WASTEWATER FACILITES PLAN REPORT

Brookfield Water Pollution Control Authority

August 2020





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Section 1

Introduction

1.1 Project Background and Goals

The Town of Brookfield located in western CT in Fairfield County, has a population of approximately 16,000 people in 2020, estimated by the CT Data Collaborative. The Town has a wastewater collection system including gravity and sewers, fourteen pumping stations and discharges the collected wastewater to the Danbury collection system and ultimately to Danbury's treatment plant for disposal. There are approximately 6,100 housing units; however, the majority of them are served by onsite subsurface disposal systems (i.e. septic systems). The commercial corridor of Town located along Route 7 and Federal Road is served by the collection system. The system is administered by the Brookfield Water Pollution Control Authority (BWPCA) which was founded in 1976 and is comprised of five appointed members plus three alternates.

Portions of the wastewater collection system are nearly 45 years old, dating back to 1975. The sewer system has approximately 2,300 connected accounts, many connections of commercial and industrial nature.

The goal of this report is to document the Town's wastewater infrastructure, evaluate the BWPCA's current practices, make recommendations for improvements and develop a capital plan to implement the recommendations.

1.2 Summary of Report

The remainder of this report consists of the following Sections:

Section 2, Existing Conditions and Needs Assessment – Describes existing collection system; describes areas evaluated for sewer extensions in the short-term and presents a proposed Sewer Service Area Map.

Section 3, Collection System Evaluation – Present an Infiltration and Inflow evaluation of the collection system, as well as the television (TV) inspection results from TV work completed in November 2019.

Section 4, Pumping Stations Evaluation – Presents an overview of BWPCA's pumping stations, comments on their overall condition, evaluated their capacity to convey the projected flow and makes recommendations for upgrades.

Section 5, Benchmarking – Presents an analysis of current staffing at Brookfield WPCA as it compares to recommended standards and other similar municipalities.

Section 6, Projected Costs and Revenue Distribution – Evaluates BWPCA's rate structure, financial situation, and evaluates the rate impact of proposed improvements.





Section 2

Existing Conditions and Needs Assessment

The Town of Brookfield, located in western Connecticut in northern Fairfield County, has a population of approximately 16,000 people and about 6,100 housing units, as estimated by the CT Data Collaborative. The Town is most densely developed along the Route 202 and Route 7 corridor, generally surrounded by larger parcel (1 to 2+ acres) residential areas.

2.1 Existing Facilities

The Town owns and maintains a wastewater collection system including gravity sewers and fourteen pumping stations which discharge flow to the City of Danbury's collection system and ultimately to Danbury's wastewater treatment facility. Portions of the wastewater collection system are 45 years old, dating back to 1975, while much of the system was constructed in the 1990s. The sewer system has approximately 1,560 residential accounts and over 760 accounts that are commercial or industrial in nature.

2.1.1 Danbury Agreement

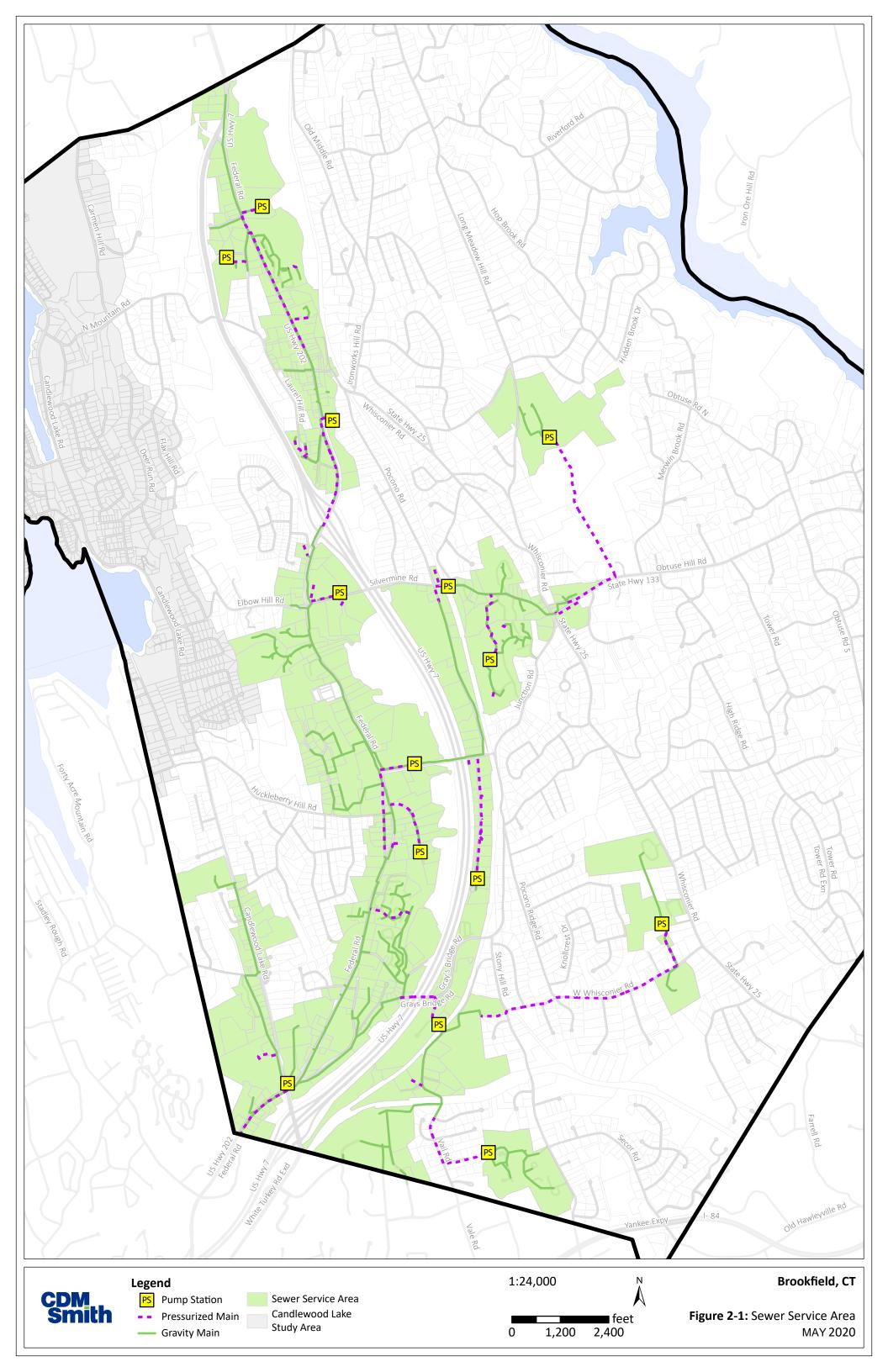
The City of Danbury accepts Brookfield's wastewater discharge under an interlocal agreement. By this agreement, Brookfield is limited to an average discharge of 500,000 gallons per day (gpd). Under Danbury's plan to reduce the capacity of its wastewater treatment plant during a statemandated upgrade, Brookfield's discharge limit is slated to decrease to 380,000 gpd in 2022. Brookfield currently discharges an average daily flow of approximately 332,000 gpd to the Danbury treatment plant.

2.1.2 Wastewater Collection System

The current sewer service area is primarily along State Routes 7 and 202 through the center of town, as shown in **Figure 2-1**. Some outlying condominium complexes are served, and all schools are connected. There are approximately 17 miles of gravity sewer ranging in size from 8 to 15 inches in diameter. There are also approximately seven miles of pressurized force mains from 14 pump stations. All flow from the system ultimately ends up at the Caldor Pump Station on Federal Road, which then pumps all of Brookfield wastewater flow to Danbury where it is treated at the Danbury Wastewater Treatment Plant.









2.1.3 Current Flows

Based on the flow metered at Caldor Pumping Station, Brookfield is currently discharging an average of 332,000 gallons per day (gpd). **Figure 2-2** shows average daily flow by fiscal year from Fiscal Year 2009-2010 through Fiscal Year 2018-2019.

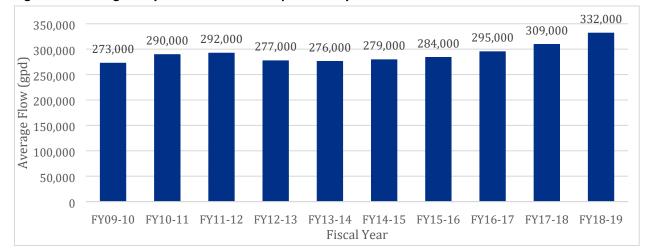
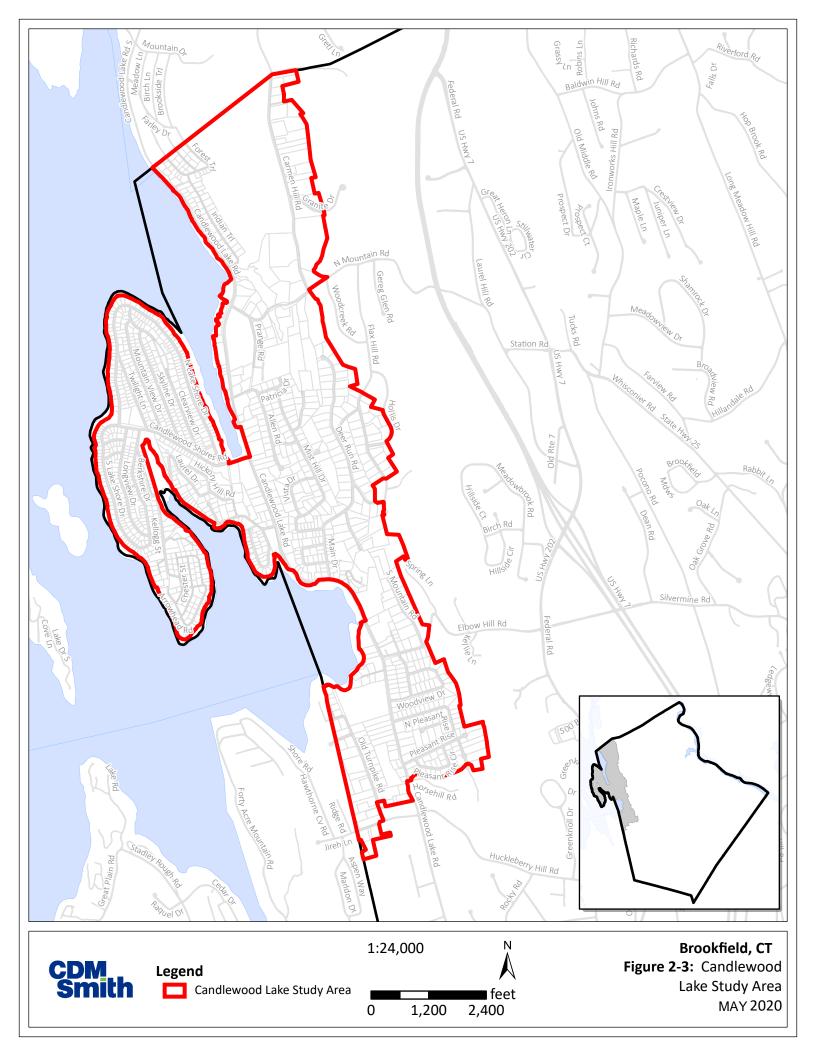


Figure 2-2: Average Daily Flows at Caldor Pump Station by Fiscal Year

2.2 Sewer Needs Assessment

This section evaluates needs related to public health and the environment by evaluating feasibility and necessity of sewer extensions. The study area includes the Town of Brookfield, however, the area adjacent to Candlewood Lake is the focus of a separate study and is not being considered in this needs assessment. The Candlewood Lake Study area, outlined in **Figure 2-3**, is comprised of approximately 1,300 properties and is also the most densely developed residential area in Brookfield.





2.2.1 Criteria for Needs Areas

Specific criteria were developed to evaluate individual areas within the Town of Brookfield. The assessment included the criteria presented below:

- Lot size distribution
- Proximity to public water supply/aquifer protection area
- Prevalence of flood plains and wetlands
- Soil potential for subsurface disposal
- On site disposal system repairs/failures

Lot size is a factor for review since small lot size can restrict the ability to construct an on-site system in compliance with state regulations. Density of development is closely related to lot size in that a large number of small lots with on-site disposal systems in close proximity can pose a threat to groundwater, and surface water, quality. Soil potential mapping from the National Resource Conservation Service (NRCS) shows various soils rated for suitability in supporting a subsurface disposal system. Areas designated for public water supply or are aquifer protection areas are of special concern due to the ultimate use of the water for human consumption.

Lot sizes were used as an identifier for residential areas of Town for review and were based on Town zoning. Residential zoning classifications are listed in **Table 2-1**.

Table 2-1: Brookfield Residential Zoning

Town Zoning Classification	Minimum Lot Size (square feet)	Approximate Lot Size (acres)
R-7	7,000	0.16
R-15	15,000	0.34
R-40	40,000	0.9
R-60	60,000	1.4
R-80, R-100	80,000 +	1.8+

The residential areas located primarily east of State Route 7, and in the northwest corner, are generally larger in lot size and are considered fit to be served by on-site subsurface disposal of domestic waste due to zoning of 1.4-acre minimum parcels (and the absence of any overarching constraints, e.g. poor soils or prone to flooding). Properties zoned at R-60, R-80, and R-100 are less likely to need connection to sewer in the planning period.

Sensitive environmental and public health resources include areas designated for public water supply, including aquifer protection areas. Other environmentally sensitive zones include wetlands, floodplains, and areas with poor performing on-site disposal systems. Flood areas were taken from Federal Emergency Management Agency (FEMA) mapping completed in June 2018, which classifies 0.2% Flood Hazard Areas, 1% Flood Hazard Areas, and Regulated Floodways. A



regulated floodway is defined by FEMA as the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height. Flood hazards areas are defined as an area that will be inundated by the flood event having a 0.2-percent-chance or 1-percent chance of being equaled or exceeded in any given year. The 1-percent-chance is also known as the 100-year flood, and the 0.2-percent chance is known as the 500-year flood.

CDM Smith met with the Town of Brookfield Sanitarian in order to gain insight on performance of on-site systems in town, however no failure records were provided to CDM Smith for use in the assessment of on-site system performance. The Town of Brookfield is in the process of transitioning to an electronic tracking system for reporting septic system pump-outs, repairs, inspections, and new installations, which is available online to the public. From information found on the online database, it was determined that the majority of records date to around 2000 and systems are therefore only about 20 years old.

The National Resources Conservation Service (NRCS) characterizes soils by slope, percolation, depth to groundwater, depth to bedrock, and flooding. These criteria are combined to assess the ability to support a typical subsurface disposal system, defined as being for a single family, 4-bedroom home on a 1-acre lot with a private well, or a $\frac{1}{2}$ -acre lot with public water supply. The ratings also provide a cost factor estimate for installation, expressed as a multiple of x, with 1x being a typical system installed in an area with high soil potential. The following are the NRCS soil rating classes:

- High Potential: These soils have the best combination of characteristics or may have limitations that can be easily overcome using standard installation practices. The cost factor is 1x to 2.0x.
- Medium Potential: These soils have significant limitations, such as low percolation rate, that are generally overcome using commonly applied designs. The cost factor ranges from 2.0x to 2.5x.
- Low Potential: These soils have one or more limitations, such as low percolation rate and depth to seasonal highwater table, that require extensive design and site preparation to overcome. The cost factor ranges from 2.5x to 3.5x.
- Very Low Potential: These soils have to overcome major soil limitations, such as depth to bedrock, that require extensive design and site preparation. A permit for a subsurface sewage disposal system may not be issued unless the naturally occurring soils meet the minimal requirements outlined in the state health code. It is unlikely these soils can be improved sufficiently to meet state health code regulations. The cost factor ranges from 4.25x to 6.0x.
- Extremely Low: These soils have multiple major limitations, such as potential flooding and depth to seasonal highwater table, which are extremely difficult to overcome. A permit for a subsurface disposal system may not be issued unless the naturally occurring soils meet the minimal requirements outlined in the state health code. It is unlikely these soils can be improved sufficiently to meet state health code regulations.



• Not Rated: Areas labeled Not Rated have characteristics that show extreme variability from one location to another. The work needed to overcome adverse soil properties cannot be estimated. Often these areas are urban land complexes or miscellaneous areas. An on site investigation is required to determine soil conditions present at the site.

For this needs assessment, soils with low, very low, or extremely low potential were considered in outlining the areas of environmental concern.

2.2.2 Needs Assessment Matrix

In order to identify Areas of Environmental Concern in Brookfield, the assessment criteria were mapped to show where they overlapped, creating the areas with a higher environmental concern with the respect to wastewater management.

Figure 2-4 shows the mapped criteria. This method presented six areas of environmental concern, outlined in **Figure 2-5**.

The needs assessment matrix was cross-referenced with property data for public water versus private well water throughout the residential areas of town, since the space required for the separation distance between the subsurface disposal system and a well is not a concern if a property is connected to a public water supply. **Figure 2-6** shows the properties that have public water.

An evaluation and ranking of each study area was performed based on the criteria outlined above. The assessment included a point scoring system to prioritize the areas identified. Determination wastewater need was assessed by assigning a point value to the individual and summing the scores. The higher the point score the greater the relative need. The scoring criteria is as follows:

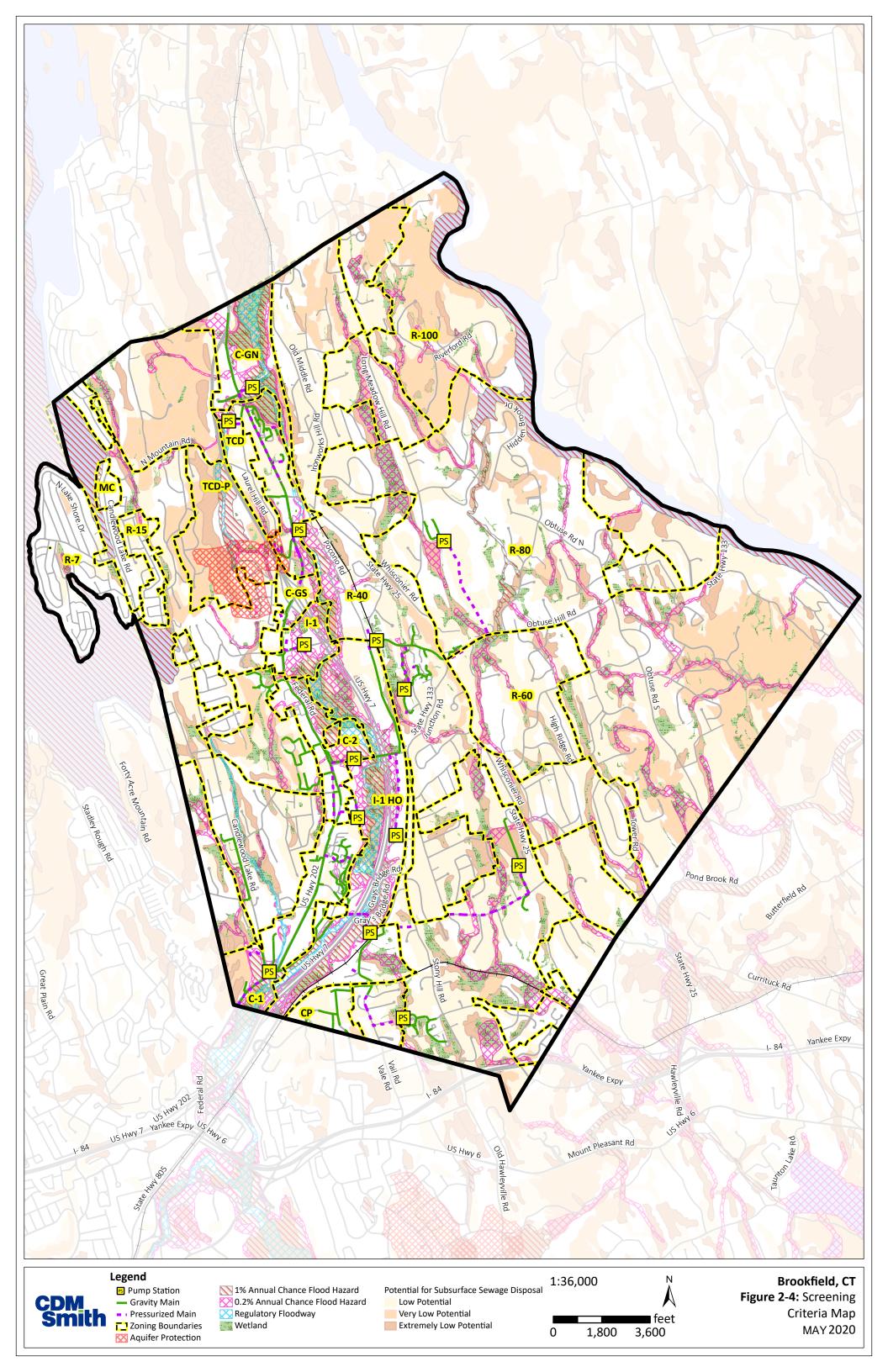
- Lot Size and density considers the distribution and prevalence of small lot sizes. Larger lot sizes are generally more favorable to onsite disposal systems, thus areas zoned for larger lots were assigned a lower score. Conversely, area where zoning allows small lots were assigned a higher score. The point score range for the Lot Size category was from 0 4.
- Wetlands are considered sensitive environmental receptors and can be negatively impacted by onsite disposal systems. Furthermore, the presence of wetlands can be an indicator of high groundwater and unfavorable conditions for onsite disposal systems. Areas with no wetlands present were assigned a point score of 0, while areas with significant areas of wetlands were assigned a point score of 4. The point score range for the Wetlands category was from 0 4.
- Floodplains and areas prone to localized flooding can have significant negative impacts on subsurface disposal systems. The area suitable for onsite disposal systems can be significantly reduced on a property in a floodplain. Areas with a floodplain were assigned the highest point score. The point score range to the Flood Hazard category was from 1-3.
- Regulatory floodways, as defined by FEMA are considered a sever limitation to onsite disposal. Areas where a regulatory floodplain is present were assigned the highest point score. The point score range to the Flood Hazard category was from 1-4.

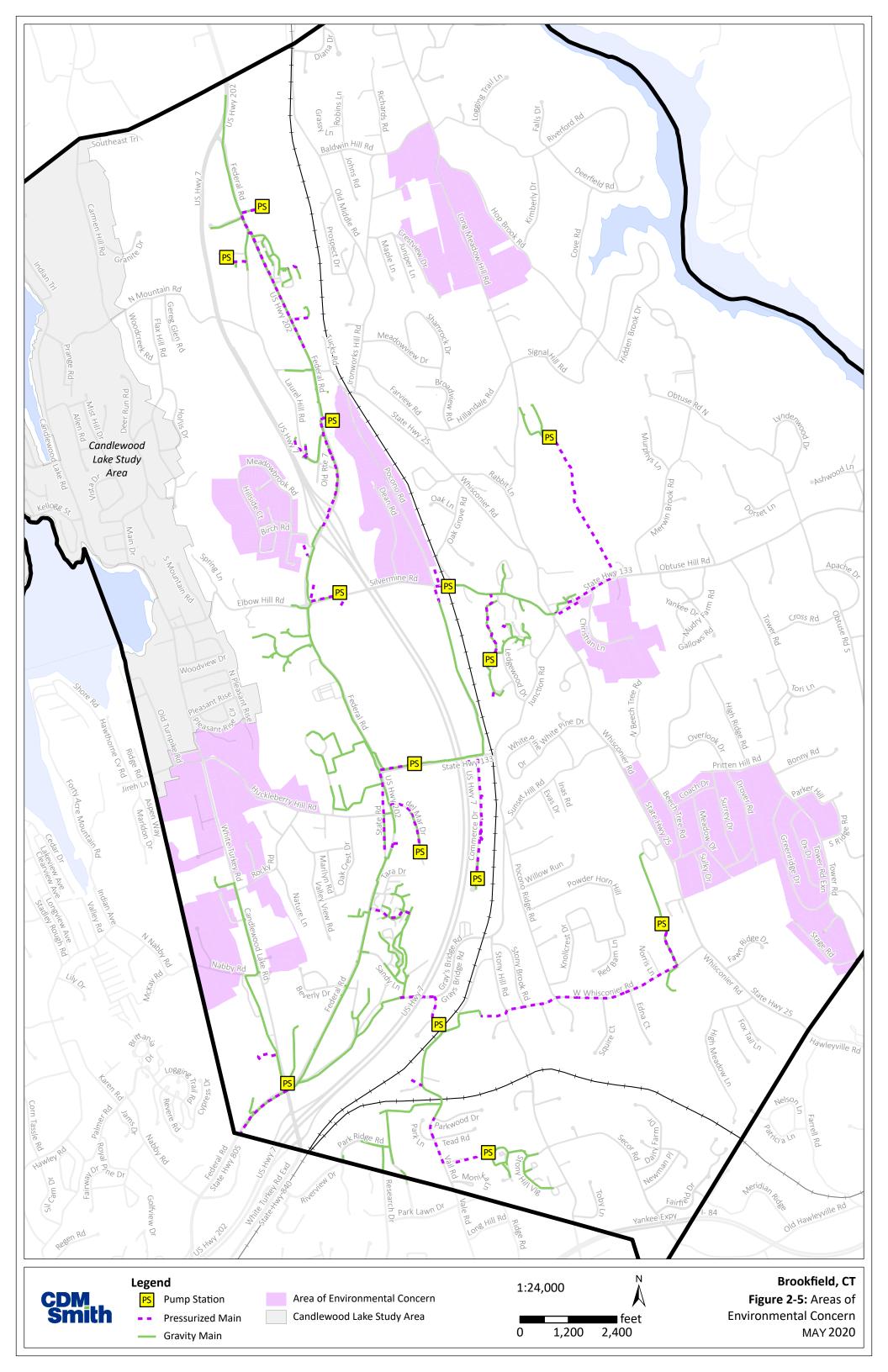


- The native soil conditions in a particular area can significantly impact the performance of an onsite disposal system. The prevalence of poor soil conditions was evaluated. Areas with the lowest soil potential were assigned the highest point score. The point score range for the Poor Soil Potential for Subsurface Disposal category was from 1 3.
- Onsite wastewater disposal in not prohibited in Aquafer Protection Areas, however; it can
 be beneficial to limit onsite disposal to reduce the risk of degrading aquifer water quality.
 Areas with were assigned a higher score based on their proximity to aquifer protection
 areas. The point score range for the Aquifer Protection Area category was from 0 3, with
 0 being assigned to areas outside of designated Aquifer Protection Areas.
- The presence of a public water supply system reduces the separation distance requirement that is present for properties with a private well. Without the separation distance constraint there is can be more potential for adequate subsurface disposal. In addition, the potential for adverse impacts on drinking water are reduced. Areas with a public water supply system were assigned a point score of 0. The point score range for Public Water Supply ranged from 0 3.

Based on the extent of the needs assessment criteria in the areas identified, presented in **Table 2-2**, each area was given a total score pertaining to need for wastewater management, highest score representing the highest need.







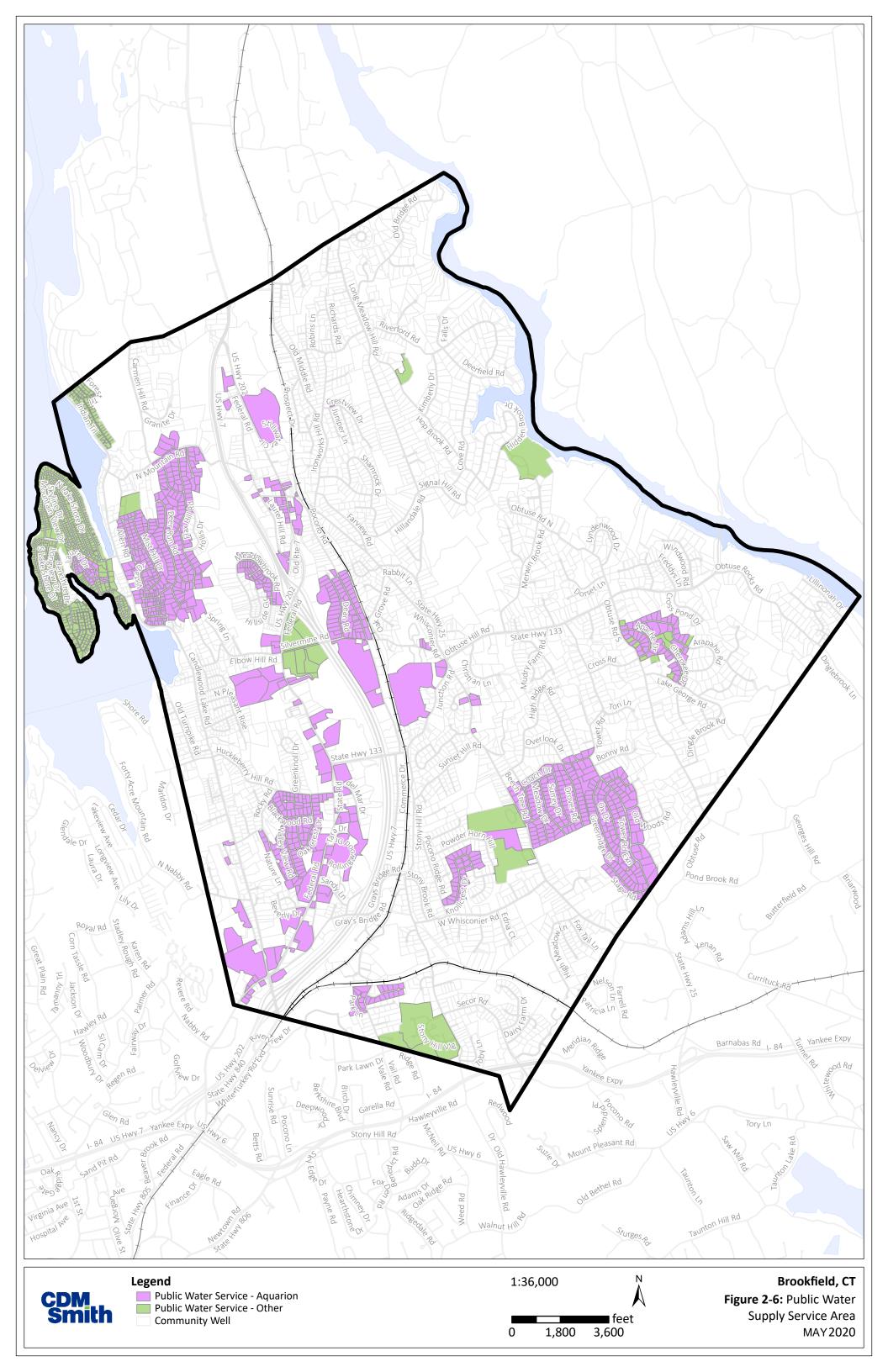




Table 2-2 - Needs Assessment Matrix

Location	Lot Size Distribution (Zoning)	Avg Lot Size (acres)	Lot Size Score (3 equates to 1 acre)	Wetlands	Flood Hazard
Christian Lane Area	R-60	3.2	0	3	2
Dean-Pocono Area	R-40	1.1	3	2	3
Greenridge Area	R-40	1.0	3	1	1
Huckleberry Hill Area	R-80	1.6	2	2	1
Long Meadow Hill Road Area	R-40, R-60	2.1	0	3	2
Meadowbrook Road Area	R-40, R-80	0.7	4	1	1
Candlewood Lake Study Area*	R-7, R-15, R-40, MC	0.7	4	1	1

		Poor Soil Potential for Subsurface Disposal		Aquifer		
Location	Regulatory Floodway	Low-Very Low	Extremely Low	Protection Area	Public Water Supply	Total Score
Christian Lane Area	0	3	2	0	1	11
Dean-Pocono Area	4	1	1	0	1	15
Greenridge Area	0	3	2	0	0	10
Huckleberry Hill Area	2	2	2	0	2	13
Long Meadow Hill Road Area	0	2	3	0	2	12
Meadowbrook Road Area	0	2	1	1	1	11
Candlewood Lake Study Area*	2	3	3	3	3	20



2.3 Future Sewer Service Area

The sewer service area outlined in **Figure 2-1** includes properties currently connected to and discharging to sewer, as well as properties with sewer available but are not connected. Most properties in this defined area are zoned as commercial or industrial in nature, as well as some in the Town Center District, which is intended to foster business development. Properties not currently connected to sewer that are in the sewer service area (generally the Route 7 corridor through Town), are anticipated to connect to the collection system within the planning period. In the sewer service area, the following properties are included:

- Previously Assessed (but not connected): properties that have been assessed for connection to sewer but have not connected to date
- Areas for Development: properties anticipated to be developed within the planning period
- Failure Only Connections: defined as having sewer available, but anticipated to connect to the sewer system only in the event of an on-site system failure

2.4 Future Flows

The population of Brookfield has remained fairly constant since 2010, showing less than a 700 person increase over 7 years (per the Connecticut Data Collaborative), shown in **Table 2-3.**

Table 2-3: Brookfield Population Trend

Year	Population
2017	17,133
2016	17,134
2015	17,106
2014	17,030
2013	16,869
2012	16,787
2011	16,627
2010	16,473

With the growth pattern seen in the past 7 years, we can expect future population growth to remain at less than a 0.5 percent annual increase. Population growth in Brookfield is not a significant indicator of increases to sewer flows. There is some recent variability in the number and size of commercial customers. A 2019 departure of a large employer and a few other has reduced flows and reduced billings by 7 percent.

Futures flows to the Brookfield collection system can be attributed to connections of properties in close proximity to sewers and also properties located in areas of environmental concern. Properties in the Route 7/Federal Road corridor not yet connected to sewer (many of which are assessed) are likely to have the greatest impact on sewer flow in the next ten years. Connections



of properties in areas of environmental concern will require sewer extensions and are less likely to be occur in the short term.

Potential connections to the sewer system have been evaluated for probability of connection, as well as anticipated flow in the case of connection. Flows from needs areas as well as future connections within the sewer service area have been considered.

In order to estimate potential flows for residential connections to the sewer system, two sources were referenced. *Guides for Wastewater Treatment Works* (Technical Report No. 16 – aka TR-16) by the New England Interstate Water Pollution Control Commission recommends using 70 gallons per capita per day (gpcd). This, along with the United States Census 2.78 average persons per household (in the portion of Brookfield generally served by sewer), equates to a flow estimate of 195 gpd for residential households. For comparison, CDM Smith reviewed water consumption data from Aquarion Water Company for Brookfield properties for the period of August 2016 to July 2019. The average of this data yields an estimated 133 gpd for single family residences (1-3 bedrooms). The value found using Aquarion water consumption data (133 gpd) appeared to be most representative of Brookfield and was used in projecting future residential connection flow in this plan.

To estimate potential flows from commercial developments, Metcalf & Eddy *Wastewater Engineer Treatment and Resource Recovery* was referced. This publication provides an average unit-flowrate for commercial developments range of 800 to 1500 gal/acre/day. Comparing this guideline to water consumption data for commercial Aquarion accounts, CDM Smith determined that Brookfield commercial water usage is on the lower end of the range, and 800 gal/acre/day was used to estimated flows for future commercial/industrial connections.

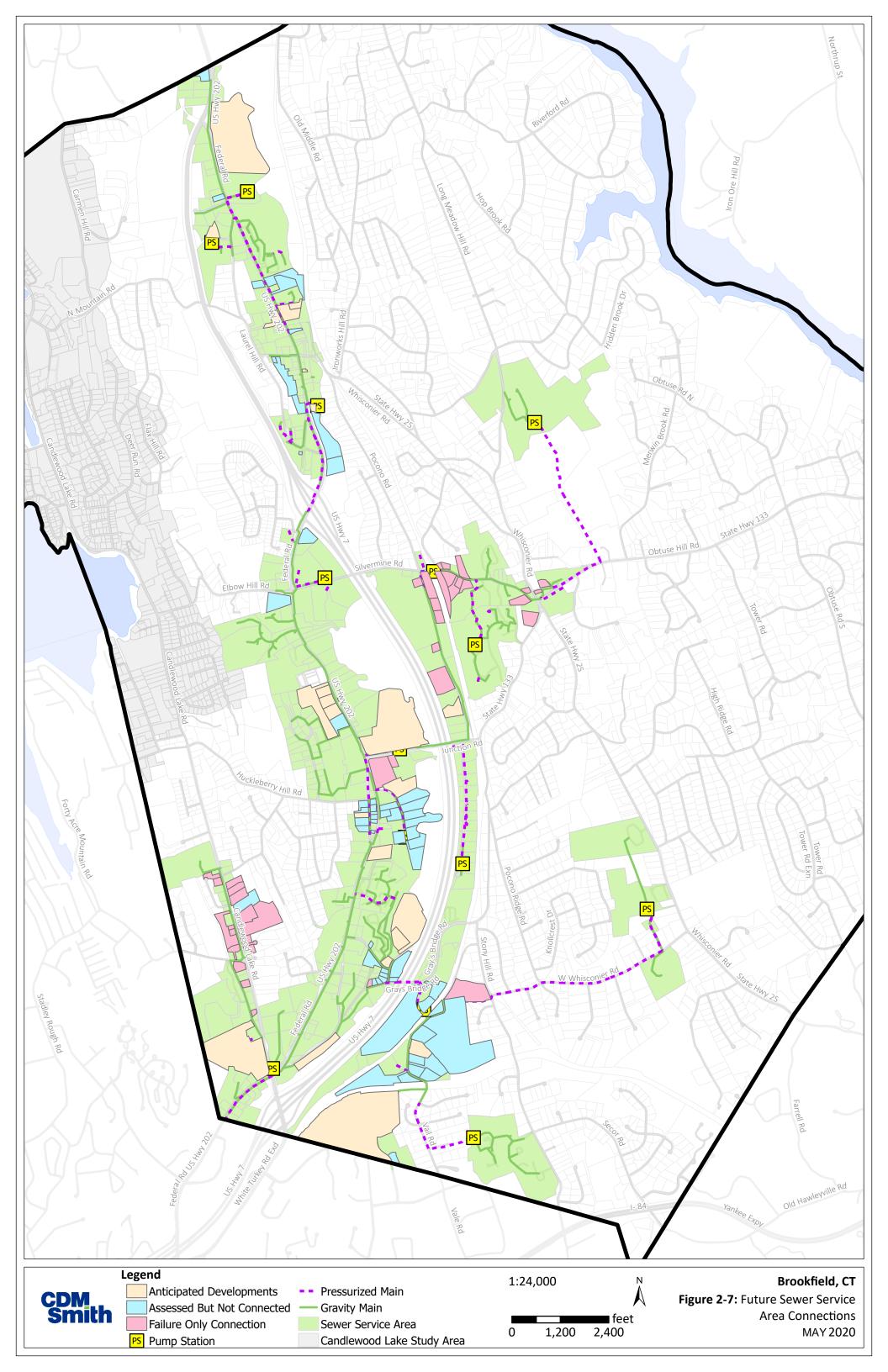
2.4.1 Future Sewer Service Area Connections

Figure 2-7 identifies properties within the Sewer Service Area that have the potential to connect in the short term along with the Areas of Environmental Concern which are less likely to connect in the near future. The existing Sewer Service Area (shown in Figure 2-1) is primarily zoned for Commercial (C-1 or C-2), Industrial (I-1 or CP), or Town Center District (TCD) use, and has been identified as favorable for connection to sewer.

For potential flow contributions, flow has been estimated based on property use. For any existing residential properties, 133 gpd was used. A flow estimate of 800 gallons per acre per day was used for commercial and industrial properties. For properties where a developer has submitted more specific information, the flow estimate provided to the BWPCA was used in place of 800 gallons per acre per day.









2.4.1.1 Assessed but Not Currently Connected

Within the central corridor Commercial/Industrial category, there are properties that were assessed for connection to the sewer system but have not connected to date. The 60 parcels that fall into this category represent approximately 70,500 gpd of potential flow. For planning purposes, these properties are anticipated to connect to the sewer system within the next ten years.

2.4.1.2 Developments

The WPCA tracks potential developments through the permitting process, listed in **Table 2-4**, that are either in progress or upcoming and are expected to connect to Town sewer. Expected date for these properties to be in service is also listed in Table 2-4. For any properties listed with "indefinite" in service date, connection within ten years has been assumed.

Table 2-4: Anticipated Future Developments

Development Address	Estimated Flow (gpd)	Estimated In Service Date
20 Old Grays Bridge Road ²	400	Indefinite
470 Federal Road ¹	1,500	2022
48 Old Grays Bridge Road ¹	500	2024
58 Old Grays Bridge Road ¹	2,000	2024
763 Federal Road ²	10,000	Indefinite
23-41 Grays Bridge Road ²	300	Indefinite
1055 Federal Road ²	20,000	Indefinite
857/857A Federal Road ²	20,000	Indefinite
800, 802, 806 Federal Road ²	12,500	2022
7 Del Mar Drive ²	700	Indefinite
3 Quarry Road	3,600	Indefinite
450-460 Federal Road ¹	3,600	2024
854-874 Federal Road ¹	15,000	2023
468 Federal Road ¹	10,000	2027
30 Pocono Road ²	600	2021
26 Old New Milford Road ²	175	Indefinite
291 Federal Road ¹	10,000	2021
77 Vale Road¹	800	2021
120 Junction Road (401 Federal Road Parcel B) ²	3,600	2024
120 Junction Road (401 Federal Road Parcel A) ²	3,900	2020
14 Candlewood Lake Road¹	300	2020
20 Vale Road ¹	20,000	Indefinite
Park Ridge (Branson) ²	6,000	2020

¹These properties are already connected to sewer, but developments at the address are anticipated by the BWPCA.



²These properties have been assessed and are not yet connected to sewer.

If all developments listed above connect to sewer, an increase of approximately 145,000gpd to the system would occur. Although all the properties listed have the potential to develop, the "indefinite" designation indicates that they are unlikely to connect during the planning period. Dismissing the "indefinite" designated properties leaves the potential for 70,000 gpd of flow.

2.4.1.3 Failure Only Connections

Properties not yet connected that have not been assessed and are not known as locations for future development fall into this category. These properties have sewer available and are within the sewer service area but would only connect in the event of an on-site sewage disposal system failure. These properties would add approximately 68,100 gpd of flow to the collection system, estimated to connect in the next ten years.

2.4.2 Areas of Environmental Concern

From the identified six areas of environmental concern, anticipated wastewater flows were calculated for each area. These areas are primarily existing residential properties, estimated using 133 gpd per property. A summary of flows from these areas is shown in **Table 2-5**.

Table 2-5: Flow from Areas of Environmental Concern

Area of Concern	Parcel Count	Estimated Flow (gpd, based on 133 gpd per residence)
Christian Lane	22	2,900
Dean-Pocono	93	12,400
Greenridge	262	34,800
Huckleberry Hill Area	164	21,800
Long Meadow Hill Road	75	10,000
Meadowbrook Road	131	17,400
Candlewood Lake Area*	1,518	202,000

^{*}Candlewood Lake Area parcel count from Candlewood Lake Report Task 3 April 2020

Since only Dean-Pocono and Greenridge areas are anticipated to potentially connect to town sewer based on lot size, the total anticipated flow to sewer is approximately 47,200 gpd. Average lot size in Christian Lane, Huckleberry Hill, and Long Meadow Hill areas are large enough they can be served by onsite systems, and therefore are not anticipated to connect to sewer. The Meadowbrook Road area is not anticipated to connect since the smaller lots have public water service, allowing them to also be served by onsite systems for wastewater. Flow from the Candlewood Lake Area (subject of a separate study) could potentially add an additional 202,000 gpd.

2.5 Conservation and Development

Future sewer service area connections and areas of concern identified using the assessment matrix were compared to the State Office of Policy Management's (OPM) *Conservation and Development Policies: The Plan for Connecticut*, for 2013-2018 (C&D Plan). The C&D Plan is intended to serve as the framework for resource management and development for the State, with the goal of balancing growth while protecting the State's environmental resources.



Consistency with the C&D Plan is required if state (or federal) funding will be provided for subsequent projects. The locational guide map (LGM), shown in **Figure 2-8** for Brookfield, shows the state priority funding areas, balanced priority funding areas, conservation areas, and protected lands.





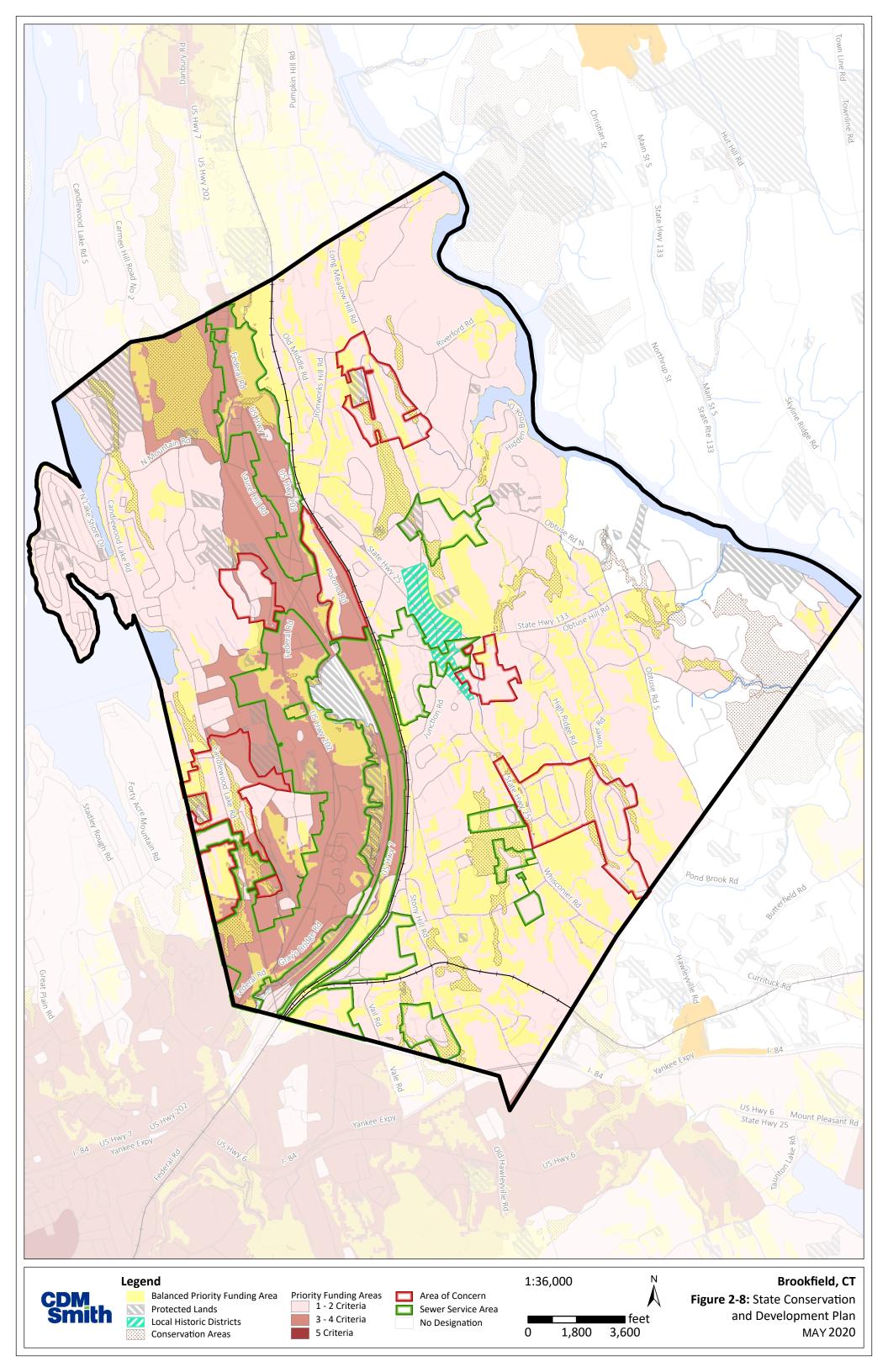




Table 2-6 below, taken from the State of Connecticut C&D Plan provides a guide to the categories included on the map.

