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Beaver Creek Raw Water Pump Station, Intake and Transmission Main

Project Narrative
Hazen Project No. 31570-001
July 9, 2026

This narrative has been prepared to support the Special Use Permit application for the proposed Site Development Plan (SDP-2025-00114) in TMP 57-04.

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1. Project Introduction and Purpose

This narrative of the proposed Beaver Creek Intake, Pump Station and Transmission Main project has been prepared in support of the Special Use Permit application required per County Code Chapter 18 - Section 30.3.11 due to the project's proposed addition of fill to a floodway fringe adjacent to the Beaver Creek Reservoir. This narrative is intended to address the applicable elements of Section 33.4(E) regarding Special Use Permits, including the public need for the project, its consistency with long-range planning for the Crozet Development Area, environmental considerations, and potential impacts to public facilities.

1.1 Project Background

Crozet, Virginia is a small residential community west of Charlottesville near the foothills of the Blue Ridge Mountains in Albemarle County. Crozet is one of three designated Development Areas in Albemarle County's Comprehensive Plan (Comprehensive Plan) where a variety of land uses, facilities and services are planned to support the County's future growth. The plan places an emphasis on density and quality design in new and infill development that is balanced with the preservation of agricultural, forested, historic, cultural, scenic and natural resources that maintain the rural character of the community outside of the development areas.

RWSA owns and operates the Crozet Water Supply System consisting of the Beaver Creek Reservoir and its associated pump station, both located within Beaver Creek Reservoir Park that is owned and managed by Albemarle County, and the Crozet Water Treatment Plant (WTP). The existing pump station withdraws approximately 1.0 mgd of raw water from the reservoir via a dedicated intake structure in the reservoir and pumps it through a raw water transmission main to the Crozet WTP as shown in **Figure 1-1**. Water treated at the WTP is delivered from the supply system to Crozet Service Area customers through a water distribution system that is partially managed by RWSA, with the remainder operated by the Albemarle County Service Authority (ACSA).

Over the past two decades, RWSA has seen a steady increase in annual finished water production serving the Crozet community, from approximately 124 million gallons in 2007 to approximately 235 million gallons in 2025. Per the Crozet Area Drinking Water Infrastructure Plan (DWIP) issued in June 2019, RWSA anticipates that the system will need to provide up to 1.85 million gallons per day (mgd) and 2.54 mgd of drinking water by 2040 and 2075, respectively, to meet forecasted maximum daily demands.

