IMPROVING COMMUNITIES TOGETHER

MEMORANDUM

Date:	May 13, 2020	Job No.:	6861-025
To:	Jeffrey McCormick - Director Burrillville, RI Department of Public Works		
Cc:	Michael Emond – Superintendent Burrillville, RI Sewer Commission		
From:	Brian Wrigley, P.E.		
Subject:	Chapel Street Sewer Alternatives		

BETA Group Inc. (BETA) is pleased to submit this Memorandum summarizing our evaluation of alternatives for providing sewer service to Chapel Street between River Street and Union Ave.

Background

James J. Geremia & Associates, Inc. (JJG) provided a memorandum dated December 19, 2019 that summarized the following two alternatives:

- Installation of a gravity sewer along Chapel Street, flowing northeast to a new pump station located west of River Street. The pump station would convey collected wastewater via a force main along Chapel Street westward, across a bridge over the Clear River, to an existing sewer manhole on Pascoag Main Street.
- Installation of a low pressure sewer system along Chapel Street. The low pressure sewer system would flow west, across the same bridge, to the existing sewer manhole on Pascoag Main Street.

The Town has requested that BETA review JJG's proposed alternatives and associated Opinion of Probable Construction Costs and provide an evaluation of alternatives to sewer Chapel Street. The Town would like to fund the evaluation and ultimate design and construction of the sewer system with State Revolving Fund (SRF) money through the RI Infrastructure Bank.

Existing Conditions

Miscellaneous Utilities

BETA conducted existing utility research for the study area to facilitate the location and completion of subsurface soil borings and for consideration in the sewer extension evaluation.

Potable Water (Harrisville Fire District)
There is a 10-inch potable water main along this section of Chapel Street with an 8-inch water main branch towards Chum Blvd and a 6-inch water main branch toward Railroad Ave.

Natural Gas (None)
There is no known natural gas utility within the study area.

Electric (Pascoag Utility District)
Electric service utility is above ground (overhead wire) within the study area.

Communications (Verizon and Cox)
Verizon utility service is buried within the study area with a duct bank that favors the shoulder of the westbound travel lane of Chapel Street. Cox utility service is overhead within the study area.

Bridges and Natural Features

The project limits are bordered by the Granite Mill Bridge (RIDOT Bridge #308) to the east and the World War Memorial Bridge (RIDOT Bridge #310) to the west, which both span the Clear River. A small bridge, Granite Mill Canal Bridge (RIDOT Bridge #309), is located in the middle of the study area between intersections with Railroad Ave and Chum Blvd. This bridge spans a small stream running beneath Chapel Street. A fourth bridge, Railroad Ave Bridge (RIDOT Bridge #354), also spans the Clear River and is located on Railroad Ave, just south of and nearby to the intersection with Chapel Street. The Railroad Ave Bridge was recently replaced with construction being completed in 2019.

Existing "Dry" Gravity Sewer (Chapel Street)

There appears to be an existing "dry" gravity sewer along Chapel Street in the vicinity of the intersection of Chapel Street, Union Avenue and Emerson Road, just east of the World War Memorial Bridge (RIDOT Bridge No. 310). The existing sewer is depicted on a 1995 RIDOT review plan set titled "State of Rhode Island Department of Transportation - Plan, Profile and Sections of Proposed State Highway Rehabilitation of the Burrillville World War Memorial Bridge No. 310, RI Contract No. 9502 / RI Federal Aid Project No. BRF 0107(002)". The RIDOT plans are not an "as-built" depiction of installed infrastructure, but the existence of the sewer can be verified visually at the road surface as sewer manhole covers are located along each of the streets mentioned above in similar alignment to that depicted in the 1995 RIDOT review plan set. The existing "dry" sewer is depicted on three drawing sheets (Sheets 7 – 9) in the above plan set that are titled 'Drainage and Utility Plans Nos. 1 – 3'.

According to the RIDOT plans, the "dry" sewer consists of 8-inch diameter PVC gravity pipe with several access manholes along Chapel Street, Union Ave and Emerson Road. A 10-inch diameter PVC gravity sewer discharge stub (capped) is depicted on the plans and is assumed to have been installed at the same time. The 10-inch PVC stub is called out as being encased in concrete below a retaining wall on the south side of Chapel Street, sloped toward the Clear River to the south. It is believed that this "dry" sewer was installed for future consideration of sewer extension to Chapel Street, Union Ave and Emerson Road with future discharge connection of the collected sewer to the Town's 24-inch diameter reinforced concrete gravity sewer interceptor across the Clear River. However, the connection to the sewer interceptor across and beneath the Clear River was not completed. In order to utilize this existing "dry" sewer infrastructure along Chapel Street, gravity connection from the downstream stub to the sewer interceptor across the Clear River will have to be constructed.

Existing Town sewer records indicate the presence of ledge (approx. depth of 8 feet) at the potential gravity discharge connection location at the 24-inch sewer interceptor south of Chapel Street and across the Clear River. Therefore, it is anticipated that ledge and/or boulders will be encountered while constructing the river crossing.

Chum Boulevard (Private Way)

At a March 10, 2020 Burrillville Sewer Commission meeting, BETA was instructed to not conduct soil borings along Chum Boulevard. Proposed borings for this evaluation effort had recently been pre-marked by BETA on February 27th, which prompted the discussion at the meeting. During the meeting, BETA was informed that Chum Boulevard is a private roadway and as such, sewers cannot be constructed by the Burrillville Sewer Commission in this road. Per direction from the Commission, BETA has assumed in its evaluation that sewer will not be installed by the Town along Chum Boulevard. However, BETA will

consider and incorporate provisions into proposed alternatives within the Chapel Street right-of-way for future extension of sewer to this street.

Subsurface Conditions

BETA subcontracted Technical Drilling Services, Inc. (TDS) out of Sterling, MA to conduct exploratory subsurface soil borings along Chapel Street between River Street and Union Ave. Six (6) borings were completed by TDS between March 13th and March 18th, 2020 and one (1) boring could not be completed due to construction activity in the vicinity of the proposed boring location near the intersection with Chum Blvd (Granite Mill Canal Bridge Improvements). Boring locations have been depicted on the attached 'Soil Boring Location Plan' for reference. Results from the soil boring effort are summarized below.

Bedrock

The following table summarizes findings specifically related to refusal due to bedrock encountered within the applicable bore holes. In all incidences of refusal, advancement of the drill was attempted multiple times and ledge is suspected to be the cause for refusal.

BORING ID#	PROPOSED BORING DEPTH (FT)	REFUSAL DEPTH (FT)	ROCK CORE EXTRACTED	NOTES
B-1	35	30	2.5-FT @30 FEET	GRANITIC GNEISS
B-2	12	N/A		
B-3	12	11		POTENTIAL LEDGE
B-4	12	4		POTENTIAL LEDGE
B-5	16	BORING NOT COMPLETED AS PROPOSED		
B-6	20	N/A		
B-7	12	4		POTENTIAL LEDGE

Ledge outcrop was also observed onsite during existing conditions assessment of the study area. The outcrop was observed within and around the banks of the Clear River south of Chapel Street. It should be noted that the presence of refusal due to bedrock outside the boring locations is unknown.

Environmental Sampling

Soil samples were obtained from boring locations B-2 and B-3 and were sent to a laboratory for environmental testing and analysis. The sites were selected for sampling and testing due to their proximity to properties with potential for contamination. The lab testing results are summarized below.

B-2 (Location in front of Sunoco station) – Sample taken from 6' to 8' depth

- Lab results indicate exceedances of RIDEM standards for seven PAH's (polynuclear aromatic hydrocarbons) and total petroleum hydrocarbons.
- Levels of exceedances are not considered to be high (and were not detected onsite following extraction) but during future excavation of a trench in this vicinity, excess soil would need to be managed, hauled and disposed accordingly (likely at the Johnston Landfill).
- Preliminary research indicates that this location (180 Chapel Street – Eagle Motors Sunoco) is listed as a LUST (Leaking Underground Storage Tank) Site. The site is listed twice with this designation with the most recent file listing indicating that it is still "active". The active designation means that a RIDEM file is still open and the site is not considered fully

remediated. The most recent file listing is from 2017 – likely when the Sunoco station underwent upgrade.

B-3 (Location in front of Auto Service Station) – Sample taken from 2' to 4' depth

- Lab results indicate measurable levels of contaminants, but none exceed the RIDEM standards.
- Preliminary research indicates that this location (158 Chapel Street – as Moe's Auto Service) is listed as a LUST (Leaking Underground Storage Tank) Site but it is shown as "inactive". The inactive designation means that a RIDEM file has been closed for the site. However, this does not always mean that the contamination is completely remediated. It is not uncommon to find additional contamination at or adjacent to an "inactive" site. The most recent file listing is from 1993.

Wastewater Flow Estimate

Buildout Analysis

On February 5th, 2020 I met with yourself and Town Planner Ray Goff to discuss the potential future development of the Chapel Street study area. Based on this meeting and additional research and analysis, BETA has estimated the potential wastewater flows that would be generated from the future buildout of the study area. This analysis is summarized below under 'Flow Estimates' and is also depicted in more detail in the attached buildout analysis table, Table 1 – Chapel Street Study Area Buildout Analysis.

Flow Estimates

BETA considered and evaluated all unsewered parcels within the immediate Chapel St study area. Parcels with potential for future connection to a sewer extension, including those along Chum Blvd (a dead-end private roadway that intersects Chapel St within the study area limits), were also included in the flow estimates. Per discussion with the Town Planner, the Town-owned property that currently contains a skate park and parking lot (Plat 142 / Lot 133) was also considered within the flow estimates based on the potential for future sale and commercial development. The study area is comprised of parcels that have the following Town of Burrillville zoning designations:

R-12: Village Residential District (Min. Lot Size of 12,000 ft^2)
GC: General Commercial

Per TR-16 Guidelines (Guides for the Design of Wastewater Treatment Works), a peaking factor was applied to estimated existing and future per capita baseline flows to calculate the peak hourly design flow for the study area. The peak hourly flow rate is defined as the largest volume of flow to be received during a one-hour period. Sanitary sewers should be designed using the peak hourly flow. The peaking factor is obtained from Figure 2-1: 'Ratio of Extreme Flow to Average Daily Flow' within TR-16.

