CHARLES TOWN UTILITY BOARD
AGENDA

WEDNESDAY, JUNE 8, 2022

Regular Meeting | **661 South George Street, Charles Town, WV 25414** | **4:00 PM**

CALL TO ORDER

1. **APPROVAL OF MINUTES**
   a. Approval of May 25, 2022 Regular Meeting Minutes
   UB Minutes 5.25.22.pdf

2. **PUBLIC COMMENT**
   This portion of the agenda is designed for members of the general public to share thoughts on items of interest in the community. By law, Board members may ask clarifying questions or discuss procedural matters but are not permitted to discuss the policy merits of any issue unless it is scheduled for discussion.

   The public is invited to attend this meeting in person or via webcast (www.ctubwv.com- Board Meetings - Meeting Agendas and Minutes 2022) or by accessing the following zoom link:

   https://us06web.zoom.us/j/89035825201?pwd=ci9vdmVzNCtXUFVSSnA3UURTZjNRQT09

   Meeting ID: 890 3582 5201
   Passcode: 782464
   +1 301 715 8592 US

3. **UNFINISHED BUSINESS**
   a. Distressed Utility Updates - Possible Executive Session Under: WV State Code Section §6-9A-4(b)(9) - To consider matters involving or affecting the purchase, sale or lease of property, advance construction planning, the investment of public funds or other matters involving commercial competition, which if made public, might adversely affect the financial or other interest of the state or any political subdivision and involving contract matters.
   i. WV PSC Case No. 21-0260-S-DU Shenandoah Junction Public Sewer
   ii. WV PSC Case No. 21-0818-S-DU Cave Road Utilities, LLC
   b. GDF - Draft Water Facility Plan Update (Water Treatment Plant)
   Water System Facility Plan Update - Apr 2022.pdf

4. **NEW BUSINESS**

a. Miller Station Development Request
Miller Station Request 6.02.02.pdf
b. RK&K Sewer Model Update - King's Crossing, Hillside, Greenfield
RK&K Sewer Model Update.pdf
Sanitary Exhibit 6.08.22.pdf
c. Dewberry
i. Draft Water CIF
Water CIF - Tech Memo.pdf
CTUB Water CIF Presentation.pdf
CTUB Water CIP Presentation.pdf
ii. Draft Water Facility Plan
Draft Water Facility Plan.pdf
d. CTUB Water and Sewer Availability Draft Letter
Draft Availability Letter.pdf
e. CTUB Financial Policy Discussion and Draft Resolution
Draft Financial Policy.pdf
f. Utility Vehicle Purchase
Vehicle Purchase.pdf

5. **MANAGER REPORTS**
a. Utility Manager Report
UM Report 6.08.22.pdf
b. Chairman Report

6. **APPROVAL OF BILLS**
a. June 8, 2022
Board Report 6.08.22.pdf

7. **ADJOURNMENT**

8. **INFORMATION ONLY**
a. Next Meeting - June 22, 2022 at 4:00 PM

May 25, 2022

The Charles Town Utility Board held a regular meeting on May 25, 2022 at 4:00 P.M. Members of the Board present were Bob Trainor, Duke Pierson, Tommy Stocks, Jacquelyn Milliron and Jeff Whitten. Also present were Kristen Stolipher, April Shultz, Hoy Shingleton and Ashley Stottlemyer. The Chairman called for changes or corrections to the April 27, 2022 regular meeting minutes. Jacquelyn suggested changes and with no objections, the Board unanimously approved the minutes as amended. Jacquelyn also suggested improvements to future meeting minutes. The Board received no public comments.

The Chairman next opened the floor for discussion on the T-Mobile 1st Lease Amendment – Sawgrass Drive. Kristen mentioned the lease agreement consisted of equipment replacement and results in a $400.00 per month increase, with the new rent totaling $2,804.00. Motion made by Tommy, second by Duke, the Board unanimously approved the T-Mobile 1st Lease Amendment for Sawgrass Drive.

Next, the Board discussed the GDF – Draft Water Facility Plan Update (Water Treatment Plant). Kristen provided that GDF has evaluated the water treatment plant and Dewberry will review their assessment on capital needs and growth related projects on the distribution side, as well as capital improvement fees at the next board meeting. Chris Eckenrode gave a brief overview of the water facility plan, the process and recommended upgrades and current estimated costs. The Board provided discussions. Kristen recommended the Board provide comments on the draft and bring back next meeting. The Board will also accept public comments on the plan at the next meeting.

Before Chris left the meeting, he also provided an update on the mandatory pre-bid meeting for the Renewal and Replacement project that took place on May 20th. Chris was pleased with the amount of interest from contractors and decided to extend the bid deadline to June 10th.

The Board next discussed the PNGI Draft Permit. Kristen provided the draft permit is for the permit renewal of the PNGI wastewater facility. This permit is renewed every five years and does not have an impact on CTUB as a Utility. The Board provided discussions.

Next, motion by Tommy, second by Duke, the Board unanimously approved convening into Executive Session at 5:14 P.M. to discuss the following items:

- Distressed Utility Updates for Shenandoah Junction Public Sewer (Case No. 21-0260-S-DU) and Cave Road Utilities, LLC (Case No. 21-0818-S-DU) - Possible Executive Session Under: WV State Code Section §6-9A-4(b)(9) - To consider matters involving or affecting the purchase, sale or lease of property, advance construction planning, the investment of public funds or other matters involving commercial competition, which if made public, might adversely affect the financial or other interest of the state or any political subdivision and involving contract matters
- Addison and Haines Civil Action Update - Possible Executive Session of the Board pursuant to the following statutory exception to the Open Governmental Proceeds Act): WV State Code Section §6-9A-4(b)(12) – To discuss any matter which, by express provision of federal law, or state statute or rule of court is rendered confidential, or which is not considered a public record within the meaning of the Freedom of Information Act, specifically in this case, matters protected by Attorney-Client Privilege.
- Draft CTUB Service Area Map and Discussion
- Discussion on Personnel Matter- Possible Executive Session Under: WV State Code Section §6-9A-4(b)(2)(A) – Matters arising from the appointment, employment of an employee.

Jacquelyn asked if the County Commission Liaison should be included in the CTUB service area map discussion and Hoy responded that it would not be necessary at this time as it is a matter of Attorney-Client Privilege. Tracey Eberling was invited to the discussion relating to the Personnel Matter and Evan Olds to participate in the civil action case. The Board declared executive session over at 7:15 P.M. No action taken by the Board.

The Chairman next opened the floor for discussion on the RK&K Task Order No. 21 – Addison civil suit. Kristen mentioned this task order is within her approval limit, but wanted to brief the Board. Jacquelyn requested a "not to exceed" clause be added to the task order so anything over can come back to the Board for review.

The Utility Manager Report was next addressed. Kristen briefed the Board on this month's sewer and water efforts including an update on the JUI billing contract, solicitation for underwriting services for bonds, notice of hydrant flushing in June and July and moving forward with the grant for cameras at the water plant and intake. Kristen also mentioned the 3rd reading and public hearing on May 16th for the Renewal and Replacement project and the Novaform demonstration scheduled for June 2nd. Kristen requested the Board provide comments on the draft availability letter to be discussed next meeting.

The Chairman mentioned he spoke with a representative from LGI Homes regarding development of the Dailey property near the water treatment plant and met with OPED Energy about a solar farm near that same area. The Chairman also mentioned this may be his last meeting as Chairman, as there may be a new City Manager to fulfill those duties. The Board held discussions. Kristen provided she will have a draft policy on project reimbursement and further financial discussions next meeting. Jacquelyn requested that staff provide a cost estimate for what CTUB pays per bill relating to the JUI contract.

The Board next discussed the Approval of Bills. Motion by Tommy, second by Duke, the Board unanimously approved the payment of bills for May 11, 2022 and May 25, 2022. With no objections, the Board adjourned the meeting at 7:26 P.M. The June 11th regular meeting will be held beginning at 4:00 P.M.

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Chairman Secretary

WATER TREATMENT SYSTEM FACILITY PLAN UPDATE

FOR

CHARLES TOWN UTILITY BOARD

CITY OF CHARLES TOWN,
JEFFERSON COUNTY, WV

APRIL 2022

DRAFT

GD&F
GWIN
DOBSON &
FOREMAN
ENGINEERS

WATER TREATMENT SYSTEM FACILITY PLAN UPDATE
CHARLES TOWN UTILITY BOARD
APRIL 2022

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Executive Summary

The City of Charles Town, WV is facing development pressures as a bedroom community to Washington, D.C. As such, based on the recent and projected future rates of development, the existing Charles Town Water Treatment Plant (CTWTP) will not be capable of meeting the potable water demands in the service area, potentially in 2036.

The current capacity of the treatment facility is 2.8 million gallons a day (MGD). The plant currently operates about 17 hours a day to meet an average daily demand of approximately 1.7 MGD. Based on the potable water demand projections, the maximum daily production requirement of the CTWTP will increase from 2.41 MGD today, to 2.68 MGD in 2032, 2.95 MGD in 2042 and 3.23 MGD in 2052.

To address these increased production and ongoing plant issues, an evaluation of the existing drinking water treatment facilities was conducted. Based on the evaluation of the existing facilities, Gwin, Dobson & Foreman, Inc., has developed a set of recommendations to address the current plant condition, along with regulatory and growth needs of the City.

It should be noted that from a regulatory perspective, the facility has had problems meeting all the provisions of the EPA's Stage 2 Disinfection Byproduct (DBP) Rule. While currently in compliance with the DBP Rule, the City has to use liquid ammonium sulfate for chloramination.

The following is a summary of the recommendations provided in this report.

Capacity Increase Recommendations

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- Expansion of the existing plant to a 3.8 MGD, water treatment facility to consist of an upgraded raw water intake system, new flocculation and sedimentation basins, membrane and granular activated carbon (GAC) filtration and sodium hypochlorite disinfection. The new treatment plant will be designed with room for modular expansion, it will consist of full unit redundancy and will also include provisions for UV disinfection.

Supplemental Sources

- Develop supplemental groundwater wells or spring sources and convey them to the WTP such to obtain approximately 500 GPM of raw water to the treatment facility.

Raw Water Intake System

- Install a separate parallel 20" intake pipe and new stainless steel air line leading from the existing wet well along with a second T-screen.
- Install a concrete diversion structure with secondary screen surrounding the T-screens.
- Provide a new automatic airburst screen cleaning system for each screen.
- Add a new level transmitter to wet well.
- Add a new telemetry system for communication to water treatment plant.
- Replace the two (2) intake pump motors.
- Replace existing 20" intake supply line knife gate valve.

New Treatment Facility Construction

Mixing, Flocculation and Sedimentation Basins

- A new in-line static mixer, flow meter and turbidimeter would be installed on the combined raw water line inside the new treatment facility.
- Install a new dual stage flocculation tank with 30 minutes of contact time per basin and a new sedimentation basin with four (4) hours of detention time. Provide new flocculators, sludge collectors, slide gates, weirs and troughs and level sensor. Install new concrete sludge and meter vault.
- Continue utilizing PACl for coagulation.
- Modify the existing flocculation tanks and sedimentation basins, taking into account their current volumes, to provide the appropriate detention times listed above.

Membrane Filtration

- Construct new, low-pressure membrane filtration system for particulate removal with a capacity of 3.8 MGD inside a new concrete and masonry building. System to consist of feed tanks and pumps, prestrainers, membrane module racks, backwash tanks and pumps, compressed air system, automated chemical clean-in-place system with neutralization and water softening system.
- Demolish the existing media filters.

GAC Filtration

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- Construct new, low-pressure granular activated carbon (GAC) filtration system with a capacity of 2.8-3.0 MGD inside a new concrete and masonry building for TOC removal. System to consist of six (6) 40,000 pound GAC vessels with consideration to add two (2) future tanks. Provide automated valves, flow meters and process piping on each set of vessels.
- Discontinue the use of chloramination.

UV Disinfection

- Provide two (2) fully redundant UV systems each rated for 3.8 MGD with associated piping and controls for use as a secondary barrier to contaminants.
- This item could be made a Bid Alternate.

Chemical Feed

- Provide a separate room in the new plant to house all new liquid chemical feed systems. Provide a new bulk coagulant and sodium hypochlorite chemical feed system. Provide new chemical feed stations for caustic soda, acid, fluoride, corrosion inhibitor and a spare with adequate redundancy, valves and containment.

Disinfection

- To increase baffling and reduce short-circuiting, eliminate the submersible mixer and install a baffle wall inside the existing 1.0 MG circular clearwell.
- Discontinue the use of chlorine gas and utilize liquid sodium hypochlorite.

Solids Handling

- Construct a new pump station that conveys all treatment plant process wastewater to the existing CTUB sewer system.
- Discontinue all process wastewater recycling.

Piloting

- Consider conducting a minimum three (3) month pilot study featuring testing the effectiveness of a new membrane and GAC system.

Estimated Project Costs

- The total estimated construction costs for all recommended raw water source development, intake and water treatment facility upgrades is about $20,000,000, while the total project cost is estimated at $24,880,000. Note that these costs do not include costs for distribution system upgrades or improvements.

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Section 1
WATER TREATMENT SYSTEM FACILITY PLAN

The City of Charles Town, WV, is currently undertaking several major initiatives associated with the development of supplemental raw water sources, improving water treatment reliability/quality, expanding treatment capacity, and enhancing transmission and distribution efficiency to serve an increasing population and service area. The purpose of this report is to review the existing water sources, production and treatment systems and plan for subsequent expansion and improvements to provide high quality water within the service area through 2052.

This Water Treatment System Facility Plan will provide the "roadmap" for improving the reliability and quality of the City's water treatment system. However, this plan, along with the current and projected growth figures and plant production rates, should be re-evaluated every five (5) years.

A. Plan Objectives

The City has specific needs that are to be addressed by this Water Treatment System Facility Plan. These include, but are not limited to:

- Provision for redundant sources
- Provision for redundancy and reliability at river intake
- Chemical feed system safety
- Adequate detention times
- Disinfection Byproduct compliance
- Sludge handling/disposal alternatives
- Haulting of process wastewater recycling
- Conventional filter upgrades and/or replacement

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1. Water Source

The City uses the Shenandoah River as an exclusive source of drinking water for its water treatment facility. The Shenandoah River is part of the Chesapeake Bay Watershed and has a drainage area of over 3,000 square miles. The large drainage area is comprised of various land uses, including agricultural, residential, municipal, industrial and undeveloped.

The Shenandoah River has adequate flow to consistently meet the water demands of the City of Charles Town. One benefit of utilizing the Shenandoah River as a primary water source is that, currently, the amount of water that can be withdrawn from the river is not regulated, providing the City with water supply for years to come.

In terms of water quality, typical of large river sources, turbidity in the River is moderate averaging approximately 11 Nephelometric Turbidity Units (NTU), but it can vary widely, with spikes well over 300 NTU. Organic compounds, such as algae and dissolved organics, become problematic during the warm summer months. The raw water contains typical levels of inorganic constituents, with a hardness ranging from 100 to 200 mg/L as calcium carbonate. Dissolved iron (Fe) and manganese (Mn) are typically below the EPA secondary MCL drinking water limits.

2. Finished Water Quality

A review of the current design and operation of the City's Water Treatment Plant (WTP) was conducted to determine what operational modifications and upgrades will be required to continue compliance with existing, as well as prepare for future, drinking water regulations. The treatment facility has experienced difficulty in the past meeting the DBP requirements, and modifications to the treatment process (notably ammonia addition) have been made to address these issues.

The average filtered water turbidity (0.03 NTU), which is currently meeting the regulatory requirement of 0.30 NTU, is higher than desired. The primary issues associated with this high turbidity is attributed to the current plant process wastewater recycle process along with outdated filter functionality.

3. Treatment Capacity

The area surrounding Charles Town is experiencing substantial growth pressure, which is expected to require additional drinking water over the next several years. As such, it is necessary for the City to undertake a treatment plant expansion project to provide additional treatment capacity to serve the new customers. The growth projection data prepared as part of the 2021 Wastewater Strategic Plan, modified to reflect the water supply customers, will be used as the basis to prepare estimates for future water demands over the 30-year planning period.

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Based on the results of this evaluation and the associated water treatment evaluation, a recommended plant expansion program to meet the treatment and capacity requirements for the planning period has been developed herein.

B. Existing Systems Overview

1. Raw Water Intake & Treatment Plant

The City of Charles Town raw water intake is located on the Shenandoah River, just upstream of the bridge carrying Route 9 over the river. A pump station located on the bank of the river is used to convey raw water to the City's treatment plant on Route 9 via approximately 7,400 linear feet of 16-inch diameter transmission main. The WTP has a nominal capacity of 2.8 MGD and has been operational since 1989. Coagulation and flocculation are followed by sedimentation and gravity filtration with gaseous chlorine and ammonia disinfection. Fluoridation and corrosion inhibitor chemicals are currently applied to the finished water.

The WTP operates approximately 17 hours per day to meet the existing demands. From the plant clearwell, the finished water is pumped into the City's distribution system.

2. Customers

The City's service area includes Charles Town, the City of Ranson, and some unincorporated portions of Jefferson County, WV. The systems serve approximately 6,387 customer accounts, including residential, commercial and industrial customers, with residential customers accounting for approximately 5,765 accounts. The corresponding estimated service population is about 15,000.

C. Previous Reports & Documentation Reviewed

The City of Charles Town prepared previous reports that provide additional background and context to this Water System Facility Plan. These reports, studies, or other documentation were used as references for this report and are listed below.

1. **Charles Town Water System Sanitary Survey, West Virginia Department of Health & Human Resources, OEHS, December 18, 2015 and January 15, 2019.**

2. **Water System Facility Plan, City of Charles Town, West Virginia, Black & Veatch Corp., February 2008.**

3. **Source Water Protection Plan, Charles Town Utility Board, Jefferson County, West Virginia, Terradon Corporation, June 2019.**

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4. **Sewer Strategic Plan, Charles Town Utility Board, Jefferson County, West Virginia, 2021.**

Section 2
FUTURE POPULATION & WATER DEMANDS

A. General

The City of Charles Town has experienced an acceleration in the growth rate that had previously been relatively modest. Based on projections from the development community, the City expects to see similar accelerated growth rates due to a series of development drivers that are adding a distinctive suburban element to the service area. Planned and projected residential developments have been proposed to provide housing for an expanding suburban Washington D.C. area. This expansion of the Washington D.C. suburbs will lead to an increase in population in Charles Town and corresponding increased demand for water services.

These development pressures result in an anticipated population growth that is projected to result in water demands that could exceed the existing WTP capacity of 2.8 MGD in 2036.

B. Service Area

The Charles Town Water Company, a private water company provider, had served the community starting in the early 1900s. The water system stayed in private ownership until the City purchased the system and took over operation and maintenance responsibility in 1969. The original Charles Town water service area was created in 1989 and included 11.25 square miles in Jefferson County surrounding the Cities of Charles Town and Ranson. In March of 2000, the CTWSA was expanded by the City of Charles Town Utility Board (CTUB) to include over 15 square miles. The service area now includes the Cities of Charles Town and Ranson and other open areas available for development. The current service area is shown in Figure 1.

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C. Population

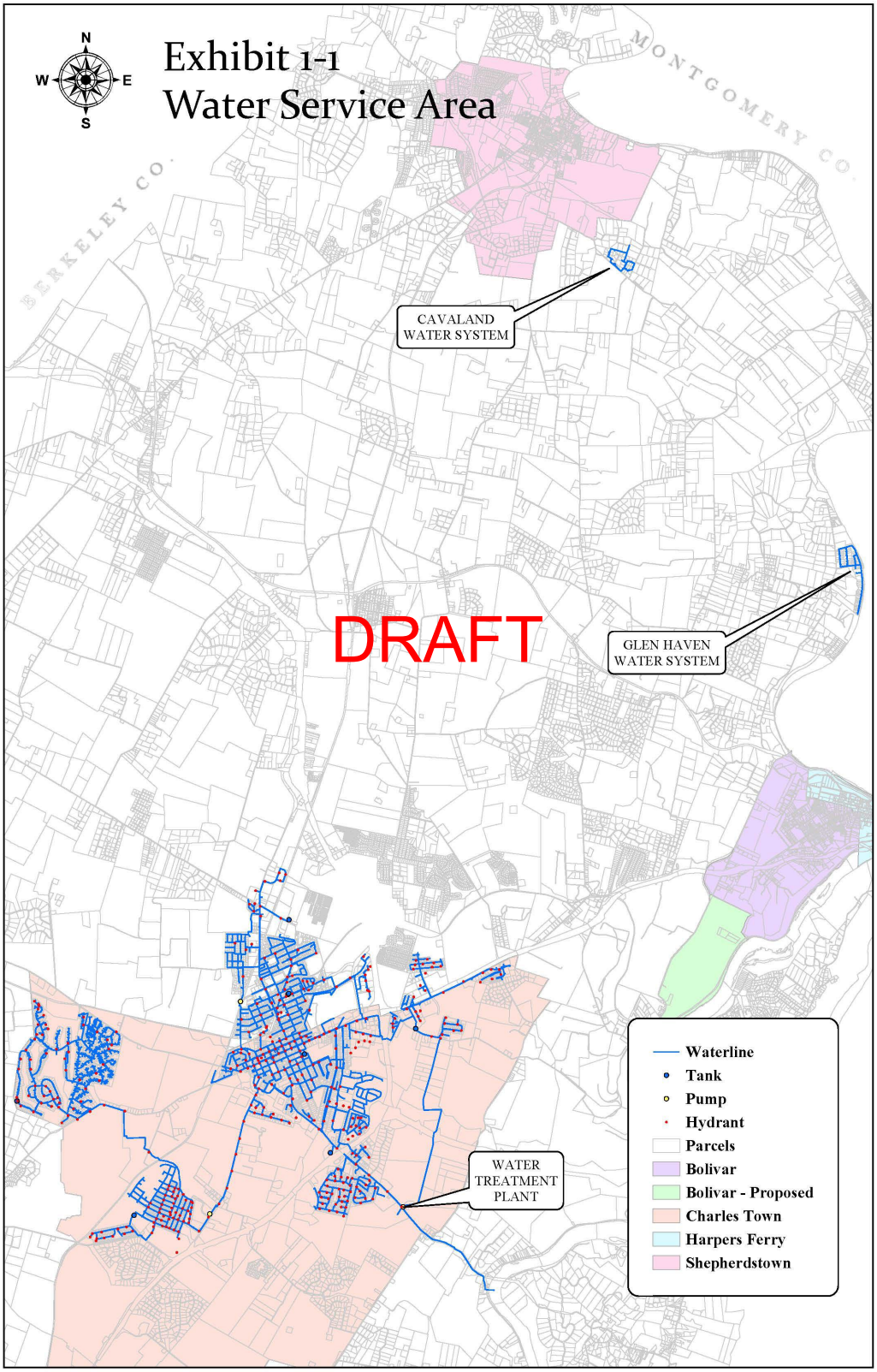
1. Historical Population

Between 1980 and 2000, the population of Charles Town remained relatively constant, increasing only 1.8 percent during that period. In fact, the 2000 census survey recorded a population of 2,907, which was a slight decrease from the 1990 census. The 2000 census also reported a population of Ranson of 2,951. Similar to Charles Town, the Ranson population has been relatively unchanged between 1980 and 2000.

The 2010 census reported a population of 5,259 for Charles Town and 4,440 for Ranson. The current 2021 census reported population of Charles Town is about 6,000 and 5,433 for Ranson. Note that the population of Charles Town has more than doubled since 2000 and the growth rate since 2010 is 14%.

The area continues to see a surge in population with new developments being constructed. The new developments have altered the landscape and have spurred additional supporting commercial development.

Figure 1: Service Area



2. Future Population & Distribution

Growth between 1980 and 2000 for Charles Town was minimal; however, the population doubled from 2000 to 2020. From April 1, 2010, to April 1, 2020, the population of Jefferson County increased 7.3 percent, a net change of 4,203. Much of this population increase took place in Charles Town and Ranson. Based on the most recent estimates, the population of Charles Town and Ranson increased 14% and 18%, respectively, between 2010 and 2020.

These increases in population will continue to be driven by large residential and commercial development. During the next 30 years, further developments are planned for Charles Town and Ranson. The pattern, rate of growth and the resulting impact to water demand will be detailed later in this section of this report.

D. Water Production

Over the past seven (7) years, the average daily amount of water produced by the CTWTP has been fairly steady. While the population has increased, significant infrastructure upgrades such as main and meter replacements have reduced the lost water. This reduction in lost water has made up the difference in the population increase.

Refer to Figure 2 which shows that the average daily production has been 1.7 MGD. The current plant capacity is 2.8 MGD.

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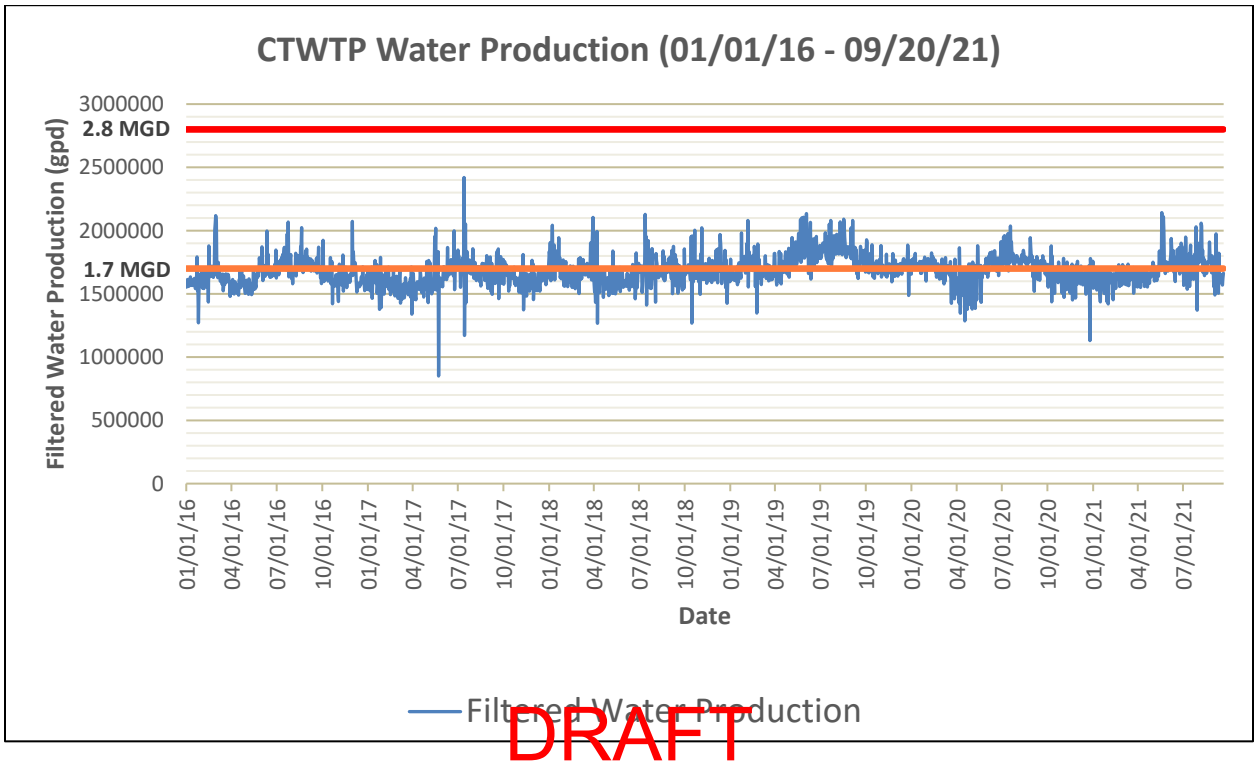
This average water production trend can be seen in Figure 2 which shows the daily water production for approximately the last six (6) years. Figure 3 displays a 365-day running average water production data, which shows a slight water production increase during the summer months. The summer flow rate increase is typical due to filling of swimming pools, washing of vehicles, watering of plants, etc.

Figure 2: CTWTP Water Production (1/1/2016 - 9/20/2021)



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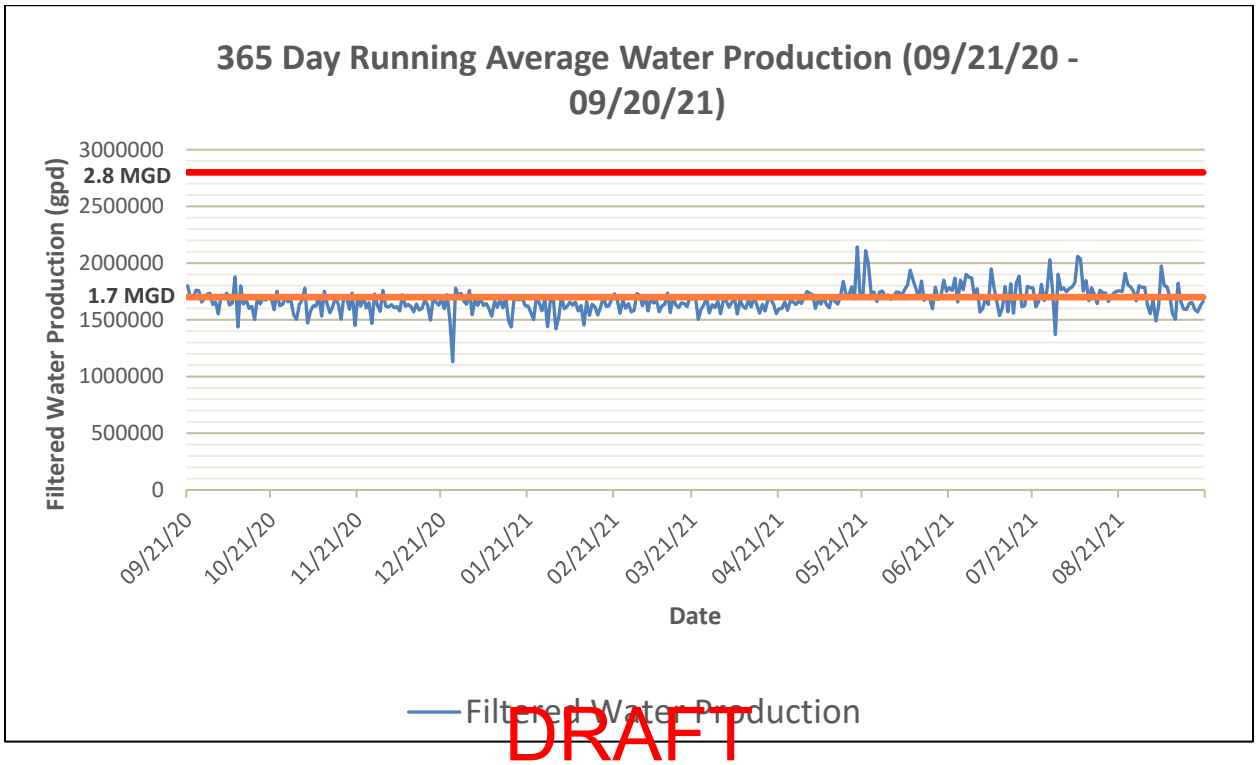
As the population of the Charles Town service area increases, obviously, so will the demand for drinking water. Based on these recent growth rates, in 2036, the peak water demand for the service area will exceed the capacity of the WTP.

Figure 3: 365 Day Running Average Water Production



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E. Unaccounted-for Water

Unaccounted-for water has been a major issue for the City's water system over many years. The City made several capital improvements to the water distribution system in an attempt to address portions of the water loss. From 1994 to 1999, the City replaced virtually all the water meters and repaired numerous leaks within the system. The City has replaced thousands of feet of main and is currently in the middle of another system-wide meter replacement program.

However, a large unaccounted-for water component (approximately 27%) still exists within the distribution system. The City is currently undertaking additional initiatives associated with improving current water operations and preparing for future growth in the service area to help reduce unaccounted-for water. The City has developed a plan for subsequent implementation that will reduce water loss within the distribution system, increase the efficiency of the water production versus billing capture process and generally improve overall water operations. The City has recently improved upon operation and maintenance of the distribution system. The Public Service Commission (PSC) and WV BPH recommend water loss be no greater than 15%.

As the City is able to reduce its lost water, they gain treatment capacity within the WTP to help offset the growing demands. The City has performed numerous audits over the years and have thus successfully lowered the lost water.

F. Future Water Demand

Over the next 30 years, it is anticipated that the Charles Town service area will see a steady increase in population. The primary centers of this growth will be located throughout the service area, in specific development areas.

In order to evaluate the potential growth, the Cities of Charles Town and Ranson have surveyed the developers who are planning to construct in the service area to determine what developments are planned, their size, and the developer's expected build-out rates.

1. Growth Scenarios

Since the rate of growth is variable and dependent upon numerous factors outside the control of the City, notably the state of the economy and the regional housing market, three (3) growth scenarios have been constructed for analysis:

Aggressive Growth - This scenario assumes that the growth will occur at the rates predicted by the developers, which is believed by the Charles Town Utility Board to overstate the growth rate.

Conservative Growth - This scenario assumes that the growth will occur at 50% of the rates proposed by the developers. This scenario is based on an assumption that the developers are optimistically projecting build-out rates and that the rate of growth will be substantially slower than that proposed in the Aggressive Growth scenario.

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Average Growth - This scenario is the average of the Aggressive and Conservative growth scenarios.

Based on a review of the growth projection options, the City elected to utilize the Conservative projections for this study. It should be noted that, since there is a significant range of potential growth rates, the population/demand projections presented herein should be reviewed every three to five years, and updated accordingly if necessary.

2. Selected Growth Projections

Table 1 quantifies the selected population and flow projections for specific proposed development projects by year, showing the number of projected new EDUs as well as the total estimated peak flow demand associated with the developments. For planning purposes, demands of 150 gpd/EDU were used to calculate the potential future peak demand impact of the identified developments.

Table 1 summarizes projections through 2052, at which time, the increase in population (over 8,850 EDU's) is expected to increase the total peak daily demand for water by approximately 0.83 MGD over the next 30 years.

Table 1 lists the incremental and cumulative increase in water demand based for several design years. By the design year 2052, the cumulative peak daily water demand in the service area is expected to be over 3.23 MGD.

Table 1: City of Charles Town Projected Peak Flow by Design Year

Design Year	Design Flow	
	Increment (MGD)	Cumulative (MGD)
Base Year-2022		*2,400,000
2027	120,000	2,520,000
2032	155,400	2,675,400
2042	272,700	2,948,100
2052	283,500	3,231,600

*This value is the peak daily flow taken from Figure 2.

Figure 4 shows the increase in demand over the entire projection time based on growth estimates. The conservative growth has been used to determine when Charles Town will be required to increase capacity and what production level should be obtained to supply future growth.

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Table 2: Projected EDUs & Peak Demand in CTWSA

Table 1.2 -CTUB Sewer Strategic Plan 2021-2024 Development Forecast																											
Development	Total Design EDUs	Total Built as of 2021	20 year forecast to be built	Total Flow	Beyond 20 year forecast	Year 1 2021	Year 2 2022	Year 3 2023	Year 4 2024	Year 5 2025	Year 6 2026	Year 7 2027	Year 8 2028	Year 9 2029	Year 10 2030	Year 11 2031	Year 12 2032	Year 13 2033	Year 14 2034	Year 15 2035	Year 16 2036	Year 17 2037	Year 18 2038	Year 19 2039	Year 20 2040	Years 11-20 2031-2040	TOTAL @ Year 20	TOTAL REMAINING
American Heritage (Huntwell)	500	0	500	75,000	200	0	0	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	0	0	160	300	200
Charles Town Infill	250	0	250	37,500	150	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	50	100	150
Fritts Property	370	0	370	55,500	50	0	0	0	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	200	320	50
Huntfield	3,200	421	2,779	480,000	2,459	0	0	0	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	200	320	2459
Jefferson Heights North	262	0	262	39,300	122	0	0	20	20	15	15	15	15	15	15	10	0	0	0	0	0	0	0	0	0	10	140	0
Tate Manor	80	0	80	12,000	0	20	20	20	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80	0
Langlet	1,000	0	1,000	150,000	800	0	0	0	0	0	0	0	0	0	0	20	20	20	20	20	20	20	20	20	200	200	800
Magnolia Springs	300	0	300	45,000	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	0	0	0	0	0	100	300	0
Norborne Glebe	1,050	246	804	157,500	484	0	0	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	0	180	320	484
Old Town Ranson - Infill	250	0	250	37,500	150	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	50	100	150
Prospect Place	170	0	170	25,500	0	0	0	0	0	9	9	25	25	25	25	25	27	0	0	0	0	0	0	0	0	52	170	0
Stolipher	324	0	324	48,600	124	0	0	0	0	0	0	0	0	0	0	20	20	20	20	20	20	20	20	20	20	200	200	124
Washington Landing	274	0	274	41,100	0	0	0	0	50	50	50	50	50	24	0	0	0	0	0	0	0	0	0	0	0	0	274	0
Winchester Cold Storage	675	0	675	101,250	125	0	0	0	0	0	0	0	0	0	50	50	50	50	50	50	50	50	50	50	500	550	125
Windmill Crossing	150	146	4	22,500	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
Total Projected Development	**8,855**	**813**	**8,042**	**1,328,250**	**4,664**	**51**	**51**	**71**	**161**	**184**	**184**	**200**	**200**	**174**	**200**	**235**	**227**	**200**	**200**	**200**	**180**	**180**	**180**	**160**	**140**	**1,902**	**3,378**	**4,542**

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Figure 4: Charles Town WTP Peak Day Demand Projections

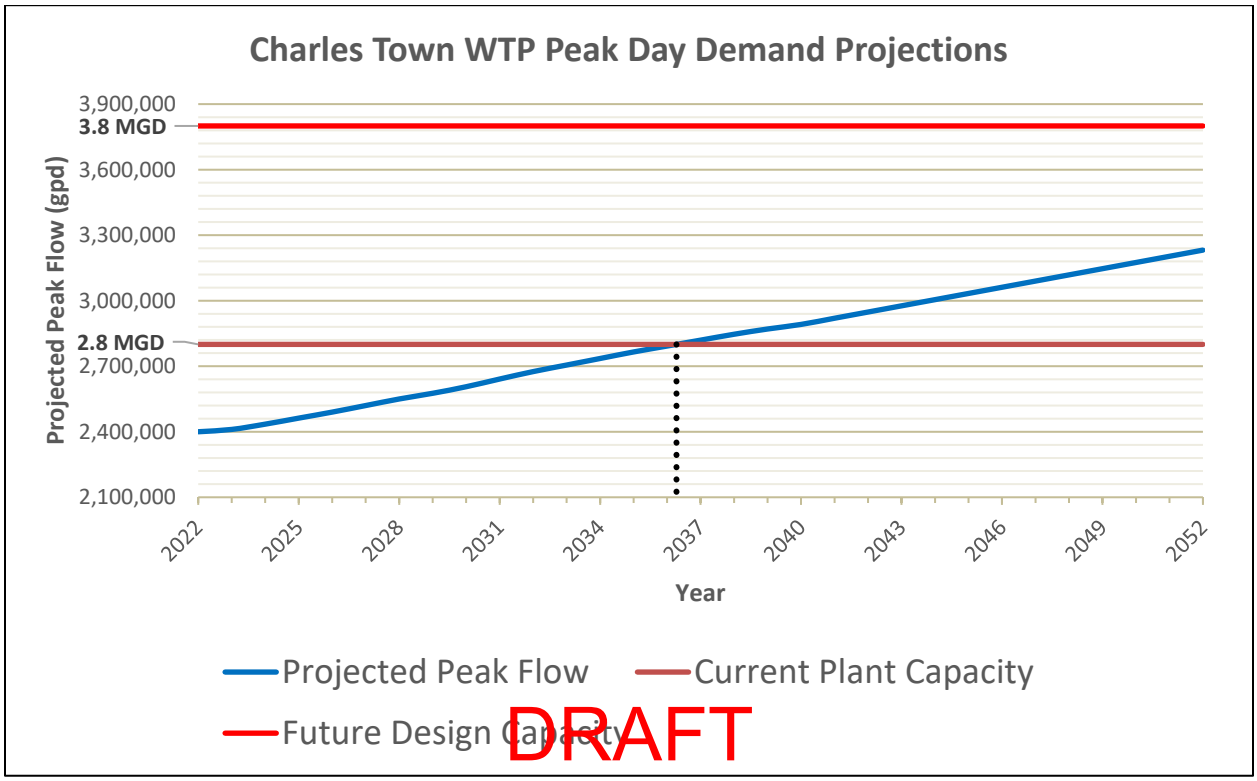

Figure 4 clearly shows the need for increased drinking water production capacity in the near future. If this conservative growth pattern occurs as projected, in 2036, the peak day demand will no longer be met by the current water treatment plant. Refer to Section 4 for additional information regarding plant capacity.

Section 3
EXISTING WATER SYSTEM FACILITIES

A. Raw Water Sources

The source water for the Charles Town WTP is the Shenandoah River. The intake is located approximately 600 feet upstream of the Route 9 bridge. Since the City's intake is located approximately eight (8) miles above the Shenandoah's confluence with the Potomac River, nearly the entire two (2) million acres, or approximately 3,000 square mile, Shenandoah River watershed contributes to the flow at the intake location.

The River has been known for sudden high raw water turbidity spikes at the plant (>300 NTU) during rain events. The River has also historically been subjected to high TOC concentrations (>4 mg/L) and recently has had its share of algae formation concerns. The City recently installed a HACH Water Quality Monitoring Station at the intake through a Source Water Protection Grant. This instrument provides the operators with online water quality monitoring that can alert them of potential contamination events and/or changes to the baseline River water quality.

The City is currently in the process of seeking a supplemental source of raw water supply to the plant. Groundwater wells and potential Springs within a few miles of the existing water treatment plant have been the focus. These sources would not only act as a backup if the Shenandoah becomes contaminated, but would lead to better finish water quality at the treatment plant. These sources have lower TOC concentrations which would lead to a decrease in DBPs. Also, these supplemental sources would assist with colder weather/freezing issues at the sedimentation basin and would lower the raw water temperature during the hot summer months to combat DBP issues.

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A Phase I and Phase II hydrogeological investigation have been completed by Terracon Consultants, Inc. out of Ashburn, Virginia. Two (2) potential well/spring sites are currently being evaluated. One is located on the Wydmyer Farm and is known as the Cattail Spring and the other is located near the intersection of S. George Street and S. Samuel Street in Charles Town. The City plans to pursue well pump tests and water quality testing of the sources this year. Ultimately, drilled wells with well buildings/pump stations would be constructed along with conveyance piping to the WTP. Associated easements or property acquisition must be obtained and power and utilities to the sources must be provided. A desirable well/spring yield of about 500 gpm is being sought to supplement the River.

1. Raw Water Intake System Overview

The existing raw water intake system was placed into operation in 1990. The raw water intake system includes the intake screen, two (2) vertical pumps and a circular concrete wet well. Currently, there are no regulations governing the maximum amount of water that the City can pull from the Shenandoah River source.

Raw water is drawn through a single 27-inch diameter stainless steel tee screen, anchored to a concrete pier. The invert of the screen is located approximately 6 inches from the river bottom and has a rated capacity of approximately 4.7 MGD when clean. At this maximum rate, the flow velocities through the tee would be over 1.8 feet per second (fps); however, at the current capacity of the plant, the flow through velocity is approximately 1.0 fps which is greater than 0.5 fps that is required. The tee outlet connects to a 20-inch diameter ductile iron pipe which spans a length of 560 feet beneath the river bottom extending back to the pump station.

The pump station is located on the west bank of the Shenandoah River, with access to the station located above the 100-year flood plain elevation. The 13'-6" high reinforced concrete structure contains two (2) 125 horsepower raw water vertical turbine pumps. The rated capacity of each pump is 2,083 gpm at a total discharge head of 180 feet. The pumps currently lack variable frequency drives (VFDs); however, new VFDs have been ordered and will be installed in 2022.

The City also owns a portable 8-inch pump that is capable of providing 1,800 gpm to the existing wet well in the event of an existing tee screen or wet well supply line failure.

Potassium permanganate is added to the raw water at the pump station with an approximate dosage of 0.5 mg/L. This helps control taste, odor and assists in TOC removal.

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Per recent LT2 source water monitoring for *Cryptosporidium*, the system is currently classified by the EPA as a "Bin 1," thus requiring no additional treatment.

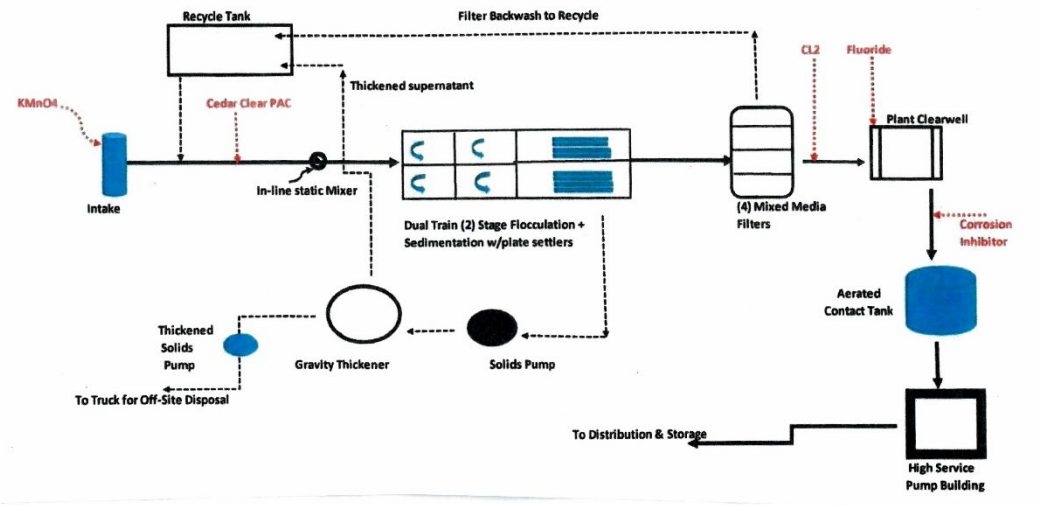
2. Treatment Process Overview

The WTP began operations in 1990 and has featured several upgrades since this time. The most recent upgrade was completed in 2016; however, no additional plant capacity was included in that project. The project consisted of a new flocculation basin, sedimentation basin with inclined plate settlers, a new sludge thickening system, 1.0 MG clearwell and finish water pump, SCADA and telemetry system upgrades. The entire facility is sited on approximately 4.5 acres of land. A site plan is provided in Figure 6.

The Charles Town WTP is a 2.8 MGD conventional treatment facility. Raw water from the Shenandoah River is treated via coagulation with poly-aluminum chloride (PACl), flocculation, sedimentation, filtration and chlorine and ammonia disinfection with fluoride addition. A treatment schematic is provided in Figure 5.

The average water demands are less than 2.8 MGD, however, the plant still operates at full capacity to produce the water in under 17 hours.

Figure 5: Treatment Process Schematic



Raw water is coagulated with PACl at typical dosage values in the 30 - 70 mg/L range (total product). The coagulant is dosed to the raw water supply after blending with recycled backwash and filter backwash waste water. Hydrofluorosilicic acid (fluoride) and a zinc orthophosphate corrosion inhibitor are added to the finish water. Mixing of raw water chemicals is accomplished by an inline static mixer. Caustic soda is not currently being fed for pH adjustment. Liquid ammonium sulfate is added after the clearwell for DBP reduction.

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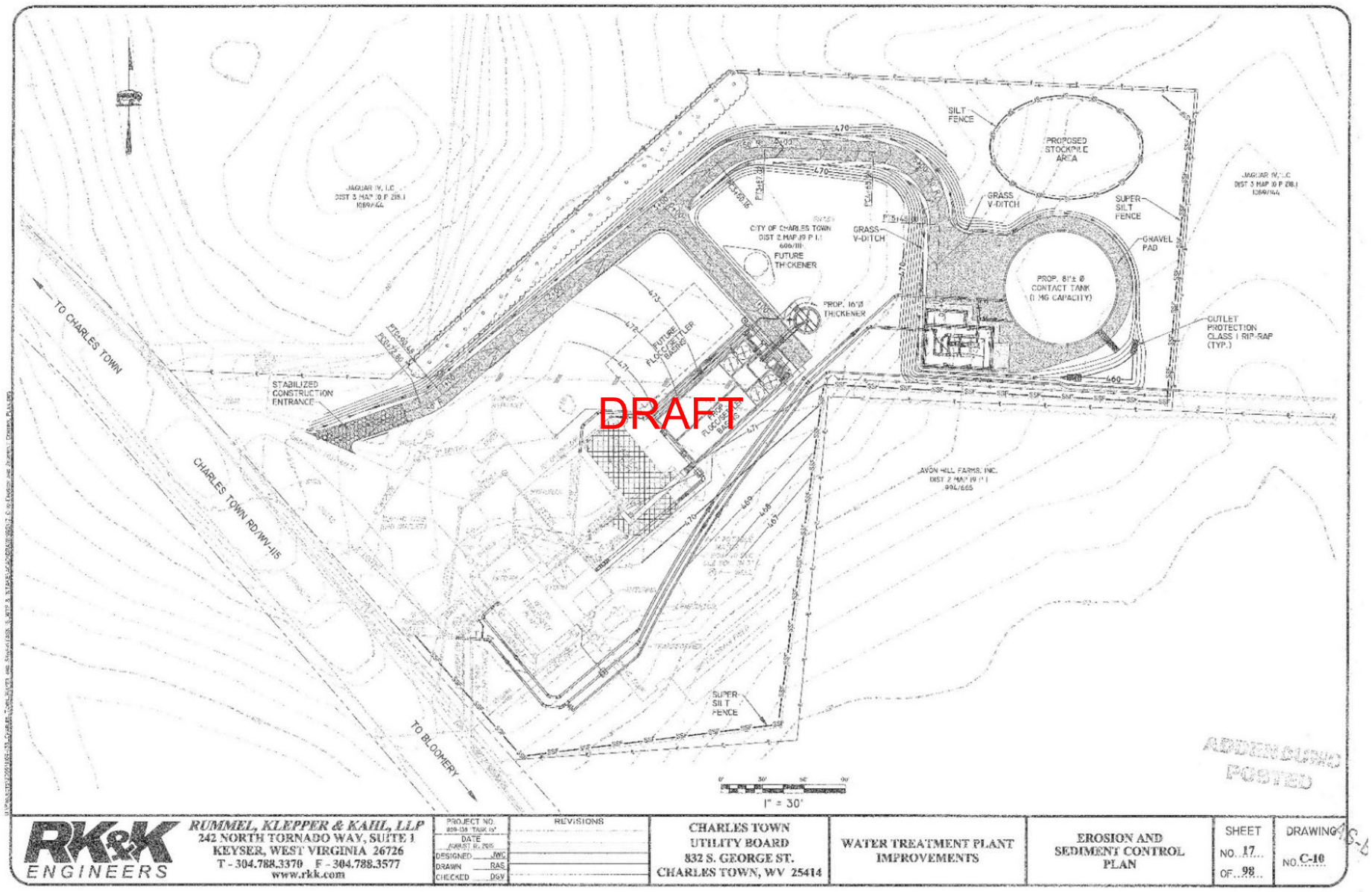
Following coagulation, the flow is split and flows through dual train, two (2) stage flocculation basins. Mixing in each flocculation basin is accomplished with variable speed vertical shaft paddle wheel flocculators. At peak production capacity, the detention time within each basin is approximately 30 minutes.

The flocculated water then flows to one of two (2) inclined plate settling basins. At peak production capacity, the detention time within the sedimentations basins is approximately 60 minutes per basin. The settled water turbidity is abnormally high and ranges anywhere from 0.80 to 4 NTU. The average settled turbidity is just over 0.70; however, it has gone above 3.0 with the current recycling system. This is attributed to the plant running at its maximum capacity which is resulting in poor settling and the process waste recycle.

Solids from the sedimentation basins are pumped to a 13,000-gallon gravity solids thickening tank. The sludge accumulated in the thickener is currently being stored on site and transported off site to the existing City owned Charles Town Wastewater Treatment Facility for processing. Decant from the thickening tank flows back to the recycle tank.

Figure 6: Existing Site Plan of Charles Town WTP (from RK&K Engineers, 2016)



Following sedimentation, the clarified water passes through one of four (4) mixed-media filters. The filter beds are 30 inches deep, comprised of 18 inches of anthracite, 9 inches of medium sand and 3 inches of high-density sand and 3 inches of course garnet. The filters have been designed to operate on a declining rate basis, which means the flow rate decreases as the filter bed captures solids, and, as such, there is no flow rate control through the filters. The total surface area of the filters is approximately 484 ft^2 which translates to a loading rate of 3.8 gpm/ft^2 at the peak production rate of 2.8 mgd and approximately 5 gpm/ft^2 when one filter cell is being backwashed. It should be noted that the design filtration rate is 4.0 gpm/ft^2. The filter media was replaced in all four (4) filters in 2017.

The four (4) filters are tied together hydraulically at the inlet end. Since there is no rate control on the filters, the result is that more flow goes through the cleanest filter than the others. The flow rates to the individual filters balance at the level where the head loss through each is equal. In a situation where one filter is clean and one or more of the others very dirty, this could result in significant excess flow through the clean filter. The operators have a standard procedure through which the raw water pumps are turned off when the operators notice the filters overflowing, which happens frequently.

The lack of rate control is exacerbated by the plant's practice of running the plant at near the peak capacity at all times. It is likely that the cleanest filter receives substantially more flow than the 4 gpm/ft^2 design value. There are currently no level sensors in the filter beds. As the levels on the filters rise, more flow and more particulates are forced through the media resulting in undesirable increased filter effluent turbidity. Mud ball accumulation in the tops of the filter beds has been an ongoing issue. The air scour filter cleaning system has been broken and offline now for several years. The existing filter valves and pneumatic air system are outdated and are currently being replaced.

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The backwash system allows for the filters to be backwashed at a rate of approximately 16 gpm/ft^2. The total backwash process lasts about 15 minutes and utilizes about 12,000 gallons per wash. Filter backwash water is supplied directly from the old 36,000 gallon clearwell; however, the filter to waste mode immediately after backwashing is currently not working due to faulty valves that are difficult to access. This is currently resulting in unwanted turbidity spikes following all backwash events. Spent backwash and filter to waste water are sent to a 65,000 gallon concrete equalization tank where it is recycled back into the raw water prior to coagulation. One (1) filter is backwashed each day.

Filtered water enters a circular clearwell with a baffling factor of 0.10 for final disinfection and finished water storage. At this point, gaseous chlorine, fluoride and a corrosion inhibitor are added. The capacity of the new clearwell is 1.0 million gallons when full. The clearwell contains a Grid Bee (GS-12) tank mixing system. Liquid ammonium sulfate is added after the clearwell.

All process wastewater is recycled and there is currently no NPDES discharge. The settled solids, filter backwash waste, filter overflow water and thickener tank overflows go into the recycle tank. The EPA limits the recycle pumps to a maximum of 10% of the combined

raw water flow rate. The recycle water is very turbid and heavy laden with high TOC. The recycle water is compounding the filter turbidity issues as well as the elevated distribution system DBP issues.

The existing 1-ton chlorine gas feed system requires major safety upgrades. The doors are rusted and lack the proper panic hardware with door contacts. The electric heater is undersized. There is no view window between the chlorine feed room and cylinder room. The chlorine gas leak detector needs tied into the SCADA system. There is no backflow prevention on the potable carry water line. New chlorine gas signage is also required along with an updated emergency kit. A new automatic flow proportional valve is needed such that the chlorine gas injection can be flow paced into the finished water. The above improvements to the chlorine gas feed system are scheduled for this year.

Chemical Feed Systems

The following chemical feed systems exist: potassium permanganate ($KMnO_4$), poly-aluminum chloride (PACl), fluoride, corrosion inhibitor, caustic soda, chlorine and ammonia. A summary of the chemical feed systems for each respective chemical is provided in Table 3.

Table 3: Chemical Feed Summary

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Chemical	Purpose	Dose
$KMnO_4$	Pre-oxidant	0.5 ppm (added at intake)
PACl	Coagulant	30-70 ppm
Caustic Soda	pH adjustment	Not Used
Fluoride	Dental Health	0.70 ppm
Corrosion Inhibitor	Distribution Corrosion	1.5 ppm
Chlorine Gas	Disinfection	95 ppd
Ammonium Sulfate	Chloramination	4 ppm

Potassium permanganate ($KMnO_4$) is added at the intake wet well in powder form. The permanganate feed system consists of a pre-mixed solution with 9 pounds of dry chemical to 30 gallons of water and then is pumped into the wet well.

Coagulant is added to the raw water in the form of a 100% solution of CES PACL 900S ahead of the inline static mixer. The coagulant feed system consists of a 2,600 gallon bulk tank and is housed in a dedicated concrete curb area. Jar testing is utilized to adjust the chemical dosage manually by speed of the pump.

Fluoride is added to the finished water in the form of a 23% hydrofluorosilicic acid solution. The fluoride feed system consists of a 300 gallon bulk tank and is housed in the same room as the corrosion inhibitor. The bulk tank features an ultrasonic level transmitter.

A zinc orthophosphate corrosion inhibitor is added to the second clearwell. The zinc orthophosphate feed system consists of a 300 gallon bulk tank and is housed in the same room as the fluoride. The bulk tank features an ultrasonic level transmitter. The orthophosphate is fed to reduce the rate of corrosion of metal pipes in the distribution system which helps limit potential lead and copper release as well as water quality complaints.

Chlorine disinfection is provided via chlorine gas. The chemical feed system utilizes dual, one-ton containers, scales, and vacuum regulators with an automatic switchover. The entire chlorine feed system is housed in an isolated room with an audio/visual alarmed, chlorine leak detector.

The delivery of the one-ton chlorine gas cylinders is coordinated to ensure that the amount of gaseous chlorine stored on site is less than 2,500 pounds. Chorine gas is a dangerous chemical, and as such, there are risks and required management/reporting associated with the storage of chlorine gas in excess of 2,500 pounds. As the population grows in the area surrounding the treatment plant and the potable water demands increase, the City should seriously consider switching to a liquid chlorine delivery system which will result in much less potential risk to staff and neighbors in the event of a leak.

Liquid ammonium sulfate (40%) is fed after the clearwell to convert free chlorine to monochloramine. This is currently assisting in lowering the DBPs in the distribution system.

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There are currently no calibration columns located on the chemical feed pump suction lines. Each chemical feed station only has one (1) online chemical metering pump and the chemical doses are varied manually. There is no flow pacing of chemicals based on the raw or finished water flow rates. Spill containment for the chemicals is lacking, specifically in terms of bulk tank containment. Some systems are missing tank level sensors and the sizes and venting of tankage is a concern. The tanks do not contain air-tight lids and chemical off-gassing is present in the facility. This can lead to corrosion and health concerns for the plant operators. Proper ventilation is also questionable throughout the treatment facility. All of these items chemical feed items should be considered in the plant upgrade project; some of them are scheduled to be addressed at the existing plant this year.

Section 4
WATER TREATMENT PLANT IMPROVEMENTS

A. General

This chapter contains a detailed list of recommended improvements that should be made to the Charles Town Water Treatment Plant. The effective capacity of the plant was reviewed and the current regulatory environment was summarized with respect to the potential impact on treatment requirements. The chapter also presents options for increasing the treatment capacity and includes a review of alternative treatment processes.

B. Capacity Assessment

The average plant production is 1.7 MGD. This number has been fairly consistent over the past few years, even as the population has increased. This is attributed to the lower percent lost water number. The City still strives to reduce the lost water percentage and plans to implement projects such as lead service lateral replacements, meter upgrades, main replacements, etc., over the next few years.

Due to the current Ranson and Charles Town population growth percentages, GD&F recommends assuming that the water plant production will increase by about 15% in the next 10 years, and subsequent ten-year periods. At this projection, the following average daily demands will be anticipated over the next 30 years. In 2032 the estimated average daily demand would be 1.955 MGD, in 2042 it would be 2.24 MGD and in 2052 it would be 2.58 MGD. The projected peak flows listed in Table 1 were: 2.67 MGD in 2032, 2.95 MGD in 2042 and 3.23 MGD in 2052.

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According to the WV Department of Health, they would prefer that water treatment facilities operate for no more than 16-18 hours per day. This gives the operators at least one (1) six to eight-hour shift to address any major issues or make repairs while the plant is offline. Thus, the treatment facility should be designed to produce 2.58 MG in seventeen (17) hours since this is the current operating duration. This equates to a plant flow rate of 3.64 MGD. Since this value is larger than the 3.23 MGD calculated using the projected peak flow, the higher of the two (2) numbers should be used. GD&F recommends utilizing 3.8 MGD, which is 1.0 MGD greater than the current WTP. This should be the design flow rate of the new water treatment facility.

C. Treatment & Regulatory Goals

1. Status of Regulations

The United States Environmental Protection Agency (USEPA) is in a continuous process of modifying and expanding drinking water regulations under the 1986 Safe Drinking Water Act (SDWA) and its subsequent amendments. Rules that are now in effect provide two levels of criteria that comprise the primary and secondary drinking water standards. Primary Drinking Water Standards are based on health-related criteria that require mandatory enforcement by state primacy agencies (West Virginia Department of Health and Human Resources). Secondary Drinking Water Standards are based on criteria that are intended to control water aesthetics (i.e. color, taste, odor) and do not pose a health

risk at levels realized in nearly any type of source water. Unlike primary standards, parameters developed as secondary standards are established as guidelines to be enforced at the discretion of the state primacy agency, but are not required in order for the agency to maintain primacy. Although parameters governed by secondary standards are not health-based, they can have a significant effect on customer satisfaction. Secondary standards include parameters such as color, taste and odor, iron, and manganese.

Two (2) primary drinking water regulations especially critical for both current compliance and for planning at the CTWTP in the near future include:

- Surface Water Treatment Rule (SWTR) and Enhanced Surface Water Treatment Rules (ESWTR), which provide for protection against microbial pathogens with specific criteria for *Cryptosporidium*, Giardia, viruses and Legionella.

- Disinfection Byproducts Rules, which regulate disinfectant residuals and disinfection byproducts that are formed by reactions of various disinfecting agents with constituents in water.

The ESWTR consists of the Interim Enhanced Surface Water Treatment Rule (IESWTR), the Long-Term 1 Enhanced Surface Water Treatment Rule (limited applicability to the Charles Town system) and the Long-Term 2 Enhanced Surface Water Treatment Rule. The IESWTR regulations require filtered water turbidity ≤ 0.3 NTU in at least 95 percent of samples taken each month, with established action limits for turbidity excursions over shorter periods of time. In addition to these turbidity criteria, the West Virginia Bureau of Public Health encourages utilities to meet goals established by the Partnership for Safe Water, a cooperative effort between the USEPA and the American Water Works Association (AWWA). These criteria have established a more stringent, voluntary turbidity goal of less than 0.1 NTU in at least 95 percent of samples.

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The third part of the ESWTR regulations is the Long-Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR). This regulation requires varying levels of treatment depending on the potential risk of *Cryptosporidium* in a source water. Under the LT2ESWTR, the amount of *Cryptosporidium* risk is classified into "bin categories" that are determined based on the extent to which sampling shows *Cryptosporidium* to be present in raw water. Based on early sampling of larger water systems, many utilities find they do not have significant levels of *Cryptosporidium* in the raw water, placing most utilities in a Bin 1 classification. Plants that fall into a Bin 1 classification are not required to add any additional treatment beyond meeting the turbidity limits set forth in the IESWTR.

The City's recent testing resulted in a Bin 1 classification; however, the raw water source will continue to be subjected to future testing.

The disinfection byproduct regulations consist of the Stage 1 Disinfectant/Disinfection Byproduct Rule (D/DBPR) and the Stage 2 D/DBPR. The Stage 1 DBPR includes requirements for total organic carbon (TOC) removal as well as for control of disinfection byproduct formation in the system. TOC removal requirements are based on the TOC concentration and the alkalinity in the raw water. The Shenandoah River in the area of

the City's intake typically has alkalinity levels of greater than 120 mg/L and TOC levels ranging from 2 to 4 mg/L. At these raw water conditions, 15 percent TOC removal is required to comply with the Stage 1 D/DBPR. The City routinely complies with this TOC removal percentage. Additional TOC removal is currently required if the City wishes to eliminate the chloramination process.

The Stage 1 D/DBR also set disinfection byproduct limits of 80 µg/L and 60 µg/L, respectively, for total trihalomethanes (TTHMs) and haloacetic acids (HAA5s) on a system-wide average basis over four (4) consecutive quarters. Stage 2 of the Disinfectants/ Disinfection Byproducts Rule has strengthened the regulation to require compliance with these levels on a four-quarter running average basis at a variety of sampling locations within the distribution system.

The EPA uses the Unregulated Contaminant Monitoring Rules (UCMRs) to collect data for suspected contaminants in drinking water that do not currently have health safety standards. The EPA is currently up to their 5th round of such testing/monitoring. Most of these focus on various organic contaminants such as endocrine disrupters, pharmaceuticals and personal care products. These are possible candidates for future regulations.

2. Treatment Goals

Gwin, Dobson & Foreman, Inc. has developed treatment goals to form the basis for evaluation of potential treatment process sequences. A list of goals is provided in Table 4. These goals were dictated by the aforementioned regulations and provide a set of criteria that must be reached to avoid non-compliance as well as exceed the minimum removal required to satisfy the regulatory requirements of some key water quality parameters. These higher goals were set to either assure customer acceptance from an aesthetic standpoint or to provide greater comfort and assurance with respect to public health.

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Table 4: Charles Town Potable Water Quality Goals

Parameter	Goal
Settled Turbidity	<1.0 NTU
Finished Turbidity	<0.10 NTU
Giardia/Cryptosporidium	Multiple Effective Barriers – 4-log removal
LRAA TTHM (Median 4-qtr LRAA)	≤60 µg/L
LRAA HAA5 (Median 4-qtr LRAA)	≤45 µg/L
TOC Removal % (12-month median)	15-25% Pretreatment [25-75% with GAC]
Iron	<0.10 mg/L
Manganese	<0.02 mg/L
Color	≤5 pcu
Lead (90th Percentile)	0.005 mg/L
Copper (90th Percentile)	0.4 mg/L
Distribution Microbials	Limit Regrowth
System Corrosion/Discoloration	Minimize

D. Discussion of Treatment Facility Needs

The existing treatment facility does not consistently meet the settled turbidity or finished water turbidity treatment goals. The process wastewater recycle process is the leading factor to this problem. The settled TOC values are just barley being met, additional TOC removal is necessary to eliminate chloramination and effectively reduce the disinfection byproducts.

Another treatment goal where there is concern between the treatment goal and the CTWTP is the barriers for Giardia and *Cryptosporidium*. The design and operation of the existing sedimentation basins and media filters create a situation where they may not be serving as consistent barriers to Giardia and *Cryptosporidium*. A discussion of these problems occurs in the following parts of this section.

1. Raw Water Intake

As mentioned previously, the CTWTP currently draws water from the Shenandoah River. The intake structure is located approximately six (6) inches above the river bottom. At this location, the historical minimum depth of the river is approximately five (5) feet. The raw water intake system consists of raw water screens and a conveyance pipe leading to the pump station.

Raw Water Screens

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The incoming water is screened through a single stainless steel tee and then conveyed through approximately 560 feet of 20-inch diameter ductile iron pipe which crosses the river bottom to reach the raw water pumping station. The intake structure has a reported capacity of 4.7 MGD. At this flow, the velocity through the screen is 0.52 ft/sec.

Flow velocities through intake screens are typically designed to be less than 0.5 ft/sec to minimize the impact to aquatic life and also to ensure a uniform flow pattern through the screen. If the flow were to increase significantly above 0.5 ft/sec its operation would be more difficult and impact to the aquatic life may be noticed.

Solids that accumulate on the submerged intake screen due to the suction are removed using an air burst system. This system delivers strong pulses of high pressure air across the screen to remove debris. Operators have reported that, at times, the air burst system performs poorly, especially at times of high turbidity. During turbidity events, the air burst system must be used very frequently (approximately every 5 minutes) to ensure the intake does not become clogged.

The intake has experienced a significant problem with the accumulation of frazil ice (similar characteristics to a "slushee") on the screen. This accumulation is caused by super-cooled water that freezes in the quiescent water, using the screen as a base. This problem can be addressed by a new fully functioning and redundant airburst system that could periodically be used in cold weather to prevent the formation of the frazil ice.

Currently, there are no regulations/limitations regarding the volume or rate of water the City can pull from the Shenandoah River. Flow in the river is more than adequate to meet the increasing water demands of the service area. The lowest flow on record in the Shenandoah at the Millville gauging station was 126 MGD, measured on July 24, 1930 (Chester Engineers, 2001). However, as noted above, the intake and screen structure will need to be expanded at the same time as the treatment plant to provide adequate capacity.

Screen and Airburst System

A second redundant tee screen, supply line and concrete debris deflector are recommended such that there is adequate supply of raw water to the treatment plant.

The existing intake structure and pump station were designed and built with cut-outs for relatively easy placement of a second intake pipe. Adding a second 20" intake pipe at the time of plant expansion will ensure that flow velocities within the pipe and within the intake screens remain below engineering limitations and will provide redundancy. Also, the existing 20” wet well supply line knife gate valve should be replaced due to its current age and condition.

A new automatic air burst screen cleaning system should also be installed for each of the two (2) screens with new stainless steel air supply lines. A level sensor should also be added to the wet well and everything should be tied into the plant SCADA system. The airburst system can then automatically airburst the screens in the event of a low wet well level.

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A new upstream tee screen concrete diversion structure should be installed out in the river to protect the integrity of the screens and consist of a grated top to keep the leaves and other debris from clogging the screens. This would require a permit through the Army Corps of Engineers. Refer to Appendix A for an example of a new concrete debris deflector with secondary screen.

2. Raw Water Pumping

Water is conveyed from the intake to the raw water pumping station on the west bank of the river. The pumping station consists of two (2) 125 horsepower pumps, with a combined capacity of approximately 6 MGD. As a result, the firm capacity of the pumping station, with one pump out of service, is approximately 3 MGD. Raw water from the pumping station is pumped through a 7,400 foot, 16-inch DIP to the treatment plant. The pumps have been rebuilt several times and are currently scheduled to be rebuilt this year. The pump motors may be original and should be replaced as part of the upgrade project. New pump VFDs are scheduled to be installed in 2022.