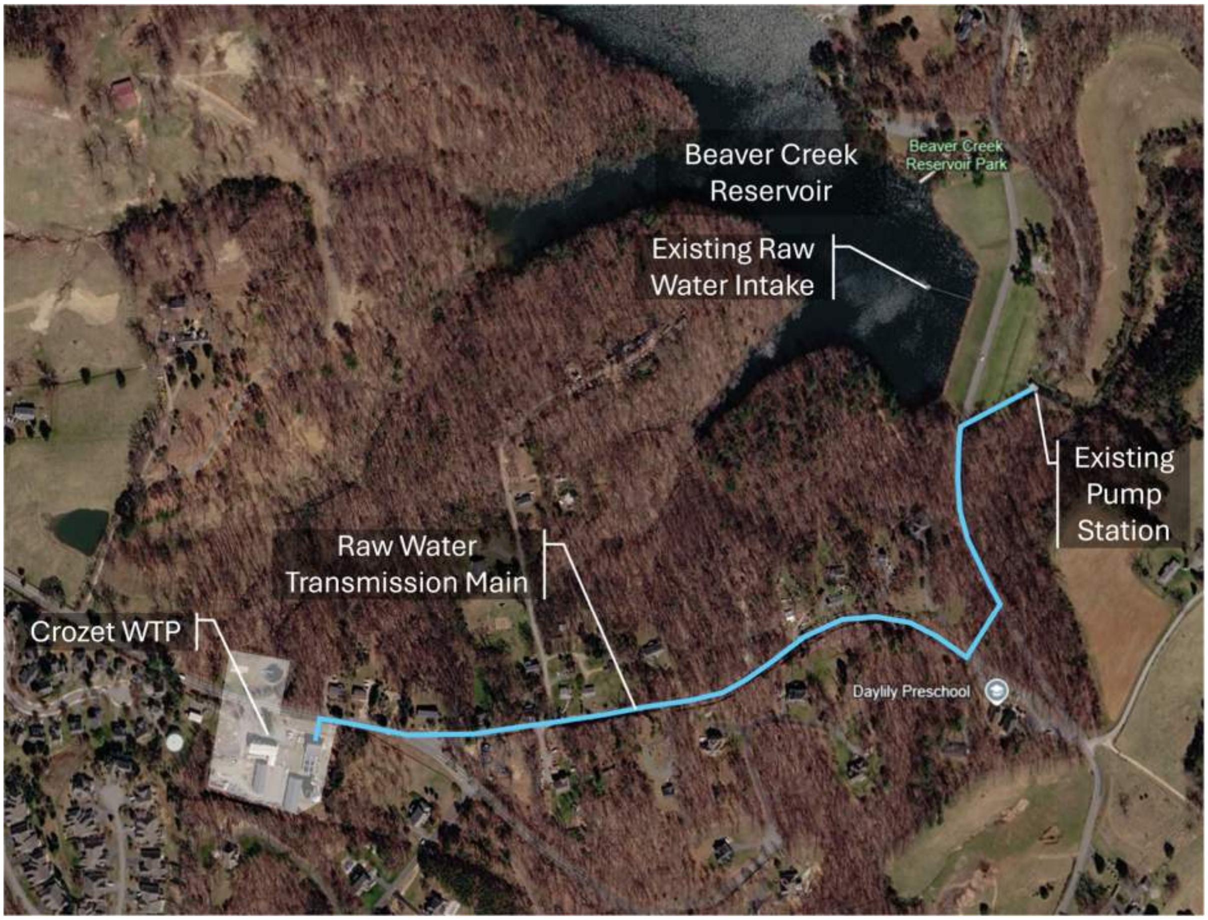

Figure 1-1: Existing Crozet Water System

1.2 Project Description

To maintain a safe and dependable water supply that provides high quality finished drinking water to the growing community and portions of the surrounding area, RWSA has acquired a new Virginia Water Protection Permit (VWP) from the Virginia Department of Environmental Quality (VADEQ) to allow for increased withdrawals from the Beaver Creek Reservoir and is expanding the capacity of both the Crozet WTP and Beaver Creek Reservoir withdrawal infrastructure (as shown in **Figure 1-2**). The Crozet WTP treatment process recently completed its first phased upgrade in 2021 to increase the overall "out the door" capacity to 2.0 mgd to meet intermediate-term demand increases. The proposed new intake, pump station and raw water transmission main infrastructure have been designed to: (1) withdraw and convey up to 2.80 mgd from the Beaver Creek Reservoir to the Crozet WTP to meet the service area's long-term demand requirements; (2) withdraw and release up to 2.0 mgd from reservoir to maintain instream flows in Beaver Creek downstream of the reconstructed dam (being implemented in a separate project) in accordance with the requirements of the VWP; and (3) provide destratification capabilities at the Beaver Reservoir to mitigate the impacts of seasonal turnover and improve water quality. The destratification and transmission main portions of the project are subsurface utilities and will not permanently alter the appearance of the reservoir or the corridor.