Estimated Existing Flow from Study Area (Existing Structures)

Type of Flow	Estimated Flow (gpd)	Notes
BASE FLOW:	3,050	Existing R-12 and GC Properties Combined
PEAK HOURLY FLOW:	16,700	Peaking Factor Applied to Base Flow
INFILTRATION:	1,900	Infiltration Factor Applied
PEAK DAILY FLOW:	18,600	
ROUNDED:	19,000	

Estimated Potential Future Flow from Study Area (Buildout)

Type of Flow	Estimated Flow (gpd)	Notes
BASE FLOW:	14,650	Existing R-12 and GC Properties Combined
PEAK HOURLY FLOW:	80,600	Peaking Factor Applied to Base Flow
INFILTRATION:	1,900	Infiltration Factor Applied
PEAK DAILY FLOW:	82,400	
ROUNDED:	83,000	Design Flow

Flow Estimate Notes:

1. Town of Burrillville Residential Minimum Lot Size: 12,000 sq. ft. ('R-12 Village Residential District' Zoning for Single-family dwelling). Flow estimate of 185 gpd per residence based on 70 gal/capita/day x 2.64 persons per household (TR-16 and current U.S. Census for Town of Burrillville).
2. General Commercial Zoning (Town Planner buildout discussion/direction). Flow estimate based on 1,500 gal/acre/day x buildable acres of lot (Ch. 3 "Commercial Districts", Metcalf & Eddy 'Wastewater Engineering Treatment and Reuse, fourth edition').
3. Peaking factor = 5.5 (TR-16 Figure 2-1)
4. The TR-16 recommended infiltration allowance for gravity sewers ranges from 250 to 500 gallons per day per inch-diameter-mile (gpd/idm, refer to TR-16 Section 2.2.3.3). We conservatively utilized 500 gpd/idm for the 8-inch diameter gravity sewer design. The infiltration allowance does not apply to low pressure sewers.
5. Flow Estimates include existing and projected flows from properties along Chum Blvd. However, construction cost estimates do not include resources to extend sewer to Chum Blvd properties (Per direction from the Burrillville Sewer Commission).

Evaluation of Discharge Locations

BETA evaluated several alternatives for discharge of wastewater collected from the Chapel Street study area. Four (4) discharge locations were reviewed based on availability, location of, and proximity to existing wastewater collection system infrastructure. All scenarios involve the discharge of collected wastewater through pumped means (force main or low pressure). A description of each discharge location, including a brief evaluation, is provided below.

Pascoag Main St south of the Chapel St/Union Ave/Emerson Rd intersection (southwest of study area)

Existing Sewer: 24-inch Reinforced Concrete Interceptor
Approx. Depth of Existing Sewer at connection location: 15-16 FT

The discharge of sewer collected from the study area to this location would involve the crossing of the World War Memorial Bridge (RIDOT Bridge #310) and overhead crossing of the Clear River. Existing grade elevations along the Chapel St study area promote wastewater discharge in this direction. Grade elevation gradually increases along Chapel St in this direction (southwest) until approximately in front of #24/#26 Chapel Street. Grade then gradually descends towards the World War Memorial Bridge to Pascoag Main St for approximately 300 feet. Wastewater collection system design guidance suggests that as far as possible, force main alignment and depth shall maintain a constant upgradient profile along the pumped flow path. This is not as critical for low pressure sewer systems, but it is preferable. BETA recommends this discharge flow direction given existing topography within the study area.

Chapel St – Existing "Dry" Sewer and Clear River Crossing to Existing Sewer Interceptor (southwest of study area)

Existing Sewer: 8-inch PVC "Dry" Sewer (Chapel Street)
Approx. Depth of Existing Sewer at Chapel Street connection location: 8-10 FT

Existing Sewer: 24-inch Reinforced Concrete Interceptor (Clear River Crossing)
Approx. Depth of Existing Sewer: 15-20 FT

The discharge of sewer collected from the study area to this location would involve connection to an existing "dry" sewer that was previously installed within Chapel Street (circa 1995) and the below-grade gravity sewer crossing of the Clear River from an existing 10-inch PVC gravity pipe stub south of Chapel Street to an existing 24-inch gravity sewer interceptor located across the Clear River to the south. Existing grade elevations along the Chapel St study area promote wastewater discharge in this direction. Grade elevation gradually increases along Chapel St in this direction (southwest) towards the existing "dry" sewer. An existing sewer manhole is located at the apex in road elevation approximately in front of #38 Chapel Street. Wastewater collection system design guidance suggests that as far as possible, force main alignment and depth shall maintain a constant upgradient profile along the pumped flow path. This is not as critical for low pressure sewer systems, but it is preferable. BETA recommends this discharge flow direction given existing topography within the study area.

Existing Town sewer records indicate the presence of ledge (approx. depth of 8 feet) at the potential gravity discharge connection location at the 24-inch sewer interceptor south of Chapel Street and across the Clear River. This connection involves the below-grade crossing underneath the Clear River. It is anticipated that ledge and/or boulders will be encountered while constructing the river crossing.

It is anticipated that an "open-cut" gravity sewer crossing beneath the Clear River would require the following:

- Easement takings (temporary construction easements and permanent easements)
- Clearing and Grubbing of brush and within existing easments
- Permitting (RIDEM)
- Potential temporary bypass, diversion of the Clear River / Portadam installation
- Temporary bypass of the 24-inch diameter sewer interceptor (for connection of new to existing sewer)

- Temporary construction vehicle access (may require bridging of the Clear River)
- Handling, removal and disposal of bedrock/boulders
- Soil stabilization
- Ductile iron gravity sewer pipe encased in concrete

Intersection of Chapel St and Maple St (east of study area)

Existing Sewer: 8-inch PVC Main
Approx. Depth of Existing Sewer at connection location: 9-10 FT

The discharge of sewer collected from the study area to this location would involve the crossing of the Granite Mill Bridge (RIDOT Bridge #308) and overhead crossing of the Clear River. The nearest downstream gravity sewer is located at the intersection of Chapel St and Maple St which flows to the School St Pump Station to the north located on Callahan School St. BETA is currently not considering this flow direction and therefore did not evaluate the existing capacity and condition of the downstream pump station as part of this evaluation. If discharge of wastewater in this direction is considered in the future, the existing pump station would have to be evaluated and assessed accordingly to determine the station's ability to manage additional flows from the study area. Existing Town sewer records indicate the presence of ledge (approx. depth of 7 FT) at the potential discharge connection location at the intersection of Chapel St and Maple St.

Railroad Ave (center of study area and south of Chapel St)

Existing Sewer: 24-inch Reinforced Concrete Interceptor
Approx. Depth of Existing Sewer at connection location: 5 FT

The discharge of sewer collected from the study area to this location would involve the crossing of the Railroad Ave Bridge (RIDOT Bridge #354) and crossing of the Clear River which the bridge spans. As previously mentioned, the Railroad Ave bridge was recently replaced with construction being completed last year. Visual observations indicate the presence of significant ledge and boulders within and around the banks of the Clear River upstream and downstream of the Railroad Ave crossing. This alone would significantly increase the difficulty and costs associated with constructing a sewer discharge line in this direction. The shallow depth of the existing downstream sewer interceptor would also limit alignment options across the bridge/river. BETA is currently not considering or recommending this discharge flow direction given the noted challenges associated with constructing piping across the River at this location as well as unfavorable hydraulic design concerns.

<u>Identified Construction Challenges</u>

Bridge/River & Stream Crossings

Extending sewer to the study area will involve the crossing of one or more RIDOT bridges and related stream/river crossings. This will involve close coordination with RIDOT and the RIDEM and it is also anticipated that a lengthy permitting process will be required to obtain permission and specific requirements for completing each crossing. Accordingly, costs associated with each anticipated crossing, including but not limited to permit application and issuance, Agency correspondence and coordination meetings, design review and comment periods, design modifications, etc. will be considered and incorporated into cost estimates associated with construction of alternatives for the study area. Based on a discharge of wastewater collected from the study area towards the west/southwest, the following bridge and/or river crossings shall be anticipated for sewer extension to the study area:

Granite Mill Canal Bridge (RIDOT Bridge #309)
World War Memorial Bridge (RIDOT Bridge #310)
Clear River

Bedrock

Refusal was encountered within several of the subsurface soil borings conducted as part of this evaluation, indicating the presence of rock/ledge within the study area. Ledge outcrop was also observed at grade within and along the banks of the Clear River which crosses and runs easterly along the alignment of and to the south of Chapel Street. Since refusal was experienced in several boring locations, it must be anticipated that ledge is present and widespread in the study area. In fact, two borings (B-4 and B-7) yielded refusal at a depth of only four (4) feet. Excavation and disposal of rock is often a costly operation and also extends the overall construction timeframe of a project as the removal process is a limiting factor with regards to a contractor's daily progress. Accordingly, estimates for rock removal and disposal will be considered and incorporated into cost estimates associated with construction of alternatives for the study area. There will be additional costs related to rock removal for the gravity sewer alternatives.

Contaminated Soil

Lab testing results received from soil samples collected during the subsurface soil boring effort indicate the presence of soil contamination in the vicinity of #180 Chapel Street (Sunoco station) and potential soil contamination in the vicinity of #158 Chapel Street (auto service station). During future excavation of a trench in these locations, excess soil would need to be managed, hauled and disposed accordingly (likely at the Johnston Landfill) with direct coordination and guidance from the Rhode Island Department of Environmental Management (RIDEM). A full RIDEM file review for each property would be required during the design phase of planned sewer extension in this area. There will be additional costs related to managing excess soils for the gravity sewer alternatives.

