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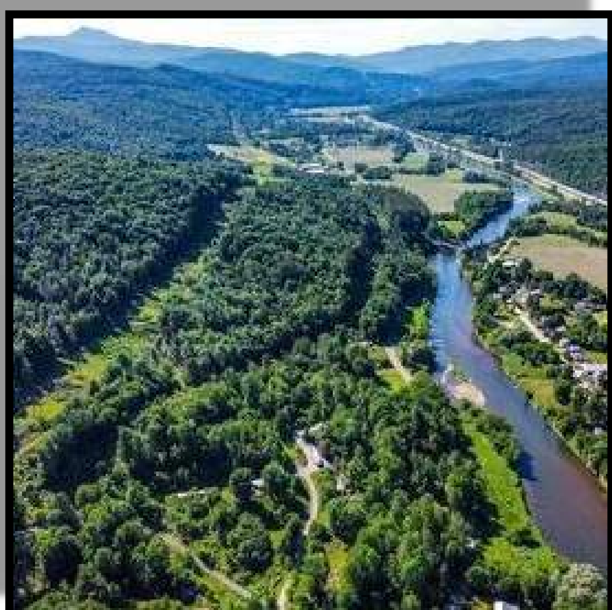
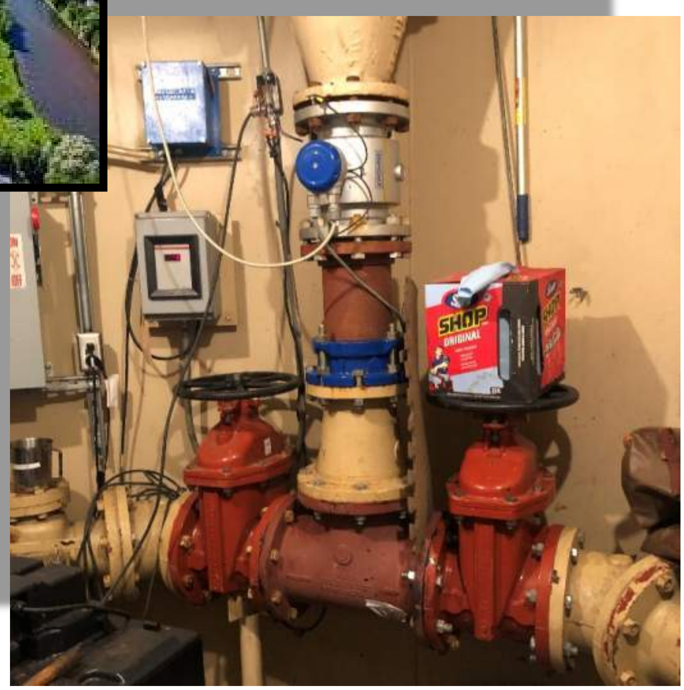
DRAFT REPORT

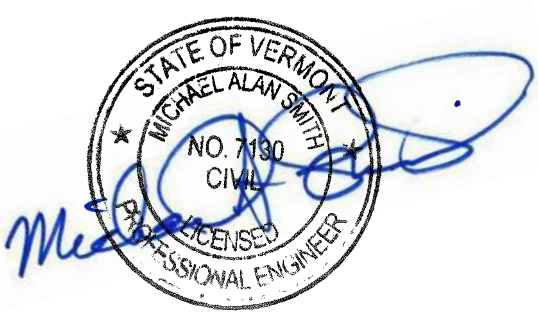
January 2023

TOWN OF
Berlin
VERMONT

Asset Management Plan







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EXECUTIVE SUMMARY

The Town of Berlin owns and operates a wastewater collection system, including 12 miles of gravity sewer, a siphon chamber, three (3) wastewater pump stations and sewage force mains associated with the pump stations. Wastewater collected within the Berlin sewer service area is discharged via the Route 302 Pump Station (main pumping facility) to the wastewater collection and treatment systems for the City of Montpelier, VT. This discharge is governed by an existing intermunicipal agreement between the two communities. Berlin's infrastructure is aging, and the Town is seeking to develop improved mapping and an Asset Management Plan (AMP) for this infrastructure.

Goals of this project included:

- Mapping the collection system
- Manhole Inspection
- Pump Station Inspection
- Identification of projects to keep the system functioning and meeting town needs into the foreseeable future.

The general condition of the wastewater collection system was evaluated by inspecting the sewer manholes and visible gravity sewer pipe, while system GIS mapping was in progress. In general, the wastewater collection system is in good condition. Defects were identified in a small percentage of the sewer manholes allowing storm water inflow and groundwater infiltration (I/I) to enter the wastewater collection system consuming flow capacity and resulting in added expense to the Town as all wastewater entering this collection system is pumped to the City of Montpelier for treatment. No I/I work or closed circuit television (CCTV) pipe inspection was included in this project. Additional study will be required at some point in the future to better ascertain the magnitude and impacts of I/I on the wastewater collection system and operation and maintenance costs.

Two of the town's three pump stations were inspected: (1) the Main Pump Station on US Route 302 and the (2) Partridge Pump Station on Cedar Drive. The Payne Turnpike Pump Station was recently commissioned and therefore not included in the assets reviewed as part of this planning effort. The Partridge Pump Station serves 73 single-family homes, is a submersible configuration and has been well maintained. This pump station has significant remaining useful life and a pumping capacity which exceeds that required for the current service area. No improvements are being recommended for the Partridge Road Pump Station at this time.

The Main Pump Station is a over 40 years old but has been well maintained. It consists of a wet pit, a concrete wetwell where sewage collects from the wastewater collection system, and a dry-pit which houses the pumping equipment. While the equipment is in good condition, the Town has expressed concern over the safety of the operators working in the dry-pit which is 30 feet below grade and can only be entered through a 20-foot long access tube. Weston & Sampson recommends That the Town undertake non-destructive wall thickness testing to determine if the dry-pit portion of this pump station has remaining service life. This was not determined during the inspection for this AMP. If the dry-pit structure proves to be sound, the Berlin may wish to rehabilitate the floor of the structure and implement additional confined space safety protocols for operations which occur within the dry-pit. Should the structure prove unsound, the least costly upgrade alternative would be to convert this pump station to a suction lift configuration using a small, packaged pump station mounted on a skid and housed in a fiberglass enclosure. In addition to being less than half the cost of the next closest-in-cost alternate evaluated, this option would minimize the impact of new construction while maximizing use of the existing site. No additional easement would need to be obtained for this work.

Included in the evaluation for this AMP was a potential point of failure on the cross-country portion of the Hospital Hill trunk sewer, extending from State Route 62 and US Route 302. This is section of cross-country sewer passes through a wooded area with no vehicular access for inspection or maintenance. It was recently observed that drainage from State Route 62 had created a small ravine perpendicular to the trunk sewer, which was eroded nearly to the pipe elevation. This posed a significant risk of failure. Because most of the wastewater generated within Berlin's collection system passes through this section of trunk sewer, failure at this location would have been catastrophic resulting in a significant threat to human health and the environment. To address both the access issue and management of storm water, Weston & Sampson recommends construction of a gravel road along the centerline of the easement and use of a vegetated, ECB-lined swale along the south side of the easement.

Last year, during sewer maintenance operations, the Town determined that there is a small section of private gravity sewer serving seven homes on US Route 302. This private sewer is undersized and does not meet current design standards. Additionally, there have been blockages and backups reported on this line in the past. Each of the seven homes served by this private gravity sewer are billed as connected users of Berlin's wastewater system. Weston & Sampson evaluated three alternatives to address this small section of private sewer: (1) construction of a low-pressure sewer, (2) a Septic Tank Effluent Pumping (STEP) system and (3) replacement in-kind with a properly designed conventional gravity sewer. Because of existing stormwater infrastructure conflicts, proximity to US Route 302 in the affected area, and existing retaining walls constructed along the path of the sewer, Weston & Sampson recommends construction of Alternate 1, a low-pressure sewer system consisting of a small, packaged grinder pump station at each residence which will discharge to a small-diameter sewage force main that serves these homes. This force main may be able to be threaded through the existing gravity sewer piping on these private properties. This would sewer these homes reliably with the least amount of capital investment and would minimize disruption to these properties during construction.

Once Berlin has had an opportunity to review the recommendations provided in this draft AMP and identified a project scope of work, Weston & Sampson will complete Chapter 5 for the final report, which will include an affordability analysis, life cycle cost analysis and recommended project phasing.

1.0 PROJECT PLANNING

1.1 Background

The Town of Berlin owns and operates a wastewater collection system, including 12 miles of gravity sewer, a siphon chamber, three (3) wastewater pump stations and sewage force mains associated with the pump stations. Wastewater collected within the Berlin sewer service area is discharged via the Route 302 Pump Station (main pumping facility) to the wastewater collection and treatment systems for the City of Montpelier, VT. This discharge is governed by an existing intermunicipal agreement between the two communities.

Figure 1- Riverton Falls
(*photo – newenglandwaterfalls.com*)

Berlin's infrastructure is aging, and the Town is seeking to develop improved mapping and a management plan for these assets.

1.2 Scope of Study

Weston & Sampson was hired by the Town of Berlin to assist the Town in the development of an Asset Management Plan (AMP) for their wastewater infrastructure. The scope of work for the AMP consisted of the following tasks:

- Task 1: Collect Available Information and Review Project Goals
- Task 2: Asset Inventory and condition assessment (*250 sewer manholes*)
- Task 3: Geographic Information System (GIS) Mapping of the wastewater facilities
- Task 4: Pump Station Inspections (*Main and Partridge Pump Stations only*)
- Task 5: Prioritization of collection system improvements and associated costs
- Task 6: ARC GIS Software Purchase and Operator Training

Due to budgetary constraints, closed circuit television inspection (CCTV), flow gauging and smoke testing of the gravity sewers were not included. All piping condition assessment for this evaluation was completed through the sewer manhole and pump station inspections.

After the initial scope of work was initiated, several structural issues with the collection system became apparent which the Town of Berlin has added to this evaluation via contract amendment. The following additional scope has been added to the initial inspection and mapping scope:

1. Additional Sewer Manholes Identified - Through their annual flushing and maintenance program, they identified 52 additional manholes which they wanted to included in the GIS Mapping of their wastewater facilities. As such, a contract amendment for the following additional scope items was executed: The original contract for the above referenced project included inspection and mapping of 250 sewer manholes, a count that was based upon existing sewer base mapping.

While performing these inspections, the Town identified an additional 52 sewer manholes that they wished to include in the scope of this project.

2. During our inspection of the two wastewater pump stations, included in the base contract, Weston & Sampson walked the trunk sewer easement leading up "Hospital Hill" with Berlin's contract operator, Maintenance Plus TLC, LLC. During this inspection, Maintenance Plus TLC identified an area where runoff from State Route 62 had washed across the easement for this gravity sewer main. The erosion was significant and had created a potential failure point for the existing 8" A.C. trunk sewer. Weston & Sampson mapped the extent of the erosion and developed options and costs for repair and stabilization as part of this AMP. This work included topographical survey within the easement in order to determine the extent of material eroded from this area, which was then used to develop repair costs.

3. A sewer main break with surfacing wastewater was reported to the Town of Berlin adjacent to the Central Vermont Hospital on November 1, 2022. An existing slope extends downward from the eastern edge of the hospital parking lot to a drainage ravine. State Route 62 is located along the east side of the ravine. There is a sewer connection pipe that extends eastward across the hospital parking lot connecting into a sewer main that extends generally from south to north within the slope as shown in the adjacent image. Weston & Sampson is under separate contract to address this emergency repair, however, this issue and how it needs to be addressed will also be included in this AMP as a point of critical failure within the wastewater collection system.

4. In August 2022, the Town of Berlin expressed interest in evaluating options and developing a design for replacement of a private sewer serving seven homes along the north side of US Route 302 in Berlin (specifically, properties 162 US Route 302 through 308 US Route 302). The existing sewer is a gravity sewer, undersized and does not meet current design standards. The sewer has posed problems in the past and the Town is considering taking over ownership of this section of private sewer and replacing it to eliminate further operation and maintenance issues.

5. Because of the increasing scope of rehabilitation work that will be required, the Town has of Berlin found it advantageous to participate in the Vermont Clean Water SRF Loan Program. As such, additional scope was added to the original AMP effort so that the report would be configured in such a way that the deliverable will meet the requirements of the Vermont Clean Water SRF Loan Program.

Correspondence with the Water Investment Division (WID) of the Vermont Agency of Natural Resources has confirmed that this report as re-configured, along with the additional scope items noted above, will meet SRF Loan Program requirements.

In support of the development and implementation of this AMP, an assessment of the asset inventory and asset condition was conducted by reviewing all available historical information about the Town's water, wastewater, and stormwater systems. To facilitate this effort, and for future inventory and condition assessment updates, a centralized, cloud-based GIS was created. Data on assets' condition, criticality, and remaining useful life was analyzed to prioritize the rehabilitation or replacement of these assets, based on the likelihood of failure and the impact that such failure would have on the system. From this analysis, recommendations were developed for the Town for improving the useful service life of all assets included in this AMP.

In addition, as a part of the AMP project Weston & Sampson provided training to Town Staff so that the Town can continue to implement the AMP leveraging the newly implemented software systems to document maintenance, repair and replacement activities to allow for periodic review and update of the plan.

1.3 Project Goals

This asset management effort aims to improve knowledge of the existing wastewater infrastructure, prolong asset life and aid in creating an efficient allocation of funds for rehabilitation or repair of critical system assets, and manage risk associated with infrastructure failure. A successful asset management plan incorporates accurate asset information, financial planning and coordination between system staff, commissioners, and customers.

The Town's goal through this AMP is to create a comprehensive, verified GIS database for the wastewater collection system to aid the Town in coordinating efforts to maintain existing critical infrastructure while identifying opportunities to improve system capacity. This will allow the Town to better plan for the maintenance and rehabilitation of critical system infrastructure while meeting the growing needs of the community and ensuring operational continuity to its customers. It is also the Town's intent to utilize the comprehensive AMP to further identify ways to promote the sustainability of its wastewater system in the future.

1.4 Project Location

The Town of Berlin, Vermont is a residential community located immediately southwest of Montpelier, Vermont. The Town's wastewater is collected by means of a gravity sewer, with pump stations, and directed to the Route 302 Pump Station (main pumping facility). From this location, all wastewater generated within Berlin's sewer service area is discharged through a force main to the City of Montpelier, where it is ultimately treated at the Montpelier Wastewater Treatment Plant (WWTF).

Berlin's wastewater collection system consists of approximately twelve miles of gravity sewer, a siphon chamber, three wastewater pumping stations and associated sewage force mains. As noted above, the primary goal for the asset management program in Berlin is to improve mapping and management of the sewer system in the Town; and secondarily, allow the Town to plan for maintenance, rehabilitation and future growth needs for this infrastructure. In addition to improvements in mapping and management of the system, the manhole inspections will readily identify and record the location and severity of defects to better prioritize infrastructure in need of replacement.

1.5 Environmental Resources Present

Refer to Figure 2, "Environmental Resources Map" for a Natural Resource Atlas map illustrating the known environmental resources present in the project area. This map was developed using GIS data from the Vermont Agency of Natural Resources. For the purposes of this report, the "project area" is Berlin's sewer service area and is delineated in gray shading. This service area is better defined in Section 2 of this report. The primary environmental resources of concern in the sewer service area are wetlands, flood hazard areas (floodways and 500-year floodplains), and hazardous waste sites (VCGI layers Hazardous Site, Hazardous Waste Generators, Brownfields, Salvage Yard, Aboveground Storage Tanks, Underground Storage Tanks (working), Dry Cleaners, Architectural Waste Recycling Service Area). The entire project area is part of the Urban Soil Background Area.

No extension of the existing infrastructure is being recommended as a result of this report. Recommendations, summarized later in this AMP include improvements and repairs to existing assets in their current locations. All of these locations have been previously disturbed and the work proposed does not directly impact environmental resources, other than to reduce risk of failure of the wastewater system and accidental discharge of untreated domestic wastewater.

1.6 Population Trends

The town of Berlin is located in Washington County. Washington County's population in 2021 was 59,969 whereas the population was approximately 59,807 at the time of the 2010 US Census. From April 1, 2020 to July 1, 2021, the population increased by approximately 0.3% in Washington County. The population of Berlin was approximately 2,849 at the time of the 2020 US Census. Between Barre and Montpelier, the two largest cities in the region, much of the commercial business of the region can be found in Berlin, including parts of the Barre-Montpelier Road (U.S. Route 302) and the Berlin Mall. Berlin's population is slowly declining from the 2010 US Census, approximately -1.3% decline according to the Vermont Center for Geographic Information (VCGI) 2020 US Census. An excerpted copy of these projections for Washington County are attached in Appendix A, "Population Projections". Based on a review of anticipated population changes there is not a current need to expand or increase the capacity of the current wastewater facilities.

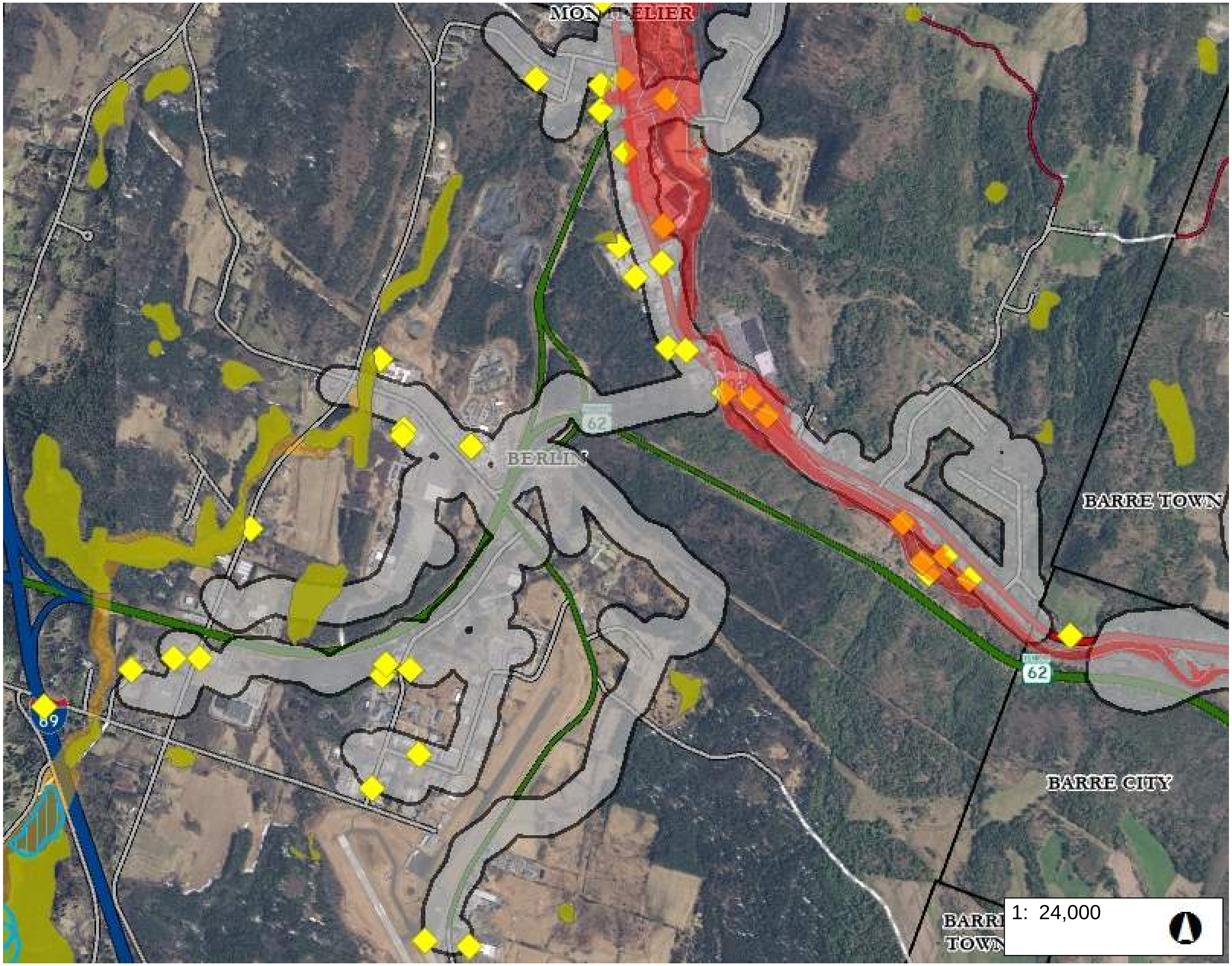
1.7 Community Engagement

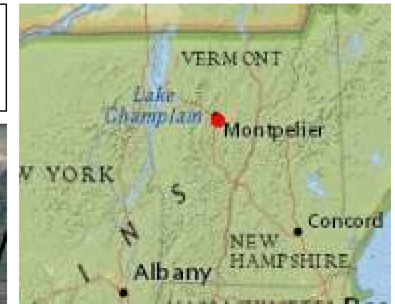
As part of the process of preparing this report and future steps, the Town of Berlin will engage the public to keep them informed on the findings of this report, review the alternatives available, and answer any questions they may have on the project. Due to the continual evolution of the scope of this project (refer

Figure 2- Environmental Resources Map

Vermont Agency of Natural Resources

vermont.gov





LEGEND

Uncommon Species and Other
- Animal
- Plant
- Natural Community

Wetland - VSWI
- Class 1 Wetland
- Class 2 Wetland
- Buffer

Flood Hazard Areas (Only FEM
- AE (1-percent annual chance flood
- A (1-percent annual chance floodpl
- AO (1-percent annual chance zone feet)
- 0.2-percent annual chance flood ha

Hazardous Site

Sewer Service Area

Roads
- Interstate
- US Highway; 1
- State Highway
- Town Highway (Class 1)
- Town Highway (Class 2,3)
- Town Highway (Class 4)
- State Forest Trail
- National Forest Trail
- Legal Trail
- Private Road/Driveway
- Proposed Roads

NOTES

4,000.0 0 2,000.00 4,000.0 Feet

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 2000 Ft. 1cm = 240 Meters

THIS MAP IS NOT TO BE USED FOR NAVIGATION

DISCLAIMER: This map is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. ANR and the State of Vermont make no representations of any kind, including but not limited to, the warranties of merchantability, or fitness for a particular use, nor are any such warranties to be implied with respect to the data on this map.

to section 1.2 above), the Town has not yet attempted to schedule any public information meetings. However, once this draft AMP has been reviewed, the Town of Berlin will post public information meeting details on websites such as Front Porch Forum and refer the pubic to the announcement on the State of Vermont DWSRF/CWSRF Website and on the Environmental Notice Bulletin (ENB).

There will be a public information meeting following a 30-day public comment period once it is determined whether this project is "FONSI" (Finding of No Significant Impact).

2.0 EXISTING CONDITIONS & FACILITIES

2.1 Location Map

Plans have been prepared for the Berlin collection system using a combination of existing record information from the Town's archives and data from a physical survey using a Global Positioning System (GPS) unit. Please see Appendix B, "Wastewater Collection System Base Map".

A more detailed ARC GIS version of this mapping has been furnished to the Town of Berlin for their use with a recently purchased ARC GIS on-line subscription. Data from the sewer manhole inspections is linked to this GIS mapping so that the Town can access infrastructure data by "clicking" on specific structures on the digital map.

2.2 History

The Town of Berlin owns and operates a municipal wastewater collection system consisting of approximately twelve miles of gravity sewer and three main sewage pump stations. The wastewater system was constructed beginning with an interceptor sewer (from Hospital Hill) and extended aeration wastewater treatment facility (located on Route 302 to the east of what is now Ashley Furniture). The primary service area was the hospital and airport business areas. The wastewater treatment facility was commissioned in the 1960s but has since been abandoned in favor of pumping all wastewater to the City of Montpelier for treatment at their municipal wastewater treatment facility. Berlin has purchased wastewater treatment capacity from the City of Montpelier since the 1980s. Since the original wastewater system was commissioned, it has grown modestly to service several commercial and residential areas of the Town.

The Town of Berlin has an allocation of 600,000 gallons per day of treatment capacity, 200,000 gallons of which is currently unused. Additional wastewater capacity to address Berlin's modest growth objectives, outlined in the Town's planning documents, is expected to be addressed through local collection system expansion and the purchase of additional available treatment capacity from the City of Montpelier. Montpelier's wastewater treatment facility has been operating at approximately 30% of its design capacity, due to an aggressive combined sewer separation program over the past 30 years. It is anticipated that the City of Montpelier will be able to address Berlin's future wastewater treatment needs for the foreseeable future. Municipal sewer service is available throughout several main areas in Berlin.

The major service areas within the Town of Berlin are as follows:

- The Airport Road Business Park is a mix of office, storage and distribution, manufacturing, and other industrial uses. This area continues to grow and there remains undeveloped land available to accommodate this expansion. There are approximately 70 businesses in this area, which are served by both municipal water and wastewater.

- Berlin Mall was constructed in 1986, houses approximately 250,000 square feet of retail space and has been occupied by 17 retail and service businesses. Some retail vacancies in the mall have occurred during the COVID-19 pandemic, resulting from the associated economic downturn. This mall and the property on which it sits has been identified by the town as the location for a new Municipal Center and is serviced by both municipal water and wastewater.

- Central Vermont Medical Center was constructed in 1968, the CVMC hospital complex is located at the intersection of Fisher Road and Vermont Route 62. CVMC is the primary health care provider for roughly 66,000 people residing in 26 central Vermont communities. This medical facility provides 24-hour emergency care, with a full spectrum of inpatient (licensed for 122 beds) and outpatient services. Staff on site includes over 200 physicians and 70 advanced practice providers. This campus is serviced by both municipal water and wastewater.

- Exit 7 Business Center is a lodging, dining and traveler service businesses have developed off I-89 Exit 7, including a large travel service center, hotel, restaurant, shopping plaza and car dealership. This area is serviced by municipal wastewater.

- Route 302 Retail Corridor is a typical “commercial strip” which serves as a shopping and service destination for the Central Vermont region; and consists of single-story retail buildings with parking areas along a high-traffic corridor between the cities of Montpelier and Barre. There are approximately 70 active businesses in this area which are serviced by municipal water and wastewater.

In addition to the gravity wastewater collection system, Berlin’s current wastewater system includes the following major infrastructure:

- Main Pump Station is a duplex wet pit/dry pit wastewater lift station, located on Route 302 and was constructed in 1982 when the Berlin WWTF was decommissioned. The pump station consists of a 25’ deep pre-cast concrete wet-well adjacent to a packaged steel dry-pit pump assembly, which is accessed through a manway from the ground surface. There are two 40 horsepower dry-pit wastewater pumps inside the packaged steel dry-pit with controls and an emergency power generator located in a brick control building above grade, adjacent to the dry-pit. Wastewater is pumped via a 12” ductile iron sewage force main approximately 1.8 miles north along the eastern side of Route 302 to a gravity sewer manhole at the edge of the Montpelier wastewater collection system, located near the driveway apron for 223 River Street (US Route 2) in Montpellier. This pump station serves the Route 302 commercial area, residences in this area and takes in all wastewater from the Hospital Hill Interceptor, which used to feed the former Berlin WWTF.

- Partridge Pump Station is a smaller duplex submersible pump station constructed in and serving Plateau Drive, Point Road, and Partridge Road. Wastewater from this small service area is pumped via a 4" ductile iron sewage force main beneath the Stevens Brook to a gravity sewer manhole, then flows south via gravity sewer to the Main Pump Station. This pump station also has a small propane-fired emergency power generator which can power the entire facility in the event of a power outage.

- Payne Turnpike Pump Station is a duplex submersible pump station constructed in 2021 and serving the Exit 7 business area. This pump station is located at the intersection of Paine Turnpike and Fisher Road, and discharges wastewater from its service area to a gravity sewer manhole on Fisher Road, in front of the Vermont Psychiatric Hospital. This pump station was recently commissioned and is therefore not included in the assets reviewed as part of this planning effort.

Much of the economic growth in Berlin has occurred in the northeastern corner of the Town and is directly related to wholesale trade, transportation, and distribution and construction. Development has occurred in the northeastern section of Town because of easy access to the interstate, and availability of water and wastewater utilities and land that can still be developed. The Town of Berlin as identified that the maintenance and expansion of high-quality water and wastewater utilities in the northeastern section of town is key to a sustainable economic future.

As noted earlier, the goal of this AMP is to identify the location and condition of the town's wastewater assets and develop a plan to address immediate infrastructure improvement needs to improve resiliency for this system. Recommendations from this report will be aligned with the goals and objectives of the Town's growth planning efforts and anticipated continued economic growth and development in the northeastern section of Berlin.

2.3 Asset Evaluation (Condition of Existing Facilities)

The following is a summary of our inspection of Berlin's wastewater assets and a description of possible areas for future improvement, for which alternatives are developed in Chapter 4.0 of this report:

2.3.1 Base Mapping

Base mapping for the Town of Berlin has consisted of partial sets of record drawings and design drawings from past development projects, as well as a dated collection system base map prepared by the Central Vermont Regional Planning Commission (RPC). In order to best support future maintenance and planning efforts, a comprehensive base map of the wastewater collection system is needed. In addition, this map must be easily accessible to Town Public Works staff so that it can be easily updated with projects, extensions and maintenance in the future.

To further this effort, Weston & Sampson received and reviewed Town archives and compiled a series of record documents that represented most of the wastewater facilities. We then scanned them to ".pdf" format for use in developing a preliminary GIS sewer system base map. GIS is a digital system used for capturing, storing, checking, and displaying data related to positions on Earth's surface. A common system used for infrastructure mapping, it can be used to record type, age and condition of sewer and wastewater infrastructure and can provide a graphic interface of these assets to utility managers and engineers.

Drawings included plan and profile sheets, lengths of sewer on specific streets and other projects; as well as an overall townwide map of the system from the RPC (noted above). These were used to establish a preliminary GIS database for constructing a baseline inventory of the sewer collection system. Features were digitized from these sources and established in a file geodatabase. Features included manholes, gravity mains, force mains, pump stations and fittings. Quantities and specific features for each were updated based upon local institutional knowledge of the system. The baseline inventory thus established was used in the preliminary field investigation of asset conditions. The GIS was published to the Town's ArcGIS Online organization for use across departments and organizations. ArcGIS is a longstanding product of Esri, the global market leader in GIS software, location intelligence, and mapping Since 1969. The maps included in Appendix B are an overview of the GIS map that was developed for this project.

2.3.2 Wastewater Collection System Inspection

Weston & Sampson used the baseline inventory established in the first phase of the program to construct an asset inspection program. With assistance from the town, buried manholes were uncovered and the process of individual inspection began. The inspection included a minimum collection of three photos of each manhole; an 'area' photo used to document the general location of the asset, a 'frame and cover' photo used to document the visible condition of the exposed portion of the manhole, and an 'internal' photo used to document the visual conditions inside the manhole.