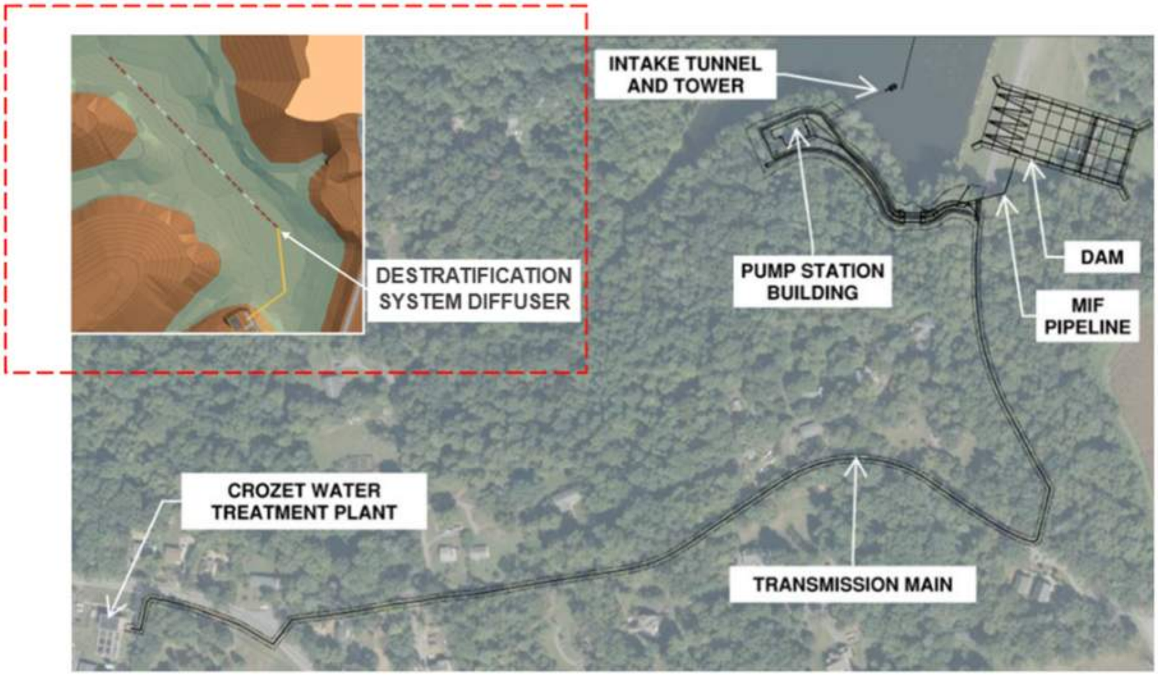

Figure 1-2: Proposed New Raw Water Intake, Pump Station, Transmission Main at Beaver Creek Reservoir

1.3 Project Consistency with County Comprehensive Planning

RWSA has planned and implemented the proposed project in accordance with development goals established in the Crozet Master Plan adopted on October 20, 2021 and AC44, Albemarle County's updated Comprehensive Plan adopted on October 15, 2025 to balance the development of a thriving community with strengthening the area's rural heritage and natural resource protection. By implementing the proposed project, RWSA is ensuring a reliable water supply for all community members and supporting the development of employment options, services and commercial and retail opportunities in the community as presented in the comprehensive plans. With the project proposed in a forested area adjacent to and visible to a water body in a public park, RWSA has also focused on conservation by maintaining the park's natural beauty, mitigating impacts to natural areas, and enhancing opportunities for outdoor recreation. These objectives have been met by (1) developing construction limits and a comprehensive landscaping plan that will maintain tree vegetation along the shoreline; (2) selecting building architecture and materials that blend with the rural character of the site; and (3) integrating Henley Hornet's Trail and a reservoir viewing area into the project site to facilitate public recreation. The pump station rendering presented in **Figure 1-3** below illustrates the project's commitment to integrating new infrastructure with Beaver Creek Park's natural beauty.

Figure 1-3: Rendering of Proposed Pump Station

1.4 Site Constraints

Development of the site is constrained by several features including a steep grade across the project site ranging from 20% to 50%, need to tie the access road into the existing Brown's Gap Turnpike, adjacency to a reservoir and 100-year flood plain, and vehicular access requirements that include maintaining a sufficiently safe slope on the access road and turnaround area at the pump station site for large vehicle (i.e. a fire truck of semi-hauler) to safely enter and exit the site. These factors limited the possible areas the pump station could be placed.

