

Hazen



Hendersonville Water Treatment Facility Master Plan – FINAL

July 2025

Hazen Project No. 31547-000

Submitted to:

City of Hendersonville, North Carolina
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Submitted by:

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Executive Summary

The City of Hendersonville, NC owns and operates the 12-MGD Hendersonville Water Treatment Facility (WTF) under PWS ID NC0145010. The WTF is located on Haywood Rd. in Mills River, NC and utilizes a conventional surface water treatment process. It was originally constructed in 1965 to treat surface water from the Bradley Creek and North Fork reservoirs in the Pisgah National Forest.

Subsequent major improvements have included the following:

- 1977 – construction of Mills River Raw Water Pump Station and transmission main, two additional process basins and filters, residuals thickening and dewatering facilities, chemical feed improvements
- 1990 – construction of new raw water transmission main for redundant feed from the Mills River, flocculator upgrades, chlorine storage building, 2 MG clearwell
- 1997 – chemical feed improvements (fluoride, sodium bicarbonate)
- 1998 – Mills River intake upgrades
- 2001 – construction of second sludge thickener
- 2007 – replacement of Mills River Raw Water Pumps, yard piping and splitter box improvements, replacement of rapid mixers/flocculators, process basin repairs and retrofits, construction of fifth sedimentation basin, filter and operations building upgrades, installation of air scour blowers, chemical feed improvements, construction of Bulk Chemical Storage Building, construction of Electrical Building
- 2019 – replacement of High Service Pumps and associated electrical gear
- Ongoing – construction of French Broad Raw Water Pump Station and transmission main and construction of fifth filter

The City engaged Hazen and Sawyer (Hazen) to evaluate the condition of the existing facilities, propose near-term improvements to optimize treatment efficiencies and maximize treatment capacity, and develop a plan for future expansion. The Hendersonville WTF Master Plan is divided into six technical memoranda (TMs) as follows:

- **TM No. 1: Existing Process Evaluation** summarizes Hazen’s findings and recommendations pertaining to the facility’s treatment process infrastructure.
- **TM No. 2: Structural Evaluation** describes Hazen’s visual condition assessment of the Hendersonville WTF structures and details recommended repairs to basins, walkways, and exterior walls.
- **TM No. 3: Electrical, Controls, and Energy Efficiency Evaluation** summarizes Hazen’s findings and recommendations pertaining to the WTF’s electrical and SCADA systems and overall energy efficiency.

- **TM No. 4: Regulatory Considerations** develops planning level strategies for future regulatory compliance.
- **TM No. 5: Demand Forecast and Proposed Expansion Phasing** reviews Hazen’s recommendations pertaining to expansion phasing to meet future demands.
- **TM No. 6: Capital Improvement Plan Summary** incorporates the findings from the preceding TMs and summarizes Hazen’s recommendations for capital improvement projects (CIPs) to be implemented over the planning horizon (through 2050).

The proposed CIPs fall into five major categories:

- Capacity Expansion
- Risk Reduction
- Replacement
- Rehabilitation
- Process Efficiency

Of these categories, CIPs associated with capacity expansion activities to meet growing system demands are the most time-critical and have the most significant impact on the overall implementation schedule. Hazen developed water demand projections as a function of population and employment projections, water demand intensity, and projections of new development and industries. The figure below illustrates the projected system demands and the associated capacity expansion steps.