Pump Station

Based on projected demand increases, the firm capacity of the raw water pumps will meet the potable water demands for the foreseeable future.

Conveyance Pipe

Calculations of headloss and velocity were done to assess the capacity of the existing 16-inch DIP. It was concluded that the 16-inch diameter raw water conveyance pipe is more than adequate to meet the future demands of the system.

3. Rapid Mix

The existing inline static mixer is 16“ diameter and was replaced several years ago. A new inline static mixer should be considered in the upgrade project sized for the maximum plant capacity.

4. Flocculation & Sedimentation

a. Flocculation

Following rapid mix, flow is split into two (2) dual stage flocculation basins. The detention time in the flocculation basins at peak production capacity is 30 minutes. The basins contain vertical paddle wheel mixers with variable speed drives. Currently, the performance of the flocculation basins is satisfactory.

The flocculation basins were constructed in 2016 and are in relatively good physical condition. However, increasing the capacity of the plant would ultimately require an increase in volume of the flocculation basins to meet treatment goals. Consideration should be given to keep the existing treatment plant in operation while constructing new flocculation basins.

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b. Sedimentation Basins

Flocculated water flows to two (2) parallel sedimentation basins. Both basins are fitted with inclined plate settlers. The detention time in the basins at peak capacity is approximately two (2) hours.

Both sedimentation basins were constructed in 2016 and are in good physical condition. When the settled solids are adequately removed, the sedimentations basins can produce settled water with turbidities less than 1 NTU. However, there are often significant basin performance issues when solids accumulation at the bottom of the sedimentation basins is excessive. As such, solids removal is critical to the overall performance of the facility, and, as plant data has shown, inadequate solids removal in the sedimentation basin results in floc carry over to the filters and potential turbidity breakthrough. Another issue is the overall size of the existing sludge thickener tank. This tank is currently undersized and is the limiting factor in the operators being able to adequately remove sludge from the basins.

The current sludge processing process is not working very effectively. Solids have to be constantly and consistently hauled offsite for further processing.

The existing sedimentation basins also lack proper detention time. It is recommended that a minimum of four (4) hours of detention time for proper solids settling be implemented. Also, the incline plate settlers appear to work fine; however, they are difficult to clean. The current sludge vacuum system has had its share of problems. Currently, there is no way to drain the flocculation tanks or sedimentation basins. The basins are currently full of bio-growth.

Consideration should be given to new sedimentation basins with at least four (4) hours of contact time between the existing and new basins combined. The new basins should be equipped with fiberglass chain and scrappers and a sludge hopper area. Automated drain valves and flow meters should be installed to displace the accumulated sludge from the basins. FRP weirs and troughs should be installed along with a new effluent channel and level sensor. See attached Appendix B for typical flocculation and sedimentation basin drawings.

5. Filtration

After sedimentation, the water is passed through one of four (4) multi-media filters. The filters operate in a declining rate mode of filtration; the water level in all four filters is the same and more water simply passes through the cleanest filter. As a result, under this mode of operation, the filters do not have individual flow control. The filter boxes are designed to allow the common water surface level to fluctuate as overall (or average) headloss through the filters varies. The water level rises as the filters become dirty and the overall headloss increases and reaches a point where the dirtiest filter must be backwashed to reduce headloss. Low headloss levels must also be managed to reduce the potential for an excessive filtration rate. Filter backwash water is currently recycled back to the headworks of the plant. It is recommended to replace the conventional filters with a new low pressure microfiltration membrane system. Refer to the Alternatives Evaluation section of the report for more information.

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6. Clearwell

A legacy baffled clearwell of 36,000 gallons is still used immediately after the filters. Filtered water is pumped to a new 1.0 MG clearwell which provides storage of treated water prior to distribution via the finished water pumps. The clearwell also provides disinfection contact time to meet the associated regulatory requirements. The WTP clearwell is a circular concrete structure with a submersible mixer. The associated tank baffling factor is 0.10, thus the effective clearwell volume is 100,000 gallons. Between the old and new clearwell, the minimum 0.50 log inactivation is easily achieved. The newer 1.0 MG clearwell will provide sufficient chlorine contact time to meet the anticipated future demands. The existing legacy clearwell should be abandoned. To facilitate better baffling, the submersible mixer should be removed in the new 1.0 MG clearwell and an interior tank baffle wall should be added between the tank inlet and outlet pipes. A mixer can promote short-circuiting and lead to a reduced baffling condition.

7. Finished Water Pumping

Following the clearwell, finished water is pumped and metered to the distribution system. The finished water pumping system consists of two (2) 150 HP, manually-controlled, horizontal centrifugal pumps each rated for 1,945 GPM at 229 feet TDH. The pumps were installed in a new Pump Building in 2016. Pump operation is based on maintaining a desired water level in the Route 9 storage tank.

The pumping system has met the needs of CTWTP; however, the firm capacity of this pumping system is 2.8 MGD. As water demands increase, this capacity will be insufficient and these pumps and their associated electrical items will need upgraded and/or a third pump added.

8. Chemical Feed Systems

Refer to previous Section 3 for additional information.

9. Residuals Handling and Disposal

Residuals handling primarily involves removing solids from the sedimentation basins which are conveyed to a sludge thickener tank. The decant water is recycled back to the head of the plant. The solids are currently being disposed of offsite to either the existing Charles Town Wastewater Treatment Facility or to another sewer plant for processing. Hauling and disposal costs vary based on the amount of solids produced.

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In terms of alternative residual handling alternatives, there is no public sewer connection available at the treatment plant to convey plant solids and residuals to a wastewater treatment facility. The current CTUB sewer system; however, is within one (1) mile of the water treatment plant. Construction of a sewer line from the WTP property to the existing CTUB sewer is a viable option for solids disposal. Alternatively, CTWTP could pursue a NPDES permit and return all liquid waste to the Shenandoah River. However, the NPDES option would require the construction of concrete bottom lagoons for solids drying and over a mile of gravity piping. These dried solids would also then need to be periodically disposed of.

Currently, filter waste water is recycled to the head of the plant, which typically degrades the quality of the plant influent and provides the potential for particulates and pathogens removed by the filters to be recycled back to the head of the plant.

10. General Facility Issues

The CTWTP was constructed in 1990, and, as such, it has been in operation over thirty years. While the physical condition has been maintained, many of the original plant components are in need of modernization and upgrade to accommodate increased production requirements and enhanced water quality goals.

a. Condition of treatment structures and buildings

There are no known or obvious structural issues at the plant site. The buildings and treatment structures appear to be in fair condition. The basement and pipe gallery are congested, wet and make it difficult to perform maintenance.

b. Space (office, lab, locker, meeting, restroom, etc.)

There has been no physical expansion of the CTWTP since its construction in 1990. The office, lab, locker room and restrooms provide adequate space to meet the current needs of the staff and visitors to the plant.

The laboratory at the treatment plant appears to have adequate space, but some analytical equipment and other labware should be upgraded and additional equipment may be required in the future.

c. Code Issues

There are some current issues with the Chlorine Gas that are discussed in Section 3 of the report.

d. HVAC Issues

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There are no known heating, ventilation, air conditioning (HVAC) issues associated with the existing facilities. However, in conjunction with plant expansion, plant support systems such as HVAC and plumbing should also be modified and improved as required to support the expanded plant.

e. Electrical and Instrumentation & Control (I&C), Standby Power

There are no known significant issues with the electrical and instrumentation and controls systems at the plant. Backup power is provided for both the intake and WTP via standby emergency generators. The existing generators would have to be evaluated as part of the upgrade project design to see if they can be re-used.

f. Security

The overall security at the CTWTP could be improved. Currently, there are no entry checkpoints, alarm systems or identification system at the plant. These relatively simple improvements could significantly increase the security of the plant and decrease the chances of theft, vandalism or contamination at the plant.

The treatment plant site is completely surrounded by a chain link fence. Consideration for a closed circuit television system should be considered as part of the plant upgrade.

g. Maintenance, Shop, Parts Storage

The CTWTP was designed and constructed with auxiliary space for maintenance and shop activities as well as for parts storage. These spaces are in reasonable condition and have adequately served the needs of the treatment plant operators. Similar to the office and lab spaces, the need for additional parts, shop and maintenance space will increase as plant production increases.

E. Recommendations

Based on the evaluation of the existing facilities, the following recommendations were developed. The intent of the recommendations is to ensure that the City of Charles Town continues to meet treatment goals at the projected future flow rate of 3.8 MGD. Capability to meet future flow rates can best be accomplished by construction of a new treatment facility.

1. Recommendations for Capacity Increase

Expansion of the existing plant to a 3.8 MGD water treatment facility that consists of backup sources, raw water intake system upgrades, new inline static mixer, flocculation and sedimentation basins modifications and expansions, membrane and GAC filtration and UV and sodium hypochlorite disinfection. Also, construction of a new pump station to convey process waste to the existing CTUB system. The new treatment plant should be designed with room for modular expansion.

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a. Additional Raw Water Sources and Water Quality Data

- Either develop a pump station for Cattail Spring or develop a well on Todd Wydmyer's property. Extend power to well and a waterline to the existing WTP.
- Develop a well near the intersection of S. George Street and S. Samuel Street. Extend power to the well and a waterline to the existing WTP.
- An extensive raw water quality analysis should be performed during the design to ensure plant meets all regulations.

b. Raw Water Intake System

- Install a parallel 20" intake pipe leading from the river to the raw water pumping station along with a new stainless steel air line. Add a second T-screen and replace the existing 20" knife gate valve.
- Install a cast-in-place concrete diversion structure in the river upstream of the two (2) screens. Place a secondary stainless steel grating structure on top of the diversion structure to further protect screens and to prevent leaves and debris from entering screen openings. Leave downstream end of concrete diversion structure open.
- Add an automatic airburst screen cleaning system inside the pump station that features a control panel, fast acting pneumatic valves, dual air compressors and air receiver tank. The panel should be programmed to automatically utilize compressed air to clean each screen.

- Add a new ultrasonic level transmitter to the intake wet well.
- Add a new telemetry system for communication between the intake system and water treatment plant.
- Provide new 125 HP inverter duty rated motors for each vertical turbine intake pump. Note that pumps will provide 2.8 MGD each and should be sufficient for several years. Once their capacity is reached, the pumps, VFDs, electrical and generator will need to be upgraded.

c. New Treatment Facility Construction

Raw Water Piping

- Connect to the existing raw water line and bring a new raw water line into the new treatment facility. Provide a new raw water turbidimeter, magnetic flow meter and inline static mixer on the line. Also provide sample taps, chemical injections, and air release valves.

Flocculation and Sedimentation Basins

- Construct a new concrete dual stage flocculation basin where each of the two (2) basins yields 30 minutes of contact time when added to the existing flocculation basins at the plant design flow rate of 3.8 MGD. Provide new variable speed floc mixers and mud valves on each floc drain with associated drain piping.
- Continue utilizing PACl for coagulation. Provide a new bulk chemical feed system inside the Chemical Room of the new plant.
- Provide two (2) new sedimentation basins each sized such that there is a four (4) minimum detention time at plant design flow rate of 3.8 MGD, when using the existing and new basins.
- Provide two (2) new chain and scraper sludge collectors.
- Provide new effluent fiberglass weirs and troughs.
- Provide new submerged pressure transducer in sedimentation basin effluent channel for level.
- Provide a common influent and effluent channel. Design a perforated wall to allow flow to enter basin evenly. Provide an underflow wall to keep solids below water surface. Slope bottom of sedimentation basins toward sludge hoppers.
- Slide gates are also required for flow isolation.
- The new structure will be above grade so aluminum stairs, grating and handrail will be required.
- Provide new precast concrete meter and valve vault for automated sludge valves and magnetic flow meters.

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Membrane Filtration

- Construct new, low-pressure membrane filtration system with a capacity of 3.8 MGD, which allows for future expansion. A new Control Building would be necessary and the recommended building type is concrete floor slab type with masonry walls, precast concrete roof structure with EPDM roofing material. Membrane system to consist of the necessary feed tanks and pumps, prestrainers, membrane module racks, backwash tanks and pumps, compressed air system, automated chemical clean-in-place (CIP) system with neutralization and water softening system. The CIP system should be housed in a separate room with the other treatment plant chemical feed stations.
- Membrane system should utilize 0.10 micron PVDF modules type as manufactured via the Thermally Induced Phase Separation (TIPS) process. Design flux rate would be around 40 gallons per day per square foot of membrane area (GFD). One (1) membrane system skid would be fully redundant.
- Demolish the existing media filters.

GAC Filtration

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- Construct new, low-pressure granular activated carbon (GAC) filtration system with a capacity of 2.8-3.0 MGD and expandable to 3.8 MGD for TOC removal.
- A total of six (6) 40,000 pound GAC vessels should be installed with consideration to add two (2) future tanks. The tanks should be designed in lead-lag formation such that the total membrane filtrate flow will be divided by three (3). Flow will go through the lead GAC vessel and then the lag vessel for TOC removal. Typical design flow rate is 6-10 gpm/ft^2 with contact times between 7-10 minutes per vessel.
- Automated valves and magnetic flow meters should be provided on each set of vessels for flow control.

UV Disinfection

- Two (2) fully redundant UV systems should be considered as a multiple barrier type treatment system. The UV system is a cheap alternative that does not utilize any chemicals or create any byproducts. UV disinfection assists in the inactivation of viruses and *Cryptosporidium*.

Chemical Feed Systems

- The new treatment facility should feature a separate chemical feed room housing all treatment chemicals. A bulk coagulant and sodium hypochlorite chemical feed system is recommended. All new feed systems should consist of duplex peristaltic chemical feed pumps with

calibration columns, valves, day tanks, digital scales, containment, etc. Caustic soda, acid, fluoride, corrosion inhibitor and a spare chemical feed station should be considered.

Disinfection

- The new 1.0 MG clearwell is currently adequate for CT. To increase baffling, consider eliminating the submersible mixer and installing an interior baffle wall.
- Discontinue use of chlorine gas and utilize sodium hypochlorite for free chlorine.
- Eliminate chloramination as it is no longer required due to functioning GAC system.

Solids Handling

- Construct a new pump station that conveys the water treatment plant process solids either to a new NPDES discharge location or ties into the existing CTUB sewer system. Note that two (2) concrete bottom lagoons and piping to the Shenandoah River would be necessary if the NPDES option is selected. Dried sludge would then need to be disposed of offsite. A slow and steady low-flow solids discharge rate into the existing CTUB sewer system is the preferred option.
- CTUB should explore all options of conveying process solids to their existing sewer system and work with the adjacent developer. CTUB should also contact DEP for their input during design and confirm that adequate capacity is available at the wastewater treatment plant.
- Discontinue all process wastewater recycling.

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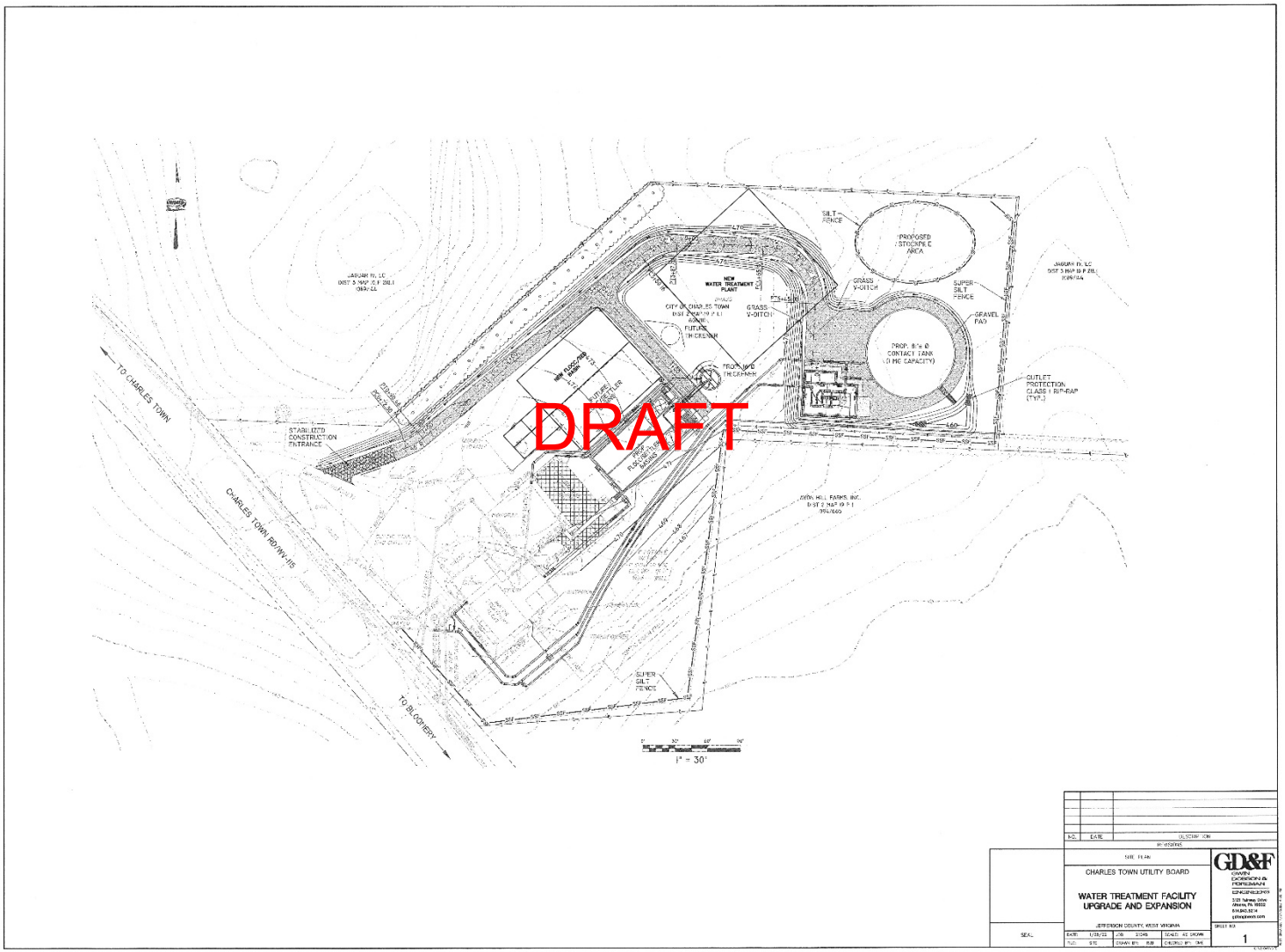
2. Piloting

Prior to design and construction of a new membrane and GAC filtration during design process, a minimum three (3) month piloting process must be done to establish and confirm design criteria and satisfactory process performance as well as help the City procure the most cost-effective membrane and GAC system for its specific water. Typical membrane pilot studies involve side-by-side testing of several different manufacturers. This enables a thorough examination of the process and selection of the most appropriate membrane system and GAC media for this application. The first step of the piloting process is for the engineer to prepare a Pilot Study Protocol and submit to the WV Health Department for approval.

Figure 7: Proposed Site Plan Layout for New WTP



Section 5
TREATMENT SYSTEM ALTERNATIVES EVALUATION

A. Pretreatment

1. Tube/Plate Settlers

Tube/plate settlers are generally installed at an incline on the top effluent end of a sedimentation basin. The purpose of the tubes/plates are such that they collect the large coagulated floc particles on their surface. The large particles then fall to the bottom of the basin where they are removed by sludge collection equipment. The installation of these tubes/plates can reduce the required four (4) hour sedimentation detention time that is normally required for surface water down to two (2) hours, which essentially cuts the size of the sedimentation basin in half. The plates themselves are generally made of plastic material and are not very expensive to install. The existing water treatment plant currently utilizes inclined plate settlers.

While the tube/plate settlers may appear to be a cheaper alternative to a conventional four (4) hour detention time sedimentation basin, GD&F's experience with them in larger outdoor plants has been problematic. The most common issues are the solids removal systems, algae formation and excessive solids built-up on tubes/plates, freezing at tops of tubes/plates and abnormally high settled turbidity. The tube/plate settler systems require bottom basin traveling sludge removal systems that are most common vacuum systems. Issues with priming of the vacuum systems and excessive sludge build-up often render them inoperable. Also, some facilities have to continually waste solids just to keep the system functional which results in additional unwanted sludge/water removal. Due to the nature of their design, the coagulant feed rate and raw water turbidity, excessive buildup of solids on the tubes/plates is often encountered. This buildup can result in undesirable high settled turbidity and can lead to algae formation on the tubes/plates which can increase DBP formation. Due to the lower detention time, higher doses of coagulant are typically necessary, along with proper coagulation chemistry for the tubes/plates to work properly. Also, the plates/tubes must be physically cleaned several times per year and this can only be performed when the basin is drained. When the basin level is lowered, the sludge collection system does not work as well and sometimes not at all which makes this cleaning process long-lasting and difficult.

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It is estimated that the installation of tube/plate settlers would reduce the overall capital cost of the new pretreatment system by about $500,000. When factoring in additional coagulant consumption, additional sludge waste volumes, sludge removal/cleaning issues and increased settled water turbidity, the recommendation would be to install a conventional four (4) hour sedimentation basin.

CTUB's existing water treatment plant has experienced all of the issues stated above with their current inclined plate settlers. While the capital cost is certainly less compared to a conventional four (4) hour detention time, the performance is simply not justified.

2. Actiflo Pretreatment Process

Another option for pretreatment is known as an Actiflo process which consists of ballasted flocculation clarifiers with Lamella tube settlers all located inside concrete tanks. The process is compact water clarification system that combines the advantages of microsand enhanced flocculation with lamellar tube settling. The addition of microsand serves as a flocculation aid and ballasting agent, allowing overflow rates as high as 30 gpm/ft^2. These high overflow rates result in footprints that are between 5 and 25 times smaller than conventional clarification systems of similar capacity. The Actiflo process is accomplished through a series of consecutive steps that consist of coagulation, microsand and polymer injection, floc maturation, settling and sand recirculation. Typically, due to the overall small size of the system, the tankage and equipment can be placed indoors. The system does involve a lot of equipment and materials such as 3-stage mixers, tube settlers, hydrocyclone, recirculation circuits, sand pumps, microsand and coagulant/ polymer chemical feed systems. It is also available with fully automated PLC for complete automation. The systems have been known to perform well when properly designed and implemented. Some disadvantages include having to utilize polymer and sand. The coagulation process must be continually monitored to ensure it functions properly and there have been issues with conveying sand/slurry. The process tends to result in additional waste solid accumulation due to polymer and sand addition. The operational and maintenance costs are significantly greater (35% or more) than a conventional four (4) hour sedimentation basin or tube/plate settler only clarifier.

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If the existing treatment plant didn't already have an existing rapid mix, flocculation and sedimentation basin, this option may be valid. It is also worth noting that it is not recommended to install a sand-type pretreatment system prior to membrane filtration, as the sand has been documented to quickly destroy the membrane modules. This option should be considered if an entirely new pretreatment system is sought and conventional filtration is used. The total cost estimate of a new actiflo pretreatment process with building enclosure is $3,500,000, which is about $800,000 more than the cost to implement a new conventional sedimentation basin.

B. Filtration

1. Conventional Filtration

The following considers the construction of new conventional filtration process train(s) to replace the outdated filters. Conventional sand/anthracite dual media filters would be designed for a loading rate flow of 4 gpm per square foot of filter area for dual media or multimedia beds. Consideration should also be given to installation of GAC type media; however, the GAC generally requires replacement on a yearly basis. The rates of filtration shall be determined through consideration of such factors as raw water quality, degree of pretreatment, filter media and other factors as may be required by WVBPH. Higher rates must be justified by the design engineer to the satisfaction of WVBPH. Evaluated are the conventional filtration process train designs as follows:

For dual media or multimedia beds at 4 gpm per square foot of filter area. The filters shall be capable of meeting the plant design capacity at the approved filtration rate with one filter removed from service.

With a design flow of 1.26 MGD or 880 gpm per filter and 4 gpm per square foot of filter area, each filter area would be 220 square feet. There would be a total of four (4) filters. Assuming square dimensions for the filters, the required filter bed area is 15 feet x 15 feet. To allow space for tank structures, process piping, pipe galleries and miscellaneous appurtenances, the approximate space required for the four (4) filters is 40 feet x 60 feet. An extensive CMU construction building is proposed to house the cast-in place concrete filter structures, media, underdrains, piping galleries, controls and all miscellaneous appurtenances. A new washwater tank would be needed of adequate size (minimum of 33,000 gallon) to provide backwash water for the proposed conventional filters.

The cost for conventional filtration process train equipment with media, underdrains, piping galleries, controls, electrical, SCADA and all miscellaneous appurtenances for a combined capacity of 3.8 MGD is approximately $2,200,000. The cost for a conventional filtration process train building with cast-in place concrete filter structures, piping galleries, mechanical piping, HVAC, plumbing, electrical, control room, misc. office and/or storage space and all miscellaneous appurtenances is approximately $3,300,000. The total cost for conventional filtration process train equipment and building totals approximately $5,500,000.

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The use of conventional filters requires optimized coagulation chemistry at all times to ensure compliance with the turbidity standards. CTUB accomplishes this using periodic jar testing, due to the variability in the source water quality. Conventional filtration requires a larger backwash tank, additional backwash water and filter-to-waste. The current conventional filter backwash operating procedures still require significant operator involvement to ensure proper operation. Recorded filter effluent turbidity spikes are a direct result from backwashing and/or increased filter influent feed water turbidity. The use of membrane filtration would provide submicron particle removal (<0.015 NTU) and would assist in meeting future drinking water regulations. Membrane Systems have specific advantages and disadvantages which have been summarized in the following sections.

In comparison of filtration alternatives, consideration should be provided for membrane filtration due to the overall similar cost for a filtration equipment/building when compared to conventional filtration process units. It's important to note that WVBPH would prefer permitting membrane filtration over conventional filtration due to their proven technology and better water quality. Advantages and disadvantages of treatment system alternatives with membrane filtration will be further discussion in the next section.

2. Membrane Filtration

The use of plate settlers and conventional filters requires optimized coagulation chemistry at all times to ensure compliance with the turbidity standards. The City accomplishes this using periodic jar testing procedures, due to the variability in the source

water quality. The current conventional filter backwash operating procedures are complicated due to old valves and require significant operator involvement. Recorded filter effluent turbidity spikes are a direct result from backwashing and/or increased filter influent feed water turbidity. The use of membrane filtration would provide physical submicron particle removal (<0.015 NTU) and would assist in meeting future drinking water regulations.

a. Membrane System Advantages Over Conventional Filtration

The following are advantages of a membrane filtration system over conventional filtration:

- Membrane filtration consists of a physical barrier, thus optimizing coagulant dosages for filtration is not necessary. The removal of particles above current system capabilities will reduce chlorine demand and will lower DBPs.

- The existing conventional filters are located inside the control building and are open to the atmosphere. This results in high humidity building conditions and large HVAC systems. Pressurized membrane systems are comprised of fully closed vessels on skids, thus there are no open tanks. This reduces condensation, high humidity conditions and resulting corrosion.

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- The current filter valves are located in a basement pipe trench which is difficult to access. All the membrane system control valves would be located above grade for easier monitoring and servicing.

- A membrane is an absolute physical barrier which prevents particulate breakthrough unless there is a fiber breach. This is not the case in a conventional filter which relies on water chemistry and addition of coagulants to optimize filtration. Membranes do not require coagulants for proper filtration, this typically results in lower coagulant dosages where less wastewater solids are generated.

- Membranes will reduce TOC on average by 5-10% without coagulation chemicals which aids in lowering the formation of disinfection byproducts. A conventional filter will generally not reduce TOC without coagulation and sometimes they depend on biological activity for TOC removal. Membrane microfiltration is capable of achieving 10-40% TOC reduction through the addition of coagulants prior to the feed water.

- Per GD&F's experience, the average filtrate turbidity of a 0.1 nominal micron membrane system is 0.015 NTU, while the average filtrate turbidity of the existing conventional filters is about 0.03 NTU. This corresponds to twice the particulate removal and in some cases (immediately following a backwash) up to ten times the particulate removal.

- Bacteria in the form of *Cryptosporidium* and *Giardia* do not pass through the membranes. Membrane systems are achieving over 6-log removal of *Cryptosporidium* or 99.9999% per third party validation testing. The average conventional filter is rated for 2.5 log removal of *Cryptosporidium* which is less than one-half the removal of membranes.

- Membranes are rated for 1 to 3-log removal of viruses. Conventional filtration will not effectively remove viruses.

- Membranes do not require an extensive filter-to-waste after a backwash. A membrane system only produces between 1 and 5% waste on average. Conventional filters generally produce between 5 and 10% waste when including the filter-to-waste and filter down-times.

- The overall physical footprint of a membrane filtration unit is generally two-thirds the size of a conventional filter due to the increased flow rate and amount of membrane surface area per module. A single standard module is generally comprised of between 500-800 square feet of membrane area and is only between 6 to 9 inches in diameter and 5 to 7 feet tall.

- Membranes are not affected by change in flow rate, they can go from low flow to maximum flow in seconds and still continuously produce the same filtrate water quality. Change in flow rates of conventional filters can lead to disturbed beds and increased headloss over the filter which can force more particulate through the filter media.

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- Through the use of daily sensitive pressure decay testing on each individual membrane module rack, the operators are able to verify the integrity of the membrane system. This fifteen (15) minute pressure hold test verifies if the membrane system module fibers have been compromised by either passing or failing the test. Other than conventional filter effluent turbidimeters and particle counters, there is no way of testing the integrity of a conventional filtration system. There is no way of knowing for sure if contaminants are passing through the filter during backwashing or if an underdrain has failed.

- Membrane systems are easily expandable by simply providing additional modules to the skids or increasing the number of module racks. Conventional filters that feature concrete or steel tanks are not easily expandable and in some circumstances, not expandable at all.

- Membrane filtration will aid the plant in meeting future WVBPH and EPA rules and regulations (particularly lower required filtrate turbidities), whereas the conventional filters may not.

- Membrane filtration should allow the City to lower the coagulant dose, this in turn will result in lower sludge production and less waste solids disposal.

- The WVBPH would much prefer permitting membrane filtration with appropriate pretreatment over conventional filtration due to their proven technology. The Sanitary Survey reports of recent GD&F membrane systems resulted in significantly fewer comments and concerns.

b. Membrane System Disadvantages

The following are disadvantages of a membrane filtration system over conventional filtration:

- Membranes are more expensive than conventional filtration. Given our extensive experience with membrane filtration water treatment facilities, they cost on average 10-20% more than it would cost to construct a new conventional treatment facility.

- The expected life of the membrane module is 10-15 years, thus future membrane module replacement costs should be included in budgeted yearly operation and maintenance (O&M) expenses.

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- Membranes require pressure for filtration (typically 5 to 20 psi) which leads to additional power consumption. No pressure filtration is required for conventional filters, but this is offset by backwash pumps that are much larger and expensive to operate.

- Membranes require chemical cleaning and neutralization of cleaning chemicals whereas conventional filtration does not. Costs for these cleaning/neutralizing chemicals, heating of cleaning water and pumping is required as part of the membrane system chemical cleaning process which results in increased plant O&M costs.

- Additional operator training and WVBPH reporting is necessary to fully operate a membrane filtration treatment facility.

c. Common Membrane Filtration Misconceptions

- Membrane filtration will not effectively reduce TOC alone. They will remove 5-10% without coagulation and up to 40% with coagulation.

- All membrane modules are not created equal. GDF currently only specifies membrane modules which are manufactured using the Thermally Induced Phase Separation (TIPS) process. This is a 2-step

process in which a more durable, permeable and longer lasting module is constructed. Current modules as manufactured by General Electric (GE), Memcor and DOW are not currently manufactured via the TIPS process.

- Except for reverse osmosis and nanofiltration, membranes have no affect on alkalinity, conductivity, hardness, total dissolved solids, nitrate or sulfate, among others. For water hardness greater than 250 mg/L calcium carbonate, the CIP potable water supply must be provided with a softener.

- Pre-treatment is vital in proper operation of a membrane system. Pre-treatment, such as an effective flocculation and sedimentation system, significantly reduces the solids loading on a membrane which results in less power consumption, lower chemical cleaning costs and longer membrane module life.

- Metals such as iron, manganese and aluminum will only be removed via membrane filtration if they are properly oxidized. If they are in the reduced state, they will pass through the membrane filters.

d. Membrane Filtration Design

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A new control building would be needed to house the membrane filtration equipment. This proposed building would consist of a concrete slab-on-grade structure with CMU masonry and veneer wall construction with precast concrete columns and roof support system. The proposed location of this new building is northeast of the existing Water Treatment Plant. A more thorough feasibility study is suggested for appropriate sizing and location of the proposed facility, should this option be pursued.

The membrane system would consist of the following preliminary components. Refer to Appendix C which include a proposal and preliminary drawings of a new membrane filtration system by Pall Corporation.

- Three (3) AP8 Units each consisting of the following components: PLC with HMI, 2,300 gallon feed tank and backwash tank, feed and backwash pumps and VFDs, 300 micron automatic backwashing pre-strainer, valve/instrumentation rack and 98 membrane module rack.

- The following membrane system accessories would be provided: 2,500 gallon CIP tank with immersion heater, CIP duplex pump skid, 15,000 gallon neutralization system, four (4) chemical feed assemblies featuring citric acid, caustic soda, sodium hypochlorite and sodium bisulfite, two (2) air compressor/dryers and one air receiver tank, Master Control Panel, SCADA and flat panel PC and additional off-skid inputs, outputs and instrumentation.

e. Membrane Cost Estimate

The budgetary cost estimate for a new installed 3.8 MGD membrane filtration system sized at approximately 40 GFD (gallons per day per square foot of membrane area) is $3.2 million. The cost to construct a new WTP building to house the equipment is $2,500,000, taking the total cost of the membrane filtration system to $5,700,000. Refer to Appendix C for a budgetary cost estimate, scope and drawings from Pall Corporation.

f. Membrane System O&M

Operation of a membrane system is more complex than conventional filtration, due to additional instrumentation, equipment and valves. However, the membrane system is fully automatic and generally only require weekly CIP chemical feed tank refills, unless there is a mechanical equipment failure. The largest expense in operating a membrane system is the future cost of replacement modules. It is estimated that there would be a total of 294 Pall modules on this project. Assuming a ten-year module life at $3,000 per replacement module, yields $88,200 per year or $7,350 per month required in savings to account for a full-scale module replacement. Estimated membrane system chemical cleaning costs can be derived following a successful pilot study and are estimated at around $25,000 per year.

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g. Membrane Pilot Study

The City would be required to conduct a minimum 3-month membrane filtration pilot study to demonstrate the effectiveness of the membrane filtration system and to evaluate water quality data, flux rates and cleaning cycles. A pilot study protocol report must be submitted to WVBPH prior to conducting the study. A final report must then be submitted and approved by the Department following the study. A three (3) month pilot study with one (1) membrane manufacturer generally costs about $50,000.

3. UV Disinfection

Ultraviolet disinfection provides an additional barrier to microbial pathogens in the finish water supply. USEPA considers UV disinfection as an "available technology" to deactivate *Cryptosporidium* under the USEPA Long Term 2 Enhanced Surface Water Treatment Rule. Depending on the future "Bin Classification" of the City's water supply for *Cryptosporidium* sampling (oocysts/liter), a log inactivation credit can be applied if UV disinfection is utilized and validated. UV disinfection can provide 3-log *Cryptosporidium* and 3-log *Giardia* inactivation.

Ultraviolet (UV) disinfection can be used as an additional treatment barrier following membrane filtration. Ultraviolet disinfection of water consists of a purely physical, chemical-free process. UV disinfection uses a UV light source, which is enclosed in a

transparent protective quartz sleeve. It is mounted so that water can pass through a flow chamber and UV rays are emitted and absorbed into the stream. When ultraviolet energy is absorbed by the reproductive mechanisms of bacteria and viruses, the genetic material (DNA/RNA) is rearranged so they can no longer reproduce. They are therefore considered "dead" and the risk of disease has been eliminated. UV disinfects water without adding chemicals and does not create new chemical complexes. Also, UV does not change the taste or odor of the water, nor remove beneficial minerals.

The UV process is cost effective, does not use chemicals and may reduce post-filtration chlorine demand. Reduced chlorine usage will reduce the formation of disinfection by-products and further aid in the City's compliance with the Stage 2 Disinfection Byproducts Rule (DBR2).

Two (2) UV reactor vessels can be designed for a maximum flow rate of 3.8 MGD (each) with a UV design dose of 40 mJ/cm^2 at a UV transmittance (253.7 nm) of 95%. Total estimated construction cost for a complete UV disinfection system including piping is $400,000. Estimated monthly O&M to operate a 3.8 MGD UV system is $400/month, which includes bulb and ballast replacements only. Due to the overall small size of the UV system, additional building space required to house the equipment would be minimal.

4. Granular Activated Carbon (GAC) Filtration

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A primary concern with the existing facility is the inability to effectively reduce TOC. The use of GAC will allow the City to eliminate ammonia addition and will result in lower DBPs.

One option is the implementation of granular activated carbon (GAC) filtration following conventional or membrane filtration. The GAC system can remove TOC and organic contaminants such as various endocrine disrupters, pharmaceuticals and personal care products down to a non-detectable level. GAC works through adsorption generally via coconut carbon based media. Average hydraulic loading rates are 6-10 gpm/ft^2 with an average empty bed contact time of 7-10 minutes. A 12-foot diameter, 40,000 pound vessel can filter at a maximum flow rate of 1,100 GPM. They operate as fixed beds in series or in lead/lag type configurations.

When the activated carbon becomes saturated (exhausted) the system it is taken off-line for replacement of the spent carbon. This can be every few months or years depending on the TOC loading and break-through rates. The GAC vessels can also be retrofitted to accommodate specific resins which will remove emerging contaminants such as Polyfluoroalkyl Substances (PFAS), 1-4, dioxane and hexavalent chromium. The implementation of this alternative alone would likely alleviate the DBP exceedances. It would also place the plant in better position to be in compliance with future regulations of organic contaminants which are currently being monitored via EPA's Unregulated Contaminant Monitoring Rules (UCMR's).

The total cost for six (6) 40,000 pound vessels with appurtenances and valve rack is estimated at $1.70 million.

The effectiveness of TOC removal is best tested via a pilot study, which could be in conjunction with a membrane filtration pilot study. The total estimated cost of a 3-month GAC system pilot rental and testing is $30,000.

It costs about $75,000 per carbon bed exchange of a 40,000 pound vessel. Estimated organic break-through can be calculated via a pilot study, if break-through occurs during the study. Refer to Appendix D for GAC system data sheets from Calgon Carbon Corporation and a drawing of a 40,000 pound modular adsorption system.

5. Ozone

Ozone gas is considered to be the optimal disinfectant and oxidant. It is typically injected into the raw water as pretreatment for various metals such as iron, manganese and aluminum and taste, odor and algae control. It can also be used as a means of disinfection; however, is very expensive to implement.

The capital and operating costs of ozone generators, air dryers, contactor tanks, diffusers, destructors and monitoring instrumentation are high, requiring extensive space and maintenance. O&M costs are also high due to the required equipment and electrical cost for ozone gas generation. The use of ozone gas at the CTUB Facility is neither recommended nor desired.

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6. Advanced Oxidation Processes (AOP)

Advanced oxidation processes in the water treatment industry typically either combining hydrogen peroxide with UV or ozone with peroxone for taste and odor control and also removal of organic contaminants. These processes form chemical reactions (hydroxyl radicals) very quickly and require little detention time. They also can remove a plethora of emerging organic contaminants such as 1-4 dioxane. They also do not generate any solid residuals. The disadvantages are a limited track record, significant capital and O&M costs, radical and sometimes unpredictable chemical reactions and removal of hydrogen peroxide residuals after the reaction process. While this new technology is not yet warranted for use by CTUB, installation of a UV disinfection system may enable a future AOP system to be installed if necessary.

Section 6
COST ESTIMATES AND SCHEDULE

A. Cost Estimate Summary

The following section includes a list of proposed improvements to the intake and water treatment plant along with their associated cost estimates. The total construction cost estimate for the development of new well/spring sources and the raw water intake system improvements is $2,745,000. The total construction cost estimate for the new water treatment plant upgrades is $17,505,000. The total project cost estimate is $24,880,000. Refer to the tables below.

Table 5: Recommended Source Development and Intake Projects Construction Cost Estimate

Item	TASK ELEMENT	ESTIMATED COST
1.	Hydrogeological Well/Spring Pump and Water Quality Testing	$80,000
2.a	New Well Development at S. George Street	$150,000
2.b	New Well Line from S. George Street to WTP	$700,000
3.a	New Well/Spring Development at Wydmyer's	$250,000
3.b	New Well Line from Wydmyer's to WTP	$300,000
4.	New 20" DIP Intake Line and 3" Air Line	$250,000
5.	New T-Screen	$50,000
6.	New Stream Concrete Debris Deflector	$750,000
7.	New Automated Air Burst System	$100,000
8.	New Wet Well Level Sensor	$5,000
9.	New 125 HP Intake Pump Motors	$50,000
10.	Intake Telemetry System	$60,000
	TOTAL INTAKE/SOURCE CONSTRUCTION COST ESTIMATE:	**$2,745,000**

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Table 6: Recommended WTP Projects Construction Cost Estimate

Item	TASK ELEMENT	ESTIMATED COST
1.	New Plant Site Piping	$1,000,000
2.	New Plant Site Work	$1,250,000
3.	New WTP Building (Foundation, Walls and Roof)	$2,500,000
4.	New Concrete Flocculation and Sedimentation Basin	$2,200,000
5.	Flocculation and Sedimentation Basin Equipment	$400,000
6.	New Sludge and Meter Vault	$100,000
7.	Interior Plant Piping	$750,000
8.	Plant Instrumentation	$200,000
9.	Plant Interior Rooms and Finishes	$700,000

Item	TASK ELEMENT	ESTIMATED COST
10.	HVAC/Plumbing	$400,000
11.	Electrical	$1,500,000
12.	Membrane System Pilot Study	$50,000
13.	3.8 MGD Membrane System Microfiltration Equipment	$3,200,000
14.	UV Disinfection Equipment	$400,000
15.	GAC System Pilot Study	$30,000
16.	3.0 MGD GAC System	$1,700,000
17.	Chemical Feed Equipment	$350,000
18.	Add Clearwell Baffle Wall	$75,000
19.	Process Waste Pump Station and Forcemain to Development	$350,000
20.	Laboratory Instrumentation and Casework	$150,000
21.	SCADA System	$200,000
	TOTAL WTP CONSTRUCTION COST ESTIMATE:	**$17,505,000**

Table 7: Recommended Total Project Cost Estimate

Item	TASK ELEMENT	ESTIMATED COST
1.	Total Well/Spring Source Construction Cost	$1,480,000
2.	Total Intake Construction Cost	$1,265,000
3.	Total WTP Construction Cost	$17,505,000
4.	Construction Contingency (+/-10%)	$2,000,000
5.	Engineering Fees (+/-12%)	$2,400,000
6.	Legal Fees	$20,000
7.	Permits and Fees	$10,000
8.	Misc. (Admin., Financing, Interest, Cost Index, etc.)	$200,000
	TOTAL PROJECT COST ESTIMATE:	**$24,880,000**

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B. Proposed Project Schedule

There are various small projects that are required to keep the existing treatment facility operational and in compliance until the new WTP is constructed. These projects consist of installing the newly purchased VFDs for the vertical turbine raw water intake pumps, replacing filter system valves and instrumentation and performing gas chlorine room upgrades. These are all scheduled to take place in 2022. The development of new groundwater/spring sources is currently ongoing, with well drilling/testing, easements and construction expected through 2023. Installation of a new process wastewater pump station and forcemain tying into the existing CTUB sewer system is recommended ASAP, thus eliminating recycle. There are currently plans for a new potential development to occur near the existing water treatment facility site, which may allow tie-in of the WTP process wastewater in the near future. Based on the projected growth and anticipated water demands, the plans for an expansion project should start no later than 2026 to ensure adequate supply by the projected year of 2036. Refer to Table 8 for a recommended project schedule.

Table 8: Recommended Project Schedule

Task	Date
Perform Existing Chlorine Room and Filter Valve Upgrades	2022
Install New VFDs on Existing Intake Pumps	2022
Develop New Well/Spring Sources	2022-2023
Perform Membrane/GAC Pilot Study	2026
Design Intake and WTP Upgrades	2027-2028
Bid Project-Start Construction-Secure Funding	2029
Final Completion of Construction - New Plant Online	2032

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APPENDIX A

INTAKE SCREEN CONCRETE DEBRIS DEFLECTOR DRAWING

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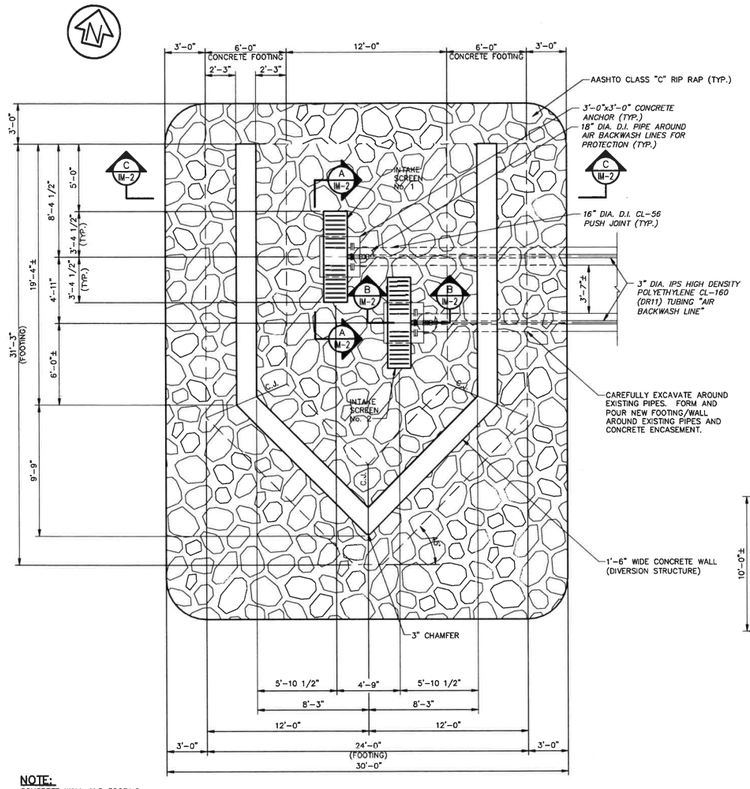
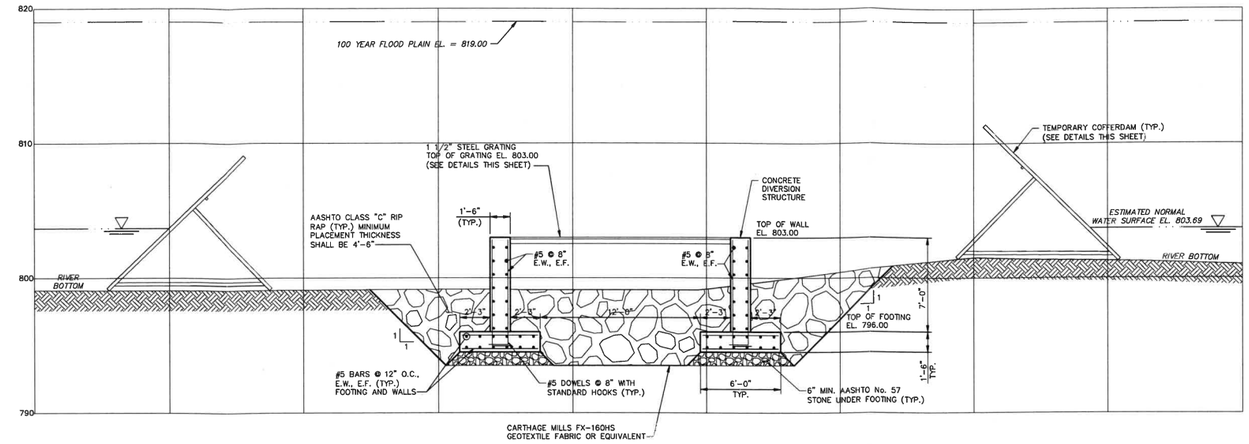


NOTE:
CONCRETE WALL AND FOOTING MAY BE PRECAST AND INSTALLED IN SEGMENTS USING EPOXY AND DOWELS.

RAW WATER INTAKE AND DIVERSION STRUCTURE SCREEN PLAN
SCALE: 1/4" = 1'-0"



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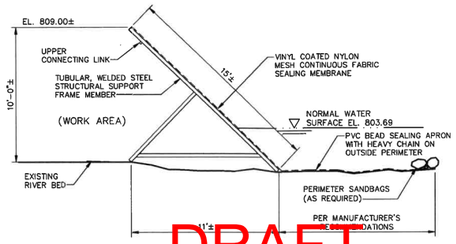

COFFERDAM STRUCTURAL SUPPORT FRAME AND MEMBRANE SEALING DETAIL
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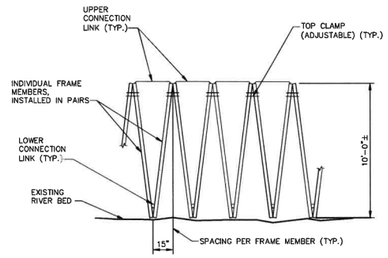
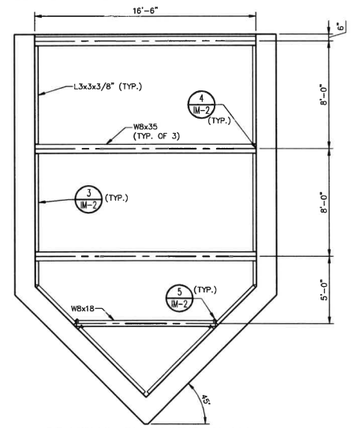


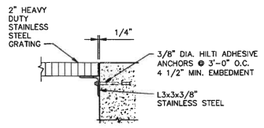
COFFERDAM FRAME ASSEMBLY DETAIL
SCALE: 1/4" = 1'-0"

COFFERDAM NOTES:
1. TEMPORARY COFFERDAM MANUFACTURER SHALL BE PORTADAM, INC., 3082 SOUTH BLACK HORSE PIKE, WILLIAMSTOWN, NEW JERSEY 08094, OR APPROVED EQUAL.
2. SANDBAGS SHALL BE POLY-WOVEN BAGS FILLED WITH CLEAN SAND.
3. EVALUATE FOUNDATION FOR LOAD BEARING CAPACITY BEFORE INSTALLATION, BASED ON ANTICIPATED HYDROSTATIC LOADING.
4. PREPARE RIVER BED SURFACES IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS AND SPECIFICATIONS.
5. CLEAR ROCKS, DEBRIS AND OBSTRUCTIONS FROM PROPOSED PVC BED SEALING APRON LOCATION.
6. LOCATE MINOR LEAKS UNDER PVC BED SEALING APRON AND SEAL WITH SANDBAGS.
7. PROVIDE THE FOLLOWING ATTACHMENTS AS REQUIRED, AT NO ADDITIONAL COST:
   - BACK BRACE POLE
   - HORIZONTAL ADDITIONAL BRACING
   - SINGLE FRAME ATTACHMENTS FOR IRREGULAR CONTOURS AND TURNS.
8. ANCHOR BOLTS MAY BE REQUIRED, AT NO ADDITIONAL COST, ON HARD ROCK, FLAT OR CONCRETE SURFACES, PER MANUFACTURERS RECOMMENDATIONS.
9. ALL STRUCTURAL SUPPORT FRAME JOINTS SHALL BE WELDED.
10. THE RELATIVE DIMENSIONS OF THE TEMPORARY COFFERDAM PROTECTION WORK AREA ARE PROVIDED FOR INFORMATIONAL PURPOSES. CONTRACTOR IS REQUIRED TO REMAIN WITHIN THE LIMIT OF DISTURBANCE PER THE SITE PLAN.
11. CONTRACTOR SHALL ADJUST COFFERDAM AREA AS REQUIRED TO FACILITATE CONSTRUCTION OPERATIONS.
12. CONTRACTOR IS FULLY RESPONSIBLE FOR HEIGHT AND PROTECTION OF COFFERDAM.

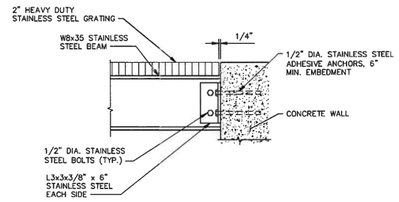


GRATING SUPPORT PLAN
SCALE: 1/4" = 1'-0"

GRATING NOTES:
1. ALL STAINLESS STEEL COMPONENTS OF THE GRATING AND SUPPORTS SHALL ADHERE TO ASTM A276.
2. GRATING SHALL BE DESIGNED FOR A 100 P.S.F. LIVE LOAD.
3. GRATING SHALL BE SECURELY FASTENED TO SUPPORTS USING 3/8" DIA. STAINLESS STEEL ANCHORS EVERY 2'-0" O.C.
4. GRATING SHALL BE FULLY BANDED AROUND PERIMETER.
5. CONTRACTOR TO VERIFY BEAM AND INTAKE CLEARANCE.



DETAIL 3 – IM-2
SCALE: 1 1/2" = 1'-0"



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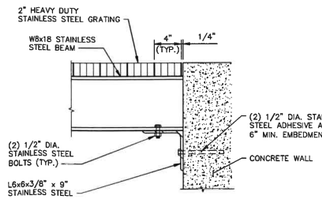

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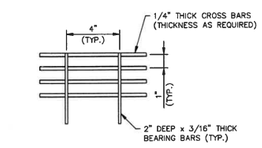

STAINLESS STEEL GRATING DETAIL
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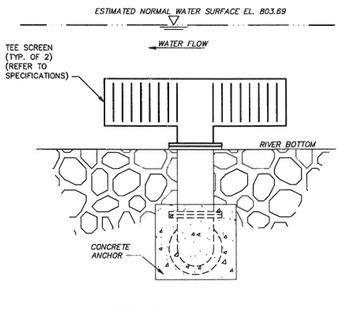

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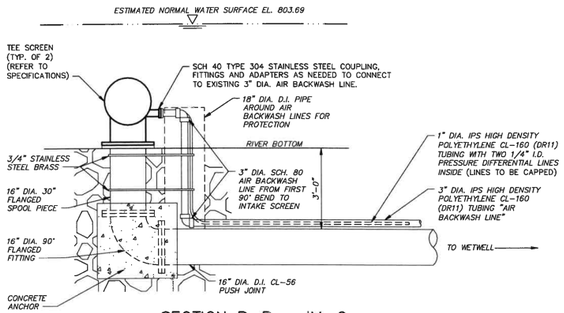

SECTION B–B – IM-2
SCALE: 1/2" = 1'-0"

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NO.	DATE	DESCRIPTION
		REVISIONS

INTAKE CONCRETE DEBRIS DEFLECTOR PLANS AND DETAILS

CHARLES TOWN UTILITY BOARD

WATER TREATMENT FACILITY UPGRADE AND EXPANSION

JEFFERSON COUNTY, WEST VIRGINIA

SEAL

DATE: 1/28/22	JOB: 21045	SCALE: AS SHOWN
FILE: IM-2	DRAWN BY: RJB	CHECKED BY: CWE

GD&F
GWIN DOBSON & FOREMAN ENGINEERS
3121 Fairway Drive
Altoona, PA 16602
814.949.8214
gdfengineers.com

SHEET NO: IM-2

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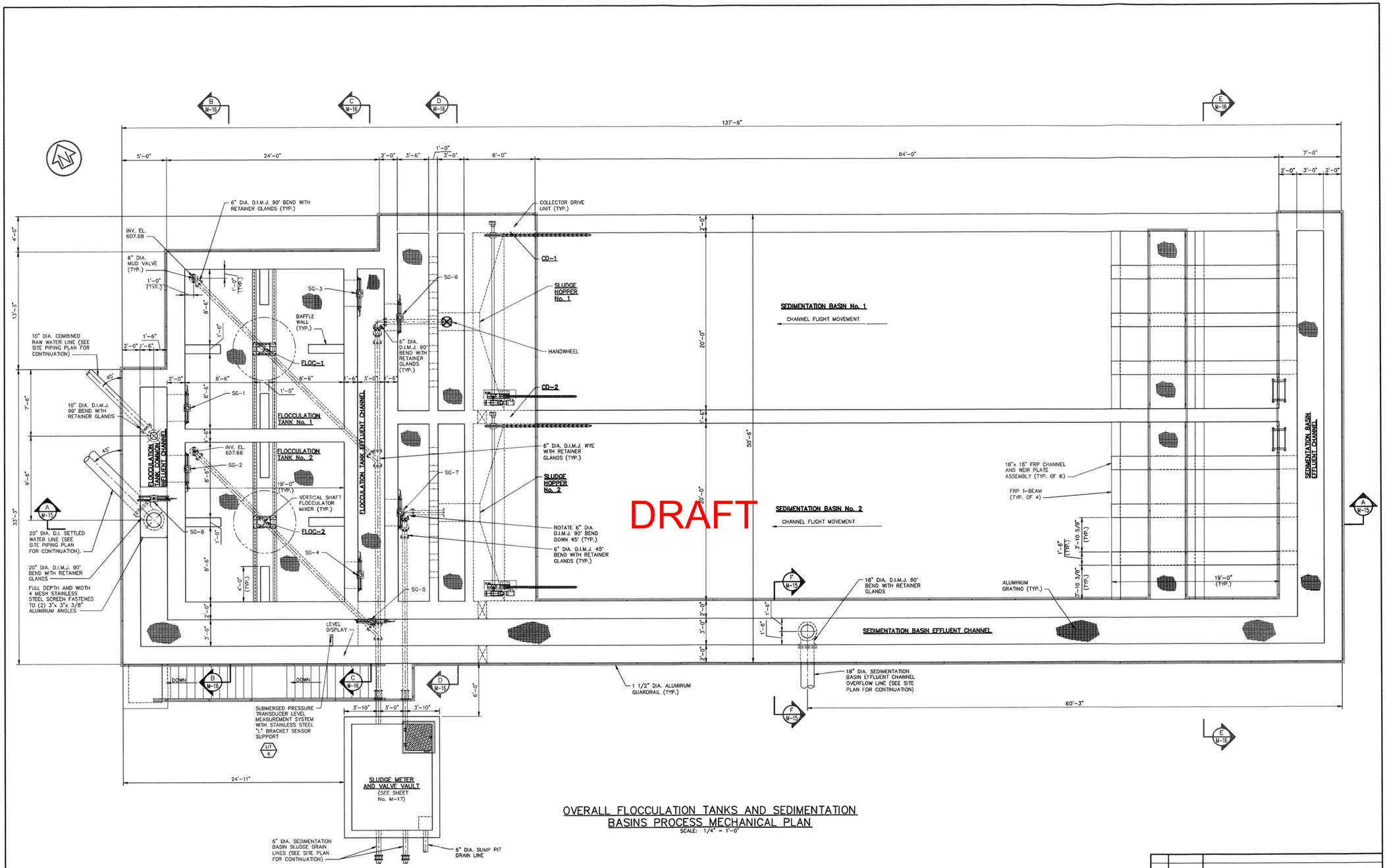
APPENDIX B

TYPICAL NEW FLOCCULATION AND SEDIMENTATION DRAWINGS

DRAFT



OVERALL FLOCCULATION TANKS AND SEDIMENTATION BASINS PROCESS MECHANICAL PLAN
SCALE: 1/4" = 1'-0"

LEGEND

INDICATES INSTRUMENTATION DEVICE

SG-# SLIDE GATE

NO.	DATE	DESCRIPTION
		REVISIONS

OVERALL FLOCCULATION TANKS AND SEDIMENTATION BASINS PROCESS MECHANICAL PLAN

CHARLES TOWN UTILITY BOARD

WATER TREATMENT FACILITY UPGRADE AND EXPANSION

JEFFERSON COUNTY, WEST VIRGINIA

SEAL

DATE: 1/28/22 | JOB: 21045 | SCALE: AS SHOWN
FILE: M-14 | DRAWN BY: RJB | CHECKED BY: CME

GWIN DOBSON & FOREMAN ENGINEERS
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Altoona, PA 16602
814.943.5214
gdfengineers.com

SHEET NO: M-14

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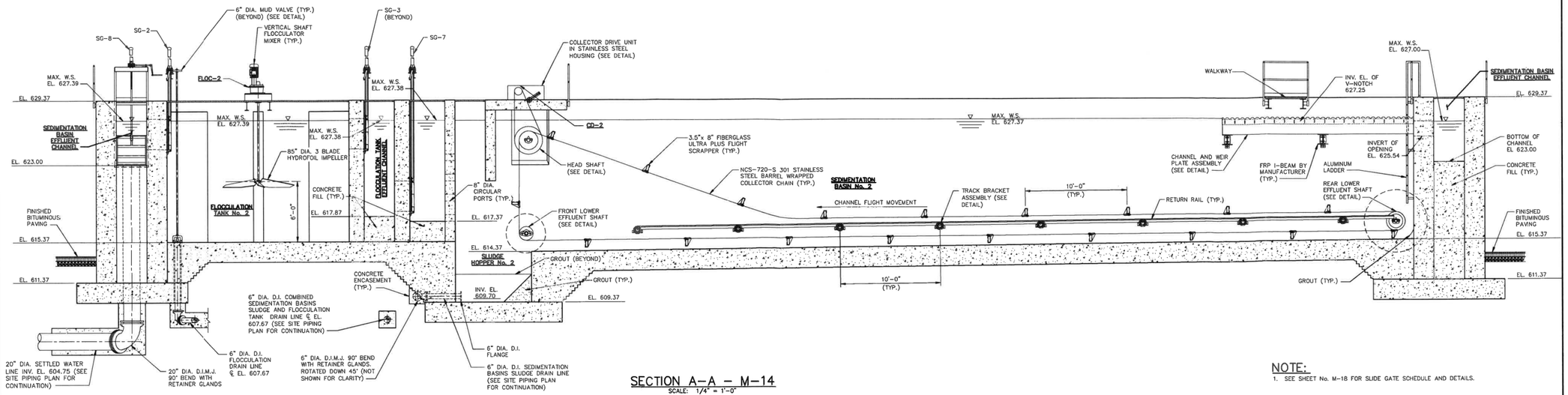

SECTION A-A – M-14
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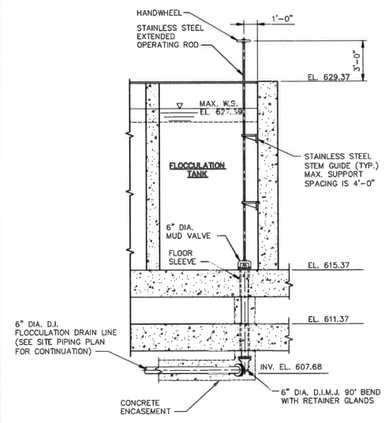
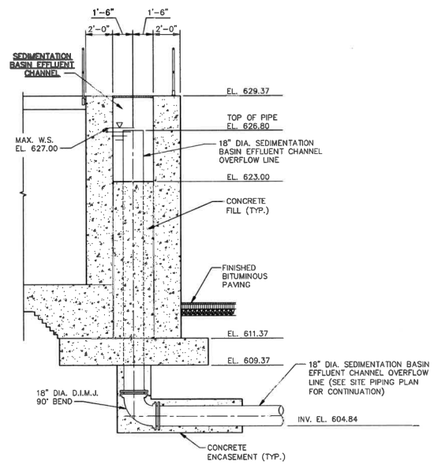
NOTE:
1. SEE SHEET No. M-18 FOR SLIDE GATE SCHEDULE AND DETAILS.

LEGEND
SG-# SLIDE GATE



MUD VALVE DETAIL
SCALE: 1/4" = 1'-0"



SECTION F-F – M-14
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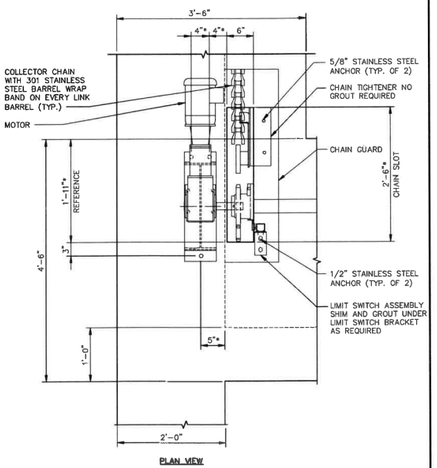
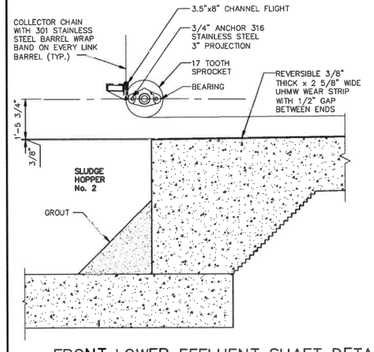


COLLECTOR DRIVE UNIT DETAIL
SCALE: 1" = 1'-0"

NOTES:
1. CONTRACTOR TO VERIFY LENGTH AND TOOLS NEEDED TO INSTALL CHAINS WITH EQUIPMENT MANUFACTURER.
2. * DENOTES GENERAL DIMENSION, CONFORM DIMENSIONS WITH EQUIPMENT MANUFACTURER.
3. CONTRACTOR TO VERIFY TYPE, LENGTH, AND TORQUE REQUIREMENTS WITH EQUIPMENT MANUFACTURER.
4. FOR COMPLETE LIST OF PARTS AND INSTALLATION INSTRUCTIONS, CONTACT EQUIPMENT MANUFACTURER.



FRONT LOWER EFFLUENT SHAFT DETAIL
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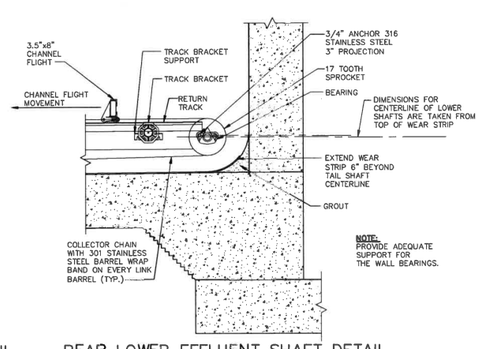

REAR LOWER EFFLUENT SHAFT DETAIL
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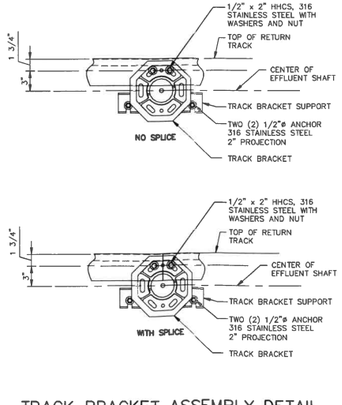

TRACK BRACKET ASSEMBLY DETAIL
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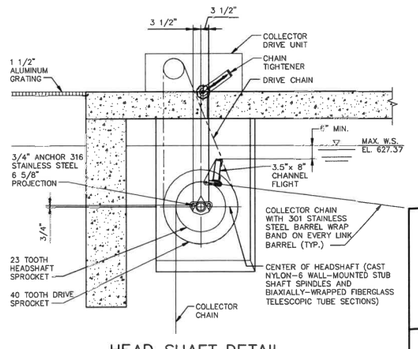

HEAD SHAFT DETAIL
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NO.	DATE	DESCRIPTION
		REVISIONS

FLOCCULATION TANKS AND SEDIMENTATION BASINS PROCESS MECHANICAL SECTIONS

CHARLES TOWN UTILITY BOARD

WATER TREATMENT FACILITY UPGRADE AND EXPANSION

JEFFERSON COUNTY, WEST VIRGINIA

SEAL

GD&F
GWIN DOBSON & FOREMAN ENGINEERS
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Altoona, PA 16602
814.943.5214
gdfengineers.com

DATE: 1/28/22	JOB: 21045	SCALE: AS SHOWN
FILE: M-15	DRAWN BY: RJB	CHECKED BY: CME

SHEET NO: M-15

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APPENDIX C

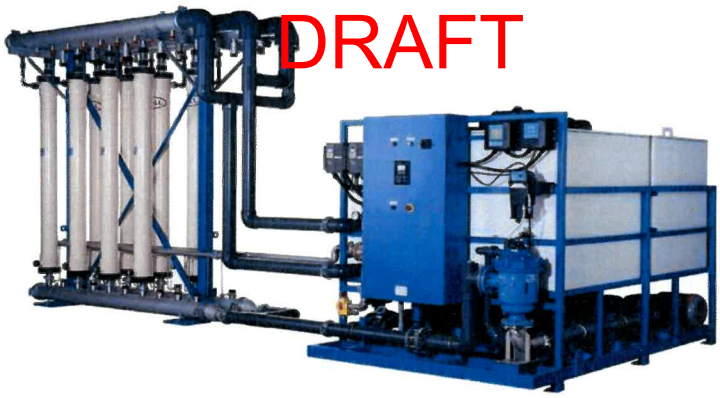
PALL CORPORATION BUDGETARY MEMBRANE SYSTEM PROPOSAL AND PRELIMINARY DRAWINGS

DRAFT

PALL Water

Budgetary Proposal for a Pall ARIA™ Membrane Filtration System

Charles Town Utility Board, W.Va



1/24/2022
Proposal #: 20220124-0-B

Confidential - Company Proprietary

PALL Water

Submitted to:

Christopher Eckenrode, P.E.
Gwin, Dobson & Foreman, Inc.
3121 Fairway Drive
Altoona, PA 16602

Submitted by:

Dave Glovinsky
Regional Sales Manager
516-924-2041
dave_glovinsky@pall.com

DRAFT

PALL Water

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- to avoid publication or other disclosure of this document or the information it contains to any third party without the prior approval of Pall Corporation.

- to make only those copies needed for recipient's internal review, and

- to return this document and any copies thereof when they are no longer needed for the purpose for which furnished or upon the request of Pall Corporation.

