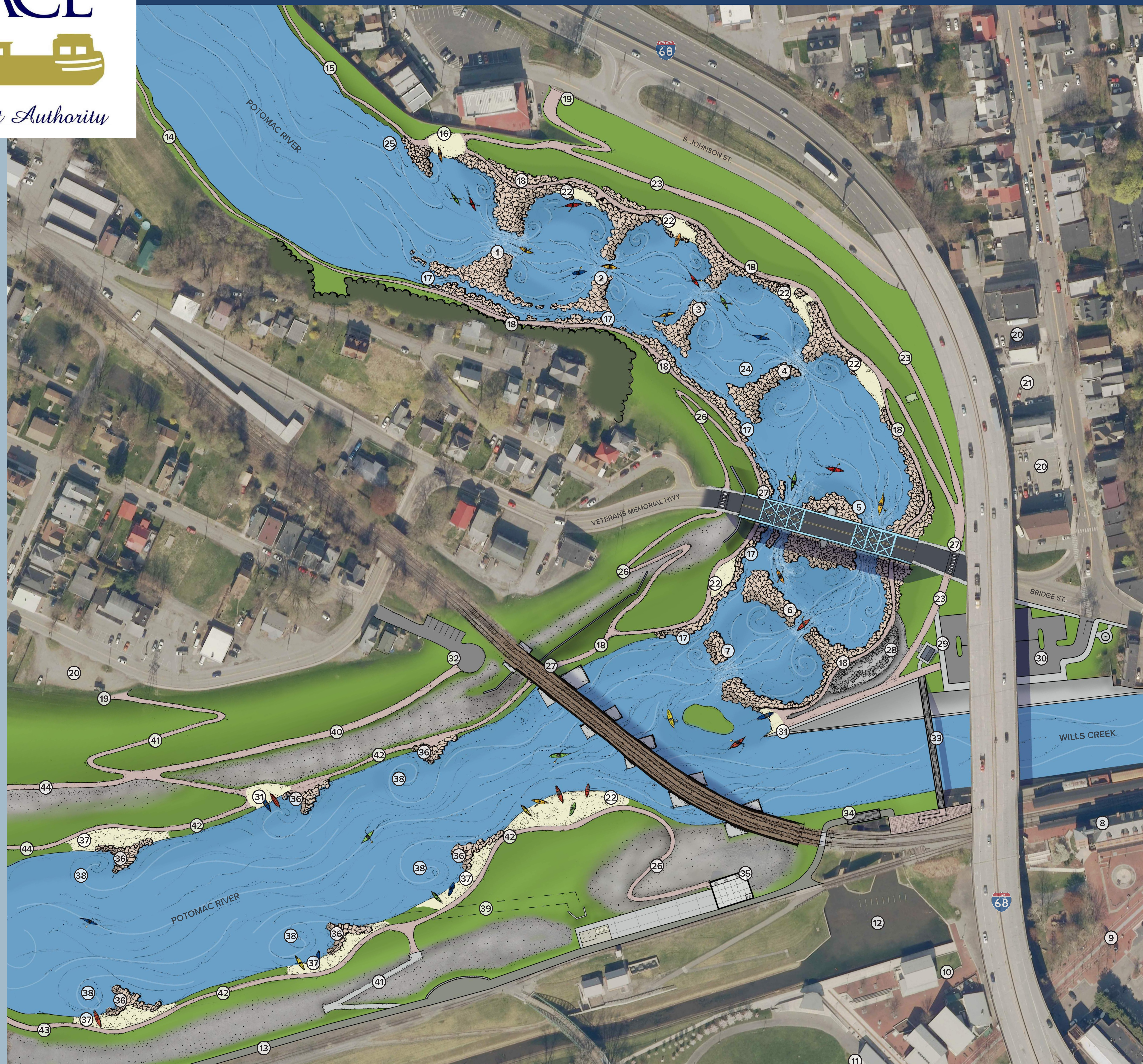
Recreation Engineering & Planning

CEC
Civil & Environmental Consultants, Inc.

RIVER PARK EXAMPLE IMAGES



UPDATED DECEMBER 2024



Plan Key

1. FEATURE 1 (2' DROP)
2. FEATURE 2 (2' DROP)
3. FEATURE 3 (2' DROP)
4. FEATURE 4 (1.5' DROP)
5. FEATURE 5 (2.5' DROP)
6. FEATURE 6 (1.5' DROP)
7. FEATURE 7 (1.5' DROP)
8. CANAL PLACE AND WESTERN MD SCENIC RAILROAD
9. GREAT ALLEGHENY PASSAGE - MILE MARKER ZERO
10. NATIONAL PARK SERVICE
11. FESTIVAL GROUNDS / CANAL PLACE SHOPS
12. CANAL BASIN
13. C&O CANAL TOWPATH NATIONAL PARK
14. FUTURE CARPENDALE, WV LOOP
15. YMCA CONNECTOR TRAIL
16. BOATER ACCESS
17. FISH PASSAGE (CONTINUOUS PASSAGE)
18. RIVERFRONT WALKWAY
19. UPPER RIVER PARK TRAIL ACCESS
20. PUBLIC SHARED PARKING
21. PUBLIC METERED PARKING
22. BEACH AND VIEWING AREA
23. TOP OF LEVEE TRAIL
24. EXISTING CANAL WATER INTAKE
25. PROPOSED CANAL WATER INTAKE
26. RIVERFRONT WALKWAY ACCESS
27. WALKWAY UNDERPASS
28. NATURAL ROCK SEATING
29. PROPOSED POINT OVERLOOK PAVILION
30. PROPOSED PARKING LOT
31. BOATER ACCESS
32. RIVER PARK TRAILHEAD AND PARKING
33. EXISTING PEDESTRIAN BRIDGE OVER WILLS CREEK
34. PROPOSED BRIDGE CONNECTOR
35. VIEWING PLATFORM
36. DEFLECTOR
37. LOWER RIVER PARK WATER ACCESS
38. FISH HABITAT
39. FUTURE CSO OUTLET MODIFICATION
40. EMERGENCY AND ADA RIVER PARK ACCESS
41. ADA RIVERFRONT ACCESS
42. RIVERFRONT WALKWAY WITH FISHING ACCESS
43. MD LOOP TRAIL (1.3 MILES)
44. TRESTLE LOOP TRAIL (3.5 MILES IN MD AND WV)

NORTH
SCALE IN FEET
0' 60' 120'

THE RIVER PARK AT CANAL PLACE CONCEPTUAL MASTERPLAN