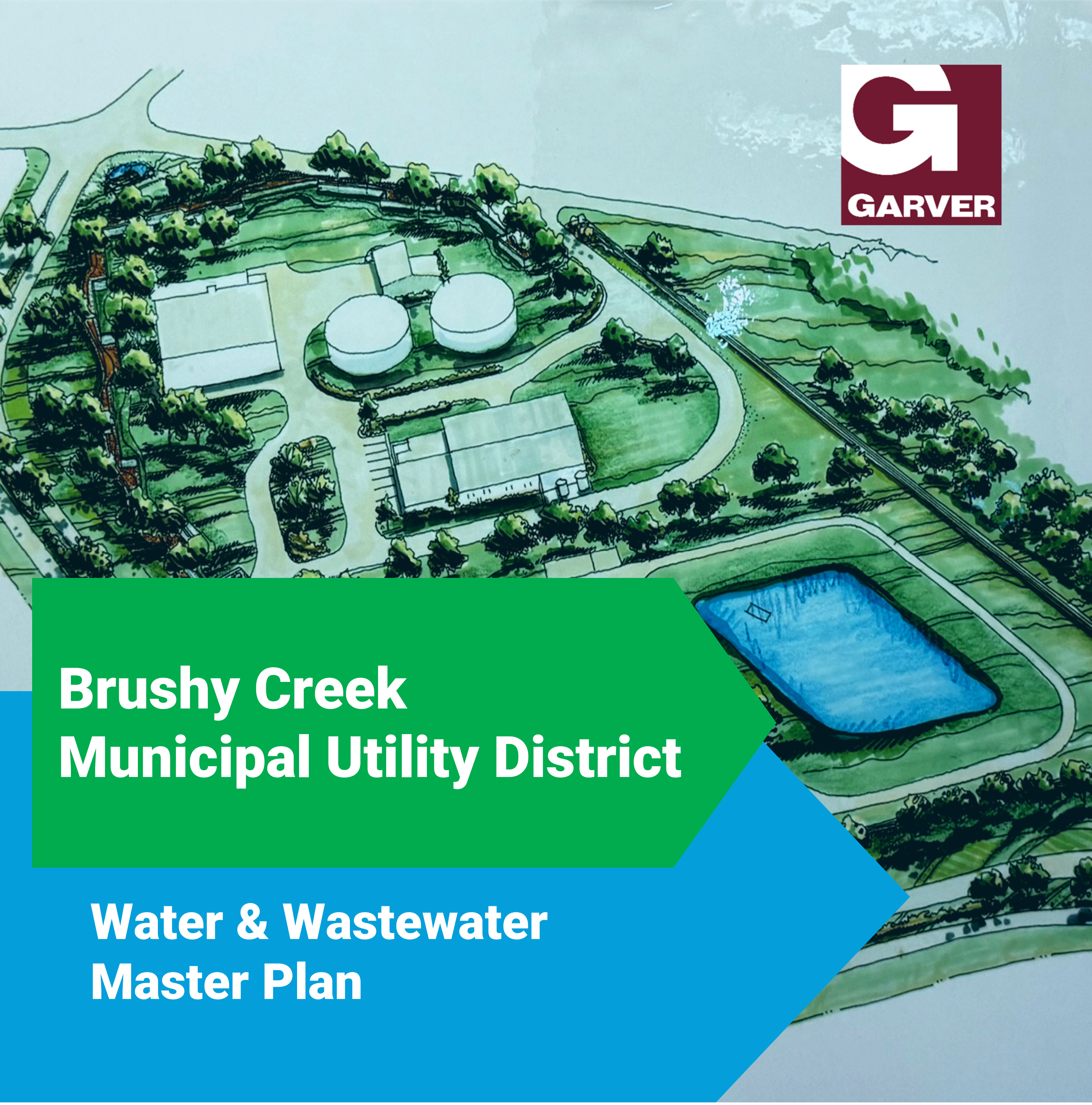

Brushy Creek Municipal Utility District

Water & Wastewater Master Plan

PREPARED FOR

Brushy Creek MUD

September 2025

Brushy Creek MUD Asset Renewal Master Plan

Water and Wastewater Master Plan

Brushy Creek
Municipal Utility District

Prepared by:

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September 2025

Garver Project No. 2301754

Engineer's Certification

I hereby certify that this Asset Renewal Master Plan Report was prepared by Garver under my direct supervision for Brushy Creek Municipal Utility District.

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List of Acronyms

Acronym	Definition
AC	asbestos cement
ACH	aluminum chlorohydrate
ADF	average day flow
ALE	action level exceedance
ARV	air release valve
BCMUD	Brushy Creek Municipal Utility District
CIP	Capital Improvement Project
CIPP	cured-in-place pipe
CORR	City of Round Rock
CWS	community water system
D/DBP	disinfectants and disinfection byproducts
EPA	Environmental Protection Agency
EST	elevated storage tank
fps	feet per second
FRP	fiberglass-reinforced plastic
GAC	granular activated carbon
GIS	geographic information system
gpm	gallons per minute
HAA5	haloacetic acids
HFPO-DA	hexafluoropropylene oxide dimer acid (also known as GenX)
HI	hazard index
HP	horsepower
HRL	health reference level
HSPS	high service pump station
H_2S	hydrogen sulfide
IX	ion exchange
LAS	liquid ammonium sulfate
LCRI	Lead and Copper Rule Improvements
LCRR	Lead and Copper Rule Revisions
LF	linear feet
LIDAR	Light Detection and Ranging
LS	lift station
LSLRP	Lead Service Line Replacement Plan
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MF	membrane filtrate
MGD	million gallons per day
MRDL	Maximum Residual Disinfectant Level
NDMA	N-nitrosodimethylamine
NPDWR	National Primary Drinking Water Regulation
PFAS	per- and polyfluoroalkyl substances

Acronym	Definition
PFBS	perfluorobutane sulfonic acid
PFHxS	perfluorohexane sulfonate
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonic acid
ppb	parts per billion
ppt	parts per trillion
psi	pounds per square inch
PWS	public water system
RO	reverse osmosis
SCADA	supervisory control and data acquisition
SDWA	Safe Drinking Water Act
SOP	standard operating procedure
SSES	Sewer System Evaluation Survey
StratMap	Strategic Mapping Program
SWTR	Surface Water Treatment Rules
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TMP	transmembrane pressure
TPWD	Texas Parks and Wildlife Department
TTHM	total trihalomethanes
UCMR5	5th Unregulated Contaminant Monitoring Rule
UPS	uninterruptible power supply
USGS	United States Geological Survey
VFD	variable frequency device
WTF	water treatment facility
WWTP	wastewater treatment plant
W/WW MP	Water and Wastewater Master Plan

Executive Summary

This Executive Summary will provide a brief description of the comprehensive Water and Wastewater Master Plan (W/WW MP) and Capital Improvement Plan developed by Garver for Brushy Creek Municipal Utility District (BCMUD). The W/WW MP was developed in close collaboration with BCMUD staff and management and was intended to evaluate the existing condition of BCMUD's water and wastewater infrastructure and facilities. The goal of the W/WW MP was to:

- Perform evaluations on the water treatment facility (WTF), groundwater well, raw water intake, and distribution facilities,
- Evaluate the feasibility of an emergency interconnect between BCMUD and the City of Round Rock (CORR), and
- Perform a wastewater collection system capacity and condition assessment.

These evaluations and assessments from the W/WW MP resulted in a Capital Improvement Plan for BCMUD to create an actionable list of recommendations and capital improvements to execute. The Capital Improvement Plan resulted in 15 recommendations and 28 capital improvement projects (CIP) that equates to approximately $12,747,100. The CIP includes short-term (zero to five years) and medium-term (five to ten years) improvement recommendations for BCMUD to pursue based on the priority status the project was given.

Capital Improvement Plan

The top three recommendations include monitoring raw alkalinity at the WTF, replacing the manual site tube indicators at the outdoor chemical storage, and upgrading the SCADA and telemetry systems. The complete list of recommendations is outlined in Section 9.0.

The top five projects include installing an emergency interconnect between CORR and BCMUD, optimizing the backwash recovery basins gravity drainage, conducting improvements at the High Service Pump Station (HSPS), conducting sitewide upgrades at Liberty Walk Lift Station (LS), and conducting upgrades at the Highland Horizon I and II LSs. The complete list of CIPs is outlined in Section 9.0. The CIP groups and their total cost are listed in Table ES-1.

Table ES-1: Water and Wastewater CIP

CIP Group	Total Cost
Emergency Interconnect CIP	$ 501,300
Water CIP	$ 9,336,600
Distribution System CIP	$ 1,000,600
Wastewater CIP	$ 1,908,700
Total	**$ 12,747,100**

1.0 Introduction

1.1 Background and Objectives

Brushy Creek Municipal Utility District (BCMUD) was established in 1977 and is a community in Williamson County that serves approximately 18,314 people, per the Texas Commission of Environmental Quality (TCEQ) Drinking Water Watch. BCMUD, Public Water System (PWS) TX2460061, obtains source water for its system through transporting raw surface water from Lake Georgetown and groundwater from three wells that pump out of the Edwards Aquifer to its water treatment facility (WTF). BCMUD then treats and delivers finished water to its distribution system from its WTF located at 2300 Great Oaks Dr, Round Rock, TX 78681. BCMUD owns, operates, and maintains the raw water conveyance infrastructure, groundwater supply infrastructure, water treatment facilities, and water infrastructure necessary to provide finished water to BCMUD's 5,880 water service line connections. BCMUD also owns and operates a wastewater collection system to provide retail wastewater service to District customers.

To maintain a proactive approach for accommodating future growth, the district selected Garver to complete a Water and Wastewater Master Plan (W/WW MP) for BCMUD that includes:

- Evaluation of the WTF, groundwater well and distribution facilities
- Distribution system hydraulic model validation and capacity assessment
- Emergency interconnect evaluation in conjunction with City of Round Rock (CORR)
- Wastewater collection system capacity and condition assessment

1.2 Acknowledgements

Staff members throughout BCMUD including the Public Works and Engineering departments, were integral to the development of this W/WW MP. The Garver team is sincerely grateful for their dedication to this effort.

2.0 Historical Data Review

Garver received the following items from BCMUD to accurately evaluate the current condition of the system and facilities:

- Tank inspection reports
- As-built drawings for all distribution and collection facilities
- Geographic information system (GIS) records
- WTF Monthly Operating Reports
- Wholesale agreements with other entities
- Supervisory control and data acquisition (SCADA) data and other operational data
- Collection system Sewer System Evaluation Survey (SSES), CCTV, and other inspection data
- Previous Asset Management Report (not approved)
- Risk and Resiliency Plan
- Water customer billing data
- Water loss audit (most recent)
- Historical per- and polyfluoroalkyl substances (PFAS) sampling results
- Historical condition assessment information associated with distribution system and collection system facilities
- Topographic data & maximum gravity main depth limits
- Lift station (LS) pump curves and pump manufacturer and serial number information

Garver analyzed the data provided by BCMUD and utilized the observations to develop recommendations described in this document.

3.0 Water Treatment Facility Evaluation

To conduct the WTF evaluation, Garver identified existing and anticipated future condition and capacity challenges by conducting and initial assessment of the facility, reviewing regulations, and analyzing technologies for PFAS, lithium, and control of Disinfectant Byproducts (DBPs).

3.1 Water Treatment Facility Assessment

A site visit of the raw water intake at Lake Georgetown, the WTF, and the raw water storage pond was conducted with BCMUD staff and operators on February 15, 2024. Along with the site visit, the water quality data was reviewed to support evaluations and make recommendations. Garver was focused on addressing system capacity and condition needs as well as understanding their impacts on treatment processes and operations. A process flow diagram of the WTF is provided as **Appendix B**.

After the site visit, CIPs were recommended to address system capacity and condition needs. The improvement projects are outlined in the subsections of the WTF assessment with regards to their location. Three general facility wide projects were recommended for the WTF; 1) implementing badge access to enhance security, 2) replacing the fence, and 3) upgrading the historian SCADA software.

1. Implementing badge entry access across the entire WTF is essential for enhancing security and controlling access to sensitive areas within the next five years. This will ensure that only authorized personnel can enter specific zones, reducing the risk of unauthorized access and potential tampering with critical infrastructure.

2. Replacing the fence at the WTF is necessary to address repairs and maintain the structural integrity of the facility within the next five to ten years. This would entail replacing the southwestern section of the fence that is fencestone precast fence panels, and the northeastern section of the fence that is a stone stack.

3. Upgrading the SCADA Historian reporting software is crucial for enhancing data collection, analysis, and reporting capabilities within the next five years. The new software will provide more advanced features for real-time monitoring, historical data analysis, and automated reporting. This upgrade will improve operational efficiency, support better decision-making, and ensure compliance with regulatory requirements by providing accurate and timely data.

A meter replacement project is recommended by BCMUD staff across the zero-to five-year and five-to-ten-year planning horizons to ensure continued accuracy in flow measurement and operational reliability at the WTF. Within the zero-to-five-year horizon, the following meters are prioritized for replacement due to their critical role in process monitoring and age-related performance concerns: the 30-inch finished water meter, the 24-inch membrane filtrate meter, the 16-inch surface water meter (including its calibration vault), and the 10-inch groundwater meter. Additionally, the pressure sustaining valve for the surface raw water line at the WTF is recommended to be replaced by BCMUD staff within the zero-to-five-year planning horizon. In the five-to-ten-year horizon, replacement is recommended for the 12-inch north finished water meter, the 24-inch south finished water meter, and the 24-inch blended water meter, which are essential for distribution system monitoring and long-term operational efficiency. These two CIPs are further outlined in Section 9.0.

WTF flow from December 24, 2023, to December 20, 2024, was used to assess how raw water production varied seasonally within the year, as shown in Figure 3-1. Production gradually increased from late December through early July, peaking around mid-July at approximately 5.5 million gallons per day (MGD). After this peak, production declined steadily until mid-September, then stabilized around 3 MGD with some fluctuations through the end of the year. This pattern suggests seasonal variation, with higher water demand or availability in the summer months and lower production during the winter.

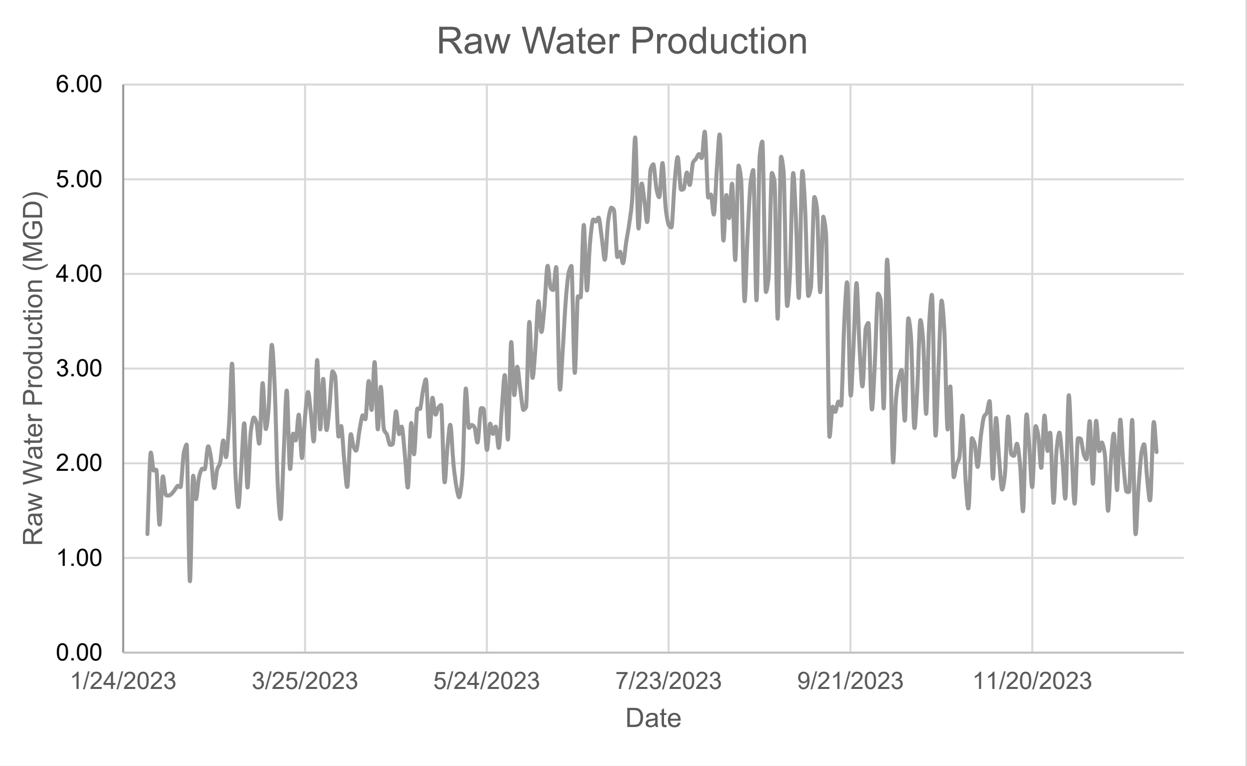


Figure 3-1: Raw Water Production

Alkalinity and turbidity of raw water were evaluated to assess how the plant is performing. Raw water alkalinity plays a crucial role in membrane system performance and maintenance. It influences the water's buffering capacity, helping to stabilize pH levels, which is important for protecting membrane integrity. Understanding and monitoring alkalinity helps optimize membrane operation, reduce fouling, and extend system longevity. As shown in Figure 3-2, BCMUD has an average alkalinity of 141 mg/L as $CaCO_3$. The highest raw water alkalinity was experienced in August and peaked on August 13, 2023, at 158 mg/L. High alkalinity, especially in the presence of calcium, can increase the risk of scaling on membranes, leading to more frequent cleanings and reduced membrane life. It is recommended that BCMUD continue to monitor raw alkalinity, and should the levels start to average >150mg/L, operators may need to adjust chemical dosing—such as adding acid or antiscalants—to prevent scale formation.

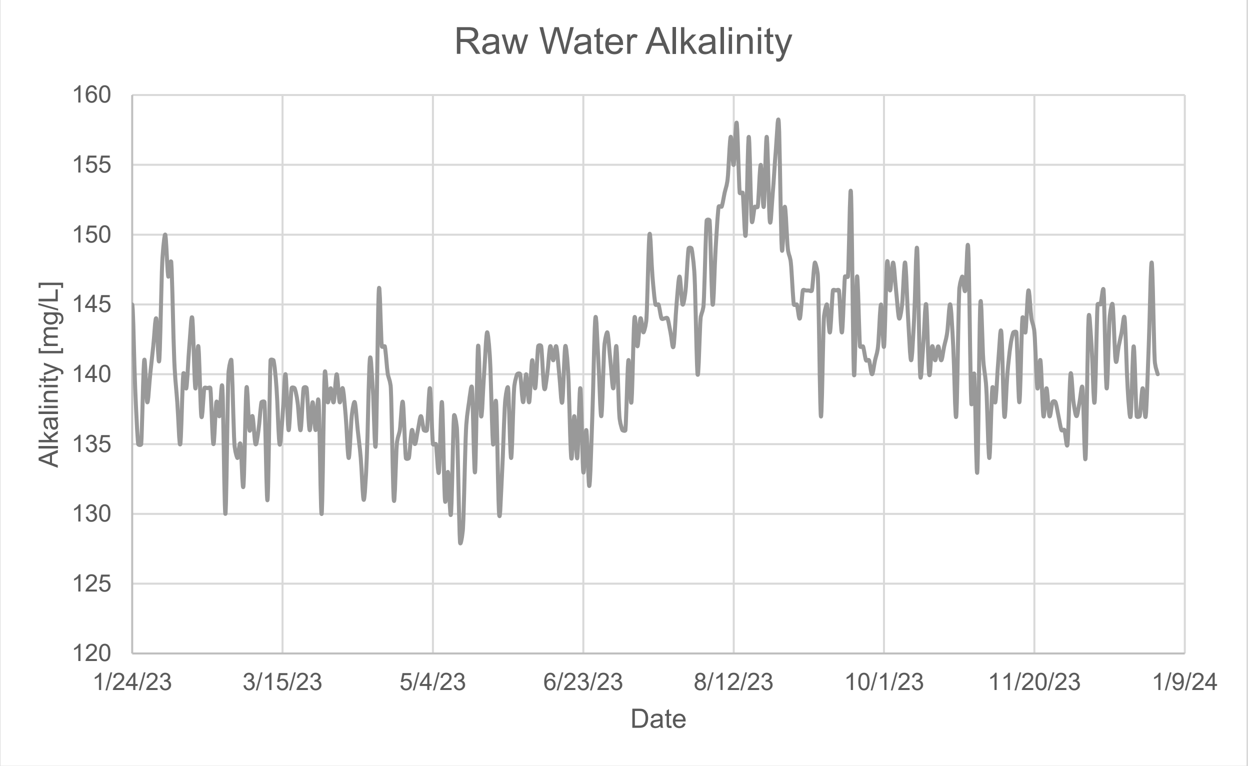


Figure 3-2: Raw Water Alkalinity

Raw water turbidity is also a critical parameter when operating a membrane system. Turbidity measures the cloudiness of water caused by suspended solids like silt, clay, organic matter, and microorganisms. High turbidity means a higher particulate load, which can challenge membrane performance. Elevated turbidity increases the risk of membrane fouling, which reduces flow rates and increases transmembrane pressure (TMP). This leads to more frequent cleanings and shorter membrane life. Turbidity levels help assess the effectiveness of pretreatment steps before water reaches the membranes. Operators may need to adjust backwash frequency, chemical dosing, or cleaning protocols based on turbidity trends.

Figure 3-3 illustrates how turbidity levels in raw water fluctuated between January 24, 2023, to January 9, 2024. Turbidity values ranged from 1.00 to 6.64 NTU, reflecting varying degrees of water clarity. Notable spikes occurred in late January and mid-November, likely due to storm events, and seasonal runoff. Despite these peaks, the baseline turbidity generally remained below 4.00 NTU, with only occasional exceedances. These episodic increases suggest external influences like heavy rainfall or watershed changes. Continuous monitoring is essential to detect such events early and adjust pretreatment and membrane operations accordingly to maintain system performance and water quality.

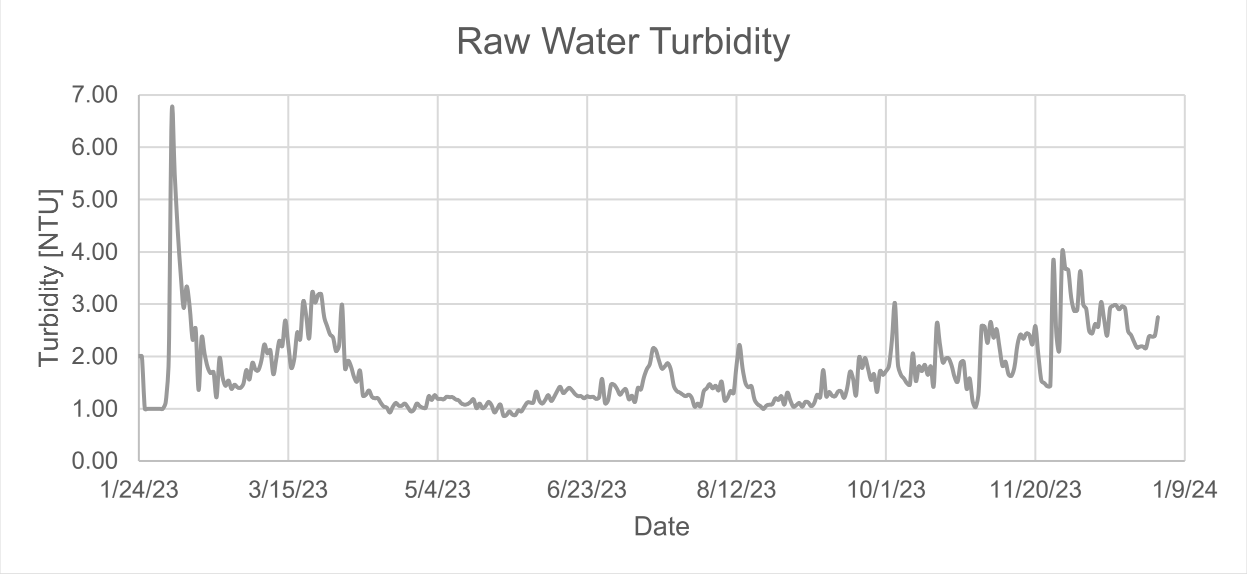


Figure 3-3: Raw Water Turbidity

Comparing the influent and effluent turbidity data reveals that the treatment process is performing effectively. While the raw water turbidity (influent) fluctuates significantly, ranging from 1.00 to 6.64 NTU with notable peaks, the filter effluent turbidity, shown in Figure 3-4, remains consistently low, between 0.02 and 0.03 NTU. This indicates that the membrane filtration is successfully removing the majority of suspended solids and particulates, even during periods of high turbidity in the raw water. The effluent turbidity values are well below typical regulatory limits of 0.3 NTU, demonstrating excellent process control and filtration performance.

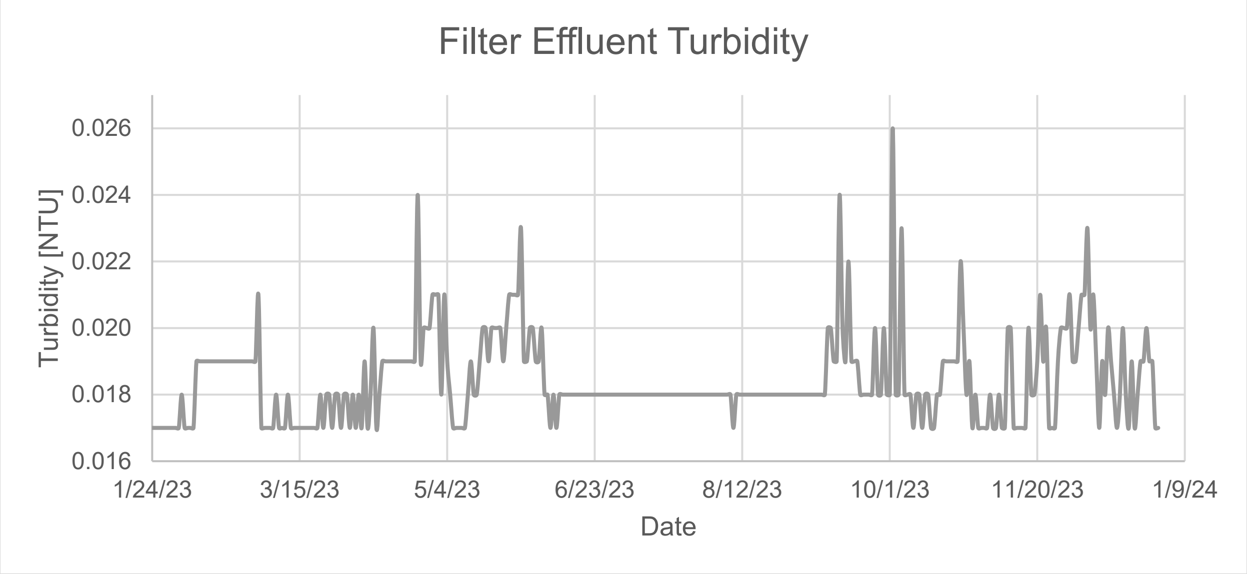


Figure 3-4: Filter Effluent Turbidity

3.1.1 Raw Water Intake at Lake Georgetown

The raw water intake at Lake Georgetown, shown in Figure 3-5, is located at 3504 FM 261 CIR, Georgetown, Texas. The raw water intake supplies most of the raw water for BCMUD, with a firm capacity of 5.9 MGD. The raw water intake is currently under construction of a winterization and electrical improvements project, which includes the installation of a generator and upgrades to the Motor Control Center room; construction on the project is estimated to be complete by September 2026. Within the zero-to-ten-year planning horizon, the singer control valves, ARVs, and the 24-inch raw water meter need to be replaced, as well as full rehabilitation of the surge tank per direction from BCMUD.

Additionally, based on direction from BCMUD, Garver has recommended a CIP to recoat the piping inside and outside the vault, implementing badge access security improvements for all buildings, and replace pump #1 with an upsized pump at the raw water intake facility. These recommendations are included as a CIP in Section 9.0, and are scheduled to be implemented within the five-to-ten-year planning horizon.

Figure 3-5: Raw Water Intake at Lake Georgetown

3.1.2 Raw Water Storage Pond

Located at the north edge of the BCMUD WTF, there is an 8.0 MG storage pond that stores water from the raw water intake, the well sites, and the backwash waste decant. The pond has two intakes that provide water to the WTF. The pond liner was installed as part of the construction of the WTF in 2004 with an estimated 20-year service life. The raw water reservoir has undergone extreme weather events, which has caused the HDPE geomembrane to crack and tear in multiple locations. Specifically, the areas exposed to the UV sunlight have suffered the most distress. An example of a split in the geomembrane liner is shown in Figure 3-6 below, though this tear has since been repaired.

Figure 3-6: Raw Water Storage Pond

While the liner was being repaired, Titan Environmental USA conducted an integrity test of the liner in 2024. This included a break elongation test and a stress crack resistance test. Based on the results, presented in **Appendix C**, Titan Environmental USA recommended to replace the HDPE geomembrane of the raw water storage pond. Garver concurs with Titan Environmental USAs recommendation, and has developed a CIP to provide BCMUD with the means to execute the project as shown in Section 9.0, that is scheduled to be implemented within the zero-to-five-year planning horizon.

3.1.3 Outdoor Chemical Storage

The outdoor chemical storage area houses bulk chemical storage of LAS (liquid ammonium sulfate), ACH (aluminum chlorohydrate) and fluorosilicic acid. These three chemical tanks are located in a concrete container partitioned from each other with concrete walls to protect from chemical mixing and protect the surrounding area from chemical exposure. Garver recommended multiple CIPs at the outdoor chemical storage facility that are outlined below and included in greater detail in Section 9.0.

Garver recommends demolishing the existing fluorosilicic acid storage tank, shown in Figure 3-7, because it has reached the end of its service life and poses potential risks due to structural degradation. BCMUD also ceased feeding fluorosilicic acid in April 2024. This project will involve safely removing the tank and disposing of any residual fluoride in accordance with environmental regulations.

Figure 3-7: Fluorosilicic Acid Tank

The sump pumps in the LAS and ACH storage area are outdated and prone to frequent failures which allow standing water and chemicals as shown in Figure 3-8 to accumulate. It is recommended that BCMUD replaces these sump pumps with newer corrosion resistant models.

Figure 3-8: Standing Water in Outdoor Chemical Storage Area

The emergency eyewash and shower station, shown in Figure 3-9, is critical for worker safety to rinse in the event of chemical exposure incident. To operate the emergency eyewash and shower station during cold weather events, it is recommended to replace it with a new station that contains insulation, and heat tracing in the unit. This will prevent freezing and allow the station to be ready for use in extreme weather events, thereby enhancing workers' safety. Additionally, when installing the new station, install in parallel a flow switch to improve the operational safety by alerting SCADA that the station has turned on, allowing operators to check the station and assist whoever may be present.

Figure 3-9: Emergency Eyewash Station

BCMUD has electronic tank level sensors for the outdoor chemical storage tanks, including ACH and LAS, that do not need to be replaced at this time. However, the manual site tube indicators are sun damaged and should be replaced as an operational project. Garver has included the recommendation in Section 9.0.

3.1.4 Process Building

The process building houses critical infrastructure for the WTF including the membrane racks, chemical feed rooms, electrical room, compressor room and the Clean-In-Place system. There are multiple CIPs that Garver is recommending to better the condition of the process building.

The external doors in the process building are degrading due to age and weather exposure. The full replacement of the existing metals doors with fiberglass-reinforced plastic (FRP) was suggested by BCMUD and supported by Garver. FRP doors (UL 10C/NFPA 252) meet local Texas building/fire codes.

Garver analyzed the Amiad strainers, shown in Figure 3-10, during the site visit. Since then, a full evaluation has been conducted by the manufacturer. The results of the evaluation were that two needed to be rebuilt and the third did not need repairs. The strainers are being recoated as part of a project that will start construction in September 2025. No other recommendations are noted at this time.

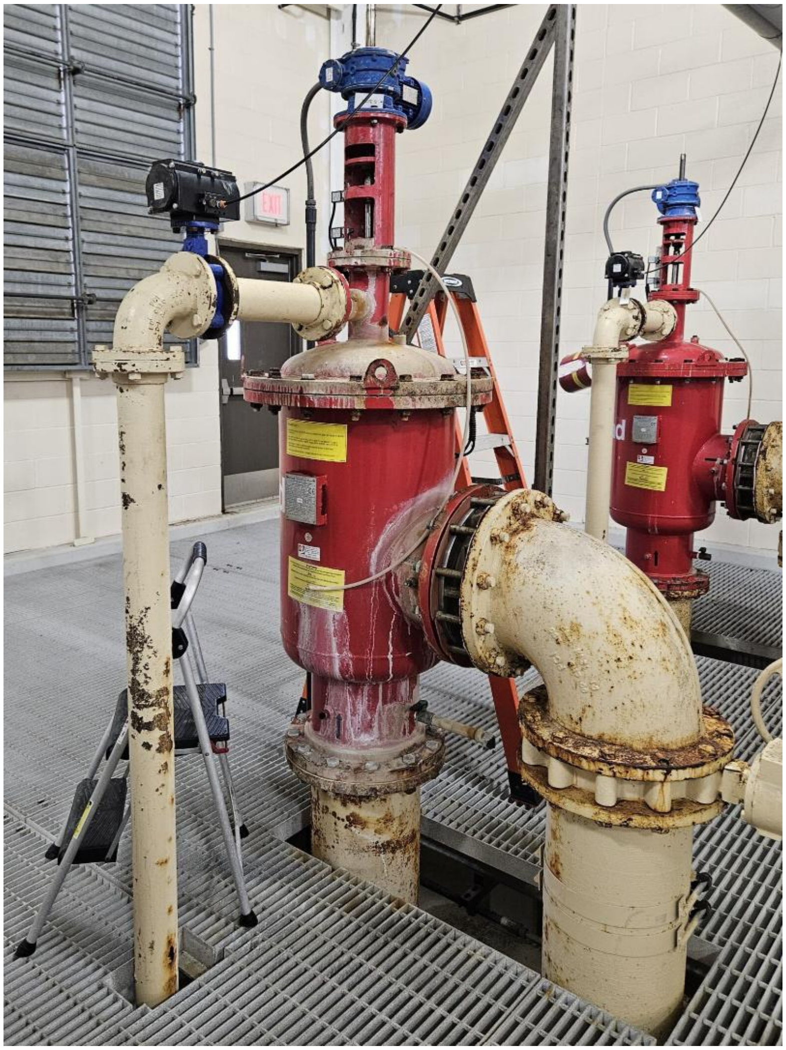


Figure 3-10: Amiad Strainers

In the compressor room, there are two compressors that were previously replaced in 2019 but are showing signs of age. Aging compressors can experience reduced efficiency, increased maintenance needs, and a higher risk of failure. In the future, it is recommended to replace the air compressors to provide reliable and efficient operation of the membrane system and other pneumatic components at the WTF. Additionally, it is recommended to perform an evaluation on the compressor sizing to assess if the system can meet current and future air demand while maintaining operational flexibility.

3.1.4.1 Pall Membrane Units

The BCMUD WTF operates four Pall Membranes that are located in their process building, shown in Figure 3-11.

Figure 3-11: Pall Membrane Racks

A comprehensive review of the Pall Membranes revealed no operational issues or parameters hindering production. The integrity test results were thoroughly evaluated and found to be satisfactory, indicating that the membranes are functioning as intended. From a process standpoint, there are no concerns regarding the current operation of the membrane units; supporting components such coagulant dosing, and total dissolved solids levels were all reviewed and deemed appropriate. Historical data shows no recurring patterns of concern, and the overall process remains stable and predictable.

While all four units exhibit natural fluctuations, shown in Figure 3-12, the data suggests relatively consistent operation across the year, with no prolonged outages or significant deviations in flow for any single unit. The overlapping trends indicate balanced system utilization, and no unit appears to be disproportionately burdened. Overall, the filtrate flow data supports the conclusion that all membrane units are operating reliably and within expected performance ranges.

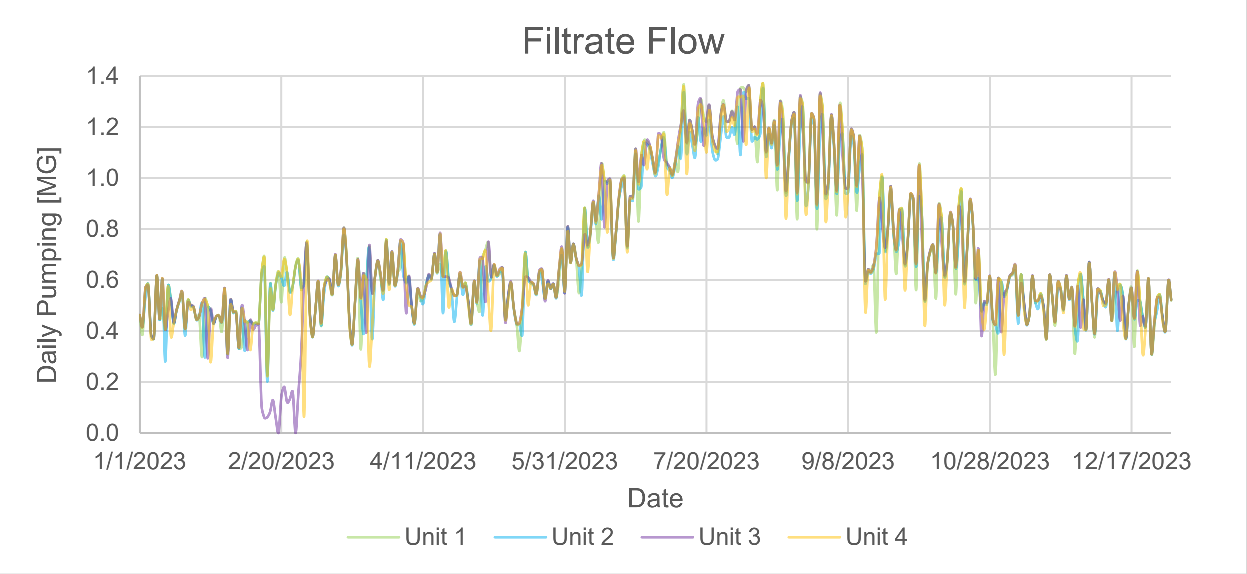


Figure 3-12: Membrane Filtrate Flow

The four units have similar performance metrics, Unit 1 is elaborated on below, all other unit data is provided in **Appendix D**. The normalized specific flux data for Unit 1, shown in Figure 3-13, shows stable membrane performance over the course of 2023. There are periodic fluctuations, but no long-term decline, indicating effective cleaning and operational practices. Peaks in the data likely correspond to post-cleaning recovery, and increased filtrate flow to accommodate heavier loading in the summer months, while troughs appear to be temporary and recoverable. The absence of a downward trend suggests that the membrane is not experiencing significant fouling or degradation. Overall, the system is operating predictably and within expected performance parameters.

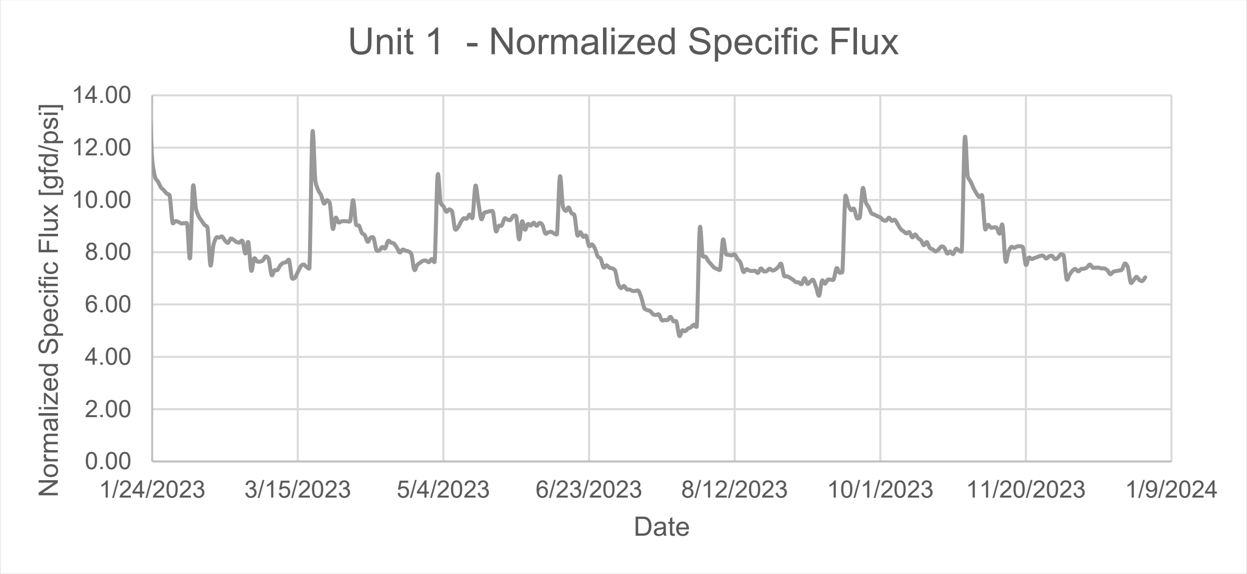


Figure 3-13: Unit 1 - Normalized Specific Flux

The pressure decay rate data for Unit 1, shown in Figure 3-14, indicates stable membrane integrity over the monitoring period. All recorded values remain consistently below the established upper control limit of 0.507 pounds per square inch (psi)/min, suggesting no breaches or abnormal pressure loss. The data points show minor fluctuations which are expected in normal operations but do not approach concerning levels. This consistency supports the conclusion that the membrane system is maintaining its structural integrity. Overall, the pressure decay performance confirms reliable and predictable operation of Unit 1.

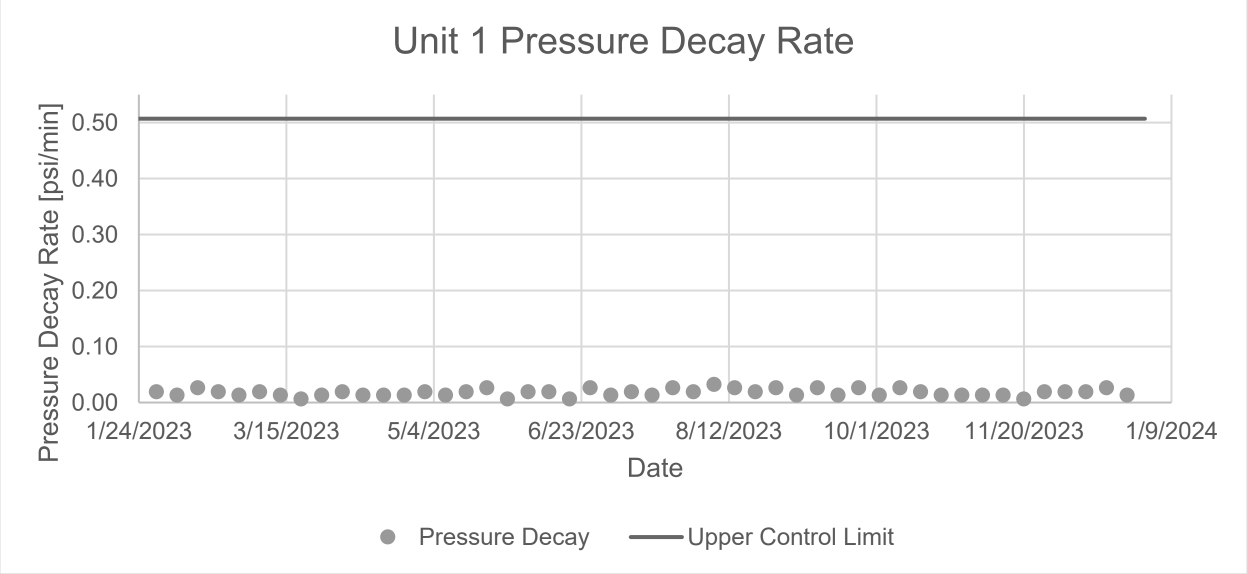


Figure 3-14: Unit 1 - Pressure Decay Rate

The membrane replacement schedule was reviewed and found to be appropriate, with no changes recommended at this time. BCMUD should continue monitoring performance data and the existing membrane replacement schedule. Adding an additional membrane filter rack is recommended as a means of reducing membrane-related maintenance. The additional unit will reduce operating flux and TMPs across all units. Since backwashing is throughput (volume based), the additional rack will also extend the time between backwash cycles. Although the extension will not result in a net improvement to water recovery, the time extension will reduce the number of backwashes performed on a daily basis, which will also reduce cyclic fatigue and open/close related loss of life for cyclic pressurized equipment. This reduction in number of cycles per day and required operation pressure is expected to have a direct impact on operation life for the membrane feed pumps (which should operate at lower speeds), membrane unit valves and membrane filter elements. Additionally, during summer peak demands, taking one membrane rack offline presents operational challenges, as the remaining three racks are insufficient to meet production demands over multiple days. The addition of a fifth membrane unit will provide the necessary flexibility, allowing one rack to undergo maintenance while the other four continue to operate within capacity. The recommendations and CIPs are outlined in Section 9.0. When the WTF was built in 2012, there was a designated space left for BCMUD to add two additional membrane racks as shown visually in Figure 3-15 and in the plans in Figure 3-16.

Figure 3-15: Additional Membrane Rack Space

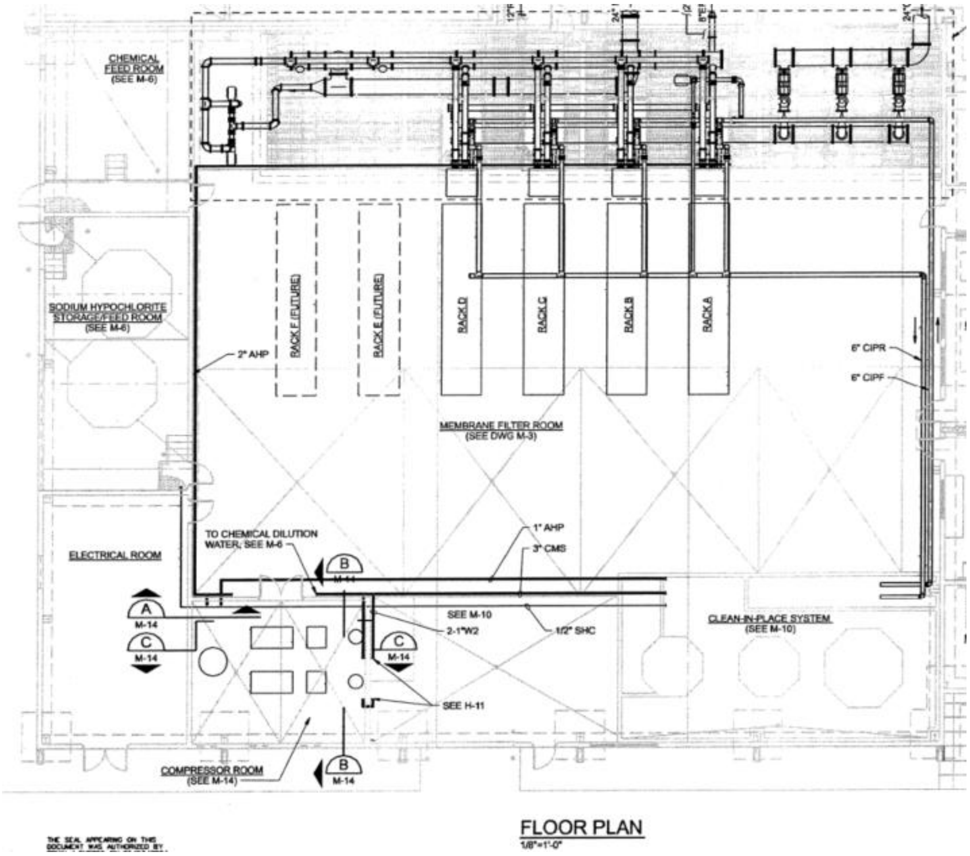


Figure 3-16: Process Building Overall Floor Plan (CH2MHILL)

Additionally, replacing the Air Release Valves (ARVs) on the membrane filtrate (MF) feed pumps is recommended for maintaining efficient system performance and protecting equipment. The ARVs have degraded as they have reached the end of their service life and replacing them will help ensure consistent flow and reduce mechanical stress on the MF feed pumps. Garver also recommends installing discharge hoses on the ARVs to safely direct the released air to a controlled location.