With the manhole opened a topside inspection of the interior of the manhole was conducted. In this case the term "topside" is to differentiate this type of inspection from an inspection that would include confined space entry, CCTV sewer line inspection or other. This inspection was based solely on what was visible from inspecting the manhole without entry. Sewer manhole details collected at the time of inspection included:

- location (street name or easement)
- surface type (dirt, grass, asphalt etc.)
- depth (in feet)
- cover type
- cover and frame material (separately)
- cover diameter

- cover and frame condition (separately)
- cover relationship to prevailing grade
- if the cover received any inflow
- the size of the manhole
- if the manhole required cleaning
- if there was visible grease in the manhole
- if there was evidence of surcharging
- if there were roots intruding into the structure
- if there were steps present and their condition (separately)
- chimney material and condition (separately)
- infiltration from the chimney
- the cone material and condition (separately)
- infiltration from the cone
- wall material and condition (separately)
- infiltration from the wall
- if there was a bench invert
- bench invert material and condition (separately if applicable)
- infiltration at the bench
- total infiltration

Additionally, for each manhole the associated inflowing and outflowing pipes were noted, along with their diameter, shape and material. At the time of inspection, the location of each manhole was recorded with a Global Positioning System (GPS) unit with a nominal accuracy greater than one foot (i.e. +/- 1 foot). These locations were then used to update the locations of the features in GIS sewer system base map. Approximately 300 manholes were inspected and updated in this way. The inspection records were saved to an access database can be linked directly to GIS using the designated manhole number.

Please refer to Appendix C, "Manhole Inspections", for the report summarizing the results from the inspection. Weston & Sampson performed the inspection a total of 300 manholes in June 2021. An estimated 5,300 gallons per day (gpd) of groundwater infiltration was observed coming from defects in 17 of the 300 manholes, and an estimated 78,200 gpd of peak stormwater inflow was approximated from defects in 20 of the manholes. Manholes identified as sources of inflow were generally subject to ponding or could otherwise collect runoff during wet weather.

2.3.3 Pump Station Inspections

In June 2021, Weston & Sampson inspected two of Berlin's three wastewater pump stations, the Main Pump Station on US Route 302 and the Partridge Pump Station on Partridge Road. The Payne Turnpike Pump Station was commissioned in 2021 and was therefore not included in our review. The following is a summary of our findings:


Figure 3 - Main Pump Station

Main Pump Station – This pump station is a duplex wet pit/dry pit wastewater lift station, located on Route 302 and was constructed in 1982 when the Berlin WWTF was decommissioned. The pump station consists of a 25' deep pre-cast concrete wet-well adjacent to a packaged steel dry-pit pump assembly, which is accessed through a manway from the ground surface. There are two 40 horsepower (Hp) three-phase 460V Fairbanks-Morse centrifugal solids handling dry-pit pumps inside the packaged steel dry-pit with controls and an emergency power generator located in a brick control building above grade, adjacent to the dry-pit. The design point for these pumps is 1,200 GPM at 90' TDH and 1,185 RPM. Wastewater is pumped via a 12" ductile iron sewage force main approximately 1.8 miles north along the eastern side of Route 302 to a gravity sewer manhole at the edge of the Montpelier wastewater collection system, located near the driveway apron for 223 River Street (US Route 2) in Montpellier. All wastewater generated within the Berlin sewer service area passes through this pump station.

This pump station has been well maintained since its commissioning and mechanical equipment has been replaced proactively, due to the critical function of this asset. An inspection summary sheet is included in the database so that critical features and equipment information for this pump station can be accessed via ArcGIS Online, similar to information about the sewer manholes. General arrangement drawings depicting this pump station are included in Appendix D, "Main Pump Station". The first and older drawing in Appendix D shows the original installed layout of the pump station and the control building. In the mid 1990s, the control building was moved further back from the road. This is depicted on the site plan on the second drawing. The general configuration of the buried piping, the wetwell and the dry pit were unchanged from the first drawing.

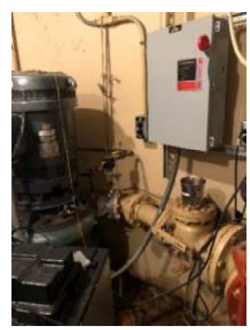


Figure 4 - Pump and Sampler

Access to the dry pit portion of this pump station for service and maintenance is through a steel tube with a small, single person, elevator platform. This platform is controlled by the operator. Ventilation for the pump station dry pit is provided by a centrifugal blower which turns on automatically when the pump station is accessed. In general, the elevator and other equipment mechanical equipment located within the dry pit is in fair condition. A dehumidifier controls humidity prolonging the life prolonging equipment life, And there is a sump pump which lift any leakage collected within the dry pit to the pump station wetwell. There is some minor corrosion on the steel floor of the pump station.

The generator and controls for this pump station are sheltered above grade as noted above. This building is lit on the exterior and doors are locked to provide security. The dry pit for the pump station, located several yards closer to the US route 302 right of way, is secured at the entrance with a padlock. The wet well, accessed via a surface mounted aluminum hatch is also secured with a padlock.

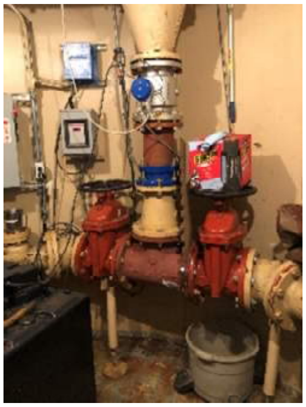


Figure 5 - Discharge Manifold

Pumps are controlled and alternated automatically using an electronic pump controller. Wetwell levels are monitored from above using an ultrasonic liquid level probe. The wastewater pumps are paced using variable frequency drives (VFDs) located in the Control Building. Pumps are paced (speeded up or slowed down) automatically to maintain a relatively constant liquid level in the wetwell. A high-level alarm float is located near the top of the wet well riser. An auto-dialer, located in the control panel, calls out alarm conditions to the wastewater system operator and the Berlin Police Department. Effluent flow is metered using a magnetic flow meter on the pump discharge header. Effluent quality can be monitored via a refrigerated composite sampler, located on the floor of the dry pit. Sample tubing is connected to a tap on the pump discharge manifold. Effluent flow data (total flow and quality) is recorded for billing purposes and furnished to the City of Montpelier. Controls for this pump station have been recently updated.


Figure 6 - Wetwell

As of the writing of the AMP, this pump station is 40 years old. Mechanical equipment and controls within the pump station which have reached their useful life have already been replaced and the pump station functions well. Pumping equipment operated without fail for 29 years (from commissioning) and was replaced at that point out of an abundance of caution. Pumps were replaced in-kind in 2012 and remain reliable and serviceable. Berlin has expressed concern over the nature of access to this pump station and the limited space available for maintenance operations in the dry pit. Entry into the dry pit constitutes a confined space entry and the workspace is physically below the operating liquid level in the wetwell.

The wetwell was inspected from above and the pre-cast concrete risers above the pump chamber appeared to be in good condition. As opposed to the welded steel dry pit structure, the concrete wetwell should have a much longer service life. Further inspection of the wet well was not undertaken as it is a confined space, and a hazardous location due to the continuous sewage flow entering the structure.

In its current configuration, this pump station has capacity to address wastewater generated from the entire service area.


Figure 7 - Partridge PS Generator

Partridge Pump Station is a smaller duplex submersible pump station constructed in 1988 and serves Plateau Drive, Point Ridge Road, and Partridge Road. Wastewater from this small service area is pumped via two 7.5 Hp 460V Myers 4VH non-clog submersible solids handling pumps. These pumps have a design point of 225 GPM at 53' TDH. Wastewater is pumped through a 4" ductile iron sewage force main beneath the Stevens Branch of the Winooski Rover to a gravity sewer manhole, then flows south via gravity sewer along US Route 302 to the Main Pump Station. This pump station also has a small propane-fired emergency power generator which can power the entire facility in the event of a power outage. This pump station has also been well maintained since its commissioning and mechanical equipment has been replaced proactively. Inspection summary data is included in the asset database so that critical features and equipment information for this pump station can be accessed via ArcGIS Online, similar to information about the sewer manholes. General arrangement drawings for this pump station are not currently available.

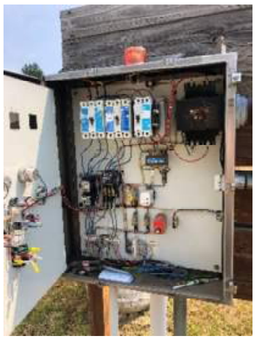


Figure 8 – Control Panel

Controls for this pump station consist of liquid level floats (including a high-level alarm float) and relays to start, stop and alternate the two submersible wastewater pumps. Pumps are mounted on slide rails and can be removed from the wetwell with the lifting chain for maintenance. The controls are housed in a stainless-steel weathertight enclosure mounted to a wooden backboard, adjacent to the pump station. The emergency power generator is on a concrete pad and inside a sound attenuated enclosure. The entire site is secured with a stockade fence and gate. The pump station components are hidden from the general public's view to prevent the pump station from becoming an attractive nuisance.

Alarm conditions result in activation of a red strobe light and an audible alarm, both mounted to the exterior of the pump station control panel.

As of the writing of the AMP, the Partridge Pump Station is approximately 25 years old. Mechanical equipment and controls within the pump station which have reached their useful life have already been replaced and the pump station functions well. This pump station does not have a flow meter, but does have an hour meter, so that flows can be approximated by multiplying the number of discharge cycles per day by the total wetwell volume discharged during each cycle. No flow records are available for this pump station. There are approximately 73 single family residences currently served by this pump station. Using the VT Environmental Protection Rules design wastewater flow rate of 210 GPD per home, we get approximately 15,330 GPD, which is fairly conservative. Assuming that this flow comes in over a 12-hour period each day, the pump station would need to be able to displace an average of 22 GMP.

The wetwell was inspected from above and the pre-cast concrete risers above the pump chamber appeared to be in good condition. In its current configuration, this pump station has more than enough capacity to address wastewater generated from the entire service area.

2.3.4 Additional Areas of Concern (Potential Points of Failure)

After Weston & Sampson began the AMP effort, the Town identified three areas of concern within the wastewater collection system. These areas of concern or, potential points of failure of the wastewater collection system are as follows:

Figure 9 – Sewer Main Break at CVH

- Hospital Hill Gravity Sewer Failure – On November 1, 2022, the Facilities Manager of the Central Vermont Hospital (CVH) contacted the Town of Berlin to report a sewer main break along the edge of Route 62, between Route 62 and the edge of the hospital parking lot. This failure was evident by sewage surfacing from the embankment below the parking lot and wastewater solids in the stream bed. This event occurred when CVH had been flushing their sewer service line. It appears that debris from the flushing operation accumulated in the gravity sewer main downstream of the CVH service line connection. When the Paine Turnpike sewage lift station discharged to the gravity sewer main above the hospital, wastewater backed up within the gravity sewer and overflowed the sewer through a misaligned joint, causing a portion of the embankment below the CVH parking lot to wash into the stream which flows between the parking lot and the Route 62 right-of-way.

  Berlin's gravity sewer in this area consists of 8-inch diameter Asbestos Cement (AC) pipe and is some of the oldest wastewater infrastructure in Town. A subsequent CCTV inspection of this sewer line, once the blockage was removed and the overflow ceased, confirmed the location of the misaligned joint and showed that the pipe had been displaced. A physical inspection of the break location from the surface showed evidence of slope failure on both sides of the drainage swale that passes between the parking lot and Route 62 right-of-way. The slope failure was evidenced by large cracks in the soil parallel to the stream path along both sides of the stream.

  Weston & Sampson observed that due to poor soil conditions, a steep bank below the hospital parking lot and continual erosion of the stream bed, destabilized embankment and soil creep were likely causes for displacement of the rigid asbestos cement sewer line in this area, ultimately resulting in failure when the sewer was surcharged and under slight pressure. Once the blockage was removed, and normal sewage flow resumed, no surfacing has since been observed. The Town of Berlin immediately reported this discharge to the Vermont Agency of Natural Resources and has since contracted with Weston & Sampson to provide geotechnical evaluation of the soils and bedrock in the vicinity of the sewer break so that appropriate soil stabilization measures can be incorporated into the sewer repair design, preventing further damage from creep. Additionally, the geotechnical information can be used to stabilize the excavation for repairs to prevent further damage to the slope and the parking lot above.

- Hospital Hill Trunk Sewer (potential failure) - During the sewer mapping and inspection portion of AMP development it was observed that a large section of the 8-inch AC trunk sewer downstream of CVH extends through approximately 1/4 mile of heavily wooded area (upstream from the Route 62 right-of-way, downstream to the former site of the Berlin WWTF on the south side of US Route 302) and is inaccessible for service or maintenance. This area needs to have some form of access so that the Town can approach the sewer manholes along this section of trunk sewer for inspection and maintenance operations.

While performing our inspection it was also observed that drainage from a large culvert passing beneath Route 62 had resulted in a washout crossing above and perpendicular to this trunk sewer, near the edge of the Route 62 right-of-way. Further inspection revealed that erosion was nearly down to the top of the AC sewer line, creating a point of imminent failure. Since all of the wastewater collected from the Exit 7 commercial area, the Berlin Mall, CVH campus and the Edward F. Knapp State Airport passes through this section of trunk sewer, a line failure at the top of this hill would result in a significant displacement of material onto US Route 302 below and discharge of a significant amount of untreated wastewater to the Stevens Branch of the Winooski River.

Since discovery of this issue, the Town of Berlin Has worked directly with Weston & Sampson and VTrans to implement drainage stabilization measures in the vicinity of the storm drain outfall and along the drainage path from the highway right-of-way to the far side of the sewer easement. These emergency stabilization measures were implemented in February 2022. While these improvements have reduced the immediate risk of failure of this trunk sewer, they are temporary in nature and additional stabilization measures must be evaluated to prevent similar erosion from occurring in the future.

- Route 302 Private Sewer Failure - In March 2022 a resident on route 302 in Berlin north and west of Highland Avenue reported a sewer blockage to the Town which they had been dealing with for several months. Reports indicate that the blockage had been a recurring problem since November of 2021. The affected resident contacted Wind River Environmental Services of Middlesex, VT to rod the sewer line and remove the obstruction. In this process they discovered that the sewer service did not cross Route 302 to the Berlin trunk sewer, as previously believed, but connected to a 4-inch diameter AC gravity sewer running parallel to Route 302 across several private properties. Further investigation showed that this private sewer serves seven residences along the north side of Route 302 (properties 162 through 308 US Route 302). While the existing sewer is gravity, it is undersized and does not meet current design standards. In addition, a portion of this sewer crosses over a small brook that runs parallel between lots number 228 and 190. The town is considering taking over ownership of the section of private sewer and replacing it with a sewer which meets current design standards, in order to eliminate further operation and maintenance issues. All of the seven properties connected to this private sewer receive a sewer bill from the Town of Berlin.

2.3.5 Right-of-Way Issues

During our due diligence for the sewer easement following the Hospital Hill Trunk Sewer (described in 2.3.5 above), our surveyor identified two separate issues with easements for the trunk sewer. The first issue is that the current easement for the Hospital Hill trunk sewer line where it passes through the woods is 30 ft. wide and not 50 ft. wide, as originally thought. Through the surveyor's research, he found that the Town originally owned a narrow lot over the sewer line, in addition to the lot for the former Berlin Wastewater Treatment Facility, at the bottom of the hill. This lot, referenced in the Town Records as Lot 3, was 50 ft wide. When the wastewater treatment facility and the property on which the sewer line were sold to Lyford in 1987, the Town opted to keep a 30-ft. wide maintenance easement. The deed shown in Book 54 Page 299 notes that this 30-ft. wide easement is located "within Lot 3". There is no description of the easement being centered on the sewer line.

Given the loose description of this easement, we recommend that the Town consider developing clearer language for the easement, noting that it is "centered on the Hospital Hill trunk sewer". Once easement language has been finalized, this clarification can be made via quitclaim deed with the current Lot 3 property owner.

While this is not an urgent matter, it will help facilitate the design and construction of proposed improvements in this area, such as ditching along the sewer line and the gravel maintenance road that the Town needs to develop for access to this trunk sewer.

A second easement definition issue exists along the 8-inch trunk sewer from the CVH campus , beneath the Route 62 ramps to the easement described in Section 2.3.5 above (from Sewer Manhole No.125 to Sewer Manhole No.184). The entire existing sewer line of in this segment falls within the State of VT Route 62 Highway right-of-way.

In 1965, before the Route 62 right-of-way was created, the Town of Berlin bought a 50-foot wide strip of land (V.36 Pg.412) for "sewer and road purposes" as filed in the Town's land records. Shortly thereafter, the Route 62 right-of-way was created and the parcel containing "Section 2" of the Berlin sewer line was taken by the State of Vermont. No documents from the taking were found describing what rights to the sewer line were to be retained by the Town of Berlin. VTrans has a plan for this project, entitled "Highway Plan 1", which depicts the sewer line and 50-foot right-of-way in the same location as described in V.36 Pg. 412 and depicted on that plan. The State's project drawing, entitled "Highway Plan 2", depicts the trunk sewer in its current alignment but does not depict a right-of-way boundary for the sewer. No deeds were found relating to the sewer line relocation.

As with the first right-of-way issue, this is not an urgent matter, but a "loose end" which will help facilitate the design and construction of any future improvements on this section of Berlin's trunk sewer, once resolved. While there are no other recommendations stemming from these observations, we have

included them in this report as they do affect management of this critical asset. For example, for a wastewater project to be fundable through the SRF loan program, a municipality will need to demonstrate that they have a legal interest in the land on which the project is constructed. This means that Berlin should have an easement in place for this existing sewer so that they have the ability to apply government grant and loan funds to any improvements required for this infrastructure in the future.
Costs related to easement acquisition or modification are not typically eligible for SRF Loan funding and would need to be covered directly by the municipality. Documents referenced with regard to the easement issues described above can be found with the Berlin Town Land Records, and are not appended to this AMP.

2.4 Financial Status of Existing Facilities

Please see Appendix E, "FY23 Sewer Budget". The only current debt service is the Paine Turnpike North Sewer Extension Project. Approximately 20% of the annual budget is set aside for capital construction and reserve. Maintenance operations have been budgeted at 3% of the total budget. Additional financial analysis is included in Chapter 5.

2.5 Water/Energy/Waste Audits

There have been no water, energy efficiency evaluations at the wastewater pump stations, or wastewater audits, or infiltration and inflow (I/I) work to date.

3.0 NEED FOR PROJECT

3.1 Health, Sanitation & Security

The Town of Berlin sewer collection system provides protection to the Berlin Pond, a major water body, as well as other surface waters like the Winooski River. As stated earlier, one of the goals of this project is to facilitate planning for the maintenance and rehabilitation of critical system infrastructure while meeting the growing needs of the community and ensuring operational continuity to its customers. There are several components of the existing wastewater infrastructure that require immediate investment in order to not only achieve the stated AMP goal, but to ensure protection of public health and the environment. They are as follows:

- Wastewater Collection System – Several sewer manholes require minor rehabilitation for more efficient system operation. Addressing minor age-related defects within these structure will eliminate extraneous water flows; freeing up valuable system capacity for future projects, and reducing transport and treatment costs for the connected users.

- Main Pump Station – Berlin's Main Pump Station on US Route 302 is well maintained, complies with state emergency power requirements and functions well; however, the equipment is obsolete. The Town has also expressed concern over dry pit access, and potential operator safety issues. This pump station could be replaced with a different pump configuration that would not only update the facility, but make it safer for routine access and maintenance.

- Hospital Hill Sewer Failure – A section of trunk sewer has failed as a result of an adjacent slope failure. The slope in this area needs to be stabilized and erosion mitigated as part of a repair to this section of sewer. Not stabilizing soils around this sewer will result in future failure and surface water contamination.

- Hospital Hill Cross Country Trunk Sewer – A large section of the trunk sewer passes through a wooded area, making this section of sewer inaccessible for maintenance or inspection; and current state highway drainage issues pose a significant threat to this section of sewer, the community and the environment. Access and drainage improvements to this easement need to be constructed to stabilize this area and make it accessible.

- Route 302 Private Sewer – There is a short section of private gravity sewer that serves seven private residences. This sewer has been problematic, has experienced back-ups and is not constructed in accordance with current gravity sewer design standards. Additionally, a portion of this sewer is exposed (on private property) in a stream bed and poses a risk of surface water contamination.

The general condition of the wastewater collection system is good, from observations we made during our manhole inspection and sewer base mapping efforts. In addition to the above major areas of concern, Weston & Sampson recommends general improvements to a portion of the existing sewer maholes to reduce infiltration from surface stormwater runoff. Reducing stormwater inflow will increase available sewer conveyance capacity and reduce pumping and treatment costs for the Town.

Because the Town has not performed any infiltration/inflow (I/I) work to date, the Town does not currently have a solid assessment of the physical condition of the gravity sewers, or an understanding of the impacts of I/I on the collection system capacity. Once understood, the Town will be able to use the findings from a future I/I study to assess and prioritize which infrastructure needs replacement and when, in addition to being able to better respond to sewer main breaks and preventing sewage from entering the environment. Decreases in response time for utility management personnel to mobilize and respond to emergencies is also a potential result of the asset management program. Information gained regarding I/I impacts within the wastewater collection system, as well as gravity sewer structural conedition and age, can easily be incorporated into the Berlin wastewater GIS database for use in making better planning decisions with regard to system maintenance and repair.

3.2 Aging Infrastructure

Sections of the existing collection system are aging and in need of regular inspection and maintenance. Most of the wastewater collection system has been in place since the 1960s and is constructed of AC pipe, which has an anticipated useful life (depending on sewer conditions, sulfide generation and groundwater conditions) of approximately 50 years. Most of the wastewater collection system has exceeded it's useful life. Addressing points of imminent failure first, then taking on planned improvements in a prioritized manner will extend the life of this system and protect community health and the environment.

3.3 Reasonable Growth

Additional wastewater capacity to address Berlin's modest growth objectives, outlined in their town planning documents is expected to be addressed as needed through local collection system expansion and the purchase of additional available treatment capacity from the City of Montpelier. Montpelier's WWTF has been operating at approximately 30% of its design capacity, due to an aggressive combined sewer separation program over the past 30 years. It is anticipated that the City of Montpelier will be able to address Berlin's future wastewater treatment needs for the foreseeable future.

No expansion of the wastewater collection system to address near-term growth is needed, and none is recommended at this time.

4.0 ALTERNATIVES CONSIDERED

4.1 Alternatives Analysis

As described in Section 2, the primary goal of this AMP is to review the wastewater collection and pumping facilities and prioritize improvements needed to help make the best and most efficient decisions moving forward with regard to system maintenance. Mapping was a very large component of this effort. Once the wastewater infrastructure was mapped, and the sewer manholes inspected, we were able to develop a matrix to help prioritize improvements for the sewer manholes based on "consequence of failure" and "likelihood of failure". This analysis is described in more detail in this Section of the AMP.

During the development of the AMP a number of specific points of failure, and potential points of imminent failure, were identified. These specific wastewater infrastructure issues require immediate attention and, as such, we did not evaluate their consequence or likelihood of failure. In some instances, the failure had already occurred, and the consequences are obvious. For these specific wastewater collection system issues, we have developed alternative improvements for consideration by the Town, as well as background information, conceptual design details and preliminary project cost information which are the basis for our recommendations moving forward. This information is being presented for the Berlin's consideration and should be most helpful in making beneficial selections to address each specific need identified through this AMP.

4.2 Wastewater Collection System

Weston & Sampson performed mapping and inspection of 300 sewer manholes in June 2021. At the Town's request, detailed inspection of the actual buried piping was not included. The AMP effort focused on the sewer manholes and asset mapping. The results of this inspection are summarized below.

4.2.1 Mapping

Weston & Sampson created a Microsoft Access database designed specifically for the management of sewer manhole data. The database was developed for this project and can be updated during subsequent investigation phases which allows for a single, comprehensive sewer manhole database to be created over time. The database contains data fields for sewer system information such as manhole location, diameter, depth, material, casting and cover size, condition of manhole components, and source of any observed infiltration. The incoming and outgoing sewer pipe diameter, material, and position within the manhole are also included. Information from the Access Database can be linked to GIS mapping. An electronic copy of the database has been provided to the Town as one of the contract deliverables.

4.2.2 Topside Manhole Inspections

Manhole inspections consisted of topside visual inspection of sanitary sewer manholes. GPS location, diameter, depth, material, casting and cover size and source of any observed infiltration or inflow (I/I) are recorded for each manhole. Removing I/I from the manholes can help free up valuable sewer capacity. The inspection also provided data on structural defects in manholes that should be repaired as part of the town's regular maintenance activities.

4.2.3 Infiltration and Inflow (I/I)

From our inspection of 300 sewer manholes an estimated 5,328 gallons per day (gpd) of infiltration was identified and attributed to 17 manholes; and an estimated 78,232 gpd of peak storm inflow was identified and attributed to defects in 20 manholes. Manholes identified as sources of inflow are generally subject to ponding or can otherwise collect runoff during wet weather. Structural defects were found in nine manholes, such as loose or missing bricks in a chimney, no existing bench and inverts, or defective frames and covers. Inspections were not performed at 16 locations where the manholes could not be opened. The results of the manhole inspections are summarized in Appendix C, Table C-1, "Manhole Inspection Summary".

One way to prioritize sewer manholes for repair is to gauge the approximate amount of groundwater infiltration and storm water inflow that is contributed by each as part of our inspection we approximated values for both of these parameters at each sewer manhole based on accepted industry practices and Weston & Sampson's extensive experience evaluating linear wastewater assets.

Structural defects were found in nine manholes, such as loose or missing bricks in a chimney, no existing bench and inverts, or defective frames and covers. Recommendations for rehabilitation and estimated costs are listed in Appendix C, Table C-2, "Manhole Structural Defects".

Inspections were not performed at 16 locations where the manholes could not be opened. These manholes are listed in Appendix C, Table C-3, "Manholes Not Inspected". Uninspected manholes should be opened and inspected. An electronic copy of manhole inspection logs and photos have already been provided.

4.2.4 Failure Analysis

A second way to prioritize improvements for an asset is to rank the condition and the criticality of failure for this asset. The condition of each of the assets, in this case sewer manholes, were ranked on a scale of 1 to 5, with 1 being the best condition (serviceable and having a remaining useful life) and 5 being the worst condition (near a point of failure). Condition ranking is based on the severity of observed structural defects, independent of observed I/I. Criticality of Failure ranking (also values of 1 through 5) is based on the perceived severity of risk to human health and the environment should this individual asset fail.

Once each asset was ranked using both of these criteria, we multiplied the "condition" value by the "criticality of failure" value to come up with a prioritization ranking. For the purposes of this report, we are recommending that any asset with a priority ranking value of 4 or greater be addressed. Of the 300 manholes inspected, only 9 of them meet this criterion. See the manhole ranking summary attached at the end of Appendix C. These specific structures include the following sewer manholes, listed in order of priority for repair (from left to right):

125, 31, 119, 120, 121, 122, 123, 124 and 244.

Please note that none of these specific manholes are included in the 17 manholes which have been identified as contributing I/I.

4.2.5 Recommended Improvements

Because the total of all of the manholes identified through both analyses comprise less than 10% of the total number of sewer manholes in the wastewater collection system, we recommend that the Town of Berlin undertake the improvements identified in Appendix C for all 26 manholes.

- I/I Related Defects (17 manholes): Based on the observations made during the 2021 Asset Management Plan, Weston & Sampson has developed a Recommended Rehabilitation Program for identified defects and sources of I/I within the inspected manholes. The recommended I/I rehabilitations are provided in Appendix C, Table C-4, "Manhole Infiltration Rehabilitation Summary" and Table C-5, "Manhole Inflow Rehabilitation Summary", with a summary provided below. The recommended structural rehabilitations and approximate costs are provided in Table C-6.

  It is important to note that manhole structures may degrade between the time of inspection and the time of rehabilitation. Generally, the more time that elapses the greater the chance of material and structural degradation.

- Observed Structural Defects (9 manholes): Defects identified in these 9 manholes are specific and there are not multiple alternatives to be evaluated for each of the recommended repairs. Please refer to the sewer manhole inspection reports for the identification of the individual defects in need of repair for each of the sewer manholes identified.

4.2.6 Additional Wastewater Collection Asset Recommendations

As noted earlier in this report, the condition of the existing gravity sewer piping was not evaluated as part of this AMP. Because of specific points of failure noted in this report, and reported high seasonal variability in total flows being pumped from this system to the City of Montpelier, Weston & Sampson recommends that an Infiltration/Inflow Analysis be completed at some point in the future to better ascertain the condition of the gravity sewer piping and to identify where structural defects exist (allowing I/I to enter the wastewater collection system) so that they can be prioritized and scheduled for repair.

Continued replacement of aging infrastructure is typically recommended to minimize the risk of catastrophic system failure and to distribute the significant replacement cost of the utility systems over a more manageable period. The Town has approximately 12 miles of wastewater collection infrastructure. If we assume that pipeline has a useful life of 75 years, the Town should be replacing on average 850 feet of gravity sewer each year. Assuming $200 per linear foot on average, Berlin could be budgeting approximately $170,000 per year for wastewater collection system replacement. Performing an I/I Analysis will help direct funds to sections of sewer in most critical need of replacement and may help identify sections which only need repair and rehabilitation vs. full replacement. This type of analysis will help the Town spend money on the wastewater utility in the most efficient manner possible.

Weston & Sampson further recommends that Berlin continue with its proactive approach towards managing its sewer system. Annual sewer system flushing and routine inspections ensure that necessary rehabilitation work is identified and performed on a regular and timely basis to reduce I/I and helps to prevent serious problems requiring costly emergency repairs.

4.3 Main Pump Station (Route 302 Pump Station)

As noted in Section 2 of the AMP, the Main Pump Station was commissioned in 1982, just prior to the Berlin WWTF being taken offline. Our inspection of this pump station showed that the internal equipment is well maintained and has been replaced as needed. The pre-cast concrete wet well is in very good condition and well within its anticipated service life. The pump station dry-pit has two minor issues: (1) it is a permit-required confined space since the piping is below the operating liquid level of the adjacent wet well (engulfment hazard) and the operators must access the pump station through a 20-foot vertical tube (access is limited). The pump station drawings from 1982 show that the steel dry-pit is protected from corrosion using a number of magnesium sacrificial anodes. The Town of Berlin has no record of these bags, which provide temporary corrosion control, ever having been replaced. Corrosion was observed inside on the floor of the pump station. The dry-pit, due to its depth, extends below ordinary groundwater levels.

For this AMP, Weston & Sampson has developed three different options to address the issues identified with this asset. These options will be compared with recommendations for rehabilitation of the existing dry pit. They are as outlined below:

4.3.1 Option No. 1 - Rehab Dry Pit (Below Grade)

As an initial phase for this option, Weston & Sampson recommends hiring a materials testing consultant to systematically gauge the steel thickness of the dry-pit equipment chamber and access tube. This step should be taken primarily to determine if rehabilitation will be effective. As noted above the only corrosion observed was on the surface of the steel floor deck in the dry-pit chamber. There was no groundwater infiltration observed. Steel thickness testing will provide a good indication of the severity of corrosion around this structure, if it is a larger issue.

If it is determined that the material thickness for the pump station dry-pit walls and floor are acceptable, Weston & Sampson recommends excavation of and replacement of the existing magnesium sacrificial anode bags. Sacrificial metals are widely used to prevent steel containers, such as this pump station or an underground storage tank, from degrading due to galvanic corrosion or stray electrical current in the area. The anode is more electronegative than iron and therefore oxidizes in preference to the iron, preventing the steel structure from corroding.