The final site development approach shown in **Figure 1-4** was selected to minimize the overall site footprint while locating the pumping infrastructure close to the reservoir, allowing for sufficient landscaping between the reservoir shoreline and new infrastructure, and minimizing the disturbance of existing hillside. A soil nail slope stabilization system and build-up of a retaining wall and associated fill will be required to install the access road and pump station site. A bridge will be installed so that the access road does not permanently impact the on-site jurisdictional water or floodplain. While this approach allows the project footprint and resulting natural resource impact to be minimized, lower levels of the retaining wall do extend into the floodplain.

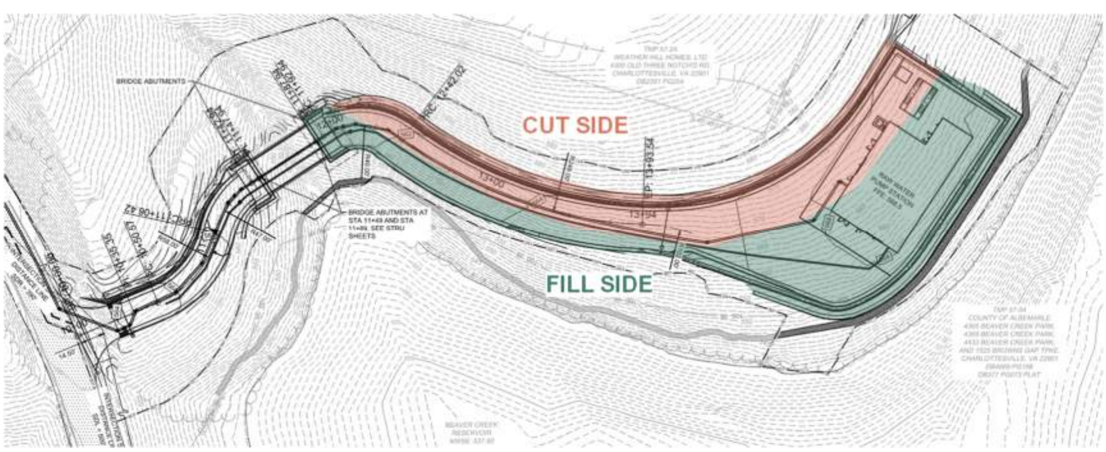

Figure 1-4: Extent of Site Development Adjacent to Reservoir

2. Project Impacts

2.1 Reservoir Water Quality Improvements

The Beaver Creek Reservoir experiences seasonal stratification from spring through fall, during which solar heating of the reservoir surface lowers the density of the top water layers in comparison to the denser reservoir bottom water, and distinct layers are formed in the reservoir that limit vertical mixing during these months. Once stratification is established the lower strata of the reservoir is deprived of aeration from mixing with oxygen-rich surface water and the resulting anoxic (i.e., low dissolved oxygen) conditions at the reservoir bottom encourage the release of nutrients (phosphorous) and metals (iron and manganese) from the bottom sediments to the overlying water column, thus reducing the quality of bottom reservoir water. During the fall turnover, this water is introduced throughout the entire reservoir column, thus impacting water quality throughout the reservoir and encouraging algal growth.

To address this water quality issue at the Beaver Creek Reservoir, RWSA is installing a diffused air/destratification (DA/D) system consisting of: (1) an air compressor and receiving tank that transfers atmospheric air from the shoreline to the bottom of the reservoir; and (2) a bottom-lying pipeline diffuser that distributes forced air to the reservoir water column via bubble plumes shall be implemented in conjunction with the new raw water infrastructure. The DA/D system will be operated on a seasonal basis (i.e., generally between May and September-November) when the reservoir thermally stratifies. Introduced bubble plumes will entrain and move cold water from the bottom to the surface, resulting in a thorough mixture of water throughout the reservoir and improved oxygen conditions at the reservoir bottom (see **Figure 2-1)**, thus mitigating water quality issues resulting from thermal stratification.