In the future, it is recommended to replace the three 2,000 gallon per minute (gpm) MF feed pumps and the one 1,300 gpm MF feed pump as they are reaching the end of their service life. These upgrades to the MF feed pumps, shown in Figure 3-17, will improve flow stability and system reliability, while reducing maintenance demands.

Figure 3-17: Membrane Feed Pumps

In the future, Garver recommends replacing the flow meters on the reverse filtration pumps for accurate monitoring and control of the backwash process. Additionally, it is recommended to replace both of the reverse filtration pumps due to age to ensure continued operational reliability. This proactive replacement strategy aligns with best practices for maintaining membrane system performance and minimizing maintenance disruptions.

3.1.4.2 Process Building Rooms

The process building houses the Clean-in-Place System, Sodium Hypochlorite Storage/Feed Room, Chemical Feed Room, and Electrical Room.

The replacement of aging metal doors with FRP doors is recommended at several key locations—including the Hypo Storage Area, Chlorine Storage/Feed Room, ACH/LAS Feed Room, and Electrical Room. This is recommended to improve the lifetime of the doors by installing a corrosion-resistant FRP door, ensuring compliance with fire codes, because the current metal doors show signs of chemical corrosion.

To improve chemical dosing consistency and system reliability, it is recommended to replace the northern and southern static mixers and all ARVs within the raw water chemical feed system due to old age and condition, these recommendations were encouraged by BCMUD operators. These components ensure uniform chemical mixing and maintain stable pressure throughout the system, which directly impacts treatment efficiency and equipment longevity.

Currently, BCMUD lacks tank level indicators for indoor chemical storage, preventing the chemical delivery company from monitoring rising tank levels during offloading operations at the outdoor chemical offload station. To enhance operational safety and monitoring capabilities, tank level sensors are recommended to be installed at the chemical offload station for the bulk chemicals stored inside. These sensors will provide real-time feedback during chemical deliveries, helping to prevent overfilling incidents.

Several upgrades are proposed for the Clean-in-Place System, shown in Figure 3-18, due to age and degradation to enhance its performance and monitoring capabilities. These include replacing all flow meters to ensure accurate flow measurement. Additionally, due to their age and critical function in draining racks and transferring waste to the neutralization system, both the Clean-in-Place system feed pump and the filter drain pump should be replaced.

Figure 3-18: Clean-in-Place System

In the electrical room it is recommended to replace the variable frequency drives (VFDs) for both the MF feed pumps and the reverse filtration pumps due to age. These upgrades will enhance motor control and ensure reliable and energy-efficient operation of pumping systems.

3.1.5 Clearwells

On June 6, 2024, Garver conducted a site visit to evaluate the condition of BCMUD's 2.0 MG clearwells, that are located at the WTF, shown in Figure 3-19. Several improvements are recommended after conducting the analysis to increase their functionality and longevity.

Figure 3-19: Clearwells #1 & #2 (Left: Clearwell #1, Right: Clearwell #2)

For Clearwell #1, it is recommended to add a continual gravel overflow to help manage overflow water effectively and direct the flow properly to the pavement. It is also recommended to install a drain for the clearwell to be emptied, as well as a tank mixer as specifically requested by BCMUD staff. For Clearwell #2, similar upgrades are proposed, including the addition of an overflow splash pad similar to the existing infrastructure at Clearwell #1, and to install a dedicated drainage system for the overflow to manage and mitigate the water and reroute it away from the recommended location of the emergency interconnect vaults. The existing drainage infrastructure is shown in Figure 3-20. Refurbishing the wire mesh at the overflow of both clearwells will restore effectiveness in screening debris and maintaining water quality.

Figure 3-20: Clearwell Existing Drainage Infrastructure (Left: Clearwell #1, Right: Clearwell #2)

Garver also recommends installing breathable sun covers over the meters at both clearwells, shown in Figure 3-21, to protect the instrumentation from UV damage and overheating. These recommendations collectively aim to reduce maintenance needs and support long-term operational efficiency.

Figure 3-21: Clearwell Meters (Left: Clearwell #1, Right: Clearwell #2)

3.1.6 High Service Pump Station

The High Service Pump Station (HSPS), shown in Figure 3-22, is equipped with five Flowserve 15EMM pumps, each rated at 200 horsepower (HP). It is recommended to replace the existing gate valves, ARVs and soft starts at the HSPS due to poor condition, to enhance flow control and reduce maintenance issues.

Figure 3-22: High-Service Pump Station

3.1.7 Generator Room

Garver and BCMUD operators discussed the challenge of ventilation in the generator room due to the louvers not opening properly when the generator, shown in Figure 3-23, is running.

Figure 3-23: WTF Generator

The louvers were actuated by a compressed air system, shown in Figure 3-24, but are currently being converted to electrical actuators powered by the uninterruptible power supply (UPS) as a part of ongoing HVAC and mechanical work at the WTF. To ensure airflow in the event of failure, the louvers are going to be mechanically left open to prevent unintentional issues and damage. There are no additional recommendations for the generator room at this time.

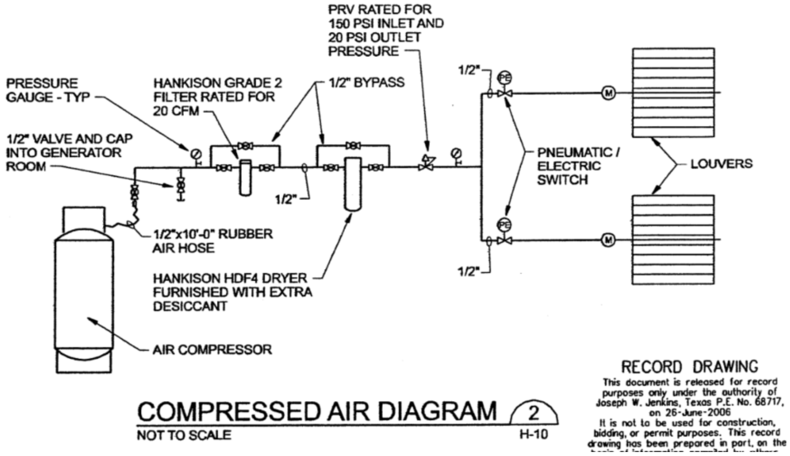


Figure 3-24: Generator Room Compressed Air Diagram

3.1.8 Backwash Recovery Basins

Garver and BCMUD operators discussed the drainage issues that operators are having at the backwash recovery basins, shown in Figure 3-25. Currently the waste is settling and not properly draining to the LS, creating extensive manual labor for operators to manage the waste. To improve efficiency and reduce manual labor, Garver recommends installing automated valves and a flow meter to enable gravity drainage of waste to the LS. This setup would automate the discharge process, ensure consistent flow monitoring, and reduce labor demands.

Figure 3-25: Backwash Recovery Basins

Additionally, enhancing solids drainage through infrastructure upgrades—such as enhanced sloped flooring, the installation of a chain & flight system to the existing rectangular basins, or installation of a new circular clarifier—could significantly improve sediment handling and minimize maintenance frequency. These three options offer distinct advantages and disadvantages as presented in Table 3-1.

Table 3-1: Recycle Basin Solids Drainage Alternatives

Treatment Method	Advantages	Disadvantages
Enhanced Sloped Flooring in the Existing Rectangular Recycle Basins	• Simple design • No moving parts, reducing failure risk	• Limited effectiveness for fine or slow-settling solids • May require periodic manual cleaning
Installation of a Chain & Flight System in the Existing Rectangular Recycle Basins	• Improves removal of settled solids under high loading conditions • Enables continuous sludge conveyance and basin cleaning	• Higher energy consumption • More complex installation and operational oversight
Installation of a New Circular Clarifier	• Provides hydraulic separation and solids settling • Facilitates automated sludge withdrawal and scum removal	• Requires additional infrastructure including pumps and electrical systems • System is limited by available footprint • Significantly higher capital investment

In the CIP, Garver has recommended a dual approach consisting of enhancing the slope of the existing basin floors and installing a chain and flight system within the rectangular recycle basins to improve solids handling and operational efficiency. Prior to implementation, BCMUD is advised to conduct a cost-benefit analysis of each option individually, as well as in combination, to determine the most suitable solution for their system.

3.2 Water Treatment Facility Regulations Review

Garver completed a comprehensive review of current and emerging Safe Drinking Water Act (SDWA) regulations that are enforced by the TCEQ that may influence the Owner's water supply system capital improvements and operational strategies. Garver has conducted a targeted analysis of key regulatory frameworks to identify potential compliance challenges and strategic planning considerations. The following SDWA regulations are examined for their relevance and anticipated impact:

- Surface Water Treatment Rules (SWTR)
- Stage 1 and Stage 2 Disinfectants and Disinfection Byproducts (D/DBP) Rules
- Lead and Copper Rules, including recent revisions and improvements (LCRR and LCRI)
- PFAS National Primary Drinking Water Regulation (NPDWR)

The findings from this regulatory review will inform future infrastructure investments and operational adjustments necessary to meet continued compliance and water quality assurance.

3.2.1 Surface Water Treatment Rules

The SWTR are a series of regulations under the SDWA designed to protect public health by minimizing the presence of microbial pathogens in drinking water. These rules specifically target organisms such as Viruses, *Giardia*, and *Cryptosporidium*, which can cause severe gastrointestinal and respiratory illnesses. The SWTRs establish performance standards for filtration and disinfection processes, requiring water systems to implement treatment techniques that achieve specified levels of pathogen removal or inactivation. Garver has evaluated current plant performance against current and upcoming regulations. Based on the findings of this evaluation, the plant is compliant with current regulatory treatment requirements including requirements of Texas Administrative Code 30 TAC 290 and key provisions of the SWTR as discussed herein.

3.2.2 Stage 1 and 2 Disinfectants and Disinfection Byproducts Rules (D/DBP) Rules

The Stage 1 and Stage 2 D/DBP Rules were established to reduce potential health risks associated with disinfectants and their byproducts in drinking water. These rules build upon the original SDWA by setting enforceable limits on both disinfectant levels and the byproducts formed when disinfectants react with natural organic matter in source water. The primary goal is to balance microbial risk reduction with the minimization of chemical exposure from disinfection processes.

The SDWA sets a Maximum Residual Disinfectant Level (MRDL) of 4.0 mg/L for both chlorine and chloramines. As shown in Figure 3-26, BCMUD has maintained an average chloramine concentration of 1.94 mg/L over the past four years, remaining well within the regulatory limit.

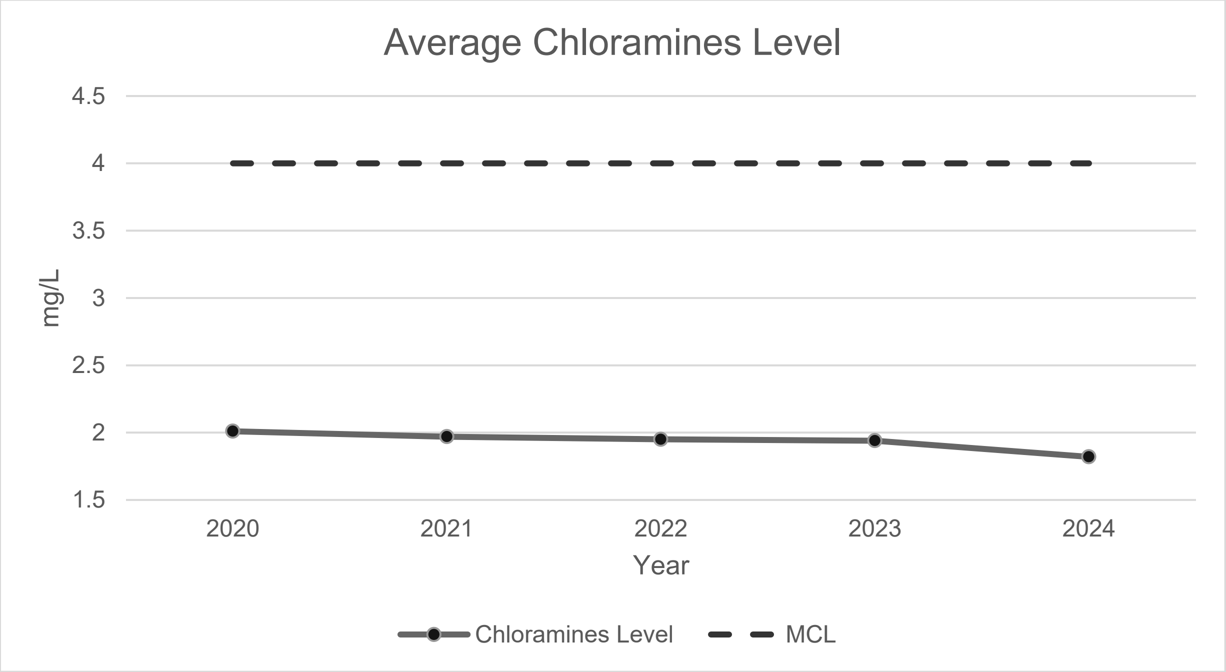


Figure 3-26: Average Chloramines Level

The SDWA also sets a Maximum Contaminant Level (MCL) of 80 parts per billion (ppb) for total trihalomethanes (TTHMs) and 60 ppb for haloacetic acids (HAA5s), with a Maximum Contaminant Level Goal (MCLG) of 0 ppb for both. According to the last four years of water quality data, the average of the highest detected level for TTHMs was 47.02 ppb, and for HAA5s was 13.24 ppb - both well within regulatory limits. As shown in Figure 3-27, the highest detected levels of both TTHMs and HAA5s have remained stable with minimal variation since 2020. These concentrations have consistently remained below the MCLs established by regulatory standards. Given this sustained compliance, there is currently no indication that immediate corrective action is required by BCMUD.

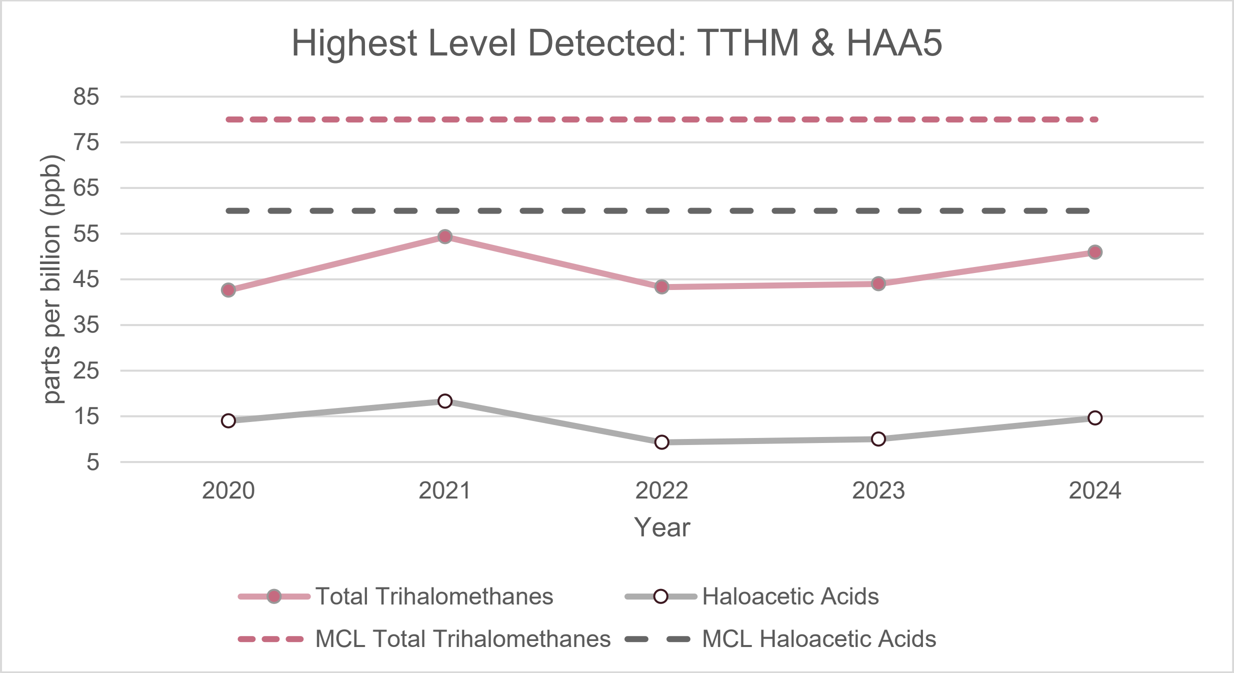


Figure 3-27: Highest Level Detected TTHM & HAA5

BCMUD currently uses chloramines as its primary disinfectant. Chloramines are formed by combining chlorine with ammonia and are favored for their ability to provide longer-lasting residual disinfection throughout the distribution system. While chloramines are effective at controlling microbial contaminants, they can also lead to the formation of specific DBPs, such as N-nitrosodimethylamine (NDMA) and haloacetonitriles, which are of emerging health concern. There are treatment technologies that can be implemented to address the concern of DBP precursors in the drinking water including granular activated carbon (GAC), reverse osmosis (RO) and ion exchange (IX). A greater review of these technologies is provided in Section 3.3.

3.2.3 Lead and Copper Rules (Revision & Improvements, LCRR and LCRI)

The Lead and Copper Rule Revisions (LCRR) and the subsequent Lead and Copper Rule Improvements (LCRI) represent significant updates to federal drinking water regulations aimed at reducing lead and copper exposure in PWS. These rules require utilities to develop comprehensive service line inventories, enhance tap sampling protocols, and implement more transparent public notification and education practices. A key component of the LCRI is the mandate to fully replace all lead and galvanized service lines within a ten-year period, eliminating partial replacements and accelerating system-wide upgrades. Additionally, the lead action level has been lowered from 15 ppb to 10 ppb, triggering earlier intervention and more aggressive mitigation strategies. Together, these regulations emphasize proactive risk management, community engagement, and long-term infrastructure improvements to protect public health.

BCMUD has met LCRR compliance by submitting a 100% non-lead service line inventory on August 15, 2024. Because BCMUD has ruled out all unknown service lines within their jurisdiction, they are exempt from LCRI requirements, such as the Lead Service Line Replacement Plan (LSLRP), service line replacement programs, and customer notifications regarding service line material. BCMUD should continue to monitor and have clear procedures in place for public notification within 24 hours in the event of a lead action level exceedance (ALE). Sampling protocols must align with updated requirements, including proper site selection and stagnation procedures, especially for homes with lead service lines. BCMUD has contracted with Garver to assist the District with the intent to develop Standard Operating Procedures (SOPs) to serve as a sampling blueprint to align with the updated requirements. Finally, the utility must demonstrate ongoing public education and outreach, particularly in vulnerable communities, to ensure transparency and build public trust.

3.2.4 PFAS National Primary Drinking Water Regulation

The Environmental Protection Agency (EPA) finalized the NPDWR for six PFAS compounds in April 2024, including PFOA, PFOS, PFNA, PFHxS, GenX (HFPO-DA), and PFBS. The rule sets enforceable MCLs as low as 4 parts per trillion (ppt) for PFOA and PFOS, and 10 ppt for the others, with a Hazard Index (HI) approach used for mixtures. This rule aims to significantly reduce PFAS exposure in drinking water and protect public health. EPA has recently announced the intention to reissue this rule in fall of 2025 in which they will only keep PFOS and PFOA standards at 4 ppt while rescinding the other contaminants from the rule for the time being. The revised rule is expected to be finalized in spring of 2026. As part of this update, the compliance deadline for PWSs is expected to be extended from 2029 to 2031. Garver has conducted an all-encompassing PFAS assessment but will tailor the recommendations toward the upcoming compliance timeline changes that are planned to occur in fall 2025. Refer to Section 3.3 for additional information on PFAS.

3.3 PFAS Treatment Assessment

The EPA's PFAS rule required community water systems (CWS) to conduct initial monitoring or obtain approval to use previously collected monitoring data by 2027, then commence ongoing compliance monitoring from 2027. After 2031, all CWS must comply with the PFAS rule or provide public notification for violations of the PFAS MCLs. MCL is the highest level of a contaminant that is allowed in drinking water and is an enforceable standard. MCLs are set as close as feasibly possible to MCLGs, which are the level of a contaminant in drinking water below which there is no known or expected risk to health. The constituents of concern in this compliance date are PFOA and PFOS. All the other PFAS related constituents will not have an enforceable MCL as stated in Section 3.2.4.

Garver analyzed the 5th Unregulated Contaminant Monitoring Rule (UCMR5) data provided by BCMUD from May 2023 to January 2024, then calculated an annual average to check the results against the MCLs for PFOA, PFOS, HFPO-DA, PFBS, PFNA, and PFHxS, results are presented in Table 3-2. Over the period of May 2023 to January 2024, there were two noted spikes in the PFAS results on May 6, 2023, and October 17, 2023. Garver recommends that, in future analysis, make notes of the spikes to see if there is a trend in the data.

A CWS is in compliance if their running annual average is less than or equal to the MCLs for all regulated PFAS. For water that contains more than one of the above compounds, a HI is a more relevant measure than average individual concentrations. The HI, seen in Equation 3-1, is made up of a sum of fractions, which compare the level of each PFAS measured in the water to highest level determined not to have health risks. PFOA and PFOS are not included in the HI calculation because any level of these contaminants could pose health risks. The MCLs for these quantities are set at 4 ppt because it is the lowest feasible level for reliable measurement and removal. The HI is a unitless quantity and the MCL of HI is 1, rounded to one significant digit. If, for example, the HI is calculated to be 1.17, this number is expressed as 1 in one significant digit and is therefore within the MCL. All calculations and guidance have been compiled and provided as **Appendix E**.

Table 3-2: EPA PFAS Regulations

Compound	Final MCLG	Final MCL (enforceable levels)	BCMUD UCMR5 Averages	Percent MCL
PFOA[1]	Zero	4.0 ppt (also expressed as ng/L)	3.83	96%
PFOS[1]	Zero	4.0 ppt	3.83	96%
HFPO-DA[2]	10 ppt	10 ppt	4.78	48%
PFBS	2000 ppt	2000 ppt	3.71	0.002%
PFNA	10 ppt	10 ppt	3.83	38%
PFHxS	10 ppt	10 ppt	3.10	31%
HI Calculation[3]	1 (unitless)	1 (unitless)	1.17	-

[1] Enforceable limits will be held in the upcoming compliance deadline of 2031.
[2] Commonly known and GenX Chemicals
[3] Mixtures containing two or more of PFHxS, PFNA, HFPO-DA, and PFBS

Equation 3-1: Hazard Index Formula

$$Hazard\ Index\ (1\ unitless) = \left(\frac{[HFPO - DA_{ppt}]}{[10\ ppt]}\right) + \left(\frac{[PFBS_{ppt}]}{[2000\ ppt]}\right) + \left(\frac{[PFNA_{ppt}]}{[10\ ppt]}\right) + \left(\frac{[PFHxS_{ppt}]}{[10\ ppt]}\right)$$

Based on the results of the analysis, BCMUD is currently in compliance with all MCLs and the HI. However, the average values of PFOA and PFOS are at the 96th percentile of the current MCL. Given that this exceeds the 80% threshold, which most systems could consider a target goal, Garver recommends continued monitoring and conducting a study, outlined as a CIP in Section 9.0. To address the PFAS levels there are multiple treatment technologies that can be put into place, including GAC, RO and IX.

Total lithium measurements were also analyzed in the UCMR5 data provided by BCMUD. Although there is no set MCL and therefore no enforceable limit on the amount of lithium in water, the results show that BCMUD is above the EPA's Health Reference Level (HRL) of 10 ug/L. This is a non-enforceable limit. Garver analyzed the data, and the results are presented in Table 3-3.

Table 3-3: Lithium Results

Date and Time of Sample	Lithium (ug/L)	Health Reference Level (HRL)
4/3/2023 8:10	13.3	10 ug/L
7/7/2023 7:55	16.3	
10/10/2023 11:28	15.9	
1/10/2024 11:20	14.4	
AVERAGE	14.98	

Although the lithium levels are above the HRL, the toxicological review is not yet complete on lithium and is projected to take many years. Garver recommends continuing to monitor levels and stay aware of the regulatory actions in case BCMUD needs to take action.

In the future, BCMUD can consider addressing elevated lithium levels with two treatment technologies that can be put into place, including RO and IX. Table 3-4 provides a comparative overview of three primary treatment technologies evaluated for the removal of PFAS and lithium, including GAC, RO, and IX. Each method is assessed based on its proposed configuration, operational advantages, and potential limitations. The table highlights key considerations such as removal efficiency, footprint, operational complexity, and waste management requirements. This comparison is intended to support informed decision-making regarding the selection of appropriate treatment strategies based on site-specific goals, regulatory requirements, and system constraints. Garver recommends that BCMUD conduct an evaluation of these treatment technologies along with conducting a cost benefit analysis to select the most appropriate technology. To support BCMUD in their evaluation, it is important to note that IX and RO may not be required for 100% of the flow, depending on design, there are possibilities to reduce contaminant concentration levels to an acceptable level by only treating a portion of the finished water and then blending it back in.

To best address the elevated lithium levels, be proactive in PFAS removal, and combat DBPs from chloramines, Garver has recommended conducting a study, outlined as a CIP in Section 9.0, to better understand the next steps for the BCMUD system in addressing PFAS, lithium and chloramines. This study will focus on developing a SOP for water sampling at the WTF; it will include monthly (or bi-monthly) sampling at the intake to assess concentrations of select constituents. Parallel sampling of settled, filtered, and finished water will be conducted to track water quality changes through the treatment process. Any updated historical operational data will be reviewed that was not previously reviewed in the W/WW MP to identify trends and correlate with sampling results. Additionally, rapid small-scale column tests will be performed using raw or filtered water to evaluate the effectiveness of various novel media in removing PFAS, and lithium while minimizing chloramines aiming to establish breakthrough profiles for key contaminants.

Table 3-4: Best Available Technologies Advantage and Disadvantages

Treatment Method	Basic Proposed Configuration	Advantages	Disadvantages	Effectiveness for Elevated Lithium Levels	Proactive PFAS Removal	Mitigation of DBPs from Chloramines
GAC	Post filter adsorbers with two 10-min contactors in series	• Widely used for PFAS removal • Provide additional robustness for taste and odor and TOC removal • Reliable PFAS removal	• TOC lowers PFAS removal, especially for short-chain compounds • Spent GAC requires offsite reactivation, incineration, or landfill disposal • Higher backwash water volume strains recycling system. • GAC replacement/ reactivation raises operational and maintenance costs • Waste disposal regulations may change in the future	• Limited effectiveness: GAC does not target lithium specifically	• Reliable for PFAS removal • Effective for long-chain PFAS	• Limited effectiveness: GAC can adsorb some DBPs and precursors
RO	Post-filter RO units	• Excellent, broad-spectrum removal of PFAS • Effective for lithium removal • High removal efficiency for DBPs	• Susceptible to fouling and may require pretreatment • RO is preferable to NF due to better removal efficiency but high operating costs • Reject water must be treated before discharging • High capital expenses associated with high energy demands • Not necessary for the sole purpose of treating PFAS	• Highly effective: RO can remove lithium ions efficiently	• Highly effective. • RO provides broad-spectrum removal including PFAS	• Highly effective: RO can remove a wide range of DBPs
IX	Post-filter anion exchange contactors with two 3-min contactors in series	• Widely accepted and efficient PFAS removal process • Lower footprint technology compared to GAC • PFAS-selective resins are available • Relatively short Empty Bed Contact Times compared to GAC	• Spent resin requires offsite incineration or landfill disposal • Minimal backwash water; less than GAC • High resin cost may raise operational expenses • Frequent resin replacement increases operational and maintenance costs • Resin is pricier per pound than GAC, but less is needed • Waste disposal rules may change • PFAS competes with other organics for resin sites. • Anion removal may impact water corrosivity	• Moderate effectiveness: IX can remove lithium ions but depends on resin type	• Efficient for PFAS removal. • PFAS-selective resins enhance performance	• Moderate effectiveness: IX can remove some DBP precursors but may compete with other ions

4.0 Groundwater Well and Distribution Facilities Evaluation

To execute the groundwater well and distribution facilities evaluation and provide recommendations for the capital improvement plan, a complete condition assessment was conducted including visual field investigations, a review of recent tank inspection reports and a desktop assessment of linear assets. The following facilities were evaluated as presented in Table 4-1.

Table 4-1: Water Distribution Facilities

Facility	Capacity
Well 3	1.6 MGD
Well 5	0.5 MGD
Well 6	1.4 MGD
North Elevated Storage Tank	0.3 MG
Neenah Elevated Storage Tank	0.75 MG
Clearwell #1	1.0 MG
Clearwell #2	1.0 MG

4.1 Well Site

On March 12, 2024, Garver conducted a site visit to evaluate the condition of BCMUD's well site, including Wells 3, 5, and 6. The assessment and discussion with BCMUD operators focused on identifying maintenance needs and prioritizing improvements to ensure continued operational reliability and safety. The well site was found to be in good condition, with only minimal maintenance needs identified, including addressing pipe corrosion by recoating, protecting the panel enclosure by recoating, improving electrical components, heat tracing and insulating, and demolishing unused infrastructure. At the time of this report, BCMUD currently has a project under construction to recoat all well piping and add heat trace and pipe insulation to wells 3, 5, and 6.

The Well 3 pump, shown in Figure 4-1, was installed in 2011 and is performing as designed. The Well 3 motor is currently being rewound. No additional reports or issues were noted and therefore, no recommendations for replacement or repair are suggested at this time. BCMUD should continue to monitor the condition of the pumps and upgrade when pump performance issues start to arise as the pump reaches the end of its service life.

Figure 4-1: Well 3 Piping

Additionally, at Well 3, the panel enclosure, shown in Figure 4-2, is recommended to be recoated to preserve its integrity and prevent further weather-related degradation.

Figure 4-2: Well 3 Panel Enclosure

At Well 5, two electrical components were flagged for replacement including the local disconnect box and the junction box for the well level reader. Both of these electrical components, shown in Figure 4-3, have since been replaced by BCMUD.

Figure 4-3: Well 5 Electrical Components

Based on BCMUD recommendation, a CIP has been recommended for demolishing unused infrastructure across the wellsite, including the area around Well 5, shown in Figure 4-4, and disconnecting it from the BCMUD system.

Figure 4-4: Unused Well 5 Piping to be Demolished

A greater explanation of the recommendation and CIPs are outlined in Section 9.0.

4.2 Elevated Storage Tanks

On June 6, 2024, Garver conducted a site visit to evaluate the condition on both of BCMUD's elevated storage tanks (EST), the 300,000 gallon North EST and the 750,000 gallon Neenah EST. The evaluation was conducted to uncover areas requiring maintenance and to prioritize potential upgrades that would support long-term functionality and safeguard operations.

After discussion with BCMUD, it is recommended to replace sections of the EST fencing at both sites to enhance site security and help prevent unauthorized access. These projects are further outlined in Section 9.0, and are scheduled to be implemented within the five-to-ten-year planning horizon. At the North EST, the stone wall that acts as the north section of fencing, highlighted in Figure 4-5, is recommended to be replaced due to condition. Additionally, the utility gate exiting onto RM 1431 as shown in Figure 4-6 is recommended to be replaced as well as per direction from BMCUD staff.

Figure 4-5: North Elevated Storage Tank Fence Replacement

Figure 4-6: North Elevated Storage Tank Wall and Gate

At the Neenah EST, shown in Figure 4-7, the southwest portion of the fence is recommended to be replaced with chain link fence due to poor condition and BCMUD staff direction.

Figure 4-7: Neenah Elevated Storage Tank Fence Replacement

To extend the operational life of the ESTs, several key improvements were recommended. It is recommended to install an overflow screen, an internal screen that will work in conjunction with the flap seal at the pipe outlet to prevent debris and wildlife from entering the overflow system and protecting water quality and infrastructure. The overflow systems are shown in Figure 4-8.

Figure 4-8: Elevated Storage Tank Overflow Systems (Left: North, Right: Neenah)

At the North EST, there was evident degradation of the ground level pipework, shown in Figure 4-9. It is recommended to re-coat the ground-level pipework to address corrosion and condition issues. Additionally, a mildew power wash is recommended for the exterior surface for not only improving aesthetics but also preventing biological growth.

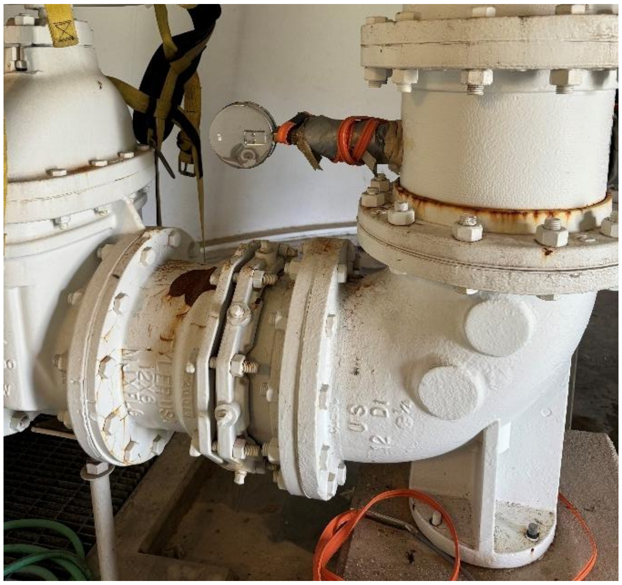


Figure 4-9: North Elevated Storage Tank Pipe Corrosion

Within the five-to-ten-year horizon, a full re-coat of the North EST, shown in Figure 4-10, is recommended to provide long-term protection against weathering and corrosion. It is also recommended to recoat the Neenah EST to maintain the tank's protective barrier and structural integrity. These upgrades collectively aim to preserve the integrity of both towers, ensure regulatory compliance, and support the long-term reliability of the water distribution system.

Figure 4-10: North Elevated Storage Tank

To enhance operational efficiency, and system responsiveness, it is recommended that the existing SCADA and telemetry systems at both ESTs be upgraded in the future. The current systems, while functional, lack advanced monitoring and control. Upgrading to a more robust SCADA architecture will provide real-time visibility into tank levels, flow rates, and system alarms, enabling operators to make faster, more informed decisions.

4.3 Linear Assets

Pipe asset information was reviewed to develop recommendations for repair or replacement. Garver reviewed historical leak data, previous waterline studies, and the previous asset management plan to identify any proposed improvement projects needed. BCMUD has 64 asbestos cement (AC) pipe locations within its water system as shown in Figure 4-11. The estimated service life of AC pipe fluctuates based on the water characteristics but estimates are about 30-50 years. AC pipes pose serious health risks because they contain microscopic fibers that can cause lung diseases like mesothelioma and asbestosis when inhaled. However, these risks are minimal when the pipes remain undisturbed underground, as the asbestos is non-friable and unlikely to release fibers. Removing the pipes can be more dangerous than leaving them in place, since cutting or breaking them during excavation can release hazardous airborne fibers. Garver conducted an initial assessment on the condition of the AC pipelines to determine if replacement is recommended.

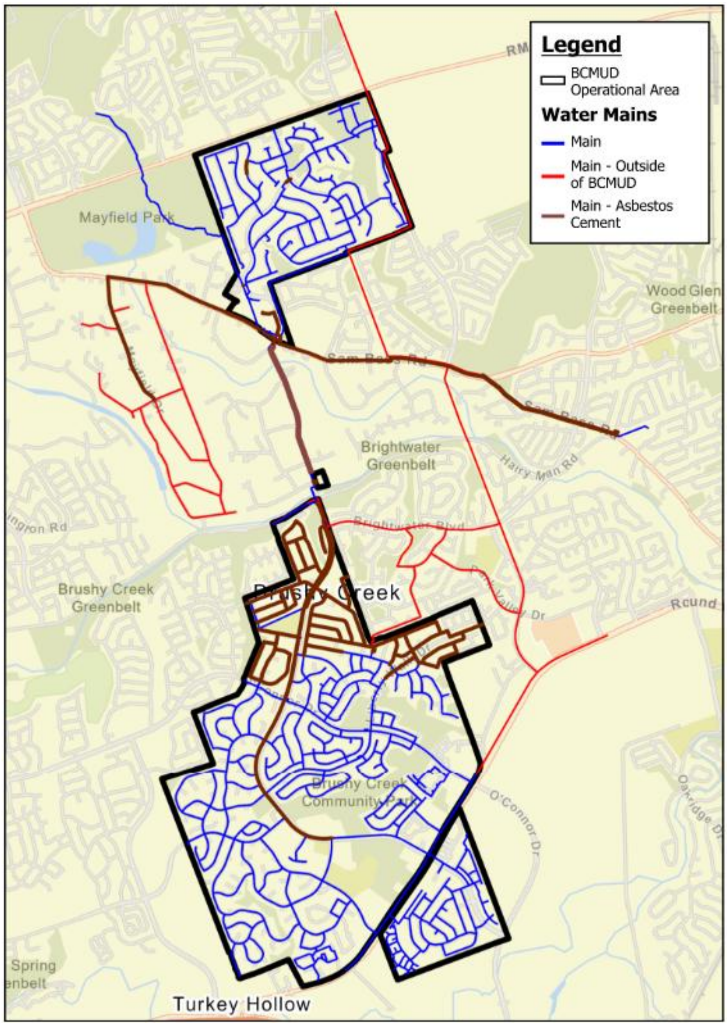


Figure 4-11: Map of Asbestos Cement Pipe Locations

BCMUD provided Garver with leak data from completed work orders that BCMUD's maintenance team has addressed starting in 2009. Garver analyzed the leak data to identify if there were any patterns in the data so that BCMUD could make proactive decisions to prevent future leaks. Garver geocoded the leak data and developed a heat map showing the hot spots where replacements are frequent as seen in Figure 4-12. This data does not differentiate between a main, a service line, a valve, etc., it encompasses all BCMUD's detected leaks for multiple reasons. The hot spots include Hillside, North Cat Hollow, and Brushy Creek South which correlates to the older subdivisions within the BCMUD service area.

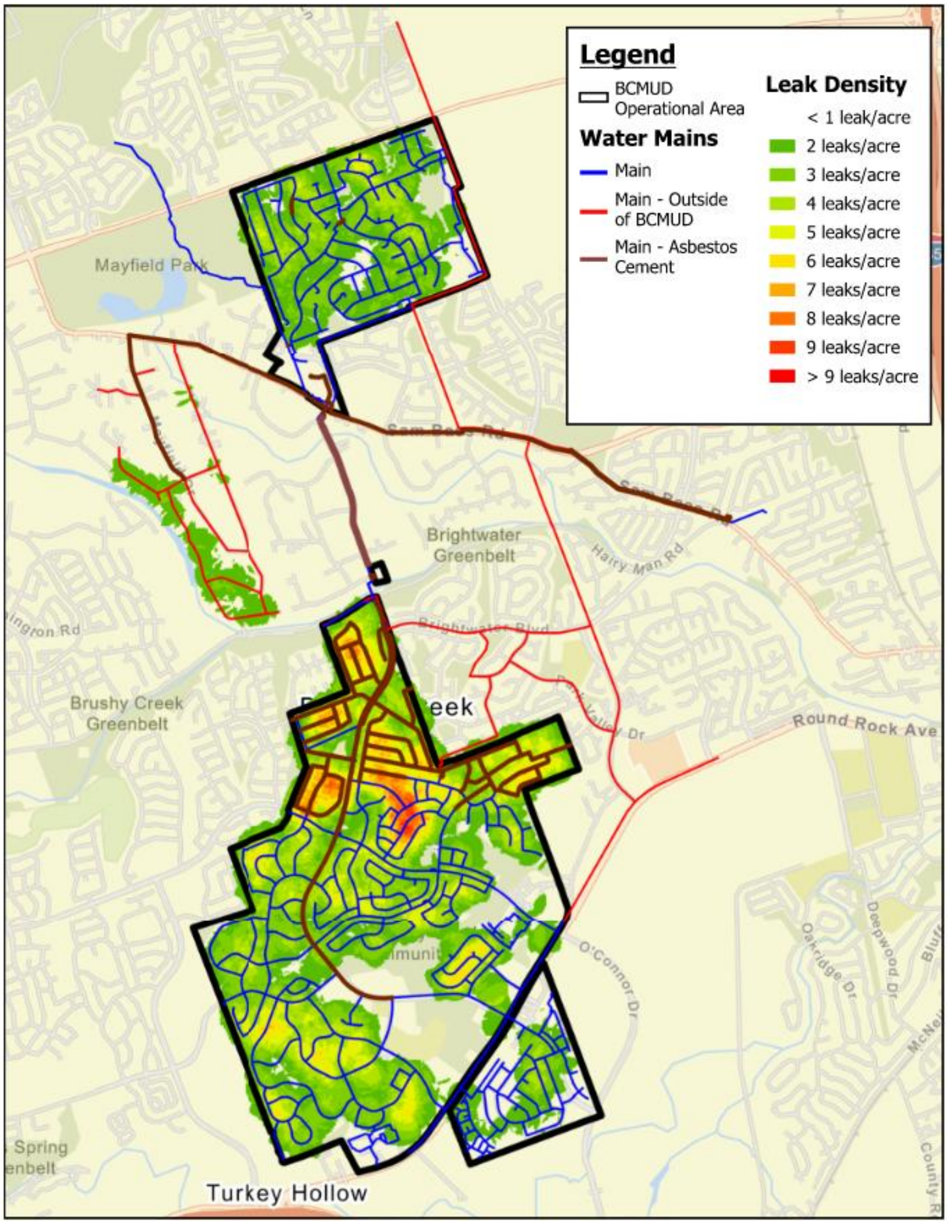


Figure 4-12: Overall BCMUD Leak Detection Data Heat Map

Garver then filtered the data with assistance from BCMUD to isolate the water main, and public side service line leak data starting in 2013, to find a correlation between leak data and AC pipe water mains. Unfortunately, this exercise was unsuccessful. As shown in Figure 4-13 the leak data was scattered and inconclusive.

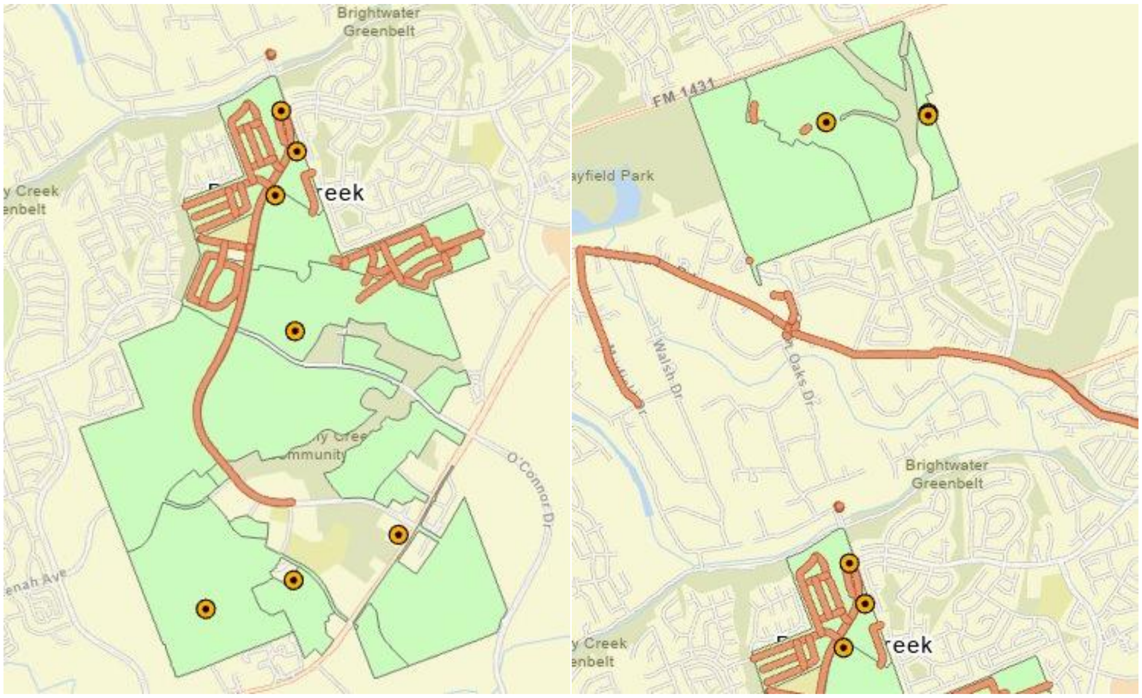
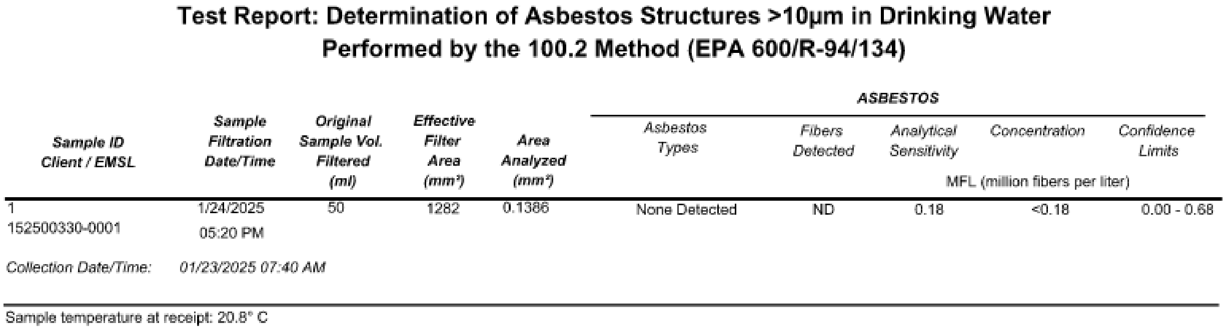


Figure 4-13: Water Main Leak Data

To accompany the leak data, Garver reviewed the previous BCS Waterline Replacement Study and the Asset Management Plan prepared by Steger Bizzell in 2020, and the most recent AC sampling results to complete a comprehensive overview of the AC lines.

The BCS Waterline Replacement Study did not recommend immediate replacement of the AC pipelines due to the hazard of inhalation during removal and low levels of AC fibers in the water. They did recommend conducting sampling every five years to continue to monitor the levels of asbestos fibers in the water. The Asset Management Plan recommended no immediate action and continued monitoring. Garver analyzed the data and recommends not to take immediate action for AC pipe removal but continue monitoring the levels of AC fibers in the water samples every five years and take action of removal if an increase is noticed. BCMUD conducted a sample on January 23, 2025, results shown in Figure 4-14. This sampling event does not show that immediate action should be taken but provides BCMUD with a data point for comparison as they are recommended to continue to sample every five years.