<u>Sewer Alternatives</u>

Alternative #1 –
Gravity Sewer and Pumping Station Option
(World War Memorial Bridge Crossing)
BETA Opinion of Probable Cost: $2,630,000.00

This option involves the installation of 8-inch PVC gravity sewer main and associated access manholes within the Chapel Street right-of-way. Sewer installation depths between 6 feet and 15 feet are anticipated along the gravity sewer's alignment due to required clearances beneath existing bridges, streams and buried utilities. Sewer depths are also predicated on providing gravity service to the majority of properties within the study area. At the anticipated excavation depths (7 to 16 feet) and given the observed subsurface conditions within the study area, rock removal and disposal will be required to facilitate sewer installation. The limits and depth of rock within the proposed sewer trench is indeterminate and variable but can be roughly estimated for the purpose of this evaluation based on the results of the recent subsurface exploratory boring effort. Estimates for rock removal and disposal have been incorporated into BETA's Opinion of Probable Cost (Attached) for Alternative #1.

One (1) service is anticipated to require a low pressure sewer service connection to the gravity main with grinder style pump located on private property at #10 Chapel Street. Existing grades will prevent gravity

service to this property should this option be considered. It is anticipated that all other unsewered properties within the study area can be sewered via gravity service pipe based on available record information.

The gravity sewer main would convey collected wastewater to a new Town-owned wastewater pumping station to be located with frontage along Chapel Street just west of River Street and the Granite Mill Bridge (RIDOT Bridge No. 308) and east of the existing Sunoco gas station. We assume that a submersible-type pumping station will be designed and constructed to service the study area. Siting of the new pumping station may require purchase of a parcel of private land for the footprint of the station. It should be noted that land purchase is not guaranteed, and costs associated with acquisition of land is unknown. In an effort to save on land acquisition costs, an optional location for the pump station site could be considered within the Town-owned property that currently contains a skate park and parking lot (Plat 142 / Lot 133).

Gravity sewer main would have to be installed across a small stream just east of Chum Blvd. In order to avoid working directly beneath the Granite Mill Canal Bridge, the gravity sewer will have to be constructed/routed around the bridge abutments off-road. This construction will involve permitting with RIDEM for constructing sewer beneath/across the stream limits and may even require easements (temporary construction and permanent). Trenchless installation methods could be considered for crossing of the stream if open-cut construction is not allowed. In either case, specific permit requirements (wetland protection, restoration, etc.) for working within wetlands and associated buffer zones are anticipated.

Force main piping from the new pumping station will have to be installed across two (2) RIDOT bridges (Granite Mill Canal Bridge and the World War Memorial Bridge) along its proposed alignment to its discharge point at the existing 24-inch sewer interceptor on Pascoag Main Street. Construction of the bridge crossings will require extensive permitting and coordination with RIDOT, as well as with RIDEM for each river/stream overhead crossing. Exposed force main piping will have to be insulated and supported/hung along each bridge. It is anticipated, assuming permission from RIDOT, that force main pipe will be installed through the bridge abutments.

BETA's Opinion of Probable Cost for Alternative #1 (attached) assumes the following:

- Sewer service installed/provided for future buildout of study area (refer to attached Table 1 – Chapel Street Study Area Buildout Analysis)
- Per the Burrillville Sewer Commission, Chum Blvd is a private road and properties will not be sewered using Town or SRF funds. Provisions for future connection of these properties will be provided within the Chapel Street right-of-way in the form of a capped pipe stub.
- Permission and constructability of RIDOT bridge crossings (further evaluation and communication with RIDOT and RIDEM will be required)
- Successful land acquisition and easement takings (as required)
- All in-situ soil will be reused as backfill with exception of the soil within the pipe envelope
- No concrete base beneath the pavement
- Curb-to-curb surface restoration of Chapel Street (RIDOT Requirement)
- Existing full pavement depth along Chapel Street is 6-inch depth (based on max. asphalt depths measured within the boring cores)
- Costs for Police Details not included

- Town will purchase E-One grinder pump(s) – NOTE: Costs for purchase of the pumps will not be covered under the SRF Program. There may be opportunities for funding through the SRF Sewer Tie-In Fund. For the purposes of this study, we assume Property Owner responsible for costs associated with installation and connection of grinder pumps/services on private property and connection to the Town's main at the property line.

Alternative #1A –
Gravity Sewer and Pumping Station Option
(Connection to Existing "Dry" Sewer and Clear River Crossing)
BETA Opinion of Probable Cost: $2,780,000.00

THIS OPTION IS SIMILAR TO ALTERNATIVE #1 BUT INVOLVES CONNECTION TO AN EXISTING "DRY" GRAVITY SEWER ON CHAPEL STREET AND NEW GRAVITY SEWER CROSSING BENEATH THE CLEAR RIVER IN LIEU OF A FORCE MAIN CROSSING OF THE WORLD WAR MEMORIAL BRIDGE.

This option involves the installation of 8-inch PVC gravity sewer main and associated access manholes within the Chapel Street right-of-way. Sewer installation depths between 6 feet and 15 feet are anticipated along the gravity sewer's alignment due to required clearances beneath existing bridges, streams and buried utilities. Sewer depths are also predicated on providing gravity service to the majority of properties within the study area. At the anticipated excavation depths (7 to 16 feet) and given the observed subsurface conditions within the study area, rock removal and disposal will be required to facilitate sewer installation. The limits and depth of rock within the proposed sewer trench is indeterminate and variable but can be roughly estimated for the purpose of this evaluation based on the results of the recent subsurface exploratory boring effort. Estimates for rock removal and disposal have been incorporated into BETA's Opinion of Probable Cost (Attached) for Alternative #1A.

It is anticipated that all unsewered properties within the study area can be sewered via gravity service pipe based on available record information, should this option be considered.

The gravity sewer main would convey collected wastewater to a new Town-owned wastewater pumping station to be located with frontage along Chapel Street just west of River Street and the Granite Mill Bridge (RIDOT Bridge No. 308) and east of the existing Sunoco gas station. We assume that a submersible-type pumping station will be designed and constructed to service the study area. Siting of the new pumping station may require purchase of a parcel of private land for the footprint of the station. It should be noted that land purchase is not guaranteed, and costs associated with acquisition of land is unknown. In an effort to save on land acquisition costs, an optional location for the pump station site could be considered within the Town-owned property that currently contains a skate park and parking lot (Plat 142 / Lot 133).

Gravity sewer main would have to be installed across a small stream just east of Chum Blvd. In order to avoid working directly beneath the Granite Mill Canal Bridge, the gravity sewer will have to be constructed/routed around the bridge abutments off-road. This construction will involve permitting with RIDEM for constructing sewer beneath/across the stream limits and may even require easements (temporary construction and permanent). Trenchless installation methods could be considered for crossing of the stream if open-cut construction is not allowed. In either case, specific permit requirements (wetland protection, restoration, etc.) for working within wetlands and associated buffer zones are anticipated.

Force main piping from the new pumping station will have to be installed across the Granite Mill Canal Bridge along its proposed alignment to its discharge point at the existing 8-inch PVC "dry" sewer on Chapel Street. Construction of the bridge crossing will require permitting and coordination with RIDOT, as well as with RIDEM for the overhead stream crossing. Exposed force main piping will have to be insulated and supported/hung along the bridge. It is anticipated, assuming permission from RIDOT, that force main pipe will be installed through the bridge abutments.

The discharge of sewer for this option will involve force main connection to the existing "dry" gravity sewer on Chapel Street. The force main discharge can be connected to an existing sewer manhole located at the apex in road elevation, situated approximately in front of #38 Chapel Street.

NOTE: BETA recommends that the following tasks be completed on the existing "dry" gravity sewer system prior to selection of this alternative to determine existing conditions:

- Pump out/remove all standing water (rainwater/groundwater) from the system
- Conduct internal pipe inspections and evaluation with CCTV camera
- Conduct manhole inspections

This option also includes the below-grade gravity sewer crossing of the Clear River. Connection of the Chapel Street sewer to the existing sewer interceptor will require installation of gravity sewer between an existing 10-inch PVC gravity pipe stub south of Chapel Street to the existing 24-inch gravity sewer interceptor located across the Clear River to the south. For the purposes of this study, BETA assumes that the 10-inch diameter PVC stub depicted on the 1995 RIDOT review plans was installed as shown and at the elevations indicated on the drawings. The approximate layout of the existing "dry" sewer on Chapel Street was previously described in the 'Existing Conditions' section of this memorandum.

Existing Town sewer records indicate the presence of ledge (approx. depth of 8 feet) at the potential gravity discharge connection location at the 24-inch sewer interceptor south of Chapel Street and across the Clear River. It is anticipated that ledge and/or boulders will be encountered while constructing the river crossing. Construction methods for the river crossing will have to be evaluated further. For the purposes of this study, a conservative allowance for this work has been included in BETA's Opinion of Probable Cost for Alternative #1A.