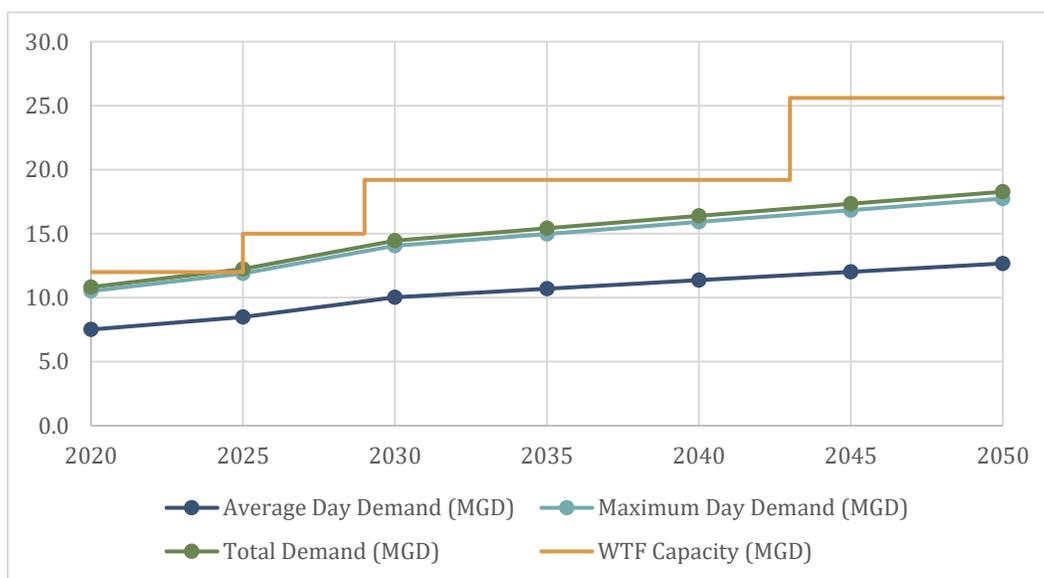


Figure 1: Projected Demands and WTF Capacity Requirements

The construction of Filter No. 3 (fifth filter overall) is currently underway, which will bring the total treatment capacity of the WTF to 15 MGD. A capacity expansion to 19.2 MGD is proposed prior to the year 2030 and would consist of the addition of a sixth filter and associated basin upgrades to allow this capacity to be treated by the existing five flocculation/sedimentation trains. Finally, an expansion to 24 MGD is proposed in advance of the year 2045, consisting of two new flocculation/sedimentation trains and filters, along with finished water pumping improvements to provide a firm pumping capacity of 24 MGD. These improvements are anticipated to meet system demands well beyond the planning horizon of 2050.

Several proposed CIPs are categorized as risk reduction efforts and are also considered time sensitive based on the potential impacts of equipment failure on the treatment process. These entail the provision of redundant equipment such as a second sodium bicarbonate feed system, second clearwell, second backwash pump, and second sludge transfer pump. In some cases, the addition of these redundant facilities will allow the existing units to be replaced or rehabilitated. At the time of writing, several of these items are being actively addressed through a separate design contract. Other risk reduction improvements can be programmed into the CIP plan to coincide with the facility expansions described above.

CIPs associated with replacing aging equipment are generally programmed to coincide with the end of the equipment's anticipated useful life or major facility expansions. These include items such as standby diesel generators, filter air scour blowers, and air burst equipment.

The rehabilitation CIP driver primarily pertains to addressing aging concrete (especially in the process basins). These structural retrofits are programmed to coincide with the 19.2 MGD capacity expansion in order to leverage the efficiency of a single, larger construction contract.

Most of the CIPs identified within this Master Plan will result in process efficiency improvements. Specific efficiency-related efforts that do not overlap with the other drivers include the installation of baffle curtains in the existing clearwell, miscellaneous SCADA system improvements, and raw water yard piping retrofits.

Cost estimates for each CIP were developed at an AACE Class 5 level, which is appropriate for initial concept screening and includes an expected accuracy range of -50% to +100%. Material unit costs, labor, and equipment rental costs were obtained from vendor quotes, recent detailed cost estimates, and best engineering judgement. Contractor Overhead and Profit costs were assumed at 20%, General Condition costs were assumed at 8%, Bonds/Insurance/Mobilization costs were assumed at 5%, Engineering and Construction Administration costs were assumed at 15%, and Contingency costs were assumed at 35%. Estimates can be indexed to ENR Construction Cost Index 13,500 (Q3 2023).

A complete list of the identified CIPs, grouped by anticipated phasing, is tabulated below.