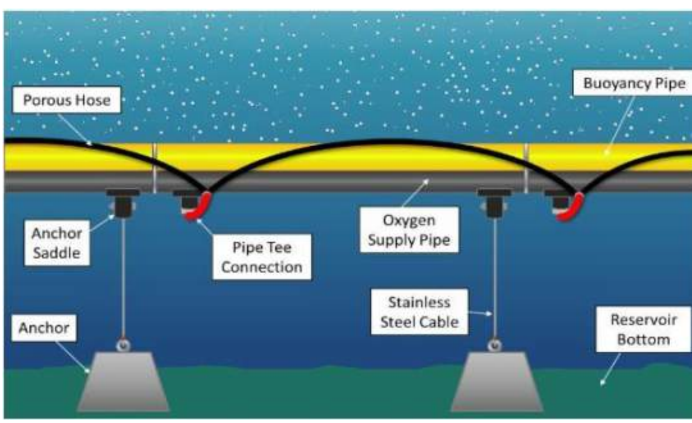

Figure 2-1: In-Reservoir Detsratification Equipment and Example System

2.2 Stormwater Management Quantity and Quality

Stormwater management at the pump station site is addressed through a combination of grading and conveyance measures that direct runoff in a controlled manner. Offsite, uphill flow is captured in concrete channels above the pump stations and is either diverted directly into the reservoir or into existing channels capable of handling the flow. Additional flow generated from the new onsite impervious area is directed through curb and gutter, drop inlets, and storm sewers that discharge onto stabilized concrete block mats above the existing on site channel. From there the stormwater flows into the existing channel where it safely discharges into the reservoir.

With a drainage area of 6,099 acres and a VADEQ target of 0.26lbs/ac/yr, Beaver Creek Reservoir is expected to receive a targeted value of 1,585 lb/yr of phosphorous. The 29,100 square feet (0.7 acres) of impervious area to be constructed at the site as part of the proposed project is expected to generate an additional 0.71 lb/yr of phosphorus to Beaver Creek Reservoir, representing an estimated increase in nutrient load of less than 0.05% of the total nutrient load delivered to the Reservoir. Onsite mitigation measures were explored but would have to be located downstream of pump station, which would require additional disturbance to the park. Ultimately the purchase of nutrient credits from a bank in the watershed was determined to be the most appropriate way to address the small increase of additional phosphorus to the reservoir resulting from the project.

2.3 Floodway Fringe and Base Flood Elevation Modeling

As previously mentioned, the raw water pump station had to be located in close proximity to Beaver Creek Reservoir due to site constraints. The reservoir and adjacent area is classified a FEMA Zone A, in the 100 yr floodplain without a defined base flood elevation. The floodplain and pump station site can be seen in **Figure 2-2** below.