BETA's Opinion of Probable Cost for Alternative #1A (attached) assumes the following:

- Existing "dry" gravity sewer along Chapel Street is in good condition and will not require repairs or major modification to facilitate the sewer extension (outside of the proposed work for this Alternative).
- Sewer service installed/provided for future buildout of study area (refer to attached Table 1 – Chapel Street Study Area Buildout Analysis)
- Per the Burrillville Sewer Commission, Chum Blvd is a private road and properties will not be sewered using Town or SRF funds. Provisions for future connection of these properties will be provided within the Chapel Street right-of-way in the form of a capped pipe stub.
- Permission and constructability of RIDOT bridge crossing (further evaluation and communication with RIDOT and RIDEM will be required)
- Successful land acquisition and easement takings (as required)
- All in-situ soil will be reused as backfill with exception of the soil within the pipe envelope

- No concrete base beneath the pavement
- Curb-to-curb surface restoration of Chapel Street (RIDOT Requirement)
- Existing full pavement depth along Chapel Street is 6-inch depth (based on max. asphalt depths measured within the boring cores)
- Costs for Police Details not included

Alternative #2 –
Low Pressure Sewer Option
(World War Memorial Bridge Crossing)
BETA Opinion of Probable Cost: $1,380,000.00

This option involves the installation of small diameter SDR 21 PVC low pressure sewer pipe within the Chapel Street right-of-way at relatively low depths below grade (approx. 5 to 6 feet). Service connections to the Town's low pressure sewer main would be connected from each property via pumped flow from individual grinder style pumps (typically by E-One or equal) located on the respective property. A curb stop shut-off/isolation valve would be installed on each service at the property line. Similar to the Town's low pressure sewer main, services would be constructed using small diameter SDR 21 PVC pipe. A terminal access manhole containing a flushing clean-out and blow-off connection will be installed on the upstream end of the pressure system.

At the anticipated excavation depths (5 to 6 feet) and given the observed subsurface conditions within the study area, rock removal and disposal may be required to facilitate sewer installation. The limits and depth of rock within the proposed sewer trench is indeterminate and variable but can be roughly estimated for the purpose of this evaluation based on the results of the recent subsurface exploratory boring effort. Estimates for rock removal and disposal have been incorporated into BETA's Opinion of Probable Cost (Attached) for Alternative #2.

The small diameter low pressure sewer piping will have to be installed across two (2) RIDOT bridges (Granite Mill Canal Bridge and the World War Memorial Bridge) along its proposed alignment to its discharge point at the existing 24-inch sewer interceptor on Pascoag Main Street. Construction of the bridge crossings will require extensive permitting and coordination with RIDOT, as well as with RIDEM for each river/stream overhead crossing. Exposed sewer piping will have to be insulated and supported/hung along each bridge. It is anticipated, assuming permission from RIDOT, that the low pressure sewer pipe will be installed through the bridge abutments by trenchless means.

BETA's Opinion of Probable Cost for Alternative #2 (attached) assumes the following:

- Sewer service installed/provided for future buildout of study area (refer to attached Table 1 – Chapel Street Study Area Buildout Analysis)
- Per the Burrillville Sewer Commission, Chum Blvd is a private road and properties will not be sewered using Town or SRF funds. Provisions for future connection of these properties will be provided within the Chapel Street right-of-way in the form of a capped pipe stub/isolation valve.
- Permission and constructability of RIDOT bridge crossings (further evaluation and communication with RIDOT and RIDEM will be required)
- All in-situ soil will be reused as backfill with exception of the soil within the pipe envelope
- No concrete base beneath the pavement
- Curb-to-curb surface restoration of Chapel Street (RIDOT Requirement)

- Existing full pavement depth along Chapel Street is 6-inch depth (based on max. asphalt depths measured within the boring cores)
- Costs for Police Details not included
- Town will purchase E-One grinder pump(s) – NOTE: Costs for purchase of the pumps will not be covered under the SRF Program. There may be opportunities for funding through the SRF Sewer Tie-In Fund. For the purposes of this study, we assume Property Owner responsible for costs associated with installation and connection of grinder pumps/services on private property and connection to the Town's main at the property line.

Alternative #2A –
Low Pressure Sewer Option
(Connection to Existing "Dry" Sewer and Clear River Crossing)
BETA Opinion of Probable Cost: $1,640,000.00

THIS OPTION IS SIMILAR TO ALTERNATIVE #2 BUT INVOLVES CONNECTION TO AN EXISTING "DRY" GRAVITY SEWER ON CHAPEL STREET AND NEW GRAVITY SEWER CROSSING BENEATH THE CLEAR RIVER IN LIEU OF A LOW PRESSURE MAIN CROSSING OF THE WORLD WAR MEMORIAL BRIDGE.

This option involves the installation of small diameter SDR 21 PVC low pressure sewer pipe within the Chapel Street right-of-way at relatively low depths below grade (approx. 5 to 6 feet). Service connections to the Town's low pressure sewer main would be connected from each property via pumped flow from individual grinder style pumps (typically by E-One or equal) located on the respective property. A curb stop shut-off/isolation valve would be installed on each service at the property line. Similar to the Town's low pressure sewer main, services would be constructed using small diameter SDR 21 PVC pipe. A terminal access manhole containing a flushing clean-out and blow-off connection will be installed on the upstream end of the pressure system.

At the anticipated excavation depths (5 to 6 feet) and given the observed subsurface conditions within the study area, rock removal and disposal may be required to facilitate sewer installation. The limits and depth of rock within the proposed sewer trench is indeterminate and variable but can be roughly estimated for the purpose of this evaluation based on the results of the recent subsurface exploratory boring effort. Estimates for rock removal and disposal have been incorporated into BETA's Opinion of Probable Cost (Attached) for Alternative #2A.

The small diameter low pressure sewer piping will have to be installed across the Granite Mill Canal Bridge along its proposed alignment to its discharge point at the existing 8-inch PVC "dry" sewer on Chapel Street. Construction of the bridge crossing will require permitting and coordination with RIDOT, as well as with RIDEM for the overhead stream crossing. Exposed sewer piping will have to be insulated and supported/hung along the bridge. It is anticipated, assuming permission from RIDOT, that the low pressure sewer pipe will be installed through the bridge abutments by trenchless means.

The discharge of sewer for this option will involve low pressure connection to the existing "dry" gravity sewer on Chapel Street. The low pressure discharge can be connected to an existing sewer manhole located at the apex in road elevation, situated approximately in front of #38 Chapel Street.

NOTE: BETA recommends that the following tasks be completed on the existing "dry" gravity sewer system prior to selection of this alternative to determine existing conditions:

- Pump out/remove all standing water (rainwater/groundwater) from the system
- Conduct internal pipe inspections and evaluation with CCTV camera
- Conduct manhole inspections

This option also includes the below-grade gravity sewer crossing of the Clear River. Connection of the Chapel Street sewer to the existing sewer interceptor will require installation of gravity sewer between an existing 10-inch PVC gravity pipe stub south of Chapel Street to the existing 24-inch gravity sewer interceptor located across the Clear River to the south. For the purposes of this study, BETA assumes that the 10-inch diameter PVC stub depicted on the 1995 RIDOT review plans was installed as shown and at the elevations indicated on the drawings. The approximate layout of the existing "dry" sewer on Chapel Street was previously described in the 'Existing Conditions' section of this memorandum.

Existing Town sewer records indicate the presence of ledge (approx. depth of 8 feet) at the potential gravity discharge connection location at the 24-inch sewer interceptor south of Chapel Street and across the Clear River. It is anticipated that ledge and/or boulders will be encountered while constructing the river crossing. Construction methods for the river crossing will have to be evaluated further. For the purposes of this study, a conservative allowance for this work has been included in BETA's Opinion of Probable Cost for Alternative #2A.

BETA's Opinion of Probable Cost for Alternative #2 (attached) assumes the following:

- Existing "dry" gravity sewer along Chapel Street is in good condition and will not require repairs or major modification to facilitate the sewer extension (outside of the proposed work for this Alternative).
- Sewer service installed/provided for future buildout of study area (refer to attached Table 1 – Chapel Street Study Area Buildout Analysis)
- Per the Burrillville Sewer Commission, Chum Blvd is a private road and properties will not be sewered using Town or SRF funds. Provisions for future connection of these properties will be provided within the Chapel Street right-of-way in the form of a capped pipe stub/isolation valve.
- Permission and constructability of RIDOT bridge crossings (further evaluation and communication with RIDOT and RIDEM will be required)
- All in-situ soil will be reused as backfill with exception of the soil within the pipe envelope
- No concrete base beneath the pavement
- Curb-to-curb surface restoration of Chapel Street (RIDOT Requirement)
- Existing full pavement depth along Chapel Street is 6-inch depth (based on max. asphalt depths measured within the boring cores)
- Costs for Police Details not included
- Town will purchase E-One grinder pump(s) – NOTE: Costs for purchase of the pumps will not be covered under the SRF Program. There may be opportunities for funding through the SRF Sewer Tie-In Fund. For the purposes of this study, we assume Property Owner responsible for costs associated with installation and connection of grinder pumps/services on private property and connection to the Town's main at the property line.

Summary and Recommendations

Below is a summary of the Alternatives presented in the previous section:

ALTERNATIVE	DESCRIPTION	OPINION OF PROBABLE COST
1	Gravity Sewer and Pumping Station Option (World War Memorial Bridge Crossing)	$ 2,630,000
1A	Gravity Sewer and Pumping Station Option (Connection to Existing "Dry" Sewer and Clear River Crossing)	$ 2,780,000
2	Low Pressure Sewer Option (World War Memorial Bridge Crossing)	$ 1,380,000
2A	Low Pressure Sewer Option (Connection to Existing "Dry" Sewer and Clear River Crossing)	$ 1,640,000

Based on the relatively small collection area (number of unsewered parcels and projected future flows), subsurface conditions (presence of bedrock and soil contamination), and the previously identified construction challenges, we would recommend Alternative #2 or #2A – Low Pressure Sewer Options. If the Town decides to move forward with design for sewer extension to the study area, the following benefits would be realized by choosing Alternative #2 or #2A over Alternative #1 or #1A:

- Relatively shallow depth of excavation (approx. 5 to 6 feet) along Chapel Street
- Less volume of rock removal and disposal along Chapel Street (related to depth of construction and the presence of bedrock and/or boulders)
- Less resources of contractor's labor and materials (gravel, trench management, etc.)
- Construction along Chapel Street would involve relatively low level of difficulty
- Shorter duration of construction (reduction in road closures, disruption, and traffic control costs)
- Town does not own and operate/maintain a wastewater pumping station (O&M and utility costs, demand on sewer department resources, etc.)
- Lower overall construction cost (directly related to all of the above listed benefits)

We also recommend that the Town evaluate the feasibility of purchasing E-One style grinder pumps for the project using Town funds or alternate source(s). As previously noted, costs for purchase of the pumps will not be covered under the SRF Program. Pumps can be purchased by the Town, and future ownership, operation and maintenance can be relinquished to the individual property owners upon transfer and connection to the Town's sewer main. This approach can positively impact private property owner buy-in for the project while at the same time relieving Town burden over maintenance, repair and future replacement of individual pumps and appurtenances. This will significantly reduce the cost that each property owner will incur to connect to the Town's sewer main once installed. There may be opportunities for funding through the SRF Sewer Tie-In Fund.