Test Report: Determination of Asbestos Structures >10µm in Drinking Water
Performed by the 100.2 Method (EPA 600/R-94/134)

Sample ID Client / EMSL	Sample Filtration Date/Time	Original Sample Vol. Filtered (ml)	Effective Filter Area (mm^2)	Area Analyzed (mm^2)	ASBESTOS				
					Asbestos Types	Fibers Detected	Analytical Sensitivity	Concentration	Confidence Limits
							MFL (million fibers per liter)		
1 152500330-0001	1/24/2025 05:20 PM	50	1282	0.1386	None Detected	ND	0.18	<0.18	0.00 - 0.68
Collection Date/Time:	*01/23/2025 07:40 AM*								

Sample temperature at receipt: 20.8° C

Figure 4-14: Asbestos Cement Spring 2025 Sampling Results

Should the asbestos fibers increase in the sampling, then BCMUD should consider removing AC pipe from the distribution system. An alternative to full replacement of these AC pipe locations would be cured-in-place pipe (CIPP) which is a trenchless rehabilitation method that can be pursued.

5.0 Distribution System Hydraulic Model Validation and Capacity Assessment

Section 5.0 of this report has been intentionally omitted at this time. The content for this section will be developed upon receipt of a validated and finalized hydraulic water model from BCMUD. Once the model is delivered, Garver will proceed with the Distribution System Hydraulic Model Validation and Capacity Assessment.

This assessment will include a comprehensive evaluation of the model's accuracy, calibration against available system data, and analysis of the system's capacity to meet current and projected demands. Upon completion of this process, Garver will finalize the report by incorporating the findings and conclusions into Section 5.0 of this Master Plan.

6.0 Emergency Interconnect Evaluation

Section 6.0 of this report was delivered to BCMUD as a separate technical memorandum under the BCMUD Asset Renewal Master Plan in October 2024. The Emergency Interconnect Technical Memorandum evaluated the feasibility of an emergency interconnect at the BCMUD WTF with a 42-inch CORR water line, including the development of CIPs to support an interconnection, costs, implementation schedule, regulatory coordination and approval requirements, and next steps for completion.

The Emergency Interconnect Technical Memorandum outlined two CIPs for BCMUD to pursue with the CORR to execute the emergency interconnect. The two CIPs have been condensed into CIP 1 for the delivery of the W/WW MP. The technical memorandum, and CIP are included as an attachment to the BCMUD Asset Renewal Master Plan as **Appendix G**.

7.0 Wastewater Collection System Capacity Assessment

Garver conducted a capacity assessment of the wastewater collection system. This assessment was performed by developing a hydraulic model utilizing field data collection, BCMUD's GIS database, and record drawings. Gravity mains, LSs, and force mains were assessed against evaluation criteria for dry and wet weather flows, and recommendations were made to increase or verify capacity when relevant.

7.1 Collection System Description

BCMUD provides wastewater collection services for a primarily residential area, with some commercial, civic, and mixed-use development. The collection system service area is shown in Figure 7-1. The system contains two primary drainage basins: a northern basin and a southern basin. Each basin conveys flows to a regional gravity interceptor that ultimately discharges to a regional wastewater treatment plant (WWTP). The regional interceptors and the regional WWTP are operated and maintained by the CORR. Flows to the regional interceptors and WWTP are not metered.

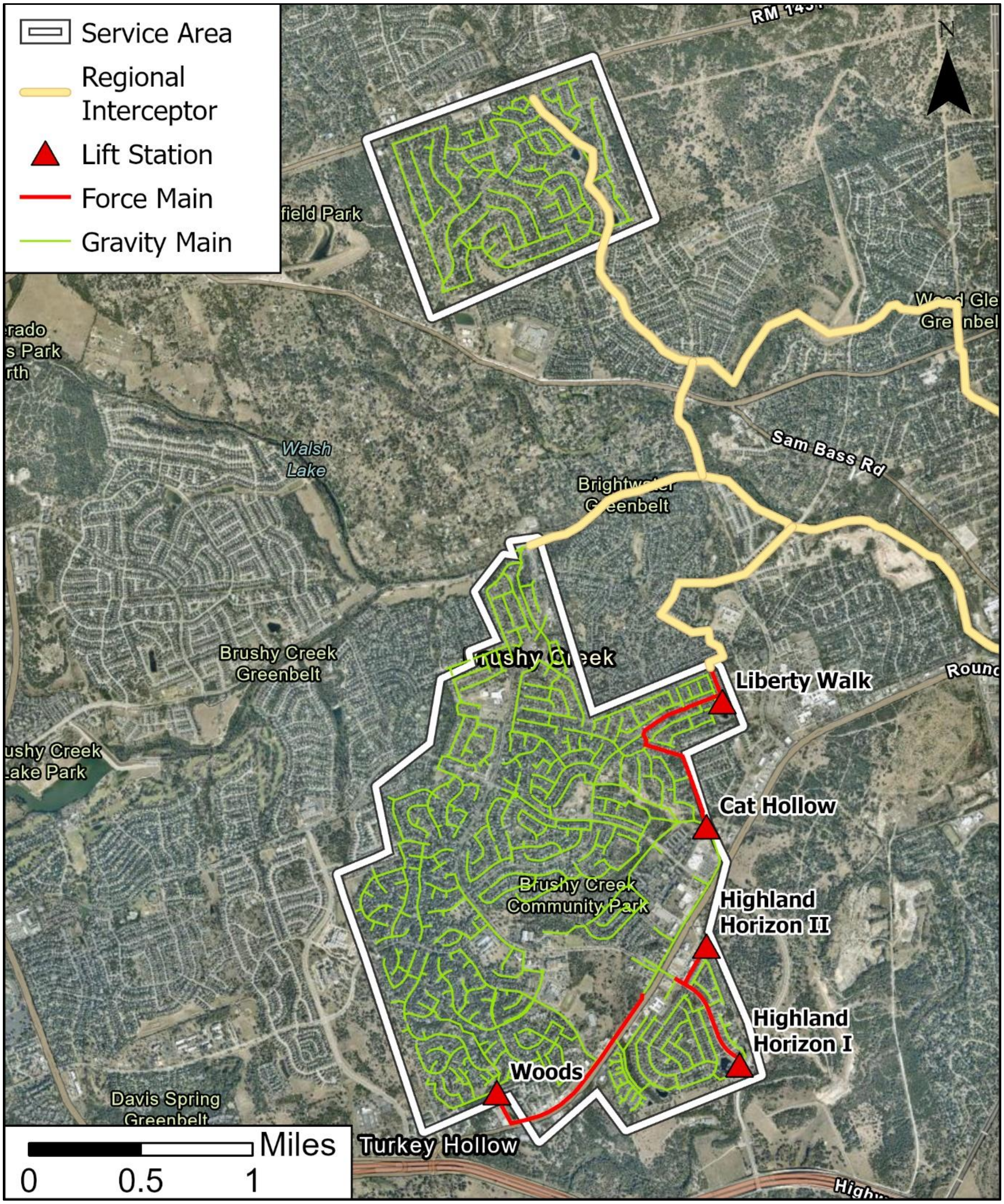


Figure 7-1: Collection System Service Area

7.2 Collection System Inventory

The collection system includes just over 300,000 linear feet (LF) of gravity main ranging in size from 6- to 24-inches. Table 7-1 presents the gravity main inventory by diameter according to BCMUD's GIS database. Pipe materials and install dates are not available in the GIS database.

Table 7-1: Gravity Main Inventory

Pipe Diameter (in)	Length (LF)
6	79,013
8	171,945
10	9,409
12	32,182
15	2,032
18	4,678
24	1,295
Unknown	360
Total	300,914

The collection system is served by four LSs. The firm and total capacities of each LS in gpm, along with the diameter and length of the force mains is presented in Table 7-2. LS capacities were taken from existing record drawing and manufacturer's pump curve data provided by BCMUD.

Table 7-2: Lift Station Inventory

Lift Station	Number of Pumps	Firm Capacity (gpm)	Force Main Diameter (in)	Force Main Length (LF)
Cat Hollow	3	5,000	18	5,650
Liberty Walk	2	310	6	130
Highland Horizon I	3	2,440	10	2,591
Highland Horizon II	2	135	4	1,114
Woods	3	1,434	10	2,402

A map of the LS basins is shown in Figure 7-2. Additionally, a schematic of the LS basins is shown in Figure 7-3. As shown in the schematic, Cat Hollow LS receives flow from the Woods LS, Highland Horizon I LS, and Highland Horizon II LS. Liberty Walk LS discharges to the Cat Hollow LS force main, and Highland Horizon II LS discharges to the Highland Horizon I LS force main.

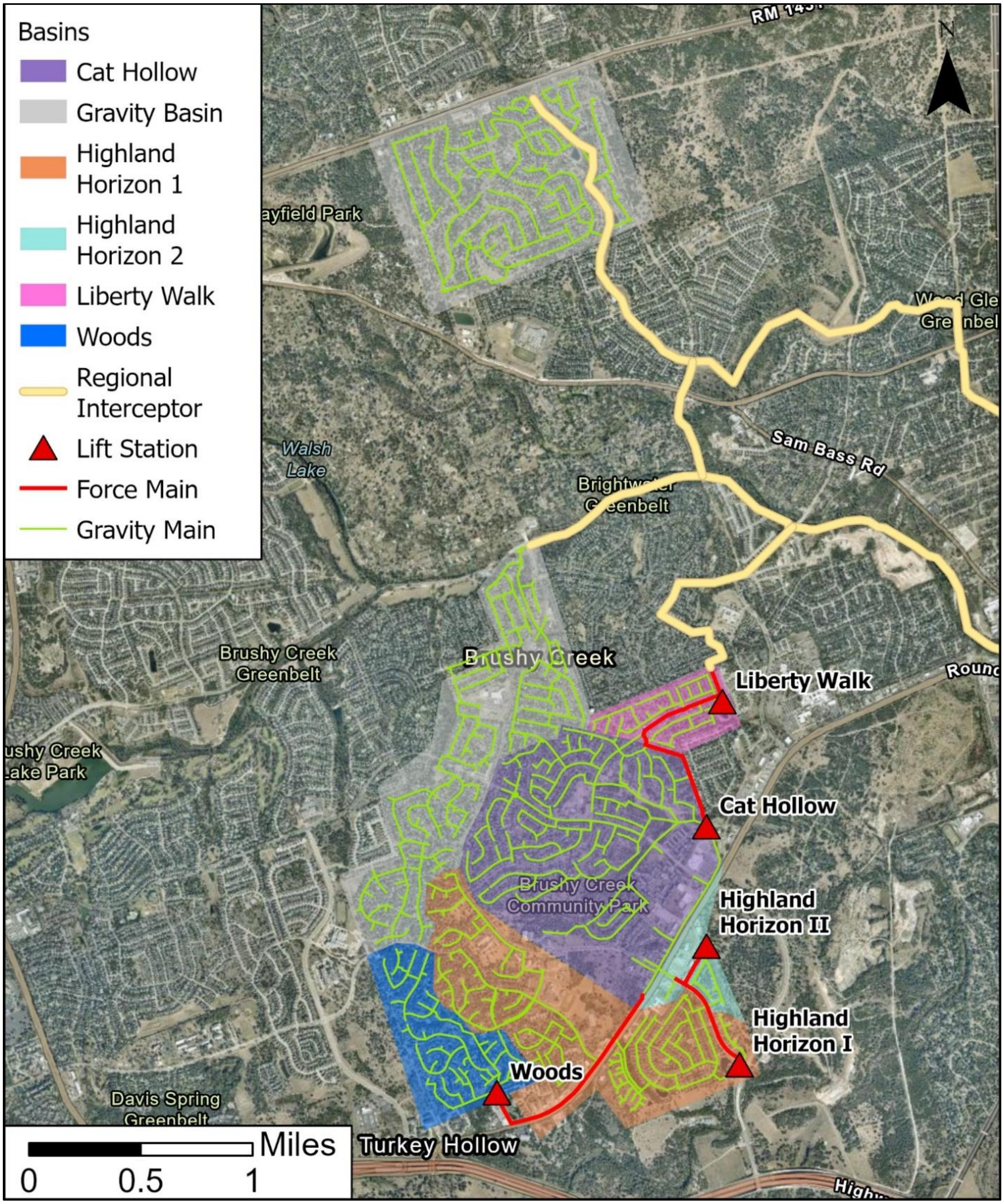


Figure 7-2: Collection System Basins

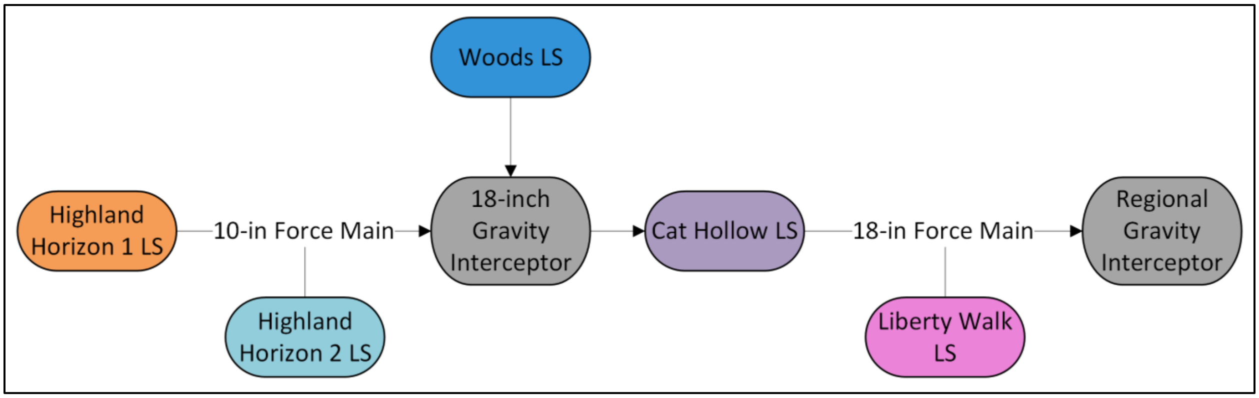


Figure 7-3: Lift Station Basin Flow Schematic

7.3 Wastewater Collection System Model Development

Garver created a hydraulic model using Bentley SewerGEMs modeling software. Information compiled from the BCMUD GIS database, record and design drawings, and field data collection was used to develop the hydraulic model.

7.3.1 Model Network

The model network includes all LSs, all force mains, and all gravity mains 10-inch and larger. Select 8-inch and smaller gravity mains were included in the model where required for connectivity. A desktop analysis was performed on 8-inch gravity mains to screen for potential capacity-limited lines. Any potential gravity-limited 8-inch mains were also included in the hydraulic model. The modeled collection system network is shown in Figure 7-4.

Gravity mains are assumed to have the same inverts as their upstream and downstream manholes. Manhole rim elevations are assumed to be equal to ground elevation. Ground elevations were interpolated from 2023 Light Detection and Ranging (LIDAR) data sourced from Texas Parks and Wildlife Department (TPWD) Strategic Mapping (StratMap) program. Manhole invert elevations are largely taken from the BCMUD GIS database. BCMUD staff conducted measure-downs to obtain missing inverts or to provide corrections to the GIS data in locations where GIS data indicated adverse slopes. **Appendix H** contains measure-down data used to build the hydraulic model. The field-conducted measure-downs were subtracted from LIDAR ground elevations to arrive at invert elevations.

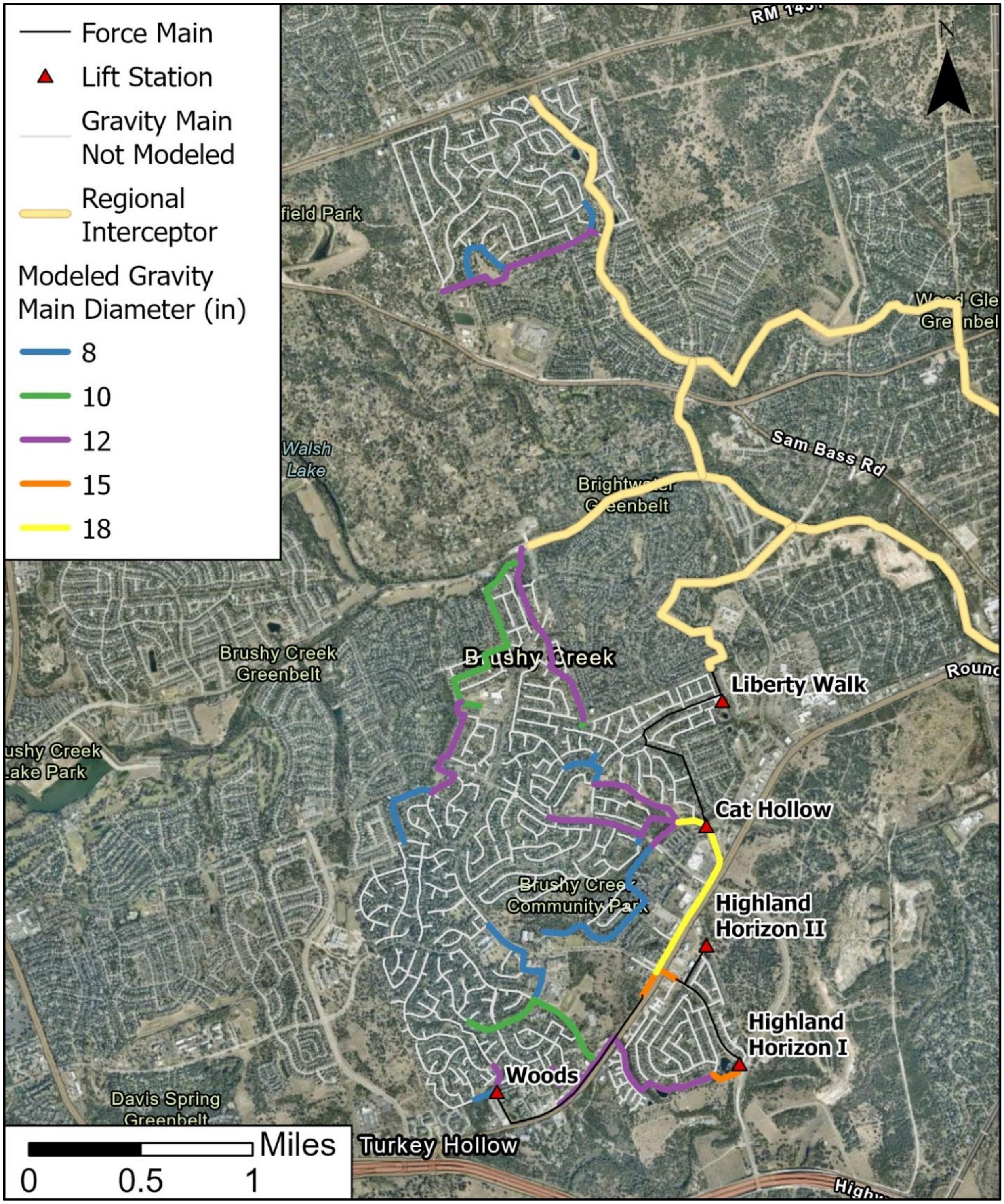


Figure 7-4: Modeled Collection System Network

The hydraulic model incorporates the completed decommissioning of the Hillside LS, located near 402 Hillside Drive, Round Rock, TX, the planned Bushy Creek North Wastewater Capacity project including the upsizing of the 8-inch, 10-inch, and 12-inch gravity main along Park Drive, and Eagle Way, and the completed rehabilitation of the Cat Hollow LS, including replacement of the wet well and pumps. Additional updates were made to reflect actual field conditions that were not reflected in the GIS database. These updates include the following:

- Revising the gravity main upstream of Cat Hollow LS from 24-inch to 18-inch
- Updating the alignment of the Liberty Walk force main so that it discharges to the Cat Hollow force main

7.3.2 Field Data Collection

Garver analyzed SCADA wet well levels, collected on 5-minute increments at all LSs, for the 2023 calendar year. This data was used to estimate average day inflows and pump flows. Level-only monitors called iTrackers were installed in select gravity mains to gain insight into wet weather flow responses. The field data collection and the time periods for which data was collected is summarized in Table 7-3.

Table 7-3: Field Data Collection Summary

Data Source	Description	Time Period
SCADA	Wet well levels for all lift stations	01/01/2023 – 12/31/2023
iTrackers	Level-only monitoring in gravity mains	10/24/2024 – 11/7/2024

7.3.3 Flow Loading

For each LS basin that is not downstream of other LSs, average day flow (ADF) was calculated from SCADA wet well level data. These ADF calculations were compared to average winter water demands in each basin. These values are shown in Table 7-4. As shown in the table, winter water demand and the SCADA-calculated ADF values are nearly equivalent in each basin. Therefore, average winter water demand was used as a surrogate for ADF.

Table 7-4: Lift Station Basin Winter Water Demands and SCADA-Calculated ADF

Basin	Winter Water Demand (MGD)	SCADA ADF (MGD)
Liberty Walk	0.06	0.04
Highland Horizon I	0.31	0.31
Highland Horizon II	0.02	0.02
Woods	0.11	0.10

iTracker data was assessed to evaluate the magnitude of the wet weather flow response to rainfall events. One rainfall event was captured by a nearby United States Geological Survey (USGS) rain gauge during the monitoring period. The rainfall event had 1.75 inches of rain over a 16.5-hour period from November 4, 2024, to November 5, 2024. Measured depths during the rainfall event were compared to average depths registered during dry weather. Depth levels increased minimally during the rainfall event at all monitoring locations. Additionally, the iTracker depth data did not indicate that surcharging was present at any monitored location. The iTracker depth data assessment can be found in **Appendix H**. The iTracker data indicates that the BCMUD collection system does not have a large-magnitude flow response to rainfall. Therefore, wet weather flows were developed by applying an industry-standard peaking factor of 4.0 to average day flows.

Table 7-5 shows the ADF and wet weather flows used to assess collection system capacity. The total ADF is 1.47 MGD and the total wet weather flow is 5.88 MGD. Flows were spatially allocated in the hydraulic model using geocoded customer meter points. The average winter water demand for each meter was allocated to the nearest manhole for the ADF. A 4.0 multiplier was applied to the ADF scenario to create the wet weather flow scenario. Flows for each flow scenario were modeled at a fixed rate over a 24-hour period.

Table 7-5: ADF and Wet Weather Flows

Basin	ADF (MGD)	Wet Weather Flow (MGD)
Cat Hollow	0.43	1.72
Liberty Walk	0.06	0.24
Highland Horizon I	0.31	1.24
Highland Horizon II	0.02	0.08
Woods	0.11	0.44
Gravity System	0.54	2.16
Total	**1.47**	**5.88**

7.4 Capacity Assessment

The hydraulic model was used to assess capacity in the collection system under ADF and wet weather flow scenarios. Garver compared model results to evaluation criteria and made recommendations to increase or monitor capacity for capacity-deficient assets according to the criteria.

7.4.1 Evaluation Criteria

The evaluation criteria are presented in Table 7-6 and are organized by tiers of importance. Infrastructure that fails to meet a Tier 1 criterion may be recommended for inclusion in the Capital Improvement Plan (CIP) or prioritized for additional monitoring. Tier 2 criteria indicate concerns that are of lower priority. Typically, for infrastructure that violates Tier 2 criteria, the recommendation would be to continue monitoring. The wet weather gravity main criteria presented in the table are conservative due to the uncertainties in wet weather flow loadings, which stem from limited data available for flow validation.

Table 7-6: Evaluation Criteria

Importance	Category	Criterion
Tier 1	Wet Weather Gravity Main Capacity	No surcharging for wet weather flows
	Lift station Capacity	Firm capacity >= peak wet weather inflow
Tier 2	Pipe Slope TCEQ Regulatory Compliance	Pipe slope sufficient to achieve 2 feet per second (fps) velocity when flowing full
	Wet Weather Gravity Main Capacity	Maximum depth/Diameter (d/D) < 0.75 for wet weather flows
	Dry Weather Gravity Main Capacity	Maximum depth/Diameter (d/D) < 0.50 for average day flows

7.4.2 Gravity Main Capacity Assessment

Figure 7-5 shows the results of the pipe slope assessment per TCEQ minimum slope criteria, which this study considers to be a Tier 2 evaluation criterion. The figure highlights pipes that are flatter than the TCEQ criteria, which requires pipe slopes to achieve a minimum velocity of 2 fps when flowing full, as calculated by Manning's equation. As shown in the map, there are several gravity main segments that have slopes flatter than TCEQ criteria. Additionally, there are a few gravity main segments that have adverse slopes. Pipe elevations are taken from the GIS database and from manhole invert measure-downs subtracted from LIDAR ground elevations. While BCMUD staff did collect measure-downs for many of the adverse-slope pipe segments, there is still some uncertainty in actual pipe invert elevations, as precise manhole rim elevations are unknown. Manhole rim elevations were interpolated form LIDAR data. It is therefore recommended that adverse slope and flat slope pipe segments be verified by survey.

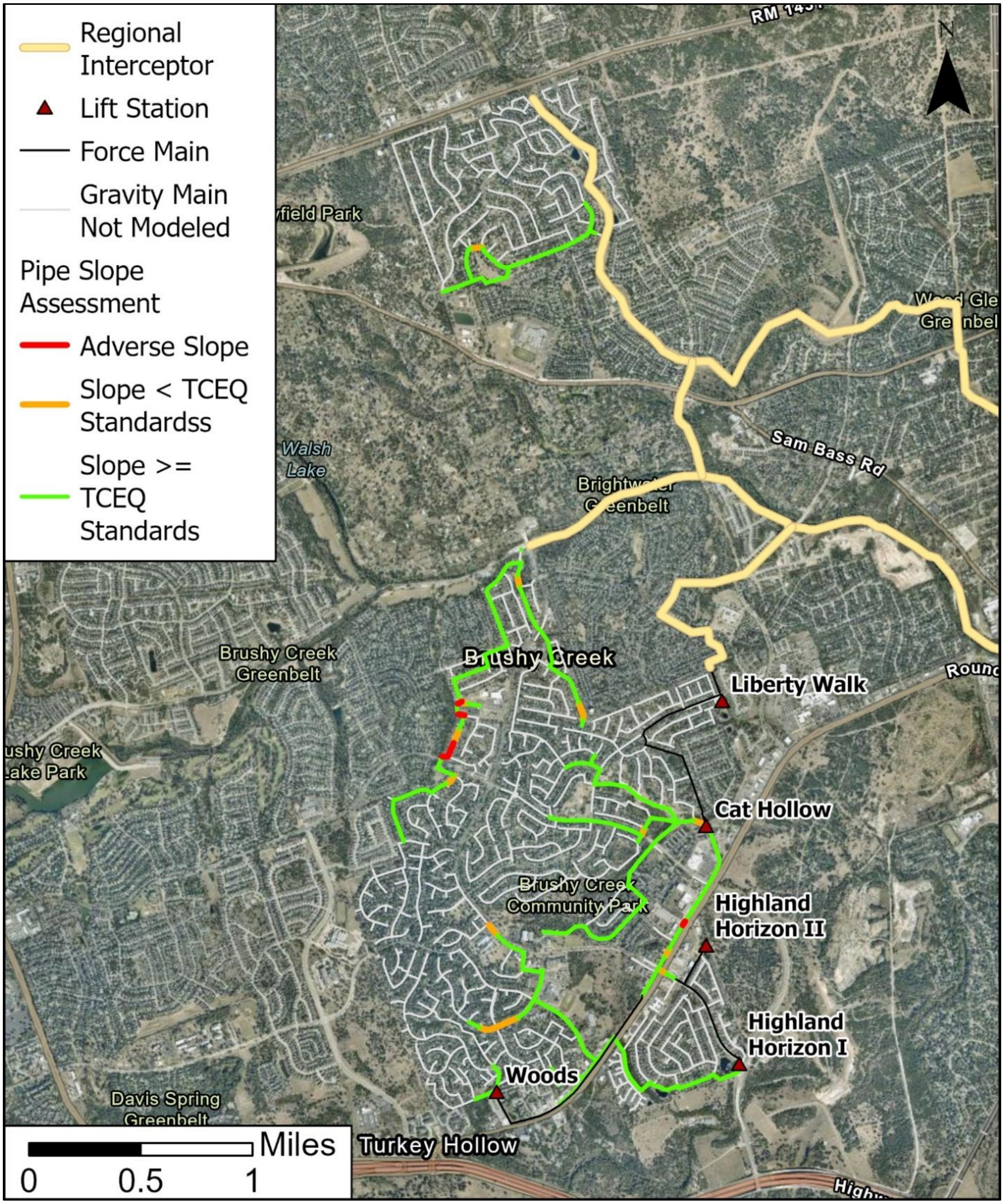


Figure 7-5: Pipe Slope Assessment

Figure 7-6 shows the dry weather capacity assessment results. This map displays maximum d/D values for average day flows. The Tier 2 capacity criteria for this flow scenario states that maximum d/D should not be greater than 0.50. The map highlights several gravity main segments that have d/D values greater than 0.50, or that are surcharged. All pipes in violation of the dry weather criteria are caused by pipes that have adverse slopes or have slopes flatter than TCEQ criteria.

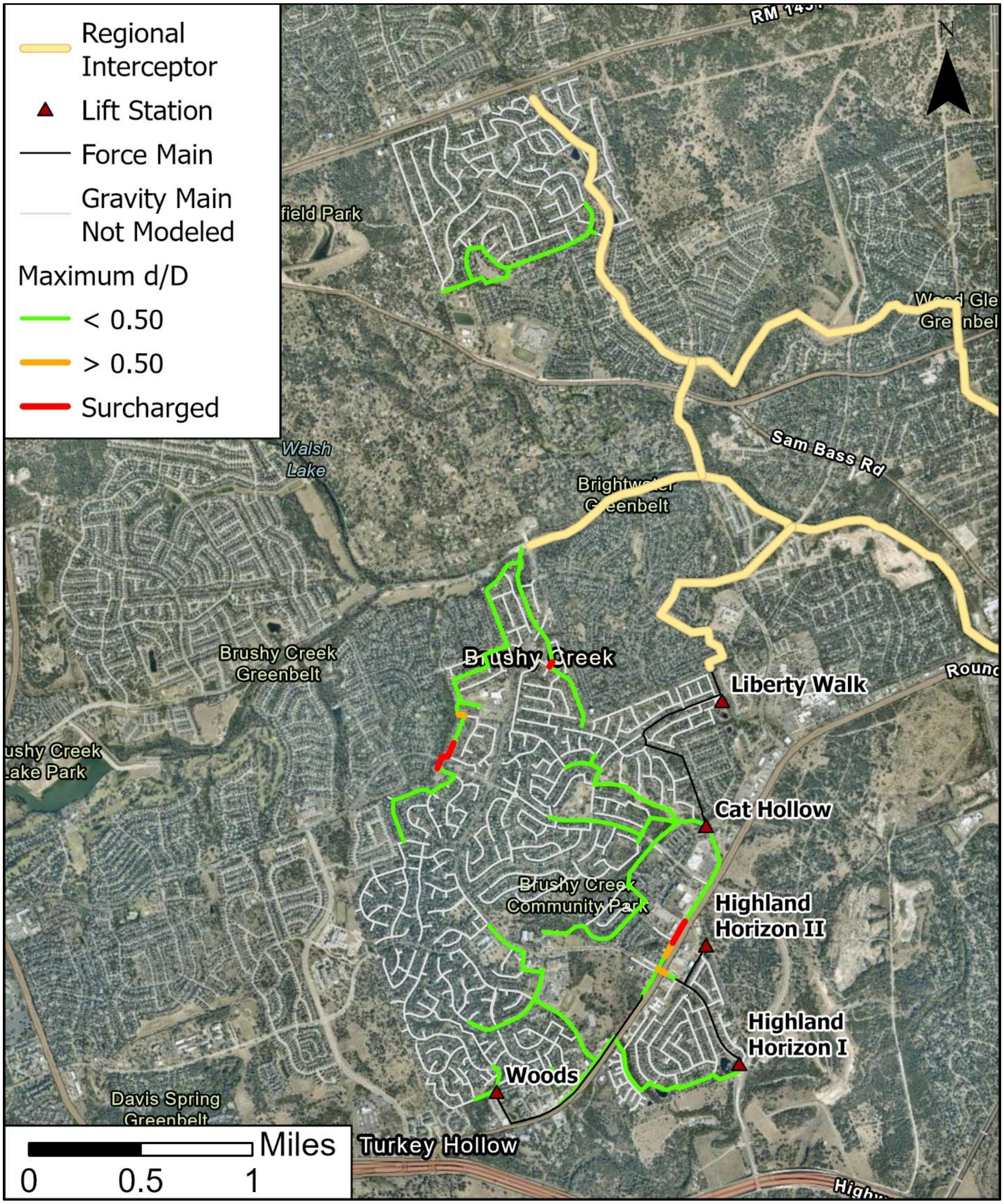


Figure 7-6: Dry Weather Capacity Assessment Results

Figure 7-7 shows the wet weather capacity assessment results. This map displays maximum d/D values for wet weather flows. The Tier 2 capacity criteria for this flow scenario states that maximum d/D should not be greater than 0.75, and the Tier 1 capacity criteria states that no gravity mains should be surcharged. As shown on the map, there are several segments of gravity main that are surcharged. The surcharged gravity mains correspond to the locations that have adverse slopes. There are also several gravity main segments that are not surcharged and have maximum d/D values greater than 0.75. Most of these segments correspond to areas with flat or adverse slopes, except for the gravity main segment upstream of Highland Horizon I LS and in the gravity main segment in northern gravity main basin (north of Sam Bass Road).

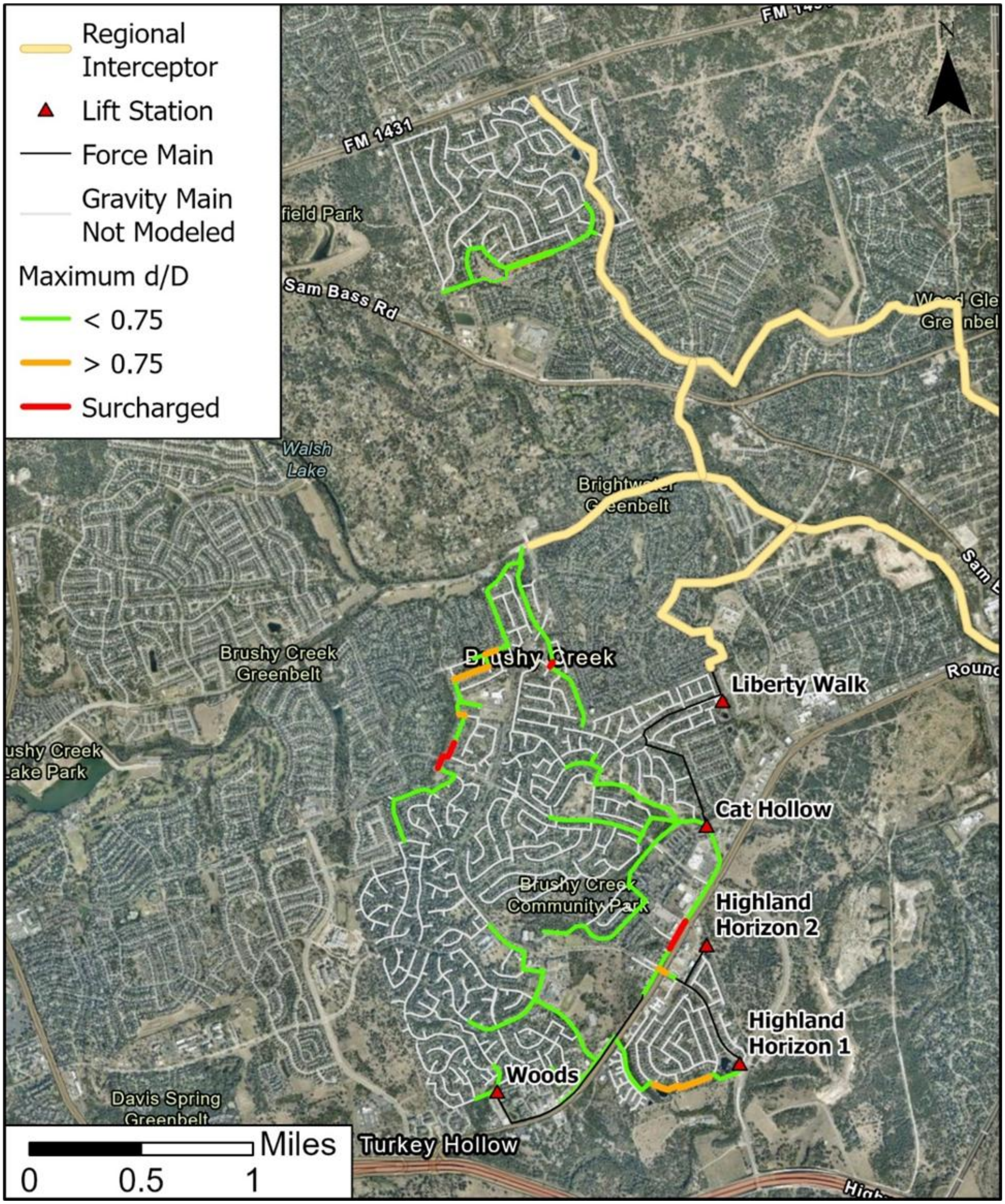


Figure 7-7: Wet Weather Capacity Assessment Results

7.4.3 Lift Station and Force Main Capacity Assessment

Table 7-7 shows the results of the LS and force main capacity assessment. As shown in the table, all LSs have peak inflows that are less than firm capacity. Therefore, all LSs have sufficient capacity in accordance with evaluation criteria. Force main minimum (1 pump on) and maximum (firm capacity: all pumps except largest pump) velocities were also assessed. The minimum velocity at Woods LS is lower than the TCEQ minimum flushing velocity of 2 fps. However, minimum flushing velocity can be achieved when multiple pumps are running. Additionally, the maximum velocity at Highland Horizon I LS is very high at firm capacity flows.

Table 7-7: Lift Station Capacity Summary

Lift Station	Number of Pumps	Firm Capacity (gpm)	Peak Inflow (gpm)	Force Main Diameter (in)	Min Velocity (fps)	Max Velocity (fps)
Cat Hollow	3	5,000	2,760	18	3.15	6.30
Liberty Walk	2	310	168	6	4.54	3.52
Highland Horizon I	3	2,440	774	10	2.12	11.23
Highland Horizon II	2	135	48	4	5.11	3.45
Woods	3	1,434	388	10	1.03	5.86

7.5 Recommendations

Table 7-8 displays the capacity-related recommendations for the collection system. These recommendations largely have to do with adverse or flat slopes present in the available collection system data. Due to uncertainty in the invert elevations used to derive these slopes, the locations noted in the table did not rise to the level of a CIP project. It is recommended that elevations and slopes be field-verified. If any pipe segments are found to have adverse slopes, those pipe segments are recommended to be re-graded. Additionally, locations where gravity mains are not surcharged but d/D is greater than 0.75 for wet-weather flows are recommended to be monitored during wet weather events. Lastly, it is recommended that a system-wide temporary flow monitoring program is deployed to gain further understanding and confidence in system flows and capacities.

Table 7-8: Collection System Capacity Recommendations

Importance	Location	Recommendation
Tier 1	18-inch gravity main from manhole C234 to C230	Survey-verify that the gravity main segment does not have an adverse slope. Re-grade gravity main segment if slope is adverse
Tier 1	12-inch gravity main from manhole M111 to V20	Survey-verify that the gravity main segment does not have an adverse slope. Re-grade gravity main segment if slope is adverse
Tier 1	12-inch gravity main from S53 to S51	Survey-verify that the gravity main segment does not have an adverse slope. Re-grade gravity main segment if slope is adverse
Tier 1	12-inch gravity main from manhole V22 to V23	Survey-verify that the gravity main segment does not have an adverse slope. Re-grade gravity main segment if slope is adverse
Tier 2	12-inch gravity main from manhole G11 to H6	Monitor water levels during wet weather events due to hydraulic model indicating maximum d/D values greater than 0.75
Tier 2	15-inch gravity main from manhole H49A to C239A	Monitor water levels during wet weather events due to hydraulic model indicating maximum d/D values greater than 0.75
Tier 2	10-inch gravity main from manhole S39 to S32	Monitor water levels during wet weather events due to hydraulic model indicating maximum d/D values greater than 0.75
Tier 2	Highland Horizon LS I	Monitor pump run times. If two pumps are frequently operating at the same time, consider upsizing the Highland Horizon LS I FM due to high velocity concerns
Tier 3	System-wide	Deploy temporary flow monitoring program, especially if Tier 2 level monitoring areas are indicating capacity concerns during wet weather events. Calibrate hydraulic model on flow monitoring data to refine capacity upgrade recommendations

7.6 Risk Analysis

The capacity assessment performed lacks flow data, and therefore the dry and wet weather flow loadings cannot be validated. The following section presents a risk analysis to demonstrate capacity concerns that may be present if flows exceed those estimated in the capacity assessment.

The SCADA data and iTracker level-only data analysis indicates that ADF is approximately equivalent to winter water demand and that a 4.0 peaking factor is a reasonable assumption. However, stress-testing the system by increasing flows allows for identification of infrastructure that is most-likely to be capacity constrained if flows are higher than estimated or if flows should increase in the future. These analyses can help guide selection of flow monitoring locations in a temporary flow monitoring program. The risk scenarios that were assessed are summarized in Table 7-9.

Table 7-9: Risk Analysis Scenarios

Scenario	Description	Rationale
Increased Wet Weather Peaking Factor	• Pipes with adverse slopes re-graded • Wet weather loadings increased to 6.0 times ADF	Peak wet weather flows may be higher than estimated or may increase in the future as assets age. Results of this analysis indicate where capacity constraints may exist under higher peak flow conditions.
All LSs Operating at Firm Capacity	• Pipes with adverse slopes re-graded • Loading to lift stations increased to trigger firm capacity pumping rates	Wet weather peaking factors of 4.0 and 6.0 do not trigger pumps to operate at their firm capacity at all LSs. This scenario shows the impact of pumping at the installed firm capacity rates on downstream infrastructure.

Figure 7-8 shows the results of the increased wet weather peaking factor risk analysis scenario. As shown in the figure, there are several segments of gravity main that are surcharged, and several manholes that experience low freeboard conditions or overflows. Flows to these areas should be prioritized for monitoring if a temporary flow monitoring program is deployed.

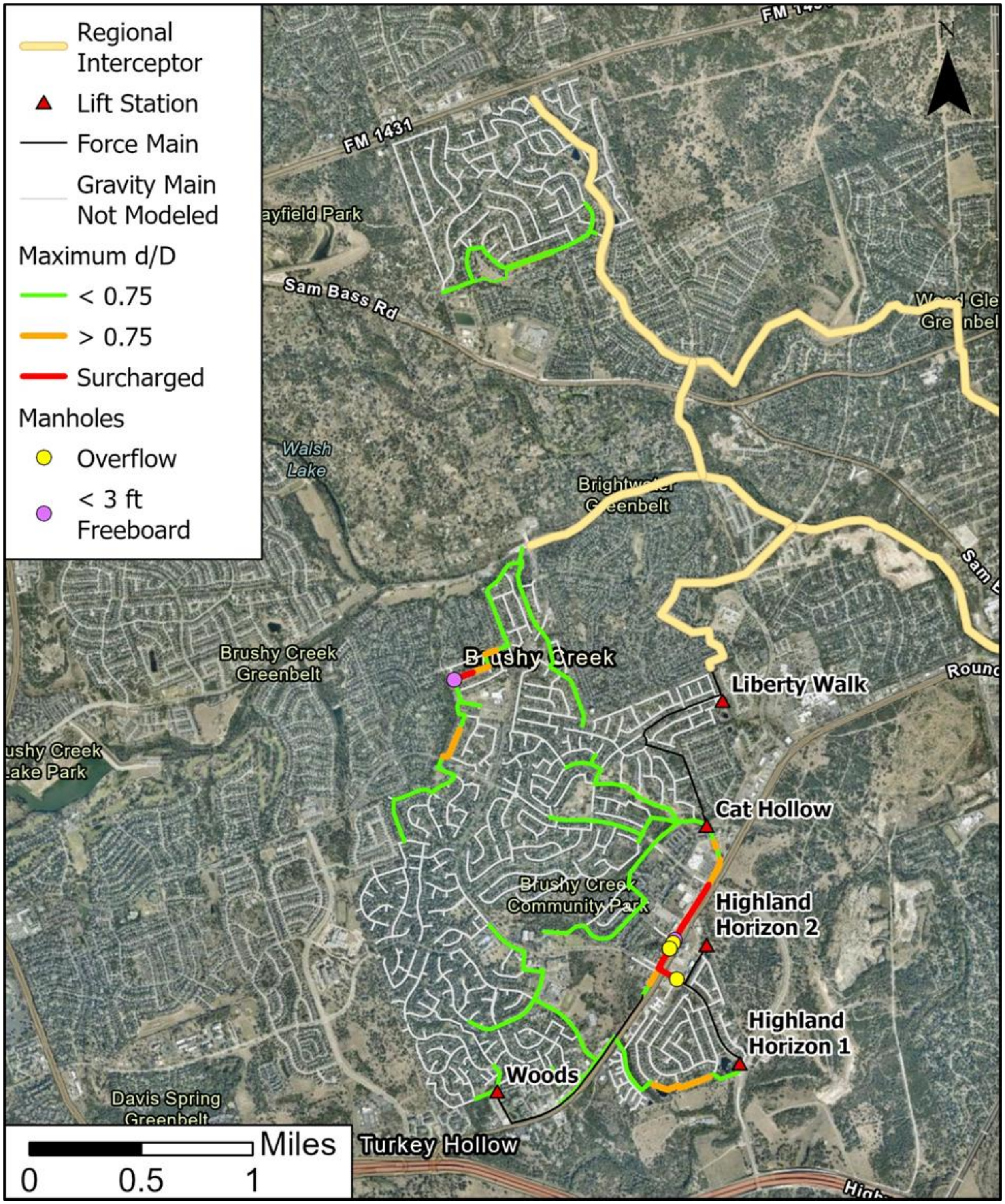


Figure 7-8: Increased Wet Weather Peaking Factor Risk Analysis Scenario

Figure 7-9 shows the results of the risk scenario for all pumps operating at firm capacity. As shown in the figure, there are several segments of gravity main that are surcharged and several manholes that experience low freeboard conditions or overflows downstream of the lift stations. Pumped flows from the lift stations should be monitored, and downstream capacity upgrades should be considered if it is found that the LSs are often operating at firm capacity during wet weather events.