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   1.2 Pricing Summary
   1.3 Delivery Schedule
   1.4 Terms and Conditions

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   2.1 Scope Summary Table
   2.2 Equipment Description
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   2.4 Services and Labor

3. Technical Summary
   3.1 Process Summary
   3.2 Treated Water Objectives
   3.3 Operational Parameters
   3.4 Acceptance Criteria

The following information can be provided upon request
   Warranty
   Overview of Pall Corporation
   Hollow Fiber Membrane System Overview
   Pall Standard Terms and Conditions

DRAFT

1 Pall Offering

1.1 Scope Summary

To evaluate the use of hollow-fiber membranes on this drinking water source

1.2 Pricing Summary

Item	Description	Sale Price (US)
1	Aria™ Membrane Filtration System (Details Per Section 2)	$2,861,500

1.3 Delivery Schedule

Typically 4 weeks after Acknowledgement of Purchase Order

The schedule provided is Pall's standard and reflects typical project execution. If requested, we would be happy to review customer schedule requirements and adjust where possible to accommodate project specific needs.

	Milestone	Typical Schedule
1	Acknowledgement of Purchase Order	Typically 1 to 2 weeks after Receipt of Purchase Order
2	Submittals/Shop Drawings	Typically 7 weeks after Acknowledgement of Purchase Order
3	Commence Manufacturing1	Typically 2 weeks after Submittals/Shop Drawings submitted
4	Equipment Ready to Ship and Preliminary O&M Manual	Typically 27 - 31 weeks after Commence Manufacturing
5	Installation Completed (by Others)	Variable
6	Commissioning Complete/Final Acceptance	Approximately 6 weeks after Installation Completed

DRAFT

Note 1: For standard equipment, manufacturing may commence order acknowledgement. The schedule above assumes standard equipment and standard submittals.

1.4 Terms and Conditions

All sales made by Pall are subject to the terms contained within this Section 1.4 and *Additional Terms and Conditions of Sale of Systems and Made to Order Goods – The Americas* (Available upon request).

Price Validity	This proposal is for discussion purposes only, does not constitute a binding agreement on either party, and remains subject to corporate approval by both parties. The information contained herein is deemed confidential and is not to be shared with any third party.
Shipping Terms	The price does not include shipping costs. Delivery shall be FCA Seller's Shipping Point, INCOTERMS® 2010.
Payment Terms	Payment of invoiced amounts due to Seller shall be paid Net 30 days and as further defined in *Additional Terms and Conditions of Sale Systems and Made to Order Goods – The Americas*.
Bonds	No bonds of any type are included with this proposal.
Taxes	No taxes are included in the pricing. Payment of all Taxes related to the Goods and Services proposed shall be the exclusive responsibility of the Buyer as further defined in *Additional Terms and Conditions of Sale Systems and Made to Order Goods – The Americas*.

DRAFT

2 Scope of Supply

2.1 Scope Summary Table

Item Description	By PALL	By OTHERS
(1) Master Control Panel with Allen Bradley Logix PLC, or equal	X	
Design and supply of systems prior to membrane filtration system.		X
Feed Tank Included as part of AP Skid	X	
Feed Pump(s) and VFD(s) included as part of AP skid	X	
Feed Strainer included as part of AP Skid	X	
3 (2 + 1) AP8 Units, each factory assembled and tested unit including valves, instruments & I/O required for operation	X	
Each AP Unit will include a 102 space membrane module rack for on-site assembly and (98) hollow fiber membrane modules	X	
RF Tank Included as part of AP Skid	X	
RF Pump(s) included as part of AP Skid	X	
(1) 2500 gallon CIP System factory assembled and tested prior to shipment with valves, instruments, pumps, tank, heater as needed for operation	X	
(1) 15000 gallon Neutralization System factory assembled per the P&ID and tested prior to shipment:	X	
(2) Air Compressors (1) Air Receiver	X	
Chemical Storage Equipment		X
Supply of any required chemicals		X
Design and supply of anchor bolts for Pall supplied Equipment		X
Receiving, unloading and safe storage of equipment until ready for installation		X
Installation of all equipment		X
Design and supply of interconnecting pipe, inclusive of pipe supports and flexible connectors		X
Motor Control Center (MCC)		X
All wiring, cabling, and tubing for power supply, signals, communications, and to connections on Pall supplied equipment		X
Design, supply, and installation of all civil infrastructure inclusive of buildings, fire and safety protection, HVAC, walkways, platforms, etc.		X
All Permits		X

DRAFT

2.3 Submittal Description

The project schedule is based on submittals/shop drawings provided in electronic format via a secure FTP site for information only. This allows work to proceed on the project without a document approval process.

Submittals/Shop Drawings
P&ID
General Arrangement Drawings for Pall-Supplied Equipment
Electrical Interconnect Drawing (Power One-Line, I/O Interconnection, and Network Layout)
Electrical Drawings for Pall-Supplied Panels
Mechanical Replacement Parts List
Electrical Replacement Parts List
Compressed Air System Information
Installation Manual
Cutsheets for Pall-Supplied Off-Skid Components
Installation & Startup Checklist
Final Submittal (provided at completion of commissioning)
Operation and Maintenance Manual
Software License Transfer Documentation

DRAFT

2.4 Services and Labor

Commissioning & Training time is estimated to be 5 man-weeks. Training activities occur during the commissioning process.

Commissioning

Each day shall be considered 8 hours on site. Commissioning will begin once the system is fully installed. A commissioning Checklist is prepared specifically for each project during project execution. Commissioning shall consist of the activities outlined in the project specific Commissioning Checklist. Commissioning activities include:

- Confirmation of network communications
- Confirmation that I/O is connected to the control system
- Confirmation of MF System functionality (components are functioning and control system sequences are functional)
- Startup and tuning of Pall controls

Operator Training

Operator training is estimated to take 1 to 3 days depending on system complexity. Training is provided on-site by a Pall Field Service Engineer. The estimated time assumes that all staff are trained at the same time. Training time will be split between a classroom presentation and hands-on training with the equipment.

DRAFT

3 Technical Summary

3.1 Process Summary

Source Description:

Blended Source (Shenandoah River & Well Sources)

Treatment processes prior to Membrane Filtration System:

coagulation & direction filtration

Membrane System Feed Water Characteristics

Quality of the water entering the Pall Membrane Filtration System as summarized in table below forms the basis of design for this proposal. In the event that the feed water to the membrane filtration system is outside these parameters the system performance, cleaning protocol, operating parameters, and/or warranties may be affected.

Parameter	Units	Range
Turbidity	NTU	5-50
TOC	ppm	3-6
Hardness	ppm	50-350
Alkalinity	ppm	60-320
TSS	ppm	10-100
Fe	ppm	<2.0
Mn	ppm	<1.0

Notes:

1 – Assumed Water Quality is based on typical water quality for similar source waters. The design parameters may change after review of actual source water quality data.

DRAFT

3.2 Treated Water Objectives

The proposed membrane system is designed to achieve the following results given the feed fluid conditions described in Section 3.1 of this proposal and operation of the system in accordance with the operation and maintenance manual.

Net Filtrate Capacity of 3.8 MGD

Turbidity less than 0.10 NTU 95% of the time, below 0.20 NTU at all times.

The membrane system shall produce effluent with Silt Density Index (SDI) value of 2.5 or less in 95% of samples using ASTM 4189-95 and a Pall nylon test membrane.

3.3 Operational Parameters

Hollow Fiber Membrane System operational parameters at design flow		
Net Filtrate Capacity	3.800	MGD
Recovery	97.0%	%
Instantaneous Flux	40	GFD
FM (Backwash) Interval	35	Minutes
EFM Interval	7	Day(s)
CIP Interval	30	Days

3.4 Acceptance Criteria

The system shall be accepted by the end user upon completion of the following:

1) Completed system commissioning per section 2.4
2) Production of 1st useable effluent

Approximately 51 per rack each day

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O&M Cost Summary

All informations regarding waste, chemical usage and electricity are based on the following assumptions:

1. All racks (including redundant racks if any) are on line
2. EFM is triggered by volume and occurs less frequenctly at lower flux.
3. Chemical solutions are not reused
4. Solution strength, chemical pricing and electricity pricing assumptions are proivded on the next page.
5. The values provided are estimated and do not account for fluid volumes associated with field piping or other plant specific conditions.

Waste Volumes			
	Frequency	Waste per Event	Daily Waste (Gal)
Flux Maintenance (Reverse Filtration)	Approximately 26 per rack each day	1,372	108,176

Chemical Cleaning Waste Volumes			
	Frequency	Monthly Waste (Gal)	Annual Waste (MGal)
Enhanced Flux Maintenance (EFM) & Clean in Place (CIP) Waste	EFM 7 day(s) CIP 30 days	62,557	0.75

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Electrical Usage		
kWhr/month	kWhr/yr	$USD/yr
25,752	309,022	$30,902

Chemical Usage			
	Gal/year	Gal/month	$USD/yr
Chlorine: (Sodium Hypochlorite)	1,772	148	$2,481
Caustic (NaOH): (Sodium Hydroxide)	2,122	177	$3,820
Citric Acid:	2,215	185	$11,961
Sodium Bisulfite:	140	12	$343

O&M Cost Summary		
Energy and Chemical Cost Assumptions		
Electricity:	Cost Per KWH	$0.10
Chlorine:	Cost Per Gallon of Stock Solution	$1.40
(Sodium Hypochlorite)	Concentration of Stock Solution	12.5%
Caustic (NaOH):	Cost Per Gallon of Stock Solution	$1.80
(Sodium Hydroxide)	Concentration of Stock Solution	25.0%
Citric Acid:	Cost Per Gallon of Stock Solution	$5.40
	Concentration of Stock Solution	50.0%
Sodium Bisulfite:	Cost Per Gallon of Stock Solution	$2.45
	Concentration of Stock Solution	40.0%

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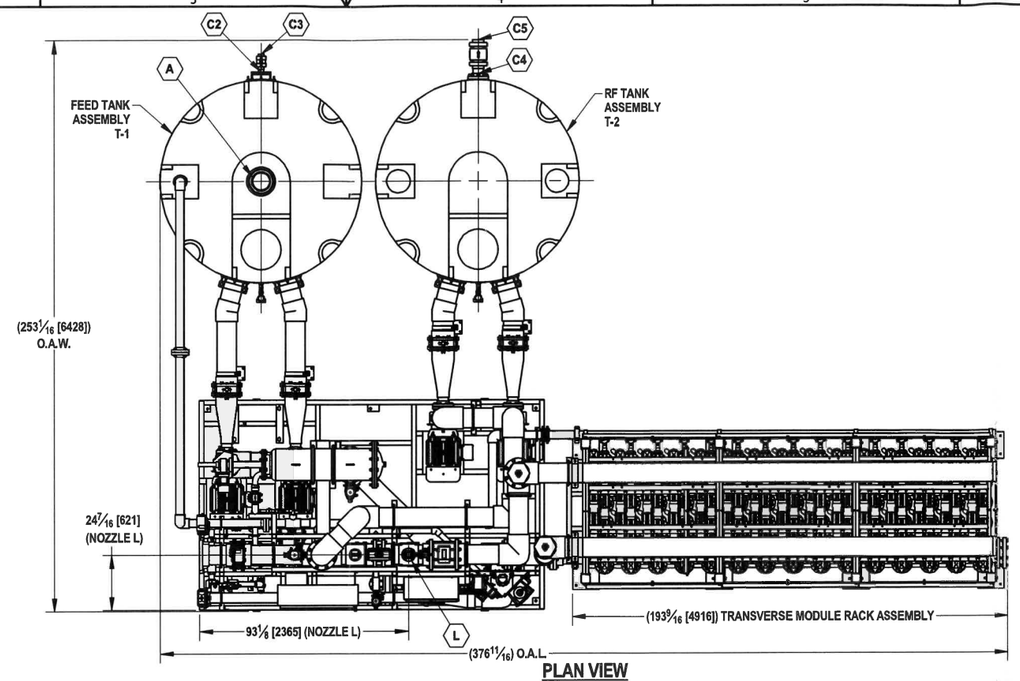
ASSY,MF SYSTEM,AP8,REL 3.0
AP8 GENERAL ARRANGEMENT DRAWING
BASE SKID W/OPTIONAL ASSEMBLIES + MODULE RACK + TANK(S)

REVISION	REVISION DESCRIPTION	CHG BY	PROJ ENG	ENG/APVD	ENG/APVD	ENG/APVD	CHKD/APVD
01	CORRECTED VIEWS FOR MISSING DIMENSIONS.	SPS 27JUN2019	JMG 26JUL2019				KRH 26JUL2019

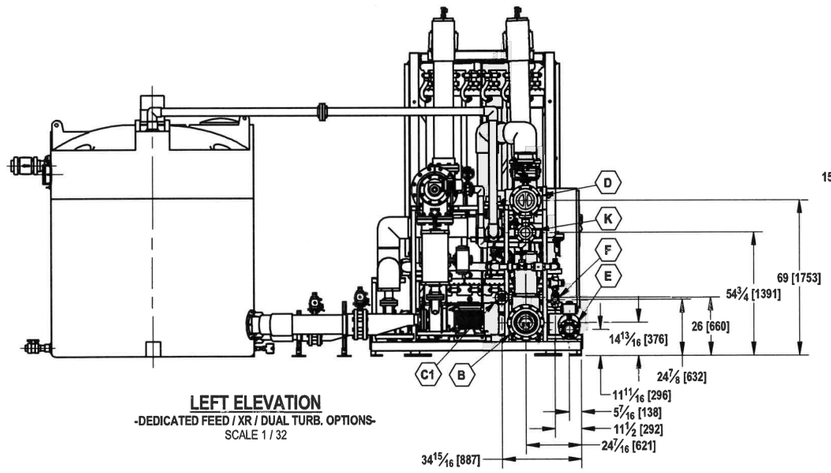
NOTES

1. ALL PIPING DESIGNER, SUPPLIED AND OR INSTALLED BY OTHERS MUST BE PLUMB, SQUARE, AND LEVEL (UNLESS FOR DRAINAGE) AND SHALL NOT TRANSMIT WEIGHT OR OTHER LOADS (THERMAL, SEISMIC, WATER HAMMER, ETC.) TO PALL WATER EQUIPMENT CONNECTIONS.
2. THE DISCS ON ELASTOMER-SEATED BUTTERFLY VALVES MUST BE AT LEAST PARTIALLY OPEN WHEN TIGHTENING FLANGE BOLTS. FAILURE TO DO SO WILL CAUSE PREMATURE FAILURE, AND WILL VOID ALL WARRANTIES ON THE VALVE.
3. REFERENCED VENT LINES SHALL BE ROUTED (BY OTHERS) TO A SUITABLE CHEMICAL DRAIN WITH AIR GAP AND SPLASH PROTECTION. THIS PIPING SHALL NOT REDUCE IN SIZE BETWEEN VALVE AND AIR GAP.
4. EACH MODULE RACK IS SHIPPED PARTIALLY ASSEMBLED. REFER TO SEPARATE INSTALLATION INSTRUCTIONS.
5. MODULES ARE SHIPPED SEPERATELY. DO NOT DROP OR EXPOSE THE MODULES OR THEIR SHIPPING CONTAINERS TO SHOCK OR IMPACT. THERE MAY BE DAMAGE TO THE MEMBRANE EVEN IF NO VISIBLE DAMAGE TO THE MODULE CASE IS EVIDENT. DO NOT STORE THE MODULES OR THEIR SHIPPING CONTAINERS OUTSIDE OR IN AN AREA WHERE THERE WILL BE EXPOSURE TO DIRECT SUNLIGHT, EXCESSIVE HEAT, OR COLD. PALL CORPORATION REQUIRES MEMBRANES BE STORED IN A CONTROLLED, SECURE ENVIRONMENT TO GUARANTEE MODULES ARE NOT DAMAGED DURING STORAGE.
6. SEE ELECTRICAL DRAWINGS FOR FIELD WIRING REQUIREMENTS.
7. ANCHOR BOLT REQUIREMENTS TO BE PROVIDED BY OTHERS.
8. ESTIMATED WEIGHTS:
   - TANK T1 DRY - 600 LB. [272 KG]
   - TANK T2 DRY - 600 LB. [272 KG]
   - SKID & INTERCONNECT DRY - 7,000 LB. [3,175 KG]
   - FILTER RACK DRY-W/MODULES - ____ LB. [____ KG]
   - TANK T1 WET - 21,000 LB. [9,525 KG]
   - TANK T2 WET - 21,000 LB. [9,525 KG]
   - SKID & INTERCONNECT WET - 8,000 LB. [3,629 KG]
   - FILTER RACK WET-W/MODULES - ____ LB. [____ KG]

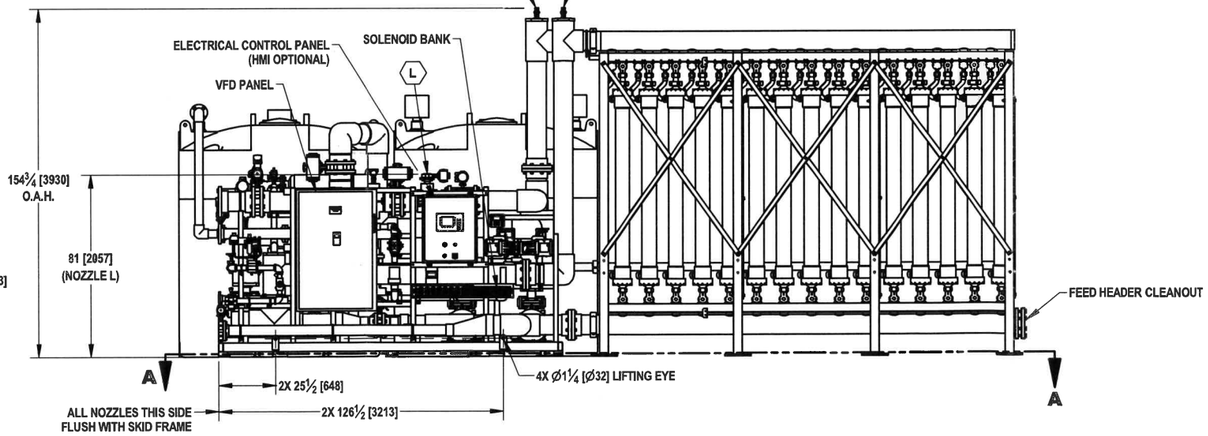


PLAN VIEW
-DEDICATED FEED / XR / DUAL TURB. OPTIONS-
(___ MODULE FILTER RACK W/___ MODULES INSTALLED)
(5 - 5 - 5 ROW MODULE SECTION ASSEMBLY)
SCALE: 1 / 32

DRAFT



LEFT ELEVATION
-DEDICATED FEED / XR / DUAL TURB. OPTIONS-
SCALE 1 / 32



FRONT ELEVATION
-DEDICATED FEED / XR / DUAL TURB. OPTIONS-
SCALE 1 / 32

ITEM	DESCRIPTION	SIZE	TYPE	MAT'L
V2	EXCESS RECIRC. I/C PIPING FILL VENT	1"	FNPT	POLYMER
V1	FILTRATE I/C PIPING FILL VENT	1"	FNPT	POLYMER
L	FILTRATE CIRCULATION OUTLET	2"	150# FLG	CI
K	FEED CIRCULATION OUTLET	4"	150# FLG	PVC
F	COMPRESSED AIR SUPPLY	2"	FNPT	SST
E	CIP / EFM - INLET / DRAIN	4"	150# FLG	CI
D	FILTRATE OUT	8"	150# FLG	PVC
C5	RF TANK DRAIN	2"	FNPT	PVC
C4	RF TANK OVERFLOW	4"	SW	PVC
C3	FEED TANK DRAIN	2"	FNPT	PVC
C2	FEED TANK OVERFLOW	8"	GROOVED PIPE	SST
C1	GRAVITY DRAIN	2"	150# FLG	PVC
B	RF / AS MISC. DRAIN	10"	150# FLG	PVC
A	FEED TANK INLET	8"	SW	PVC

SCOPE LIMIT TABLE

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TOLERANCE: ANGLE ± 1/2 DEG; FRACTION ±1/4 [6]; .XXXX ±; .XXX ±; .XX ±; .X ±
ALL FINISHED SURFACES ✓ µIN ✓ µm
SCALE: AS NOTED — DO NOT SCALE FROM DRAWING
THIRD ANGLE PROJECTION

	NAME	DATE
DRAWN BY	D. TRAVIS	14AUG2018
PROJECT ENGINEER	J. GRIFFIN	24SEP2018
ENGINEER	--	--
ENGINEER	--	--
ENGINEER	--	--
CHECKER	K. HAWKS	24SEP2018

CODE IDENTIFICATION NO. 17238
PROJECT ID: AP8 STANDARD
DRAWING NAME: DEDICATED AP8 MF SYSTEM G.A. TEMPLATE R3.0

IMPORTANT *BEFORE ATTEMPTING TO OPERATE OR INSTALL THIS SYSTEM, IT IS ESSENTIAL TO READ AND UNDERSTAND THIS PRODUCT'S OPERATION AND MAINTENANCE MANUAL (SHIPPED UNDER SEPARATE COVER). FAILURE TO READ THE OPERATION AND MAINTENANCE MANUAL BEFORE ATTEMPTING TO OPERATE ANY PALL CORPORATION EQUIPMENT MAY RESULT IN SERIOUS PERSONAL INJURY AND/OR PRODUCT DAMAGE, AND VOID ANY AND/OR ALL WARRANTIES.*

PALL Corporation
Pall Advanced Separation Systems
Industrial, Cortland NY

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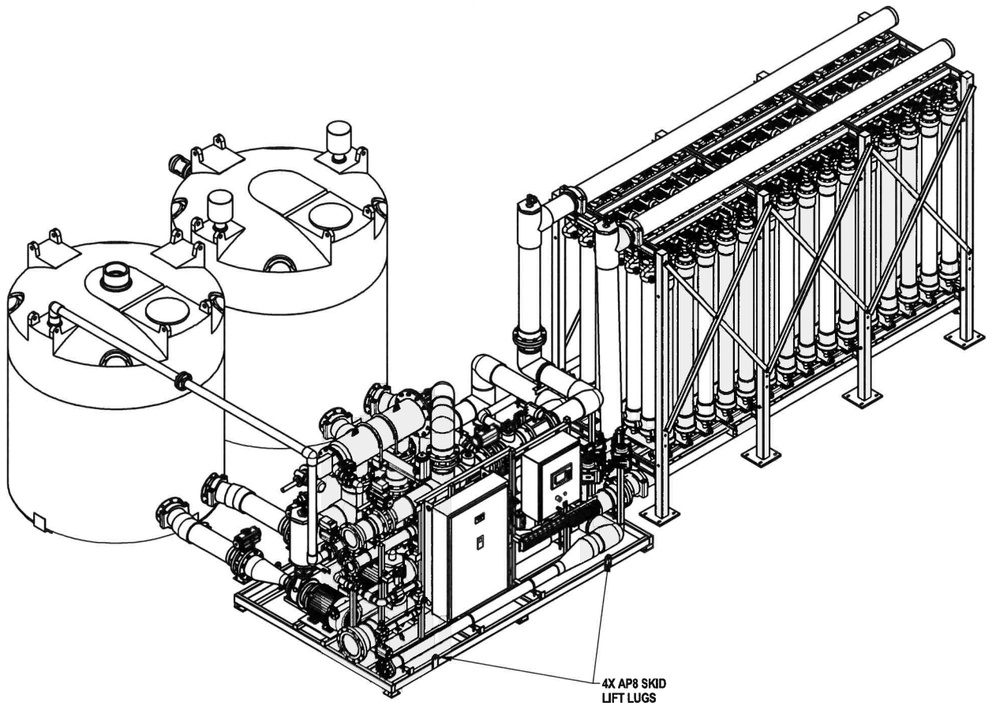
REVISION: 01
MATERIAL MASTER: ---
DWG SIZE: D
SHEET 1 OF 3
FORMAT VER: R2013.4



LEFT / FRONT ISOMETRIC VIEW
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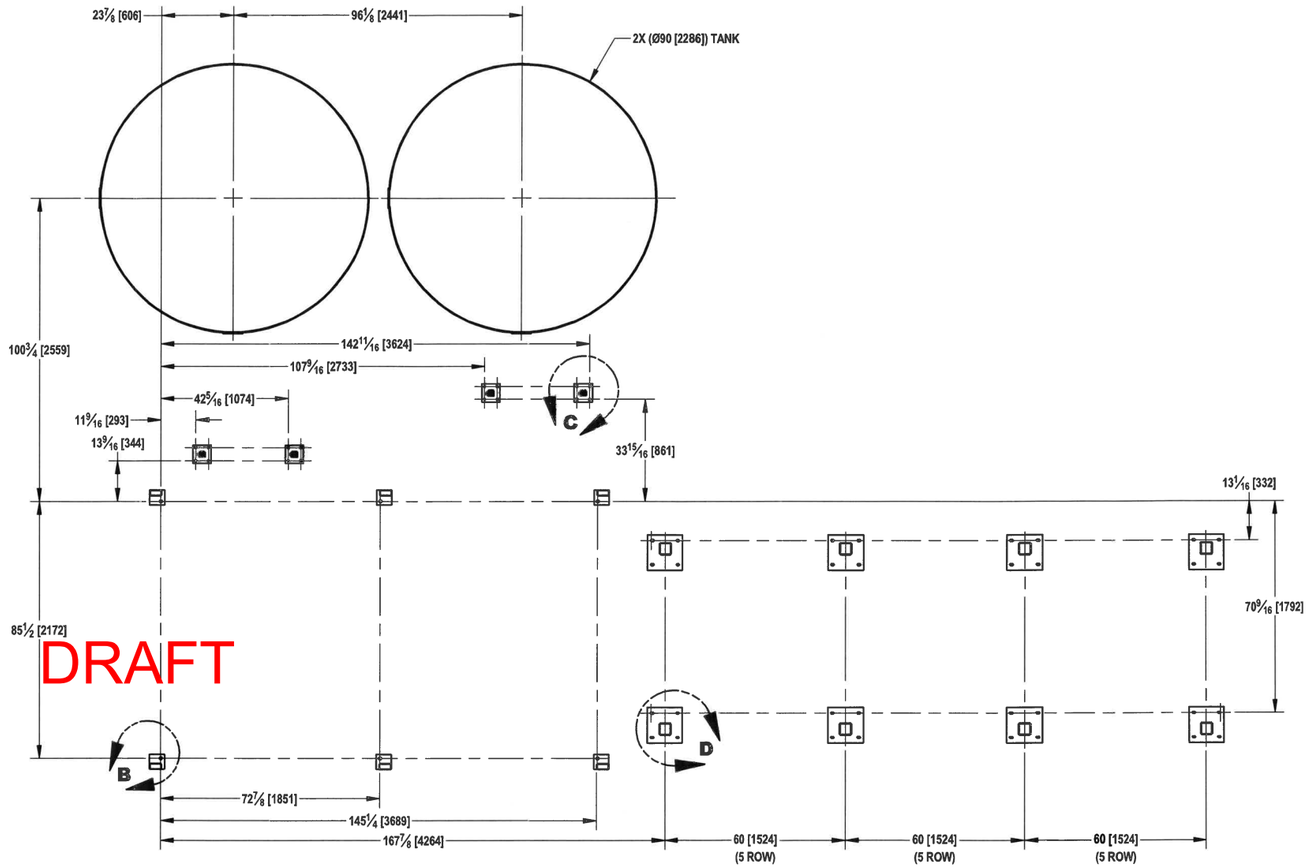
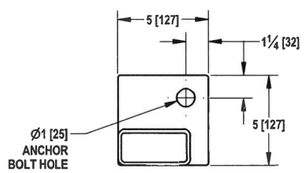
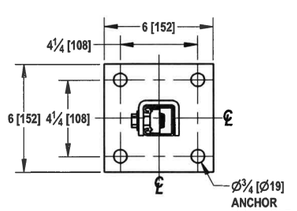


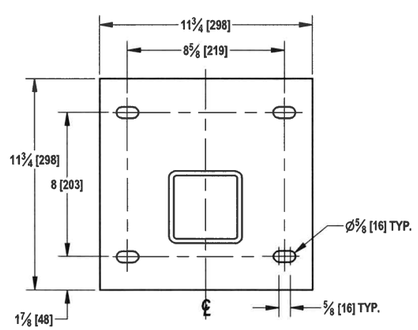
SECTION A-A
-EQUIPMENT BASES-
SCALE 1 / 24



DETAIL B
AP8 SKID BASEPLATE
(TYPICAL (6) LOCATIONS)
SCALE 1 / 4



DETAIL C
PIPING SUPPORT BASEPLATE
(TYPICAL (4) LOCATIONS)
SCALE 1 / 4



DETAIL D
MODULE RACK BASEPLATE
(TYPICAL (__) LOCATIONS)
SCALE 1 / 4

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TOLERANCE: ANGLE ± 1/2 DEG; FRACTION ±1/4 [6]; .XXXX ±; .XXX ±; .XX ±; .X ±; X. ±
ALL FINISHED SURFACES ✓ µIN ✓ µm
SCALE AS NOTED — DO NOT SCALE FROM DRAWING
THIRD ANGLE PROJECTION

	NAME	DATE
DRAWN BY	D. TRAVIS	14AUG2018
PROJECT ENGINEER	J. GRIFFIN	24SEP2018
ENGINEER	--	--
ENGINEER	--	--
ENGINEER	--	--
CHECKER	K. HAWKS	24SEP2018

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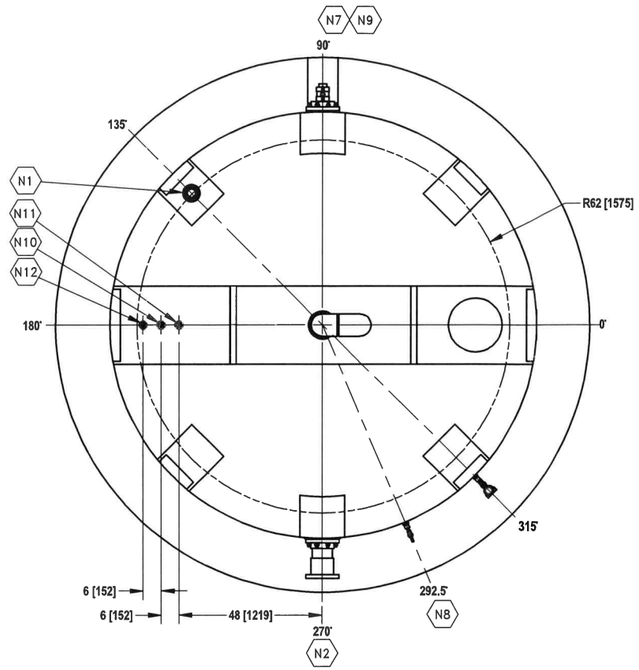
DRAWING NUMBER NYCS000011237
REVISION 01
MATERIAL MASTER ---
DWG SIZE D
SHEET 2 OF 3
FORMAT VER: R2013.4

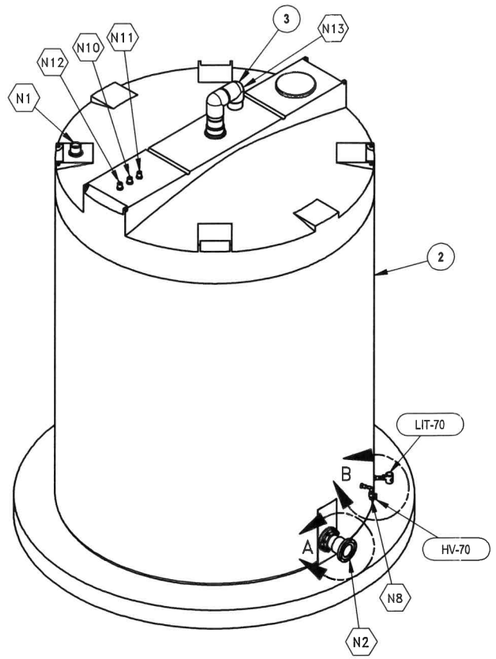
REVISION	REVISION DESCRIPTION	CHG BY	PROJ ENG	ENG/APVD	ENG/APVD	ENG/APVD	CHK/APVD
01	REVISED FOR VENDOR BUILT ASSEMBLY	SS 25/JUN/2018	JG 25/JUL/2018				KH 25/JUL/2018

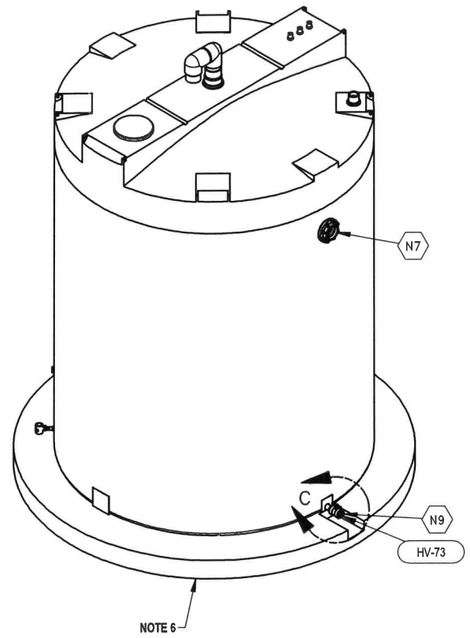
CONNECTION TABLE

CONNECTION	SIZE	DESCRIPTION	TYPE	MAT'L
MANWAY	15" [381]	MANWAY	SCREWED LID	HDPE
N1	3" [80]	TANK RETURN INLET	SOCKET WELD	PVC
N2	6" [150]	OUTLET	150LB FLANGE	PVC
N7	6" [150]	OVERFLOW	SOCKET WELD	PVC
N8	1/2" [15]	SAMPLE PORT	FNPT	PVC
N9	2" [50]	DRAIN	FNPT	PVC
N10	1" [25]	CAUSTIC INLET	FNPT	PVC
N11	1" [25]	ACID INLET	FNPT	PVC
N12	1" [25]	SODIUM BISULFITE INLET	FNPT	PVC
N13	6" [150]	VENT	SOCKET WELD	PVC
LIT-70	1/2" [15]	LEVEL INDICATING TRANSMITTER	FNPT	SST



PLAN VIEW
SCALE 1 / 24





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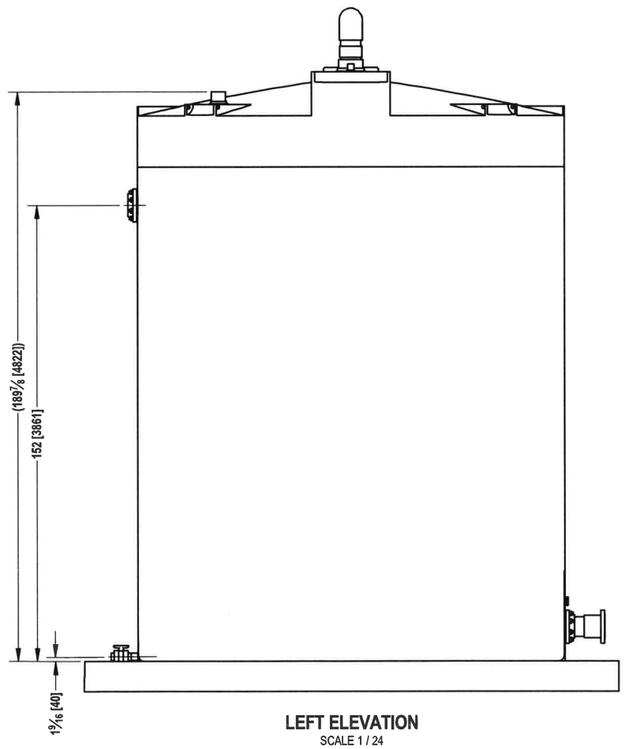
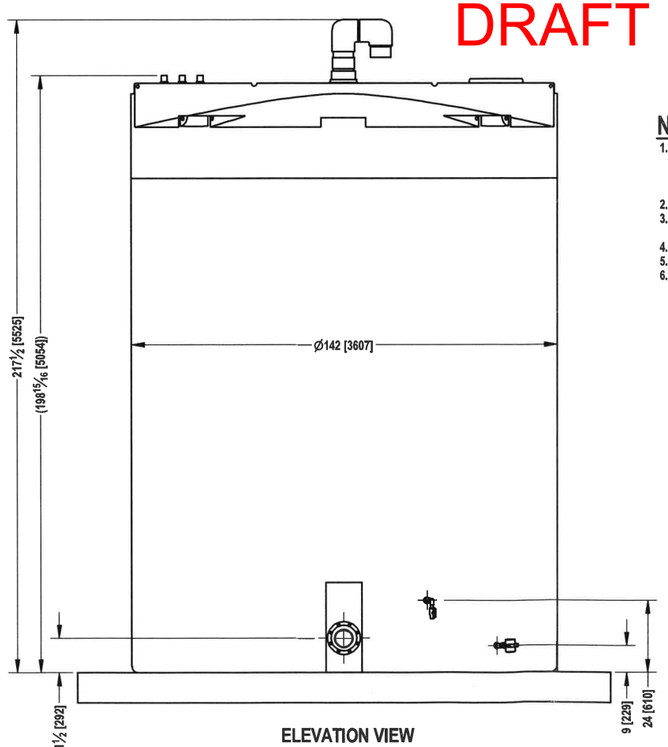


LEFT ELEVATION
SCALE 1 / 24



ELEVATION VIEW
SCALE 1 / 24

NOTES:

1. MATERIALS OF CONSTRUCTION:
   TANK HDPE - SNYDER MODEL 5350
   FITTINGS - PVC
   GASKETS - EPDM
2. HIGH DENSITY LINEAR POLYETHYLENE (HDLPE) WHITE. SPECIFIC GRAVITY RATING 1.9.
3. REFER TO TANK MANUFACTURER'S INSTALLATION DOCUMENT FOR SPECIFIC FABRICATION / INSTALLATION REQUIREMENTS.
4. ALL ITEMS SHOWN ARE SUPPLIED LOOSE FOR FIELD INSTALLATION BY OTHERS.
5. PIPING CONNECTIONS TO TANK MUST BE ADEQUATELY SUPPORTED TO PREVENT NOZZLE LOADS ON THE TANK.
6. TANK FOUNDATION (SUPPLIED AND DESIGNED BY OTHERS) REQUIRES A RECESS 10" MINIMUM WIDE, 5" MINIMUM DEPTH EXTENDING FROM TANK WALL OUT 18" MINIMUM AT DRAIN CONNECTION. THIS RECESS IS FOR PROPER ACCESS AND OPERATION OF DRAIN VALVE.

CAPACITY: 12,500 GALLONS
DESIGN PRESSURE: ATM
DESIGN OPERATING TEMPERATURE: 104°F
MAXIMUM ALLOWABLE FLUID TEMPERATURE: 104°
ESTIMATED DRY WEIGHT: 4,200 LBS.
ESTIMATED WET WEIGHT: 110,450 LBS.

ITEM	QTY	NAME	DESCRIPTION	MM#	LENG	COMMENTS	MATL	APP CODE	MFR	MFR P/N
11	1	VALVE,BALL	2 in NPT SCH 80 235 PSI TRUE UNION	WH018230		EPDM O-RING	PVC/EPDM	ASTM F 1970	SPEARS MFG	3629-020
10	1	VALVE,BALL	1/2 FNPT 235 PSI FULL LEVER,COMPACT	WH068191		REFER TO MM#	PVC	ASTM F 1970	SPEARS MFG	2121-005
9	1	NIPPLE,PIPE	6 SCH 80 NSF	WH085012	6 in	TBE	PVC GRAY	ASTM D1785	SPEARS MFG	892-060
8	1	NIPPLE,PIPE	2 in SCH 80 NSF	WH085010	3 1/2 in	TBE	PVC GRAY	ASTM D1785	SPEARS MFG	887-035
7	2	NIPPLE,PIPE	1/2 in SCH 80 NSF	WH085014	2 in	TBE	PVC GRAY	ASTM D1785	SPEARS MFG	882-020
6	1	NIPPLE,PIPE	1/2 SCH 40 NPT	WH012123	1 1/2 in	TBE	A312 TP316	ASME B36.19		
5	1	INSTR,PRESSURE	TRANSMITTER 1/2in NPT 0-30 PSI	WH020129		REFER TO MM#	316 SST		ROSEMOUNT	2088G1S22A1C6M5Q4DW
4	1	FLANGE,VANSTONE	6 RF 150 LB FNPT SCH 80	WH085013			PVC GRAY	ASTM D1784	SPEARS MFG	855-060
3	1	EQUIP,U VENT	GIN SCH 40	WH085015			PVC		SNYDER	347197
2	1	EQUIP,TANK	142 DIA 12,500 GALLON NEUT AP	APX3501011						
1	1	ELBOW,WELD	1/2 FNPT SCH 80 90°	WH056052			PVC GRAY	ASTM D2467	SPEARS MFG	808-055R

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DIMENSIONS ARE IN: ☐ INCHES ONLY ☐ MILLIMETERS ONLY ☒ IN [mm] ☐ mm [IN]

TOLERANCE: ANGLE ± 1/2 DEG; FRACTION ± 1/4 [6]; XXXX ±; XXX ±; .XX ±; .X ±; X. ±

ALL FINISHED SURFACES ✓ µIN ✓ µm

SCALE 1:24 — DO NOT SCALE FROM DRAWING

THIRD ANGLE PROJECTION

	NAME	DATE
DRAWN BY	S. SMITH	16/JUL/2018
PROJECT ENGINEER		
ENGINEER	–	–
ENGINEER	–	–
ENGINEER	–	–
CHECKER	–	–

CODE IDENTIFICATION NO. 17238
PROJECT ID AP STD
DRAWING NAME ASSY, TANK, GA, 12500 GAL, NEUT, AP, R1.0

PALL Corporation
Pall Advanced Separation Systems
Industrial, Cortland NY

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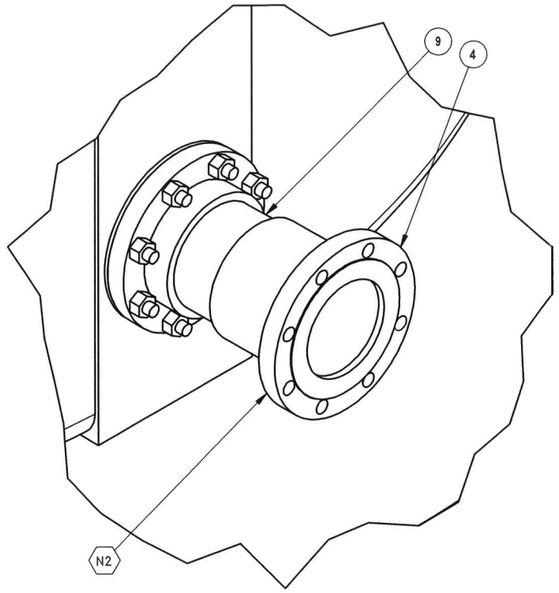
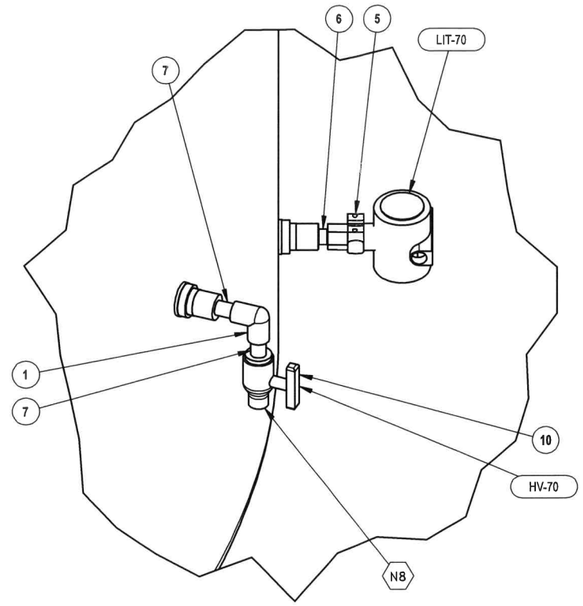
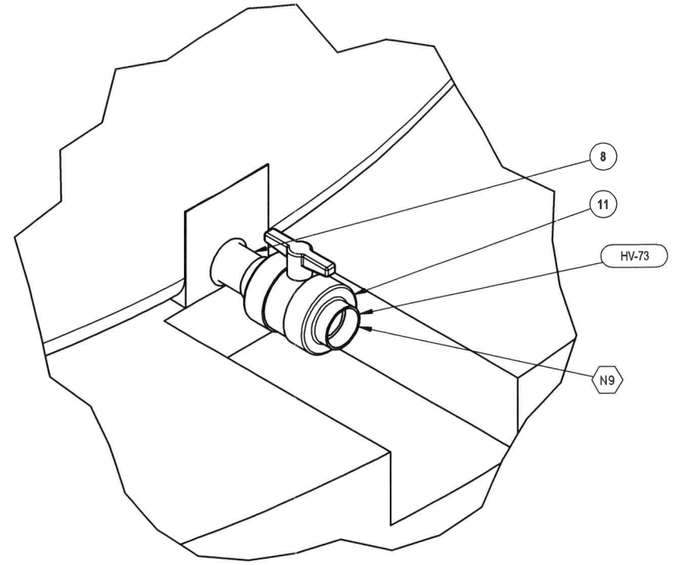
DRAWING NUMBER NYCS000010881 — REVISION 01
MATERIAL MASTER APX3501001 — DWG SIZE D — SHEET 1 OF 2
FORMAT VER: R2013.4



DETAIL A
SEE NOTE 4
SCALE 1 / 4



DETAIL B
SEE NOTE 4
SCALE 1 / 4



DETAIL C
SEE NOTE 4
SCALE 1 / 4

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ALL FINISHED SURFACES √ µIN √ µm

SCALE AS NOTED — DO NOT SCALE FROM DRAWING

THIRD ANGLE PROJECTION

TOLERANCE: ANGLE ± 1/2 DEG; FRACTION ± 1/8; .XXXX ±; .XXX ±; .XX ±; .X ±; X. ±

	NAME	DATE
DRAWN BY	S. SMITH	16/JUL/2018
PROJECT ENGINEER		
ENGINEER	–	–
ENGINEER	–	–
ENGINEER	–	–
CHECKER		

CODE IDENTIFICATION NO. 17238

PROJECT ID AP STD

DRAWING NAME ASSY, TANK, GA, 12500 GAL, NEUT, AP, R1.0

PALL Corporation
Pall Advanced Separation Systems
Industrial, Cortland NY

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DRAWING NUMBER NYCS000010881 — REVISION 01
MATERIAL MASTER APX3501001 — DWG SIZE D — SHEET 2 OF 2
FORMAT VER: R2013.4

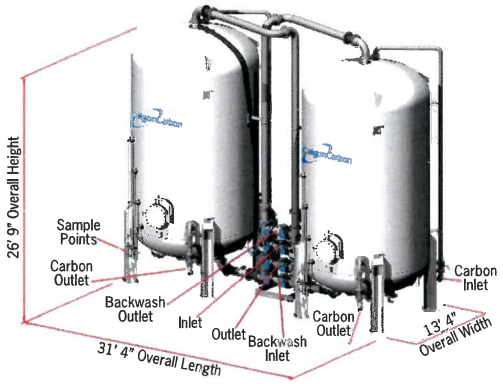
APPENDIX D

CALGON CORPORATION GAC DATASHEETS AND PRELIMINARY DRAWINGS

DRAFT

MODEL 12-40

Modular Carbon Adsorption System



Description

The Calgon Carbon MODEL 12-40 is an adsorption system designed for the removal of dissolved organic contaminants, including disinfection byproducts (DBP) or natural organic matter (NOM) from liquids using granular activated carbon (GAC). The vessels are sized to hold 40,000 pounds of GAC, which provides the additional contact time required to remove either compounds at low concentrations or poorly adsorbing compounds. The standard design (MODEL 12-40 SYSTEM) consists of two vessels combined with a centralized pipe manifold to allow for series operation. Many of the DBP installations utilize multiple vessels operated in parallel. For these cases, an optional offering is the single vessel concept (MODEL 12-40 SINGLE). This flexibility of configurations allows the engineer to select the alternative that best meets the requirements of the site and treatment objectives.

The MODEL 12-40 SYSTEM is delivered as two adsorbers, a centrally located valve manifold and interconnecting piping requiring minimal space and field assembly. The process piping network for the MODEL 12-40 SYSTEM accommodates operation of the adsorbers in series (with either adsorber placed in first stage) or parallel. The valve manifold can be configured to isolate either adsorber from the flow, which permits carbon exchange or backwash operations to be performed on one adsorber without interrupting treatment. Each vessel is provided with GAC fill and discharge pipe including appropriate quick connect fittings for connection to water and compressed air sources. All valves and accessories are located at low elevations for ease of operation and maintenance.

The MODEL 12-40 SINGLE is delivered as a single adsorber with process pipe extending to grade. The single vessel is typically provided for systems consisting of multiple units operated in parallel. Process valves are not part of the standard package but can be supplied as an option. The vessel is provided with GAC fill and discharge pipe including appropriate quick connect fittings for connection to water and compressed air sources. All valves and accessories are located at low elevations for ease of operation and maintenance.

The MODEL 12 vessels – either systems or single vessels – are provided with features common in either configuration:

- The unique internal cone under-drain design provides for the efficient collection of treated water and the distribution of backwash water. The internal cone also insures efficient and complete discharge of spent carbon from the adsorber without the need to open the manway to manually wash out the residual spent carbon.
- In bed sample ports. The MODEL 12 vessel is provided with three (3) nozzles located along the straight side of the vessel. These nozzles can be fitted with in-bed sample assemblies which allow the operator to monitor the progress of the adsorbent as it flows through the bed. For the MODEL 12-40 SYSTEM in-bed sample assemblies are an option. For the MODEL 12-40 SINGLE in-bed sample assemblies are standard.
- The MODEL 12 vessel is provided with one (1) GAC fill line and two (2) GAC discharge lines. The multiple discharge lines are positioned to each extract 20,000 pounds of spent carbon. This feature minimizes the time required for GAC exchanges by eliminating the guesswork of loading the spent to the trailers. The one (1) side mounted discharge nozzle is provided with a stainless steel insert which has two functions. The stainless nozzle projects into the vessel and protects the lining during carbon exchange. Also, since GAC can vary in density depending on starting material and activity, the discharge nozzle inserts can be rotated 360 degrees to accommodate the differing densities. If the nozzle insert wears away, it is designed to be easily removed and replaced.
- The MODEL 12 vessel is sized to contain 40,000 lbs of GAC and to allow for backwash expansion of approximately 25% contained within the straight side of the vessel.

The pre-engineered MODEL 12-40 design assures that all adsorption system functions can be performed with the system as provided. Standard designs have the benefit of Calgon Carbon's extensive expertise and have been proven in numerous applications. The engineering package can be provided quickly and the system expedited through Calgon Carbon's production capabilities.

DRAFT

Safety Message

Wet activated carbon can deplete oxygen from air in enclosed spaces. If use in an enclosed space is required, procedures for work in an oxygen deficient environment should be followed.

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The MODEL 12-40 system is designed for use with Calgon Carbon's closed loop carbon exchange service. Using specially designed carbon transport trailers, the spent carbon can be removed from the adsorber via pressurized carbon-water slurry and fresh carbon refilled in the same manner. This closed loop transfer is accomplished without exposure of personnel to either spent or fresh carbon. Calgon Carbon can also manage the disposition of the spent carbon, which is typically returned to Calgon Carbon for reactivation – avoiding the need for the site to arrange for disposal.

Carbon Adsorbers	System	Single
Carbon Steel ASME code pressure vessels	✓	✓
Internal vinyl ester lining (nominal 35 to 45 mil) where GAC contacts steel for potable water and most liquid applications	✓	✓
Polypropylene slotted nozzles for water collection and backwash distribution	✓	✓
Standard Adsorption System Piping	✓	✓
Schedule 40 carbon steel process piping with cast iron fittings	✓	✓
Cast iron butterfly valves for process piping	✓	●
Full bore stainless steel ball valves for GAC fill and discharge	✓	✓
PPL lined steel pipe for GAC discharge	✓	✓
Pressure relief using graphite rupture discs	✓	✓
Pressure gages to measure pressure drop across system and each adsorber	✓	✓
System External Coating	✓	✓
High solids epoxy paint system	✓	✓
System skid, shipped seperately, upon which system components can be assembled	●	●
In-bed water sample collection probes	●	✓

✓ Included as Standard ● Available as Option



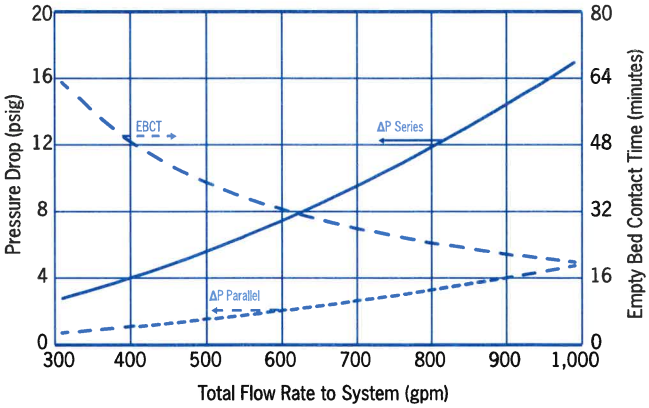
Dimensions and Field Conditions	MODEL 12-40
Adsorber Vessel Diameter	12' (3,660 mm)
Process and Backwash Pipe	8"
Process Pipe Connection	125# ANSI flange
Utility Water Connection	3/4" hose connection
Utility Air Connection	3/4" hose connection
Carbon Hose Connection	4" Kamlock type
Backwash Connections	8" flange
Drain/Vent Connection	8" flange
Adsorber Maintenance Access	20" round flanged man-way, 14" x 18" man-way below cone
Adsorber Shipping Weight	25,400 lbs. empty (11,550 kg)
System Operating Weight	385,000 lbs. (175,000 kg)

Operating Conditions	MODEL 12-40
Carbon per Adsorber	40,000 lbs. (18,180 kg)
Pressure Rating	125 psig (862 kPa) @ 140°F
Pressure Relief	Graphite rupture disk (125 psig)
Temperature Rating	140°F maximum (60°C)
Backwash Rate	Typical 1,700 gpm (25% expansion)
Carbon Transfer	Air pressure slurry transfer
Utility Air	100 scfm at 30 psig (reduce to 15 psig for trailer)
Utility Water	100 gpm at 30 psig
Freeze Protection	None provided; enclosure or protection recommended

DRAFT

Pressure Drop Model 12-40 System

with 40,000 lbs. 8x30 Mesh GAC per Vessel 8" Sch. 40 Pipe, 60°F



Safety Message

Wet activated carbon can deplete oxygen from air in enclosed spaces. If use in an enclosed space is required, procedures for work in an oxygen deficient environment should be followed.

1.800.4CARBON calgoncarbon.com

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DS-MODEL124015-EIN-E1

FILTRASORB® 400

Granular Activated Carbon

Applications

- Industrial Wastewater
- Groundwater
- Surface Water
- Pond/Aquarium/ Swim
- Bottle & Brewing
- Water Processing
- Pharmaceuticals
- Environmental Water
- Food & Beverage
- Drinking Water Industrial
- Water Reuse
- Drinking Water (Potable)
- Granular Activated Carbon
- Municipal
- Reactivation

FILTRASORB 400 activated carbon can be used in a variety of liquid phase applications for the removal of dissolved organic compounds. FILTRASORB 400 has been successfully applied for over 40 years in applications such as drinking and process water purification, wastewater treatment, and food, pharmaceutical, and industrial purification.

DRAFT

Description

FILTRASORB 400 is a granular activated carbon for the removal of dissolved organic compounds from water and wastewater as well as industrial and food processing streams. These contaminants include taste and odor compounds, organic color, total organic carbon (TOC), industrial organic compounds such as TCE and PCE, and PFAS.

This activated carbon is made from select grades of bituminous coal through a process known as reagglomeration to produce a high activity, durable, granular product capable of withstanding the abrasion associated with repeated backwashing, hydraulic transport, and reactivation for reuse. The raw coal is mined and subsequently manufactured into GAC in the United States to ensure the highest quality and consistency in the finished product. Activation is carefully controlled to produce a significant volume of both low and high energy pores for effective adsorption of a broad range of high and low molecular weight organic contaminants.

FILTRASORB 400 is formulated to comply with all the applicable provisions of the AWWA Standard for Granular Activated Carbon (B604) and Food Chemicals Codex. This product may also be certified to the requirements of NSF/ANSI 61 for use in municipal water treatment facilities. Only products bearing the NSF Mark are certified to the NSF/ANSI 61 - Drinking Water System Components - Health Effects standard. Certified Products will bear the NSF Mark on packaging or documentation shipped with the product.

Features / Benefits

- Produced in the United States from a pulverized blend of high quality, domestically mined bituminous coals resulting in a consistent, high quality product.
- Carbon granules are uniformly activated through the whole granule, not just the outside, resulting in excellent adsorption properties and constant adsorption kinetics.
- The reagglomerated structure ensures proper wetting while also eliminating floating material.
- High mechanical strength relative to other raw materials, thereby reducing the generation of fines during backwashing and hydraulic transport.
- Carbon bed segregation is retained after repeated backwashing, ensuring the adsorption profile remains unchanged and therefore maximizing the bed life.
- Reagglomerated with a high abrasion resistance, which provides excellent reactivation performance.
- High density carbon resulting in a greater adsorption capacity per unit volume.

Specifications[1]	FILTRASORB 400
Iodine Number, mg/g	1000 (min)
Moisture by Weight	2% (max)
Effective Size	0.55–0.75 mm
Uniformity Coefficient	1.9 (max)
Abrasion Number	75 (min)
Screen Size by Weight, US Sieve Series	
On 12 mesh	5% (max)
Through 40 mesh	4% (max)

[1]Calgon Carbon test method

Typical Properties*	FILTRASORB 400
Apparent Density (tamped)	0.54 g/cc
Water Extractables	<1%
Non-Wettable	<1%

*For general information only, not to be used as purchase specifications.

Safety Message

Wet activated carbon can deplete oxygen from air in enclosed spaces. If use in an enclosed space is required, procedures for work in an oxygen deficient environment should be followed.

1.800.4CARBON calgoncarbon.com

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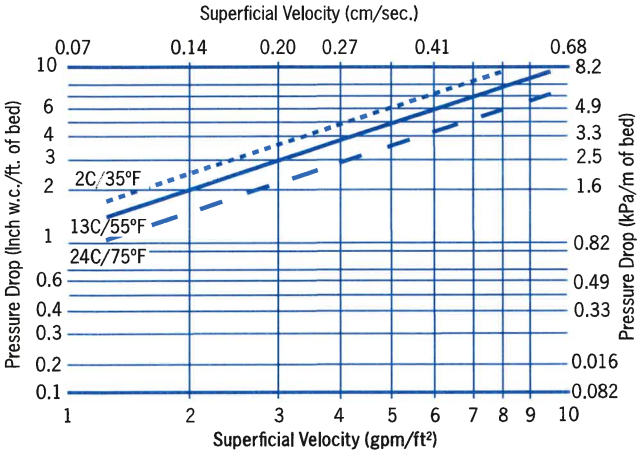
DS-FILTRA40019-EIN-E1

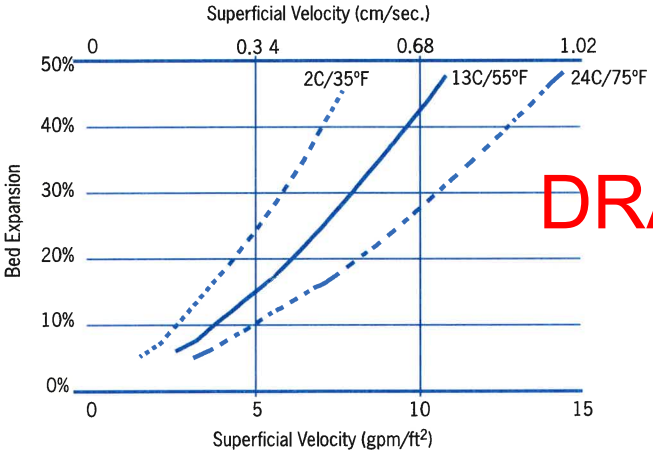
Typical Pressure Drop

Based on a backwashed and segregated bed



Typical Bed Expansion During Backwash

Based on a backwashed and segregated bed



Conditioning and Backwashing

Backwashing and conditioning fresh GAC before placing into operation is critical to GAC performance. The reasons for backwashing before placing fresh media online are to: (1) size segregate the media so subsequent backwashing will return the media to the same relative position in the bed, (2) remove any remaining air from the bed, and (3) remove media fines which can lead to excessive pressure drop and flow restriction. In addition, proper backwashing is a crucial step to collecting the most representative and meaningful post-start up data on compounds of interest, such as metals listed in the NSF/ANSI 61 standard.

Below are the recommended steps for proper conditioning and backwashing of GAC based on Filtrasorb 400 GAC being backwashed at 55°F:

1. Fully submerge GAC bed in clean, contaminant free water for at least 16 hours (overnight)
2. Open backwash inlet and begin up-flow at 3 gpm/ft² for 2 minutes
3. Increase flow to 5 gpm/ft² and maintain for 2 minutes
4. Increase flow to 7 gpm/ft² and maintain for 2 minutes
5. Increase flow to 8.5 gpm/ft² and maintain for 30 minutes*
6. Decrease flow to 7 gpm/ft² and maintain for 2 minutes
7. Decrease flow to 5 gpm/ft² and maintain for 2 minutes
8. Decrease flow to 3 gpm/ft² and maintain for 2 minutes
9. Close backwash inlet and stop flow

*Duration representative of initial backwash conditions. Required duration during operational backwashes can be shorter but will vary by utility, solids load, and GAC throughput. Contact Calgon Carbon for more information"

DRAFT

Design Considerations

FILTRASORB 400 activated carbon is typically applied in down-flow packed-bed operations using either pressure or gravity systems. Design considerations for a treatment system is based on the user's operating conditions, the treatment objectives desired, and the chemical nature of the compound(s) being adsorbed.

Safety Message

Wet activated carbon can deplete oxygen from air in enclosed spaces. If use in an enclosed space is required, procedures for work in an oxygen deficient environment should be followed.

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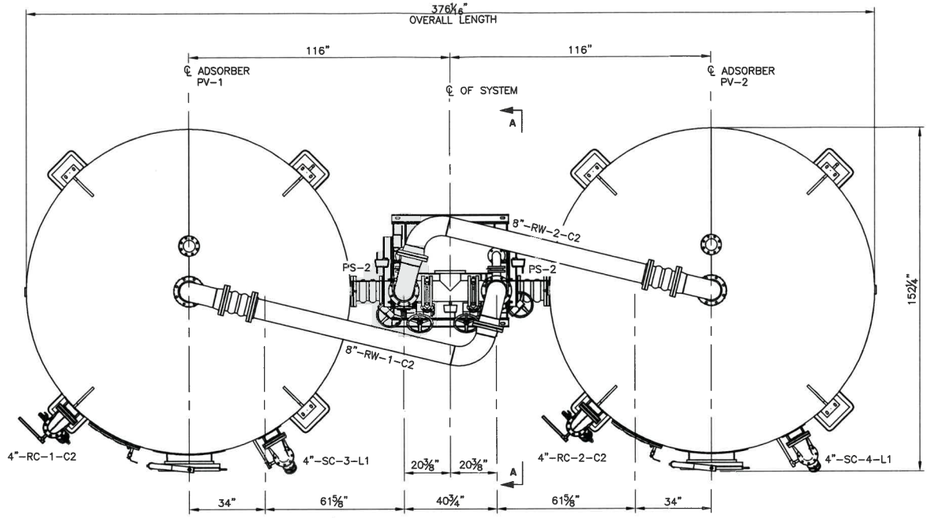
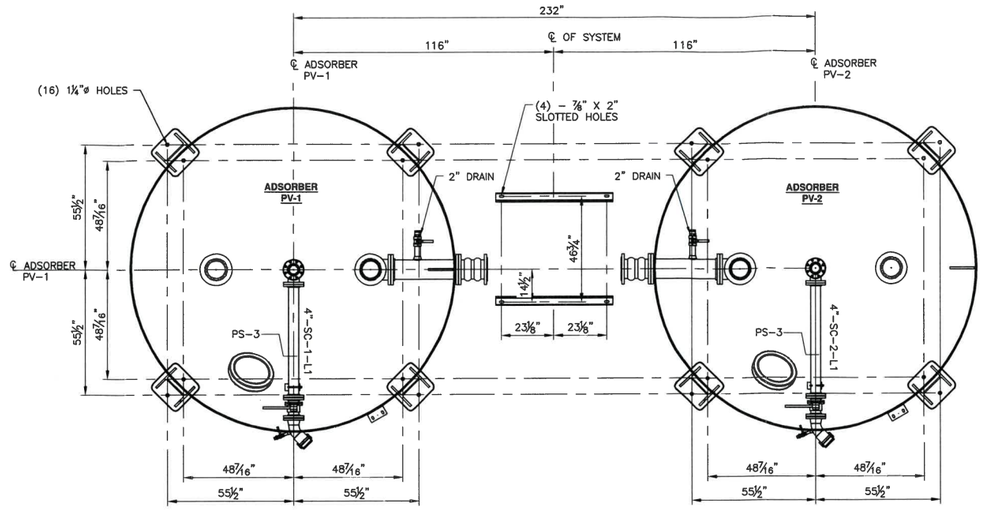
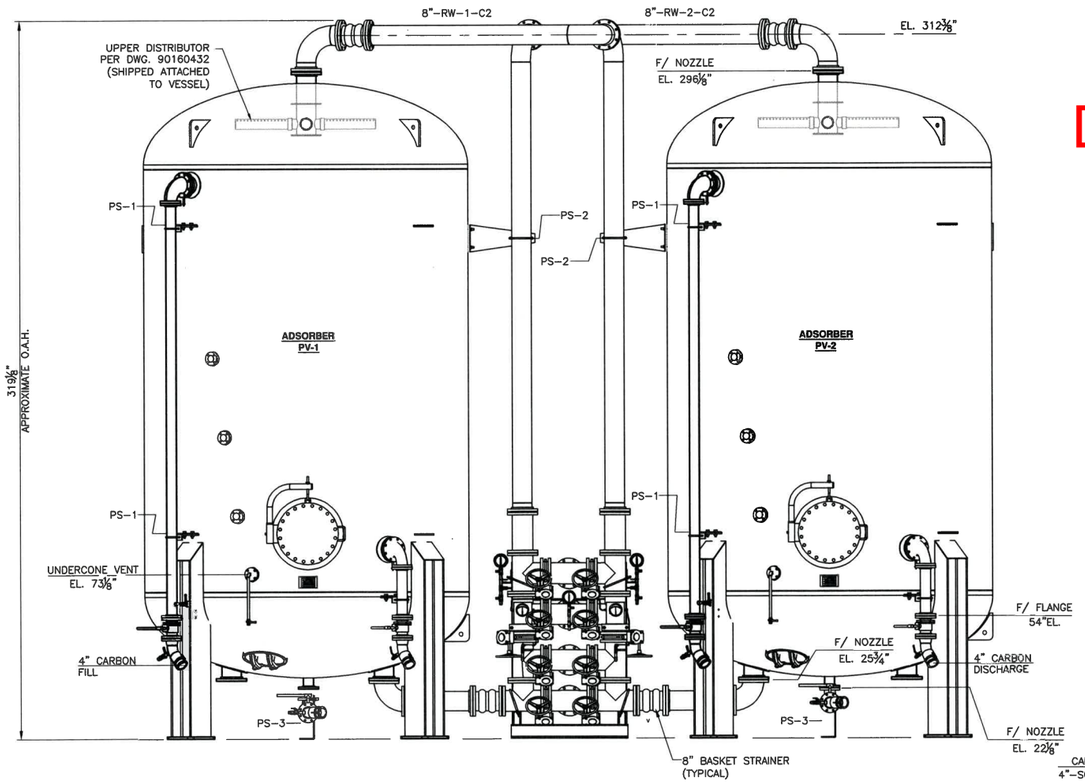




SYSTEM DATA	
DESIGN CONDITIONS	125 PSIG @ 140° F
DESIGN CODE	ASME SECTION VIII DIVISION1
APPROXIMATE WEIGHTS (LB.)	
VESSEL (EMPTY)	31,000
CARBON (PER VESSEL)	40,000
VESSEL (OPERATING)	191,000
SYSTEM (EMPTY)	69,000
SYSTEM (OPERATING)	391,000

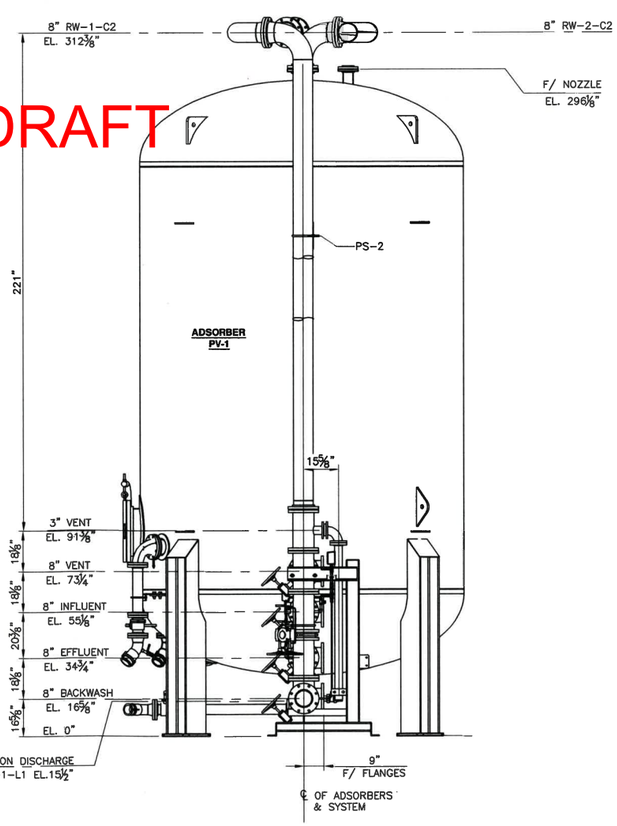
	PIPE SUPPORT SCHEDULE		
#	DRAWING NO.	DESCRIPTION	QTY.
PS-1	90160401	4" CARBON FILL 4" CARBON DISCHARGE (UPPER)	6
PS-2	90130162	8" INFLUENT	2
PS-3	90130158	4" CARBON DISCHARGE	2

PLAN

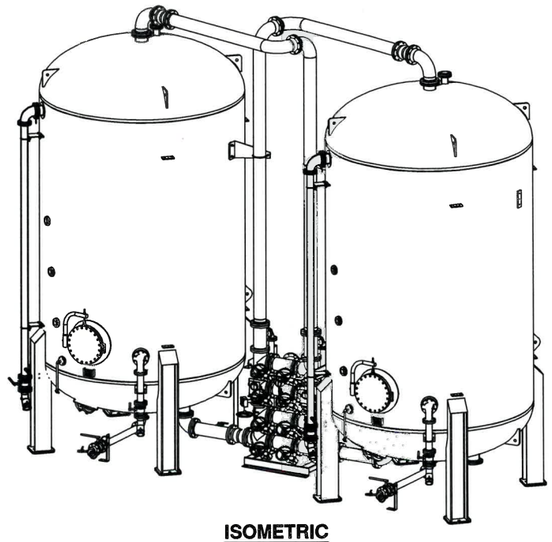


ELEVATION

ANCHOR BOLT PLAN



VIEW A-A



ISOMETRIC

DRAFT

REV	DESCRIPTION	APP	DATE
0	ISSUED FOR FABRICATION	MA	5/31/17

REVISIONS

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

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	NAME	DATE
DRAFTER	JFS	5/9/17
DESIGNER		
CHECKER	M. ANTONETTI	5/24/17
APPROVAL		
PROJECT No.	STANDARD	

CalgonCarbon

CLIENT: STANDARD

TITLE: MODULAR ADSORBER SYSTEM MODEL 12-40, 8" PIPING GENERAL ARRANGEMENT

DWG. Size	SHEET No.	SCALE
D	1 OF 1	NONE

DWG. No. 90110100 REV. 0

V:\Products\Carbon\Model 12-40\General Arrangement\90110100 M12-40 GA.dwg Jun 01, 2017 - 2:51pm

KEANE
ENTERPRISES

June 2, 2022

Ms. Kristen Stolipher, Utility General Manager
Charles Town Utility Board
661 South George Street, Suite 101
Charles Town, WV 25414

Dear Ms. Stolipher,

Keane Enterprises is the contract purchaser of Miller Station, located at the intersection of Patrick Henry Way and Captain Chews Trace. Please let this letter serve as our formal request to be placed on the June 8th, 2022 agenda CTUB's regular Board meeting to review the sanitary sewer situation at Miller Station.