NOTE: Similar to disposal restrictions for a gravity sewer collection system, property owners receiving E-One style grinder pumps must be reminded that certain items should never be flushed down the toilet or dumped down a sink or tub/shower drain. A list of those restricted items is highlighted within the Owner's Guide for the particular pump. Property Owners who receive pumps should be provided with all related paperwork associated with the pump that may include the Owner's Guide, installation instructions, operation, maintenance and care instructions, troubleshooting information, etc. Failure to properly

operate and maintain the pumps, including discharge of restricted items to the pumps, may result in damage to the system and/or sewer backups to the property. BETA recommends that the Town not maintain ownership of the individual pumps or pumping systems installed on private property, regardless of how they are initially purchased/funded. In this scenario, all future repair and replacement costs for the pump system (beyond and not covered by manufacturer's warranties) would be borne by the individual property owner and the Town's burden would be limited to the infrastructure installed within the public right-of-way.

J:\Burrillville\Chapel Street\ACAD\DrawingFiles\PlanSet\Boring Location Plan.dwg Plot Date: 4/24/2020 3:06 PM

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Town of Burrillville, Rhode Island

Chapel Street

Soil Boring Location Map

Scale: 1" = 250'

N

TABLE 1 - CHAPEL STREET STUDY AREA BUILDOUT ANALYSIS
(MAY 2020)

LEGEND

CHUM BLVD PROPERTIES (PRIVATE WAY)	
POTENTIAL SALE AND RE-ZONING TO GC	(Per Meeting with Town Planner)
UNBUILDABLE LOT	(Based on Minimum Lot Size or Other Factors)

Physical Property Address	Plat/Lot	Owner	Current or Recent Property Description/Type	Zoning	Total Lot Size (acres)	Approx. Wetland Area (acres)	Approx. Buildable Area (acres)	Building Count		Estimated Flow			
								Existing	Potential Future	Per Structure (gpd)	Per Buildable Area (gpd)	Existing (gpd)	Potential Future (gpd)
10 Chapel St	158/004	Paquette, Norman & Holly	Residential	R-12	0.31		0.31	1	1	185		185	185
24/26 Chapel St	158/006	Chisnall, Matthew	Residential (Multi-Unit)	R-12	1.28		1.28	2	3	185		370	555
38 Chapel St	158/007	Levreault, Paul & Kasey	Residential	R-12	0.92		0.92	1	1	185		185	185
67 Chapel St	158/020	Bubis, Margaret	Residential	R-12	0.26		0.26	1	1	185		185	185
82 Chapel St	141/141	Lowell, Richard	Residential	R-12	2.38		2.38	1	3	185		185	555
42 Chum Blvd	141/136	Shanna, Richard	Residential	R-12	0.32		0.32	1	1	185		185	185
48 Chum Blvd	141/140	Simmons, Carl & Dorothy	Residential	R-12	2.95		2.95	1	4	185		185	740
54 Chum Blvd	141/137	Leduc, David & Donna	Residential	R-12	0.36		0.36	1	1	185		185	185
94 Chapel St	142/122	Pelkey, Maurice	Chum's Spirits	R-12	0.25		0.25	1	1	185		185	185
111 Chapel St	142/124	Town of Burrillville	American Legion	R-12	1.22	0.90	0.32	1	1	185		185	185
0 Chapel St	142/123	Lewin, Kenneth & Carol	Empty Lot	R-12	0.19		0.19	0	0	185		0	0
0 Chapel St	158/021	Hopkins, Ralph A. Jr. & James Gervasio TS	Clear River/Granite Mill Canal/Empty Lot	R-12	1.60	1.17	0.43	0	0	185		0	0
0 Chapel St	158/019	Town of Burrillville	Clear River	R-12	0.45	0.21	0.24	0	0	185		0	0
0 Chapel St	158/018	Benoit, Lorraine	Empty Lot	R-12	0.28		0.28	0	0	185		0	0
120 Chapel St	142/025	Young Family Trust		GC	3.60		3.60	6	6		1,500		5,400
			Harrisville Self Storage	GC								0	
			Lawrence Brothers Hardware	GC								100	
148 Chapel St			Cloud 9 Tattoo	GC								200	
158 Chapel St			Repair Garage / U-Haul	GC								200	
180 Chapel St	142/024	Chapel St Realty LLC		GC	0.25		0.25	1	1		1,500		375
			Sunoco / North Country Store	GC								200	
172 Chapel St	142/023	Depalo, Robert		GC	2.30	0.86	1.44	2	3		1,500		2,160
			Eagle Motors Service Center	GC								100	
			Empty Building (potential)	GC								200	
58 Hill Rd	142/013	US Bank National Assoc.	Empty Lot / Granite Mill Canal	GC	11.08	10.06	1.02	0	2		1,500		1,530
0 Chapel St	142/133	Town of Burrillville	Skate Park / Parking Lot	R-12	1.36		1.36	0	1		1,500		2,033
0 Chapel St	142/134	Town of Burrillville	Clear River	R-12	1.96	1.75	0.21	0	0			0	0
							TOTALS:	20	30			3,035	14,643

FLOW CALCULATION FACTORS

Factors	Value	Units	Source
Commercial:	1,500	gal/acre/day	(M&E: Ch. 3 "Commercial Districts")
Residential:	185	gpd/bldg	(TR-16 & U.S. Census) [2.64 x 70 gal/cap per day]
Peaking Factor:	5.5	---	(TR-16: Figure 2-1)
Infiltration Factor:	500	gpd/idm	(TR-16: Section 2.2.3.3)
Length of gravity sewer:	2,400	ft	Based on Conceptual Layout - ALT. #1
Dia. of gravity sewer:	8	in	Based on Conceptual Layout - ALT. #1

Estimated Existing Flow		
Base Flow:	3,035	gpd
Peak Flow:	16,693	gpd
Infiltration:	1,818	gpd
Peak Daily flow:	18,511	gpd
Rounded:	19,000	gpd

Estimated Potential Future Flow		
Base Flow:	14,643	gpd
Peak Flow:	80,534	gpd
Infiltration:	1,818	gpd
Peak Daily flow:	82,352	gpd
Rounded:	83,000	gpd

N

#54 CHUM BLVD
141/137

#42 CHUM BLVD
141/136

#48 CHUM BLVD
141/140

#94
142/122

CHUM BLVD (PRIVATE)

CLEAR RIVER

#120
142/025

#172
142/023

#180
142/024

#58 HILL RD
142/013

CLEAR RIVER

PROP. PUMP
STATION

RIVER ST

B-1

B-2

B-3

B-4

B-5

B-6

B-7

#0
142/133

CHAPEL ST (RT 107)

CLEAR RIVER

GRANITE MILL
BRIDGE (#308)

#0
142/134

PROP. 8" PVC
STUB TO
CHUM BLVD

#82
141/141

#38
158/007

#24/26
158/006

#111
142/124

RAILROAD AVE

RAILROAD AVE
BRIDGE (#354)

GRANITE MILL CANAL
BRIDGE (#309)

EMERSON RD

UNION AVE

#10
158/004

#0
158/019

CLEAR RIVER

#0
158/021

#0
142/123

#67
158/020

HARRISVILLE PASCOAG PEDESTRIAN PATH

PROPOSED BORING B-5 NOT
COMPLETED DUE TO
UNRELATED CONSTRUCTION

24" RCP

PROP. LOW PRESSURE
SEWER SERVICE

#0
158/018

EXISTING SEWER
INTERCEPTOR

CLEAR RIVER

WORLD WAR
MEMORIAL BRIDGE
(#310)

PASCOAG
MAIN STREET

CONNECT PROP. FORCE
MAIN TO EX. SMH

NOTE: EXISTING "DRY" GRAVITY SEWER ON CHAPEL ST, UNION AVE, AND EMERSON RD NOT SHOWN FOR CLARITY PURPOSES, REFER TO ALTERNATIVE #1A AND #2A FIGURES FOR LAYOUT OF THE EXISTING DRY SEWER.