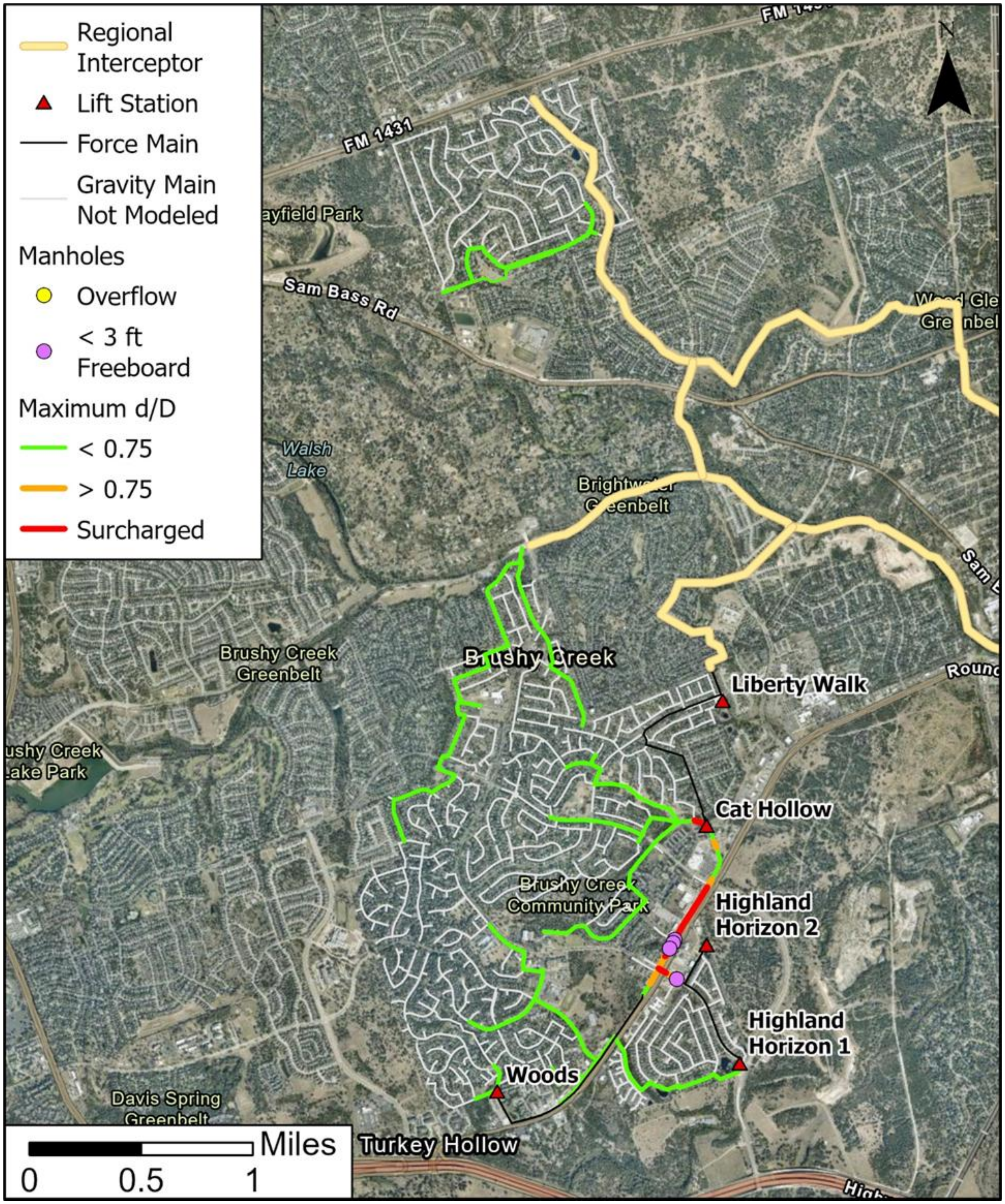


Figure 7-9: All LSs Operating at Firm Capacity Risk Analysis Scenario

8.0 Wastewater Collection System Condition Assessment

To execute the wastewater collection system condition assessment and to provide recommendations for CIP projects, a complete condition assessment was conducted including visual field investigations, and a review of historical condition assessment information was conducted. The following facilities were evaluated as listed below:

- Woods LS
- Cat Hollow LS
- Liberty Walk LS
- Highland Horizon I LS
- Highland Horizon II LS
- Critical Manhole Locations

8.1 Woods Lift Station

The Woods LS, shown in Figure 8-1, was evaluated during the site visit and was found to be in good operational condition. BCMUD staff has identified CIPs for this LS including demolishing and filling the dry pit for safety, updating SCADA to allow remote operations, and installation of a grinder pump to address ragging issues. These recommendations have been outlined in Section 9.0, and are scheduled to be implemented in the zero-to-five-year planning horizon.

Figure 8-1: Woods Lift Station

8.2 Cat Hollow Lift Station

The Cat Hollow LS, shown in Figure 8-2, was reviewed onsite, and no additional recommendations are being made at this time. All necessary improvements, including decommissioning activities, site restoration, and utility modifications, are already addressed in the plans and current ongoing construction of the Cat Hollow LS Improvements which is scheduled for substantial completion in September 2025. These plans comprehensively cover the scope of work required to ensure proper decommissioning and site compliance, and no further action is needed beyond what is outlined in the current design documentation.

Figure 8-2: Cat Hollow Lift Station

8.3 Liberty Walk Lift Station

The Liberty Walk LS, shown in Figure 8-3, was reviewed by Garver and has been given several recommendations to enhance its operational reliability, safety, and environmental compliance.

Figure 8-3: Liberty Walk Lift Station

A new permanent generator mounted on a concrete pad with an automatic transfer switch is recommended to ensure continuous power during outages. This project was recommended by BCMUD staff because the current mobile generator onsite, shown in Figure 8-4, is oversized, nearing the end of its life, and loud for nearby residents when in use. This recommendation supports Texas Senate Bill 3 and Texas Water Code §13.1394, which outlines that utilities are required to ensure continuity of service during extended power outages.

Figure 8-4: Liberty Walk Mobile Generator

The existing jib crane, shown in Figure 8-5, should be replaced or rehabilitated to improve maintenance efficiency and worker safety due to its poor condition.

Figure 8-5: Liberty Walk Lift Station Jib Crane

It is recommended to install a pipe stanchion to support the bypass pump line and prevent mechanical stress to replace the existing stone stack shown in Figure 8-6.

Figure 8-6: Liberty Walk LS Pipe Stanchion

A general rehabilitation of this LS is recommended, including the installation of a vent to reduce the buildup of hazardous gases. BCMUD suggested that odor control measures should be taken to minimize the odor issues for the neighboring homes. Garver agrees with the recommendation and has created a CIP for implementing an odor control system for the Liberty Walk LS.

Additional recommendations were made by BMCUD to ease upkeep and maintenance for operators. For improved access and safety, a new wet well ladder should be installed, as well as a full rehabilitation of the wet well. The electrical controls and canopy are recommended to be rehabilitated to meet current standards and ensure reliable performance. Site improvements, including the installation of a driveway, is recommended to enhance accessibility for maintenance and emergency response. Additionally, the perimeter fence should be repaired or replaced to secure the facility due to the current poor condition of the fence. These comprehensive upgrades will significantly improve the functionality, safety, and longevity of the LS.

8.4 Highland Horizon I Lift Station

The Highland Horizon I LS CIP targets improvements to enhance safety and operational efficiency. To improve worker safety, fall protection systems should be installed at the wet well access hatches since there is no fall system currently in place, shown in Figure 8-7. To improve operational efficiency, a grinder pump is recommended to be installed to prevent ragging issues in the wet well.

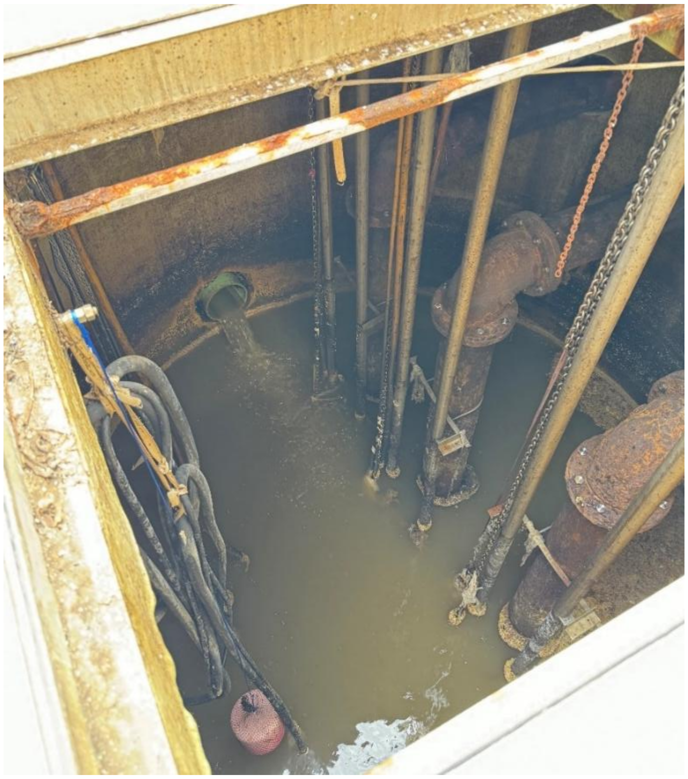


Figure 8-7: Highland Horizon I Lift Station Wet Well

The existing pipe stanchions in the vault should be replaced to ensure proper support and alignment of piping systems. This will reduce the risk of mechanical failure that is possible with the current pipe stanchions due to their critical condition, shown in Figure 8-8.

Figure 8-8: Highland Horizon I LS Pipe Stanchions

Additionally, BCMUD suggested that odor control measures should be taken to minimize the odor issues for the neighboring homes. Garver agrees with the recommendation and has created a CIP for implementing an odor control system for Highland Horizon I LS. These upgrades will help ensure the LS operates safely, efficiently, and in accordance with regulatory requirements.

8.5 Highland Horizon II Lift Station

The Highland Horizon II LS CIP targets improvements to enhance safety and operational efficiency. To improve worker safety, fall protection systems should be installed at the wet well access hatches since there is no fall system currently in place, shown in Figure 8-9.

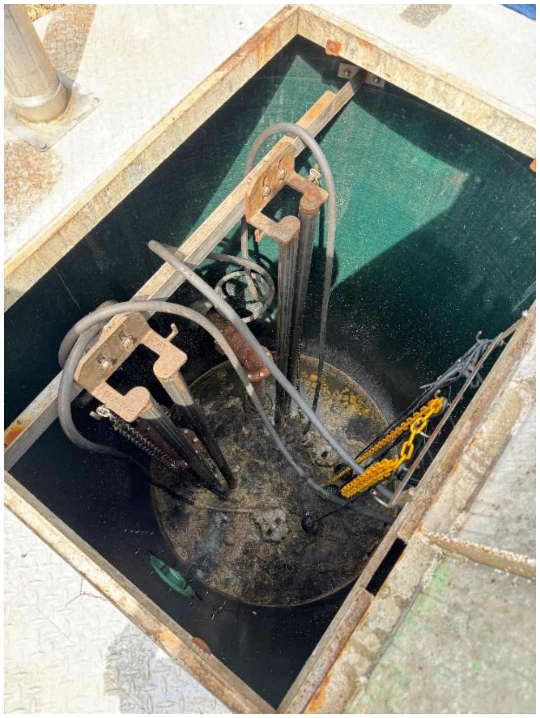


Figure 8-9: Highland Horizon II Wet Well

The vent at Highland Horizon II LS is corroded, shown in Figure 8-10, and is recommended to be replaced.

Figure 8-10: Highland Horizon II Corroded Vent

Additionally, BCMUD suggested that odor control measures should be taken to minimize the odor issues for the neighboring homes. Garver agrees with the recommendation and has created a CIP for implementing an odor control system for Highland Horizon II LS. These upgrades will help ensure the LS operates safely, efficiently, and in accordance with regulatory requirements.

8.6 Critical Manhole Locations

Garver conducted a site visit to evaluate the condition of selected BCMUD's manholes. The critical manhole locations that were evaluated were located along N 620 Road as shown in Figure 8-11.

Figure 8-11: Manhole Locations for Rehab and Venting

The following observations were made during the evaluation: the sewer manholes appear to be structurally intact, with no major cracks or signs of collapse visible, and the barrel and cone of the manholes show severe corrosion from sewer gases, including hydrogen sulfide (H_2S), as shown in Figure 8-12.

Figure 8-12: Manhole Condition Photos

The critical manholes identified for rehabilitation are listed in Table 8-1. BCMUD has elected to rehabilitate by coating instead of conducting a full manhole replacement. During the recoating process, the WW main will be temporarily plugged and bypassed to continue WW service operations to the CORR Wastewater Treatment Facility. To preserve the rehabilitation and extend the service life of the coating, Garver recommends installing vents at certain manholes to release the sewer gases from the manhole. These vented manhole locations as shown in Figure 8-11, are strategically placed to prioritize areas that are will not cause odor concerns for the public.

Table 8-1: Critical Manholes to be Rehabilitated and Vented

Manhole ID	Notes
C222	Rehab by coating
C224A	Rehab by coating
C225A	Rehab by coating, Candidate for ventilation
C226	Rehab by coating
C227	Rehab by coating
C229	Rehab by coating, Candidate for ventilation
C230	Rehab by coating

Manhole ID	Notes
C231	Rehab by coating
C232	Rehab by coating, Candidate for ventilation
C232C	Concrete Covered (location to be determined by BCMUD – not shown in figure)
C233	Candidate for ventilation
C234	Rehab by coating
C237	Rehab by coating
C237A	Rehab by coating
C238	Rehab by coating, Candidate for ventilation
C239	Rehab by coating

These manholes are located along a commercial corridor where they are closely encountered by the community and local businesses. Should the sewer gases present issues to the public, BCMUD should consider odor control technologies to mitigate the odor. There are multiple technologies that can be implemented to control odor control. Garver recommends contacting an odor control manufacturer to conduct an evaluation and measure the levels of sewer gases to properly design an odor control system unique to BCMUD's circumstances and odor levels.

9.0 Capital Improvement Plan and Recommendations

The Asset Renewal Master Plan for BCMUD presents a strategic and data-driven roadmap for maintaining and enhancing BCMUD's water and wastewater infrastructure. Based on extensive field evaluations, historical data analysis, regulatory review, and stakeholder collaboration, Garver has developed a comprehensive capital improvement plan that addresses both immediate needs and long-term system resilience.

The capital improvement plan includes 28 CIPs totaling approximately $12.7 million, categorized into short-term (zero to five years) and medium-term (five to ten years) horizons. These projects span across the WTF, groundwater wells, elevated and ground storage tanks, LSs, and linear assets. These projects currently exclude recommendations regarding the hydraulic capacity of the system; these recommendations will be provided upon completion of the water hydraulic model. Key recommendations are listed in Table 9-1, including the location and description of the recommendation. Table 9-2 provides an overview of the recommended CIPs, including a description of each project, its project horizon, total duration and estimated cost in 2025 dollars. A brief overview of the tables is outlined below:

- **Water Treatment Facility Enhancements**: Installation of a fifth Pall membrane rack to increase redundancy, replacement of aging pumps and ARVs, SCADA historian software upgrades, and improvements to the recycle basins and chemical storage areas.
- **Sitewide Improvements:** Implementation of badge access for enhanced security, and replacement of deteriorated doors, fencing and infrastructure components.
- **Storage and Distribution System Upgrades:** Recoating and fencing improvements at ESTs, SCADA and telemetry upgrades, and overflow system enhancements at clearwells.
- **Wastewater System Improvements:** Generator installation, structural and operational upgrades at Liberty Walk LS, sitewide and operational improvements to Woods LS, safety and odor control enhancements at both Highland Horizon I and Highland Horizon II LSs, and rehabilitation of critical manholes with venting and odor control to mitigate corrosion and extend service life.
- **Regulatory and Monitoring Recommendations:** Continued monitoring of PFAS and lithium levels, maintaining compliance with LCRR/LCRI, and tracking raw water quality parameters to optimize treatment performance.

The CIP also includes proactive measures such as re-lining the raw water reservoir, and replacing compressors and VFDs to ensure operational reliability. These investments are designed to extend asset life, improve system efficiency, and support regulatory compliance.

In conclusion, the recommended CIPs and operational strategies outlined in this W/WW MP will position BCMUD to meet current service demands and maintain a high standard of water quality and system reliability. Continued implementation of these projects, along with routine monitoring and maintenance, will ensure the long-term sustainability of BCMUD's water and wastewater infrastructure.

Table 9-1: Water and Wastewater Recommendations

Location	Recommendation
Water Treatment Facility	Continue to monitor raw alkalinity.
Outdoor Chemical Storage Tanks	Replace the manual site tube indicators that are sun damaged as an operational project.
Membrane Units	Continue with the current replacement schedule.
Elevated Storage Tanks	Upgrade the SCADA and telemetry systems.
Linear Assets – AC Water Mains	Continue to monitoring the levels of AC fibers in the water samples and take action on removal if they increase. Monitor for breaks and leaks due to age of pipe.
18-inch gravity main from manhole C234 to C230	Survey-verify that the gravity main segment does not have an adverse slope. Re-grade gravity main segment if slope is adverse.
12-inch gravity main from manhole M111 to V20	Survey-verify that the gravity main segment does not have an adverse slope. Re-grade gravity main segment if slope is adverse.
12-inch gravity main from S53 to S51	Survey-verify that the gravity main segment does not have an adverse slope. Re-grade gravity main segment if slope is adverse.
12-inch gravity main from manhole V22 to V23	Survey-verify that the gravity main segment does not have an adverse slope. Re-grade gravity main segment if slope is adverse.
12-inch gravity main from manhole G11 to H6	Monitor water levels during wet weather events due to hydraulic model indicating maximum d/D values greater than 0.75.
15-inch gravity main from manhole H49A to C239A	Monitor water levels during wet weather events due to hydraulic model indicating maximum d/D values greater than 0.75.

Location	Recommendation
10-inch gravity main from manhole S39 to S32	Monitor water levels during wet weather events due to hydraulic model indicating maximum d/D values greater than 0.75.
Highland Horizon LS I	Monitor pump run times. If two pumps are frequently operating at the same time, consider upsizing the Highland Horizon LS I FM due to high velocity concerns.
System-wide	Deploy temporary flow monitoring program, especially if Tier 2 level monitoring areas are indicating capacity concerns during wet weather events. Calibrate hydraulic model on flow monitoring data to refine capacity upgrade recommendations.
Critical Manhole Locations	Contact an odor control manufacturer to conduct a measure of sewer gases to properly design an odor control system.

Table 9-2: Water and Wastewater CIP

Number	Name	Location	Description	Project Horizon	Total Project Duration (months)	Total Cost^1
1	Emergency Interconnect	WTF	Install the Yard Piping and Valve Vault for the Emergency Interconnect	0-5 years	18	$ 501,291
					Emergency Interconnect CIP Total	$ 501,291
2	Raw Water Reservoir Geomembrane Replacement	Raw Water Reservoir	Replace geomembrane	0-5 years	12	$ 294,157
3	Backwash Recovery Basins Gravity Drainage Optimization	Backwash Recovery Basins	Install actuated valve	0-5 years	14	$ 2,169,024
			Install flow meter			
			Regrade the basin floor			
			Install Chain & Flight system			
4	SCADA System Historian Upgrade	SCADA	Upgrade historian reporting software	0-5 years	3	$ 139,040
5	Membrane System, Chemical Feed and Pressure Optimization	Membrane Feed Pumps	Replace ARVs	0-5 years	14	$ 161,808
		Membrane Units	Add hoses to ARV discharge			
		RW Chem Feed	Replace static mixers			
			Replace ARVs			
		Surface Raw Water Line	Replace pressure sustaining valve			
6	Clear Well #1 & #2 Upgrades	Clearwell #1	Add drainage out of overflow	0-5 years	8	$ 137,823
			Install sun cover over meter			
			Replace wire mesh at overflow			
			Add tank mixer			
			Add clearwell drain			

Number	Name	Location	Description	Project Horizon	Total Project Duration (months)	Total Cost[1]
		Clearwell #2	Add overflow/splash pad Add drainage out of overflow Install sun cover over meter Replace wire mesh at overflow Add tank mixer Add clearwell drain			
7	Outdoor Chemical Storage and Feed Room Upgrades	Outdoor Chemical Storage	Demolish the fluoride storage tank Replace sump pumps in LAS and ACH storage area Add flow switch to the emergency eyewash/shower Install a new eyewash/shower	0-5 years	10	$ 80,469
8	Process Building Door Replacement	Sodium Hypochlorite Storage/Feed Room Chemical Feed Room Electrical Room Process Building	Replace existing metal door with an FRP door	0-5 years	4	$ 28,677
9	Clean-in-Place System Upgrades	Clean-in-Place System	Replace CIP feed pump Replace filter drain pump	0-5 years	8	$ 52,140
10	High Service Pump Station Improvements	HSPS	Replace gate valves Replace ARVs Replace soft starts	0-5 years	10	$ 553,553
11	WTF Sitewide Improvements	Entire site	Badge entry across site	0-5 years	7	$ 86,900

Number	Name	Location	Description	Project Horizon	Total Project Duration (months)	Total Cost[1]
12	Priority Meter Replacements	WTF	Replacement of the 30" finished water meter	0-5 years	8	$ 204,389
			Replacement of the 24" membrane filtrate meter			
			Replacement of the 16" surface water meter			
			Replacement of the 10" groundwater meter			
		Raw Water Intake Facility	Replacement of the 24" raw water meter at intake			
13	Primary Raw Water Intake Facility Improvements	Raw Water Intake Facility	Replace ARVs at intake vault	0-5 years	14	$ 204,215
			Surge tank rehab at intake			
			Replace singer control valves			
14	WTF Water Quality Study	WTF	Water Quality Study	0-5 years	12	$ 150,000
15	Membrane Filtration System Expansion	Membrane Units	Install additional Pall Membrane unit	5-10 years	16	$ 901,683
			Install equipment support pads			
			Integration and control of the electrical room to the valve rack			
			Add piping, pipe supports, valves, and pipe accessories			
16	Process Pumps and Compressor Replacements	Membrane Feed Pumps	Replace pump (100HP)	5-10 years	9	$ 1,899,634
			Replace pump (75 HP)			
		Reverse Filtration Pumps	Replace pump (20 HP)			
			Replace flow meter			
		Compressor Room	Replace compressor			
		HSPS	Replace pump (200 HP)			
17	Electrical Room VFD Upgrades	Electrical Room	Replace MF Feed pump VFD	5-10 years	6	$ 556,160
			Replace reverse filtration pump VFD			

Number	Name	Location	Description	Project Horizon	Total Project Duration (months)	Total Cost[1]
18	Secondary Raw Water Intake Facility Improvements	Raw Water Intake	Recoating of pipes inside and outside of vault	5-10 years	9	$ 643,060
			Implement badge access and security improvements			
			Replace pump #1 with larger pump			
19	Secondary Meter Replacements	WTF	Replacement of the 12" N finished water meter	5-10 years	8	$ 117,141
			Replacement of the 24" S finished water meter			
			Replacement of the 24" blended water meter at WTP			
20	Water Treatment Facility Fence Replacement	WTF	Fence replacement – stone stack	5-10 years	10	$ 956,699
			Fence replacement – precast fencestone stacked panel wall			
					Water CIP Total	$ 9,336,573
21	Wellsite upgrades	Well 3	Recoat panel enclosure	0-5 years	6	$ 39,105
		Well Site	Demolish unused infrastructure			
22	Elevated Storage Tower Fence Replacements	North Elevated Storage Tank	Replace the fence – stone stack	5-10 years	4	$ 87,291
			Replace the fence gate			
		Neenah Elevated Storage Tank	Replace the fence – chain link			
23	Elevated Storage Tank Upgrades	North Elevated Storage Tank	Add tank mixer	5-10 years	12	$ 874,180
			Add overflow screen			
			Recoat pipework			
			Perform mildew power wash			
			Recoat the EST			
		Neenah Elevated Storage Tank	Add tank mixer			
			Add overflow screen			
			Recoat the EST			
					Distribution System CIP Total	$ 1,000,576

Number	Name	Location	Description	Project Horizon	Total Project Duration (months)	Total Cost^1
24	Liberty Walk Lift Station Upgrades	Liberty Walk LS	Install vent	0-5 years	26	$ 850,056
			Install a generator (permanent)			
			Install an odor control technology			
			Install a wet well ladder			
			Install access hatch over valves			
			Add pipe stanchion			
			Replace jib crane			
			Replace northeast fence perimeter			
			Rehabilitate wet well			
			Rehabilitate concrete retaining wall			
			Rehab electrical controls & canopy			
			Construct site improvements & driveway installation			
25	Highland Horizon I & II Lift Station Upgrades	Highland Horizon I LS	Replace pipe stanchion	0-5 years	8	$ 316,490
			Add fall protection at wet well access hatches			
			Install an odor control technology			
		Highland Horizon II LS	Add fall protection at wet well access hatches			
			Install an odor control technology			
26	Woods Lift Station Upgrades	Woods LS	Install a grinder pump	0-5 years	6	$ 225,940
			Demolish and fill dry pit			
			Update SCADA to allow for remote operations			
27	Manhole Rehabilitation and Ventilation	Critical Manholes	Rehabilitation by recoating	0-5 years	12	$ 246,796
			Install vents and odor control			
		MH C232C	Remove concrete cover to rehabilitate by recoating			

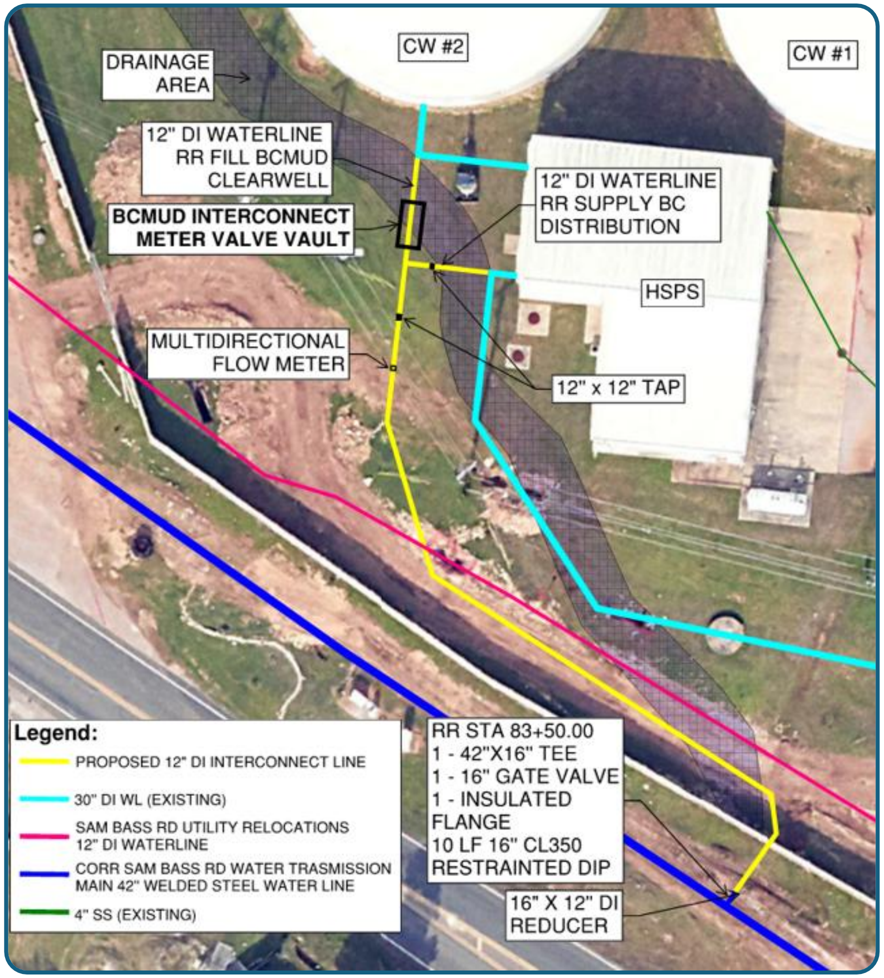
Number	Name	Location	Description	Project Horizon	Total Project Duration (months)	Total Cost[1]
28	Highland Horizon I & II Lift Station Future Upgrades	Highland Horizon I LS	Install bypass pumping line	5-10 years	8	$ 269,390
			Install grinder pump			
		Highland Horizon II LS	Install grinder pump			
					Wastewater CIP Total	$ 1,908,672
					Total	$12,747,111

[1]AACE Class IV cost estimates based on 2025 dollars.

Appendix A

Capital Improvement Plan
Exhibits

CIP 1: Emergency Interconnect Yard Piping and Valve Vault



Project Description

1. The yard piping required to serve BCMUD water from the CORR will be laid in the ground.
2. Once the yard piping is installed, the valve vault can be installed.

Special Considerations

This project is included in the 0-5 year CIP due to its medium priority status.

Potential Alternatives

The tap location on the CORR 42" Transmission main might be moved to optimize the length of yard piping and overall yard piping quantity and cost.

PROJECT IMPLEMENTATION

Engineering/Design **6** Months

\+

Bid/Construction **12** Months

Total Project Duration **18** Months

CIP	Location	Description	Quantity		Unit Cost	Total Cost
1	Emergency Interconnect Yard Piping	12" DI pipe (including fittings)	255	LF	$ 500	$127,500
		12" gate valve	1	EA	$ 9,500	$ 9,500
		12" flow meter (two-way)	1	EA	$15,000	$ 15,000
		12" swing check valve	1	EA	$ 9,500	$ 9,500
		2" gate valve	1	EA	$ 4,000	$ 4,000
		Connection to existing 30"	2	EA	$15,000	$ 30,000
		5' pre-cast manhole	1	EA	$12,000	$ 12,000
	Emergency Interconnect Valve Vault	Cla-Val Meter Vault	1	EA	$96,313	$ 96,313
					Subtotal	$303,813
					Contingency (40%)	$121,525
					Design (25%)	$ 75,953
					Opinion of Probable Construction Cost	$501,291

CIP 2: Raw Water Reservoir Geomembrane Replacement

Project Description

1. Replace the entire raw water reservoir geomembrane to prevent water loss from the existing cracks in the geomembrane. Titan Environmental USA recommends to replace the geomembrane based on results from the integrity, break elongation and stress crack resistance test.

Special Considerations

This project is included in the 0-5 year CIP due to its high priority status.

Potential Alternatives

Repair broken sections of the liner in patches.

PROJECT IMPLEMENTATION

Engineering/Design	3 Months
+	
Bid/Construction	9 Months
Total Project Duration	12 Months

CIP	Location	Project	Quantity		Unit Cost	Total Cost
2	Raw Water Reservoir	Replace geomembrane	1	EA	$ 169,250	$ 169,250
					Subtotal	$ 169,250
					Contingency (40%)	$ 67,700
					Design (15%)	$ 25,388
					Inspection Services (12%)	$ 8,124
					Mobilization (10%)	$ 23,695
					Opinion of Probable Construction Cost	$ 294,157

Brushy Creek Municipal Utility District

CIP 3: Backwash Recovery Basins Gravity Drainage Optimization

Project Description

1. Install an actuated valve and flow meter to improve efficiency and reduce manual intervention to enable gravity drainage of waste to the lift station.
2. Improve the solids drainage by regrading the basin floor to account for a more aggressive slope, as well as adding in a chain & flight system to mechanically move solids to a drain point.

Special Considerations

This project is included in the 0-5 year CIP due to its high priority status.

Potential Alternatives

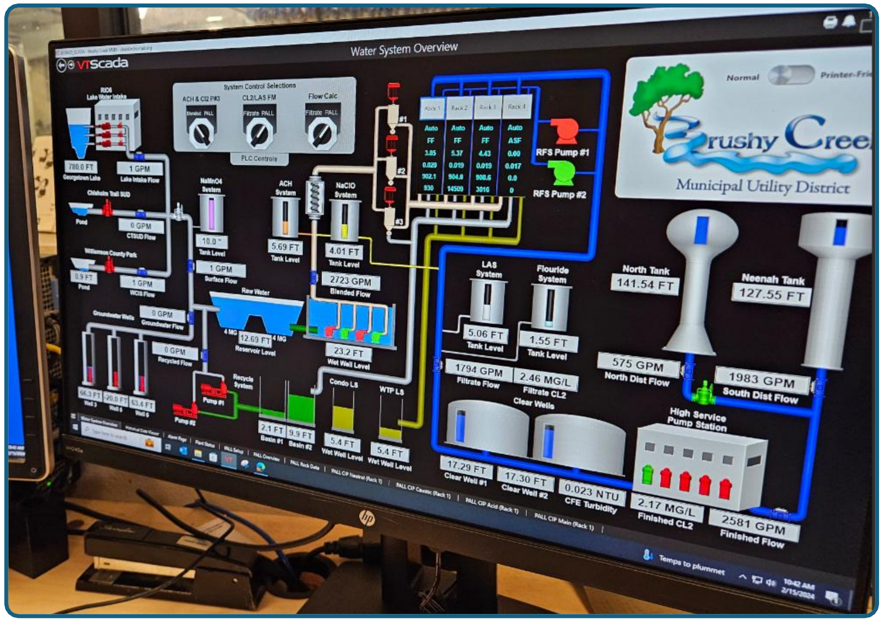
Implement a new circular clarifier system to optimize sludge withdrawal and scum removal through automated and continuous operation.

PROJECT IMPLEMENTATION

Engineering/Design	8 Months
+	
Bid/Construction	6 Months
Total Project Duration	14 Months

CIP	Location	Project	Quantity		Unit Cost	Total Cost
3	Backwash Recovery Basins	Install actuated valve	2	EA	$ 28,000	$ 56,000
		Install flow meter	1	EA	$ 12,000	$ 12,000
		Regrade the basin floor	2	EA	$ 350,000	$ 700,000
		Install Chain & Flight System	2	EA	$ 240,000	$ 480,000
					Subtotal	$ 1,248,000
					Contingency (40%)	$ 499,200
					Design (15%)	$ 187,200
					Inspection Services (12%)	$ 59,904
					Mobilization (10%)	$ 174,720
					Opinion of Probable Construction Cost	$ 2,169,024

CIP 4: SCADA System Historian Upgrade



Project Description

1. Upgrading the SCADA historian reporting software will provide more advanced features for real-time monitoring, historical data analysis, and automated reporting which will improve operational efficiency.

Special Considerations

This project is included in the 0-5 year CIP due to its medium priority status.

Potential Alternatives

N/A.

PROJECT IMPLEMENTATION

Engineering/Design — 0 Months

+

Bid/Construction — 3 Months

Total Project Duration — 3 Months

CIP	Location	Project	Quantity		Unit Cost	Total Cost
4	SCADA	Upgrade historian reporting software	1	EA	$ 80,000	$ 80,000
					Subtotal	$ 80,000
					Contingency (40%)	$ 32,000
					Design (15%)	$ 12,000
					Inspection Services (12%)	$ 3,840
					Mobilization (10%)	$ 11,200
					Opinion of Probable Construction Cost	$ 139,040

CIP 5: Membrane System, Chemical Feed, and Pressure Optimization

Project Description

1. Replace the ARVs at the membrane feed pumps to ensure proper air release and increase efficiency.
2. Add hoses to the ARV discharge at the membrane units to reduce safety risks and improve cleanliness.
3. Replace the static mixers at the raw water chemical feed pump to enhance chemical mixing.
4. Replace the ARVs at the raw water chemical feed pump to ensure proper air release and increase efficiency.
5. Replace the pressure sustaining valve on the surface raw line for enhanced flow regulation.

Special Considerations

This project is included in the 0-5 year CIP due to its medium priority status.

Potential Alternatives

N/A.

PROJECT IMPLEMENTATION

Engineering/Design	**6** Months
+	
Bid/Construction	**8** Months
Total Project Duration	**14** Months

CIP	Location	Project	Quantity		Unit Cost	Total Cost
5	Membrane Feed Pumps	Replace ARVs	4	EA	$ 2,500	$ 10,000
	Membrane Units	Add hoses to ARV discharge	1	EA	$ 5,000	$ 5,000
	RW Chem Feed	Replace static mixers	2	EA	$ 2,500	$ 5,000
		Replace ARVs	1	EA	$ 2,500	$ 2,500
	Surface Raw Water Line	Replace pressure sustaining valve	1	EA	$ 70,600	$ 70,600
					Subtotal	$ 93,100
					Contingency (40%)	$ 37,240
					Design (15%)	$ 13,965
					Inspection Services (12%)	$ 4,469
					Mobilization (10%)	$ 13,034
					Opinion of Probable Construction Cost	$ 161,808

Brushy Creek Municipal Utility District

CIP 6: Clearwell #1 & #2 Upgrades

Special Considerations

This project is included in the 0-5 year CIP due to its medium priority status.

Potential Alternatives

N/A.

PROJECT IMPLEMENTATION

Engineering/Design	3 Months
+	
Bid/Construction	5 Months
Total Project Duration	8 Months

CIP	Location	Description	Quantity		Unit Cost	Total Cost
6	Clearwell #1	Add drainage out of overflow	1	EA	$ 3,500	$ 3,500
		Install sun cover over meter	1	EA	$ 1,500	$ 1,500
		Replace wire mesh at overflow	1	EA	$ 150	$ 150
		Add tank mixer	1	EA	$ 30,000	$ 30,000
		Add clearwell drain	1	EA	$ 2,500	$ 2,500
	Clearwell #2	Add overflow/splash pad	1	EA	$ 2,500	$ 2,500
		Add drainage out of overflow	1	EA	$ 5,000	$ 5,000
		Install sun cover over meter	1	EA	$ 1,500	$ 1,500
		Replace wire mesh at overflow	1	EA	$ 150	$ 150
		Add tank mixer	1	EA	$ 30,000	$ 30,000
		Add clearwell drain	1	EA	$ 2,500	$ 2,500
					Subtotal	$ 79,300
					Contingency (40%)	$ 31,720
					Design (10%)	$ 11,895
					Easement Acquisition (10%)	$ 3,806
					Mobilization (5%)	$ 11,102
					Opinion of Probable Construction Cost	$137,823

Project Description

1. Add an overflow/splash pad to Clearwell #2 similar to the current design of Clearwell #1. Install a drainage system to route water away from future infrastructure (emergency interconnect) and the Clearwell's base.
2. Install a sun cover over both meters to protect the unit from sun damage.
3. Replace the wire mesh at the outlet of the tank to prevent animals and debris from entering the Clearwell.
4. Install a mixer at both clearwells to mix the finished water in the tanks.
5. Add a clearwell drain to allow BCMUD operators the ability to drain the clearwells as needed.

CIP 7: Outdoor Chemical Storage and Feed Room Upgrades

Project Description

1. Demolish the existing fluoride storage tank in the outdoor chemical storage facility to improve chemical containment.
2. Replace the three sump pumps in the LAS/ACH storage area to ensure proper chemical hazard upkeep.
3. Add a flow switch to the outdoor emergency eyewash and shower unit to enhance worker safety.
4. Install a new eyewash and shower unit that includes heat trace and insulation for proper operation during extreme weather.

Special Considerations

This project is included in the 0-5 year CIP due to its medium priority status.

Potential Alternatives

N/A.

PROJECT IMPLEMENTATION

Engineering/Design — 4 Months

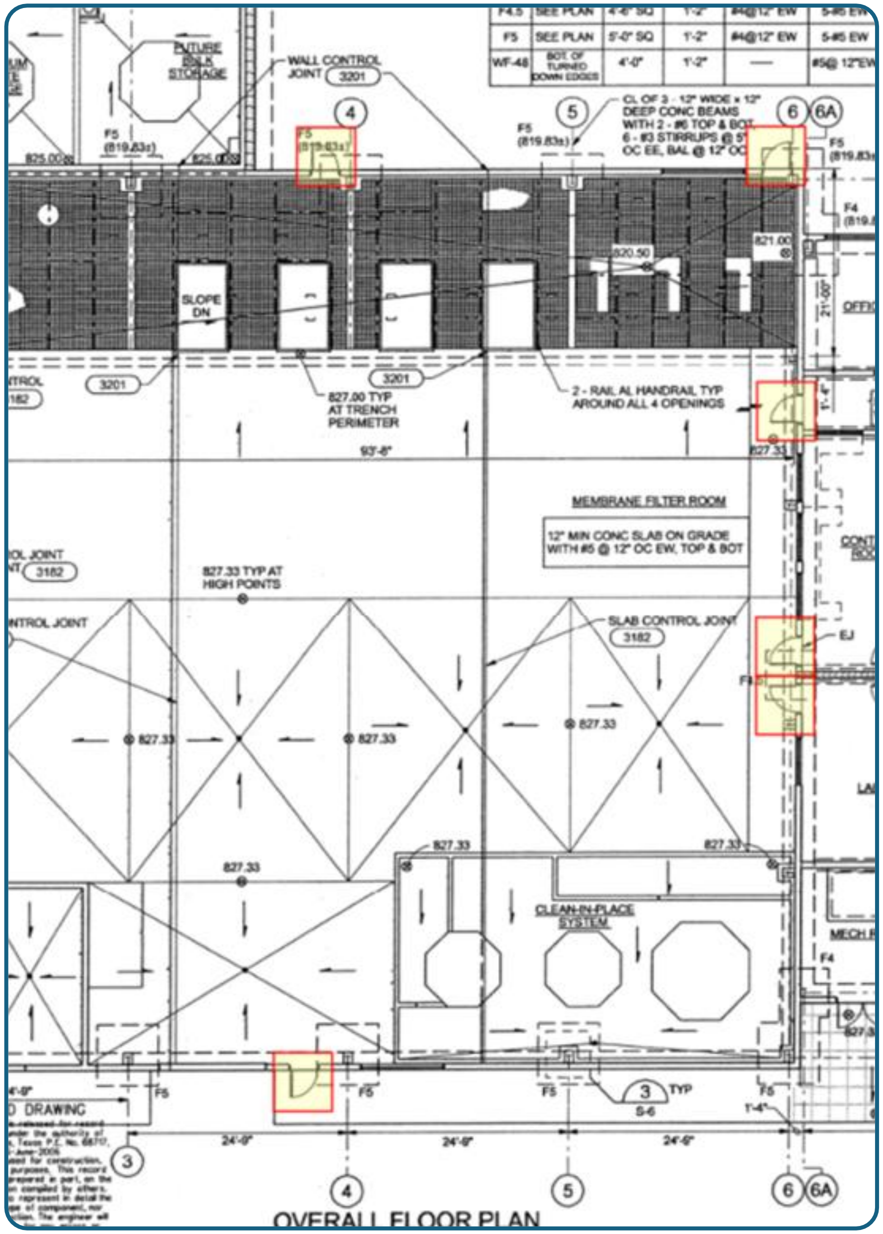
+

Bid/Construction — 6 Months

Total Project Duration — 10 Months

CIP	Location	Project	Quantity		Unit Cost	Total Cost
7	Outdoor Chemical Storage	Demolish the fluoride storage tank	1	EA	$ 5,000	$ 5,000
		Replace sump pumps in LAS and ACH storage area	3	EA	$ 12,100	$ 36,300
		Add flow switch to the emergency eyewash/shower	1	EA	$ 1,000	$ 1,000
		Install a new eyewash/shower	1	EA	$ 4,000	$ 4,000
					Subtotal	$ 46,300
					Contingency (40%)	$ 18,520
					Design (15%)	$ 6,945
					Inspection Services (12%)	$ 2,222
					Mobilization (10%)	$ 6,482
					Opinion of Probable Construction Cost	$ 80,469

CIP 8: Process Building Door Replacement



Project Description

1. Replace interior doors to the hypo storage area, chlorine storage/feed room, ACH/LAS feed room, and electrical room with FRP doors to prevent corrosion.

2. Replace the exterior door to the process room with FRP doors to improve condition and prevent corrosion.

Special Considerations

This project is included in the 0-5 year CIP due to its medium priority status.

Potential Alternatives

N/A.

PROJECT IMPLEMENTATION

Engineering/Design — 0 Months

\+

Bid/Construction — 4 Months

Total Project Duration — 4 Months

CIP	Location	Description	Quantity	Unit Cost	Total Cost
8	Sodium Hypochlorite Storage/Feed Room	Replace existing metal door with an FRP door	1 EA	$ 2,500	$ 2,500
	Chemical Feed Room		1 EA	$ 2,500	$ 2,500
	Electrical Room		1 EA	$ 2,500	$ 2,500
	Process Building		6 EA	$ 1,500	$ 9,000
				Subtotal	$ 16,500
				Contingency (40%)	$ 6,600
				Design (15%)	$ 2,475
				Inspection Services (12%)	$ 792
				Mobilization (10%)	$ 2,310
				Opinion of Probable Construction Cost	$ 28,677

CIP 9: Clean-in-Place System Upgrades

Project Description

1. Replace the CIP feed pump to enhance pumping and operations.
2. Replace the filter drain pump to enhance transferring waste to the neutralization system.

Special Considerations

This project is included in the 0-5 year CIP due to its medium priority status.

Potential Alternatives

N/A.

PROJECT IMPLEMENTATION

Engineering/Design	4 Months
+	
Bid/Construction	4 Months
Total Project Duration	8 Months

CIP	Location	Description	Quantity		Unit Cost	Total Cost
9	Clean-in-Place System	Replace CIP feed pump	1	EA	$15,000	$ 15,000
		Replace filter drain pump	1	EA	$15,000	$ 15,000
					Subtotal	$ 30,000
					Contingency (40%)	$ 12,000
					Design (15%)	$ 4,500
					Inspection Services (12%)	$ 1,440
					Mobilization (10%)	$ 4,200
					Opinion of Probable Construction Cost	$ 52,140

CIP 10: High Service Pump Station Improvements

Project Description

1. Replace the gate valves due to age and condition to optimize operations.
2. Replace the ARVs due to age and condition to optimize operations.
3. Replace the soft starts to reduce maintenance issues.

Special Considerations

This project is included in the 0-5 year CIP due to its medium priority status.

Potential Alternatives

N/A.

PROJECT IMPLEMENTATION

Engineering/Design	4 Months
+	
Bid/Construction	6 Months
Total Project Duration	10 Months

CIP	Location	Project	Quantity		Unit Cost	Total Cost
10	HSPS	Replace gate valves	10	EA	$ 7,500	$ 75,000
		Replace ARVs	10	EA	$ 2,500	$ 25,000
		Replace soft starts	5	EA	$ 43,700	$ 218,500
					Subtotal	$ 318,500
					Contingency (40%)	$ 127,400
					Design (15%)	$ 47,775
					Inspection Services (12%)	$ 15,288
					Mobilization (10%)	$ 44,590
					Opinion of Probable Construction Cost	$ 553,553

CIP 11: Water Treatment Facility Sitewide Improvements

Project Description

1. Install badge entry across the entire WTF to improve security and access control.

Special Considerations

This project is included in the 0-5 year CIP due to its medium priority status.

Potential Alternatives

N/A.

PROJECT IMPLEMENTATION

Engineering/Design	4 Months
+	
Bid/Construction	3 Months
Total Project Duration	7 Months

CIP	Location	Description	Quantity		Unit Cost	Total Cost
11	Entire site	Badge entry across site	1	LS	$ 50,000	$ 50,000
					Subtotal	$ 50,000
					Contingency (40%)	$ 20,000
					Design (10%)	$ 7,500
					Easement Acquisition (10%)	$ 2,400
					Mobilization (5%)	$ 7,000
					Opinion of Probable Construction Cost	$ 86,900

CIP 12: Priority Meter Replacements

Project Description

1. Replace the 30" finished water meter, 24" membrane filtrate meter, 16" surface water meter, and 10" groundwater meter due to aging infrastructure and the need for improved flow accuracy.
2. Replace the 24" raw water meter at intake due to inaccurate intake measurement and the need to optimize treatment processes.

Special Considerations

This project is included in the 0-5 year CIP due to its medium priority status.