Table 2-6: Summary of C&D Location Guide Map Areas

Priority Funding	Balanced Priority	Village Priority	Conservation Areas	Undesignated
Areas	Funding Areas	Funding Areas		Areas
Growth-related projects may proceed without an exception	Growth-related projects may proceed without an exception, if the sponsoring agency documents how it will address any potential policy conflicts	Growth-related projects may proceed without an exception, if the sponsoring agency documents how it will help sustain village character	Growth-related projects may proceed with an exception*	Growth-related projects may proceed with an exception*

^{*} Note: In order for a growth-related project to be funded outside of a PFA, CGS Section 16a35d requires the project to be supported by the municipal plan of conservation and Development and to be approved by OPM.

The categories shown on the C&D guide map are further defined as:

- Priority Funding Area (PFA): delineated based on conditions that exist at the Census Block level (smallest geographical unit delineated by the U.S. Census Bureau). Census Blocks are statistical areas which in Connecticut are typically bounded by visible features, such as streets, roads, streams, and railroad lines. Priority Funding Areas are classified by Census Blocks that include:
 - Designation as an Urban Area or Urban Cluster in the 2010 Census
 - Boundaries that intersect a ½ mile buffer surrounding existing or planned mass-transit stations
 - Existing or planned sewer service from an adopted Wastewater Facility Plan
 - Existing or planned water service from an adopted Public Drinking Water Supply Plan
 - Local bus service provided 7 days a week
- Conservation Area: based on the presence of factors that reflect environmental or natural resource values. Conservation Areas include any one or more of the following factors:
 - Core Forest Areas Greater than 250 acres based on the 2006 Land Cover Dataset
 - Existing or potential drinking water supply watersheds
 - Aquifer Protection Areas
 - Wetland Soils greater than 25 acres
 - Undeveloped Prime, Statewide Important and locally important agricultural soils greater than 25 acres
 - Category 1, 2, or 3 Hurricane Inundation Zones
 - 100-year Flood Zones



- Critical Habitats (depicts the classification and distribution of 25 rare and specialized wildlife habitats in the state)
- Locally Important Conservation Areas (based on data authorized/submitted by municipalities)
- Balanced Priority Funding Area: areas meeting the criteria of both Priority Funding Areas and Conservation Areas. State agencies that propose certain actions in these areas must provide balanced consideration of all factors in determining the extent to which it is consistent with the policies of the C&D Plan
- Protected Land: lands with some form of restriction on development, such as permanently protected open space or water company owned land
- Local Historic District: established by the town to help ensure that the distinctive characteristics of each district are protected, by having local preservation commissions review architectural changes for compatibility
- Undesignated Land: typically rural in nature and lack the criteria necessary for being delineated as either Priority Funding Areas or Conservation Areas

One of the goals of the C&D Plan is to support sewer services (or on-site wastewater treatment systems) when there is a demonstrated environmental, public health, or public safety concern. The areas of concern for wastewater disposal as well as the sewer service area align with the State's C&D Plan. The outlined areas of concern were identified based on environmental factors, which is consistent with Balanced Priority Funding Areas. There are various Conservation Areas in town, however, none are in the areas of environmental concern identified. Conservation Areas in the central corridor are also not included in the Sewer Service Area unless already connected to sewer.

In addition to the State's C&D Plan, the Western Connecticut Council of Governments, of which the Town of Brookfield is a member, also has a Regional Plan of Conservation and Development. This plan includes sewer avoidance strategies, which directs sewers not to be extended into rural areas designated as agricultural or open space areas or residential lots larger than or equal to one acre. Since Brookfield WPCA will align its plans with the regional Plan, areas of environmental concern identified with parcel sizes larger than one acre are not be recommended to be connected to the town sewer. If these properties would require additional wastewater disposal solutions (in the event of a septic system failure), options other than town sewers will be considered in accordance with the regional Plan of Conservation and Development. The Town of Brookfield recommends regular maintenance for on-site subsurface disposal systems to extend the life of each system.



2.6 Potential Connections Flow Summary

If the areas discussed were all to connect to sewer, it would mean an increase of approximately 458,000 gpd to the collection system. Combined with current flows of 332,000 gpd this would put Brookfield's total average daily flow at 790,000 gpd. The projected total is 410,000 gpd over the current Danbury agreement limit of 380,000 gpd.

The anticipated timeline for connections is outlined for all areas in **Table 2-7**.

Table 2-7: Summary of Future Connections

Classification	Anticipated Flow (gpd)	Expected Connection		
Assessed but Not Connected Properties	70,500	0 - 10 years		
Developments	70,000	0 - 10 years		
Failure Only Connections	68,100	0 – 10 Years		
Christian Lane Area of Concern	Not Anticipated to Connect			
Dean-Pocono Area of Concern	12,400	0 - 10 years		
Greenridge Area of Concern	34,800	10+ Years		
Huckleberry Hill Area of Concern	Not Anticipated to Connect			
Long Meadow Hill Road Area of Concern	Not Anticipated to Connect			
Meadowbrook Road Area of Concern	Not Anticipated to Connect			
Candlewood Lake Area	202,000	0-10 years		

Based on the timeline presented in Table 2-7, the anticipated additional flow within 10 years is approximately 423,000 gpd. Potential flow anticipated beyond the next 10 years is approximately 35,000 gpd.



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Section 3

Collection System Assessment

This section will describe the inflow and infiltration study as well as the closed-circuit television (CCTV) inspections completed and corresponding recommendations.

3.1 Inflow and Infiltration Study Methodology

3.1.1 Data Sources and Information

CDM Smith evaluated the following data to understand the relative impact of inflow and infiltration (I/I) on the Town of Brookfield's sanitary sewer system.

- Flow data from four gravity meters for fall 2017 and calendar year 2018:
 - 10-inch and 12-inch gravity mains at the 67 Federal Road.
 - 8-inch and 15-inch gravity mains at the Caldor pump station. The 15-inch gravity meter represents flow from almost the entire Brookfield collection system.
- Pump station records from town-owned pump stations for fall 2017 and spring 2018.
- 2017 I/I study conducted by Langan Engineering, which evaluated pump station records between January 2015 and December 2016.

3.1.2 Overview of Analysis

CDM Smith reviewed the available data to evaluate the magnitude of I/I in the Town's sanitary sewer system. The tasks included the following.

- Estimation of base wastewater flows for each sewershed based on Aquarion Water Company consumption data.
- Identify the portion of flow attributable to sanitary flow, inflow, and infiltration within each gravity sewer area.
- Compare inflow and infiltration to available standards and guidance on excessive I/I from EPA and the Massachusetts Department of Environmental Protection (MassDEP). CTDEEP does not have numeric definitions of excessive I/I.

3.2 Inflow and Infiltration Data Analysis Techniques

Sanitary sewer system wastewater flow consists of sanitary flow, groundwater infiltration, and inflow. Flow in the sewer system can be represented using the equation:

$$0 = San + GWI + RDI$$



where Q is average daily wastewater flow, San is sanitary wastewater flow, RDI is rainfall-dependent inflow, and GWI is rainfall-derived infiltration plus base groundwater infiltration. These are defined as follows:

- Average Daily Wastewater Flow (Q) the sum of sanitary flow, RDI, and GWI.
- Sanitary Flow (San) wastewater flow from buildings connected to the Town's sewer system. This flow occurs year-round and typically occurs in a diurnal pattern with the maximum daily wastewater flow in the morning and the minimum daily wastewater flow in the overnight hours. The sanitary flow scales with population.
- Groundwater Infiltration (GWI) GWI represents the base infiltration plus infiltration caused by rainfall and includes the remaining portion of sump pump flows as well as seepage through pipe defects. This occurs during and after a rainfall event. The primary source of infiltration is groundwater and it is observed at an increased rate during winter and early spring when the groundwater is highest due to ground thaw, snow melt, and rainfall. The duration after a rainfall event that this can occur varies system to system but typically lasts between 5 to 7 days.
- Rainfall-dependent inflow (RDI) Rainfall-dependent inflow or more simply termed "inflow" represents the flow from direct connections to the sewer system, such as roof leaders, as well as a portion of sump pump flows. This flow occurs only during a rainfall event and is represented by a rapid increase in flow.

Figure 3-1 shows these components on a dry weather day (includes only sanitary and base infiltration). In this figure, the sanitary flow is identified as *Total Daily Sanitary Flow*, and its components *Average Daily Sanitary Flow* and *Sanitary Flow at Minimum Flow*. GWI is shown as *base infiltration*. If precipitation had occurred then the rainfall-driven infiltration portion of GWI and RDI would also be included in the flow curve.

3.2.1 Sanitary Flow

Sanitary flow (San) was estimated from water consumption data obtained from Aquarion Water Company for all parcels served by Aquarion within the Brookfield town boundaries. An initial consumptive use factor of 90 percent was assumed and adjusted by inspection based on observed flow rates at the Brookfield gravity meters.

3.2.2 Inflow and Infiltration

Base daily flow (San plus GWI) was estimated using the Lyne-Hollick recursive digital filter applied to average daily flows. The Lyne-Hollick filter is widely used for river baseflow separation (Ladson *et al.*, 2013). While this methodology was originally developed to use in natural hydrology, CDM Smith has widely applied this approach to baseflow separation in natural streams and in collection systems (Eichenwald *et al.*, 2016).

Base daily flow can be estimated as:

$$BDF_t = ADF_t - max\{0, \alpha(ADF_{t-1} - BDF_{t-1}) + (1 + \alpha)(ADF_t - ADF_{t-1})/2\}$$



where BDF $_t$ is base daily flow at day t, ADF is average daily flow, and α is a fitting parameter. CDM Smith has found that typical values for α range from 0.7 to 1. The fitting parameter was adjusted to 0.9 to best match the partition between baseflow and inflow observed in the Caldor and 67 Federal Road gravity meters data in 2017 and 2018. The estimated sanitary flow was subtracted from the filtered baseflow to calculate the sum of the rainfall-driven infiltration and base infiltration on each day:

$$GWI = BDF - San$$

The inflow is then calculated by subtracting the base daily flow from the total flow:

$$RDI = Q - BDF$$

DIURNAL FLOW CURVE SHOWING THE EFFECTS OF INFILTRATION

KEY TERMS Diurnal Flow: Plot of wastewater flow vs. time. Average Daily Wastewater Flow: The total area under the diurna flow curve. Average Daily Sanitary Flow: Area under the diurnal flow curve between the minimum flow and maximum flow. It is approximate to 88% of total daily sanitary flow Maximum Daily Minimum Daily Wastewater Flow: Minimum wastewater flow Diurnal Flow Wastewater Flow within a 24 hour period. Maximum Daily Wastewater Flow: Maximum wastewater flow within a 24 hour period. Sanitary Flow at Minimum Flow: Accounts for 12% of the Total Daily Sanitary Flow. Base Infiltration: The portion of flow entering the sewer other than Average Daily the Total Daily Sanitary Flow. Wastewater Flow FLOW (mgd) Minimum Daily Average Wastewater Flow Daily Total Daily Sanitary Sanitary Flow Flow Sanitary Flow at Minimum Flow Base Infiltration 00:00 24:00 TIME (hrs)

Figure 3-1: Partitioning of Flows in a Sanitary Sewer System on a Dry Weather Day

3.2.3 Definition of Excessive I/I

CTDEEP does not have a regulatory definition of excessive I/I. Therefore, to benchmark the Town's I/I against typical values, CDM Smith used guidance from MassDEP and EPA for excessive I/I. This approach is consistent with the approach taken by CDM Smith for other Connecticut I/I analyses.



MassDEP I/I Guidance

MassDEP has developed guidance (MassDEP 2017) for municipalities to use to evaluate sanitary collection system data for excessive I/I. Overall, MassDEP defines excessive I/I sources to be (see Page 2 of MassDEP 2017):

- I/I sources directly or indirectly contributing substantial volumes to wet weather SSO events, as set forth in a MassDEP enforcement action, or otherwise as necessary to prevent SSO events for a five year storm event, or a twenty five year storm event to areas with sensitive uses, such as public water supplies, bathing areas, shell fishing areas, or endangered species habitats.
- Infiltration sources which can cost-effectively be removed from the sewer system.
- All public and private inflow sources, unless existing conditions render such removal technically infeasible or cost-prohibitive.

The MassDEP guidance recommends additional study, such as CCTV inspection, for peak infiltration rates greater than 4,000 gallons per day per inch-diameter-mile (gpd/idm) during a high groundwater period. The guidance does not have a numeric target for excessive inflow, but recommends ranking the inflow by subsystem for a one-year, six-hour design storm and performing an SSES on the subsystems comprising 80 percent of the total inflow volume.

EPA Guidance

EPA has issued guidance (EPA 1985) to determine whether I/I is non-excessive based on an analysis of 270 cities nationwide.

- Excessive infiltration = dry weather flow greater than 120 gallons per capita per day (gpcd)
- Excessive inflow = wet weather flow greater than 275 gpcd.

The EPA guidance is population based, and references the average daily flow during dry- and wetweather periods. Since these metrics are population based, they are only applicable to sewersheds that are predominantly residential.

3.3 Brookfield I/I Assessment

CDM Smith estimated the inflow and infiltration observed at the four gravity meters and available pump station flow records. The evaluation was conducted for three periods:

- Fall 2017 (inflow response): October 23 through November 2, 2017
- Spring 2018 (high groundwater): April 1 through June 1, 2018
- Calendar year 2018 (gravity meters only, subject to data availability).

The analysis completed for each period was based on the data available and the underlying characteristics of the sewershed. In all cases the data were evaluated in aggregate, without subtracting upstream flows. This was done for several reasons. First, the total I/I flow was relatively low and the estimated sanitary flow is uncertain due the limited water consumption



data available within the Brookfield sewer service area. Second, the gravity meters have not been calibrated, so the relative flow measured between the meters may not be consistent. To avoid compounding errors while estimating the I/I rate, upstream meters were not subtracted. Furthermore, given the uncertainties in the meter calibration and maintenance, the I/I analysis and flow partitioning are approximate and limited by the resolution of the metering currently available. While the overall study conclusions are not likely to change given more precise metering data, the relative fraction of I/I and sanitary flow may be slightly different than are presented below.

Pump station records are difficult to subdivide into sanitary, inflow, and infiltration because the pump cycling can mask the impact and timing of I/I in the sewer system. For this reason, a full component analysis identifying the portion attributable to sanitary, inflow, and infiltration was limited to the gravity sewer system. The pump stations with available data during the study period were North, 777 Federal Road, Railroad, Del Mar, Route 133, and Sand Cut.

Meter and pump station characteristics are listed in **Table 3-1**.

Table 3-1: Characteristics of Meters and Pump Stations with Available Data During the Study Period

Туре	Meter	Upstream	Sewershed Area (acres)	Miles of Gravity Sewer	Inch- Diameter- Miles	Percent Residential (Approx.)	Notes
	10-inch Federal	None	528	5.2	43	17	
Meter	12-inch Federal	10-inch Federal	1,876	19	166	30	
Gravity Meter	8-inch Caldor	None	145	1.2	13		Data not valid 5/23/18 through 10/27/18
		8-inch Caldor, 10-inch Federal, 12-inch Federal	1,947	19.4	170	27	Data not valid past 9/1/18
	777 Federal Road	North, Brooks Quarry*	93	2.4	21.8	3	
_	Railroad	High Meadow*, High School*	316	2.0	22	63	
atior	Del Mar	None	6.6	0.32	2.5	0	
Pump Station	Route 133	Del Mar, Commerce*, North, Brooks Quarry*, 777 Federal, High School*, Railroad, Silvermine*, High Meadow*	1,196	12.4	116	33	
	Sand Cut	None	36	1.5	12	25	

^{*} Data not available in Mission Control SCADA during study period



3.3.1 Sanitary Flow

CDM Smith worked with Aquarian Water Company to obtain water consumption data by account for all properties served by Aquarion within the Brookfield town limits between August 2016 and July 2019. **Table 3-2** presents the number of properties in the database by property type. Properties with an unknown property type listed do not have a corresponding entry in the Brookfield assessor's database.

Table 3-2: Properties in Aquarion Database by Land Use Code in the Brookfield Assessor's Database

Property Type	Count
Residential	707
Commercial	56
Industrial	11
Unknown ¹	187
Tax Except (church, charity, Town-owned)	6
Total	967

Notes: 1. No matching address in Brookfield assessor's database

Most of the properties served by Aquarion are residential and are located outside of the Brookfield sewer system service area. Other properties in town are served by private community water supply systems and private wells and are not included in this dataset. This includes the commercial and industrial properties in the Brookfield sewer system not included in the Aquarion water use dataset.

Parcel water use was estimated based on the entire 3-year record for each parcel and land use code. For properties in the Town sewer service area that were in the Aquarion water use database, the water consumption rate was used directly in the calculation of wastewater flow. Water use for properties within the Town sewer service area that are not served by Aquarion were estimated based on the average water consumption rate for the corresponding land use code. If water consumption data were not available for a given land use code, the average water consumption rate for the "master" code (e.g., all commercial properties have a land use code in the 300-series) was used. Very few properties fall into this category. Average water use by land use code and "master" land use code is presented in **Table 3-3**.

Table 3-3: Average Water Consumption Rate by Land Use Code in the Brookfield Assessor's Database based on Aquarion Water Company Data from August 2016 through July 2019

Land Use Code	Average Water Consumption (gpd)
100	138
101	133
101C	94
102	119
103	398



105A	1,834
All Residential	153
304	362
306	1,571
311	230
312	702
315	901
316	140
320	70
322	294
323	1,469
326	236
328	2,644
329	32
331	452
332	147
337	1,388
338	208
340	218
341	7,926
342	693
344	2,277
348	1,516
355	49
359	8,678
377	897
390	930
All Commercial	1,190
400	437
401	47
406	2,763
407	317
440	152
All Industrial	655
960	419
962	29
All Tax Exempt	172

Sanitary flow was evaluated within the four gravity meter sewershed areas. While typically the water use data would be applied directly with a factor to account for consumptive use, the Brookfield sewer system service area is unique in that (1) most of the sewer system is



commercial or industrial use and (2) most of the properties served by the sewer system are not served by Aquarion, making it difficult to directly translate the water use data to a wastewater flow rate via a consumptive use factor. Therefore, the water use data were used as a starting point for developing the sanitary flow rate for each sewershed; the sanitary flow rate was adjusted to best match the flow metering data. Assumed sanitary flow rates for each sewershed are presented in **Table 3-4**. Note that the sewershed areas are overlapping and have not been separated for this assessment.

Table 3-4: Estimated Sanitary Flow Rate by Sewershed for Gravity Flow Meters

Sewershed	Area (ac)	Upstream Sewersheds	Sanitary Flow (gpd)
8-inch Caldor	145	None	16,600
10-inch Federal	528	None	30,200
12-inch Federal	1,876	10-inch	163,000
15-inch Caldor	1,947	8-inch, 10-inch, 12-inch	188,000

3.3.2 Inflow and Infiltration

Fall 2017 (Inflow Response Assessment)

The inflow response was evaluated by assessing the system response to a large precipitation event in October 2017. An intensity-duration-frequency curve depicting this event is presented in **Figure 3-2**.

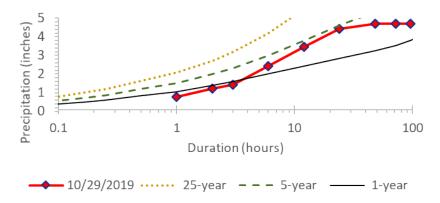


Figure 3-2: Intensity-Duration-Frequency Curve for the October 2017 Precipitation Event at the Danbury Municipal Airport

This figure shows the precipitation total at durations between one hour and 4 days based on hourly precipitation data from the Danbury Municipal Airport. The precipitation total at each frequency is compared against precipitation frequency estimates in NOAA Atlas 14 for Brookfield, CT. The measured precipitation depth and associated approximate average recurrence interval (ARI) is shown in **Table 3-5**.



Table 3-5: Precipitation Depth and Approximate Average Recurrence Interval (ARI) for the October 29, 2017 Storm at Danbury Municipal Airport

Duration	Precipitation (inches)	Approximate ARI
1-hour	0.79	6-month
2-hour	1.22	1-year
3-hour	1.42	1-year
6-hour	2.43	3-year
12-hour	3.45	4-year
24-hour	4.41	5-year
2-day	4.70	4-year
3-day	4.70	3-year
4-day	4.71	2-year
7-day	5.58	2-year

This data indicates that this event was approximately a 5-year, 24-hour precipitation event.

CDM Smith evaluated data from the four gravity meters to assess whether there is evidence of significant or excessive inflow during this event in the Brookfield collection system. Qualitatively, there was very little discernable impact metered flows during this event, suggesting that direct inflow sources are not significant. Statistics describing average and peak I/I for this event are shown in **Table 3-6**.

Table 3-6: Maximum Daily Flow Components for a 5-year, 24-hour Storm in October 2017

Meter	Maximum Daily Flow Component (gpd)					Per	centage (I	Maximum Dail	y)
	Sanitary	Inflow	Infiltration	Total I/I	Total Flow	Sanitary	Inflow	Infiltration	Total I/I
8-inch	16,600	24,600	16,500	41,100	57,700	29%	43%	29%	71%
15-inch	198,000	90,400	82,600	173,000	371,000	53%	24%	22%	47%
10-inch	54,400	40,700	11,000	51,700	106,000	51%	38%	10%	49%
12-inch	163,000	72,000	41,000	113,000	276,000	59%	26%	15%	41%

Most of the contributing area to the four gravity sewersheds is non-residential and is therefore not able to be compared against the EPA criteria. The sewershed for the 8-inch Caldor meter is 81 percent residential. The maximum wet weather flow rate (inclusive of sanitary flow, per EPA guidelines) was 57,700 gpd, or 218 gpcd. This is below the EPA threshold of 275 gpcd for excessive I/I.

Spring 2018 (Infiltration Response Assessment)

Groundwater response was assessed using available data between April 1 and June 1, 2018. Over this period there were 6.82 inches of rain at the Danbury Airport, and groundwater was



seasonally high (see **Figure 3-3**). **Table 3-7** presents a flow component analysis during this period.

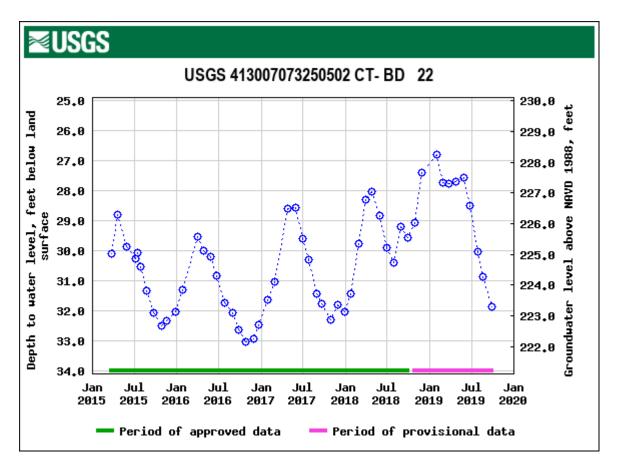


Figure 3-3: Depth to Groundwater at a USGS Water Table Well Located at the Brookfield/New Milford Line on Route 202 Showing High Seasonal Groundwater Levels

Table 3-7: Average Flow Component Analysis for Spring 2018 (April 1 through June 1)

Meter	Average Daily Flow Component (gpd)					Per	centage (N	Maximum Dail	y)
	Sanitary	Inflow	Infiltration	Total I/I	Total Flow	Sanitary	Inflow	Infiltration	Total I/I
8-inch	16,600	7,400	15,200	22,600	39,200	42%	19%	39%	58%
15-inch	198,000	36,700	56,700	93,400	291,000	68%	13%	19%	32%
10-inch	54,400	3,250	37,900	41,200	95,600	57%	3%	40%	43%
12-inch	163,000	30,300	46,200	76,500	240,000	68%	13%	19%	32%

The groundwater infiltration at each meter was compared against the MassDEP groundwater infiltration criteria to evaluate whether these subareas merit further investigation. For this evaluation, the maximum daily groundwater infiltration throughout the spring analysis period was used. This result is presented in **Figure 3-4**.



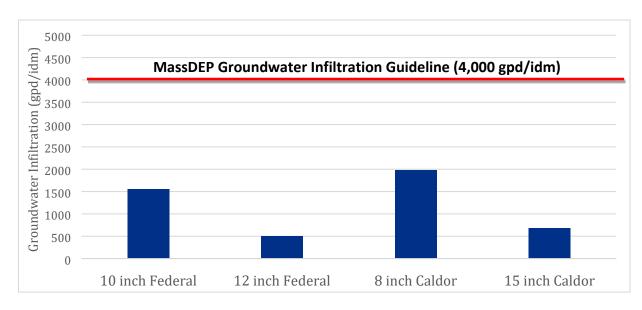


Figure 3-4: Maximum Daily Groundwater Infiltration Rate Normalized by Inch-Diameter-Mile in Spring 2018 for the Four Brookfield Gravity Meters

In addition, the dry weather flow rate for the 8-inch Caldor meter was 115 gpcd, below the EPA criterion of 125 gpcd. Based on this information, the groundwater infiltration in the Brookfield collection system is below both the MassDEP and EPA targets at each of the four gravity meters.

Calendar Year 2018 (Flow Component Analysis)

The inflow and infiltration were evaluated for the four gravity meters for calendar year 2018 to understand the general proportion of I/I in the system relative to sanitary flow. Average flow components by meter are presented in **Table 3-8**.

Table 3-8: Average Flow Component Analysis for Calendar Year 2018

Meter	Average Daily Flow Component (gpd)						Percentage (Maximum Daily)			
	Sanitary	Inflow	Infiltration	Total I/I	Total Flow	Sanitary	Inflow	Infiltration	Total I/I	
8-inch ¹	16,600	7,210	13,500	20,700	37,300	45%	19%	36%	55%	
15-inch ²	198,000	29,200	71,000	100,000	298,000	66%	10%	24%	34%	
10-inch	54,400	7,570	21,500	29,100	83,500	65%	9%	26%	35%	
12-inch	163,000	21,700	67,000	88,700	252,000	65%	9%	27%	35%	

Notes:

- 1. Data not valid between 5/23 and 10/17.
- 2. Data not valid after 9/1/2018.

To put these data into context, CDM Smith compared the average flow component analysis for calendar year 2018 to statistics reported by the Massachusetts Water Resources Authority (MWRA) for its 43 member communities in the Fiscal Year 2019 Annual Infiltration and Inflow Reduction Report (MWRA, 2019). The MWRA is the regional water and sewer authority for communities in metropolitan Boston. As part of its routine NPDES permit compliance reporting, MWRA performs a wastewater component analysis annually for wastewater in each member community, separating the flow into sanitary, inflow, and infiltration. In 2018, the average



percentage I/I (as a percentage of the total flow) was 54 percent, with a minimum of 41 percent and a maximum of 70 percent. A box-and-whisker plot showing the overall range of I/I expressed as a percentage of overall average daily flow across the MWRA member communities is shown in **Figure 3-5**. Compared with these figures, the estimated proportion of I/I in the Brookfield system is average to significantly below average, supporting the findings in this report that the overall I/I contribution in the Brookfield collection system is relatively low.

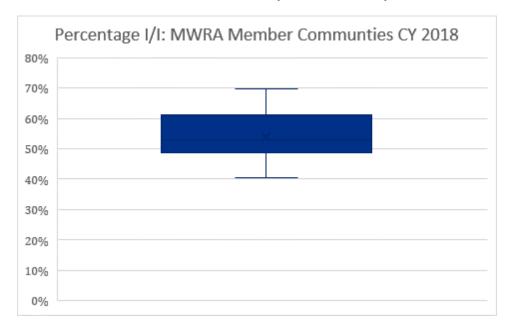


Figure 3-5: Percentage of Average Daily Flow that is Inflow or Infiltration Across the 43 MWRA Member Communities in Calendar Year 2018

3.3.3 Discussion and Conclusions

CDM Smith evaluated available data from gravity meters and pump stations in the Town of Brookfield's collection system to understand the extent of I/I in the Town's collection system. The results of this assessment found that the fraction of I/I in the collection system is relatively low, and is below MassDEP and EPA guidance for evaluating excessive I/I. While the I/I appears relatively low at the four gravity meters and in the pump station records, there remains the possibility that isolated areas of the collection system experience higher I/I rates that may be considered excessive. Since the I/I assessment described in this study was conducted at gravity meters and pump stations located at the downstream end of the collection system, isolated areas of relatively higher I/I in upstream areas of the collection system could be obscured by the impact of pump stations or additional linear pipe distance that causes the I/I to be low at the gravity meter or pump station location. Brookfield could conduct additional CCTV inspection or install additional gravity meters in upstream locations within the collection system to monitor for excessive I/I in other parts of the system.

In addition, this analysis found that the gravity meter and pump station data are unreliable. Brookfield should ensure that all flow meters are properly calibrated and maintained so that the data can reliably be used in future I/I studies and to fully characterize flows from its collection system.



3.4 Closed Circuit Television (CCTV) Inspections

To evaluate the condition of the sewers, CCTV inspections were performed along portions of Federal Road and Candlewood Lake Road. The pipes were installed in the 1970s, are constructed of polyvinyl chloride (PVC), and range in diameter from 8 to 12 inches. These areas were identified for inspection due to their age and criticality.

CDM Smith's subcontractor performed the CCTV inspections between November 12th and 21st, 2019. CDM Smith then reviewed the video footage to assess the condition of the pipe and to determine if rehabilitation is needed.

3.4.1 PACP Coding

The inspection videos were coded according to National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP). PACP is an internationally accepted method for recording pipeline defects and observations in a standardized manner. In PACP, defects and observations are divided into four families of codes:

- Operational and Maintenance such as grease, roots, infiltration
- Structural such as cracks, surface damage, collapsed pipe
- Construction Features such as taps, sealing material, access points
- Miscellaneous Features such as material change, joint change, water mark

Standardizing the coding system creates more consistent data gathering and utilization. It also provides the ability to compare sewers within one area to another geographic location.

Another feature is the PACP Grading, which represents the highest grade defect (structural and O&M) observed in the pipe. In general, the higher the Grade, the worse the condition of the pipe. The PACP coded logs for the pipe segments inspected can be found in **Appendix A**.

3.4.1.1 PACP Results

The summary of PACP Structural and O&M Quick Rating results for the inspected pipe segments is shown in **Table 3-9** and **Figure 3-6** below.

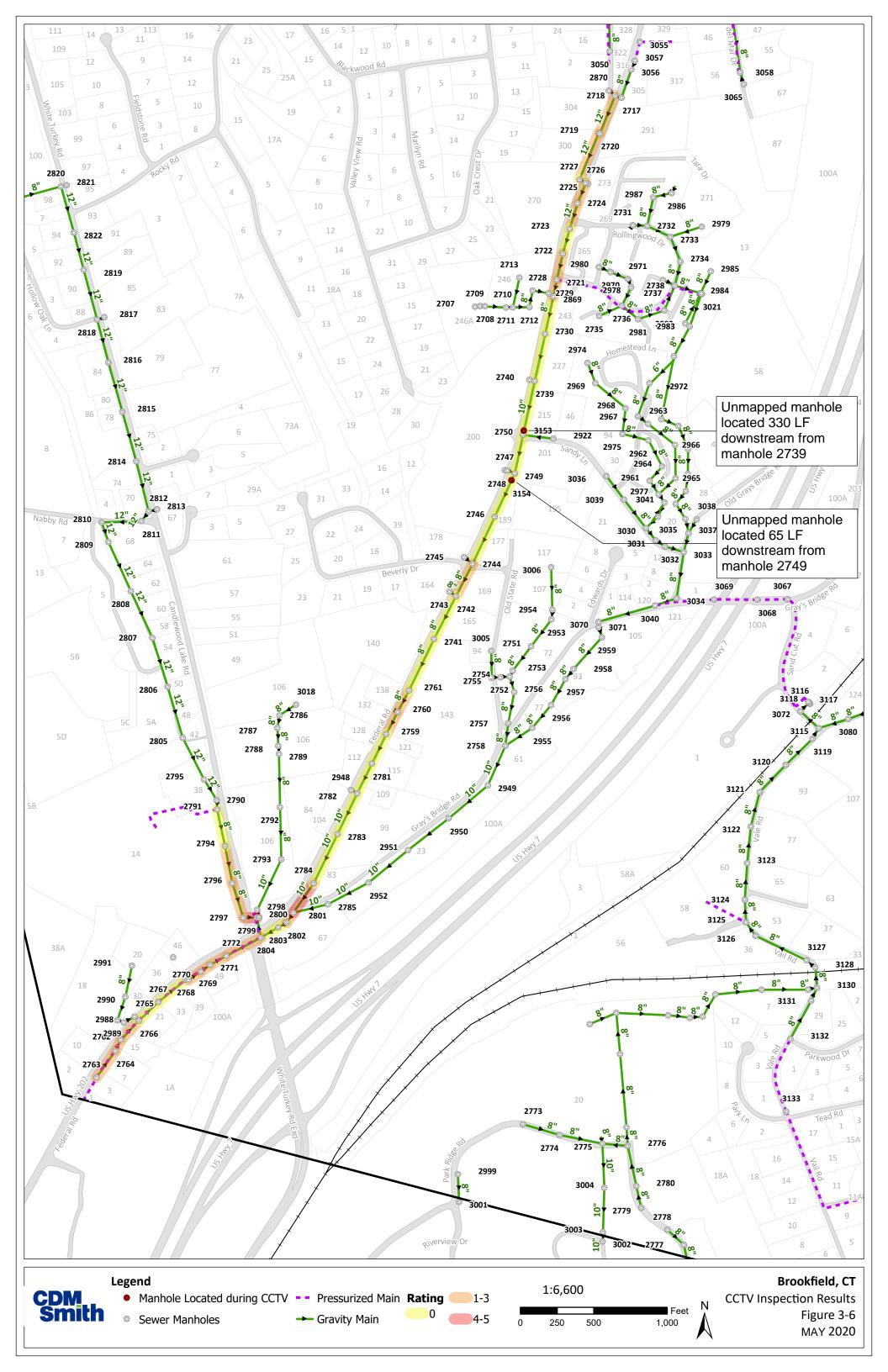
Table 3-9 Summary PACP of Results

Highest Rating in Pipe Segment	Rating Description	Number of Segments	Percent of Total
0	Minor or No Defects	20	49%
1	Millior of No Defects	0	0%
2	Madarata Defeats	17	41%
3	Moderate Defects	2	5%
4	Cignificant Defeats	0	0%
5	Significant Defects	2	5%



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Ninety five percent of the pipes inspected had an O&M or Structural rating of 0 to 3, which means they did not have significant defects. Only five percent had a rating of 4 or 5, which means the pipe has at least one significant defect. Pipes with significant defects are recommended for repairs in the near future. CDM Smith reviewed each pipe segment and made corresponding recommendations, discussed below.

3.4.2 Recommendations

CDM Smith determined recommendations based on PACP scoring as well as review of the inspection data. A higher PACP Rating would generally correspond to a higher priority maintenance or rehabilitation recommendation. **Table 3-10** at the end of this section shows the complete list of pipe segments with their corresponding recommendations. The most common defects seen in the pipes inspected was grease (O&M) and sags in the pipes (Structural).

The majority of the inspected pipe sections are in good condition and are recommended for regular cleaning due to grease present as well as sags, which could allow for debris to settle. Pipe segment 2770-2771 on Federal Road requires debris removal due to an object impeding flow towards the downstream end of the pipe segment. The pipe just upstream of Caldor Pump Station on Candlewood Lake Road, segment 2797-2799, requires cleaning at the downstream end due to deposits and grease at the connection to the Pump Station, shown in **Figure 3-7a**. Segment 2784-2802, also on Federal Road, near the intersection with Gray's Bridge Road, is recommended for a point repair. The defect is an object protruding through the wall of the pipe, as seen in **Figure 3-7b**.



Figure 3-7 (a) Grease at downstream end of 2797-2799. (b) Intruding Object through Pipe Wall of 2784-2802 at 234 LF from upstream manhole.

The defect shown in Figure 3-7b is the only significant structural defect observed in the 41 pipes inspected in November 2019. It is recommended for a point repair. The remainder of the pipes have less significant defects and are not in urgent need of maintenance. CDM Smith recommends Brookfield WPCA inspect pipes with existing sags regularly to monitor any changes. If sags increase in severity, the BWPCA should consider rehabilitation or replacement.

In addition to PACP defects, during inspections two manholes were found that are not included in Brookfield's GIS mapping. One is located between manholes 2739 and 2750, and the other one located between manholes 2749 and 2746, shown on Figure 3-6.



Table 3-10: Pipe Recommendation Summary

		Table 3	-10: Pipe Re	ecomme	ndations Sum	nmary
Pipe ID	Footage Inspected (LF)	Pipe Diameter (inches)	Pipe Material	O&M Grade	Structural Grade	Recommendations
2797-2799	92.7	8	PVC	5	0	Cleaning (grease at d/s end)
2796-2797	247.5	8	PVC	0	2	Regular Monitoring
2794-2796	258.7	8	PVC	0	2	Regular Monitoring
2791-2794	256.7	8	PVC	0	0	no current recommendation
2764-2762	86.6	8	PVC	0	2	Regular Monitoring
2763-2764	219.1	8	PVC	0	2	Regular Monitoring
2762-2766	176.3	8	PVC	2	2	Regular Monitoring
2766-2767	185.1	8	PVC	0	0	No Current Recommendation
2767-2768	240.8	8	PVC	0	0	No Current Recommendation
2770-2771	79.1	8	PVC	2	0	Cleaning (grease)
2769-2770	98.5	8	PVC	2	0	Cleaning (grease)
2719-2727	338.5	12	PVC	0	2	Regular Monitoring
2771-2772	128.3	8	PVC	2	0	No Current Recommendation
2772-2804	269	8	PVC	2	0	No Current Recommendation
2718-2720	274.9	12	PVC	0	3	No Current Recommendation
2727-2726	42.2	12	PVC	0	0	No Current Recommendation
2726-2724	146.8	12	PVC	2	2	No Current Recommendation
2724-2723	179	12	PVC	0	2	No Current Recommendation
2723-2722	171.5	10	PVC	0	0	No Current Recommendation
2722-2721	183.4	10	PVC	0	3	Regular Monitoring
2869-2730	262.4	8	PVC	0	0	No Current Recommendation
2721-2869	118.3	8	PVC	0	2	Regular Monitoring
2730-2739	328.4	8	PVC	0	0	No Current Recommendation
2750-2749	268.1	10	PVC	0	0	No Current Recommendation
			PVC			Unmapped manhole identified
2739-2750	372.1	10		0	0	during inspection
2746-2744	354.4	8	PVC	0	0	No Current Recommendation
2749-2746	325.1	10	PVC	0	0	Unmapped manhole identified during inspection
2744-2742	244.8	8	PVC	2	0	Cleaning (deposits & grease)
2742-2741	324.7	8	PVC	0	0	No Current Recommendation
2741-2761	392.2	8	PVC	0	0	No Current Recommendation
2784-2802	241.9	10	PVC	0	5	Point Repair



Pipe ID	Footage Inspected (LF)	Pipe Diameter (inches)	Pipe Material	O&M Grade	Structural Grade	Recommendations
2783-2784	373.8	10	PVC	0	0	No Current Recommendation
2782-2783	309.4	10	PVC	0	0	No Current Recommendation
2781-2782	220	10	PVC	0	0	No Current Recommendation
2720-2719	5.9	12	PVC	0	0	No Current Recommendation
2725-2726	Operator did not consider it safe for the equipment to attempt inspection due to extreme drop and slope.					
2760-2759	168.5	10	PVC	0	2	Regular Monitoring
2761-2760	165	8	PVC	0	2	Regular Monitoring
2802-2803	59.3	12	PVC	0	0	No Current Recommendation
2801-2802	78.1	12	PVC	2	0	No Current Recommendation
2759-2781	219.3	10	PVC	0	0	No Current Recommendation
2803-2804	138	12	PVC	0	0	No Current Recommendation



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Section 4

Wastewater Pumping Station Evaluation

4.1 Pumping Stations Background

The Town of Brookfield owns and operates 14 wastewater pumping stations that convey raw sewage to the City of Danbury's collection system. All of the pumping stations are duplex, submersible, centrifugal pump styles except for the Caldor Pumping Station which is a duplex, dry pit, centrifugal pump style station. Though there are over 30 additional private pumping systems located throughout the Town, these are not operated by the Town's Water Pollution Control Authority (WPCA) and were not evaluated as part of this project.

The submersible, centrifugal style pumping stations typically consist of a wet well that receives the wastewater flow and contains the submersible, centrifugal pumps. A separate dry well vault contains the station check and isolation valves. At select pump stations, the check and isolation valves are located in an aboveground enclosure. Electrical and control equipment is located in exterior mounted panels or a small control building. The Caldor Pumping Station consists of a wet well with suction piping to duplex centrifugal pumps located in an adjacent dry well with check and isolation valves. The electrical and control panels are located in an at grade control building with access to the dry and wet wells.

The fourteen pumping stations are distributed throughout the Town and include:

- Brooks Quarry Pumping Station
- Caldor Pumping Station
- Cedarbrook Pumping Station
- Commerce Pumping Station
- Del Mar Pumping Station
- High Meadow Pumping Station
- High School Pumping Station
- North Pumping Station
- Railroad Pumping Station
- Route 133 Pumping Station
- Sand Cut Pumping Station
- Silvermine Pumping Station



- Stony Hill Pumping Station
- 777 Federal Road Pumping Station

The age of these 14 stations varies with original construction ranging from 1975 to 2015. WPCA staff have continuously maintained all the stations with some major upgrades at select stations. The age and upgrade of the pumping stations are discussed in the individual pumping station paragraphs in this Section.

4.2 Evaluation Purpose

The purpose of this evaluation is to perform an assessment and review of the 14 pumping stations. Many of the stations have been upgraded in the past ten years and need minimal or no improvements, but for other stations, upgrades, modifications, or complete station replacement may be warranted. To focus the evaluation of the stations, CDM Smith set the following goals for this project:

- 1. Upgrade stations when deemed necessary for reliable and sustainable operations for the next 20 years;
- 2. Improve overall reliability, including permanent bypass provisions or emergency power provisions;
- 3. Improve infrastructure security and ease of access;
- 4. Comply with applicable codes and standards and address confined space entry where possible and improve ease of operation and maintenance activities;
- 5. Provide discharge flow monitoring at all stations.

4.3 Evaluation Approach

This wastewater pumping station evaluation section identifies the major facility upgrades necessary to meet the stations' flow requirements and address the identified project goals. To develop this section, the following steps were taken:

4.3.1 Field Assessment

CDM Smith conducted field visits to each pumping station to inspect the condition, including the overall station structure, pumps, valves, piping, electrical power supply, standby power systems, instrumentation and controls, site access and security.

4.3.2 Information Gathering

Following the field assessment, CDM Smith staff performed an initial station design review and flow capacity analysis. Staff reviewed the available site layout and original and/or as-built design drawings for each station and spoke with WPCA staff to determine maintenance practices, operational issues, constraints, and station limitations. Existing engineering design and planning documents as well as the WPCA's GIS database were also reviewed to determine the pump station force main routes, lengths, and topography. Design documents and station/pump information were reviewed to the extent they were available. CDM Smith also reviewed available records to



identify significant maintenance issues, and reviewed hydraulic conditions including wet well and force main capacity.

4.3.3 Design Concepts

Recommendations for upgrading, modifying or replacing each station are included in this report. Consideration has been given to simplicity of operation, ease of maintenance, reliability, accessibility, aesthetics, and standardization.

Other key concerns include health and safety issues including compliance with OSHA confined space requirements, NFPA ventilation requirements, NEC electrical code requirements, and other as applicable.

Planning-level costs for improvements at the stations are also included within this assessment. As discussed in more detail later in this report, using these costs, along with WPCA staff input, a prioritized list of station improvements was developed.