Prepared by:

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Legend

Proposed

- 8" PVC Gravity Sewer
- SS — 6" PVC Gravity Service
- SS — PVC LP Service
- (S) — 4' dia. SMH
- Force Main
- B-1 — Completed Borings (*B-5 was not completed)

Existing

- S — 24" RCP Interceptor
- (S) — SMH
- Building
- Driveway / EOP
- Bridge
- Stream / River

Chapel Street Sewer Alternatives

Town of Burrillville, RI

Scale: 1" = 200'

Figure No. 1

Alternative #1 (Gravity Sewer and Pumping Station Option)

\\BETA-INC.COM\RI\ENVIRON\BURRILLVILLE\CHAPEL STREET\GIS_PDFS\ALTERNATIVE 1\ALTERNATIVE 1.DWG

OPINION OF PROBABLE COST

CHAPEL STREET SEWER EXTENSION - BURRILLVILLE, RI
ALTERNATIVE #1 - GRAVITY SEWER AND PUMPING STATION OPTION
(WORLD WAR MEMORIAL BRIDGE CROSSING)

MAY 2020

Item No.	Description	Units	Quantity	Unit Price	Total Price
SEWER INSTALLATION					
1	Construct 8-inch Gravity Sewer (SDR 35 PVC)	LF	2,400	$200.00	$480,000.00
2	8-inch x 6-inch PVC Wye Branches	EA	25	$60.00	$1,500.00
3	Construct 6-inch Gravity Sewer Service Connections (SDR 35 PVC)	LF	800	$80.00	$64,000.00
4	Construct Force Main and Fittings	LF	2,000	$50.00	$100,000.00
5	Connect Force Main to Existing Manhole	LS	1	$5,000.00	$5,000.00
6	Manhole Bases	EA	15	$3,000.00	$45,000.00
7	Manhole Walls and Cones	VF	150	$150.00	$22,500.00
8	Standard Manhole Frames and Covers	EA	15	$800.00	$12,000.00
9	Low Pressure Sewer Services within R-O-W (SDR 21 PVC)	LF	50	$30.00	$1,500.00
10	Curb Stop Valves w/ Valve Box	EA	1	$500.00	$500.00
11	E-One Pumps (Pump Purchase Only)	EA	1	$5,500.00	$5,500.00
SEWER PUMPING STATION CONSTRUCTION					
12	Pump Station - Lump Sum	LS	1	$250,000.00	$250,000.00
SEWER EARTHWORK					
13	Gravel Borrow	Allow	1	$20,000.00	$20,000.00
14	Rock Excavation and Disposal*	CY	500	$250.00	$125,000.00
15	Earth Excavation Below Normal Depth*	CY	100	$20.00	$2,000.00
16	Earth Excavation and Backfill for Test Pits*	CY	50	$70.00	$3,500.00
17	Additional Crushed Stone*	CY	100	$30.00	$3,000.00
18	Controlled Low Strength Material*	CY	100	$100.00	$10,000.00
BRIDGE & RIVER CROSSINGS					
19	Granite Mill Canal Bridge (RIDOT Bridge No. 309)	Allow	1	$15,000.00	$15,000.00
20	World War Memorial Bridge (RIDOT Bridge No. 310)	Allow	1	$20,000.00	$20,000.00
UTILITY RELOCATION					
21	Miscellaneous Utility Relocation Allowance	Allow	1	$30,000.00	$30,000.00
PAVING					
22	Gravel Base Course, 16-inch Depth in State Roads	CY	1,400	$30.00	$42,000.00
23	Trench-width Temporary Pavement, 2-inch Depth in State Roads	TONS	450	$200.00	$90,000.00
24	Trench-width Bituminous Base Course, 6-inch Depth in State Roads	TONS	1,100	$200.00	$220,000.00
25	Cold Plane (Curb-to-Curb), 2-inch Depth in State Roads	SY	10,800	$5.00	$54,000.00
26	Leveling Course*	TONS	100	$120.00	$12,000.00
27	Bituminous Surface Course (Curb-to-Curb), 2-inch Depth in State Roads	TONS	1,220	$120.00	$146,400.00
28	Reconstruct Bituminous Driveway Aprons	TONS	20	$200.00	$4,000.00
29	Construct Bituminous Berm	LF	320	$10.00	$3,200.00
30	Remove & Reset Granite Curb	LF	100	$50.00	$5,000.00
31	Repair Concrete Sidewalk Sections	CY	2	$1,000.00	$2,000.00
32	4-inch Epoxy Resin Double Yellow Pavement Markings	LF	2,300	$1.00	$2,300.00
33	6-inch Epoxy Resin Single White Pavement Markings	LF	4,600	$0.50	$2,300.00
MISCELLANEOUS					
34	Concrete Encasement*	LF	50	$120.00	$6,000.00
35	Contaminated Soil Management and Disposal*	Allow	1	$50,000.00	$50,000.00
36	Clearing and Grubbing	AC	0.25	$50,000.00	$12,500.00
37	Wetland / Stream Protection (Silt Fence / Compost Filter Sock)	LF	500	$10.00	$5,000.00
38	Erosion Control Measures (Compost Filter Sock)	LF	4,000	$2.00	$8,000.00
39	Catch Basin Management and Protection	EA	15	$150.00	$2,250.00
40	Testing of Materials and Methods (Compaction Testing, etc.)	LS	1	$5,000.00	$5,000.00
41	Traffic Protection / Control Signage and Safety Materials	LS	1	$5,000.00	$5,000.00
42	Mobilization and Demobilization	LS	1	$50,000.00	$50,000.00
				SUBTOTAL:	***$1,942,950.00***
				35% Engineering and Contingency:	$680,032.50
				TOTAL OPINION OF PROBABLE COST =	**$2,630,000.00**

* Indeterminate Item

NOTES:

1. Approximate costs for the purchase/furnishing of individual E-One grinder pumps (one per property) have been included.
Costs for purchase of the pumps will not be covered under the SRF Program. There may be opportunities for funding through the SRF Sewer Tie-In Fund.
For the purposes of this study, we assume Property Owner responsible for costs associated with installation and connection of grinder pumps/services on private property and connection to the Town's main at the property line.
2. Costs associated with bridge crossings must be considered and have been assumed for this evaluation. Further review and discussion with RIDOT will be required to obtain permission and to determine exact scope of work and requirements as well as related costs for each bridge/stream crossing.
3. Does not include Police Details.

N

#54 CHUM BLVD
141/137

#42 CHUM BLVD
141/136

#48 CHUM BLVD
141/140

#94
142/122

CHUM BLVD (PRIVATE)

CLEAR RIVER

#120
142/025

#172
142/023

#180
142/024

#58 HILL RD
142/013

CLEAR RIVER

PROP. PUMP
STATION

RIVER ST

B-1

B-2

B-3

B-4

B-5

B-6

B-7

#0
142/133

CHAPEL ST (RT 107)

CLEAR RIVER

GRANITE MILL
BRIDGE (#308)

#0
142/134

PROP. 8" PVC
STUB TO
CHUM BLVD

CONNECT PROP.
FORCE MAIN TO
EX. SMH

#82
141/141

#111
142/124

RAILROAD AVE

RAILROAD AVE
BRIDGE (#354)

GRANITE MILL CANAL
BRIDGE (#309)

EMERSON RD

#38
158/007

#24/26
158/006

UNION AVE

#10
158/004

CLEAR RIVER

#0
158/019

#0
142/123

#0
158/021

#67
158/020

HARRISVILLE PASCOAG PEDESTRIAN PATH

PROPOSED BORING B-5 NOT
COMPLETED DUE TO
UNRELATED CONSTRUCTION

PROP. LOW PRESSURE
SEWER SERVICE

24" RCP

EXISTING SEWER
INTERCEPTOR

#0
158/018

WORLD WAR
MEMORIAL
BRIDGE (#310)

PASCOAG
MAIN STREET

CLEAR RIVER

INSTALL NEW GRAVITY SEWER
BENEATH THE CLEAR RIVER.
CONNECT NEW SEWER BETWEEN
EXIST. 10" PIPE STUB AND EXIST.
SEWER INTERCEPTOR

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Prepared by:

BETA

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Legend

Proposed

- 8" PVC Gravity Sewer
- 10" PVC Gravity Sewer (River Crossing)
- SS — 6" PVC Gravity Service
- SS — PVC LP Service
- 4' dia. SMH
- Force Main
- B-1 — Completed Borings (*B-5 was not completed)

Existing

- S — 24" RCP Interceptor
- SMH
- Building
- Driveway / EOP
- Bridge
- Stream / River

Chapel Street Sewer Alternatives

Town of Burrillville, RI

Scale: 1" = 200'

Figure No. 2

Alternative #1A (Gravity Sewer and Pumping Station Option)

OPINION OF PROBABLE COST

CHAPEL STREET SEWER EXTENSION - BURRILLVILLE, RI

ALTERNATIVE #1A - GRAVITY SEWER AND PUMPING STATION OPTION

(CONNECTION TO EXISTING "DRY" SEWER AND CLEAR RIVER CROSSING)