The property is owned by the family of Dr. Gerald Miller, who passed a few years ago. Dr. Miller's intent was to sell finished commercial pads and the site is improved with water, sanitary sewer, storm water management and paving. The plan was to connect to a pump station located at the northeast corner of the property (see highlights on the next page from a 2008 existing conditions plat by Alpha). The development plans stalled, and in the meantime CTUB decommissioned the pump station intended to serve the site. The property owner has no record of a notice from CTUB about this change. In fact, our civil (MRA) visited their civil's office (Alpha) to examine their records related to this and found nothing.

Our intent is to develop 218 garden style apartments, likely to be configured in 6-8 buildings. The grade of the site makes it impossible for a gravity connection to the sanitary line in Patrick Henry Way. The solution is either a new pump station on site or perhaps grinder pumps for each individual building. We contacted STH, Inc. out of Frederick MD for guidance on costs for these solutions. They estimated $35-40K per building for grinder pumps, and about $250K for a dedicated pump station, not including install.

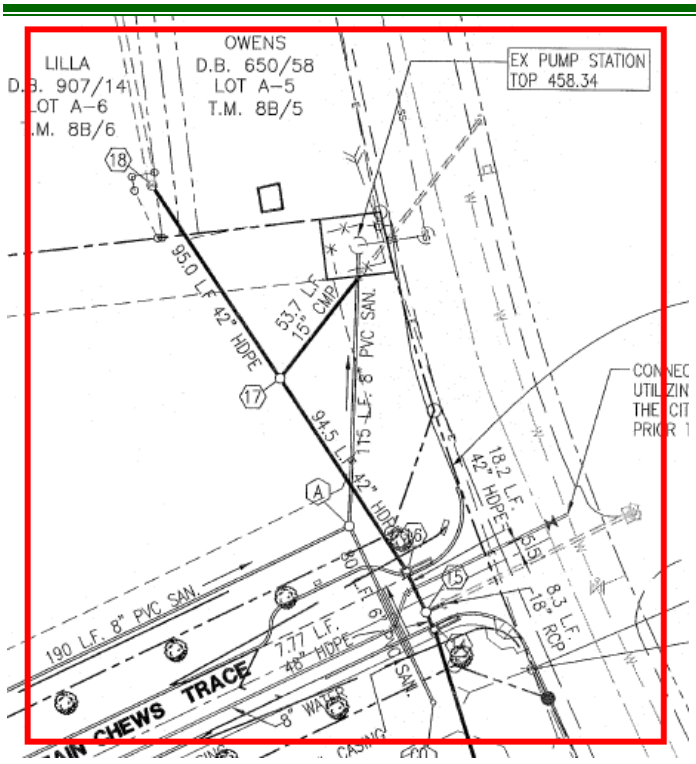
These are preliminary estimates and of course would change as design and engineering is advanced, but we were alarmed by the prices and felt a formal discussion with CTUB is required. We did not budget for this expense as it was assumed we could tie into the (now decommissioned) pump station when we put the property under contract.

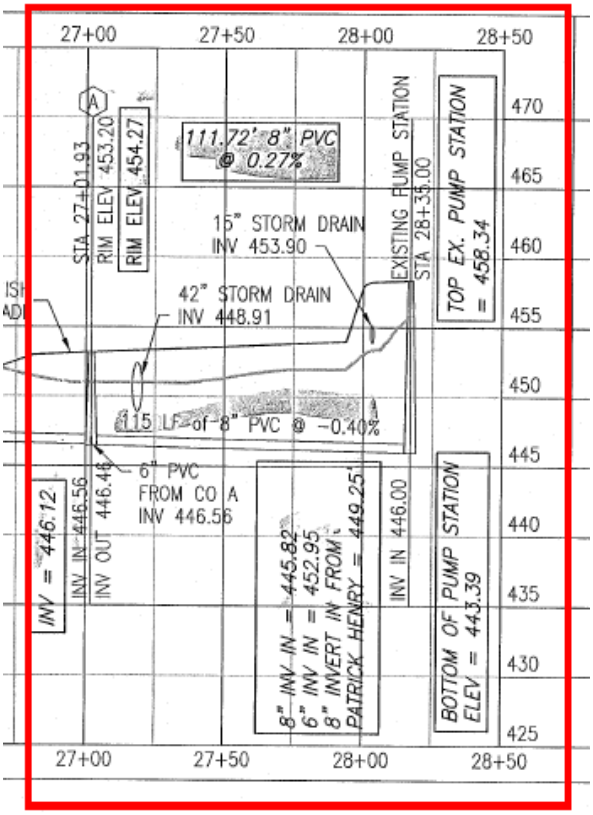
Thanks for your attention to this matter.

Sincerely,

Andrew Shuckra
Principal, Keane Enterprises Inc.

44031 Pipeline Plaza, Suite 100
Ashburn, VA 20147
Phone: 571-223-0001





44031 Pipeline Plaza, Suite 100
Ashburn, VA 20147
Phone: 571-223-0001

CHARLES TOWN UTILITY BOARD
WATER/SEWER SYSTEMS UPGRADE PROJECTS

RUMMEL, KLEPPER & KAHL, LLP

TASK NO. 05
SCOPE OF WORK CHANGE NO. 02

PROFESSIONAL ENGINEERING & SURVEYING SERVICES

SEWER MODEL UPDATE
KING'S CROSSING AND HILLSIDE – SANITARY SEWER REVIEW

June 1, 2022

Being a part of Agreement Between
Charles Town Utility Board and Rummel, Klepper & Kahl, LLP
dated November 13, 2019

This Scope of Work Change No. 02 to Task No. 05 dated June 1, 2022 to Agreement between Charles Town Utility Board (CTUB) and Rummel, Klepper & Kahl, LLP (RK&K) dated November 13, 2019 is to provide professional engineering services for evaluating the feasibility and downstream impacts of connecting the proposed King's Crossing and Hillside Developments to the existing wastewater system. Evaluation will include assessing the available capacity of the gravity sewer system and force mains between the proposed connection point and the WWTP, including the Greenfield Pump Station, the Norborne Glebe Pump Station, and the Samuel Street Pump Station.

Scope of Services

The following summarizes RK&K's anticipated scope of services as part of this effort:

1. RK&K will expand the existing sewer model by including the existing gravity sewer system between the proposed King's Crossing and Hillside Subdivisions and the WWTP. The original sewer model only included main interceptors specified by CTUB which did not include the area of the collection system East of the Samuel Street Pump Station.
2. RK&K will work with CTUB Staff to analyze the existing collection system for expanding and calibrating the sewer model in this area. This effort will consist of flow monitoring and reviewing existing water meter usage data.
3. RK&K will utilize the flow monitoring data provided by CTUB Staff to calibrate the sewer model for the new area.
4. RK&K will create a flow scenario for the additional King's Crossing and Hillside proposed units within the two developments.
5. RK&K will utilize the sewer model to provide a summary of the existing capacity in the system between the proposed King's Crossing and Hillside Subdivisions and the WWTP.
6. RK&K will provide a technical memorandum summarizing the methodology and findings of the impact of the King's Crossing and Hillside units on the hydraulic model.

7. RK&K will propose a maximum of three (3) alternatives for conveying sewage from the proposed subdivisions to the WWTP and will prepare cost estimates for each alternative.

8. RK&K will meet with CTUB staff to review the letter style memorandum along with incorporating any comments received.

Schedule

Subject to CTUB review time and flow data results, RK&K anticipates sixty (60) working days to perform the evaluation from issuance of notice to proceed.

Estimated Person-Hours per Phase by Category, Engineer's Consultant Costs and Other Direct Costs

A fee derivation is attached as Page 4 which includes RK&K's estimated person-hours per Phase by category and other direct costs anticipated to complete the work for this project.

Materials and Resources Required of CTUB

- CTUB will be responsible for installing temporary flow monitors in the sewer manholes designated by RK&K over the 60-working day period. Responsibilities also include periodic downloading and processing of data for distribution to RK&K.

- CTUB will be responsible for providing updated pump runtime and flow monitoring (if available) for the Greenfield, Norborne Glebe, and Samuel Street Pump Stations

- CTUB will be responsible for providing O&M manuals, pump curves, and engineering drawings (if available) for the Greenfield, Norborne Glebe, and Samuel Street force mains and pump stations.

- CTUB will be responsible for providing record drawings showing invert elevations and pipe sizes (if available) for the gravity lines between the proposed developments and the CTUB WWTP.

Estimated Not-To-Exceed Fee

RK&K will provide the scope of services described above at an amount equal to Engineer's Direct Labor Costs times a factor of 2.7 for the services of Engineer's personnel engaged on the Project, plus Reimbursable Expenses.

The total estimated Not-to-Exceed fee to perform the work is $27,900.00 as shown on RK&K's enclosed fee derivation.

Authorization

This Scope of Work Change No. 02 to Task No. 05 Sewer Model Update for King's Crossing and Hillside Review dated June 1, 2022 and being a part of the Agreement between Charles Town Utility Board and Rummel, Klepper & Kahl, LLP for Engineering Services for Water/Sewer Systems Upgrade Projects dated November 13, 2019, is approved by the following duly authorized officials:

Engineer: RUMMEL, KLEPPER & KAHL, LLP

_____ 06/01/2022_____
John W. Cole, PE Date
Senior Manager, Municipal Engineering

Owner: Charles Town Utility Board

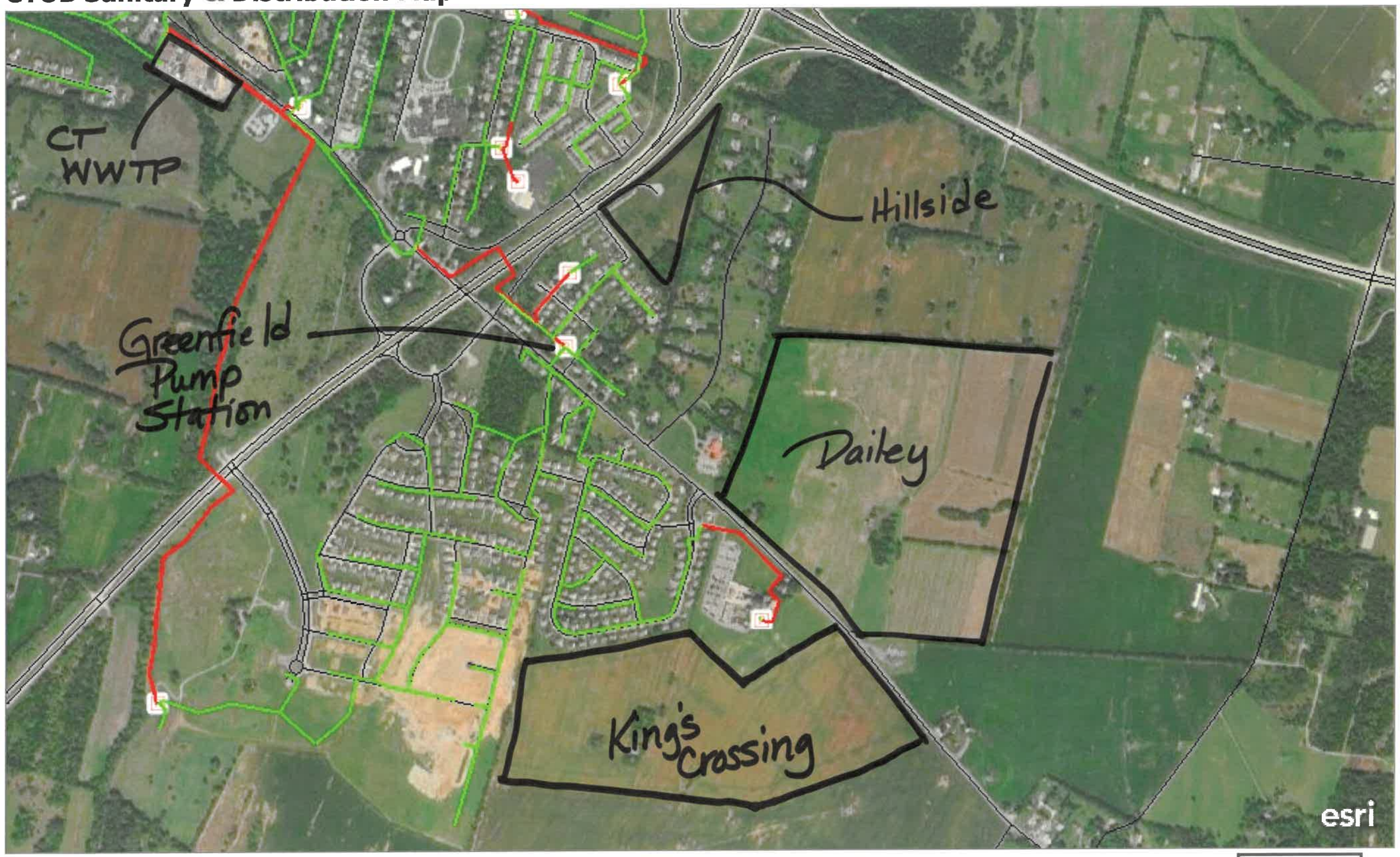
_____ _____
Bob Trainor Date
Interim Chairman

RUMMEL, KLEPPER KAHL, LLP
FEE DERIVATION
CHARLES TOWN UTILITY BOARD
TASK 05 SWC 02
SEWER MODEL
KING'S CROSSING AND HILLSIDE REVIEW
June 1, 2022

Scope of Services	Manager	Project Engineer	Associate Engineer	Senior Engineer	Engineer	GIS	Misc. Exp.	Task Total Hours
Technical Assistance								
Meetings	4		4	4				**12**
Pump Station Operational Data Review				20	8			**28**
Review of Available Data and Mapping			4		4			**8**
GIS Mapping and Input of Attributes						24		**24**
Current/Proposed Flow Estimates		8	4					**12**
Sewer Model - Existing/Proposed Conditions		16						**16**
Calibrate Sewer Model		8						**8**
Develop Alternatives		16						**16**
Technical Memorandum	1	24	8	16	8			**57**
Cost Estimates			16	20	8			**44**
Total Hours	**5**	**72**	**36**	**60**	**28**	**24**	**$ -**	**225**

NTE Cost	**$ 27,900.00**

CTUB Sanitary & Distribution Map



pipe,manholes, pumpstations, roads, customers

0.2mi

County of Loudoun, Maxar

Dewberry

DRAFT

TECHNICAL MEMORANDUM
WATER CAPACITY IMPROVEMENT FEE (CIF) ANALYSIS AND BENCHMARKING STUDY

Date: June 2, 2022

To: Ms. Kristen M. Stolipher, Utility General Manager, Charles Town Utility Board (CTUB)

From: Martin A. Kazmierczak, PE, PMP, Principal Engineer, Senior Associate, Dewberry Engineers, Inc. (Dewberry)

Subject: Water CIF Validation and Benchmarking Study

Background

The Charles Town Utility Board (CTUB) authorized Dewberry Engineers, Inc. (Dewberry) to proceed with a Capacity Improvement Fee (CIF) analysis for the CTUB and a benchmarking study of other similar district's CIFs.

Disclaimer

In evaluating the CIF presented in this report, Dewberry has used "generally accepted" engineering and rate-making principles. This statement should not, however, be construed as a legal opinion with respect to West Virginia Law. Dewberry recommends that CTUB have appropriate legal counsel review the CIF set forth in this Technical Memorandum for compliance with West Virginia Law.

Overview of Capacity Improvement Fees

Capacity improvement fees are generally defined as follows:

"One time charges assessed against new wastewater (and/or water) customers or developers/builders to recover a proportional share of capital costs incurred to provide capacity for the new utility customers.[1]"

This service capacity may be already constructed, funded, and available in existing facilities, or the service capacity may be planned and included as future capital projects in a capital improvements plan (CIP). The application of such fees has generally occurred in areas that are experiencing relatively rapid growth and development. CIFs seek to recognize equity between historical and new customers where new capital required for expanding a water system to accommodate growth is often more costly per unit of capacity than the historical costs for the original infrastructure benefitting the existing customers. CIFs are generally adopted to add equity so that "growth pays for growth" and so that existing customers do not subsidize new growth through their user rates.[2]

Capacity Fee Evaluation

Dewberry reviewed data provided by, or developed in conjunction with, CTUB including the following:

- The timing of capital projects to be implemented over the next 10 years, including water main improvements, pump station improvements, storage tank improvements, and treatment plant improvements, and the costs associated with each.
- The anticipated useful life of historical and planned assets.
- The timing of existing and future projected bond issuances.
- The historical cost for water treatment projects constructed in 2016.
- Existing water treatment plant production data.

[1] *Water and Wastewater Financing and Pricing,* Chapter 5, George A. Raftelis, CPA, 2015, CRC Press.

[2] Ibid.

While some CIFs use upwards of 20-year planning horizons for future capital projects, CTUB elected to only include projects in a 10-year planning horizon.

Dewberry applied construction cost indices from *Engineering News Record (ENR)* to determine the current asset value for historical assets and to project costs for planned capital projects over the next 10 years. Based on the ENR Index over the last 5 years, a 3.25% annual inflation rate for future construction costs was applied in the CIF evaluation. For historical assets, the asset was also depreciated to account for a reduction in asset value over time. Historical projects that were not undertaken specifically to improve system-wide capacity were not included.

The growth-related percentage for each historical or planned CIP project was determined in consultation with CTUB based upon the project's intended purpose and use.

In aggregate, $12.54 million in non-growth related costs were identified and $43.95 million in growth-related costs as shown in Attachment A. The non-growth related costs are not applied in the CIF determination.

A debt principal credit calculation was performed on existing and future projected bond-financed projects included in the CIF so that new customers paying the CIF are not charged twice – once when the CIF is paid, and a second time when user rates are paid over time to help retire the debt.[3] The debt principal credit calculation is shown in Attachment B and totals $14.56 million at an anticipated weighted average bond interest rate of 3.97 percent. The resulting net growth-related costs (including the credit) are $29.39 million.

Upon implementing the capital improvements, the equivalent average day excess capacity available in the water treatment and distribution system will be 0.99 million gallons per day (MGD) based on the CTUB's water production records. In applying the current flow per EDU of 154 gpd, 6,439 new EDUs are accommodated with the excess capacity available through implementation of the historical and planned projects.

The resulting Capacity Improvement Fee can therefore be determined as follows:

Parameter	Value	Units
Expanded Plant Capacity (Max. Day)	3.80	MGD
Current Average Plant Demand	1.70	MGD
Current Ratio of Max. Day to Average Day	1.41	
Current Max. Day Demand	2.40	MGD
Max. Day Capacity Available	1.40	MGD
Equivalent Average Day Excess Capacity Available	0.99	MGD
Average Demand Per EDU	154	gpd per EDU
Number of EDUs Supported	6,439	EDUs
Growth Related Costs per Capital Improvement Plan	$43,946,697	Dollars
Debt Principal Credit	$(14,556,904)	Dollars
Net Growth Related Costs	$29,389,793	Dollars
Calculated CIF	4,564	Per EDU
Calculated CIF	29.64	Per gpd

[3] *Water and Wastewater Financing and Pricing,* Chapter 5, George A. Raftelis, CPA, 2015, CRC Press.

Under these assumptions, each new residential EDU would be assessed a fee of $4,564. Each commercial or industrial user would be assessed $29.64 per gpd of capacity.

Care should be exercised by CTUB in the exact wording of their CIF resolution to avoid misapplication or misuse.

Comparable Water Service Providers

Comparable Water Service Providers were reviewed by looking at various utilities within a 50-mile radius of Jefferson County that have implemented a CIF (or similar fee), and those that serve populations generally between 1,000 and 100,000 customers.

Summary of CIFs for Various Water Service Providers

Using available public records, Dewberry researched the CIFs in place for water service providers and the time periods they went into effect. A table summarizing this information with a list of the water service providers and their CIFs is shown in Attachment C.

During Dewberry's research, it was also found that water service providers used varying amounts of water flow for one equivalent dwelling unit (EDU) in the calculations of their CIF. These varying flows per EDU are provided in Attachment C. For ease of comparison, Dewberry calculated a normalized CIF price expressed in terms of cost per gallon per day ($ per gpd) of water (the CIF charge divided by the respective flow per EDU) to normalize the fees.

Results

Dewberry found that there are several water service providers within the state of West Virginia that currently impose a CIF, such as the City of Martinsburg and the Berkeley County Public Service Water District. Many other water service providers from the nearby geographic regions of Virginia and Maryland include, but are not limited to, the City of Frederick, City of Hagerstown, and the Town of Leesburg. The CIFs for these providers ranged from $1,301 to $14,115, with a mean of $5,644, including the proposed CIF for CTUB. Similarly, the normalized price per gpd, based on the service provider's CIF and respective flow per EDU, ranged from $4.44 to $56.46 per gpd, with a mean of $22.69 per gpd.

Dewberry confirmed the CTUB CIF methodology per AWWA Manual M1 standards and concluded that a CIF of $4,564 per EDU or $29.64 per gpd was appropriate for CTUB (based on 154 gallons as the utility's demand per EDU). Attachment D shows a table and graph of the published CIFs of water service providers, ordered least to greatest, in comparison to that of CTUB. Attachment E, similarly, shows a table and a graph of the normalized CIFs of these varying water service providers, ordered least to greatest, in comparison to that of CTUB.

In summary, compared to others in the region, the CTUB proposed CIF is slightly below the mean CIF value and slightly above the mean normalized CIF value.

Dewberry

TECHNICAL MEMORANDUM
WATER CAPACITY IMPROVEMENT FEE (CIF) ANALYSIS AND BENCHMARKING STUDY

Attachments

1. **Attachment A – Capacity Improvement Fee Analysis**
2. **Attachment B – Debt Principal Credit Calculation**
3. **Attachment C – Various Water Service Providers in the Region and their CIFs**
4. **Attachment D – Various Water Service Providers' Published CIFs**
5. **Attachment E – Various Water Service Providers' Normalized CIFs**

Attachment A
Charles Town Utility Board
Water Capacity Improvement Fee Analysis

DRAFT

6/2/2022

Name of Improvement	Year Completed or Proposed	Useful Life Yrs	Total Cost of Project	Local Cost to CTUB	Notes	ENR Factor Relative to 2022	Local Replacement Value	Depreciation Percentage Relative to 2022	Replacement Cost New Less Depreciation	Percent System Improvement	Percent Non-Growth Related	Percent Growth Related	Notes	Value for Local Non-Growth System Improvement	Value for Local Growth Related Improvement
Prior Projects															
2016 Water Projects - WTP Improvements	2016	30	$ 7,695,000.00	$ 7,695,000		1.170	$ 9,003,150	20%	$ 7,202,520	100%	85.7%	14.3%	1	$ 6,173,589	$ 1,028,931
		Sub Total	$ 7,695,000	$ 7,695,000			$ 9,003,150		$ 7,202,520					$ 6,173,589	$ 1,028,931
Current & Future 10-Year CIP Projects (Opinions of Probable Cost)															
Charles Town Racetrack	2022	30	$ 88,000	$ 88,000		1.0000	$ 88,000	0%	$ 88,000	100%	50%	50%		$ 44,000	$ 44,000
5th Street Hydrant	2022	30	$ 7,000	$ 7,000		1.0000	$ 7,000	0%	$ 7,000	100%	70%	30%		$ 4,900	$ 2,100
6th Avenue Hydrant	2022	30	$ 7,000	$ 7,000		1.0000	$ 7,000	0%	$ 7,000	100%	70%	30%		$ 4,900	$ 2,100
S. Mildred Hydrants	2022	30	$ 9,000	$ 9,000		1.0000	$ 9,000	0%	$ 9,000	100%	70%	30%		$ 6,300	$ 2,700
7th Avenue	2023	30	$ 35,000	$ 35,000		1.0325	$ 36,138	0%	$ 36,138	100%	70%	30%		$ 25,296	$ 10,841
W. Avis Hydrant	2023	30	$ 9,000	$ 9,000		1.0325	$ 9,293	0%	$ 9,293	100%	70%	30%		$ 6,505	$ 2,788
W. Academy Tie	2023	30	$ 88,000	$ 88,000		1.0325	$ 90,860	0%	$ 90,860	100%	70%	30%		$ 63,602	$ 27,258
Main Zone Maintenance	2023	30	$ 28,000	$ 28,000		1.0325	$ 28,910	0%	$ 28,910	100%	100%	0%		$ 28,910	$ -
Northern High Zone Maintenance	2023	30	$ 2,000	$ 2,000		1.0325	$ 2,065	0%	$ 2,065	100%	100%	0%		$ 2,065	$ -
Huntfield Zone Maintenance	2023	30	$ 10,000	$ 10,000		1.0325	$ 10,325	0%	$ 10,325	100%	100%	0%		$ 10,325	$ -
Ameritech Street	2023	30	$ 333,000	$ 333,000		1.0325	$ 343,823	0%	$ 343,823	100%	70%	30%		$ 240,676	$ 103,147
N. Mildred Street B	2024	30	$ 200,000	$ 200,000		1.0661	$ 213,211	0%	$ 213,211	100%	10%	90%		$ 21,321	$ 191,890
Burns St. PS Upgrade	2024	30	$ 3,526,000	$ 3,526,000		1.0661	$ 3,758,914	0%	$ 3,758,914	100%	10%	90%		$ 375,891	$ 3,383,023
Well Development/Spring Source Construction	2024	30	$ 1,480,000	$ 1,480,000		1.0661	$ 1,577,763	0%	$ 1,577,763	100%	25%	75%		$ 394,441	$ 1,183,322
Church Street	2025	30	$ 595,000	$ 595,000		1.1007	$ 654,918	0%	$ 654,918	100%	25%	75%		$ 163,730	$ 491,189
South George Street	2025	30	$ 279,000	$ 279,000		1.1007	$ 307,096	0%	$ 307,096	100%	80%	20%		$ 245,677	$ 61,419
Water Street	2025	30	$ 2,400,000	$ 2,400,000		1.1007	$ 2,641,687	0%	$ 2,641,687	100%	70%	30%		$ 1,849,181	$ 792,506
Route 340	2025	30	$ 1,173,000	$ 1,173,000		1.1007	$ 1,291,125	0%	$ 1,291,125	100%	0%	100%		$ -	$ 1,291,125
Huntwell West (Formerly American Heritage)	2026	30	$ 2,695,000	$ 2,695,000		1.1365	$ 3,062,803	0%	$ 3,062,803	100%	0%	100%		$ -	$ 3,062,803
N. Mildred Street A	2026	30	$ 648,000	$ 648,000		1.1365	$ 736,436	0%	$ 736,436	100%	20%	80%		$ 147,287	$ 589,149
E. 10th St.	2026	30	$ 298,000	$ 298,000		1.1365	$ 338,670	0%	$ 338,670	100%	70%	30%		$ 237,069	$ 101,601
Huntfield	2027	30	$ 210,000	$ 210,000		1.1734	$ 246,416	0%	$ 246,416	100%	0%	100%		$ -	$ 246,416
Fritts & Old Town Ranson	2028	30	$ 1,295,000	$ 1,295,000		1.2115	$ 1,568,954	0%	$ 1,568,954	100%	0%	100%		$ -	$ 1,568,954
Magnolia Springs	2028	30	$ 1,085,000	$ 1,085,000		1.2115	$ 1,314,529	0%	$ 1,314,529	100%	0%	100%		$ -	$ 1,314,529
Norborne Greene	2028	30	$ 7,000	$ 7,000		1.2115	$ 8,481	0%	$ 8,481	100%	0%	100%		$ -	$ 8,481
Charles Town Infill	2028	30	$ 35,000	$ 35,000		1.2115	$ 42,404	0%	$ 42,404	100%	0%	100%		$ -	$ 42,404
Windmill Crossing	2028	30	$ 7,000	$ 7,000		1.2115	$ 8,481	0%	$ 8,481	100%	0%	100%		$ -	$ 8,481
Augustine Ave. PS Discharge	2029	30	$ 298,000	$ 298,000		1.2509	$ 372,775	0%	$ 372,775	100%	0%	100%		$ -	$ 372,775
Locust Hill	2029	30	$ 2,400,000	$ 2,400,000		1.2509	$ 3,002,214	0%	$ 3,002,214	100%	0%	100%		$ -	$ 3,002,214
Roper/Stolipher	2029	30	$ 1,243,000	$ 1,243,000		1.2509	$ 1,554,897	0%	$ 1,554,897	100%	0%	100%		$ -	$ 1,554,897
Augustine Ave. PS Upgrade	2029	30	$ 780,000	$ 780,000		1.2509	$ 975,720	0%	$ 975,720	100%	0%	100%		$ -	$ 975,720
Intake Construction Cost	2030	30	$ 1,265,000	$ 1,265,000		1.2916	$ 1,633,846	0%	$ 1,633,846	100%	10%	90%		$ 163,385	$ 1,470,461
WTP Upgrade	2031	30	$ 17,505,000	$ 17,505,000		1.3336	$ 23,343,859	0%	$ 23,343,859	100%	10%	90%		$ 2,334,386	$ 21,009,473
		Sub Total	$ 40,040,000	$ 40,040,000			$ 49,287,612		$ 49,287,612					$ 6,369,846	$ 42,917,765
		Totals	$ 47,735,000	$ 47,735,000			$ 58,290,762		$56,490,132					$ 12,543,435	**$ 43,946,697**

Capacity Improvement Fee Determination			
Expanded Plant Capacity (Max. Day):	3.80	MGD	
Current Average Plant Demand:	1.70	MGD	
Current Ratio of Max. Day to Average Day:	1.41		
Current Max. Day Demand:	2.40	MGD	
Max. Day Capacity Available:	1.40	MGD	
Equivalent Average Day Excess Capacity Available:	0.99	MGD	
Average Demand Per EDU:	154	gpd/EDU	
Number of EDUs Supported:	6,439	EDUs	
Growth Related Costs per Capital Improv. Plan	$ 43,946,697		
Debt Principal Credit	$ (14,556,904)	(See Attachment B)	
Net Growth Related Costs	$ 29,389,793		
Calculated Capacity Improvement Fee	**$ 4,564**	per EDU	
Calculated Capacity Improvement Fee	$ 29.64	per gpd	

	Year	Capital Costs by Year	Growth Costs by Year
	2022	$ 111,000	$ 50,900
	2023	$ 521,413	$ 144,034
	2024	$ 5,549,889	$ 4,758,235
	2025	$ 4,894,827	$ 2,636,239
	2026	$ 4,137,909	$ 3,753,553
	2027	$ 246,416	$ 246,416
	2028	$ 2,942,848	$ 2,942,848
	2029	$ 5,905,605	$ 5,905,605
	2030	$ 1,633,846	$ 1,470,461
	2031	$ 23,343,859	$ 21,009,473
Not Included	2032	$ -	$ -
Not Included	2033	$ -	$ -
Not Included	2034	$ -	$ -
Not Included	2035	$ -	$ -
Not Included	2036	$ -	$ -
	TOTAL	$ 49,287,612	$ 42,917,765

Notes:
1. Based on current plant max. demand of 2.4 MGD versus current plant capacity of 2.8 MGD.

Attachment B
Debt Principal Credit Calculation

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Year	Total Existing Debt Principal (Growth-Related Portion)	Projected New Debt Principal (Growth-Related Portion)	Total Debt Service Principal (Growth-Related Portion)	Present Value of Debt Service Principal (Growth-Related Portion)
2022	$ (27,447)	$ -	$ (27,447)	$ (27,447)
2023	$ (28,284)	$ 0	$ (28,284)	$ (27,204)
2024	$ (29,147)	$ (13,347)	$ (42,494)	$ (39,311)
2025	$ (30,036)	$ (50,705)	$ (80,740)	$ (71,840)
2026	$ (30,952)	$ (109,478)	$ (140,430)	$ (120,179)
2027	$ (31,896)	$ (113,857)	$ (145,753)	$ (119,971)
2028	$ (32,869)	$ (154,885)	$ (187,754)	$ (148,642)
2029	$ (33,871)	$ (256,197)	$ (290,069)	$ (220,874)
2030	$ (34,904)	$ (282,483)	$ (317,387)	$ (232,447)
2031	$ (35,969)	$ (658,202)	$ (694,171)	$ (488,983)
2032	$ (37,066)	$ (684,530)	$ (721,596)	$ (488,893)
2033	$ (38,196)	$ (711,911)	$ (750,108)	$ (488,804)
2034	$ (39,361)	$ (740,388)	$ (779,749)	$ (488,718)
2035	$ (40,562)	$ (770,003)	$ (810,565)	$ (488,634)
2036	$ (41,799)	$ (800,803)	$ (842,603)	$ (488,551)
2037	$ (43,074)	$ (832,836)	$ (875,910)	$ (488,471)
2038	$ (44,388)	$ (866,149)	$ (910,537)	$ (488,392)
2039	$ (45,742)	$ (900,795)	$ (946,536)	$ (488,316)
2040	$ (47,137)	$ (936,827)	$ (983,963)	$ (488,241)
2041	$ (48,574)	$ (974,300)	$ (1,022,874)	$ (488,168)
2042	$ (50,056)	$ (1,013,272)	$ (1,063,328)	$ (488,097)
2043	$ (51,583)	$ (1,053,803)	$ (1,105,385)	$ (488,028)
2044	$ (53,156)	$ (1,095,955)	$ (1,149,111)	$ (487,961)
2045	$ (54,777)	$ (1,139,793)	$ (1,194,570)	$ (487,895)
2046	$ -	$ (1,185,385)	$ (1,185,385)	$ (465,657)
2047	$ -	$ (1,232,800)	$ (1,232,800)	$ (465,791)
2048	$ -	$ (1,282,112)	$ (1,282,112)	$ (465,926)
2049	$ -	$ (1,333,396)	$ (1,333,396)	$ (466,060)
2050	$ -	$ (1,386,732)	$ (1,386,732)	$ (466,195)
2051	$ -	$ (1,442,202)	$ (1,442,202)	$ (466,329)
2052	$ -	$ (1,499,890)	$ (1,499,890)	$ (466,464)
2053	$ -	$ (1,559,885)	$ (1,559,885)	$ (466,598)
2054	$ -	$ (1,578,990)	$ (1,578,990)	$ (454,278)
2055	$ -	$ (1,522,717)	$ (1,522,717)	$ (421,360)
2056	$ -	$ (1,399,578)	$ (1,399,578)	$ (372,498)
2057	$ -	$ (1,455,561)	$ (1,455,561)	$ (372,605)
2058	$ -	$ (1,395,484)	$ (1,395,484)	$ (343,586)
2059	$ -	$ (1,142,803)	$ (1,142,803)	$ (270,629)
2060	$ -	$ (1,136,499)	$ (1,136,499)	$ (258,859)
Total Debt Principal Credit (Growth Related Portion)				**$ (14,556,904)**

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ATTACHMENT C - VARIOUS WATER SERVICE PROVIDERS IN THE REGION AND THEIR CIFS

Service Provider	Geographic Region	Number of Customers	Primary Water Source (Ground/Surface)	Effective Date of CIF	Published CIF ($/EDU)	Flow per EDU (gpd)	Normalized CIF ($/gpd)
West Virginia							
Charles Town Utility Board	Jefferson County, WV	5,890	Surface	2022	$4,564	154	$29.64
Berkeley County Public Service Water District	Berkeley County, WV	27,000	Surface	2019 - Present	$2,012	152	$13.24
City of Martinsburg	Berkeley County, WV	6,500	Ground	2020 - Present	$1,301	293	$4.44
Maryland							
City of Frederick	Frederick County, MD	48,000	Surface	2011 - Present	$6,244	250	$24.98
City of Hagerstown	Washington County, MD	89,000	Surface	July 1, 2020 - Present	$2,734	200	$13.67
City of Hagerstown (Servicing Town of Williamsport, MD)	Washington County, MD	2,139	Ground	2017 - Present	$3,200	200	$16.00
Town of Thurmont	Frederick County, MD	6,200	Ground	2013 - Present	$2,885	250	$11.54
Town of Emmitsburg	Frederick County, MD	2,821	Surface	2014 - Present	$8,200	200	$41.00
Virginia							
Frederick County (VA)	Frederick County, VA	15,911	Surface	2019 - Present	$14,115	250	$56.46
Town of Strasburg	Shenandoah County, VA	2,684	Surface	2019 - Present	$6,500	350	$18.57
Town of Leesburg	Loudoun County, VA	18,174	Surface Ground	2016 - Present	$4,683	350	$13.38
Loudoun Water	Loudoun County, VA	82,387	Surface	2020 - Present	$7,180	550	$13.05
Town of Front Royal	Warren County, VA	6,000	Surface	2013 - Present	$9,750	250	$39.00

ATTACHMENT D - VARIOUS WATER SERVICE PROVIDERS' PUBLISHED CIFS

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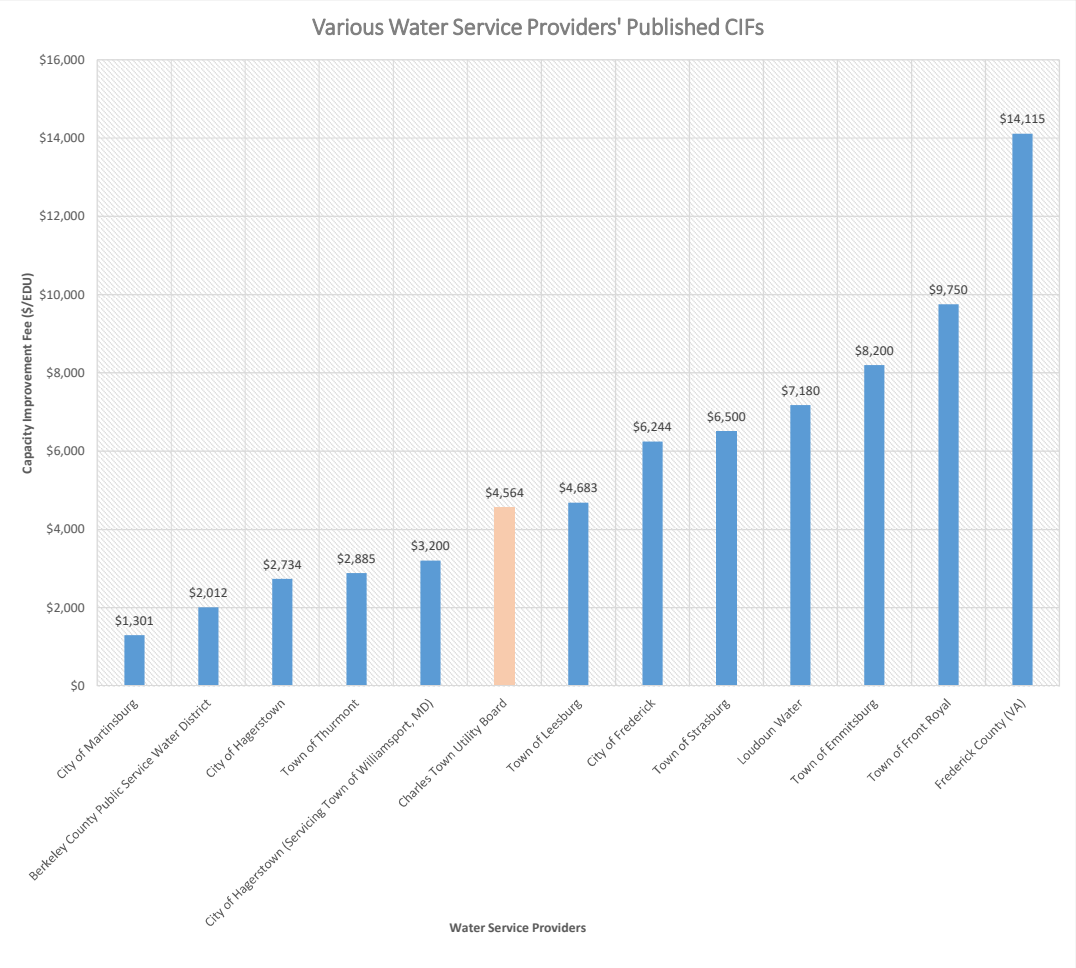
Service Provider	Published CIF ($/EDU)
City of Martinsburg	$1,301
Berkeley County Public Service Water District	$2,012
City of Hagerstown	$2,734
Town of Thurmont	$2,885
City of Hagerstown (Servicing Town of Williamsport, MD)	$3,200
Charles Town Utility Board	$4,564
Town of Leesburg	$4,683
City of Frederick	$6,244
Town of Strasburg	$6,500
Loudoun Water	$7,180
Town of Emmitsburg	$8,200
Town of Front Royal	$9,750
Frederick County (VA)	$14,115

Mean Fee: $5,644



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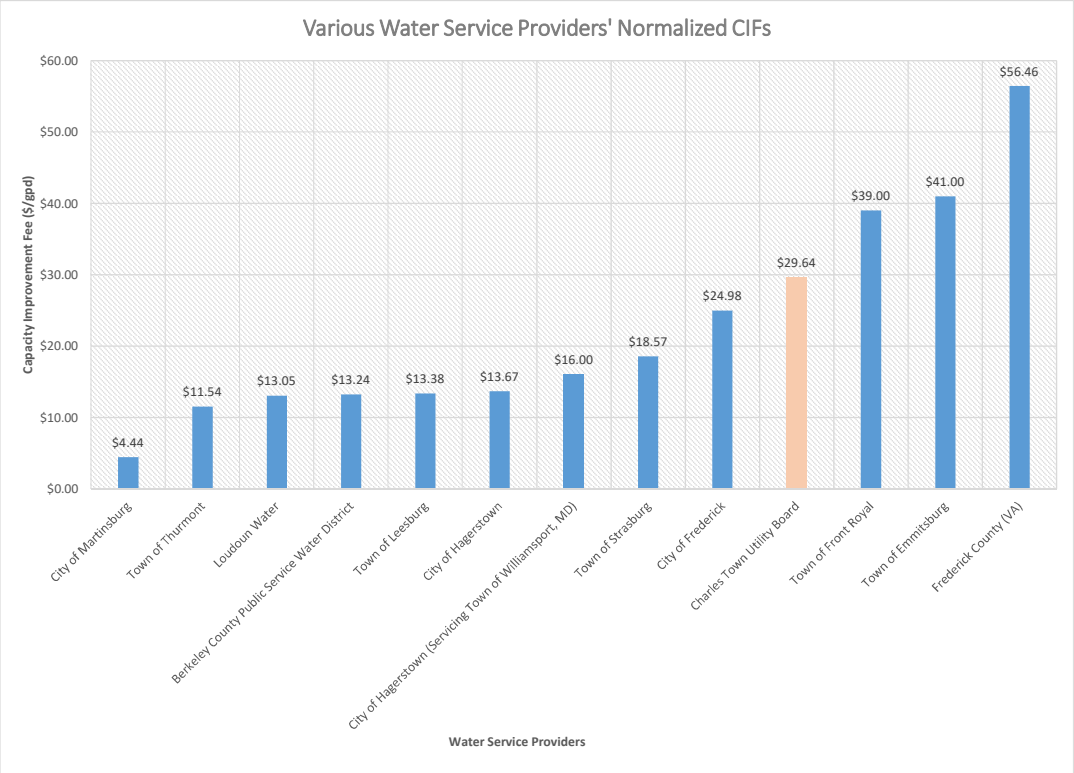
ATTACHMENT E - VARIOUS WATER SERVICE PROVIDERS' NORMALIZED CIFS

Service Provider	$/GPD
City of Martinsburg	$4.44
Town of Thurmont	$11.54
Loudoun Water	$13.05
Berkeley County Public Service Water District	$13.24
Town of Leesburg	$13.38
City of Hagerstown	$13.67
City of Hagerstown (Servicing Town of Williamsport, MD)	$16.00
Town of Strasburg	$18.57
City of Frederick	$24.98
Charles Town Utility Board	$29.64
Town of Front Royal	$39.00
Town of Emmitsburg	$41.00
Frederick County (VA)	$56.46
Mean Dollars per GPD:	$22.69



Dewberry

WATER CAPACITY IMPROVEMENT FEES:
FUNDING CAPITAL PROGRAMS TO ADDRESS GROWTH

Martin A. Kazmierczak, P.E., PMP | Dewberry

June 8, 2022, Charles Town Utility Board

Agenda

- Growth Projections
- CIF Theory and Methods
- CIF Model Input and Output
- CIF Calculation
- Benchmarking Information
- Questions and Answers

Jefferson County Growth Projections

West Virginia Population Forecast by County

- Rapid growth forecasted in Berkeley, Jefferson and Monongalia Counties
- Approx. 0.76% growth per year in Jefferson County (2010-2020)
- Capital improvements plan (CIP) currently being developed and implemented to support both existing needs and ongoing growth
- 125 New connections per year anticipated

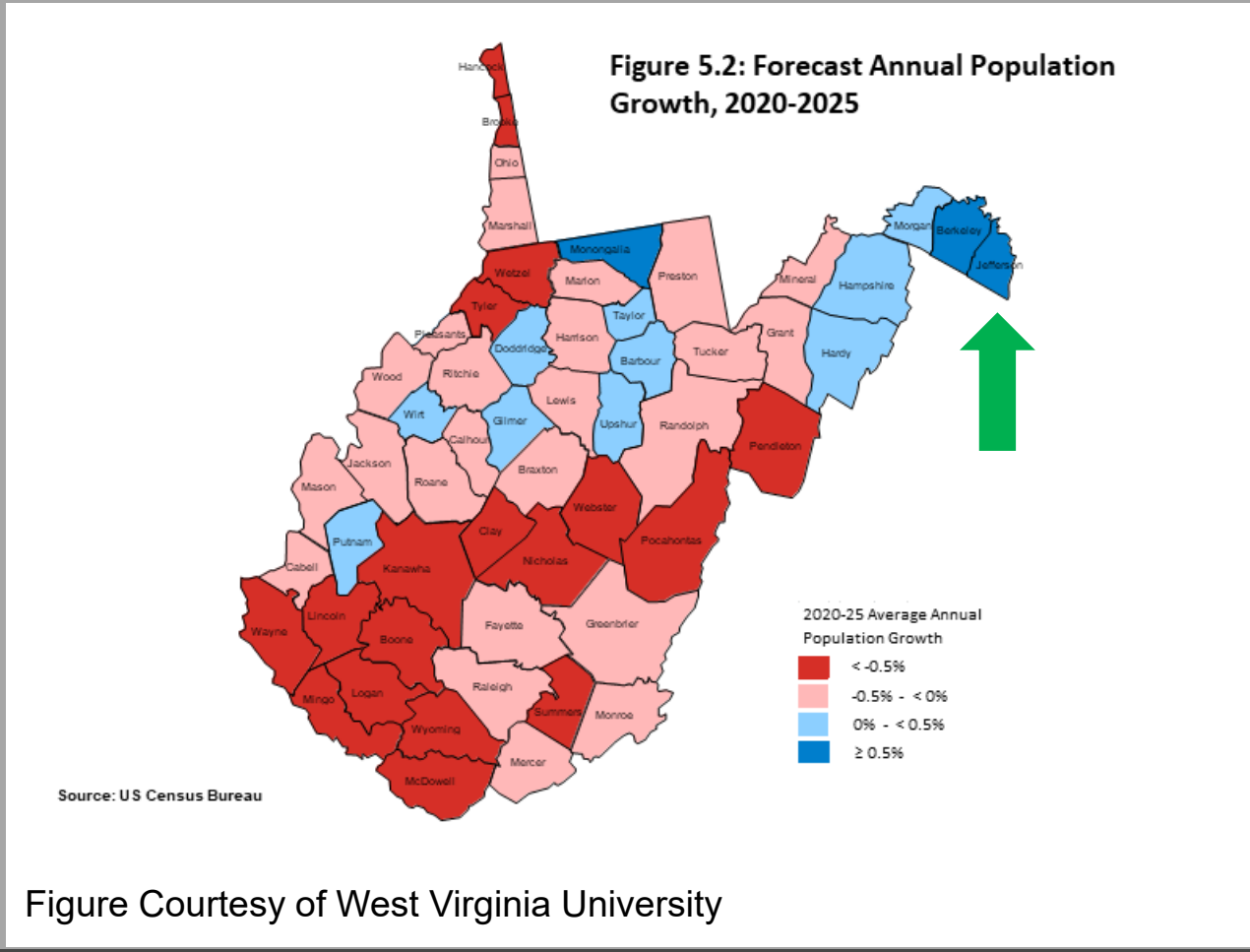
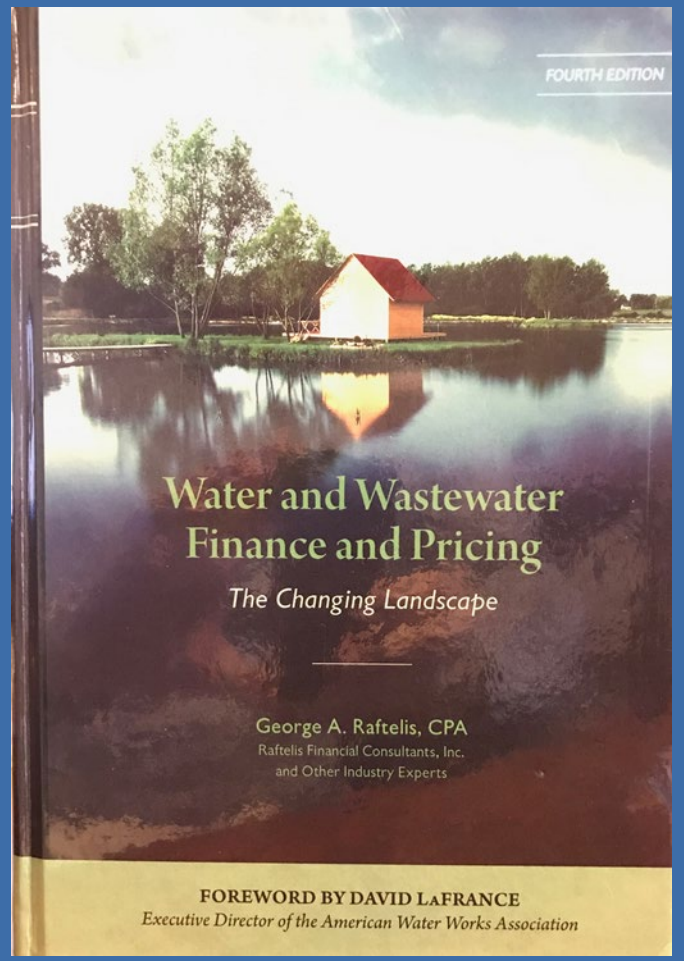


Figure Courtesy of West Virginia University

CIF Theory and Methods

Theory Behind CIFs

- Basic Principle*:*
  Growth pays for growth
- Applicable to expenditures attributable to expanding facilities to meet new customer demand *
- Referred to in many states as system development charges or water & sewer availability fees
- Generally excludes non-growth related capital expenses



* Source: Water and Wastewater Finance and Pricing, The Changing Landscape, Fourth Edition, CRC Press, c. 2015.

Potential CIF Revenue

Revenue at Various Customer Growth Rates (EDUs per Year)							
CIF per EDU	100	150	200	250	300	350	400
$ 2,000	$ 200,000	$ 300,000	$ 400,000	$ 500,000	$ 600,000	$ 700,000	$ 800,000
$ 2,500	$ 250,000	$ 375,000	$ 500,000	$ 625,000	$ 750,000	$ 875,000	$ 1,000,000
$ 3,000	$ 300,000	$ 450,000	$ 600,000	$ 750,000	$ 900,000	$ 1,050,000	$ 1,200,000
$ 3,500	$ 350,000	$ 525,000	$ 700,000	$ 875,000	$ 1,050,000	$ 1,225,000	$ 1,400,000
$ 4,000	$ 400,000	$ 600,000	$ 800,000	$ 1,000,000	$ 1,200,000	$ 1,400,000	$ 1,600,000
$ 4,500	$ 450,000	$ 675,000	$ 900,000	$ 1,125,000	$ 1,350,000	$ 1,575,000	$ 1,800,000
$ 5,000	$ 500,000	$ 750,000	$ 1,000,000	$ 1,250,000	$ 1,500,000	$ 1,750,000	$ 2,000,000
$ 5,500	$ 550,000	$ 825,000	$ 1,100,000	$ 1,375,000	$ 1,650,000	$ 1,925,000	$ 2,200,000
$ 6,000	$ 600,000	$ 900,000	$ 1,200,000	$ 1,500,000	$ 1,800,000	$ 2,100,000	$ 2,400,000
$ 6,500	$ 650,000	$ 975,000	$ 1,300,000	$ 1,625,000	$ 1,950,000	$ 2,275,000	$ 2,600,000
$ 7,000	$ 700,000	$ 1,050,000	$ 1,400,000	$ 1,750,000	$ 2,100,000	$ 2,450,000	$ 2,800,000
$ 7,500	$ 750,000	$ 1,125,000	$ 1,500,000	$ 1,875,000	$ 2,250,000	$ 2,625,000	$ 3,000,000
$ 8,000	$ 800,000	$ 1,200,000	$ 1,600,000	$ 2,000,000	$ 2,400,000	$ 2,800,000	$ 3,200,000

When growth pays for growth, user fees can be better managed.

Common CIF Methodologies *

- **Marginal Incremental Cost Approach:** Focus is on adding new facilities to serve new customers. Costs of capacity are tied to a Capital Improvements Plan.
- **System Buy-In Methodology:** Existing customers through service charges have developed a valuable public facility. Excess capacity is available. New customers should "buy-into" that excess capacity.
- **Hybrid or Combined Methodology:** New customers benefit both from facilities already in place and future expansions. Combines the above two methods.

The hybrid methodology was used for CTUB's CIF determination.

* Source: Water and Wastewater Finance and Pricing, The Changing Landscape, Fourth Edition, CRC Press, c. 2015.

Debt Principal Credit

- If Capital Expenditures are debt financed, an adjustment is made for relevant principal payments that would be recovered from customers through future utility rates (monthly user fees).
- Avoids new customers paying for the same capacity twice: Once up-front with the CIF and then again later through user fees.
- Requires net present cost of future growth-related debt principal payments be evaluated.

The debt principal credit can help mitigate objections to the CIF.

* Source: Water and Wastewater Finance and Pricing, The Changing Landscape, Fourth Edition, CRC Press, c. 2015.

Legal Implications

- Dewberry is not in a position to provide legal advice. CTUB should consult appropriate legal counsel.
- Rational Nexus Test *:
  - The need for CIF is the result of new growth.
  - The amount of the CIF does not exceed the reasonable cost to provide capacity to accommodate growth.
  - The funds collected must be adequately earmarked for the sufficient benefit of new customers required to pay the fee.
- West Virginia may have state-specific legislation.

* Source: Water and Wastewater Finance and Pricing, The Changing Landscape, Fourth Edition, CRC Press, c. 2015.

CIF Model Input and Output

Key Input Parameters

Parameter	Model Value	Impact on CIF
Capital Cost of Projects and Year Built	See Attachment A	
Growth-Related Percentage for each Project	See Attachment A (0-100%)	↑ Growth Percentage → CIF ↑
Cost Adjustments to 2022	Based on Engineering News Record (ENR) Index Values for each of the last 20 years	
Excess Treatment Capacity	0.99 Million Gallons per Day	↑ Excess Capacity → CIF ↓
Cost Adjustments to Future Years	3.25% per year (Based on ENR Values over the last 5 years)	↑ ENR Index Increase → CIF ↑
Useful Life of Asset (for Depreciation)	30-40 years depending on asset	↑ Useful Life → CIF ↑
Connection Rate per Year (Equivalent Dwelling Units, EDUs)	125 EDUs per Year	↑ EDUs/Year → CIF ↑
Flow per Equivalent Dwelling Unit	154 gallons per day per EDU	↑ Flow/EDU → CIF ↑
Weighted Average Bond Rate—Historical	3.05% (Average of Variable Interest Rate Bond)	↑ Bond Rate → CIF ↑
Projected Bond Rate—Future Projects	4.0%	↑ Flow/EDU → CIF ↑

Historical Project

Project Name	Year Completed	Useful Life (Years)	Total Cost
2016 Water Projects - WTP Improvements	2016	30	$ 7,695,000
		Sub Total	**$ 7,695,000**

Current & Future Projects

Project Name	Year Completed	Total Cost
Charles Town Racetrack	2022	$88,000.00
5th Street Hydrant	2022	$7,000.00
6th Avenue Hydrant	2022	$7,000.00
S. Mildred Hydrants	2022	$9,000.00
7th Avenue	2023	$35,000.00
W. Avis Hydrant	2023	$9,000
W. Academy Tie	2023	$88,000
Main Zone Maintenance	2023	$28,000
Northern High Zone Maintenance	2023	$2,000
Huntfield Zone Maintenance	2023	$10,000
Ameritech Street	2023	$333,000
N. Mildred Street B	2024	$200,000
Burns St. PS Upgrade	2024	$3,526,000
Well Development/Spring Source Construction	2024	$1,480,000
Church Street	2025	$595,000
South George Street	2025	$279,000.00
Water Street	2025	$2,400,000.00

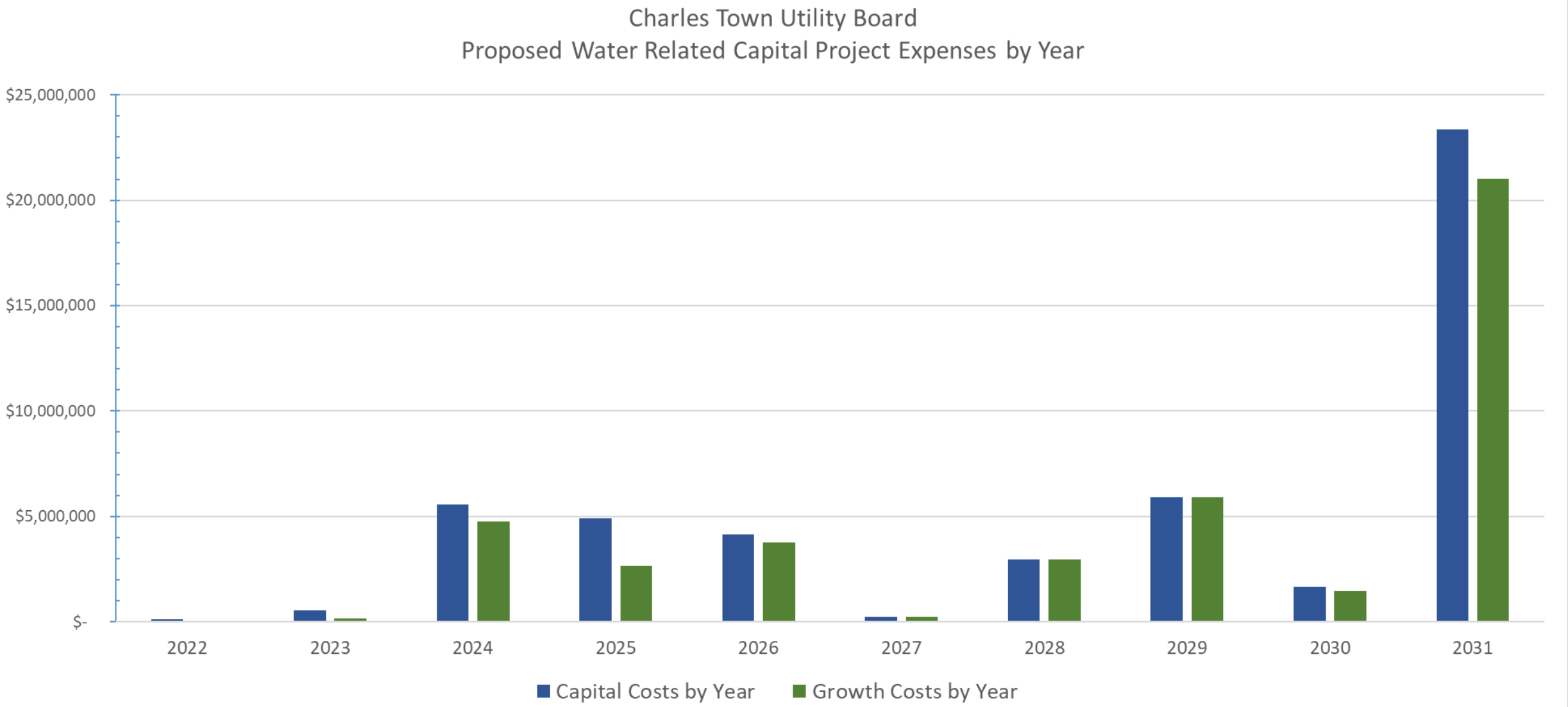
Current & Future Projects (Cont.)