4.4 Assessment Criteria

The following systems were reviewed at each station:

- Site/Civil Conditions This review assessed the general conditions of the existing site and surrounding area, access for parking and snow removal, site fencing and security, confined space conditions, and site availability for expansion or construction of a new station.
- Architectural/Structural The architectural/structural review assessed the structural building components and exterior shell systems such as walls, doors, windows, louvers, and pedestrian circulation. The condition of below grade concrete and metal in direct contact with wastewater was observed when possible without entering active station wet wells. This review identified building modifications necessary to accommodate the recommended equipment upgrades and meet current building codes and design standards.
- Process/Mechanical The process mechanical evaluation included an inspection of the pumps (when able), pump protection equipment, piping, valves, etc.
- Force Main The size and material of the force mains was observed in the field and confirmed on design drawings. Force main operating history was also reviewed with WPCA staff to assess plugging, surge, and any other historical issues.
- Plumbing/HVAC The plumbing and HVAC review assessed the fuel systems, unit heaters, ventilators, air handling units, exhausts, drainage systems, potable water supply and fire protection where applicable.
- Electrical The electrical review assessed the existing incoming service voltage, number of phases and routing, amperage size of the service, service transformers, power transfer switches, building lighting, power distribution, equipment starters, fire alarm, and lightning protection.



- Standby Power Systems The standby power review assessed the age and condition of
 existing standby power systems and the impact of the recommended improvements
 relative to the existing standby power systems. The fuel type and the condition of the
 existing fuel system was also assessed.
- Instrumentation and Controls The review of the existing instrumentation noted the alarm settings at each station, style of control system, type of the field mounted instruments, presence of any fire or intrusion alarms, and the mode of communication of the alarms and status indication.
- Hydraulic and Capacity Analysis This review was based on available design drawings, operating records, and size of in-place mechanical conveyance equipment. CDM Smith used TR-16 peaking factors to compare the pumping rates to a peak hourly flow. Reference: (NEIWPCC Technical Report #16 Guides for the Design of Wastewater Treatment Works)

The remainder of this section discusses the findings of the pumping stations facility assessment, options to mitigate existing deficiencies and recommended improvements at each respective pumping station.

4.5 Emergency Power

4.5.1 Existing Emergency Power

The 14 pumping stations are located throughout the Town and are all fed by individual power feeds from the utility power. Using a single utility electrical feed makes the stations susceptible to power outages when there is a loss of utility power. As such, some of the Town's pumping stations do have emergency power provisions to keep them running during power outages. The stations which currently include standby power systems are shown in the left column of **Table 4-1**.

Table 4-1: Pumping Station Standby Power Systems

Pumping Stations with Permanent Standby Power Systems	Pumping Stations without Permanent Standby Power Systems		
Caldor Pumping Station	Brooks Quarry Pumping Station		
Cedarbrook Pumping Station	Commerce Pumping Station		
High Meadow Pumping Station	Del Mar Pumping Station		
High School Pumping Station	North Pumping Station		
Railroad Pumping Station	Silvermine Pumping Station		
Route 133 Pumping Station	-		
Sand Cut Pumping Station	-		
Stony Hill Pumping Station	-		
777 Federal Road Pumping Station	-		

The pumping stations in the right column of **Table 4-1** do not have permanent backup generators installed on site. However, all of these stations do have receptacles on the main electrical control equipment to permit the connection of a portable emergency standby generator in the event of an



outage. There are two garaged portable generators on trailers available for deployment. These are normally staged at the most needed sites in advance of a storm by the field crew.

4.5.2 Pumping Station Requirements

To ensure that pumping operations can continue with minimal interruption at the stations that do not have permanently installed emergency generators, consideration should be made to improving the Town's backup power capabilities by reducing pumping station downtimes and labor requirements for mobilizing portable units. The pumping stations that lack permanent emergency power are all relatively small in size and capacity. Based on these requirements, a conservatively sized 30 kW generator would appear to be sufficient to power the pumping systems included ancillary items such as site lighting, 120 V receptacles, etc.

4.5.3 Emergency Power Alternatives and Recommendations

The two main alternatives for emergency power for the stations that currently do not have permanent emergency power is to either install permanently mounted generator units at the stations, or to maintain the existing portable, trailer mounted generators.

For the permanently mounted generator alternative, it has been assumed that an outdoor mounted 30 kW generator with sound attenuated enclosure would be installed and connected to the station's electrical system through an automated transfer switch. The costs to procure and install these systems are included in the individual pump station sections.

There would be no capital cost for the alternative to maintain the existing portable, trailer mounted generators and generator connections at the pumping stations. Except for the Commerce Road Station, all the others without generators are along Federal Road. This is a main service line feeding New Milford High School and much of New Milford. So, it is rare that this area is out of service for long and one of the first lines to be restored in the event of an area wide electrical outage.

CDM Smith recommends that the BWPCA proceed with installing permanent generators at the stations that currently lack units. Although this is costly, this will provide improved reliability for the stations and eliminates staff time to mobilize and move a trailer mounted unit to a station when there is potential that a power outage is requiring staff attention at a higher priority location. Additionally, given the recent significant weather events that have occurred over the past few years, it can be reasonably expected that more than one station without permanent backup power can be without utility power at the same time. Permanently installed generators at all pumping stations will provide the WPCA with the greatest level of protection against pumping station failure and potential sewer backups in the event of utility power interruptions. The costs for installing permanent backup power at the various stations are included with the other pumping station recommendations summarized in Subsection 4.6 of this report.

4.6 Pumping Station Assessments

The following subsections provide summaries of the document review and field assessment of the fourteen pumping stations owned and maintained by the BWPCA.



4.6.1 Brooks Quarry Pumping Station

4.6.1.1 Station Description

Station Layout

The Brooks Quarry Pumping Station is a submersible, centrifugal pump style pumping station located at approximately 126 Brooks Quarry Road. The station was constructed in 2015. The site consists of a concrete wet well chamber with integral valve vault and outdoor main control panel with portable generator connection. The site is located off the road and is surrounded by a chain link fence with vehicle gate.

The station conveyance system is contained within a precast concrete below grade vault



which includes a wet well with two submersible pumps, station level controls and an integrated drywell containing the individual pump check and isolation valves, the outgoing force main pipe, and bypass connection piping and valve.

Pumps and Piping

The station is equipped with two submersible, centrifugal pumps within the wet well, rated for approximately 81 gpm at 32 feet of totally dynamic head. The pumps are Flygt, model 3068.090 and were installed in 2015. The dry well valve vault contains a swing type check valve and an isolation valve on the discharge lines from each pump. The two separate lines connect to a common 3" force main with a branch off of the force main for bypass connection.

Capacity and Flow

The station has a theoretical maximum capacity of 116,000 gpd assuming that one 81 gpm pump is in constant operation with the second pump available as a standby. To analyze the station capacity for peak flows, CDM Smith applied a peaking factor to the average daily flow (obtained from pump run times) based on TR-16's published guideline for the ratio of peak flow to average flow for municipal systems. With a peaking factor of 10.0, the station is currently appropriately sized for expected peak daily flows.

Electrical

The station is supplied with 208 V, three phase underground electrical service. The main electrical and control panels are located in the outdoor control cabinet. The station does not have an emergency backup generator, but there is a portable generator connection on the exterior of the control cabinet.

Controls

The pump station control panel, located in the exterior cabinet, operates the pumps and monitors the wet well level with a pressure transducer. Float switches in the wet well serve as backup pump control in the event of pressure transducer failure. For remote monitoring, the station is



equipped with the Mission Communications alarm system that notifies staff of wet well high level and equipment failure alarms via cellular signal. The Mission system also records pump run times, pump starts, and wet well level. This and Mission circuit boards are equipped with battery backup.

Force Main

The Brooks Quarry Pumping Station has a 3" PVC force main. The force main exits the valve vault east to Brooks Quarry Road, follows the road, and discharges into a manhole at the intersection with Laurel Hill Road. The force main is approximately 580 feet in length.

4.6.1.2 Existing Conditions and Deficiencies

In general, the pumping station is in very good condition. The structure is in good condition with no need for structural repairs. No major deficiencies were noted, but the following minor deficiencies were noted:

The WPCA staff desire a canopy over the pumping station structures and control cabinet.

4.6.1.3 Future Flows

Over the next ten years, there is approximately 1,000 gpd of additional flow, on average, that the Brook Quarry Pumping Station will receive from the existing sewer service area. This includes a property that is within the existing sewer service area and could connect in the future.

4.6.1.4 Recommendation

The Brooks Quarry Pumping Station is generally in very good overall condition. One suggestion that the WPCA Staff had was to install a canopy over the pumping station structure and control cabinet. This alternative is a low priority because it is not critical to the operation of the pumping station but would increase the ease of operation and maintenance for the WPCA staff. The WPCA should consider this alternative either as a stand-alone project or when higher priority, future improvements are needed.

4.6.2 Caldor Pumping Station

4.6.2.1 Station Description

Station Layout

The Caldor Pumping Station is a dry well, centrifugal pump style pumping station located at approximately 64 Federal Road, at the intersection with Candlewood Lake Road. The station was constructed in 1975 and the pumps upgraded last in 2006. The site consists of a one-story building containing electrical equipment and controls with below grade wet well and dry well, and outdoor emergency generator. The site is surrounded by a chain link fence with vehicle gate.





Most of the station conveyance system is contained within the below grade level of the pumping station building: a grinder added in 2014, a wet well with influent sewer, manual bar rack, and pump suction piping; and a dry well containing two centrifugal pumps, individual pump check valves and isolation valves, and the single outgoing force main pipe. The discharge pump header has a blind flange connection and there is a force main clean out at grade adjacent to the pumping station building, but the station does not have pipe and valve provisions for an emergency pump station bypass.

There are two additional below grade structures: upstream of the pumping station is a below grade vault with one wastewater grinder and bypass channel and downstream of the pumping station is a manhole containing the force main and venturi meter to measure the discharge flow.

Pumps and Piping

The station is equipped with two centrifugal pumps within the dry well, each rated for approximately 1,250 gpm at 50.6 feet of total dynamic head. The pumps are KSB, model 9970894127-000100 and were installed in 2005. 10-inch suction piping penetrates through the wall into the wet well. The dry well contains a swing type check valve and an isolation plug valve on the discharge lines from each pump. The two separate lines connect to a common 10-inch force main. A 6-inch blow off from the force main discharges back into the wet well.

The pumps are protected in two ways. The first is with the a JWC Channel Monster Grinder located in a separate below grade structure upstream of the pumping station. The second is with a manual bar rack located in the wet well which catches larger debris that bypasses the grinder particularly when the grinder is out of service. Accumulated debris is raked and physically removed from the wet well by WPCA operators.

Electrical

The station is supplied with 208 V, three phase underground electrical service. The main electrical and control panels are located inside the control building. In 2014 the station was equipped with a new onsite emergency generator to provide power when normal power is lost through an automatic transfer switch connected to the main panel. The Kohler generator is fueled by natural gas. There is also a generator hook up on the exterior of the pumping station building for connection to a portable generator.

Controls

The pump station control panel located in the pumping station building, operates the pumps and monitors the wet well level with a pressure transducer. Float switches in the wet well serve as backup pump control in the event of pressure transducer failure. Pumping station discharge flows are monitored with a venturi meter in the manhole downstream of the station. For remote monitoring, the station is equipped with the Mission Communications alarm system that notifies staff of wet well high level and equipment failure alarms via cellular signal. The Mission system also records pump run times, pump starts, wet well level, and discharge flow rates.

Force Main

The Caldor Pumping Station has a single 10" ductile iron force main. The force main exits the dry well, turns south and passes through the venturi meter manhole, and turns west onto Federal



Road (Route 202) where it continues into the City of Danbury and discharges into their collection system. The force main is approximately 1,670 feet in length.

4.6.2.2 Existing Conditions and Deficiencies

In general, the pumping station is in good condition. There is sufficient adjacent space available to expand the station or construct a new station, if needed. The building structure is in good condition with no deterioration noted and no need for structural or architectural repairs. The following minor deficiencies were noted:

- The main electrical service, switchgear and MCC are original mid-1970s vintage and appear to be beyond their useful life expectancy. The electrical equipment is located in the ground level area which is connected to the dry-pit below. Current NFPA 820 standards allow this area to be unclassified, provided there is a gas-tight physical separation between the wetwell and dry-pit. It appears that this space complies with this standard, therefore physical alterations to the station is not required to meet this standard.
- The fence around the site is sound; however, it is only about three feet tall and the vehicle gate must be manually unlocked and opened which is not ideal on the busy Candlewood Lake Road. WPCA staff noted their desire for automatic vehicle gates at all pumping stations.
- The grinder was out of service for maintenance.
- There is a manual bar rack at operating level in the wet well. Operators must manually remove debris from the rack and then carry it up the stairs and outside for disposal. While removal from the rack is adequate, a better solution is desired for transport of the removed debris from the operating level to grade. Improvements to safety and confined space entry of the wet well are also desired.
- There is a hatch in the floor of the control room for pump removal but there isn't a hoist or monorail; therefore a portable gantry lift must be positioned over the hatch to remove the equipment from the lower level.
- The WPCA would prefer a mag meter instead of the venturi meter currently installed.
- There is currently not a straightforward way to bypass the pumping station. There are a pair of blind flanges on the force main which could be used, but additional piping and valving would help make the connection easier.

4.6.2.3 Future Flows

As discussed in Section 2, there is the potential for a sizable increase in flow in the service area and several areas of environmental concern that may warrant sewer extensions. As a result, the flow to the Caldor station could increase by about 240,000 gpd on an annual average basis and the Candlewood Lake Area has the potential to generate an additional 200,000 gpd. On a peak flow basis, the addition flow (excluding the Candlewood Lake Area) added to the existing flow equates to 1,475 gpm which exceeds the station capacity by about 225 gpm.



4.6.2.4 Recommendations

The Caldor Pumping Station has been well maintained and is generally in good overall condition, but the age of the electrical system is a concern. In addition, the area classification should be addressed as part of a larger upgrade. Modifications to the station should include:

- Upgrade the station to completely replace 1976 vintage electrical gear
- Install higher capacity pumps
- Replace HVAC and lighting
- Replace channel grinder, have the existing grinder rebuilt and kept as a shelf spare
- Mag meter for flow measurement
- Exterior piping to include a forcemain tap for bypass pumping connection
- Automatic vehicle gate on existing fencing
- Electric hoist in wet well and modifications to allow trash rack debris removal
- Gas detection in wet well and HVAC improvements to increase safety of confined space entry
- Monorail and hoist for pump removal

CDM Smith considers the recommended upgrades for the Caldor Station as a high priority, due to the critical nature of the station and age of the main electrical distribution system which is forty-five years old.

4.6.3 Cedarbrook Pumping Station

4.6.3.1 Station Description

Station Layout

The Cedarbrook Pumping Station is a submersible, centrifugal pump style pumping Station located at approximately 12 Cedarbrook Road. The station was constructed in 2008. The site consists of a concrete wet well chamber, above grade valve enclosure, outdoor main control panel, outdoor emergency generator, above grade fuel tank, and bioxide storage tank and feed system. The wet well, valve enclosure, and control panel are covered by a roof structure.



The site is located off the road is surrounded by a chain link fence with vehicle gate.

The station conveyance system is contained within the precast concrete wet well and above grade fiberglass valve enclosure. The wet well contains the two submersible pumps, station level



controls, and trash basket on the incoming 8" sewer. The valve enclosure provides protection for the isolation valves on pump discharges and force mains, and pump disconnects. A bypass connection is located on the exterior of the enclosure.

Pumps and Piping

The station is equipped with two submersible, centrifugal pumps within the wet well, rated for 75 gpm. The pumps are Flygt, model 3102.890 and were installed in 2008. The pumps are protected by a trash basket located on the influent pipe to the wet well. The valve enclosure contains isolation ball valves on the discharge lines from each pump and on the two 3" force main pipes. There is a branch for a bypass pump connection off of the pump discharge header.

Electrical

The station is supplied with 240 V, single phase underground electrical service. The main electrical and control panels are located inside the exterior electrical enclosure with the pump disconnects located in the fiberglass valve enclosure located above the wet-well. The electrical components in the valve enclosure appear to be NEMA 1 and NEMA 4 which do not comply with NFPA 820 standards. According to the standard, a gas-tight physical separation is required to declassify this space, otherwise continuous ventilation or NEMA 7 explosion proof (Class I, Division 1, Group D) components are required. Furthermore, the enclosure is within three feet of the wetwell hatch opening which would require Division 2 equipment. The station is equipped with an outdoor emergency generator to provide power when normal power is lost through an automatic transfer switch connected to the main panel. The 35 kW Cummins generator is fueled by propane.

Controls

The pump station control panel located in the outdoor enclosure, operates the pumps and monitors the wet well level with a pressure transducer. Float switches in the wet well serve as backup pump control in the event of pressure transducer failure. For remote monitoring, the station is equipped with the Mission Communications alarm system that notifies staff of wet well high level and equipment failure alarms via cellular signal. The Mission system also records pump run times, pump starts, and wet well level. A pulse flow meter was added to this station May 2020 that reports into the Mission system.

Force Main

The Cedarbrook Pumping Station has dual 4" PVC force mains. The force mains exit the valve enclosure as 3" piping, increase to 4" and head south cross country, turning west on West Whisconier Road and then discharge into a manhole west of the intersection with Stony Hill Road. The force mains are approximately 1,160 feet in length.

4.6.3.2 Existing Conditions and Deficiencies

In general, the pumping station has been well maintained and is in very good condition. The pumping station structures are in good condition with no deterioration and no need for structural repairs. No major deficiencies were noted, but the following deficiencies were noted:

 Within the fiberglass enclosure, gas tight seal off fittings should be installed on all electrical and instrument conduits connected to the wet-well. Other NEMA 1 and NEMA 4



components should be replaced with NEMA 7 rated components. Alternatively, certification from the Engineer of Record could be obtained or approval by the Authority Having Jurisdiction (AHJ), typically the fire marshal, could be obtained.

- The trash rack is difficult to move and does not adequately capture large debris.
- The WPCA staff desire changing to three phase service.

4.6.3.3 Future Flows

Over the next ten years, there is no additional flow anticipated for this station. However, as discussed in Section 2, if sewers are extended to the Greenridge Area of Concern in the future, on average, an additional 34,800 gpd could be conveyed to the station. On a peak flow basis, the Cedar Brook Pump Station would require an additional 135 gpm capacity for a total peak flow capacity of 210 gpm.

4.6.3.4 Recommendations

The Cedarbrook Pumping Station has been well maintained and is in very good overall condition. The deficiencies identified are considered minor and are low priority because they are not critical to the operation of the pumping station. The WPCA should consider these alternatives either as a stand-alone project or include then when higher priority, future improvements are needed.

4.6.4 Commerce Drive Pumping Station

4.6.4.1 Station Description

Station Layout

The Commerce Drive Pumping Station is a submersible, centrifugal pump style pumping Station located near 101 Commerce Road. The station was constructed in 2014. The site consists of a concrete wet well chamber, concrete dry well valve vault, and outdoor main control panel with portable generator connection. The site is located off the road and is surrounded by a chain link fence with vehicle gate.



The station conveyance system is contained

within two precast concrete below grade vaults: a wet well with two submersible pumps and station level controls; and a valve vault containing the individual pump check and isolation valves, the two outgoing force main pipes, and bypass connection piping and valve.

Pumps and Piping

The station is equipped with two submersible, centrifugal pumps within the wet well. The pumps, rated for approximately 45 gpm, are manufactured by Flygt and were installed in 2014. The valve vault contains a swing type check valve and an isolation plug valve on the discharge lines from



each pump. The two separate pipes leave the vault as force mains with a valve connection between them. Each force main has a branch with valve and bypass connection.

Electrical

The station is supplied with 230 V, single phase underground electrical service. The main electrical and control panels are located in the outdoor control cabinet. The station does not have an emergency backup generator, but there is a portable generator connection on the exterior of the control cabinet.

Controls

The pump station control panel located in the exterior cabinet, operates the pumps and monitors the wet well level with float switches located in the wet well. For remote monitoring, the station is equipped with the Mission Communications alarm system that notifies staff of wet well high level and equipment failure alarms via cellular signal. The Mission system also records pump run times and pump starts.

Force Main

The Commerce Pumping Station has a dual 3" PVC force main. The force mains exit the valve vault north Commerce Drive and discharge into a manhole at the intersection with Route 133. The force mains are approximately 3,100 feet in length.

4.6.4.2 Existing Conditions and Deficiencies

In general, the pumping station has been well maintained and is in very good condition. The below grade structures are in good condition with no deterioration and no need for structural repairs. No major deficiencies were noted, but the following minor deficiencies were noted:

- The pumping station is not NEC compliant for an explosive area. The electrical and control panels are within three feet of the wet-well hatch opening and vents. The close proximity requires NEMA 7 components.
- PVC conduit was located in the explosive area.
- Explosion proof seal off fittings are not present.
- One of the force mains is currently clogged.
- The WPCA staff desire the ability to run both force mains at the same time.

4.6.4.3 Future Flows

Over the next ten years, there is the potential for approximately 680 gpd of additional flow, on average, that the Commerce Drive Pumping Station. This flow is attributed to additional parcels on Commerce Drive. On a peak flow basis, the projection equals 10 gpm which is well below the 45 gpm capacity of the station.



4.6.4.4 Recommendations

The Commerce Drive Pumping Station has been well maintained and is generally in very good overall condition. The following recommendations are presented to address the deficiencies noted.

- Move electrical and control panels to be out of the explosive area
- Replace PVC conduit and seal off fittings to be code compliant
- Perform cleaning of the clogged force main
- Configure pipe discharge layout and controls for parallel force main operation

CDM Smith considered the first two alternatives to be medium priority because they are electrical code violations which should be corrected. The last two alternatives were considered low priority because they are not critical to the operation of the pumping station but would increase the ease of operation and maintenance for the WPCA staff. The WPCA should consider these alternatives either as a stand-alone project or when higher priority, future improvements are needed.

4.6.5 Del Mar Pumping Station

4.6.5.1 Station Description

Station Layout

The Del Mar Pumping Station is a submersible, centrifugal pump style pumping Station located at approximately 56 Del Mar Drive. The station was constructed in 2012. The site consists of a concrete wet well chamber, concrete valve vault, and outdoor main control panel with portable generator connection. The site is located off the road and does not have any fencing. The station is at the end of a dead-end road.



The station conveyance system is contained within two precast concrete below grade vaults: a wet well with two submersible pumps and station level controls; and a valve vault containing the individual pump check and isolation valves, the outgoing force main pipe, and bypass connection piping and valve.

Pumps and Piping

The station is equipped with two submersible, centrifugal pumps within the wet well, rated for approximately 45 gpm. The pumps are manufactured by HOMA, model AM13654-2-3 and were installed in 2012. The valve vault contains a swing type check valve and an isolation plug valve on the discharge lines from each pump. The two separate lines combine with a branch of the header for bypass connection. The single outgoing force main has flow meter.



Electrical

The station is supplied with 480 V, three phase underground electrical service. The main electrical and control panels are located in the outdoor control cabinet. The station does not have an emergency backup generator, but there is a portable generator connection on the exterior of the control cabinet.

Controls

The control panel operates the pumps and monitors the wet well level with a pressure transducer. Float switches in the wet well serve as backup pump control in the event of pressure transducer failure. Pumping station discharge flows are monitored with a magnetic flow meter in the valve vault. For remote monitoring, the station is equipped with the Mission Communications alarm system that notifies staff of wet well high level and equipment failure alarms via cellular signal. The Mission system also records pump run times, pump starts, wet well level, and discharge flow rates.

Force Main

The Del Mar Pumping Station has a single 3" PVC force main. The force mains exit the valve vault and flows north along Del Mar Drive and discharges into a manhole at the intersection with Route 202. The force mains are approximately 1,065 feet in length.

4.6.5.2 Existing Conditions and Deficiencies

In general, the pumping station has been well maintained and is in very good condition. The below grade structures are in good condition with no deterioration and no need for structural repairs. No major deficiencies were noted, but the following minor deficiencies were noted:

- The flow meter diameter appears to be 1-1/2-inch diameter which could be subject to frequent clogging.
- Plowed snow accumulates from Del Mar Drive accumulates on the pumping station.
- The site lacks fencing for security.

4.6.5.3 Future Flow

Over the next ten years, there is the potential for approximately 11,750 gpd of additional flow, on average, that the Del Mar Pumping Station could receive from the existing sewer service area. This includes the industrial properties on Del Mar Drive that have been assessed but are not yet connected. If the full projected flow is realized, the peak flow to the station could be exceeded by about 26 gpm. It is noted that the majority of these properties are designated as industrial warehouses which typically generate a minimal amount of wastewater, therefore, the flow figure above is likely to be conservatively high and the peak flow capacity of the station is likely adequate.

4.6.5.4 Recommendations

The Del Mar Pumping Station is generally in very good overall condition. The following alternatives are presented to address the minor deficiencies.

Install snow barrier.



- Upgrade site with fencing with privacy slats.
- Modify piping to include a valved bypass around mag meter to make servicing and/or unclogging easier.

These alternatives are low priority because they are not critical to the operation of the pumping station but would increase the ease of operation and maintenance for the WPCA staff. If fencing is desired, then the ease of plowing or shoveling out the fenced in area will need consideration.

4.6.6 High Meadow Pumping Station

4.6.6.1 Station Description

Station Layout

The High Meadow Pumping Station is a submersible, centrifugal pump style pumping Station located at the end of Eastview Drive in the High Meadow Condominium Complex. The station was constructed in 2014. The site consists of a concrete wet well chamber, concrete valve vault, outdoor main control panel, and outdoor emergency generator. The site is located off the road and is surrounded by a chain link fence with manual gate.



The station conveyance system is

contained within two precast concrete below grade vaults: a wet well with two submersible pumps and station level controls; and a valve vault containing the individual pump check and isolation valves, the single outgoing force main pipe, flow meter, and bypass connection piping and valve.

Pumps and Piping

The station is equipped with two submersible, centrifugal pumps within the wet well, rated for approximately 95 gpm. The pumps are Flygt, model 3127.890 and were installed in 2018. The dry well valve vault contains a swing type check valve and an isolation plug valve on the discharge lines from each pump. The two separate lines connect to a common 4" force main with a branch off of the force main header for bypass connection. A magnetic flow meter is also contained in the valve vault on the force main piping.

Electrical

The station is supplied with 240 V, single phase underground electrical service. The main electrical and control panels are located inside outdoor panel enclosure. The station is equipped with an outdoor emergency generator to provide power when normal power is lost through an automatic transfer switch connected to the main panel. The 35 kW Cummins generator is fueled by diesel.



Controls

The pump station control panel located in the pumping station building, operates the pumps and monitors the wet well level with a pressure transducer. Float switches in the wet well serve as backup pump control in the event of pressure transducer failure. Pumping station discharge flows are monitored with a magnetic flow meter in the valve vault. For remote monitoring, the station is equipped with the Mission Communications alarm system that notifies staff of wet well high level and equipment failure alarms via cellular signal. The Mission system also records pump run times, pump starts, wet well level, and discharge flow rates.

Force Main

The High Meadow Pumping Station has a single 4" PVC force main. The force main exits the valve vault, turns north through the condominium complex and cross country and then discharges into a manhole on Silvermine Road. The force main is approximately 1,860 feet in length.

4.6.6.2 Existing Conditions and Deficiencies

In general, the pumping station is in very good condition. The below grade structures are in good condition with no deterioration and no need for structural repairs. No major deficiencies were noted, but the following minor deficiencies were noted:

- The flow meter diameter appears to be 2-inch diameter which could be subject to frequent clogging. Subsequent to inspection by CDM Smith, the flow meter failed and was examined. It was found to be clean.
- The wiring enclosed within the pedestal cabinet is not NEC code compliant, all the wiring and cable terminals are installed exposed with no physical protection for the cables.
- The fence around the site is sound; however, the gate must be manually unlocked and opened. WPCA staff noted their desire for automatic vehicle gates at all pumping stations.

4.6.6.3 Future Flow

There is no additional flow projected for this station.

4.6.6.4 Recommendations

The High Meadow Pumping Station is generally in very good overall condition. The following alternatives are presented to address the minor deficiencies.

- Add physical protection to cable terminals and wiring in the electrical cabinet
- Modify piping to include a valved bypass around mag meter to make servicing and/or unclogging easier.
- Automatic vehicle gate on existing fencing

CDM Smith considered the first recommendation to be medium priority because it is an electrical code violation which needs correction. The second and third alternatives are considered low priority because it is not critical to the operation of the pumping station. Additionally, the area inside the pumping station fence is limited. The WPCA should consider the need for an automatic



gate at this location and whether the fence footprint would need to be expanded to accommodate a truck.

4.6.7 High School Pumping Station

4.6.7.1 Station Description

Station Layout

The High School Pumping Station is a submersible, centrifugal pump style pumping Station located at next to the high school at 45 Long Meadow Hill Road. The station was constructed in 2005. The site consists of a concrete wet well chamber, above grade valve enclosure, outdoor main control panel, outdoor emergency generator, above grade fuel tank, and bioxide storage tank and feed system. The wet well, valve enclosure, and control panel are covered by a roof structure. The site is located off the road is surrounded by a chain link fence with vehicle gate.



The station conveyance system is contained within the precast concrete wet well and above grade valve enclosure. The wet well contains the two submersible pumps, station level controls, and incoming 8" sewer. The valve enclosure provides protection for the isolation valves on pump discharges and force mains, and pump disconnects. A bypass connection is located on the exterior of the enclosure.

Pumps and Piping

The station is equipped with two submersible, centrifugal pumps within the wet well, rated for approximately 85 gpm at 130 feet of totally dynamic head. The pumps are manufactured by Flygt and were installed in 2005. The dry valve enclosure contains isolation ball valves on the discharge lines from each pump and on the two 3" force main pipes. Off of the pump discharge header is a branch for bypass connection.

Electrical

The station is supplied with 240 V, three phase underground electrical service. The main electrical and control panels are located inside the exterior electrical enclosure with the pump disconnects located in the fiberglass valve enclosure located above the wet-well. The electrical components in the valve enclosure appear to be NEMA 1 and NEMA 4 which do not comply with NFPA 820 standards. A gas-tight physical separation is required to declassify this space, otherwise continuous ventilation or NEMA 7 explosion proof (Class I, Division 1, Group D) components are required. Furthermore, the enclosure is within three feet of the wetwell hatch opening which would require Division 2 equipment. The station is equipped with an outdoor emergency generator to provide power when normal power is lost through an automatic transfer switch connected to the main panel. The 40 kW Cummins generator is fueled by diesel.



Controls

The pump station control panel located in the outdoor enclosure, operates the pumps and monitors the wet well level with a pressure transducer. Float switches in the wet well serve as backup pump control in the event of pressure transducer failure. For remote monitoring, the station is equipped with the Mission Communications alarm system that notifies staff of wet well high level and equipment failure alarms via cellular signal. The Mission system also records pump run times, pump starts, and wet well level.

Force Main

The High School Pumping Station has dual 4" PVC force mains. The force mains exit the valve enclosure as 3" piping, increase to 4" and head south cross country, turning west on Route 133 then discharge into a manhole between School Street and Route 133. The force mains are approximately 5,340 feet in length.

4.6.7.2 Existing Conditions and Deficiencies

In general, the pumping station is in very good condition. The pumping station structures are in good condition with no deterioration and no need for structural repairs. No major deficiencies were noted, but the following minor deficiencies were noted:

- The generator has a history of operating issues.
- The WPCA staff desires water and natural gas at the site.

4.6.7.3 Future Flows

There is no additional flow projected for this station.

4.6.7.4 Recommendations

The High School Pumping Station is generally in very good overall condition. The following recommendations are presented to address the minor deficiencies.

- Within the fiberglass enclosure, gas tight seal off fittings should be installed on all electrical and instrument conduits connected to the wet-well. Other NEMA 1 and NEMA 4 components should be replaced with NEMA 7 rated components. Alternatively, certification from the Engineer of Record could be obtained or approval by the Authority Having Jurisdiction (AHJ), typically the fire marshal, could be obtained.
- Install water and natural gas service to pumping station
- Replace generator (with natural gas driven engine)
- Repave site

CDM Smith considered the generator replacement as a low, however service and an evaluation an authorized representative to address the operational issues reported. The generator is an important component because the pumping station serves the high school, which is an emergency



evacuation center for the Town. While this pumping station only serves this building, it needs to be reliably operational during a loss of power.

The paving and utility services are considered low priority because they are not critical to the operation of the pumping station but would increase aesthetics of the site and the ease of operation and maintenance for the WPCA staff. The WPCA should consider these alternatives either as a standalone project or when higher priority, future improvements are needed.

4.6.8 North Pumping Station

4.6.8.1 Station Description

Station Layout

The North Pumping Station is a submersible, centrifugal pump style pumping station located at approximately 993 Federal Road. The station was constructed in 1994 and last upgraded in 2015. The site consists of a concrete wet well chamber, concrete dry well valve vault and outdoor main control panel with portable generator connection. The site is located off the road but does not have fencing.

The station conveyance system is contained within three precast concrete below grade vaults: an incoming sewer vault; wet well with two submersible pumps, trash basket, and station level controls; and a valve vault containing the individual pump check and isolation valves, the two outgoing force main pipes, flow meter, and bypass connection piping and valve.



Pumps and Piping

The station is equipped with two submersible, centrifugal pumps within the wet well, rated for approximately 110 gpm at 100 feet of totally dynamic head. The pumps are Flygt, model 3127.910-022 and were installed in 2016 replacing two 55 gpm pumps. The valve vault contains a swing type check valve and an isolation gate valve on the discharge lines from each pump. The two separate lines connect to a common 4" header with a branch off of the header for bypass connection. From the header, there are two 4" ductile iron force mains. A magnetic flow meter is also contained in the valve vault on one of the force main pipes.

Electrical

The station is supplied with 480 V, three phase underground electrical service. The main electrical and control panels are located in the outdoor control cabinet. The station does not have an emergency backup generator, but there is a portable generator connection on the exterior of the control cabinet.

Controls

The pump station control panel located in the exterior cabinet, operates the pumps and monitors the wet well level with a pressure transducer. Float switches in the wet well serve as backup



pump control in the event of pressure transducer failure. Pumping station discharge flows are monitored with a magnetic flow meter in the valve vault. For remote monitoring, the station is equipped with the Mission Communications alarm system that notifies staff of wet well high level and equipment failure alarms via cellular signal. The Mission system also records pump run times, pump starts, wet well level, and discharge flow rates.

Force Main

The North Pumping Station has a dual 4" ductile iron (DI) force mains. The force mains exit the valve vault, turn west toward Federal Road and then turn south on Federal Road (Route 202) where they discharge into a manhole at approximately 839 Federal Road. The force mains are approximately 4,020 feet in length.

4.6.8.2 Existing Conditions and Deficiencies

In general, the pumping station is in very good condition. The structures are in good condition with no need for structural repairs. No major deficiencies were noted, but the following minor deficiencies were noted:

- The wiring within the pedestal cabinet is not NEC code compliant. All the wiring and cable terminals were installed exposed with no physical protection for the cables.
- The junction box installed for the wet well is not NEC compliant for an explosive area.
- The structures are located off the road surrounded by grass. The area around the structures must be shoveled the access the station.
- The site lacks fencing for security.
- The WPCA staff noted the station is undersized, requiring the duty and standby pump to operate in parallel during wet weather. To reduce the friction head on the pumps they would like to operate the force mains in parallel.

4.6.8.3 Future Flows

Over the next ten years, there is approximately 4,600 gpd of additional flow, on average, that the North Pumping Station could potentially receive from the existing sewer service area. This includes properties that are within the existing sewer service area, many of which have been previously assessed and could connect in the future. The most significant potential connection is the 44-acre property at 1055 Federal Road. Planning documents indicate 20,000 gpd of wastewater could be generated from this site; however, development of this site is not anticipated during the planning period. If the planned developments and connections come to fruition, the station's peak flow capacity would need to be increased by about 45 gpm.

4.6.8.4 Recommendations

The North Pumping Station is generally in good overall condition. The following recommendations are presented to address the deficiencies noted.

- Add physical protection to cable terminals and wiring in the electrical cabinet
- Replace junction box with a NEMA 7 rated box suitable for use in explosive area



- Upgrade site with paving and fencing
- Configure pipe discharge layout and controls for parallel force main operation
- Monitor development within the upstream tributary area to ensure additional development does not over tax the station, plan for upgrade prior to that point in time

CDM Smith considered the first two alternatives to be medium priority because they are electrical code violations and should be corrected. The last two alternatives were considered low priority because they are not critical to the operation of the pumping station. The site paving and fencing would help with ease of maintenance and operation and provide a more secure site. A reconfiguration to allow for parallel force main operation would be helpful for operation when increased flows are observed. This may help the WPCA delay a more significant future upgrade due to development in the collection system. The WPCA should consider these alternatives either as a stand alone project or when higher priority, future improvements are needed.

4.6.9 Railroad Pumping Station

4.6.9.1 Station Description

Station Layout

The Railroad Pumping Station is a submersible, centrifugal pump style pumping station located at approximately 35A Silvermine Road. The station was constructed in 1996 and last upgraded in 2015. The site consists of a concrete wet well chamber, concrete valve vault, concrete meter vault and outdoor main control panel with portable generator connection. The site is located off the road but does not have fencing.



The station conveyance system is

contained within three precast concrete below grade vaults: a wet well with two submersible pumps and station level controls; and a valve vault containing the individual pump check and isolation valves, the two outgoing force main pipes, and bypass connection piping and valve; and a meter vault with magnetic flow meter on the 4" force main.

Pumps and Piping

The station is equipped with two submersible, centrifugal pumps within the wet well. The pumps are manufactured by Flygt and were installed in 2016. The valve vault contains a swing type check valve and an isolation gate valve on the discharge lines from each pump. The two separate lines connect to a common 4" header with a branch off of the header for bypass connection. From the header, there are three force mains, with diameters of 2", 4", and 6". A magnetic flow meter is located in the 4" force main in the meter vault.



Electrical

The station is supplied with 480 V, three phase underground electrical service. The main electrical and control panels are located in the outdoor control cabinet. The station is equipped with an outdoor emergency generator to provide power when normal power is lost through an automatic transfer switch connected to the main panel. The 25 kW Cummins generator is fueled by diesel.

Controls

The pump station control panel located in the exterior cabinet, operates the pumps and monitors the wet well level with a pressure transducer. Float switches in the wet well serve as backup pump control in the event of pressure transducer failure. Pumping station discharge flows are monitored with a magnetic flow meter in the valve vault. For remote monitoring, the station is equipped with the Mission Communications alarm system that notifies staff of wet well high level and equipment failure alarms via cellular signal. The Mission system also records pump run times, pump starts, wet well level, and discharge flow rates.

Force Main

The Railroad Pumping Station has three force mains with diameters 2", 4", and 6". The force mains exit the valve vault, west on Silvermine Road, crosses over the railroad right-of-way, turn south on Pocono Road where they discharge into a manhole at approximately 115 Pocono Road. The force mains are approximately 725 feet in length.

4.6.9.2 Existing Conditions and Deficiencies

In general, the pumping station is in very good condition. Space is limited on site; there is some adjacent land that could potentially be used for a future construction, but it is currently privately owned. The structures are in good condition with no need for structural repairs. No major deficiencies were noted, but the following minor deficiencies were noted:

- The site lacks fencing for security.
- The WPCA staff desire a canopy over the pumping station structures and control cabinet.

4.6.9.3 Recommendations

Over the next ten years, there is approximately 3,860 gpd of additional flow, on average, that the Railroad Pumping Station could potentially receive from the existing sewer service area. The majority of this flow can be attributed to "failure only" connection along Silvermine Road and Whisconier Road. If these connections occur, the station's peak flow capacity would need to be increased by 30 gpm.

4.6.9.4 Recommendations

The Railroad Pumping Station is generally in good overall condition. The following recommendations are presented to address the minor deficiencies. An estimated cost and priority level are presented with each alternative.

- Upgrade site with fencing
- Install canopy over existing pumping station



Monitor station flow over time

These alternatives as low priority because they are not critical to the operation of the pumping station. The site fencing would provide a more secure site. A canopy over the pumping station would be helpful for operation and maintenance of the station. The WPCA should consider these alternatives either as a stand alone project or when higher priority, future improvements are needed.

4.6.10 Route 133 Pumping Station

4.6.10.1 Station Description

Station Layout

The Route 133 Pumping Station is a submersible, centrifugal pump style pumping Station located at approximately 120 Junction Road (Route 133). The station was last upgraded in 2006. The site consists of a concrete wet well chamber, concrete dry well valve vault and one-story control building with indoor emergency generator. The control building roof extends over the wet well access hatch. The site is located off the road and is surrounded by a chain link fence with vehicle gate.



The station conveyance system is contained within

three precast concrete below grade vaults: a grinder vault with incoming 12" sewer, one wastewater grinder and bypass channel; wet well with two submersible pumps and station level controls; and a drywell containing the individual pump check and isolation valves, the single outgoing force main pipe, flow meter, and bypass connection piping and valve.

Pumps and Piping

The station is equipped with two submersible, centrifugal pumps within the wet well, rated for approximately 400 gpm at 70 feet of totally dynamic head. The pumps are manufactured by Flygt and were installed in 2006. The dry well valve vault contains a swing type check valve and an isolation plug valve on the discharge lines from each pump. The two separate lines connect to a common 6" force main with a branch off of the force main for bypass connection at grade. A magnetic flow meter is also contained in the valve vault on the force main piping.

The pumps are protected with a JWC Channel Monster Grinder located in a separate below grade structure upstream of the pumping station.

Electrical

The station is supplied with 480 V, three phase underground electrical service. The main electrical and control panels are located inside the control building. The station is equipped with an indoor emergency generator to provide power when normal power is lost through an automatic transfer switch connected to the main panel. The 100 kW Kohler generator is fueled by natural gas. There is also a generator hook up on the exterior of the pumping station building for connection to a portable generator.



Controls

The pump station control panel located in the pumping station building, operates the pumps and monitors the wet well level with a pressure transducer. Float switches in the wet well serve as backup pump control in the event of pressure transducer failure. Pumping station discharge flows are monitored with a magnetic flow meter in the valve vault. For remote monitoring, the station is equipped with the Mission Communications alarm system that notifies staff of wet well high level and equipment failure alarms via cellular signal. The Mission system also records pump run times, pump starts, wet well level, and discharge flow rates.

Force Main

The Route 133 Pumping Station has a single 6" PVC force main. The force main exits the valve vault, runs west parallel to Route 133, turns south onto Route 202 and branches south onto Old New Milford Road where it discharges into a manhole at approximately 2 Old New Milford Road. The force main is approximately 2,870 feet in length.

4.6.10.2 Existing Conditions and Deficiencies

In general, the pumping station is nearing the end of its useful life. The building structure appears to be in good condition but there were many electrical and mechanical deficiencies noted during the site visit:

- The WPCA staff noted the wet well is undersized and causes the pumps to cycle on and off at a high frequency.
- The generator needs replacement due to its age. It currently poses a safety issue for the maintenance staff.
- Multiple NEC compliancy issues.
- Electrical and control cabinets need replacement.

The property for the pumping station is contained to the fenced in area and is large enough to accommodate a new or expanded station.

4.6.10.3 Future Flows

As discussed in Section 2, there is the potential for a sizable increase in flow in the service area and several areas of environmental concern that may warrant sewer extensions. Due to this station's location in the collection system, a large amount of the projected flow would pass through it. As a result, the flow to the Route 133 station could increase by about 74,650 gpd on an annual average basis. The projection includes connections from the existing service area (62,250 gpd) and from the Dean/Pocono Area of Concern (12,400). On a peak flow basis, the addition flow from the existing service area would require the station to be sized for 905 gpm and if the Dean/Pocono area were added the station would need a full buildout capacity of 945 gpm.

4.6.10.4 Recommendations

The Route 133 Pumping Station needs replacement due to its aging condition and to accommodate the projected flow. The following recommendation is presented to address the noted deficiencies.



- Replace station by building a new station adjacent to the existing.
- Following commissioning of the new station, the existing station should be demolished.
- Install new precast submersible pump station (integral "Onelift" design for wet well and valve vault).
- Control Building dimensions approximately 12-ft x 20-ft x 8-ft precast concrete with architectural finishes.
- Emergency generator installed in Control Building.
- Due to increased flow capacity, install 2,900 linear feet of 10" ductile iron forcemain from the new station to run west along Route 133 before turning south on Federal Road and terminating at the high point on Old New Milford Road.

CDM Smith considered replacement of the pumping station a high priority as the Route 133 Pumping Station is the second largest pumping station in the collection system and is in the worst condition due to its age and lack of capacity. The WPCA should consider replacing this pumping station to improve the operation and reliability of its system. This has been recognized by the WPCA as an area needing urgent attention. A complete rebuild has been budgeted in stages for 2020-2022 and engineering and site work is already underway.

4.6.11 Sand Cut Pumping Station

4.6.11.1 Station Description

Station Layout

The Sand Cut Pumping Station is a submersible, centrifugal pump style pumping station located at approximately 2 Sand Cut Road. The station was constructed in 2008. The site consists of a concrete wet well chamber, concrete dry well valve vault and one-story control building with indoor emergency generator. The control building roof extends over the wet well access hatch and jib crane. The site is located off the road and is surrounded by a chain link fence with vehicle gate.



The station conveyance system is contained within three precast concrete below grade vaults: a grinder vault with incoming 8" sewer, one wastewater grinder, bypass channel, and channel gates; wet well with two submersible pumps and station level controls; and a drywell containing the individual pump check and isolation valves, the single outgoing force main pipe, flow meter, and bypass connection piping and valve.



Garage

This site includes a 3-door high bay garage that is used to store WPCA vehicles, trailered generators and spare parts.

Pumps and Piping

The station is equipped with two submersible, centrifugal pumps within the wet well. The pumps are Flygt, model 3127.090 0930127 and were installed in 2008. The dry well valve vault contains a swing type check valve and an isolation gate valve on the discharge lines from each pump. The two separate lines connect to a common 6" force main with a branch off of the force main for bypass connection. A magnetic flow meter is also contained in the valve vault on the force main piping.

The pumps are protected with a JWC Channel Monster Grinder located in a separate below grade structure upstream of the pumping station. Stop plates can be removed to allow for bypass of the grinder.

Electrical

The station is supplied with 480 V, three phase underground electrical service. The main electrical and control panels are located inside the control building. The station is equipped with an indoor emergency generator to provide power when normal power is lost through an automatic transfer switch connected to the main panel. The 47 kW Cummins generator is fueled by propane.