MAY 2020

Item No.	Description	Units	Quantity	Unit Price	Total Price
SEWER INSTALLATION					
1	Construct 8-inch Gravity Sewer (SDR 35 PVC)	LF	2,000	$200.00	$400,000.00
2	8-inch x 6-inch PVC Wye Branches	EA	20	$60.00	$1,200.00
3	6-inch Service Connection Taps to Existing Gravity Sewer Main	EA	5	$500.00	$2,500.00
4	Construct 6-inch Gravity Sewer Service Connections (SDR 35 PVC)	LF	850	$80.00	$68,000.00
5	Construct Force Main and Fittings	LF	1,600	$50.00	$80,000.00
6	Connect Force Main to Existing Manhole	LS	1	$5,000.00	$5,000.00
7	Manhole Bases	EA	13	$3,000.00	$39,000.00
8	Manhole Walls and Cones	VF	140	$150.00	$21,000.00
9	Standard Manhole Frames and Covers	EA	13	$800.00	$10,400.00
SEWER PUMPING STATION CONSTRUCTION					
10	Pump Station - Lump Sum	LS	1	$250,000.00	$250,000.00
SEWER EARTHWORK					
11	Gravel Borrow	Allow	1	$20,000.00	$20,000.00
12	Rock Excavation and Disposal*	CY	500	$250.00	$125,000.00
13	Earth Excavation Below Normal Depth*	CY	100	$20.00	$2,000.00
14	Earth Excavation and Backfill for Test Pits*	CY	50	$70.00	$3,500.00
15	Additional Crushed Stone*	CY	100	$30.00	$3,000.00
16	Controlled Low Strength Material*	CY	100	$100.00	$10,000.00
BRIDGE & RIVER CROSSINGS					
17	Granite Mill Canal Bridge (RIDOT Bridge No. 309)	Allow	1	$15,000.00	$15,000.00
18	Clear River Gravity Sewer Crossing	Allow	1	$300,000.00	$300,000.00
UTILITY RELOCATION					
19	Miscellaneous Utility Relocation Allowance	LS	1	$30,000.00	$30,000.00
PAVING					
20	Gravel Base Course, 16-inch Depth in State Roads	CY	1,300	$30.00	$39,000.00
21	Trench-width Temporary Pavement, 2-inch Depth in State Roads	TONS	420	$200.00	$84,000.00
22	Trench-width Bituminous Base Course, 6-inch Depth in State Roads	TONS	1,000	$200.00	$200,000.00
23	Cold Plane (Curb-to-Curb), 2-inch Depth in State Roads	SY	9,300	$5.00	$46,500.00
24	Leveling Course*	TONS	100	$120.00	$12,000.00
25	Bituminous Surface Course (Curb-to-Curb), 2-inch Depth in State Roads	TONS	1,050	$120.00	$126,000.00
26	Reconstruct Bituminous Driveway Aprons	TONS	20	$200.00	$4,000.00
27	Construct Bituminous Berm	LF	320	$10.00	$3,200.00
28	Remove & Reset Granite Curb	LF	100	$50.00	$5,000.00
29	Repair Concrete Sidewalk Sections	CY	2	$1,000.00	$2,000.00
30	4-inch Epoxy Resin Double Yellow Pavement Markings	LF	2,300	$1.00	$2,300.00
31	6-inch Epoxy Resin Single White Pavement Markings	LF	4,600	$0.50	$2,300.00
MISCELLANEOUS					
32	Concrete Encasement*	LF	50	$120.00	$6,000.00
33	Contaminated Soil Management and Disposal*	Allow	1	$50,000.00	$50,000.00
34	Clearing and Grubbing	AC	0.25	$50,000.00	$12,500.00
35	Wetland / Stream Protection (Silt Fence / Compost Filter Sock)	LF	500	$10.00	$5,000.00
36	Erosion Control Measures (Compost Filter Sock)	LF	4,000	$2.00	$8,000.00
37	Catch Basin Management and Protection	EA	15	$150.00	$2,250.00
38	Testing of Materials and Methods (Compaction Testing, etc.)	LS	1	$5,000.00	$5,000.00
39	Traffic Protection / Control Signage and Safety Materials	LS	1	$5,000.00	$5,000.00
40	Mobilization and Demobilization	LS	1	$50,000.00	$50,000.00
				SUBTOTAL:	***$2,055,650.00***
				35% Engineering and Contingency:	$719,477.50
				TOTAL OPINION OF PROBABLE COST =	**$2,780,000.00**

* Indeterminate Item

NOTES:

1. Costs associated with bridge and river crossings must be considered and have been assumed for this evaluation. Further review and discussion with RIDOT and RIDEM will be required to obtain permission and to determine exact scope of work and requirements as well as related costs for each crossing.
2. Does not include Police Details.

Prepared by:

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Legend

Proposed

- PVC LP Main
- PVC LP Service
- Terminal SMH
- B-1 — Completed Borings (*B-5 was not completed)

Existing

- 24" RCP Interceptor
- SMH
- Building
- Driveway / EOP
- Bridge
- Stream / River

Chapel Street Sewer Alternatives

Town of Burrillville, RI

Scale: 1" = 200'

Figure No. 3

Alternative #2 (Low Pressure Sewer Option)

N

#54 CHUM BLVD 141/137

#42 CHUM BLVD 141/136

#48 CHUM BLVD 141/140

#94 142/122

CHUM BLVD (PRIVATE)

PROP. STUB TO CHUM BLVD

#82 141/141

#38 158/007

#24/26 158/006

#10 158/004

#0 158/019

#0 158/018

#67 158/020

#0 142/123

#0 158/021

#111 142/124

#120 142/025

#172 142/023

#180 142/024

#58 HILL RD 142/013

#0 142/133

#0 142/134

CLEAR RIVER

CHAPEL ST (RT 107)

BLOW-OFF/FLUSHING TERMINAL MANHOLE

GRANITE MILL BRIDGE (#308)

RAILROAD AVE BRIDGE (#354)

GRANITE MILL CANAL BRIDGE (#309)

PROPOSED BORING B-5 NOT COMPLETED DUE TO UNRELATED CONSTRUCTION

EXISTING SEWER INTERCEPTOR

24" RCP

WORLD WAR MEMORIAL BRIDGE (#310)

CONNECT PROP. LOW PRESSURE SEWER TO EXISTING SMH

RAILROAD AVE

HARRISVILLE PASCOAG PEDESTRIAN PATH

RIVER ST

EMERSON RD

UNION AVE

PASCOAG MAIN STREET

B-1 B-2 B-3 B-4 B-5 B-6 B-7

NOTE: EXISTING "DRY" GRAVITY SEWER ON CHAPEL ST, UNION AVE, AND EMERSON RD NOT SHOWN FOR CLARITY PURPOSES, REFER TO ALTERNATIVE #1A AND #2A FIGURES FOR LAYOUT OF THE EXISTING DRY SEWER.

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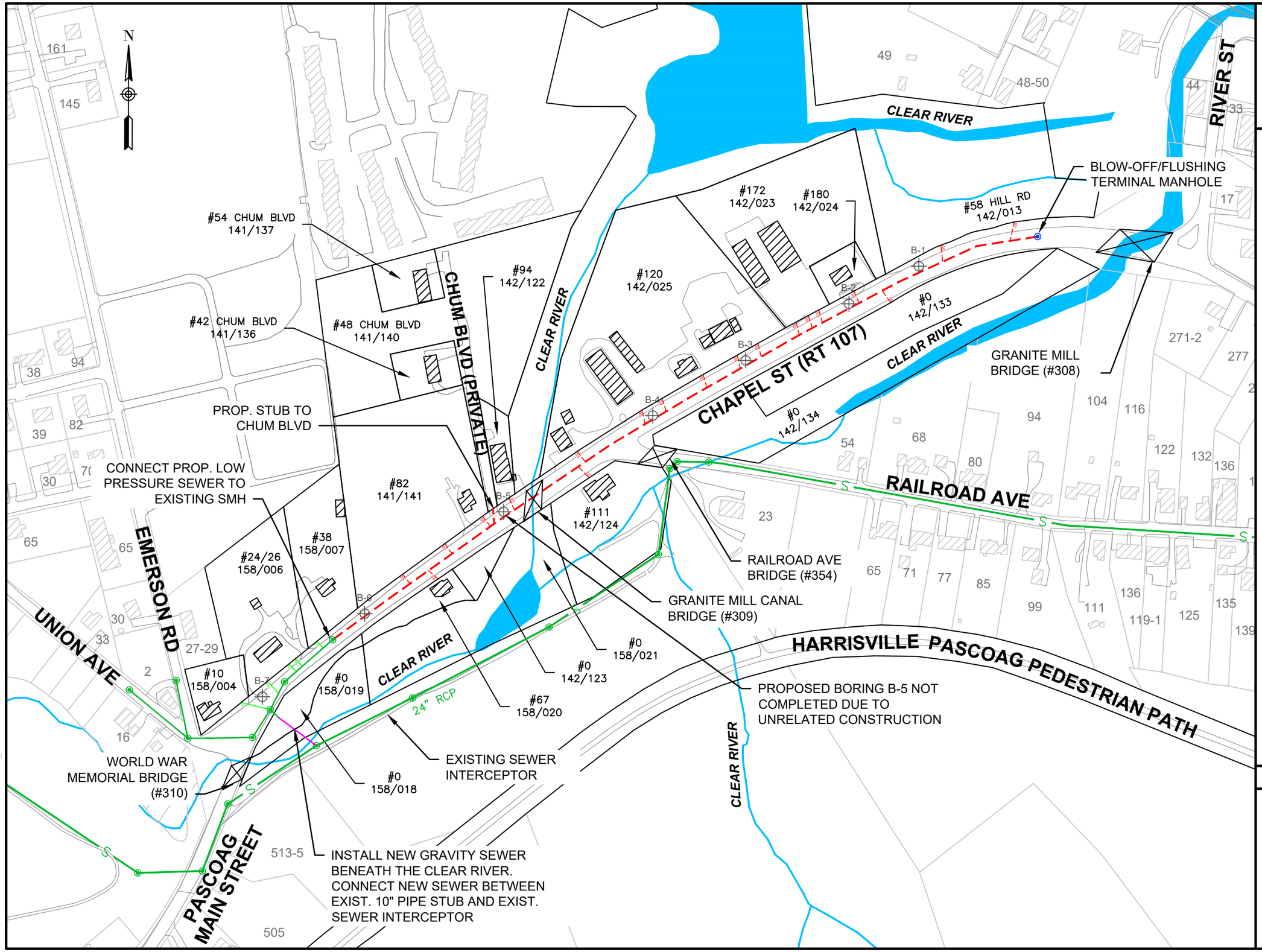
OPINION OF PROBABLE COST
CHAPEL STREET SEWER EXTENSION - BURRILLVILLE, RI
ALTERNATIVE #2 - LOW PRESSURE SEWER OPTION
(WORLD WAR MEMORIAL BRIDGE CROSSING)