Potential Alternatives

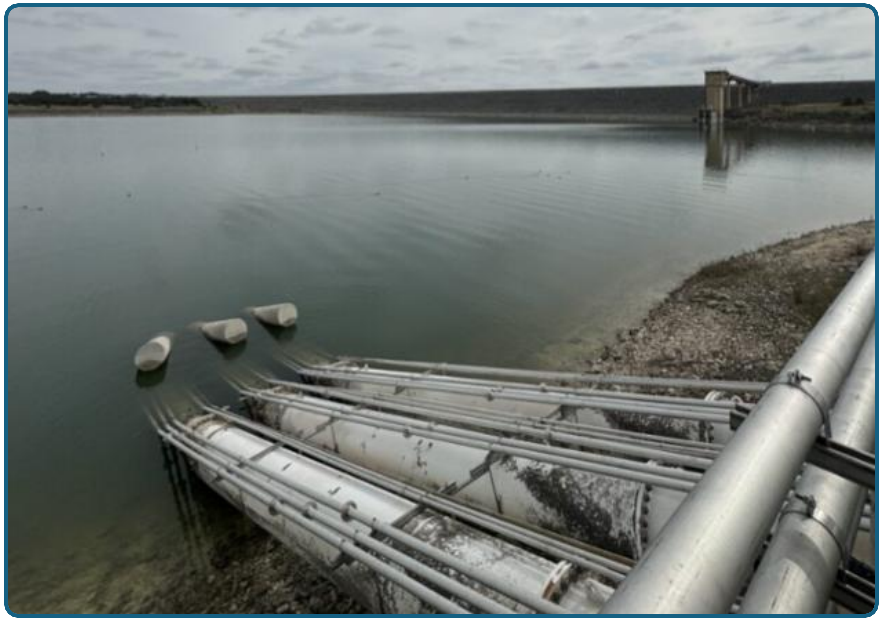
N/A.

PROJECT IMPLEMENTATION

Engineering/Design	2 Months
+	
Bid/Construction	6 Months
Total Project Duration	8 Months

CIP	Location	Project	Quantity		Unit Cost	Total Cost
12	WTF	Replacement of the 30" finished water meter	1	EA	$ 29,500	$ 29,500
		Replacement of the 24" membrane filtrate meter	1	EA	$ 25,600	$ 25,600
		Replacement of the 16" surface water meter	1	EA	$ 19,500	$ 19,500
		Replacement of the 10" groundwater meter	1	EA	$ 17,400	$ 17,400
	Raw Water Intake Facility	Replacement of the 24" raw water meter at intake	1	EA	$ 25,600	$ 25,600
					Subtotal	$ 117,600
					Contingency (40%)	$ 47,040
					Design (15%)	$ 17,640
					Inspection Services (12%)	$ 5,645
					Mobilization (10%)	$ 16,464
					Opinion of Probable Construction Cost	$ 204,389

CIP 13: Primary Raw Water Intake Facility Improvements



Project Description

1. Replace the ARVs vault due to aging components and reduced reliability in air release performance.
2. Rehabilitate the surge tank due to age.
3. Replace the Singer control valves due to improve flow control.

Special Considerations

This project is included in the 0-5 year CIP due to its medium priority status.

Potential Alternatives

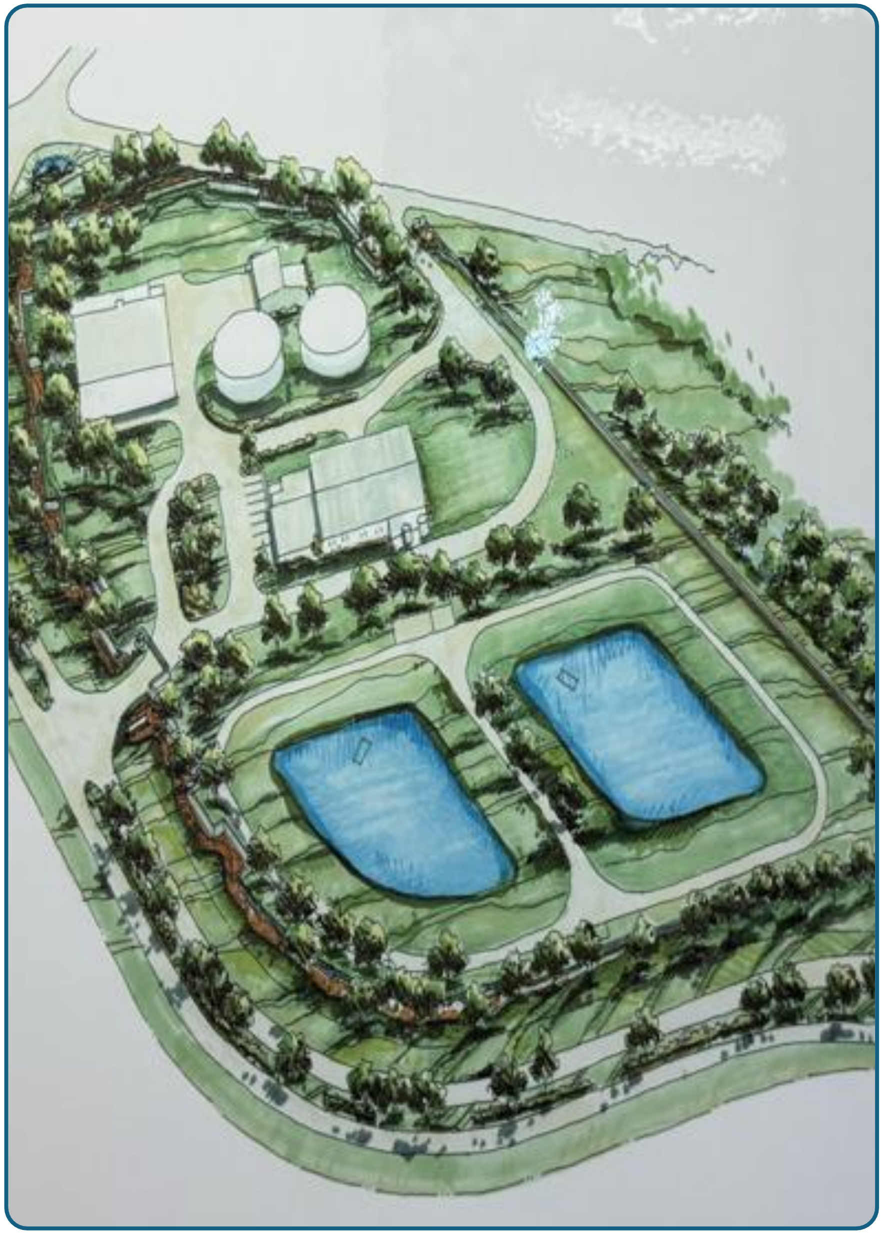
N/A.

PROJECT IMPLEMENTATION

Engineering/Design	6 Months
+	
Bid/Construction	8 Months
Total Project Duration	14 Months

CIP	Location	Project	Quantity		Unit Cost	Total Cost
13	Raw Water Intake Facility	Replace ARVs at intake vault	3	EA	$ 2,500	$ 7,500
		Surge tank rehab at intake	1	EA	$ 50,000	$ 50,000
		Replace singer control valves	3	EA	$ 20,000	$ 60,000
					Subtotal	$ 117,500
					Contingency (40%)	$ 47,000
					Design (15%)	$ 17,625
					Inspection Services (12%)	$ 5,640
					Mobilization (10%)	$ 16,450
					Opinion of Probable Construction Cost	$ 204,215

CIP 14: WTF Water Quality Study



Project Description

1. Conduct a water quality study to best address the elevated lithium levels, be proactive in PFAS removal, and combat DBPs from chloramines.

Special Considerations

This project is included in the 0-5 year CIP due to its medium priority status.

Potential Alternatives

N/A.

PROJECT IMPLEMENTATION

Engineering/Design	12 Months
+ Bid/Construction	0 Months
Total Project Duration	12 Months

CIP	Location	Description	Quantity		Unit Cost	Total Cost
14	WTF	Water Quality Study	1	EA	$150,000	$150,000
					Opinion of Probable Construction Cost	$150,000

CIP 15: Membrane Filtration System Expansion

Project Description

1. Install a fifth membrane unit in the designated space to enhance the performance of the water treatment facility and increase redundancy during the higher loading summer months.

Special Considerations

This project is included in the 5-10 year CIP due to its low priority status. TCEQ approval is needed to conduct this project.

Potential Alternatives

N/A.

PROJECT IMPLEMENTATION

Engineering/Design	8 Months
+	
Bid/Construction	8 Months
Total Project Duration	16 Months

CIP	Location	Description	Quantity		Unit Cost	Total Cost
15	Membrane Units	Install additional Pall Membrane unit	1	EA	$ 450,000	$ 450,000
		Install equipment support pads	1	LS	$ 6,825	$ 6,825
		Integration and control of the electrical room to the valve rack	1	LS	$ 11,700	$ 11,700
		Add piping, pipe supports, valves, and pipe accessories	1	LS	$ 50,280	$ 50,280
					Subtotal	$ 518,805
					Contingency (40%)	$ 207,522
					Design (15%)	$ 77,821
					Inspection Services (12%)	$ 24,903
					Mobilization (10%)	$ 72,633
					Opinion of Probable Construction Cost	$ 901,683

CIP 16: Process Pumps and Compressor Replacements

Project Description

1. Replace the three 2000 gpm, and the one 1300 gpm MF Feed pumps.
2. Replace the 20 HP reverse filtration pumps and the flow meter.
3. Replace the compressors in kind.
4. Replace the five 200 HP high service pumps.

Special Considerations

This project is included in the 5-10 year CIP due to its low priority status.

Potential Alternatives

N/A.

PROJECT IMPLEMENTATION

Engineering/Design 3 Months

+

Bid/Construction 6 Months

Total Project Duration 9 Months

CIP	Location	Project	Quantity		Unit Cost	Total Cost
16	Membrane Feed Pumps	Replace pump (100HP)	3	EA	$ 100,000	$ 300,000
		Replace pump (75 HP)	1	EA	$ 80,000	$ 80,000
	Reverse Filtration Pumps	Replace pump (20 HP)	2	EA	$ 20,000	$ 40,000
		Replace flow meter	1	EA	$ 3,000	$ 3,000
	Compressor Room	Replace compressor	2	EA	$ 85,000	$ 170,000
	HSPS	Replace pump (200 HP)	5	EA	$ 100,000	$ 500,000
					Subtotal	$ 1,093,000
					Contingency (40%)	$ 437,200
					Design (15%)	$ 163,950
					Inspection Services (12%)	$ 52,464
					Mobilization (10%)	$ 153,020
					Opinion of Probable Construction Cost	$ 1,899,634

CIP 17: Electrical Room VFD Upgrades

Project Description

1. Replace the four MF feed pump VFDs to prevent potential issues due to aging and deteriorating equipment.
2. Replace the two reverse filtration pump VFDs to prevent potential issues due to aging and deteriorating equipment.

Special Considerations

This project is included in the 5-10 year CIP due to its low priority status.

Potential Alternatives

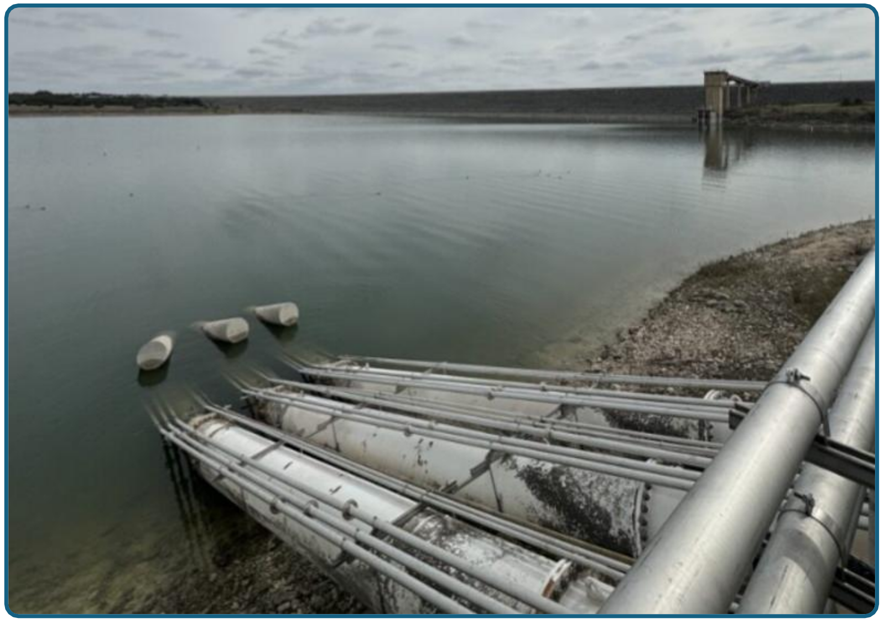
N/A.

PROJECT IMPLEMENTATION

Engineering/Design	2 Months
+	
Bid/Construction	4 Months
Total Project Duration	6 Months

CIP	Location	Project	Quantity		Unit Cost	Total Cost
17	Electrical Room	Replace MF Feed pump VFD	4	EA	$ 60,000	$ 240,000
		Replace reverse filtration pump VFD	2	EA	$ 40,000	$ 80,000
					Subtotal	**$ 320,000**
					Contingency (40%)	**$ 128,000**
					Design (15%)	**$ 48,000**
					Inspection Services (12%)	**$ 15,360**
					Mobilization (10%)	**$ 44,800**
					Opinion of Probable Construction Cost	**$ 556,160**

CIP 18: Secondary Raw Water Intake Facility Improvements



Project Description

1. Recoat all of the piping inside and outside of the vault to extend the service life and prevent corrosion.
2. Implement badge access at all facilities located at the intake to enhance security.
3. Replace pump #1 with a larger pump to increase performance and capacity.

Special Considerations

This project is included in the 5-10 year CIP due to its low priority status.

Potential Alternatives

N/A.

PROJECT IMPLEMENTATION

Engineering/Design	3 Months
+	
Bid/Construction	6 Months
Total Project Duration	9 Months

CIP	Location	Project	Quantity		Unit Cost	Total Cost
18	Raw Water Intake	Recoating of pipes inside and outside of vault	1	EA	$ 100,000	$ 100,000
		Implement badge access and security improvements	1	EA	$ 20,000	$ 20,000
		Replace pump #1 with larger pump	1	EA	$ 250,000	$ 250,000
					Subtotal	$ 370,000
					Contingency (40%)	$ 148,000
					Design (15%)	$ 55,500
					Inspection Services (12%)	$ 17,760
					Mobilization (10%)	$ 51,800
					Opinion of Probable Construction Cost	$ 643,060

CIP 19: Secondary Meter Replacements

Project Description

1. Replace the 12" north finished water meter, 24" south finished water meter, and the 24" blended water meter due to aging infrastructure and the need for improved flow accuracy.

Special Considerations

This project is included in the 5-10 year CIP due to its low priority status.

Potential Alternatives

N/A.

PROJECT IMPLEMENTATION

Engineering/Design	2 Months
+ Bid/Construction	6 Months
Total Project Duration	8 Months

CIP	Location	Project	Quantity		Unit Cost	Total Cost
19	WTF	Replacement of the 12" N finished water meter	1	EA	$ 16,200	$ 16,200
		Replacement of the 24" S finished water meter	1	EA	$ 25,600	$ 25,600
		Replacement of the 24" blended water meter	1	EA	$ 25,600	$ 25,600
					Subtotal	$ 67,400
					Contingency (40%)	$ 26,960
					Design (15%)	$ 10,110
					Inspection Services (12%)	$ 3,235
					Mobilization (10%)	$ 9,436
					Opinion of Probable Construction Cost	$ 117,141

Brushy Creek
Municipal Utility District

CIP 20: Water Treatment Facility Fence Replacement

Project Description

1. Replace 1,118 LF of Stone Stack fence on the northeastern portion of the WTF.

2. Replace 1,367 LF of fencestone precast fence panels on the southwestern portion of the WTF.

Special Considerations

This project is included in the 5-10 year CIP due to its low priority status.

Potential Alternatives

N/A.

PROJECT IMPLEMENTATION

Engineering/Design 4 Months
+
Bid/Construction 6 Months

Total Project Duration 10 Months

CIP	Location	Description	Quantity		Unit Cost	Total Cost
20	WTF	Fence replacement - stone stack	1,118	LF	$ 150	$167,700
		Fence replacement - precast fencestone stacked panel wall	1,367	LF	$ 280	$382,760
Subtotal						$550,460
Contingency (40%)						$220,184
Design (10%)						$ 82,569
Easement Acquisition (10%)						$ 26,422
Mobilization (5%)						$ 77,064
Opinion of Probable Construction Cost						$956,699

GARVER

CIP 21: Wellsite Upgrades

Project Description

1. Recoat the Well 3 panel enclosure for extension of service life.

2. Demolish the unused infrastructure at the wellsite and remove from the BCMUD system.

Special Considerations

This project is included in the 0-5 year CIP due to its medium priority status.

Potential Alternatives

N/A.

PROJECT IMPLEMENTATION

Engineering/Design	**4** Months
+	
Bid/Construction	**2** Months
Total Project Duration	**6** Months

CIP	Location	Description	Quantity		Unit Cost	Total Cost
21	**Well 3**	**Recoat panel enclosure**	**1**	**EA**	**$ 2,500**	**$ 2,500**
	Well Site	**Demolish unused infrastructure**	**1**	**EA**	**$20,000**	**$ 20,000**
					Subtotal	**$ 22,500**
					Contingency (40%)	**$ 9,000**
					Design (10%)	**$ 3,375**
					Easement Acquisition (10%)	**$ 1,080**
					Mobilization (5%)	**$ 3,150**
					Opinion of Probable Construction Cost	**$ 39,105**

CIP 22: Elevated Storage Tank Fence Replacements

Project Description

1. Along RM 1431, at the North EST, replace the fence in kind, and install a new fence gate.
2. At the Neenah EST, replace the southwest portion of the fence with chain link fence.

Special Considerations

This project is included in the 5-10 year CIP due to its low priority status.

Potential Alternatives

A different fence material can be considered.

PROJECT IMPLEMENTATION

Engineering/Design 0 Months

\+

Bid/Construction 4 Months

Total Project Duration 4 Months

CIP	Location	Description	Quantity		Unit Cost	Total Cost
22	North Elevated Storage Tank	Replace the fence - stone stack	165	LF	$ 150	$ 24,750
		Replace the fence gate	1	EA	$14,000	$ 14,000
	Neenah Elevated Storage Tank	Replace the fence - chain link	135	LF	$ 85	$ 11,475
					Subtotal	$ 50,225
					Contingency (40%)	$ 20,090
					Design (10%)	$ 7,534
					Easement Acquisition (10%)	$ 2,411
					Mobilization (5%)	$ 7,032
					Opinion of Probable Construction Cost	$ 87,291

CIP 23: Elevated Storage Tank Upgrades

Project Description

1. Add tank mixers at the North EST and Neenah EST.
2. Add an overflow screen at the North EST and Neenah EST.
3. Recoat all of the pipework at the ground level of the North EST.
4. Perform a mildew power wash of the North EST.
5. Perform a full EST recoat at the North EST and Neenah EST

Special Considerations

This project is included in the 5-10 year CIP due to its low priority status.

Potential Alternatives

N/A.

PROJECT IMPLEMENTATION

Engineering/Design 4 Months

+

Bid/Construction 8 Months

Total Project Duration 12 Months

CIP	Location	Description	Quantity		Unit Cost	Total Cost
23	North Elevated Storage Tank	Add tank mixer	1	EA	$ 30,000	$ 30,000
		Add overflow screen	1	EA	$ 150	$ 150
		Recoat pipework	1	EA	$ 2,000	$ 2,000
		Perform mildew power wash	1	EA	$ 20,000	$ 20,000
		Recoat the EST	18,840	SF	$ 12.56	$236,630
	Neenah Elevated Storage Tank	Add tank mixer	1	EA	$ 30,000	$ 30,000
		Add overflow screen	1	EA	$ 150	$ 150
		Recoat the EST	12,270	SF	$ 15	$184,050
					Subtotal	$502,980
					Contingency (40%)	$201,192
					Design (10%)	$ 75,447
					Easement Acquisition (10%)	$ 24,143
					Mobilization (5%)	$ 70,417
					Opinion of Probable Construction Cost	$874,180

Brushy Creek
Municipal Utility District

CIP 24: Liberty Walk Lift Station Upgrades

Project Description

1. Install a vent on the wet well.
2. Install a permanent generator on a concrete pad that is correctly sized for the LS.
3. Install an odor control system.
4. Install a wet well ladder.
5. Install access hatch over the valve vault.
6. Add a pipe stanchion to the bypass line.
7. Replace the jib crane.
8. Replace the northeast fence with chain link fence.
9. Rehabilitate the wet well.
10. Rehabilitate the concrete retaining wall at the wet well.
11. Rehabilitate the electrical controls and canopy.
12. Conduct site improvements and install a caliche driveway.

Special Considerations

This project is included in the 0-5 year CIP due to its high priority status. TCEQ approval is needed to conduct this project.

Potential Alternatives

N/A.

PROJECT IMPLEMENTATION

Engineering/Design	14 Months
+	
Bid/Construction	12 Months
Total Project Duration	26 Months

CIP	Location	Project	Quantity		Unit Cost	Total Cost
24	Liberty Walk LS	Install a vent	1	EA	$ 850	$ 850
		Install a generator (permanent)	1	EA	$ 150,000	$ 150,000
		Install an odor control technology	1	EA	$ 60,000	$ 60,000
		Install a wet well ladder	1	EA	$ 5,000	$ 5,000
		Install access hatch over valves	1	EA	$ 4,150	$ 4,150
		Add pipe stanchion	1	EA	$ 700	$ 700
		Replace jib crane	1	EA	$ 65,000	$ 65,000
		Replace northeast fence perimeter (chain link fence)	140	LF	$ 85	$ 11,900
		Rehabilitate wet well	1	EA	$ 100,000	$ 100,000
		Rehabilitate concrete retaining wall	1	EA	$ 1,500	$ 1,500
		Rehabilitate electrical controls & canopy	1	EA	$ 30,000	$ 30,000
		Construct site improvements & driveway installation	1	EA	$ 60,000	$ 60,000
					Subtotal	$ 489,100
					Contingency (40%)	$ 195,640
					Design (15%)	$ 73,365
					Inspection Services (12%)	$ 23,477
					Mobilization (10%)	$ 68,474
					Opinion of Probable Construction Cost	$ 850,056

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CIP 25: Highland Horizon I & II Lift Station Upgrades

Project Description

1. Replace pipe stanchions at the Highland Horizon I LS.
2. Install fall protection at the wet well access hatch at Highland Horizon I & II LS.
3. Install an odor control technology at the wet well access hatch at Highland Horizon I & II LS.

Special Considerations

This project is included in the 0-5 year CIP due to its high priority status.

Potential Alternatives

N/A.

PROJECT IMPLEMENTATION

Engineering/Design	4 Months
+ Bid/Construction	4 Months
Total Project Duration	8 Months

CIP	Location	Project	Quantity		Unit Cost	Total Cost
25	Highland Horizon I LS	Replace pipe stanchion	3	EA	$ 700	$ 2,100
		Add fall protection at wet well access hatches	1	EA	$ 30,000	$ 30,000
		Replacement of the 24" blended water meter at WTP	1	EA	$ 80,000	$ 80,000
	Highland Horizon II LS	Add fall protection at wet well access hatches	1	EA	$ 30,000	$ 30,000
		Install an odor control technology	1	EA	$ 40,000	$ 40,000
					Subtotal	$ 182,100
					Contingency (40%)	$ 72,840
					Design (15%)	$ 27,315
					Inspection Services (12%)	$ 8,741
					Mobilization (10%)	$ 25,494
					Opinion of Probable Construction Cost	$ 316,490

CIP 26: Woods Lift Station Upgrades

Project Description

1. Install a grinder pump at the LS.
2. Demolish and fill the dry pit.
3. Update SCADA to allow for remote operations.

Special Considerations

This project is included in the 0-5 year CIP due to its high priority status.

Potential Alternatives

N/A.

PROJECT IMPLEMENTATION

Engineering/Design: **3** Months

+

Bid/Construction: **3** Months

Total Project Duration: **6** Months

CIP	Location	Project	Quantity		Unit Cost	Total Cost
26	Woods LS	Install a grinder pump	1	EA	$ 60,000	$ 60,000
		Demolish and fill dry pit	1	LS	$ 30,000	$ 30,000
		Update SCADA to allow for remote operations	1	LS	$ 40,000	$ 40,000
					Subtotal	$ 130,000
					Contingency (40%)	$ 52,000
					Design (15%)	$ 19,500
					Inspection Services (12%)	$ 6,240
					Mobilization (10%)	$ 18,200
					Opinion of Probable Construction Cost	$ 225,940

CIP 27: Manhole Rehabilitation and Ventilation

Project Description

1. Rehabilitate the critical manholes by recoating.
2. Install a candy cane vent at select manhole locations to allow for sewer gas release.
3. The concrete cover over MH C232C needs to be removed, and the manhole needs to be rehabilitated by recoating.

Special Considerations

This project is included in the 0-5 year CIP due to its high priority status.

Potential Alternatives

Full replacement can be conducted instead of recoating.

PROJECT IMPLEMENTATION

Engineering/Design **3** Months

+

Bid/Construction **9** Months

Total Project Duration **12** Months

CIP	Location	Project	Quantity		Unit Cost	Total Cost
27	Critical Manholes	Rehabilitation by recoating	14	EA	$ 6,500	$ 91,000
		Install vents and odor control	5	EA	$ 7,200	$ 36,000
	MH C232C	Remove concrete cover to rehabilitate by recoating	1	EA	$ 15,000	$ 15,000
					Subtotal	$ 142,000
					Contingency (40%)	$ 56,800
					Design (15%)	$ 21,300
					Inspection Services (12%)	$ 6,816
					Mobilization (10%)	$ 19,880
					Opinion of Probable Construction Cost	$ 246,796

CIP 28: Highland Horizon I & II Lift Station Future Upgrades

Project Description

1. Installation of a bypass line at Highland Horizon I LS allows for continued wastewater flow during maintenance or emergency repairs, minimizing service disruptions and reducing the risk of overflows or backups.
2. Installing a grinder at Highland Horizon I & II will assist in breaking down solids overall reducing clogging.

Special Considerations

This project is included in the 5-10 year CIP due to its low priority status.

Potential Alternatives

Full replacement can be conducted instead of recoating.

PROJECT IMPLEMENTATION

Engineering/Design 3 Months

+

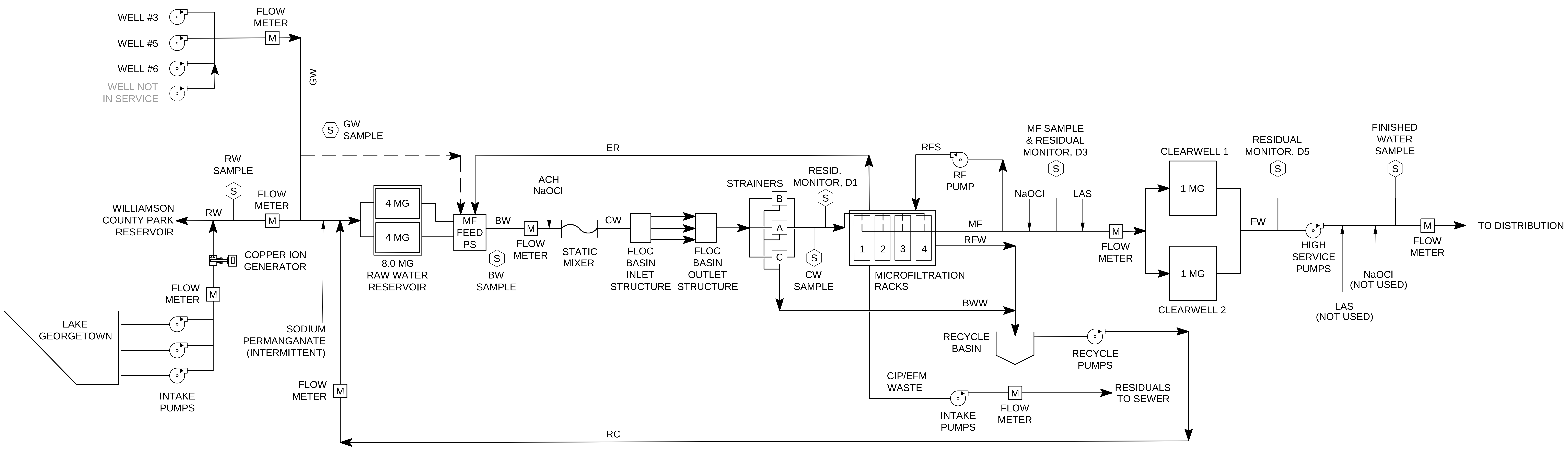
Bid/Construction 5 Months

Total Project Duration 8 Months

CIP	Location	Project	Quantity		Unit Cost	Total Cost
28	Highland Horizon I LS	Install bypass pumping line	1	EA	$ 35,000	$ 35,000
		Install grinder pump	1	EA	$ 60,000	$ 60,000
	Highland Horizon II LS	Install grinder pump	1	EA	$ 60,000	$ 60,000
					Subtotal	$ 155,000
					Contingency (40%)	$ 62,000
					Design (15%)	$ 23,250
					Inspection Services (12%)	$ 7,440
					Mobilization (10%)	$ 21,700
					Opinion of Probable Construction Cost	$ 269,390

Appendix B

WTF Process Flow Diagram



PROCESS WATER ABBREVIATIONS:

GW	GROUND WATER
RW	RAW WATER
BW	BLENDED WATER
CW	COAGULATED WATER
MF	MEMBRANE FILTRATE
RFS	REVERSE FLUSH SUPPLY
RFW	REVERSE FLUSH WASTE
BWW	BACKWASH WASTE
FW	FINISHED WATER
ER	EXCESS RECIRCULATION
RC	RECYCLED WATER

CHEMICAL ABBREVIATIONS:

ACH	ALUMINUM CHLOROHYDRATE
LAS	LIQUID AMMONIUM SULFATE
NaOCl	SODIUM HYPOCHLORITE
NaMnO4	SODIUM PERMANGANATE

SAMPLING POINTS:

S	PROCESS MONITORING AND DISINFECTION SAMPLING POINTS

File: C:\Work\01. Projects\Brushy Creek\BCMUD-PFS.dwg Last Save: 6/19/2025 10:26 AM Last saved by: REBoysen
Last plotted by: Boysen, Robert E. (Buddy) Plot Style: ---- Plot Scale: 1:2.5849 Plot Date: 6/19/2025 10:29 AM Plotter used: None

GARVER

REGISTRATION NO.
F-5713

PRELIMINARY DESIGN

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF INTERIM REVIEW UNDER THE AUTHORITY OF ROBERT BOYSEN, P.E., NO. 119621, ON 4/22/2025. IT IS NOT TO BE USED FOR CONSTRUCTION, OR PERMIT PURPOSES.

REV.	DATE	DESCRIPTION	BY

Brushy Creek
Municipal Utility District

BRUSHY CREEK MUD
ROUND ROCK, TX

BRUSHY CREEK WATER FACILITY

PROCESS FLOW
SCHEMATIC

JOB NO.: 2301754
DATE: APRIL 2025
DESIGNED BY: ARH
DRAWN BY: REB

BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DRAWING NUMBER
G-101

SHEET NUMBER

Appendix C

Raw Water Storage Pond Liner Evaluation

TRI ENVIRONMENTAL
TESTING, RESEARCH, CONSULTING AND FIELD SERVICES
Austin, TX - USA | CA - USA | SC - USA | Gold Coast - Australia | Suzhou - China | Sao Paulo, Brazil | Johannesburg - Africa

July 29, 2024
August 19, 2024 Update: Added Remaining Test

Mail To:	**Bill To:**
Titan Environmental **Shauna Carpenter**	**<= Same**

email: shauna.carpenter@titanenviro.com

Dear, Ms. Carpenter

Thank you for consulting TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report of the laboratory testing for the sample(s) listed below.

Project:	**Geomembrane Testing**
TRI Job Reference Number:	24-003108
Material(s) Tested:	Two, Geomembrane(s)
Test(s) Requested:	Tensile Properties (ASTM D6693) SP-NCTL Stress Crack Resistance (ASTM D5397, App) FTIR

If you have any questions or require any additional information, please call us at 1-800-880-8378

Sincerely,

Mansukh Patel
Laboratory Manager
Geosynthetic Services Division

GEOMEMBRANE TEST RESULTS
TRI Client: Titan Environmental
Project: Geomembrane Testing

Material: Geomembrane
Sample Identification:M-2122
TRI Log #: 24-003108

PARAMETER	TEST REPLICATE NUMBER 1	2	3	4	5	MEAN	STD. DEV.
Tensile Properties (ASTM D6693, 2 ipm strain rate)							
MD Yield Strength (ppi)	174	183	184	174	175	**178**	5
TD Yield Strength (ppi)	187	182	182	179	182	**182**	3
MD Break Strength (ppi)	136	204	152	132	137	**152**	30
TD Break Strength (ppi)	139	118	113	122	140	**126**	12
MD Yield Elongation (%)	16	19	18	20	18	**18**	1
TD Yield Elongation (%)	16	16	15	16	16	**16**	0
MD Break Elongation (%)	80	537	338	80	108	**229**	204
TD Break Elongation (%)	111	69	149	62	179	**114**	50

SP-NCTL Stress Crack Resistance (ASTM D5397, App)
Material Type: Plaque from TX GM

SURFACTANT: CO-630
EXPOSURE PERIOD: **500 Hours**
DATE TEST STARTED: **26-Jul-24**
TEST TEMPERATURE: 50C

Yield stress: **2618** (psi)
x 30% 785 (x 0.30)
x hinge thickness (in) **0.061** (80% of thickness)
x specimen width 0.124 (0.124")
Load 5.92 (lbs)

Mechanical Advantage 5
Lever Weight 0.33 (lbs)
Grip Weight 0.09 (lbs)

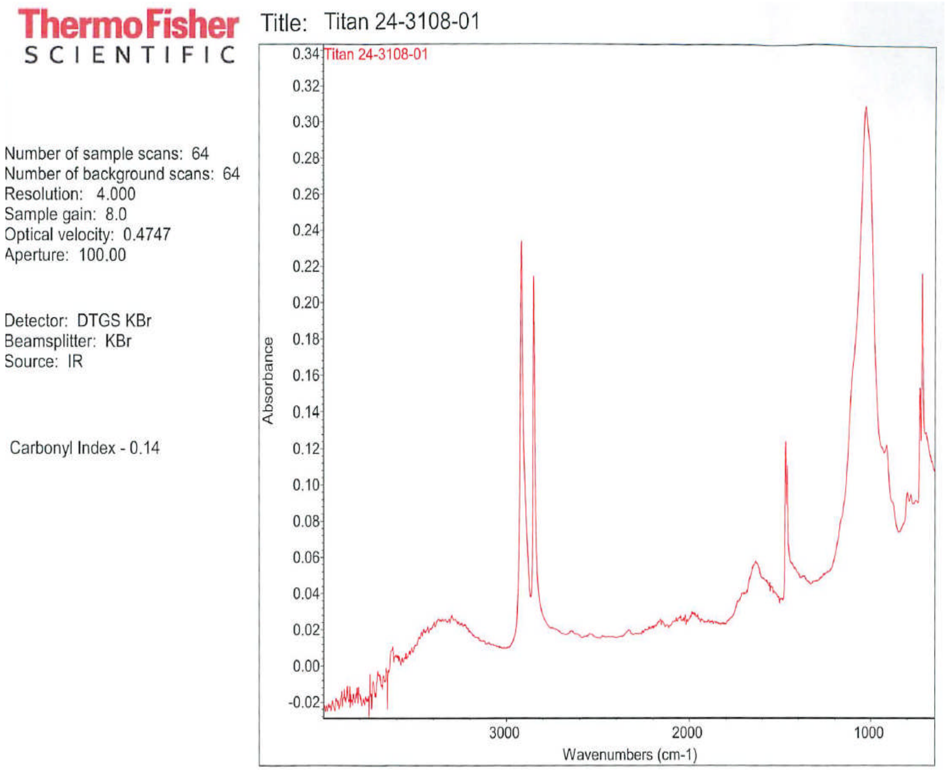
Applied load = (Load - Lever Weight + Grip Weight)/Mechanical Advantage = 1.14 lbs = 516 grams

Replicate No.:	1	2	3	4	5	MEAN
No. Hours to Failure:	>500	>500	>500	>500	>500	>500

GEOMEMBRANE TEST RESULTS
TRI Client: Titan Environmental
Project: Geomembrane Testing

Material: Geomembrane
Sample Identification:M-2122
TRI Log #: 24-003108

PARAMETER	TEST REPLICATE NUMBER 1	2	3	4	5	MEAN	STD. DEV.
FTIR							



ThermoFisher SCIENTIFIC

Title: Titan 24-3108-01

Number of sample scans: 64
Number of background scans: 64
Resolution: 4.000
Sample gain: 8.0
Optical velocity: 0.4747
Aperture: 100.00

Detector: DTGS KBr
Beamsplitter: KBr
Source: IR

Carbonyl Index - 0.14

GEOMEMBRANE TEST RESULTS
TRI Client: Titan Environmental
Project: Geomembrane Testing

Material: Geomembrane
Sample Identification: NL
TRI Log #: 24-003108

PARAMETER	TEST REPLICATE NUMBER 1	2	3	4	5	MEAN	STD. DEV.
Tensile Properties (ASTM D6693, 2 ipm strain rate)							
MD Yield Strength (ppi)	172	180	178	176	179	**177**	3
TD Yield Strength (ppi)	195	191	190	196	189	**192**	3
MD Break Strength (ppi)	138	140	138	166	143	**145**	12
TD Break Strength (ppi)	126	133	123	134	136	**130**	6
MD Yield Elongation (%)	16	18	18	20	21	**19**	2
TD Yield Elongation (%)	15	16	15	19	17	**16**	2
MD Break Elongation (%)	110	88	138	408	197	**188**	129
TD Break Elongation (%)	46	63	46	127	58	**68**	34

SP-NCTL Stress Crack Resistance (ASTM D5397, App)
Material Type:

SURFACTANT: CO-630
EXPOSURE PERIOD: **500 Hours**
DATE TEST STARTED: **26-Jul-24**
TEST TEMPERATURE: 50C

Yield stress: **2636** (psi)
x 30% 791 (x 0.30)
x hinge thickness (in) **0.066** (80% of thickness)
x specimen width 0.124 (0.124")
Load 6.51 (lbs)

Mechanical Advantage 5
Lever Weight 0.33 (lbs)
Grip Weight 0.09 (lbs)

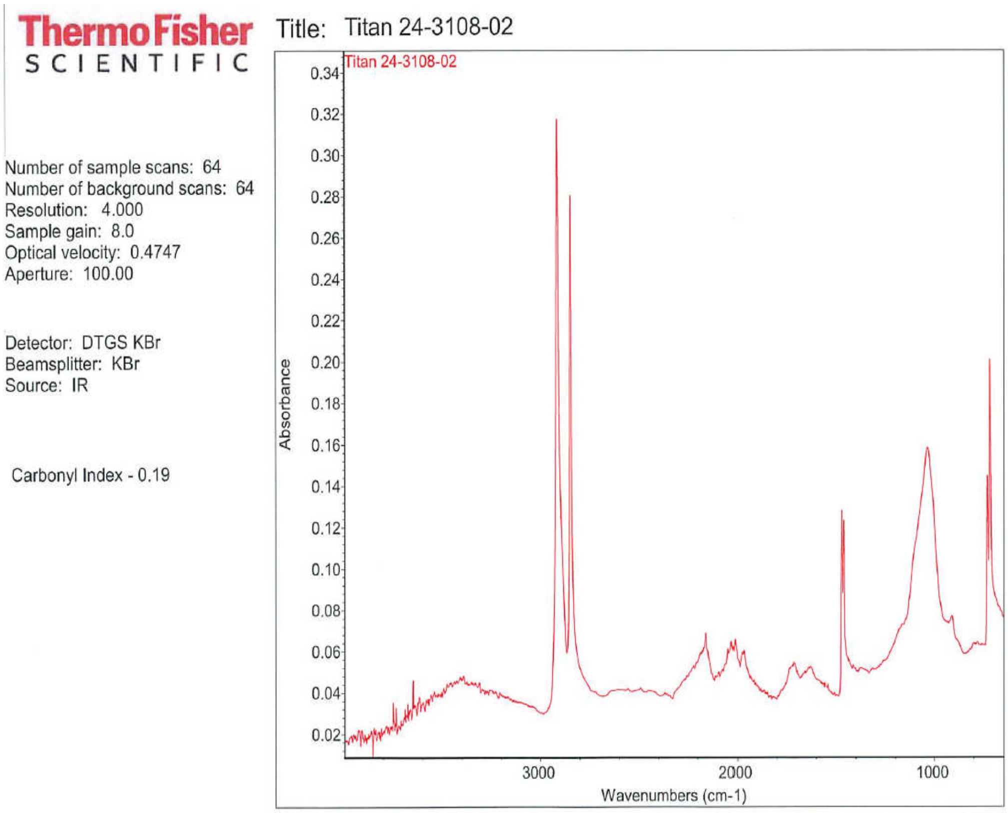
Applied load = (Load - Lever Weight + Grip Weight)/Mechanical Advantage = 1.25 lbs = 569 grams

Replicate No.:	1	2	3	4	5	MEAN
No. Hours to Failure:	>500	>500	>500	>500	>500	>500

GEOMEMBRANE TEST RESULTS
TRI Client: Titan Environmental
Project: Geomembrane Testing

Material: Geomembrane
Sample Identification: NL
TRI Log #: 24-003108

PARAMETER	TEST REPLICATE NUMBER					MEAN	STD. DEV.
	1	2	3	4	5		
FTIR							



Title: Titan 24-3108-02

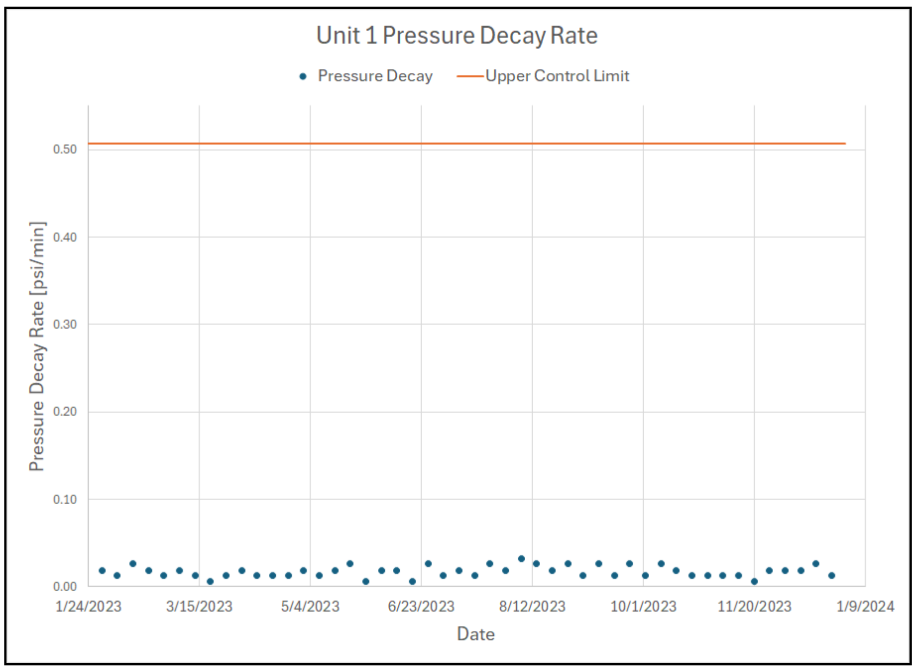
Number of sample scans: 64
Number of background scans: 64
Resolution: 4.000
Sample gain: 8.0
Optical velocity: 0.4747
Aperture: 100.00

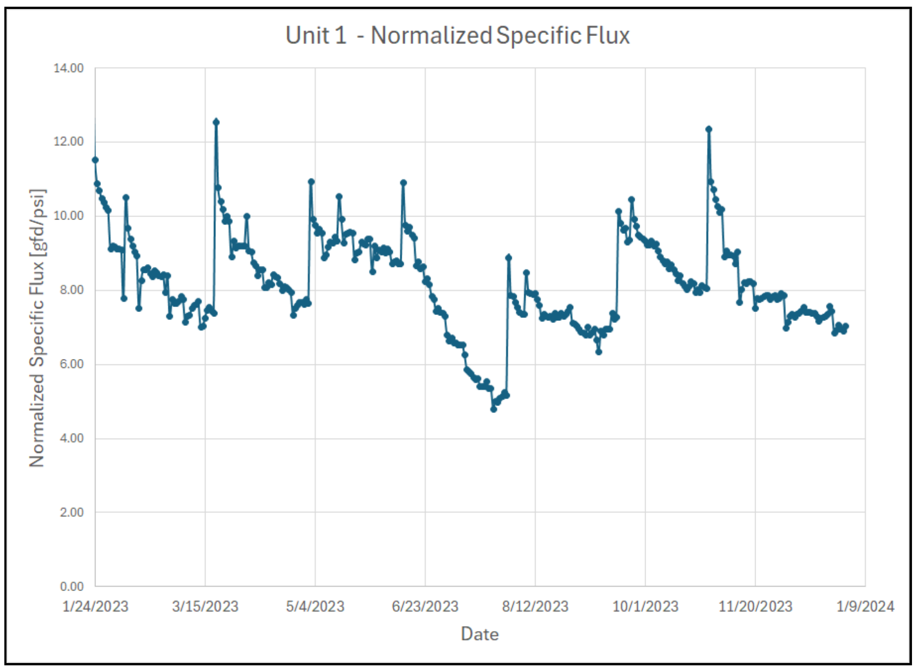
Detector: DTGS KBr
Beamsplitter: KBr
Source: IR