Controls

The pump station control panel located in the pumping station building, operates the pumps and monitors the wet well level with a pressure transducer. Float switches in the wet well serve as backup pump control in the event of pressure transducer failure. Pumping station discharge flows are monitored with a magnetic flow meter in the valve vault. For remote monitoring, the station is equipped with the Mission Communications alarm system that notifies staff of wet well high level and equipment failure alarms via cellular signal. The Mission system also records pump run times, pump starts, wet well level, and discharge flow rates.

Force Main

The Sand Cut Pumping Station has a single 6" PVC force main. The force main exits the valve vault, turns northwest on Sand Cut Road and turns west onto Grays Bridge Road where it discharges into a manhole shortly after the intersection with Old Grays Bridge Road. The force main is approximately 895 feet in length.

4.6.11.2 Existing Conditions and Deficiencies

In general, the pumping station is in very good condition. There is sufficient adjacent space available to expand the station or construct a new station, if needed. The building structure is in good condition with no deterioration and no need for structural or architectural repairs. No major deficiencies were noted, but the following minor deficiencies were noted:

- There are some cracks in the concrete slabs near the wet well hatch.
- The WPCA staff noted the force main is oversized for the pumping station.



4.6.11.3 Future Flows

Over the next ten years, there is approximately 48,000 gpd of additional flow, on average, that the Sand Cut Pumping Station could potentially receive from the existing sewer service area. The majority of this flow can be attributed to commercial/industrial zoned properties on Vale Road that have been assessed but not connected. If these properties connect, the station's peak flow capacity would need to be increased to 320 gpm. Additionally, if sewers are extended to the Greenridge Area of Concern the station's peak flow capacity would need to be increased to 430 gpm.

4.6.11.4 Recommendations

The Sand Cut Pumping Station is generally in very good overall condition. The WPCA should monitor station flow over time to determine if higher capacity pumps are needed. As new connections are made the forcemain will be flushed on a more frequent basis.

4.6.12 Silvermine Pumping Station

4.6.12.1 Station Description

Station Layout

The Silvermine Pumping Station is a submersible, centrifugal pump style pumping station located at approximately 595A Federal Road. The station was constructed in 1994. The site consists of a concrete wet well chamber, concrete dry well valve vault and control panel located in the WPCA Garage and Maintenance Building with portable generator connection. The site is located off the road and the controls are located inside but the exterior structures do not have security fencing.



The station conveyance system is contained within three precast concrete below grade vaults: an incoming sewer vault; wet well with two submersible pumps and station level controls; and a drywell containing the individual pump check and isolation valves, the two outgoing force main pipes and bypass connection piping and valve.

Garage

This site includes a 2-door high bay garage that is used to store WPCA vehicles, generators, landscaping equipment and spare parts.

Pumps and **Piping**

The station is equipped with two submersible, centrifugal pumps within the wet well, rated for approximately 80 gpm at 25 feet of totally dynamic head. The pumps are manufactured by Flygt and were installed in 1994. The dry well valve vault contains a swing type check valve and an isolation valve on the discharge lines from each pump. The two separate lines connect to a



common 4" header with a branch off of the header for bypass connection. From the header, there are two 4" PVC force mains.

Electrical

The station is supplied with 480 V, three phase underground electrical service. The main electrical and control panels are located in the maintenance building. The station does not have an emergency backup generator, but there is a portable generator connection on the exterior of the building and a portable generator is kept in one of the garage bays.

Controls

The pump station control panel operates the pumps and monitors the wet well level with a pressure transducer. Float switches in the wet well serve as backup pump control in the event of pressure transducer failure. For remote monitoring, the station is equipped with the Mission Communications alarm system that notifies staff of wet well high level and equipment failure alarms via cellular signal. The Mission system also records pump run times, pump starts and wet well level.

Force Main

The Silvermine Pumping Station has a dual 4" PVC force mains. The force mains exit the valve vault, turn west on Silvermine Road and discharge into a manhole at the intersection of Silvermine Road and Route 202. The force mains are approximately 810 feet in length.

4.6.12.2 Existing Conditions and Deficiencies

In general, the pumping station is in good condition. There is sufficient adjacent space available to expand the station or construct a new station, if needed. The structures are in good condition with no need for structural repairs. No major deficiencies were noted, but the following minor deficiencies were noted:

- The structures are located off the road surrounded by grass. The area around the structures must be shoveled the access the station.
- The site lacks fencing for security.
- The electrical equipment, controls and pumps have outlasted their design life and should be replaced.

4.6.12.3 Future Flows

There is no additional flow from new connections projected, in fact, Silvermine Station currently handles a fraction of flow it once did. There are several commercial/industrial buildings in the tributary area of this station that are currently vacant.

4.6.12.4 Recommendations

The Silvermine Pumping Station is generally in good overall condition but is operating beyond its design life. Due to the low flows experienced at this station upgrading it is a low priority. If the vacant buildings are re-occupied in the future, the WPCA should consider upgrading the station.



4.6.13 Stony Hill Pumping Station

4.6.13.1 Station Description

Station Layout

The Stony Hill Pumping Station is a submersible, centrifugal pump style pumping Station located at approximately 1 Stony Hill Village. The station was constructed in 2008. The site consists of a concrete wet well chamber, above grade valve enclosure, outdoor main control panel, outdoor emergency generator, and above grade fuel tank. The wet well, valve enclosure, and control panel are covered by a roof structure.



The site is located off the road is surrounded by a chain link fence with vehicle gate.

The station conveyance system is contained within the precast concrete wet well and above grade valve enclosure. The wet well contains the two submersible pumps, station level controls, and trash basket on the incoming 8" sewer. The valve enclosure provides protection for the isolation valves on pump discharges and force mains, and pump disconnects. A bypass connection is located on the exterior of the enclosure.

Pumps and Piping

The station is equipped with two submersible, centrifugal pumps within the wet well, rated for approximately 65 gpm. The pumps are Flygt, model 3127.890 and were installed in 2008. The pumps are protected by a trash basket located on the influent pipe to the wet well. The dry valve enclosure contains isolation ball valves on the discharge lines from each pump and on the two 3" force main pipes. Off of the pump discharge header is a branch for bypass connection.

Electrical

The station is supplied with 480 V, three phase underground electrical service. The main electrical and control panels are located inside the exterior electrical enclosure with the pump disconnects located in the fiberglass valve enclosure located above the wet-well. The electrical components in the valve enclosure appear to be NEMA 1 and NEMA 4 which do not comply with NFPA 820 standards. A gas-tight physical separation is required to declassify this space, otherwise continuous ventilation or NEMA 7 explosion proof (Class I, Division 1, Group D) components are required. Furthermore, the enclosure is within three feet of the wetwell hatch opening which would require Division 2 equipment. The station is equipped with an outdoor emergency generator to provide power when normal power is lost through an automatic transfer switch connected to the main panel. The Cummins generator is fueled by propane.

Controls

The pump station control panel located in the outdoor enclosure, operates the pumps and monitors the wet well level with a pressure transducer. Float switches in the wet well serve as backup pump control in the event of pressure transducer failure. For remote monitoring, the station is equipped with the Mission Communications alarm system that notifies staff of wet well



high level and equipment failure alarms via cellular signal. The Mission system also records pump run times, pump starts, and wet well level.

Force Main

The Stony Hill Pumping Station has dual 4" PVC force mains. The force mains exit the valve enclosure as 3" piping, increase to 4" and head west cross country, turning north on Vale Road and then discharge into a manhole at the intersection with Parkwood Drive. The force mains are approximately 1,080 feet in length.

4.6.13.2 Existing Conditions and Deficiencies

In general, the pumping station is in very good condition. The pumping station structures are in good condition with no deterioration and no need for structural repairs. No major deficiencies were noted, but the following minor deficiencies were noted:

- The trash rack is difficult to move and does not adequately capture large debris.
- The backup float switches are mounted and bundled together on a vertical bracket which limits their movement preventing them from tripping.
- The WPCA staff desires a flow meter at the station. This feature was implemented in May 2020. A pulse flow meter was installed that reports into the Mission data system.

4.6.13.3 Future Flows

There a no additional flows project for this station.

4.6.13.4 Recommendations

The Stony Hill Pumping Station is generally in very good overall condition. The following recommendations are presented to address the minor deficiencies.

- Remove trash rack
- Within the fiberglass enclosure, gas tight seal off fittings should be installed on all electrical and instrument conduits connected to the wet-well. Other NEMA 1 and NEMA 4 components should be replaced with NEMA 7 rated components. Alternatively, certification from the Engineer of Record could be obtained or approval by the Authority Having Jurisdiction (AHJ), typically the fire marshal, could be obtained.
- Replace the vertical bracket mounded float switches with a horizontal bracket at the top of the structure to allow for more movement.

These alternatives are considered low priority because they are not critical to the operation of the pumping station but would increase the ease of operation and maintenance for the WPCA staff. The WPCA should consider these alternatives either as a standalone project or when higher priority, future improvements are needed.



4.6.14 777 Federal Road Pumping Station

4.6.14.1 Station Description

Station Layout

The 777 Federal Road Pumping Station is a submersible, centrifugal pump style pumping station located at approximately 777 Federal Road. The station was originally constructed in 1994 and last upgraded in 2015. The site consists of a concrete wet well chamber, concrete dry well valve vault, outdoor main control panel, outdoor emergency generator, and above grade fuel tank. The site is located off the road is surrounded by a chain link fence with an automatic vehicle gate.

The station conveyance system is contained within three precast concrete below grade vaults: an incoming sewer vault; wet well with two submersible pumps, trash



basket, and station level controls; and a drywell containing the individual pump check and isolation valves, the two outgoing force main pipes, flow meter, and bypass connection piping and valve.

Pumps and Piping

The station is equipped with two submersible, centrifugal pumps within the wet well, rated for approximately 290 gpm at 100 feet of totally dynamic head. The pumps are Flygt, model 3127.190 and were installed in 2015. The dry well valve vault contains a swing type check valve and an isolation valve on the discharge lines from each pump. The two separate lines connect to a common 4" header with a branch off of the header for bypass connection. From the header, there are two ductile iron force mains with diameters of 4" and 6". A magnetic flow meter is also contained in the valve vault on one of the force main pipes.

Electrical

The station is supplied with 480 V, three phase underground electrical service. The main electrical and control panels are located inside the exterior electrical enclosure. The station is equipped with an outdoor emergency generator to provide power when normal power is lost through an automatic transfer switch connected to the main panel. The Cummins generator is fueled by propane.

Controls

The pump station control panel located in the exterior cabinet, operates the pumps and monitors the wet well level with a pressure transducer. Float switches in the wet well serve as backup pump control in the event of pressure transducer failure. Pumping station discharge flows are monitored with a magnetic flow meter in the valve vault. For remote monitoring, the station is equipped with the Mission Communications alarm system that notifies staff of wet well high level and equipment failure alarms via cellular signal. The Mission system also records pump run times, pump starts, wet well level, and discharge flow rates.



Force Main

The 777 Federal Road Pumping Station has a 4" and a 6" DI force main. The force mains exit the valve vault, turn west toward Federal Road and then turn south on Federal Road (Route 202) where they discharge into a manhole near the on and off ramps with Route 7. The force mains are approximately 3,110 feet in length.

4.6.14.2 Existing Conditions and Deficiencies

In general, the pumping station is in good condition. The structures are in good condition with no need for structural repairs. No major deficiencies were noted, but the following minor deficiencies were noted:

- The wiring enclosed within the pedestal cabinet is not NEC code compliant, all the wiring and cable terminals are installed exposed with no physical protection for the cables.
- The junction box installation for the pump chamber is not NEC compliant for an explosive area.
- The trash rack is difficult to move and does not adequately capture large debris.
- The WPCA staff desire a canopy over the pumping station structures and control cabinet.

4.6.14.3 Future Flows

As discussed in Section 2 there is the potential for a some additional flow in this sewershed. On an annual average basis there is the potential for an additional 30,400 gpd in the area tributary to the station. On a peak flow basis, this would require the peak flow capacity to be 360 gpm.

4.6.14.4 Alternatives and Recommendations

The 777 Federal Road Pumping Station is generally in good overall condition. The following recommendations are presented to address the deficiencies.

- Replace electrical cabinet to address code issues and accommodate higher capacity pumps.
- Replace junction box for use in explosive area.
- Remove trash rack.
- Replace generator to accommodate higher capacity pumps.
- Install canopy over the pumping station structures and control cabinet.

Upgrading this station appears to be medium priority because they are electrical code violations which should be corrected, but more importantly it appears that more pumping capacity will be required in the future.



4.7 Summary and Recommendations

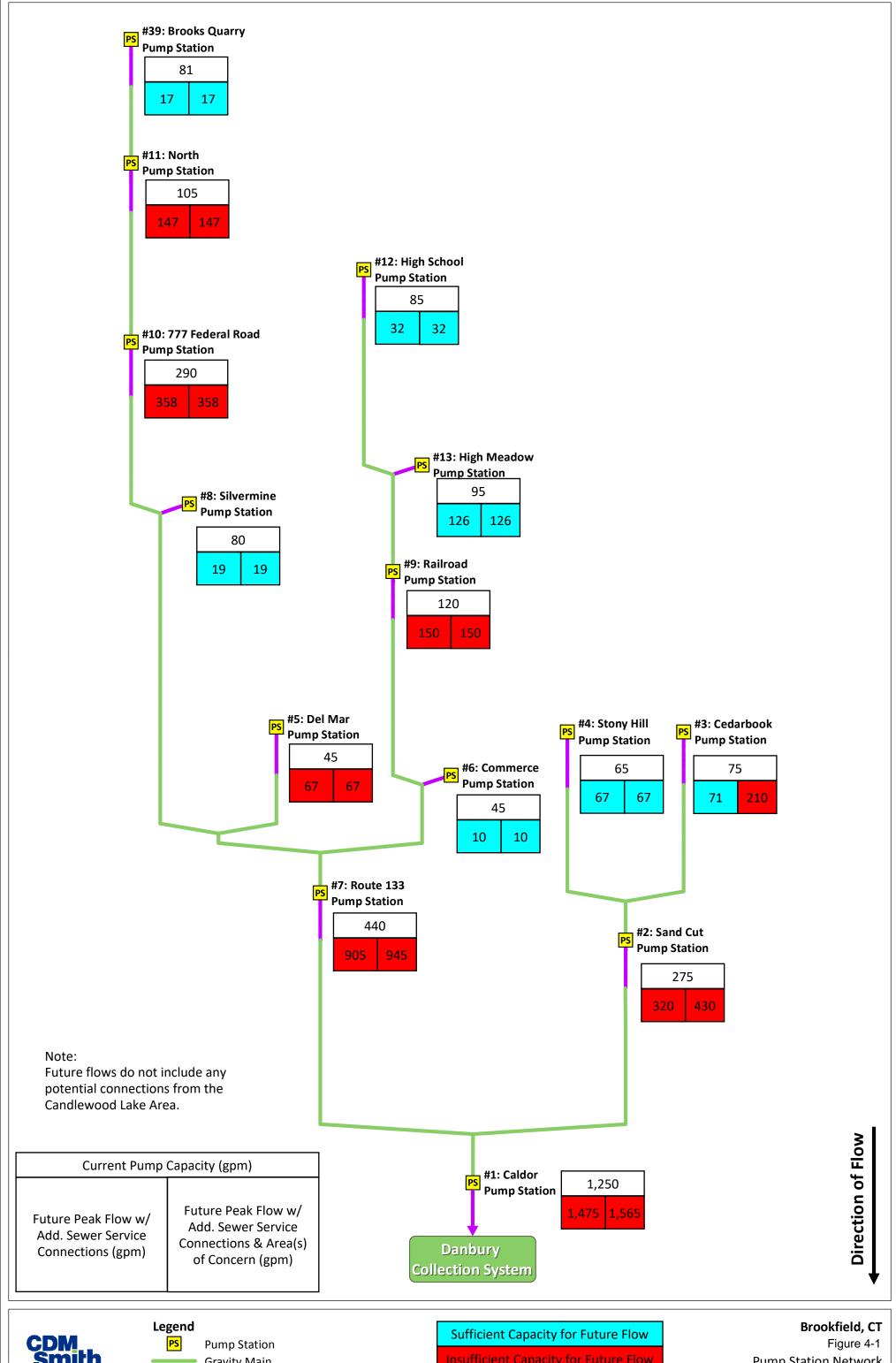
4.7.1 General Summary

The fourteen wastewater pumping stations evaluated as part of this project were mostly in very good condition. The Caldor Station, the Route 133 Station and the 777 Federal Road Station were identified for upgrades to address aging equipment and capacity shortfalls. The other pumping stations require lower priority improvements that could be implemented on an as needed basis. The routine and excellent maintenance and monitoring will keep the pumping stations operating without major issues. Recommended work at these stations typically focused on rectifying electrical code violations or providing enhancements to the ease of operation and maintenance.

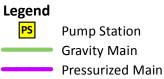
As noted in the previous sections many stations will be impacted by the projected flow increases throughout the collection system. **Figure 4-1** provides a schematic of the collection system, the rated capacity of each station and projected peak flow for each station. It is evident from this figure that the Caldor Station, the Route 133 Station and the 777 Federal Road Stations are all critical components of the collection system.

In addition, the WPCA commissioned a review of the stations by their on-call engineer. A copy of their findings can be found in Appendix B.









Insufficient Capacity for Future Flow

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4.7.2 Inventory Data Sheets

CDM Smith compiled the pump station data into an inventory database. Station data sheets can be created by querying the data base by station name. The data can be maintained and updated by the WPCA in the future as components are upgraded or replaced. Copies of the data sheets for each station can be found on the following pages.



Station Name: Brooks Quarry

Station Address: 126a Brooks Quarry Road

Year Built: 2015

Pump Station Type:Duplex SubmersibleStation Capacity:120,000 gpd (0.12 MGD)Station Avg. Daily Flow:1,300 gpd (0.001 MGD)

Data Sheet Last Updated: 11/1/2019

Site Information

Confined Space(s): Yes - Wetwell & Valve Vault Valve

Security System:

Site Fence: Yes

Control Building: No

Valve Vault: Yes

Exterior Lighting: Yes Hydrant/Water On Site: Yes

81 gpm at 32'

Transformers:

Pump Information

Pump #1 Pump #2 Spare Pump

Type Grinder Grinder Grinder Manufacturer Flygt Flygt

Model 3068.090-1650069 imp 291 3068.090-1650069 imp 291

Capacity (gpm/TDH) 81 gpm at 32'

Discharge Size

Motor HP 2.7 2.7

Max Running Amps (A)

Avg. Daily Run Time 8 mins 8 mins N/A
Year Installed 2016 2016 N/A

Electrical Service

Service Voltage (V): 208 Distribution: 208V Dist. Panel

Service Size (A):

Services No. of Phases: 3 Pump Starters: Magnetic Motor Starters

Above or Underground: Underground Lighting Panel:

Generator

Make/Model: Portable Location: Outdoor (Portable)
Size (kW): Portable Fuel Type: Diesel (Portable)

Year Installed: N/A Tank Age: N/A Method of Exercise: N/A Tank Location: N/A

Instrumentation/Controls

Control Type: Relays Remote Monitoring: Cellular via Mission Comm.

Primary Level Sensor: Floats Fire Alarm System:

Sec. Level Sensor: N/A

Force Main

Size/Material: 3" PVC Elevation Change:

Length: 580 ft Bypass Provisions: Yes
Discharge Location: Brooks Quarry Road Valve Vault Pipe Size: 3" DI



Station Name: Caldor

Station Address: 64 Federal Road

Year Built: 1975

Pump Station Type: Dry Pit Centrifugal

Station Capacity: 1,800,000 gpd (1.8 MGD) Station Avg. Daily Flow: 340,000 gpd (0.34 MGD)

Data Sheet Last Updated: 11/1/2019

Site Information

Confined Space(s): Yes - Wetwell Valve Vault: No

Security System: Exterior Lighting: Yes
Site Fence: Yes Hydrant/Water On Site: Yes

Control Building: Yes

Pump Information

Pump #1 Pump #2 Spare Pump

Type Waste handler Waste handler

Manufacturer KSB KSB

Model 9970894127-000100 9970894127-000100 Capacity (gpm/TDH) 1,250 gpm at 50' 1,250 gpm at 50'

Discharge Size

Motor HP 40 40

Max Running Amps (A)

Avg. Daily Run Time 134 mins 134 mins N/A
Year Installed 2005 2005 N/A

Electrical Service

Service Voltage (V): 208 Distribution: 208V Dist. Panel

Service Size (A):

Services No. of Phases: 3 Pump Starters: Magnetic Motor Starters

Transformers:

Above or Underground: Underground Lighting Panel:

Generator

Make/Model:KohlerLocation:OutdoorSize (kW):100Fuel Type:Natural Gas

Year Installed: 2006 Tank Age: N/A
Method of Exercise: Manual Tank Location: N/A

Instrumentation/Controls

Control Type: Relays Remote Monitoring: Cellular via Mission Comm.

Primary Level Sensor: Pressure Transducer Fire Alarm System:

Sec. Level Sensor: Floats

Force Main

Size/Material: 10" DI Elevation Change:

Length: 1,900 ft Bypass Provisions: No
Discharge Location: Route 202 Valve Vault Pipe Size: 10" DI



Station Name: Cedarbrook
Station Address: 12 Cedarbrook

Year Built: 2008

Pump Station Type:Duplex SubmersibleStation Capacity:110,000 gpd (0.11 MGD)Station Avg. Daily Flow:13,000 gpd (0.013 MGD)

Data Sheet Last Updated: 11/1/2019

Site Information

Confined Space(s): Yes - Wetwell & Valve Vault \

Security System:

Site Fence: Yes

Control Building: No

Valve Vault: No

Exterior Lighting: Yes Hydrant/Water On Site: Yes

Pump Information

 Pump #1
 Pump #2
 Spare Pump

 Type
 Grinder
 Grinder

Manufacturer Flygt Flygt

Model 3102 .890 216 imp 3102 .890 216 imp Capacity (gpm/TDH) 75 gpm at XX' 75 gpm at XX'

Discharge Size

Motor HP 5.4 5.4

Max Running Amps (A)

Avg. Daily Run Time88 mins87 minsN/AYear Installed20082008N/A

Electrical Service

Service Voltage (V): 240 Distribution: 240V Dist. Panel

Service Size (A):

Services No. of Phases: 1 Pump Starters: Magnetic Motor Starters

Transformers:

Above or Underground: Underground Lighting Panel:

Generator

Make/Model: Cummins Location: Outdoor Size (kW): 35 Fuel Type: Propane Year Installed: 2008 Tank Age: 2008

Method of Exercise: Manual Tank Location: Aboveground

Instrumentation/Controls

Control Type: Relays Remote Monitoring: Cellular via Mission Comm.

Primary Level Sensor: Pressure Transducer Fire Alarm System:

Sec. Level Sensor: Floats

Force Main

Size/Material: Dual 4" PVC Elevation Change:

Length:6,300 ftBypass Provisions:YesDischarge Location:Whisconier RoadValve Vault Pipe Size:2" SS



Station Name: Commerce

Station Address: 115 Commerce Road

Year Built: 1988

Pump Station Type:Duplex SubmersibleStation Capacity:65,000 gpd (0.065 MGD)Station Avg. Daily Flow:800 gpd (0.0008 MGD)

Data Sheet Last Updated: 11/1/2019

Site Information

Confined Space(s): Yes - Wetwell & Valve Vault

Security System:

Site Fence: Yes

Control Building: No

Valve Vault: Yes

Spare Pump

Exterior Lighting: No Hydrant/Water On Site: No

Pump Information

Pump #1 Pump #2

Grinder Grinder

Manufacturer Flygt Flygt

Model

Type

Capacity (gpm/TDH) 45 gpm at XX' 45 gpm at XX'

Discharge Size

Motor HP 5 5

Max Running Amps (A)

Avg. Daily Run Time 10 mins 9 mins N/A
Year Installed 2015 2015 N/A

Electrical Service

Service Voltage (V): 240 Distribution: 240V Dist. Panel

Service Size (A):

Services No. of Phases: 3 Pump Starters: Magnetic Motor Starters

Transformers:

Above or Underground: Underground Lighting Panel:

Generator

Make/Model: Portable Location: Outdoor (Portable)
Size (kW): Portable Fuel Type: Diesel (Portable)

Year Installed: N/A Tank Age: N/A Method of Exercise: N/A Tank Location: N/A

Instrumentation/Controls

Control Type: Relays Remote Monitoring: Cellular via Mission Comm.

Primary Level Sensor: Floats Fire Alarm System:

Sec. Level Sensor: N/A

Force Main

Size/Material: Dual 3" PVC Elevation Change:

Length: 3,100 ft Bypass Provisions: No
Discharge Location: Route 133 Valve Vault Pipe Size: 4" DI



Station Name: Del Mar

Station Address: 56 Del Mar Drive

Year Built: 2012

Pump Station Type:Duplex SubmersibleStation Capacity:65,000 gpd (0.065 MGD)Station Avg. Daily Flow:1,300 gpd (0.001 MGD)

Data Sheet Last Updated: 11/1/2019

Site Information

Confined Space(s): Yes - Wetwell & Valve Vault

Security System:

Site Fence: No

Control Building: No

Valve Vault: Yes

Exterior Lighting: Yes Hydrant/Water On Site: Yes

Pump #2

Transformers:

Spare Pump

Pump Information

Type Waste handler Waste handler

Manufacturer Homa Homa

Pump #1

Model Am13654-2-3 #276521 Am13654-2-3 #276521

Capacity (gpm/TDH) 45 gpm at XX' 45 gpm at XX'

Discharge Size

Motor HP 4.1 4.1

Max Running Amps (A)

Avg. Daily Run Time17 mins18 minsN/AYear Installed20132013N/A

Electrical Service

Service Voltage (V): 480 Distribution: 480V Dist. Panel

Service Size (A):

Services No. of Phases: 3 Pump Starters: Magnetic Motor Starters

Above or Underground: Underground Lighting Panel:

Generator

Make/Model: Portable Location: Outdoor (Portable)
Size (kW): Portable Fuel Type: Diesel (Portable)

Year Installed: N/A Tank Age: N/A Method of Exercise: N/A Tank Location: N/A

Instrumentation/Controls

Control Type: Relays Remote Monitoring: Cellular via Mission Comm.

Primary Level Sensor: Pressure Transducer Fire Alarm System:

Sec. Level Sensor: Floats

Force Main

Size/Material: 3" PVC Elevation Change:

Length: 1,600 ft Bypass Provisions: Yes
Discharge Location: Route 202 Valve Vault Pipe Size: 3" PVC



Station Name: High Meadow
Station Address: East View Drive

Year Built: 2014

Pump Station Type:Duplex SubmersibleStation Capacity:140,000 gpd (0.14 MGD)Station Avg. Daily Flow:27,000 gpd (0.027 MGD)

Data Sheet Last Updated: 11/1/2019

Site Information

Confined Space(s): Yes - Wetwell & Valve Vault Valve Vault

Security System:

Site Fence: Yes

Control Building: No

Valve Vault: Yes

Exterior Lighting: Yes Hydrant/Water On Site: No

Pump Information

Pump #1 Pump #2 Spare Pump

Type Grinder Grinder Grinder Manufacturer Flygt Flygt

Model 3127.890-212 imp 3127.890-212 imp Capacity (gpm/TDH) 95 gpm at XX' 95 gpm at XX'

Discharge Size

Motor HP 7.5 7.5

Max Running Amps (A)

Avg. Daily Run Time130 mins151 minsN/AYear Installed20182018N/A

Electrical Service

Service Voltage (V): 240 Distribution: 240V Dist. Panel

Service Size (A):

Services No. of Phases: 1 Pump Starters: Magnetic Motor Starters

Transformers:

Above or Underground: Underground Lighting Panel:

Generator

Make/Model:CumminsLocation:OutdoorSize (kW):35Fuel Type:DieselYear Installed:2014Tank Age:2014

Method of Exercise: Manual Tank Location: Aboveground

Instrumentation/Controls

Control Type: Relays Remote Monitoring: Cellular via Mission Comm.

Primary Level Sensor: Pressure Transducer Fire Alarm System:

Sec. Level Sensor: Floats

Force Main

Size/Material: 4" PVC Elevation Change:

Length: 1,900 ft Bypass Provisions: Yes
Discharge Location: Silvermine Road Valve Vault Pipe Size: 4" PVC



Station Name: High School

Station Address: 45 Long Meadow Hill Road

Year Built: 2005

Pump Station Type: Duplex Submersible Station Capacity: 140,000 gpd (0.14 MGD) Station Avg. Daily Flow: 5,200 gpd (0.005 MGD)

Data Sheet Last Updated: 11/1/2019

Site Information

Confined Space(s): Yes - Wetwell & Valve Vault

Security System:

Site Fence: Yes

Control Building: No Valve Vault: No

Yes Exterior Lighting: Hydrant/Water On Site: No

Pump Information

Pump #1 Pump #2 **Spare Pump** Type Grinder with mix Grinder with mix

Flygt

11

95 gpm at 130'

Transformers:

Manufacturer Flygt

Model

Capacity (gpm/TDH) 95 gpm at 130'

Discharge Size

Motor HP 11

Max Running Amps (A)

Avg. Daily Run Time 35 mins 26 mins N/A Year Installed 2007 2007 N/A

Electrical Service

Service Voltage (V): 240 Distribution: 240V Dist. Panel

Service Size (A):

Services No. of Phases: 3 Pump Starters: Magnetic Motor Starters

Above or Underground: Underground Lighting Panel:

Generator

Outdoor Make/Model: Cummins Location: Diesel Size (kW): 40 Fuel Type: Year Installed: 2005 Tank Age: 2005

Method of Exercise: Tank Location: Manual Aboveground

Instrumentation/Controls

Cellular via Mission Comm. Control Type: Relays Remote Monitoring:

Primary Level Sensor: Pressure Transducer Fire Alarm System:

Sec. Level Sensor: Floats

Force Main

Size/Material: Dual 4" PVC Elevation Change:

Length: 5,300 ft **Bypass Provisions:** Yes 2" SS Discharge Location: Route 133 Valve Vault Pipe Size:



Station Name: North

Station Address: 993 Federal Road

Year Built: 1994

Pump Station Type:Duplex SubmersibleStation Capacity:150,000 gpd (0.15 MGD)Station Avg. Daily Flow:31,000 gpd (0.031 MGD)

Data Sheet Last Updated: 11/1/2019

Site Information

Confined Space(s): Yes - Wetwell & Valve Vault Valve Vault:

Security System: Exterior Lighting: Yes Site Fence: No Hydrant/Water On Site: Yes

Control Building: No

Pump Information

Pump #1 Pump #2 Spare Pump

Yes

Type Waste handler Waste handler

Manufacturer Flygt Flygt

Model 3127.910-022 12 hp 3600 rpm l'3127.910-022 12 hp 3600 rpm l'

Capacity (gpm/TDH) 105 gpm at 100' 105 gpm at 100'

Discharge Size

Motor HP 12 12

Max Running Amps (A)

Avg. Daily Run Time 177 mins 174 mins N/A
Year Installed 2015 2015 N/A

Electrical Service

Service Voltage (V): 480 Distribution: 480V Dist. Panel

Service Size (A): Transformers:

Services No. of Phases: 3 Pump Starters: Magnetic Motor Starters

Above or Underground: Underground Lighting Panel:

Generator

Make/Model: Portable Location: Outdoor (Portable)
Size (kW): Portable Fuel Type: Diesel (Portable)

Year Installed: N/A Tank Age: N/A Method of Exercise: N/A Tank Location: N/A

Instrumentation/Controls

Control Type: Relays Remote Monitoring: Cellular via Mission Comm.

Primary Level Sensor: Pressure Transducer Fire Alarm System:

Sec. Level Sensor: Floats

Force Main

Size/Material: Dual 4" PVC Elevation Change:

Length: 4,400 ft Bypass Provisions: No Discharge Location: Route 202 Valve Vault Pipe Size: 4" DI



Railroad Station Name:

Station Address: 35a Silvermine Road

Year Built: 1996

Pump Station Type: Duplex Submersible Station Capacity: 170,000 gpd (0.17 MGD) Station Avg. Daily Flow: 28,000 gpd (0.028 MGD)

Data Sheet Last Updated: 11/1/2019

Site Information

Confined Space(s): Yes - Wetwell & Valve Vault

Security System:

Site Fence: No

Control Building: No Valve Vault:

120 gpm at XX'

Transformers:

Yes Exterior Lighting:

Yes

Spare Pump

Hydrant/Water On Site: No

Pump Information

Pump #1 Pump #2 Type Waste handler Waste handler

Manufacturer Flygt Flygt

Model

Capacity (gpm/TDH) 120 gpm at XX'

Discharge Size

Motor HP 7.5 7.5

Max Running Amps (A)

Avg. Daily Run Time 124 mins 106 mins N/A Year Installed 2015 2015 N/A

Electrical Service

Service Voltage (V): 480 Distribution: 480V Dist. Panel

Service Size (A):

Services No. of Phases: 3 Pump Starters: Magnetic Motor Starters

Above or Underground: Underground Lighting Panel:

Generator

Outdoor Make/Model: Cummins Location: Diesel Size (kW): 25 Fuel Type: Year Installed: 2015 Tank Age: 2015

Method of Exercise: Tank Location: Manual Aboveground

Instrumentation/Controls

Cellular via Mission Comm. Control Type: Relays Remote Monitoring:

Pressure Transducer Primary Level Sensor: Fire Alarm System:

Sec. Level Sensor: Floats

Force Main

Size/Material: 2" 4" & 6" PVC Elevation Change:

Length: 720 ft **Bypass Provisions:** No Pocono Road 4" DI Discharge Location: Valve Vault Pipe Size:



Route 133 Station Name:

Station Address: 120 Junction Road

Year Built: 1983

Pump Station Type: Duplex Submersible Station Capacity: 630,000 gpd (0.63MGD) Station Avg. Daily Flow: 180,000 gpd (0.18 MGD)

Data Sheet Last Updated: 11/1/2019

Site Information

Confined Space(s): Yes - Wetwell & Valve Vault

Security System:

Site Fence: Yes

Control Building: Yes Valve Vault:

Yes Yes Exterior Lighting:

Hydrant/Water On Site: No

Pump Information

Pump #1 Pump #2 **Spare Pump** Type Waste handler Waste handler

Flygt

60

440 gpm at 170'

Transformers:

Manufacturer Flygt

Model

Capacity (gpm/TDH) 440 gpm at 170'

Discharge Size

Motor HP 60

Max Running Amps (A)

Avg. Daily Run Time 224 mins 203 mins N/A Year Installed 2006 2006 N/A

Electrical Service

Service Voltage (V): 480 Distribution: 480V Dist. Panel

Service Size (A):

Services No. of Phases: 3 Pump Starters: Magnetic Motor Starters

Above or Underground: Underground Lighting Panel:

Generator

Make/Model: Kohler Location: Indoor 100 Size (kW): Fuel Type: Diesel Year Installed: 1983 Tank Age: 1983 Method of Exercise: Tank Location: Manual Indoor

Instrumentation/Controls

Cellular via Mission Comm. Control Type: Relays Remote Monitoring:

Primary Level Sensor: Pressure Transducer Fire Alarm System:

Sec. Level Sensor: Floats

Force Main

Size/Material: 6" PVC Elevation Change:

Length: **Bypass Provisions:** Yes 3,000 ft 6" DI Discharge Location: Old Milford Road Valve Vault Pipe Size:



Sand Cut Station Name:

Station Address: 2 Sand Cut Road

Year Built: 2008

Pump Station Type: Duplex Submersible Station Capacity: 400,000 gpd (0.4 MGD) Station Avg. Daily Flow: 34,000 gpd (0.034 MGD)

Data Sheet Last Updated: 11/1/2019

Site Information

Confined Space(s): Yes - Wetwell & Valve Vault

Security System:

Site Fence: Yes

Control Building: Yes Valve Vault: Yes

Yes Exterior Lighting:

Hydrant/Water On Site: Yes

Pump Information

Pump #2 Pump #1 **Spare Pump** Type Waste handler Waste handler

Manufacturer

Flygt Flygt

Model 3127.090 0930127, imp 489 3127.090 0930127, imp 489

Capacity (gpm/TDH) 275 gpm at XX' 275 gpm at XX'

Discharge Size

Motor HP 7.5 7.5

Max Running Amps (A)

Avg. Daily Run Time 67 mins 79 mins N/A Year Installed 2008 2008 N/A

Electrical Service

Service Voltage (V): 480 Distribution: 480V Dist. Panel

Service Size (A):

Services No. of Phases: 3 Pump Starters: Magnetic Motor Starters

Transformers:

Above or Underground: Underground Lighting Panel:

Generator

Make/Model: Cummins Location: Outdoor Size (kW): 47 Fuel Type: Propane Year Installed: 2008 Tank Age: 2008

Method of Exercise: Tank Location: Manual Aboveground

Instrumentation/Controls

Cellular via Mission Comm. Control Type: Relays Remote Monitoring:

Primary Level Sensor: Pressure Transducer Fire Alarm System:

Sec. Level Sensor: Floats

Force Main

Size/Material: 6" PVC Elevation Change:

Length: **Bypass Provisions:** Yes 1,800 ft 6" DI Discharge Location: Grays Bridge Road Valve Vault Pipe Size:



Brookfield, CT **Water Pollution Control Authority**

Station Name: Silvermine

Station Address: 595 Federal Road

Year Built: 1994

Pump Station Type: Duplex Submersible Station Capacity: 120,000 gpd (0.12 MGD) Station Avg. Daily Flow: 2,800 gpd (0.003 MGD)

Data Sheet Last Updated: 11/1/2019

Site Information

Confined Space(s): Yes - Wetwell & Valve Vault

Security System:

Site Fence: No

Control Building: No Valve Vault: Yes No

Exterior Lighting:

Hydrant/Water On Site: Yes

Spare Pump

Pump Information

Pump #1 Pump #2 Type Waste handler Waste handler

Manufacturer Flygt

Model

Capacity (gpm/TDH) 80 gpm at 25'

Discharge Size

Motor HP 5

Max Running Amps (A)

Avg. Daily Run Time 13 mins 19 mins N/A Year Installed 1994 1994 N/A

Electrical Service

Service Voltage (V): 480

Service Size (A):

Services No. of Phases: 3

Above or Underground: Underground Distribution:

80 gpm at 25'

Flygt

5

Transformers:

Pump Starters: Magnetic Motor Starters

480V Dist. Panel

Lighting Panel:

Generator

Outdoor (Portable) Make/Model: Portable Location: Diesel (Portable) Size (kW): Portable Fuel Type:

Year Installed: N/A Tank Age: N/A Method of Exercise: Tank Location: N/A N/A

Instrumentation/Controls

Relays Cellular via Mission Comm. Control Type: Remote Monitoring:

Primary Level Sensor: Floats Fire Alarm System:

Sec. Level Sensor: N/A

Force Main

Size/Material: Dual 4" PVC Elevation Change:

Length: 810 ft **Bypass Provisions:** No 4" DI Discharge Location: Route 202 Valve Vault Pipe Size:

Station Notes:



Brookfield, CT Water Pollution Control Authority

Station Name: Stony Hill

Station Address: 1 A Stony Hill Village

Year Built: 2008

Pump Station Type:Duplex SubmersibleStation Capacity:94,000 gpd (0.094 MGD)Station Avg. Daily Flow:12,000 gpd (0.012 MGD)

Data Sheet Last Updated: 11/1/2019

Site Information

Confined Space(s): Yes - Wetwell & Valve Vault

Security System:

Site Fence: Yes

Control Building: No

Valve Vault: No

Exterior Lighting: Yes Hydrant/Water On Site: Yes

rang water on oite.

Spare Pump

Pump Information

 Pump #1
 Pump #2

 Type
 Grinder
 Grinder

Manufacturer Flygt Flygt

Model 3127.890 212 imp 3127.890 212 imp Capacity (gpm/TDH) 65 gpm at XX' 65 gpm at XX'

Discharge Size

Motor HP 11 11

Max Running Amps (A)

Avg. Daily Run Time 88 mins 100 mins N/A
Year Installed 2008 2008 N/A

Electrical Service

Service Voltage (V): 480 Distribution: 480V Dist. Panel

Service Size (A):

Services No. of Phases: 3 Pump Starters: Magnetic Motor Starters

Transformers:

Above or Underground: Underground Lighting Panel:

Generator

Make/Model:CumminsLocation:OutdoorSize (kW):0Fuel Type:PropaneYear Installed:2008Tank Age:2008

Method of Exercise: Manual Tank Location: Aboveground

Instrumentation/Controls

Control Type: Relays Remote Monitoring: Cellular via Mission Comm.

Primary Level Sensor: Pressure Transducer Fire Alarm System:

Sec. Level Sensor: Floats

Force Main

Size/Material: Dual 4" PVC Elevation Change:

Length: 2,300 ft Bypass Provisions: Yes
Discharge Location: Vale Road Valve Vault Pipe Size: 2" SS

Station Notes:



Brookfield, CT **Water Pollution Control Authority**

777 Federal Road Station Name: Station Address: 777 Federal Road

Year Built: 1994

Pump Station Type: Duplex Submersible Station Capacity: 420,000 gpd (0.42 MGD) Station Avg. Daily Flow: 67,000 gpd (0.067 MGD)

Data Sheet Last Updated: 11/1/2019

Site Information

Confined Space(s): Yes - Wetwell & Valve Vault Valve Vault:

Security System:

Yes Exterior Lighting: Site Fence: Yes Hydrant/Water On Site: No

Control Building: No

Pump Information

Pump #2 Pump #1 **Spare Pump**

Yes

Waste handler Type Waste handler

Manufacturer Flygt Flygt

Model 3127.190 serial1630001-3 3127.190 serial1630001-3

Capacity (gpm/TDH) 290 gpm at 100' 290 gpm at 100'

Discharge Size

Motor HP 12 12

Max Running Amps (A)

Avg. Daily Run Time 140 mins 152 mins N/A Year Installed 2016 2016 N/A

Electrical Service

Service Voltage (V): 480 Distribution: 480V Dist. Panel

Service Size (A):

Services No. of Phases: 3 Pump Starters: Magnetic Motor Starters

Transformers:

Above or Underground: Underground Lighting Panel:

Generator

Make/Model: Cummins Location: Outdoor Size (kW): 36 Fuel Type: Propane Year Installed: 2015 Tank Age: 2015

Method of Exercise: Tank Location: Manual Aboveground

Instrumentation/Controls

Cellular via Mission Comm. Control Type: Relays Remote Monitoring:

Pressure Transducer Primary Level Sensor: Fire Alarm System:

Sec. Level Sensor: Floats

Force Main

Size/Material: 4" & 6" DI Elevation Change:

Length: 3,300 ft **Bypass Provisions:** No 4" DI Discharge Location: Route 202 Valve Vault Pipe Size:

Station Notes:



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Section 5

Benchmarking

The intent of this section is to review the current staffing levels of the Brookfield Water Pollution Control Authority (BWPCA). CDM Smith reviewed the staff levels of the BWPCA and comparison against available industry metrics and similar municipalities.

5.1 Current Organizational Structure

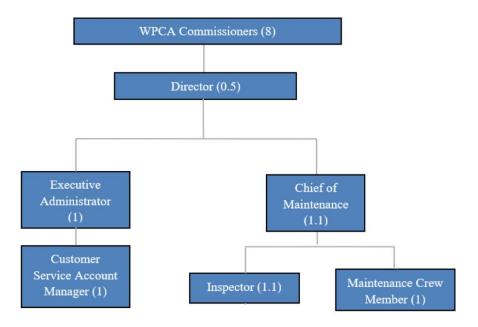
The Brookfield Water Pollution Control Authority currently operates with six (6) total staff. CDM Smith has performed a review of the current staffing levels for sewer related activities. Our review is based on the current staffing with comparisons against available industry metrics.

The BWPCA staff reside in the Water Pollution Control Authority Office on Commerce Road. Staff serve under the direction of the BWPCA Director who reports to the WPCA Commission. The Commissioners are volunteers. They are appointed by the Board of Selectman for 4-year terms.

Figure 5-1 presents the organizational chart of the Wastewater Department. Collection systems currently has 6 staff including:

- Office Staff (3 2 full time, 1 part time)
- Maintenance Staff (3 full time)

Figure 5-1: Brookfield WPCA Organizational Chart





The office staff consists of a director, executive assistant and customer service account manager. The staff reports to the director who is responsible for interfacing with other Town departments, budgeting and personnel matters. The executive assistant is the information point person administrating payables, reviewing and filing all changes to customer sewer installations, monitoring the budget and supporting the public, commissioners, director and maintenance crew. The customer service account manager administrates all the customer accounts, billing, receipts of all payments and manages delinquencies.

The maintenance staff are primarily responsible for operation and maintenance (0&M) of the wastewater collection system. The majority of collection system 0&M activities are performed in-house using existing staff. Activities include inspection of the 14-pump stations on a regular schedule, seven days a week, each day of the year. The 0&M function also includes upkeep of the buildings and grounds at each of the facilities operated by the WPCA, and inspection and administration of the Fats Oils and Grease (FOG) program. Simple pump station repairs are done in-house. Heavier tasks including rebuilding in-line grinders, generators, motors and pumps is contracted out. The field staff are also responsible for engaging other maintenance specialty services, like grounds keeping, electrical and telemonitoring.

5.2 Benchmarking

CDM Smith has performed a desktop benchmarking evaluation to compare Brookfield's staffing levels to other industry benchmarks and similar municipalities. While not all situations are identical, comparison against these metrics can yield support to staffing levels within the department. Metrics have been obtained from 3 primary sources for comparison to Brookfield:

- EPA Guide for Evaluating Capacity, Management, Operation and Maintenance (CMOM)
 Programs at Sanitary Sewer Collection Systems Staff Complements for Wastewater
 Collection System Maintenance
- 2018 AWWA Utility Benchmarking Report
- California State University Sacramento Manual Collection Systems Methods for Evaluating and Improving Performance

EPA CMOM Guidance

The EPA CMOM Guidance estimates staffing requirements based on service population size. The guidance document includes populations ranging from 5,000 to over 500,000. Data was proportioned using Brookfield's estimated service to 2000 accounts which corresponds to a population served of about 5,000 people. However, due to the amount of commercial accounts it is recommended to use an "equivalent" population size of 6,000. Staff categories in the guidance document do not directly correlate to descriptions used by Brookfield currently, however they can be effectively compared.