MAY 2020

Item No.	Description	Units	Quantity	Unit Price	Total Price
SEWER INSTALLATION					
1	Low Pressure Sewer Main & Fittings (SDR 21 PVC)	LF	2,300	$50.00	$115,000.00
2	Low Pressure Sewer Services within R-O-W (SDR 21 PVC)	LF	750	$30.00	$22,500.00
3	Curb Stop Valves w/ Valve Box	EA	25	$500.00	$12,500.00
4	Connect Low Pressure Main to Existing Manhole	LS	1	$3,000.00	$3,000.00
5	Blow-off / Flushing Terminal Manhole	EA	1	$8,000.00	$8,000.00
6	Standard Manhole Frames and Covers	EA	1	$800.00	$800.00
7	E-One Pumps (Pump Purchase Only)	EA	25	$5,500.00	$137,500.00
EARTHWORK					
8	Gravel Borrow	Allow	1	$10,000.00	$10,000.00
9	Rock Excavation and Disposal*	CY	150	$250.00	$37,500.00
10	Earth Excavation and Backfill for Test Pits*	CY	25	$70.00	$1,750.00
11	Controlled Low Strength Material*	CY	50	$100.00	$5,000.00
BRIDGE & RIVER CROSSINGS					
12	Granite Mill Canal Bridge (RIDOT Bridge No. 309)	Allow	1	$10,000.00	$10,000.00
13	World War Memorial Bridge (RIDOT Bridge No. 310)	Allow	1	$15,000.00	$15,000.00
UTILITY RELOCATION					
14	Miscellaneous Utility Relocation Allowance	Allow	1	$15,000.00	$15,000.00
PAVING					
15	Gravel Base Course, 16-inch Depth in State Roads	CY	900	$30.00	$27,000.00
16	Trench-width Temporary Pavement, 2-inch Depth in State Roads	TONS	250	$200.00	$50,000.00
17	Trench-width Bituminous Base Course, 6-inch Depth in State Roads	TONS	950	$200.00	$190,000.00
18	Cold Plane (Curb-to-Curb), 2-inch Depth in State Roads	SY	10,800	$5.00	$54,000.00
19	Leveling Course*	TONS	100	$120.00	$12,000.00
20	Bituminous Surface Course (Curb-to-Curb), 2-inch Depth in State Roads	TONS	1,220	$120.00	$146,400.00
21	Reconstruct Bituminous Driveway Aprons	TONS	20	$200.00	$4,000.00
22	Construct Bituminous Berm	LF	320	$10.00	$3,200.00
23	Remove & Reset Granite Curb	LF	100	$50.00	$5,000.00
24	Repair Concrete Sidewalk Sections	CY	1	$1,000.00	$1,000.00
25	4-inch Epoxy Resin Double Yellow Pavement Markings	LF	2,300	$1.00	$2,300.00
26	6-inch Epoxy Resin Single White Pavement Markings	LF	4,600	$0.50	$2,300.00
MISCELLANEOUS					
27	Concrete Encasement*	LF	100	$120.00	$12,000.00
28	Contaminated Soil Management and Disposal*	Allow	1	$30,000.00	$30,000.00
29	Wetland / Stream Protection (Silt Fence / Compost Filter Sock)	LF	500	$10.00	$5,000.00
30	Erosion Control Measures (Compost Filter Sock)	LF	4,000	$2.00	$8,000.00
31	Catch Basin Management and Protection	EA	15	$150.00	$2,250.00
32	Permitting (RIDEM, RIDOT)	LS	1	$5,000.00	$5,000.00
33	Testing of Materials and Methods (Compaction Testing, etc.)	LS	1	$10,000.00	$10,000.00
34	Traffic Protection / Control Signage and Safety Materials	LS	1	$5,000.00	$5,000.00
35	Mobilization and Demobilization	LS	1	$50,000.00	$50,000.00
				SUBTOTAL:	***$1,018,000.00***
				35% Engineering and Contingency:	$356,300.00
				TOTAL OPINION OF PROBABLE COST =	**$1,380,000.00**

* Indeterminate Item

NOTES:
1. Approximate costs for the purchase/furnishing of individual E-One grinder pumps (one per property) have been included.
Costs for purchase of the pumps will not be covered under the SRF Program. There may be opportunities for funding through the SRF Sewer Tie-In Fund.
For the purposes of this study, we assume Property Owner responsible for costs associated with installation and connection of grinder pumps/services on private property and connection to the Town's main at the property line.
2. Costs associated with bridge crossings must be considered and have been assumed for this evaluation. Further review and discussion with RIDOT will be required to obtain permission and to determine exact scope of work and requirements as well as related costs for each bridge/stream crossing.
3. Does not include Police Details.



Prepared by:

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Legend

Proposed

- PVC LP Main
- SS — PVC LP Service
- 10" PVC Gravity Sewer (River Crossing)
- Terminal SMH
- B-1 — Completed Borings (*B-5 was not completed)

Existing

- S — 24" RCP Interceptor
- SMH
- Building
- Driveway / EOP
- Bridge
- Stream / River

Chapel Street Sewer Alternatives

Town of Burrillville, RI

Scale: 1" = 200'

Figure No. 4

Alternative #2A (Low Pressure Sewer Option)

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OPINION OF PROBABLE COST

CHAPEL STREET SEWER EXTENSION - BURRILLVILLE, RI
ALTERNATIVE #2A - LOW PRESSURE SEWER OPTION
(CONNECTION TO EXISTING "DRY" SEWER AND CLEAR RIVER CROSSING)

MAY 2020

Item No.	Description	Units	Quantity	Unit Price	Total Price
SEWER INSTALLATION					
1	Low Pressure Sewer Main & Fittings (SDR 21 PVC)	LF	1,900	$50.00	$95,000.00
2	Low Pressure Sewer Services within R-O-W (SDR 21 PVC)	LF	600	$30.00	$18,000.00
3	Curb Stop Valves w/ Valve Box	EA	20	$500.00	$10,000.00
4	Construct 6-inch Gravity Sewer Service Connections (SDR 35 PVC)	LF	200	$80.00	$16,000.00
5	6-inch Service Connection Taps to Existing Gravity Sewer Main	EA	5	$500.00	$2,500.00
6	Connect Low Pressure Main to Existing Manhole	LS	1	$3,000.00	$3,000.00
7	Blow-off / Flushing Terminal Manhole	EA	1	$8,000.00	$8,000.00
8	Standard Manhole Frames and Covers	EA	1	$800.00	$800.00
9	E-One Pumps (Pump Purchase Only)	EA	20	$5,500.00	$110,000.00
EARTHWORK					
10	Gravel Borrow	Allow	1	$10,000.00	$10,000.00
11	Rock Excavation and Disposal*	CY	150	$250.00	$37,500.00
12	Earth Excavation and Backfill for Test Pits*	CY	25	$70.00	$1,750.00
13	Controlled Low Strength Material*	CY	50	$100.00	$5,000.00
BRIDGE & RIVER CROSSINGS					
14	Granite Mill Canal Bridge (RIDOT Bridge No. 309)	Allow	1	$10,000.00	$10,000.00
15	Clear River Gravity Sewer Crossing	Allow	1	$300,000.00	$300,000.00
UTILITY RELOCATION					
16	Miscellaneous Utility Relocation Allowance	LS	1	$15,000.00	$15,000.00
PAVING					
17	Gravel Base Course, 16-inch Depth in State Roads	CY	800	$30.00	$24,000.00
18	Trench-width Temporary Pavement, 2-inch Depth in State Roads	TONS	220	$200.00	$44,000.00
19	Trench-width Bituminous Base Course, 6-inch Depth in State Roads	TONS	860	$200.00	$172,000.00
20	Cold Plane (Curb-to-Curb), 2-inch Depth in State Roads	SY	9,300	$5.00	$46,500.00
21	Leveling Course*	TONS	100	$120.00	$12,000.00
22	Bituminous Surface Course (Curb-to-Curb), 2-inch Depth in State Roads	TONS	1,050	$120.00	$126,000.00
23	Reconstruct Bituminous Driveway Aprons	TONS	20	$200.00	$4,000.00
24	Construct Bituminous Berm	LF	320	$10.00	$3,200.00
25	Remove & Reset Granite Curb	LF	100	$50.00	$5,000.00
26	Repair Concrete Sidewalk Sections	CY	1	$1,000.00	$1,000.00
27	4-inch Epoxy Resin Double Yellow Pavement Markings	LF	2,300	$1.00	$2,300.00
28	6-inch Epoxy Resin Single White Pavement Markings	LF	4,600	$0.50	$2,300.00
MISCELLANEOUS					
29	Concrete Encasement*	LF	100	$120.00	$12,000.00
30	Contaminated Soil Management and Disposal*	Allow	1	$30,000.00	$30,000.00
31	Wetland / Stream Protection (Silt Fence / Compost Filter Sock)	LF	500	$10.00	$5,000.00
32	Erosion Control Measures (Compost Filter Sock)	LF	4,000	$2.00	$8,000.00
33	Catch Basin Management and Protection	EA	15	$150.00	$2,250.00
34	Permitting (RIDEM, RIDOT)	LS	1	$5,000.00	$5,000.00
35	Testing of Materials and Methods (Compaction Testing, etc.)	LS	1	$10,000.00	$10,000.00
36	Traffic Protection / Control Signage and Safety Materials	LS	1	$5,000.00	$5,000.00
37	Mobilization and Demobilization	LS	1	$50,000.00	$50,000.00
				SUBTOTAL:	***$1,212,100.00***
				35% Engineering and Contingency:	$424,235.00
				TOTAL OPINION OF PROBABLE COST =	**$1,640,000.00**

* Indeterminate Item

NOTES:

1. Approximate costs for the purchase/furnishing of individual E-One grinder pumps (one per property) have been included.
Costs for purchase of the pumps will not be covered under the SRF Program. There may be opportunities for funding through the SRF Sewer Tie-In Fund.
For the purposes of this study, we assume Property Owner responsible for costs associated with installation and connection of grinder pumps/services on private property and connection to the Town's main at the property line.
2. Costs associated with bridge and river crossings must be considered and have been assumed for this evaluation. Further review and discussion with RIDOT and RIDEM will be required to obtain permission and to determine exact scope of work and requirements as well as related costs for each crossing.
3. Does not include Police Details.