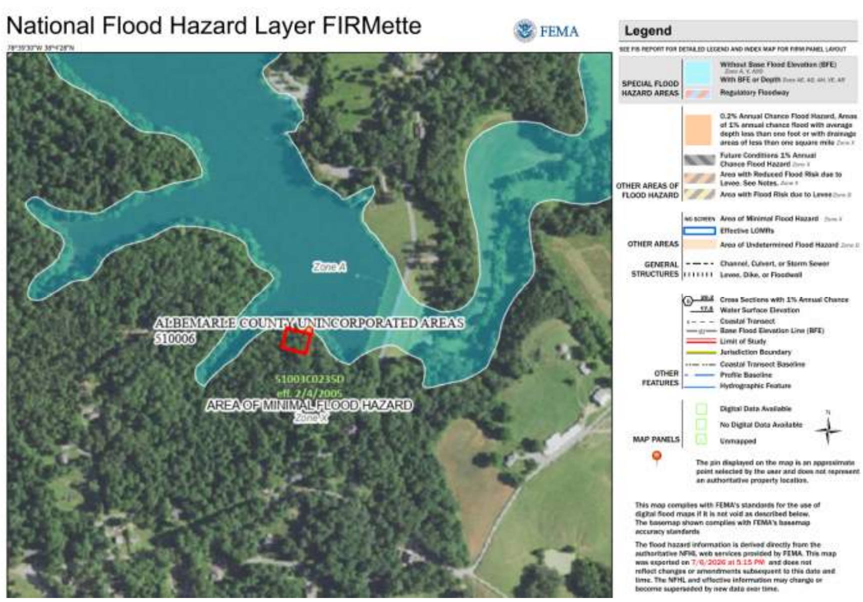

Figure 2-2: FEMA Flood Zone at Proposed Site

A 2D HEC-RAS model was used to perform an analysis of the reservoir and further clarify the flood conditions at the site. This analysis modeled unsteady inflows associated with the 100-yr storm through a cross section of the reservoir with exiting topography and established a base flood elevation (BFE) of 549.44’ at the pump station, which generally follows the approximate FEMA boundary. The model was then run through a cross section of the reservoir with the proposed pump station grading and generated the same BFE of 549.44, thus demonstrating that the grading associated with the proposed project will not cause a measurable rise to the flooding associated with the 100-year storm. This “No Rise” certification and model are included under separate cover as part of this application.

Figure 2-3 below shows the site plan with a red line drawn at elevation 549.44, the normal water surface elevation indicated at 537.8, and the proposed fill area below the flood elevation hatched green.

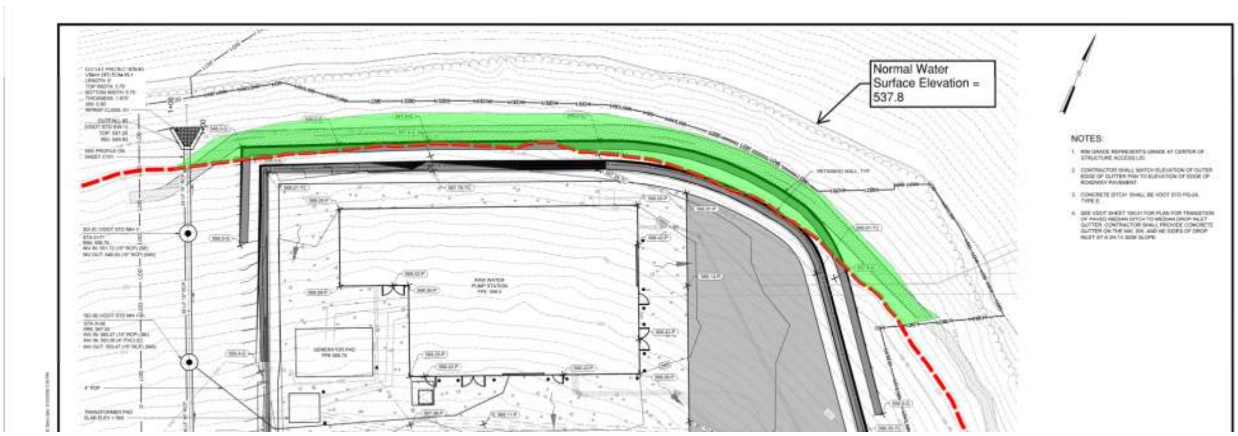

Figure 2-3: Site Plan with Flood Elevation and Fill Area

The project layout reflects consideration of floodplain conditions and resilience to flooding. Critical operations systems including the building, and all chemical, electrical and control equipment associated with the intake, are located well above the 100-year flood elevation. The retaining wall and minor grading required to restore the Henley Hornet’s walking trail, representing approximately 465 cubic yards of fill (note that this number is the entirety of fill placed, including fill above the 100-year flood elevation and behind the wall), are the only structure or site feature of the proposed project that are within in the 100-yr floodplain.