Project Name	Year Completed	Total Cost
Route 340	2025	$1,173,000.00
Huntwell West (Formerly American Heritage)	2026	$2,695,000.00
N. Mildred Street A	2026	$648,000.00
E. 10th St.	2026	$298,000.00
Huntfield	2027	$210,000.00
Fritts & Old Town Ranson	2028	$1,295,000.00
Magnolia Springs	2028	$1,085,000.00
Norborne Greene	2028	$7,000.00
Charles Town Infill	2028	$35,000.00
Windmill Crossing	2028	$7,000.00
Augustine Ave. PS Discharge	2029	$298,000.00
Locust Hill	2029	$2,400,000.00
Roper/Stolipher	2029	$1,243,000.00
Augustine Ave. PS Upgrade	2029	$780,000.00
Intake Construction Cost	2030	$1,265,000.00
WTP Upgrade	2031	$17,505,000.00
	Sub Total	**$40,040,000.00**

Model Output Information

- Replacement cost new less depreciation (RCNLD)
- Forecasted capital expenses by year
- Forecasted growth-related capital expenses by year
- CIF without debt principal credit
- Debt principal credit calculation
- CIF with debt principal credit

Forecasted Water Capital Costs by Year



CIF Calculation

DRAFT CIF Calculation Summary
(See Attachment A)

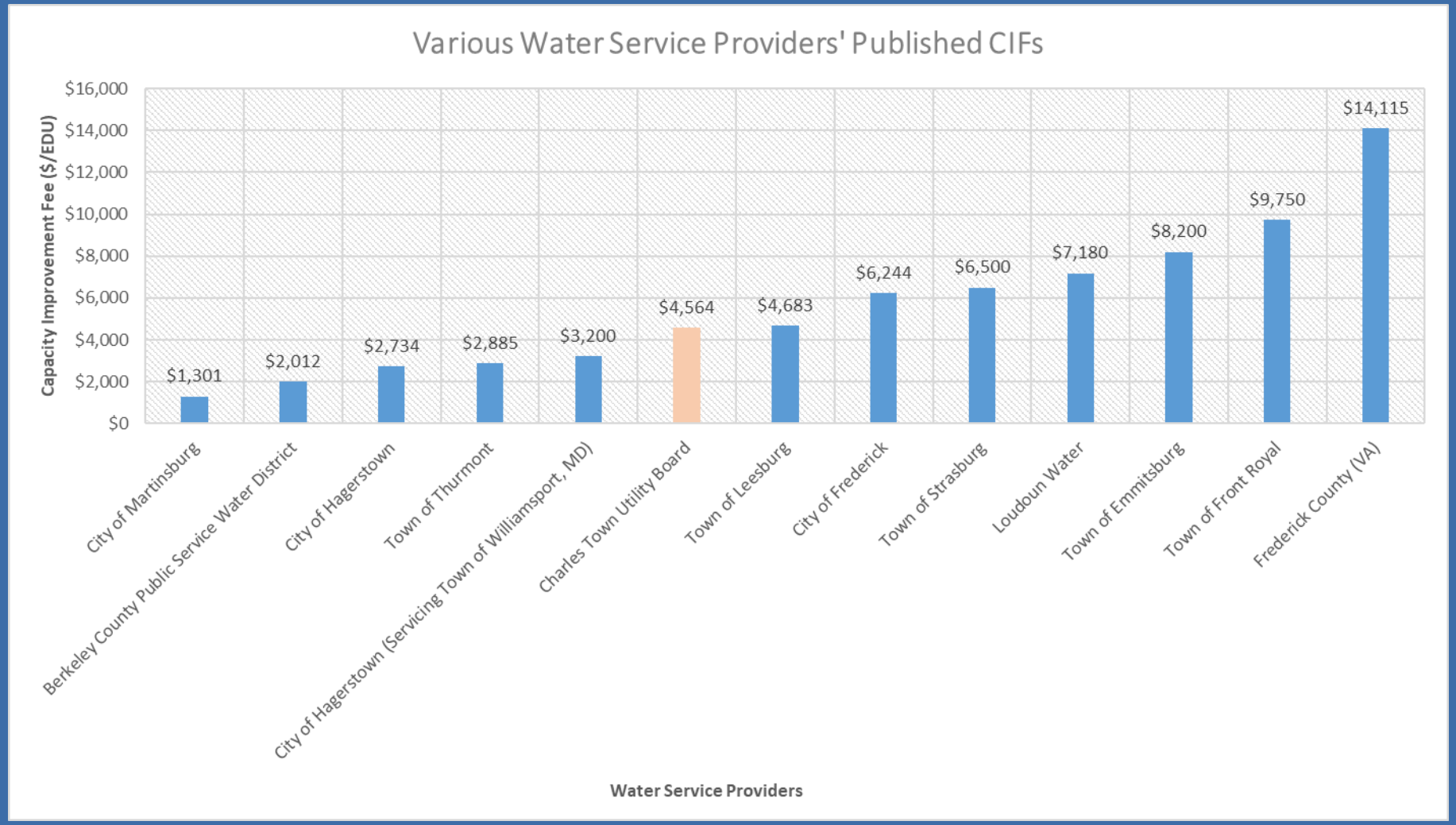
Capacity Improvement Fee Determination			
Expanded Plant Capacity (Max. Day):		3.80	MGD
Current Average Plant Demand:		1.70	MGD
Current Ratio of Max. Day to Average Day:		1.41	
Current Max. Day Demand:		2.40	MGD
Max. Day Capacity Available:		1.40	MGD
Equivalent Average Day Excess Capacity Available:		0.99	MGD
Average Demand Per EDU:		154	gpd/EDU
Number of EDUs Supported:		6,439	EDUs
Growth Related Costs per Capital Improv. Plan	$	43,946,697	
Debt Principal Credit	$	(14,556,904)	(See Attachment B)
Net Growth Related Costs	$	29,389,793	
Calculated Capacity Improvement Fee	**$**	**4,564**	per EDU
Calculated Capacity Improvement Fee	$	29.64	per gpd

DRAFT Debt Principal Credit (Attachment B)

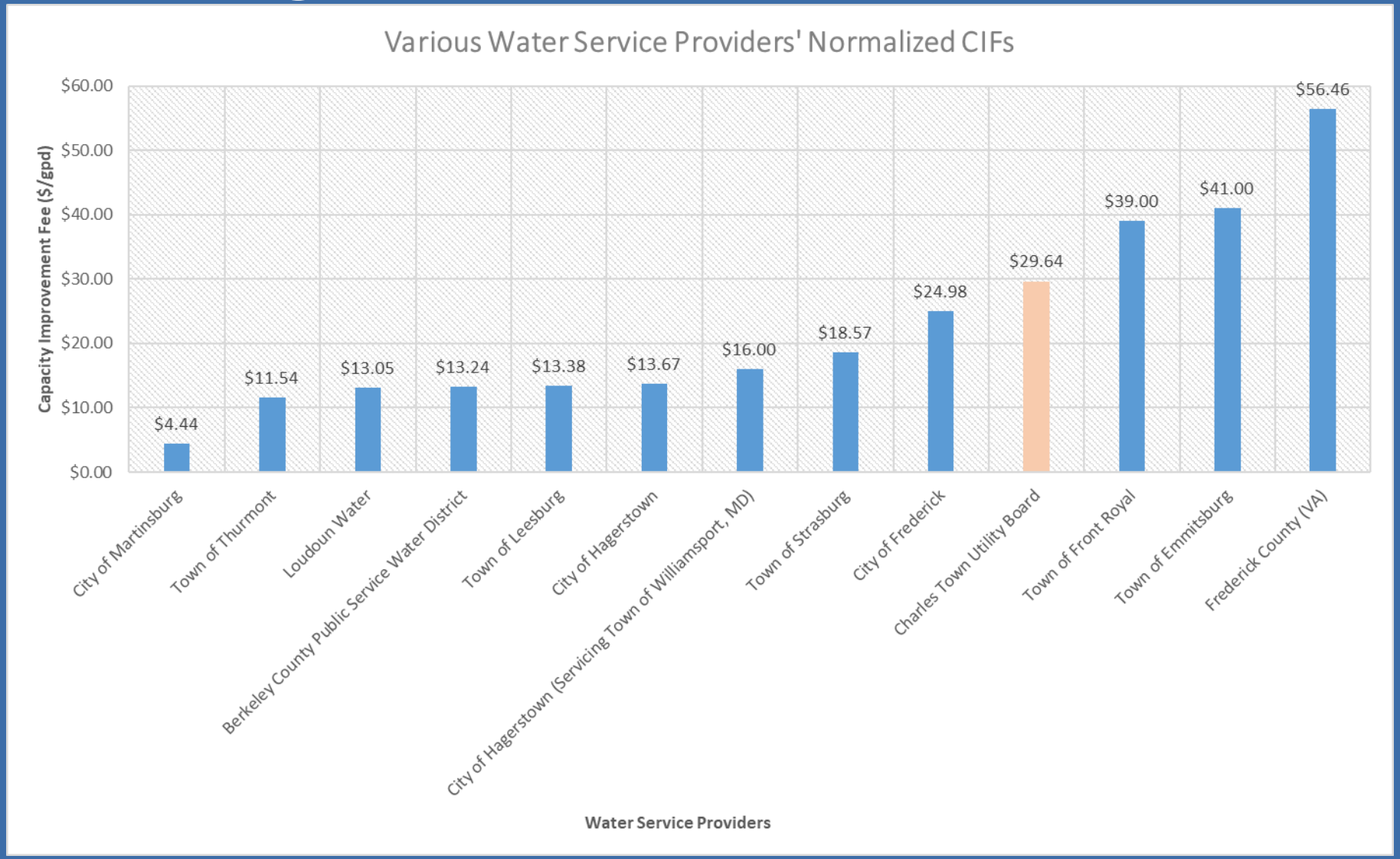
Year	Total Existing Debt Principal (Growth-Related Portion)	Projected New Debt Principal (Growth-Related Portion)	Total Debt Service Principal (Growth-Related Portion)	Present Value of Debt Service Principal (Growth-Related Portion)
2022	$ (27,447)	$ -	$ (27,447)	$ (27,447)
2023	$ (28,284)	$ 0	$ (28,284)	$ (27,204)
2024	$ (29,147)	$ (13,347)	$ (42,494)	$ (39,311)
2025	$ (30,036)	$ (50,705)	$ (80,740)	$ (71,840)
2026	$ (30,952)	$ (109,478)	$ (140,430)	$ (120,179)
2027	$ (31,896)	$ (113,857)	$ (145,753)	$ (119,971)
2028	$ (32,869)	$ (154,885)	$ (187,754)	$ (148,642)
2029	$ (33,871)	$ (256,197)	$ (290,069)	$ (220,874)
2030	$ (34,904)	$ (282,483)	$ (317,387)	$ (232,447)
2031	$ (35,969)	$ (658,202)	$ (694,171)	$ (488,983)
2032	$ (37,066)	$ (684,530)	$ (721,596)	$ (488,893)
2033	$ (38,196)	$ (711,911)	$ (750,108)	$ (488,804)
2034	$ (39,361)	$ (740,388)	$ (779,749)	$ (488,718)
2035	$ (40,562)	$ (770,003)	$ (810,565)	$ (488,634)
2036	$ (41,799)	$ (800,803)	$ (842,603)	$ (488,551)
2037	$ (43,074)	$ (832,836)	$ (875,910)	$ (488,471)
2038	$ (44,388)	$ (866,149)	$ (910,537)	$ (488,392)
2039	$ (45,742)	$ (900,795)	$ (946,536)	$ (488,316)
2040	$ (47,137)	$ (936,827)	$ (983,963)	$ (488,241)
2041	$ (48,574)	$ (974,300)	$ (1,022,874)	$ (488,168)
2042	$ (50,056)	$ (1,013,272)	$ (1,063,328)	$ (488,097)
2043	$ (51,583)	$ (1,053,803)	$ (1,105,385)	$ (488,028)
2044	$ (53,156)	$ (1,095,955)	$ (1,149,111)	$ (487,961)
2045	$ (54,777)	$ (1,139,793)	$ (1,194,570)	$ (487,895)
2046	$ -	$ (1,185,385)	$ (1,185,385)	$ (465,657)
2047	$ -	$ (1,232,800)	$ (1,232,800)	$ (465,791)
2048	$ -	$ (1,282,112)	$ (1,282,112)	$ (465,926)
2049	$ -	$ (1,333,396)	$ (1,333,396)	$ (466,060)
2050	$ -	$ (1,386,732)	$ (1,386,732)	$ (466,195)
2051	$ -	$ (1,442,202)	$ (1,442,202)	$ (466,329)
2052	$ -	$ (1,499,890)	$ (1,499,890)	$ (466,464)
2053	$ -	$ (1,559,885)	$ (1,559,885)	$ (466,598)
2054	$ -	$ (1,578,990)	$ (1,578,990)	$ (454,278)
2055	$ -	$ (1,522,717)	$ (1,522,717)	$ (421,360)
2056	$ -	$ (1,399,578)	$ (1,399,578)	$ (372,498)
2057	$ -	$ (1,455,561)	$ (1,455,561)	$ (372,605)
2058	$ -	$ (1,395,484)	$ (1,395,484)	$ (343,586)
2059	$ -	$ (1,142,803)	$ (1,142,803)	$ (270,629)
2060	$ -	$ (1,136,499)	$ (1,136,499)	$ (258,859)
Total Debt Principal Credit (Growth Related Portion)				**$ (14,556,904)**

Benchmarking Information

Benchmarking Data—Published CIFs



Benchmarking Data—Normalized CIFs



Next Steps

- Dewberry to Issue Final Water CIF Memorandum
- CTUB Board Approval of Proposed Water CIF
- CTUB Legal Counsel Drafts the Rate Ordinance
- City Council Approval

Questions and Answers

Dewberry

FUTURE DEMAND PROJECTIONS AND WATER SYSTEMS CAPITAL IMPROVEMENTS PLANNING

Richard Kincheloe, P.E. | Dewberry

June 8, 2022, Charles Town Utility Board

Agenda

- Condition Assessment
- Simulation of existing conditions
- Development of future demand projections
- Simulation of future demand conditions
- Identification of a phased capital improvements plan and cost opinions including inspection and preventative maintenance projects
- Additional Recommendations
- Questions

Condition Assessment

Photo 5 – Tank View	Photo 6 – Access Port Coating Failure	Photo 7 – Loose Cable
		
Photo 8 – Loose Fence Rail	**Photo 9 – Missing Gravel**	**Photo 10 – Vegetation Overgrowth**
		

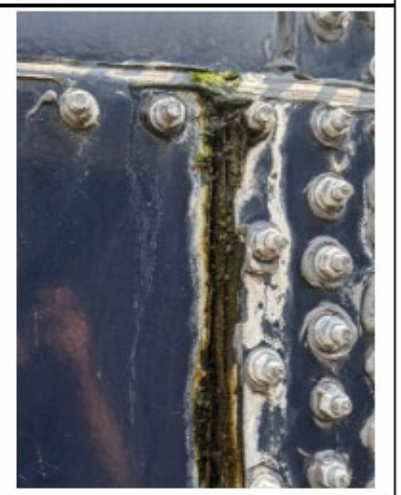
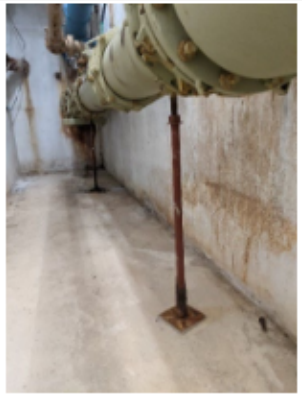
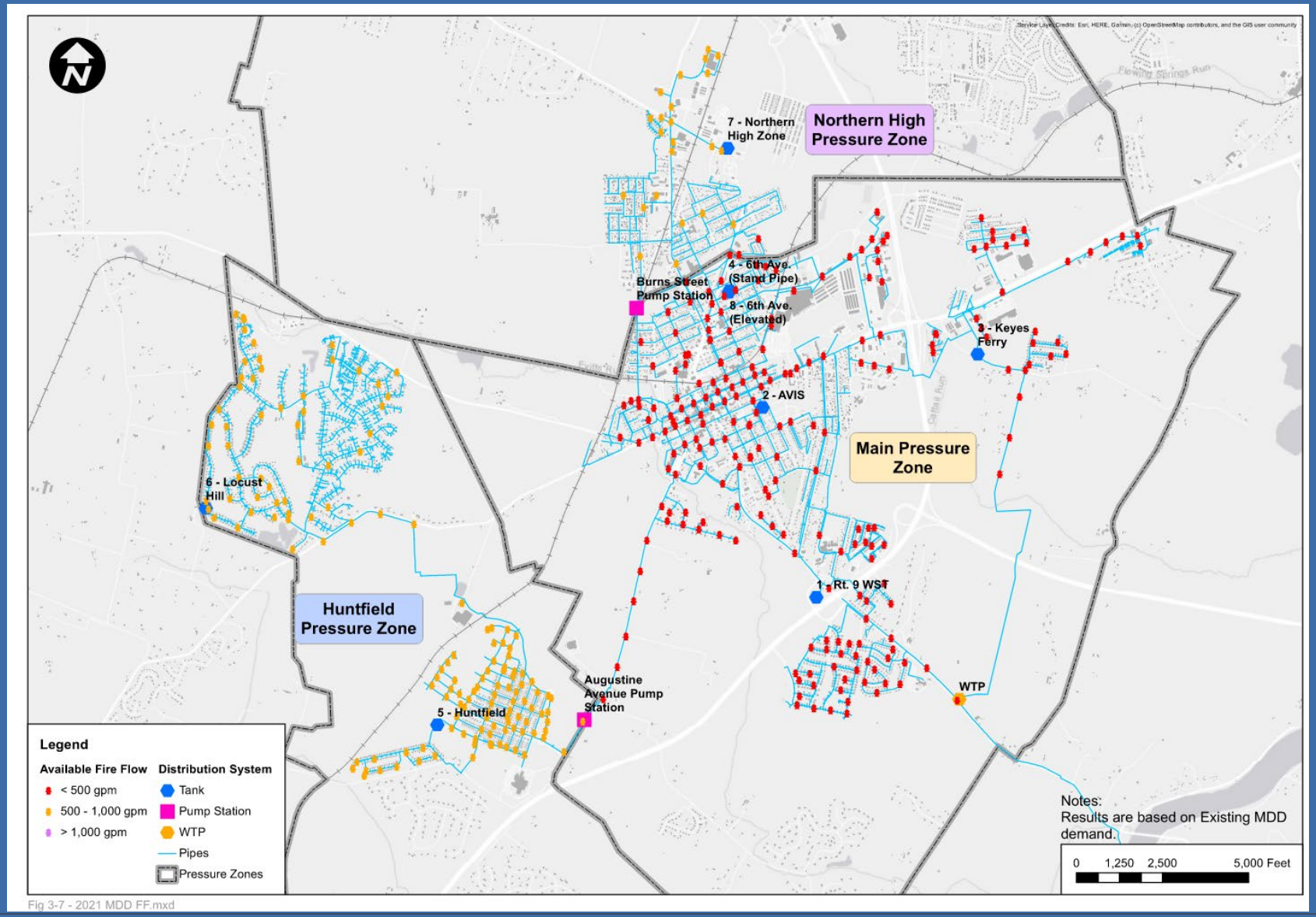
Photo 13 – Active Leak	Photo 14 – Active Leak	Photo 15 – Active leak with moss growth
		

Photo 28 – Pipe and Fitting Coating Failure	Photo 29 – Pipe and Fitting Coating Failure	Photo 30 – Pipe Stand Failure
		

Existing System Conditions



Demand Projections

TABLE 2-1: PROJECTED DEMAND FOR FUTURE DEVELOPMENT					
DEVELOPMENT ID	DEVELOPMENT	AGGRESSIVE GROWTH		CONSERVATIVE GROWTH	
		ADD (GPM)	MDD (GPM)	ADD (GPM)	MDD (GPM)
1	American Heritage (Huntwell)	33.33	47.00	16.67	23.5
9	Charles Town Infill	10.42	14.69	5.21	7.34
12	Fritts Property	33.33	47.00	16.67	23.50
14	Huntfield	39.58	55.81	19.79	27.91
15	Jefferson Heights North	14.58	20.56	7.29	10.28
16	Tate Manor	8.33	11.75	4.17	5.88
19	Langlet	20.83	29.38	10.42	14.69
22	Magnolia Springs	31.25	44.06	15.63	22.03
23	Norborne Glebe	33.33	47.00	16.67	23.50
24	Old Town Ranson – Infill	10.42	14.69	5.21	7.34
27	Prospect Place	17.71	24.97	8.85	12.48
30	Stolipher	20.83	29.38	10.42	14.69
31	Washington Landing	28.54	40.24	14.27	20.12
32	Winchester Cold Storage	57.29	80.78	28.65	40.39
33	Windmill Crossing	0.42	0.59	0.21	0.29
Total (gpm)		**360.21**	**507.90**	**180.1**	**253.94**
Total (mgd)		**0.52**	**0.73**	**0.26**	**0.37**

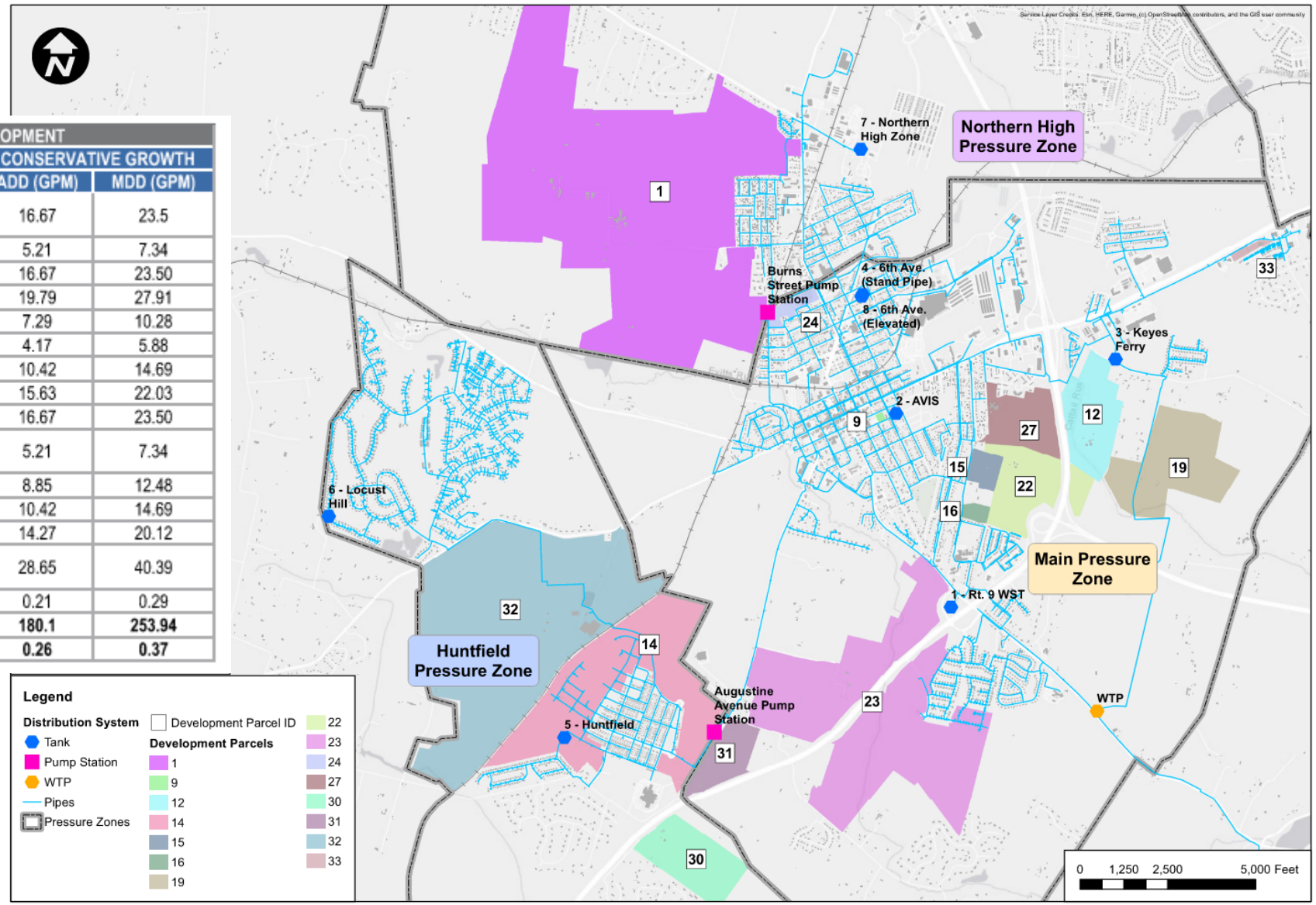


Fig 2-3 - Development Parcels.mxd

Future Demand Conditions

TABLE 2-2: EXISTING AND FUTURE DEMAND SUMMARY

PRESSURE ZONE	EXISTING		2040					
	ADD	MDD	ADD			MDD		
	ZONE DEMAND (GPM)	ZONE DEMAND (GPM)	ZONE DEMAND (GPM)	NEW DEMAND (GPM)	SUB-TOTAL (GPM)	ZONE DEMAND (GPM)	NEW DEMAND (GPM)	SUB-TOTAL (GPM)
Main System	756.25	1,067.63	773.15	104.58	***877.73***	1,090.15	147.45	**1,237.60**
Huntfield	283.28	399.93	347.46	58.85	***406.31***	489.91	82.99	**572.90**
Northern High	149.35	210.84	152.21	16.67	***168.87***	214.61	23.5	**238.11**
Total (gpm)	**1,188.88**	**1,678.4**	**1272.81**	**180.10**	**1452.91**	**1,794.67**	**253.94**	**2,048.61**
Total (mgd)	***1.7 mgd***	***2.4 mgd***	***1.83 mgd***	***0.26 mgd***	***2.09 mgd***	***2.58 mgd***	***0.37 mgd***	***2.95 mgd***

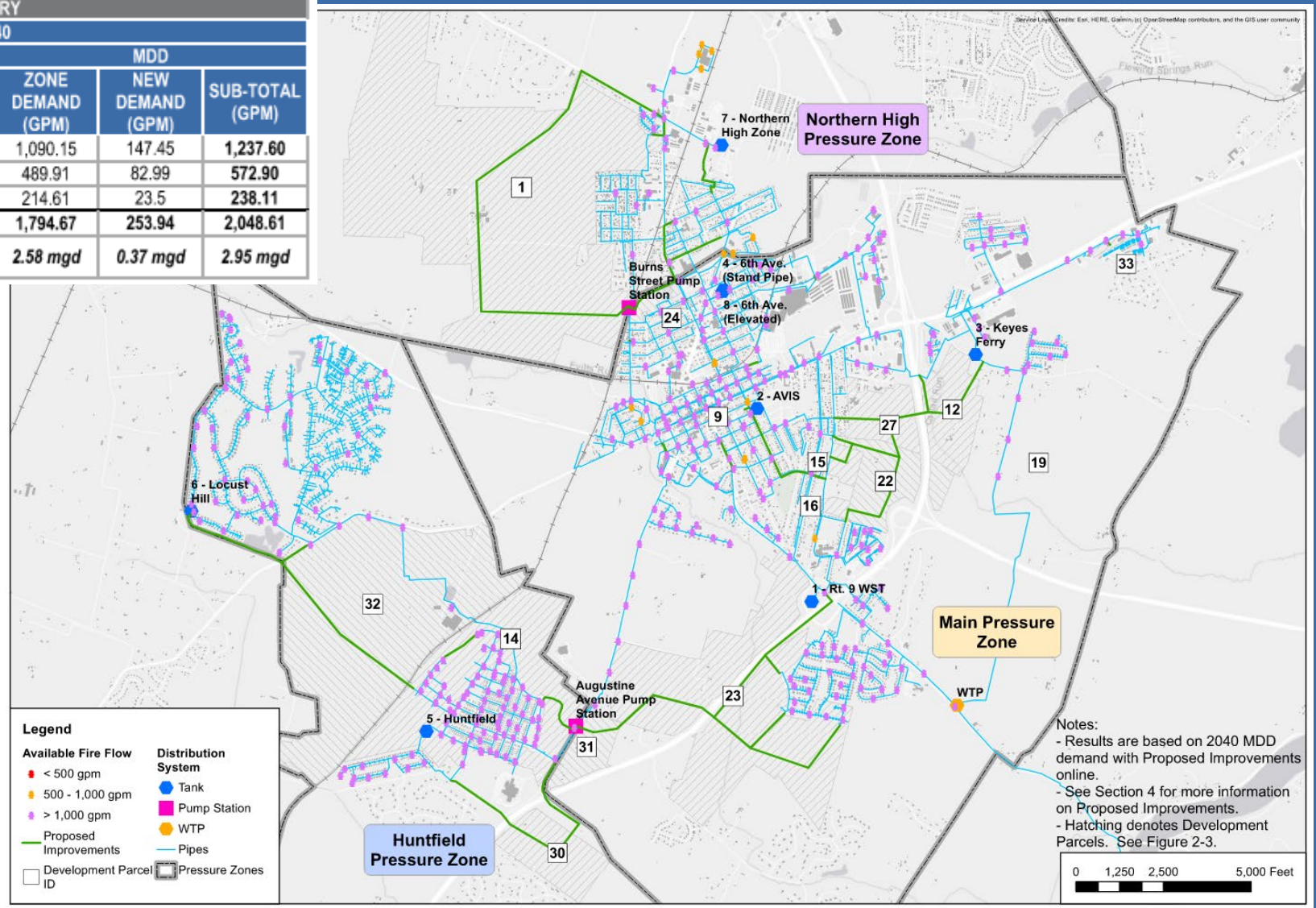


Fig 3-9 - 2040 MDD FF prop projects.mxd

Proposed Capital Improvements

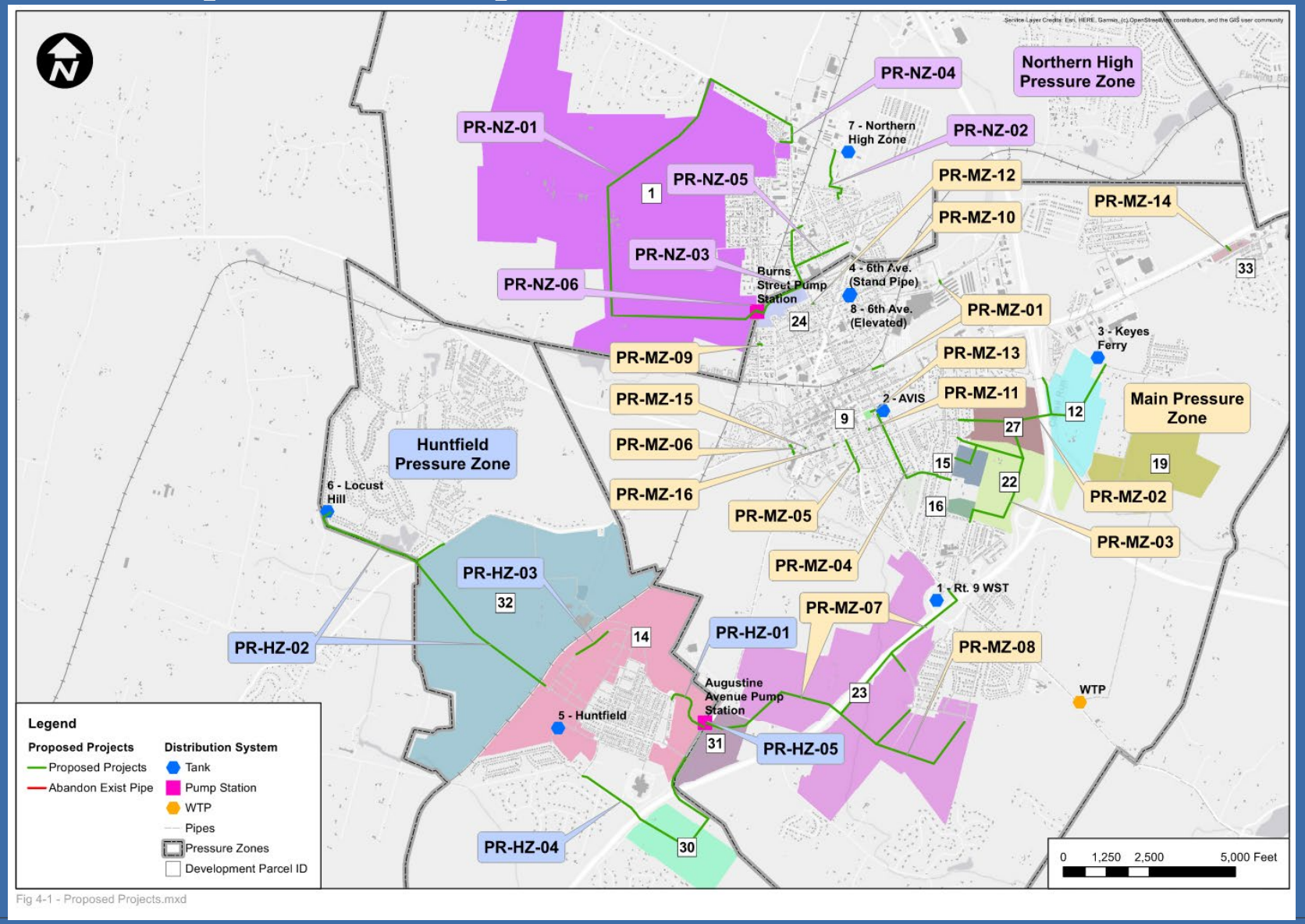


Fig 4-1 - Proposed Projects.mxd

Budgetary Cost Estimates

TABLE 4-1: SUMMARY OF IMPROVEMENTS

MAIN PRESSURE ZONE

PROJECT ID	PROJECT NAME	DESCRIPTION	FIGURE	SIZE	QUANTITY	ESTIMATED COST	PHASE
PR-MZ-01	Charles Town Racetrack	8" loop closure around the racetrack to improve normal operating pressure and increase fire flow capacity.	4.12	8"	500 LF	$88,000	A
PR-MZ-02	Fritts & Old Town Ranson	8" loop providing capacity for Fritts Property and Old Town Ranson.	4.13	8"	7,400 LF	$1,295,000	C
PR-MZ-03	Magnolia Springs	8" loop providing capacity for Magnolia Springs.	4.14	8"	6,200 LF	$1,085,000	C
PR-MZ-04	Church Street	8" line along Church Street between Avis tank and Route 34 to close a loop and increase fire flow capacity.	4.15	8"	3,400 LF	$595,000	B
PR-MZ-05	South George Street	8" loop closure along S. George St. between Mason St. and E. Academy with a connection to the 6" in Hunter St. Increases fire flow capacity in the MPZ.	4.16	6" 8"	20 LF 1,000 LF	$178,000 $101,000	B
PR-MZ-06	Water Street	12" loop closure along S. Water St. between W. Avis St. and W. Congress St. Increases fire flow capacity in the MPZ.	4.17	12"	400 LF	$2,400,000	B
PR-MZ-07	Route 340	12" line along Route 340 from S. George St. to Augustine Ave. PS. Provides redundant capacity to the pump station and eliminates the need for an upgrade to the station. Provides capacity to the west side of Norborne Greene.	4.18	12"	9,600 LF	$1,173,000	B
PR-MZ-08	Norborne Greene	8" looping to provide capacity to the Norborne Greene.	4.19	8"	6,700 LF	$7,000	C
PR-MZ-09	5th Street Hydrant	Connect fire hydrant in W. 5th Avenue to the 12" line in McDonald St. Increases fire flow capacity in the MPZ. Currently connected to a 2" line.	4.20	6"	50 LF	$7,000	A
PR-MZ-10	6th Avenue Hydrant	Connect fire hydrant in E. 6th Avenue to the 12" line in S. Marshall St. Increases fire flow capacity in the MPZ. Currently connected to a 2" line.	4.21	6"	50 LF	$7,000	A
PR-MZ-11	S. Mildred Hydrants	Provide a connection from the 8" line in E. academy St. to the two hydrants at the intersection. Increases fire flow capacity in the MPZ. Currently connected to a 2" line.	4.22	6"	50 LF	$9,000	A
PR-MZ-12	7th Avenue	Close loop between 8" lines at the intersection of E. 7th Avenue and S. Mildred Street. Increases fire flow capacity in the MPZ.	4.23	8"	50 LF	$35,000	A
PR-MZ-13	Charles Town	8" line to provide capacity to Charles Town Infill.	4.24	8"	200 LF	$35,000	C
PR-MZ-14	Windmill Crossing	8" line to provide capacity to Windmill Crossing.	4.25	8"	200 LF	$7,000	C
PR-MZ-15	W. Avis Hydrant	Connect fire hydrant at the intersection of W. Avis St. and S. West St. Increases fire flow to the MPZ.	4.26	6"	50 LF	$9,000	A
PR-MZ-16	W. Academy Tie	Connect 6" waterlines at the intersection of W. Academy St. and	4.27	8"	50 LF	$88,000	A
PR-MZ-17	Main Zone Maintenance	Repairs to tank and WTP facilities were identified in the condition assessment.	3.4	---	---	$28,000	A
					Main Pressure Zone Subtotal	$7,147,000	

TABLE 4-1: SUMMARY OF IMPROVEMENTS – CONT'D

NORTHERN HIGH PRESSURE ZONE

PROJECT ID	PROJECT NAME	DESCRIPTION	FIGURE	SIZE	QUANTITY	ESTIMATED COST	PHASE
PR-NZ-01	Huntwell West	8" loop providing capacity for Huntwell West.	4.6	8"	15,400 LF	$2,695,000	B
PR-NZ-02	Ameritech Street	8" loop closure between the Northern High Zone Tank and the 8" line at the intersection of N. Marshal St. and E. 14th St. to increase fire flow capacity to the NHPZ.	4.7	8"	1,900 LF	$333,000	A
PR-NZ-03	N. Mildred Street A	8" loop closure from Burns St. PS along W. Beltline Ave., N. Mildred St., E. 13th St. to N. Preston St. to increase fire flow capacity in the NHPZ.	4.8	8"	3,700 LF	$648,000	B
PR-NZ-04	N. Mildred Street B	12" loop closure between the 10" line feeding the subdivision near Robelie Dr, along N. Mildred St. to the intersection of 16th St. to increase fire flow capacity to the NHPZ.	4.9	12"	800 LF	$200,000	A
PR-NZ-05	E. 10th St.	8" loop along E. 1oth St. from the proposed 8" line in N. Mildred St. (PR-NZ-03) to the 6" line near the intersection of N. Fairfax Blvd. to increase fire flow capacity in the NHPZ.	4.10	8"	1,700 LF	$298,000	B
PR-NZ-06	Burns St. PS Upgrade	Upgrade Pumps at the Burns Street Pumping Station.	4.11	700 gpm	2 EA	$3,526,000	A
PR-NZ-07	Northern High Zone Maintenance	Repairs to tank and pumping station facilities identified in the condition assessment.	3.4	---	---	$2,000	A
					Northern High Pressure Zone Subtotal	$7,702,000	

HUNTFIELD ZONE

PROJECT ID	PROJECT NAME	DESCRIPTION	FIGURE	SIZE	QUANTITY	ESTIMATED COST	PHASE
PR-HZ-01	Augustine Ave. PS Discharge	8" discharge line from Augustine Ave. PS to provide capacity to Huntfield. Also provides redundant supply to Huntfield, Winchester, and Locust Hill.	4.2	8"	1,700 LF	$298,000	C
PR-HZ-02	Locust Hill	12" loop from Huntfield to Locust Hill to provide capacity to Winchester. Also provides a redundant loop to Locust Hill.	4.3	12"	9,600 LF	$2,400,000	C
PR-HZ-03	Huntfield	8" loop closure along the backside of Huntfield to provide additional capacity to Huntfield.	4.4	8"	1,200 LF	$210,000	B
PR-HZ-04	Roper/Stolipher	8" loop to provide capacity for Roper/Stolipher.	4.5	8"	7,100 LF	$1,243,000	C
PR-HZ-05	Augustine Ave. PS Upgrade	Add a new pump to the station.	4.6	450 GPM	1	$780,000	C
PR-HZ-06	Huntfield Zone Maintenance	Repairs to tank and pumping station facilities identified in the condition assessment.	3.4	---	---	$10,000	A
					Huntfield Pressure Zone Subtotal	$4,941,000	
					Total	$19,790,000	

Additional Recommendations

- Develop a preliminary engineering report to evaluate the capacity of the Burns Street pumping station and evaluate upgrade options required to meet future demand and system conditions.

- Evaluate the existing and future WTP hydraulic grade and flow requirements to ensure the plant has the capacity to deliver existing and future demands while maintaining the ability to fill the Main PZ tanks.

- Install individual PRV's at service connections with pressures greater than 135 psi.

Questions

FUTURE DEMAND PROJECTIONS AND WATER SYSTEMS CAPITAL IMPROVEMENTS PLANNING

Charles Town Utility Board
Charles Town, West Virginia

MAY 2022

Dewberry

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1. EXECUTIVE SUMMARY

1.1 Introduction

The City of Charles Town, West Virginia, has been seeing a steady increase in residential and commercial customers since the early 2000s. Charles Town Utility Board (CTUB) currently serves about 6,387 customers in the area; approximately 5,765 (90%) of these customers are residential and 10% are commercial (based on the number of customers), with Hollywood Casino at Charles Town Races and Jefferson Medical Center as their two largest customers. The water model was updated as part of the Basis of Design Report submitted in September of 2019. The updates for this report include adding future demands for 13 developments identified by CTUB.

This report includes an inventory of major water distribution system components (tanks, pumps, valves, etc.), current and recommended operating philosophy, water model results, figures, and recommendations to improve the water distribution and fire flow suppression systems.

1.2 Scope of Work

The Phase 1 Scope of Work agreed upon between CTUB and Dewberry includes the following key elements, which have each been addressed in this report:

- Development of future demand projections for the year 2040
- Simulation of future demand conditions under steady-state and extended period conditions
- Identification of hydraulic limitations and upgrades to address them
- Identification of a phased capital improvements plan and cost opinions including inspection and preventative maintenance projects
- Preparation of a water systems capital improvements plan report

The future demand projections and model updates are provided in **Section 2** of this report. An evaluation of the distribution system is provided in **Section 3**. Recommended improvements to the CTUB system are presented in **Section 4** of this report.

1.3 Water Model Development

The water model consists of three pressure zones, the Main pressure zone (MPZ), the Huntfield pressure zone (HPZ), and the Northern High pressure zone (NHPZ). CTUB owns and operates a water treatment plant (WTP), with a treatment capacity of 2.8 mgd, located south of Town along Charles Town Road. The plant pumps into the MPZ and supplies all the water for the system. There are two additional pumping stations in the system the Augustine Avenue pumping station (AAPS) and the Burns Street pumping station (BSPS). The AAPS is a 0.65 mgd station located along Augustine Avenue and supplies the HPZ. The BSPS is a 1.1 mgd station located at the southern end of Burns Street and supplies the NHPZ. **Figure 2-1** shows a map of the distribution system with the locations of the WTP, pumping stations, tanks, and pressure zone boundaries. **Figure 2-2** shows a schematic of the system, displaying the relative operating levels of each pressure zone.

Future Demands projections for the 13 development areas are provided by CTUB and are shown in **Table 2-2**. The existing and future average and maximum day demands are shown in **Table 2-3**.

1.4 System Analysis

The system is evaluated based on tank operation, pumping station capacity, minimum and maximum system pressure, and available fire flow. The evaluation identifies projects required to meet the capacity of the distribution system as the system grows.

2. WATER MODEL DEVELOPMENT

2.1 Water Model Overview and Update

The Model that was provided to Dewberry contained the location of major assets (pumps, tanks, valves, and pipelines). As part of the 2019 Basis of Design Report, Dewberry added control rules for valves, pumps, tank levels, etc. to best represent the current CTUB's system and operation. For this report, new piping and nodes are added to represent the expansion of the distribution system to serve the 13 redevelopment areas.

The water model consists of three pressure zones, the Main pressure zone (MPZ), the Huntfield pressure zone (HPZ), and the Northern High pressure zone (NHPZ). CTUB owns and operates a water treatment plant (WTP), with a treatment capacity of 2.8 mgd, located south of Town along Charles Town Road. The plant pumps into the MPZ and supplies all the water for the system. There are two additional pumping stations in the system the Augustine Avenue pumping station (AAPS) and the Burns Street pumping station (BSPS). The AAPS is a 0.65 mgd station located along Augustine Avenue and supplies the HPZ. The BSPS is a 1.1 mgd station located at the southern end of Burns Street and supplies the NHPZ. **Figure 2-1** shows a map of the distribution system with the locations of the WTP, pumping stations, tanks, and pressure zone boundaries. **Figure 2-2** shows a schematic of the system, displaying the relative operating levels of each pressure zone.

2.2 Demand Projection and Distribution

The last update to the model was completed in September of 2019 (by Dewberry). This model update adds future developments located in the Main System pressure zone (MPZ), Huntfield Pressure Zone (HPZ), and the Northern High Pressure Zone (NHPZ) to the demand. **Figure 2-3** shows the locations of the future developments.

Growth in the system is variable and dependent upon numerous factors outside the control of the City, notably the state of the economy and the regional housing market, three growth scenarios are utilized for analysis:

1. Aggressive Growth – Full Buildout – all developments grow to full density per developer projections.
2. Conservative Growth – Assumes 50% of the developer projected density occurs.
3. Average Growth – This scenario is the average of the Aggressive and Conservative growth scenarios.

The Conservative projections are elected by the City for evaluation in this study. Refer to the *'Water Treatment System Facility Plan Update', April 2022* for more information on the growth scenarios and methodology behind each.

Table 2-1 shows the projected demands for each development as provided by CTUB. **Table 2-2** shows the existing and future Average Day Demand (ADD) and Maximum Day Demand (MDD) separated by pressure zone. The model is used to evaluate the system performance, including the development demands, and determine any capacity-related projects required to support the future development.

Per City guidance, the Average Day to Maximum Day peaking factor of 1.41, developed in the *'Water Treatment System Facility Plan Update'* is utilized in this evaluation.

TABLE 2-1: PROJECTED DEMAND FOR FUTURE DEVELOPMENT					
DEVELOPMENT ID	DEVELOPMENT	AGGRESSIVE GROWTH		CONSERVATIVE GROWTH	
		ADD (GPM)	MDD (GPM)	ADD (GPM)	MDD (GPM)
1	American Heritage (Huntwell)	33.33	47.00	16.67	23.5
9	Charles Town Infill	10.42	14.69	5.21	7.34
12	Fritts Property	33.33	47.00	16.67	23.50
14	Huntfield	39.58	55.81	19.79	27.91
15	Jefferson Heights North	14.58	20.56	7.29	10.28
16	Tate Manor	8.33	11.75	4.17	5.88
19	Langlet	20.83	29.38	10.42	14.69
22	Magnolia Springs	31.25	44.06	15.63	22.03
23	Norborne Glebe	33.33	47.00	16.67	23.50
24	Old Town Ranson – Infill	10.42	14.69	5.21	7.34
27	Prospect Place	17.71	24.97	8.85	12.48
30	Stolipher	20.83	29.38	10.42	14.69
31	Washington Landing	28.54	40.24	14.27	20.12
32	Winchester Cold Storage	57.29	80.78	28.65	40.39
33	Windmill Crossing	0.42	0.59	0.21	0.29
Total (gpm)		**360.21**	**507.90**	**180.1**	**253.94**
Total (mgd)		**0.52**	**0.73**	**0.26**	**0.37**

TABLE 2-2: EXISTING AND FUTURE DEMAND SUMMARY								
PRESSURE ZONE	EXISTING		2040					
	ADD	MDD	ADD			MDD		
	ZONE DEMAND (GPM)	ZONE DEMAND (GPM)	ZONE DEMAND (GPM)	NEW DEMAND (GPM)	SUB-TOTAL (GPM)	ZONE DEMAND (GPM)	NEW DEMAND (GPM)	SUB-TOTAL (GPM)
Main System	756.25	1,067.63	773.15	104.58	***877.73***	1,090.15	147.45	**1,237.60**
Huntfield	283.28	399.93	347.46	58.85	***406.31***	489.91	82.99	**572.90**
Northern High	149.35	210.84	152.21	16.67	***168.87***	214.61	23.5	**238.11**
Total (gpm)	**1,188.88**	**1,678.4**	**1272.81**	**180.10**	**1452.91**	**1,794.67**	**253.94**	**2,048.61**
Total (mgd)	***1.7 mgd***	***2.4 mgd***	***1.83 mgd***	***0.26 mgd***	***2.09 mgd***	***2.58 mgd***	***0.37 mgd***	***2.95 mgd***

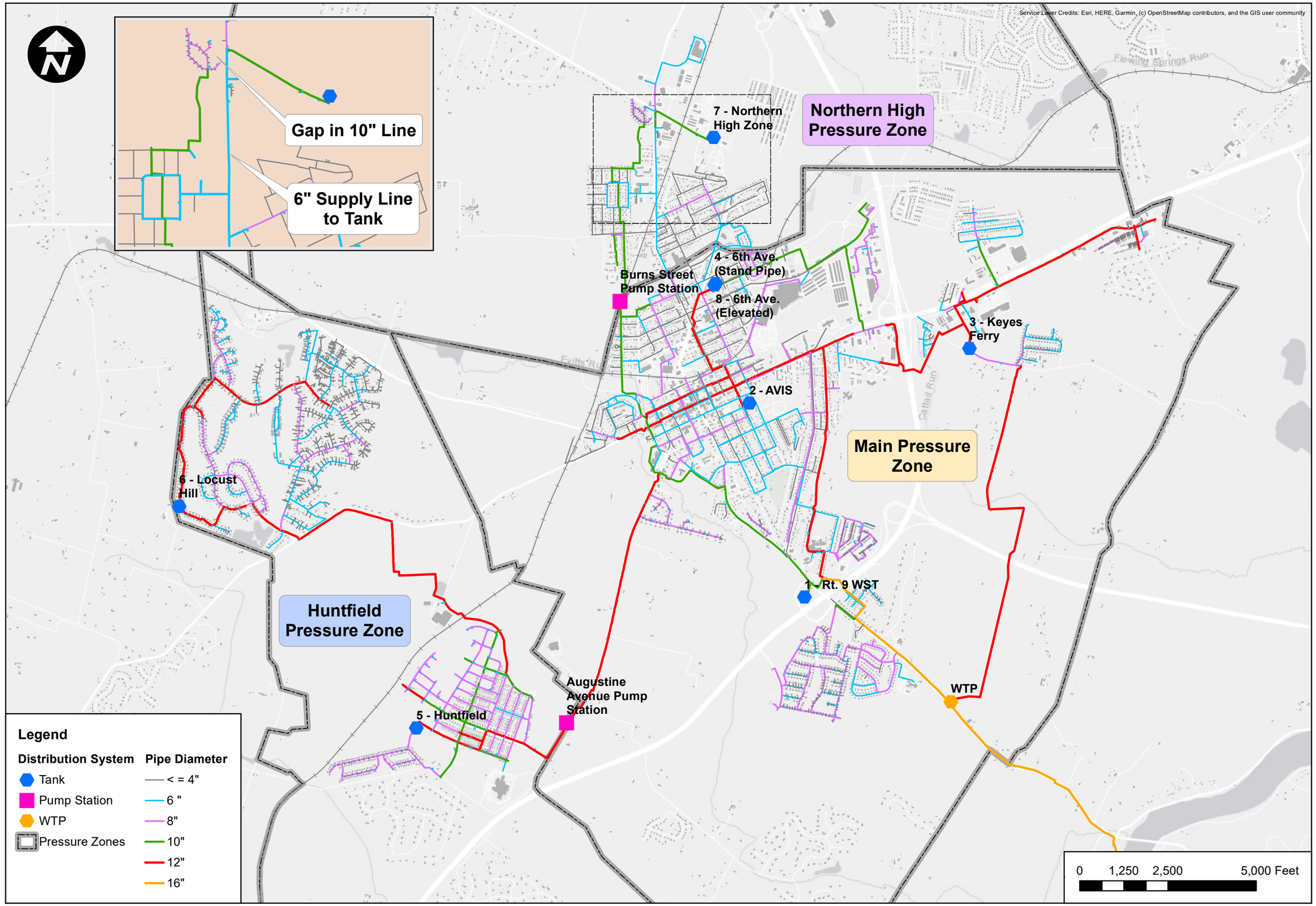

FIGURE NO. 2.1

TITLE EXISTING SYSTEM

SCALE 1 inch = 2,500 feet

PROJECT WATER MASTER PLAN
CHARLES TOWN UTILITY BOARD

DATE MAY 2022

PROJ. NO. 5107007

Dewberry®
Dewberry Engineers Inc.
4805 LAKE BROOK DRIVE, SUITE 200
GLEN ALLEN, VIRGINIA 23060
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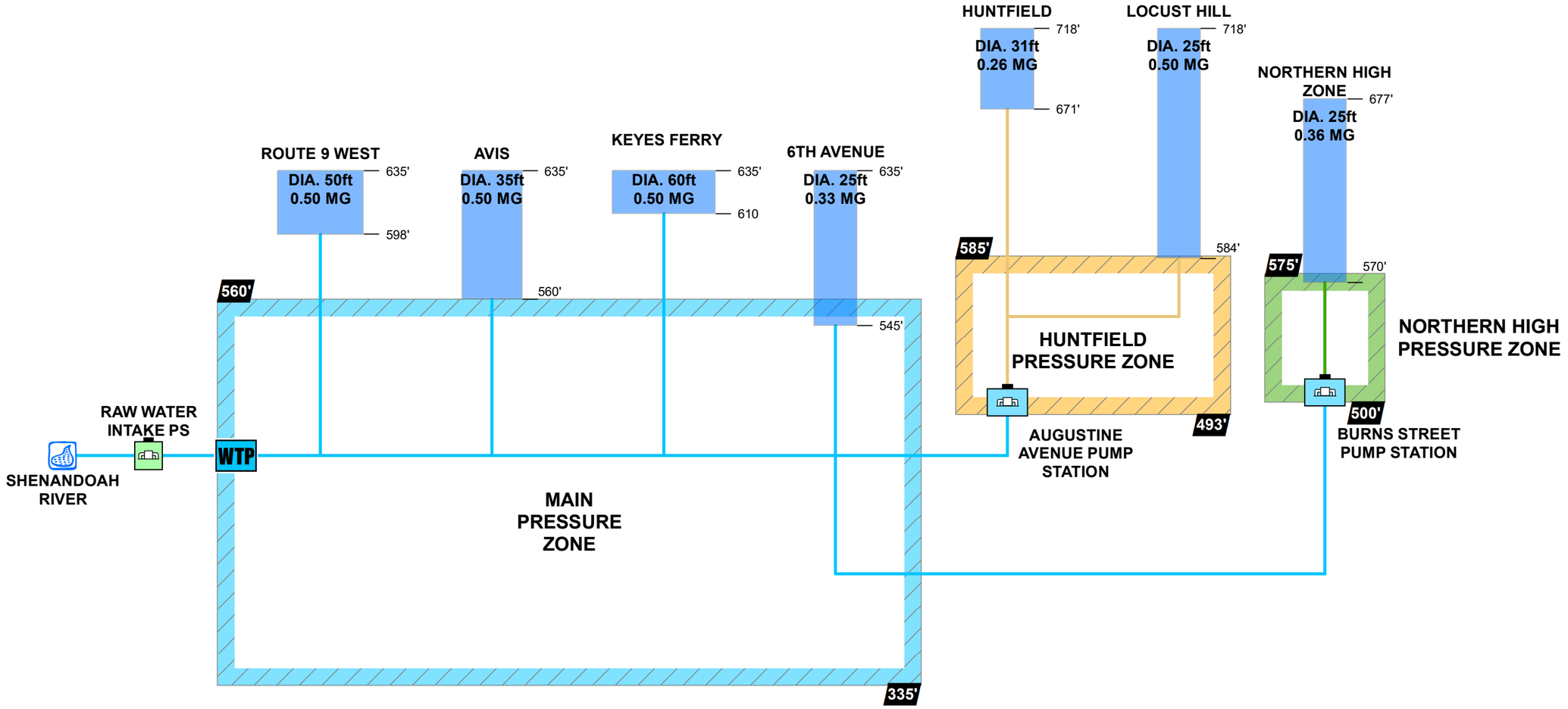

Legend

Facilities

- Intake Pump Station
- Pump Station
- WTP — Water Treatment Plant
- River

Pressure Zone

- Hunfield Pressure Zone
- Main Pressure Zone
- Northern High Pressure Zone
- Ground Elevation

Pressure Zone Piping

- Huntfield Zone
- Main Zone
- Northern High Zone

FIGURE NO. 2.2

TITLE EXISTING SYSTEM SCHEMATIC

PROJECT WATER MASTER PLAN
CHARLES TOWN UTILITY BOARD

SCALE

DATE MAY 2022

PROJ. NO. 5107007

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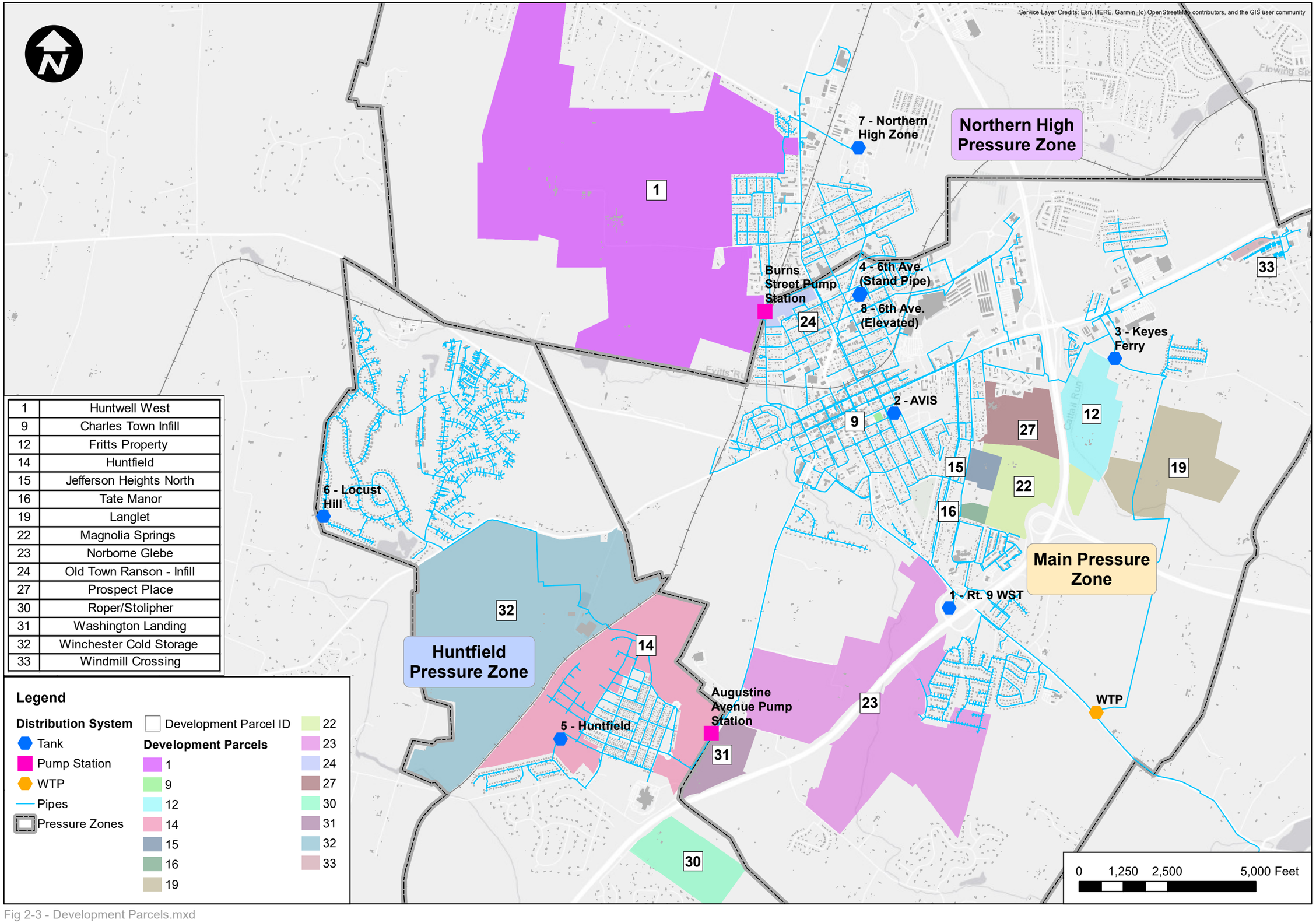

1	Huntwell West
9	Charles Town Infill
12	Fritts Property
14	Huntfield
15	Jefferson Heights North
16	Tate Manor
19	Langlet
22	Magnolia Springs
23	Norborne Glebe
24	Old Town Ranson - Infill
27	Prospect Place
30	Roper/Stolipher
31	Washington Landing
32	Winchester Cold Storage
33	Windmill Crossing

Legend

Distribution System
- Tank
- Pump Station
- WTP
- Pipes
- Pressure Zones

Development Parcel ID

Development Parcels
- 1
- 9
- 12
- 14
- 15
- 16
- 19
- 22
- 23
- 24
- 27
- 30
- 31
- 32
- 33

FIGURE NO. 2.3

TITLE PROPOSED DEVLOPMENT PARCELS

SCALE 1 inch = 2,500 feet

PROJECT WATER MASTER PLAN
CHARLES TOWN UTILITY BOARD

DATE MAY 2022

PROJ. NO. 5107007

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3. DISTRIBUTION SYSTEM ANALYSIS

Municipalities operating utility systems are governed by Title 64 Series 77 of the West Virginia Bureau of Public Health (WVBPH) Public Water System Design Standards (hereafter BPH Regulations). Portions of the regulations are quoted in the paragraphs below serving as the basis of evaluation.

According to the BPH Regulations, pressures in these pipelines (and all such pipelines in the distribution system) need to be maintained at 30 psi minimum under static conditions and 20 psi under all dynamic flow conditions (including fire flow). An excerpt from the regulations appears below:

9.4.a. Pressures. -- The maximum variation between high and low levels in standpipes or elevated storage structures providing pressure to a distribution system shall not exceed thirty (30) feet (thirteen (13) pounds per square inch). The minimum pressure in the distribution system shall be thirty (30) pounds per square inch under static conditions and twenty (20) pounds per square inch under all flow conditions. The normal working pressures of the distribution mains shall be designed based upon the pipe manufacturer's recommendations and the applicable AWWA standards for the type of pipe. Pressure-regulating/pressure reducing valves shall be used to protect the distribution mains from excessive pressures. When static pressures in the distribution mains exceed one hundred thirty-five (135) pounds per square inch, the utility shall have the option of installing pressure reducing valves on service lines or requiring (or recommending) the customer install and maintain a pressure reducing valve on the customer's service line.

In practice, a pressure range of between 40 and 100 psi is typically preferred. The existing system is analyzed using the calibrated model ensuring compliance with the following conditions:

- Greater than 20 psi minimum pressure under maximum day demands coupled with fire-flow conditions
- Greater than 30 psi minimum pressure under normal operating conditions with maximum day demands
- Less than 135 psi maximum pressure under normal operating conditions with average day demands

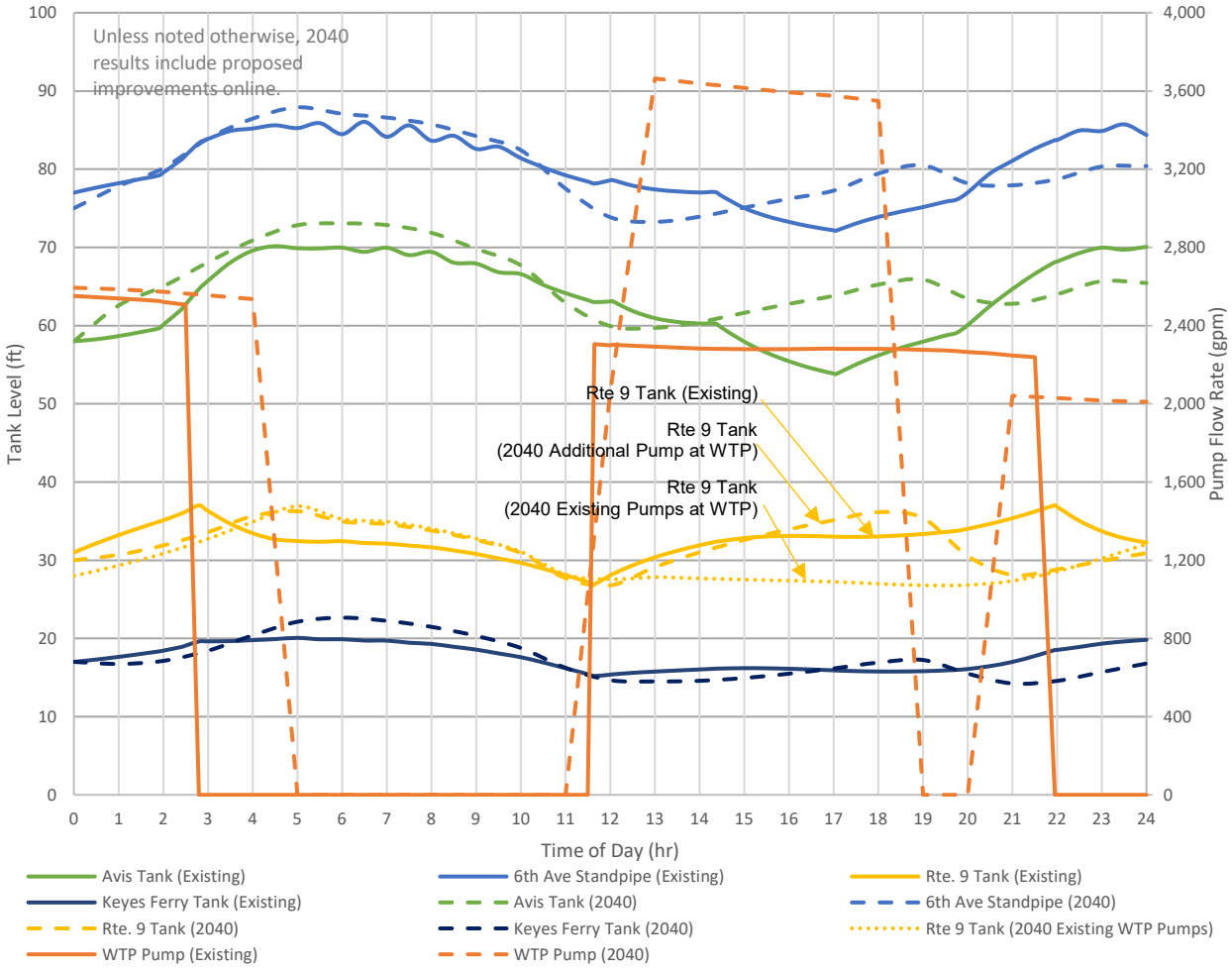
3.1 Pumping Station and Tank Operation

The pump stations and tanks are evaluated by comparing the stations' delivery capacity against the future MDD required as the system demand grows over time. Capacity of the station is driven by the ability to refill the tanks after a MDD, maintenance of system pressure within the acceptable range, and where the pumps are operating on their pump curves. All of the above items are driven by head-loss in the system and head-loss is driven by the amount of flow in the pipes. Subsequently, the best way to evaluate pump capacity and determine operating points is to develop a system curve. The system curve is a representation of headloss across a range of flows. A system curve is developed under two conditions, a) discharge side tanks at their high levels and the suction side tanks at their low points, and b) discharge side tanks at their low points and suction side tanks at their high points, respectively called the maximum system curve and the minimum system curve. Minimum and maximum system curves are developed for each pumping station in the system under existing and 2040 demands. On each system curve, the station's particular pump curve is plotted. Where the pump curve intercepts the minimum and maximum head system curve shows the minimum and maximum flow the pump can produce and the minimum and maximum total dynamic head at which the pump operates. System curves for the WTP, AAPS, and BSPS are provided in **Figure 3-2**, **Figure 3-4,** and **Figure 3-6**, respectively. Each Figure shows the existing curve (with no system improvements), and the future curve (with proposed improvements in place).

3.1.1 Main Pressure Zone

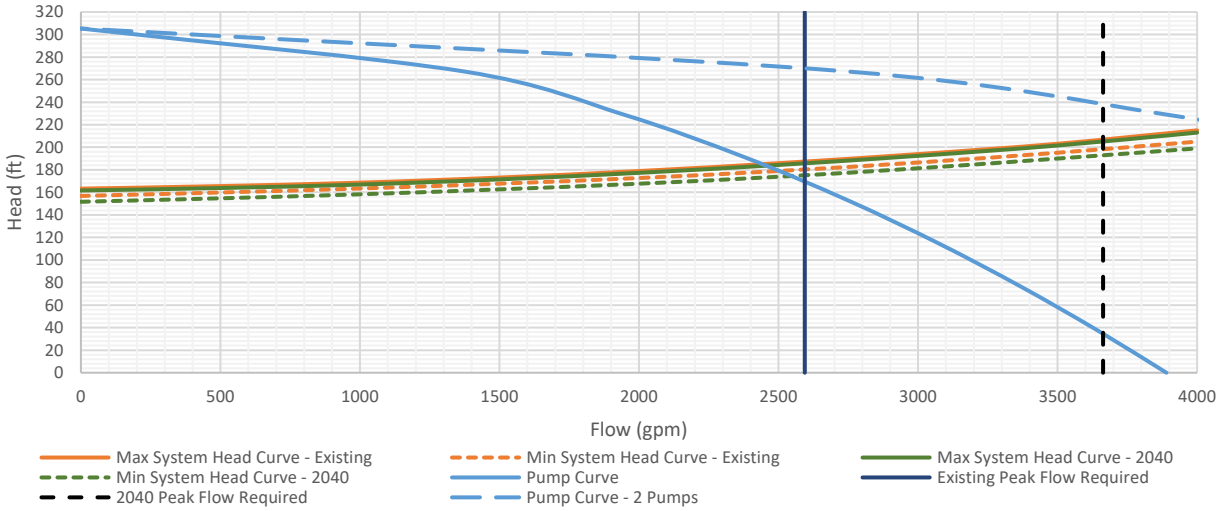
The Main Pressure zone contains four tanks, Route 9 West Tank, Avis Tank, Keyes Ferry Tank, and 6th Street Ave Tank, with the Route 9 tank controlling the WTP pumps. As shown in **Figure 3-1** (see notations for the yellow line), under existing demand conditions, the tank fills at 10:00 PM with a flow rate of approximately 2,300 gpm. Under 2040 demand conditions, the existing WTP pumps produce approximately 2,000 gpm and cannot fill the Route 9 tank.

FIGURE 3-1: Main Pressure Zone Tank Levels and Pumping Station Flow



The WTP system curve, **Figure 3-2,** is considered flat, with a change of approximately 30-ft of head across the operating range of the existing pump curve. The pumps at the WTP are variable speed with a design point of 1,945 gpm @ 229' at full speed. The WTP finished water pumps will require an upgrade to have the capacity to fill the MPZ tanks (Refer to the *'Water Treatment System Facility Plan Update', April 2022*, for more information regarding upgrades to the plant). **Dewberry recommends evaluating the existing and future WTP hydraulic grade and flow requirements to ensure the plant has the capacity to deliver existing and future demands while maintaining the ability to fill the Main PZ tanks.**

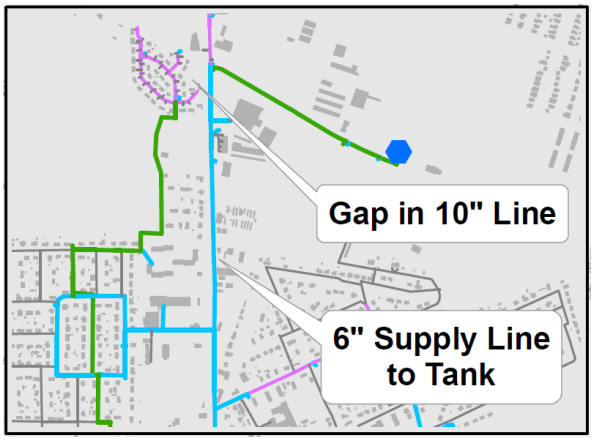
FIGURE 3-2: Water Treatment Plant System Curve and Pump Curve



3.1.2 Northern High Pressure Zone

The Northern High Zone Tank controls the Burns Street Pumping Station. **Figure 3-3** (see notations for the blue line) shows that the existing BSPS, under 2040 conditions (with all improvements online) runs at a high rate of 1,200 gpm, which exceeds the actual capacity of 750 gpm. This is caused by the reduction in headloss from the closure of the 10" pipe gap (see inset and project PR-NZ-04) as well as the closure of other loops in the zone. This reduction in headloss flattens the system curve, see **Figure 3-4**, causing the pump to run at a higher rate. Replacing the pumps with lower head pumps will allow the pumps to operate at an efficient rate, while still filling the Northern High Zone tank.

The existing BSPS system curve is steep, with a design point of 750 gpm @ 145' for the pump curve. When the station is operating, the discharge grade is approximately 760' (83' above the overflow of the tank). The high discharge grade is due to a hydraulic restriction between Robelei Drive and 16th Street. While there is a 10" waterline from the PS up to Robelei Drive and a 10" line along 16th Street from North Mildred Street to the tank, there is no connection between the two 10" sections. The tank is fed by a 10" line up to Ambrose Drive and 2300 LF of 6" along North Mildred Drive up to 16th Street where it ties into the 10" connecting to the tanks. See Inset to the right (also shown in **Figure 2-1**), showing the 6"-10" waterlines in the system. The proposed projects in the NHPZ fill the gap in the 10" lines, as well as complete several 8" loops in the system. The projects will increase capacity to the tank, increase fire flow capacity for the zone overall, and provide capacity for the future demand in the zone. The 2040 system curve, **Figure 3-4**, for the station shows the impact of the proposed projects on headloss in the system. The flatter curve indicates a large reduction in headloss resulting in several benefits for the station and zone including:



Inset – Gap in 10" Line

- Lower energy costs for the station,
- Decrease in maximum system pressures,
- Reduced breaks and leaks due to the lower pressures.

The reduction in headloss requires the replacement of the existing pumps with two pumps rated for approximately 700 gpm @ 70' TDH. A preliminary engineering report (PER) is recommended to further evaluate the station and required upgrades. The PER should evaluate the pump upgrades project PR-NZ-06 and the pipe project PR-NZ-04. These projects should be completed together, the pipeline project will reduce the system head-loss and cause the existing pumps to exceed design capacity.

FIGURE 3-3: Northern High Pressure Zone Tank Levels and Pumping Station Flow

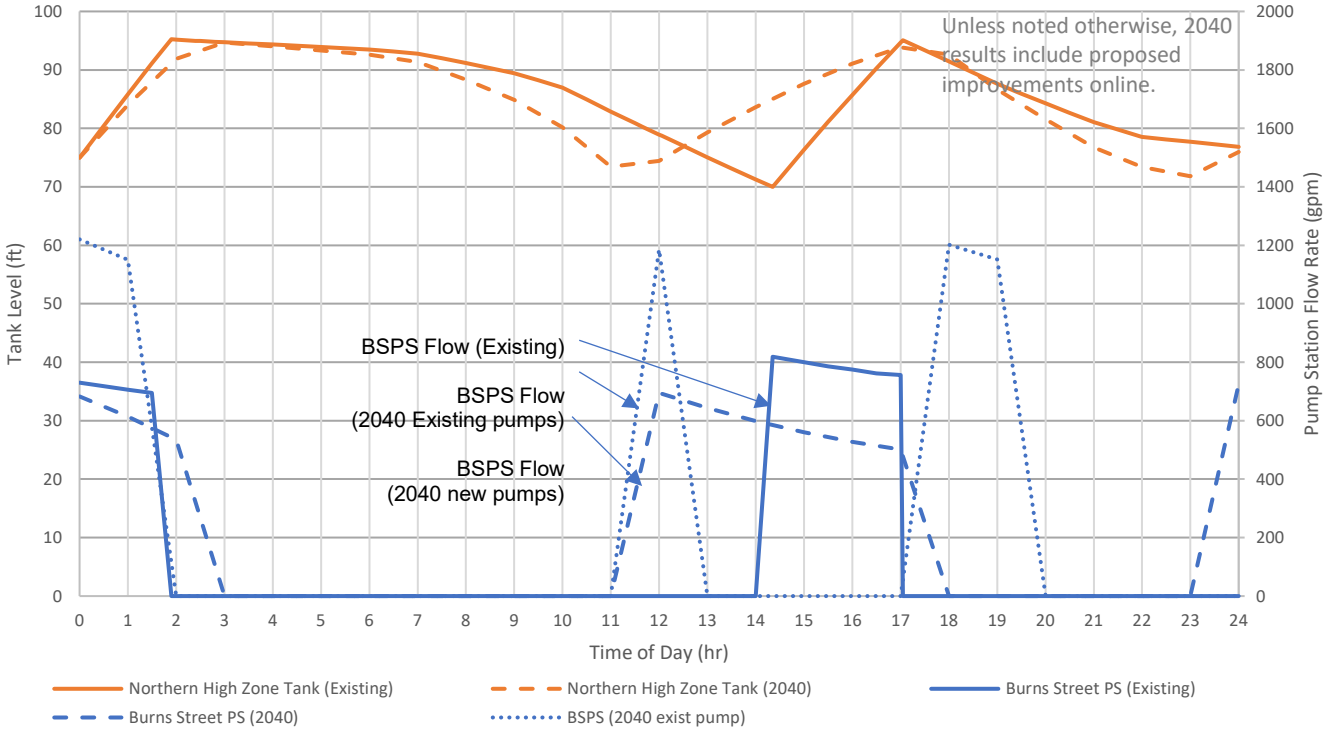
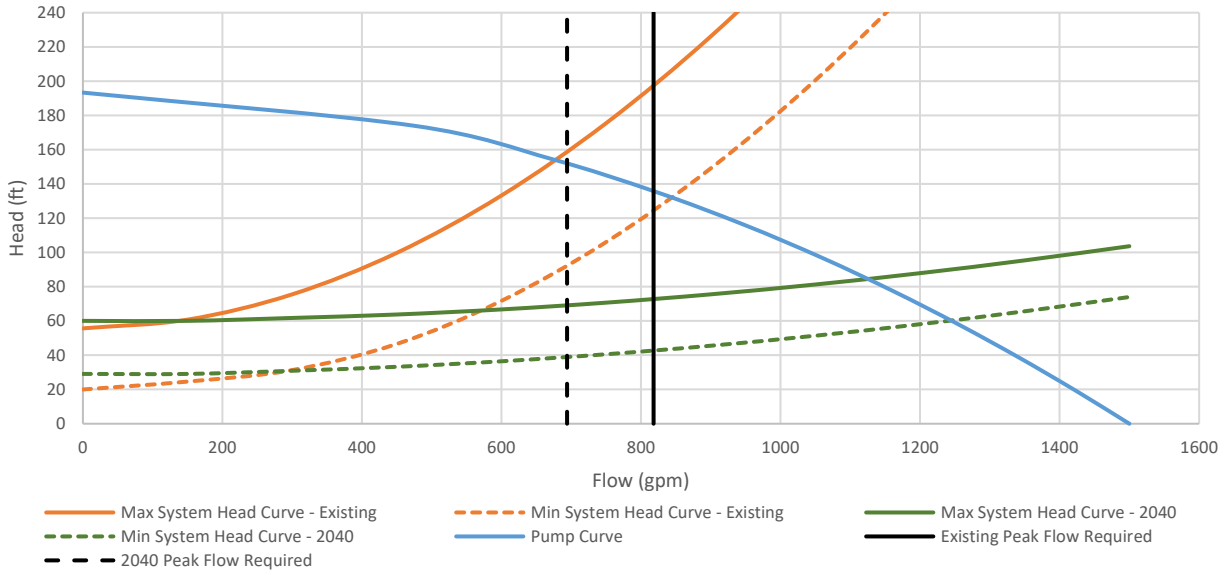


FIGURE 3-4: Burns Street Pumping Station System Curve and Pump Curve



3.1.3 Huntfield Pressure Zone

Two tanks are in the Huntfield Pressure Zone Huntfield and Locust Hill, with the Huntfield Tank controlling the Augustine Avenue Pumping Station. The existing pumps are rated for 450 gpm @ 156' TDH. The maximum day demand is increasing from 266.62 gpm to 502.04 gpm. **Figure 3-5** (see notations for the green and grey lines) shows that, with the increase in demand, the existing AAPS pump does not have the capacity to fill the tanks in the evening for the 2040 demand condition. Adding an additional pump to the station will allow the station to produce a higher flow in the afternoon to fill the tank by 7:00 PM. **Figure 3-6** shows the system curve for AAPS. The existing and year 2040 curves are both generally flat. The proposed improvements in the HPZ lower the future curve by approximately 10' and increase flows by roughly 50 gpm.