Figure 10 – Magnesium Anode

Due to the limited lifespan of these anodes, it is recommended that they be monitored and replaced periodically. A high-grade magnesium alloy is recommended since it has a higher driving voltage, which is typically required for buried applications. These anodes are prepackaged in a cotton bag, surrounded by a special chemical fill with high carbon content; providing a low anode-to-soil current resistance. The anodes are installed a certain distance from the tank (as recommended by the manufacturer) to ensure sufficient protective current distribution. Each sacrificial anode is connected to the steel structure to provide a path for the electrical current from the structure to the bag and then the soil. In order to measure the level of cathodic protection into the future, monitoring equipment should be installed adjacent to, or inside, the existing pump station dry well dry-pit.

A second recommendation for rehabilitation of the existing dry pit is to grind down the paint at the bottom of the equipment chamber wall, along the periphery of the dry-pit floor. Where the paint has been removed a floating steel replacement deck should be welded in place in sections resting on the existing floor. Once the deck is in place and the welds have been ground, the new floor should be sandblasted and coated with an epoxy primer and two coats of epoxy finish paint. Sandblasting to remove surface corrosion of the steel replacement deck should also continue approximately 1 foot vertically from the floor surface up of the wall of the existing chamber so that the paint system, once applied, will create a good seal between the floor decking and the existing walls.

Advantages of this approach include:

- Relatively low implementation cost
- Re-uses the existing facilities, which have already been paid for
- Minimizes disruption of property in the vicinity of the pump station

Disadvantages of this approach include:

- Does not address confined space entry issues
- Is not SRF Program Eligible as it consists of maintenance projects

A preliminary opinion of construction cost addressing all of the above recommendations is included in Appendix D, “Main Pump Station”.

4.3.2 Alternative No. 2 - Replace Dry-pit with Pre-cast Concrete

This alternative consists of replacing the existing steel dry-pit with a precast concrete dry-pit, having a larger footprint to allow for easier, safer access to the equipment level; and more space for maintenance operations around the pumping equipment. A precast structure was selected as opposed to field casting this structure because it can be delivered to the site and erected quickly, thereby reducing the number of days that an open excavation would required, and would to be dewatered and secured from passersby. Please refer to Appendix D for a conceptual plan of the proposed improvements and supporting information from the precast vendor.

It is assumed that, for this option, much of the existing equipment in the existing pump station dry-pit will be reused, with the exception of the pumps which have been in service since 2012. Construction of this project would include the following components:

- Excavation and dewatering to a depth of approximately 35 feet,
- Casting a reinforced concrete ballast slab adjacent to the existing precast concrete wet well,
- Erection of a 10-foot by 14-foot precast concrete vault to serve as the new dry-pit,
- Installation of stairs, decking and safety rails for access to the lower level,
- Interconnection of the existing wet well to the new dry-pit, and
- Connection of a new 12-inch discharge force main to the existing sewage force main.

Construction of the new dry-pit would take place to the South of the existing wet well as there are many buried utilities and abandoned pumping facilities buried just to the north.

Advantages of this approach include:

- Addresses confined space entry issues
- Better equipment access and working space
- Addresses structure corrosion issues
- Re-uses some the existing facilities, which have already been paid for
- Would likely be SRF Loan Eligible (major infrastructure overhall)

Disadvantages of this approach include:

- Complicated construction
- Requires additional easement and will likely affect property owner parking
- Highest cost alternative evaluated for upgrade of this pump station
- Does not address confined space entry issues

A preliminary opinion of project cost for this alternative is included in Appendix D.

4.3.3 Alternative No. 3 – Convert Dry-pit Configuration to Submersible

This alternative consists of constructing an extension to the existing precast concrete wet well, installing two 40 horsepower submersible solids handling pumps on a slide rail system, and construction of a small precast above grade structure to house controls and a by-pass pumping connection.

Converting to a submersible pumping configuration will eliminate the need for a below grade dry-pit to house pumping and flow metering equipment and will facilitate pump removal and allow for above grade maintenance. With this configuration a small extension to the existing wetwell could be constructed of precast concrete, for the same reasons noted in the previous option. This wetwell extension would have room enough for two submersible solids handling pumps which would sit in the bottom of the structure adjacent to a trash basket. A small structure would be constructed above grade to house the flow meter, sampling equipment, alarms, controls and an emergency by-pass piping connection.

Currently, debris entering the wastewater pump station is pulled from the bottom of the wetwell horizontally into the existing pumps with the wastewater and discharged through the force main. With a submersible pump configuration, the pumps would sit several inches above the wet well floor, potentially allowing for “dead zones” where debris from the wastewater collection system could accumulate. Typically, submersible pump stations have sloped floors to help mitigate this and direct solids toward the suction end of the pump. Installation of a large trash basket will help reduce pump removal for servicing.

Directly above the wetwell and outside of the above-grade structure will be a large hatch. Pumps can be removed for servicing above grade via the slide rail system and this hatch. These 40 Hp pumps will be very heavy and, as such, we recommend that a hoisting beam be incorporated above the center of the wetwell extension to allow for attachment of a chainfall to facilitate pump removal. This lifting structure can also be used to raise the trash basket. Please refer to Appendix D for a conceptual plan of the proposed improvements and supporting information from the precast vendor.

Construction of this project would include the following components:

- Excavation and dewatering to a depth of approximately 35 feet;
- Casting a reinforced concrete ballast slab adjacent to the existing precast concrete wet well;
- Construction of an 8-foot by 8-foot precast concrete wetwell extension with a rail-mounted stainless-steel trash basket;
- Installation of two rail-mounted 40 Hp submersible solids handling pumps with lifting chains;
- Interconnection of the existing wetwell to the wetwell extension;
- Construction of an above-grade structure to house flow metering equipment, wastewater sampling equipment, check valves and an emergency bypass pumping connection; and
- The connection of a new 12-inch discharge force main to the existing sewage force main.

As with option Alternate No. 2, much of the existing equipment can remain in use (wetwell, flow meter emergency power generator) once the new pump station has been constructed. The new structure will again need to be south of the existing wetwell due to utility conflicts. Once the new system has been commissioned the existing pumping equipment can be decommissioned, removed from the dry pit and the dry pit filled with gravel and backfilled.

Advantages of this approach include:

- Addresses confined space entry issues
- Better equipment access and working space
- Easily accessible emergency by-pass piping connection
- Addresses structure corrosion issues
- Re-uses some the existing facilities, which have already been paid for
- Would likely be SRF Loan Eligible (major infrastructure overhaul and configuration change)

Disadvantages of this approach include:

- Complicated construction
- Requires additional easement and will likely affect property owner parking
- Higher maintenance needs than current dry-pit configuration
- Additional above-grade structure required

A preliminary opinion of project cost for this alternative is also included in Appendix D.

4.3.4 Alternative No. 4 – Convert Dry-pit Configuration to Above Grade Suction Lift

This alternative consists of placing a packaged self-priming suction lift pump station at grade above the existing pump station wetwell. Suction lines for these pumps would drop straight down to just above the bottom of the existing wetwell, through holes in the top of the structure, to avoid installation of piping in the service access manway. Suction lines would be sealed into the top of the structure using link-type pipe seals. Suction lift applications and self-priming pumps are slightly less efficient than submersible pumps or pumps with flooded suctions, so these pumps would be 60 Hp, 460V, 3 phase so as to operate in a non-overload condition across the operating range of the pumps. Since they were conservatively sized, we will assume that their electrical load will not be that much more than the existing pumps and that the existing backup generator will suffice for emergency operation.

Self-priming centrifugal pumps are different from standard centrifugal pumps because they have a liquid reservoir built into the unit. The built-in reservoir, sometimes called the separation chamber, enables the pump to discharge air from the casing and the suction line by recirculating liquid during the priming cycle. Centrifugal self-priming pumps have two phases or cycles to operate: the priming cycle and the pumping cycle. Please refer to Figure 11, "Self-priming Pump Operation". In cases where the pumps are located too far above the liquid level, and Net Positive Suction Head (NPSH) values dictate, a vacuum priming system can be implemented to help pull air out of the suction line before the first cycle initiates, giving the pump a "head start" for the priming cycle. This application is on the very edge of requiring additional vacuum assistance; however, the applications engineers were able to compensate for this with a little more power.

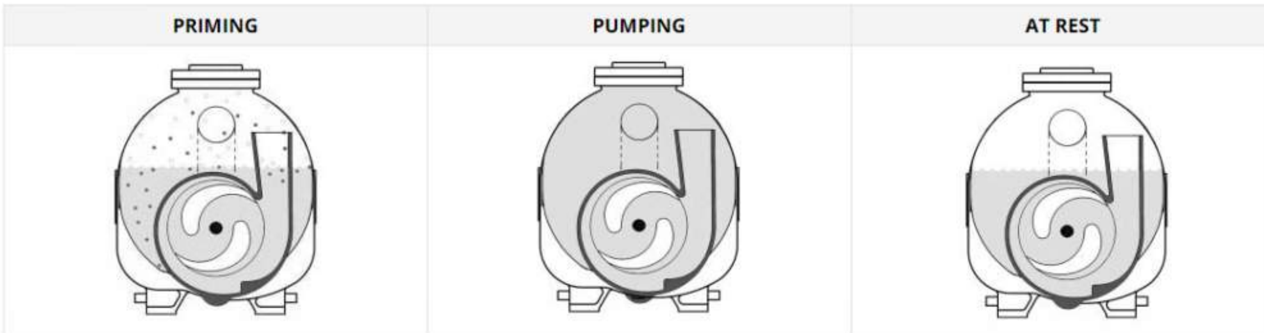


Figure 21 – Self-priming Pump Operation
(Gorman-Rupp Pumps)

Since we would not be planning to modify the existing wetwell structure for this option, and because these pumps are designed to handle heavy solids, we would likely not recommend a debris screen or basket. For the reasons noted in the submersible pump retrofit alternative, additional cleaning operations may be required beyond the current annual wetwell cleaning. Please refer to Appendix D for a conceptual plan of the proposed improvements and supporting information from the equipment vendor.

Construction of this project would include the following components:

- Excavation from the surface down to the top of the existing wetwell;
- Coring holes through the concrete wetwell ceiling to allow for the two new vertical suction lines;
- Casting a reinforced concrete equipment pad on a footing, above the existing precast concrete wet well;
- Installation of a skid-mounted duplex self-priming solids handling pumps with 60 Hp motors, VFDs and a fiberglass locking enclosure;
- Interconnection of the existing wetwell to the wetwell extension;
- Construction of an above-grade structure to house flow metering equipment, wastewater sampling equipment, check valves and an emergency bypass pumping connection; and
- The connection of a new 12-inch discharge force main to the existing sewage force main.

As with option Alternate No. 2, much of the existing equipment can remain in use (wetwell, flow meter emergency power generator) once the new pump station has been constructed. The new structure will located directly over the existing wetwell, and should not require modifications to the existing easaement for the pump station. Once the new system has been commissioned the existing pumping equipment can be decommissioned, removed from the dry pit and the dry pit filled with gravel and backfilled.

Advantages of this approach include:

- Addresses confined space entry issues
- Better equipment access and working space
- Easily accessible emergency by-pass piping connection
- Simplified construction
- Easement modification not required
- Addresses structure corrosion issues
- Re-uses some the existing facilities, which have already been paid for
- Would likely be SRF Loan Eligible (major infrastructure overhall and configuration change)

Disadvantages of this approach include:

- Suction lift is less efficient than flooded suction
- Anticipated higher maintenance needs than current dry-pit configuration
- Additional above-grade structure

A preliminary opinion of project cost for this alternative is also included in Appendix D.

4.3.5 Recommended Project

Of the four pump station modification alternatives described above, three of them involve new construction versus simple rehabilitation. The least costly alternative is rehabilitation of the existing dry pit; however, this alternative does not address confined space entry and worker safety issues that have been expressed by the Town. The new construction alternatives each address this safety component but are considerably more expensive. Weston & Sampson recommends that the Town undertake non-destructive testing to determine if the dry-pit portion of the pump station has remaining service life. If the dry-pit structure proves to be sound, the Town may wish to rehabilitate and implement additional confined space safety protocols for work within this structure.

If the structure is not sound, the Town may wish to consider an upgrade project to replace or eliminate the dry-pit. Should an upgrade project be considered, Alternate 4 (suction lift pump station retrofit) would addresses the Berlin's safety concerns for half of the cost of the next lowest cost alternative. This option also minimizes the overall impact of new construction while maximizing use of the existing site. No additional easement would need to be obtained for this work.

4.4 Hospital Hill Trunk Sewer Failure

A section of 8-inch diameter AC trunk sewer has failed adjacent to the Central Vermont Hospital (CVH) parking lot as a result of a localized slope failure. The slope in this area needs to be stabilized and erosion mitigated as part of an emergency repair to this section of sewer. Failure to stabilize soils in the vicinity of this break will result in future failures and potential surface water contamination with untreated wastewater. While this specific section of sewer and the ensuing repair project were not in the original scope of the AMP, we are mentioning it as part of this report in case these repairs become part of a larger project requiring funding through the Vermont Clean Water SRF Loan Program.

At this stage of project development, Berlin has contracted with Weston & Sampson to undertake a geotechnical investigation to determine the best approach for soil stabilization along the CVH parking lot. While field data has been gathered and the borings are complete, evaluation of the information from this effort has not yet been completed, nor has a formal design for these repairs. This work is in progress.

No sewage is currently being discharged to the surface at this location, and a design to address slope and trunk sewer stability is in progress.

4.5 Hospital Hill Cross-country Trunk Sewer Access

As noted earlier in this report, the cross-country portion of the Hospital Hill Trunk Sewer (SMH 48 to SMH 127 inclusive) is approximately ¼ mile of aging AC gravity sewer which passes through a wooded area and is inaccessible for maintenance or inspection operations. Failure of this section of sewer would likely result in a landslide onto Route 302 in the vicinity of Ashley Furniture and direct discharge of untreated wastewater to the Stevens Branch of the Winooski River. Drainage issues from Route 62, and the upgradient end of this sewer segment, have resulted in the near failure of this critical infrastructure. While temporary repairs have already been implemented, a more permanent solution is required to address both access and drainage along this asset segment. Please refer to Appendix F, “Hospital Hill Cross-country Sewer Access”.

The intent of the access is to provide an easier method of inspecting and maintaining SMH 48 – SMH 127. The average grade of this roadway will range from 5% - 7%. The existing sewer manholes extend above grade; in some instances, this is as little as 12 inches and in others as much as 36 inches. A typical drive will consist of 18 inches of subbase material, so without any adjustments to the manholes their rims will extend well above the finished surface of the roadway. Because the existing easement is narrow, and because the manholes are centered on the easement, access to each of the manholes will require driving along the easement center. While it is not necessary for the sewer manholes to be strictly flush with the road surface, there will be a need to modify the manholes to lower their structure height to be close to the finished surface of the roadway. Refer to Appendix F, Figure F-1 for a site plan illustrating the layout. Figures F-2 and F-3 provide engineering details of the items discussed below.

The access route will remain the same regardless of design detail, however, there are some aspects that can be considered for this alternatives analysis. Surface finish of the access road is one aspect, management of stormwater from the road itself and offsite contributions of runoff are another. These alternatives are evaluated below:

4.5.1 Road Surfaces

The following alternative road surfaces are being considered for the purposes of this report:

- Gravel Surface - Unpaved gravel is commonly used for many rural roads in Vermont, and also commonly used by construction equipment to access work areas. A gravel finish surface would have the lowest capital cost compared to asphalt or other materials, however, there is the need for regular maintenance to ensure that the surface does not wash out due to stormwater runoff. Occasional re-grading and re-surfacing of gravel roads is required.

- Paved Surface – Bituminous concrete (asphalt) pavement is used on high-traffic roads and is noted for its durability. However, asphalt paving is expensive, and there still are maintenance requirements for asphalt surfaces that will result in ongoing O&M. One potential advantage of paved surfaces is that on very steep roads asphalt provides an extra measure of traction and stability for cars/trucks, but this road is well under 10% in grade and will have very limited use. For these reasons, asphalt paving was not explored further as a viable alternative.

- Recycled Asphalt Pavement (RAP) - RAP is a reclaimed product consisting of asphalt and aggregates, typically generated when existing paved surfaces are milled and resurfaced. This material, otherwise a waste product, can be compacted into place and used as a finished surface for roadways and driveways. RAP provides a more durable surface than gravel at a much lower price than asphalt, however, it is still considerably more expensive than just gravel.

4.5.2 Stormwater Conveyance

Stormwater conveyance for roadways is chiefly for ensuring that stormwater runoff does not impact road surfaces, which could result in washouts. Proper stormwater management considers the ultimate fate of runoff, ensuring (1) that its discharge does not result in erosion on, or damage to, adjoining properties, (2) that pollutants (chiefly sediment) are removed to the extent practicable and (3) that runoff does not cause flooding conditions downstream. For this project, runoff from VT Route 62 will impact the site via a culvert that takes drainage from the South side of VT Route 62 (south of the project area), as well as the forested area between the project area and VT Route 62. A swale will be needed on the south side of the access road, but on the north side a fill slope

For this AMP, a HydroCAD model was developed to generally understand the amount of runoff volume and rate that would be expected for the project area. This was used to identify appropriate products for stabilization of the swale as well as sizing the energy dissipator needed to reduce swale velocity to a non-erosive condition before discharge offsite. Refer to Appendix F for a modeling report. The model results confirm that the following approaches can be taken for stormwater management that protect the sanitary sewer line from erosion-related damage:

- Rip Rap Lined Swales - Rip rap is the traditional treatment for drainage swales that can be expected to manage high-velocity flows. For this site, VAOT Type II material (6" minus) is appropriate. Rip rap is effective in a broad range of applications, including locations with minimal sunlight where the establishment of vegetation could be problematic.

  A 24" depth of material will be provided, resulting in a swale cross section with a 2-foot wide bottom, 24" swale depth, and 3H:1V side slopes. Refer to detail B on Figure F-2 for detail. Anticipated gravel access road construction costs, assuming rip rap lined drainage swales, are also included in Appendix F.

- Vegetated/ECB Swales - Vegetated swales offer several benefits over rip rap swales in many circumstances, including lower cost, ease of installation, enhanced pollutant removal, improved infiltration of stormwater into the subsurface, and ease of maintenance. However, vegetation takes time to establish, and while the earth is bare, storm events can wash seed and mulch away as well as causing additional damage to the swale that needs to be repaired.

  Erosion Control Blankets (ECBs) have been developed to provide temporary, medium-term, and long-term protection to allow vegetation to be used to stabilize soils in higher flow environments. For applications in drainage swales, these blankets consist of a plastic netting that sandwiches straw, coconut coir, plastic substrate, or a combination of these materials. While grass seed is being established, high velocity water's energy is dissipated by the ECB, allowing germination to occur and protecting the seedlings as their root systems are established. ECBs are not a stand-alone product, they require vegetation to be effective.

  For this project, an ECB similar to North American Green SC250 should be used. This product has a blend of 70% straw and 30% coconut coir sandwiched between UV stabilized netting. A seed mix similar to the Conservation Mix provided by LD Oliver Seed company can be used in areas of thin topsoil and partial shade, making it the best product for this application. A detail of the ECB-reinforced swale is provided in Figure F-3. Anticipated gravel access road construction costs, assuming ECB-lined drainage swales, are also included in Appendix F.

4.5.3 Green Stormwater Infrastructure (GSI)

GSI encompasses a broad range of design and construction techniques to mimic natural hydrologic conditions: a significant portion of runoff being infiltrated into the subsurface and natural materials (such as grass) used where appropriate. For this project, an ECB-lined swale would best represent an appropriate GSI structure. In addition, the energy dissipator at the end of the swale can be stabilized using seed and ECB.

4.5.4 Recommended Project

As described above, a gravel road constructed along the centerline of the trunk sewer easement would be more than adequate to provide access for maintenance and inspection. Because this road is rarely accessed, we recommend that gravel be used as a finished surface. Asphalt pavement and recycled asphalt pavement would both be unnecessarily expensive and could become an attractive nuisance for recreational vehicles, requiring costly maintenance. To best protect the trunk sewer, drainage improvements need to be incorporated into the road design and construction. Storm water from Route 62 would be diverted along a swale on the south side of the easement, preventing stormwater runoff from crossing perpendicularly across the easement and threatening stability of the pipe and slope. Options for swale construction include rip rap and ECB. Anticipated costs for a gravel road with both methods of erosion control were developed and are included in Appendix F. Construction of the gravel access road using a rip rap lined swale is double the cost of the same project using ECB. Weston & Sampson recommends addressing access and drainage improvements by construction of a gravel access road with an ECB lined Swale

4.6 Route 302 Private Sewer Failure

As described in Section 3, there is a recently discovered private gravity sewer that serves seven single-family residences (properties 162 through 308 US Route 302). This 4-inch line discharges to a Town-owned sewer manhole on the northeast side of US Route 302, roughly at the center of the string of homes served by this private gravity sewer. The alignment and extent of this private gravity sewer is shown on Figure G-1, "Route 302 Existing Conditions Plan" of Appendix G, "Route 302 Sewerage Options". A replacement for this 4-inch line is needed as it is currently failing and a portion of this sewer crosses through a small brook that runs between lots No. 228 and 190. Berlin currently bills all seven of these properties for sewer service and is considering taking over ownership of the section of private sewer and replacing it with a sewer which meets current design standards, in order to eliminate further operation and maintenance issues.

There are three feasible alternatives that the Town may consider for servicing these seven homes while eliminating the failing infrastructure and the associated risk of surface water contamination:

- Low-pressure Sewer
- Septic Tank Effluent Pumping (STEP)
- Conventional Gravity Sewer

The following discussion addresses the differences in their design requirements, lists the advantages and disadvantages of each configuration and outlines each option's anticipated project costs.

4.6.1 Low-pressure Sewer

A low-pressure sewer system has proven to be a viable alternative where implementation of a gravity sewer system (described in Section 4.6.3) is impractical and/or uneconomical. A low-pressure sewer system consists of small diameter pipes fed by individual grinder pumps, located at each residence. A pressure sewer system makes use of small diameter piping, buried at a relatively shallow depth (typically five feet deep) following the profile of the ground. The pressure main and service pipe are generally manufactured from polyvinyl chloride (PVC) or high-density polyethylene (HDPE). The pressure sewer mains and laterals are buried below the historical depth of frost penetration, and will follow the contour of the ground. Piping can easily be insulated where frost depth cannot be maintained.

Standard manholes are not required in a pressure sewer system. Instead, flushing connections/drain manholes are installed at the end of branches and where major changes in directions or size of pipe occur. Air relief/vacuum valve manholes are installed at high points in the system to allow trapped air to escape. Cleanouts would be typically be installed approximately every 1,000 feet to provide access for periodic maintenance.

In a low-pressure sewer system, each customer will utilize an individual grinder pump for discharge of sewerage into the main. Each grinder pump station is equipped with a grinder pump, check valve, tank, and all necessary controls. The units can be located outdoors close to each customer's existing septic tank (if applicable) so that the connection to the existing service pipe exiting the building can be made easily. The pump stations can also be located inside the building if permissible under local plumbing codes. The grinder pump macerates the solids present in the wastewater to a slurry in the manner of a kitchen sink garbage grinder, and discharges wastewater to the pressure sewer collection pipes. If a malfunction occurs, a high liquid alarm is activated. This alarm may be a light mounted on the outside of the building or an audible alarm that can be silenced by the customer, or may include telemetry for remote response. The customer will then notify an approved technician or contractor to come and make necessary repairs.

A typical schematic of a pressure sewer is included in Appendix G. This schematic, taken from information on pressure sewers provided by Hunter Water Corporation of New South Wales, Australia, is an excellent representation of the components comprising such a system.

For each of the affected homes on US Route 302, a grinder pump station would be located outside of the residence and fed using their existing gravity sewer service line. A 2-inch diameter pressure sewer would be installed across the existing properties to service each of the grinder pump stations. In order to do this in the most cost-effective manner possible, Weston & Sampson is assuming that the pressure sewer could be threaded through the existing 4-inch AC gravity sewer. Grinder pump station discharge piping, which will connect to the pressure sewer, would follow the path of the existing gravity sewer lateral from each residence to further minimize excavation. The pressure sewers from north and south of the newly discovered municipal sewer manhole (referenced earlier) would discharge into that existing manhole. Sewage from the connected residences would flow from this manhole across US Route 302 via the existing 8-inch AC gravity sewer which connects the manhole to the existing trunk sewer on the southwest side of US Route 302. A pressure sewer clean-out would be located at the end of each of the two pressure sewers.

We are assuming that the grinder pump stations would initially be provided by the Town as part of the cost of construction for this project. Once the pump stations are installed, the owners would be responsible for electrical costs. Berlin would assume maintenance costs and replacement of the pumps when they reach the end of their useful life. A maintenance easement would be required along the pressure sewer and around the grinder pump stations.

A conceptual plan of the proposed pressure sewer is depicted on Figure G-2 and included in Appendix G. Since the actual sewer lateral locations have not been confirmed at each residence, the locations of the proposed grinder pump stations are assumed for the purposes of developing preliminary costs. Actual locations of sewer service laterals and the final location of each grinder pump station will need to be undertaken as part of the final design, should this alternative be selected for advancement. Anticipated costs for replacement of the existing gravity sewer using a low-pressure sewer as described above are also included in Appendix G. Equipment costs are based on information provided by the Environment One Corporation of Niskayuna, NY.

Advantages of this type of system, in this application, include:

- low construction cost compared to gravity sewer
- not subject to infiltration from ground water or from surface storm water entering through leaking pipe joints and manholes
- piping does not need to follow a consistent downward slope
- could be installed inside existing gravity piping to save trenching costs and disruption to private property
-

Disadvantages of this type of system, in this application, include:

- Higher operation and maintenance cost for homeowner
- Electrical costs
- Spare/replacement pumps needed
- A maintenance easement would be needed from each lot for the pressure sewer

4.6.2 Septic Tank Effluent Pumping (STEP)

STEP systems are similar in overall construction, operation, and maintenance to grinder pumps and pressure sewers with the exception that solids and grease are removed from the wastewater at each residence or commercial/industrial establishment utilizing a conventional septic tank prior to pumping. This system employs a combination of on-site/off-site system technologies. Preliminary treatment takes place on each individual property and secondary treatment takes place at a centralized (or decentralized) facility.

STEP systems require the installation of watertight septic tanks at each home to remove solids and grease followed by an effluent pump that conveys the wastewater to a low-pressure sewer system. A screen is typically installed between the septic tank and the effluent pump to prevent solids from entering the piping system. The STEP pressure sewer system requires the same integral components as the grinder pump pressure sewer system. Since a majority of the solids are removed in the septic tank, velocities of only 0.5 fps are required in the pipelines. Therefore, slightly longer mainline pressure sewers may be utilized as compared to grinder pump pressure sewers. Wastewater delivered to the treatment system from a STEP system typically has 30% lower biochemical oxygen demand (BOD), and can therefore be easier to treat. Unfortunately, the septic wastewater has a higher potential for generating odors and can cause corrosion in collection system structures.

STEP systems require periodic pump outs to remove accumulated solids (septage) and grease from the septic tank to protect the effluent pumps. The septage is typically removed at an interval of approximately three to five years depending on system usage and must be conveyed for disposal to an approved facility. This interval is the same as recommended for an on-site wastewater disposal system.

A typical STEP system layout would look nearly identical to a pressure sewer, with the exception that there is a septic tank in front of the pump station and, while there is an effluent pump, a grinder pump is not needed. Appendix G contains an engineering section of a typical STEP pumping system, which can be a single pre-cast unit combined with a septic tank. This section is from information provided by CAMP Precast Concrete Products of Milton, VT. Their STEP system tankage incorporates pre-engineered septic tank effluent pumping equipment manufactured by ORENCO Systems of Sutherlin, Oregon.

For each of the affected homes on US Route 302, a 1,000-gallon septic tank and effluent pump station would be located outside of the residence and fed using their existing gravity sewer service line. A 2-inch diameter effluent force main would be installed across the existing properties to service each of the STEP pump stations. To do this in the most cost-effective manner possible, Weston & Sampson is assuming that the STEP force main could be threaded through the existing 4-inch AC gravity sewer. Pump station discharge piping, which will connect to the proposed STEP force main, would follow the path of the existing gravity sewer lateral from each residence to further minimize excavation. STEP force mains from north and south of the newly discovered municipal sewer manhole (referenced earlier) would discharge into that existing manhole. Septic tank effluent from the connected residences would flow from this manhole across US Route 302 via the existing 8-inch AC gravity sewer which connects the manhole to the existing trunk sewer on the southwest side of US Route 302. Similar to the pressure sewer option, a clean-out would be located at the end of each of the two force mains.

We are assuming that the septic tanks and pump stations would initially be provided by the Town as part of the cost of construction for this project. Once the pump stations are installed, the owners would be responsible for electrical costs. Berlin would assume maintenance costs and replacement of the pumps when they reach the end of their useful life; as well as periodic septic tank pumping (so service would be equivalent to that of other billed wastewater customers). A maintenance easement would be required along the pressure sewer and around the septic tanks.

A conceptual plan of the proposed STEP system is depicted on Figure G-3. Since the actual sewer lateral locations have not been confirmed at each residence, the locations of the proposed septic tanks and pump stations are assumed for the purposes of developing preliminary costs. Actual locations of sewer service laterals and the final location of each septic tank will need to be undertaken as part of the final design, should this alternative be selected for advancement. Anticipated costs for replacement of the existing gravity sewer using a STEP system as described above, are also included in Appendix G and are based on similar systems cost information provided by CAMP Precast.

Advantages of this type of system, in this application, include:

- low construction cost compared to gravity sewer
- not subject to infiltration from ground water or from surface storm water entering through leaking pipe joints and manholes
- piping does not need to follow a consistent downward slope
- could be installed inside existing gravity piping to save trenching costs and disruption to private property
- smaller pumps than required for pressure sewer system (no grinder pumps required)

Disadvantages of this type of system, in this application, include:

- Septic tank needs to be installed at each home
- Higher operation and maintenance cost for homeowner than gravity sewer
- Electrical costs
- Spare/replacement pumps needed
- Septic tank will require pumping every 3-5 years
- A maintenance easement would be needed from each lot for the force main

4.6.3 *Conventional Gravity Sewer*

A gravity sewer, by definition, is a conduit utilizing the energy resulting from a difference in elevation to remove unwanted water. New gravity sewers need to meet specific design criteria as follows:

- systems shall be designed on the basis of an average daily per capita flow of sewage of 70 to 120 gallons per day. This range is assumed to consist of 70 gpd of domestic sewage plus 0 to 50 gpd of infiltration.
- The amount of infiltration will depend on the type, size, and length of the sewer system.
- No gravity sewer conveying raw sewage shall be less than 8 inches in diameter.
- House laterals (service lines) shall be no less than 4 inches in diameter.
- 8-inch gravity sewer line has a minimum allowable slope of 0.004 ft/linear foot of sewer line.
- Sewer shall be sufficiently deep to be protected from surface loading and to receive sewage from basements and to prevent freezing (typically 5 feet deep minimum).
- Gravity sewers shall be laid with uniform slope between manholes.
- Runs of sewer between manholes must be straight.
- Manholes need to be provided for access at a minimum of 350 feet on center, with terminal runs having a manhole at the end of the line for maintenance access.