2.4 Retaining Wall Design

The proposed retaining wall will be comprised of gravity, mechanically stabilized earth (MSE) and hybrid wall systems. These systems utilize specially placed backfill and heavy weight blocks, and in the case of the MSE wall, a geogrid anchoring system resist the loads and anchor the systems into place (see **Figure 2-4** for a cross section of the proposed wall system).

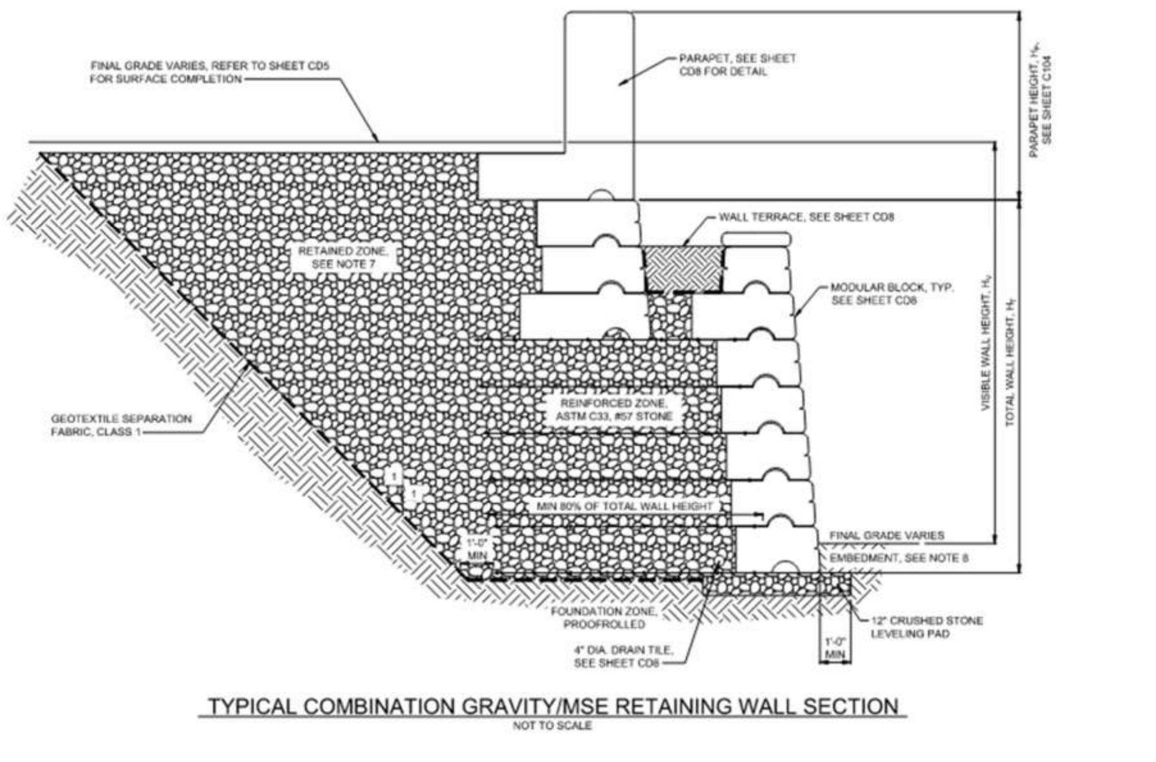

Figure 2-4: Retaining Wall

Construction of the walls includes subgrade preparation to establish a minimum 12-inch thick crushed stone leveling foundation pad upon which to place the blocks and establishment of a final grade that maintains a minimum 24-inch embedment of the block. With a minimum established grade of elevation 548.0 at the section of retaining wall that will be installed within the floodway fringe and retaining wall water level design criteria at elevation 549.4 (corresponding to the base flood elevation), the wall's design appropriately accounts for submergence, wave action and shear stress imparted by flowing water.