FIGURE 3-5: Huntfield Pressure Zone Tank Levels and Pumping Station Flow

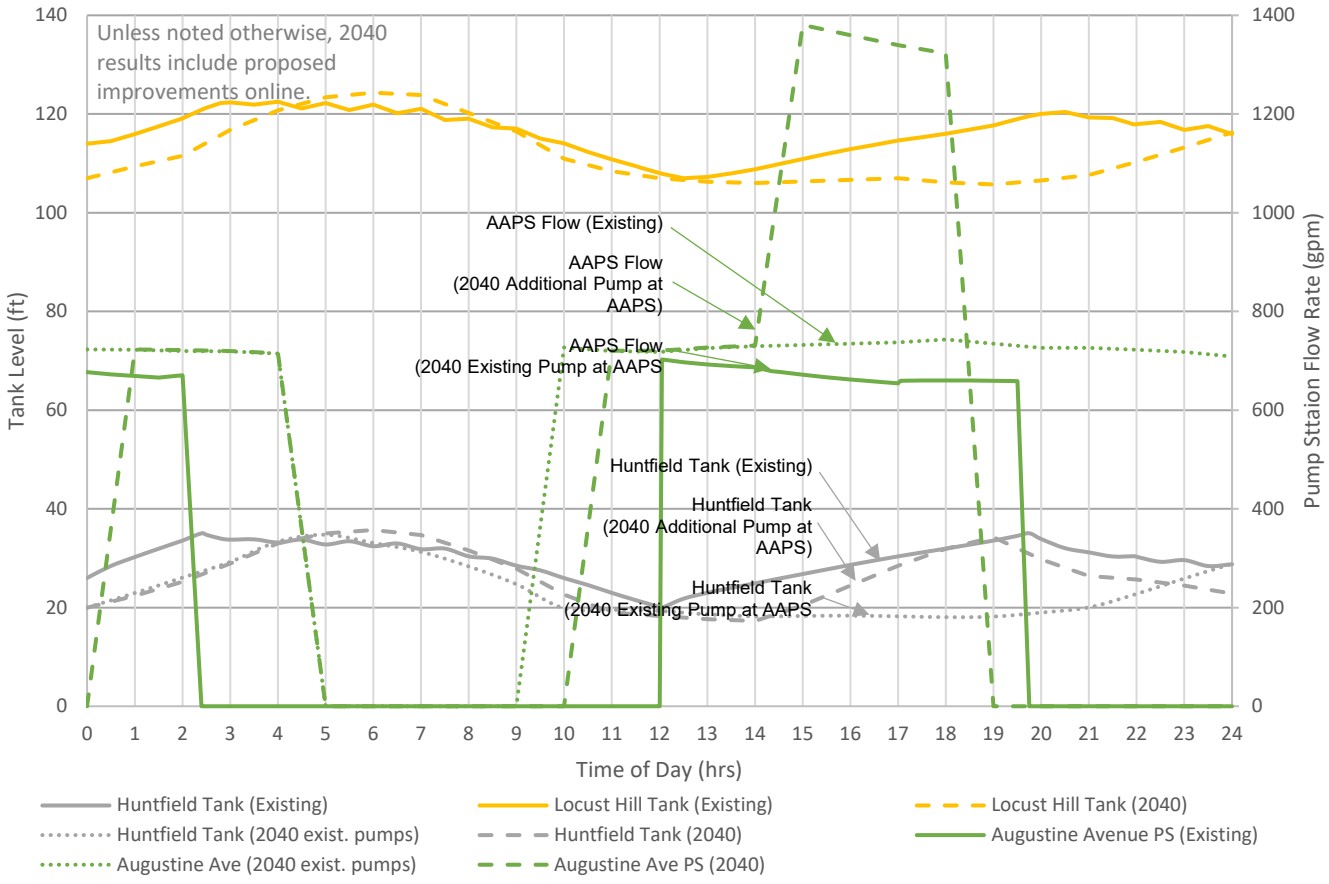
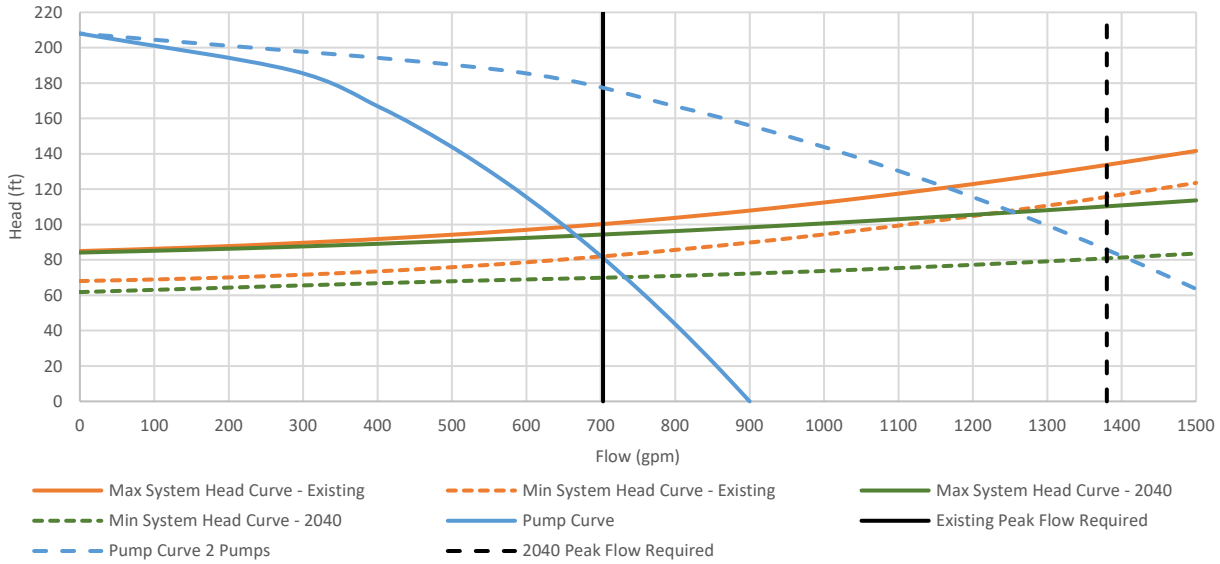


FIGURE 3-6: Augustine Avenue Pumping Station System Curve and Pump Curve



3.2 Fire Flow Analysis

Dewberry developed the fire flow analysis to determine the system's response to a fire flow event of 500 gpm. **Table 3-1** shows the Fire Flow constraints used to analyze the system

TABLE 3-1: FIRE FLOW CONSTRAINTS	
DESCRIPTION	**CONSTRAINT**
Fire Flow Needed	500 gpm
Fire Flow (Upper Limit)	1,000 gpm
Apply Fire Flows By	Adding to Baseline Demand
Pressure (Residual Lower Limit)	20 psi
Pressure (Zone Lower Limit)	20 psi

Initial tank levels are set at the corresponding pump start level to conservatively analyze system pressure. Based on the fire flow analysis report generated in WaterCAD, Dewberry determined which nodes are not compliant with state and local regulations for required fire flows and residual pressures during maximum day demands. **Figure 3-7** shows a map of the distribution system with the hydrant color-coded based on available fire flow. Hydrants failing to meet the needed fire flow of 500 gpm are shown in red. A large number of hydrants do meet the required flow. This is caused by the racetrack demands and the hydraulic restrictions surrounding the track. The inset on **Figure 3-7** shows the track and identifies the restrictions caused by the 2" pipe feeding the track from the north and west. **Figure 3-8** shows the existing system fire flow, with no demand for the racetrack. Under this scenario only the areas around the track see low fire flows. Project **PR-MZ-01** removes the restriction by replacing the 2" lines with 8" lines, this improves fire flow to the racetrack and the rest of the MPZ. **Figure 3-9** shows the available fire flow with 2040 demands and all proposed improvements online. Under the 2040 conditions with improvements online, the system meets or exceeds the required fire flow for all hydrants in the system.

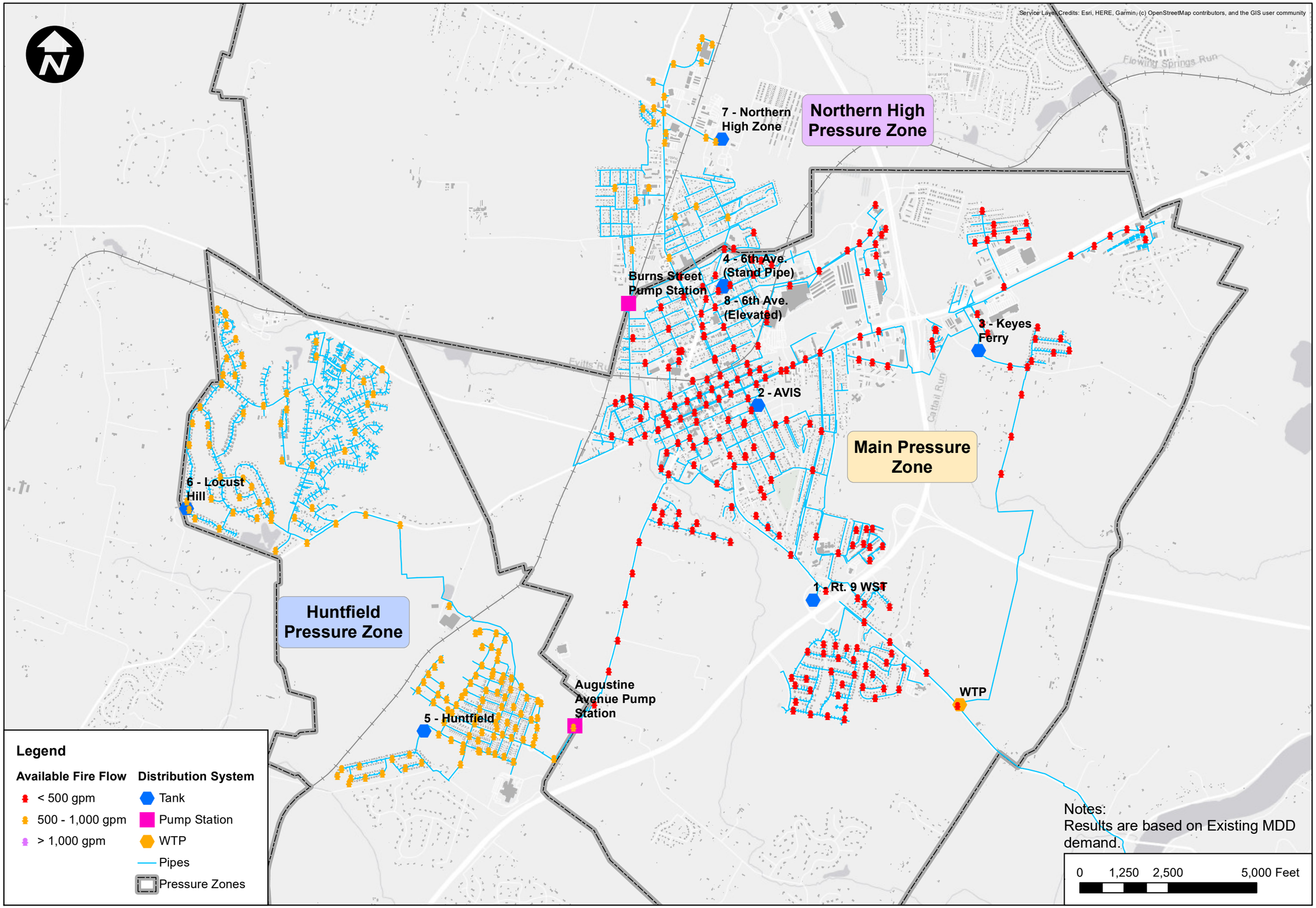


FIGURE NO. 3-7

TITLE AVAILABLE FIRE FLOW EXISTING MDD

SCALE 1 inch = 2,500 feet

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DATE MAY 2022

PROJ. NO. 5107007

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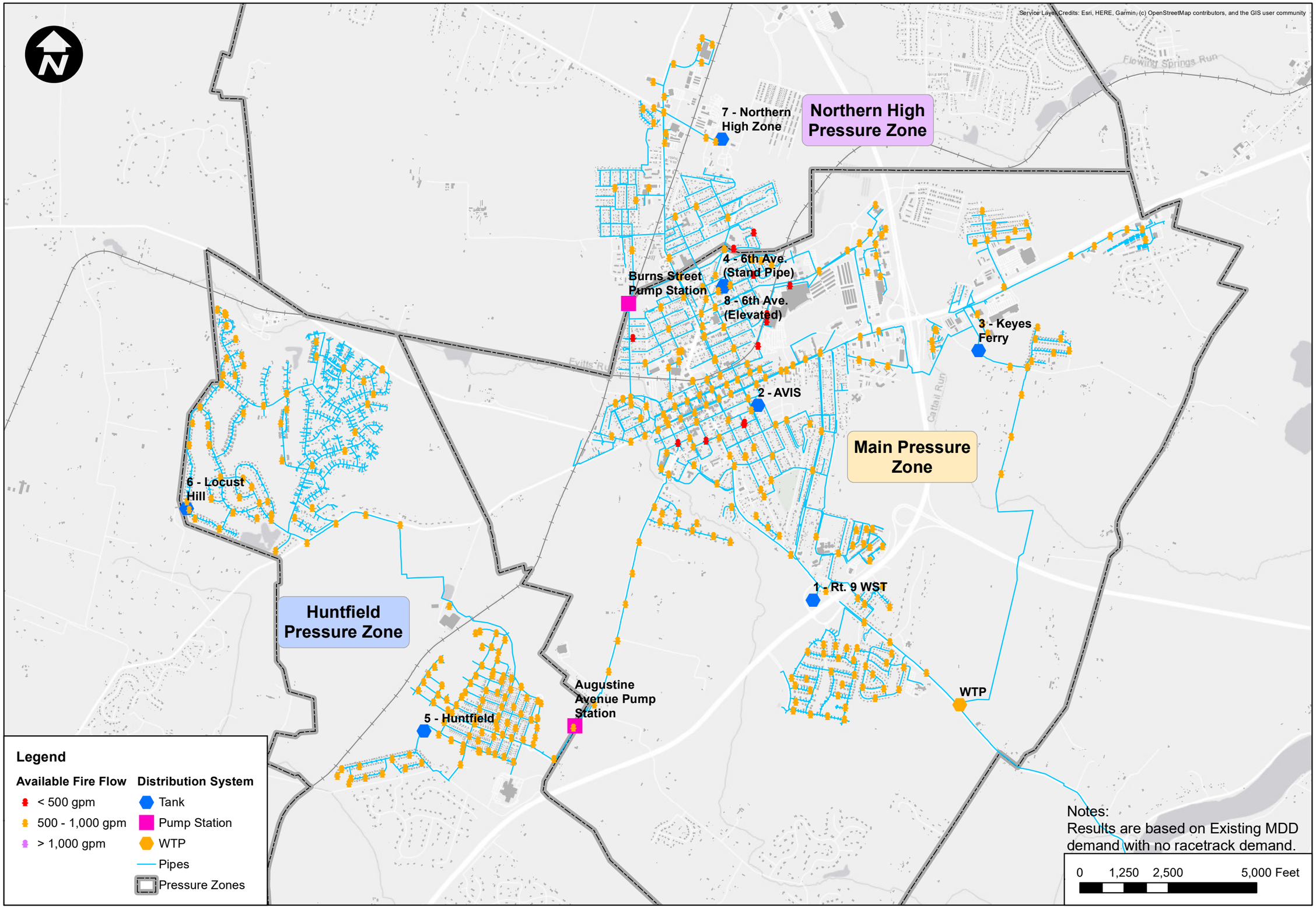

FIGURE NO. 3-8

TITLE AVAILABLE FIRE FLOW
EXISTING MDD - NO RACETRACK

WATER MASTER PLAN
CHARLES TOWN UTILITY BOARD

SCALE 1 inch = 2,500 feet

PROJECT

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Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

Flowing Springs Run

Northern High Pressure Zone

7 - Northern High Zone

1

Burns Street Pump Station

4 - 6th Ave. (Stand Pipe)

8 - 6th Ave. (Elevated)

24

33

3 - Keyes Ferry

Fellis Run

2 - AVIS

9

12

27

15

22

19

16

6 - Locust Hill

32

1 - Rt. 9 WST

Main Pressure Zone

14

Augustine Avenue Pump Station

23

WTP

5 - Huntfield

31

Huntfield Pressure Zone

30

Legend

Available Fire Flow
- < 500 gpm
- 500 - 1,000 gpm
- > 1,000 gpm
- Proposed Improvements
- Development Parcel ID

Distribution System
- Tank
- Pump Station
- WTP
- Pipes
- Pressure Zones

Notes:
- Results are based on 2040 MDD demand with Proposed Improvements online.
- See Section 4 for more information on Proposed Improvements.
- Hatching denotes Development Parcels. See Figure 2-3.

0 1,250 2,500 5,000 Feet

FIGURE NO. 3-9

TITLE AVAILABLE FIRE FLOW 2040 MDD

SCALE 1 inch = 2,500 feet

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3.3 System Pressure Evaluation

System pressure was evaluated to identify nodes that do not meet state and local pressure requirements. **Figure 3-10** shows a color-coded map of minimum system pressure for the existing system with existing MDD. The low pressures in the system occur around the racetrack, Avis Tank and the higher ground elevations in the NHPZ, insets on the figure show a more detailed of each area. The areas around the Avis tank and in the NHPZ are above 20 psi. Low pressure of 30 psi is a preferred minimum, these areas are close to the tanks and the tank level is driving the pressure. The low pressures at the racetrack are caused by the hydraulic restrictions discussed in **Section 3.3**.

Figure 3-11 shows the maximum system pressures for the existing system with existing MDD. There are a few areas above 100 psi in the northern High Zone, near the discharge of BSPS, and in the easternmost area of the zone. The high pressure in the NHPZ is caused by the hydraulic restrictions discussed in **Section 3.1**, the steep system curve (high headloss) is causing the pumps to discharge at a high head to allow the tanks to fill.

Figure 3-12 shows the minimum system pressure with the recommended improvements online and 2040 MDD. Comparison of this figure to **Figure 3-10**, shows that the recommended improvements fix the low pressures surrounding the racetrack. Otherwise, the low pressures are generally consistent between the existing and 2040 systems.

Figure 3-13, the maximum pressure for the 2040 system, shows a significant improvement in high pressures in the NHPZ. The reduction in pressure is due to the reduction in system head loss that comes with the proposed improvements flattening the system curve, as discussed in **Section 3.1**. Some areas will have pressures greater than 100 psi as the system grows. The high pressures are the result of ground elevation.

The most feasible solution for the high pressures is to install individual PRV's at any service connection with high pressure. Dewberry recommends installing a PRV at any residential service connection below the ground elevations shown in **Table 3-2**. The Huntfield and Northern High zone do not currently have ground elevations below the high-pressure limit, however, as the system grows it has the potential to expand into the lower elevations which will exceed the high-pressure limit.

TABLE 3-2: SERVICE ELEVATION PRV LIMIT

PRESSURE ZONE	GROUND ELEVATION
Main	404 ft
Northern High	446 ft
Huntfield	487 ft

Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

Inset - Low Pressure near Racetrack

7 - Northern High Zone

Northern High Pressure Zone

4 - 6th Ave. (Stand Pipe)

Burns Street Pump Station

8 - 6th Ave. (Elevated)

3 - Keyes Ferry

2 - AVIS

6 - Locust Hill

1 - Rt. 9 W

Main Pressure Zone

WTP

Augustine Avenue Pump Station

5 - Huntfield

Huntfield Pressure Zone

Legend

Minimum Pressure	Distribution System
< 20 psi	Tank
20- 30 psi	Pump Station
30-40 psi	WTP
40 - 100 psi	Pipes
> 100 psi	Pressure Zones

Notes:
Results are based on Existing MDD demand.

0 1,250 2,500 5,000 Feet

FIGURE NO. 3-10

TITLE MINIMUM SYSTEM PRESSURE - EXISTING MDD

SCALE 1 inch = 2,083 feet

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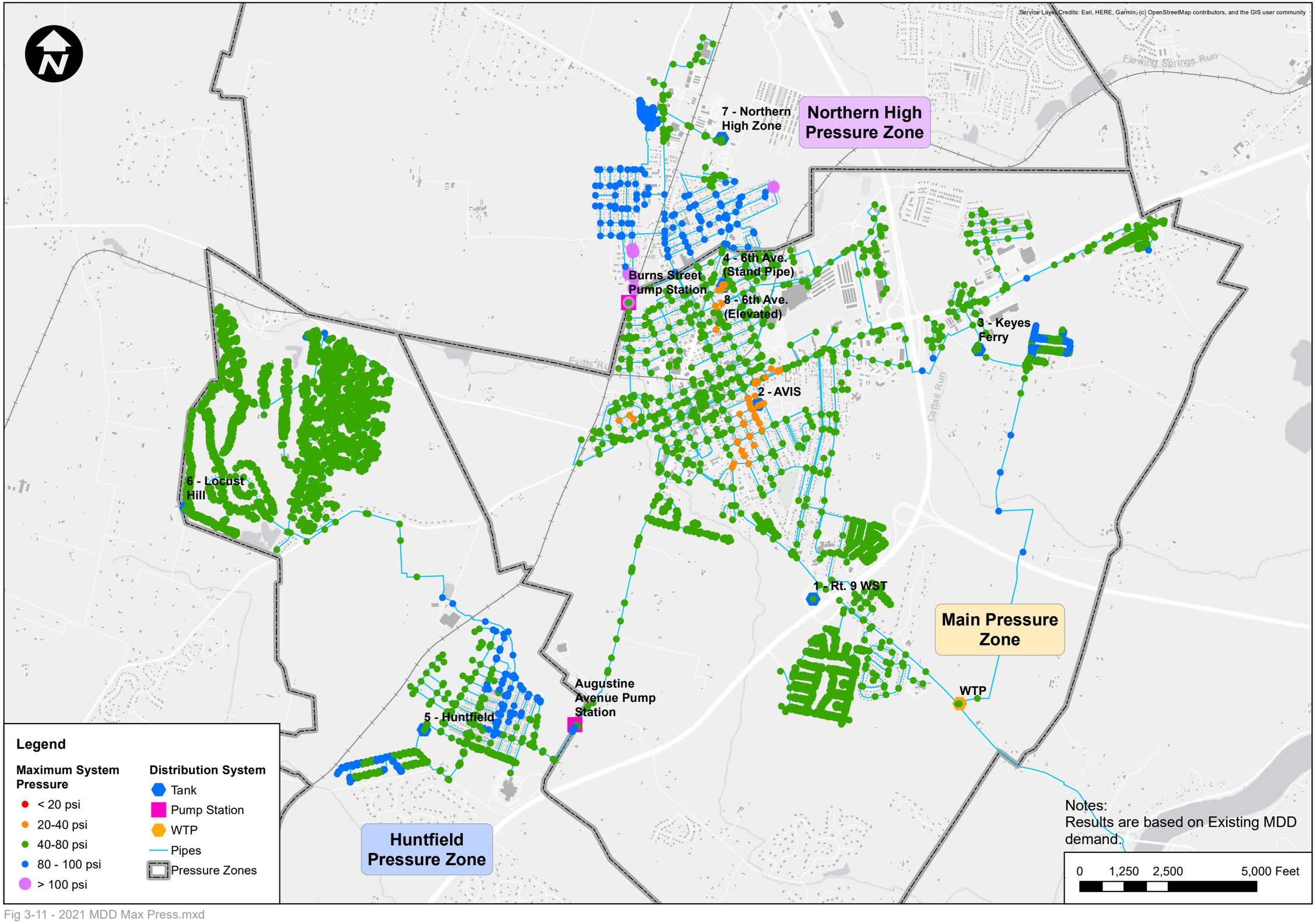

FIGURE NO. 3-11

TITLE MAXIMUM SYSTEM PRESSURE - EXISTING MDD

SCALE 1 inch = 2,500 feet

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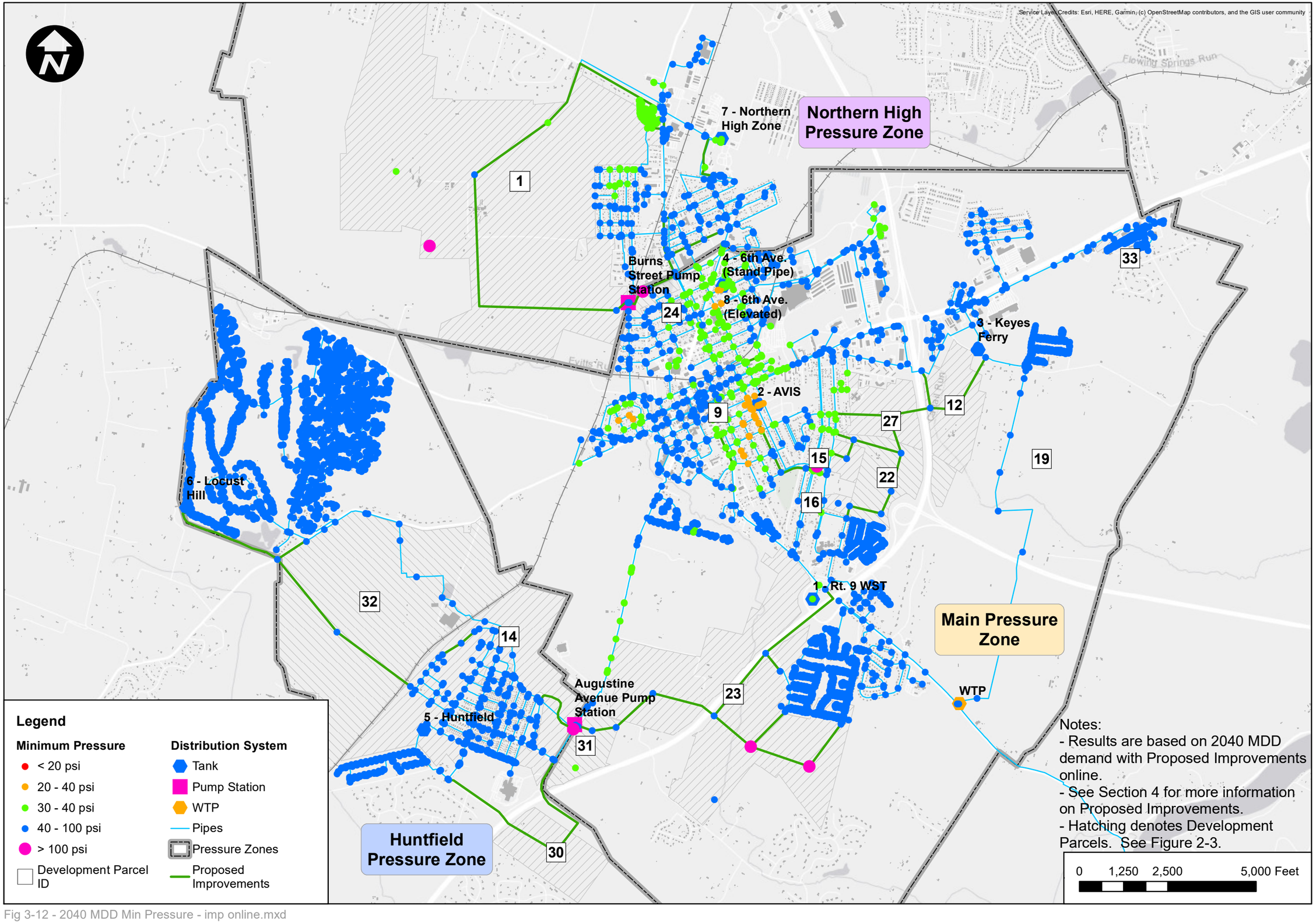

FIGURE NO. 3-12

TITLE MINIMUM SYSTEM PRESSURE - 2040 MDD

SCALE 1 inch = 2,500 feet

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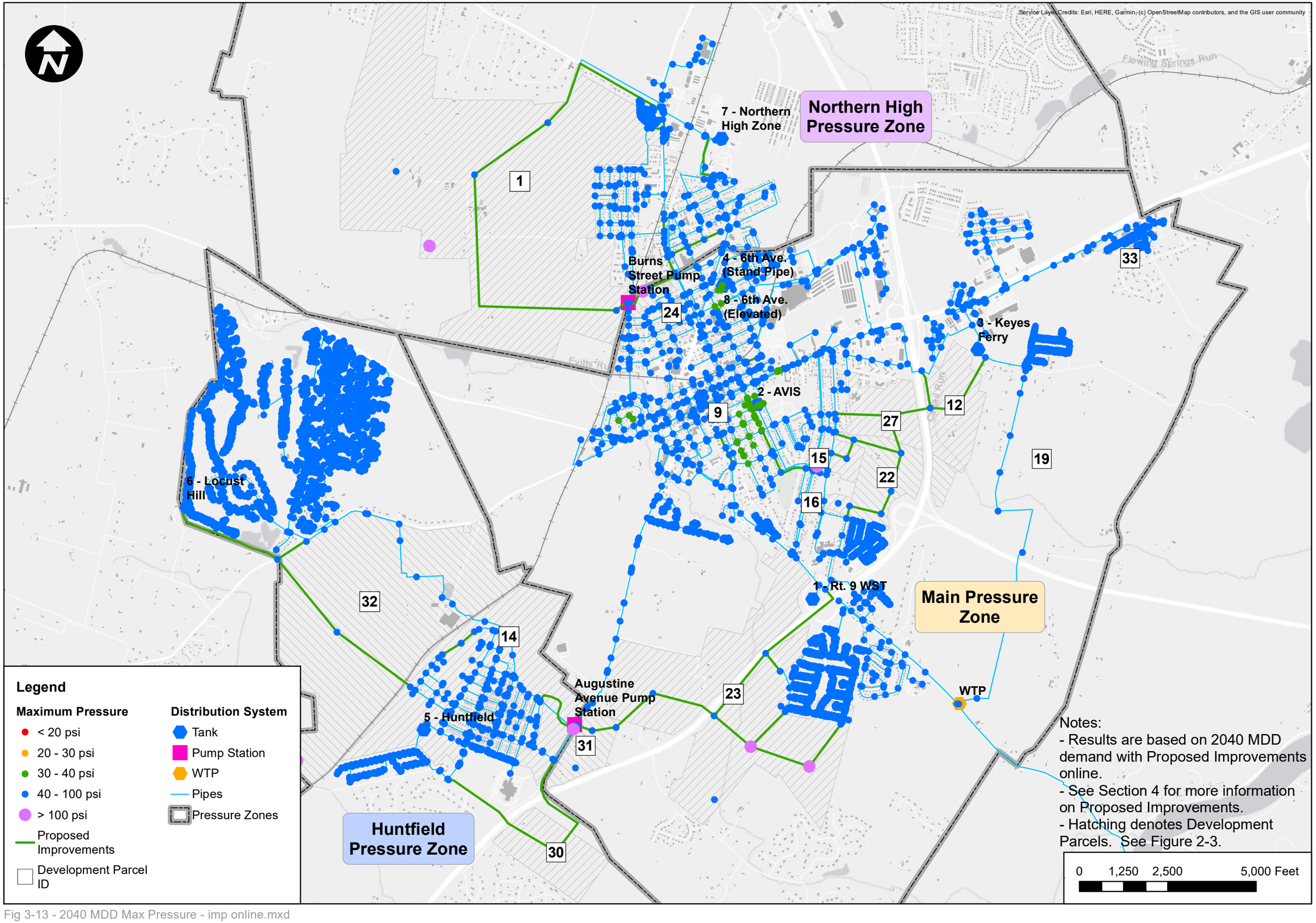

FIGURE NO. 3-13

TITLE MAXIMUM SYSTEM PRESSURE - 2040 MDD

SCALE 1 inch = 2,500 feet

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3.4 Condition Assessment

On July 15, 2021, Dewberry Engineers performed a site visit of the water distribution system facilities to perform a limited condition assessment. The assessment includes a visual evaluation of the outside of each site, with photos taken of any apparent defects. An inspection of the inside of each tank was not performed, however, it is recommended to be completed on a 5-year interval. No testing or structural evaluations are performed as part of this assessment. The facilities include:

- Route 9 Elevated Storage Tank
- Northern High Zone Standpipe
- 6th Avenue Standpipe/Elevated Tank
- Avis Standpipe
- Huntfield Standpipe
- Locust Hill Standpipe
- Keyes Ferry Elevated Tank
- Burns Street Pumping Station
- Augustine Avenue Pumping Station

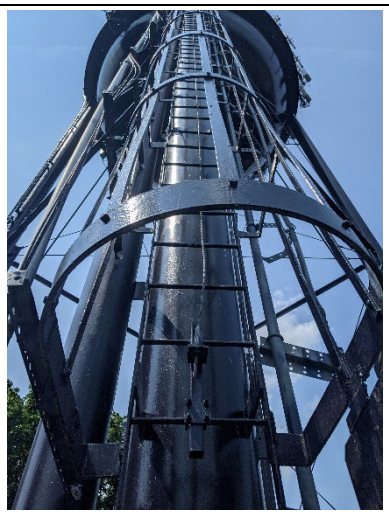
A general issue common to all facilities is grass clippings left on coated parts of the structure and sealed joints. The grass clippings, if not removed, can collect dirt and moisture which can lead to premature failure of the coating or joint. Notify grounds crews to remove all clippings from the structure before leaving the site.

3.4.1 6th Avenue Standpipe/Elevated Tank

The 6th Avenue site contains an elevated toro-spheroid with a volume of 125,000 gallons constructed in 1991 and a standpipe with a volume of 337,000 gallons.

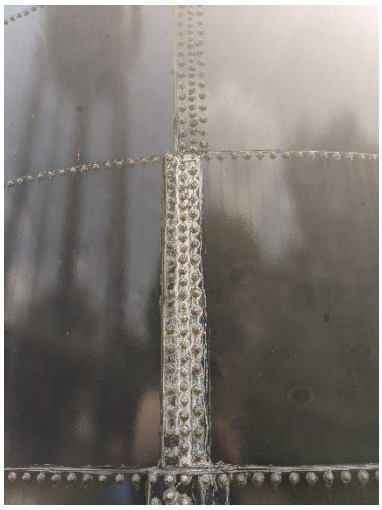
The elevated tank is in good condition. The following deficiencies are noted:

- The vertical climbing system cable on the access ladder is bent or slack. Inspect and repair cable per manufacturer's recommendations. See **Photo 2**.
- Bent Bird screen on the overflow drainpipe air gap. Replace screen or install Duckbill style check valve. See **Photo 3**.

Photo 1 – Tank View	Photo 2 – Safety Cable	Photo 3 – Bird Screen
		

The standpipe is in fair condition. Several of the joints between plates and bolt penetrations are leaking and have been patched with caulk. The caulk appears to be hard, brittle, and failing in several locations. The following deficiencies are noted:

- Failing caulk at joints and bolt holes. Remove clean and replace caulking with a flexible sealant that is NSF rated for drinking water similar to Sikaflex®-201 US or Sikaflex®-291. The sealant manufacturer should be consulted to determine the appropriate product for the application.

Photo 3 – Failing Caulk/Leak	Photo 4 – Failing Caulk	Sealant Options
		Sikaflex®-201 Sikaflex®-291

3.4.2 Avis Standpipe

The Avis standpipe has a volume of 500,000 gallons constructed in 1976. In general, the tank appears in good condition with some minor repairs and maintenance as noted below:

- Clean, prime, and recoat coating failure at access port. See **Photo 6**.
- Repair or remove the loose cable. Cable is a safety issue, potential trip hazard, and may cause damage to grounds maintenance equipment. See **Photo 7**.
- Repair loose fence rail. See **Photo 8**.
- Add gravel/rip-rap to overflow drainpipe outfall to prevent erosion of soil. See **Photo 9**.
- Cut back vegetation 3 to 4-feet beyond the fence line. The vegetation against the tank and fence will cause premature failure in the coatings of both systems. See **Photo 10**.

Photo 5 – Tank View	**Photo 6 – Access Port Coating Failure**	**Photo 7 – Loose Cable**
		
Photo 8 – Loose Fence Rail	**Photo 9 – Missing Gravel**	**Photo 10 – Vegetation Overgrowth**
		

3.4.3 Huntfield Standpipe

The Huntfield tank is a short standpipe located on a concrete pedestal base with a volume of 260,000 gallons. The fenced area surrounding the tank is overgrown which limited access for visual assessment.

- Remove vegetation should be removed 3 to 4-feet beyond the fence line. See **Photo 11**.

Photo 11– Vegetation overgrowth



3.4.4 Keyes Ferry Elevated Storage Tank

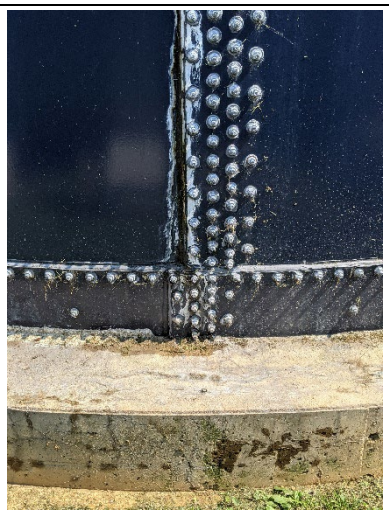
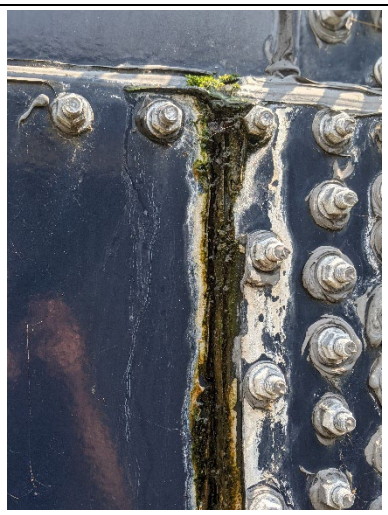
The Keyes Ferry tank is an elevated toro-ellipsoidal style tank with a volume of 500,000 gallons constructed in 1988. The tank is in good condition and no deficiencies were identified.

Photo 12– Tank View



3.4.5 Locust Hill

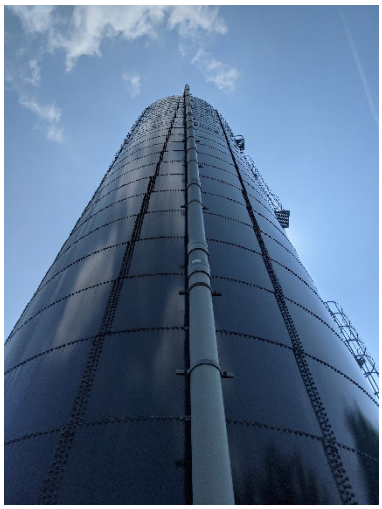
The Locust Hill standpipe has a volume of 498,000 gallons. Several active leaks were noted along the joints near the base. One of the leaks has moss growth along the joint, which is a potential source of contamination in the water. The tank should be inspected for additional leaks and all leaks cleaned, primed, and sealed with a similar product as noted in **Section 3.5.1**.

Photo 13 – Active Leak	Photo 14 – Active Leak	Photo 15 – Active leak with moss growth
		

3.4.6 Northern High Zone Standpipe

The Northern High Zone standpipe has a volume of 360,000 gallons. The tank is in good condition with no deficiencies identified. Following are items on the grounds to be addressed:

- Repair bent fence rail, see **Photo 17**.
- Cut back vegetation 3 to 4-feet beyond the fence line. See **Photo 18**.

Photo 16 – Tank View	Photo 17 – Bent Fence Rail	Photo 18 – Vegetation Overgrowth
		

3.4.7 Route 9 Elevated Storage Tank

The Route 9 Tank is a toro-ellipsoidal style tank with a volume of 500,000 gallons constructed in 1988. The tank is in good condition. The following deficiencies are noted:

- Repair or replace bent bird screen, consider installing a duckbill style valve. See **Photo 20**.
- Add riprap at the tank overflow drain. See **Photo 21**.

Photo 19 – Tank View	Photo 20 – Bent Bird Screen	Photo 21 – Add Riprap
		

3.4.8 Augustine Avenue Pumping Station

The Augustine Ave pumping station has a firm capacity of 0.65 mgd. The facility is in good condition. Deficiencies are noted below:

- Repair leak at joint between the check valve and the turbine meter. See **Photo 23**.
- A plastic bag hanging on the control panel is a fire risk and should be removed. See **Photo 24**.

Photo 22 – Station View	Photo 23 – Joint Leak	Photo 24 – Fire Hazard
		

3.4.9 Burns Street Pumping Station

The Burns Street pumping station is an above-ground station with CMU block walls on a slab. The station has a capacity of 1.08 mg. The station is in good condition. Vegetation growth is the only area of concern. The vegetation should be cleared 3 to 4-feet beyond the fence line.

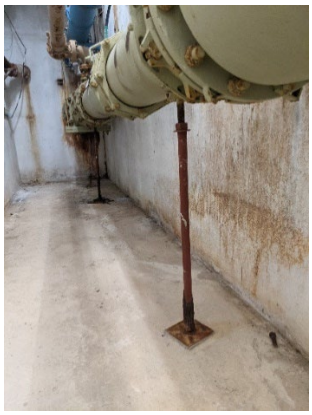
Photo 25 – Station View	Photo 26 – Vegetation Overgrowth	Photo 27 – Vegetation Overgrowth
		

3.4.10 Water Treatment Plant

The Charles Town Utility Board Water Treatment Plant has a capacity of 2.8 mgd and was originally constructed in 1989 with subsequent upgrades. The plant is in good condition with the following deficiencies identified:

- Clean, prime and recoat pipe and fittings showing signs of coating failure. See **Photos 28 and 29**.
- Replace pipe stands that have corroded and are no longer structurally sound. See **Photo 30**.

The plant is currently under evaluation for plant-wide upgrades and improvements (Refer to the *'Water Treatment System Facility Plan Update', April 2022*, for more information regarding upgrades to the plant). It is assumed that the deficiencies noted will be addressed during the plant improvements.

Photo 28 – Pipe and Fitting Coating Failure	Photo 29 – Pipe and Fitting Coating Failure	Photo 30 – Pipe Stand Failure
		

4. RECOMMENDED IMPROVEMENTS

Table 4-1 shows a summary of each project including a brief description and cost estimate and phasing for each project. Phase A is to be constructed between the years 2022-2024, Phase B years 2025-2027, and Phase C years 2028-2031 **Figure 4-1** shows an overall map of the project locations. **Figures 4-2** through **Figure 4-28** (Appendix B) provide a detailed view of each project.

TABLE 4-1: SUMMARY OF IMPROVEMENTS

MAIN PRESSURE ZONE							
PROJECT ID	PROJECT NAME	DESCRIPTION	FIGURE	SIZE	QUANTITY	ESTIMATED COST	PHASE
PR-MZ-01	Charles Town Racetrack	8" loop closure around the racetrack to improve normal operating pressure and increase fire flow capacity.	4.12	8"	500 LF	$88,000	A
PR-MZ-02	Fritts & Old Town Ranson	8" loop providing capacity for Fritts Property and Old Town Ranson.	4.13	8"	7,400 LF	$1,295,000	C
PR-MZ-03	Magnolia Springs	8" loop providing capacity for Magnolia Springs.	4.14	8"	6,200 LF	$1,085,000	C
PR-MZ-04	Church Street	8" line along Church Street between Avis tank and Route 34 to close a loop and increase fire flow capacity.	4.15	8"	3,400 LF	$595,000	B
PR-MZ-05	South George Street	8" loop closure along S. George St. between Mason St. and E. Academy with a connection to the 6" in Hunter St. Increases fire flow capacity in the MPZ.	4.16	6" 8"	20 LF 1,000 LF	$178,000 $101,000	B
PR-MZ-06	Water Street	12" loop closure along S. Water St. between W. Avis St. and W. Congress St. Increases fire flow capacity in the MPZ.	4.17	12"	400 LF	$2,400,000	B
PR-MZ-07	Route 340	12" line along Route 340 from S. George St. to Augustine Ave. PS. Provides redundant capacity to the pump station and eliminates the need for an upgrade to the station. Provides capacity to the west side of Norborne Greene.	4.18	12"	9,600 LF	$1,173,000	B
PR-MZ-08	Norborne Greene	8" looping to provide capacity to the Norborne Greene.	4.19	8"	6,700 LF	$7,000	C
PR-MZ-09	5th Street Hydrant	Connect fire hydrant in W. 5th Avenue to the 12" line in McDonald St. Increases fire flow capacity in the MPZ. Currently connected to a 2" line.	4.20	6"	50 LF	$7,000	A
PR-MZ-10	6th Avenue Hydrant	Connect fire hydrant in E. 6th Avenue to the 12" line in S. Marshall St. Increases fire flow capacity in the MPZ. Currently connected to a 2" line.	4.21	6"	50 LF	$7,000	A
PR-MZ-11	S. Mildred Hydrants	Provide a connection from the 8" line in E. academy St. to the two hydrants at the intersection. Increases fire flow capacity in the MPZ. Currently connected to a 2" line.	4.22	6"	50 LF	$9,000	A
PR-MZ-12	7th Avenue	Close loop between 8" lines at the intersection of E. 7th Avenue and S. Mildred Street. Increases fire flow capacity in the MPZ.	4.23	8"	50 LF	$35,000	A
PR-MZ-13	Charles Town	8" line to provide capacity to Charles Town Infill.	4.24	8"	200 LF	$35,000	C
PR-MZ-14	Windmill Crossing	8" line to provide capacity to Windmill Crossing.	4.25	8"	200 LF	$7,000	C
PR-MZ-15	W. Avis Hydrant	Connect fire hydrant at the intersection of W. Avis St. and S. West St. Increases fire flow to the MPZ.	4.26	6"	50 LF	$9,000	A
PR-MZ-16	W. Academy Tie	Connect 6" waterlines at the intersection of W. Academy St. and	4.27	8"	50 LF	$88,000	A
PR-MZ-17	Main Zone Maintenance	Repairs to tank and WTP facilities were identified in the condition assessment.	3.4	---	---	$28,000	A
					Main Pressure Zone Subtotal	**$7,147,000**	

TABLE 4-1: SUMMARY OF IMPROVEMENTS – CONT'D							
NORTHERN HIGH PRESSURE ZONE							
PROJECT ID	**PROJECT NAME**	**DESCRIPTION**	**FIGURE**	**SIZE**	**QUANTITY**	**ESTIMATED COST**	**PHASE**
PR-NZ-01	Huntwell West	8" loop providing capacity for Huntwell West.	4.6	8"	15,400 LF	$2,695,000	B
PR-NZ-02	Ameritech Street	8" loop closure between the Northern High Zone Tank and the 8" line at the intersection of N. Marshal St. and E. 14th St. to increase fire flow capacity to the NHPZ.	4.7	8"	1,900 LF	$333,000	A
PR-NZ-03	N. Mildred Street A	8" loop closure from Burns St. PS along W. Beltline Ave., N. Mildred St., E. 13th St. to N. Preston St. to increase fire flow capacity in the NHPZ.	4.8	8"	3,700 LF	$648,000	B
PR-NZ-04	N. Mildred Street B	12" loop closure between the 10" line feeding the subdivision near Robelie Dr, along N. Mildred St. to the intersection of 16th St. to increase fire flow capacity to the NHPZ.	4.9	12"	800 LF	$200,000	A
PR-NZ-05	E. 10th St.	8" loop along E. 1oth St. from the proposed 8" line in N. Mildred St. (PR-NZ-03) to the 6" line near the intersection of N. Fairfax Blvd. to increase fire flow capacity in the NHPZ.	4.10	8"	1,700 LF	$298,000	B
PR-NZ-06	Burns St. PS Upgrade	Upgrade Pumps at the Burns Street Pumping Station.	4.11	700 gpm	2 EA	$3,526,000	A
PR-NZ-07	Northern High Zone Maintenance	Repairs to tank and pumping station facilities identified in the condition assessment.	3.4	---	---	$2,000	A
					Northern High Pressure Zone Subtotal	**$7,702,000**	
HUNTFIELD ZONE							
PROJECT ID	**PROJECT NAME**	**DESCRIPTION**	**FIGURE**	**SIZE**	**QUANTITY**	**ESTIMATED COST**	**PHASE**
PR-HZ-01	Augustine Ave. PS Discharge	8" discharge line from Augustine Ave. PS to provide capacity to Huntfield. Also provides redundant supply to Huntfield, Winchester, and Locust Hill.	4.2	8"	1,700 LF	$298,000	C
PR-HZ-02	Locust Hill	12" loop from Huntfield to Locust Hill to provide capacity to Winchester. Also provides a redundant loop to Locust Hill.	4.3	12"	9,600 LF	$2,400,000	C
PR-HZ-03	Huntfield	8" loop closure along the backside of Huntfield to provide additional capacity to Huntfield.	4.4	8"	1,200 LF	$210,000	B
PR-HZ-04	Roper/Stolipher	8" loop to provide capacity for Roper/Stolipher.	4.5	8"	7,100 LF	$1,243,000	C
PR-HZ-05	Augustine Ave. PS Upgrade	Add a new pump to the station.	4.6	450 GPM	1	$780,000	C
PR-HZ-06	Huntfield Zone Maintenance	Repairs to tank and pumping station facilities identified in the condition assessment.	3.4	---	---	$10,000	A
					Huntfield Pressure Zone Subtotal	**$4,941,000**	
					Total	**$19,790,000**	

In addition to the projects outlined above, this report makes the following recommendations:

- ***Develop a preliminary engineering report to evaluate the capacity of the Burns Street pumping station and evaluate upgrade options required to meet future demand and system conditions.***
- ***Evaluate the existing and future WTP hydraulic grade and flow requirements to ensure the plant has the capacity to deliver existing and future demands while maintaining the ability to fill the Main PZ tanks.***
- ***Install individual PRV's at service connections with pressures greater than 135 psi.***

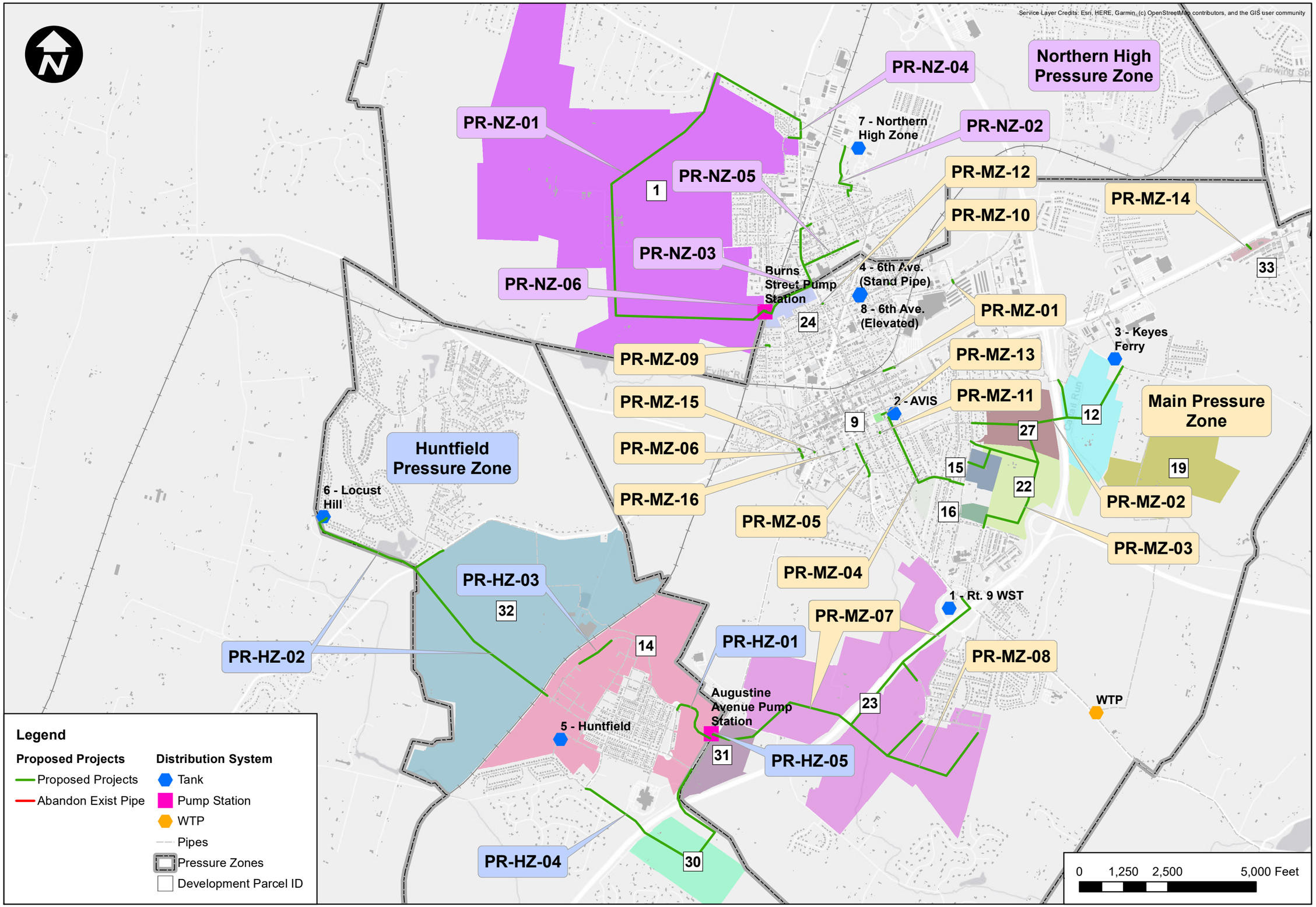


FIGURE NO. 4-1

TITLE PROPOSED PROJECTS

SCALE 1 inch = 2,500 feet

PROJECT WATER MASTER PLAN
CHARLES TOWN UTILITY BOARD

DATE MAY 2022

PROJ. NO. 5107007

Dewberry®
Dewberry Engineers Inc.
4805 LAKE BROOK DRIVE, SUITE 200
GLEN ALLEN, VIRGINIA 23060
PHONE: 804.290.7957
FAX: 804.290.7928

APPENDIX A

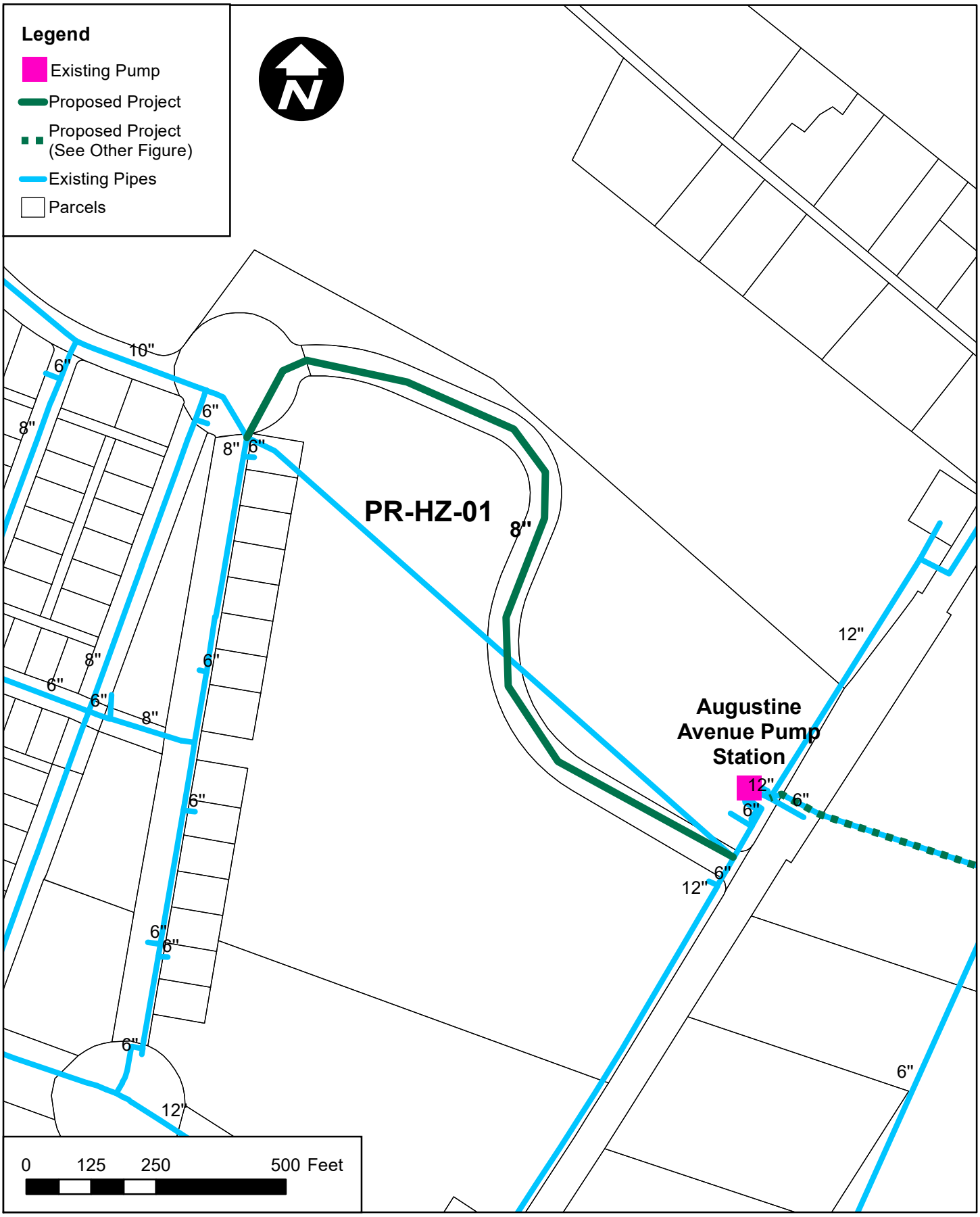
FUTURE GROWTH DEMAND DERIVATION

ID	Development	Total Design EDUs	Total Built as of 2021	20 year forecast to be built	Total Flow	Beyond 20 year forecast	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2031 to 2040	TOTAL @ Year 20	Total Remaining	2021-2040 - Aggressive Growth			2021-2040 - Conservative			ID
																														GPD	GPM	MGD	GPD	GPM	MGD	
1	American Heritage (Huntwell)	500	0	500	75,000	180	0	0	**20**	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	0	0	160	320	180	48,000	33.33	0.05	24,000	16.67	0.02	1
9	Charles Town Infill	250	0	250	37,500	150	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	50	100	150	15,000	10.42	0.02	7,500	5.21	0.01	9
12	Fritts Property	370	0	370	55,500	50	0	0	0	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	200	320	50	48,000	33.33	0.05	24,000	16.67	0.02	12
14	Huntfield	3,200	421	2,779	480,000	2,399	0	**20**	**20**	**20**	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	200	380	2399	57,000	39.58	0.06	28,500	19.79	0.03	14
15	Jefferson Heights North	262	0	262	39,300	122	0	0	20	20	15	15	15	15	15	15	10	0	0	0	0	0	0	0	0	0	10	140	0	21,000	14.58	0.02	10,500	7.29	0.01	15
16	Tate Manor	80	0	80	12,000	0	20	20	20	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80	0	12,000	8.33	0.01	6,000	4.17	0.01	16
19	Langlet	1,000	0	1,000	150,000	800	0	0	0	0	0	0	0	0	0	0	20	20	20	20	20	20	20	20	20	20	200	200	800	30,000	20.83	0.03	15,000	10.42	0.02	19
22	Magnolia Springs	300	0	300	45,000	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	0	0	0	0	0	100	300	0	45,000	31.25	0.05	22,500	15.63	0.02	22
23	Norborne Glebe	1,050	246	804	157,500	484	0	0	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	0	180	320	484	48,000	33.33	0.05	24,000	16.67	0.02	23
24	Old Town Ranson - Infill	250	0	250	37,500	150	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	50	100	150	15,000	10.42	0.02	7,500	5.21	0.01	24
27	Prospect Place	170	0	170	25,500	0	0	0	0	0	9	9	25	25	25	25	25	27	0	0	0	0	0	0	0	0	52	170	0	25,500	17.71	0.03	12,750	8.85	0.01	27
30	Stolipher	324	0	324	48,600	124	0	0	0	0	0	0	0	0	0	0	20	20	20	20	20	20	20	20	20	20	200	200	124	30,000	20.83	0.03	15,000	10.42	0.02	30
31	Washington Landing	274	0	274	41,100	0	0	0	0	50	50	50	50	50	24	0	0	0	0	0	0	0	0	0	0	0	0	274	0	41,100	28.54	0.04	20,550	14.27	0.02	31
32	Winchester Cold Storage	675	0	675	101,250	125	0	0	0	0	0	0	0	0	0	50	50	50	50	50	50	50	50	50	50	50	500	550	125	82,500	57.29	0.08	41,250	28.65	0.04	32
33	Windmill Crossing	150	146	4	22,500	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	600	0.42	0.001	300	0.21	0.0003	33
	Total Projected Development	**8,855**	**813**	**8,042**	**1,328,250**	**4,584**	**51**	**71**	**111**	**181**	**184**	**184**	**200**	**200**	**174**	**200**	**235**	**227**	**200**	**200**	**200**	**180**	**180**	**180**	**160**	**140**	**1,902**	**3,458**	**4,462**	**518,700**	**360.21**	**0.52**	**259,350**	**180.10**	**0.26**	

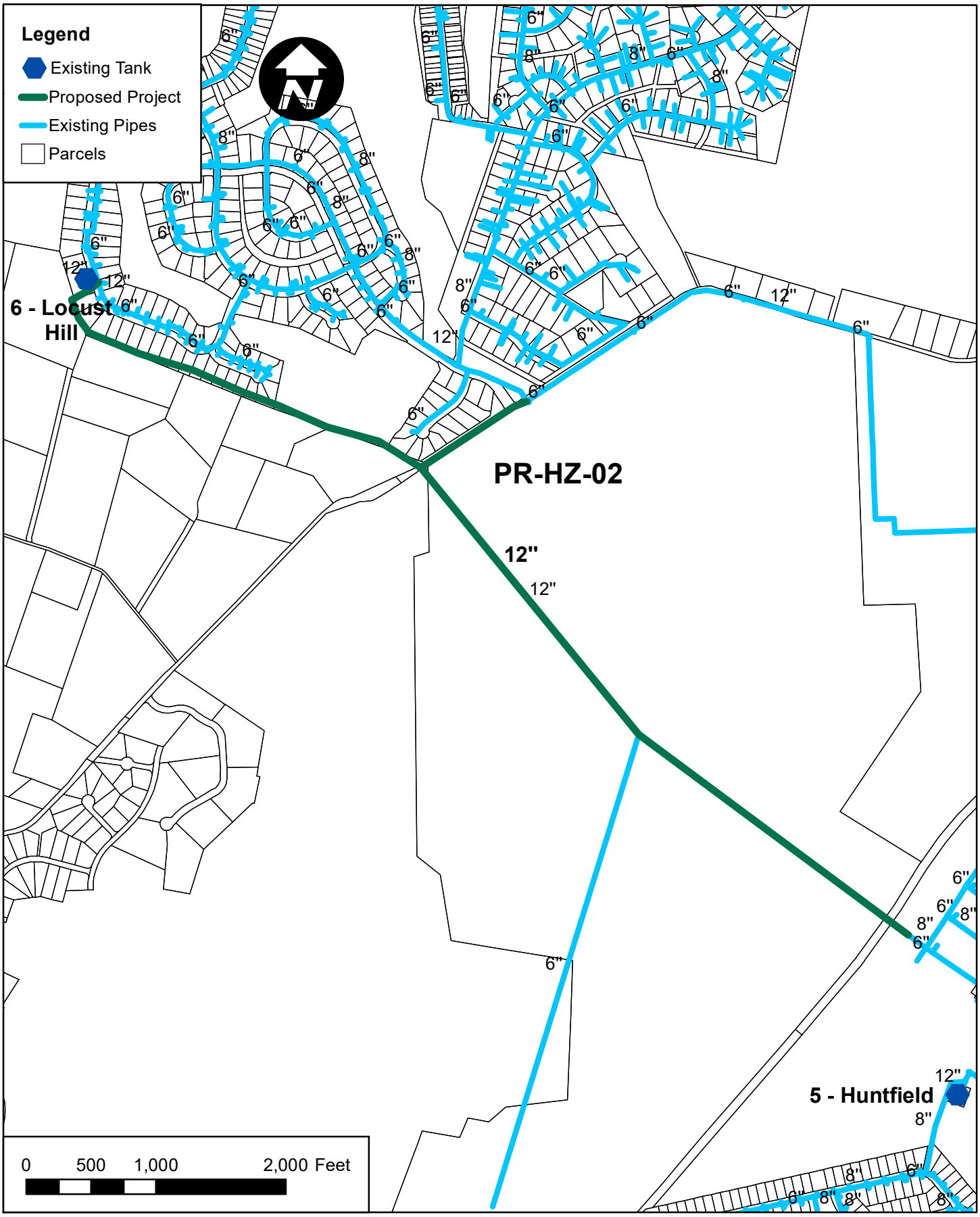
APPENDIX B

PROPOSED IMPROVEMENTS

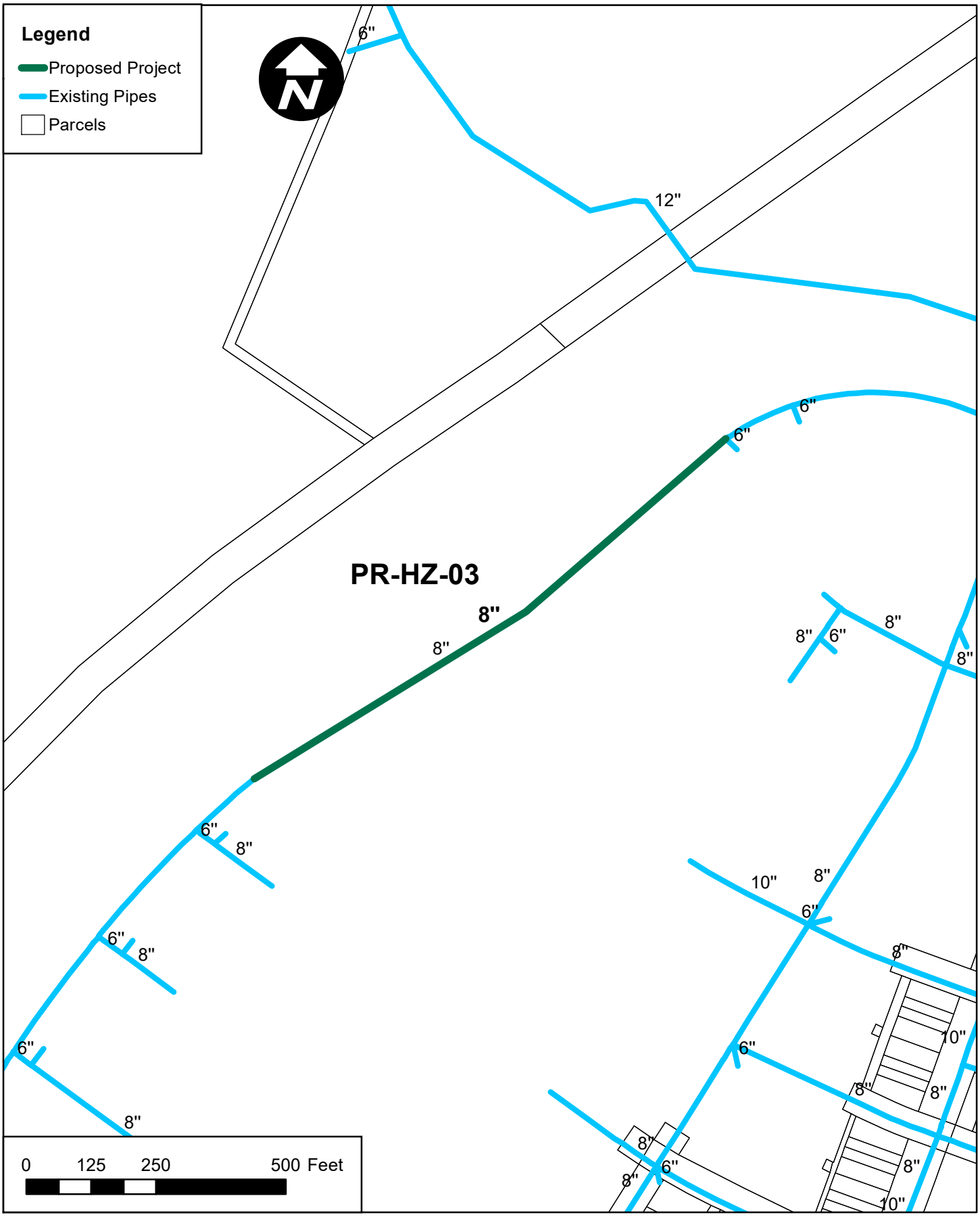
FIGURE 4-2 TO FIGURE 4-28



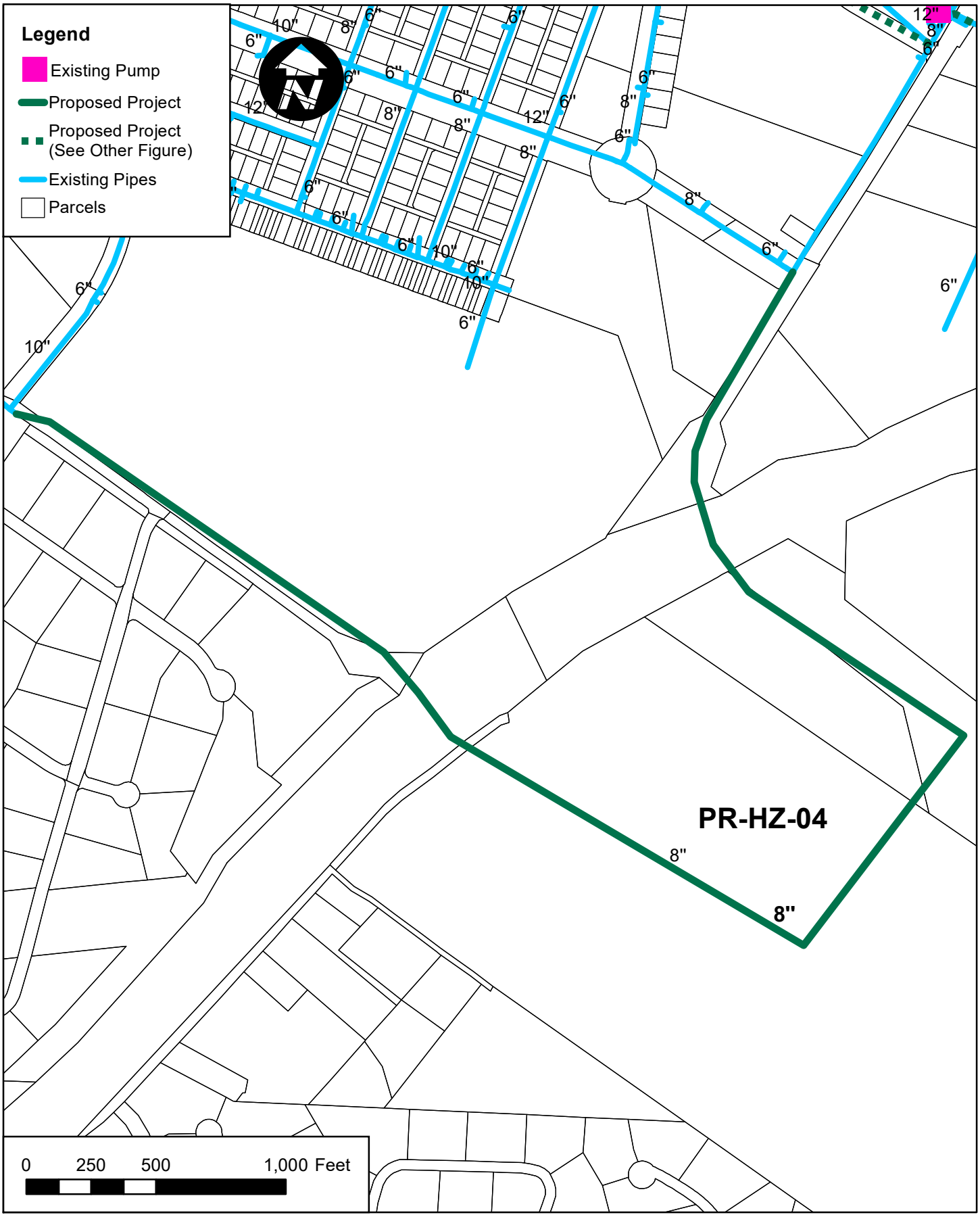
Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 250 feet	TITLE PR-HZ-01
	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD	FIGURE NO. 4-02