Figure G-4 depicts a typical gravity sewer layout which could replace the existing private gravity sewer. This gravity sewer would need to be installed to the north along the boundary between the State highway right-of-way and the properties served by the sewer. To the south, the sewer would need to cross private property (as does the existing sewer) in order to avoid conflicts with a brook and existing stormwater infrastructure. As with the alternatives discussed earlier, the exact location of the sewer service laterals for these residences are not known. Sewer service laterals are depicted on Figure G-4 for the purpose of conceptual layout and preliminary costing. Because of the new grade and alignment of the proposed gravity sewer, all of the existing sewer service laterals would need to be replaced from the sewer line to the building foundations.

The gravity sewer line would extend both north and south from the municipal sewer manhole in front of No. 228 US route 302. The northern segment would extend as far as No. 292 and the southern segment would extend as far as No. 162. There appears to be the remnants of existing granite curb and concrete sidewalk on the shoulder of the road. This would add difficulty and cost to the construction of gravity sewer as these features would likely need to be replaced where impacted. An existing retaining wall is located along the entire property in front of No. 292 US Route 302. This retaining wall would be heavily impacted by construction of a gravity sewer and would likely need to be removed and replaced.

Anticipated costs for construction of a gravity sewer to serve these seven homes along US route 302 is included in Appendix G.

Advantages of a gravity conventional gravity sewer system, in this application, include:

- no septic tank pumping
- no wiring or electrical costs for each residence
- no replacement parts or equipment O&M

Disadvantages of a conventional gravity sewer system, in this application, include:

- Much higher initial construction cost.
- Greater disruption to replace service connections to existing residences.
- A maintenance easement would be needed from each lot for the force main.

4.6.4 *Recommended Project*

After reviewing anticipated project costs and difficulties associated with implementation of each of the three alternatives above, Weston & Sampson recommends Alternative 1: construction of a low-pressure sewer (Alternate 1) to serve the seven homes that are currently on the private gravity sewer. We recommend Alternate 1 for the following reasons:

- Capital cost is least of the three alternatives evaluated
- O&M costs for the Town will be minimal and should only include replacement of the grinder pumps once every 7 to10 years (per the manufacturer)
- This option allows the greatest flexibility for routing the utility on private property (pumped and not reliant on minimum pipe slopes)
- This option results in the least amount of disturbance on private property of the three alternatives evaluated

5.0 PROJECT SELECTION & PHASING

This section will be included in the final report, after the Town has confirmed which of the recommended projects in this report they plan to move forward.

5.1 Affordability Analysis

5.2 Life Cycle Cost Analysis

5.3 Anticipated Cost Benefit

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APPENDIX A

Population Projections

State of Vermont

Vermont Population Projections – 2010 - 2030

August, 2013

Produced by:
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This project was developed with the assistance and oversight of a committee of State Agency representatives. The Committee reviewed the methodology and results leading to the final figures presented in this report.

<u>Population Projection Review Committee</u>

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Vermont Population Projections – 2010 - 2030

How are Population Projections developed?

Vermont's population projections are based on an age cohort model (defined age groupings such as: 35-39 year-olds) using US Census data as the basis for calculations. Mortality, birth rate and migration rate data from 1990-2010 are factors used to develop the projections.

In general, an age cohort projection model starts with the population total for a particular age group at a given point in time. The Census bureau reports most age cohorts in 5 year groups and thus, five year groups are used in this model. At the end of a ten year period, the population for an age cohort is equal to the beginning population total minus the mortality and plus or minus the migration during the ten year period. For example,

> In year 2000, according to the US census, Vermont's 25-29 age cohort population was 34,182. Ten years later, in year 2010, Vermont's 35-39 age cohort population was 36,358 - according to Census reporting. Between 2000 and 2010, about 50 people in that age cohort died (0.15% mortality rate over the ten year period).
>
> By taking into account the population increase and mortality rate for the the age cohort, the migration rate can be calculated.
> Migration = 36,358 – 34,182 + 50
> = 2226 or 6.51% of the 2000 five year age cohort

"Projecting" into the future, would suggest that the 2020 population of 35-39 year olds will equal the 2010 population of 25-29 year olds (35,441) minus mortality (again, about .15%) plus the 6.51% net migration rate. 2020 projected population of 35-39 year olds = 37,700

Migration

The migration rate for the 2010 to 2020 and 2020 to 2030 decades could be similar to the migration rate for the 2000 to 2010 period or the 1990 to 2000 period. These different migration assumptions are the basis for the two sets of projections presented in this report – Scenario A and Scenario B. In Vermont, there is a relationship between the national economy and the direction and magnitude of migration. During the 1990s (Scenario A), the national economy was generally healthier than during the 2000s (Scenario B) and Vermont saw greater rates of net in-migration. As a result, Scenario A using 1990s migration rates generally, show higher populations than Scenario B using the migration rates of the 2000s.

Mortality

The mortality rates for age cohorts greater than 50 years old continue to decrease. For the population projections, we use mortality rates that continue the decline. For younger populations, the mortality rate is leveling off and the mortality rates used for the projection do not have the same proportional decreases that other age cohorts exhibit.

Births

The number of children born during the projection period requires the use of age specific birth rates. The Vermont Department of Health publishes county and age-specific birth rates each year in its Vital Statistics publication. In Vermont, each county is witnessing decreases in the birth rates for teenage women. Birth rates for women in their 20s and early 30s are relatively more stable, while the birth rates for women in older age cohorts continue to increase. As with the mortality rates, these Vermont population projections assume a continuation in the trend in birth rates seen for the past twenty years to provide birth rates for each age cohort into the next twenty years. Unlike mortality, the birth rates in Vermont vary significantly for each county. Therefore, the county projections use county-specific birth rates for each age cohort.

In order to complete the projections for children born during the projection period, there are three steps. The first step is to complete the population projections for females in each county using statewide mortality rates and county and age specific migration rates based on 1990s and 2000s Census data. The second step is to apply the age and county specific birth rates to each projected female age cohort resulting in the number of births during the time period. The final step is to review the migration rates for young children during the 1990s and 2000s and apply those migration rates to the number of births projected from Steps One and Two.

Normalizing the county and town projections

For all age cohorts, a state projection is completed in addition to one for each county. Because the statistical validity of a projection is greater with larger numbers, the state projection serves as a base against which the county projections are normalized. In other words, for any age cohort, the state projected total is compared against the total of each county cohort. Any differences are normalized by reducing or increasing county figures proportionally to the population size of that cohort in each county. For example, the age 40-44 state population is projected to be 35,561 when assuming the migration pattern of the 2000s. The sum of the county projections for that cohort is 35,570. For consistency, the county population numbers for that cohort are decreased proportionally to result in a county total equal to the state projected figure.

Town and City projections

The county projections are the basis for determining town and city level projections. As with the county migration rates, the changes in the population for each town that took place in 2000-2010 and 1990 – 2000 combined with the projected changes in county numbers result in an equation to project town populations. Specifically,

2020 Town projected figure = Town population in 2010 + (50% of the rate of town population change from 2000-2010) + (25% of the rate of town population change from 1990 – 2000) + (25% of the rate of county population change from 2000-2010)

2030 Town projected figure = Town population in 2020 + (35% the rate of town population change from 2000-2010)+(15% of the rate of town population change from 1990 – 2000) + (50% of the rate of county population change from 2000-2010)

Similar to normalizing county age cohort figures to correspond to the state projections, town populations are either increased or decreased to assure that the sum of the town populations in a county equal the county population.

Caveats when considering the Vermont Population Projections

Projections, not predictions

Projections assume that conditions that occurred in the past will continue into the future. For these projections, there are assumptions about mortality rates (continuing a downward trajectory for the next 20 years), birth rates and two sets of assumptions about migration rates. Events may alter the conditions that led to population changes in the past 20 years and those events will affect the changes in population. Examples of changes that are not predicted for these estimates:

- Changes in the birth rate from social changes different than what has occurred in the past 20 years
- Changes in health care practices or epidemics that could affect mortality rates
- Changing economic conditions that result in shifts in national (internal) migration
- Changes in national immigration policies

Census populations, not the actual number of inhabitants at a given time

Many individuals, particularly those that are retired and those attending colleges and universities have more than one home. The Census Bureau does not have a requirement that individuals determine their residency with a particular set of standards and does not allow any individual to split their residence to multiple towns or states. The residence as of April 1, in the year the Census is conducted is a standard upon which many people determine their census filing “home”.

In Vermont, individuals that reside in other states such as “snow bird” destinations in the southern United States may not file their Census return from Vermont and yet may be registered to vote in Vermont, hold a Vermont driver’s license, pay taxes or even live the majority of the year in Vermont. Because the Census does not capture the true nature of these residents, the projections may give a misleading estimate on how many individuals reside in a particular community during different times of the year.

Statistical limitations

When working with relatively small population sizes, data can be susceptible to fluctuations that may not represent trends, but rather individual, non-replicable events. The margin of error for any statistical calculation increases as the size of the population decreases These small numbers are evident in some of the small county age cohort projections as well as small town populations.

Vermont Population Projections by Age and County, 2020, 2030 - Scenario A

Ages	2010 Census	2020	%change from 2010	2030	%change from 2010
Washington County					
<5	3,087	2,999	-2.9%	3,140	1.7%
5-9	3,366	3,249	-3.5%	3,498	3.9%
10-14	3,542	3,339	-5.7%	3,297	-6.9%
15-19	4,146	3,421	-17.5%	3,290	-20.6%
20-24	3,597	3,226	-10.3%	3,040	-15.5%
25-29	3,085	3,351	8.6%	2,753	-10.8%
30-34	3,342	3,678	10.1%	3,308	-1.0%
35-39	3,690	3,518	-4.7%	3,825	3.7%
40-44	4,211	3,615	-14.2%	3,987	-5.3%
45-49	4,760	3,777	-20.7%	3,609	-24.2%
50-54	5,096	4,234	-16.9%	3,638	-28.6%
55-59	4,810	4,627	-3.8%	3,683	-23.4%
60-64	4,185	4,855	16.0%	4,054	-3.1%
65-69	2,654	4,448	67.6%	4,316	62.6%
70-74	1,952	3,668	87.9%	4,315	121.1%
75-79	1,554	2,216	42.6%	3,750	141.3%
80-84	1,160	1,421	22.5%	2,700	132.8%
85+	1,297	1,544	19.0%	2,169	67.2%
Total	59,534	61,186	2.8%	62,372	4.8%

Vermont Population Projections by Age and County, 2020, 2030 - Scenario B

Ages	2010 Census	2020	%change from 2010	2030	%change from 2010
Washington County					
<5	3,087	2,877	-6.8%	2,893	-6.3%
5-9	3,366	3,208	-4.7%	3,411	1.3%
10-14	3,542	3,493	-1.4%	3,355	-5.3%
15-19	4,146	3,731	-10.0%	3,546	-14.5%
20-24	3,597	3,006	-16.4%	2,972	-17.4%
25-29	3,085	2,993	-3.0%	2,685	-13.0%
30-34	3,342	3,457	3.4%	2,899	-13.3%
35-39	3,690	3,702	0.3%	3,625	-1.8%
40-44	4,211	3,591	-14.7%	3,726	-11.5%
45-49	4,760	3,791	-20.4%	3,810	-20.0%
50-54	5,096	4,276	-16.1%	3,651	-28.4%
55-59	4,810	4,529	-5.8%	3,618	-24.8%
60-64	4,185	4,759	13.7%	4,016	-4.0%
65-69	2,654	4,175	57.3%	3,976	49.8%
70-74	1,952	3,515	80.1%	4,058	107.9%
75-79	1,554	2,086	34.2%	3,315	113.3%
80-84	1,160	1,309	12.8%	2,381	105.3%
85+	1,297	1,529	17.9%	2,023	56.0%
Total	59,534	60,027	0.8%	59,960	0.7%

Vermont 2010 Census Count Projections by Town, 2020, 2030 - Scenario A

Town	2010 Census	2020	%change from 2010	2030	%change from 2010
Washington County					
BARRE TOWN	7,924	8,116	2.4%	8,252	4.1%
BARRE CITY	9,052	8,864	-2.1%	8,743	-3.4%
BERLIN	2,887	2,974	3.0%	3,029	4.9%
CABOT	1,433	1,615	12.7%	1,753	22.3%
CALAIS	1,607	1,645	2.4%	1,672	4.0%
DUXBURY	1,337	1,464	9.5%	1,550	15.9%
EAST MONTPELIER	2,576	2,664	3.4%	2,718	5.5%
FAYSTON	1,353	1,590	17.5%	1,772	31.0%
MARSHFIELD	1,588	1,680	5.8%	1,744	9.8%
MIDDLESEX	1,731	1,787	3.2%	1,823	5.3%
MONTPELIER	7,855	7,694	-2.0%	7,591	-3.4%
MORETOWN	1,658	1,724	4.0%	1,766	6.5%
NORTHFIELD	6,207	6,458	4.0%	6,638	6.9%
PLAINFIELD	1,243	1,215	-2.3%	1,196	-3.8%
ROXBURY	691	757	9.6%	809	17.1%
WAITSFIELD	1,719	1,815	5.6%	1,880	9.4%
WARREN	1,705	1,895	11.1%	2,023	18.7%
WATERBURY	5,064	5,213	2.9%	5,314	4.9%
WOODBURY	906	970	7.1%	1,016	12.1%
WORCESTER	998	1,046	4.8%	1,083	8.5%
County Total	59,534	61,186	2.8%	62,372	4.8%

Vermont 2010 Census Count Projections by Town, 2020, 2030 - Scenario B

Town	2010 Census	2020	%change from 2010	2030	%change from 2010
Washington County					
BARRE TOWN	7,924	7,962	0.5%	7,933	0.1%
BARRE CITY	9,052	8,694	-4.0%	8,400	-7.2%
BERLIN	2,887	2,918	1.1%	2,912	0.9%
CABOT	1,433	1,585	10.6%	1,687	17.7%
CALAIS	1,607	1,613	0.4%	1,607	0.0%
DUXBURY	1,337	1,436	7.4%	1,491	11.5%
EAST MONTPELIER	2,576	2,613	1.4%	2,613	1.4%
FAYSTON	1,353	1,561	15.4%	1,706	26.1%
MARSHFIELD	1,588	1,649	3.8%	1,677	5.6%
MIDDLESEX	1,731	1,754	1.3%	1,752	1.2%
MONTPELIER	7,855	7,546	-3.9%	7,294	-7.1%
MORETOWN	1,658	1,692	2.1%	1,698	2.4%
NORTHFIELD	6,207	6,336	2.1%	6,382	2.8%
PLAINFIELD	1,243	1,191	-4.2%	1,149	-7.6%
ROXBURY	691	743	7.5%	778	12.6%
WAITSFIELD	1,719	1,781	3.6%	1,808	5.2%
WARREN	1,705	1,860	9.1%	1,947	14.2%
WATERBURY	5,064	5,115	1.0%	5,108	0.9%
WOODBURY	906	951	5.0%	977	7.8%
WORCESTER	998	1,027	2.9%	1,041	4.3%
County Total	59,534	60,027	0.8%	59,960	0.7%

APPENDIX B

Wastewater Collection System Base Map

MAP SHEET 1 OF 6

TOWN OF BERLIN, VERMONT

OVERALL WASTEWATER
COLLECTION SYSTEM MAP

JULY 2022 — 1" = 600'

Weston & Sampson


MAP SHEET 2 OF 6
TOWN OF BERLIN, VERMONT
PARTIAL WASTEWATER COLLECTION SYSTEM MAP
JULY 2022
1" = 200'
Weston & Sampson
0 200 400 600 800 Feet
Legend
Hazardous_Sites
Sewer Manholes
Pump Station
Gravity Main
Class II Wetlands
Special Flood Hazard Areas
Notes:
1. Sewer data collected by Weston & Sampson Engineers on
2. Hazardous waste sites, flood hazard areas, and wetland information taken from the Vermont Center for Geographic Information (VCGI)
BROOKFIELD RD
PAINE TRNPK S
ROUTE 89 S
ROUTE 89 N
OLD BROOKFIELD RD
SUNSET DR
BOSWORTH RD
SHED RD
CROSSTOWN RD
BIRCHWOOD DR
RICHARDSON RD
PIKE DR
STEWART RD
SCOTT HILL RD
ROUTE 62
PAINE TRNPK N
WILLARD BEAN RD
COMSTOCK RD
BERLIN MALL RD
PS-1025
SMH 220
SMH 305
SMH 304
SMH 303
SMH 302
SMH 301
SMH 300
SMH 217A
SMH 217
SMH 218
SMH 218A
SMH 218B
SMH 239A
SMH 240
SMH 240A
SMH 239
SMH 238
SMH 310
SMH 311
SMH 312
SMH 314
SMH 313
SMH 315
SMH 316
SMH 317
SMH 318
SMH 319
SMH 320
SMH 321
SMH 322
SMH 324
SMH 323
SMH 237
SMH 236
SMH 216C
SMH 216B
SMH 216A
SMH 216
SMH 243
SMH 242
SMH 233
SMH 232
SMH 231
SMH 230
SMH 229
SMH 228
SMH 227

Notes:

1. Sewer data collected by Weston & Sampson Engineers on

2. Hazardous waste sites, flood hazard areas, and wetland information taken from the Vermont Center for Geographic Information (VCGI)

MAP SHEET 3 OF 6

TOWN OF BERLIN, VERMONT

PARTIAL WASTEWATER
COLLECTION SYSTEM MAP

JULY 2022 1" = 200'

Weston & Sampson

Legend

- Hazardous_Sites
- Sewer Manholes
- Pump Station
- Gravity Main
- Forcemain
- Class II Wetlands
- Floodways
- Special Flood Hazard Areas

Notes:

1. Sewer data collected by Weston & Sampson Engineers on

2. Hazardous waste sites, flood hazard areas, and wetland information taken from the Vermont Center for Geographic Information (VCGI)

MAP SHEET 4 OF 6

TOWN OF BERLIN, VERMONT

PARTIAL WASTEWATER COLLECTION SYSTEM MAP

JULY 2022 | 1" = 200'

Weston & Sampson

Legend

- Hazardous_Sites
- Sewer Manholes
- Gravity Main
- Class II Wetlands
- Floodways
- Special Flood Hazard Areas

Notes:

1. Sewer data collected by Weston & Sampson Engineers on

2. Hazardous waste sites, flood hazard areas, and wetland information taken from the Vermont Center for Geographic Information (VCGI)

MAP SHEET 5 OF 6

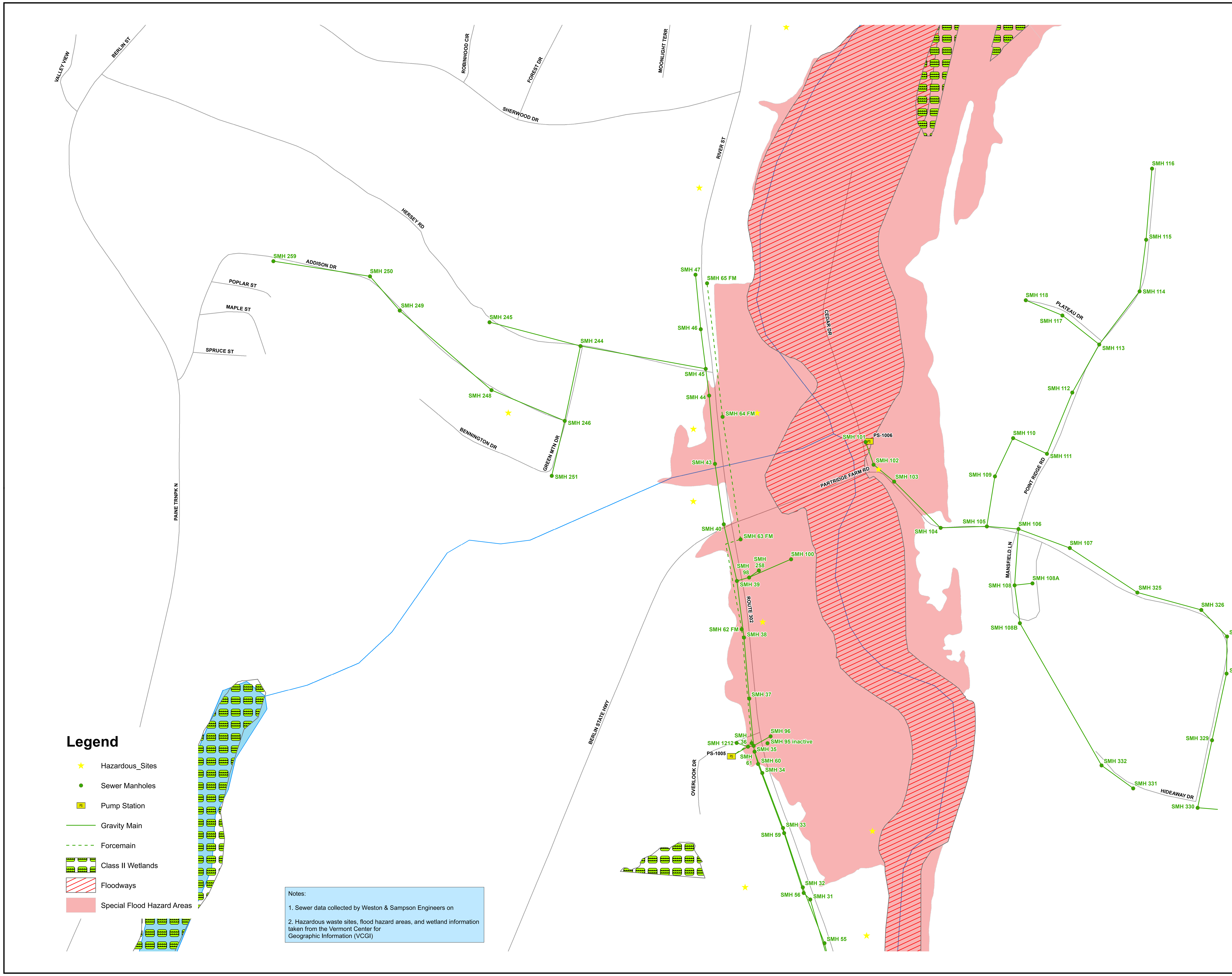
TOWN OF BERLIN, VERMONT

PARTIAL WASTEWATER COLLECTION SYSTEM MAP

JULY 2022

1" = 200'

Weston & Sampson



Notes:

1. Sewer data collected by Weston & Sampson Engineers on

2. Hazardous waste sites, flood hazard areas, and wetland information taken from the Vermont Center for Geographic Information (VCGI)

MAP SHEET 6 OF 6

TOWN OF BERLIN, VERMONT

PARTIAL WASTEWATER
COLLECTION SYSTEM MAP

JULY 2022 1" = 200'

Weston & Sampson

APPENDIX C

Manhole Inspections

TABLE C-1
MANHOLE INSPECTION SUMMARY
2021 ASSET MANAGEMENT PLANNING

Manhole	Street Name/Location	Material	Manhole Depth (ft)	Infiltration (gpd)	Inflow (gpd)
001	ROUTE 302	PRECAST	16.2	144	0
002	ROUTE 302	PRECAST	16	288	6,701
003	ROUTE 302	PRECAST	15.2	288	0
004	ROUTE 302	PRECAST	7.8	0	0
005	ROUTE 302	PRECAST	7	0	2,929
006	ROUTE 302	PRECAST	7.5	0	0
007	ROUTE 302	PRECAST	8.8	0	0
008	ROUTE 302	PRECAST	8.8	0	0
009	ROUTE 302	PRECAST	12.6	0	0
010	ROUTE 302	PRECAST	14.7	0	0
011	ROUTE 302	PRECAST	11.5	0	0
012	ROUTE 302	PRECAST	17.1	0	0
014	ROUTE 302	PRECAST	8.3	0	0
015	ROUTE 302	PRECAST	9.3	0	0
016	ROUTE 302	PRECAST	11.5	0	0
017	ROUTE 302	PRECAST	9.9	0	469
018	ROUTE 302	PRECAST	8.9	0	4,686
019	ROUTE 302	PRECAST	12.4	0	0
020	ROUTE 302	PRECAST	11.4	0	0
021	ROUTE 302	PRECAST	11.4	0	0
022	ROUTE 302	PRECAST	7.1	0	0
023	ROUTE 302	PRECAST	7.7	0	260
024	ROUTE 302	PRECAST	6.7	0	0
026	ROUTE 302	PRECAST	17.1	0	0
027	ROUTE 302	PRECAST	18	0	0
028	ROUTE 302	PRECAST	16.5	0	0
029	ROUTE 302	PRECAST	14.2	0	0
030	ROUTE 302	PRECAST	7.8	0	0
031	ROUTE 302	PRECAST	8.9	0	0
032	ROUTE 302	CNO			
033	ROUTE 302	PRECAST	13.5	0	1,171
034	ROUTE 302	BRICK	11.9	0	0
035	ROUTE 302	BLOCK	17.8	288	0

Manhole	Street Name/Location	Material	Manhole Depth (ft)	Infiltration (gpd)	Inflow (gpd)
036	ROUTE 302	PRECAST	17.5	0	0
037	ROUTE 302	PRECAST	14.7	0	0
038	ROUTE 302	PRECAST	13.1	0	691
039	ROUTE 302	PRECAST	14.2	0	0
040	ROUTE 302	PRECAST	11.5	0	0
043	ROUTE 302	PRECAST	9.1	144	761
044	ROUTE 302	PRECAST	8	144	0
046	ROUTE 302	PRECAST	11.5	0	0
047	ROUTE 302	PRECAST	13.6	0	0
048 A (FM)	ROUTE 302	PRECAST		0	0
050	ROUTE 302	PRECAST	9.2	0	0
051	ROUTE 302	PRECAST	9.5	0	0
052	ROUTE 302	PRECAST	9.1	0	0
053	ROUTE 302	PRECAST	9.9	0	0
054	ROUTE 302	PRECAST	7.8	0	0
055	ROUTE 302	PRECAST	12.2	0	0
056	ROUTE 302	PRECAST	8.9	0	0
059	ROUTE 302	PRECAST	8.6	0	11,714
060	ROUTE 302	PRECAST	7.8	0	0
062 FM	ROUTE 302	PRECAST		0	0
064 FM	ROUTE 302	CNO			
065 FM	ROUTE 302	PRECAST		0	0
066	HIGHLAND AVENUE	PRECAST	6.3	0	29,169
068	HIGHLAND AVENUE	PRECAST	6.6	0	117
071	HIGHLAND AVENUE	PRECAST	9.5	0	0
072	HIGHLAND AVENUE	CNO			
073	HIGHLAND AVENUE	CNO			
074	HIGHLAND AVENUE	PRECAST	7.4	0	0
075	PAUL AVENUE	PRECAST	5.3	0	0
076	PAUL AVENUE	PRECAST	5.5	0	0
077	CRESCENT LANE	PRECAST	8.2	0	0
078	CRESCENT LANE	PRECAST	8.3	0	0
080	ROUTE 302	PRECAST	6	0	0
082	EVERGREEN DRIVE	CNO			
083	EVERGREEN DRIVE	PRECAST	6.2	0	0
084	ROUTE 302	PRECAST	9.4	0	0
085	VINE STREET	PRECAST	10.3	0	0

Manhole	Street Name/Location	Material	Manhole Depth (ft)	Infiltration (gpd)	Inflow (gpd)
086	VINE STREET	PRECAST	10.6	0	0
088	VINE STREET	PRECAST	8.6	432	0
089	VINE STREET	PRECAST	9.2	0	0
090	VINE STREET	PRECAST	8.9	0	0
091	VINE STREET	PRECAST	8.5	0	0
092	VINE STREET	PRECAST	5.4	0	0
095	ROUTE 302	PRECAST	8.2	0	1,171
096	ROUTE 302	PRECAST	8.4	0	785
098	ROUTE 302	PRECAST	9.5	0	0
100	ROUTE 302	CNO			
101	PARTRIDGE FARM ROAD	PRECAST	12.2	0	0
102	PARTRIDGE FARM ROAD	PRECAST	10.6	0	0
103	PARTRIDGE FARM ROAD	CNO			
104	PARTRIDGE FARM ROAD	PRECAST	7.5	0	0
105	PARTRIDGE FARM ROAD	PRECAST	8.1	0	0
106	PARTRIDGE FARM ROAD	PRECAST	14.6	0	0
107	PARTRIDGE FARM ROAD	PRECAST	11.2	0	0
108	PARTRIDGE FARM ROAD	PRECAST	12.6	0	0
108 A	PARTRIDGE FARM ROAD	PRECAST	10.4	0	0
108 B	PARTRIDGE FARM ROAD	PRECAST	13.8	0	0
109	POINT RIDGE ROAD	PRECAST	11.3	432	0
110	POINT RIDGE ROAD	PRECAST	8.1	0	0
111	POINT RIDGE ROAD	PRECAST	10.5	0	0
112	POINT RIDGE ROAD	PRECAST	7.5	0	0
113	POINT RIDGE ROAD	PRECAST	8.4	0	0
114	POINT RIDGE ROAD	PRECAST	7.5	0	0
115	POINT RIDGE ROAD	PRECAST	8.2	0	0
116	POINT RIDGE ROAD	PRECAST	11.4	0	293
117	PLATEAU ROAD	PRECAST	7.2	0	0
118	PLATEAU ROAD	PRECAST	5.8	0	0
119	CROSS COUNTRY RUN	PRECAST	9.7	0	0
120	CROSS COUNTRY RUN	PRECAST	12.2	0	0
121	CROSS COUNTRY RUN	PRECAST	11.4	0	0
122	CROSS COUNTRY RUN	PRECAST	10.5	0	0
123	CROSS COUNTRY RUN	PRECAST	11.8	0	0
124	CROSS COUNTRY RUN	PRECAST	6	0	0
125	CROSS COUNTRY RUN	PRECAST	13.1	0	0

Manhole	Street Name/Location	Material	Manhole Depth (ft)	Infiltration (gpd)	Inflow (gpd)
126	CROSS COUNTRY RUN	PRECAST	7.3	0	0
127	CROSS COUNTRY RUN	PRECAST	5.4	0	0
128	CROSS COUNTRY RUN	PRECAST	6.7	0	0
129	CROSS COUNTRY RUN	PRECAST	9.8	0	0
130	CROSS COUNTRY RUN	PRECAST	9.5	0	0
131	CROSS COUNTRY RUN	PRECAST	9.9	0	0
132	CROSS COUNTRY RUN	PRECAST	8.9	0	0
133	CROSS COUNTRY RUN	PRECAST	7.4	0	0
134	CROSS COUNTRY RUN	PRECAST	12.3	0	0
134 A	BERLIN STATE HIGHWAY	PRECAST	12.3	432	0
135	BERLIN STATE HIGHWAY	CNO			
136	BERLIN STATE HIGHWAY	PRECAST	8.3	0	0
138	BERLIN STATE HIGHWAY	CNO			
140	BERLIN STATE HIGHWAY	CNO			
141	BERLIN STATE HIGHWAY	PRECAST	7.4	0	0
142	ROUTE 302	PRECAST	7.7	0	0
143	CROSS COUNTRY RUN	PRECAST	7.1	0	0
144	CROSS COUNTRY RUN	PRECAST	8.7	0	0
145	CROSS COUNTRY RUN	PRECAST	6.2	0	0
149	CROSS COUNTRY RUN	PRECAST	6	0	0
150	CROSS COUNTRY RUN	PRECAST	9	0	0
151	CROSS COUNTRY RUN	PRECAST	7.3	0	0
152	CROSS COUNTRY RUN	PRECAST	7.1	0	0
153	CROSS COUNTRY RUN	PRECAST	6	0	0
154	CROSS COUNTRY RUN	PRECAST	7	0	0
155	CROSS COUNTRY RUN	PRECAST	7	0	0
156	CROSS COUNTRY RUN	PRECAST	8.8	0	0
157	CROSS COUNTRY RUN	PRECAST	7.3	0	0
158	CROSS COUNTRY RUN	PRECAST	9.1	0	0
159	CROSS COUNTRY RUN	PRECAST	8.1	0	0
160	CROSS COUNTRY RUN	PRECAST	5.9	0	0
161	CROSS COUNTRY RUN	PRECAST	5.8	0	0
162	CROSS COUNTRY RUN	PRECAST	9	0	0
163	CROSS COUNTRY RUN	PRECAST	7	0	0
163 A	CROSS COUNTRY RUN	PRECAST	8.1	0	0
164	CROSS COUNTRY RUN	PRECAST	9.2	432	0
165	CROSS COUNTRY RUN	PRECAST	8.1	288	0