Table 5-1 is calibrated based on population for a collection system only with no Wastewater Treatment Facility. An estimate for staffing (based on full time employees, FTE) is presented along with an estimate for numbers of hours needed per week per job description.



Table 5-1: EPA Collection System Personnel

		Area Population 000
Occupational Title	FTE	Man-Hours/Week
Foreman (collection)	1	15
Maintenance Man II (collection)	1	15
Maintenance Man I (collection)	1	15
Laborer (collection)	1	15
Maintenance Mechanic II (pump stations)	0.9	37
Maintenance Mechanic I (pump stations)	0.35	14
Maintenance Mechanic Helper (pump stations)	0.35	14
Totals	~6	125

Although Brookfield's number of staff is below the suggested number, Brookfield's level of effort in on par with EPA's recommendation and is at 128 hours including weekend checks of 4 hours each Saturday, Sunday and Holidays.

Based on the EPA guidance, the number of Brookfield O&M employees is appropriate for the size of the collection system and number of pump stations. The current situation allows for two employees on duty at all times allowing for vacation and sick leave. Although EPA's guidance, as presented in Table 5-1 suggest four staff for sewer maintenance and an equivalent of 1.6 staff for pump station operations, it is normal and appropriate for staff in smaller communities to "cross train" as is the case in Brookfield.

AWWA Benchmarking

The AWWA benchmarking report issued in 2018 presents staff estimates based on full time employees (FTE) per million gallons of flow. An evaluation was performed using Brookfield's average daily wastewater flow of 0.35 MGD. The AWWA document presents staff requirements in several ranges including Top 25%, Median, and Top 75%. Staffing is reported in FTE. Based on this analysis the Town's staffing requirements are shown in Table 5-2.

Table 5-2: AWWA Wastewater per Employee

2018 AWWA Wastewater Benchmark RPT							
MGD of Wastewater per Employee							
Brookfield		0.35 MG					
Top 25%	0.3 employees/MG	1.17 MG					
Median	0.29 employees/MG	1.21 MG					
Top 75%	0.18 employees/MG	1.94 MG					

Based on the AWWA benchmark median presented in the above table (Table 5-2), Brookfield should have 1 maintenance employee. But it is judged the AWWA report is designed to give norms for large systems and breaks down for systems below about 5 MGD.



California State University Sacramento (CSUS)

The CSUS document presents metrics of collection system maintenance staffing (Collection Systems Methods for Evaluating and Improving Performance) based on a sampling of several agencies (A, B, C, D in Table 5-3). Criteria used to describe the agencies include miles of sewer and population. Brookfield's system was fit into the data set for comparison. By comparison, the Town's criteria (number of sewer miles and population served) shows the need for operation and maintenance staff consistent with or less than current levels.

Methods for Evaluating and Improving Collection System Performance								
Agency	Sewer (Miles)	Population	# of O&M Staff					
Brookfield	17	7,000	3.2 (current)					
А	44.5	10,444	2					
В	114	40,000	6					
С	400	75,560	12					
D	348	88,250	20					

Brookfield's system was also fit into the data provided on Pump Station inspection crews, number, and size for comparison. A summary is shown in Table 5-4 for Brookfield along with 4 agencies (A, B, C, D in table) for comparison.

Agency A has 44.5 miles of sewer and 9 pump stations, that were inspected three times per week. Agency B has 114 miles of sewer and 11 pump stations that are inspected weekly. Agency C has 400 miles of sewer and 8 pump stations, that are inspected daily with monitoring, but no scheduled weekend inspections. Agency D has 348 miles of sewer and 27 pump stations that are inspected either weekly or biweekly. The system most like Brookfield's collection system is Agency B, having 11 pump stations. Agency B inspects pump stations on a weekly basis.

Table 5-4 CSUS Pump Station Inspection Crews

Methods for Evaluating and Improving Collection System Performance							
Agency	Sewer (Miles)	Number of Pump Stations	Frequency of Inspections				
Brookfield	17	14	daily (current operations)				
А	44.5	9	3 times per week				
В	114	11	weekly				
С	400	8	daily				
D	348	27	weekly, biweekly				

5.3 Summary of Benchmarking

Comparison of the three-benchmarking metrics performed for Brookfield indicates a current field staffing levels of effort are high. Due to the size of the collection system of Brookfield and the existing staff being able to multi-task it is difficult to rigorously benchmark. The BWPCA's current maintenance staff of 3 full time employees but at 3.2 FTE with weekend pump station checks is



above range of the three benchmarks. Also, based on the size and age of the collection system and Brookfield being extremely proactive with maintenance, the frequency of pump stations visits appears excessive. The practice of 7-day per week station checks was established in an era before the on-line SCADA telemetry system was installed. With pump station visits and a thorough SCADA monitoring service with each pump station reporting issues by cell-phone alerts, daily on-site pump station checks are well above industry norms.

CDM Smith recommends pump station visits to the larger sized pump stations on Monday, Wednesday, and Fridays and pump station visits to the smaller sized pump stations on Tuesdays and Thursdays. Routine weekend visits are not warranted, and weekend visits should be limited to an emergency or an alarm condition that needs immediate attention.

Brookfield has been extremely proactive with daily pump station visits. Our inspection of each of the 14 pump stations revealed they are well maintained and some of the cleanest pump stations we have seen in the industry. According to EPA guidelines and benchmarking of other local municipalities, CDM Smith finds daily pump station visits, including weekends and holidays, to each pump station is not necessary, especially since each station is tied to a high-end telemetry system. Most municipalities are performing weekly inspections when a telemetry system is in place.

When or if weekend and holiday station checks are eliminated, it is recommended that an O&M staff member be on-call over the weekend and on holidays if an alarm were to go off or an emergency happens. With multiple inspectors, it is suggested to create an on-call schedule. Most towns have outside vendors on stand-by for emergency situations. Some towns will use their own staff to engage a two-man team for safety during emergencies.



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Section 6

Capital Planning

6.1 Introduction

This section summarizes a review of the Brookfield Water Pollution Control Authority's (BWPCA) anticipated expenditures for FY 2021 through FY 2030 to evaluate future rate requirements. The forecast is based largely on data provided by BWPCA and assumptions regarding current and future economic and budgetary factors. The impact of the capital plan on projected expenditures and anticipated rate requirements is evaluated.

6.2 Data Sources and Assumptions

The financial projections are based on the FY 2021 budget covering July 1, 2020 through June 30, 2021. A financial model has been developed that projects future expenses and revenue requirements over a 10-year period. Future year expenses and revenue requirements are based on anticipated future changes, including capital projects and the effects of inflation. The major assumptions are as follows:

- The BWPCA FY 2021 budget was used as the basis for the analysis.
- The base year for capital inflation purposes is FY 2020.
- Operations and maintenance costs are assumed to inflate at 3% annually.
- Danbury Wastewater Treatment Plant (WWTP) capacity charges, the toll cost to treat Brookfield wastewater, are assumed to inflate at 3% annually.
- Capital costs are assumed to inflate at 4% annually. Capital costs presented in this memorandum are stated in 2020 dollars, unless noted otherwise.
- Miscellaneous revenue is assumed to remain constant through projections.
- Depreciation expenses are not included as part of the revenue requirements for the purposes of projecting rates.
- For the purpose of the financial projections, three cases are considered. Billable units:
 - Low Growth Case: Assumed growth at an historical rate of 2% annually after 2023. The number of billable units in FY 2021 is 3,649, which is derived from the BWPCA FY 2021 budget (Page 1, noted in Comments). The units are projected to be 3700 in 2022 and 3900 in 2023 based on known projects approved for the near term or under construction.
 - Medium Growth Case: Assumed growth at a rate shown in the Plan at Section 2.6. For revenue planning, flow is estimated to increase from 320,000 GPD to 450,000 GPD.
 - High Growth Case: Assumed if the Candlewood Lake project is approved with up to 906 properties. The growth is to 550,000 GPD

The High, Medium and Low Growth Cases are presented in Section 6.2.3 below.



- It is assumed that the treatment costs will increase will remain the same with the Danbury Plant expansion, increasing at 3% per year for inflation. There is no indication from Danbury rates will change with the plant upgrade due to be commissioned in 2022.
- The "Danbury Capacity" fees are now at \$0.0028 per gallon. That is \$2.80 per thousand gallons or \$102,200 for each 100,000 GPD for the year.
- The current rate structure is assumed to remain intact through the projection period.
 - BWPCA plans to charge a base fee of \$420 per unit in FY 2021, according to the FY 2021 budget. It is subject to review late 2020 billing due to impact from the economic disruption of Covid-19.
 - BWPCA charges a plant charge of \$68 per unit in FY 2021, according to the FY 2021 budget. This charge is intended to generate revenue exclusively to pay for future allocation reservation from Danbury as part of the WWTP expansion project. Plant charge revenue is held in a separate account and not co-mingled with operating funds.
 - BWPCA evaluated the feasibility of adjusting its rate structure to a flow-based rate, charging customers based on water usage. BWPCA concluded that currently there did not exist the data required to successfully implement a flow-based rate structure. Only a small fraction of commercial customers are connected to an Aquarion water line. As more customers install water meters, BWPCA can re-evaluate the usage charge when more information is available, probably later in the decade.
- The Danbury WWTP expansion project is assumed to occur in FY 2022. The anticipated share of the project costs is \$4.0M (2020 dollars) for BWPCA. This updated cost allocation has been included in the FY 2021 budget, with the expectation that this project is not eligible for grant funding.
 - It is assumed that the \$4.0M will be issued through a loan from Danbury with payback beginning in FY 2022.
 - It is assumed that the billed Danbury Plant charge will be adjusted as necessary to cover the cost of this loan.
- Clean Water State Revolving Fund (SRF) debt is assumed to carry an interest rate of 2.0%, with a term of 20 years, and a 1.0% cost of issuance. If the SRF is not available, debt will be covered with bonds and/or short-term Bond Anticipation Notes (BANs).
- BWPCA currently charges separate betterment assessments to six (6) distinct districts for recovery of debt service payments associated with the projects that benefit each district specifically. Each of the districts are self-funded and the current assessments are set to the appropriate level to generate the appropriate revenues for the associated debt service.
- With the exception of the Danbury plant expansion, future capital costs and any associated debt service is assumed to be funded through the base charge, not through a creation of, or allocation to, an individual district; and a capital cost recovery connection charge (CCRCC) as allowed by CGS Sections 7-255; 7-267 and 7-273. This is a 2% charge on the incremental Grand List Value (GLV) assessment of an improved property. The CCRCC applies in sewer districts where the original construction bond has been paid off. The CCRCC is 2% of the new GLV on an improved property less the previous property sewer assessment.



- The unrestricted cash balance. At the beginning of FY 2021, an estimated \$630,000 is available to fund capital projects.
- It is assumed that BWPCA will pursue SRF or bond financing for the major capital projects in the Facilities Plan, listed below. A range of values is presented to bracket the possible project costs depending on the extent of renovations selected.
 - \$800,000 to \$3.85M for Route 133 Pump Station Upgrade. Estimated project completion in FY 2022. Approximately \$500,000 in the Federal Road North district account is available for this project.
 - \$900,000 to \$1.65M for Caldor Pump Station Upgrade. Estimated project completion in FY 2025.
 - \$400,000 to \$740,000 for 777 Pump Station Upgrade. Estimated project completion in FY 2028.
- The timing of SRF debt service payback is set to the year following project completion.
- For purposes of financial modeling, the detailed cash flow associated with the capital expenditures and debt issuance are not included as part of the rate projections. The rate projections incorporate the debt service payments triggered by all such debt issues.
- The projections assume that all capital projects identified in BWPCA's FY 2021 budget are expensed in FY 2021 through cash (i.e. not debt financed), and no projects are planned to be deferred to future years.
- An allowance of \$190,000 per year is assumed for purchase of capital maintenance equipment, starting in FY 2021 and inflated 3% annually. This cost is expensed in the 0&M budget. No other capital items are carried in the projections beyond the major projects identified in this Facilities Plan.
- Additional O&M resulting from this Facilities Plan is estimated at \$100,000 annually. This projection includes \$20,000 annually for cleaning and CCTV of the system, and \$20,000 annually for sewer manhole trenchless rehab. These costs are inflated at 3% annually.
- Accumulated funds from the plant charge is assumed to be reserved for use to offset the
 costs of the Danbury plant expansion project only, and not to offset costs intended to be
 recovered through the base charge.
- The projected base charges shown assumes that the base charge is set annually at a level sufficient to generate revenues to cover the expenses in that year. The FY 2021 budget is breakeven with the capital improvements planned. It is assumed that BWPCA has sufficient balances in reserves to cover any shortfalls in FY 2021 from an unanticipated impact from Covid-19 revenue adjustments, if any.



6.3 Flow Assumptions

The Revenue requirements are dependent on the flow to be treated with the assumption flows ranging from 300,000 to 550,000 GPD the costs can be estimated if the Danbury Capacity charges remain the same with the 3% inflation assumption. Below are costs per year for the Low, Medium and High Flow rate cases of wastewater flow to Danbury.

Table 6-1 – Flow Estimates for Historical Low increases, Plan flow, High flow including Candlewood

		Low Flow Estimate (Historical Growth)			Medium Growth Case High Estimate (Plan Flow Estimate) (Candlewood)				
FYE	Units	MGD	Cost	Units	MGD	Cost	Units	MGD	Cost
2016	3,426	0.27	\$280,000	3,426	0.27	\$280,000	3,426	0.27	\$280,000
2017	3,611	0.29	\$295,000	3,611	0.29	\$295,000	3,611	0.29	\$295,000
2018	3,821	0.30	\$312,000	3,821	0.31	\$312,000	3,821	0.31	\$312,000
2019	4,000	0.32	\$327,000	4,000	0.32	\$327,000	4,000	0.32	\$327,000
2020	3,811	0.31	\$312,000	3,811	0.31	\$312,000	3,811	0.31	\$312,000
2021	3,649	0.29	\$307,000	3,649	0.29	\$307,000	3,649	0.29	\$307,000
2022	3,800	0.30	\$330,000	3,800	0.30	\$330,000	3,800	0.30	\$330,000
2023	4,000	0.32	\$357,000	4,000	0.32	\$357,000	4,000	0.32	\$357,000
2024	4,080	0.33	\$375,000	4,120	0.33	\$379,000	4,120	0.33	\$379,000
2025	4,162	0.33	\$394,000	4,340	0.35	\$411,000	5,200	0.42	\$493,000
2026	4,245	0.34	\$414,000	4,600	0.37	\$449,000	5,600	0.45	\$547,000
2027	4,330	0.35	\$435,000	4,900	0.39	\$493,000	5,940	0.48	\$597,000
2028	4,416	0.35	\$457,000	5,100	0.41	\$528,000	6,280	0.50	\$650,000
2029	4,505	0.36	\$481,000	5,300	0.42	\$565,000	6,620	0.53	\$706,000
2030	4,595	0.37	\$505,000	5,500	0.44	\$604,000	6,900	0.55	\$758,000

The historical (Low Flow) estimate assume modest growth in economic activity in town that has been roughly 3% per year, with some spurts and valleys. In 2019, the Town lost a big employer that had a substantial impact on WPCA revenue without a proportional reduction in flow.

In 2021 a new national corporate headquarters is due to open. That is expected to replace much of the lost commercial revenue. In 2022 and 2023, additional apartment housing is due to be built and occupied and a new supermarket in the northern area is expected.

For purposes of planning, a new sewer system in the Candlewood Lake Area is anticipated for the High Flow Case in 2025.

The Cost for treating wastewater is directly proportional to flow. Other fixed costs are typically unaffected. It is expected that the staffing will remain unchanged in this analysis until the Candlewood Lake district is installed. That will likely require another field person and another office staff person for billing and customer service.



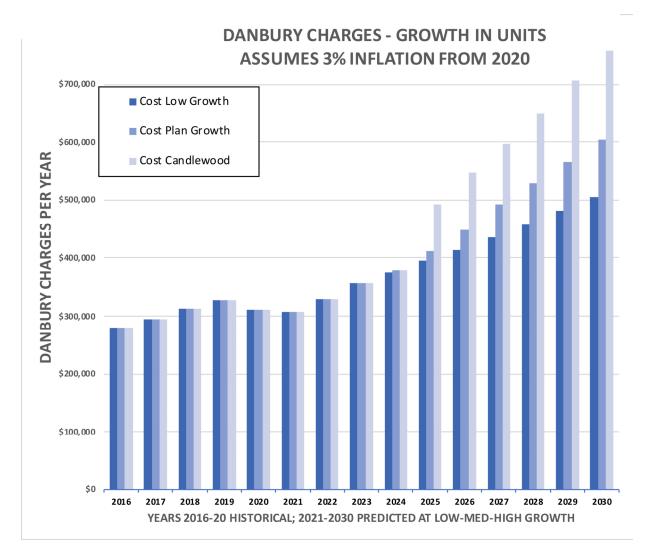


Figure 6-1 Danbury Toll Charges for Low, Medium and High Growth.

6.4 Revenue Requirements

6.4.1 Operations and Maintenance

Operations and Maintenance (0&M) expenses have been separated into five categories:

- Danbury Fees. This includes the "capacity charges" from Danbury. This is the toll cost of processing wastewater flow delivered from Brookfield to Danbury.
- Employee Costs. This includes items such as salaries, benefits, and payroll taxes.
- Operations. This includes items such as utility expenses, small equipment, and general repair and maintenance.
- Administration. This includes items such as the cost of supplies, accounting, routine
 engineering support, legal, IT support, office mortgage payment, and other overhead type
 activities.
- Additional O&M. This includes an annual allowance for sewer manhole trenchless rehab and system cleaning and CCTV.



Total 0&M expenditures are projected to grow from \$1.58 million in FY 2021 to \$1.85 million in FY 2025 and \$2.3 million in 2030 as summarized in **Table 6-2** for the Medium Growth case. This calculates to an average annual increase of 4.3 percent with inflation and growth assumptions.

Table 6-2 – Operations and Maintenance Expenses for the Medium Growth Case

Category	2021	2022	2023	2024	2025	2030
Danbury Capacity Fees	\$307,000	\$330,000	\$357,700	\$379,000	\$411,000	\$604,000
Employee Costs	\$678,700	\$699,100	\$720,100	\$741,700	\$763,900	\$885,600
Operations	\$278,500	\$286,900	\$295,500	\$304,400	\$313,500	\$363,400
Administration	\$158,100	\$161,300	\$166,200	\$171,100	\$176,300	\$206,300
Additional O&M	\$100,000	\$103,000	\$106,100	\$109,300	\$112,600	\$130,500
Total Operating Expenses	\$1,522,300	\$1,580,300	\$1,645,600	\$1,705,500	\$1,777,300	\$2,189,800

6.4.2 Anticipated Capital and Debt Service

The Facilities Plan identifies future anticipated capital expenditures through FY 2030. **Table 6-3** summarizes the future capital spending by project (assuming the low end of the projected cost range). Included is the assumed funding and financing mechanism for each project with the timing of the anticipated spending. Note that the costs shown in the table include both the totals for the spending in base dollars (2020 \$), and with the impact of assumed inflation.

Table 6-3 - Capital Spending by Category

Capital Project	Funding Source	Financing Source	Year	Capital Spending (2020 \$)	Inflated Spending
Danbury Plant Expansion	Plant Charge	SRF/Loan	2022	\$4,000,000	N/A
New Truck (These last 10 years+)	Base Charge	Cash	2021	\$37,000	\$41,000
Route 133 Pump Station Upgrade	Base Charge	Cash	2021-22	\$800,000	\$849,000
Caldor Pump Station Upgrade	Base Charge	SRF/Bond	2023-24	\$900,000	\$1,031,000
777 Pump Station Upgrade	Base Charge	SRF/Bond	2025-26	\$400,000	\$478,000
Capital Maintenance Equipment	Base Charge	Cash	Annually*	\$100,000	\$227,000#
Total Capital Spending FY 2021-2030	Not including D	anbury Plan Ex	\$2,240,000	\$2,637,000#	

^{*\$} represents total; # in year 2025

6.4.3 Debt Service and Capital Expenditures

Table 6-4 summarizes projected debt service and cash funded capital expenditures through FY 2030. BWPCA currently has existing debt service associated with specific extension projects. As noted previously, BWPCA funds these expenses by charging an assessment to the districts that benefit from the projects or partially by the CCRCC in districts where the bond is retired. Since the focus of this section pertains to the revenue requirement for the base charge (and no future capital is assumed to be funded through district-specific charges for these named projects), the district-specific debt service is not included.



Cash funded capital represents capital spending that is funded through cash the year in which the spending occurs. The anticipated debt service does not include short term interest payments on the outstanding SRF or BAN balance prior to the permanent SRF or bond issue, which could be required if there are insufficient unrestricted capital funds. For the purposes of financial modeling, the detailed cash flow associated with timing of capital expenditures and SRF reimbursement are not evaluated as part of the rate projections. The inherent assumption is that reimbursement from the SRF or bonds directly offsets the capital expenditures for projects in the year of expenditure.

Table 6-4 - Expenditures versus Revenue

	E	Expenditures			Revenue			
Year	O&M \$,000s	Debt Service	Total \$,000s	Units	Annual Rate	Revenue \$,000s	Excess Revenue ⁽¹⁾	Comment
2020	\$1,501	\$0	\$1,501	3,811	420	\$1,601	\$ 99,620	
2021	\$1,576	\$0	\$1,576	3,649	420	\$1,533	\$(43,420)	
2022	\$1,637	\$0	\$1,637	3,800	450	\$1,710	\$ 73,000	
2023	\$1,707	\$0	\$1,707	4,000	450	\$1,800	\$ 93,000	
2024	\$1,771	\$63,000	\$1,834	4,120	450	\$1,854	\$ 20,000	Caldor PS
2025	\$1,848	\$63,000	\$1,911	4,340	450	\$1,953	\$ 42,000	
2026	\$1,937	\$92,000	\$2,029	4,600	450	\$2,070	\$ 41,000	777 PS
2027	\$2,026	\$92,000	\$2,118	4,900	450	\$2,205	\$ 87,000	
2028	\$2,155	\$92,000	\$2,247	5,100	450	\$2,295	\$ 48,000	
2029	\$2,204	\$92,000	\$2,296	5,300	450	\$2,385	\$ 89,000	
2030	\$2,294	\$92,000	\$2,386	5,500	450	\$2,475	\$ 89,000	

⁽¹⁾ Excess revenue available to apply to capital reserve account

Table 6-4 above includes the impact of debt service resulting from the two pump station upgrade projects, as the estimated today with allowance for inflation in the year anticipated. The table excludes the impact of the Danbury plant expansion project, as this is intended to be fully funded through the separate plant charge.

Note that Operation and Maintenance is from **Table 6-2** presenting the Medium growth case. **Table 6-3** shows major capital expenditures that could be financed, either by cash or loans. **Table 6-4** shows the debt service added to the O&M in the **Total** column in thousands with the stated assumptions. It seems user fees at \$450 per unit through the decade will be sufficient to support the WPCA operation and allow for growth in staff, if needed.

The anticipated revenue needed to cover expenses is treated below.

6.4.4 Miscellaneous Revenue

Miscellaneous or non-rate revenue consists of revenue generated from special fees by BWPCA that are not directly related to rates. **Table 6-5** summarizes the miscellaneous revenue by category for the 10-year period. It is assumed that the miscellaneous revenues received are used to offset future base charge increases. Miscellaneous revenue generally is assumed to remain constant throughout projections is about 4% of the total revenue.



Table 6-5 - Miscellaneous Revenue

Category	2021	2022	2023	2024	2030
Delinquency Related Interest/Liens/Fees	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000
Pump Station & Grease Trap Inspections	\$14,400	\$14,400	\$14,400	\$14,400	\$14,400
Application/Miscellaneous Fees	\$4,600	\$4,600	\$4,600	\$4,600	\$4,600
Interest Income	\$12,000	\$12,000	\$12,000	\$12,000	\$12,000
Total Miscellaneous Revenue	\$61,000	\$61,000	\$61,000	\$61,000	\$61,000

6.4.5 Revenue Requirement – Base Charge

The revenue requirement is the total revenue that must be generated annually from the base charge to fund BWPCA's expenses, calculated by subtracting miscellaneous revenue from total allocated expenses including debt service. **Table 6-6** shows the total projected revenue requirement to be recovered through the base charge. This is intended to show the magnitude of the annual expenses to be recovered through a combination of rate revenue and reserve transfers.

Table 6-6 - Projected Revenue Requirement

Category (Dollars in Thousands)	2021	2022	2023	2024	2025	2026	2030
Operations and Maintenance#	\$1,575	\$1,637	\$1,707	\$1,771	\$1,848	\$1,925	\$2,204
Debt Service and Capital Expenditures	\$0	\$0	\$0	\$63	\$63	\$92	\$92
Miscellaneous Revenue	(\$61)	(\$61)	(\$61)	(\$61)	(\$61)	(\$61)	(\$61)
Total Revenue Requirement - Base Charge	\$1,514	\$1,576	\$1,646	\$1,773	\$1,850	\$1,956	\$2,235

for the Medium Growth Case

Brookfield has typically raised rates to cover cost several years into the future, then keep the base fee stable to sustain operations for several years into the future. See the graph below that compares Brookfield rates in a 2020 Tighe & Bond report, "2019 Connecticut Sewer Rate Survey." Free copies are available upon request at tighebond.com

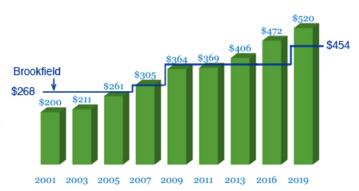


The image as **Figure 6-2** below shows the average historical rates across Connecticut as captured by this tri-annual study. The Brookfield rates are superimposed on the image from 2001 to 2019. The rate was increased from 380 per unit to \$420 per unit in 2017.

Figure 6-2 Historical Rates in CT Compared to Brookfield Since 2001

Average annualized sewer costs, based on a 6,000-gallon per month household water usage, is \$520, with a median of \$467, a low of \$130, and a high of \$2,060. 73% of survey respondents have increased rates since our last survey (2016). At the same time, the cost of sewer service has increased 10% over 3 years.

One of the most commonly reported challenges facing wastewater systems across Connecticut is our aging infrastructure. A rate structure designed to provide sustainable revenue for operations and capital programs is critical to assure reliable, and environmentally sound sewer service.



6.4.6 Projected Base Charge

BWPCA assesses its customers a base charge per unit. **Table 6-7** summarizes the projected base charge increases through FY 2025.

Table 6-7 - Projected Base Charge

Category	2021	2022	2023	2024	2025	2026	2027
Base Charge per Unit	\$420	\$450	\$450	\$450	\$450	\$450	\$450
Total Units	3,649	3,800	4,000	4,120	4,340	4,600	4,900
Base Charge & Misc Revenue (\$,000s)	\$1,594	\$1,771	\$1,861	\$1,915	\$2,014	\$2,231	\$2,266
Revenue Requirement - Base Charge# (\$,000s)	\$1,576	\$1,637	\$1,707	\$1,834	\$1,911	\$2,029	\$2,118
Annual Surplus/(Deficit) (\$,000s)	\$18	\$134	\$154	\$81	\$103	\$202	\$148
Ave Rate Increase Since, 2017†	0	1.7%	1.3%	1.1%	1.0%	0.9%	0.8%

for the Medium Growth Case; †2017 is year of last increase to \$420/unit

The projected base charge is projected to be flat over the period FY 2022 to FY 2027. This projection assumes that BWPCA has sufficient cash to cover any unexpected expenses through existing fund balances. This also assumes that BWPCA is collecting the full amounts billed each year (i.e. a collection rate of essentially 100 percent since charges are covered by a lien on delinquent properties). However, this assumption is uncertain for 2020, as the impact of Covid-19 on 2021 revenue cannot be predicted.

The projected income for the base charge does not include revenue generated from benefit assessments. For new connections to the system, BWPCA charges an assessment based on district-specific rates, tied to the property Grand List Value (GLV) of the connecting property. For connections to a district with an ongoing payback of capital costs, the assessment is based on the defined schedule by district. For new connections to areas where a previous project has been completed and the Bond debt is retired, BWPCA assesses a capital cost recovery connection



charge (CCRCC) 2% of the value of the property, or 2% of the GLV increase for existing structures. The average revenue for the assessments has been roughly \$30,000 annually for the past 5 years. While the impact of these assessments has not been factored into the rate projections, any future revenues from these CCRCC assessments would effectively reduce the funding required by future use rates.

Through FY 2030, the average the base charge is expected to be stable with fund requirements being met though system growth. **Table 6-7** shows the projected base charge over that timeframe. The years with the more significant expenses (e.g. FY 2024), the timing of the debt service payments for the projects listed as part of this Facilities Plan. As noted, the projections were developed showing the annual requirements, and does not factor in potential rate smoothing options BWPCA could utilize. This could include the use of existing reserve balances, or larger more periodic base charge increases.

6.5 Covid-19

Brookfield sends bills to its customers for use charges twice-a-year and in advance. For example, June 2020 bills cover the period from July 1 through December 31, 2020. With the Covid-19 emergency, it is difficult to evaluate if there will be an interruption of 2020 revenue. Many businesses such as gyms, salons, restaurants, and schools were closed. But WPCA flows and costs remained about the same. It is thought that cash on hand may absorb some revenue loss should it be required to issue credits. The situation could mean a Base Charge hike to carry this utility into the future may be required by June 2021 or even by the end of 2020.

6.6 Danbury Sewer Plant Charge

BWPCA charges a separate Danbury Sewer Plant Charge, which is intended to generate revenues to cover Brookfield's share of expenses related to the Danbury WWTP Expansion project. BWPCA's portion of the Danbury plant expansion project has been estimated at \$4.0M (2020 \$).

The plant charge for FY 2021 was originally \$44 per unit set by BWPCA with the intent to generate enough revenue over the life of the Danbury plant loan to cover the expenses. BWPCA reduced the unit rate to \$34 per unit, basing the calculation on BWPCA share of the Danbury expansion project to be \$2.83M. But this subject to be adjusted as this cost comes into focus. The FY 2021 budget identifies the BWPCA portion of the Danbury expansion project to be \$4.0M.

The Danbury expansion project is scheduled to start in FY 2022. The revenues generated through the plant charge are held in a separate fund to be used exclusively for the allocated costs of the project. The projections include the use of the accumulated funds projected to offset the amount of a final loan or bond amount.

The Brookfield share of the Danbury Plant upgrade is uncertain as that work is currently underway as a design-build project. Also, Brookfield has requested a greater allocation in anticipation of adding sewers to the Peninsula at Candlewood Lake. The approach is to adjust the Danbury Plant charge in the use bills to cover the fee to be charged by Danbury. It is anticipated that the full levy will eventually be covered by a 2% loan by issued by Danbury.



The balance in the Danbury plant charge fund is projected to be approximately \$645,000 by the end of FY 2021.

6.7 Wrap Up and Recommendations

This is a capital spending and future financial plan. It should be considered fluid, as it includes more than 40 assumptions. Any one of a myriad of factors influencing any assumption could have a profound effect on the trajectory of capital and rate forecasting. Putting it all together with interdependencies in a model should prove instructive.

It is recommended that this financial section by revisited every year to understand the impact of decisions through the year and to assess the sensitivity of each important assumption. For example, as system use trends come into focus it will become clear if the Low, Medium or High Growth case applies. It is suggested that a spreadsheet or other business modeling software be used for the purpose of future-casting.



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Appendix A

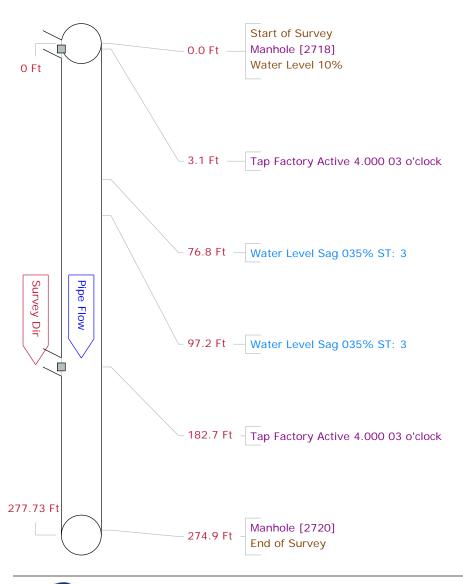
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Pipe Graphic Report of PSR 2718-2720

for	CDM
101	CDIVI

Setup 5 S	Surveyor JO)G	Certificate #	U-615-07000378	System Ow	ner BROOK	FIELD WP	CA
Drainage		Survey Custo	mer CDM SMITI	Н				
P/O #	I	Date 2019/11/15	Time 11:12	Street FEDE	ERAL RD			
City BROOK	KFIELD	Further	ocation details					
Up 2718		Rin	to invert	Grade to	invert	Rim to	grade	Ft
Down 2720		Rin	to invert	Grade to	invert	Rim to	grade	Ft
Use Sanitary		Direction	Downstream	Flow control	Not Controlled	Medi	a No	
Shape Circular		Height	12 Width	ins Pred	lean J	Date Cle	aned	
Material Polyvin	yl Chloride	,	Joint length 12	.Œ1 Total leng	th 277.7 Ft	Length :	Surveyed	274.90 Ft
Lining			Year laid	Year rehabili	ated	Weather	Dry	
Purpose Rout	ine Assessme	ent	С	at				
Additional info					Structural	O & M	Constru	ıctional
Location Ma	in Highway - S	Suburban/Rural			Miscellaneous	Hydraulic		
Project BROO	KFIELD SSE	S-11-15-2019			Work	Order		
Northing			Easting		Elev	ation		
Coordinate Syst	em				GPS Accurac	у		





CCTV Picture List of 2718-2720 for CDM

Work Order			Setup 5
Video	Survey Date	2019/11/15	
Path to picture files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\S	Snaps\191115-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\M	Movies\191115-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\N	/ledia\191115-CDM-1991\



Video Index Count 0.0 Ft

Code Start of Survey

Remarks

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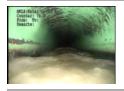


Video Index Count 3.1 Ft

Code Tap Factory Active

Remarks

File Name 14.jpg



Video Index Count 76.8 Ft

Code Water Level Sag

Remarks

File Name 15.jpg



Video Index Count 97.2 Ft

Code Water Level Sag

Remarks

File Name 16.jpg



Video Index Count 182.7 Ft

Code Tap Factory Active

Remarks

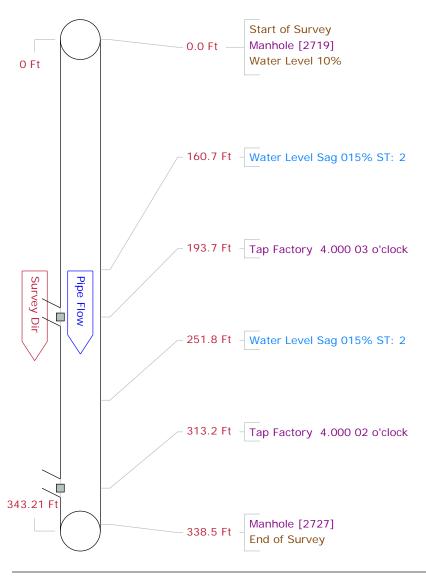
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Pipe Graphic Report of PSR 2719-2725

for CDM

Setup 6 Surveyor JOG	Certificate #	U-615-07000378 Sy	ystem Owner B	ROOKFIELD WPCA
Drainage Survey Cus	tomer CDM SMIT	Н		
P/O # Date 2019/11/15	Time 12:28	Street FEDERAL	RD	
City BROOKFIELD Furthe	r location details	i		
Up 2719	im to invert	Grade to inver	t R	im to grade Ft
Down 2727	im to invert	Grade to inver		im to grade Ft
Use Sanitary Directi	on Downstream	Flow control De-W	atered using	Media No
Shape Circular Heigh	nt 12 Width	ins Preclean	J Dat	te Cleaned
Material Polyvinyl Chloride	Joint length	Ft Total length 34	3.2 Ft Le	ength Surveyed 338.50 Ft
Lining	Year laid	Year rehabilitated	Wea	ather Dry
Purpose Routine Assessment	C	at		
Additional info CORRECTED MH#		Struct	ural O & M	Constructional
Location Main Highway - Suburban/Rural		Misce	llaneous Hydrau	ulic
Project BROOKFIELD SSES-11-15-2019			Work Order	
Northing	Easting		Elevation	
Coordinate System		GPS	S Accuracy	





CCTV Picture List of 2719-2725 for CDM

		Setup 6
Survey Date	2019/11/15	
Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\S	naps\191115-CDM-1991\
Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\N	Novies\191115-CDM-1991\
Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\N	ledia∖191115-CDM-1991∖
	Z:\AES\1991 - CDM BF Z:\AES\1991 - CDM BF	Survey Date 2019/11/15 Z:\AES\1991 - CDM BROOKFIELD SSE\191115-CDM-1991\N Z:\AES\1991 - CDM BROOKFIELD SSE\191115-CDM-1991\N Z:\AES\1991 - CDM BROOKFIELD SSE\191115-CDM-1991\N



Video Index Count 160.7 Ft

Code Water Level Sag

Remarks

File Name 18.jpg



Video Index Count 193.7 Ft

Code Tap Factory

Remarks

File Name 19.jpg



Video Index Count 193.7 Ft

Code Tap Factory

Remarks

File Name 20.jpg



Video Index Count 251.8 Ft

Code Water Level Sag

Remarks

File Name 21.jpg



Video Index Count 313.2 Ft

Code Tap Factory

Remarks

File Name 22.jpg



CCTV Picture List of 2719-2727 for CDM

		Setup 6
Survey Date	2019/11/15	
Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\S	naps\191115-CDM-1991\
Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\N	Novies\191115-CDM-1991\
Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\N	ledia∖191115-CDM-1991∖
	Z:\AES\1991 - CDM BF Z:\AES\1991 - CDM BF	Survey Date 2019/11/15 Z:\AES\1991 - CDM BROOKFIELD SSE\191115-CDM-1991\N Z:\AES\1991 - CDM BROOKFIELD SSE\191115-CDM-1991\N Z:\AES\1991 - CDM BROOKFIELD SSE\191115-CDM-1991\N



Video Index Count 160.7 Ft

Code Water Level Sag

Remarks

File Name 40.jpg



Video Index Count 193.7 Ft

Code Tap Factory

Remarks

File Name 41.jpg



Video Index Count 193.7 Ft

Code Tap Factory

Remarks

File Name 42.jpg



Video Index Count 251.8 Ft

Code Water Level Sag

Remarks

File Name 43.jpg



Video Index Count 313.2 Ft

Code Tap Factory

Remarks

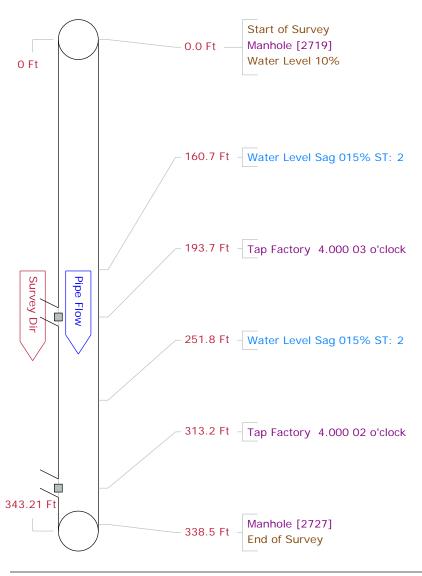
File Name 44.jpg



Pipe Graphic Report of PSR 2719-2727

for CDM

Setup 6 Surveyor JOG	Certificate #	U-615-07000378	System Own	er BROOKFIE	LD WPCA
Drainage Survey Custo	mer CDM SMITI	Н			
P/O # Date 2019/11/15	Time 12:28	Street FED	ERAL RD		
City BROOKFIELD Further I	ocation details	•			
Up 2719 Ri m	to invert	Grade to	invert	Rim to gra	de Ft
Down 2727 Rim	to invert	Grade to		Rim to gra	de Ft
Use Sanitary Direction	Downstream	Flow control	De-Watered using Jetter	Media N	0
Shape Circular Height	12 Width	ins Pre	clean J	Date Cleane	d
Material Polyvinyl Chloride	Joint length	F1 Total len	gth 343.2 Ft	Length Sur	veyed 338.50 Ft
Lining	Year laid	Year rehabili	tated	Weather Dry	
Purpose Routine Assessment	С	at			
Additional info CORRECTED MH#			Structural	M & C	Constructional
Location Main Highway - Suburban/Rural			Miscellaneous	Hydraulic	
Project BROOKFIELD SSES-11-15-2019		_	Work C	rder	
Northing	Easting	l	Elevat	tion	
Coordinate System			GPS Accuracy		

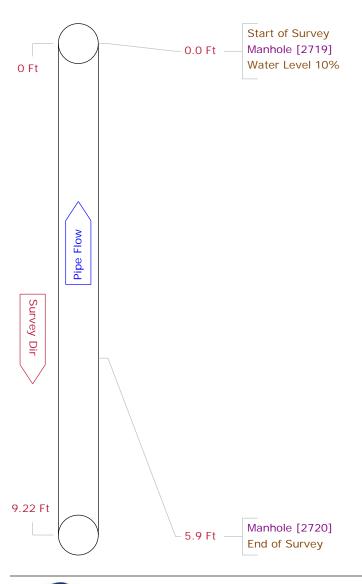




Pipe Graphic Report of PSR 2720-2719

for CDM

Setup	7	Surveyor	JOG	Ce	rtificate #	U-615-07000	0378 Syster	m Owner	BROOKFIELD	WPCA
Drainage			Sur	vey Customer	CDM SMITI	Н				
P/O #			Date 2019	/11/21 1	ime 13:03	Street	FEDERAL RD			
City	BRO	OKFIELD		Further locat	tion details	i				
Up 2	720			Rim to i	nvert	Grad	le to invert		Rim to grade	Ft
Down 2	719			Rim to i	nvert	Grad	le to invert		Rim to grade	Ft
Use San	itary			Direction Up:	stream	Flow cor	ntrol Not Contro	olled	Media No	
Shape C	Circular			Height 12	Width	ins	Preclean J	I	Date Cleaned 2	019/11/21
Material	Polyv	inyl Chloride	;	Join	t length 12	.Œ1 Tota	l length 9.2	Ft	Length Survey	ed 05.90 Ft
Lining				Ye	ar laid	Year reh	abilitated	V	Veather Dry	
Purpose	Ro	utine Assess	sment		С	at				
Additiona	al info	EXC	CESSIVE FLO	W DUE TO FOR	RCE MAINS		Structural	0 &	k M Con	structional
Location	M	lain Highway	∕ - Suburban/R	tural			Miscellane	ous Hyd	draulic	
Project	BRO	OOKFIELD S	SES-11-21-20)19			'	Work Ord	er	
Northing					Easting			Elevation	า	
Coordina	te Sy	stem					GPS Ac	curacy		

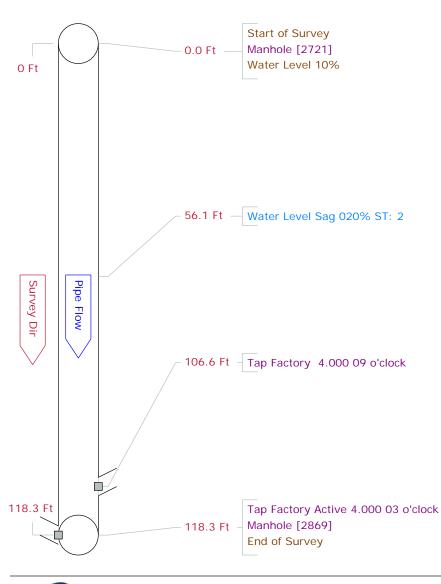




Pipe Graphic Report of PSR 2721-2869

for CDM

Setup 6 Surveyor JOG	Certificate #	U-615-07000378 System Ov	vner BROOKFIELD WI	PCA
Drainage S	urvey Customer CDM SMITH	I		
P/O # Date 20	19/11/18 Time 13:49	Street FEDERAL RD		
City BROOKFIELD	Further location details			
Up 2721	Rim to invert	Grade to invert	Rim to grade	Ft
Down 2869	Rim to invert	Grade to invert	Rim to grade	Ft
Use Sanitary	Direction Downstream	Flow control Not Controlled	Media No	
Shape Circular	Height 8 Width	ins Preclean H	Date Cleaned 201	9/11/18
Material Polyvinyl Chloride	Joint length 12.0	F1 Total length 117.3 Ft	Length Surveyed	118.30 Ft
Lining	Year laid	Year rehabilitated	Weather Light Rain	
Purpose Routine Assessment	Ca	at		
Additional info		Structural	O & M Constr	uctional
Location Main Highway - Suburbar	n/Rural	Miscellaneous	Hydraulic	
Project BROOKFIELD SSES-11-18	-2019	Work	Order	
Northing	Easting	Elev	ration	
Coordinate System		GPS Accura	су	





CCTV Picture List of 2721-2869 for CDM

Work Order			Setup 6
Video	Survey Date	2019/11/18	
Path to picture files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191118-CDM-1991\S	Snaps\191118-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191118-CDM-1991\M	Movies\191118-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191118-CDM-1991\N	Media\191118-CDM-1991\