To address hydrostatic loading and potential overturning, sliding and bearing capacity issues, free-draining aggregate backfill of #57 stone will be installed behind the walls. The free-draining nature of this aggregate backfill ensures that floodwater can freely permeate the wall water rises and drains away, preventing the formation of the formation of hydrostatic conditions behind the wall that could result if floodwater were to get trapped behind the walls. The use of this aggregate backfill also strengthens the overall stability of the retaining wall as it replaces the native sandy silt and silty sand soils immediately adjacent to the reservoir.

The base of the retaining wall elevation varies, but the minimum has been established at 548.0, approximately 10 feet above the normal pond elevation of 537.8. While the existing grade varies across the project site a representative profile of the proposed and existing grades wall extending from the pump station site to the pool is shown in **Figure 2-5** below.

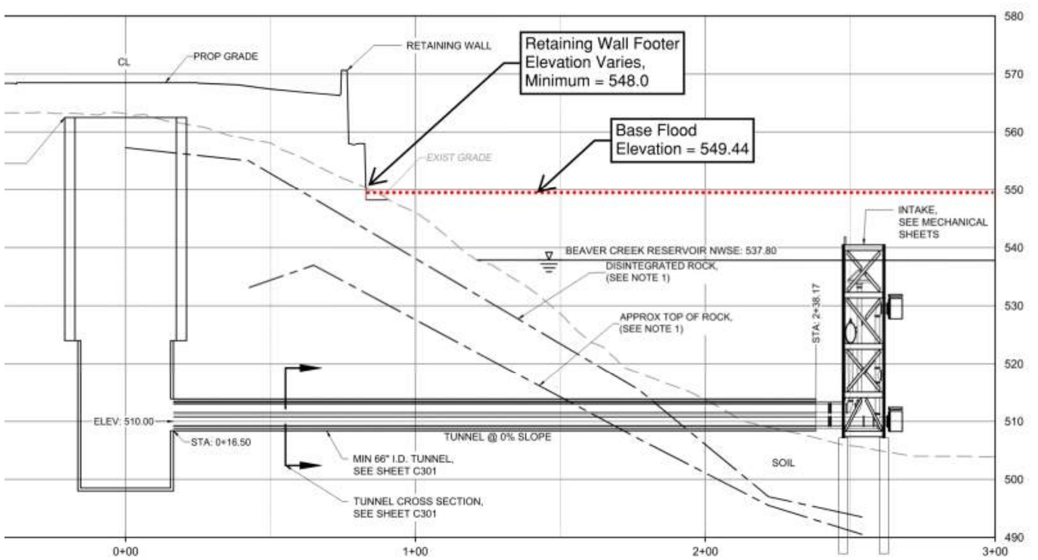

Figure 2-5: Retaining Wall Profile

2.5 Velocity and Erosion

The HEC-RAS model discussed in Section 2.3 demonstrated a maximum velocity in the reservoir cross section that intersects the portion of the proposed project in the floodway fringe of 0.025 ft/s. Vegetated slopes and channels are designed to withstand approximately 4.0 ft/s and the project site is not expected to erode at the velocities imparted during the flood event. In addition, the block components of the retaining walls are designed to minimize obstruction, resist and protect against erosion, and are of a non-polluting material. Erosion concerns outside of the floodplain have been addressed through the stormwater management system previously discussed.

2.6 Public Facilities

The project will have a temporary impact to limited areas of the public park during construction that will be prohibited to public access during construction including the staging area on the auxiliary spillway, parking lot off Brown's Gap Turnpike, southern portion of the reservoir where the new intake is being constructed, and general project site. The project will also temporarily impact traffic with lane closure during the construction of the pump station access road driveway onto Brown's Gap Turnpike and installation of the new raw water transmission main along Old Three Notch'd Road and Three Notch'd Road. Once construction is complete, with the exception of the pump station site and access road, access to the park and travel on Brown's Gap will be fully restored with no permanent impact to the facilities.