Manhole	Street Name/Location	Material	Manhole Depth (ft)	Infiltration (gpd)	Inflow (gpd)
166	CROSS COUNTRY RUN	PRECAST	8.3	288	0
167	CROSS COUNTRY RUN	PRECAST	9.2	0	0
168	CROSS COUNTRY RUN	PRECAST	8	0	0
169	CROSS COUNTRY RUN	PRECAST	8.2	144	0
170	CROSS COUNTRY RUN	PRECAST	6	0	0
171	CROSS COUNTRY RUN	PRECAST	5.9	0	0
172	CROSS COUNTRY RUN	PRECAST	8	0	0
173	AIRPORT ROAD	PRECAST	8.4	0	0
174	AIRPORT ROAD	PRECAST	10	0	0
175	AIRPORT ROAD	PRECAST	6.7	0	0
176	AIRPORT ROAD	PRECAST	8.8	0	0
177	AIRPORT ROAD	PRECAST	7.8	0	0
178	AIRPORT ROAD	PRECAST	7.2	0	0
179	AIRPORT ROAD	PRECAST	9.5	0	0
182	BERLIN STATE HIGHWAY	PRECAST	9.2	0	0
184	FISHER ROAD	PRECAST	21.8	0	0
185	FISHER ROAD	PRECAST	8.3	0	0
187	AIRPORT ROAD	PRECAST	6.4	0	0
188	GRANGER ROAD	PRECAST	8.9	0	0
189	GRANGER ROAD	PRECAST	8.5	0	0
190	GRANGER ROAD	PRECAST	9.8	0	0
191	GRANGER ROAD	PRECAST	5.4	0	0
193	CROSS COUNTRY RUN	PRECAST	7	0	0
194	CROSS COUNTRY RUN	PRECAST	7.2	0	0
195	CROSS COUNTRY RUN	PRECAST	6.4	0	0
195 A	CROSS COUNTRY RUN	PRECAST	7.2	0	0
195 B	CROSS COUNTRY RUN	PRECAST	6.3	0	0
196	CROSS COUNTRY RUN	PRECAST	5	0	0
198	GRANGER ROAD	PRECAST	7.9	0	0
198 A	GRANGER ROAD	PRECAST	7.3	0	0
198 B	GRANGER ROAD	PRECAST	3.8	0	0
199	CROSS COUNTRY RUN	PRECAST	12.9	0	0
200	CROSS COUNTRY RUN	CNO			
201	CROSS COUNTRY RUN	PRECAST	8.9	0	0
202	CROSS COUNTRY RUN	PRECAST	10.7	0	0
203	INDUSTRIAL LANE	PRECAST	8.6	0	0
203 A	INDUSTRIAL LANE	PRECAST	5.5	0	0

Manhole	Street Name/Location	Material	Manhole Depth (ft)	Infiltration (gpd)	Inflow (gpd)
203 B	INDUSTRIAL LANE	CNO			
203 C	CROSS COUNTRY RUN	PRECAST	6.6	0	0
203 D	CROSS COUNTRY RUN	PRECAST	7.5	0	0
203 E	CROSS COUNTRY RUN	PRECAST	7.6	0	0
203 F	INDUSTRIAL LANE	PRECAST	11.7	0	0
203 G	INDUSTRIAL LANE	PRECAST	13.3	0	0
204	INDUSTRIAL LANE	PRECAST	8.5	0	0
205	INDUSTRIAL LANE	CNO			
206	EAST ROAD	PRECAST	10.3	0	0
206 A	INDUSTRIAL LANE	PRECAST	7.9	0	0
207	EAST ROAD	PRECAST	7.3	0	0
207 A	EAST ROAD	PRECAST	6	0	586
208	EAST ROAD	PRECAST	9.4	0	0
209	EAST ROAD	PRECAST	4.5	0	0
210	EAST ROAD	PRECAST	7.8	0	703
211	EAST ROAD	PRECAST	12	0	0
211 A	GRANGER ROAD	PRECAST	13.2	0	3,983
212	GRANGER ROAD	PRECAST	7.5	0	0
212 A	GRANGER ROAD	PRECAST	8.8	0	0
212 B	GRANGER ROAD	PRECAST	5.6	0	0
213	CROSS COUNTRY RUN	PRECAST	11.6	0	0
214	CROSS COUNTRY RUN	PRECAST	6.4	0	0
216	SHAW'S PLAZA	PRECAST	10.5	0	0
216 A	SHAW'S PLAZA	PRECAST	12.1	0	0
216 B	SHAW'S PLAZA	PRECAST	7.6	0	2,343
216 C	SHAW'S PLAZA	PRECAST	6.9	0	2,343
217	PAINE TURNPIKE	PRECAST	8.8	0	0
217 A	PAINE TURNPIKE	PRECAST	6.4	0	0
218	PAINE TURNPIKE	CNO			
218 A	PAINE TURNPIKE	PRECAST	2.8	0	0
218 B	PAINE TURNPIKE	PRECAST	4.8	0	0
220	PAINE TURNPIKE	PRECAST	9.2	0	0
221	FISHER ROAD	PRECAST	21.4	0	0
222	FISHER ROAD	PRECAST	16.9	0	0
223	FISHER ROAD	PRECAST	17.3	0	0
224	FISHER ROAD	PRECAST	13.1	0	0
225	BERLIN MALL ROAD	PRECAST	15.3	0	0

Manhole	Street Name/Location	Material	Manhole Depth (ft)	Infiltration (gpd)	Inflow (gpd)
225 A	BERLIN MALL ROAD	PRECAST	15	0	0
226	BERLIN MALL ROAD	PRECAST	14.2	0	0
227	BERLIN MALL ROAD	PRECAST	14.5	0	0
228	BERLIN MALL ROAD	PRECAST	13.7	0	0
229	BERLIN MALL ROAD	PRECAST	6.7	0	0
230	BERLIN MALL ROAD	PRECAST	7.1	0	0
231	BERLIN MALL ROAD	PRECAST	6.7	0	0
232	BERLIN MALL ROAD	PRECAST	6.3	0	0
233	BERLIN MALL ROAD	CNO			
236	PAINE TURNPIKE	PRECAST	3.3	0	0
237	PAINE TURNPIKE	PRECAST	3	0	0
238	PAINE TURNPIKE	PRECAST	7.8	0	0
239	PAINE TURNPIKE	PRECAST	7.9	0	0
239 A	PAINE TURNPIKE	PRECAST	6.2	0	0
240	PAINE TURNPIKE	PRECAST	7.1	0	0
240 A	PAINE TURNPIKE	PRECAST	5.5	0	0
241	FISHER ROAD	PRECAST	11.2	0	0
242	FISHER ROAD	PRECAST	6.3	0	0
243	FISHER ROAD	PRECAST	3.2	0	0
244	HERSEY ROAD	PRECAST	9.5	144	0
245	HERSEY ROAD	PRECAST	7.2	0	0
246	GREEN MOUNTAIN DRIVE	PRECAST	10.2	0	0
248	ADDISON DRIVE	PRECAST	7.5	144	0
249	ADDISON DRIVE	PRECAST	6	0	0
250	ADDISON DRIVE	PRECAST	7	144	0
251	GREEN MOUNTAIN DRIVE	PRECAST	9.2	0	0
253	CECILE AVENUE	PRECAST	7.4	0	0
254	CECILE AVENUE	PRECAST	7.2	0	0
255	CECILE AVENUE	PRECAST	7.1	0	0
258	ROUTE 302	PRECAST	8.2	0	0
259	ADDISON DRIVE	PRECAST	6.1	0	0
300	PAINE TURNPIKE	PRECAST	8.8	0	0
301	PAINE TURNPIKE	PRECAST	9.3	0	0
302	PAINE TURNPIKE	PRECAST	7.7	0	0
303	PAINE TURNPIKE	PRECAST	10.6	0	0
304	PAINE TURNPIKE	PRECAST	9.1	1,152	0
305	PAINE TURNPIKE	PRECAST	7.8	0	0

Manhole	Street Name/Location	Material	Manhole Depth (ft)	Infiltration (gpd)	Inflow (gpd)
310	PAINE TURNPIKE	PRECAST	6	0	0
311	PAINE TURNPIKE	PRECAST	7.3	0	0
312	PAINE TURNPIKE	PRECAST	8.2	0	0
313	PAINE TURNPIKE	PRECAST	8.9	0	0
314	PAINE TURNPIKE	PRECAST	8.3	0	0
315	PAINE TURNPIKE	PRECAST	12.6	0	0
316	PAINE TURNPIKE	PRECAST	12.3	0	0
317	PAINE TURNPIKE	PRECAST	6.9	0	0
318	PAINE TURNPIKE	PRECAST	6.8	0	0
319	PAINE TURNPIKE	PRECAST	5.1	0	0
320	PAINE TURNPIKE	PRECAST	4.9	0	0
321	PAINE TURNPIKE	PRECAST	7.4	0	0
322	PAINE TURNPIKE	PRECAST	7.9	0	0
323	PAINE TURNPIKE	PRECAST	10.9	0	0
324	PAINE TURNPIKE	PRECAST	7.7	0	0
325	PARTRIDGE FARM ROAD	BRICK	7.9	0	0
326	PARTRIDGE FARM ROAD	PRECAST	8.2	0	0
327	PARTRIDGE FARM ROAD	PRECAST	7.6	0	0
328	PARTRIDGE FARM ROAD	PRECAST	12.2	0	0
329	PARTRIDGE FARM ROAD	PRECAST	10.1	0	0
330	PARTRIDGE FARM ROAD	PRECAST	7	0	0
331	PARTRIDGE FARM ROAD	PRECAST	7.9	0	0
332	PARTRIDGE FARM ROAD	PRECAST	6.9	0	0
340	WARNER ROAD	PRECAST	6.8	0	0
350	WOODRIDGE DRIVE	PRECAST	4.6	0	0
611 FM	ROUTE 302	PRECAST		0	0
911	VINE STREET	PRECAST	7.2	0	0
912	VINE STREET	PRECAST	8.2	0	0
913	BERLIN HEIGHTS	PRECAST	11	0	0
913 A	VINE STREET	PRECAST	6.8	0	0
913 B	VINE STREET	PRECAST	6.3	0	0
914	BERLIN HEIGHTS	PRECAST	8.9	0	0
915	BERLIN HEIGHTS	PRECAST	8	0	0
916	BERLIN HEIGHTS	PRECAST	6.9	0	0
1003	ROUTE 302	PRECAST	7.6	0	0
1004	ROUTE 302	CNO			
1212	OVERLOOK DRIVE	PRECAST	8.5	0	7,357

Manhole	Street Name/Location	Material	Manhole Depth (ft)	Infiltration (gpd)	Inflow (gpd)
1451	CROSS COUNTRY RUN	PRECAST	6.2	0	0
1452	CROSS COUNTRY RUN	PRECAST	5.8	0	0
1453	HOSPITALITY DRIVE	PRECAST	6.3	0	0
1454	HOSPITALITY DRIVE	PRECAST	8	0	0
1611	WARNER ROAD	PRECAST	5.9	0	0
1612	WARNER ROAD	PRECAST	7.3	0	0
1612A	WARNER ROAD	PRECAST	3.8	0	0
1612B	WARNER ROAD	PRECAST	5.3	0	0
TOTAL MANHOLE INFILTRATION/INFLOW				**5,328**	**78,232**
TOTAL NUMBER OF MANHOLES				**300**	
TOTAL NUMBER OF MANHOLES INSPECTED				**284**	

NOTE:

CNL = CANNOT LOCATE
CNO = CANNOT OPEN

TABLE C-2

MANHOLE STRUCTURAL DEFECTS

2021 ASSET MANAGEMENT PLANNING

Manhole	Street/Location	Recommended Rehabilitation	Rehabilitation Cost
031	ROUTE 302	REPLACE FRAME AND COVER	$2,000
083	EVERGREEN DRIVE	BUILD BENCH AND INVERT	$1,500
116	POINT RIDGE ROAD	BUILD BENCH AND INVERT	$1,500
118	PLATEAU ROAD	BUILD BENCH AND INVERT	$1,500
175	AIRPORT ROAD	REPLACE FRAME AND COVER	$2,000
203 G	INDUSTRIAL LANE	BUILD BENCH AND INVERT	$1,500
216 C	SHAW'S PLAZA	REPAIR CHIMNEY	$750
244	HERSEY ROAD	REPLACE FRAME AND COVER	$2,000
916	BERLIN HEIGHTS	BUILD BENCH AND INVERT	$1,500
		TOTAL REHABILITATION COST	$14,250
		TOTAL NUMBER OF MANHOLES	9

TABLE C-3

MANHOLES NOT INSPECTED

2021 ASSET MANAGEMENT PLANNING

Manhole	Street/Location	Inspection Status	Comments
032	ROUTE 302	CNO	RECENTLY SEEDED OVER
064 FM	ROUTE 302	CNO	IN HIGH TRAFFIC AREA
072	HIGHLAND AVENUE	CNO	BURIED UNDER GRAVEL ROAD
073	HIGHLAND AVENUE	CNO	RUSTED SHUT
082	EVERGREEN DRIVE	CNO	PAVED OVER
100	ROUTE 302	CNO	PAVED OVER
103	PARTRIDGE FARM ROAD	CNO	BURIED IN GRAVEL ROAD
135	BERLIN STATE HIGHWAY	CNO	RAISED MANHOLE ON STEEP SLOPE
138	BERLIN STATE HIGHWAY	CNO	RAISED MANHOLE ON STEEP SLOPE
140	BERLIN STATE HIGHWAY	CNO	RAISED MANHOLE ON STEEP SLOPE
200	CROSS COUNTRY RUN	CNO	RUSTED SHUT
203 B	INDUSTRIAL LANE	CNO	LOCKING COVER - UNABLE TO OPEN
205	INDUSTRIAL LANE	CNO	COVER PARTIALLY UNDER GENERATOR
218	PAINE TURNPIKE	CNO	PARTIALLY PAVED OVER
233	BERLIN MALL ROAD	CNO	WITHIN FENCED CONSTRUCTION SITE
1004	ROUTE 302	CNO	CIPHON MH

TOTAL NUMBER OF MANHOLES 16

TABLE C-4
MANHOLE INFILTRATION REHABILITATION SUMMARY
2021 ASSET MANAGEMENT PLANNING

Manhole	Street/Location	Manhole Depth (ft)	Infiltration (gpd)	Removable Infiltration (gpd)	Rehabilitation	Rehabilitation Cost
001	ROUTE 302	16.2	144	72	Cementitious Lining	$2,835
002	ROUTE 302	16	288	144	Cementitious Lining	$2,800
003	ROUTE 302	15.2	288	144	Cementitious Lining	$2,660
035	ROUTE 302	17.8	288	144	Cementitious Lining	$3,115
043	ROUTE 302	9.1	144	72	Cementitious Lining	$1,593
044	ROUTE 302	8	144	72	Cementitious Lining	$1,400
088	VINE STREET	8.6	432	216	Cementitious Lining	$1,505
109	POINT RIDGE ROAD	11.3	432	216	Cementitious Lining	$1,978
134 A	BERLIN STATE HIGHWAY	12.3	432	216	Cementitious Lining	$2,153
164	CROSS COUNTRY RUN	9.2	432	216	Cementitious Lining	$1,610
165	CROSS COUNTRY RUN	8.1	288	144	Cementitious Lining	$1,418
166	CROSS COUNTRY RUN	8.3	288	144	Cementitious Lining	$1,453
169	CROSS COUNTRY RUN	8.2	144	72	Cementitious Lining	$1,435
244	HERSEY ROAD	9.5	144	72	Cementitious Lining	$1,663
248	ADDISON DRIVE	7.5	144	72	Cementitious Lining	$1,313

Manhole	Street/Location	Manhole Depth (ft)	Infiltration (gpd)	Removable Infiltration (gpd)	Rehabilitation	Rehabilitation Cost
250	ADDISON DRIVE	7	144	72	Cementitious Lining	$1,225
304	PAINE TURNPIKE	9.1	1,152	576	Cementitious Lining	$1,593
TOTAL			**5,328**	**2,664**		**$31,745**

TABLE C-5
MANHOLE INFLOW REHABILITATION SUMMARY
2021 ASSET MANAGEMENT PLANNING

Manhole	Street/Location	Inflow (gpd)	Rehabilitation
002	ROUTE 302	6,701	Install Inflow Dish
005	ROUTE 302	2,929	Install Inflow Dish
017	ROUTE 302	469	Install Inflow Dish
018	ROUTE 302	4,686	Install Inflow Dish
023	ROUTE 302	260	Install Inflow Dish
033	ROUTE 302	1,171	Install Inflow Dish
038	ROUTE 302	691	Install Inflow Dish
043	ROUTE 302	761	Install Inflow Dish
066	HIGHLAND AVENUE	29,169	Install Inflow Dish
068	HIGHLAND AVENUE	117	Install Inflow Dish
095	ROUTE 302	1,171	Install Inflow Dish
116	POINT RIDGE ROAD	293	Install Inflow Dish
207 A	EAST ROAD	586	Install Inflow Dish
210	EAST ROAD	703	Install Inflow Dish
211 A	GRANGER ROAD	3,983	Install Inflow Dish
216 B	SHAW'S PLAZA	2,343	Install Inflow Dish
216 C	SHAW'S PLAZA	2,343	Install Inflow Dish
TOTAL INFLOW		58,376	
TOTAL NUMBER OF MANHOLES		17	
TOTAL ESTIMATED COST		$3,400	

TABLE C-6

ANTICIPATED COSTS FOR SEWER MANHOLE REHABILITATION

Cementitious lining of 17 manholes:	$	31,800
Replace three manhole frames and covers:	$	6,000
Repair one manhole chimney:	$	800
Build five manhole bench and inverts:	$	7,500
Installation of 17 inflow dishes:	$	3,400
Total Anticipated Construction Cost:	$	49,500

It is important to note that manhole structures may degrade between the time of inspection and the time of rehabilitation. Generally, the more time that elapses the greater the chance of material and structural degradation.

MANHOLE RANKING
Berlin, VT

Manhole	Location	Condition	Consequence of Failure	Rank
31	Route 302	4	1	4
244	Hersey Road	4	1	4
88	Vine Street	3	1	3
134 A	Berlin State Highway	3	1	3
304	Paine Turnpike	3	1	3
125	Cross Country Run	2	4	8
1	Route 302	2	1	2
2	Route 302	2	1	2
3	Route 302	2	1	2
35	Route 302	2	1	2
37	Route 302	2	1	2
43	Route 302	2	1	2
44	Route 302	2	1	2
51	Route 302	2	1	2
77	Crescent Lane	2	1	2
83	Evergreen Drive	2	1	2
109	Point Ridge Road	2	1	2
164	Cross Country Run	2	1	2
165	Cross Country Run	2	1	2
166	Cross Country Run	2	1	2
169	Cross Country Run	2	1	2
216 B	Shaw's Plaza	2	1	2
246	Green Mountain Drive	2	1	2
248	Addison Drive	2	1	2
249	Addison Drive	2	1	2
250	Addison Drive	2	1	2
253	Cecile Avenue	2	1	2
313	Paine Turnpike	2	1	2
1452	Cross Country Run	2	1	2
119	Cross Country Run	1	4	4
120	Cross Country Run	1	4	4
121	Cross Country Run	1	4	4
122	Cross Country Run	1	4	4
123	Cross Country Run	1	4	4
124	Cross Country Run	1	4	4
126	Cross Country Run	1	3	3
66	Highland Avenue	1	2	2
68	Highland Avenue	1	2	2
4	Route 302	1	1	1
5	Route 302	1	1	1

Manhole	Location	Condition	Consequence of Failure	Rank
7	Route 302	1	1	1
8	Route 302	1	1	1
9	Route 302	1	1	1
10	Route 302	1	1	1
11	Route 302	1	1	1
12	Route 302	1	1	1
14	Route 302	1	1	1
15	Route 302	1	1	1
16	Route 302	1	1	1
17	Route 302	1	1	1
18	Route 302	1	1	1
19	Route 302	1	1	1
20	Route 302	1	1	1
21	Route 302	1	1	1
22	Route 302	1	1	1
23	Route 302	1	1	1
24	Route 302	1	1	1
26	Route 302	1	1	1
27	Route 302	1	1	1
28	Route 302	1	1	1
29	Route 302	1	1	1
30	Route 302	1	1	1
33	Route 302	1	1	1
34	Route 302	1	1	1
36	Route 302	1	1	1
38	Route 302	1	1	1
39	Route 302	1	1	1
40	Route 302	1	1	1
46	Route 302	1	1	1
47	Route 302	1	1	1
50	Route 302	1	1	1
52	Route 302	1	1	1
53	Route 302	1	1	1
54	Route 302	1	1	1
55	Route 302	1	1	1
56	Route 302	1	1	1
59	Route 302	1	1	1
60	Route 302	1	1	1
65	Route 302	1	1	1
71	Highland Avenue	1	1	1
74	Highland Avenue	1	1	1
75	Paul Avenue	1	1	1
76	Paul Avenue	1	1	1
78	Crescent Lane	1	1	1
80	Route 302	1	1	1

Manhole	Location	Condition	Consequence of Failure	Rank
84	Route 302	1	1	1
85	Vine Street	1	1	1
86	Vine Street	1	1	1
89	Vine Street	1	1	1
90	Vine Street	1	1	1
91	Vine Street	1	1	1
92	Vine Street	1	1	1
96	Route 302	1	1	1
98	Route 302	1	1	1
101	Partridge Farm Road	1	1	1
102	Partridge Farm Road	1	1	1
104	Partridge Farm Road	1	1	1
105	Partridge Farm Road	1	1	1
106	Partridge Farm Road	1	1	1
107	Partridge Farm Road	1	1	1
108	Partridge Farm Road	1	1	1
108 A	Partridge Farm Road	1	1	1
108 B	Partridge Farm Road	1	1	1
110	Point Ridge Road	1	1	1
111	Point Ridge Road	1	1	1
112	Point Ridge Road	1	1	1
113	Point Ridge Road	1	1	1
114	Point Ridge Road	1	1	1
115	Point Ridge Road	1	1	1
116	Point Ridge Road	1	1	1
117	Plateau Road	1	1	1
118	Plateau Road	1	1	1
127	Cross Country Run	1	1	1
128	Cross Country Run	1	1	1
129	Cross Country Run	1	1	1
130	Cross Country Run	1	1	1
131	Cross Country Run	1	1	1
132	Cross Country Run	1	1	1
133	Cross Country Run	1	1	1
134	Cross Country Run	1	1	1
135	Berlin State Highway	1	1	1
136	Berlin State Highway	1	1	1
140	Berlin State Highway	1	1	1
141	Berlin State Highway	1	1	1
142	Route 302	1	1	1
143	Cross Country Run	1	1	1
144	Cross Country Run	1	1	1
145	Cross Country Run	1	1	1
149	Cross Country Run	1	1	1
150	Cross Country Run	1	1	1

Manhole	Location	Condition	Consequence of Failure	Rank
151	Cross Country Run	1	1	1
152	Cross Country Run	1	1	1
153	Cross Country Run	1	1	1
154	Cross Country Run	1	1	1
155	Cross Country Run	1	1	1
156	Cross Country Run	1	1	1
157	Cross Country Run	1	1	1
158	Cross Country Run	1	1	1
159	Cross Country Run	1	1	1
160	Cross Country Run	1	1	1
161	Cross Country Run	1	1	1
162	Cross Country Run	1	1	1
163	Cross Country Run	1	1	1
163 A	Cross Country Run	1	1	1
167	Cross Country Run	1	1	1
168	Cross Country Run	1	1	1
170	Cross Country Run	1	1	1
171	Cross Country Run	1	1	1
172	Cross Country Run	1	1	1
173	Airport Road	1	1	1
174	Airport Road	1	1	1
175	Airport Road	1	1	1
176	Airport Road	1	1	1
177	Airport Road	1	1	1
178	Airport Road	1	1	1
179	Airport Road	1	1	1
182	Berlin State Highway	1	1	1
184	Fisher Road	1	1	1
185	Fisher Road	1	1	1
187	Airport Road	1	1	1
188	Granger Road	1	1	1
189	Granger Road	1	1	1
190	Granger Road	1	1	1
191	Granger Road	1	1	1
193	Cross Country Run	1	1	1
194	Cross Country Run	1	1	1
195	Cross Country Run	1	1	1
195 A	Cross Country Run	1	1	1
195 B	Cross Country Run	1	1	1
196	Cross Country Run	1	1	1
198	Granger Road	1	1	1
198 A	Granger Road	1	1	1
198 B	Granger Road	1	1	1
199	Cross Country Run	1	1	1
201	Cross Country Run	1	1	1

Manhole	Location	Condition	Consequence of Failure	Rank
202	Cross Country Run	1	1	1
203	Industrial Lane	1	1	1
203 A	Industrial Lane	1	1	1
203 C	Cross Country Run	1	1	1
302 D	Cross Country Run	1	1	1
203 E	Cross Country Run	1	1	1
203 F	Industrial Lane	1	1	1
203 G	Industrial Lane	1	1	1
204	Industrial Lane	1	1	1
206	East Road	1	1	1
206 A	Industrial Lane	1	1	1
207	East Road	1	1	1
207 A	East Road	1	1	1
208	East Road	1	1	1
209	East Road	1	1	1
210	East Road	1	1	1
211	East Road	1	1	1
211 A	Granger Road	1	1	1
212	Granger Road	1	1	1
212 A	Granger Road	1	1	1
212 B	Granger Road	1	1	1
213	Cross Country Run	1	1	1
214	Cross Country Run	1	1	1
216	Shaw's Plaza	1	1	1
216 A	Shaw's Plaza	1	1	1
216 C	Shaw's Plaza	1	1	1
217	Paine Turnpike	1	1	1
217 A	Paine Turnpike	1	1	1
218 A	Paine Turnpike	1	1	1
218 B	Paine Turnpike	1	1	1
220	Paine Turnpike	1	1	1
222	Fisher Road	1	1	1
223	Fisher Road	1	1	1
224	Fisher Road	1	1	1
225	Berlin Mall Road	1	1	1
225 A	Berlin Mall Road	1	1	1
226	Berlin Mall Road	1	1	1
228	Berlin Mall Road	1	1	1
229	Berlin Mall Road	1	1	1
230	Berlin Mall Road	1	1	1
231	Berlin Mall Road	1	1	1
232	Berlin Mall Road	1	1	1
236	Paine Turnpike	1	1	1
237	Paine Turnpike	1	1	1
238	Paine Turnpike	1	1	1

Manhole	Location	Condition	Consequence of Failure	Rank
239	Paine Turnpike	1	1	1
239 A	Paine Turnpike	1	1	1
240	Paine Turnpike	1	1	1
240 A	Paine Turnpike	1	1	1
241	Fisher Road	1	1	1
242	Fisher Road	1	1	1
243	Fisher Road	1	1	1
245	Hersey Road	1	1	1
251	Green Mountain Drive	1	1	1
254	Cecile Avenue	1	1	1
255	Cecile Avenue	1	1	1
258	Route 302	1	1	1
259	Addison Drive	1	1	1
300	Paine Turnpike	1	1	1
301	Paine Turnpike	1	1	1
302	Paine Turnpike	1	1	1
303	Paine Turnpike	1	1	1
305	Paine Turnpike	1	1	1
310	Paine Turnpike	1	1	1
311	Paine Turnpike	1	1	1
312	Paine Turnpike	1	1	1
314	Paine Turnpike	1	1	1
315	Paine Turnpike	1	1	1
316	Paine Turnpike	1	1	1
317	Paine Turnpike	1	1	1
318	Paine Turnpike	1	1	1
319	Paine Turnpike	1	1	1
320	Paine Turnpike	1	1	1
321	Paine Turnpike	1	1	1
322	Paine Turnpike	1	1	1
323	Paine Turnpike	1	1	1
324	Paine Turnpike	1	1	1
325	Partridge Farm Road	1	1	1
326	Partridge Farm Road	1	1	1
327	Partridge Farm Road	1	1	1
328	Partridge Farm Road	1	1	1
329	Partridge Farm Road	1	1	1
330	Partridge Farm Road	1	1	1
331	Partridge Farm Road	1	1	1
332	Partridge Farm Road	1	1	1
340	Warner Road	1	1	1
350	Woodridge Drive	1	1	1
911	Vine Street	1	1	1
912	Vine Street	1	1	1
913	Berlin Heights	1	1	1

Manhole	Location	Condition	Consequence of Failure	Rank
913 A	Vine Street	1	1	1
913 B	Vine Street	1	1	1
914	Berlin Heights	1	1	1
915	Berlin Heights	1	1	1
916	Berlin Heights	1	1	1
1003	Route 302	1	1	1
1212	Overlook Drive	1	1	1
1451	Cross Country Run	1	1	1
1453	Hospitality Drive	1	1	1
1454	Hospitality Drive	1	1	1
1611	Warner Road	1	1	1
1612	Warner Road	1	1	1
1612 A	Warner Road	1	1	1
1612 B	Warner Road	1	1	1
221	Fisher Road	1	1	
48A	Route 302	0	0	0
62	Route 302	0	0	0
95	Route 302	0	0	0
100	Route 302	0	0	0
103	Partridge Farm Road	0	0	0
138	Berlin State Highway	0	0	0
203 B	Industrial Lane	0	0	0
205	Industrial Lane	0	0	0
218	Paine Turnpike	0	0	0
233	Berlin Mall Road	0	0	0
611	Route 302	0	0	0
1004	Route 302	0	0	0
6	Route 302			0
25	Route 302			0
32	Route 302			0
57	Route 302			0
58	Route 302			0
64	Route 302			0
72	Highland Avenue			0
73	Highland Avenue			0
82	Evergreen Drive			0
200	Cross Country Run			0