Video Index Count 56.1 Ft

Code Water Level Sag

Remarks

File Name 20.jpg



Video Index Count 106.6 Ft

Code Tap Factory

Remarks

File Name 21.jpg



Video Index Count 118.3 Ft

Code Tap Factory Active

Remarks

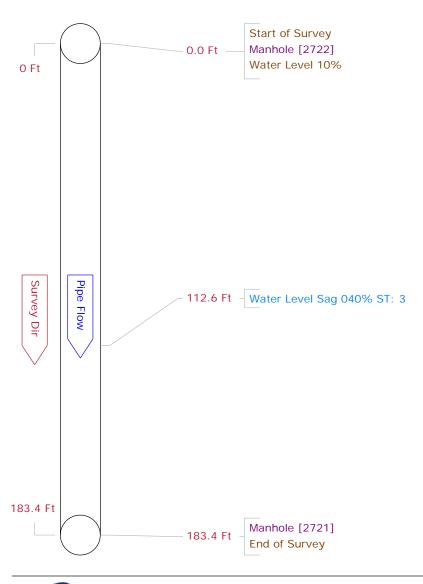
File Name 22.jpg



Pipe Graphic Report of PSR 2722-2721

for CDM

Setup	5	Surveyor	JOG	Ce	rtificate #	U-615-0	7000378	System Ow	ner BROOF	KFIELD WF	PCA
Drainag	е		S	urvey Customer	CDM SMITH	4					
P/O #			Date 20	19/11/18 1	Time 13:27	St	reet FEDE	RAL RD			
City	BRO	OKFIELD		Further locat	tion details						
Up	2722			Rim to i	nvert		Grade to i	nvert	Rim to	grade	Ft
Down	2721			Rim to i	nvert		Grade to i	nvert	Rim to	grade	Ft
Use Sa	anitary			Direction Do	wnstream	Flow	control N	lot Controlled	Med	ia No	
Shape	Circula	ar		Height 10	Width	ins	Preci	ean J	Date Cle	aned 2019	9/11/18
Material	l Poly	vinyl Chloride)	Join	t length 12.	.OF1	Total lengt	th 182.1 Ft	Length	Surveyed	183.40 Ft
Lining				Ye	ar laid	Yea	r rehabilita	ated	Weather	Light Rain	
Purpose	e R	outine Assess	sment		С	at					
Addition	nal inf	0					S	tructural	O & M	Constru	uctional
Location	n	Main Highway	/ - Suburbar	n/Rural			N	liscellaneous	Hydraulic		
Project	BF	ROOKFIELD S	SES-11-18	-2019				Work	Order		
Northin	g				Easting			Eleva	ation		
Coordin	ate Sy	/stem						GPS Accurac	:y		





CCTV Picture List of for CDM 2722-2721

Work Order			Setup 5
Video	Survey Date	2019/11/18	
Path to picture files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191118-CDM-1991\	Snaps\191118-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191118-CDM-1991\	Movies\191118-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191118-CDM-1991\	Media\191118-CDM-1991\



Video Index **Count** 112.6 Ft Code Water Level Sag

File Name 19.jpg

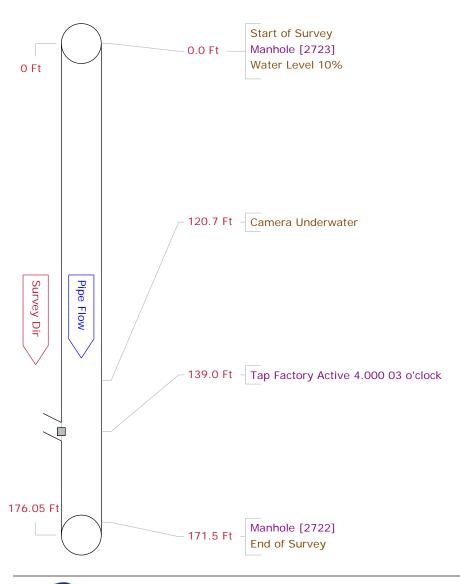
Remarks



Pipe Graphic Report of PSR 2723-2722

for CDM

Setup 4 Surveyor JOG	Certificate #	U-615-07000378	System Own	er BROOKF	IELD WPCA
Drainage Survey Cust	omer CDM SMITH	1			
P/O # Date 2019/11/18	Time 12:59	Street FEDE	ERAL RD		
City BROOKFIELD Furthe	r location details				
Up 2723 Ri	Rim to invert		Grade to invert		rade Ft
Down 2722 R i	Rim to invert Grade to invert		invert	Rim to g	rade Ft
Use Sanitary Direction	on Downstream Flow control Not Controlled		Media No		
Shape Circular Heigh	t 10 Width	ins Pred	lean H	Date Cleaned 2019/11/18	
Material Polyvinyl Chloride	Joint length 12.0F1 Total length		th 176.1 Ft	Length Surveyed 171.50 Ft	
Lining	Year laid	Year rehabilitated		Weather Light Rain	
Purpose Routine Assessment	Ca	at			
Additional info		:	Structural	O & M	Constructional
Location Main Highway - Suburban/Rural			Miscellaneous	Hydraulic	
Project BROOKFIELD SSES-11-18-2019		Work Order			
Northing	Easting	ting Elevation		tion	
Coordinate System	GPS Accuracy				





CCTV Picture List of 2723-2722 for CDM

Work Order			Setup 4
Video	Survey Date	2019/11/18	
Path to picture files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191118-CDM-1991\\$	Snaps\191118-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191118-CDM-1991\I	Movies\191118-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191118-CDM-1991\I	Media\191118-CDM-1991\



Count 120.7 Ft Video Index

Code Camera Underwater

Remarks

File Name 17.jpg



Video Index **Count** 139.0 Ft

Code Tap Factory Active

Remarks

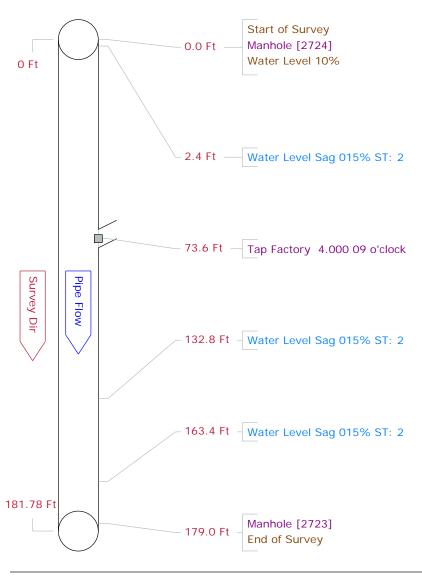
File Name 18.jpg



Pipe Graphic Report of PSR 2724-2723

for	CDM
101	CDIVI

Setup 3	Surveyor	JOG	Cer	tificate #	U-615-0	07000378	System Ow	ner BROO	KFIELD WF	PCA
Drainage		Survey	/ Customer	CDM SMITI	Н					
P/O #		Date 2019/11	/18 T	ime 11:31	St	reet FEDE	RAL RD			
City BR	OOKFIELD	F	urther locat	ion details	;					
Up 2724			Rim to i	nvert		Grade to i	nvert	Rim to	grade	Ft
Down 2723			Rim to i	nvert		Grade to i	nvert	Rim to grade		Ft
Use Sanitary	,	D	irection Dov	vnstream	Flow	control N	lot Controlled	Med	ia No	
Shape Circul	ar		Height 12	Width	ins	Preci	ean H	Date Cle	aned 2019	9/11/18
Material Po	yvinyl Chloride		Joint	length 12	.0 F1	Total lengt	h 181.8 Ft	Length	Surveyed	179.00 Ft
Lining			Ye	ar laid	Yea	r rehabilita	ated	Weather	Light Rain	
Purpose I	Routine Assess	sment		С	at					
Additional in	fo					S	tructural	O & M	Constr	uctional
Location	Main Highway	· - Suburban/Rura	al			N	liscellaneous	Hydraulic		
Project B	ROOKFIELD S	SES-11-18-2019					Work	Order		
Northing				Easting	I		Elev	ation		
Coordinate S	ystem						GPS Accurac	у		





CCTV Picture List of 2724-2723 for CDM

Work Order			Setup 3
Video	Survey Date	2019/11/18	
Path to picture files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191118-CDM-1991\	Snaps\191118-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191118-CDM-1991\	Movies\191118-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191118-CDM-1991\	Media\191118-CDM-1991\



Count 2.4 Ft Video Index

Code Water Level Sag

Remarks

File Name 13.jpg



Video Index **Count** 73.6 Ft

Code Tap Factory

Remarks

File Name 14.jpg



Count 132.8 Ft Video Index

Code Water Level Sag

Remarks

File Name 15.jpg



Video Index **Count** 163.4 Ft

Code Water Level Sag

Remarks

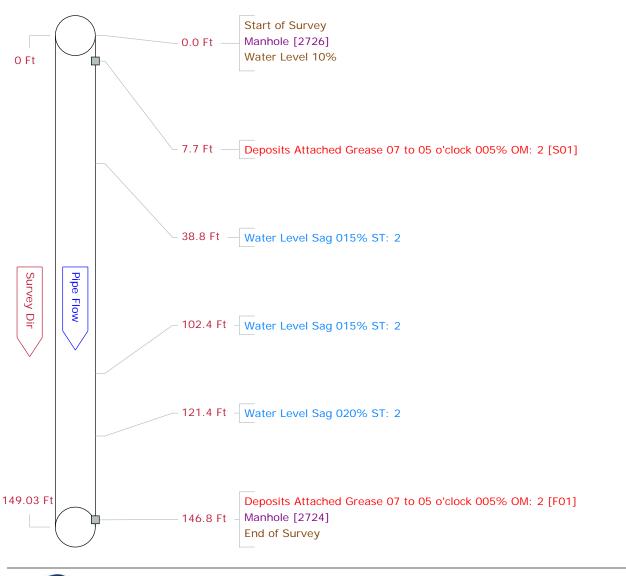
File Name 16.jpg



Pipe Graphic Report of PSR 2726-2724

for CDM

Setup	2 Surveyo	r JOG	Certificate #	U-615-07000378	System Ow	ner BROOK	FIELD WPCA
Drainage	•	Survey Custo	mer CDM SMITI	Н			
P/O #		Date 2019/11/18	Time 10:36	Street FEDE	RAL RD		
City	BROOKFIELD	Further	location details	•			
Up 2	726	Rin	n to invert	Grade to i	invert	Rim to g	grade Ft
Down 2	2724	Rin	n to invert	Grade to i	invert	Rim to g	grade Ft
Use Sar	nitary	Direction	n Downstream	Flow control		Media	a No
Shape C	Circular	Height	12 Width	ins Prec	lean H	Date Clea	ned 2019/11/18
Material	Polyvinyl Chlorid	de	Joint length 12	⊕ Total leng	th 149.0 Ft	Length S	Surveyed 146.80 Ft
Lining			Year laid	Year rehabilit	ated	Weather L	ight Rain
Purpose	Pre-Acceptan	nce	С	at			
Addition	al info				Structural	O & M	Constructional
Location	Main Highwa	ay - Suburban/Rural		1	Miscellaneous	Hydraulic	
Project	BROOKFIELD	SSES-11-18-2019			Work	Order	
Northing			Easting	l	Eleva	ation	
Coordina	ate System				GPS Accurac	y	





CCTV Picture List of 2726-2724 for CDM

Work Order			Setup 2
Video	Survey Date	2019/11/18	
Path to picture files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191118-CDM-1991\	Snaps\191118-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191118-CDM-1991\	Movies\191118-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191118-CDM-1991\	Media\191118-CDM-1991\



Count 7.7 Ft Video Index

Code Deposits Attached Grease

Remarks

File Name 9.jpg



Video Index Count 38.8 Ft

Code Water Level Sag

Remarks

File Name 10.jpg



Count 102.4 Ft Video Index

Code Water Level Sag

Remarks

File Name 11.jpg



Count 121.4 Ft Video Index

Code Water Level Sag

Remarks

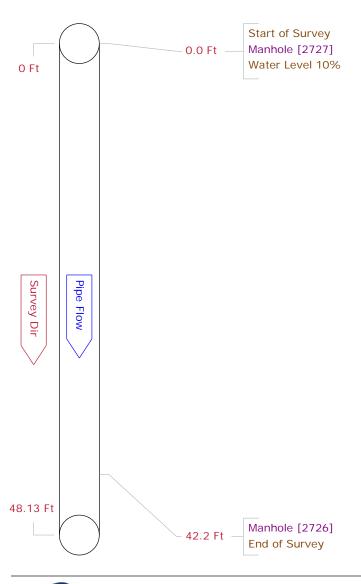
File Name 12.jpg



Pipe Graphic Report of PSR 2727-2726

for CDM

Setup 1 Surveyor JOG	Certificate #	U-615-07000378 System O	wner BROOKFIELD WF	CA
Drainage Survey Cu	stomer CDM SMITH	4		
P/O # Date 2019/11/18	Time 10:25	Street FEDERAL RD		
City BROOKFIELD Furth	er location details			
Up 2727	Rim to invert	Grade to invert	Rim to grade	Ft
Down 2726	Rim to invert	Grade to invert	Rim to grade	Ft
Use Sanitary Direc	tion Downstream	Flow control	Media No	
Shape Circular Heig	ght 12 Width	ins Preclean H	Date Cleaned 2019	9/11/18
Material Polyvinyl Chloride	Joint length 12.	OF1 Total length 48.1 Ft	Length Surveyed	42.20 Ft
Lining	Year laid	Year rehabilitated	Weather Light Rain	
Purpose Routine Assessment	C	at		
Additional info		Structural	O & M Constru	uctional
Location Main Highway - Suburban/Rural		Miscellaneous	Hydraulic	
Project BROOKFIELD SSES-11-18-2019		Wor	k Order	
Northing	Easting	Ele	vation	
Coordinate System		GPS Accura	асу	

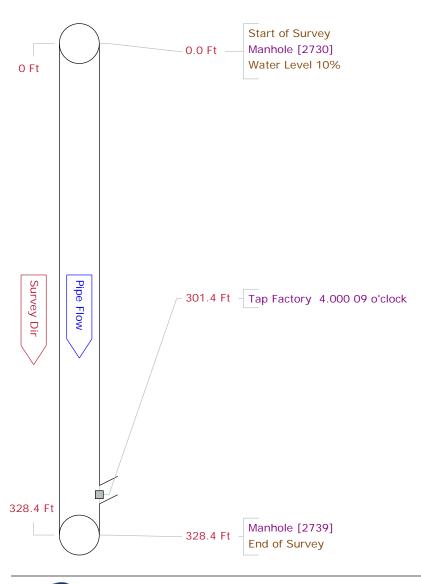




Pipe Graphic Report of PSR 2730-2739

for	CDM SMITH
101	

Setup 1 Surveyor JOG	Certificate #	U-615-07000378	System Own	er BROOKFIEL	.D WPCA
Drainage Survey Cus	tomer BROOKFIE	LD WPCA			
P/O # Date 2019/11/19	Time 8:27	Street FED	ERAL RD		
City BROOKFIELD Further	r location details				
Up 2730 R	im to invert	Grade to	invert	Rim to grad	le Ft
Down 2739	im to invert	Grade to	invert	Rim to grad	le Ft
Use Sanitary Directi	on Downstream	Flow control	Not Controlled	Media No)
Shape Circular Heigh	nt 8 Width	ins Pre	clean J	Date Cleaned	I
Material Polyvinyl Chloride	Joint length 12.	Œ1 Total len	gth 327.6 Ft	Length Surv	eyed 328.40 Ft
Lining	Year laid	Year rehabili	tated	Weather Dry	
Purpose Routine Assessment	С	at			
Additional info PUMP STATIONS CAUSIN	NG EXCESSIVE WA	ATER FLOW	Structural	O & M C	onstructional
Location Main Highway - Suburban/Rural			Miscellaneous	Hydraulic	
Project BROOKFIELD SSES-11-19-2019			Work C	Order	
Northing	Easting		Eleva	tion	
Coordinate System			GPS Accuracy	•	





for CDM SMITH **CCTV Picture List of** 2730-2739

Work Order			Setup 1
Video	Survey Date	2019/11/19	
Path to picture files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191119-CDM\Snaps	\191119-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191119-CDM\Movies	s\191119-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191119-CDM\Media\	191119-CDM-1991\



Count 301.4 Ft Video Index Code Tap Factory Remarks

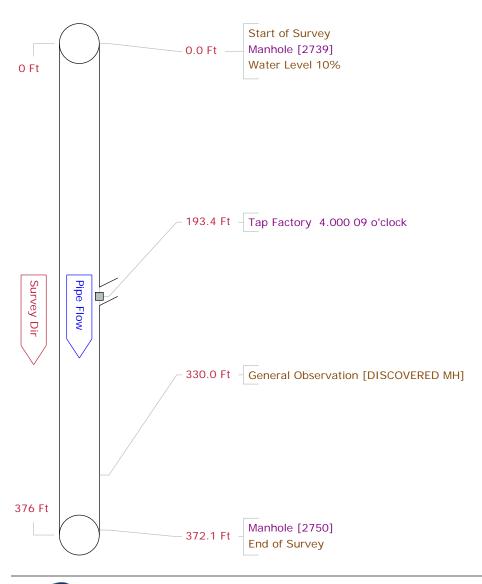
File Name 7.jpg



Pipe Graphic Report of PSR 2739-2750

for	CDM SMITH
101	

Setup	2	Surveyor	JOG	Cei	rtificate #	U-615-070003	78 System Ov	vner BROOK	KFIELD W	PCA
Drainage	е		Su	rvey Customer	CDM SMIT	Н				
P/O #			Date 2019	9/11/19 1	ime 8:58	Street FE	DERAL RD			
City	BRC	OKFIELD		Further locat	ion details	3				
Up 2	2739			Rim to i	nvert	Grade	to invert	Rim to	grade	Ft
Down 2	2750			Rim to i	nvert	Grade	to invert	Rim to	grade	Ft
Use Sa	nitary			Direction Do	wnstream	Flow contr	ol De-Watered usi Jetter	^{ng} Medi	ia No	
Shape (Circula	ır		Height 10	Width	ins P	reclean J	Date Cle	aned	
Material	Poly	vinyl Chloride)	Join	t length 12	∴0F1 Total le	ngth 376.0 Ft	Length	Surveyed	372.10 Ft
Lining				Ye	ar laid	Year rehab	ilitated	Weather	Dry	
Purpose	P	re-Acceptance	е		C	at				
Addition	al inf	o PUI	MP STATION	IS CAUSING EXC	CESSIVE W	ATER FLOW	Structural	O & M	Const	ructional
Location	1 I	Main Highway	/ - Suburban/l	Rural			Miscellaneous	Hydraulic		
Project	BR	OOKFIELD S	SES-11-19-2	2019			Work	Order		
Northing	3				Easting	J	Elev	ation		
Coordina	ate Sy	/stem					GPS Accura	су		

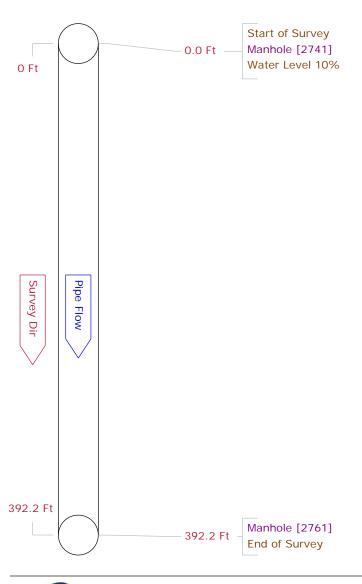




Pipe Graphic Report of PSR 2741-2761

for CDM

Setup	6	Surveyor	JOG		Certificate #	U-615-	07000378	System Ow	ner BROOK	KFIELD WF	PCA
Drainage)			Survey Custo	mer CDM SMIT	Ή					
P/O #			Date 2	2019/11/20	Time 12:26	S	treet FEDE	RAL RD			
City	BRO	OKFIELD		Further I	ocation details	3					
Up 2	2741			Rim	to invert		Grade to i	nvert	Rim to	grade	Ft
Down 2	2761			Rim	to invert		Grade to i	nvert	Rim to	grade	Ft
Use Sai	nitary			Direction	Downstream	Flov	v control N	lot Controlled	Med	ia No	
Shape (Circula	r		Height	8 Width	ins	Prec	ean J	Date Cle	aned 2019	9/11/20
Material	Poly	vinyl Chloride	•		Joint length 12	2. 0F1	Total lengt	h 390.4 Ft	Length	Surveyed	392.20 Ft
Lining					Year laid	Yea	ır rehabilita	ated	Weather	Saturated	
Purpose	Ro	outine Assess	sment		C	Cat					
Addition	al info)					S	itructural	O & M	Constru	uctional
Location	ı N	Лаin Highway	/ - Suburb	an/Rural			N	liscellaneous	Hydraulic		
Project	BR	OOKFIELD S	SES-11-2	0-2019				Work	Order		
Northing	I				Easting	3		Eleva	ation		
Coordina	ate Sy	stem						GPS Accurac	y		

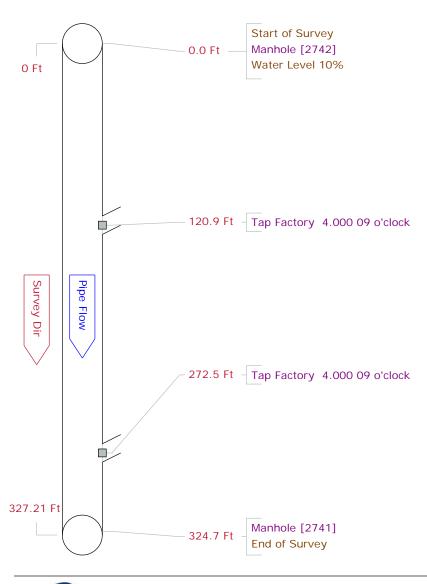




Pipe Graphic Report of PSR 2742-2741

for CDM

Setup	5	Surveyor	JOG		Certificate #	U-615-0700037	8 System Ov	vner BROOK	KFIELD WF	PCA
Drainage	е			Survey Custo	mer CDM SMIT	Ή				
P/O #			Date	2019/11/20	Time 12:04	Street FE	DERAL RD			
City	BRC	OKFIELD		Further	location details	S				
Up 2	2742			Rin	n to invert	Grade 1	o invert	Rim to	grade	Ft
Down 2	2741			Rin	n to invert	Grade 1	o invert	Rim to	grade	Ft
Use Sa	nitary			Direction	n Downstream	Flow contro	Not Controlled	Medi	ia No	
Shape (Circula	r		Height	8 Width	ins Pr	eclean J	Date Cle	aned 2019	9/11/20
Material	Poly	vinyl Chloride	:		Joint length 12	.0F1 Total le	ngth 327.2 Ft	Length	Surveyed	324.70 Ft
Lining					Year laid	Year rehab	ilitated	Weather	Saturated	
Purpose	R	outine Assess	sment		C	Cat				
Addition	al info)					Structural	O & M	Constri	uctional
Location	ı M	Main Highway	- Subur	ban/Rural			Miscellaneous	Hydraulic		
Project	BR	OOKFIELD S	SES-11-	20-2019			Work	Order		
Northing)				Easting	3	Elev	ation		
Coordina	ate Sy	stem					GPS Accura	су		





for CDM **CCTV Picture List of** 2742-2741

Work Order			Setup 5
Video	Survey Date	2019/11/20	
Path to picture files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191120-CDM\Snaps	s\191120-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191120-CDM\Movie	s\191120-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191120-CDM\Media	\191120-CDM-1991\



Count 120.9 Ft Video Index Code Tap Factory

Remarks

File Name 19.jpg



Count 272.5 Ft Video Index Code Tap Factory

File Name 20.jpg

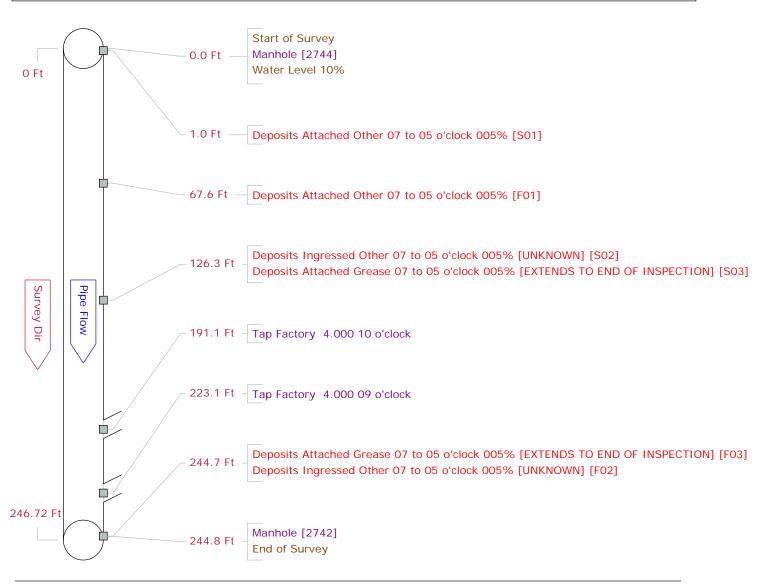
Remarks



Pipe Graphic Report of PSR 2744-2742

for	CDM SMITH
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Setup	6	Surveyor	JOG		Certificate #	U-615-070003	78 System Ov	vner BROOK	FIELD WI	PCA
Drainag	je		,	Survey Custom	er CDM SMIT	Н				
P/O #			Date 2	019/11/19	Time 14:07	Street F	EDERAL RD			
City	BR	OOKFIELD		Further lo	cation details	5				
Up	2744			Rim	to invert	Grade	to invert	Rim to	grade	Ft
Down	2742			Rim	to invert	Grade	to invert	Rim to	grade	Ft
Use Sa	anitary			Direction	Downstream	Flow conti	ol Not Controlled	Medi	a No	
Shape	Circula	ar		Height 8	Width	ins F	reclean J	Date Cle	aned	
Materia	I Pol	vinyl Chloride	•	Jo	oint length 12	.Œt Total l	ength 246.7 Ft	Length	Surveyed	244.80 Ft
Lining					Year laid	Year reha	bilitated	Weather	Dry	
Purpos	e F	Routine Asses	sment		C	at				
Additio	nal inf	o PU	MP STATION	ONS CAUSING I	EXCESSIVE W	ATER FLOW	Structural	O & M	Constr	uctional
Locatio	n	Main Highway	y - Suburba	an/Rural			Miscellaneous	Hydraulic		
Project	BF	ROOKFIELD S	SSES-11-1	9-2019			Work	Order		
Northin	g				Easting	3	Elev	ation		
Coordin	nate S	ystem					GPS Accura	су		





CCTV Picture List of 2744-2742 for CDM SMITH

Work Order			Setup 6
Video	Survey Date	2019/11/19	
Path to picture files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191119-CDM\Snaps	s\191119-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191119-CDM\Movie	s\191119-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191119-CDM\Media	\191119-CDM-1991\



Video Index Count 1.0 Ft

Code Deposits Attached Other

Remarks

File Name 15.jpg



Video Index Count 126.3 Ft

Code Deposits Ingressed Other

Remarks UNKNOWN

File Name 16.jpg



Video Index Count 191.1 Ft

Code Tap Factory

Remarks

File Name 13.jpg



Video Index Count 223.1 Ft

Code Tap Factory

Remarks

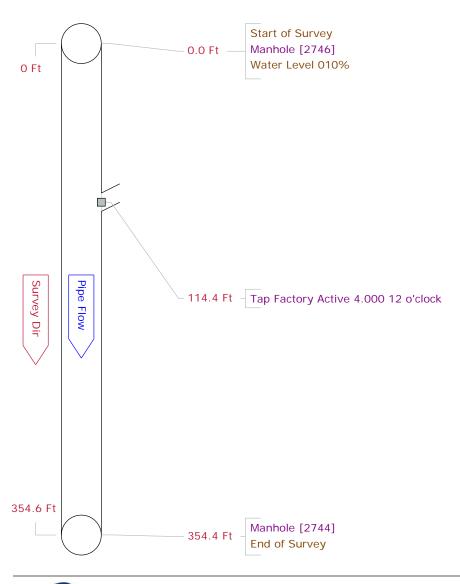
File Name 14.jpg



Pipe Graphic Report of PSR 2746-2744

for	CDM SMITH
101	

Setup 5 Surveyor JOG	Certificate #	U-615-07000378	System Ow	ner BROOK	FIELD WPCA
Drainage Survey Custo	mer CDM SMITH	4			
P/O # Date 2019/11/19	Time 13:35	Street FED	ERAL RD		
City BROOKFIELD Further	location details				
Up 2746 Ri n	n to invert	Grade to	invert	Rim to	grade Ft
Down 2744 Rin	n to invert	Grade to	invert	Rim to	grade Ft
Use Sanitary Direction	n Downstream	Flow control	Not Controlled	Medi	a No
Shape Circular Height	8 Width	ins Pre	clean J	Date Clea	aned
Material Polyvinyl Chloride	Joint length 12.	©F1 Total len	gth 354.6 Ft	Length S	Surveyed 354.40 Ft
Lining	Year laid	Year rehabili	itated	Weather	Dry
Purpose Routine Assessment	C	at			
Additional info PUMP STATIONS CAUSING	S EXCESSIVE WA	ATER FLOW	Structural	O & M	Constructional
Location Main Highway - Suburban/Rural			Miscellaneous	Hydraulic	
Project BROOKFIELD SSES-11-19-2019			Work	Order	
Northing	Easting		Eleva	ation	
Coordinate System			GPS Accurac	y	





for CDM SMITH **CCTV Picture List of** 2746-2744

Work Order			Setup 5
Video	Survey Date	2019/11/19	
Path to picture files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191119-CDM\Snaps	s\191119-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191119-CDM\Movie	s\191119-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191119-CDM\Media	\191119-CDM-1991\



Video Index **Count** 114.4 Ft Code Tap Factory Active Remarks

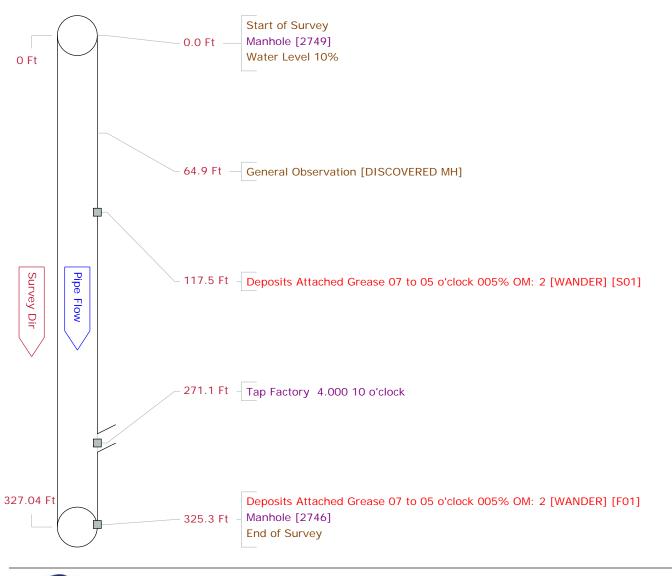
File Name 12.jpg



Pipe Graphic Report of PSR 2749-2746

for CDM SMITH

Surveyor	JOG	Се	rtificate #	U-615-07000378	System Ov	vner BROOK	FIELD W	PCA
	Surv	vey Customer	CDM SMIT	Н				
	Date 2019/	/11/19 -	Γime 12:57	Street FED	ERAL RD			
ROOKFIELD		Further loca	tion details	3				
)		Rim to	invert	Grade to	invert	Rim to	grade	Ft
;		Rim to	invert	Grade to	invert	Rim to	grade	Ft
у		Direction Do	wnstream	Flow control	Not Controlled	Medi	a No	
ılar		Height 10	Width	ins Pre	clean J	Date Cle	aned	
olyvinyl Chloride)	Join	t length 12	.Œ1 Total len	gth 327.0 Ft	Length	Surveyed	325.30 Ft
		Υe	ar laid	Year rehabil	itated	Weather	Dry	
Routine Assess	sment		C	at				
nfo PUI	MP STATIONS	CAUSING EX	CESSIVE W	ATER FLOW	Structural	O & M	Const	uctional
Main Highway	/ - Suburban/R	ural			Miscellaneous	Hydraulic		
ROOKFIELD S	SES-11-19-20	19		L	Work	Order		
			Easting]	Elev	ation		
System					GPS Accurac	cy		
	Surveyor ROOKFIELD S S Juliar Solyvinyl Chloride Routine Assess Info PUI Main Highway BROOKFIELD S	Surveyor JOG Su	Survey Customer Date 2019/11/19 ROOKFIELD Further loca Rim to a R	Surveyor JOG Certificate # Survey Customer CDM SMIT Date 2019/11/19 Time 12:57 ROOKFIELD Further location details Rim to invert Rim to invert Direction Downstream Height 10 Width Divvinyl Chloride Joint length 12 Year laid Routine Assessment Company STATIONS CAUSING EXCESSIVE W Main Highway - Suburban/Rural BROOKFIELD SSES-11-19-2019 Easting	Surveyor JOG Certificate # U-615-07000378 Survey Customer CDM SMITH Date 2019/11/19 Time 12:57 Street FED ROOKFIELD Further location details Rim to invert Grade to Rim to invert Grade to Sy Direction Downstream Flow control Ular Height 10 Width ins Presolyvinyl Chloride Joint length 12.0F1 Total len Year laid Year rehabil Routine Assessment Cat Info PUMP STATIONS CAUSING EXCESSIVE WATER FLOW Main Highway - Suburban/Rural BROOKFIELD SSES-11-19-2019 Easting	Surveyor JOG Certificate # U-615-07000378 System Ov Survey Customer CDM SMITH Date 2019/11/19 Time 12:57 Street FEDERAL RD ROOKFIELD Further location details Rim to invert Grade to invert Rim to invert Grade to invert Direction Downstream Flow control Not Controlled Instruction Precious Joint length 12.0F1 Total length 327.0 Ft Year laid Year rehabilitated Routine Assessment Cat Main Highway - Suburban/Rural BROOKFIELD SSES-11-19-2019 Work Easting Elever	Surveyor JOG Certificate # U-615-07000378 System Owner BROOM Survey Customer CDM SMITH Date 2019/11/19 Time 12:57 Street FEDERAL RD ROOKFIELD Further location details Rim to invert Grade to invert Rim to	Surveyor JOG Certificate # U-615-07000378 System Owner BROOKFIELD WIND Survey Customer CDM SMITH Date 2019/11/19 Time 12:57 Street FEDERAL RD ROOKFIELD Further location details Rim to invert Grade to invert Rim to grade Rim to invert Grade to invert Rim to grade Rim to invert Grade to invert Rim to grade Rim to invert Grade to invert Rim to grade Rim to invert Grade to invert Rim to grade Rim to invert Grade to invert Rim to grade Rim to grade Rim to invert Grade to invert Rim to grade Rim to grade Rim to invert Grade to invert Rim to grade Rim to grade Rim to invert Grade to invert Rim to grade Rim to grade Rim to invert Grade to invert Rim to grade Rim to





CCTV Picture List of 2749-2746 for CDM SMITH

Work Order			Setup 4
Video	Survey Date	2019/11/19	
Path to picture files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191119-CDM\Snaps	\191119-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191119-CDM\Movie	s\191119-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191119-CDM\Media	\191119-CDM-1991\



Count 64.9 Ft Video Index

Code General Observation Remarks DISCOVERED MH

File Name 9.jpg



Video Index **Count** 117.5 Ft

Code Deposits Attached Grease

Remarks WANDER

File Name 10.jpg



Count 271.1 Ft Video Index

Code Tap Factory

Remarks

File Name 11.jpg



CCTV Picture List of 2749-2746 for CDM

		Setup 4
Survey Date	2019/11/19	
Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\S	Snaps\191115-CDM-1991\
Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\N	Movies\191115-CDM-1991\
Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\N	/ledia\191115-CDM-1991∖
	Z:\AES\1991 - CDM BF Z:\AES\1991 - CDM BF	Survey Date 2019/11/19 Z:\AES\1991 - CDM BROOKFIELD SSE\191115-CDM-1991\N Z:\AES\1991 - CDM BROOKFIELD SSE\191115-CDM-1991\N Z:\AES\1991 - CDM BROOKFIELD SSE\191115-CDM-1991\N



Count 64.9 Ft Video Index

Code General Observation Remarks DISCOVERED MH

File Name 49.jpg



Video Index **Count** 117.5 Ft

Code Deposits Attached Grease

Remarks WANDER

File Name 50.jpg



Count 271.1 Ft Video Index

Code Tap Factory

Remarks

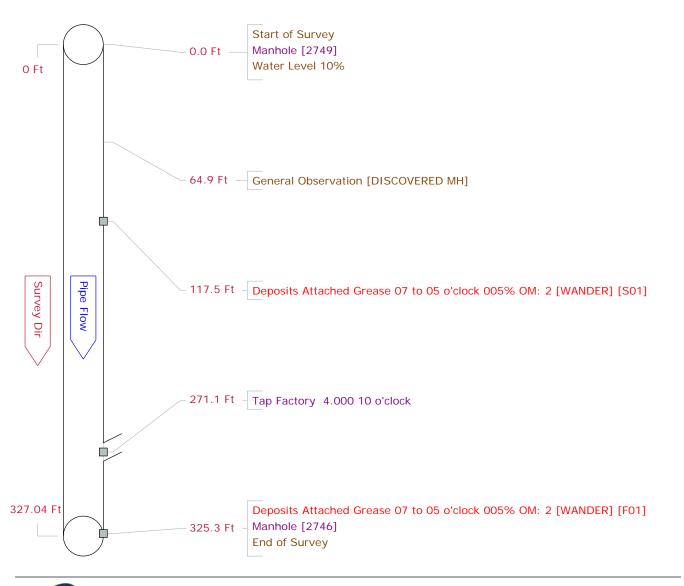
File Name 51.jpg



Pipe Graphic Report of PSR 2749-2746

for CDM

Setup	4	Surveyor	JOG	Се	rtificate #	U-615-070003	78 System Ov	vner BROOK	KFIELD W	PCA
Drainage)		Su	ırvey Customer	CDM SMIT	Н				
P/O #			Date 201	9/11/19	Time 12:57	Street Fl	EDERAL RD			
City	BRO	OKFIELD		Further loca	tion details	3				
Up 2	749			Rim to	invert	Grade	to invert	Rim to	grade	Ft
Down 2	2746			Rim to	invert	Grade	to invert	Rim to	grade	Ft
Use Sar	nitary			Direction Do	wnstream	Flow contr	ol Not Controlled	Med	ia No	
Shape C	Circular			Height 10	Width	ins P	reclean J	Date Cle	aned	
Material	Poly	inyl Chloride	;	Joir	it length 12	∴Œ1 Total le	ength 327.0 Ft	Length	Surveyed	325.30 Ft
Lining				Ye	ear laid	Year rehal	oilitated	Weather	Dry	
Purpose	Ro	utine Assess	sment		C	at				
Addition	al info	PUN	MP STATION	S CAUSING EX	CESSIVE W	ATER FLOW	Structural	O & M	Const	ructional
Location	N	1ain Highway	/ - Suburban/	/Rural			Miscellaneous	Hydraulic		
Project	BRO	OKFIELD S	SES-11-19-2	2019			Work	Order		
Northing					Easting	J	Elev	ation		
Coordina	ate Sy	stem					GPS Accura	су		

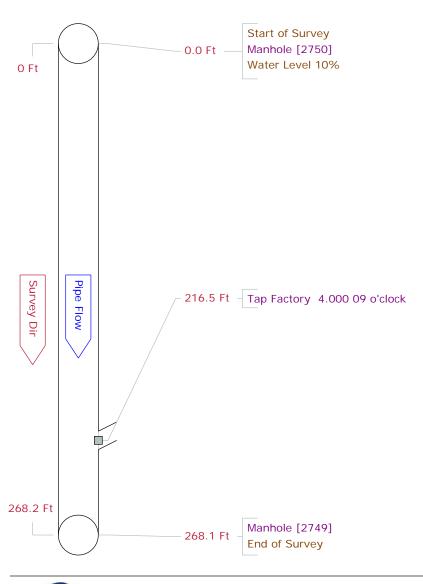




Pipe Graphic Report of PSR 2750-2749

for	CDM SMITH
-----	-----------

Setup 3 Surveyor JOG	Certificate #	U-615-07000378	System Owr	ner BROOKFII	ELD WPCA
Drainage Survey Co	ustomer CDM SMITH	1			
P/O # Date 2019/11/19	Time 10:43	Street FED	ERAL RD		
City BROOKFIELD Furt	her location details				
Up 2750	Rim to invert	Grade to	invert	Rim to gra	ade Ft
Down 2749	Rim to invert	Grade to	invert	Rim to gra	ade Ft
Use Sanitary Direct	ction Downstream	Flow control	Not Controlled	Media I	No
Shape Circular Hei	ght 10 Width	ins Pre	clean H	Date Clean	ed
Material Polyvinyl Chloride	Joint length 12.	Œ1 Total len	gth 268.2 Ft	Length Su	rveyed 268.10 Ft
Lining	Year laid	Year rehabil	itated	Weather Dry	/
Purpose Routine Assessment	Ca	at			
Additional info PUMP STATIONS CAUS	SING EXCESSIVE WA	ATER FLOW	Structural	O & M	Constructional
Location Main Highway - Suburban/Rural			Miscellaneous	Hydraulic	
Project BROOKFIELD SSES-11-19-2019			Work (Order	
Northing	Easting		Eleva	ition	
Coordinate System			GPS Accuracy	У	





for CDM SMITH **CCTV Picture List of** 2750-2749

Work Order			Setup 3
Video	Survey Date	2019/11/19	
Path to picture files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191119-CDM\Snaps	s\191119-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191119-CDM\Movie	s\191119-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191119-CDM\Media	\191119-CDM-1991\

Count 216.5 Ft



Video Index Code Tap Factory Remarks

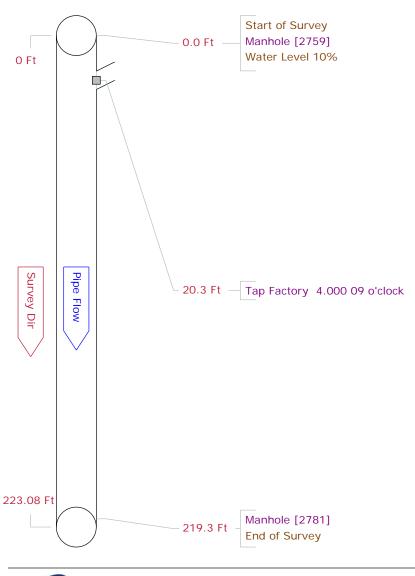
File Name 8.jpg



Pipe Graphic Report of PSR 2759-2781

for CDM

Setup	3	Surveyor	JOG	Cer	tificate #	U-615-	07000378	System Ow	ner BROO	KFIELD WP	PCA
Drainag	je		Sur	vey Customer	CDM SMITH	4					
P/O #			Date 2019	9/11/21 T	ime 9:00	St	reet FEDE	RAL RD			
City	BF	ROOKFIELD		Further locat	ion details						
Up	2759			Rim to i	nvert		Grade to i	nvert	Rim to	grade	Ft
Down	2781			Rim to i	nvert		Grade to i			grade	Ft
Use Sa	anitar	/		Direction Dov	vnstream	Flov		De-Watered usir letter	^{ng} Med	lia No	
Shape	Circu	lar		Height 10	Width	ins	Prec	lean J	Date Cle	eaned 2019	9/11/21
Materia	l Po	lyvinyl Chloride	Э	Joint	t length 12.	Œ1	Total leng	th 223.1 Ft	Length	Surveyed	219.30 Ft
Lining				Ye	ar laid	Yea	r rehabilit	ated	Weather	Dry	
Purpos	е	Routine Asses	sment		C	at					
Additio	nal ir	ifo EX	CESSIVE FLC	W DUE TO FOR	RCE MAINS		5	Structural	O & M	Constru	uctional
Locatio	n	Main Highway	y - Suburban/F	Rural			N	/liscellaneous	Hydraulic		
Project	В	ROOKFIELD S	SSES-11-21-20	019				Work	Order		
Northin	g				Easting			Elev	ation		
Coordin	nate S	System						GPS Accurac	у		





CCTV Picture List of for CDM 2759-2781

Work Order			Setup 3
Video	Survey Date	2019/11/21	
Path to picture files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191121-CDM\Snap	s\191121-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191121-CDM\Movie	es\191121-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191121-CDM\Media	a\191121-CDM-1991\



Video Index Count 20.3 Ft Code Tap Factory Remarks

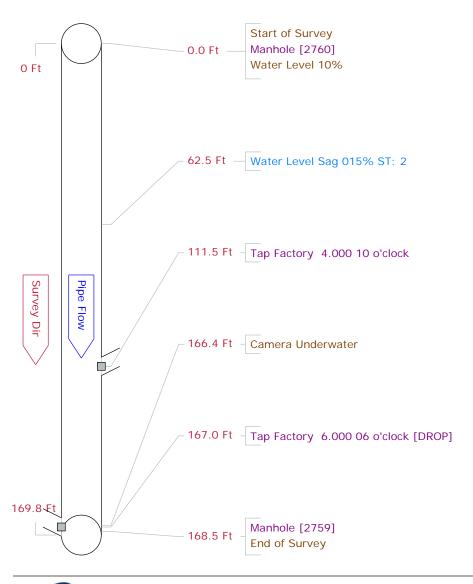
File Name 15.jpg



Pipe Graphic Report of PSR 2760-2759

for CDM

Setup	2	Surveyor	JOG	Cei	rtificate #	U-615-070	00378	System Ow	ner BROOK	KFIELD WF	PCA
Draina	ge		Su	rvey Customer	CDM SMIT	Н					
P/O #			Date 2019	9/11/21 1	ime 8:40	Stree	t FEDER	RAL RD			
City	BR	OOKFIELD		Further locat	ion details	;					
Up	2760			Rim to i	nvert	Gra	ade to in	vert	Rim to	grade	Ft
Down	2759			Rim to i	nvert	Gra	ade to in	vert	Rim to	grade	Ft
Use S	Sanitary			Direction Do	wnstream	Flow co	ontrol No	ot Controlled	Medi	ia No	
Shape	Circul	ar		Height 10	Width	ins	Precle	an J	Date Cle	aned 2019	9/11/21
Materia	al Pol	yvinyl Chloride)	Join	t length 12	.Œ1 Tot	al length	າ 169.8 Ft	Length	Surveyed	168.50 Ft
Lining				Ye	ar laid	Year re	habilitat	ted	Weather	Dry	
Purpos	se F	Routine Assess	sment		C	at					
Additio	onal in	fo EXC	CESSIVE FLO	OW DUE TO FOR	RCE MAINS		St	ructural	O & M	Constr	uctional
Location	on	Main Highway	/ - Suburban/l	Rural			Mi	scellaneous	Hydraulic		
Project	t BI	ROOKFIELD S	SES-11-21-2	2019				Work	Order		
Northir	ng				Easting	I		Eleva	ation		
Coordi	inate S	ystem					(GPS Accurac	;y		