Carbonyl Index - 0.19

Appendix D

Pall Membrane Analysis


Unit 1 Pressure Decay Rate
● Pressure Decay
— Upper Control Limit
Pressure Decay Rate [psi/min]
0.50
0.40
0.30
0.20
0.10
0.00
1/24/2023
3/15/2023
5/4/2023
6/23/2023
8/12/2023
10/1/2023
11/20/2023
1/9/2024
Date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6.00
4.00
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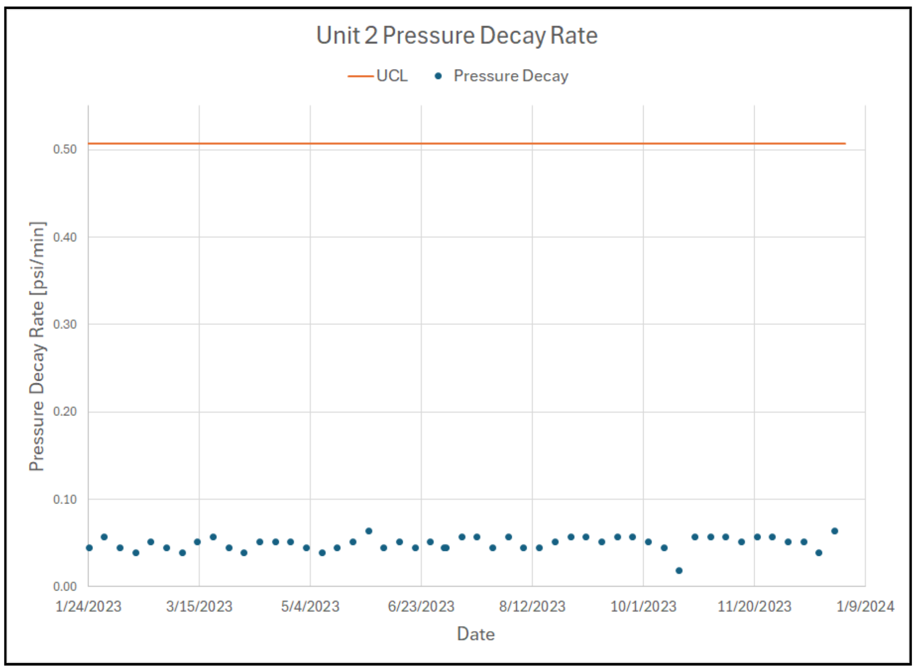
3/15/2023
5/4/2023
6/23/2023
8/12/2023
10/1/2023
11/20/2023
1/9/2024
Date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— UCL
● Pressure Decay
Pressure Decay Rate [psi/min]
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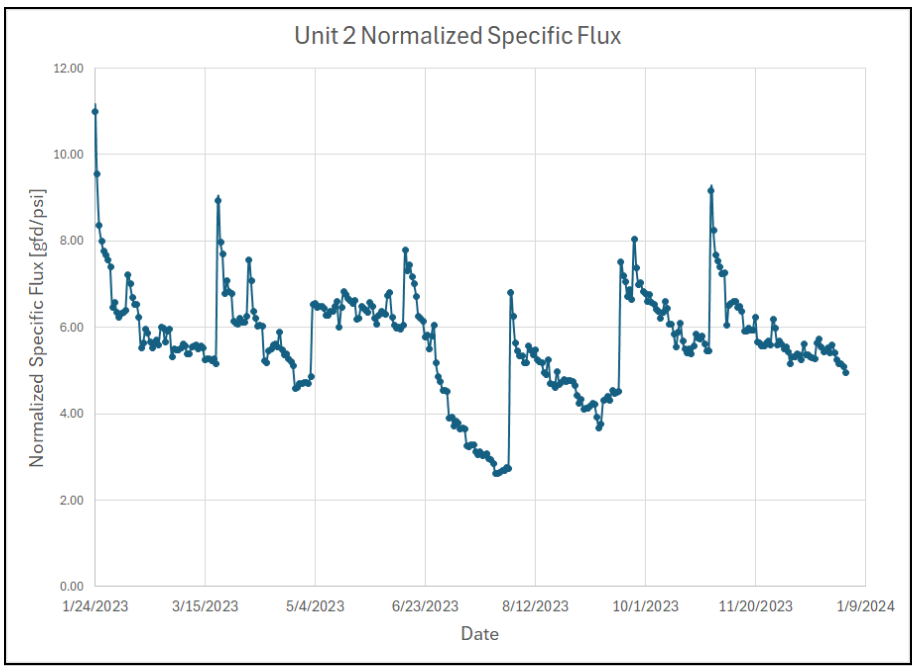
0.40
0.30
0.20
0.10
0.00
1/24/2023
3/15/2023
5/4/2023
6/23/2023
8/12/2023
10/1/2023
11/20/2023
1/9/2024
Date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Normalized Specific Flux [gfd/psi]
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6.00
4.00
2.00
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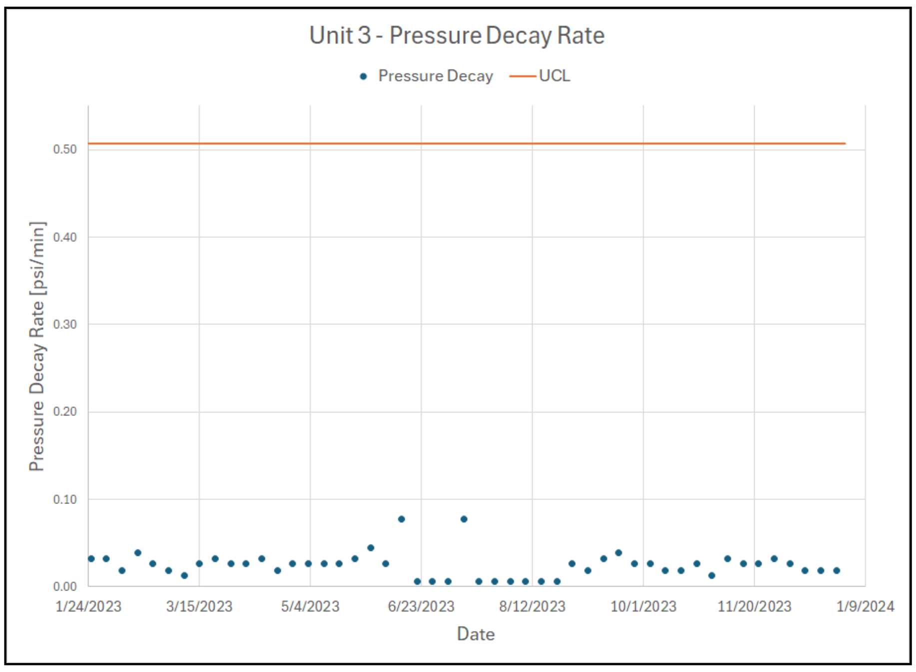
11/20/2023
1/9/2024
Date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— UCL
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3/15/2023
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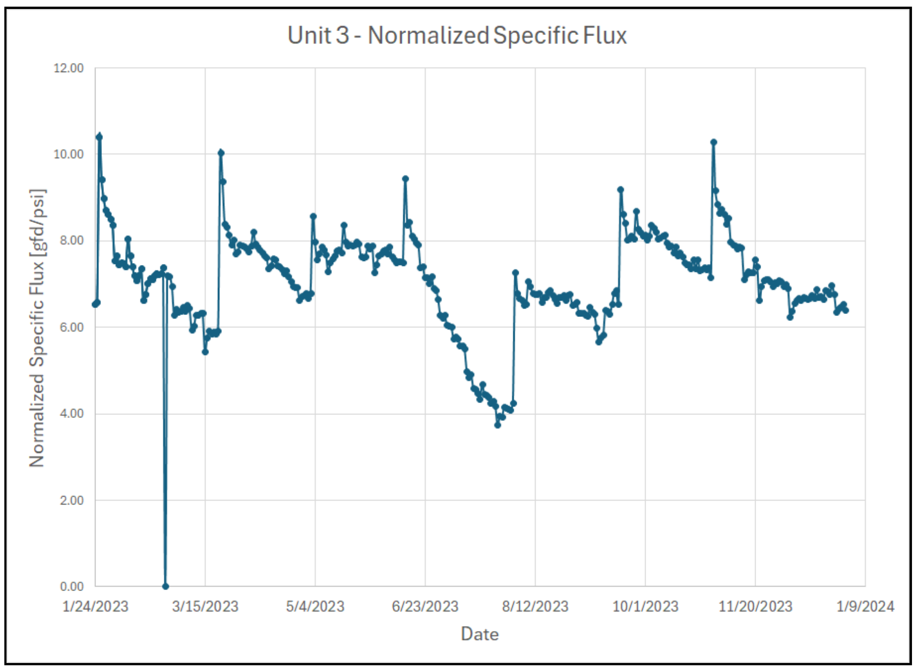
10/1/2023
11/20/2023
1/9/2024
Date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Normalized Specific Flux [gfd/psi]
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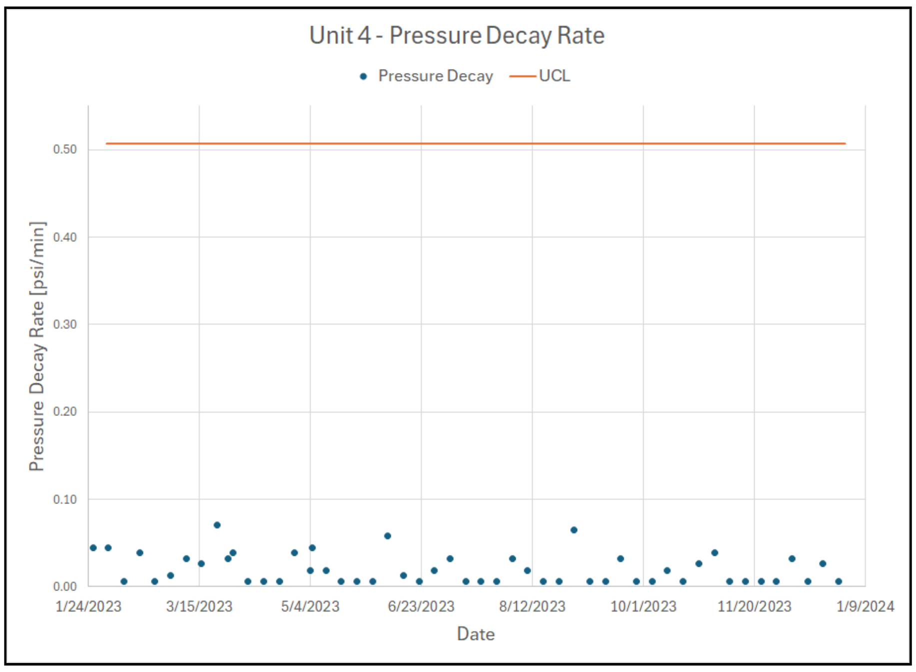
11/20/2023
1/9/2024
Date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— UCL
Pressure Decay Rate [psi/min]
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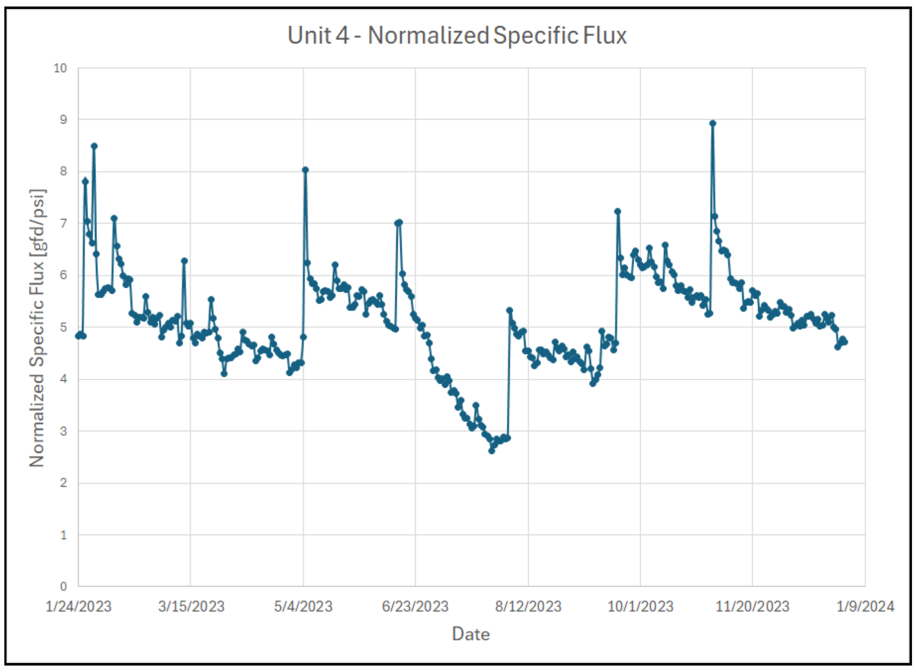
0.00
1/24/2023
3/15/2023
5/4/2023
6/23/2023
8/12/2023
10/1/2023
11/20/2023
1/9/2024
Date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3/15/2023
5/4/2023
6/23/2023
8/12/2023
10/1/2023
11/20/2023
1/9/2024
Date

Appendix E

PFAS Assessment Calculations

PFAS Regulations Review

Compound	Final MCLG	Final MCL (enforceable levels)
PFOA	Zero	4.0 parts per trillion (ppt) (also expressed as ng/L)
PFOS	Zero	4.0 ppt
PFHxS	10 ppt	10 ppt
PFNA	10 ppt	10 ppt
HFPO-DA (commonly known and GenX Chemicals)	10 ppt	10 ppt
Mixtures Containing two or more of PFHxS, PFNA, HFPO-DA, and PFBS	1 (unitless) Hazard Index	1 (unitless) Hazard Index

PFAS UCMR5 Combined Results

Compound	Workorder	Q231188		Q2326263		Q2349534		Q2401128		Average	MCL	MCL Violation (MCL-Average)
	Date/Time Sampled	04/06/2023 11:30	05/18/2023 09:15	7/17/2023 7:47	07/24/2023 08:05	10/17/2023 7:31	12/7/2023 7:35	01/11/2024 07:48	01/26/2024 07:53			
	Units	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt
PFOA	PFOA (CAS 335-67-1)	3.97	3.71	3.83	3.75	4.05	3.8	3.76	3.74	3.82625	4.0	0.17375
PFOS	PFOS (CAS 1763-23-1)	3.97	3.71	3.83	3.75	4.05	3.8	3.76	3.74	3.82625	4.0	0.17375
HFPO-DA (Gen X)	HFPO-DA (CAS 13252-13-6)	4.96	4.63	4.79	4.68	5.07	4.74	4.7	4.68	4.78125	10.0	5.21875
PFHxS	PFHxS (CAS 355-46-4)	3.69	2.78	2.87	2.81	3.38	2.85	3.64	2.81	3.10375	10.0	6.89625
PFNA	PFNA (CAS 375-95-1)	3.97	3.71	3.83	3.75	4.05	3.8	3.76	3.74	3.82625	10.0	6.17375

Hazard Index Calculation

$$\text{Hazard Index (1 unitless)} = \left(\frac{[\text{HFPO}-\text{DA}_{\text{ppt}}]}{[10\ \text{ppt}]}\right) + \left(\frac{[\text{PFBS}_{\text{ppt}}]}{[2000\ \text{ppt}]}\right) + \left(\frac{[\text{PFNA}_{\text{ppt}}]}{[10\ \text{ppt}]}\right) + \left(\frac{[\text{PFHxS}_{\text{ppt}}]}{[10\ \text{ppt}]}\right)$$

Hazard Index

Compound	Workorder	Q231188		Q2326263		Q2349534		Q2401128		Average
	Date/Time Sampled	04/06/2023 11:30	05/18/2023 09:15	7/17/2023 7:47	07/24/2023 08:05	10/17/2023 7:31	12/7/2023 7:35	01/11/2024 07:48	01/26/2024 07:53	
	Units	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt
PFBS	PFBS (CAS 375-73-5)	3.95	2.78	3.9	2.81	5.01	2.85	5.53	2.81	3.705
HFPO-DA (Gen X)	HFPO-DA (CAS 13252-13-6)	4.96	4.63	4.79	4.68	5.07	4.74	4.7	4.68	4.78125
PFHxS	PFHxS (CAS 355-46-4)	3.69	2.78	2.87	2.81	3.38	2.85	3.64	2.81	3.10375
PFNA	PFNA (CAS 375-95-1)	3.97	3.71	3.83	3.75	4.05	3.8	3.76	3.74	3.82625
Calculation										
	Hazard Index Denominators (HID) [ppt]	=HID*Concentration								Average
HFPO-DA (Gen X)	10.00	0.496	0.463	0.479	0.468	0.507	0.474	0.470	0.468	0.48
PFBS	2000.00	0.002	0.001	0.002	0.001	0.003	0.001	0.003	0.001	0.001853
PFHxS	10.00	0.369	0.278	0.287	0.281	0.338	0.285	0.364	0.281	0.31
PFNA	10.00	0.397	0.371	0.383	0.375	0.405	0.380	0.376	0.374	0.38
Hazard Index Calculation (unitless)		1	1	1	1	1	1	1	1	1

Appendix F

Asbestos Cement Sampling Results

EMSL Analytical, Inc.
5950 Fairbanks N. Houston Rd. Houston, TX 77040
Phone/Fax: (713) 686-3635 / (713) 686-3645
http://www.EMSL.com / houstonlab@emsl.com

EMSL Order ID: 152500330
Customer ID: BCMU42
Customer PO: 525-John
Project ID:

Attn: John Smith
Brushy Creek MUD
16318 Great Oaks Dr.
Round Rock, TX 78681

Phone: (512) 255-7871
Fax:
Received: 01/23/2025
Analyzed: 01/28/2025

Proj: Asbestos Q1-2025

Test Report: Determination of Asbestos Structures >10µm in Drinking Water Performed by the 100.2 Method (EPA 600/R-94/134)

					ASBESTOS				
Sample ID Client / EMSL	***Sample Filtration Date/Time***	***Original Sample Vol. Filtered (ml)***	***Effective Filter Area (mm^2)***	***Area Analyzed (mm^2)***	*Asbestos Types*	*Fibers Detected*	*Analytical Sensitivity*	*Concentration*	*Confidence Limits*
							MFL (million fibers per liter)		
1 152500330-0001	1/24/2025 05:20 PM	50	1282	0.1386	None Detected	ND	0.18	<0.18	0.00 - 0.68

Collection Date/Time: *01/23/2025 07:40 AM*

Sample temperature at receipt: 20.8° C

Analyst(s)	
Michelle Leggett	(1)

Michelle Leggett

Michelle Leggett, Laboratory Manager
or Other Approved Signatory

Any questions please contact Michelle Leggett.

Initial report from: 01/28/2025 13:54:48

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. Estimation of uncertainty is available on request. Sample collection performed by the client. Pre-cleaned sample containers are available for purchase from EMSL. Note if sample containers are provided by the client, acceptable bottle blank level is defined as ≤0.01MFL for >=10um fibers. ND=None Detected. No Fibers Detected: the value will be reported as less than 369% of the concentration equivalent to one fiber. 1 to 4 fibers: The result will be reported as less than the corresponding upper 95% confidence limit (Poisson),5 to 30 fibers: Mean and 95% confidence intervals will be reported on the basis of the Poisson assumption. When more than 30 fibers are counted, both the Gaussian 95% confidence interval and the Poisson 95% confidence interval will be calculated. The large of these two intervals will be selected for data reporting. When the Gaussian 95% confidence interval is selected for data reporting, the Poisson will also be noted.

Samples analyzed by EMSL Analytical, Inc. Houston, TX Accredited by Texas Commision on Env. Quality

Appendix G

Emergency Interconnect Technical Memorandum

Emergency Interconnect Technical Memorandum

Brushy Creek MUD
Asset Renewal Master Plan

PREPARED FOR

Brushy Creek MUD

October 2024

Brushy Creek MUD Asset Renewal Master Plan

Emergency Interconnect Technical Memorandum

Prepared by:

3755 S Capital of Texas Hwy, Suite 325
Austin, TX 78704

October 2024

Garver Project No. 2301754

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Appendix A	Valve Vault Exhibits
Appendix B	Valve Vault Model E-Sheets
Appendix C	CIP Exhibits

List of Acronyms

Acronym	Definition
BCMUD	Brushy Creek Municipal Utility District
CORR	City of Round Rock
CIP	Capital Improvement Projects
DI	ductile iron
FW	finished water
HSPS	high service pump station
MGD	million gallons per day
PWS	public water system
WTF	water treatment facility

1.0 Introduction

This technical memorandum evaluates the feasibility of an emergency interconnect at the Brushy Creek Municipal Utility District (BCMUD) water treatment facility (WTF) with a 42" City of Round Rock (CORR) water line, including the development of Capital Improvement Projects (CIP) to support an interconnection, costs, implementation schedule, regulatory coordination and approval requirements, and next steps for completion.

BCMUD prioritizes water system resiliency and providing continuous water service to its residents and water customers, even during emergency situations, when possible. BCMUD and CORR have three (3) existing emergency water system interconnections that have remained in place since BCMUD previously purchased finished water from CORR prior to securing source water from the Brazos River Authority and the construction of the BCMUD WTF. In addition, BCMUD has two (2) emergency interconnections with Fern Bluff MUD, which sources finished water (FW) from the CORR for its system. In the past 24 months, BCMUD has provided water to Fern Bluff MUD and CORR on four occasions through the existing interconnections due to emergency situations occurring in the CORR water system.

An additional emergency interconnect at the BCMUD WTF can provide proactive water system redundancy measures to enable BCMUD to have an additional source of water should an emergency situation necessitate the use. The proposed location and size of the interconnect would allow BCMUD to provide FW to its residents and customers throughout the system, should source water become unavailable in an emergency situation. The proposed interconnect can also benefit the CORR if a two-way interconnect is constructed as well. This technical memorandum includes a preliminary analysis and plan to establish an additional interconnect between the CORR and BCMUD. As a result of this project, CIPs are recommended by Garver which support the future design and construction of projects necessary to install the emergency interconnect, shown in **Appendix C**.

2.0 Purpose

The purpose of this technical memorandum is to evaluate a water system emergency interconnection to meet the BCMUD water demands in the event of an emergency where BCMUD is unable to produce an adequate water supply to support water service to its residents and water customers. Should the entities agree to move forward with the interconnection, the CORR would assist BCMUD by providing an emergency FW source that would be able to directly feed into the BCMUD distribution system in a location that could benefit the entire water system. Should the CORR agree to receive FW from BCMUD, the emergency interconnect will be constructed as a two-way emergency interconnection, allowing the CORR to receive water in an emergency situation as well.

2.1 Entity Information

BCMUD, PWS TX2460061, obtains source water for its system through transporting raw surface water from Lake Georgetown and groundwater from three wells that pump out of the Edwards Aquifer to its WTF. BCMUD then treats and delivers FW to its distribution system from its WTF located at 2300 Great Oaks Dr, Round Rock, TX 78681.

CORR, PWS TX2460003, provides drinking water to its residents from a combination of sources. These include surface water from Lake Georgetown, Lake Travis, groundwater from wells that pump out of the Edward's Aquifer, and when needed, the City pumps water into Lake Georgetown from Lake Stillhouse Hollow. As per TCEQ §290.44(g)(1)(B), each water supply shall be of a safe, potable quality.

2.2 Location

The emergency interconnect is proposed to be located at the BCMUD WTF, specifically within the fenced area southwest of the clear wells and high service pump station (HSPS), as shown in **Figure 2-1**. The CORR is currently constructing a 42" transmission main along the north side of Sam Bass Road. As part of the ongoing construction of the transmission main, a 42"X16" tee is planned to be installed at STA 83+50 to support a future interconnection with BCMUD, as shown in **Figure 2-2**. The CORR is evaluating an alternative location for the 42"X16" tee to optimize the yard piping design for the proposed interconnection. The ideal location of the 42"X16" tee is near STA 82+00, shown in **Figure 2-2.** This alternate stationing would lower the quantity of yard piping required for the interconnect, which would significantly optimize the project's cost.

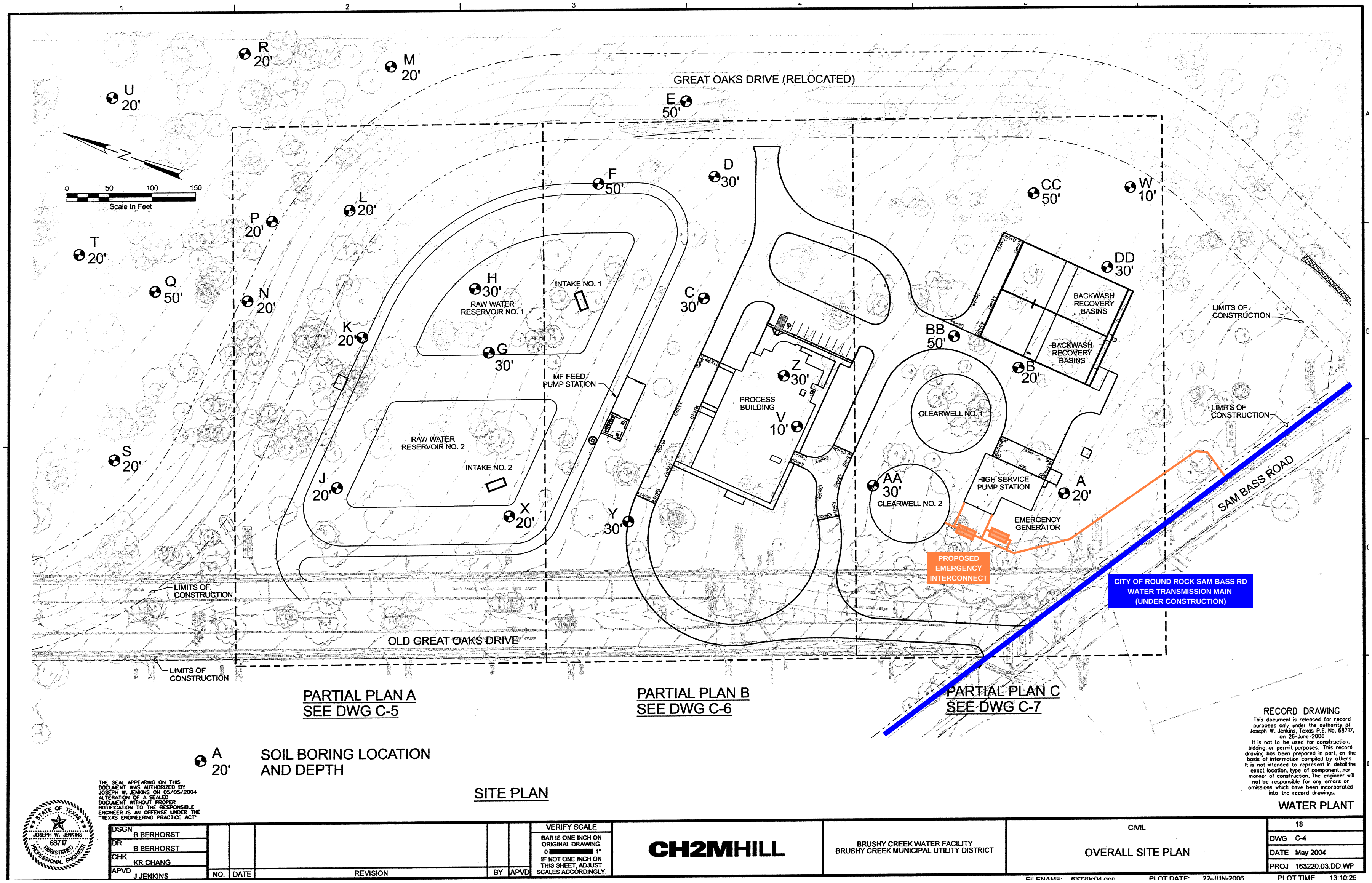


Figure 2-1: Overall Site Plan

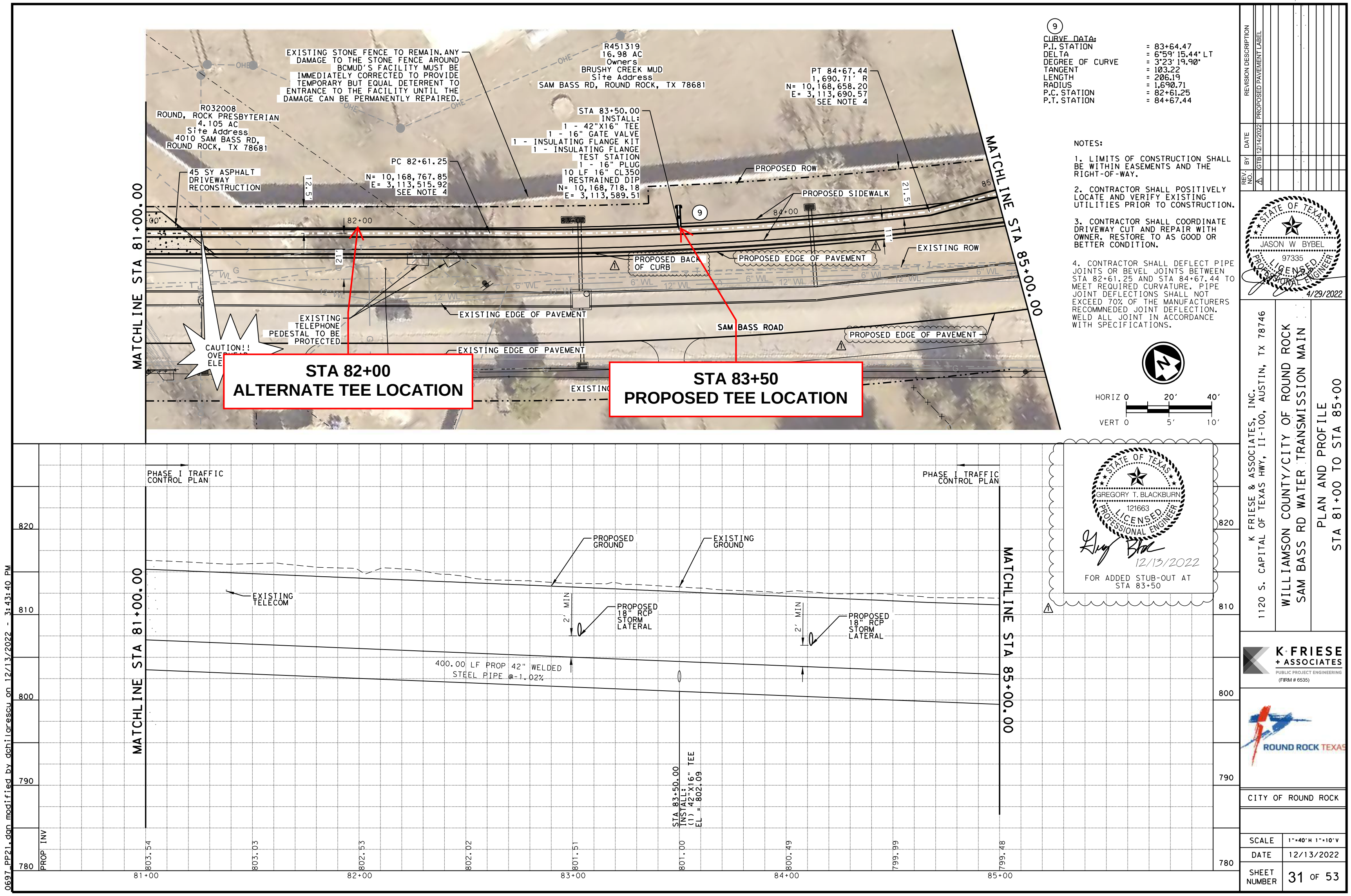


Figure 2-2: Transmission Main Drawings

3.0 Preliminary Analysis and Plan for Interconnection

3.1 Overall Yard Piping

The yard piping for the emergency interconnect will be designed to have two (2) feed locations to increase the redundancy and allow for variability feeding into the BCMUD system. The two feed locations, shown in **Figure 3-1**, include the following options:

- Option 1: Connection to the 30" FW Line from Clear Well #2 to HSPS
- Option 2: Connection to the 30" FW Line from the HSPS Directly into BCMUD Distribution

Option #1 will feed the CORR water into the 30" FW line from Clear Well #2 to utilize the BCMUD pumps at the BCMUD HSPS to pump water into the distribution system. Option #2 will feed CORR water directly from the CORR distribution into the BCMUD distribution system by utilizing the existing the CORR pressure. Option #2 will be pursued in the case of an emergency where the BCMUD HSPS is affected by an emergency and is unable to pump water into water distribution.

The yard piping consists of the following infrastructure:

- 12" Ductile Iron (DI) Pipe
- 12" Gate Valve
- 12" Flow Meter (Two-Way)
- 12" Swing Check Valve
- 2" Gate Valve
- Connection to Existing 30" FW (2)
- 5' Pre-Cast Manhole

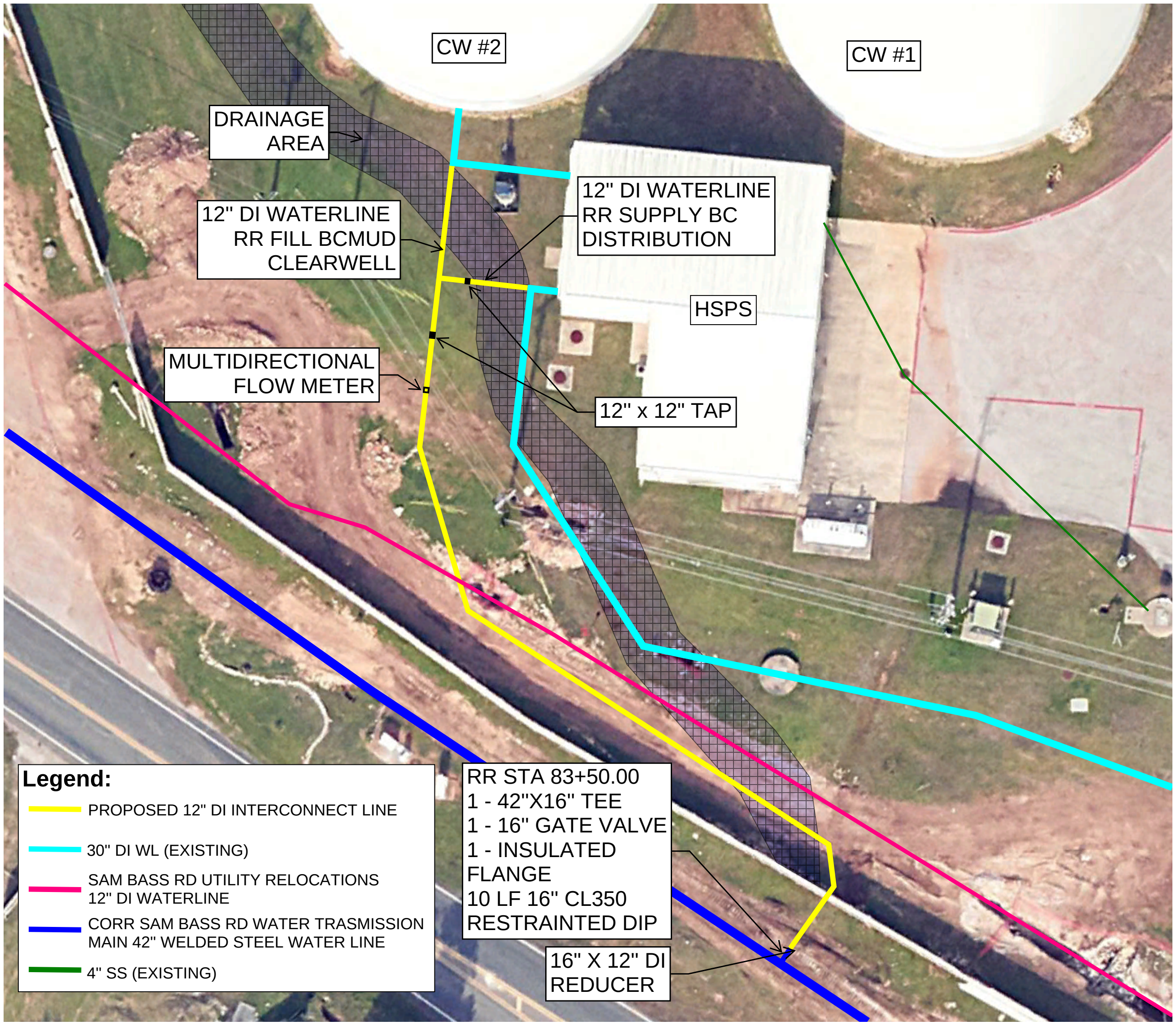


Figure 3-1: Emergency Interconnect Yard Piping

3.2 BCMUD Valve Vault and Improvements

The valve vault, shown in **Figure 3-2**, reflects the infrastructure needed for BCMUD to receive water from the CORR by Option 1: Connection to the 30" FW Line from Clear Well #2 to HSPS. The valve vault consists of the following infrastructure:

- 8" Cla-Val Model 58-01 Pressure Sustaining/Solenoid Valve
- 12" NRS Gate Valve (2)
- 12" Cla-Val Model 585LW Swing Check Valve
- 12" Ductile Iron (DI) Inlet/Outlet Connection
- 12" DI Pipe
- 12" to 8" Reducer (2)
- 7' x 13' Pre-Cast Concrete Meter Vault
- Sump Pump
- Aluminum Access Hatch (Not Shown)

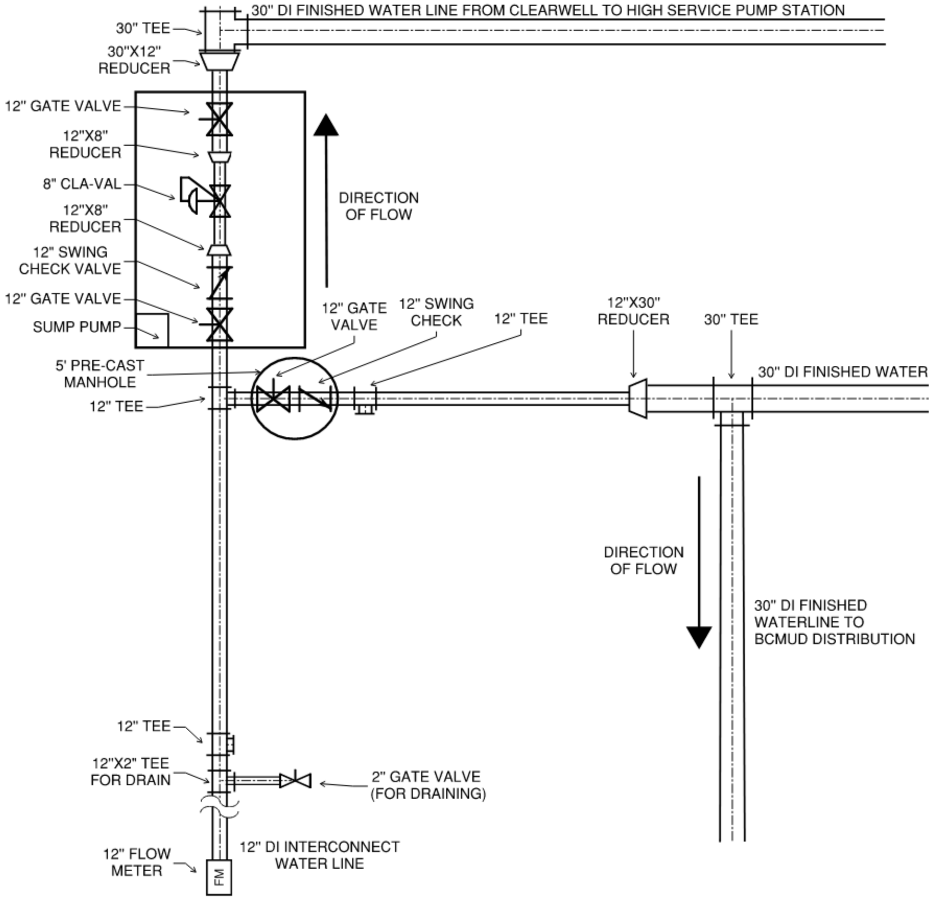


Figure 3-2: BCMUD Valve Vault

The infrastructure in the valve vault will accommodate high pressure flows from the CORR. The 8" Cla-Val Model 58-01 is a Combination Back Pressure and Solenoid Shut-Off Valve which is designed to reduce and sustain pressure from the CORR distribution system to deliver water more efficiently into the BCMUD 30" DI FW line. The valve vault designed by Cla-Val, shown in **Appendix A**, will be prefabricated into a pre-cast vault box, and delivered to the site in three (3) sections. See **Appendix B** for the E-Sheets related to the Cla-Val Model 58-01 and the Series 585.

3.3 CORR Valve Vault (Optional)

The secondary valve vault, shown in **Figure 3-3**, reflects the infrastructure needed for the CORR to receive water from BCMUD. Should the CORR decide to participate in the project, the valve vault could be constructed to consist of the following infrastructure:

- 12" Gate Valve (2)
- 12" Swing Check Valve
- 12" DI Inlet/Outlet Connection
- 12" DI Pipe
- 5' x 8' Pre-Cast Concrete Meter Vault
- Sump Pump
- Aluminum Access Hatch (Not Shown)

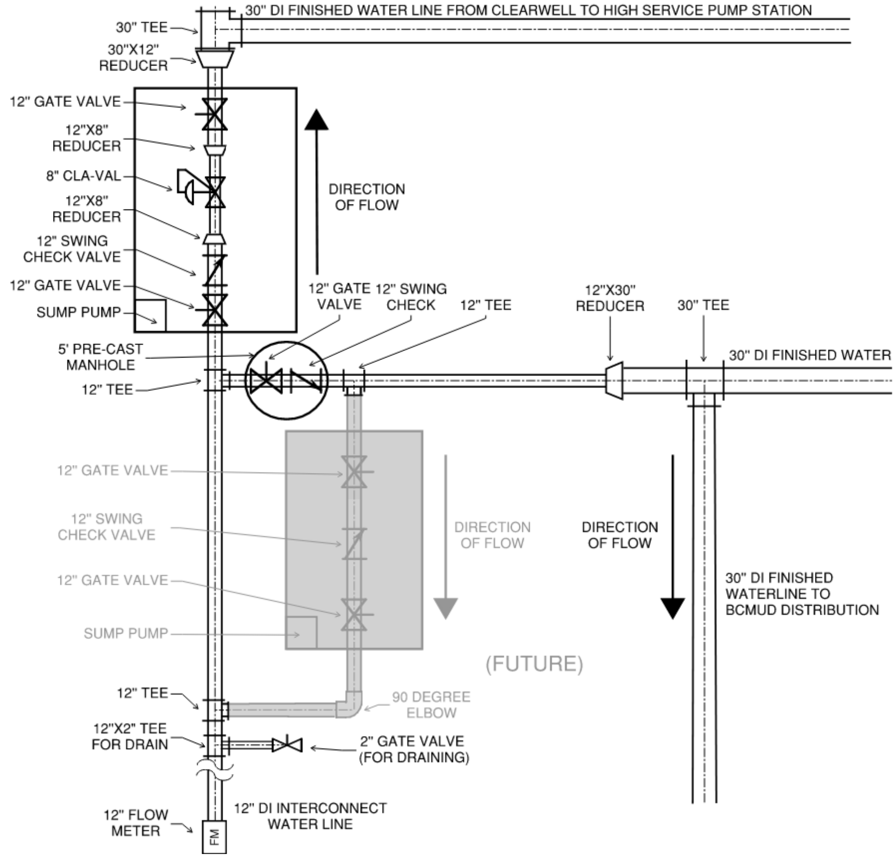


Figure 3-3: CORR Valve Vault (Optional)

The CORR valve vault will need two (2) connection points onto the yard piping to receive and distribute water directly from the BCMUD HSPS. The two connection points should be completed with the yard piping phase of the project to allow for an ease of the CORR valve vault installation. BCMUD will be able to provide water to the CORR using their HSPS in an emergency situation.

4.0 Hydraulic Considerations

4.1 Purchasing System Capacity

It was assumed for preliminary design that the maximum water to be distributed through the emergency interconnect is 4.0 MGD. The emergency interconnect was designed to accommodate half of BCMUD existing capacity of 8.2 MGD. This capacity will allow the BCMUD system to have confidence that its residents and customers can continue to receive water in the event of an emergency with source water.

Should the CORR pursue a two-way interconnect, the purchasing system capacity will be decided upon at that point in time. For design purposes the CORR valve vault was sized to accommodate a 3.0 to 4.0 MGD capacity.

4.2 Pipe Size and Material

To accommodate the desired flows through the emergency interconnect, a 12" DI pipe will be the primary pipe size and material. The desired velocity though the valve vault was below 10 ft/s, as shown in **Table 4-1**, 12" DI was preferred to meet the desired velocity.

Table 4-1: Pipe Velocity Comparison

Pipe Dia (in)	Q (MGD)	Velocity (ft/s)
8	4.00	21.30
10	4.00	13.63
12	4.00	9.47
16	4.00	5.33

4.3 Pressure Plane Data

Table 4-2 compares the tank water levels between the BCMUD and CORR water towers.

Table 4-2: Water Tower Levels

Entity	Peak Water Tower Levels (ft)	Low Water Tower Levels (ft)
BCMUD	1051	1015
CORR	1031	1001
Difference	20	-14

BCMUD averages a 1051' tank elevation which would mean that their pressure head is greater than CORR. The pressure plane information plays a critical role for both options of water feed outlined in Section 3.1. For Option #1, direct feed into the 30" Clearwell FW line, the pressure from the CORR would need to be reduced to efficiently feed into Clearwell #2 which has a high-water level of 836'. For Option #2, direct feed into BCMUD distribution, the BCMUD tanks would need to be lower than the CORR tanks in order to fill. If BCMUD were to use Option #2, the respective gate valves would be opened/closed and the CORR would flow to BCMUD tanks until the tanks reach the same water level. Due to the pressure plane differences, when using Option #2, the maximum fill that BCMUD tanks would reach is 1031'. An emergency scenario would be initiated by low tank levels for the interconnect to perform as designed.

Further hydraulic pressure analysis will occur in the design phase of the interconnection, should the project move forward.

5.0 Capital Improvement Plans

Two (2) CIPs are necessary to complete the emergency interconnect.

- CIP 1: Emergency Interconnect Yard Piping
- CIP 2: BCMUD Emergency Interconnect Valve Vault
    - CIP 2a: CORR Emergency Interconnect Valve Vault (Optional)

Should the CORR pursue a two-way interconnect, CIP 2a should be completed. To facilitate CIP 2a, CIP 1 should include the two (2) 12" taps where necessary to allow easy installation for CIP 2a. The CIP exhibits include the cost estimate and implementation schedule for each CIP which is detailed in **Appendix C**.

The cost estimates are separated based on the infrastructure required to serve each entity; each entity is responsible for their infrastructure. **Figure 5-1** outlines the individual and shared cost between entities.

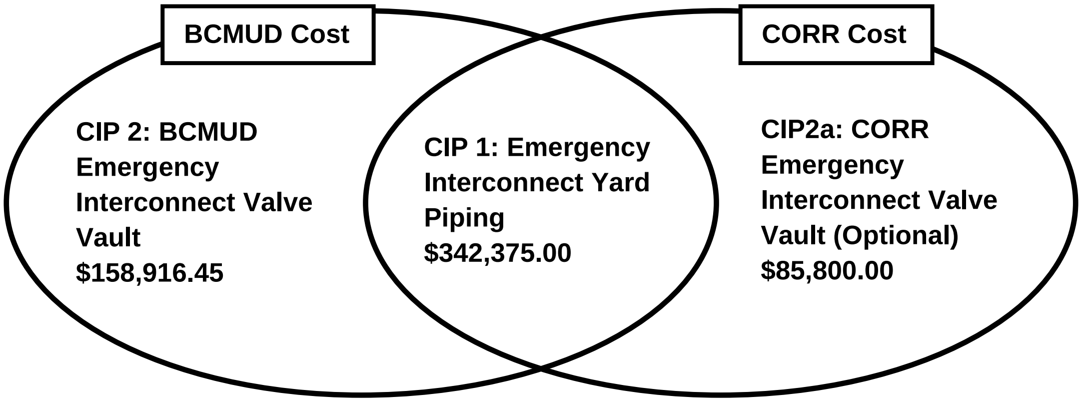
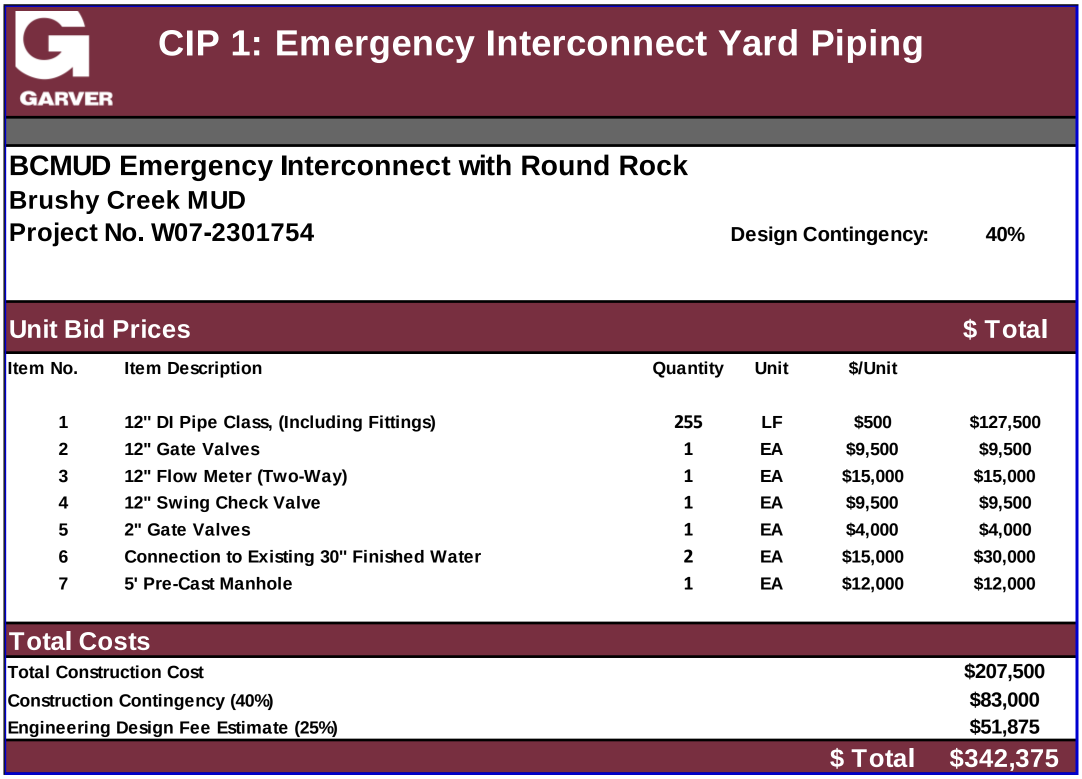


Figure 5-1: Venn Diagram - Entity Cost Breakdown

A cost estimate for CIP 1, CIP 2, and CIP 2a are shown in Figure 5-2, Figure 5-3, and Figure 5-4 respectively.