APPENDIX D

Main Pump Station Alternatives

MAIN PUMP STATION

Existing Configuration Drawings


PUMP STATION SITE PLAN
SCALE: 1"=5'-0"
STANDPIPE UTILITY POLE TO 10' ABOVE GRADE. PROVIDE 30' OF SLACK CABLE BEYOND STANDPIPE (SEE SPECS. SEC. 16 A.5 FOR ADDITIONAL REQUIREMENTS)
LIMIT OF PAYMENT ITEM 27
CLEAN OUT/DRAIN MH (INCLUD. IN ITEM 27)
18" MOWING STRIP
EXISTING PUMP STATION
SEEDED TOPSOIL
FOR PIER LOCATION SEE DETAIL THIS SHT.
EXISTING CONTROL HOUSE (TO BE REMOVED ITEM 32)
EMERGENCY GENERATOR BUILDING FL. EL. 550.25
EXIST. WET WELL
15" ACCGMP
12" AC SEWER
8" F.M.
12" D.I. F.M.
FUTURE 2" PVC TO BE PLUGGED BOTH ENDS (SCHEDULE 80)
3" PVC VENT
12" PVC
WET WELL
PUMP STATION
24"×14" REINF. CONC. BASE SLAB
GUARD POSTS
UNDERGROUND FUEL OIL TANK
RELOCATED W/6" COVER
BIT. CONC. CURB
LAND OF THE HOWARD BANK
RT. 302
LIMIT OF PAYMENT ITEM 27
NOTES:
1) ALL WORK EXCEPT OTHERWISE NOTED WILL BE PAID FOR UNDER ITEM 27
2) REQUIRED AREA TO BE PAVED W/3" OF BIT. CONC. OVER 12" OF BANK GRAVEL BASE.
3) WATER SERVICE TO ADJACENT BANK IS SERVED FROM P.ST. SERVICE. LOCATION UNKNOWN. RELOCATE IF REQUIRED.
4) CONTRACTOR SHALL TEMPORARILY RELOCATE 15" ACCGMP DRAIN TO PERMIT CONSTRUCTION & REPLACE DRAIN & CATCH BASIN.
5) POWER SUPPLY TO EXISTING PUMP STATION TO BE PROTECTED DURING CONSTRUCTION
SECTION C-C
SCALE: 3/8"=1'-0"
ACCESS TUBE TOP EL. 551.0±
4' I.D. PRECAST CONC. M.H. SECTIONS
3" PVC VENT
FLEXIBLE RUBBER COUPLING
MAGNETIC FLOWMETER
PRECAST CONC. WET WELL (SEE SPEC. SECTION 2J)
H.W. ALARM EL. 530.0
"O"-RING RUBBER GASKET-TYP.
PUMP OFF EL.
CONC. FILL ALL SIDES EAST & WEST - SLOPE 1:1 NORTH & SOUTH - SLOPE 1.75:1.0
521.0 TOP OF SLAB
SUMP PUMP
6" MIN. BANK RUN GRAVEL
SECTION D-D
EXISTING WET WELL
SCALE: 3/8"=1'-0"
EXIST. 12" SEWER TO REMAIN INV. EL. 529.6
CUT HOLE FOR NEW 12" CONNECTION TO NEW WET WELL
EXIST. TWO 6" SUCTION LINES TO BE PLUGGED & SEALED WITHIN WET WELL AFTER NEW PUMP STATION OPERATIVE
EXIST. CONC. FILL
PIER LOCATION DETAIL
FOR EMERGENCY GENERATOR BLDG
SCALE: 1/4"=1'-0"
18"Φ PIER
TYPICAL PIER DETAIL
N.T.S.
3/4" THREADED ROD LOCATE TO SUIT TO ANCHOR BLDG.
3/4" NUTS WASHER
STRUCTURAL DESIGN BY
MISTRY ASSOCIATES INC.
WAKEFIELD, MA.
TOWN OF BERLIN, VERMONT
INTERMUNICIPAL SEWERAGE FACILITIES
PUMP STATION SITE PLAN & DETAILS
SCALE AS NOTED
DRAWN BY V.B.
DEPT. CHECK P.B.
PROJ. CHECK D.A.D.
FEB. 1983
APPROVED
FOR BETHEL, DUNCAN & ASSOCIATES, INC.
BETHEL, DUNCAN & ASSOCIATES, INC.
ENGINEERS
BURLINGTON, MA.
055-02-21
K-217
SHEET 20 OF 21

Figure D-1

SITE PLAN
SCALE: 1" = 10'

LEGEND:

(line)	PROPERTY LINE
------000------	EXISTING CONTOUR LINE
——(000)——	PROPOSED CONTOUR LINE
---W---	EXISTING WATER LINE
——W——	PROPOSED WATER LINE
(line)	EXISTING EASEMENT LINE
(line)	PROPOSED EASEMENT LINE
(line)	EXISTING CURBING
(line)	PROPOSED ASPHALT CURBING
===S===	EXISTING SEWER LINE AND M.H.
===D===	EXISTING STORM DRAIN AND DROP INLET
(hatch)	AREA TO BE REPAVED
00/00	POWER POLE
00/00	TELEPHONE POLE
00/00	COMBINATION POLE
o IRF	IRON ROD FOUND

EXISTING DROP INLET ELEVATIONS

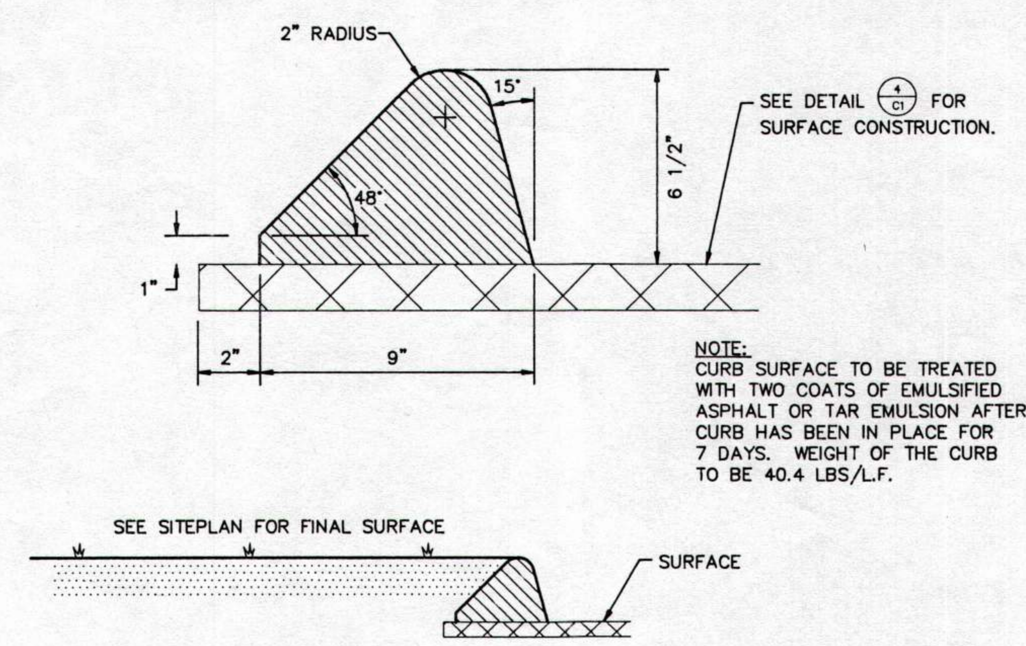
D.I. NO.	RIM ELEV.	INV. IN	INV. OUT
D.I. 1	552.13	546.53 (6")	544.98 (15")
D.I. 2	551.14	544.33 (15")	544.31 (15")
D.I 3	549.26	543.31 (15")	543.31 (15")

NOTES:

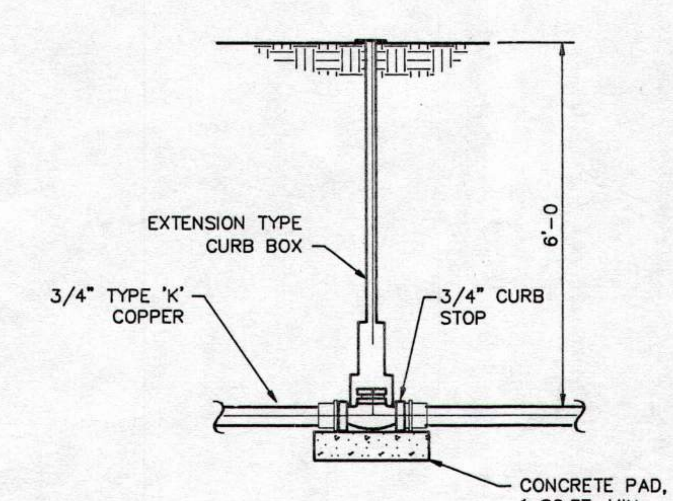
3 1.) THE EXISTING 15" STORM DRAIN FROM D.I.1 TO D.I.2 SHALL BE REMOVED AND REPLACED WITH NEW 16" CLASS 51 DUCTILE IRON PIPE.

2.) THE EXISTING GENERATOR BUILDING IS A PRECAST CONCRETE AND BRICK STRUCTURE APPROXIMATELY 10' x 14' IN SIZE. THE STRUCTURE IS SUPPORTED ON SIX(6) – 18" DIA. BY 6' DEEP CONCRETE PIERS. THE BUILDING AND PIERS SHALL BE REMOVED FROM THE SITE IN ACCORDANCE WITH SPECIFICATION SECTION 02060.

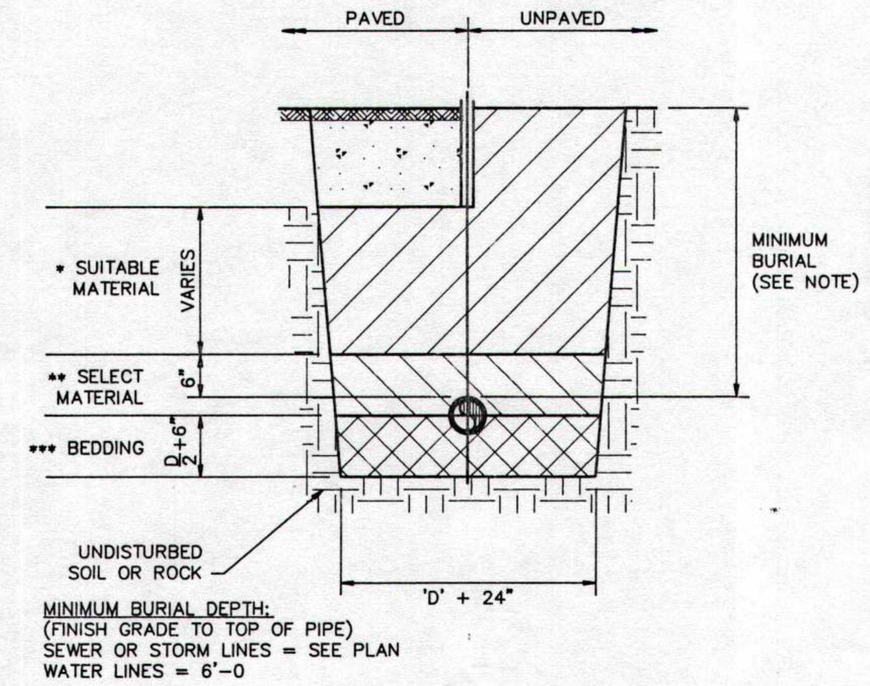
2 3.) SEE DWG E1 FOR UNDERGROUND ELECTRICAL AND TELEPHONE CONDUIT LOCATIONS.



DETAIL BITUMINOUS CONCRETE CURB 1/C1
SCALE: NONE



DETAIL CURB STOP 2/C1
SCALE: NONE



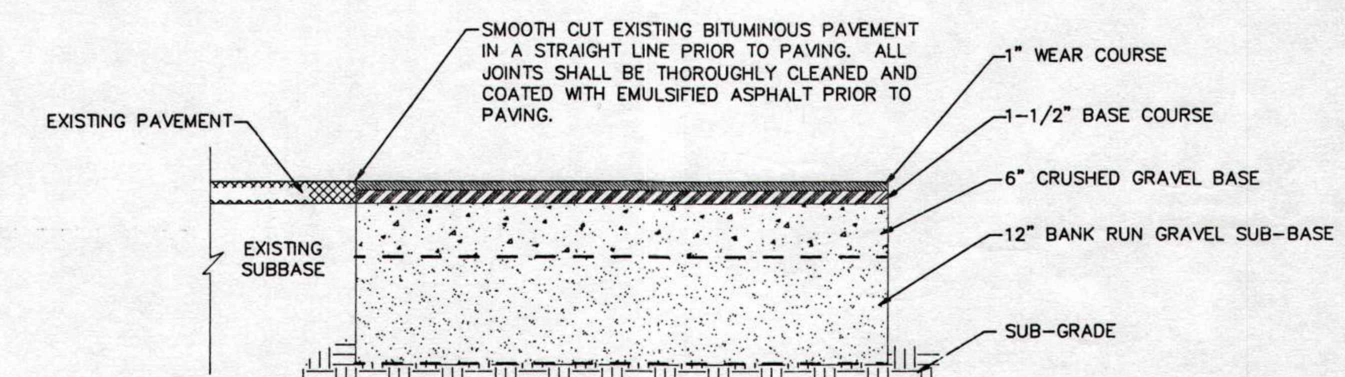
* SUITABLE MATERIAL SHALL CONTAIN NO STONES GREATER THAN 3" IN DIAMETER, NO FROZEN LUMPS, AND ONLY MINOR AMOUNTS OF CLAY OR ORGANIC MATERIAL. ALL MATERIAL TO BE PLACED IN MAXIMUM OF 6" LIFTS AND COMPACTED BEFORE PLACING NEXT LIFT. MATERIAL PLACED BELOW THE AREA OF THE NEW BUILDING SHALL MEET THE REQUIREMENTS FOR STRUCTURAL FILL.

** SELECT MATERIAL SHALL BE EITHER GRAVEL OR EXCAVATED MATERIAL CONTAINING NO STONES GREATER THAN 1 1/2" IN DIAMETER, NO FROZEN MATERIAL, NO CLAY, AND NO ORGANIC MATERIAL, THOROUGHLY COMPACTED.

*** BEDDING MATERIAL SHALL BE CRUSHED STONE UNIFORMLY GRADED FROM 3/4" – 1/4", THOROUGHLY COMPACTED.

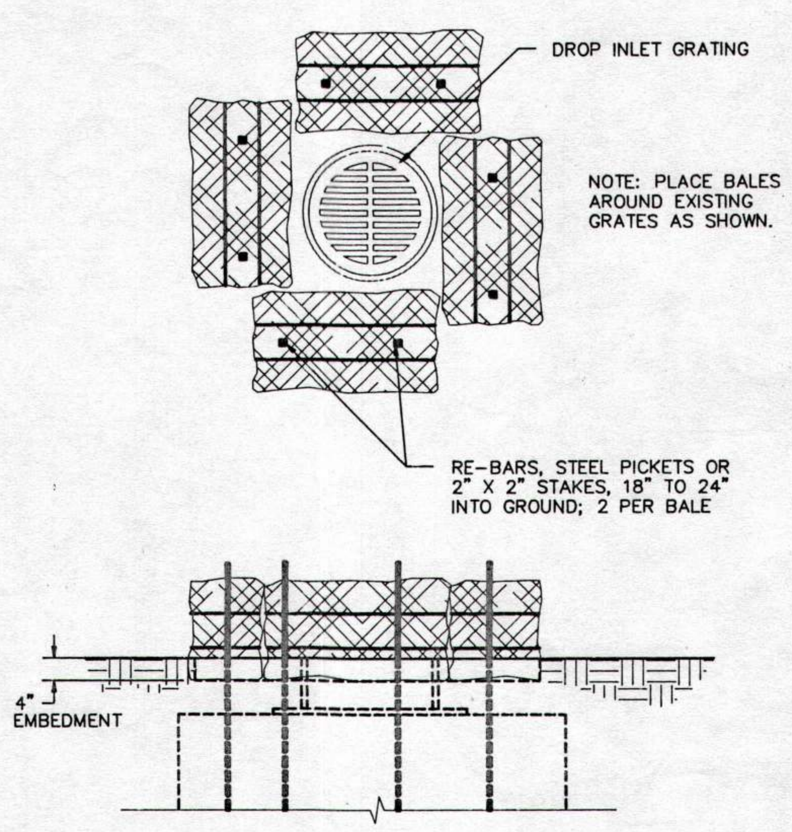
NOTES:
1. WHERE BACKFILL IS DESIGNATED "COMPACTED", THIS MEANS 95% STANDARD PROCTOR, AASHTO T-99.
2. A WET TRENCH SHALL BE DEWATERED PRIOR TO INSTALLING BEDDING.
3. THE SIDES OF TRENCHES 4' OR MORE IN DEPTH ENTERED BY PERSONNEL SHALL BE SHEETED OR SLOPED TO THE ANGLE OF REPOSE.

DETAIL TYPICAL TRENCH CONSTRUCTION 3/C1
SCALE: NONE



PAVEMENT NOTES:
1. GRAVEL: ALL GRAVEL AND CRUSHED GRAVEL FOR SUB-BASE USE SHALL CONFORM TO VERMONT DEPT. OF HIGHWAYS (VDOH) SPECIFICATION 704.05 – "GRAVEL FOR SUB-BASE" AND SPECIFICATION 704.07 – "CRUSHED GRAVEL FOR SUB-BASE."
2. SUBGRADE: CONSTRUCTION SHALL CONFORM TO VDOH SPECIFICATION 203.11 – "SUBGRADE"WITH RESPECT TO MATERIAL QUALITY AND COMPACTION.
3. SUB-BASE: SUB-BASE MATERIAL SHALL BE PLACE IN 2 EQUAL LAYERS, EACH COMPACTED TO AT LEAST 95% MAXIMUM DRY DENSITY (A.A.S.H.T.O. T-99-C) (VT A.O.T. 303.25)
4. PAVEMENT: PAVEMENT SHALL CONSIST OF TWO BITUMINOUS COURSES, CONFORMING TO VDOH SPECIFICATION 406 – "BITUMINOUS CONCRETE PAVEMET"
   1. 1-1/2" OF TYPE II COMPOSITION (BASE COURSE)
   2. 1" OF TYPE III COMPOSITION (WEAR COURSE)

DETAIL REPLACEMENT OF EXISTING BITUMINOUS PAVEMENT 4/C1
SCALE: NONE



DETAIL INLET PROTECTION 5/C1
SCALE: NONE

Rev No	Date	Description	Made by	Checked by	App'd by
3	12/95	AS-BUILT	SAR	MJC	MJC
2	4/15/94	CONDUIT LOCATION NOTE	JJS	MJC	MJC
1	1/18/94	WATER LINE LOCATION, CROSSING NOTE	JJS	MJC	MJC

Figure D-2

TOWN OF BERLIN, VERMONT
SEWAGE PUMP STATION
SITE PLAN & DETAILS

C1

CEI
CHENETTE ENGINEERING, INC.
50 STATE STREET
MONTPELIER, VERMONT 05602

Sheet	1 of
Scale	AS NOTED
Des. By	MJC
Drn. By	DH,JS
Chk. By	MJC
Date	JAN 1993
Dwg.	02-003-1

STATE OF VERMONT MICHAEL CHENETTE No. 3869 PROFESSIONAL ENGINEER

C:\BERLINPM\FINLSITE.DWG

ALTERNATE 1

Replace Anodes/Floor

Berlin, VT

PRELIMINARY OPINION OF CONSTRUCTION COST

Alternate 1 - Replace Anodes / Floor

Item No.	Description	Unit	Est. Qty	Cost/Unit	Total Cost
1	**Contractor's General Conditions**				
	Mobilization/Demobilization (5%)	L.S.	1	$ 3,100	$ 3,100
	Bonds and Insurance (8%)	L.S.	1	$ 4,960	$ 5,000
	General Conditions (5%)	L.S.	1	$ 3,100	$ 3,100
				General Conditions Total	**$ 12,000**
2	**Site Work**				
	Excavation and Backfill	C.Y.	54	$ 80	$ 4,400
	Rent/Install/Remove Excavation Support	S.F.	1,600	$ 13	$ 20,500
	Replace Anodes	L.S.	4	$ 2,028	$ 8,200
				Site Work Total	**$ 34,000**
3	**Structural**				
	Non-destructive Testing	L.S.	1	$ 6,500	$ 6,500
	Sand-blast Dry-pit Floor	L.S.	1	$ 650	$ 700
	1/4" Carbon Steel Deck Plates	L.S.	64	$ 40	$ 2,600
	Deck Plate Welding	L.F.	45	$ 110	$ 5,000
	Sand-blast New Dry-pit Floor	S.F.	50	$ 10	$ 500
	Epoxy Prime and 2 Coats of Paint	L.S.	75	$ 30	$ 2,300
				Structural Total	**$ 18,000**
2	**Misc. Work and Clean-up**				
	Site Restoration	S.Y.	300	$ 5	$ 1,500
	Traffic Control / Signs / 2 Flaggers	Day	2	$ 1,100	$ 2,200
	Install Anode Monitoring System	L.S.	1	$ 6,250	$ 6,300
				Misc. Work Total	**$ 10,000**
				Construction Total	**$ 74,000**
				Engineering and Project Development (23%)	$ 17,000
				Construction Contingencies (30%)	$ 27,300
				Legal and Admin.	$ 5,000

TOTAL OPINION OF CONSTRUCTION COST $ 130,000

Notes:

1. *ENR CCI for January 2023 is 13175.03*
2. *Subtotal amounts have been rounded to the next $1,000*
3. *Overall anticipated project costs have been rounded to the next $10,000*
4. *Anticipated costs have been developed based on recent similar projects, manufacture's equpiment costs, and RS Means database.*
5. *Project costs have been developed without the benefit of final design drawings. A 30% contingency should be carried.*
6. *Assumes re-use of Existing Generator, Control Pannel, Sampler, Flow Meter and Level Controls.*

ALTERNATE 2

New Precast Concrete Dry Pit

UNITED CONCRETE PRODUCTS INC.
www.unitedconcrete.com

Headquarters
173 Church Street
Yalesville, CT. 06492
(800) 234-3119 or (203) 269-3119
Fax: (203) 265-4941

TO:	Weston & Sampson Inc.	**FROM:**	Steve Riccitelli – Sales Manager
ATTENTION:	Rhiannon	**DATE:**	**January 6, 2023**
PHONE:		**EMAIL:**	sriccitelli@unitedconcrete.com
PROJECT:	Inter-municipal Sewage Facility Pump Station Replacement Berlin, Vermont	**PAGES:**	7

BUDGET PROPOSAL NO: 27640

Pre-Cast Wet Well — Heaviest Weight 75,000 pounds

Pre-cast Concrete Wet Well (12'-0" long x 9'-0" wide x 26'-2" inside) complete with the following:

- Five (5) Sections
- VT PE Structural Calculations
- 5,000 PSI concrete minimum *(to be confirmed during design)*
- Site technicians to assist in the setting of the structure
- Extended base slab *(Any additional concrete required over our extension for buoyancy is by others)*
- Interior fillet
- Exterior Tar Coat Bay Oil 'Aqua-Safe" with interior to remain natural concrete
- Joint sealant and exterior joint wrap *(12" wide)*
- Flexible Boots for the following:
  - One (1) 12" Inlet
  - One 6" vent
  - One (1) 2" sump pump
- Sleeves 304SS will be cast in as follows:
  - Two (2) 8" DI Suction
  - One (1) 12" Discharge

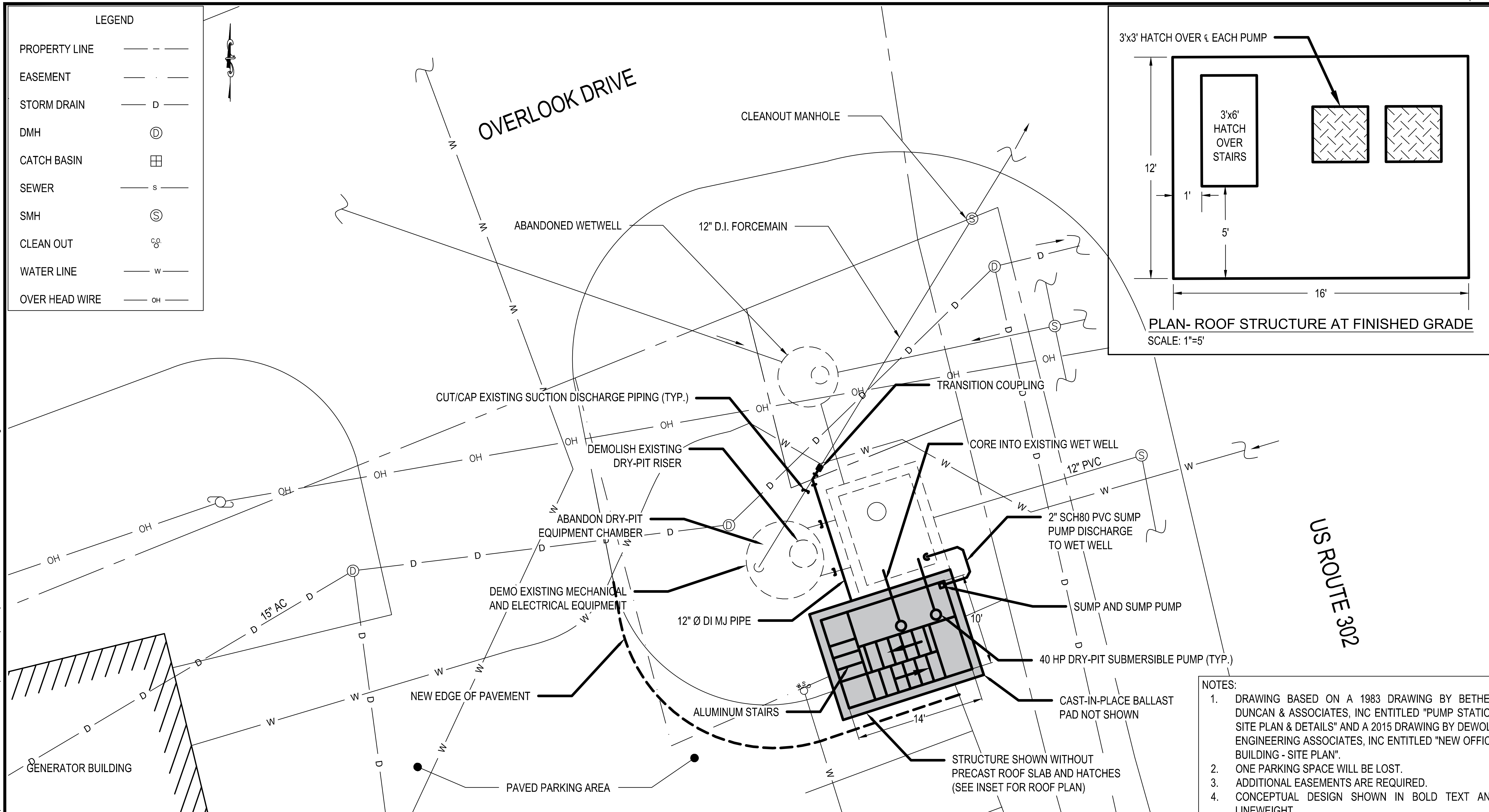
  (Modular links for the above by others)
- Conduit Sleeve Assemblies
- Roof slab with the following:
  - Aluminum access cover (36" x 36" clear opening for entrance ladder) complete with the following:
    - Channel frame construction with drain
    - H-20 load rating
    - Enclosed springs
    - Bitumastic coating
    - Recessed lock box
    - Odor reduction gasket
- Cast iron frame and cover 30" diameter over the inlet pipe
- Aluminum ladder with Safety Climb system consisting of the following:
  - Safety notch carrier rail 304SS
  - Rung clamps
  - Removable extension with quick release
  - Safety grip sleeve

- Comfort fit safety climb harness
- Lanyard

Pre-cast Concrete Dry Pit Chamber (12'-0" long x 9'-0" wide x 26'-2" inside) complete with the following:

- Five (5) Sections
- VT PE Structural Calculations
- 5,000 PSI concrete minimum *(to be confirmed during design)*
- Site technicians to assist in the setting of the structure
- Extended base slab *(Any additional concrete required over our extension for buoyancy is by others)*
- Interior sloped floor to sump
- Exterior Tar Coat Bay Oil 'Aqua-Safe" with interior to remain natural concrete
- Joint sealant and exterior joint wrap *(12" wide)*
- Flexible Boots for the following:
  - One 6" vent
  - One (1) 2" sump pump
- Sleeves 304SS will be cast in as follows:
  - Two (2) 8" DI Suction
  - One (1) 12" Discharge
  - Conduit Sleeve Assemblies

  (Modular links for the above by others)
- Roof slab with the following:
  - Two (3) Aluminum access covers (36" x 36" clear opening two (2) for each of the pumps and one (1) for ladder access) complete with the following:
    - Channel frame construction with drain
    - H-20 load rating
    - Enclosed springs
    - Bitumastic coating
    - Recessed lock box
    - Odor reduction gasket
- Aluminum ladder with Safety Climb system consisting of the following:
  - Safety notch carrier rail 304SS
  - Rung clamps
  - Removable extension with quick release
  - Safety grip sleeve
  - Comfort fit safety climb harness
  - Lanyard



NOTES:

1. DRAWING BASED ON A 1983 DRAWING BY BETHEL, DUNCAN & ASSOCIATES, INC ENTITLED "PUMP STATION SITE PLAN & DETAILS" AND A 2015 DRAWING BY DEWOLF ENGINEERING ASSOCIATES, INC ENTITLED "NEW OFFICE BUILDING - SITE PLAN".
2. ONE PARKING SPACE WILL BE LOST.
3. ADDITIONAL EASEMENTS ARE REQUIRED.
4. CONCEPTUAL DESIGN SHOWN IN BOLD TEXT AND LINEWEIGHT.