CCTV Picture List of 2760-2759 for CDM

Work Order			Setup 2
Video	Survey Date	2019/11/21	
Path to picture files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191121-CDM\Snaps	s\191121-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191121-CDM\Movie	s\191121-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191121-CDM\Media	\191121-CDM-1991\



Count 62.5 Ft Video Index

Code Water Level Sag

Remarks

File Name 11.jpg



Video Index **Count** 111.5 Ft

Code Tap Factory

Remarks

File Name 12.jpg



Count 166.4 Ft Video Index

Code Camera Underwater

Remarks

File Name 13.jpg



Video Index **Count** 167.0 Ft

Code Tap Factory Remarks DROP

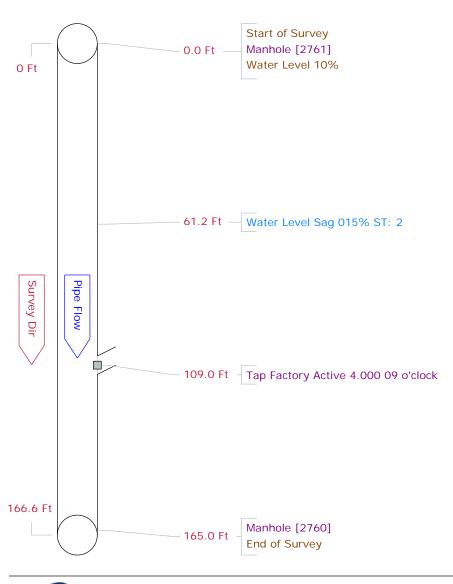
File Name 14.jpg



Pipe Graphic Report of PSR 2761-2760

for CDM

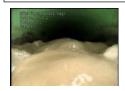
Setup	1	Surveyor	JOG	Ce	rtificate #	U-615-07	000378	System Ow	ner BROOK	KFIELD WF	CA
Drainage	е		Sur	vey Customer	CDM SMITH	4					
P/O #			Date 2019	/11/21 1	ime 8:29	Stre	et FEDE	RAL RD			
City	BRO	OKFIELD		Further locat	tion details						
Up :	2761			Rim to i	nvert	G	rade to i	nvert	Rim to	grade	Ft
Down	2760			Rim to i	nvert	G	rade to i	nvert	Rim to	grade	Ft
Use Sa	nitary			Direction Do	wnstream	Flow	control N	lot Controlled	Med	ia No	
Shape	Circula	r		Height 8	Width	ins	Preci	ean J	Date Cle	aned 2019	9/11/21
Material	Poly	vinyl Chloride	•	Join	t length 12.	Œ1 To	tal lengt	th 166.6 Ft	Length	Surveyed	165.00 Ft
Lining				Ye	ar laid	Year	rehabilita	ated	Weather	Dry	
Purpose	e Ro	outine Assess	sment		C	at					
Addition	al info	eX(CESSIVE FLO	W DUE TO FOR	RCE MAINS		S	itructural	O & M	Constru	uctional
Location	1 N	∕lain Highway	/ - Suburban/R	tural			N	liscellaneous	Hydraulic		
Project	BR	OOKFIELD S	SSES-11-21-20)19				Work	Order		
Northing	3				Easting			Eleva	ation		
Coordin	ate Sy	stem						GPS Accurac	;y		





for CDM **CCTV Picture List of** 2761-2760

Work Order			Setup 1
Video	Survey Date	2019/11/21	
Path to picture files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191121-CDM\Snaps	s\191121-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191121-CDM\Movie	s\191121-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191121-CDM\Media	\191121-CDM-1991\



Count 61.2 Ft Video Index

Code Water Level Sag

Remarks

File Name 9.jpg



Count 109.0 Ft Video Index

Code Tap Factory Active

Remarks

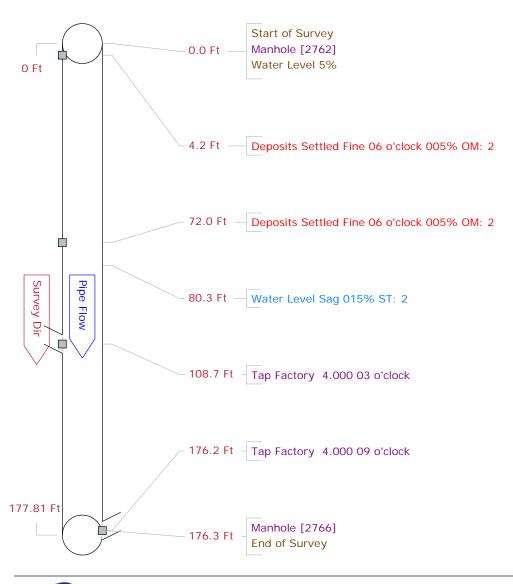
File Name 10.jpg



Pipe Graphic Report of PSR 2762-2766

for CDM

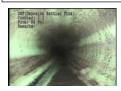
Setup	3 Surv	eyor	JOG		Certificate #	U-615-07	000378	System Ow	ner BROOK	KFIELD W	PCA
Drainage			8	Survey Custon	ner CDM SMIT	Н					
P/O #			Date 2	019/11/14	Time 10:59	Stre	et FEDE	RAL RD			
City	BROOKFIE	LD		Further Id	cation details	6					
Up 27	762			Rim	to invert	Gı	ade to i	nvert	Rim to	grade	Ft
Down 27	766			Rim	to invert	Gı	ade to i	nvert	Rim to	grade	Ft
Use Sani	itary			Direction	Downstream	Flow c	ontrol N	lot Controlled	Med	ia No	
Shape Ci	ircular			Height 8	Width	ins	Prec	lean J	Date Cle	aned	
Material	Polyvinyl C	hloride		J	oint length 12	.0F1 To	tal leng	th 177.8 Ft	Length	Surveyed	176.30 Ft
Lining					Year laid	Year r	ehabilita	ated	Weather	Damp	
Purpose	Routine A	Assess	ment		C	at					
Additiona	ıl info						5	Structural	O & M	Const	ructional
Location	Main Hi	ghway	- Suburba	n/Rural			N	liscellaneous	Hydraulic		
Project	BROOKFI	ELD S	SES-11-14	4-2019				Work	Order		
Northing					Easting	J		Elev	ation		
Coordinat	te System							GPS Accurac	;y		





CCTV Picture List of 2762-2766 for CDM

		Setup 3
Survey Date	2019/11/14	
Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191114-CDM-1991\S	Snaps\191114-CDM-1991\
Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191114-CDM-1991\M	Movies\191114-CDM-1991\
Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191114-CDM-1991\N	/ledia\191114-CDM-1991\
	Z:\AES\1991 - CDM BF Z:\AES\1991 - CDM BF	Survey Date 2019/11/14 Z:\AES\1991 - CDM BROOKFIELD SSE\191114-CDM-1991\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\



Video Index Count 4.2 Ft

Code Deposits Settled Fine

Remarks

File Name 16.jpg



Video Index Count 72.0 Ft

Code Deposits Settled Fine

Remarks

File Name 17.jpg

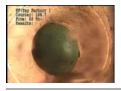


Video Index Count 80.3 Ft

Code Water Level Sag

Remarks

File Name 18.jpg



Video Index Count 108.7 Ft

Code Tap Factory

Remarks

File Name 19.jpg



Video Index Count 176.2 Ft

Code Tap Factory

Remarks

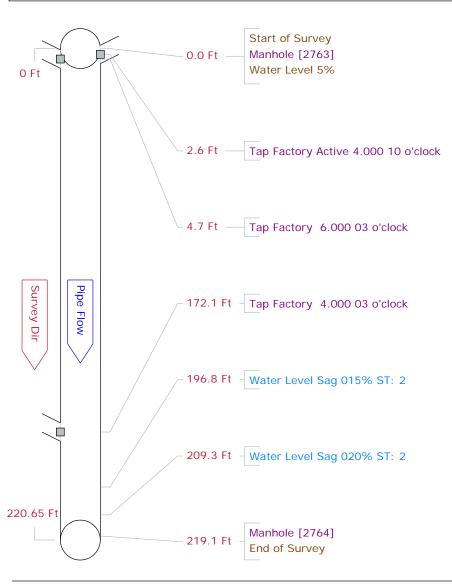
File Name 20.jpg



Pipe Graphic Report of PSR 2763-2764

for CDM

Setup 1 Surveyor JOG	Certificate #	U-615-07000378 System Ov	vner BROOKFIELD W	PCA		
Drainage Sur	vey Customer CDM SMITI	Н				
P/O # Date 2019	9/11/14 Time 9:34	Street FEDERAL RD				
City BROOKFIELD	Further location details					
Up 2763	Rim to invert	Grade to invert	Rim to grade	Ft		
Down 2764	Rim to invert	Grade to invert	Rim to grade	Ft		
Use Sanitary	Direction Downstream	Flow control Not Controlled	Media No			
Shape Circular	Height 8 Width	ins Preclean J	Date Cleaned			
Material Polyvinyl Chloride	Joint length 12	OF1 Total length 220.7 Ft	Length Surveyed 219.10			
Lining	Year laid	Year rehabilitated	Weather Damp			
Purpose Routine Assessment	С	at				
Additional info		Structural	O & M Const	ructional		
Location Main Highway - Suburban/F	Rural	Miscellaneous	Hydraulic			
Project BROOKFIELD SSES-11-14-2	019 Work Order					
Northing	Easting	Easting Elevation				
Coordinate System	GPS Accuracy					





CCTV Picture List of 2763-2764 for CDM

Work Order			Setup 1
Video	Survey Date	2019/11/14	
Path to picture files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191114-CDM-1991\S	Snaps\191114-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191114-CDM-1991\M	Movies\191114-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191114-CDM-1991\N	/ledia\191114-CDM-1991\



Video Index Count 2.6 Ft

Code Tap Factory Active

Remarks

File Name 9.jpg



Video Index Count 4.7 Ft

Code Tap Factory

Remarks

File Name 10.jpg



Video Index Count 172.1 Ft

Code Tap Factory

Remarks

File Name 11.jpg



Video Index Count 196.8 Ft

Code Water Level Sag

Remarks

File Name 12.jpg



Video Index Count 209.3 Ft

Code Water Level Sag

Remarks

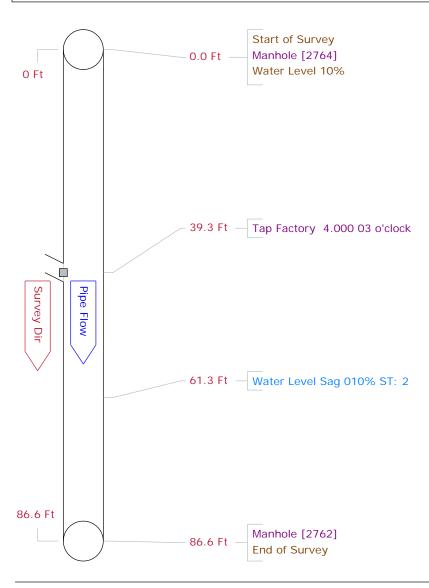
File Name 13.jpg



Pipe Graphic Report of PSR 2764-2762

for CDM

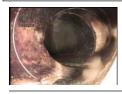
Setup	2 Surveyor	JOG	Cer	rtificate #	U-615-07000	378 System O	wner BROOF	KFIELD WPCA
Drainage		Survey (Customer	CDM SMIT	Н			
P/O #		Date 2019/11/1	4 T	ime 10:02	Street	FEDERAL RD		
City	BROOKFIELD	Fu	rther locat	ion details	;			
Up 27	64		Rim to i	nvert	Grad	e to invert	Rim to	grade Ft
Down 2762			Rim to i	im to invert Grade to invert		Rim to	grade Ft	
Use Sanit	ary	Dir	ection Dov	wnstream	Flow con	trol Not Controlled	Med	ia No
Shape Circular			eight 8	Width	ins	ins Preclean J		aned
Material	Polyvinyl Chloride	Joint	Joint length 12.0F1 Total length 85.3 Ft		Length Surveyed 86.60			
Lining			Ye	ar laid	Year reh	abilitated	Weather	Damp
Purpose	Routine Assess	sment		C	at			
Additional	info					Structural	O & M	Constructional
Location	Main Highway	- Suburban/Rural				Miscellaneous	Hydraulic	
Project	BROOKFIELD S	SES-11-14-2019				Worl	k Order	
Northing			Easting Elevation					
Coordinate	e System					GPS Accura	су	





for CDM **CCTV Picture List of** 2764-2762

Work Order			Setup 2
Video	Survey Date	2019/11/14	
Path to picture files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191114-CDM-1991\S	naps\191114-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BR	ROOKFIELD SSE\191114-CDM-1991\M	lovies\191114-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BR	ROOKFIELD SSE\191114-CDM-1991\M	ledia\191114-CDM-1991\



Video Index Count 39.3 Ft Code Tap Factory Remarks

File Name 14.jpg



Video Index Count 61.3 Ft

Remarks

File Name 15.jpg

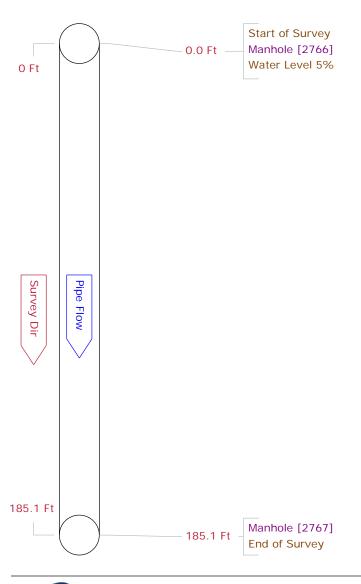
Code Water Level Sag



Pipe Graphic Report of PSR 2766-2767

for CDM

Setup 4 Surveyor JOG	Certificate #	U-615-07000378	System Own	er BROOK	FIELD WPCA	
Drainage Survey Custo	mer CDM SMITH	ł				
P/O # Date 2019/11/14	Time 12:21	Street FEDE	RAL RD			
City BROOKFIELD Further	location details					
Up 2766 Ri r	n to invert	Grade to	invert	Rim to g	grade Ft	
Down 2767 Rin	im to invert Grade to in		invert	Rim to g	grade Ft	
Use Sanitary Direction	n Downstream	Flow control	Not Controlled	Media	a No	
Shape Circular Height	8 Width	ins Pred	lean J	Date Clea	ned	
Material Polyvinyl Chloride	Joint length 12.0	Ft Total leng	th 184.1 Ft	Length S	Surveyed 185.10 Ft	
Lining	Year laid	Year rehabilit	ated	Weather [Damp	
Purpose Routine Assessment	Ca	at				
Additional info		:	Structural	O & M	Constructional	
Location Main Highway - Suburban/Rural		1	Miscellaneous	Hydraulic		
Project BROOKFIELD SSES-11-14-2019			Work C	Order		
Northing	Easting	Easting Elevation				
Coordinate System			GPS Accuracy	,		

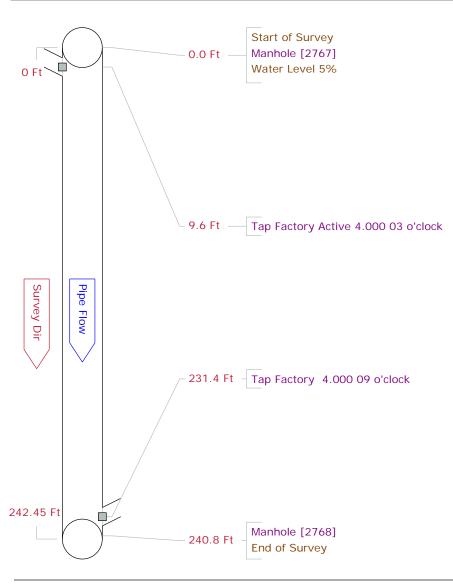




Pipe Graphic Report of PSR 2767-2768

for CDM

Setup	5	Survey	or	JOG		Certificate #	t U-61	5-07000378	System Ow	ner BROOK	KFIELD W	PCA
Draina	ge				Survey Custo	mer CDM SM	ITH					
P/O #				Date 2	2019/11/14	Time 13:5	1 :	Street FEDE	RAL RD			
City	В	ROOKFIELD			Further	location deta	ils					
Up	276	7			Rin	Rim to invert Grade t		Grade to	e to invert		Rim to grade	
Down 2768				Rin	im to invert Grade to invert		invert	Rim to grade		Ft		
Use Sanitary Dir					Direction	n Downstream	Flo	Flow control Not Controlled		Media No		
Shape Circular				Height	8 Width	ins	ins Preclean J		Date Cleaned			
Material Polyvinyl Chloride						Joint length 12.0F1 Total length 242.5 Ft		th 242.5 Ft	Length Surveyed 240.80		240.80 Ft	
Lining						Year laid	Υe	ar rehabilit	ated	Weather	Damp	
Purpos	se	Routine Ass	essr	nent			Cat					
Additio	onal i	nfo							Structural	O & M	Const	ructional
Location	on	Main High	vay -	- Suburb	an/Rural			1	Miscellaneous	Hydraulic		
Projec	t I	BROOKFIEL	D SS	SES-11-1	4-2019	Work Order						
Northi	ng					Easting Elevation						
Coordi	inate	System	GPS Accuracy									





for CDM **CCTV Picture List of** 2767-2768

Work Order			Setup 5
Video	Survey Date	2019/11/14	
Path to picture files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191114-CDM-1991\	Snaps\191114-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191114-CDM-1991\	Movies\191114-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191114-CDM-1991\	Media\191114-CDM-1991\



Count 9.6 Ft Video Index

Code Tap Factory Active

Remarks

File Name 21.jpg



Count 231.4 Ft Video Index

Code Tap Factory

Remarks

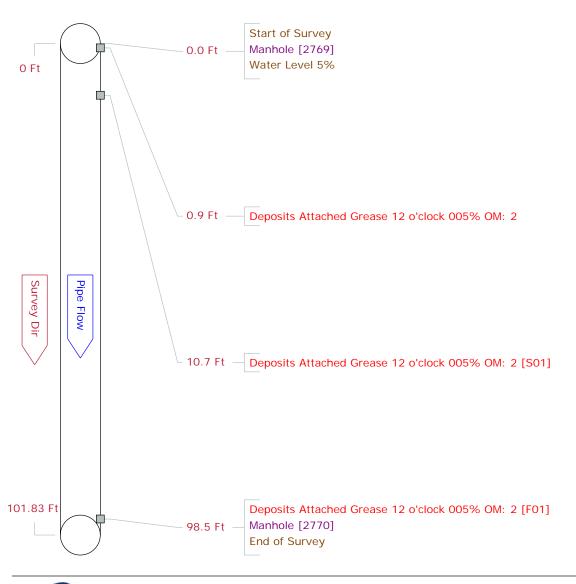
File Name 22.jpg



Pipe Graphic Report of PSR 2769-2770

for CDM

Setup 6 Surveyor JOG	Certificate #	U-615-07000378 System	n Owner BROOKFIELD	WPCA
Drainage Survey Cu	stomer CDM SMITH	1		
P/O # Date 2019/11/14	Time 14:39	Street FEDERAL RD		
City BROOKFIELD Furth	er location details			
Up 2769	Rim to invert	Grade to invert	Rim to grade	Ft
Down 2770	Rim to invert	Grade to invert	Rim to grade	Ft
Use Sanitary Direct	tion Downstream	Flow control Not Control	lled Media No	
Shape Circular Heig	jht 8 Width	ins Preclean J	Date Cleaned	
Material Polyvinyl Chloride	Joint length 12.	0F1 Total length 101.8 I	Ft Length Survey	ed 98.50 Ft
Lining	Year laid	Year rehabilitated	Weather Damp	
Purpose Routine Assessment	Ca	at		
Additional info		Structural	O & M Cor	structional
Location Main Highway - Suburban/Rural		Miscellane	ous Hydraulic	
Project BROOKFIELD SSES-11-14-2019			Work Order	
Northing	Easting		Elevation	
Coordinate System		GPS Ac	curacy	





CCTV Picture List of 2769-2770 for CDM

Work Order			Setup 6
Video	Survey Date	2019/11/14	
Path to picture files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191114-CDM-1991\	Snaps\191114-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191114-CDM-1991\	Movies\191114-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191114-CDM-1991\	Media\191114-CDM-1991\



Count 0.9 Ft Video Index

Code Deposits Attached Grease

Remarks

File Name 23.jpg



Video Index Count 10.7 Ft

Code Deposits Attached Grease

Remarks

File Name 24.jpg



for CDM **CCTV Picture List of** 2769-2770

Work Order			Setup 1
Video	Survey Date	2019/11/15	
Path to picture files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191115-CDM-1991\	Snaps\191115-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191115-CDM-1991\	Movies\191115-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191115-CDM-1991\	Media\191115-CDM-1991\



Video Index Count 1.0 Ft **Code** Deposits Attached Grease Remarks

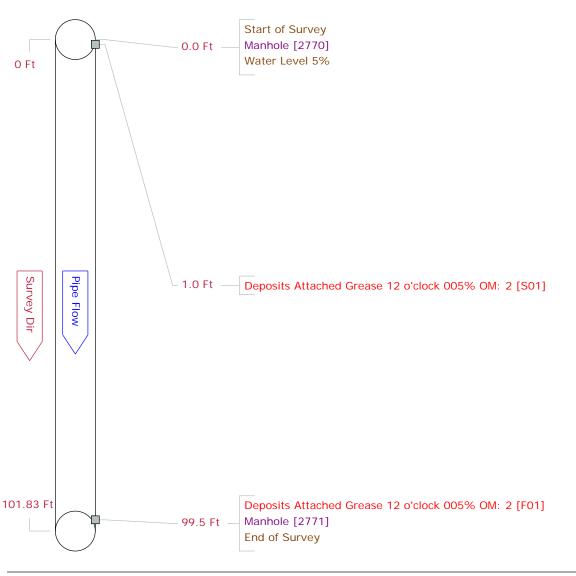
File Name 35.jpg



Pipe Graphic Report of PSR 2769-2770

for CDM

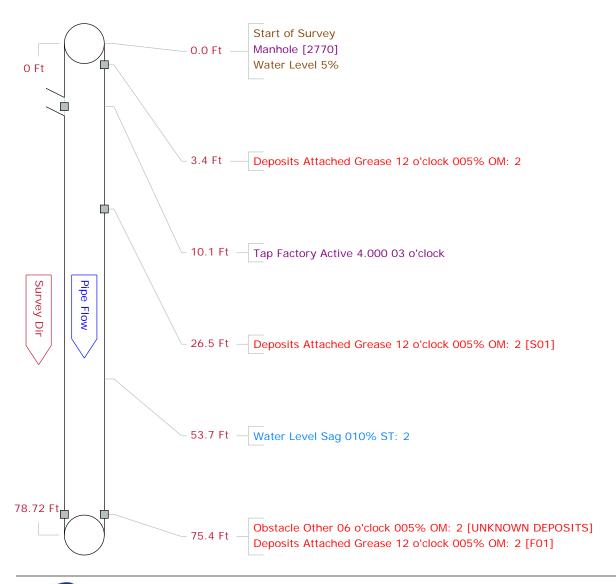
Setup	1	l Su	rveyor	JOG		Certificate #	U-615-0	7000378	System Ow	ner BROO	KFIELD WE	PCA
Draina	ge				Survey Custor	mer CDM SMIT	Ή					
P/O #				Date 2	2019/11/15	Time 9:03	Str	eet FEDE	RAL RD			
City	E	BROOKF	IELD		Further I	ocation details	8					
Up	276	39			Rim	to invert	(Grade to i	nvert	Rim to	grade	Ft
Down	277	70			Rim	to invert	(Grade to i	nvert	Rim to	grade	Ft
Use S	anita	ary			Direction	Downstream	Flow	control N	Not Controlled	Med	ia No	
Shape	Circ	cular			Height	8 Width	ins	Prec	lean J	Date Cle	aned	
Materia	al F	Polyvinyl	Chloride)		loint length 12	2. 0F1 T	otal leng	th 101.8 Ft	Length	Surveyed	99.50 Ft
Lining						Year laid	Year	rehabilit	ated	Weather	Dry	
Purpos	se	Routin	e Assess	sment		C	Cat					
Additio	nal	info	CO	RRECTE	MH #S RE-DC	OF 11-14-2019)	5	Structural	O & M	Constr	uctional
Location	on	Main	Highway	/ - Suburb	an/Rural			N	/liscellaneous	Hydraulic		
Project	t	BROOK	FIELD S	SES-11-1	5-2019				Work	Order		
Northir	ng					Easting	9		Elev	ation		
Coordi	nate	Systen	n						GPS Accurac	у		





Pipe Graphic Report of PSR 2770-2771

Setup 7 Surveyor JOG	Certificate #	U-615-07000378	System Ow	ner BROOK	KFIELD WPCA
Drainage Survey Custo	mer CDM SMITH	1			
P/O # Date 2019/11/14	Time 14:47	Street FEDE	RAL RD		
City BROOKFIELD Further I	location details				
Up 2770 Rim	n to invert	Grade to i	nvert	Rim to	grade Ft
Down 2771 Rim	n to invert	Grade to i	nvert	Rim to	grade Ft
Use Sanitary Direction	Downstream	Flow control N	lot Controlled	Medi	ia No
Shape Circular Height	8 Width	ins Prec	ean J	Date Cle	aned
Material Polyvinyl Chloride	Joint length 12.	₵₣1 Total lengt	th 78.7 Ft	Length	Surveyed 75.40 Ft
Lining	Year laid	Year rehabilita	ated	Weather	Damp
Purpose Routine Assessment	C	at			
Additional info		S	tructural	O & M	Constructional
Location Main Highway - Suburban/Rural		N	liscellaneous	Hydraulic	
Project BROOKFIELD SSES-11-14-2019			Work	Order	
Northing	Easting		Eleva	ation	
Coordinate System			GPS Accurac	s y	





CCTV Picture List of 2770-2771 for CDM

Work Order			Setup 7
Video	Survey Date	2019/11/14	
Path to picture files	Z:\AES\1991 - CDM BR	ROOKFIELD SSE\191114-CDM-1991\S	Snaps\191114-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BR	ROOKFIELD SSE\191114-CDM-1991\M	Movies\191114-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BR	ROOKFIELD SSE\191114-CDM-1991\N	Media\191114-CDM-1991\



Video Index Count 3.4 Ft

Code Deposits Attached Grease

Remarks

File Name 25.jpg



Video Index Count 10.1 Ft

Code Tap Factory Active

Remarks

File Name 26.jpg



Video Index Count 10.1 Ft

Code Tap Factory Active

Remarks

File Name 27.jpg



Video Index Count 10.1 Ft

Code Tap Factory Active

Remarks

File Name 28.jpg



Video Index Count 10.1 Ft

Code Tap Factory Active

Remarks

File Name 29.jpg



CCTV Picture List of 2770-2771 for CDM

		Setup 2
Survey Date	2019/11/15	
Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\S	Snaps\191115-CDM-1991\
Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\M	Movies\191115-CDM-1991\
Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\N	Media\191115-CDM-1991\
	Z:\AES\1991 - CDM BF Z:\AES\1991 - CDM BF	Survey Date 2019/11/15 Z:\AES\1991 - CDM BROOKFIELD SSE\191115-CDM-1991\N Z:\AES\1991 - CDM BROOKFIELD SSE\191115-CDM-1991\N Z:\AES\1991 - CDM BROOKFIELD SSE\191115-CDM-1991\N



Video Index Count 0.0 Ft

Code Start of Survey **Remarks**

File Name 30.jpg



Video Index Count 0.0 Ft

Code Start of Survey

Remarks

File Name 31.jpg



Video Index Count 9.6 Ft

Code Tap Factory

Remarks

File Name 32.jpg



Video Index Count 16.7 Ft

Code Deposits Attached Grease

Remarks

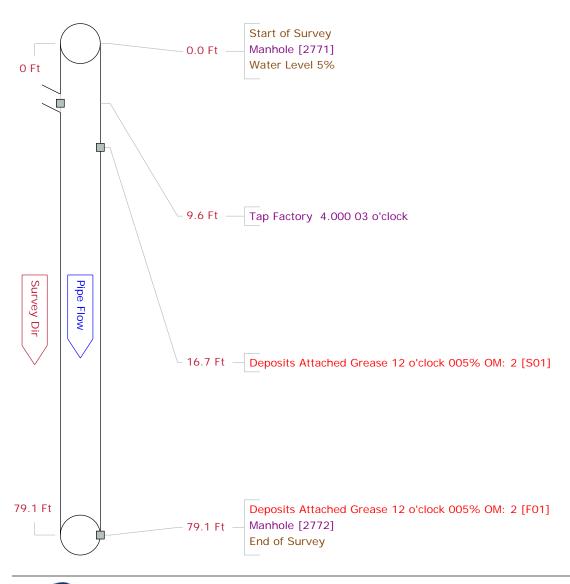
File Name 33.jpg



Pipe Graphic Report of PSR 2770-2771

for CDM

Setup 2 Surveyor JOG	Certificate #	U-615-07000378	System Ow	ner BROOK	FIELD WPCA
Drainage Survey Custo	mer CDM SMITH	1			
P/O # Date 2019/11/15	Time 9:45	Street FEDE	ERAL RD		
City BROOKFIELD Further	location details				
Up 2770 Rin	n to invert	Grade to	invert	Rim to	grade Ft
Down 2771 Rin	n to invert	Grade to	invert	Rim to	grade Ft
Use Sanitary Direction	n Downstream	Flow control	Not Controlled	Medi	a No
Shape Circular Height	8 Width	ins Pred	lean J	Date Clea	aned
Material Polyvinyl Chloride	Joint length 12.	Œ1 Total leng	th 78.7 Ft	Length S	Surveyed 79.10 Ft
Lining	Year laid	Year rehabilit	ated	Weather	Dry
Purpose Routine Assessment	Ca	at			
Additional info CORRECTED MH #S; RE-D	O OF 11-14	:	Structural	O & M	Constructional
Location Main Highway - Suburban/Rural			Miscellaneous	Hydraulic	
Project BROOKFIELD SSES-11-15-2019		_	Work	Order	
Northing	Easting		Eleva	ition	
Coordinate System			GPS Accuracy	y	

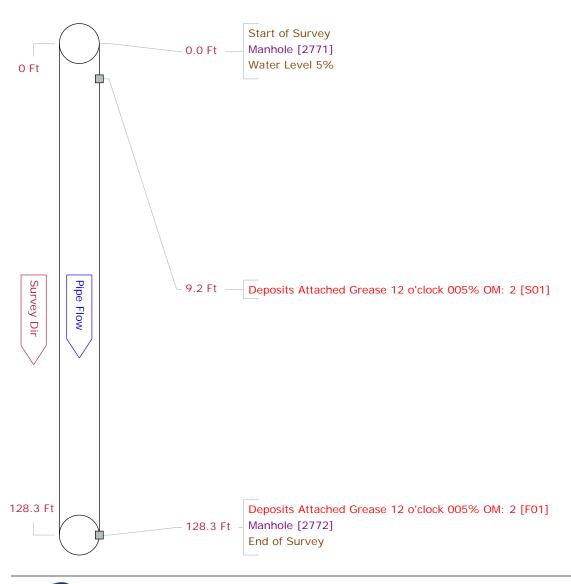




Pipe Graphic Report of PSR 2771-2772

for CDM

Setup	;	3 S	urveyor	JOG		Cert	tificate #	U-615	-07000378	System Ow	ner BROOK	KFIELD W	PCA
Draina	ige				Survey Cust	omer	CDM SMITI	Н					
P/O #				Date	2019/11/15	Ti	i me 9:56	S	treet FEDE	RAL RD			
City		BROOK	FIELD		Furthe	r locati	on details	;					
Up	27	71			Ri	im to ir	nvert		Grade to i	nvert	Rim to	grade	Ft
Down	27	72			Ri	im to ir	nvert		Grade to i	nvert	Rim to	grade	Ft
Use	Sanit	ary			Direction	on Dow	nstream	Flo	w control	Not Controlled	Medi	ia No	
Shape	Cir	cular			Heigh	t 8	Width	ins	Prec	lean J	Date Cle	aned	
Materi	al	olyviny	l Chloride)		Joint	length 12	. 0F1	Total leng	th 125.8 Ft	Length	Surveye	d 128.30 Ft
Lining						Yea	ar laid	Ye	ar rehabilit	ated	Weather	Dry	
Purpo	se	Routi	ne Assess	sment			С	at					
Additi	onal	info							5	Structural	O & M	Const	ructional
Locati	on	Mair	n Highway	/ - Subu	rban/Rural				N	Miscellaneous	Hydraulic		
Projec	t	BROO	KFIELD S	SES-11	-15-2019				_	Work	Order		
Northi	ng						Easting	l		Elev	ation		
Coord	inate	Syste	m							GPS Accurac	су		





2771-2772 for CDM **CCTV Picture List of**

Work Order			Setup 3
Video	Survey Date	2019/11/15	
Path to picture files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\	Snaps\191115-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\	Movies\191115-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\	Media\191115-CDM-1991\



Video Index Count 0.0 Ft

Code Start of Survey Remarks

File Name 10.jpg



Video Index Count 9.2 Ft

Code Deposits Attached Grease

Remarks

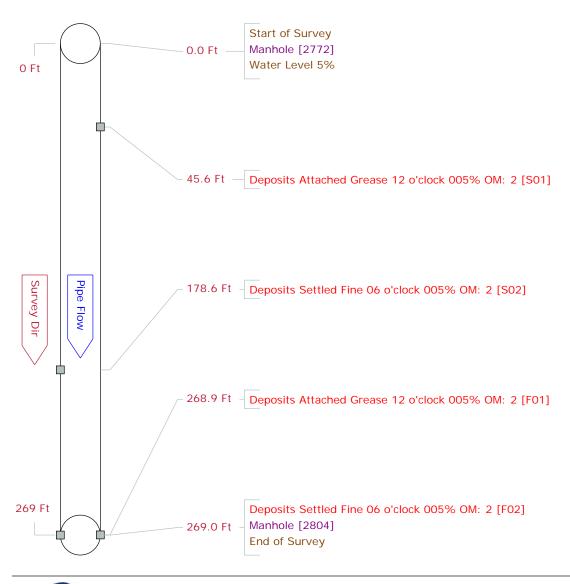
File Name 25.jpg



Pipe Graphic Report of PSR 2772-2804

for CDM

Setup	4	Surveyor	JOG		Certificate #	U-615	-07000378	System Ow	ner BROOk	KFIELD W	PCA
Drainag	је			Survey Custo	mer CDM SMIT	ГН					
P/O #			Date	2019/11/15	Time 10:10	S	treet FEDE	RAL RD			
City	BR	OOKFIELD		Further	location detail	s					
Up	2772			Rin	n to invert		Grade to i	nvert	Rim to	grade	Ft
Down	2804			Rin	n to invert		Grade to i	nvert	Rim to	grade	Ft
Use Sa	anitary			Direction	n Downstream	Flo	w control N	Not Controlled	Med	ia No	
Shape	Circula	ar		Height	8 Width	ins	Prec	lean J	Date Cle	aned	
Materia	l Pol	yvinyl Chloride	:		Joint length 13	2.0 F1	Total lengt	th 266.4 Ft	Length	Surveyed	269.00 Ft
Lining					Year laid	Ye	ar rehabilita	ated	Weather	Dry	
Purpos	e F	Routine Assess	sment		(Cat					
Additio	nal inf	o					S	Structural	O & M	Const	ructional
Locatio	n	Main Highway	/ - Suburl	ban/Rural			V	/liscellaneous	Hydraulic		
Project	BF	ROOKFIELD S	SES-11-	15-2019				Work	Order		
Northin	ıg				Eastin	g		Elev	ation		
Coordin	nate S	ystem						GPS Accurac	су		





CCTV Picture List of 2772-2804 for CDM

Work Order			Setup 4
Video	Survey Date	2019/11/15	
Path to picture files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\S	Snaps\191115-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\M	Movies\191115-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191115-CDM-1991\N	/ledia\191115-CDM-1991\



Count 45.6 Ft Video Index

Code Deposits Attached Grease

Remarks

File Name 11.jpg



Video Index **Count** 45.6 Ft

Code Deposits Attached Grease

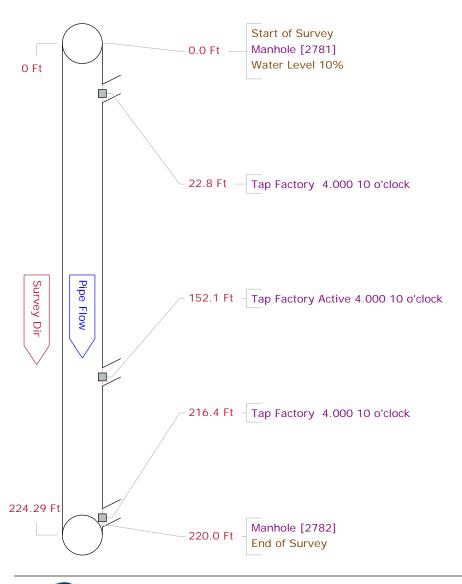
Remarks

File Name 12.jpg



Pipe Graphic Report of PSR 2781-2782

Setup	2	Surveyor	JOG	Cer	tificate #	U-615-	07000378	System Ow	ner BROO	KFIELD WF	PCA
Drainage			Sur	vey Customer	CDM SMITI	Н					
P/O #			Date 2019	9/11/20 T	ime 9:37	St	reet FEDE	RAL RD			
City	BROO	KFIELD		Further locat	ion details	;					
Up 2	781			Rim to i	nvert		Grade to i	nvert	Rim to	grade	Ft
Down 2	782			Rim to i	nvert		Grade to i	nvert	Rim to	grade	Ft
Use San	itary			Direction Dov	vnstream	Flov	v control N	lot Controlled	Med	ia No	
Shape C	ircular			Height 10	Width	ins	Prec	ean H	Date Cle	aned 2019	9/11/20
Material	Polyvi	nyl Chloride	;	Joint	length 12	.0 F1	Total lengt	h 224.3 Ft	Length	Surveyed	220.00 Ft
Lining				Ye	ar laid	Yea	r rehabilita	ated	Weather	Saturated	
Purpose	Ro	utine Assess	sment		С	at					
Additiona	al info						S	tructural	O & M	Constr	uctional
Location	M	ain Highway	/ - Suburban/F	Rural			N	liscellaneous	Hydraulic		
Project	BRC	OKFIELD S	SES-11-20-2	019				Work	Order		
Northing					Easting	I		Elev	ation		
Coordina	te Sys	tem						GPS Accurac	у		





CCTV Picture List of 2781-2782 for CDM

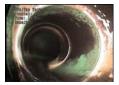
Work Order			Setup 2
Video	Survey Date	2019/11/20	
Path to picture files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191120-CDM\Snaps	\191120-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191120-CDM\Movies	s\191120-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191120-CDM\Media	\191120-CDM-1991\



Video Index Count 22.8 Ft

Code Tap Factory Remarks

File Name 13.jpg



Video Index Count 152.1 Ft

Code Tap Factory Active

Remarks

File Name 14.jpg



Video Index Count 216.4 Ft

Code Tap Factory

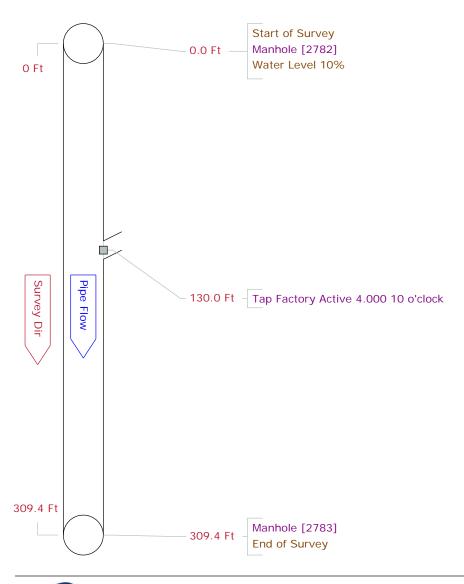
Remarks

File Name 15.jpg



Pipe Graphic Report of PSR 2782-2783

Setup	3	Surveyor	JOG		Certificate #	# U-615	-07000378	System Ow	ner BROOK	KFIELD WI	PCA
Drainage	е	•		Survey Custo	omer CDM SM	ITH		•			
P/O #			Date	2019/11/20	Time 10:5	53 S	Street FEDE	RAL RD			
City	BRC	OKFIELD		Further	location deta	ils					
Up 2	2782			Rir	n to invert		Grade to i	nvert	Rim to	grade	Ft
Down 2	2783			Rir	n to invert		Grade to i	nvert	Rim to	grade	Ft
Use Sa	nitary			Directio	n Downstream	Flo	w control	Not Controlled	Medi	ia No	
Shape (Circula	r		Height	10 Width	ins	Prec	lean J	Date Cle	aned 201	9/11/20
Material	Poly	vinyl Chloride	:		Joint length	12.0 F1	Total leng	th 308.8 Ft	Length	Surveyed	309.40 Ft
Lining					Year laid	Ye	ar rehabilit	ated	Weather	Saturated	
Purpose	Re	outine Assess	sment			Cat					
Addition	al info)					5	Structural	O & M	Constr	ructional
Location	ı M	∕lain Highway	- Suburk	oan/Rural			N	/liscellaneous	Hydraulic		
Project	BR	OOKFIELD S	SES-11-	20-2019				Work	Order		
Northing	3				Easti	ng		Elev	ation		
Coordin	ate Sy	stem						GPS Accurac	су		





CCTV Picture List of for CDM 2782-2783

Work Order			Setup 3
Video	Survey Date	2019/11/20	
Path to picture files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191120-CDM\Snaps	s\191120-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191120-CDM\Movie	es\191120-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191120-CDM\Media	a\191120-CDM-1991\



Video Index **Count** 130.0 Ft Code Tap Factory Active Remarks

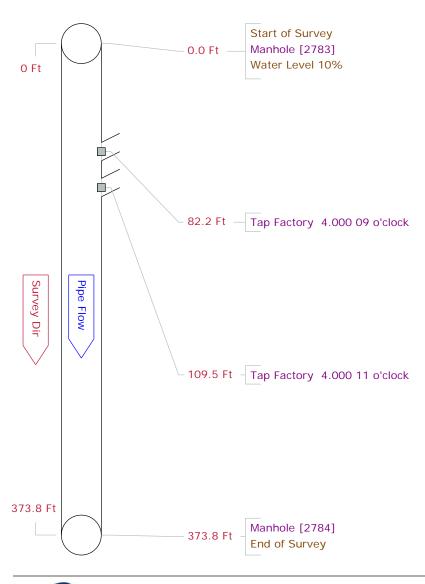
File Name 16.jpg



Pipe Graphic Report of PSR 2783-2784

for CDM

Setup 4	Surveyor	JOG	Cer	tificate #	U-615-	07000378	Systen	n Owner	BROOK	FIELD WP	CA
Drainage		Survey	Customer	CDM SMITH	Н						
P/O #		Date 2019/11/2	20 T	ime 11:08	S	treet FEDE	RAL RD				
City BF	ROOKFIELD	Fu	ırther locat	ion details	i						
Up 2783			Rim to i	nvert		Grade to i	nvert		Rim to	grade	Ft
Down 2784			Rim to in	nvert		Grade to i	nvert		Rim to	grade	Ft
Use Sanitary	/	Diı	rection Dov	vnstream	Flov	w control N	lot Contro	lled	Media	a No	
Shape Circu	lar	Н	leight 10	Width	ins	Prec	lean H	1	Date Clea	ned 2019	/11/20
Material Po	lyvinyl Chloride)	Joint	length 12.	.0 F1	Total lengt	th F	ŧ	Length S	Surveyed	373.80 Ft
Lining			Yea	ar laid	Yea	ar rehabilita	ated	V	Weather S	Saturated	
Purpose	Routine Assess	sment		С	at						
Additional in	ıfo					S	Structural	0.8	k M	Constru	ctional
Location	Main Highway	/ - Suburban/Rural				N	/liscellaned	ous Hyd	draulic		
Project B	ROOKFIELD S	SES-11-20-2019					٧	Vork Ord	er		
Northing				Easting				Elevation	n		
Coordinate S	System						GPS Acc	curacy			





for CDM **CCTV Picture List of** 2783-2784

Work Order			Setup 4
Video	Survey Date	2019/11/20	
Path to picture files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191120-CDM\Snaps	s\191120-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191120-CDM\Movie	s\191120-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191120-CDM\Media	\191120-CDM-1991\

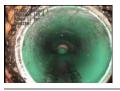


Video Index Count 82.2 Ft Code Tap Factory

Remarks

Remarks

File Name 17.jpg



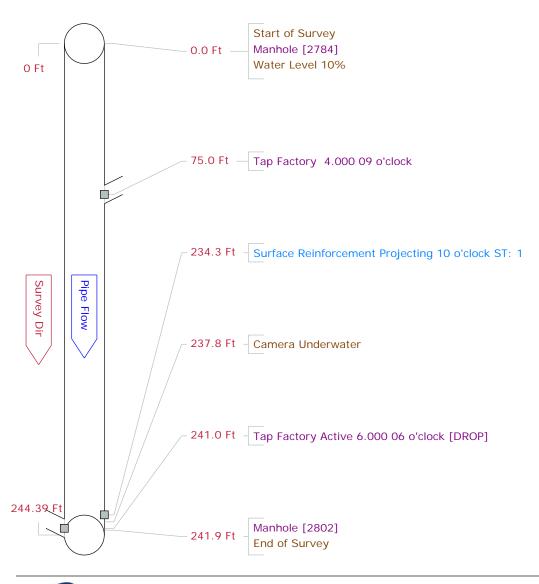
Video Index **Count** 109.5 Ft Code Tap Factory