CIP 1: Emergency Interconnect Yard Piping

BCMUD Emergency Interconnect with Round Rock
Brushy Creek MUD
Project No. W07-2301754

Design Contingency: 40%

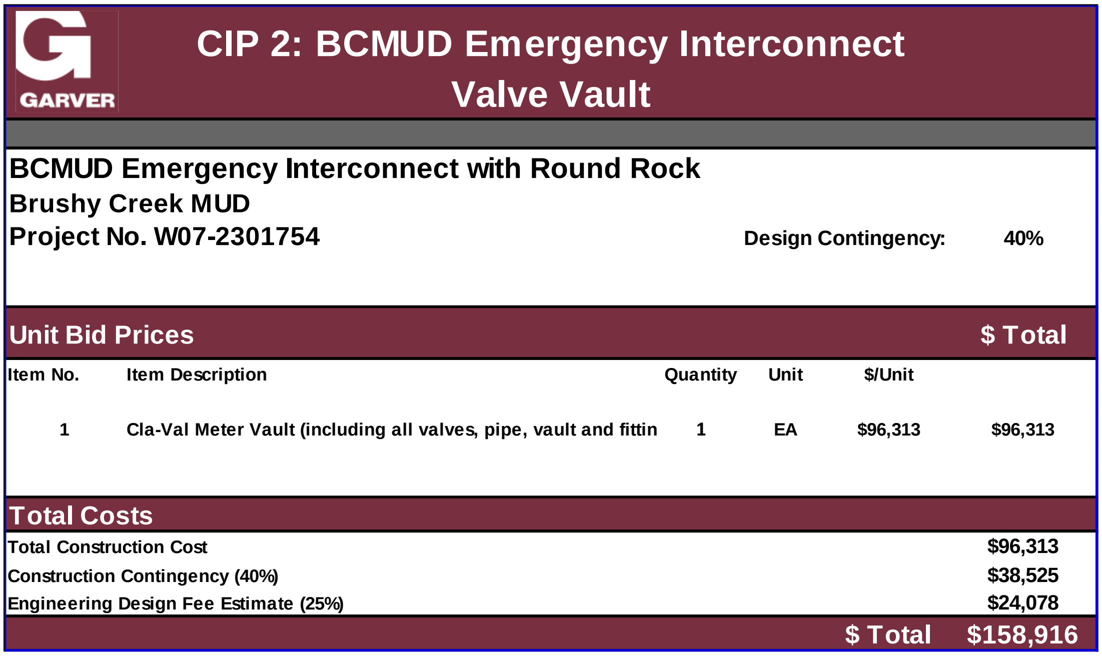
Unit Bid Prices — **$ Total**

Item No.	Item Description	Quantity	Unit	$/Unit	
1	12" DI Pipe Class, (Including Fittings)	255	LF	$500	$127,500
2	12" Gate Valves	1	EA	$9,500	$9,500
3	12" Flow Meter (Two-Way)	1	EA	$15,000	$15,000
4	12" Swing Check Valve	1	EA	$9,500	$9,500
5	2" Gate Valves	1	EA	$4,000	$4,000
6	Connection to Existing 30" Finished Water	2	EA	$15,000	$30,000
7	5' Pre-Cast Manhole	1	EA	$12,000	$12,000

Total Costs

Total Construction Cost	$207,500
Construction Contingency (40%)	$83,000
Engineering Design Fee Estimate (25%)	$51,875
$ Total	**$342,375**

Figure 5-2: CIP 1 Cost Estimate



CIP 2: BCMUD Emergency Interconnect Valve Vault

BCMUD Emergency Interconnect with Round Rock
Brushy Creek MUD
Project No. W07-2301754

Design Contingency: 40%

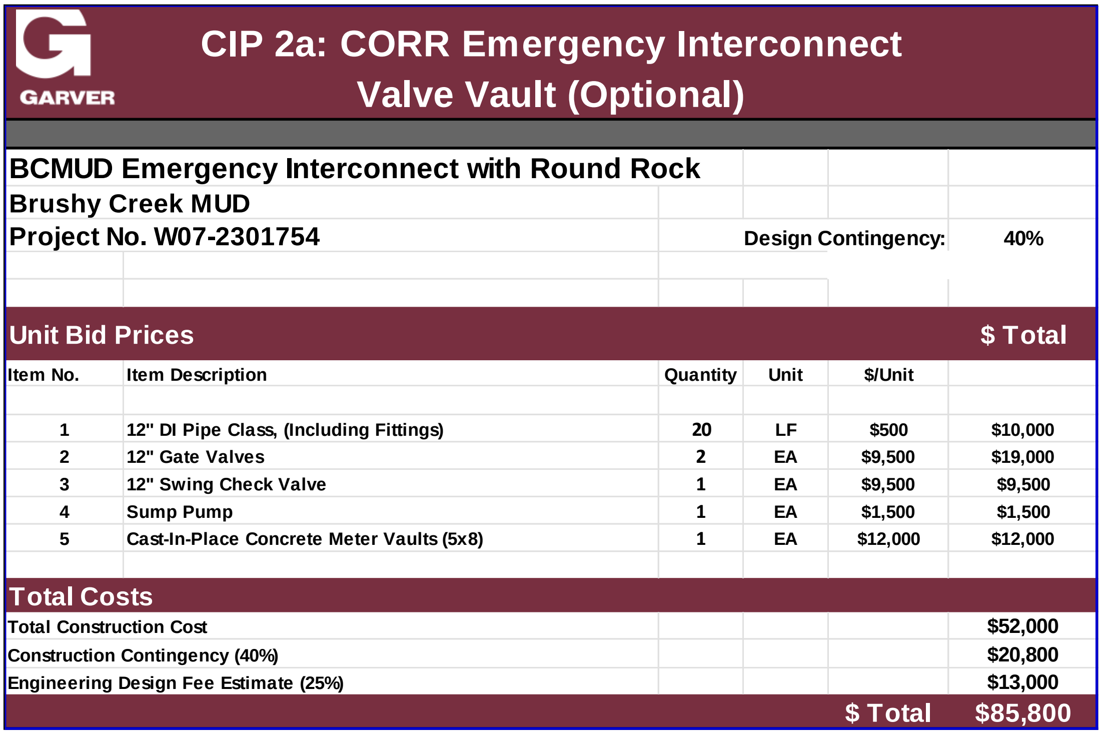
Unit Bid Prices — **$ Total**

Item No.	Item Description	Quantity	Unit	$/Unit	
1	Cla-Val Meter Vault (including all valves, pipe, vault and fittin	1	EA	$96,313	$96,313

Total Costs

Total Construction Cost	$96,313
Construction Contingency (40%)	$38,525
Engineering Design Fee Estimate (25%)	$24,078
$ Total	**$158,916**

Figure 5-3: CIP 2 Cost Estimate



CIP 2a: CORR Emergency Interconnect Valve Vault (Optional)

BCMUD Emergency Interconnect with Round Rock
Brushy Creek MUD
Project No. W07-2301754

Design Contingency: 40%

Unit Bid Prices

Item No.	Item Description	Quantity	Unit	$/Unit	$ Total
1	12" DI Pipe Class, (Including Fittings)	20	LF	$500	$10,000
2	12" Gate Valves	2	EA	$9,500	$19,000
3	12" Swing Check Valve	1	EA	$9,500	$9,500
4	Sump Pump	1	EA	$1,500	$1,500
5	Cast-In-Place Concrete Meter Vaults (5x8)	1	EA	$12,000	$12,000

Total Costs

Total Construction Cost	$52,000
Construction Contingency (40%)	$20,800
Engineering Design Fee Estimate (25%)	$13,000
$ Total	**$85,800**

Figure 5-4: CIP 2a Cost Estimate

6.0 Next Steps

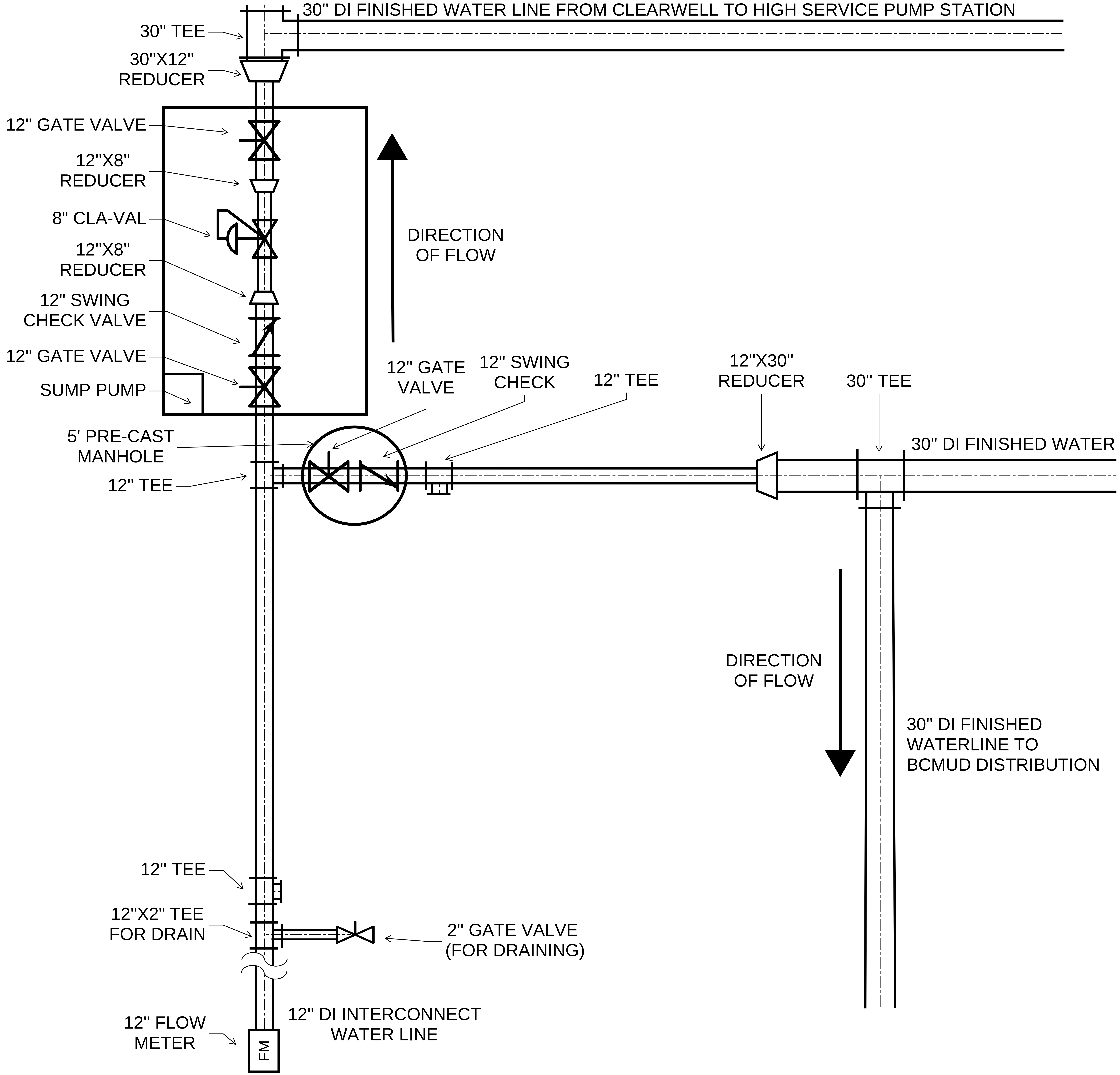
Should BCMUD and the CORR pursue the design and construction of the emergency interconnection, the following next steps must take place:

- Develop an agreement between both PWS parties (6-9 months),
- Complete an engineering report and design (6-9 months),
- Submit sealed engineering report, plans, and specifications to the TCEQ for review (3 months),
- Bidding and construction (9-12 months).

During the design of the interconnect, negotiations with the TCEQ can occur in parallel to expedite completion. TCEQ approval of the interconnect is required before construction is pursued as per §290.39(j)(1)(D).

APPENDIX A

Valve Vault Exhibits



GARVER

REV	DATE	DESCRIPTION	BY

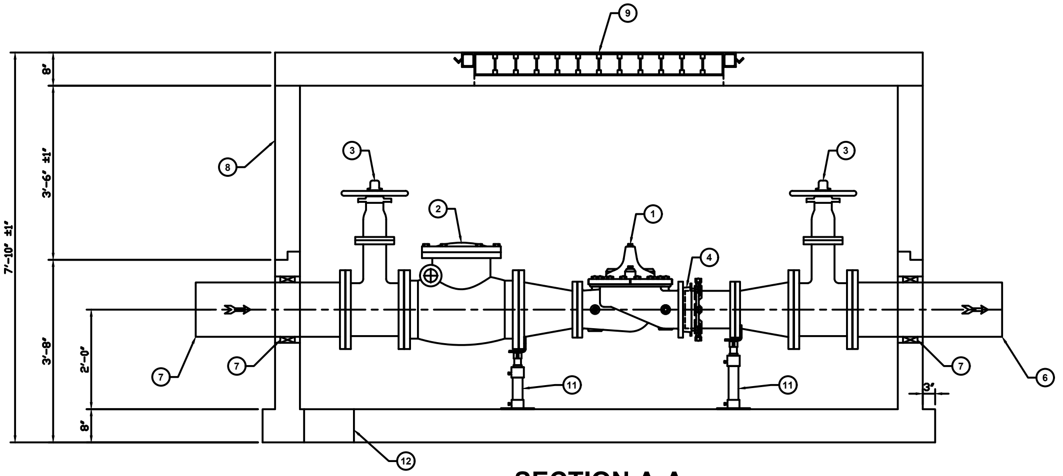
BCMUD ASSET RENEWAL MASTER PLAN
BRUSHY CREEK MUD
EMERGENCY INTERCONNECT

ONE-WAY BCMUD EMERGENCY INTERCONNECT VALVE VAULT EXHIBIT

NOT DRAWN TO SCALE

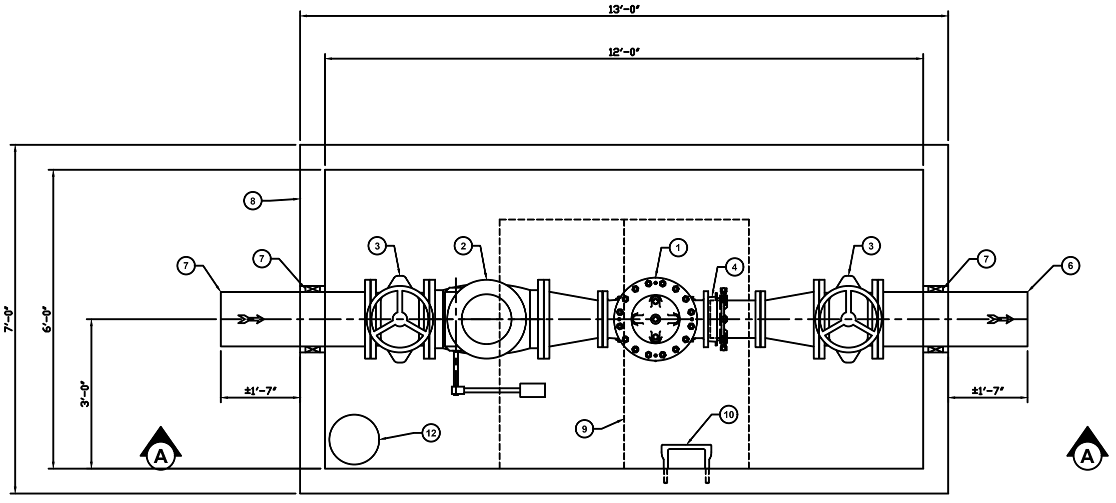
DRAWING NUMBER
01-G002

SHEET NUMBER **02**



SECTION A-A

BILL OF MATERIALS		
ITEM	QTY	DESCRIPTION
1	1	8" CLA-VAL MODEL 58G-01 PRESSURE SUSTAINING/SOLENOID VALVE
2	1	12" CLA-VAL MODEL 585LW LEVER AND WEIGHT CHECK VALVE
3	2	12" NRS GATE VALVE (OPEN LEFT)
4	1	8" EBAA MEGAFLANGE
5	1	12" DUCTILE IRON PIPE INLET CONNECTION
6	1	12" DUCTILE IRON PIPE OUTLET CONNECTION
7	2	PIPE PENETRATION SEAL
8	1	PRECAST CONCRETE VAULT
9	1	60" X 60" ALUMINUM HATCH (H20 RATED)
10		VAULT STEPS
11	2	PIPE SUPPORTS
12	1	12"Ø DRAIN OPENING



PLAN VIEW

NOTES: FITTINGS ARE DUCTILE IRON IN ACCORDANCE WITH ANSI/AWWA C110/A21.10. FLANGES ARE ANSI CLASS 125, B16.1.

PIPE SPOOLS ARE CL53 DUCTILE IRON WITH FLANGES IN ACCORDANCE WITH ANSI/AWWA C115/A21.15. FLANGES ARE ANSI CLASS 125, B16.1.

INTERIOR COATING MEETS THE REQUIREMENT OF NSF-61 STANDARD.

EXTERIOR COATING TO BE A 2-PART EPOXY.

THE VAULT WILL BE DELIVERED IN THREE (3) SECTIONS. OFF-LOADING AND SETTING OF EACH SECTION BY INSTALLING CONTRACTOR, NOT ESI FAB SYSTEMS. THE HEAVIEST LIFT WILL BE APPROXIMATELY 23,000 POUNDS.

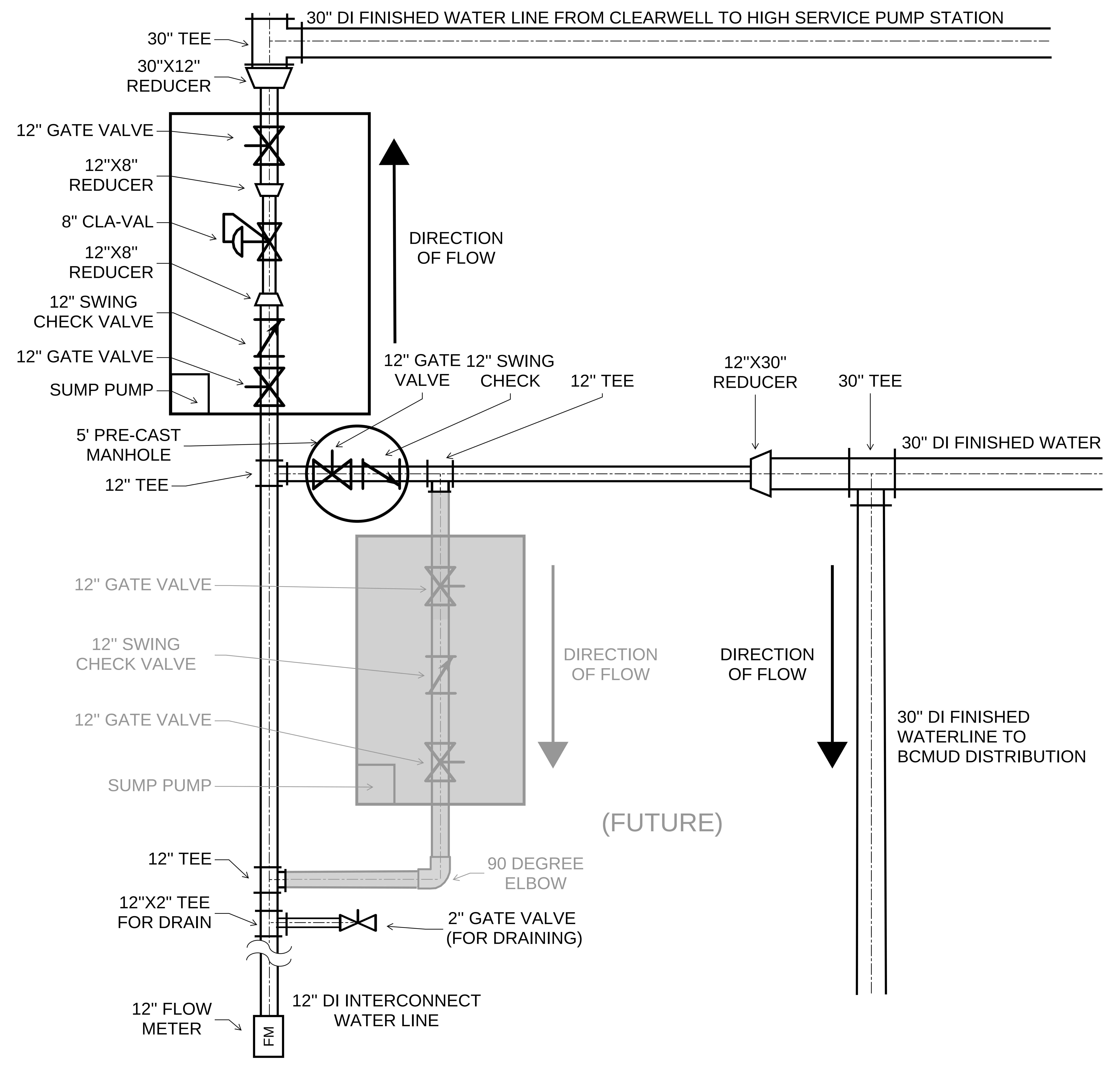
JOINT SEALANT WILL BE SUPPLIED FOR INSTALLATION BY CONTRACTOR BETWEEN THE THREE (3) SECTIONS.

PIPE AND FITTINGS ARE NON-DOMESTIC.

ESI FAB SYSTEMS
15410 S MAHAFFIE ST
OLATHE, KS 66062
PH: 816-468-9119 - www.esiwater.com

EPS07930 - REV: 0

PROJECT: BCMUD INTERCONNECT



REV	DATE	DESCRIPTION	BY

BCMUD ASSET RENEWAL MASTER PLAN
BRUSHY CREEK MUD

EMERGENCY INTERCONNECT

TWO-WAY BCMUD AND CORR EMERGENCY INTERCONNECT VALVE VAULT EXHIBIT

NOT DRAWN TO SCALE

DRAWING NUMBER
01-G002

SHEET NUMBER **02**

APPENDIX B

Valve Vault Model E-Sheets

CLA-VAL™

MODEL 58-01

Combination Back Pressure & Solenoid Shut-Off Valve

- **Accurate Pressure Control**
- **Wide Adjustment Ranges**
- **Optional Check Feature Available**
- **Quick Acting Solenoid Shut-Off**
- **Easy Installation and Maintenance**

The Cla-Val Model 58-01 valve performs two separate functions. It maintains a constant back pressure by discharging excess pressure downstream and when the solenoid is activated the valve closes drip-tight.

In operation, the valve is actuated by hydraulic line pressure through the pilot control system. When inlet pressure is greater than the control setting, the valve opens. When inlet pressure is equal to the control setting, the pilot modulates the valve, maintaining the preselected back pressure. When inlet pressure is less than the control setting, the pilot system closes the valve drip tight. Changing the pressure setting simply involves turning an adjusting screw on the pilot control.

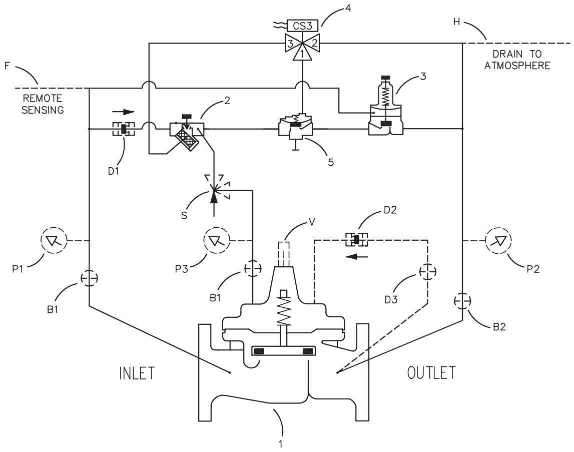
The solenoid control is available in energize to open or de-energize to open models.

Schematic Diagram

Item	Description
1	100-01 Hytrol Main Valve
2	X42N-3 Strainer & Needle Valve
3	CRL-60 Pressure Relief Control
4	CS3 Solenoid Control
5	100-01 Hytrol (Reverse Flow)

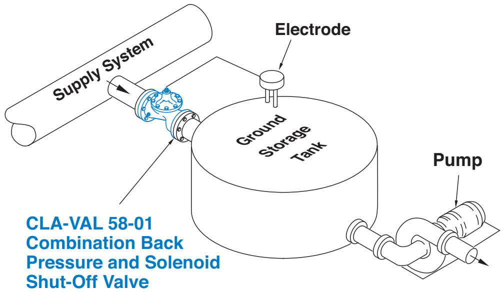
Optional Features

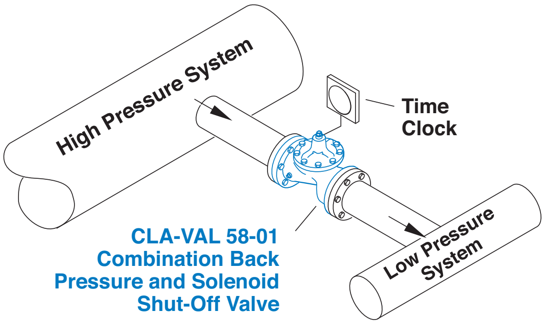
Item	Description
B	Shutoff Isolation Valve
D	Check Valves with Isolation Valve
F	Remote Pilot Sensing
H	Drain to Atmosphere
P	X141 Pressure Gauge
S	CV Speed Control (Opening)
V	X101 Valve Position Indicator



The "D" feature on a vertically installed 6" and larger valve must be horizontally oriented.

Typical Applications





Back Pressure Maintenance Service

A frequent application of this valve is to maintain minimum back pressure in the system while supplying water to a reservoir. The electrode in the storage tank activates the solenoid shutoff feature when the tank reaches a preset level.

Electronic Control Service

Using a timer connected to the solenoid control of the valve, flow from the high pressure system to the low pressure system can be controlled at certain times during the day.

Model 58-01 (Uses 100-01 Hytrol Main Valve)

Pressure Ratings (Recommended Maximum Pressure - psi)

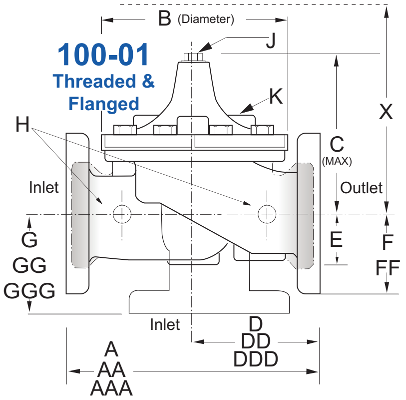
Valve Body & Cover		Pressure Class				
		Flanged			Grooved	Threaded
Grade	Material	ANSI Standards*	150 Class	300 Class	300 Class	End‡ Details
ASTM A536	Ductile Iron	B16.42	250	400	400	400
ASTM A216-WCB	Cast Steel	B16.5	285	400	400	400
UNS 87850	Bronze	B16.24	225	400	400	400

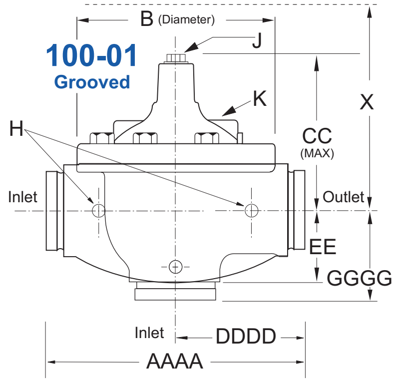
Note: * ANSI standards are for flange dimensions only.
Flanged valves are available faced but not drilled.
‡ End Details machined to ANSI B2.1 specifications.
Valves for higher pressure are available; consult factory for details

Materials

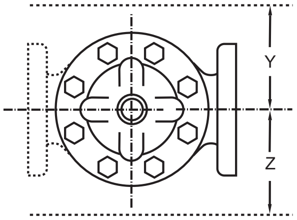
Component	Standard Material Combinations		
Body & Cover	Ductile Iron	Cast Steel	Bronze
Available Sizes	1" - 36" 25 - 900mm	1" - 16" 25 - 400mm	1" - 16" 25 - 400mm
Disc Retainer & Diaphragm Washer	Cast Iron	Cast Steel	Bronze
Trim: Disc Guide, Seat & Cover Bearing	Bronze is Standard Stainless Steel is Optional		
Disc	Buna-N® Rubber		
Diaphragm	Nylon Reinforced Buna-N® Rubber		
Stem, Nut & Spring	Stainless Steel		

For material options not listed, consult factory.
Cla-Val manufactures valves in more than 50 different alloys.





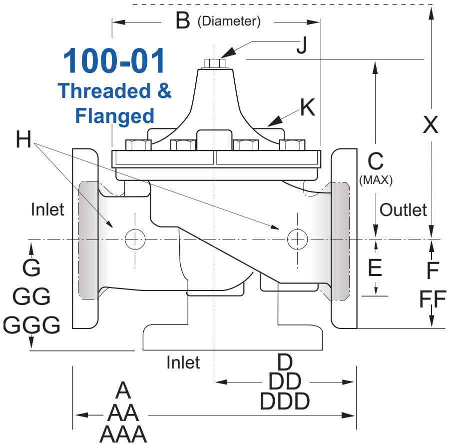
For sizes 18 - 36-inches, use 50-66 E-Sheet

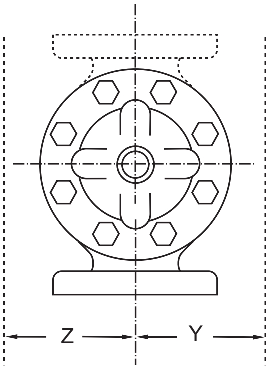


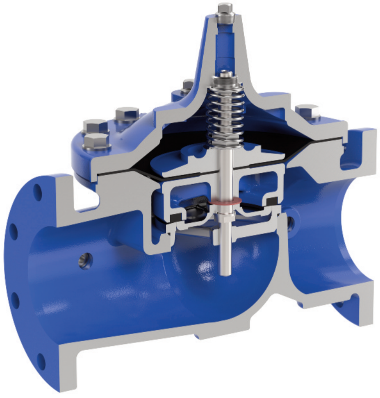
Model 58-01 Dimensions (in inches)

Valve Size (Inches)	**1**	**1¼**	**1½**	**2**	**2½**	**3**	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**24**	**30**	**36**
A Threaded	7.25	7.25	7.25	9.38	11.00	12.50	—	—	—	—	—	—	—	—	—	—	—	—
AA 150 ANSI	—	—	8.50	9.38	11.00	12.00	15.00	20.00	25.38	29.75	34.00	39.00	41.38	46.00	52.00	61.50	63.00	72.75
AAA 300 ANSI	—	—	9.00	10.00	11.62	13.25	15.62	21.00	26.38	31.12	35.50	40.50	43.50	47.64	53.62	63.24	64.50	74.75
AAAA Grooved End	—	—	8.50	9.00	11.00	12.50	15.00	20.00	25.38	—	—	—	—	—	—	—	—	—
B Diameter	5.62	5.62	5.62	6.62	8.00	9.12	11.50	15.75	20.00	23.62	28.00	32.75	35.50	41.50	45.00	53.16	56.00	66.00
C Maximum	5.50	5.50	5.50	6.50	7.56	8.19	10.62	13.38	16.00	17.12	20.88	24.19	25.00	39.06	41.90	43.93	54.60	59.00
CC Maximum Grooved End	—	—	4.75	5.75	6.88	7.25	9.31	12.12	14.62	—	—	—	—	—	—	—	—	—
D Threaded	3.25	3.25	3.25	4.75	5.50	6.25	—	—	—	—	—	—	—	—	—	—	—	—
DD 150 ANSI	—	—	4.00	4.75	5.50	6.00	7.50	10.00	12.69	14.88	17.00	19.50	20.81	—	—	30.75	—	—
DDD 300 ANSI	—	—	4.25	5.00	5.88	6.38	7.88	10.50	13.25	15.56	17.75	20.25	21.62	—	—	31.62	—	—
DDDD Grooved End	—	—	—	4.75	—	6.00	7.50	—	—	—	—	—	—	—	—	—	—	—
E	1.12	1.12	1.12	1.50	1.69	2.06	3.19	4.31	5.31	9.25	10.75	12.62	15.50	12.95	15.00	17.75	21.31	24.56
EE Grooved End	—	—	2.00	2.50	2.88	3.12	4.25	6.00	7.56	—	—	—	—	—	—	—	—	—
F 150 ANSI	—	—	2.50	3.00	3.50	3.75	4.50	5.50	6.75	8.00	9.50	10.50	11.75	15.00	16.50	19.25	22.50	28.50
FF 300 ANSI	—	—	3.06	3.25	3.75	4.13	5.00	6.25	7.50	8.75	10.25	11.50	12.75	15.00	16.50	19.25	24.00	30.00
G Threaded	1.88	1.88	1.88	3.25	4.00	4.50	—	—	—	—	—	—	—	—	—	—	—	—
GG 150 ANSI	—	—	4.00	3.25	4.00	4.00	5.00	6.00	8.00	8.62	13.75	14.88	15.69	—	—	22.06	—	—
GGG 300 ANSI	—	—	4.25	3.50	4.31	4.38	5.31	6.50	8.50	9.31	14.50	15.62	16.50	—	—	22.90	—	—
GGGG Grooved End	—	—	—	3.25	—	4.25	5.00	—	—	—	—	—	—	—	—	—	—	—
H NPT Body Tapping	0.375	0.375	0.375	0.375	0.50	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00
J NPT Cover Center Plug	0.25	0.25	0.25	0.50	0.50	0.50	0.75	0.75	1.00	1.00	1.25	1.50	2.00	1.00	1.00	1.00	2.00	2.00
K NPT Cover Tapping	0.375	0.375	0.375	0.375	0.50	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00
Stem Travel	0.40	0.40	0.40	0.60	0.70	0.80	1.10	1.70	2.30	2.80	3.40	4.00	4.50	5.10	5.63	6.75	7.50	8.50
Approx. Ship Weight (lbs)	15	15	15	35	50	70	140	285	500	780	1165	1600	2265	2982	3900	6200	7703	11720
Approx. **X** Pilot System	11	11	11	13	14	15	17	29	31	33	36	40	40	43	47	68	79	85
Approx. **Y** Pilot System	9	9	9	9	10	11	12	20	22	24	26	29	30	32	34	39	40	45
Approx. **Z** Pilot System	9	9	9	9	10	11	12	20	22	24	26	29	30	32	34	39	42	47

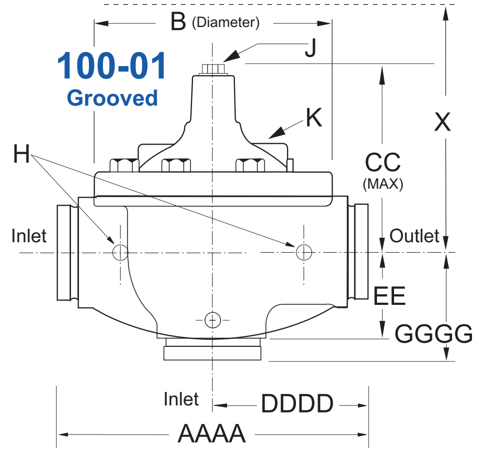
Model 58-01 Metric Dimensions (Uses 100-01 Hytrol Main Valve)







Model 100-01 Full Port Hytrol Main Valve



Model 58-01 Dimensions (in mm)

Valve Size (mm)	25	32	40	50	65	80	100	150	200	250	300	350	400	450	500	600	750	900
A Threaded	184	184	184	238	279	318	—	—	—	—	—	—	—	—	—	—	—	—
AA 150 ANSI	—	—	216	238	279	305	381	508	645	756	864	991	1051	1168	1321	1562	1600	1848
AAA 300 ANSI	—	—	229	254	295	337	397	533	670	790	902	1029	1105	1210	1326	1606	1638	1899
AAAA Grooved End	—	—	216	228	279	318	381	508	645	—	—	—	—	—	—	—	—	—
B Diameter	143	143	143	168	203	232	292	400	508	600	711	832	902	1054	1143	1350	1422	1676
C Maximum	140	140	140	165	192	208	270	340	406	435	530	614	635	992	1064	1116	1387	1499
CC Maximum Grooved End	—	—	120	146	175	184	236	308	371	—	—	—	—	—	—	—	—	—
D Threaded	83	83	83	121	140	159	—	—	—	—	—	—	—	—	—	—	—	—
DD 150 ANSI	—	—	102	121	140	152	191	254	322	378	432	495	528	—	—	781	—	—
DDD 300 ANSI	—	—	108	127	149	162	200	267	337	395	451	514	549	—	—	803	—	—
DDDD Grooved End	—	—	—	121	—	152	191	—	—	—	—	—	—	—	—	—	—	—
E	29	29	29	38	43	52	81	110	135	235	273	321	394	329	381	451	541	624
EE Grooved End	—	—	52	64	73	79	108	152	192	—	—	—	—	—	—	—	—	—
F 150 ANSI	—	—	64	76	89	95	114	140	171	203	241	267	298	381	419	489	572	724
FF 300 ANSI	—	—	78	83	95	105	127	159	191	222	260	292	324	381	419	489	610	762
G Threaded	48	48	48	83	102	114	—	—	—	—	—	—	—	—	—	—	—	—
GG 150 ANSI	—	—	102	83	102	102	127	152	203	219	349	378	399	—	—	560	—	—
GGG 300 ANSI	—	—	102	89	110	111	135	165	216	236	368	397	419	—	—	582	—	—
GGGG Grooved End	—	—	—	83	—	108	127	—	—	—	—	—	—	—	—	—	—	—
H NPT Body Tapping	0.375	0.375	0.375	0.375	0.50	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00
J NPT Cover Center Plug	0.25	0.25	0.25	0.50	0.50	0.50	0.75	0.75	1.00	1.00	1.25	1.50	2.00	1.00	1.00	1.00	2.00	2.00
K NPT Cover Tapping	0.375	0.375	0.375	0.375	0.50	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00
Stem Travel	10	10	10	15	18	20	28	43	58	71	86	102	114	130	143	171	190	216
Approx. Ship Weight (kgs)	7	7	7	16	23	32	64	129	227	354	528	726	1027	1353	1769	2812	3494	5316
Approx. **X** Pilot System	280	280	280	331	356	381	432	737	788	839	915	1016	1016	1093	1194	1728	2007	2159
Approx. **Y** Pilot System	229	229	229	229	254	280	305	508	559	610	661	737	762	813	864	991	1016	1143
Approx. **Z** Pilot System	229	229	229	229	254	280	305	508	559	610	661	737	762	813	864	991	1067	1194

58-01 Valve Selection		**100-01 Pattern:** Globe (G), Angle (A), **End Connections:** Threaded (T), Grooved (GR), Flanged (F) Indicate Available Sizes																	
	Inches	1	1¼	1½	2	2½	3	4	6	8	10	12	14	16	18	20	24	30	36
	mm	25	32	40	50	65	80	100	150	200	250	300	350	400	450	500	600	750	900
Main Valve 100-01	Pattern	G, A	G, A	G, A	G, A	G, A	G, A	G, A	G, A	G, A	G, A	G, A	G, A	G, A	G	G	G, A	G	G
	End Detail	T	T	T, F, Gr*	T, F, Gr	T, F, Gr*	T, F, Gr	F, Gr	F, Gr*	F, Gr*	F	F	F	F	F	F	F	F	F
Suggested Flow (gpm)	Maximum	55	93	125	210	300	460	800	1800	3100	4900	7000	8400	11000	14000	17000	25000	42000	50000
	Maximum Surge	120	210	280	470	670	1000	1800	4000	7000	11000	16000	19000	25000	31000	39000	56500	63000	85000
Suggested Flow (Liters/Sec)	Maximum	3.5	6	8	13	19	29	50	113	195	309	442	530	694	883	1073	1577	2650	3150
	Maximum Surge	7.6	13	18	30	42	63	113	252	441	693	1008	1197	1577	1956	2461	3560	3975	5360
100-01 Series is the full internal port Hytrol.																			*Globe Grooved Only

Notes:
- For sizes 18 through 36-inches / 450mm though 900 mm, use 50-66 E-Sheet
- Many factors should be considered in sizing pressure reducing valves including inlet pressure, outlet pressure and flow rates.
- For sizing questions or cavitation analysis, consult Cla-Val with system details.

Pilot System Specifications

CRL-60 Pilot Control

CS3 Solenoid Control

Adjustment Ranges

0	to	75 psi Max.
20	to	105 psi
20	to	200 psi *
100	to	300 psi

***Supplied unless otherwise specified. Other ranges are available, please consult factory.**

Temperature Range

Water: to 180°F (82°C)

Materials

Standard Pilot System Materials

Pilot Control:	Low Lead Bronze
Trim:	Stainless Steel Type 303
Rubber:	Buna-N® Synthetic Rubber
Tubing & Fittings:	Copper and Bronze

Optional Pilot System Materials

Pilot Systems are available with optional Aluminum, Stainless Steel or Monel materials.

Electrical Ratings:

Voltage:
24, 48, 120, 240, 480 – 60 Hz. VAC
6, 12, 24, 120, 240 VDC

When Ordering, Specify:

1. Catalog No. 58-01
2. Valve Size
3. Pattern - Globe or Angle
4. Pressure Class
5. Threaded or Flanged
6. Trim Material
7. Energized or De-energized to Open Main Valve
8. Adjustment Range
9. Desired Options
10. Electrical Selection
11. When Vertically Installed

Main Valve Options

EPDM Rubber Parts

Optional diaphragm, disc and o-ring fabricated with EPDM synthetic rubber

Viton® Rubber Parts - suffix KB

Optional diaphragm, disc and o-ring fabricated with Viton® synthetic rubber

Epoxy Coating - suffix KC

NSF/ANSI 61 Fusion Bonded Epoxy

Dura-Kleen® Stem - suffix KD

Fluted design prevents dissolved minerals build-up on the stem

LFS Trim

Designed to regulate precisely and smoothly at typical flow rates as well as lower than the industry standard of 1 fps, without decreasing the valve's capacity

---

CLA-VAL

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www.cla-valpacific.com
E-mail: info@cla-valpacific.com

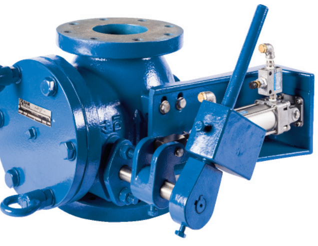
visit www.cla-val-latinamerica.com for Spanish literature

CLA-VAL™

Series 585

Swing Check Valve

Lever and Weight



Air Cushion

Lever and Spring

Meets the Federal Mandate Limiting Lead in Drinking Water

Pressure Ratings (Ambient Temperature)

For Valve Sizes 2 through 42-inches:
250 psi CWP
For Valve Sizes 20 through 1100mm:
1724 kPA CWP

- **Full Pipe Size Flow Area - Unrestricted flow**
- **Heavy Duty Disc Connections**
- **Non-Clog Design**
- **Fusion Bonded Epoxy Coating NSF-61**
- **Designed, Manufactured and Tested in Accordance with ANSI/AWWA C508 Standard**
- **Resilient Seat - Drip Tight Seating**
- **Three field adjustable closure options:**
  - **Lever and Weight (LW)**
  - **Air Cushion (AC)**
  - **Lever and Spring (LS)**

The Cla-Val 585 Swing Check Valve is designed for long service life and maintenance free operation. It has a full-flow area body and is equipped with a disc arm with dual precision pins for optimum disc connection and protection against damage due to vibration. The body is fitted with a raised 300 Series Stainless Steel seat as well as a resilient seat to help ensure drip tight seating, even in applications with high solids. The seats are replaceable in the field without removing the valve from the pipeline.

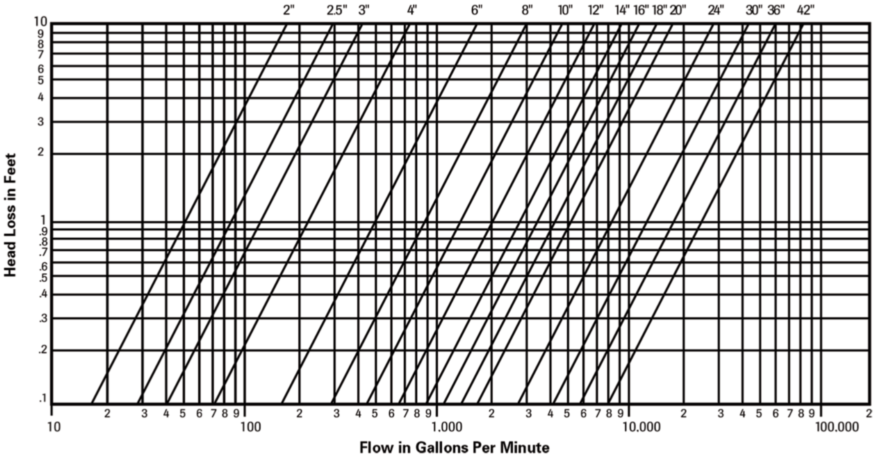
The valve is constructed of Ductile Iron to provide greater durability and protection in applications with high stresses and shock loads. The body and cover are fusion bonded NSF-61 epoxy coated in accordance with AWWA C550 for long service life in potable and non-potable systems.

During system flowing conditions the disc swings up to the open position allowing unrestricted flow through the valve. When system reverse flow conditions occur, the disc swings down to the closed position, preventing reverse flow.