NO	DATE	BY	DESCRIPTION
-	-	-	-

DRAWN BY: REG | CHK'D BY: MAS | 01/06/2022

Weston & Sampson

TOWN OF BERLIN, VT

FIGURE D-3: PUMP STATION ALTERNATE 2

P:\VT\Berlin, VT\Route 302 Private Sewer Replacement\CAD\berlin – PS alternatives 2023 0110.dwg

Berlin, VT

PRELIMINARY OPINION OF CONSTRUCTION COST

Alternate 2 - New Pre-cast Concrete Dry Pit

Item No.	Description	Unit	Est. Qty.	Cost/Unit	Total Cost
1	**Contractor's General Conditions**				
	Mobilization/Demobilization (5%)	L.S.	1	$ 44,550	$ 44,600
	Bonds and Insurance (8%)	L.S.	1	$ 71,280	$ 71,300
	General Conditions (5%)	L.S.	1	$ 44,550	$ 44,600
				General Conditions Total	**$ 161,000**
2	**Site Work**				
	Excavation, Backfill and Compaction	C.Y.	299	$ 80	$ 24,000
	Excavation Support	S.F.	2,045	$ 19	$ 39,300
	Trenching	L.S.	1	$ 1,000	$ 1,000
	Connect to Existing 12" Sewage Force Main	L.S.	1	$ 5,471	$ 5,500
	12" Dia. Core Existing Wet-well	Ea.	2	$ 6,500	$ 13,000
	Cut & Cap Existing 8" Suction Piping	Ea.	2	$ 3,200	$ 6,400
	Dewatering	Day	90	$ 609	$ 54,800
	8" D.I. M.J. Suction Piping to Wetwell	L.F.	10	$ 76	$ 800
	12" D.I. M.J. Discharge Piping to Existing F.M.	L.F.	30	$ 120	$ 3,600
	Install Buried Power from Gen. Building	L.F.	80	$ 7	$ 600
	Install Buried Communications from Gen. Building	L.F.	80	$ 17	$ 1,400
	3/4" Cu Water Line to Dry-pit	L.F.	60	$ 16	$ 1,000
				Site Work Total	**$ 152,000**
3	**Structural**				
	18" Crushed Stone Bedding	C.Y.	10	$ 50	$ 500
	12' x 16' x 18" C.I.P. Ballast Slab	C.Y.	12	$ 650	$ 7,800
	Pre-cast Concrete Dry-pit Sections (10' x 14')	L.S.	1	$ 350,000	$ 350,000
	Crane (Place Pre-cast Sections)	Day	7	$ 1,236	$ 8,700
	Seal Dry-pit	S.F.	5.5	$ 200	$ 1,100
	Stairs (aluminum)	Riser	42	$ 663	$ 27,900
	3' x 3'Aluminum Pump Hatch	Ea.	2	$ 120	$ 300
	3' x 6' Aluminum Entry Hatch	Ea.	1	$ 250	$ 300

		Day	1,100	$	30	$	33,000
					Structural Total	**$**	**430,000**
4	**Mechanical / Electrical**						
	40 Hp Dry-pit Submersible Pump	Ea.	2	$	11,581	$	23,200
	Sump Pump	Ea.	1	$	5,093	$	5,100
	Pump Equipment Installation	L.S.	1	$	4,168	$	4,200
	6" D.I. Flanged Piping	L.F.	26	$	70	$	1,900
	6" D.I. Flanged Fittings	Ea.	2	$	405	$	900
	8" D.I. Flanged Fittings	Ea.	4	$	684	$	2,800
	12" D.I. Flanged Fittings	Ea.	2	$	1,246	$	2,500
	4" Flanged Resilient Wedge Gate Valves	Ea.	4	$	1,309	$	5,300
	6" Flanged Check Valves	Ea.	2	$	1,801	$	3,700
	2" Sch. 40 PVC Sump Pump Discharge	L.F.	20	$	28	$	600
	Pump Station Seal Water Plumbing	L.S.	1	$	1,817	$	1,900
	Modify Existing Pump Control Panel	Hr.	4	$	125	$	500
	Replace Auto-dialer	L.S.	1	$	631	$	700
	Dry-pit Lighting and Conduit (Exp. Proof)	Ea.	2	$	1,763	$	3,600
	Dry-pit Flooding Alarm w/ Service Panel	Ea.	1	$	1,196	$	1,200
	Ventillation Blower	Ea.	1	$	453	$	500
	8" PVC Ventillation Ductwork	L.F.	26	$	55	$	1,500
	Pump Station Grounding	L.S.	1	$	1,023	$	1,100
					Mechanical / Electrical Total	**$**	**62,000**
5	**Misc. Work and Clean-up**						
	Paving	S.Y.	1,300	$	80	$	104,000
	8" Pre-cast Concrete Curb	L.F.	750	$	65	$	48,800
	Demolish Existing P.S. Internal Equipment	Ea.	7	$	250	$	1,800
	Cut Holes in Existing Dry-pit	Ea.	3	$	6,500	$	19,500
	Demolish Existing Dry-pit Access Tube	Ea.	2	$	3,200	$	6,400
	Fill Existing Dry-pit with Crushed Gravel	Ea.	7	$	4,700	$	32,900
	Traffic Control / Signs / 2 Flaggers	Day	30	$	1,100	$	33,000
					Misc. Work Total	**$**	**247,000**

Construction Total	**$1,052,000**
Engineering and Project Development (23%)	$ 242,000
Construction Contingencies (30%)	$ 388,200
Obtain Easements	$ 35,000
Legal and Admin.	$ 5,000
TOTAL OPINION OF CONSTRUCTION COST	**$1,730,000**

Notes:

1. ENR CCI for January 2023 is 13175.03

2. Subtotal amounts have been rounded to the next $1,000

3. Overall anticipated project costs have been rounded to the next $10,000

4. Anticipated costs have been developed based on recent similar projects, manufacture's equpiment costs, and RS Means database.

5. Project costs have been developed without the benefit of final design drawings. A 30% contingency should be carried.

6. Assumes re-use of Existing Generator, Control Pannel, Sampler, Flow Meter and Level Controls.

ALTERNATE 3

Submersible Lift Station

CARLSEN SYSTEMS
WATER WASTEWATER

176 AMITY RD. #102
WOODBRIDGE, CT 06525
203-663-1314
WWW.CARLSENSYSTEMS.COM

Project: USEMCO Modular Pumpmate - pre-packaged wastewater pump station
Location: Franklin, CT
Pumps: Sulzer 7.5hp with semi-open impeller
Controls: USEMCO PLC with VFDs

41 Crossroads Plz. #107
West Hartford, CT 06117
203-663-1314
www.carlsensystems.com

Sept. 21, 2022

Rhiannon Goetz
Weston & Sampson

RE: Rt. 302 Pump Station

Carlsen Systems is pleased to offer the following budget price:

USEMCO PumpMate Packaged Pump Station
Modular building installed on welded steel base with nominal dimensions of 12.5' L x 10.5' W

- Gable roof with asphalt shingles
- Aggregate exterior finish
- 36" wide entry door
- Four (4) exterior lights
- Interior lights
- Alarm light
- Ventilation
- Heater
- Building low temperature alarm and thermostat
- Dehumidifier
- 8" piping, 8" check valves, 8' isolation valves
- Air release valve
- 8" emergency bypass connection

Auto dialer
Control panel

- NEMA 1 wall mount control panel for operation on a 120-volt 1 phase 2 wire service. Controls to operate two motors on a pump down mode and include the following:
- Main breaker
- Lightning arrestor
- Control circuit breaker
- Panel heater with integral thermostat
- GFCI convenience receptacle
- Panel interior light
- Serialized UL 698A label relating to hazardous locations with intrinsically safe circuit extensions
- USEMCO "SENTRY" constant speed pump controller with 7" color touch screen operator interface
- Blue Ribbon Birdcage submersible level sensor with 40 feet of cord
- Intrinsically safe barrier protection for level sensor
- Intrinsically safe back-up float circuit
- (2) Float switches with 50' cord
- Low level light
- High level light
- Wetwell level and set points - Integral to the operator interface
- Pump delay timers - Integral to the operator interface
- (2) Hand-Off-Auto selector switches
- (2) Run lights
- (2) Off lights
- (2) Run Time Meters
- (2) Fail lights - Integral to the operator interface
- (2) Fail reset push buttons - Integral to the operator interface

41 Crossroads Plz. #107
West Hartford, CT 06117
203-663-1314
www.carlsensystems.com

- Overtemp shutdown
- (2) Overtemp alarm lights - Integral to the operator interface
- (2) Seal fail alarm lights - Integral to the operator interface
- (2) Overtemp/seal fail reset push buttons - Integral to the operator interface
- Back-Up Active light
- Power On light
- Wire numbered
- Terminal strip
- Factory wired & tested
- One-year factory warranty

Two (2) 50hp VFDs
One (1) IXOM AP500 wet well mixing system
Freight, FOB Factory
Startup

BUDGET PRICE: $ 385,000.00
- Submittals: 4 weeks
- USEMCO Packaged Pump Station: 38-42 weeks

Two (2) Sulzer/ABS Model XFP 155J CB2 PE350/6 dry pit submersible pumps
- 47 HP motor, 1200 RPM, 230/3/60
  - Premium efficiency
  - Inverter duty rated
  - Explosion proof
- 8” suction
- 6” discharge
- Sulzer/ABS Contrablock system with semi-open impeller and self-cleaning bottom plate
- 3”x3.9” solids passing
- Motor overtemp and seal fail protection
- 49 FT of power and control cable
- Five year warranty (3 year full / 2 year prorated)
- Factory Testing
  - Certified factory performance test, HI Grade 1U
  - Hydrostatic Testing
  - Vibration Testing

Two (2) guide rail assemblies including
- Base elbow
- Slide bracket
- Stainless steel upper guide rail bracket
- Lifting chain stainless steel – 25ft

NOTE: Guide rails by others. One (1) guide rail required per pump.

Two (2) combination relays for seal failure and motor overtemperature protection
- Relay requires 120 VAC power.

Freight, FOB Factory
Factory Startup

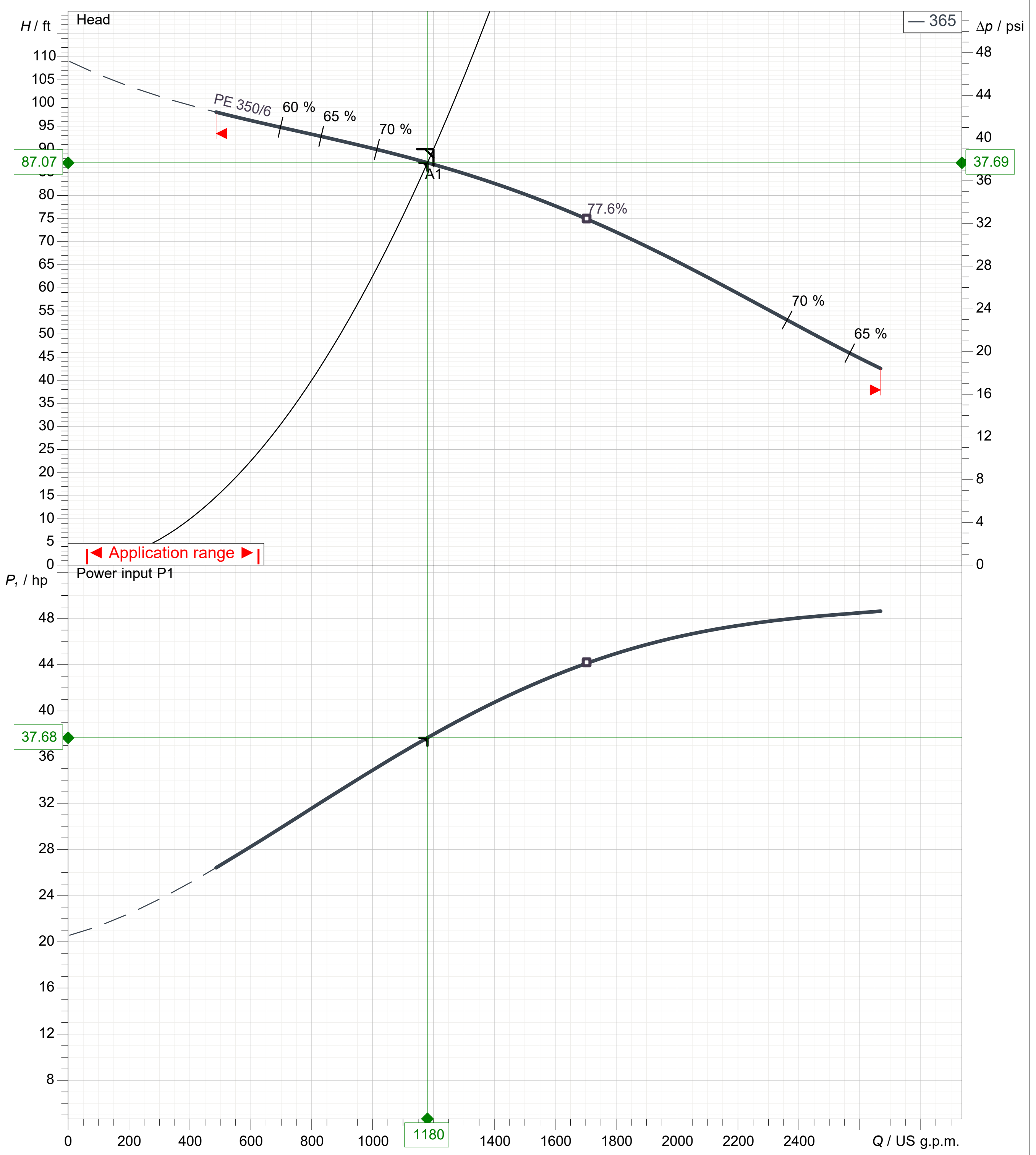
BUDGET PRICE: $92,300.00
Lead time: 14-16 weeks

Curve number	Pump performance curves	
Reference curve XFP155J-CB2 60Hz	XFP155J-CB2 60 HZ	SULZER

	Discharge	Frequency
	DN150	60 Hz

Density	Viscosity	Test Standard	Rated speed	Date
62.31 lb/ft³	1.077E-5 ft²/s	ISO 9906, HI 11.6/14.6 Gr 2B	1188 rpm	2022-09-19

Flow	Head	Shaft power	Power input	Rated power P2	Hyd. efficiency	NPSH
1180 US g.p.m.	87.1 ft	35.4 hp	37.7 hp	46.9 hp	73.2 %	7.07 ft



Wet well vertical installation 2"

Impeller size	N° of vanes	Impeller	Solid size	Revision
14 3/8 inch	2	Contrablock Plus impeller	2.95 x 3.94 inch	

Cable Data, PE4 Frame

	Motor	Motor Voltage	Cable Qty	Cable Type	Cable Nominal Outside Diameter +/- .5mm (.02") Power	Ground
Power Cable	PE 210/6	230	1	G-GC 4-3	30.2mm (1.19")	Integrated w/ Power
		460	1	G-GC 8-3	24.6mm (0.97")	Integrated w/ Power
		600	1	G-GC 8-3	24.6mm (0.97")	Integrated w/ Power
	PE 250/6	230	1	G-GC 2-3	34.0mm (1.34")	Integrated w/ Power
		460	1	G-GC 8-3	24.6mm (0.97")	Integrated w/ Power
		600	1	G-GC 8-3	24.6mm (0.97")	Integrated w/ Power
	PE 350/6	230	2	G-GC 4-3	30.2mm (1.19")	Integrated w/ Power
		460	1	G-GC 6-3	26.7mm (1.05")	Integrated w/ Power
		600	1	G-GC 8-3	24.6mm (0.97")	Integrated w/ Power
	PE 430/6	230	2	G-GC 4-3	30.2mm (1.19")	Integrated w/ Power
		460	1	G-GC 4-3	30.2mm (1.19")	Integrated w/ Power
		600	1	G-GC 6-3	26.7mm (1.05")	Integrated w/ Power

	Motor Monitoring Type [3]	Cable Qty	Cable Type	Cable Nominal Outside Diameter +/- .5mm (.02")
Control Cable	Std monitoring	1	SOOW 16/4	10.6mm (0.42")
	Opt full monitoring	1	SOOW 16/8	14.2mm (0.56")
	Opt full monitoring w/ 3 RTDs	1	SOOW 16/12	17.7mm (0.70")
	Opt full monitoring w/ 5 RTDs	2	SOOW 16/10	17.2mm (0.68")
Cable Length	Standard: 15m (49 feet)	Optional: 20m (65 feet), 30m (98 feet); Consult Factory for longer lengths		

[3] See motor protection on page 1. Optional full monitoring systems with RTD options do not include bearing bi-metallic switches.

Pump Data

Discharge Size	6" flanged, compatible with 6" class 125 ANSI flanges
Suction Size (Wet-Pit / Dry-Pit) [5]	8" flanged, compatible with 8" class 125 ANSI flanges, threaded for 8x3/4-10 UNC screws, 22mm (7/8") deep
Volute Pressure Rating	16 bar (232 psi)
Impeller Type	Semi-open, 2-vane, Contrablock Plus, w/ Seal Protection System

Impeller Code	-	-	-	-	-	-	-			
Impeller Diameter, mm (in.)	290 (11.4)	305 (12.0)	320 (12.6)	335 (13.2)	350 (13.8)	365 (14.4)	380 (15.0)			
Solids Passage Size, mm (in.)	75x100 (3.0x3.9)	75x100 (3.0x3.9)	75x100 (3.0x3.9)	75x100 (3.0x3.9)	75x100 (3.0x3.9)	75x100 (3.0x3.9)	75x100 (3.0x3.9)			
Min. Recommended Flow, GPM [6]	570	640	690	730	780	855	860			

[5] Wet-pit version can be drilled to dry-pit specifications upon request. Consult factory for details. [6] Recommend minimum continuous flow. Consult factory for applications below this flow rate.

Materials of Construction

	Standard	Optional
Power/Control Cable Jacket	Chlorinated Polyethylene (CPE)	
Lifting Hoop	Ductile Iron EN-GJS-400-18 (ASTM A-536; 60-40-18)	Duplex Stainless Steel 1.4470 (ASTM A890, CD3MN Grade 4A)
Cable Connection Chamber	Cast Iron EN-GJL-250 (ASTM A-48, Class 35B)	
Motor Housing	Cast Iron EN-GJL-250 (ASTM A-48, Class 35B)	
Cooling Jacket	Steel 1.0036 (ASTM A-570, Grade D)	
Intermediate Housing	Cast Iron EN-GJL-250 (ASTM A-48, Class 35B)	
Seal Plate/Cooling Chamber	Cast Iron EN-GJL-250 (ASTM A-48, Class 35B)	
Pump and Motor Shaft	Stainless Steel 1.4021 (AISI 420)	Duplex Stainless Steel 1.4462 (UNS S31803)
Impeller	Cast Iron EN-GJL-250 (ASTM A-48, Class 35B) [7]	Duplex Stainless Steel 1.4470 (ASTM A890, CD3MN Grade 4A)
Wear Parts: Impeller Wear Ring	N/A	
Wear Parts: Volute Wear Ring	N/A	
Wear Parts: Bottom/Wear Plate	Cast Iron EN-GJL-250 (ASTM A-48, Class 35B) [7]	Duplex Stainless Steel 1.4470 (ASTM A890, CD3MN Grade 4A)
Volute	Cast Iron EN-GJL-250 (ASTM A-48, Class 35B)	Duplex Stainless Steel 1.4470 (ASTM A890, CD3MN Grade 4A)
External Hardware	Stainless Steel 1.4401 (AISI 316)	
O-Rings and Cable Glands	Nitrile (Buna-N)	Viton®
Mechanical Seals: Lower	Silicon Carbide / Silicon Carbide, Nitrile, 316 SS	Silicon Carbide / Silicon Carbide, Viton®, 316 SS
Mechanical Seals: Upper	Silicon Carbide / Silicon Carbide, Nitrile, 316 SS	
Lower Bearing Lip Seal	Nitrile (Buna-N)	
Coating/Protection	Two-part epoxy, blue, 120µm (4.7 mil) DFT	Two-part epoxy, blue, 400µm (15.7 mil); Wet-end liquid ceramic coating, 500µm (19.7 mil); Zinc Anodes

[7] Hardening of bottom edge of impeller vane and wear plate surface available. Consult factory for details.

General Data (Standard Materials of Construction & Cable Length)

	PE 210/6	PE 250/6	PE 350/6	PE 430/6		
Overall Height	1480mm (58.3")	1480mm (58.3")	1560mm (61.4")	1560mm (61.4")		
≈ Pump Weight (Non-Cooled)	615 kg (1356 lb)	655 kg (1444 lb)	705 kg (1555 lb)	715 kg (1577 lb)		

DS-E02-126 REV: 1 DATE: 10/16 Specifications Subject to Change Without Notice

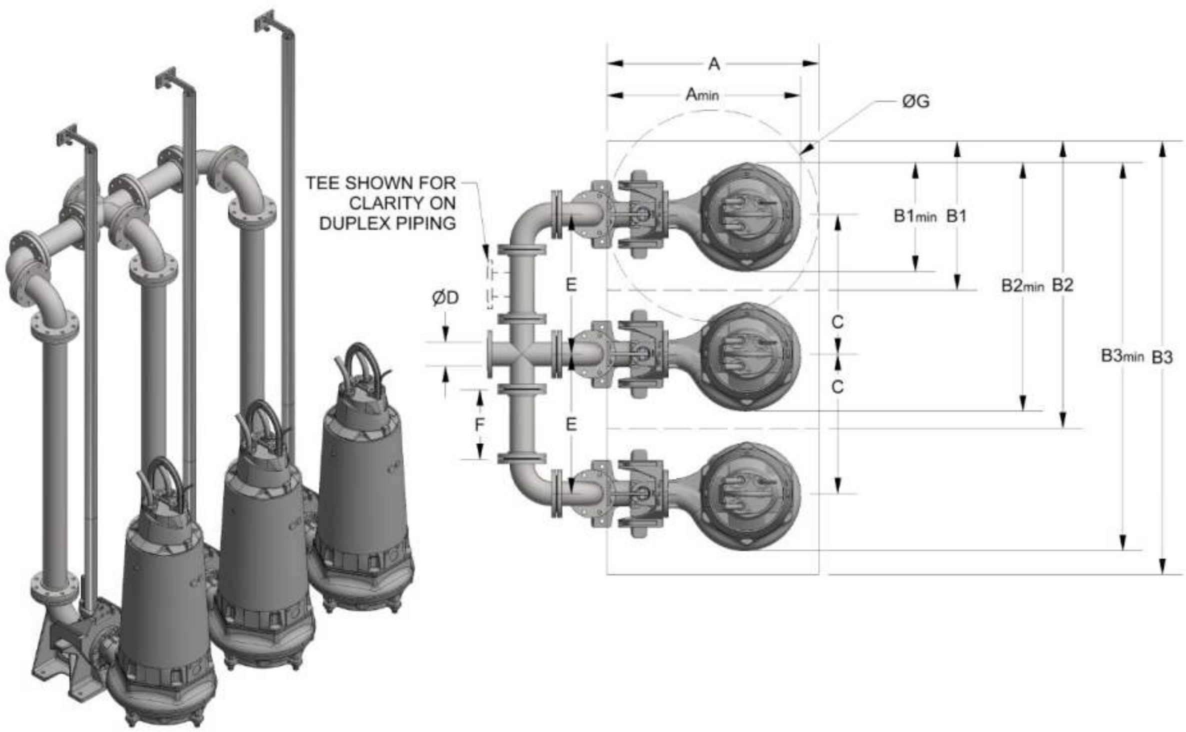
XFP Clear Opening & Spacing

XFP 155J-CB2

Guide Rail Assembly[1]	Pipe Size (D)	(G)	Recommended Clear Opening I Simplex (A x B1)	II Duplex (A x B2)	III Triplex (A x B3)	Minimum Edge to Edge Distance I Simplex (Amin x B1min)	II Duplex (Amin x B2min)	III Triplex (Amin x B3min)	Minimum Hydraulic Distance CL[2] (C)	Manifold CL[3] (E)	Spool Length[4] (F)
Single Rail	6	44	44 x 31	44 x 63	44 x 95	39.8 x 23.5	39.8 x 55.5	39.8 x 87.5	29	32	16
	8	44	44 x 31	44 x 67	44 x 103	39.8 x 23.5	39.8 x 59.5	39.8 x 95.5	29	36	18
	10	44	44 x 31	44 x 75	44 x 119	39.8 x 23.5	39.8 x 67.5	39.8 x 111.5	29	44	22
Dual Rail	6	46	46 x 31	46 x 63	46 x 95	42.1 x 23.5	42.1 x 55.5	42.1 x 87.5	29	32	16
	8	46	46 x 31	46 x 67	46 x 103	42.1 x 23.5	42.1 x 59.5	42.1 x 95.5	29	36	18
	10	46	46 x 31	46 x 75	46 x 119	42.1 x 23.5	42.1 x 67.5	42.1 x 111.5	29	44	22

Guide Rail Assembly (GRA) P/N Reference

GRA Type	Base Configuration	Rail(s) Size	Applicable GRA Part Numbers
Single Rail (Heavy Duty)	Integral Elbow	2"	DPS9xxxxx
Dual Rail (Heavy Duty)	Integral Elbow	2"	DPSHxxxxx



NOTES:

- All units are inches until otherwise specified.
- Dimensions are for general guidelines only. The specific application will determine actual required dimensions.
- Configurations and pumps shown are for illustrative purposes only.
- Consider safety net, grating, and other obstructions for true clear opening.

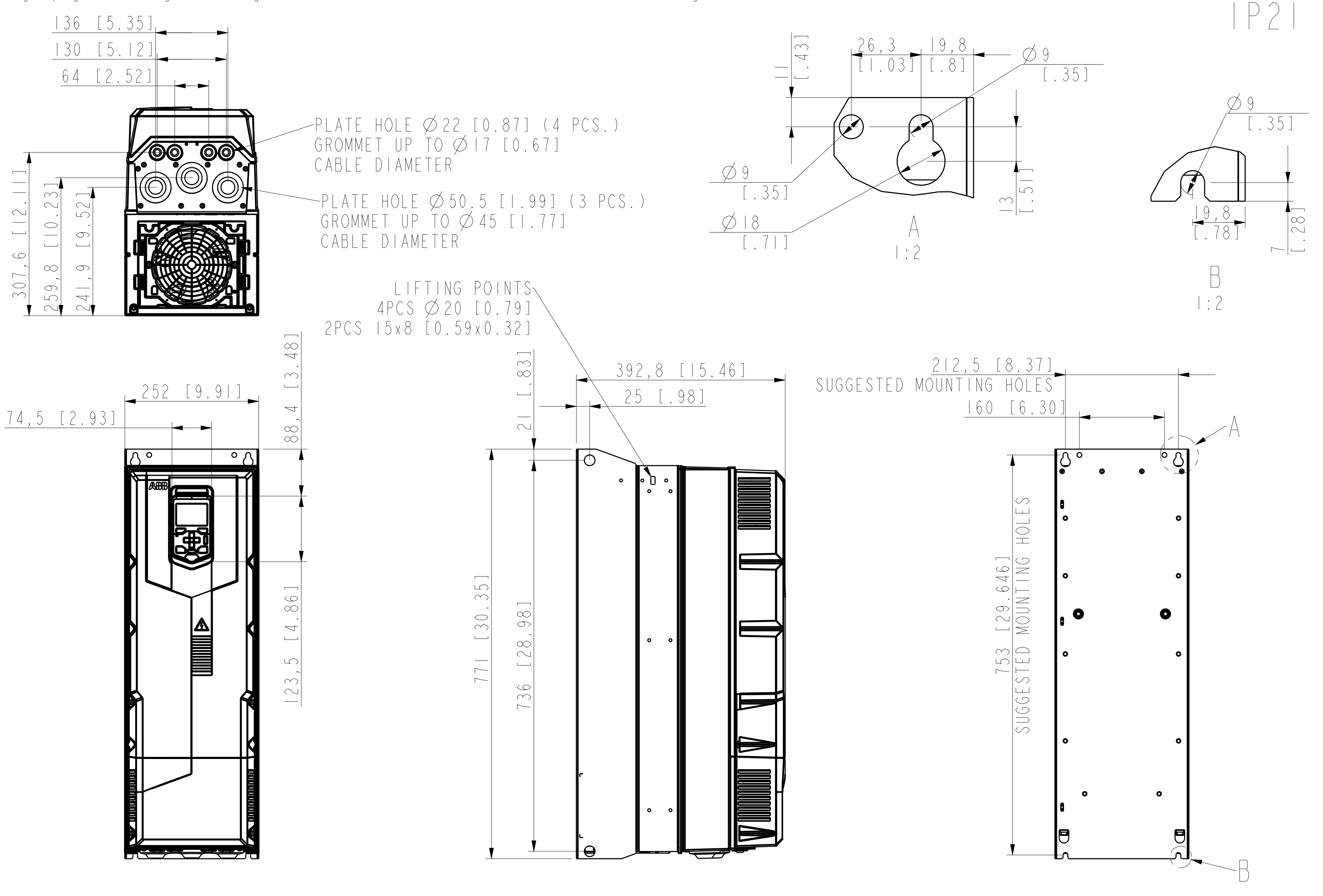
[1] See Guide Rail Assembly (GRA) P/N Reference table for applicable part numbers used for dimensional references. Consult Factory for part numbers not shown.

[2] Minimum distance required for proper hydraulic performance. Consult Factory for special circumstance requiring reduced spacing.

[3] Minimum separation distances accommodate typical hatch beam supports and standard AWWA fittings (when applicable). However, actual requirements should be verified with the hatch manufacturer and adjusted if necessary. Not applicable to simplex installations.

[4] Spool and fitting dimensions are based on AWWA C110, ANSI A21.10 standards. Other minimums can be achieved with different fittings or custom spool lengths.

First angle projection. Original drawing made with 3D CAD. Set the correct scale factor when adding dimensions after DWG/DXF conversion.