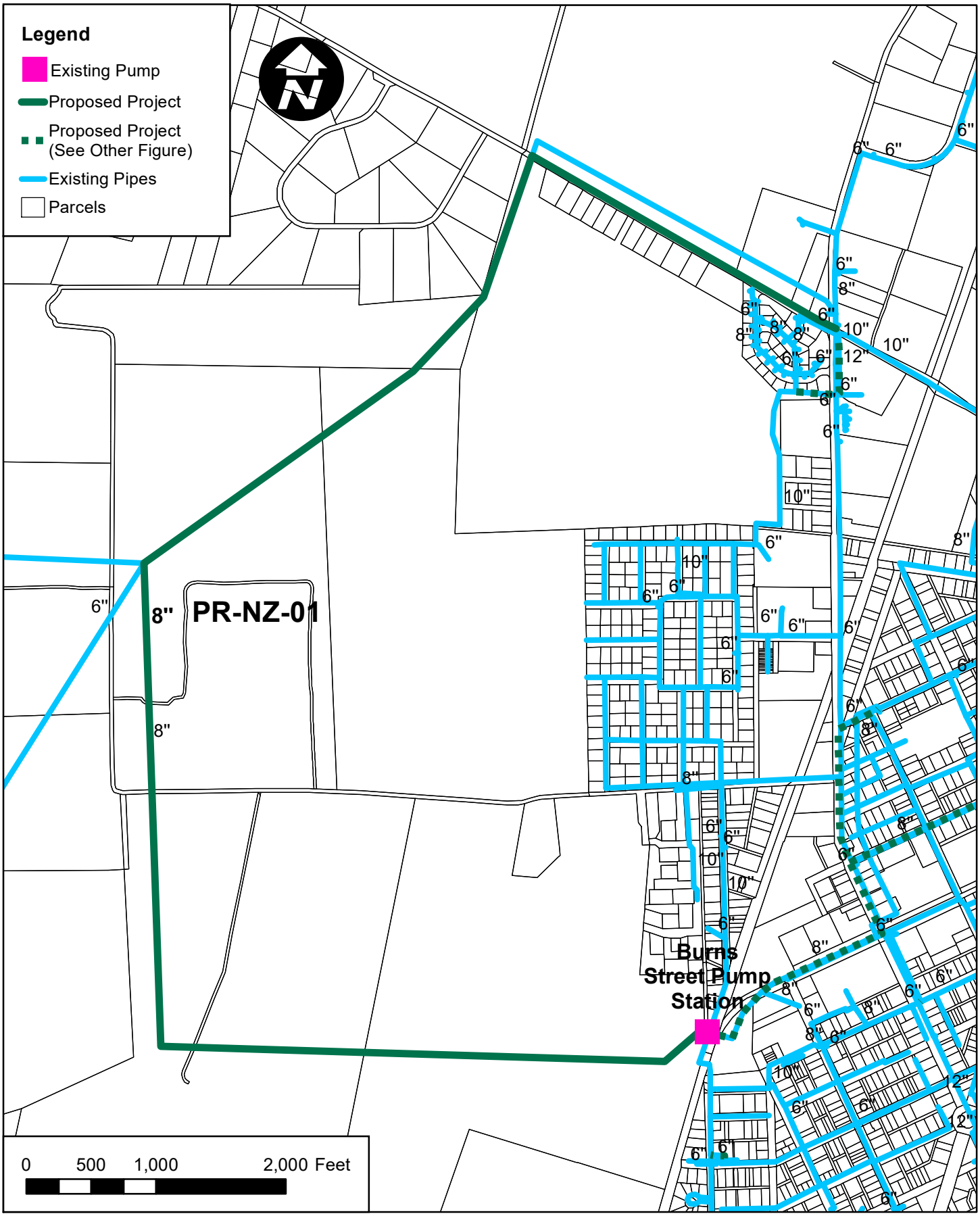
Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 1,000 feet	TITLE PR-HZ-02
	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD	FIGURE NO. 4-03



Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 250 feet	TITLE PR-HZ-03
	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD	FIGURE NO. 4-04



Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 500 feet	TITLE PR-HZ-04	FIGURE NO. 4-05
	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD		



Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 1,000 feet	TITLE PR-NZ-01	FIGURE NO. 4-06
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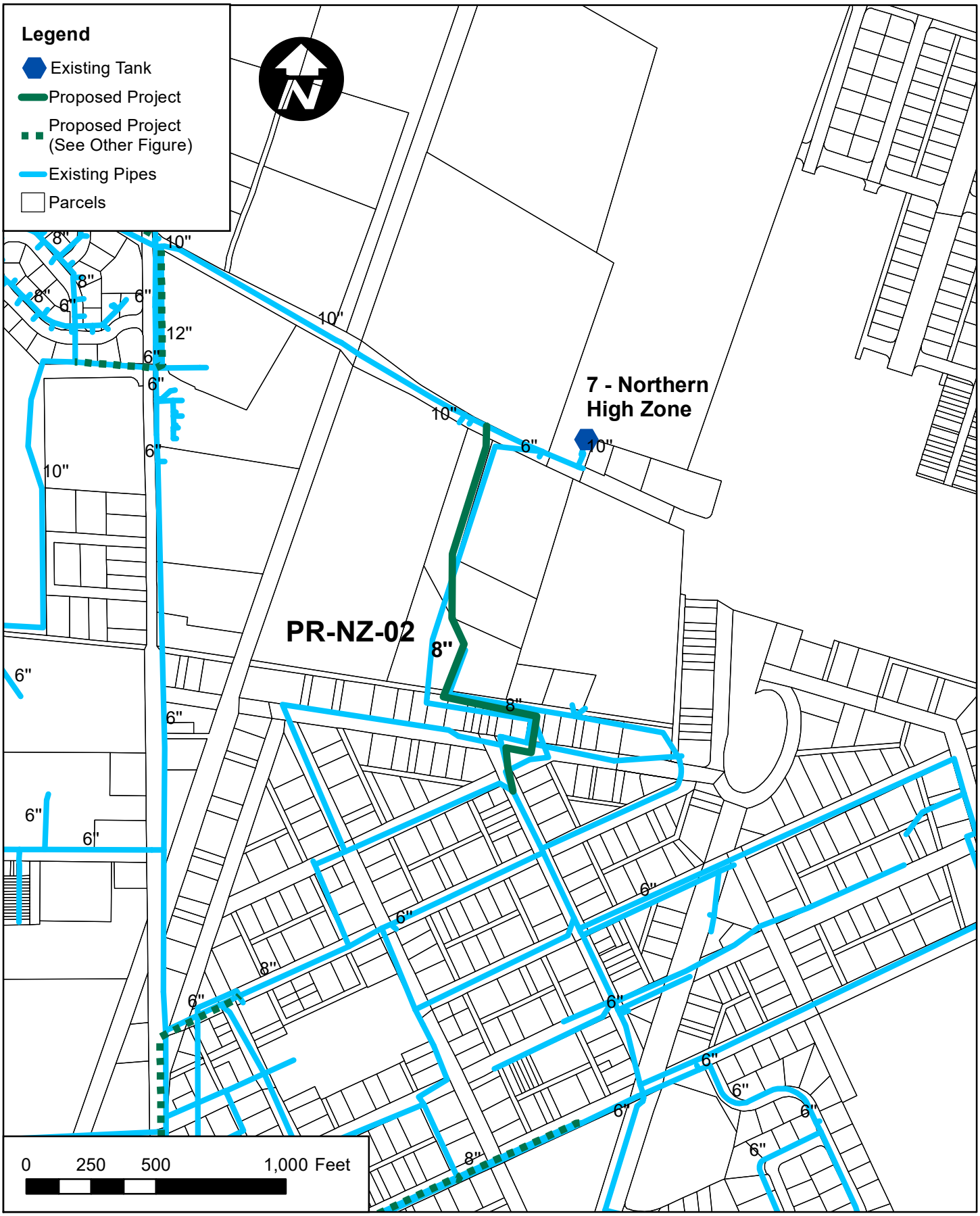
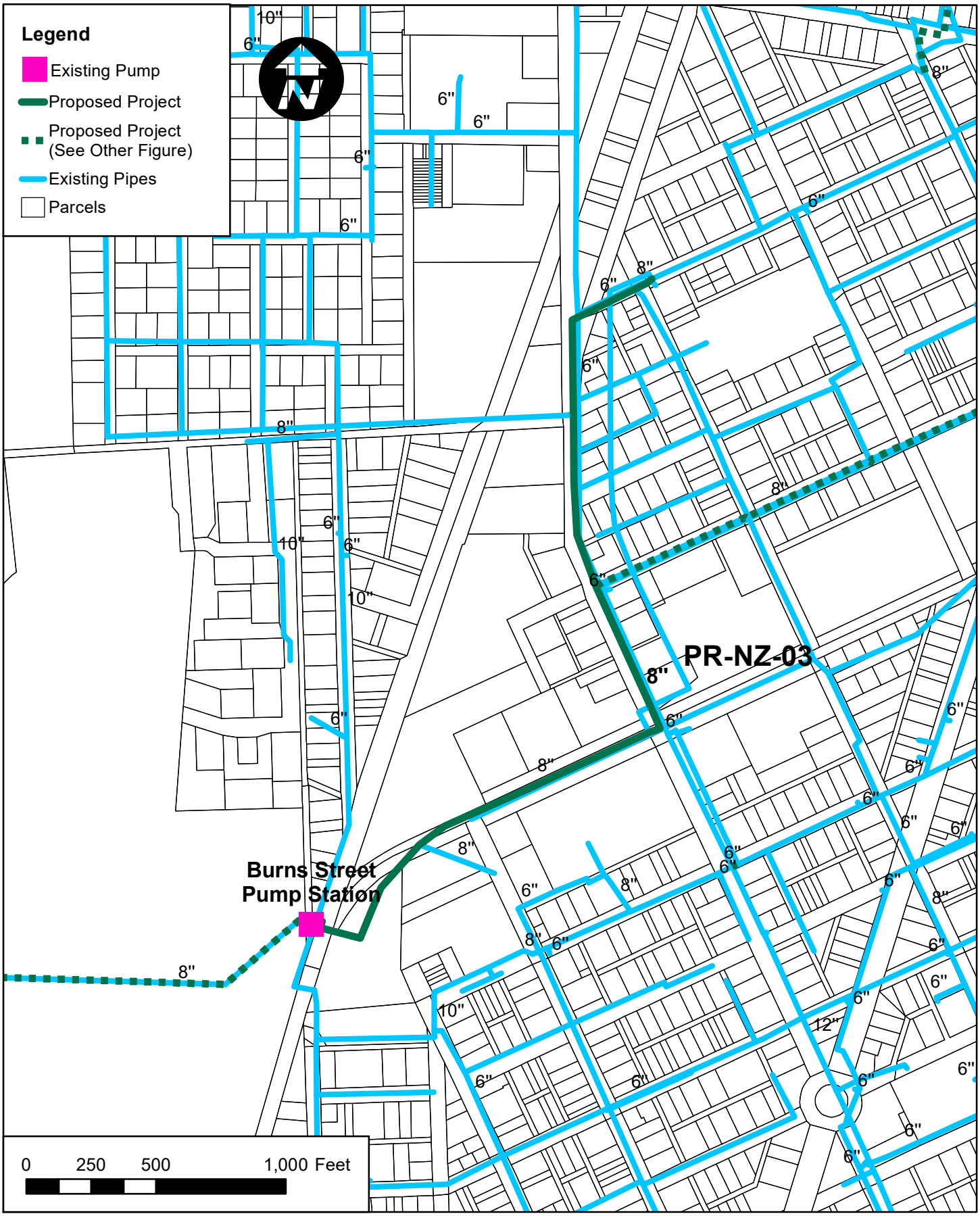


Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 500 feet	TITLE PR-NZ-02
	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD	FIGURE NO. 4-07



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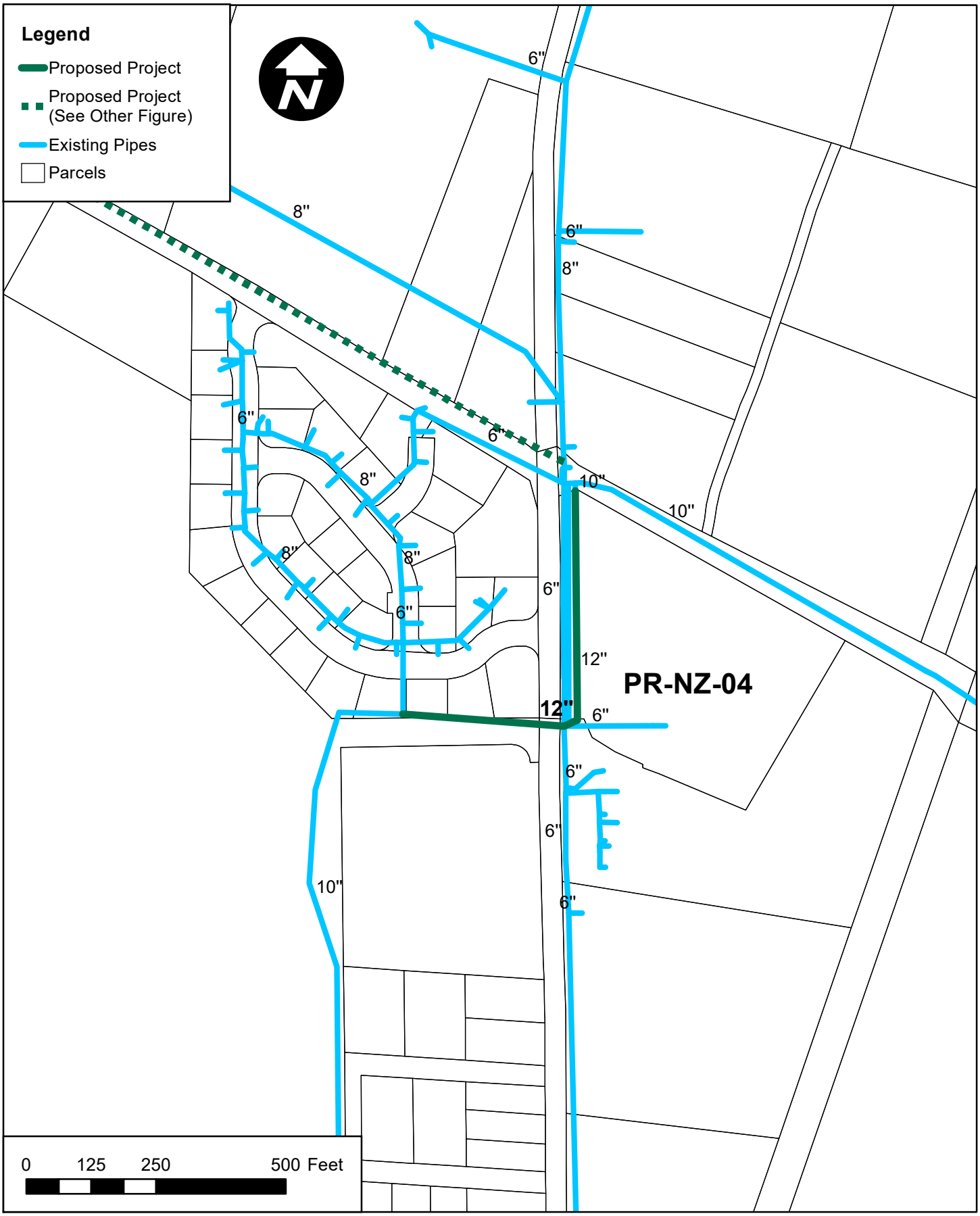

Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 250 feet	TITLE PR-NZ-04	FIGURE NO. 4-09
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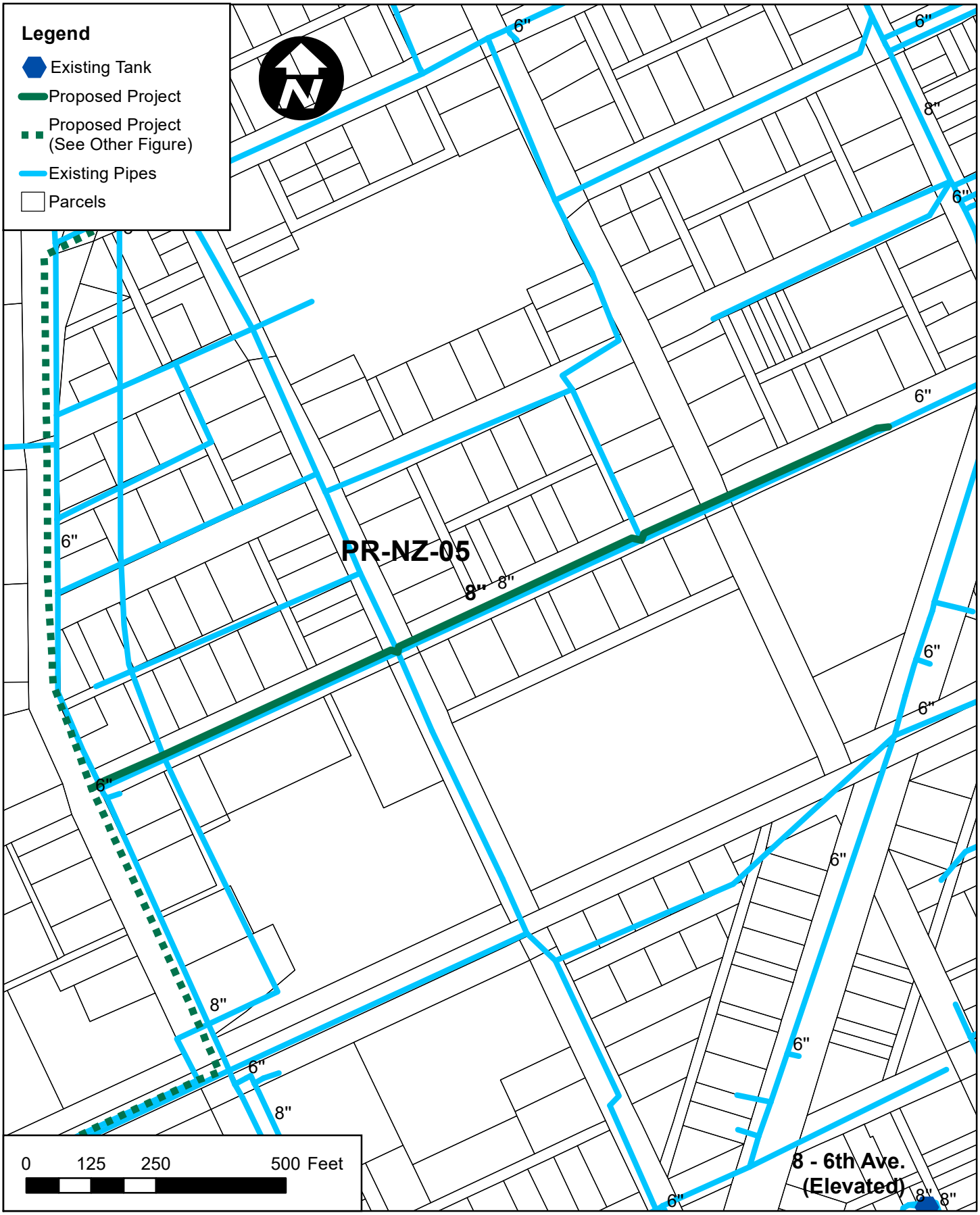
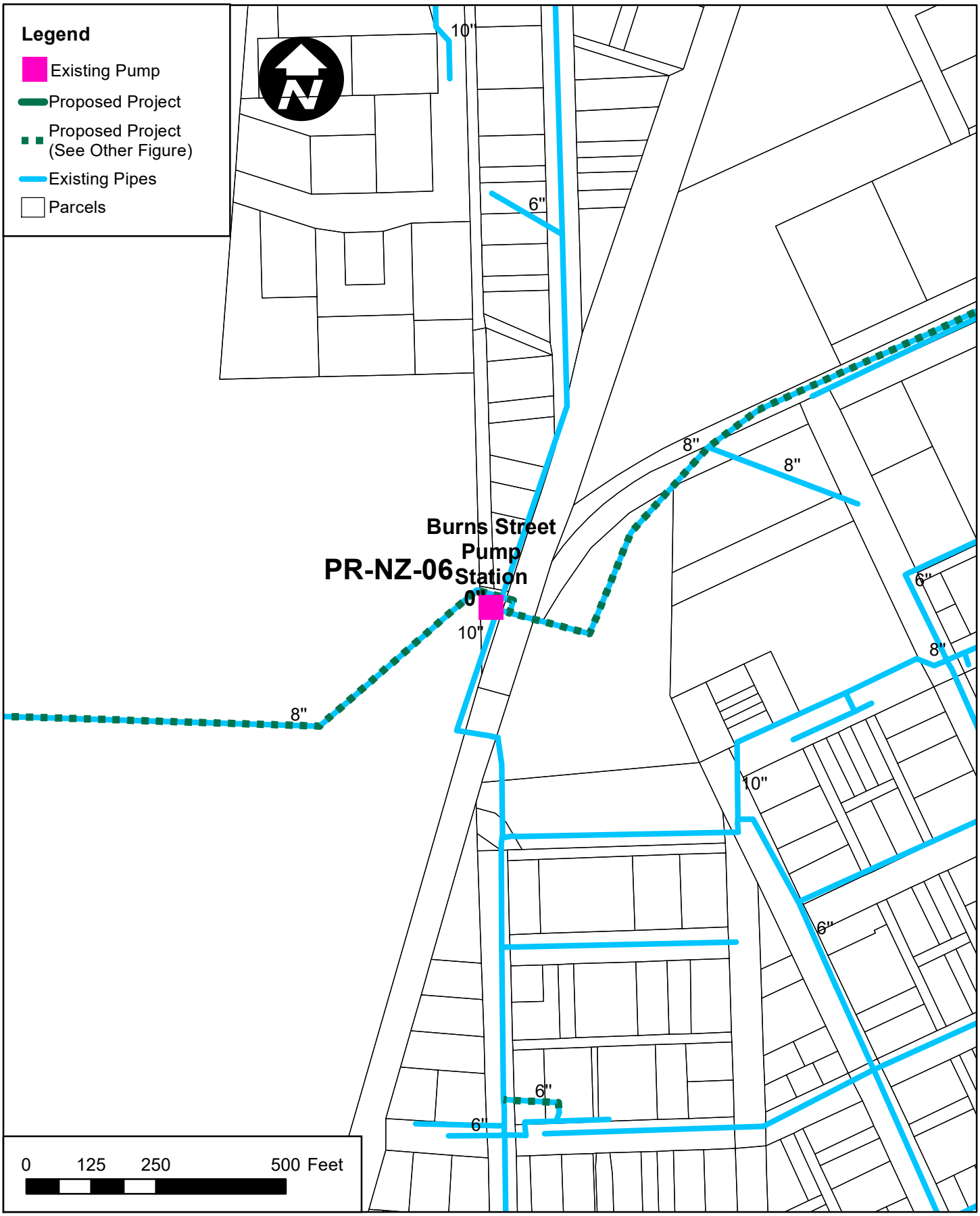


Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE: NOVEMBER 2021	SCALE: 1 inch = 250 feet	TITLE: PR-NZ-05
	PROJ. NO.: 5107007	PROJECT: WATER MASTER PLAN CHARLES TOWN UTILITY BOARD	FIGURE NO.: 4-10



Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 250 feet	TITLE PR-NZ-06	FIGURE NO. 4-11
	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD		

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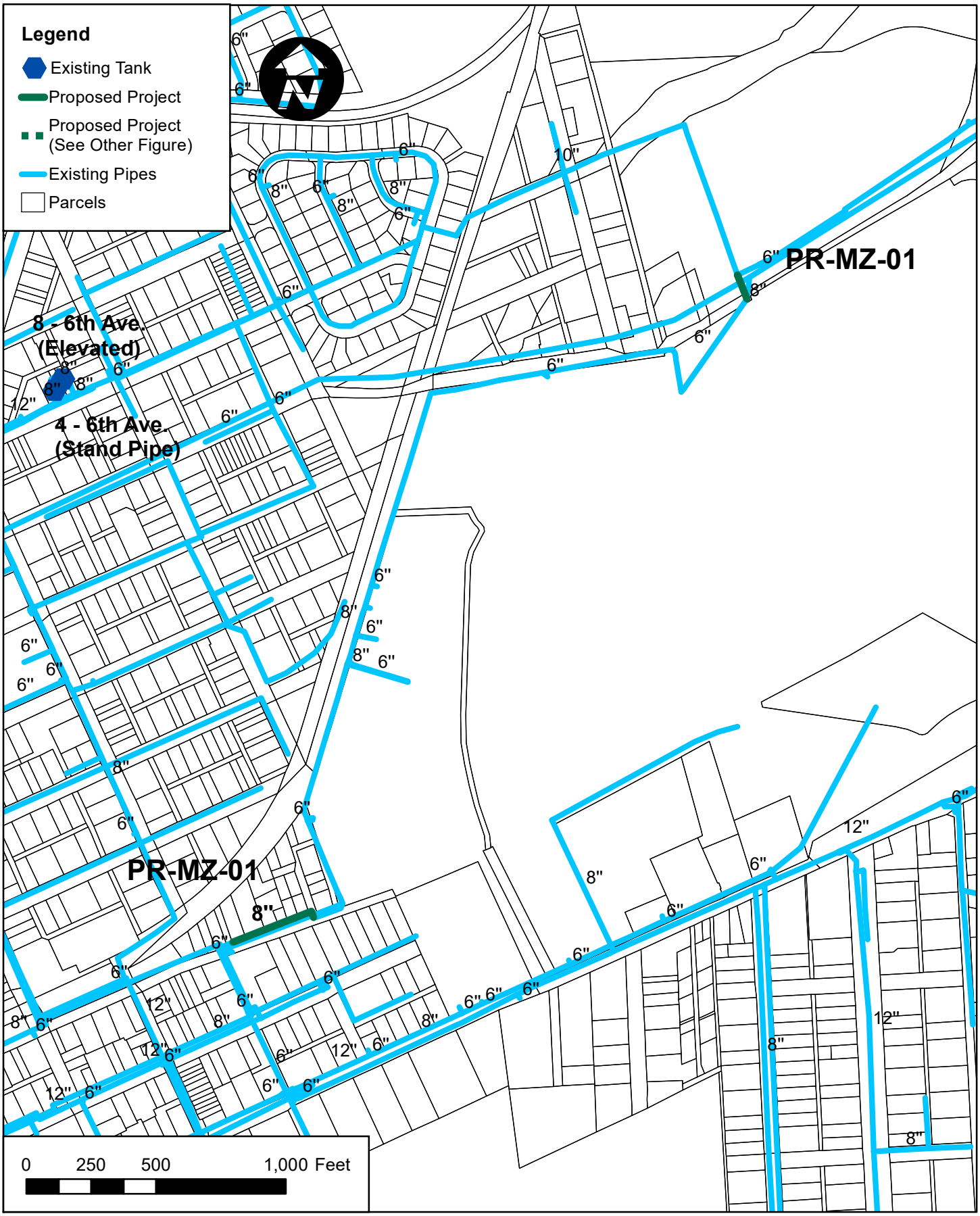

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Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	PROJ. NO.: 5107007	PROJECT: WATER MASTER PLAN CHARLES TOWN UTILITY BOARD	FIGURE NO.: 4-12

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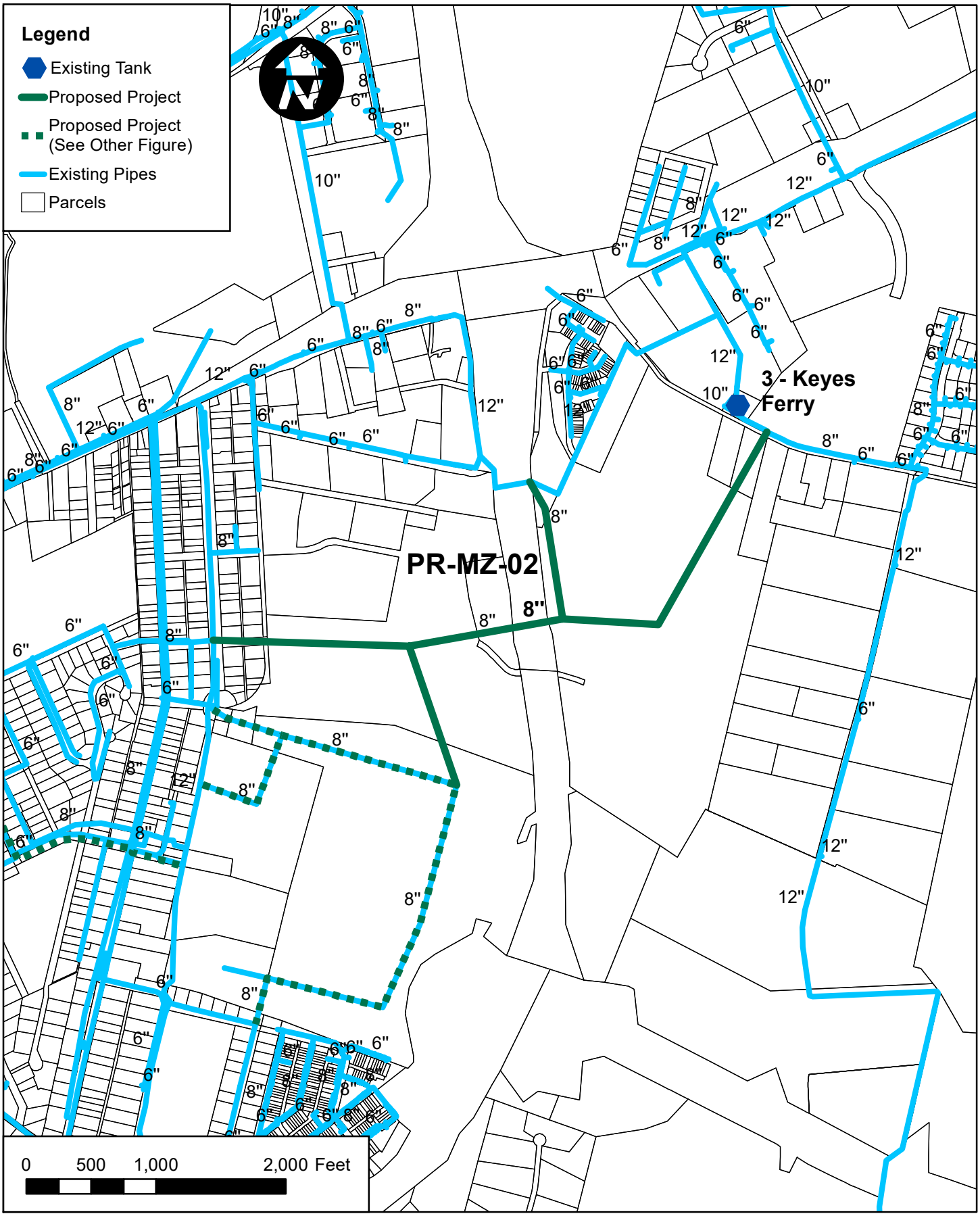
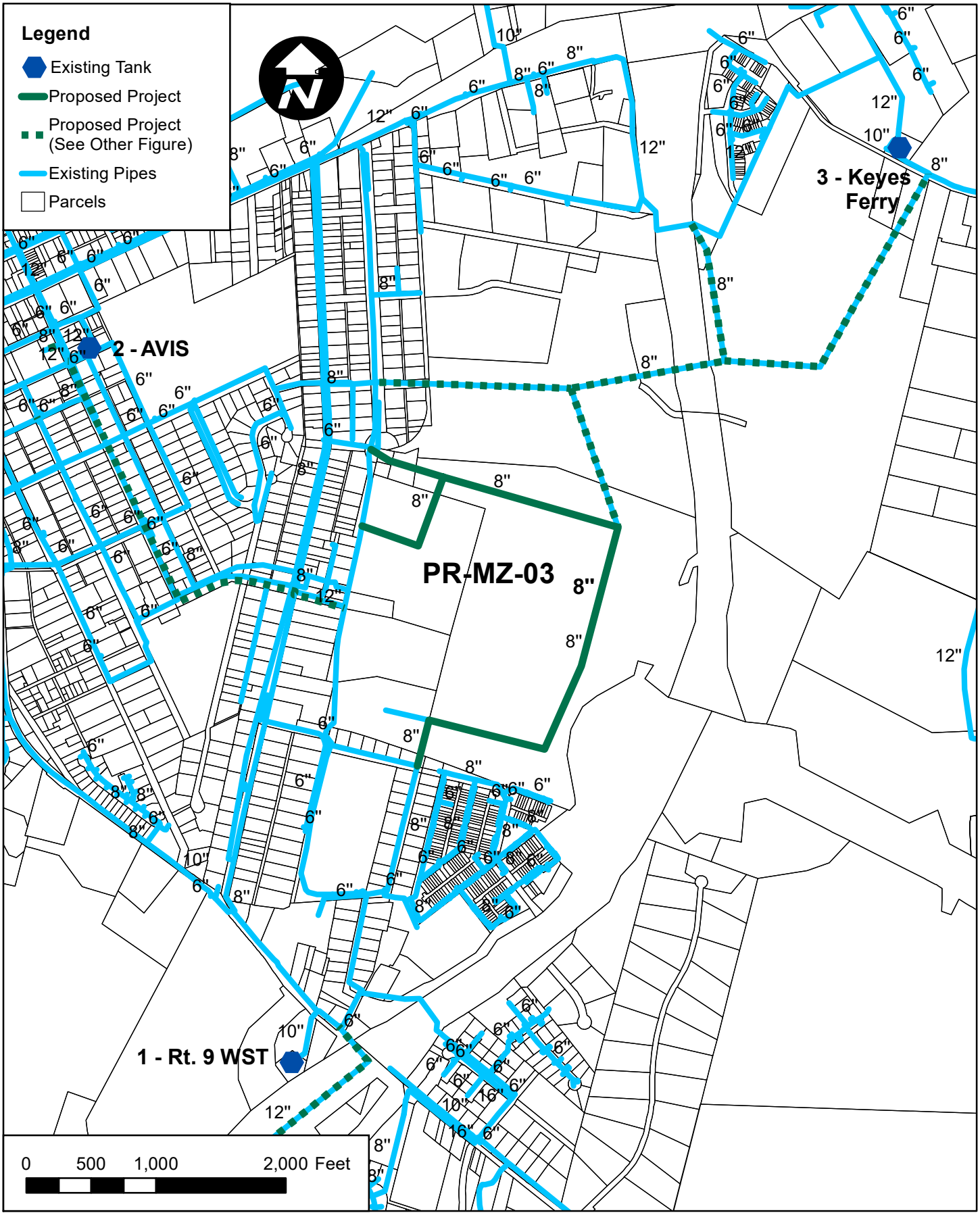
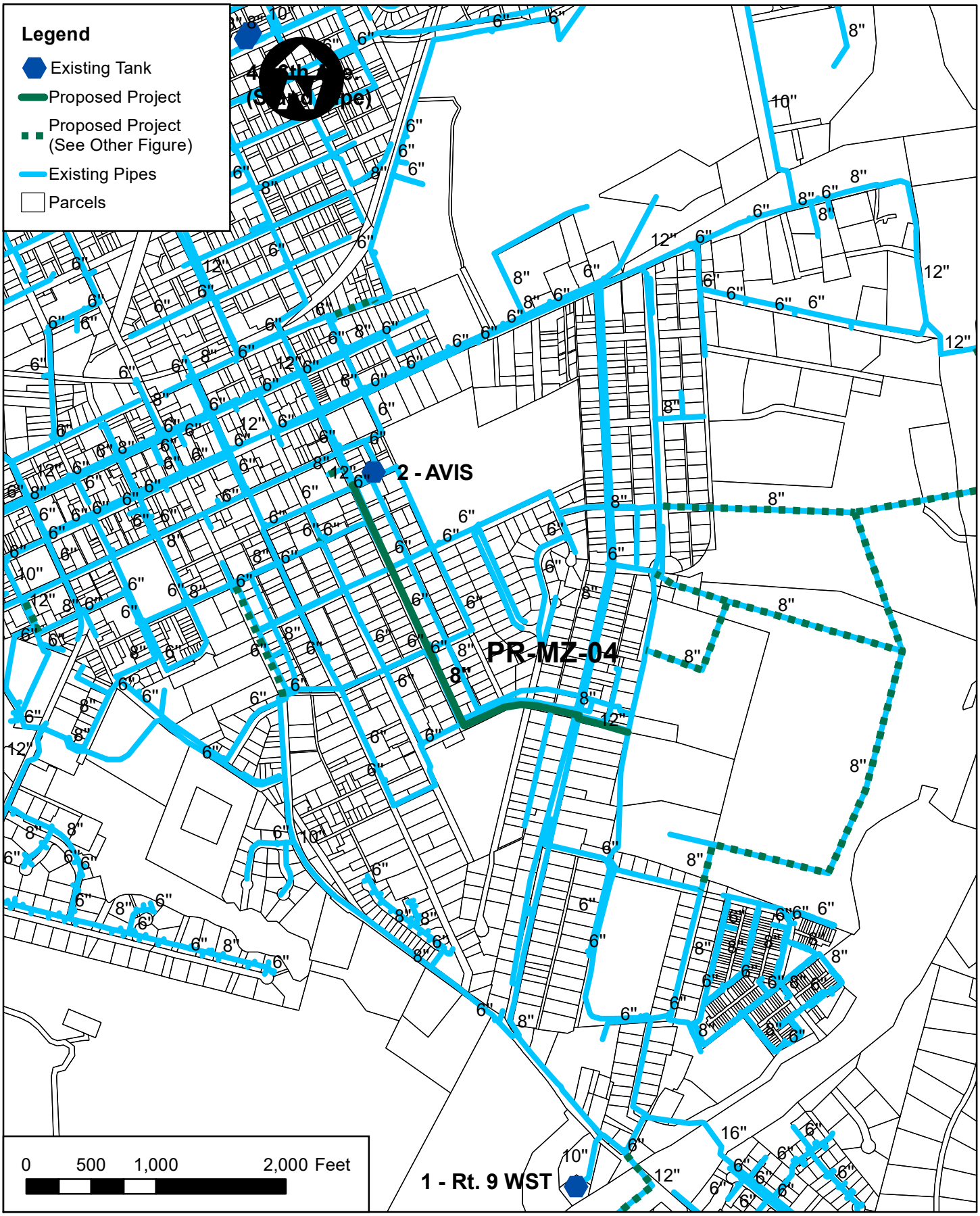


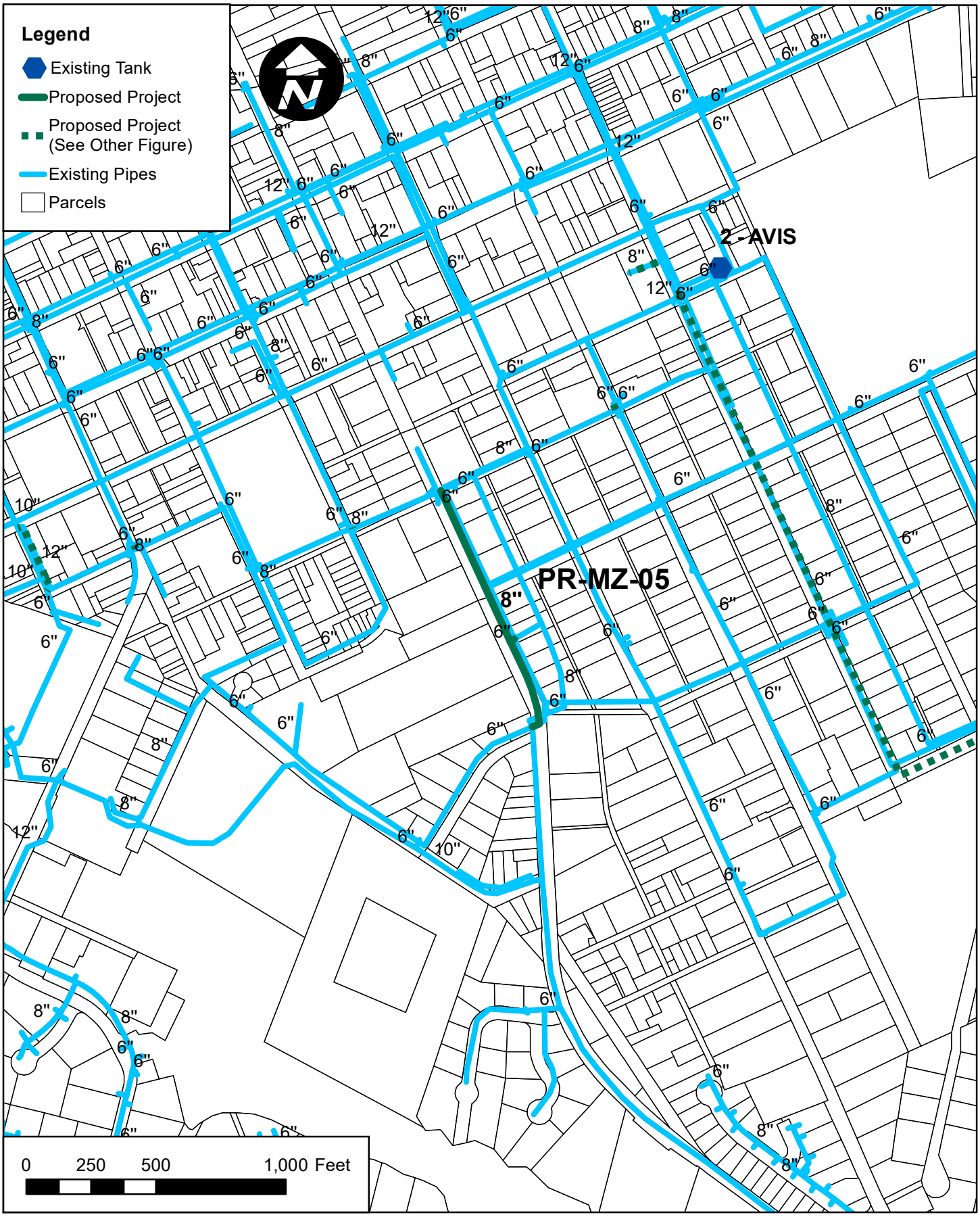
Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 1,000 feet	TITLE PR-MZ-02
	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD	FIGURE NO. 4-13



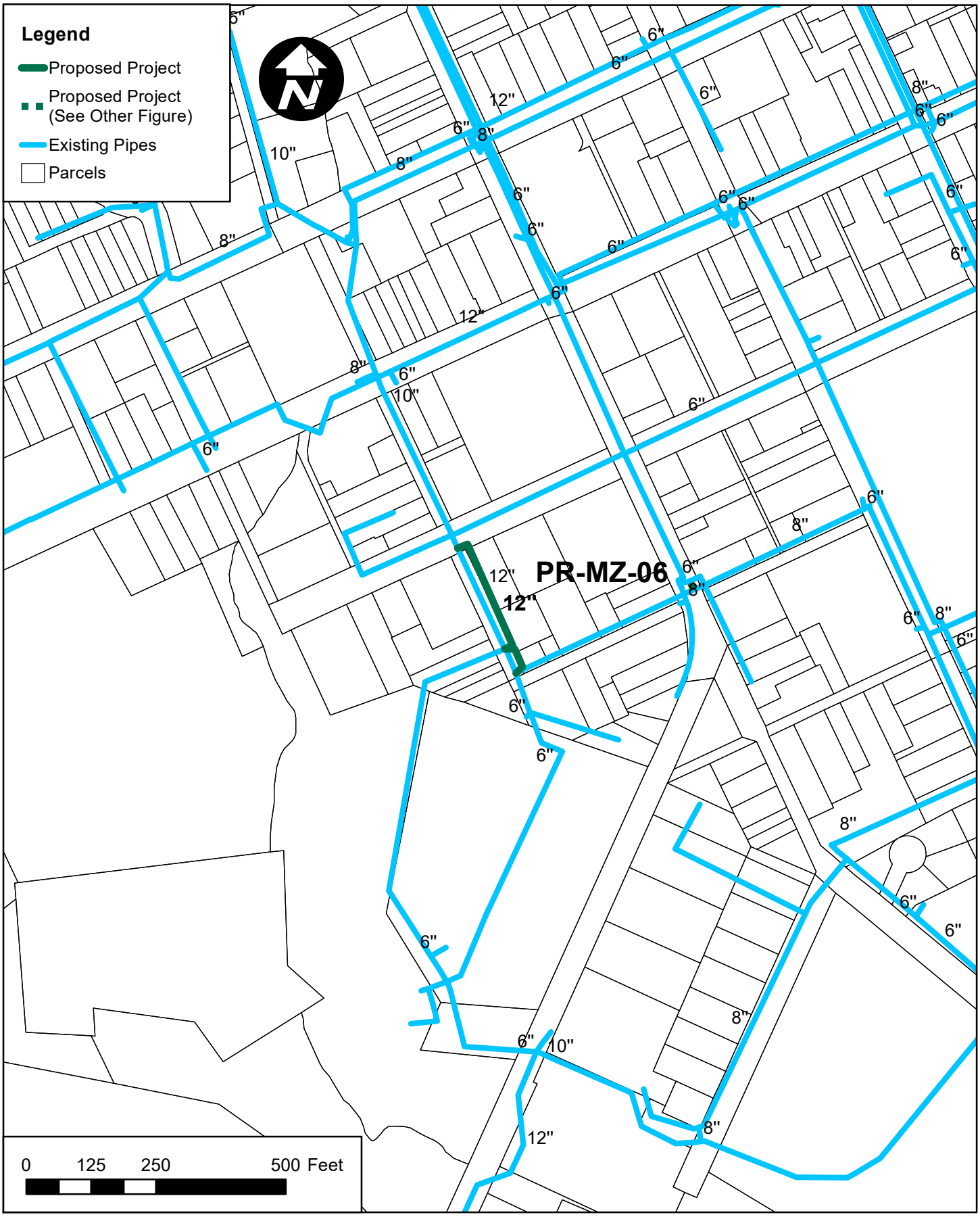
Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 1,000 feet	TITLE PR-MZ-03
	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD	FIGURE NO. 4-14



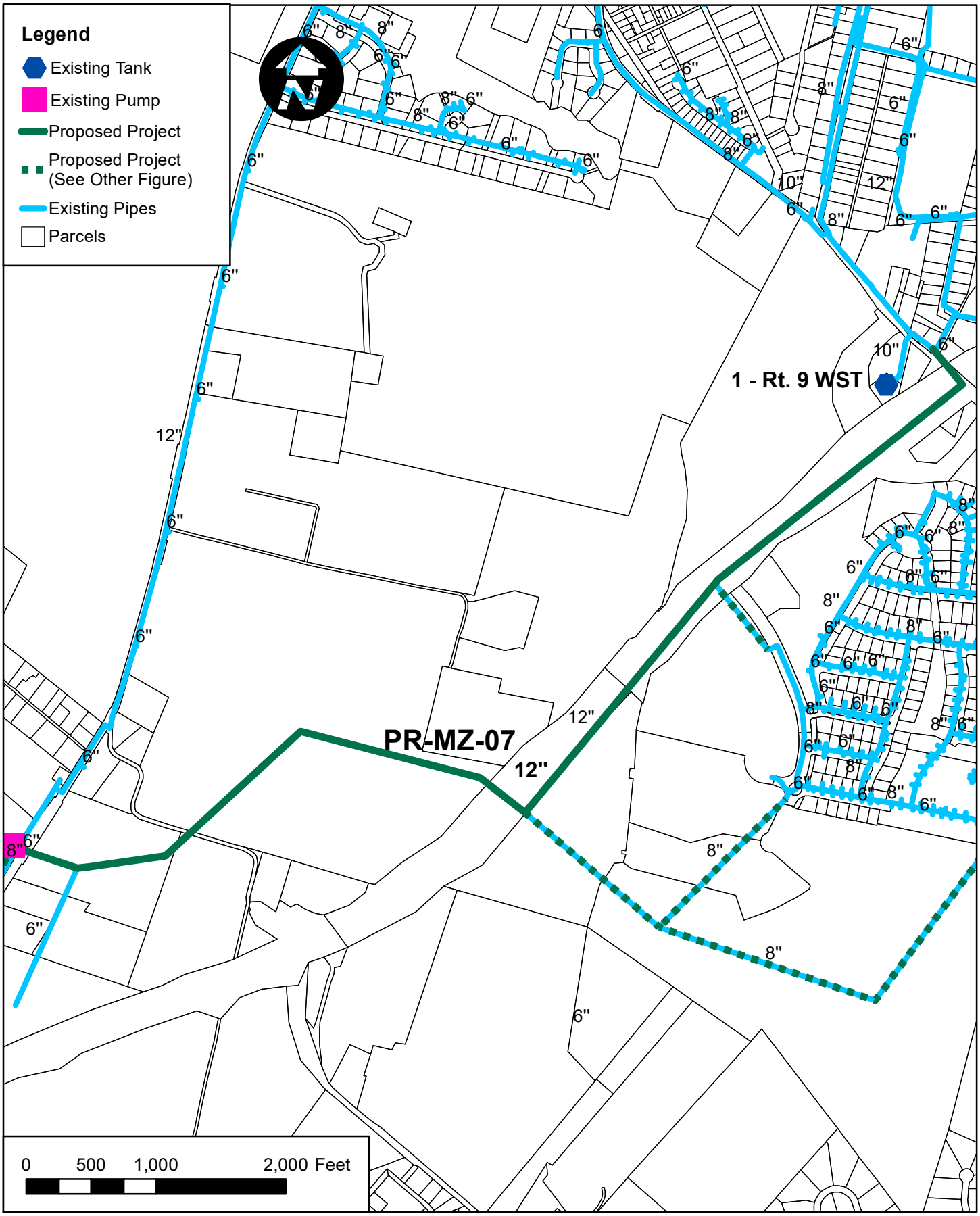
Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 1,000 feet	TITLE PR-MZ-04
	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD	FIGURE NO. 4-15



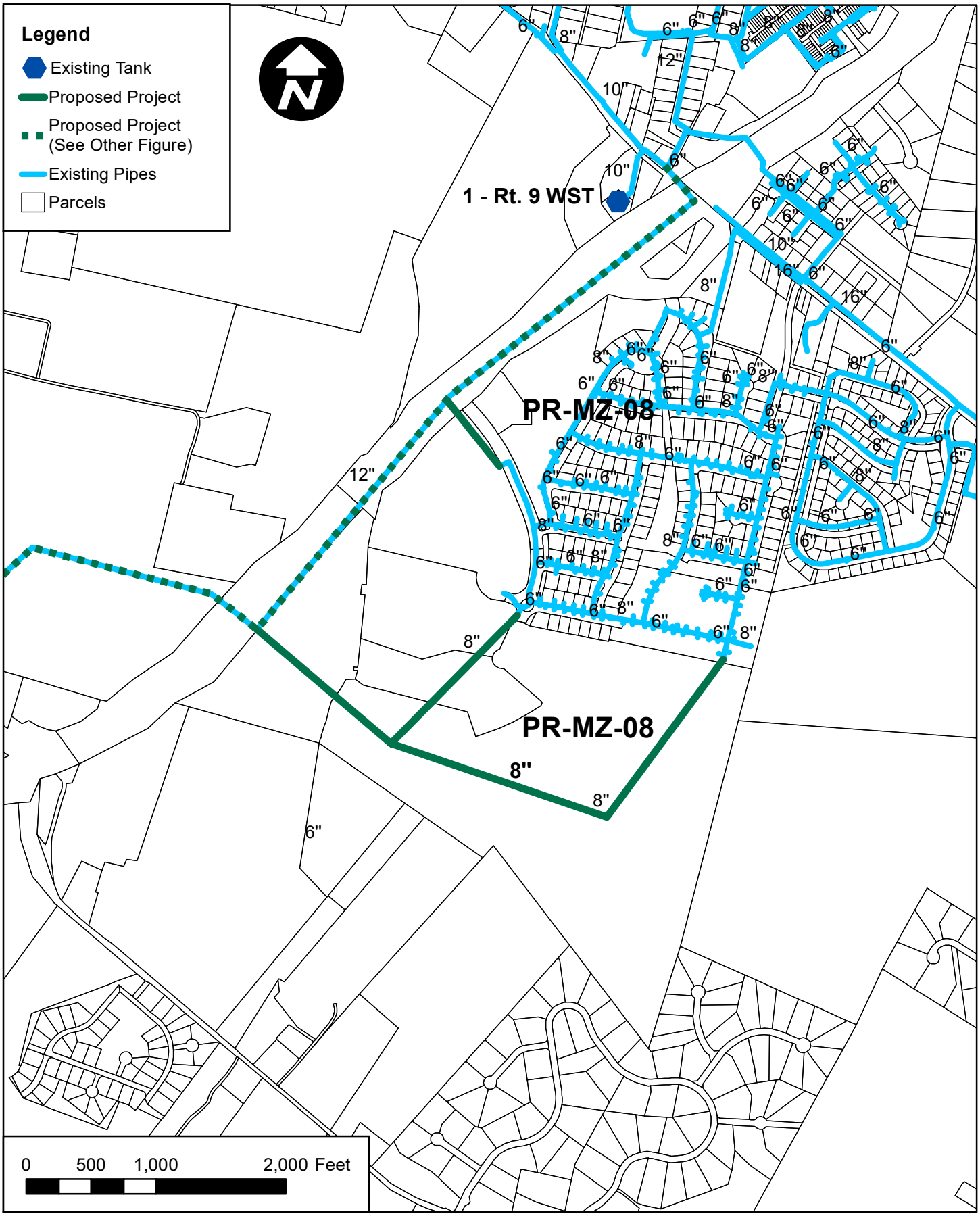
Dewberry	DATE	SCALE	TITLE
Dewberry Engineers Inc.	NOVEMBER 2021	1 inch = 500 feet	PR-MZ-05
4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD	FIGURE NO. 4-16



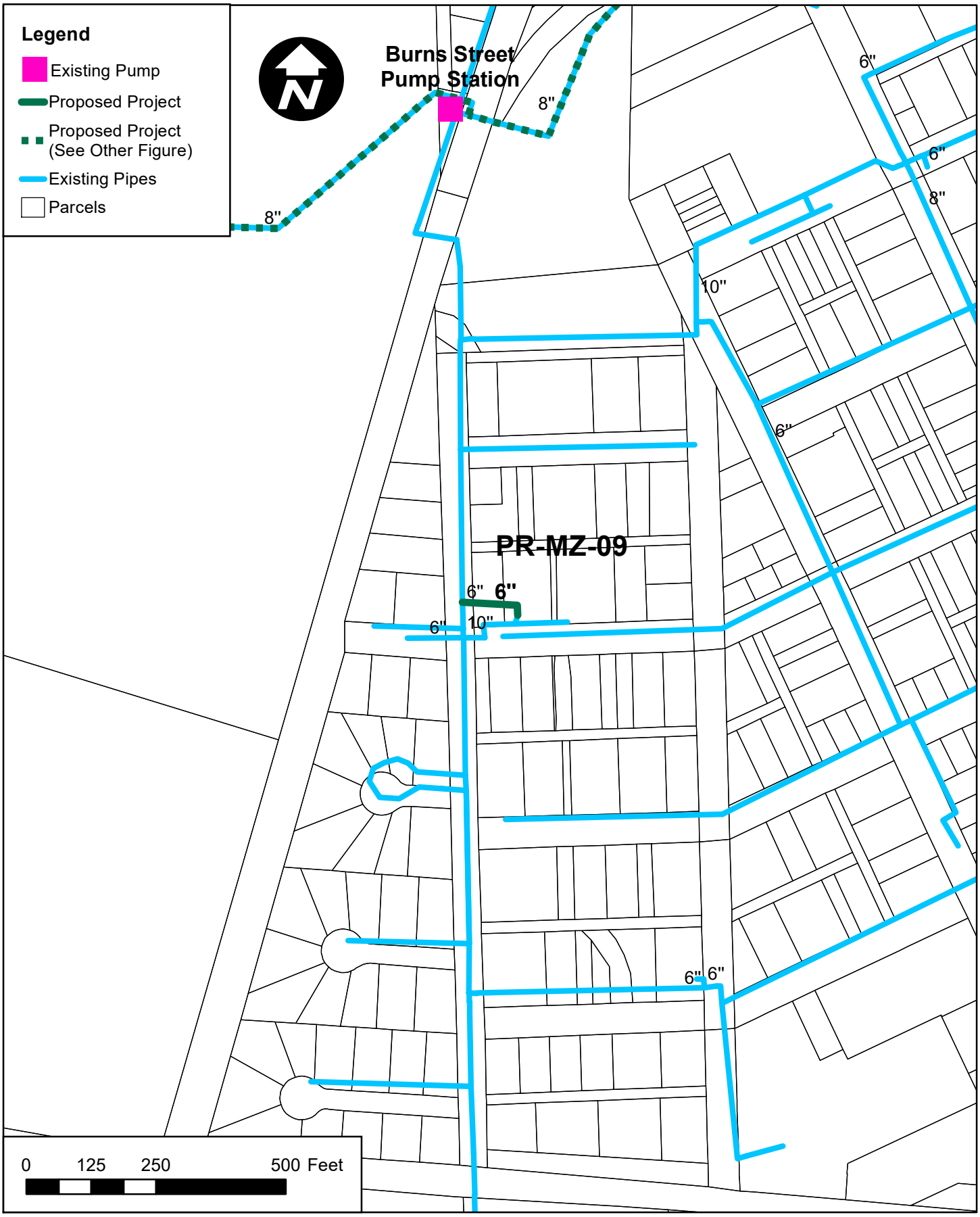
Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 250 feet	TITLE PR-MZ-06
	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD	FIGURE NO. 4-17



Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 1,000 feet	TITLE PR-MZ-07	FIGURE NO. 4-18
	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD		



Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 1,000 feet	TITLE PR-MZ-08	FIGURE NO. 4-19
	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD		



Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 250 feet	TITLE PR-MZ-09	FIGURE NO. 4-20
	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD		

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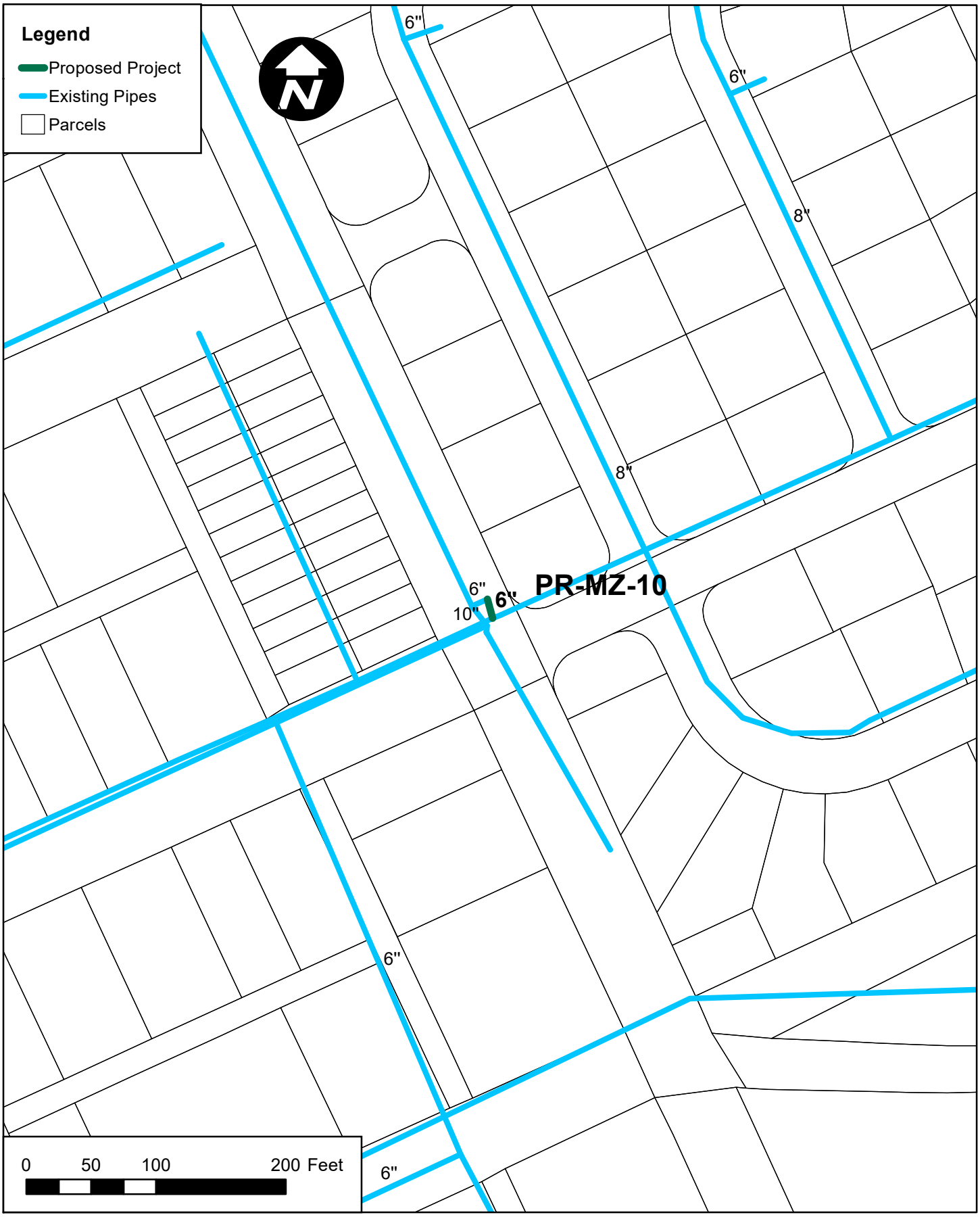

Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 100 feet	TITLE PR-MZ-10	FIGURE NO. 4-21
	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD		



Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 100 feet	TITLE PR-MZ-11	FIGURE NO. 4-22
	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD		

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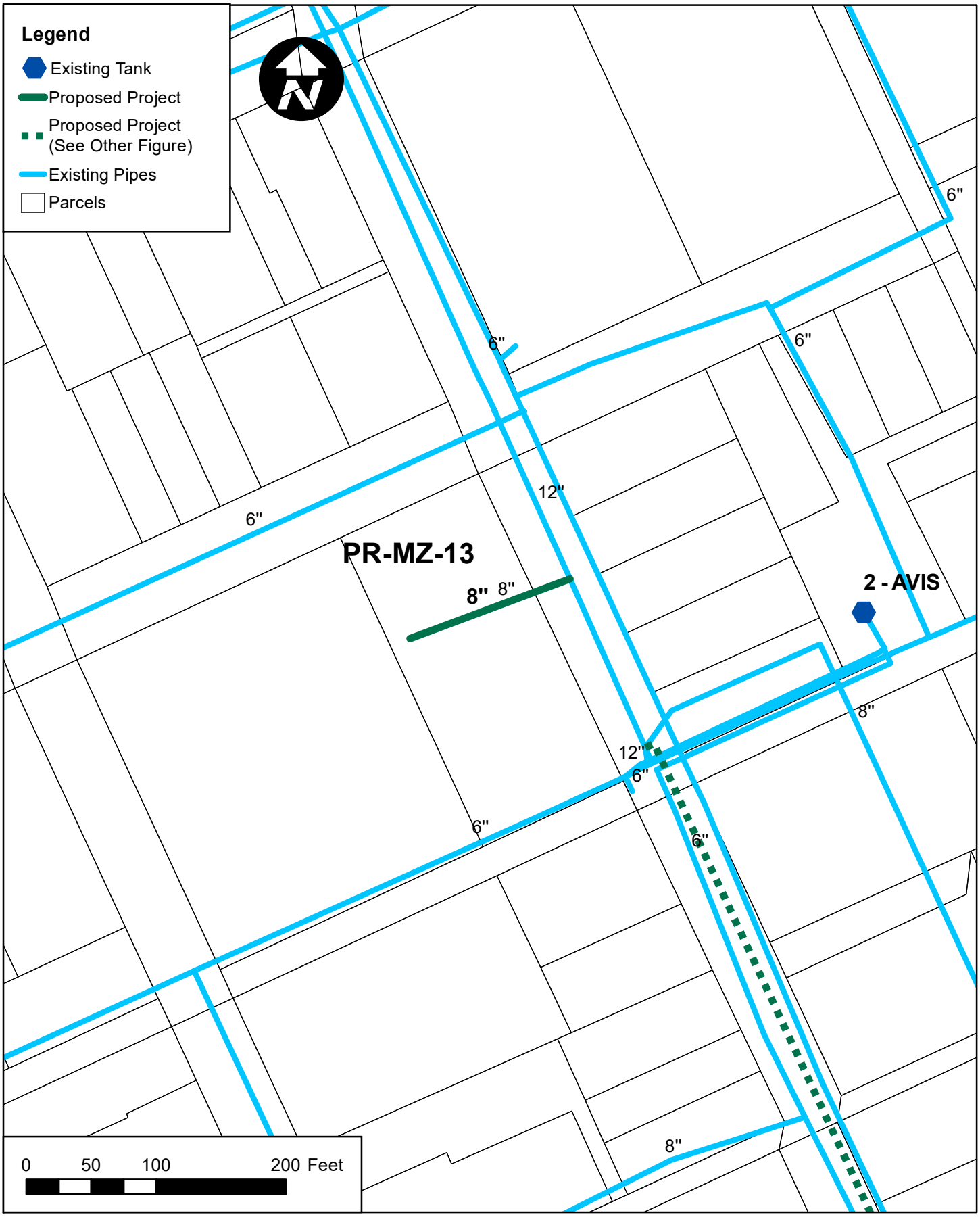
Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 100 feet	TITLE PR-MZ-12	FIGURE NO. 4-23
	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD		



Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 100 feet	TITLE PR-MZ-13	FIGURE NO. 4-24
	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD		

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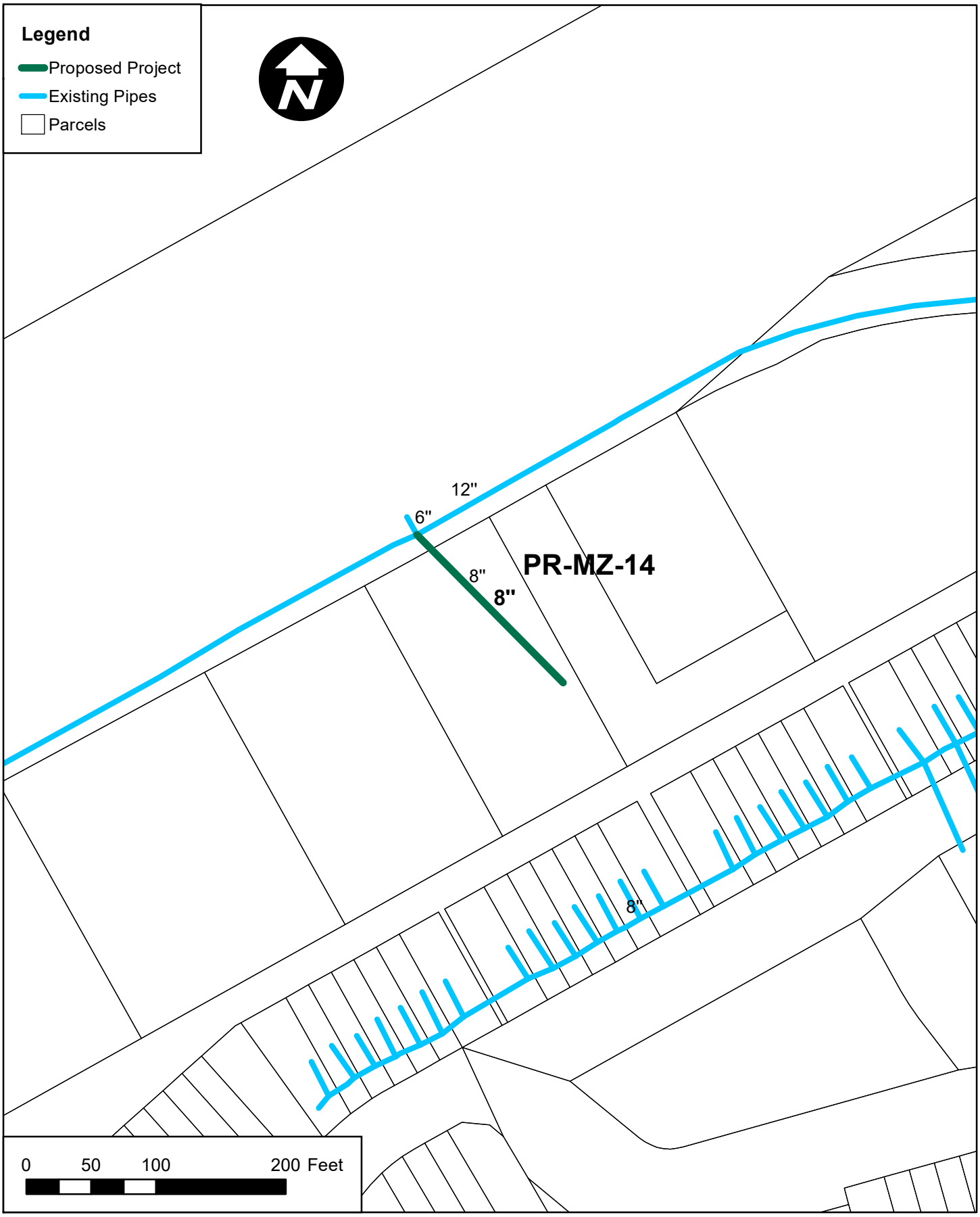
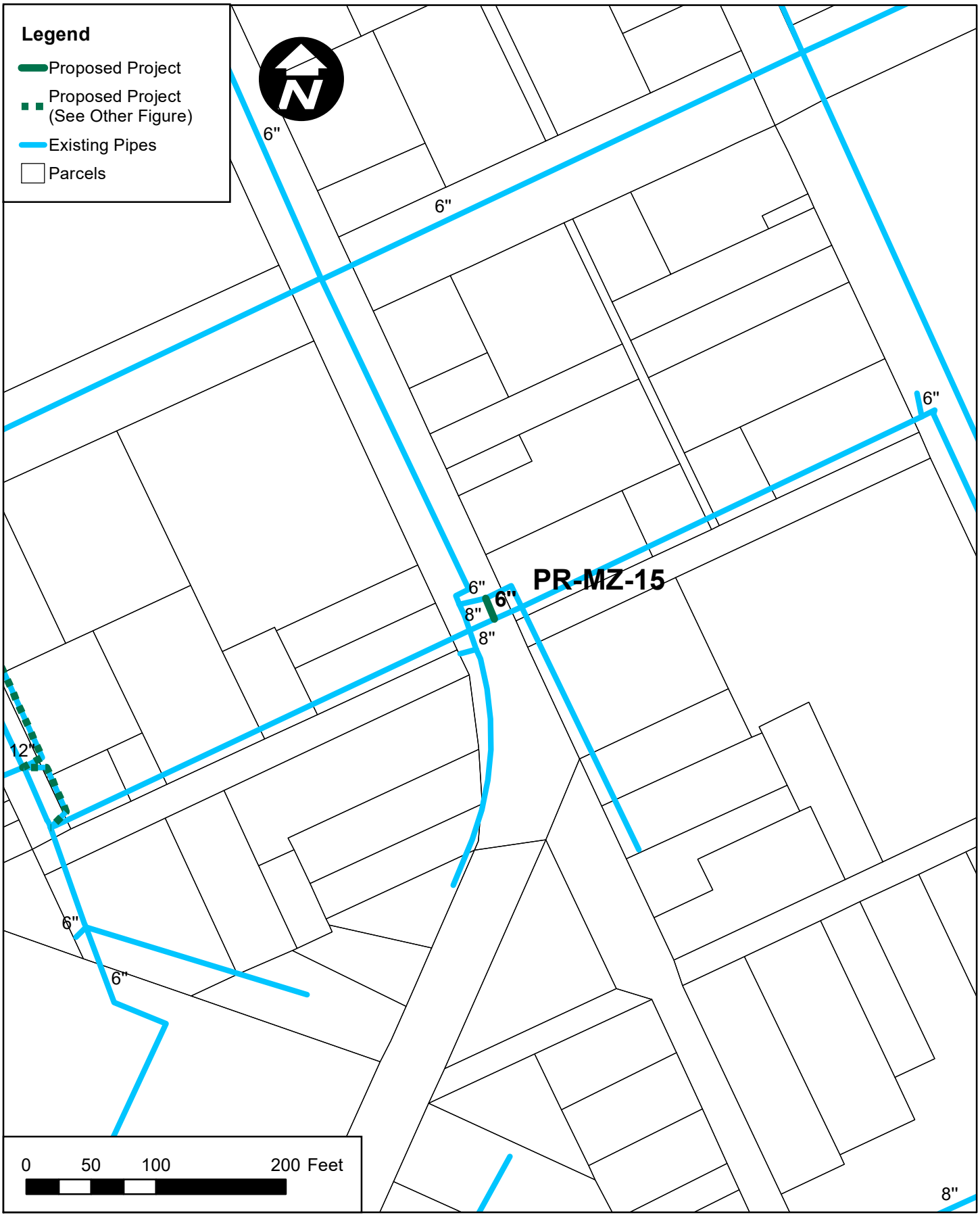
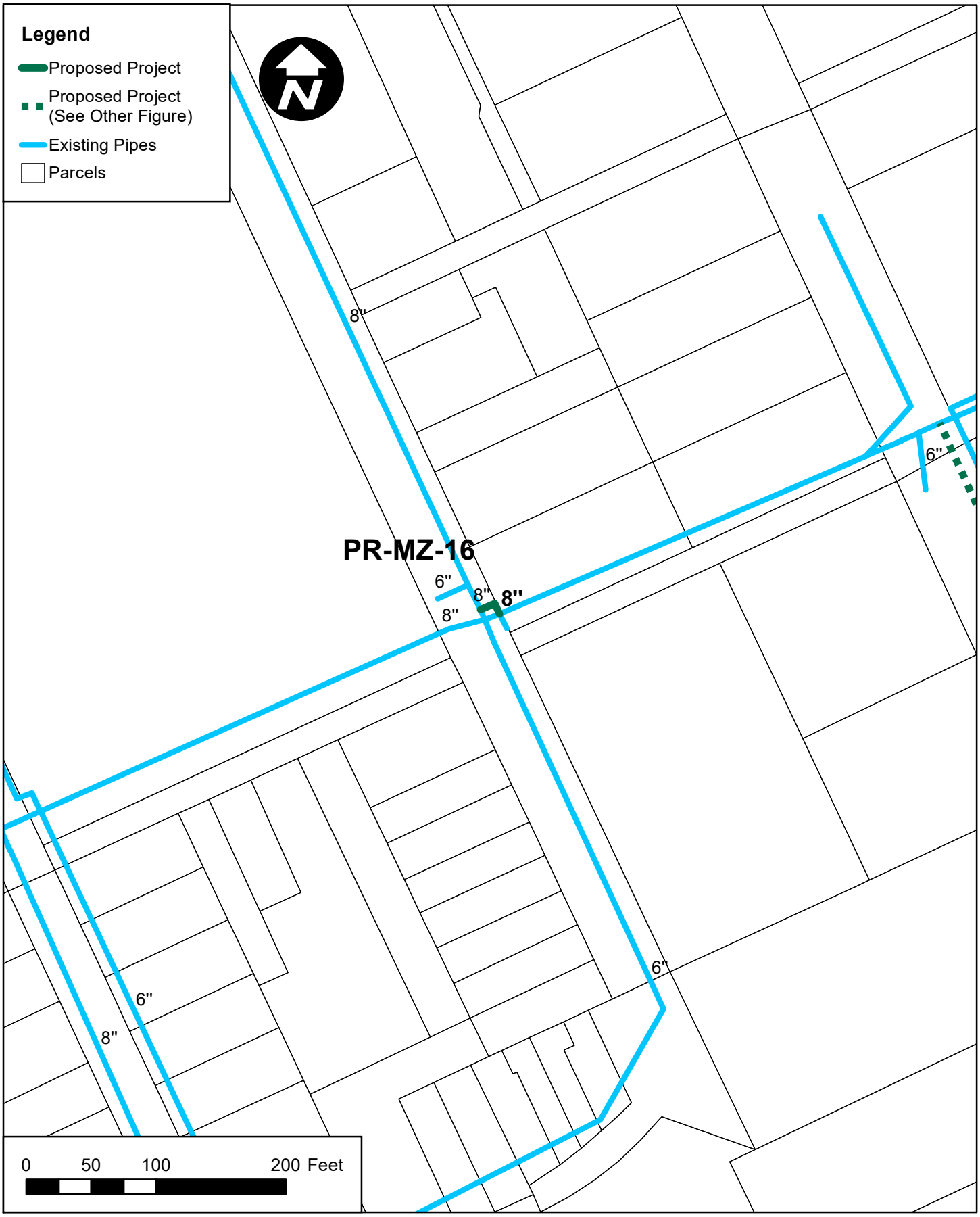


Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 100 feet	TITLE PR-MZ-14	FIGURE NO. 4-25
	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD		



Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 100 feet	TITLE PR-MZ-15	FIGURE NO. 4-26
	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD		



Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE: NOVEMBER 2021	SCALE: 1 inch = 100 feet	TITLE: PR-MZ-16
	PROJ. NO.: 5107007	PROJECT: WATER MASTER PLAN CHARLES TOWN UTILITY BOARD	FIGURE NO.: 4-27

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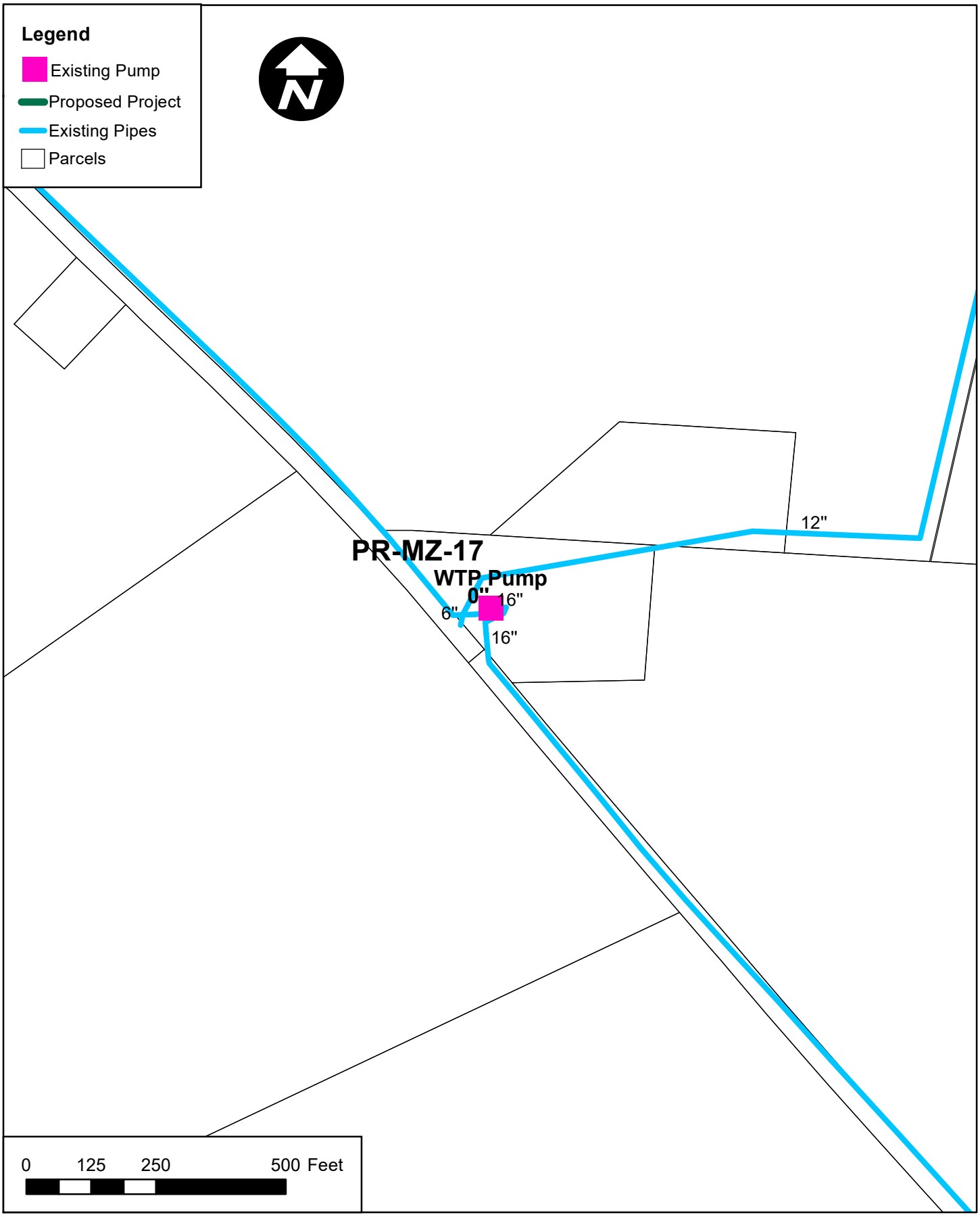

Dewberry Dewberry Engineers Inc. 4805 LAKE BROOK DRIVE, SUITE 200 GLEN ALLEN, VIRGINIA 23060 PHONE: 804.290.7957 FAX: 804.290.7928	DATE NOVEMBER 2021	SCALE 1 inch = 250 feet	TITLE PR-MZ-17	FIGURE NO. 4-28
	PROJ. NO. 5107007	PROJECT WATER MASTER PLAN CHARLES TOWN UTILITY BOARD		

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Charles Town
Utility Board

661 S. George Street, Suite 101 Charles Town, WV 25414
Phone: (304) 725-2316 ♦ Fax: (304) 725-7150 ♦ Web: www.ctubwv.com

UTILITY BOARD

INTERIM CHAIRMAN
City of Charles Town
Mayor Bob Trainor

VICE CHAIRMAN
City of Ranson
Mayor
Duke
Pierson

TREASURER
Thomas
Stocks

INTERIM SECRETARY
Ashley
Stottlemyer

County Commission Representative
Jacquelyn
Milliron

Board Member
Jefferson
Whitten

UTILITY MANAGER
Kristen
Stolipher

Date

Re: Water/Sewer Availability

Dear _____:

Pursuant to your request for water and sewer availability for the subject property located at _____, we offer the following:

Water Service:

The Charles Town Utility Board (CTUB) can furnish water service for the development as of this time. Please note that CTUB cannot hold or reserve capacity for any project. Capacity of the water system is provided on a first come, first serve basis. The Water Capacity Improvement Fees (CIF) at the time of building permit will apply. The current Water CIF is $2,576.00 per equivalent dwelling unit (EDU). Additionally, a $500.00 tap fee will be required per residential tap should the builder want CTUB to perform the tap. Please provide our office with separate checks for the CIF fees and tap fees. A copy of the CTUB Rates, Rules and Regulations can be found at: www.ctubwv.com.

Sewer Service:

CTUB can furnish sewer service for the development of a single-family residential unit as of this date. Please note that CTUB cannot hold or reserve capacity for any project. Capacity of the sanitary collection system is given as a first come, first serve, basis. The Sewer Capacity Improvement Fees at time of building permit will apply. The current Sewer CIF is $2,930.00 per equivalent dwelling unit (EDU). Additionally, a $400.00 tap fee will be required per residential tap should the builder want CTUB to perform the tap. Please provide our office with separate checks for the CIF fees and tap fees. A copy of the CTUB Rates, Rules and Regulations can be found at: www.ctubwv.com.

If you have any questions, please contact me at (304) 725-2316.

Sincerely,

Travis Markley
Engineering Technician

DRAFT

RESOLUTION NO. 2022-04

CHARLES TOWN UTILITY BOARD

A RESOLUTION TO ESTABLISH A FINANCIAL POLICY FOR WORKING CAPITAL, OPERATING CASH ON HAND AND PROJECT REIMBURSEMENT THROUGH BOND ISSUES

UTILITY BOARD

INTERIM CHAIRMAN
City of Charles Town
Mayor Bob Trainor

VICE CHAIRMAN
City of Ranson
Mayor
Duke
Pierson

TREASURER
Thomas
Stocks

INTERIM SECRETARY
Ashley
Stottlemyer

County Commission Representative
Jacquelyn
Milliron

Board Member
Jefferson
Whitten

UTILITY MANAGER
Kristen
Stolipher

WHEREAS, the Charles Town Utility Board's (CTUB) financial policy is to promote financial stability through formal periodic and annual fiscally sound budgeting practices, monitoring and adherence to adequate debt service coverage ratios, monitoring liquidity to determine sufficiency for operations and providing for capital improvements and replacements through internal funding when deemed appropriate; and

WHEREAS, CTUB staff monitors financial, economic and demographic indicators that could potentially impact the financial condition of the Utility; and

WHEREAS, working capital is a crucial consideration in long-term financial planning and credit agencies consider the availability of working capital in their evaluations of continued creditworthiness; and

NOW THEREFORE, BE IT RESOLVED by CTUB in the exercise of its discretion, as follows:

CTUB will strive to achieve and maintain a minimum benchmark debt service coverage ratio of 130% with an ultimate goal of increasing to a minimum 150% within a period of 10 years.

CTUB will establish a target minimum benchmark of 365 days of cash on hand throughout the fiscal year in the Water and Wastewater funds for each. The value of XX days of operating expenditures to be held in reserve shall be re-calculated annually every July, at the close of the previous fiscal year.

In the event that the working capital balance in a fund falls below the established minimum threshold, staff will develop a plan to replenish the deficit as soon as possible.

CTUB staff will prepare an analysis of cash on hand for Board consideration to determine amounts that may be available for internal capital project budgeting including forgoing reimbursements of advances for preliminary capital project costs. The analysis will be prepared annually every July, at the close of the previous fiscal year.

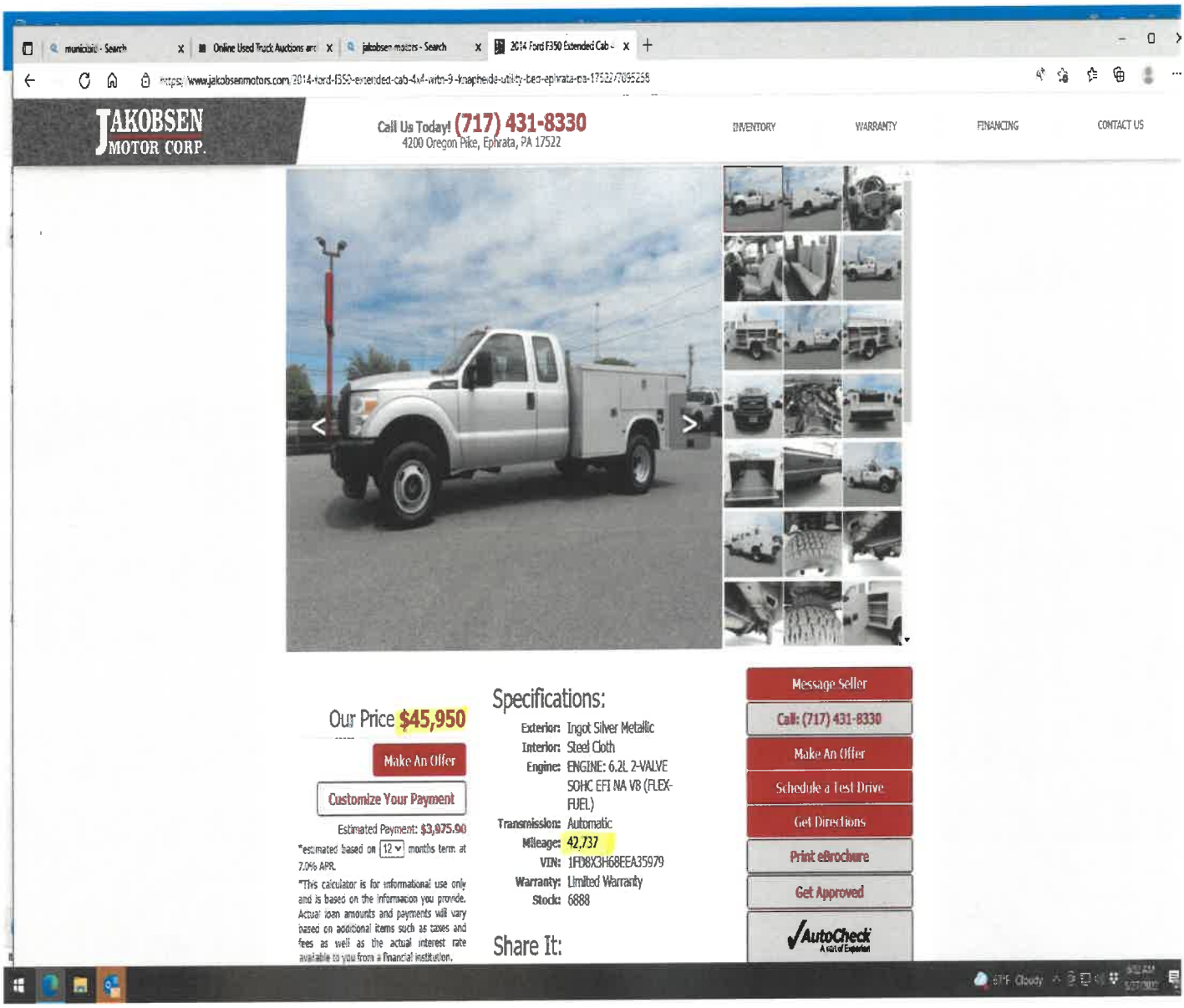
DRAFT

CHARLES TOWN UTILITY BOARD
VEHICLE/DRIVER LIST
Updated 5/31/2022

SEWER DEPARTMENT			
DRIVER	**VEHICLE**	**YEAR**	**MILEAGE**
JB	GMC Sierra	2020	25364
CC	Ford F350	2012	88159
RS	Ford F250	2014	149084
DS	Ford F150	2011	127721
OR	Ford F250	2014	79070
BC	Ford Super Duty 350	2019	30788
RL	Chevy Silverado	2007	83000
NW	Ford F350	2001	84226
TM			
TS			

MAINTENANCE DEPARTMENT			
DRIVER	**VEHICLE**	**YEAR**	**MILEAGE**
BG	Dodge Utility Truck	2018	19405
MW	Ford F350	2011	95000
WB	Chevy 3500 Silverado	2012	24041
SF	GMC 2500	2016	58375
LS	Chevy Silverado	2015	100750
DE			
SW			
AH			

WATER DEPARTMENT			
DRIVER	**VEHICLE**	**YEAR**	**MILEAGE**
Chris O.	Ford F150	2017	35410
LS	Ford F150	2015	62204
JC	Ford F250	2003	89998
CO	Ford F150	2011	120554
CN			



Ford F350 4x4






PROMO

Used 2016 CHEVROLET Utility Truck - Service Truck

SILVERADO

51,322 Miles # 350606

$43,995

Highline Motor Cars

Popularity Stats

- **Seen 33 times** *(last 30 days)*
- Saved by 3 people
- The price has not decreased recently

Description

350606 51,322 Miles

2016 Chevrolet, Silverado 2500HD, Truck, 4WD Double Cab 158.1" Work Truck, Air Conditioning,Cruise Control,Tachometer,6-speaker audio system (Standard on Crew Cab and Double Cab models and Included and only available on Regular Cab models with (IOB) 7"" diagonal color touch screen display

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PROMO



Used 2017 FORD Utility Truck - Service Truck, Mechanics Truck, Plumber Service Truck

F350

72,716 Miles # VM35221

$48,990

Vitale Motors

Popularity Stats

- **Seen 190 times** *(last 30 days)*
- Saved by 4 people
- The price recently **decreased by $1,000**

Description

VM35221 72,716 Miles

2017 Ford, Super Duty F-350 DRW, Service Body, SUPER CAB 4X4 DRW UTILITY BODY TRUCK, 4x4,Air Conditioning,AM/FM,Anti-Lock Brakes,Aux Audio Jack,Cruise Control,Driver Airbag,Front Split Bench Seat,Handsfree Wireless,Heated Exterior Mirror,Interval Wipers,Keyless Entry,Passenger Airbag,Power

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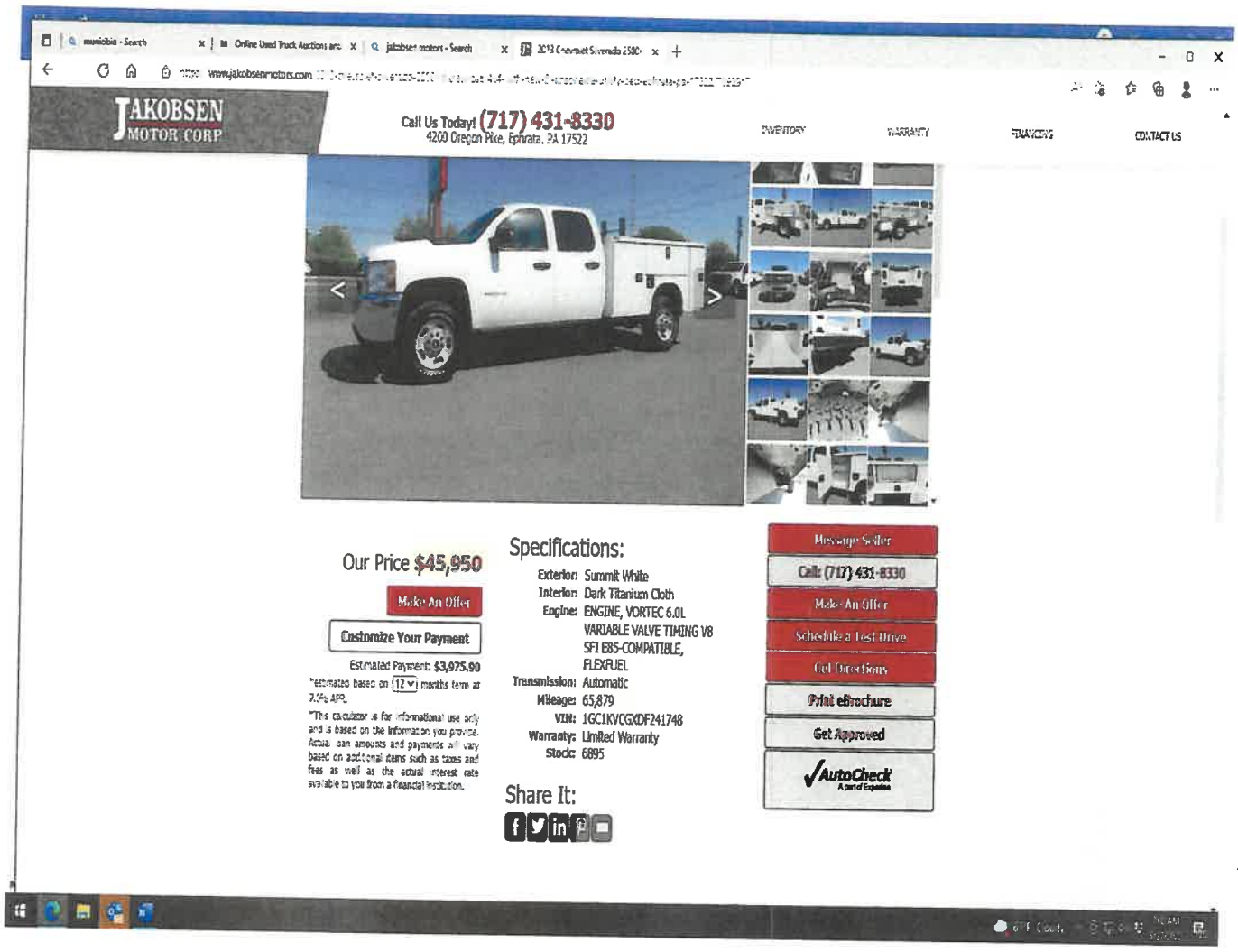

2013 Chevy Silverado 2500HD Crew Cab 4x4

65,000 mile's

45,950





PROMO



Used 2017 FORD Utility Truck - Service Truck

F250

64,094 Miles | Ford F250 New 8' Service Body | # 112363

$49,995

Schepel GMC

Schepel GMC

Popularity Stats

Seen 82 times *(last 30 days)*

Be the first user to .

price has not decreased recently

Description

Ford F250 New 8' Service Body # 112363 64,094 Miles

2017 Ford F-250, Service Body, Transmission, 4x4, 2017 Ford F-250 Regular Cab 4x4, Service Body --- HOUSE / COM, VIN: 1FTBF2B64HEE45425, Airbags - Front - Side,Airbags - Front - Side Curtain,Exterior Mirrors Manual Telescoping,Towing And Hauling Trailer Wiring: 4-Pin,Towing And Hauling Trailer Wiring: 7-

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Charles Town Utility Board

661 S. George Street, Suite 101 Charles Town, WV 25414
Phone: (304) 725-2316 ♦ Fax: (304) 725-7150 ♦ Web: www.ctubwv.com

MEMORANDUM TO THE BOARD OF DIRECTORS

FROM: Kristen Stolipher, Utility General Manager
SUBJECT: Utility General Manager's Report
DATE: June 8, 2022

ADMINISTRATIVE

- Customer Counts
  - Sewer 8,308 (2,066 billed by JUI)
  - Water 6,405
- Request for Qualifications to provide underwriting services to the City of Charles Town, WV

WATER

- Water Facility Plan update
  - Dewberry DRAFT report and Water CIF presentation - June 8, 2022
- Hydrant Flushing
  - Flushing to begin in June and will continue to through the end of July.
- Grant update – Neal Nilsen is working on schedule and equipment selection

SEWER

- 2022 Renewal and Replacement Project updates
  - Bids Due June 10, 2022
- Novaform Expand-in-place demonstration – June 2, 2022

Customer Name	Location	Lot Number	CIF Date Paid	Number of Sewer EDUs	Sewer CIF Amount Paid	Number of Water EDU's	Water CIF Amount Paid
Wormald	Beallair	134	1/11/2022	1	$ 3,207.00		
Gordon	Burr West - TeMa	20-21	1/11/2022	1.5	$ 4,810.50		
Leonard, Dave	10th Avenue	A-C	1/13/2022	2	$ 2,254.00	2	$ 5,152.00
Lennar	Norborne Glebe	304-317	1/20/2022	14	$ 44,898.00	14	$ 36,064.00
Dan Ryan	Tate Manor	30-40	1/24/2022	11	$ 12,397.00	11	$ 28,336.00
Wormald	Beallair	136	1/25/2022	1	$ 3,207.00		
Sheetz	Burr Park	13-14	1/25/2022	0.03	$ 962.10		
Wormald	Beallair	153-154	2/8/2022	2	$ 6,414.00		
Roper	418 S Charles St		2/16/2022	1	$ 1,127.00	1	$ 2,576.00
Dan Ryan	Huntfield	858-871	2/25/2022	14	$ 15,778.00	14	$ 36,064.00
Wormald	Beallair	143, 145	3/8/2022	2	$ 6,414.00		
Integrity Engineering	Sheetz-Augustine Avenue		3/14/2022	16.66	$ 66,673.32	16.66	$ 42,916.16
Dan Ryan	Tate Manor	41-46	3/11/2022	6	$ 6,762.00	6	$ 15,456.00
Lutman	Maple Ave	2-3	3/15/2022	1	$ 1,127.00	1	$ 2,576.00
Lutman	Higgs Blvd	23-28	3/15/2022	6	$ 6,762.00	6	$ 15,456.00
Lutman	Maple Ave (Apt)	2-3	3/16/2022	1	$ 1,127.00	1	$ 2,576.00
Lutman	Pacel 2 MLK Blvd		3/16/2022	2	$ 2,254.00	2	$ 5,152.00
Lennar	Norborne Glebe	1-14	3/17/2022	14	$ 44,898.00	14	$ 36,064.00
Washington Landing L	Washington Landing (270 Apt Units, Clubhouse, Pool		3/24/2022	129.93	$ 519,720.00		
Washington Landing L	Washington Landing (Building 100, Clubhouse)		3/24/2022			22.69	$ 28,042.00
Wormald	Beallair	148, 151	3/25/2022	2	$ 6,414.00		
3.4 Homes WV	115 Park Avenue		4/1/2022	3	$ 3,381.00		
Dan Ryan Builders	Huntfield	614	4/4/2022	1	$ 1,127.00	1	$ 2,576.00
DRH	Magnolia Springs	16-17, 29-31, 50-51	4/6/2022	7	$ 7,889.00	7	$ 18,032.00
Lennar	Norborne Glebe	15-31, 273-277, 280-281	4/7/2022	24	$ 76,968.00	24	$ 61,824.00
Dan Ryan Builders	Huntfield	615	4/8/2022	1	$ 2,930.00	1	$ 2,576.00
Wormald	Beallair	59, 137, 146, 147, 155	4/8/2022	5	$ 14,650.00		
DRH	Magnolia Springs	1, 11-12, 15, 49, 52, 54-57, 60-64, 79-83, 90	4/13/2022			21	$ 54,096.00
Dan Ryan Builders	Huntfield	884-887	4/14/2022	4	$ 11,720.00	4	$ 10,304.00
Stanley Martin	Presidents Pointe	77-96	4/18/2022	20	$ 91,100.00		
Washington Landing L	Washington Landing (Building 200, 300)		4/21/2022			23.03	$ 59,328.00
DRH	Magnolia Springs	53	4/25/2022	1	$ 2,930.00	1	$ 2,576.00
DRH	Magnolia Springs	1, 11-12, 15, 49, 52, 54-57, 60-64, 79-83, 90	4/25/2022	21	$ 61,530.00		
DRH	Magnolia Springs	16-17, 29-31, 50-51	4/25/2022	7	$ 12,621.00		
Roper	406 S Charles St, 418 S Lawrence St, 423 S Lawrence St		4/26/2022	3	$ 8,790.00	3	$ 7,728.00
Lennar	Norborne Glebe	269-272, 282-285	4/28/2022	8	$ 23,440.00	8	$ 20,608.00
Dan Ryan	Tate Manor	47-52, 59-63	4/28/2020	11	$ 32,230.00	11	$ 28,336.00
Wormald	Beallair	156	5/13/2022	1	$ 2,930.00		
DRH	Magnolia Springs	13	5/16/2022	1	$ 2,930.00	1	$ 2,576.00
DRH	Magnolia Springs	14, 59	5/23/2022	2	$ 5,860.00	2	$ 5,152.00
DHR	Magnolia Springs	58, 65, 76-78, 85, 172-174, 177-178	5/26/2022	11	$ 32,230.00	11	$ 28,336.00
			Total	**359.12**	$ 1,152,461.92	**229.38**	$ 560,478.16

Charles Town Utility Board
2022 Capacity Improvement Fee Collections/EDU for Sewer

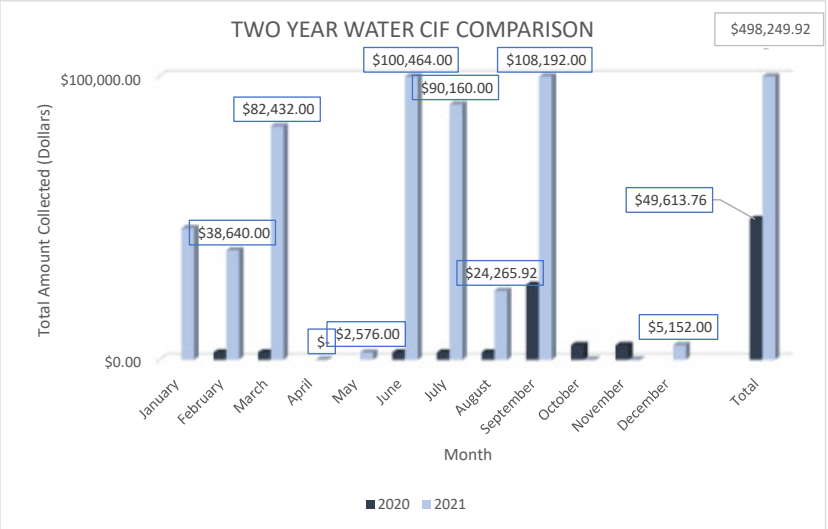
Month	Commercial	Residential	Total Number of EDU's	Total Sewer CIF Collected	CIF Paid to Ranson	Total
Jan-22	1.53	29	30.53	$ 71,735.60		$ 71,735.60
Feb-22		17	17	$ 23,319.00		$ 23,319.00
Mar-22	146.59	34	180.59	$ 662,151.32		$ 662,151.32
Apr-22		116	116	$ 351,306.00	$ 32,500.00	$ 318,806.00
May-22		15	15	$ 43,950.00		$ 43,950.00
Jun-22			0			$ -
Jul-22			0			$ -
Aug-22			0			$ -
Sep-22			0			$ -
Oct-22			0			$ -
Nov-22			0			$ -
Dec-22			0			$ -
Total 2022	**148.12**	**211**	**359.12**	**$ 1,152,461.92**	**$ 32,500.00**	**$ 1,119,961.92**

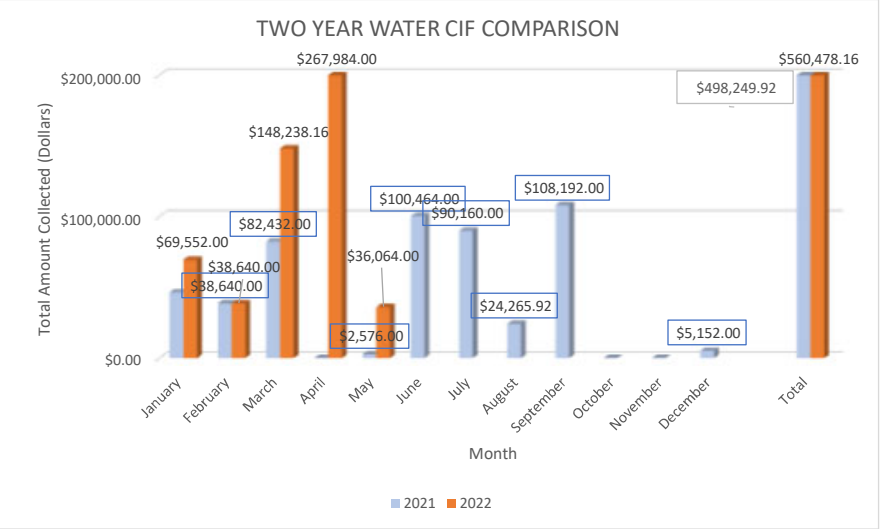
Charles Town Utility Board
2022 Capacity Improvement Fee Collections/EDU for Water

Month	Commercial	Residential	Total Number of EDU's	Total Water CIF
Jan-22		27	27	$ 69,552.00
Feb-22		15	15	$ 38,640.00
Mar-22	39.35	30	69.35	$ 148,238.16
Apr-22	23.03	81	104.03	$ 267,984.00
May-22		14	14	$ 36,064.00
Jun-22			0	
Jul-22			0	
Aug-22			0	
Sep-22			0	
Oct-22			0	
Nov-22			0	
Dec-22			0	
Total 2021	**62.38**	**167**	**229.38**	**$ 560,478.16**

Charles Town Utility Board 2021 Capacity Improvement Fee Collections/EDU for Water				
Month	Commercial	Residential	Total Number of EDU's	Total Water CIF
Jan-21		18	18	$ 46,368.00
Feb-21		15	15	$ 38,640.00
Mar-21		32	32	$ 82,432.00
Apr-21				$ -
May-21		1	1	$ 2,576.00
Jun-21	36	3	39	$ 100,464.00
Jul-21		35	35	$ 90,160.00
Aug-21	7.42	2	9.42	$ 24,265.92
Sep-21		42	42	$ 108,192.00
Oct-21				$ -
Nov-21				$ -
Dec-21		2	2	$ 5,152.00
Total 2021	**43.42**	**108**	**193.42**	**$ 498,249.92**

Charles Town Utility Board 2022 Capacity Improvement Fee Collections/EDU for Water				
Month	Commercial	Residential	Total Number of EDU's	Total Water CIF
Jan-22		27	27	$ 69,552.00
Feb-22		15	15	$ 38,640.00
Mar-22	39.35	30	69.35	$ 148,238.16
Apr-22	23.03	81	104.03	$ 267,984.00
May-22		14	14	$ 36,064.00
Jun-22				
Jul-22				
Aug-22				
Sep-22				
Oct-22				
Nov-22				
Dec-22				
Total 2022	**62.38**	**167**	**229.38**	**$ 560,478.16**



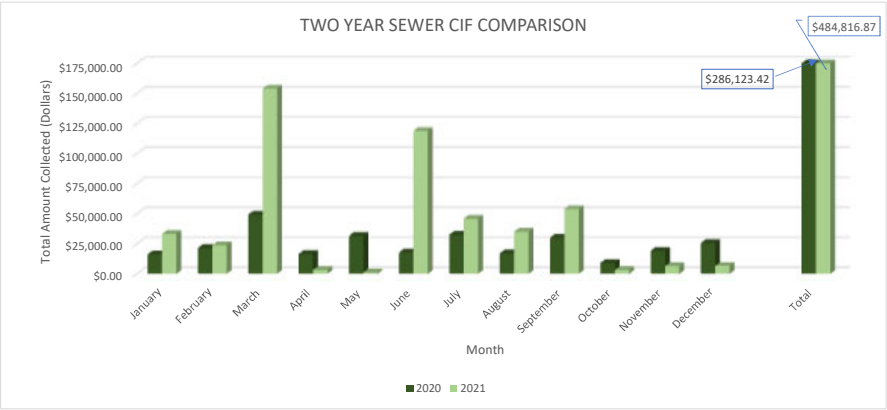


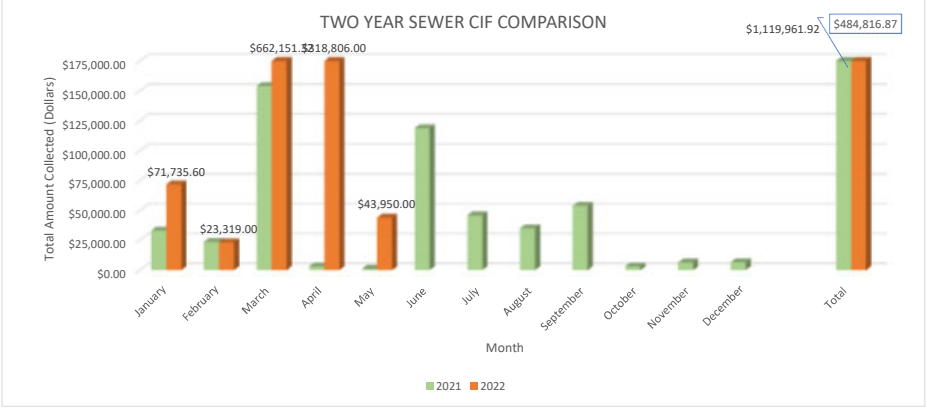
Charles Town Utility Board
2021 Capacity Improvement Fee Collections/EDU for Sewer

Month	Commercial	Residential	Total Number of EDU's	Total Sewer CIF Collected	CIF Paid to Ranson	Total
Jan-21		22	22	$ 33,114.00		$ 33,114.00
Feb-21		21	21	$ 33,417.00	$ 9,750.00	$ 23,667.00
Mar-21		32	136.7	$ 154,023.33		$ 154,023.33
Apr-21		1	1	$ 3,207.00		$ 3,207.00
May-21		1	1	$ 1,127.00		$ 1,127.00
Jun-21	36	3	39	$ 118,833.00		$ 118,833.00
Jul-21		37	37	$ 45,859.00		$ 45,859.00
Aug-21	9.22	3	12.22	$ 35,029.54		$ 35,029.54
Sep-21		44	44	$ 53,748.00		$ 53,748.00
Oct-21		1	1	$ 3,207.00		$ 3,207.00
Nov-21		2	2	$ 6,414.00		$ 6,414.00
Dec-21		4	4	$ 6,588.00		$ 6,588.00
Total 2021	**45.22**	**124**	**320.92**	**$494,566.87**	**$9,750.00**	**$484,816.87**

Charles Town Utility Board
2022 Capacity Improvement Fee Collections/EDU for Sewer

Month	Commercial	Residential	Total Number of EDU's	Total Sewer CIF Collected	CIF Paid to Ranson	Total
Jan-22	**1.53**	29.03	30.56	$ 71,735.60		$ 71,735.60
Feb-22		17	17	$ 23,319.00		$ 23,319.00
Mar-22	146.59	34	180.59	$ 662,151.32		$ 662,151.32
Apr-22		116	116	$ 351,306.00	$ 32,500.00	$ 318,806.00
May-22		15	15	$ 43,950.00		$ 43,950.00
Jun-22						
Jul-22						
Aug-22						
Sep-22						
Oct-22						
Nov-22						
Dec-22						
Total 2022	**1.53**	**177**	**359.15**	**$1,152,461.92**	**$32,500.00**	**$1,119,961.92**





CHARLES TOWN UTILITY BOARD
WATER TREATMENT PLANT FLOW DATA

CHARLES TOWN WATER PLANT FLOW DATA						
YEAR	Total Design (MGD)	TOTAL ANNUAL FLOW (MG)	AVERAGE DAILY (MGD)	Total Design minus Average Daily	Total Available (gpd)	Total Available (EDU's)
2019	2.8	644.32	1.77	1.03498	1,034,980	6,900
2020	2.8	615.64	1.68	1.12	1,117,946	7,453
2021	2.8	601.87	1.64	1.16	1,164,627	7,764
2022	2.8	236.82	1.56	1.24	1,237,948	8,253

2020		
	Total	AVERAGE
JANUARY	53,689,445	1,731,918
FEBRUARY	49,700,448	1,713,809
MARCH	51,009,216	1,645,459
APRIL	46,966,864	1,565,562
MAY	50,753,036	1,637,195
JUNE	52,587,142	1,752,905
JULY	54,394,477	1,754,661
AUGUST	54,972,785	1,773,316
SEPTEMBER	50,996,141	1,699,871
OCTOBER	51,222,251	1,652,331
NOVEMBER	49,014,344	1,633,811
DECEMBER	50,338,278	1,623,815
Annual Total	615,644,427	1,682,054

2021		
	Total	AVERAGE
JANUARY	50,030,727	1,613,894
FEBRUARY	45,304,029	1,618,001
MARCH	50,881,983	1,641,354
APRIL	49,098,224	1,636,607
MAY	53,910,537	1,739,050
JUNE	53,051,728	1,711,346
JULY	53,198,248	1,716,073
AUGUST	54,959,872	1,772,899
SEPTEMBER	49,200,580	1,587,115
OCTOBER	49,336,781	1,591,509
NOVEMBER	45,777,260	1,476,686
DECEMBER	47,118,143	1,519,940
Annual Total	601,868,112	1,635,373

2022		
	Total	AVERAGE
JANUARY	47,918,736	1,545,766
FEBRUARY	43,703,896	1,580,853
MARCH	48,063,482	1,550,435
APRIL	47,294,978	1,525,644
MAY	49,834,352	1,607,560
JUNE		
JULY		
AUGUST		
SEPTEMBER		
OCTOBER		
NOVEMBER		
DECEMBER		
Annual Total	236,815,444	1,562,052

GLEN HAVEN WATER PLANT FLOW DATA						
YEAR	Total Design (MGD)	TOTAL ANNUAL FLOW (MG)	AVERAGE DAILY (MGD)	Total Design minus Average Daily	Total Available (gpd)	
2020	0.0216	1.04	0.01	0.01	13,120	
2021	0.0216	3.06	0.01	0.01	13,213	-
2022	0.0216	1.03	0.01	0.01	14,933	-

2020		
	Total	AVERAGE
JANUARY		
FEBRUARY		
MARCH		
APRIL		
MAY		
JUNE		
JULY		
AUGUST		
SEPTEMBER	283,900	9,158
OCTOBER	265,000	8,548
NOVEMBER	250,800	8,360
DECEMBER	243,500	7,855
Annual Total	1,043,200	8,480

2021		
	Total	AVERAGE
JANUARY	242,200	7,813
FEBRUARY	203,500	7,268
MARCH	241,800	8,636
APRIL	262,300	8,743
MAY	289,700	9,345
JUNE	276,500	8,919
JULY	302,900	9,771
AUGUST	302,900	9,771
SEPTEMBER	227,800	7,348
OCTOBER	285,100	9,197
NOVEMBER	227,200	7,329
DECEMBER	201,500	6,500
Annual Total	3,063,400	8,387

2022		
	Total	AVERAGE
JANUARY	204,300	6,590
FEBRUARY	178,600	5,761
MARCH	191,200	6,168
APRIL	222,000	7,161
MAY	237,300	7,655
JUNE		
JULY		
AUGUST		
SEPTEMBER		
OCTOBER		
NOVEMBER		
DECEMBER		
Annual Total	1,033,400	6,667

CAVALAND WATER PLANT FLOW DATA						
YEAR	Total Design (MGD)	TOTAL ANNUAL FLOW (MG)	AVERAGE DAILY (MGD)	Total Design minus Average Daily	Total Available (gpd)	
2020	0.036	0.59	0.00	0.03	31,210	
2021	0.036	1.91	0.01	0.03	30,766	
2022	0.036	0.69	0.00	0.03	31,521	

2020		
	Total	AVERAGE
JANUARY		
FEBRUARY		
MARCH		
APRIL		
MAY		
JUNE		
JULY		
AUGUST		
SEPTEMBER	141,900	4,577
OCTOBER	140,300	4,526
NOVEMBER	151,500	5,050
DECEMBER	155,200	5,006
Annual Total	588,900	4,790

2021		
	Total	AVERAGE
JANUARY	150,900	4,868
FEBRUARY	132,900	4,746
MARCH	145,800	5,207
APRIL	152,900	5,097
MAY	177,900	5,739
JUNE	159,000	5,129
JULY	169,600	5,471
AUGUST	177,300	5,719
SEPTEMBER	175,600	5,665
OCTOBER	176,000	5,677
NOVEMBER	151,200	4,877
DECEMBER	143,000	4,613
Annual Total	1,912,100	5,234

2021		
	Total	AVERAGE
JANUARY	150,100	4,842
FEBRUARY	127,200	4,103
MARCH	130,300	4,203
APRIL	141,600	4,568
MAY	145,000	4,677
JUNE		
JULY		
AUGUST		
SEPTEMBER		
OCTOBER		
NOVEMBER		
DECEMBER		
Annual Total	694,200	4,479

CHARLES TOWN UTILITY BOARD
WASTEWATER TREATMENT PLANT FLOW DATA

CHARLES TOWN WASTEWATER PLANT FLOW DATA						
YEAR	Total Design (MGD)	TOTAL ANNUAL FLOW (MG)	AVERAGE DAILY (MGD)	Total Design minus Average Daily	Total Available (gpd)	Total Available (EDU's)
2015	1.75	384	1.05	0.7	700,000	4,667
2016	1.75	419	1.14	0.61	610,000	4,067
2017	1.75	393	1.08	0.67	670,000	4,467
2018	1.75	491	1.34	0.41	410,000	2,733
2019	1.75	459	1.26	0.49	490,000	3,267
2020	1.75	419.7	1.15	0.60	603,333	4,022
2021	1.75	401.61	1.11	0.64	637,500	4,250
2022	1.75	173.17	1.15	0.60	602,000	4,013

TUSCAWILLA WASTEWATER PLANT FLOW DATA						
YEAR	Total Design (MGD)	TOTAL ANNUAL FLOW (MG)	AVERAGE DAILY (MGD)	Total Design minus Average Daily	Total Available (gpd)	Total Available (EDU's)
2015	0.5	48	0.13	0.37	370,000	2,467
2016	0.5	49	0.13	0.37	370,000	2,467
2017	0.5	48	0.14	0.36	360,000	2,400
2018	0.5	78	0.21	0.29	290,000	1,933
2019	0.5	55.24	0.15	0.35	350,000	2,333
2020	0.5	1.09	0.16	0.34	340,000	2,267
2021	0.5	32.55	0.10	0.40	400,833	2,672
2022	0.5	15.05	0.10	0.40	402,000	2,680

Total EDU's available between CT and Tuscawilla	
2015	7,133
2016	6,533
2017	6,867
2018	4,667
2019	5,600
2020	6,289
2021	6,922
2022	6,693

2020		
	Total	AVERAGE
JANUARY	39.05	1.26
FEBRUARY	36.74	1.27
MARCH	36.76	1.19
APRIL	33.32	1.11
MAY	35.50	1.15
JUNE	33.44	1.11
JULY	34.45	1.11
AUGUST	32.65	1.05
SEPTEMBER	32.43	1.08
OCTOBER	33.91	1.09
NOVEMBER	33.49	1.12
DECEMBER	37.96	1.22
Annual Total	419.7	1.15

2021		
	Total	AVERAGE
JANUARY	35.83	1.22
FEBRUARY	32.98	1.18
MARCH	36.39	1.17
APRIL	34.33	1.18
MAY	33.24	1.07
JUNE	36.24	1.21
JULY	30.99	1.00
AUGUST	29.94	0.97
SEPTEMBER	36.36	1.17
OCTOBER	29.97	0.97
NOVEMBER	30.12	1.00
DECEMBER	35.22	1.21
Annual Total	401.61	1.11

2022		
	Total	AVERAGE
JANUARY	37.25	1.20
FEBRUARY	33.8	1.21
MARCH	33.28	1.07
APRIL	32.98	1.1
MAY	35.86	1.16
JUNE		
JULY		
AUGUST		
SEPTEMBER		
OCTOBER		
NOVEMBER		
DECEMBER		
Annual Total	173.17	1.15

2020		
	Total	AVERAGE
JANUARY		
FEBRUARY		
MARCH		
APRIL		
MAY		
JUNE		
JULY		
AUGUST	1.09	0.16
SEPTEMBER		
OCTOBER		
NOVEMBER		
DECEMBER		
Annual Total	1.09	0.16

2021		
	Total	AVERAGE
JANUARY	0.52	0.07
FEBRUARY	2.22	0.08
MARCH	4.22	0.14
APRIL	1.12	0.04
MAY	0.89	0.03
JUNE	3.37	0.11
JULY	3.9	0.13
AUGUST	3.6	0.12
SEPTEMBER	4.53	0.15
OCTOBER	3.94	0.13
NOVEMBER	3.73	0.12
DECEMBER	0.51	0.07
Annual Total	32.55	0.10

2022		
	Total	AVERAGE
JANUARY	0	0
FEBRUARY	0	0
MARCH	4.34	0.14
APRIL	4.68	0.16
MAY	6.03	0.19
JUNE		
JULY		
AUGUST		
SEPTEMBER		
OCTOBER		
NOVEMBER		
DECEMBER		
Annual Total	15.05	0.10

VENDOR SORT KEY	DESCRIPTION	FUND	DEPARTMENT	AMOUNT

APPROVED BY: _____

APPROVED BY: _____

This Packet: $ 144,802.33
Security Deposit refunds: 1,545.12

Total: $ 146,347.45

VENDOR SORT KEY	DESCRIPTION	FUND	DEPARTMENT		AMOUNT
	CAVE RD UTILITIES 4/26-5/3	SEWER FUND	SEWER		1,019.76
	SHEN JCT 5/04 - 5/31/22	SEWER FUND	SEWER		476.00
	JUI, INC 5/06/22	SEWER FUND	SEWER		170.00
				TOTAL:	3,161.76
SPRINT	MONTHLY CELL SERVICE	WATER FUND	WATER		486.60
	MONTHLY CELL SERVICE	SEWER FUND	SEWER		238.63
				TOTAL:	725.23
STH, INC.	11TH AVE PS:GRNDRPMP,CPCTR	SEWER FUND	SEWER		2,917.00
				TOTAL:	2,917.00
GERALD TAYLOR CO., INC.	VAC / TRANSPORT	WATER FUND	WATER		812.00
	VAC / TRANSPORT	WATER FUND	WATER		863.77
	PUMP / TRANSPORT	WATER FUND	WATER		671.69
	TRANSPORT	SEWER FUND	SEWER		1,108.80
	TRANSPORT	SEWER FUND	SEWER		1,108.80
	VAC / TRANSPORT	SEWER FUND	SEWER		1,666.38
				TOTAL:	6,231.44
THE CI THORNBURG CO, INC.	CHLORINE	WATER FUND	WATER		2,075.00
				TOTAL:	2,075.00
TEXAS COMPTROLLER OF PUBLIC ACCOUNTS	RY2022 UNCLAIMED PROPERTY	WATER FUND	NON-DEPARTMENTAL		39.43
				TOTAL:	39.43
USA BLUEBOOK	SVCBXCMBOKY,BEAKR,PRBE,CNE	SEWER FUND	SEWER		1,107.58
				TOTAL:	1,107.58
WIRELESS NETWORKS GROUP, INC.	MISC SVCS, MAY	WATER FUND	WATER		697.50
				TOTAL:	697.50

========== FUND TOTALS ==========	
50 WATER FUND	57,584.76
60 SEWER FUND	87,217.57
GRAND TOTAL:	144,802.33

TOTAL PAGES: 4

VENDOR SORT KEY	DESCRIPTION	FUND	DEPARTMENT		AMOUNT
HACH COMPANY	AMMONIA TNT, NITRATE, TNT	SEWER FUND	SEWER		956.55
	SERVICE PARTNERSHIP RENEWA	SEWER FUND	SEWER		1,431.62
				TOTAL:	2,388.17
INTELLIPOINT TECHNOLOGIES, LLC	IT-REGULAR-REMOTE	WATER FUND	WATER		50.00
				TOTAL:	50.00
PROTOUCH COMMUNICATIONS, LLC	MAY SVCS: AFTER-HRS EMERGE	WATER FUND	WATER		65.32
	MAY SVCS: AFTER-HRS EMERGE	SEWER FUND	SEWER		65.32
				TOTAL:	130.64
INWOOD QUARRY, INC.	I8 & I10 PICKUPS: 5/23/22	WATER FUND	WATER		792.33
	I8 PICKUPS: 5/27/22	WATER FUND	WATER		521.56
	I8 & C1 PICKUPS: 5/31/22	WATER FUND	WATER		718.51
				TOTAL:	2,032.40
IRON MOUNTAIN, INC	SHREDDING, STORAGE	WATER FUND	WATER		287.71
	SHREDDING, STORAGE	SEWER FUND	SEWER		287.71
				TOTAL:	575.42
JEFFERSON PUBLISHING COMPANY	5/25 & 6/01 ADS: HYDRNT FL	WATER FUND	WATER		45.22
				TOTAL:	45.22
JOHN P PLACE, INC.	ERDCTRWRPLTS, O-RNGBUNA	SEWER FUND	SEWER		3,016.46
				TOTAL:	3,016.46
KM ELECTRICAL SOLUTIONS LLC	ELECTRICAL WORK @ TWWTP	SEWER FUND	SEWER		1,200.00
				TOTAL:	1,200.00
TRAVIS MARKLEY	MILEAGE 5/23 - 6/02/22	WATER FUND	WATER		29.25
	MILEAGE 5/23 - 6/02/22	SEWER FUND	SEWER		29.25
				TOTAL:	58.50
DONALD MICKEY	5/26 MOWING SMMTPT & PLYGR	WATER FUND	WATER		137.50
	5/26 MOWING SMMTPT & PLYGR	SEWER FUND	SEWER		137.50
				TOTAL:	275.00
LOGICAL CONCEPTS, INC	FLNGSPRGS,GRNFLDSTH4-5,BUR	SEWER FUND	SEWER		427.00
				TOTAL:	427.00
PACE ANALYTICAL SERVICES, LLC	TESTING: ROCKWOOL	SEWER FUND	SEWER		232.00
	TESTING: UIC-1432-15-037	SEWER FUND	SEWER		259.00
	TESTING: RACETRACK QRTLY	SEWER FUND	SEWER		66.00
	TESTING: TUSC WKLY	SEWER FUND	SEWER		136.00
				TOTAL:	693.00
PARKSON CORPORATION	DRIVEN SPROCKET	SEWER FUND	SEWER		1,890.55
				TOTAL:	1,890.55
RAILROAD MGMT CO, IV LLC	RANSON, PIPE SWR LICNSE FE	SEWER FUND	SEWER		603.27
				TOTAL:	603.27
SG PLUMBING, INC.	402 S SAMUEL ST	WATER FUND	WATER		1,620.00
				TOTAL:	1,620.00
LAW OFFICES OF HOY SHINGLETON, L.C.	GENERAL 5/02 - 5/25/22	WATER FUND	WATER		1,496.00

VENDOR SORT KEY	DESCRIPTION	FUND	DEPARTMENT		AMOUNT
COLLIN COLE	REIMB HOMEDEPOT PURCHASE	SEWER FUND	SEWER		301.95
				TOTAL:	301.95
CORE & MAIN	BRSSNPPL,BRSSCMPNFLNG,COMP	WATER FUND	WATER		255.61
	B&TMMP182230MTRPTBLLT,AYM7	WATER FUND	WATER		808.08
	B&TMMP182230MTRPTBLLT,AYM7	WATER FUND	WATER		2,424.24
	BRSSBSHNG,BRSSNPPL,CPLGPVC	WATER FUND	WATER		2,057.69
	721-20WDQQ33 5/8X3/4 STTRQ	WATER FUND	WATER		4,311.24
	CB-4.215RM6-12"X4"SWRSDDLS	SEWER FUND	SEWER		1,500.12
	PVC SDR26 HW SWR PIPE 14'	SEWER FUND	SEWER		3,679.20
				TOTAL:	15,036.18
COYNE CHEMICAL	AMMNMNSLFT40%NSF,HYDRFLSCA	WATER FUND	WATER		2,380.15
	CES PACL 2000	SEWER FUND	SEWER		20,612.34
	ZETAG 8868 FS	SEWER FUND	SEWER		6,898.04
	CES PACL 2040	SEWER FUND	SEWER		3,203.20
				TOTAL:	33,093.73
CUMMINS, INC	REPAIRS @ FLWNGSPRGS PS	SEWER FUND	SEWER		2,032.35
				TOTAL:	2,032.35
DELL MARKETING L.P.	UNIVERSAL DOCKING STATIONS	WATER FUND	WATER		363.29
				TOTAL:	363.29
DEWBERRY ENGINEERS INC	WA & WW CIFS: THRU 4/29/22	WATER FUND	WATER		5,900.00
	TO2 ONCLL WA MODL & RELTD	WATER FUND	WATER		5,865.00
				TOTAL:	11,765.00
WV DEPT OF HEALTH & HUMAN SERVICES	BACTERIOLOGICAL TEST	WATER FUND	WATER		100.00
	BACTERIOLOGICAL TEST	WATER FUND	WATER		100.00
	BACTERIOLOGICAL TEST	WATER FUND	WATER		40.00
				TOTAL:	240.00
FIFTH THIRD BANK	PCARD 4726	WATER FUND	WATER		680.04
	PCARD 4726	WATER FUND	WATER		681.25
	PCARD 4726	WATER FUND	WATER		678.09
	PCARD 4726	WATER FUND	WATER		46.87
	PCARD 4726	WATER FUND	WATER		37.98
	PCARD 4726	WATER FUND	WATER		233.24
	PCARD 4726	SEWER FUND	SEWER		1,040.99
	PCARD 4726	SEWER FUND	SEWER		1,160.09
	PCARD 4726	SEWER FUND	SEWER		932.85
	PCARD 4726	SEWER FUND	SEWER		2,431.70
	PCARD 4726	SEWER FUND	SEWER		110.94
	PCARD 4726	SEWER FUND	SEWER		98.16
	PCARD 4726	SEWER FUND	SEWER		1,257.28
				TOTAL:	9,389.48
GUTTMAN ENERGY	W/E 5/22/22	WATER FUND	WATER		850.22
	W/E 5/29/22	WATER FUND	WATER		1,553.36
	W/E 5/22/22	SEWER FUND	SEWER		757.55
	W/E 5/22/22	SEWER FUND	SEWER		88.83
	W/E 5/29/22	SEWER FUND	SEWER		1,028.10
	W/E 5/29/22	SEWER FUND	SEWER		47.76
				TOTAL:	4,325.82

VENDOR SORT KEY	DESCRIPTION	FUND	DEPARTMENT		AMOUNT
AMERIGAS	PROPANE: JOB CORP	SEWER FUND	SEWER		390.99
	PROPANE: PERRY DR	SEWER FUND	SEWER		385.07
	PROPANE: PERRY DR	SEWER FUND	SEWER		105.93
	TANK RENTAL: RT 9W	SEWER FUND	SEWER		130.30
	TANK RENTAL: WOODLAWN	SEWER FUND	SEWER		130.30
	TANK RENTAL: MOOSE	SEWER FUND	SEWER		130.30
	TANK RENTAL: APPLETREE	SEWER FUND	SEWER		130.30
	TANK RENTAL: CRANES LN	SEWER FUND	SEWER		130.30
	TANK RENTAL: JEFF AVE	SEWER FUND	SEWER		164.65
				TOTAL:	1,698.14
APPLE VALLEY TIRE	SEWER TRUCK TIRES	SEWER FUND	SEWER		949.08
	LAWNMOWER TIRES	SEWER FUND	SEWER		68.18
				TOTAL:	1,017.26
ARDEN EQUIPMENT REPAIR, INC.	MOWER BLADES	SEWER FUND	SEWER		75.69
				TOTAL:	75.69
NEAL O NILSEN	OFFICE 365 BASIC - 23 USER	WATER FUND	WATER		69.00
	OFFICE 365 BASIC - 23 USER	WATER FUND	WATER		69.00
	OFFICE 365 BASIC - 23 USER	WATER FUND	WATER		69.00
	OFFICE 365 BASIC - 23 USER	SEWER FUND	SEWER		69.00
	OFFICE 365 BASIC - 23 USER	SEWER FUND	SEWER		69.00
	OFFICE 365 BASIC - 23 USER	SEWER FUND	SEWER		69.00
				TOTAL:	414.00
AUTOZONE	DIESEL EXHAUST FLUID	WATER FUND	WATER		122.70
				TOTAL:	122.70
JP & RF BURNS PARTNERSHIP	MAY LOADS - 41	SEWER FUND	SEWER		7,339.00
				TOTAL:	7,339.00
CHARLES TOWN PLUMBING LLC	SWRLINE RPR 5/18/22	SEWER FUND	SEWER		4,300.00
				TOTAL:	4,300.00
CHARLES TOWN UTILITY BOARD	MAY FUNDING	WATER FUND	NON-DEPARTMENTAL		11,806.47
				TOTAL:	11,806.47
CITY NATIONAL BANK	LOCKBOX SVCS: MAY	WATER FUND	WATER		1,651.30
	LOCKBOX SVCS: MAY	WATER FUND	WATER		716.12
	LOCKBOX SVCS: MAY	SEWER FUND	SEWER		1,651.30
	LOCKBOX SVCS: MAY	SEWER FUND	SEWER		716.12
				TOTAL:	4,734.84
CITY OF CHARLES TOWN	APR UTILITIES@ 661 S GEORG	WATER FUND	WATER		449.18
	JUNE RENT@ 661 S GEORGE ST	WATER FUND	WATER		1,275.00
	APR UTILITIES@ 661 S GEORG	SEWER FUND	SEWER		449.18
	JUNE RENT@ 661 S GEORGE ST	SEWER FUND	SEWER		1,275.00
				TOTAL:	3,448.36
CLIFFS CLEANING SERVICE	MAY CLEANING	WATER FUND	WATER		125.00
	MAY CLEANING	WATER FUND	WATER		456.25
	MAY CLEANING	SEWER FUND	SEWER		200.00
	MAY CLEANING	SEWER FUND	SEWER		100.00
	MAY CLEANING	SEWER FUND	SEWER		456.25
				TOTAL:	1,337.50