Material Specifications

Component	Standard
Body and Cover 2-24” C508-09 Compliant	Ductile Iron ASTM A536 GR 65-45-12
Body and Cover 30-42”	Ductile Iron ASTM A536 GR 65-45-12
Disc and Disc Arm	Ductile Iron ASTM A536 GR 65-45-12
Shaft	304 Stainless Steel
Seat	316 Stainless Steel
Disc Seat	NBR

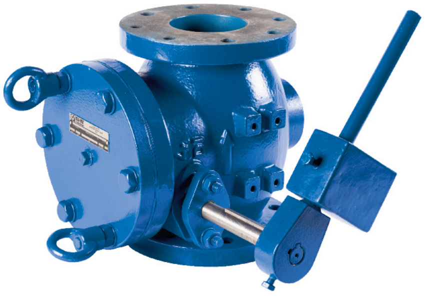
Head Loss Characteristics for Swing Check Valves

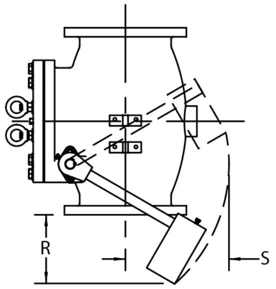


585LW Lever and Weight Check Valve

Valve Size	A	B	C	D	E	F	H	Q	R	S
2" 50mm	8.00 203	9.25 235	3.50 89	10.92 277	4.12 105	6.00 152	0.63 16	10.00 254	6.00 152	9.38 238
2.5" 65mm	8.50 216	9.72 247	3.50 89	10.92 277	4.12 105	7.00 178	0.88 22	9.88 251	6.13 156	9.38 238
3" 80mm	9.50 241	10.00 254	4.50 114	11.00 279	4.00 102	7.50 191	0.75 19	10.13 257	5.50 140	9.25 235
4" 100mm	11.50 292	10.75 273	5.00 127	11.75 299	5.00 127	9.00 229	0.94 24	10.75 273	4.88 124	8.75 222
6" 150mm	14.00 356	11.75 299	5.75 146	13.50 343	6.50 165	11.00 279	1.00 25	11.63 295	4.63 118	7.88 200
8" 200mm	19.50 495	13.75 349	7.25 184	17.00 432	7.50 191	13.50 343	1.13 29	15.50 394	5.88 149	10.38 264
10" 250mm	24.50 622	15.00 381	9.38 238	16.25 413	9.00 229	16.00 406	1.19 30	18.38 467	9.00 229	13.63 346
12" 300mm	27.50 699	19.00 483	11.00 279	18.25 464	11.00 279	19.00 483	1.25 32	21.13 537	9.00 229	14.25 362
14" 350mm	31.00 787	22.50 572	13.50 343	26.00 660	14.00 356	21.00 533	1.38 35	25.88 657	11.75 299	18.75 476
16" 400mm	36.00 914	24.50 622	14.25 362	29.50 749	15.00 381	23.50 597	1.44 37	32.00 813	7.25 184	15.88 403
18" 450mm	40.00 1016	26.50 673	17.38 441	31.00 787	18.63 473	25.00 635	1.56 40	36.00 914	9.25 235	21.25 540
20" 500mm	40.00 1016	28.75 730	17.63 448	32.38 822	18.63 473	27.50 699	1.69 43	41.00 1041	—	—
24" 600mm	48.00 1219	32.50 826	20.13 511	34.00 864	21.00 533	32.00 813	1.88 48	38.00 965	8.75 222	19.25 489
30" 750mm	56.00 1422	44.13 1121	29.75 756	39.00 991	24.00 610	38.75 984	2.13 54	53.13 1349	15.50 394	24.00 610
36" 900mm	63.00 1600	50.50 1283	33.50 851	42.00 1067	27.00 686	46.00 1168	2.38 60	57.50 1461	15.00 381	21.00 533
42" 1100mm										

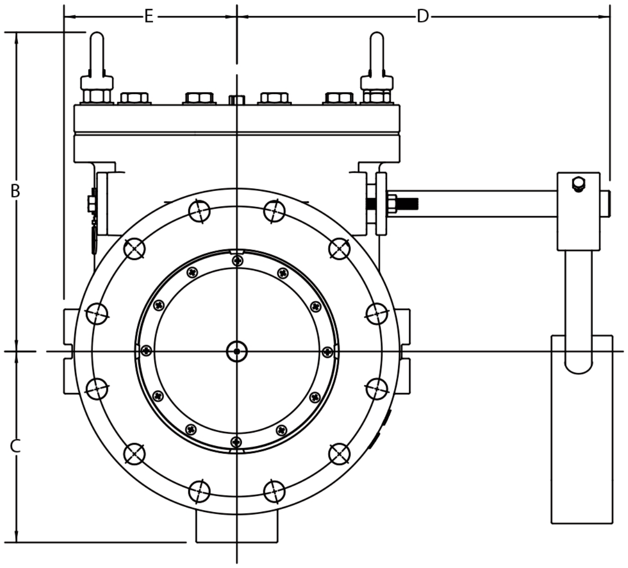
Inches
Millimeters

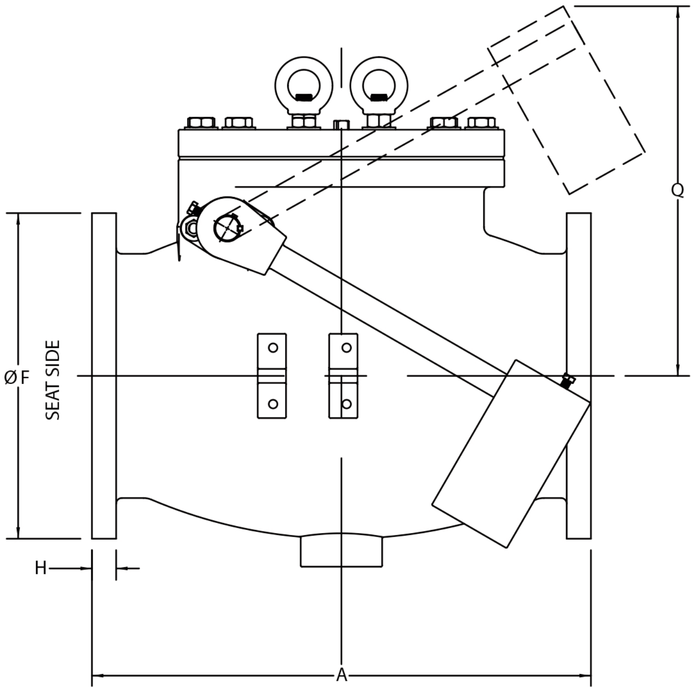




VP, VERTICAL FLOW UP
POSITION INSTALLATION
LEVER ARM SWING

Series 585 Swing Check Valves
meet the Federal Mandate for
Lead Content Limits



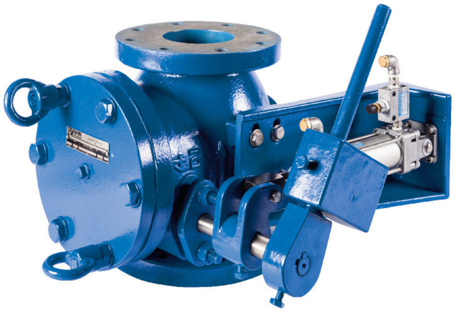


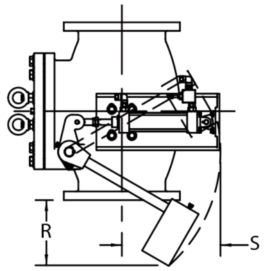
585AC Air Cushioned Check Valve

Valve Size	A	B	C	D	E	F	H	Q	R	S	T
2" 50mm	8.00 203	9.25 235	3.50 89	10.92 277	3.83 97	6.00 152	0.63 16	10.00 254	6.00 152	9.38 238	11.25 286
2.5" 65mm	8.50 216	9.72 247	3.50 89	10.92 277	3.83 97	7.00 178	0.88 22	9.88 251	6.13 156	9.38 238	11.13 283
3" 80mm	9.50 241	10.00 254	4.50 114	11.00 279	4.00 102	7.50 191	0.75 19	10.13 257	5.50 140	9.25 235	12.00 305
4" 100mm	11.50 292	10.75 273	5.00 127	11.75 299	5.00 127	9.00 229	0.94 24	10.75 273	4.88 124	8.75 222	10.88 276
6" 150mm	14.00 356	11.75 299	5.75 146	13.50 343	6.50 165	11.00 279	1.00 25	11.63 295	4.63 118	7.88 200	10.88 276
8" 200mm	19.50 495	13.75 349	7.25 184	17.00 432	7.50 191	13.50 343	1.13 29	15.50 394	5.88 149	10.38 264	13.50 343
10" 250mm	24.50 622	15.00 381	9.38 238	16.25 413	9.00 229	16.00 406	1.19 30	18.38 467	9.00 229	13.63 346	13.50 343
12" 300mm	27.50 699	19.00 483	11.00 279	18.25 464	11.00 279	19.00 483	1.25 32	21.13 537	9.00 229	14.25 362	13.50 343
14" 350mm	31.00 787	22.50 572	13.50 343	26.00 660	14.00 356	21.00 533	1.38 35	25.88 657	11.75 299	18.75 476	13.50 343
16" 400mm	36.00 914	24.50 622	14.25 362	29.50 749	15.00 381	23.50 597	1.44 37	32.00 813	7.25 184	15.88 403	14.50 368
18" 450mm	40.00 1016	26.50 673	17.38 441	31.00 787	18.63 473	25.00 635	1.56 40	36.00 914	9.25 235	21.25 540	13.00 330
20" 500mm	40.00 1016	28.75 730	17.63 448	32.38 822	18.63 473	27.50 699	1.69 43	41.00 1041	—	—	14.50 368
24" 600mm	48.00 1219	32.50 826	20.13 511	34.00 864	21.00 533	32.00 813	1.88 48	38.00 965	8.75 222	19.25 489	11.75 299
30" 750mm	56.00 1422	44.13 1121	29.75 756	39.00 991	24.00 610	38.75 984	2.13 54	53.13 1349	15.50 394	24.00 610	17.25 438
36" 900mm	63.00 1600	50.50 1283	33.50 851	42.00 1067	27.00 686	46.00 1168	2.38 60	57.50 1461	15.00 381	21.00 533	13.00 330
42" 1100mm											

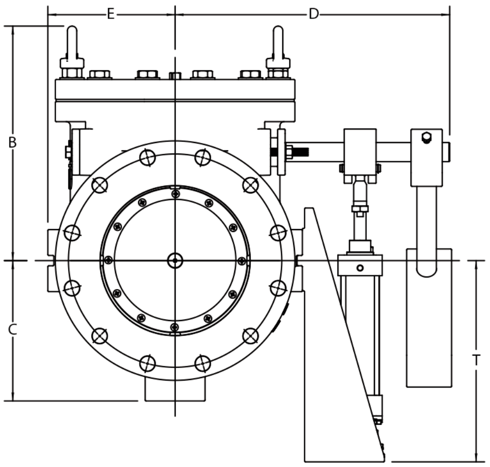
Inches
Millimeters

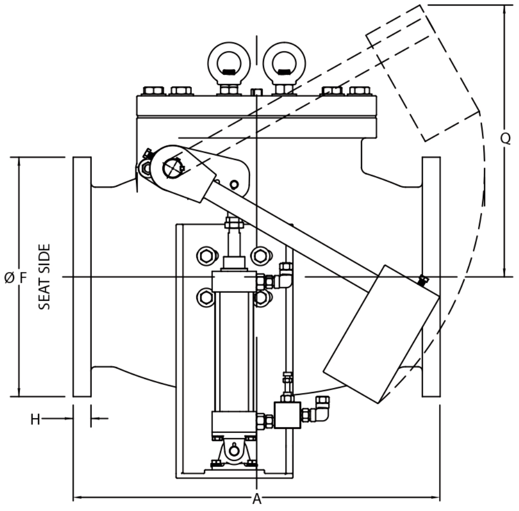
Valve Size	Weight lbs/kg
3" 80mm	110 50
4" 100mm	145 66
6" 150mm	205 93
8" 200mm	330 150
10" 250mm	500 227
12" 300mm	800 363
14" 350mm	1260 672
16" 400mm	1600 726
18" 450mm	2100 963
20" 500mm	2500 1134
24" 600mm	3700 1678
30" 750mm	6000 2722
36" 900mm	9100 4128
42" 1100mm	Consult Factory





VP, VERTICAL FLOW UP
POSITION INSTALLATION
LEVER ARM SWING

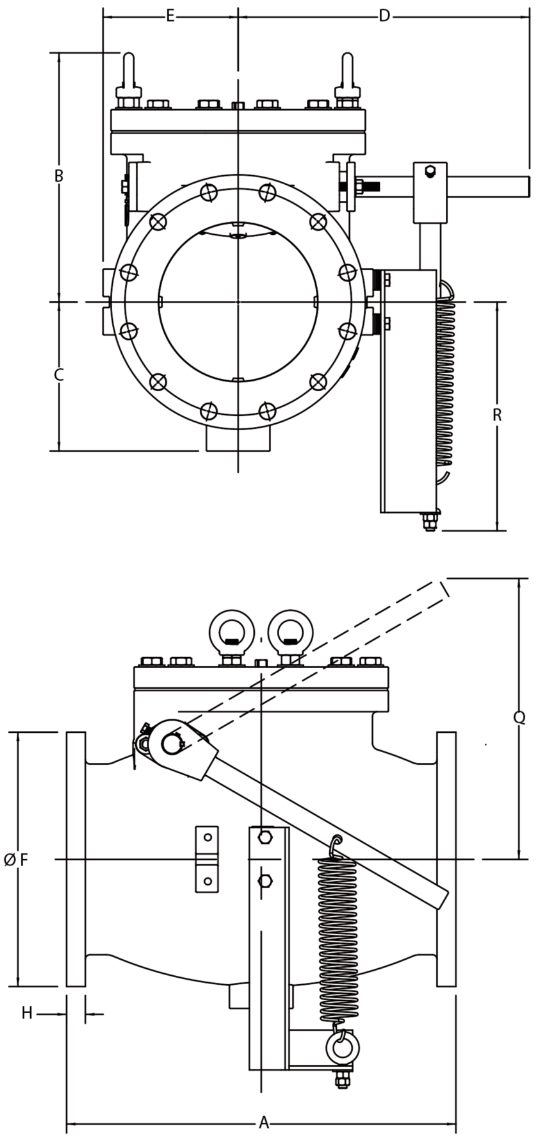


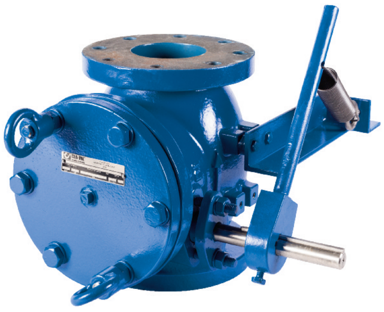


585LS Lever and Spring Check Valve

Valve Size	A	B	C	D	E	F	H	Q	R
2" 50mm	8.00 203	9.25 235	3.50 89	10.92 277	3.83 97	6.00 152	0.63 16	9.25 235	9.83 250
2.5" 65mm	8.50 216	9.72 247	3.50 89	10.92 277	3.83 97	7.00 178	0.88 22	9.25 235	9.83 250
3" 80mm	9.50 241	10.00 254	4.50 114	11.00 279	4.00 102	7.00 178	0.75 19	9.39 239	10.64 270
4" 100mm	11.50 292	10.75 273	5.00 127	11.75 299	5.00 127	9.00 229	0.94 24	10.00 254	9.50 241
6" 150mm	14.00 356	11.75 299	5.75 146	13.50 343	6.50 165	11.00 279	1.00 25	10.90 277	9.50 241
8" 200mm	19.50 495	13.75 349	7.25 184	17.00 432	7.50 191	13.50 343	1.13 29	14.84 377	6.50 165
10" 250mm	24.50 622	15.00 381	9.38 238	16.25 413	9.00 229	16.00 406	1.19 30	17.63 448	13.24 336
12" 300mm	27.50 699	19.00 483	11.00 279	18.25 464	11.00 279	19.00 483	1.25 32	20.40 518	13.25 336
14" 350mm	31.00 787	22.50 572	13.50 343	26.00 660	14.00 356	21.00 533	1.38 35	25.22 641	18.75 476
16" 400mm	36.00 914	24.50 622	14.25 362	29.50 749	15.00 381	23.50 597	1.44 37	32.00 813	15.50 394
18" 450mm	40.00 1016	26.50 673	17.38 441	31.00 787	18.63 473	25.00 635	1.56 40	36.00 914	19.45 494
20" 500mm	40.00 1016	28.75 730	17.63 448	32.38 822	18.63 473	27.50 699	1.69 43	41.00 1041	14.50 368
24" 600mm	48.00 1219	32.50 826	20.13 511	34.00 864	21.00 533	32.00 813	1.88 48	38.00 965	20.83 529
30" 750mm	56.00 1422	44.13 1121	29.75 756	39.00 991	24.00 610	38.75 984	2.13 54	53.13 1349	17.71 450
36" 900mm	63.00 1600	50.50 1283	33.50 851	42.00 1067	27.00 686	46.00 1168	2.38 60	57.50 1461	13.45 342
42" 1100mm									

Inches
Millimeters





Cla-Val 585 Series Swing Check Valve Specifications

The check valve shall be of the Swing Check Valve full body flanged type, with a domed access cover and only one moving part - the swing check valve disc.

The valve body shall have full flow equal to nominal pipe diameter at any point through the valve. The top access port of the body shall be full size, allowing removal of the disc without removal of the valve from the pipeline. The cover shall be domed to create a flushing action around the disc when valve is open. The valve body and cover shall be ASTM A536 Grade 65-45-12, Class B Ductile Iron coated and lined with an ANSI/NSF61 approved fusion bonded epoxy coating. The 585 Series Swing Check shall be designed, manufactured, and tested in accordance with ANSI/AWWA Standard C508-09.

The disc shall be raised one-piece Stainless Steel construction and equipped with a molded resilient seat mounted on the disc with an integral)-Ring for drip tight sealing. Both seats shall be secured with stainless steel fasteners and must be field replaceable without removing the valve from the pipeline.

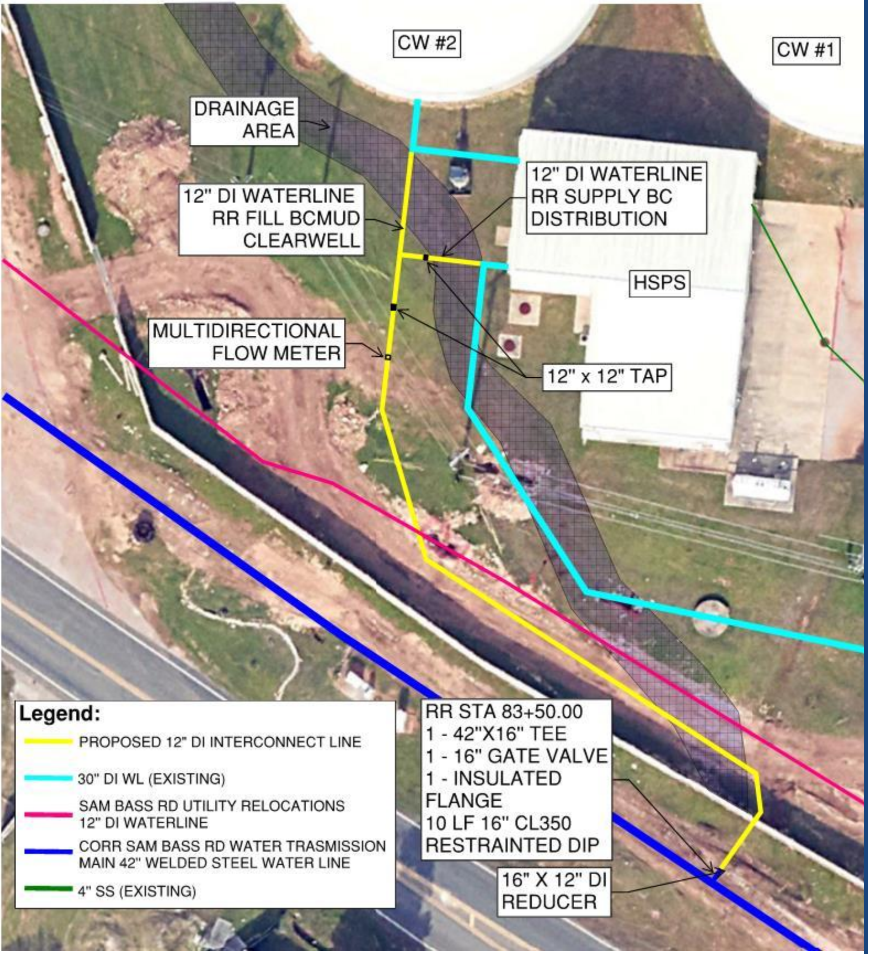
The valve shall be available with a choice of three closure options:
1) Lever and Weight 2) Air Cushion 3) Lever and Spring

This valve shall be a Cla-Val 585 Swing Check Valve as supplied by Cla-Val, Newport Beach, CA 92659-0325.

APPENDIX C

CIP Exhibits

CIP 1: Emergency Interconnect Yard Piping



Lay the Yard Piping Necessary For the Interconnect

Justification

The yard piping required to serve BCMUD water from the CORR will be layed in the ground.

Special Considerations

This project is in the 5-year CIP list because BCMUD would like to prioritize putting emergency backups in place to enhance the safety of their system.

Potential Alternatives

The tap location on the CORR 42" Transmission main might be moved to optimize the length of yard piping and overall yard piping quantity and cost.

PROJECT IMPLEMENTATION

Engineering/Design — **3** Months

+

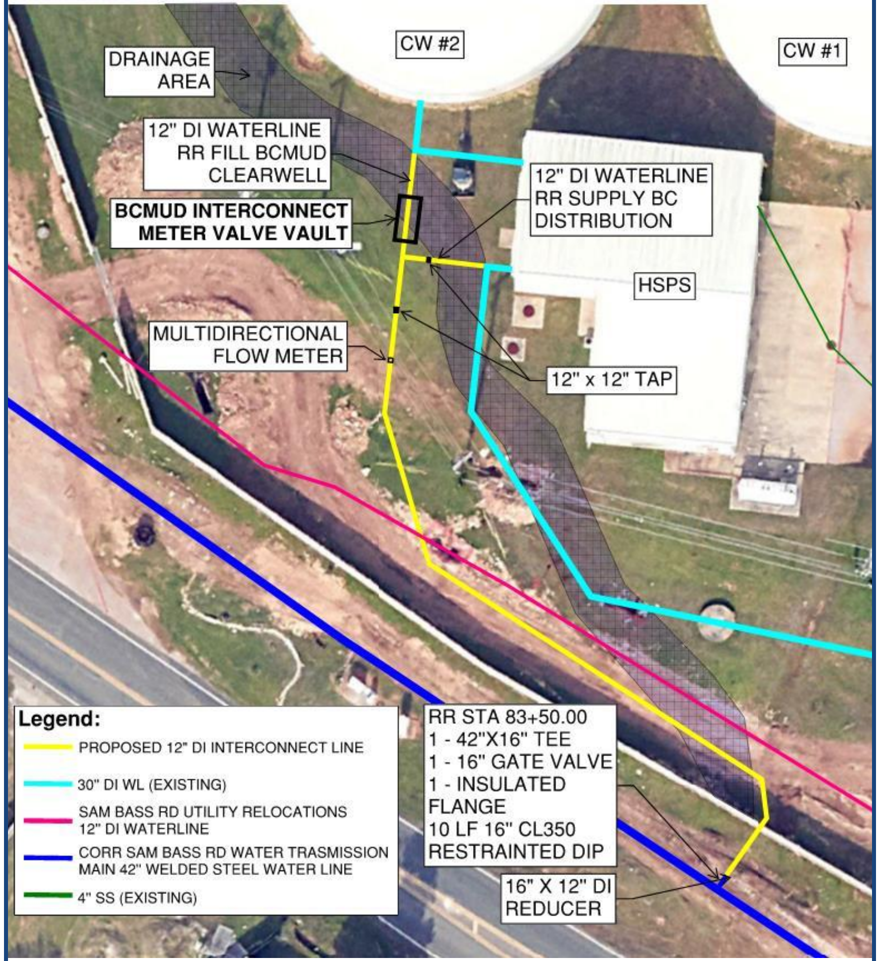
Bid/Construction — **6** Months

Total Project Duration — **9** Months

CIP 1: Emergency Interconnect Yard Piping

Item No.	Item Description	Unit	Quantity	$/Unit	Total
1	12" DI Pipe (Including Fittings)	LF	255	$500.00	$127,500.00
2	12" Gate Valve	EA	1	$9,500.00	$9,500.00
3	12" Flow Meter (Two-Way)	EA	1	$15,000.00	$15,000.00
4	12" Swing Check Valve	EA	1	$9,500.00	$9,500.00
5	2" Gate Valve	EA	1	$4,000.00	$4,000.00
6	Connection to Existing 30"	EA	2	$15,000.00	$30,000.00
7	5' Pre-Cast Manhole	EA	1	$12,000.00	$12,000.00
				Subtotal	**$207,500.00**
				Contingency (40%)	$83,000.00
				Design (25%)	$51,875.00
				OPCC	**$342,375.00**

CIP 2: BCMUD Emergency Interconnect Valve Vault



Install the BCMUD Valve Vault

Justification

Once the yard piping is installed, the valve vault can be installed.

Special Considerations

This project is in the 5-year CIP list because BCMUD would like to prioritize putting emergency backups in place to enhance the safety of their system.

Potential Alternatives

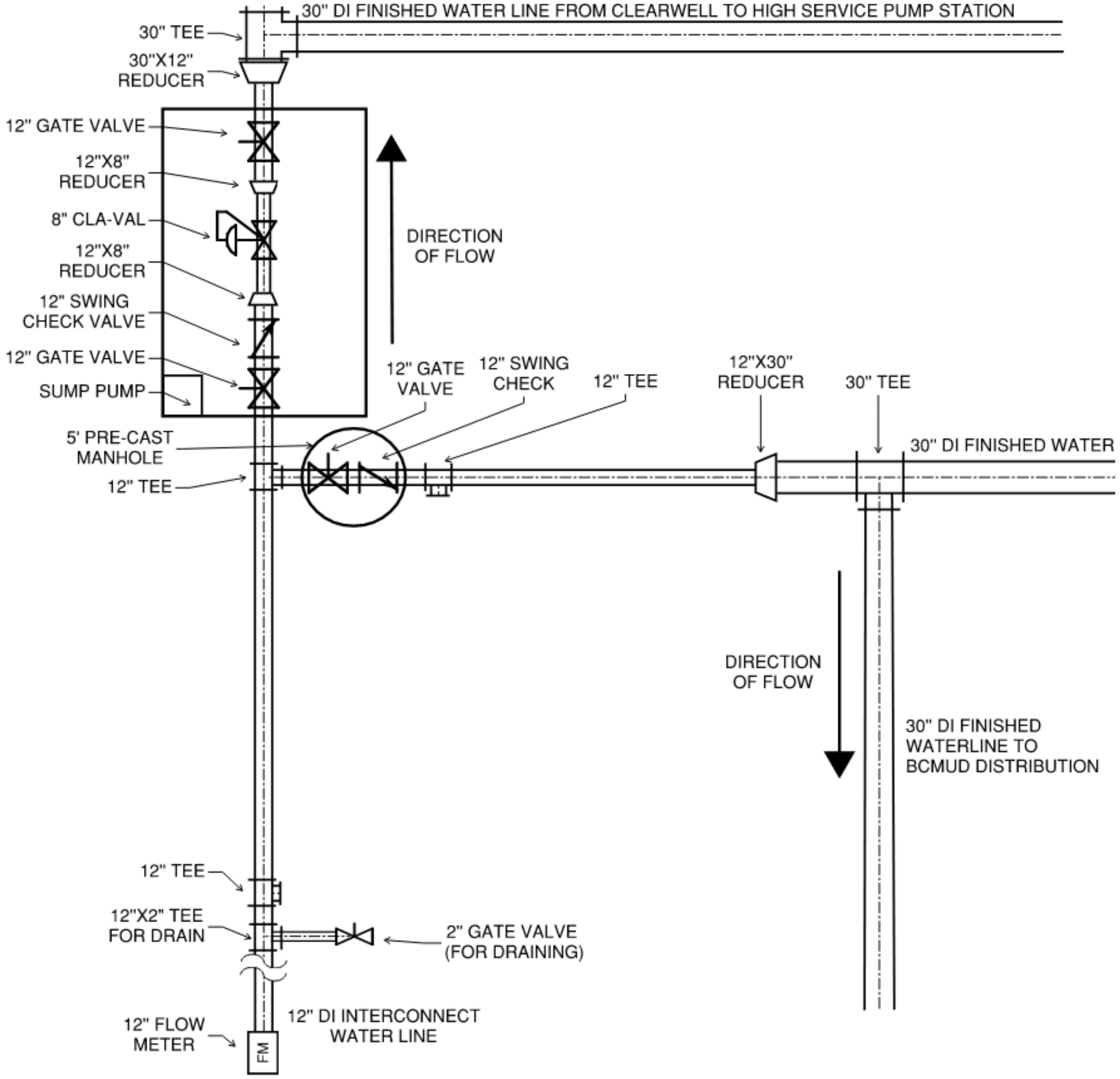
N/A

PROJECT IMPLEMENTATION

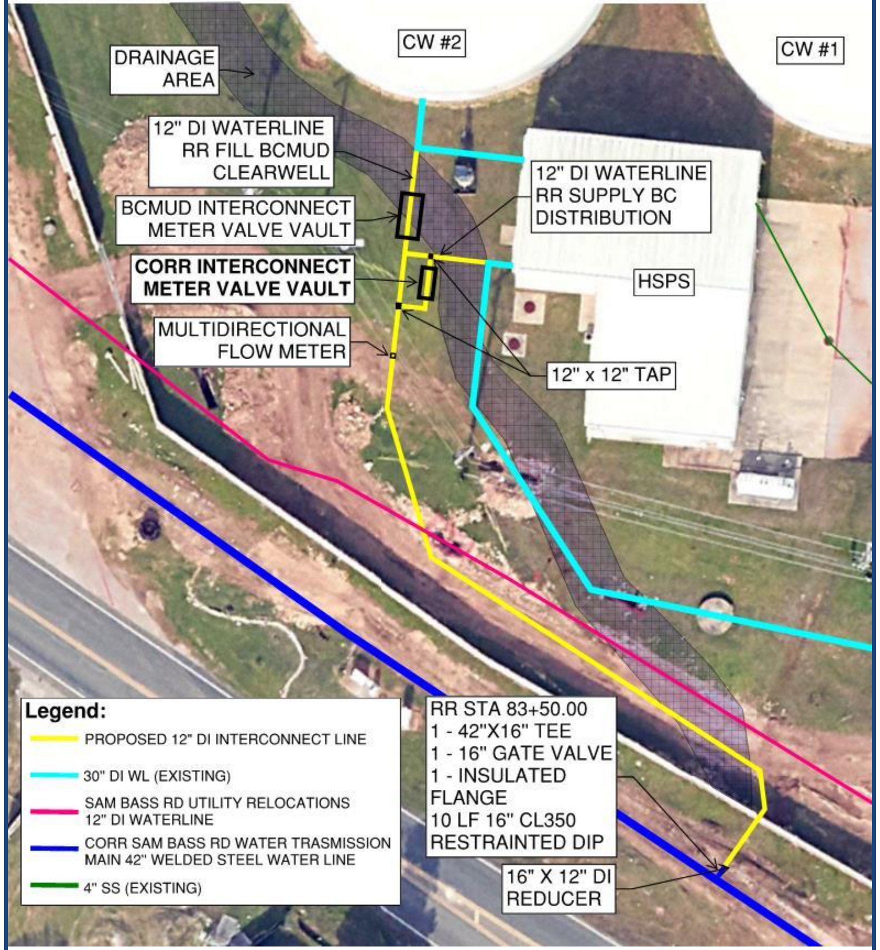
Engineering/Design	**3** Months
+	
Bid/Construction	**6** Months
Total Project Duration	**9** Months

CIP 2: BCMUD Valve Vault					
Item No.	**Item Description**	**Unit**	**Quantity**	**$/Unit**	**Total**
1	Cla-Val Meter Vault	EA	1	$96,313.00	$96,313.00
				Subtotal	**$96,313.00**
				Contingency (40%)	$38,525.20
				Design (25%)	$24,078.25
				OPCC	**$158,916.45**

CIP 2: BCMUD Emergency Interconnect Valve Vault (Continued)



CIP 2a: CORR Emergency Interconnect Valve Vault (Optional)



Install the CORR Valve Vault

Justification

Once CIP 1 has been completed, the CORR can install additional yard piping and a valve vault to receive water from BCMUD.

Special Considerations

This project is in the 5-year CIP list because BCMUD would like to prioritize putting emergency backups in place to enhance the safety of their system.

Potential Alternatives

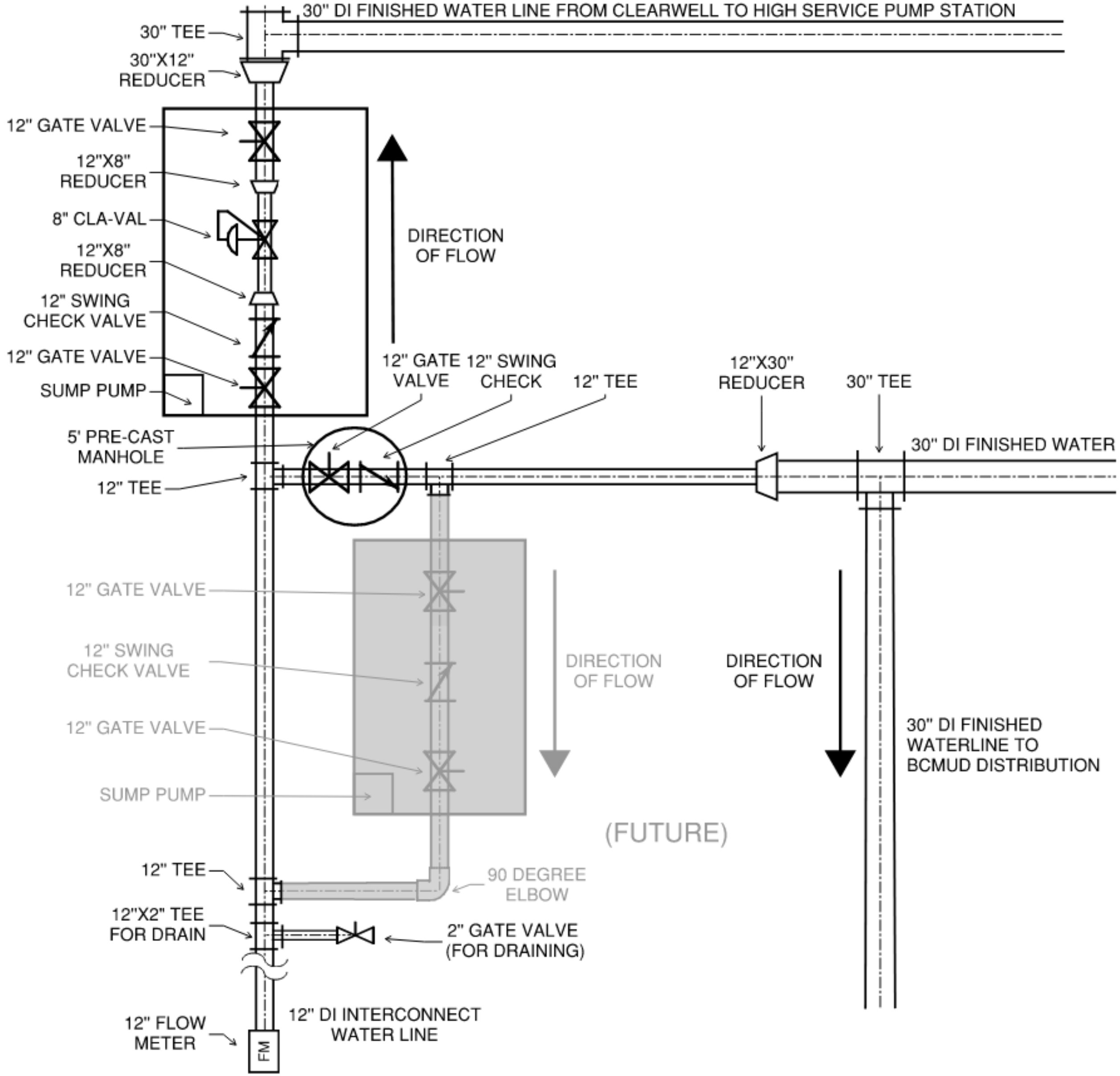
N/A

PROJECT IMPLEMENTATION

Engineering/Design	**3** Months
+	
Bid/Construction	**6** Months
Total Project Duration	**9** Months

CIP 2a: CORR Yard Piping & Valve Vault					
Item No.	**Item Description**	**Unit**	**Quantity**	**$/Unit**	**Total**
1	12" DI Pipe (Including Fittings)	LF	20	$500.00	$10,000.00
2	12" Gate Valve	EA	2	$9,500.00	$19,000.00
3	12" Swing Check Valve	EA	1	$9,500.00	$9,500.00
4	Sump Pump	EA	1	$1,500.00	$1,500.00
5	Meter Vault (5'x8')	EA	1	$12,000.00	$12,000.00
				Subtotal	**$52,000.00**
				Contingency (40%)	$20,800.00
				Design (25%)	$13,000.00
				OPCC	**$85,800.00**

CIP 2a: CORR Emergency Interconnect Valve Vault (Optional) (Continued)



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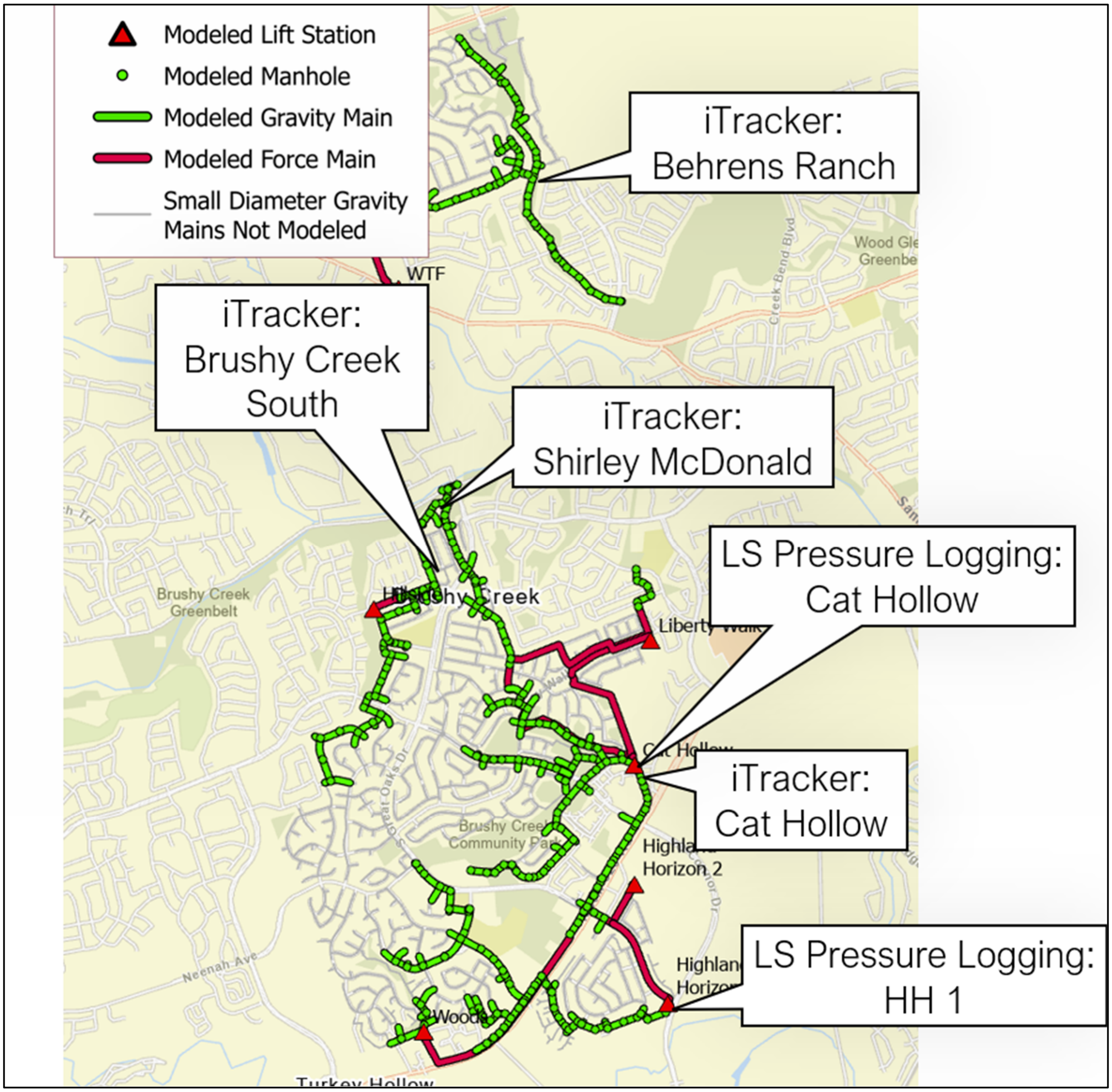
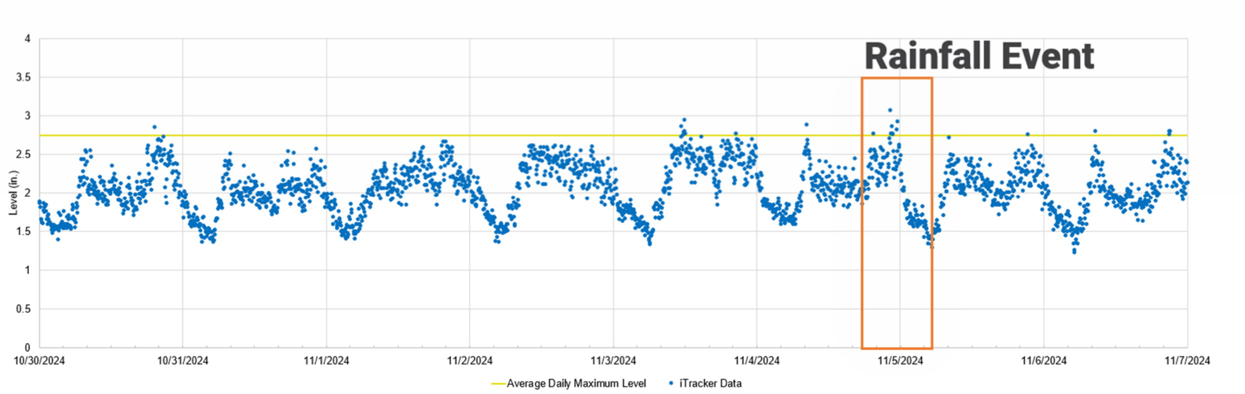
Appendix H

Collection System Field Data Collection

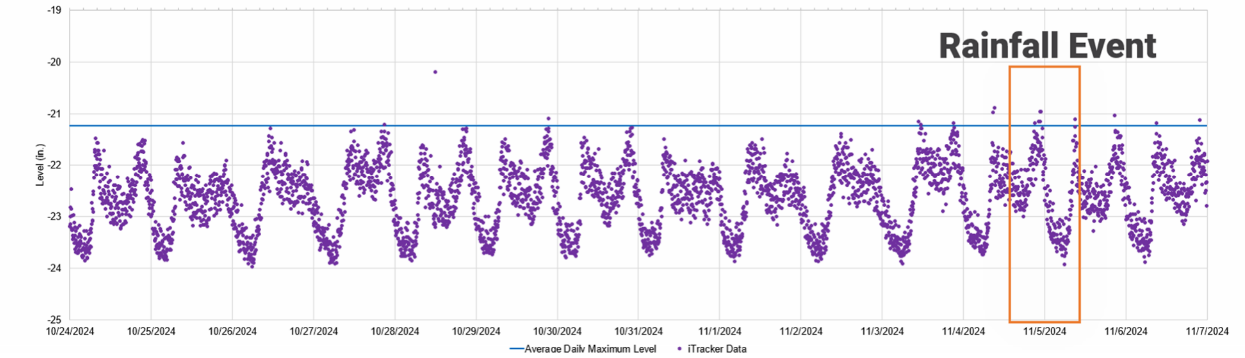
iTracker Location Map and Level Data



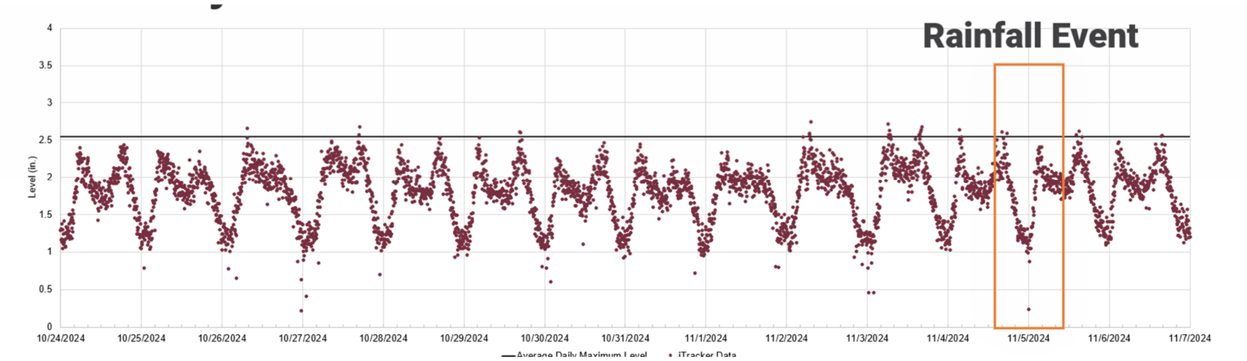
Shirley McDonald



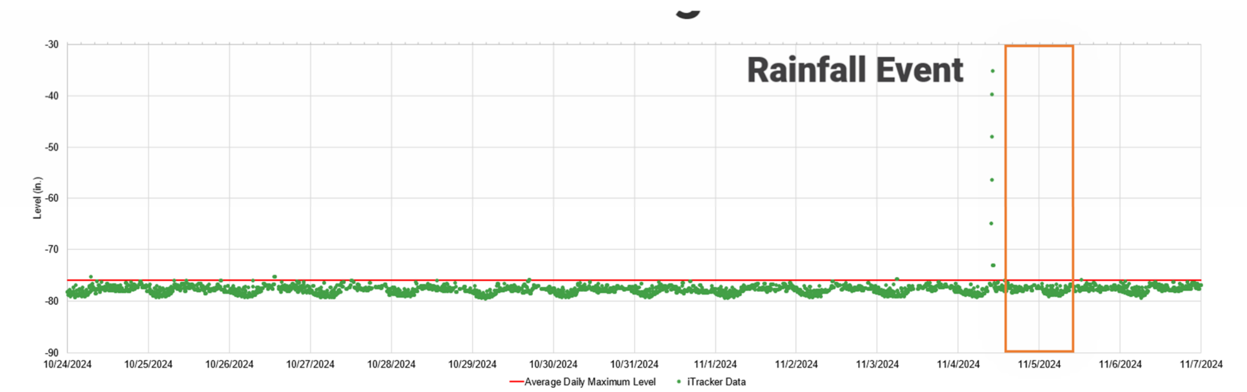
Brushy Creek South



HH 1



Cat Hollow



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