File Name 18.jpg



Pipe Graphic Report of PSR 2784-2802

Setup 1 Surveyor JOG	Certificate #	U-615-07000378 S	System Owner	BROOKFIELD WPCA	1
Drainage Survey Cust	omer CDM SMITH	4			
P/O # Date 2019/11/20	Time 8:47	Street FEDERAL	. RD		
City BROOKFIELD Furthe	r location details				
Up 2784 Ri	m to invert	Grade to inve	rt	Rim to grade	Ft
Down 2802 Ri	m to invert	Grade to inve	rt	Rim to grade	Ft
Use Sanitary Direction	on Downstream	Flow control Not 0	Controlled	Media No	
Shape Circular Heigh	t 10 Width	ins Preclean	ı H	Date Cleaned 2019/17	1/20
Material Polyvinyl Chloride	Joint length 12.	F1 Total length 2	44.4 Ft	Length Surveyed 24	1.90 Ft
Lining	Year laid	Year rehabilitated	ı v	Veather Saturated	
Purpose Routine Assessment	C	at			
Additional info		Struc	tural O &	& M Constructi	onal
Location Main Highway - Suburban/Rural		Misce	ellaneous Hyd	draulic	
Project BROOKFIELD SSES-11-20-2019	BROOKFIELD SSES-11-20-2019 Work Order				
Northing	Easting		Elevation	n	
Coordinate System		GP	S Accuracy		





CCTV Picture List of 2784-2802 for CDM

Work Order			Setup 1				
Video	Survey Date	2019/11/20					
Path to picture files	Z:\AES\1991 - CDM BR	Z:\AES\1991 - CDM BROOKFIELD SSE\191120-CDM\Snaps\191120-CDM-1991\					
Path to video files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191120-CDM\Movies	s\191120-CDM-1991\				
Path to media files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191120-CDM\Media	\191120-CDM-1991\				



Video Index Count 75.0 Ft

Code Tap Factory

Remarks

File Name 9.jpg



Video Index Count 234.3 Ft

Code Surface Reinforcement Projecting

Remarks

File Name 10.jpg



Video Index Count 237.8 Ft

Code Camera Underwater

Remarks

File Name 11.jpg



Video Index Count 241.0 Ft

Code Tap Factory Active

Remarks DROP

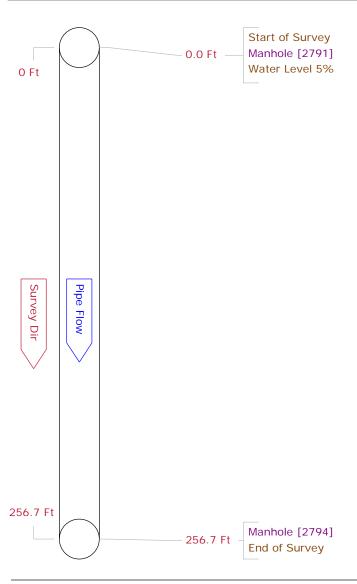
File Name 12.jpg



Pipe Graphic Report of PSR 2791-2794

for CDM

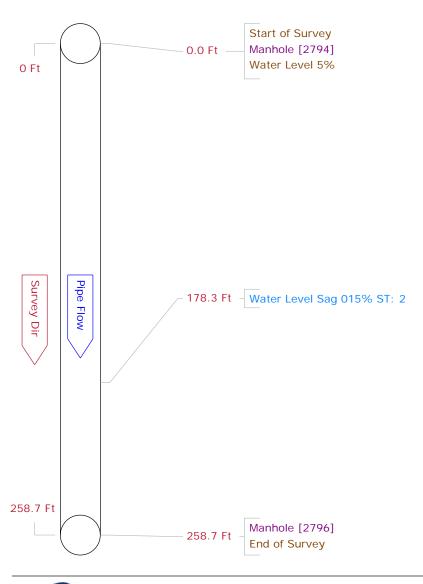
Setup	1 Surveyor	JOG	Certificate #	U-615-07000378	System Ow	vner BROOK	FIELD WPCA	ı
Drainage		Survey Custo	mer CDM SMIT	Н				
P/O #		Date 2019/11/12	Time 10:27	Street CAN	IDLEWOOD LAK	Œ RD		
City	BROOKFIELD	Further	location details	•				
Up 27	791	Rim	n to invert	Grade to	invert	Rim to g	grade	Ft
Down 27	794	Rim	n to invert	Grade to	invert	Rim to g	grade	Ft
Use Sani	tary	Direction	n Downstream	Flow control	Not Controlled	Media	a No	
Shape C	ircular	Height	8 Width	ins Pre	clean J	Date Clea	ned	
Material	Polyvinyl Chloride	,	Joint length 12	Ft Total len	gth 256.6 Ft	Length S	Surveyed 256	6.70 Ft
Lining			Year laid	Year rehabil	itated	Weather [Ory	
Purpose	Routine Assess	sment	C	at				
Additiona	l info				Structural	O & M	Construction	onal
Location	Light Highway				Miscellaneous	Hydraulic		
Project	BROOKFIELD S	SES-11-12-2019			Work	Order		
Northing			Easting	ı	Elev	ation		
Coordina	te System				GPS Accurac	су		





Pipe Graphic Report of PSR 2794-2796

Setup	2 Surveyor	JOG	Certificate #	U-615-07000378	System Ow	vner BROOK	FIELD WP	CA
Drainage		Survey Custo	mer CDM SMIT	Н				
P/O #		Date 2019/11/12	Time 10:40	Street CAN	DLEWOOD LAK	Œ RD		
City	BROOKFIELD	Further	location details	•				
Up 27	794	Rin	n to invert	Grade to	invert	Rim to	grade	Ft
Down 27	796	Rin	n to invert	Grade to	invert	Rim to	grade	Ft
Use Sani	tary	Direction	n Downstream	Flow control	Not Controlled	Medi	a No	
Shape C	ircular	Height	8 Width	ins Pred	clean J	Date Clea	aned	
Material	Polyvinyl Chloride		Joint length 12	.Œ1 Total lenç	jth 257.2 Ft	Length S	Surveyed	258.70 Ft
Lining			Year laid	Year rehabili	tated	Weather	Dry	
Purpose	Routine Assess	sment	C	at				
Additiona	l info				Structural	O & M	Constru	ctional
Location	Light Highway	,			Miscellaneous	Hydraulic		
Project	BROOKFIELD S	SES-11-12-2019			Work	Order		
Northing			Easting	l	Elev	ation		
Coordina	te System				GPS Accurac	су		





for CDM **CCTV Picture List of** 2794-2796

Work Order			Setup 2
Video	Survey Date	2019/11/12	
Path to picture files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191112-CDM-1991\;	Snaps\191112-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191112-CDM-1991\I	Movies\191112-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191112-CDM-1991\I	Media\191112-CDM-1991\



Video Index **Count** 178.3 Ft Code Water Level Sag

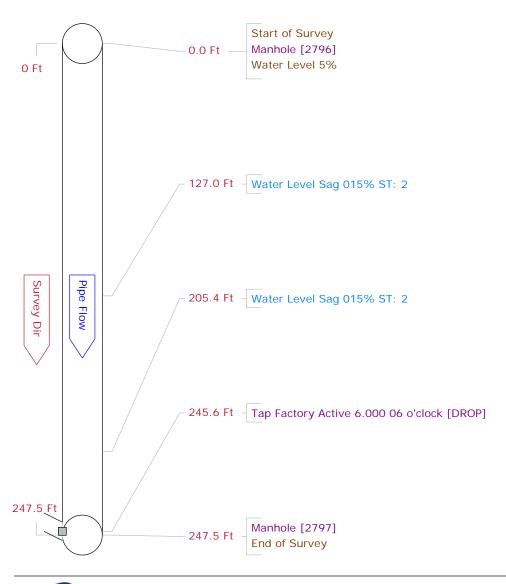
File Name 5.jpg

Remarks



Pipe Graphic Report of PSR 2796-2797

Setup 3	Surveyor	JOG	Certificate #	U-615-07000378	System Ow	ner BROOK	FIELD WPCA
Drainage		Survey Cust	omer CDM SMITI	Н			
P/O #		Date 2019/11/12	Time 10:54	Street CAI	NDLEWOOD LAK	E RD	
City BRO	OKFIELD	Furthe	r location details	•			
Up 2796		Ri	m to invert	Grade to	invert	Rim to	grade Ft
Down 2797		Ri	m to invert	Grade to	invert	Rim to	grade Ft
Use Sanitary		Direction	on Downstream	Flow contro	Not Controlled	Media	a No
Shape Circular		Heigh	t 8 Width	ins Pre	eclean J	Date Clea	ned
Material Polyv	inyl Chloride		Joint length 12	.Œ1 Total ler	igth 246.7 Ft	Length S	Surveyed 247.50 F
Lining			Year laid	Year rehabi	litated	Weather [Ory
Purpose Ro	utine Assessn	ment	С	at			
Additional info	ı				Structural	O & M	Constructional
Location L	ight Highway				Miscellaneous	Hydraulic	
Project BR0	OOKFIELD SS	SES-11-12-2019			Work	Order	
Northing			Easting	I	Elev	ation	
Coordinate Sys	stem				GPS Accurac	с у	





CCTV Picture List of 2796-2797 for CDM

Work Order			Setup 3
Video	Survey Date	2019/11/12	
Path to picture files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191112-CDM-1991\S	Snaps\191112-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191112-CDM-1991\M	Movies\191112-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191112-CDM-1991\N	Media\191112-CDM-1991\



Count 127.0 Ft Video Index

Code Water Level Sag

Remarks

File Name 6.jpg



Video Index **Count** 205.4 Ft

Code Water Level Sag

Remarks

File Name 7.jpg



Count 245.6 Ft Video Index

Code Tap Factory Active

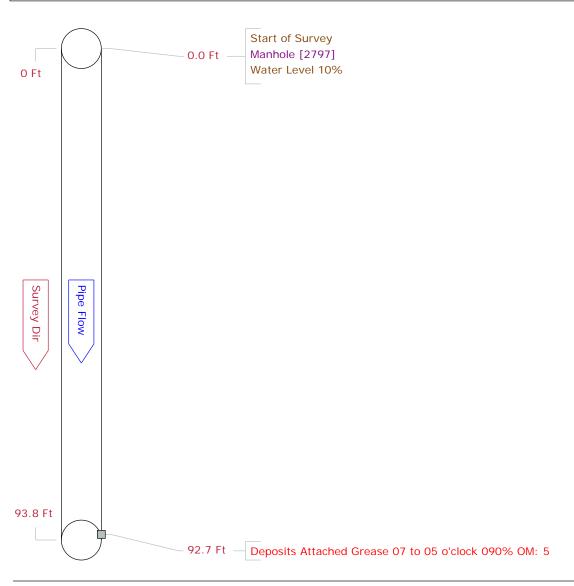
Remarks DROP

File Name 8.jpg



Pipe Graphic Report of PSR 2797-2799

Setup 4 Surve	eyor JOG Ce	ertificate # U-61	5-07000378 System Ov	vner BROOKFIELD WI	PCA
Drainage	Survey Customer	r CDM SMITH			
P/O #	Date 2019/11/12	Time 11:54	Street CANDLEWOOD LAK	KE RD	
City BROOKFIEL	D Further loca	ation details			
Up 2797	Rim to	invert	Grade to invert	Rim to grade	Ft
Down 2799	Rim to	invert	Grade to invert	Rim to grade	Ft
Use Sanitary	Direction Do	ownstream Fl o	ow control Not Controlled	Media No	
Shape Circular	Height 8	Width ins	Preclean J	Date Cleaned	
Material Polyvinyl Ch	loride Joi r	nt length 12.0F1	Total length 93.8 Ft	Length Surveyed	92.70 Ft
Lining	Y	ear laid Ye	ear rehabilitated	Weather Dry	
Purpose Routine A	ssessment	Cat			
Additional info			Structural	O & M Constr	ructional
Location Light Hig	hway		Miscellaneous	Hydraulic	
Project BROOKFIE	ELD SSES-11-12-2019		Work	Order	
Northing		Easting	Elev	ation	
Coordinate System			GPS Accura	су	





CCTV Picture List of for CDM 2797-2799

Work Order			Setup 4
Video	Survey Date	2019/11/12	
Path to picture files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191112-CDM-1991\S	Snaps\191112-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191112-CDM-1991\N	Movies\191112-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191112-CDM-1991\N	Media\191112-CDM-1991\



Video Index Count 92.7 Ft Code Deposits Attached Grease Remarks

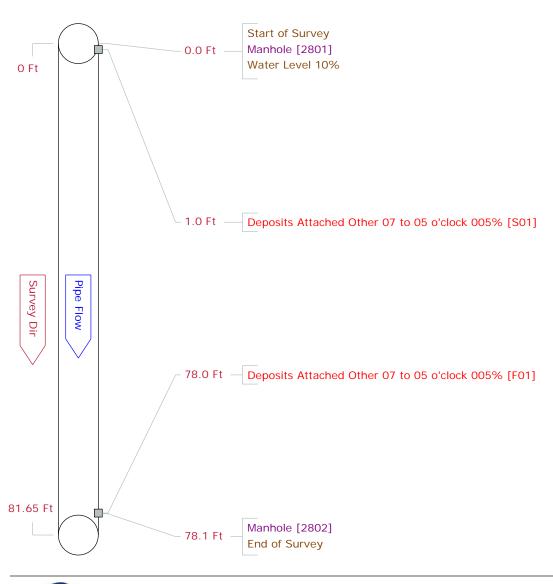
File Name 9.jpg



Pipe Graphic Report of PSR 2801-2802

for CDM

Setup	4 Surveyor	JOG	Certificate #	U-615-07000378	System Ow	ner BROOK	(FIELD WCPA
Drainage		Survey Custo	omer CDM SMIT	Н			
P/O #		Date 2019/11/21	Time 10:46	Street FEI	DERAL RD		
City	BROOKFIELD	Further	location details	•			
Up 28	01	Rir	n to invert	Grade to	invert	Rim to	grade Ft
Down 28	02	Rir	m to invert	Grade to	invert	Rim to	grade Ft
Use Sanit	ary	Directio	n Downstream	Flow contro	Not Controlled	Medi	a No
Shape Cir	cular	Height	12 Width	ins Pre	eclean J	Date Clea	aned 2019/11/21
Material	Polyvinyl Chloride)	Joint length 12	.Œ1 Total ler	gth 81.7 Ft	Length 9	Surveyed 78.10 Ft
Lining			Year laid	Year rehabi	itated	Weather	Dry
Purpose	Routine Assess	sment	C	at			
Additional	info EXC	CESSIVE FLOW DUE TO	O FORCE MAINS		Structural	O & M	Constructional
Location	Main Highway	/ - Suburban/Rural			Miscellaneous	Hydraulic	
Project	BROOKFIELD S	SSES-11-21-2019			Work	Order	
Northing			Easting	I	Elev	ation	
Coordinate	e System				GPS Accurac	у	





2801-2802 for CDM **CCTV Picture List of**

Work Order			Setup 4
Video	Survey Date	2019/11/21	
Path to picture files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191121-CDM\Snaps	s\191121-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191121-CDM\Movie	s\191121-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191121-CDM\Media	\191121-CDM-1991\



Count 1.0 Ft Video Index Code Deposits Attached Other Remarks

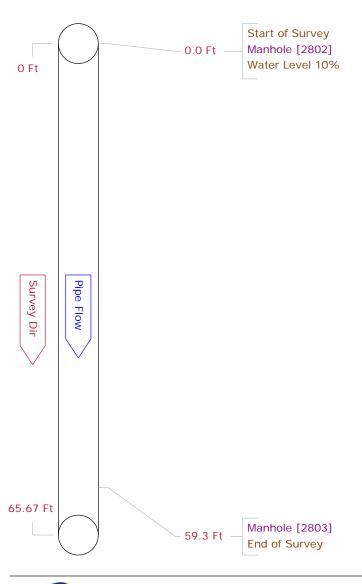
File Name 16.jpg



Pipe Graphic Report of PSR 2802-2803

for CDM

Setup 5 Surveyor JOG	Certificate #	U-615-07000378 System Ov	wner BROOKFIELD W	PCA
Drainage Surv	vey Customer CDM SMITH	ł		
P/O # Date 2019.	/11/21 Time 10:52	Street FEDERAL RD		
City BROOKFIELD	Further location details			
Up 2802	Rim to invert	Grade to invert	Rim to grade	Ft
Down 2803	Rim to invert	Grade to invert	Rim to grade	Ft
Use Sanitary	Direction Downstream	Flow control De-Watered us	Media No	
Shape Circular	Height 12 Width	ins Preclean J	Date Cleaned 201	9/11/21
Material Polyvinyl Chloride	Joint length 12.0	0F1 Total length 65.7 Ft	Length Surveyed	59.30 Ft
Lining	Year laid	Year rehabilitated	Weather Dry	
Purpose Routine Assessment	Ca	at		
Additional info EXCESSIVE FLO	W DUE TO FORCE MAINS	Structural	O & M Const	ructional
Location Main Highway - Suburban/R	ural	Miscellaneous	Hydraulic	
Project BROOKFIELD SSES-11-21-20	119	Work	C Order	
Northing	Easting	Elev	vation	
Coordinate System		GPS Accura	су	

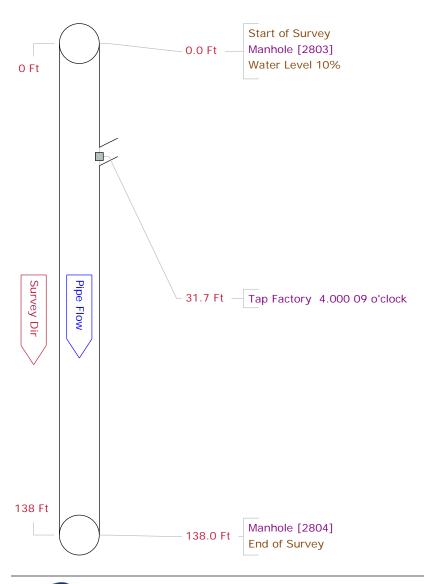




Pipe Graphic Report of PSR 2803-2804

tor CDM	for	CDM	
---------	-----	-----	--

Setup 6 Surveyor JOG	Certificate #	U-615-07000378	System Own	er BROOKFIE	ELD WPCA
Drainage Survey Custo	omer CDM SMITH	4			
P/O # Date 2019/11/21	Time 12:21	Street FEDE	ERAL RD		
City BROOKFIELD Further	location details				
Up 2803 Rin	n to invert	Grade to	invert	Rim to gra	ade Ft
Down 2804 Rin	n to invert	Grade to		Rim to gra	ade Ft
Use Sanitary Directio	n Downstream		De-Watered using Jetter	Media N	lo
Shape Circular Height	12 Width		lean J	Date Cleane	ed 2019/11/21
Material Polyvinyl Chloride	Joint length 12.	ाम Total leng	th 137.0 Ft	Length Sui	rveyed 138.00 Ft
Lining	Year laid	Year rehabilit	ated	Weather Dry	,
Purpose Routine Assessment	С	at			
Additional info EXCESSIVE FLOW DUE TO	FORCE MAINS	:	Structural (M & C	Constructional
Location Main Highway - Suburban/Rural			Miscellaneous I	Hydraulic	
Project BROOKFIELD SSES-11-21-2019			Work O	rder	
Northing	Easting		Elevat	ion	
Coordinate System			GPS Accuracy		





CCTV Picture List of for CDM 2803-2804

Work Order			Setup 6
Video	Survey Date	2019/11/21	
Path to picture files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191121-CDM\Snaps	s\191121-CDM-1991\
Path to video files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191121-CDM\Movie	s\191121-CDM-1991\
Path to media files	Z:\AES\1991 - CDM BR	OOKFIELD SSE\191121-CDM\Media	ı\191121-CDM-1991\



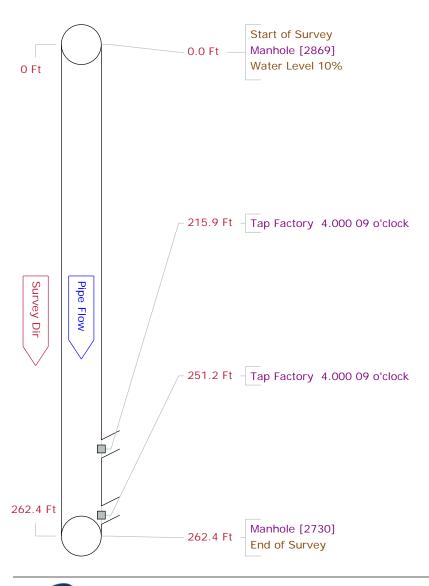
Video Index Count 31.7 Ft Code Tap Factory Remarks

File Name 17.jpg



Pipe Graphic Report of PSR 2869-2730

Setup 7 Surveyor JOG	Certificate #	U-615-07000378	System Owr	ner BROOK	FIELD WPCA
Drainage Survey Cust	omer CDM SMITH	I			
P/O # Date 2019/11/18	Time 14:01	Street FEDE	ERAL RD		
City BROOKFIELD Further	location details				
Up 2869 Ri	m to invert	Grade to	invert	Rim to g	grade Ft
Down 2730 Ri	m to invert	Grade to	invert	Rim to g	grade Ft
Use Sanitary Direction	n Downstream	Flow control	Not Controlled	Media	a No
Shape Circular Heigh	t 8 Width	ins Pred	lean H	Date Clea	ned 2019/11/18
Material Polyvinyl Chloride	Joint length 12.0	∓1 Total leng	th 262.0 Ft	Length S	Surveyed 262.40 Ft
Lining	Year laid	Year rehabilit	ated	Weather L	ight Rain
Purpose Routine Assessment	Ca	at			
Additional info			Structural	O & M	Constructional
Location Main Highway - Suburban/Rural			Miscellaneous	Hydraulic	
Project BROOKFIELD SSES-11-18-2019		_	Work (Order	
Northing	Easting		Eleva	tion	
Coordinate System			GPS Accuracy	/	





for CDM **CCTV Picture List of** 2869-2730

Work Order			Setup 7	
Video	Survey Date	2019/11/18		
Path to picture files	Z:\AES\1991 - CDM BROOKFIELD SSE\191118-CDM-1991\Snaps\191118-CDM-1991\			
Path to video files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191118-CDM-1991\M	Novies\191118-CDM-1991\	
Path to media files	Z:\AES\1991 - CDM BF	ROOKFIELD SSE\191118-CDM-1991\N	/ledia\191118-CDM-1991\	



Video Index **Count** 215.9 Ft Code Tap Factory Remarks

File Name 23.jpg



Video Index **Count** 251.2 Ft Code Tap Factory

File Name 24.jpg

Remarks



CCTV Picture List of 2723-2722 for CDM

Work Order			Setup 4
Video	Survey Date	2019/11/18	
Path to picture files	Z:\AES\1991 - CDM BROOKFIELD SSE\191118-CDM-1991\Snaps\191118-CDM-1991\		
Path to video files	Z:\AES\1991 - CDM BROOKFIELD SSE\191118-CDM-1991\Movies\191118-CDM-1991\		
Path to media files	Z:\AES\1991 - CDM BROOKFIELD SSE\191118-CDM-1991\Media\191118-CDM-1991\		

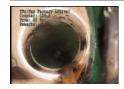


Count 120.7 Ft Video Index

Code Camera Underwater

Remarks

File Name 17.jpg



Video Index **Count** 139.0 Ft

Code Tap Factory Active

Remarks

File Name 18.jpg



Appendix B

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Memorandum

Langan CT, Inc.

One North Broadway, Suite 910 White Plains, NY 10601 T: 914.323.7400 F: 914.323.7401

To: Nelson Malwitz, Chairman

Water Pollution Control Authority 53A Commerce Road, Unit 1

Brookfield, CT 06804

From: W. Charles Utschig Jr., PE.

Info: John Siclari, Director

Roger Prinz, Maintenance Manager

Kristi McPadden, Executive Administrator

Eric Kingsbury, Langan

Bill Bleiler, PE, Keystone Engineering Group

Date: July 16, 2020 (rev1)

Re: Response to the Facilities Plan Pump Station's Deficiencies

Water Pollution Control Authority

Brookfield, CT 06804

Langan Project No.: 190011054

As requested, we have reviewed Section 4 of the draft Facilities Plan and specifically the pump station electrical "items to be addressed" prepared by CDM Smith. As part of this review, we also made a visual inspection of each Pump Station which was conducted on June 10, 2020 by Eric Kingsbury (Langan), Bill Bleiler (Keystone Engineering Group) and Tim Strid (Brookfield Water Pollution Control Authority). The following is a summary of the CDM Smith "items to be addressed", our technical review comments, and recommendations to address items of concern. During our site visit, we noted additional items that should be addressed as part of the routine maintenance and upgrade of the pump stations. These items are listed as Supplemental Observations in this memo.

It is important to note that NFPA 820, which is referenced in many of these comments, was not created until 1990 and has gone through many updates since. Also, although it is considered to be a "best practices" set of guidelines, the State of Connecticut has not adopted it as a code, therefore, it remains a set of guidelines. We do recommend that the Brookfield Water Pollution Control Authority follow these guidelines as to the extent practical.

BROOKS QUARRY PUMP STATION

No action required.

Response to the Facilities Plan Pump Station's Deficiencies Water Pollution Control Authority Brookfield, CT 06804 Langan Project No.: 190011054

July 16, 2020 (rev1)- Page 2 of 24

CALDOR PUMP STATION

1. Draft Facilities Plan Deficiency comment (page 4-9): The main electrical service, switchgear and MCC are original mid-1970's vintage and appear to be beyond their useful life expectancy. The electrical equipment is located in the ground level area which is connected to the dry-pit below. Current NFPA 820 standards allow this area to be unclassified provided there is a gastight physical separation between the wet-well and dry-pit. It appears that this space complies with this standard, therefore physical alterations to the station is not required to meet this standard.

Langan/Keystone Comments: Our understanding is that the Caldor Station is compliant with the regulations in affect when it was constructed. However, we agree with CDM Smith that the main electrical service, switchgear and MMC at this station are beyond their design life. The WPCA should establish a projection of probable construction costs for replacing this equipment and then factor that into the budget.

We have a different interpretation than CDM Smith relative to the area classification question. NFPA 820 (note NFPA 820 did not exist when the Caldor Station was constructed) classifies the below grade dry well as a Class I, Division II location (possible exposure to gases) and is not physically separated from the electrical room above. The below figures show the NFPA 820 area classification table reference and image illustrating a dry well ventilated at ventilation C (6 air changes per hour (ACH) continuously) and ventilation D (less than 6 ACH continuously):

$\overline{}$								
17	a	BELOWGRADE OR PARTIALLY	Buildup of vapors from flammable or combustible liquids	С	Entire space or room	Unclassified	NC, LC, or LFS	FE
	b	BELOWGRADE WASTEWATER PUMPING STATION DRY WELL. Pump room physically separated from wet well; pumping of wastewater from a sanitary or combined sewer system through closed pumps and pipes		D	Entire space or room	Division 2	NC, LC, or LFS	FE

Note: The following codes are used in this table:

A: No ventilation or ventilated at less than 12 air changes per hour

B: Continuously ventilated at 12 changes per hour

C: Continuously ventilated at six air changes per hour

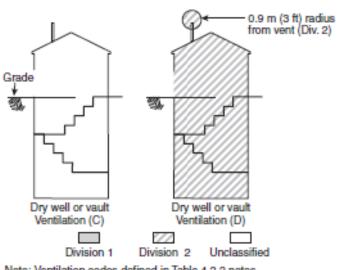
CGD: Combustible gas detection system

D: No ventilation or ventilated at less than six air changes per hour

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NFPA 820: 4.2.2.17



Note: Ventilation codes defined in Table 4.2.2 notes.

FIGURE A.4.2(e) Belowgrade or Partially Belowgrade Equipment Housing or Vault Physically Separated from Wet Well or Basin; Illustration of Table 4.2.2, Rows 5, 12, 17, 31, and 36.

To bring the station into compliance with the current version of NFPA 820 for this specific issue, we recommend that the existing ventilation system be upgraded with a two-speed exhaust fan capable of providing 6 air changes at high speed to de-classify the drywell and electrical areas of the pump station. An airflow switch will need to be installed in the air system and connected to Mission Control to be monitored as required by NFPA 820 Section 7.5. The existing natural gas unit heaters will need to be evaluated as part of this process to verify they are adequately sized to account for this rate of air exchange in the winter months. Using a two-speed exhaust fan will allow the fan to run at low speeds when the building is not occupied and the outdoor temperature is less than 50°F. This is a safety issue for the WPCA staff and we strongly recommend that this item be placed on the maintenance agenda to be addressed.

2. Draft Facilities Plan Deficiency comment (page 4-9): There is a manual bar rack at operating level in the wet well. Operators must manually remove debris from the rack and then carry it up the stairs and outside for disposal. While removal from the rack is adequate, a better solution is desired for transport of the removed debris from the operating level to grade. Improvements to safety and confined space entry of the wet well are also desired.

Langan/Keystone Comments: This is an operational and safety concern that should be discussed with the WPCA Chief of Maintenance and a plan developed to resolve any concerns he might have over this item.

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- 3. Draft Facilities Plan Deficiency comment (page 4-9): There is a hatch in the floor of the control room for pump removal but there is not a hoist or monorail.
 - **Langan/Keystone Comments:** There is a hoist and a monorail at the station that the WPCA staff uses to remove and service the pumps. Per our discussion with WPCA staff, the hoist is temporarily removed for convenience of the WPCA staff at the station.
- 4. Draft Facilities Plan Deficiency comment (page 4-9): The WPCA would prefer a mag meter instead of the venturi meter currently installed.
 - **Langan/Keystone Comments:** Comment noted. The WPCA has been working on options to either replace or supplement the existing venture meter.
- 5. Draft Facilities Plan Deficiency comment (page 4-9): Currently, there is not a straightforward way to bypass the pumping station. There are a pair of blind flanges on the force main which could be used, but additional piping and valving would help make the connection easier.

Langan/Keystone Comments: Comment Noted. The WPCA has been reviewing various options for addressing this.

SUPPLEMENTAL OBSERVATIONS:

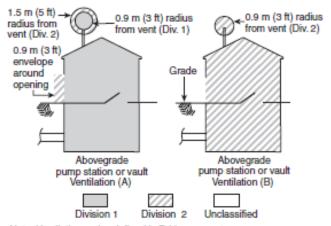
Langan/Keystone, based on our site visit, have identified the following items that should be addressed as part of the ongoing maintenance or future upgrade of the station to bring it into compliance with NFPA 820 standards:

- Safe Entry Displays should be installed to let operators know the space is safe to enter. This will be installed next to all pump station doors to dry well and wet well as per NFPA 820 section 7.6. A safe entry display consists of two lights which are labeled 'SAFE TO ENTER' and 'NOT SAFE TO ENTER'. The wet well would be considered safe to enter if no combustible gases are detected, lights are on (space occupied), and ventilation fan is active. The dry well would be considered safe to enter if the ventilation system airflow switch is above the minimum airflow set point and the lights are on (space occupied). If any of the above conditions are not met, the Safe Entry Displays will indicate 'NOT SAFE TO ENTER'.
- The light above the door and the electrical outlet next to the wet well are in the Class 1, Division 2 location per NFPA 820. The light and the electrical outlet will need to be relocated 3-ft from the door opening as per NFPA 820 Section 4.2.2.16 or continuously ventilate the wet well at 12 ACH. Ventilating the wet well at 12 ACH will remove the area classification around the doors of the wet well. See below for reference NFPA Section and the picture of the lights and electrical outlet to be relocated.



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Note: Ventilation codes defined in Table 4.2.2 notes.

FIGURE A.4.2(f) Abovegrade Equipment Housing or Vault not Physically Separated from Wet Well or Basin; Illustration of Table 4.2.2, Row 19.



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CEDARBROOK PUMP STATION

1. Draft Facilities Plan Deficiency comment (page 4-11): Within the fiberglass enclosure, gas tight seal off fittings should be installed on all electrical and instrument conduits connected to the wet-well and NEMA 1 and NEMA 4 components should be replaced with NEMA 7 rated components.

Langan/Keystone Comments: Gas tight seal off fittings should be installed on all electrical and instrument conduits connected to the wet-well.

The enclosure is classified as class 1, division 2 areas. Based on this classification, we recommend modifying the fan operation versus replacing the components with a NEMA 7 rating. The existing fan can be re-wired to run continuously at a 6-air change per hour. This will de-classify the enclosure to unclassified. The continuously running fan will need to be monitored by Mission Control.

SUPPLEMENTAL OBSERVATIONS:

Langan/Keystone, based on our site visit, have identified the following items that should be addressed as part of the ongoing maintenance or future upgrade of the station to bring it into compliance with NFPA 820 standards:

• NFPA 820 required a 5-foot separation between any source of gas and all electrical equipment. The exhaust fan in the fiberglass enclosure and wet well vent are within 5-feet of the electrical equipment enclosure. To address these items, we recommend the existing exhaust fan be replaced with a continuously running supply fan, the air intake damper to be changed to an exhaust air damper and re-route the vent pipe to the opposite side of the fiberglass enclosure.





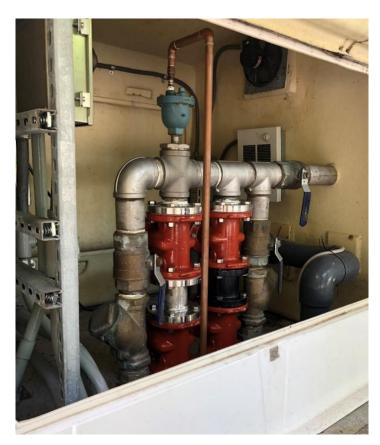
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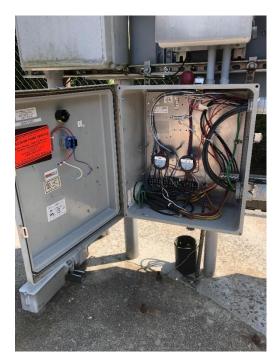


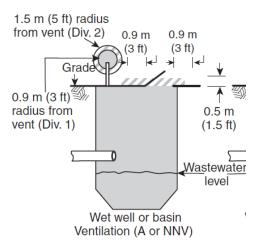
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COMMERCE PUMP STATION

1. Draft Facilities Plan Deficiency comment (page 4-13): The pumping station is not NEC compliant for an explosive area. The electrical and control panels are within three feet of the wet-well hatch opening and vents. The close proximity requires NEMA 7 components.

Langan/Keystone Comments: This is a pump station that was recently taken over by the WPCA and many of these conditions existed when the WPCA took over the operation and maintenance of this system. The wet well hatch as an 18-inch high and 3'-0" wide class 1, division 2 area classification around it. There is one (1) piece of equipment mounted on the rack that measures 15-inches from the ground. We recommend this enclosure be replaced with a smaller box which will then bring the bottom of the equipment to 18-inch from the ground. This equipment box serves as a splice box to the pump control panel and can easily be modified as recommended and the pump run time meter can be relocated into the pump control panel if necessary.





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1a. The vent that is located closer to the equipment rack than 5-foot.

Langan/Keystone Comments: Vents have a 5'-0" class 1 division 2 area classification. The vent closest to the control panes needs to be capped and the vent that is located farther away needs to be rotated to the opposite direction of the equipment rack. This will allow the equipment rack to be out of the 5-foot radius of the vent pipe. See the photo below:



2. Draft Facilities Plan Deficiency comment (page 4-13): PVC conduit is located in the explosive area

Langan/Keystone Comments: NEC does not permit PVC in the explosive area. We recommend that the WPCA replace the PVC pipes from the wet well to the control panel with galvanized steel conduit and install conduit seals per NEC 501.15. See the picture below:



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3. Draft Facilities Plan Deficiency comment (page 4-13): Explosion proof seal off fittings are not present.

Langan/Keystone Comments: We recommend that explosion proof seal off fittings be install per NEC 501.15 when the PVC conduits are being replaced.

DEL MAR PUMP STATION

There are no electrical deficiencies noted in the Facilities Plan at this station.

SUPPLEMENTAL OBSERVATIONS:

Langan/Keystone, based on our site visit, have identified the following items that should be addressed as part of the ongoing maintenance or future upgrade of the station to bring it into compliance with NFPA 820 standards:

 The pole mounted flood light was installed in a different location than what was on the approved plans. The light pole was installed adjacent to the vent pipe. The light pole switch needs to be 5-feet away from the vent pipe per NFPA 820. The light pole switch can be relocated to under the lighting panel and next to the Mission panel to resolve this code issue.



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• The valve pit vent pipe adjacent to the Kohler Automatic Transfer Switch is located within a controlled area. To address this issue, this vent pipe can be capped.



HIGH MEADOW PUMP STATION

1. Draft Facilities Plan Deficiency comment (page 4-17): The wiring enclosed within the pedestal cabinet is not NEC code compliant, all the wiring and cable terminals are installed exposed with no physical protection for the cables.

Langan/Keystone Comments: We have a different interpretation of this code requirement. It is our opinion that the panel is NEC compliant in accordance with Article 409 – Industrial Control Panels. Our interpretation is that this is an industrial control panel constructed in the field and therefore compliant.

SUPPLEMENTAL OBSERVATIONS:

Langan/Keystone, based on our site visit, have identified the following items that should be addressed as part of the ongoing maintenance or future upgrade of the station to bring it into compliance with NFPA 820 standards:

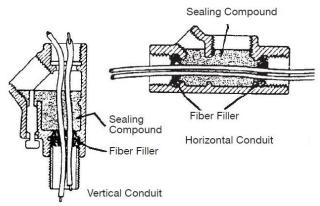
• The conduit seals do not have the sealing compound installed per NEC 501.15. Only the fiber filler. We recommend that the required sealing compound be installed in accordance with the figure below:



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Damming and Pouring:





• The vent pipe is located 4'-10" from the generator. It is recommended to rotate the vent pipe to face the opposite direction of the generator to provide a 5'-0" clearance.



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HIGH SCHOOL PUMP STATION

There are no electrical deficiencies noted in the Facilities Plan at this station.

SUPPLEMENTAL OBSERVATIONS:

Langan/Keystone, based on our site visit, have identified the following items that should be addressed as part of the ongoing maintenance or future upgrade of the station to bring it into compliance with NFPA 820 standards:

- The gas tight seal off fittings should be installed on all electrical and instrument conduits connected to the wet-well.
- The enclosure is classified as class 1, division 2. Instead of replacing the components with NEMA 7, we recommend that the existing fan to be re-wired to run continuously at a 6- air change per hour. This will de-rate the enclosure to unclassified. The continuously running fan should be monitored through the Mission Control system.



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NORTH PUMP STATION

1. Draft Facilities Plan Deficiency comment (page 4-21): The wiring enclosed within the pedestal cabinet is not NEC code compliant, all the wiring and cable terminals are installed exposed with no physical protection for the cables.

Langan/Keystone Comments: We have a different interpretation of this code requirement. It is our opinion that the panel is NEC compliant in accordance with Article 409 – Industrial Control Panels. Our interpretation is that this is an industrial control panel constructed in the field and therefore compliant.





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2. Draft Facilities Plan Deficiency comment (page 4-21): The junction box installed for the wet well is not NEC compliant for an explosive area.

Langan/Keystone Comments: The approved plans called for an explosion proof box. We recommend that the existing box be with an explosion proof box per NEC 501.15.



SUPPLEMENTAL OBSERVATIONS:

Langan/Keystone, based on our site visit, have identified the following items that should be addressed as part of the ongoing maintenance or future upgrade of the station. We have identified an additional item that we recommend to be placed on the maintenance agenda to bring the pump station into compliance with NEC standards:

• We recommend to place a conduit cap on all open conduits per NEC 110.12(A). See picture below:



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RAIL ROAD PUMP STATION

There are no electrical deficiencies noted in the Facilities Plan at this station.

Langan/Keystone, based on our site visit, have identified the following items that should be addressed as part of the ongoing maintenance or future upgrade of the station to bring it into compliance with NFPA 820 standards:

• The approved plans called for an explosion proof box. We recommend that the existing box be replaced with an explosion proof box per NEC 501.15.



ROUTE 133 PUMP STATION

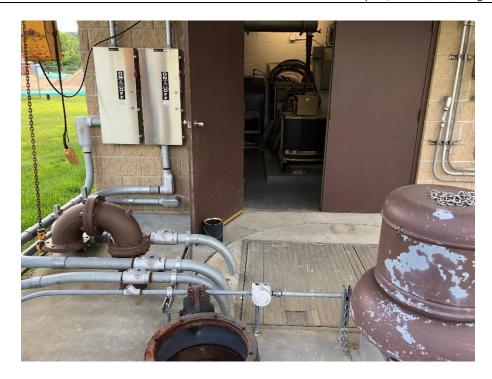
1. Draft Facilities Plan Deficiency comment (page 4-25): Multiple NEC compliancy issues.

Langan/Keystone Comments: The draft Facilities Plan does not identify the compliancy issues. Based on our site visit, we have identified specific items that we recommend be placed on the maintenance and/or upgrade program to bring the pump station into compliance with the current NEC and NFPA standards. These items are as follows:

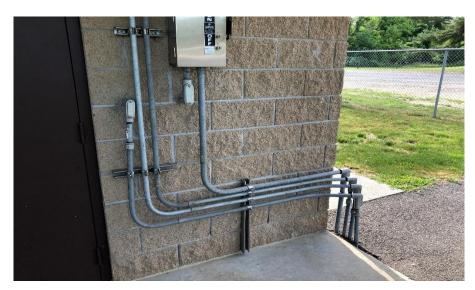
- The wet well fan is explosion proof but it is not a supply fan. The exhaust fan has a 5-foot radius which is class 1, division 1 and a 10-foot radius of class 1, division 2 per NFPA 820. This radius extends inside the pump station building through the double doors. We recommend to replace the exhaust fan with a supply fan to force air down into the wet well.
- The vent pipe is 4'-4" from the building and is required to be 5-feet. We recommend that the existing vent pipe be capped and a new vent pipe installed in the new wet well.



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- The wet well hatch is located 2'-6" from the double doors and is required to be 3-feet. The class 1, division 2 area classification extends into the pump station building. A potential solution would be to remove the double doors. There is no longer a need for a double door since the generator will be removed as part of another project. The single door on the roadside of the station would be sufficient for equipment access. We recommend that this modification be incorporation into the future planned pump station upgrade.
- There are no conduit seals on the grinder conduits. We recommend to install conduit seals. See picture below:



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- The exhaust fan in the building was running but the motorized intake damper was closed.
 We recommend that the exhaust fan be connected to the motorized intake louver. This is not a code related issue, but will help the station maintain lower temperatures during the warm summer months by having the louver open.
- The main circuit breaker distance to the manual transfer switch was measured at 2'-8" and it is required to have a minimum of 3-foot clearance per NEC 110.26. The manual transfer switch would need to be relocated to provide for proper clearance in front of the main circuit breaker. This modification can be completed as part of the station upgrade planned for the future. See picture below:



The TVSS surge protector lights are currently not working. This could indicate the
equipment is no operating correctly and not providing adequate protection to the pump
station from power surges. We recommend to replace the TVSS surge protector.



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SAND CUT PUMP STATION

There are no electrical deficiencies noted at this station.

SILVERMINE PUMP STATION

1. Draft Facilities Plan Deficiency comment (page 4-29): The electrical equipment, controls and pumps have outlasted their design lift and should be replaced.

Langan/Keystone Comments The electrical equipment, controls and pumps are beyond their design life. The WPCA should develop a plan to replace this equipment.

SUPPLEMENTAL OBSERVATIONS:

Langan/Keystone, based on our site visit, have identified the following items that should be addressed as part of the ongoing maintenance or future upgrade of the station. We have identified an additional item that we recommend to be placed on the maintenance agenda to bring the pump station into compliance with NFPA 820 and NEC standards.

 There are exposed wires with broken conduits. This is a NEC code violation per NEC 300.4. We believe these conduits/wires are abandoned and if so, conduit should be removed and the opening sealed watertight material (see photo below for reference).



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• Conduit is open and filled with water. We recommend that a conduit cap be provided per NEC 110.12(A) (refer to photo below).



• The panel disconnect switch on the remote monitoring panel should to be located lower to the floor because the panel disconnect is more than 6'-6" above the floor. This is a violation per NEC 404.8. Also, relocating the panel closer to the floor will provide better access for maintenance of the equipment. This item should be addressed when the station is upgraded.



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STONY HILL PUMP STATION

There are no electrical deficiencies noted in the Facilities Plan at this station.

SUPPLEMENTAL OBSERVATIONS:

Langan/Keystone, based on our site visit, have identified the following items that should be addressed as part of the ongoing maintenance or future upgrade of the station. We have identified an additional item that we recommend to be placed on the maintenance agenda to bring the pump station into compliance with NEC standards:

• The enclosure is classified as class 1, division 2 which would require NEMA 7 components. To address this concern, we recommend that the existing fan be re-wired to run continuously at a 6-air change per hour. This will de-rate the enclosure to unclassified. The continuously running fan should be monitored by Mission Control system.



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• The exhaust fan in the fiberglass enclosure and wet well vent are within 5-feet of the electrical equipment enclosure. In addition to a continuously running fan, we recommend that the exhaust fan be replaced with a supply fan, change the air intake damper to an exhaust air damper and re-route the vent pipe to the opposite side of the fiberglass enclosure.



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777 FEDERAL PUMP STATION

1. Draft Facilities Plan Deficiency comment (page 4-33): The wiring enclosed within the pedestal cabinet is not NEC code compliant, all the wiring and cable terminals are installed exposed with no physical protection for the cables.

Langan/Keystone Comments: We have a different interpretation of this code requirement. It is our opinion that the panel is NEC compliant in accordance with Article 409 – Industrial Control Panels. Our interpretation is that this is an industrial control panel constructed in the field and therefore compliant.



2. Draft Facilities Plan Deficiency comment (page 4-33): The junction box installed for the wet well is not NEC compliant for an explosive area.

Langan/Keystone Comments: The approved plans called for an explosion proof box. We recommend that the existing box be replaced with an explosion proof box per NEC 501.15.





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SUPPLEMENTAL OBSERVATIONS:

Langan/Keystone, based on our site visit, have identified the following items that should be addressed as part of the ongoing maintenance or future upgrade of the station. We have identified an additional item that we recommend to be placed on the maintenance agenda:

• The surge protection lights are not on. This could indicate the equipment is not operating correctly and not providing adequate protection to the pump station from power surges. We recommend that it be tested and replaced as necessary.



CONCLUSION

There are a number of recommendations to address the items of concern noted in the memorandum. We can provide assistance to the WPCA to help prioritize these items of concern as they are placed on the maintenance agenda or upgrades to the pump station.



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