Table 1: Ongoing Evaluations and Projects

Process Area	Improvement	Timing	Estimated Material and Labor Cost
Filters	Additional Backwash Pump	Ongoing	\$800,000
Finished Water Pump Station	Reroute Sump Pump Discharge	Ongoing	\$43,000
	FWPS Access Improvements	Ongoing	\$6,000
	18,500-gal Surge Tank	Ongoing	\$550,000
Sludge Transfer Pump Station	Two Dry-Pit Submersible Pumps	Ongoing	\$424,000
Various	Control System Improvements	Ongoing	\$200,000
AACE Class 5 Cost			\$4,052,000

Table 2 – 19 MGD Expansion

Process Area	Improvement	Timing	Estimated Material and Labor Cost
Chemical Facilities	New Backup Sodium Hypochlorite System	2025 – 2030	\$272,000
	Bulk Chemical Building No. 2	2025 – 2030	\$1,440,000
	Sodium Bicarbonate Silo No. 2	2025 – 2030	\$804,000
	Rehab of Sodium Bicarbonate Feed System	2025 – 2030	\$298,000
	Spare Orthophosphate Metering Pump	2025 – 2030	\$16,000
	Bulk Chemical Room Partition Wall	2025 – 2030	\$19,000
	Duty/Standby Coagulant and Caustic Transfer Pumps	2025 – 2030	\$84,000
Clearwells	Additional 2-MG Clearwell	2025 – 2030	\$3,777,000
	Installation of Geomembrane Baffle Curtains in Clearwell No. 1	2025 – 2030	\$172,000

Process Area	Improvement	Timing	Estimated Material and Labor Cost
Filters	Construct Filter No. 6	2025 – 2030	\$1,281,000
Flocculation / Sedimentation Basins	New Mud Valves	2025 – 2030	\$104,000
	Addition of Tube Settlers in Existing Basins 4 and 5	2025 – 2030	\$861,000
	Davit Crane Bases	2025 – 2030	\$14,000
	Cast-in-Place Concrete Partition or Fabricated Stainless Steel Baffle Walls	2025 – 2030	\$15,600
	Miscellaneous Structural Repairs	2025 – 2030	\$1,250,000
	Retrofit of Basins 1-3 to add Tube Settlers and additional Flocculation Stages	2025 – 2030	\$1,916,000
AACE Class 5 Cost			\$24,722,000

Table 3: Mills River RWPS Improvements

Process Area	Improvement	Timing	Estimated Material and Labor Cost
Raw Water Facilities	New Air Burst System	2025 – 2030	\$255,000
	New Raw Water Pump VFDs	2025 – 2030	\$247,000
AACE Class 5 Cost			\$1,061,000

Table 4: Splitter Box Upgrades

Process Area	Improvement	Timing	Estimated Material and Labor Cost
Splitter Box / Rapid Mix Basins	Interconnection Upstream of Splitter Box	2025 – 2030	\$90,000
AACE Class 5 Cost			\$191,000

Table 5: Gravity Raw Water Piping

Process Area	Improvement	Timing	Estimated Material and Labor Cost
Raw Water Facilities	North Fork Gravity Main Inspection	2030 – 2035	\$399,000
	16-inch Flow Meter	2030 – 2035	\$32,000
AACE Class 5 Cost			\$431,000

Table 6: Pre-24 MGD Expansion

Process Area	Improvement	Timing	Estimated Material and Labor Cost
WTF Electrical Facilities	New Electrical Building, Switchboard, and 1,250 kW Generator	2035 – 2040	\$3,563,000
Mills River RWPS	New 400 kW Generator	2035 – 2040	\$340,000
AACE Class 5 Cost			\$8,246,000

Table 7: 24 MGD Expansion

Process Area	Improvement	Timing	Estimated Material and Labor Cost
Finished Water Pump Station	Redundant 36-inch Finished Water Line with Flow Measurement	2040 – 2045	\$808,000
	Replacement of two (2) FWP to match 8 MGD capacity (per pump)	2040 – 2045	\$1,020,000
Filters	Addition of two new Filters	2040 – 2045	\$3,647,000
	Replacement and Relocation of Blowers	2040 – 2045	\$469,000
Flocculation / Sedimentation Basins	Addition of Two New Trains	2040 – 2045	\$2,949,000

Process Area	Improvement	Timing	Estimated Material and Labor Cost
Splitter Box / Rapid Mix Basins	Parallel Yard Piping to West Basin	2040 – 2045	\$262,000
AACE Class 5 Cost			\$19,342,000

Table 8: Miscellaneous Future Upgrades

Process Area	Improvement	Timing	Estimated Material and Labor Cost
Miscellaneous	New Maintenance Facility	2045 – 2050	\$920,000
Finished Water Pump Station	9,300-gal Surge Tank	2025 – 2050	\$362,000
AACE Class 5 Cost			\$2,709,000



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