Rev.	Description	Date	Name	No.
A	Initial Approval	15-Dec-17	B.Baldwin	5000000894743
B	drawing tiltle changed	05-Aug-19	J.Zhuang	5000001221733

3AXD50000037446
ACXX80-XI_R6_MAIN_ASSEMBLY (ASSEM)92
B.3+

Based on	Prepared	B.Baldwin	15-Dec-17
Customer	Check.	D.Crawley	06-Aug-19
	Appr.	M.Karis	06-Aug-19
Cust. Doc. No.	Project name		
DMS Number 3AXD10000491640	Weight kg		

Title DIMENSION DRAWING
R6 IP21 DIMENSION DRAWING
ACH/ACQ580-31

ABB

Doc. des. DIMENSION DRAWING	Scale 1:10	Form A4	
Resp.dept.	Rev.ind. B (AP)		Lang. EN
Doc. No. 3AXD50000037446			Sheet 1
			Total 1

www.unitedconcrete.com

Headquarters
173 Church Street
Yalesville, CT. 06492
(800) 234-3119 or (203) 269-3119
Fax: (203) 265-4941

TO:	Weston & Sampson Inc.	**FROM:**	Steve Riccitelli – Sales Manager
ATTENTION:	Rhiannon	**DATE:**	**January 6, 2023**
PHONE:		**EMAIL:**	sriccitelli@unitedconcrete.com
PROJECT:	Inter-municipal Sewage Facility Pump Station Replacement Berlin, Vermont	**PAGES:**	7

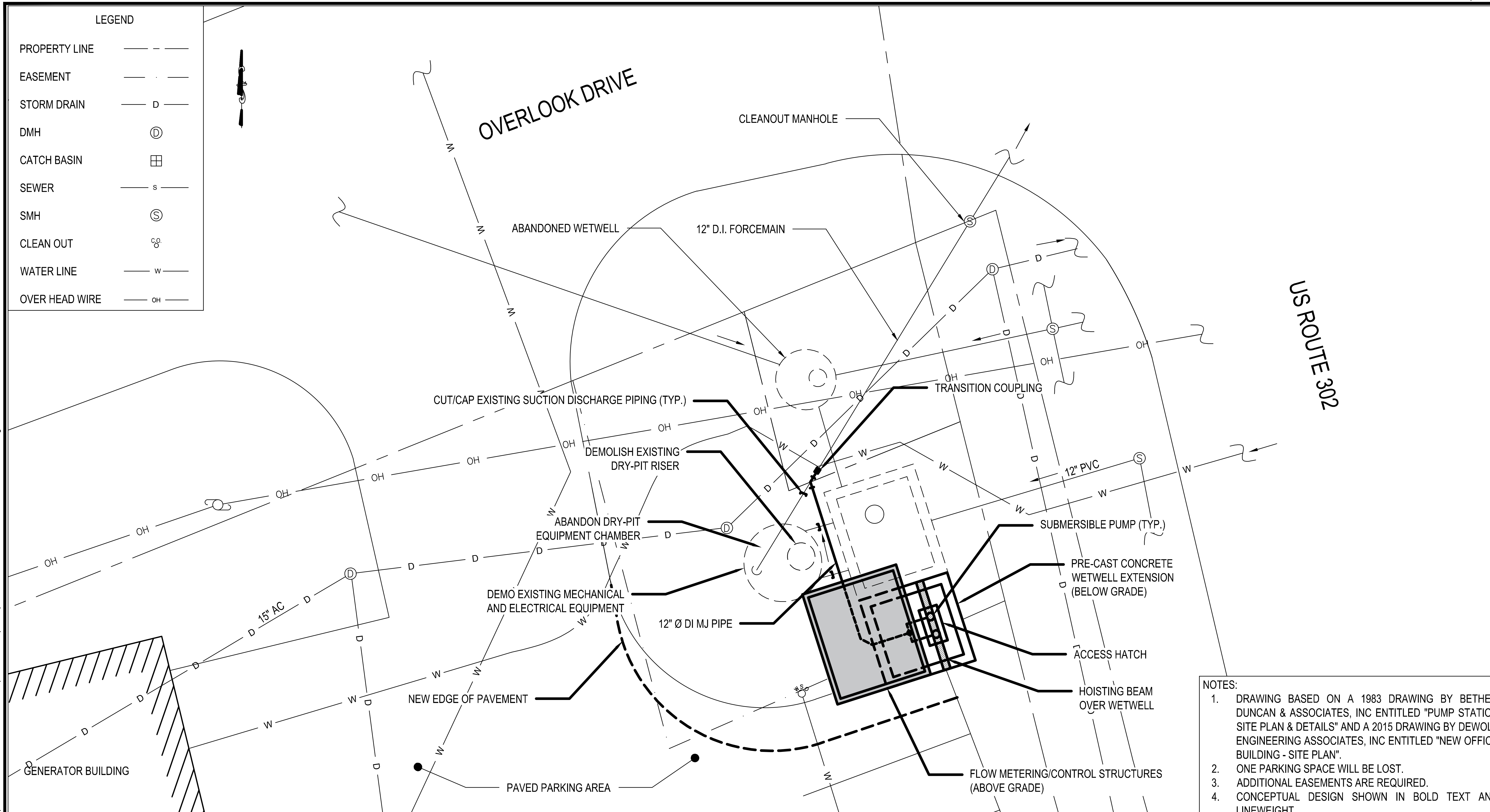
BUDGET PROPOSAL NO: 27640

Pre-Cast Wet Well — Heaviest Weight 75,000 pounds

Pre-cast Concrete Wet Well (12'-0" long x 9'-0" wide x 26'-2" inside) complete with the following:

- Five (5) Sections
- VT PE Structural Calculations
- 5,000 PSI concrete minimum *(to be confirmed during design)*
- Site technicians to assist in the setting of the structure
- Extended base slab *(Any additional concrete required over our extension for buoyancy is by others)*
- Interior fillet
- Exterior Tar Coat Bay Oil 'Aqua-Safe" with interior to remain natural concrete
- Joint sealant and exterior joint wrap *(12" wide)*
- Flexible Boots for the following:
  - One (1) 12" Inlet
  - One 6" vent
  - One (1) 2" sump pump
- Sleeves 304SS will be cast in as follows:
  - Two (2) 8" DI Suction
  - One (1) 12" Discharge

  (Modular links for the above by others)
- Conduit Sleeve Assemblies
- Roof slab with the following:
  - Aluminum access cover (36" x 36" clear opening for entrance ladder) complete with the following:
    - Channel frame construction with drain
    - H-20 load rating
    - Enclosed springs
    - Bitumastic coating
    - Recessed lock box
    - Odor reduction gasket
- Cast iron frame and cover 30" diameter over the inlet pipe
- Aluminum ladder with Safety Climb system consisting of the following:
  - Safety notch carrier rail 304SS
  - Rung clamps
  - Removable extension with quick release
  - Safety grip sleeve



10 5 0 10 20

SCALE: 1" = 10'

NO	DATE	BY	DESCRIPTION
-	-	-	-

DRAWN BY: REG | CHK'D BY: MAS | 01/06/2022

Weston & Sampson

TOWN OF BERLIN, VT

FIGURE D-4: SUBMERSIBLE PUMP STATION ALTERNATE 3

P:\VT\Berlin, VT\Route 302 Private Sewer Replacement\CAD\berlin – PS alternatives 2023 0110.dwg

Berlin, VT

PRELIMINARY OPINION OF CONSTRUCTION COST

Alternate 3 - Submersible Lift Station

Item No.	Description	Unit	Est. Qty.	Cost/Unit	Total Cost
1	**Contractor's General Conditions**				
	Mobilization/Demobilization (5%)	L.S.	1	$ 5,050	$ 5,100
	Bonds and Insurance (8%)	L.S.	1	$ 8,080	$ 8,100
	General Conditions (5%)	L.S.	1	$ 5,050	$ 5,100
				General Conditions Total	**$ 19,000**
2	**Pre-packaged Components**				
	USEMCO PumpMate Package (Building/Mech/Elec)	L.S.	1	$ 385,000	$ 385,000
	Submersible Pumps	L.S.	1	$ 92,300	$ 92,300
	Pump Equipment Installation	L.S.	1	$ 23,075	$ 23,100
	United Concrete Pre-Cast Wet Well (8'x8'x26')	L.S.	1	$ 174,800	$ 174,800
				Site Work Total	**$ 676,000**
3	**Site Work**				
	Excavation, Backfill and Compaction (Wetwell Extension)	C.Y.	160	$ 80	$ 12,800
	Site Preparation (Above Grade Pump Station)	L.S.	1	$ 1,000	$ 1,000
	Trenching	L.S.	1	$ 1,000	$ 1,000
	Connect to Existing 12" Sewage Force Main	L.S.	1	$ 5,471	$ 5,500
	12" Dia. Core Existing Wet-well	Ea.	2	$ 6,500	$ 13,000
	Cut & Cap Existing 8" Suction Piping	Ea.	2	$ 3,200	$ 6,400
	Install Buried Power from Gen. Building	L.F.	80	$ 7	$ 600
	Install Buried Communications from Gen. Building	L.F.	80	$ 17	$ 1,400
				Site Work Total	**$ 42,000**
4	**Structural**				
	18" Crushed Stone Bedding	C.Y.	10	$ 50	$ 500
	10' x 10' x 12" C.I.P. Foundation Slab	C.Y.	8	$ 650	$ 5,200
	CM Hurricane 360 Hoist & Trolley Combo Standard 1 Ton, 30 ft Lift	L.S.	1	$ 1,659	$ 1,700
	8 ft Steel 1 Ton Capacity Hoist Beam	L.S.	1	$ 6,685	$ 6,700
				Structural Total	**$ 15,000**
5	**Mechanical / Electrical**				
	6" PVC Vent	L.F.	40	$ 12	$ 500
	6" PVC Vent Fittings	Ea.	2	$ 223	$ 500
	12" D.I. M.J. Discharge Piping to Existing F.M.	L.F.	25	$ 120	$ 3,000
	12" D.I. Flanged Fittings	Ea.	2	$ 1,246	$ 2,500
	12" x 4" DI Reducer	Ea.	1	$ 1,255	$ 1,300

	Pump Station Grounding	L.S.	1	$ 1,023	$ 1,100
				Mechanical / Electrical Total	**$ 9,000**
6	**Misc. Work and Clean-up**				
	Demolish/Dispose of Existing P.S. Internal Equipment	L.S.	1	$ 10,000	$ 10,000
	Cut Holes in Existing Dry-pit	Ea.	3	$ 6,500	$ 19,500
	Demolish Existing Dry-pit Access Tube	L.S.	1	$ 3,200	$ 3,200
	Fill Existing Dry-pit with Crushed Gravel	L.S.	1	$ 1,500	$ 1,500
				Misc. Work Total	**$ 35,000**
				Construction Total	**$ 796,000**
				Engineering and Project Development (23%)	$ 183,100
				Construction Contingencies (30%)	$ 293,700
				Obtain Easements	$ 35,000
				Legal and Admin.	$ 5,000
				TOTAL OPINION OF CONSTRUCTION COST	**$1,320,000**

Notes:

1. ENR CCI for January 2023 is 13175.03

2. Subtotal amounts have been rounded to the next $1,000

3. Overall anticipated project costs have been rounded to the next $10,000

4. Anticipated costs have been developed based on recent similar projects, manufacture's equpiment costs, and RS Means database.

5. Project costs have been developed without the benefit of final design drawings. A 30% contingency should be carried.

6. Assumes re-use of Existing Generator, Control Pannel, Sampler, Flow Meter and Level Controls.

ALTERNATE 4

Packaged Suction Lift Station

RELIASOURCE®

RELIASOURCE®

Your Single Source for Total Lift Station Reliability.

GORMAN-RUPP PUMPS

The Pump People®

THE MUNICIPAL MARKET'S MOST RELIABLE LIFT STATION. GUARANTEED.

For decades, municipalities have trusted Gorman-Rupp for the most reliable heavy-duty sewage pumps in the industry. But even the world's best pump can't operate alone.

Effective wastewater handling requires lift stations with valves, controls, pipes and pumps that all work together to meet your sewage handling needs. If any one of these components fails, it can put your operation–and your investment–at risk.

Gorman-Rupp created the ReliaSource® line of packaged, fully customizable, above-ground lift stations to eliminate costly service interruptions caused by inferior parts. Every component of a ReliaSource lift station–from the pumps, to the NEMA-rated controls, to the corrosion- and weather-resistant fiberglass enclosures–is 100% Gorman-Rupp custom-engineered, manufactured and assembled. With Gorman-Rupp quality inside and out, ReliaSource lift stations outlast and outperform any other lift station on the market, delivering trouble-free performance you can rely on. Guaranteed.

For applications dealing with flushable wipes, rags, sludge or any other clog-prone material, the Eradicator® Solids Management System is available for all sizes of Gorman-Rupp Super T Series® and Ultra V Series® pumps. For the most aggressive applications and more effective solids management, 3", 4" and 6" Super T Series models are available with Eradicator Plus™ technology for cutting and tearing organic solids before they are passed through the pump.

A 99% CUSTOMER SATISFACTION RATING BEGINS WITH 100% GORMAN-RUPP QUALITY.

There's more than one reason why ReliaSource® customers are completely satisfied with their lift stations. From specifying the right equipment, to custom-engineering and design, through testing and installation, Gorman-Rupp is your single source for complete lift station satisfaction.

Specification

Our highly trained distribution team works hand-in-hand with both municipalities and consulting engineers to understand your wastewater and solids-handling challenges and analyze your total system requirements. Our distributors can help recommend and specify the best ReliaSource® lift station for the job.

Custom Engineering and Design

Our experienced engineers custom-design your ReliaSource lift station to your specifications. We precision-match pumps, motors, controls, valves, pipes and accessories for maximum compatibility and maximum performance.

Factory-Built

Every component of a ReliaSource lift station is 100% manufactured by Gorman-Rupp in our state-of-the-art facilities, taking advantage of the latest technologies and innovations. Each lift station is fully assembled in-house by our experts.

Testing

Every ReliaSource lift station is rigorously tested using a wide range of testing options based on customer specifications and guided by Hydraulic Institute testing standards. By testing the complete unit under your unique operating requirements, we ensure your equipment performs exactly as it should.

Integrinex® Liquid Level Controls

The performance of any pumping system is dependent on the reliability of the pump controls. All ReliaSource lift stations come equipped with Integrinex® liquid level controls. Our expert electrical engineers help you design an efficient pumping system that includes the best, precisely matched controls in the industry.

Installation

ReliaSource lift stations are shipped complete from the factory, ready for professional installation. Just add power and connect piping for years of reliable lift station performance.

RELIASOURCE® DELIVERS DECADES OF PERFORMANCE AND PASSES THE EYE TEST.

Gorman-Rupp is committed to meeting your sewage and wastewater handling requirements. And we now offer a variety of visually-pleasing exterior enclosure solutions.

Modular Above-Ground Enclosure Options

The ReliaSource® modular above-ground lift station represents the long-lasting performance, quality and convenience of the ReliaSource brand...both inside and out. Fully customizable and available in a variety of sizes, the modular lift station offers multiple brick enclosure (in addition to the standard enclosures) options including:


Contempo Baked Clay


Contempo Spiced Brick


Old Chicago Antique Brick


Old Chicago Baked Clay


Old Chicago Dusky Evening


Old Chicago Merlot Brick


Old Chicago Mocha


Old Chicago Spiced Brick

Standard Enclosure Options

Gorman-Rupp ReliaSource lift station enclosures are manufactured with durable fiberglass for flexural strength and corrosion, mold, mildew and UV resistance. All enclosure options provide a superior barrier to caustic or acidic atmospheres and offer vandal-resistant security. Enclosures come standard with R12 insulation (optional to R20).


Green


Tan


Cool Gray


White

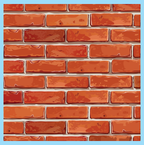

High Definition Moss Green


High Definition Arizona


High Definition Medium Gray

ReliaSource® Vinyl Wrapped Solutions

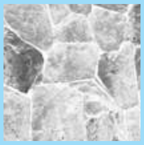
Gorman-Rupp's 8x9, 6x6, 6x6T and Above-Ground Submersible Valve Package (ASVP) ReliaSource lift stations are now available with your choice of standard 3M™ vinyl wraps to help your station blend in to the surrounding environment. Each station's wrap is applied directly to the enclosure surface using a pressure-activated adhesive that stands up to the elements. Custom, high resolution artwork can be submitted for unique applications. Consult factory for details.


Red Brick


White Brick


Weathered Red Brick


Stone Wall


Abstract Stone


Cypress Shrub


Forest Camo

RELIASOURCE® LIFT STATION MODELS AND FEATURES

Every ReliaSource® lift station is engineered to accommodate an extensive selection of heavy-duty, solids-handling Gorman-Rupp self-priming or submersible pumps.

All ReliaSource® packaged lift stations come standard with a five-year warranty.

ReliaSource® Modular Above-Ground Lift Station

Accommodates Gorman-Rupp Super T Series®, Ultra V Series® or 10 Series® self-priming centrifugal, heavy duty solids-handling pumps.

Specifications:

- Pump Size: 2" (50 mm)*, 3" (75 mm), 4" (100 mm), 6" (150 mm), 8" (200 mm), 10" (250 mm), 12" (300 mm)
- Max. Capacity: 5200 GPM (328.1 lps)
- Max. Solids: 3" (76.2 mm)
- Max. Head: 320' (97.5 m)
- Max Temperature: 160°F (71°C)
- Motor – Voltage: 200 V 3P, 230 V 1P, 230 V 3P, 460 V 3P
- Motor – Cycles: 60 Hz
- Horsepower: 2 HP to 150 HP

ReliaSource® 8x9 Above-Ground Lift Station

Accommodates Gorman-Rupp Super T Series® or Ultra V Series® self-priming centrifugal, heavy duty solids-handling pumps

Specifications:

- Pump Size: 2" (50 mm), 3" (75 mm), 4" (100 mm), 6" (150 mm), 8" (200 mm)
- Max. Capacity: 2600 GPM (164.0 lps)
- Max. Head: 160' (48.8 m)
- Max. Solids: 3" (76.2 mm)
- Max Temperature: 160°F (71°C)
- Motor – Voltage: 200 V 3P, 230 V 1P, 230 V 3P, 460 V 3P
- Motor – Cycles: 60 Hz
- Horsepower: 2 HP to 60 HP

Several ReliaSource® lift stations are available with custom vinyl wraps to blend in with the surrounding environment.

RELIASOURCE® LIFT STATIONS

Every ReliaSource® lift station is engineered to accommodate an extensive selection of heavy-duty, solids-handling Gorman-Rupp self-priming or submersible pumps.

Above-ground stations feature robust NEMA controls, corrosion-, weather-, and vandal-resistant fiberglass enclosures, and easy access for maintenance and service. Every ReliaSource® lift station is fully customizable, and your knowledgeable Gorman-Rupp distributor can help specify the right equipment for your job.

ReliaSource® 8x12 Above-Ground Lift Station

Accommodates Gorman-Rupp Super T Series®, Ultra V Series® or VS Series self-priming centrifugal, heavy duty solids-handling pumps.

Specifications:

- Pump Size: 2" (50 mm), 3" (75 mm), 4" (100 mm), 6" (150 mm), 8" (200 mm)
- Max Capacity: 2600 GPM (164.0 lps)
- Max Head: 320' (97.5 m)
- Max Solids: 3" (76.2 mm)
- Max Temperature: 160°F (71°C)
- Motor – Voltage: 200 V 3P, 230 V 1P, 230 V 3P, 460 V 3P
- Motor – Cycles: 60 Hz
- Horsepower: 2 HP to 100 HP

ReliaSource® 6x6T Above-Ground Lift Station

Accommodates two Gorman-Rupp Super T Series® or Ultra V Series® self-priming pumps.

Specifications:

- Pump Size: 2" (50 mm), 3" (75 mm), 4" (100 mm), 6" (150 mm)
- Max Capacity: 1475 GPM (93.1 lps)
- Max Head: 160' (48.8 m)
- Max Solids: 3" (76.2 mm)
- Max Temperature: 160°F (71°C)
- Motor – Voltage: 200 V 3P, 230 V 1P, 230 V 3P, 460 V 3P
- Motor – Cycles: 60 Hz
- Horsepower: 5 HP to 50 HP

ReliaSource® 6x6 Above-Ground Lift Station

Accommodates two Gorman-Rupp Super T Series® or Ultra V Series® self-priming pumps.

Specifications:

- Pump Size: 2" (50 mm), 3" (75 mm), 4" (100 mm), 6" (150 mm)
- Max Capacity: 1300 GPM (82.0 lps)
- Max Head: 150' (45.7 m)
- Max Solids: 3" (76.2 mm)
- Max Temperature: 160°F (71°C)
- Motor – Voltage: 200 V 3P, 230 V 1P, 230 V 3P, 460 V 3P
- Motor – Cycles: 60 Hz
- Horsepower: 2 HP to 25 HP

ReliaSource® Above-Ground Submersible Valve Package (ASVP)

Available with SF Series® slide rail-mounted submersible pumps.

Specifications:

- Pump Size: 3" (75 mm), 4" (100 mm), 6" (150 mm)
- Max Capacity: 1600 GPM (100.9 lps)
- Max Head: 155' (47.2 m)
- Max Solids: 3" (76.2 mm)
- Max Temperature: 104°F (40°C)
- Motor – Voltage: 208 V 3P, 230 V 1P, 230 V 3P, 460 V 3P
- Motor – Cycles: 60 Hz
- Horsepower: 3 HP to 50 HP

ReliaSource® 7x10 Above-Ground Lift Station

Accommodates two Gorman-Rupp Super T Series® or Ultra V Series® self-priming pumps.

Specifications:

- Pump Size: 2" (50 mm), 3" (75 mm), 4" (100 mm), 6" (150 mm), 8" (200 mm)
- Max Capacity: 2500 GPM (157.7 lps)
- Max Head: 160' (48.8 m)
- Max Solids: 3" (76.2 mm)
- Max Temperature: 160°F (71°C)
- Motor – Voltage: 200 V 3P, 230 V 1P, 230 V 3P, 460 V 3P
- Motor – Cycles: 60 Hz
- Horsepower: 2 HP to 50 HP

ReliaSource® Auto-Start Lift Station

Accommodates Gorman-Rupp Super T Series®, Ultra V Series®, or VS Series self-priming centrifugal, heavy duty solids-handling pumps.

Specifications:

- Pump Size: 2" (50 mm), 3" (75 mm), 4" (100 mm), 6" (150 mm), 8" (200 mm), 10" (250 mm)
- Max Capacity: 3400 GPM (214.5 lps)
- Max Head: 320' (97.5 m)
- Max Solids: 3" (76.2 mm)
- Max Temperature: 160°F (71°C)
- Motor – Voltage: 200 V 3P, 230 V 3P, 460 V 3P
- Motor – Cycles: 60 Hz
- Horsepower: 3 HP to 150 HP

ReliaSource® Base-Mounted Lift Station

Accommodates Gorman-Rupp Super T Series®, Ultra V Series® or VS Series self-priming centrifugal, heavy duty solids-handling pumps.

Specifications:

- Pump Size: 2" (50 mm), 3" (75 mm), 4" (100 mm), 6" (150 mm), 8" (200 mm), 10" (250 mm)
- Max Capacity: 3400 GPM (214.5 lps)
- Max Head: 320' (97.5 m)
- Max Solids: 3" (76.2 mm)
- Max Temperature: 160°F (71°C)
- Motor – Voltage: 200 V 3P, 230 V 1P, 230 V 3P, 460 V 3P
- Motor – Cycles: 60 Hz
- Horsepower: 2 HP to 150 HP

RELY ON THE LIFT STATION EXPERTS SINCE 1967

Make ReliaSource® your single source for lift station satisfaction today.

★ **Manufacturing Facilities**
● **Distribution Centers**

Gorman-Rupp USA
Mansfield, Ohio, USA

Gorman-Rupp Canada
St. Thomas, Ontario, Canada

Gorman-Rupp Europe
Waardenburg, Netherlands
Namur, Belgium

Gorman-Rupp Africa
Cape Town, South Africa
Durban, South Africa
Johannesburg, South Africa (Headquarters)

Distribution Centers
Dubai, United Arab Emirates
Grand Prairie, Texas, USA

Engineering and manufacturing superiority has been the hallmark of Gorman-Rupp since our inception in 1933. Today we bring our products to life in some of the most efficient, modern and state-of-the-art manufacturing facilities in the world. Over the past decades, Gorman-Rupp has manufactured more than 13,000 pump stations, and our world-class team of distributors has worked closely with thousands of municipalities around the world. We have the proven expertise and the resources to specify, manufacture, test and service your complete packaged lift station, and to ensure reliable solids-handling performance for the long haul.

ISO 9001:2015 REGISTERED COMPANY GORMAN-RUPP PUMPS USA

ISO 14001:2015 REGISTERED COMPANY GORMAN-RUPP PUMPS USA

GORMAN-RUPP PUMPS
P.O. BOX 1217
MANSFIELD, OHIO 44901-1217 | USA
TEL: 419.755.1011 | FAX: 419.755.1251

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United Concrete provides one source responsibility to your projects with our design engineers, Cad specialists and technical support team.

- Above Grade Pumps Stations
- Submersible Pump Stations
- Dry Pit Pump Stations
- Valve Pits
- Water Meter Vaults
- Above Grade Buildings
- Below Grade Buildings
- Wet wells

Please visit our website or call us for detailed information.

UNITED CONCRETE PRODUCTS

RELIASOURCE®

Feb 2021 | LSIS8X9

8X9 LIFT STATION INFORMATION SHEET

ABOVE-GROUND LIFT STATION

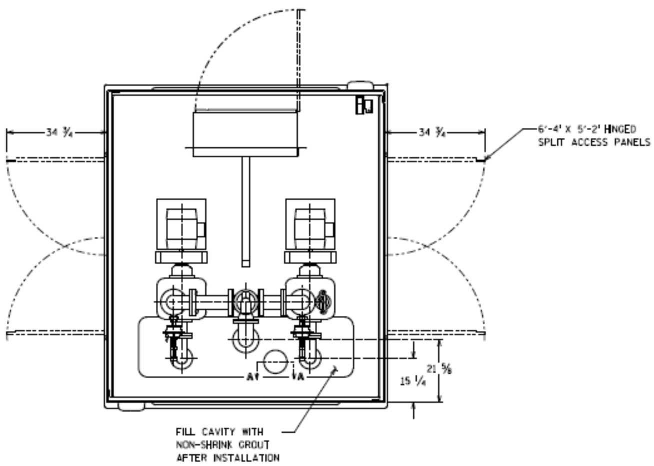
Berlin, VT - 8x9 Option
Duplex T8A3S
60hp 460v 3P
Options per E-mail
Budget Cost: ~$272,500.00

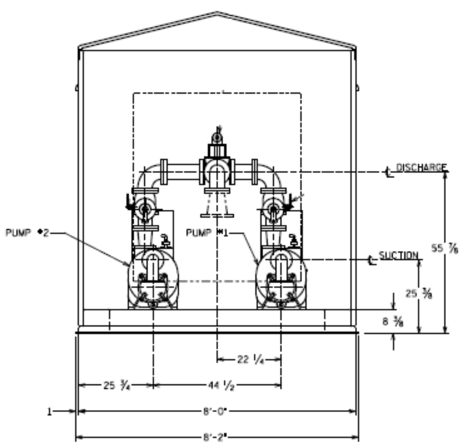
Standard Mechanical and Electrical

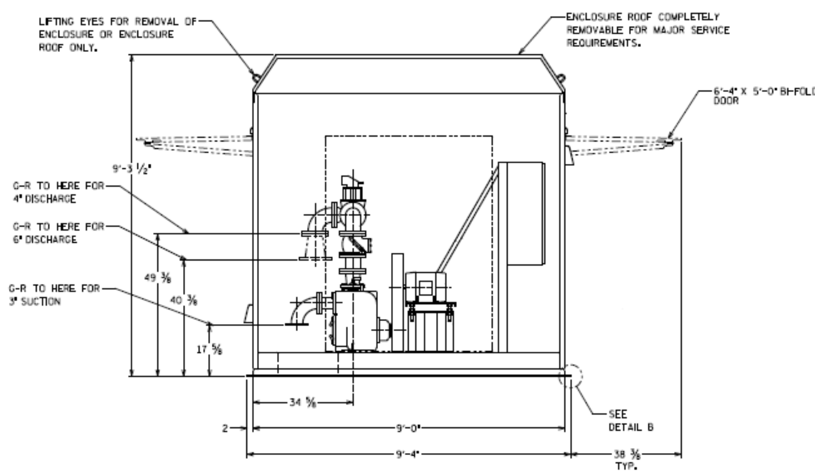
Station Type	8 X 9 with Duplex Pumps (Available with Triplex Pumps on some sizes)
Station Specs	• Max Capacity 2600 GPM (164.0 lps) • Max Head: 160' (48.8 m) • Max Solids 3" (76.2 mm) • Max Temperature 160°F (71°C) • Assembled and tested in Gorman Rupp's USA Facilities
Pump Specs	• Super T Series® 3" (75 mm), 4" (100 mm), 6" (150 mm), 8" (200 mm) • Ultra V Series® or VS Series 3" (75 mm), 4" (100 mm), 6 (150 mm)
Pump Motor	• Voltage: 200 V 3P, 230 V 1P, 230 V 3P, 460 V 3P • Cycles: 60 hz • Horsepower: 2 HP to 60 HP
Station Piping	• Individual suction spools • Individual swing check valves • 3-way plug valve w/duplex pumps • Individual automatic air release valves • Station ships fully assembled and wired. Pumps, piping, controls and fiberglass enclosure mounted on a common steel base.
Enclosure	• Enlcosure: Manufactured with Nida-Fusion® STO complexes, created by Nida-Core Corp • Composed of a sheet of closed-cell foam, covered with a reinforcing fiber layer linked by fiber-glass bridging strands that form a triangular truss network • Two bi-fold hinge doors • Two side access panels
Control Panel Assembly	• InteGRinex® Liquid Level controls designed to handle basic pump station requirements • Custom Engineered NEMA Rated Automatic controls to operate pump and warning systems • Reduced Voltage Solid State (RVSS) Starters and Variable Frequency Drives (VFDs) available upon request • Fully customized control panels available, including H-O-A selectors, overload reset buttons and circuit • Available U.L. and C.S.A. listings • NEMA Rated Control Enclosures

GORMAN-RUPP PUMPS *The Pump People*

8X9 SAMPLE OUTLINE DRAWING







Note: Drawing is a general layout of a lift station, for drawings specific to your application please contact your Gorman-Rupp Distributor.

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P.O. BOX 1217
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TEL: 419.755.1011 | FAX: 419.755.1251
GRPUMPS.COM

Self Priming Centrifugal Pump

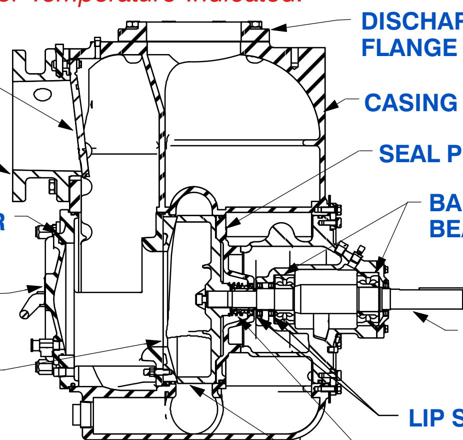
Model T8A3S-B

Super T SERIES
VARIOUS PATENTS APPLY

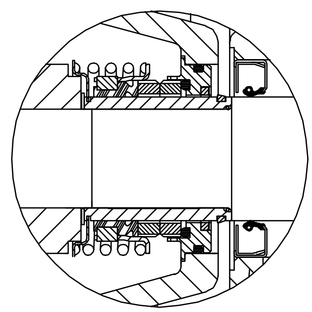
Size 8” x 8”

PUMP SPECIFICATIONS
Size: 8” (203 mm) ASA Flanged Suction x 8” (203 mm) NPT Female Discharge.
Casing: Gray Iron 30. Maximum Operating Pressure 83 psi (572 kPa).*
Semi-Open Type, Two Vane Impeller: Ductile Iron 65-45-12. Handles 3” (76,2 mm) Diameter Spherical Solids.
Impeller Shaft: Alloy Steel 4150.
Shaft Sleeve: Alloy Steel 4130.
Replaceable Wear Plate: Gray Iron 30.
Removable Adjustable Cover Plate: Gray Iron 30.
Removable Inspection Cover Plate: Gray Iron 30; 20 lbs. (9,1 kg.).
Flap Valve: Neoprene W/Nylon and Steel Reinforcing.
Seal Plate: Gray Iron 30.
Radial and Thrust Bearings: Open Double Row Ball.
Bearing Housing: Gray Iron 30.
Bearing and Seal Cavity Lubrication: SAE 30 Non-Detergent Oil.
Flanges: Gray Iron 30.
Gaskets: Buna-N, Compressed Synthetic Fibers, PTFE, Cork and Rubber.
O-Rings: Buna-N.
Hardware: Standard Plated Steel.
Brass Pressure Relief Valve.
Bearing and Seal Cavity Oil Level Sight Gauges.
Optional Equipment: Metal Bellows Seal. Automatic Air Release Valve. High Pump Temperature Shutdown Kit. 120V/240V Casing Heater.
Gray Iron 30 Spool Flanges:
8” ASA Discharge **(Specify Model T8A3S-B /F)**.
200 mm DIN 2527 (PN 16) Suction and Discharge **(Specify Model T8A3S-B /FM)**.

**Consult Factory for Applications Exceeding Maximum Pressure and/or Temperature Indicated.*



Shown with Optional Discharge Spool Flange (Available in ASA or DIN Standard Sizes).



SEAL DETAIL

Cartridge Type, Mechanical, Oil-Lubricated, Double Floating, Self-Aligning. Tungsten Titanium Carbide Rotating and Stationary Faces. Stainless Steel 316 Stationary Seat. Fluorocarbon Elastomers (DuPont Viton® or Equivalent). Stainless Steel 18-8 Cage and Spring. Maximum Temperature of Liquid Pumped, 160°F (71°C).*

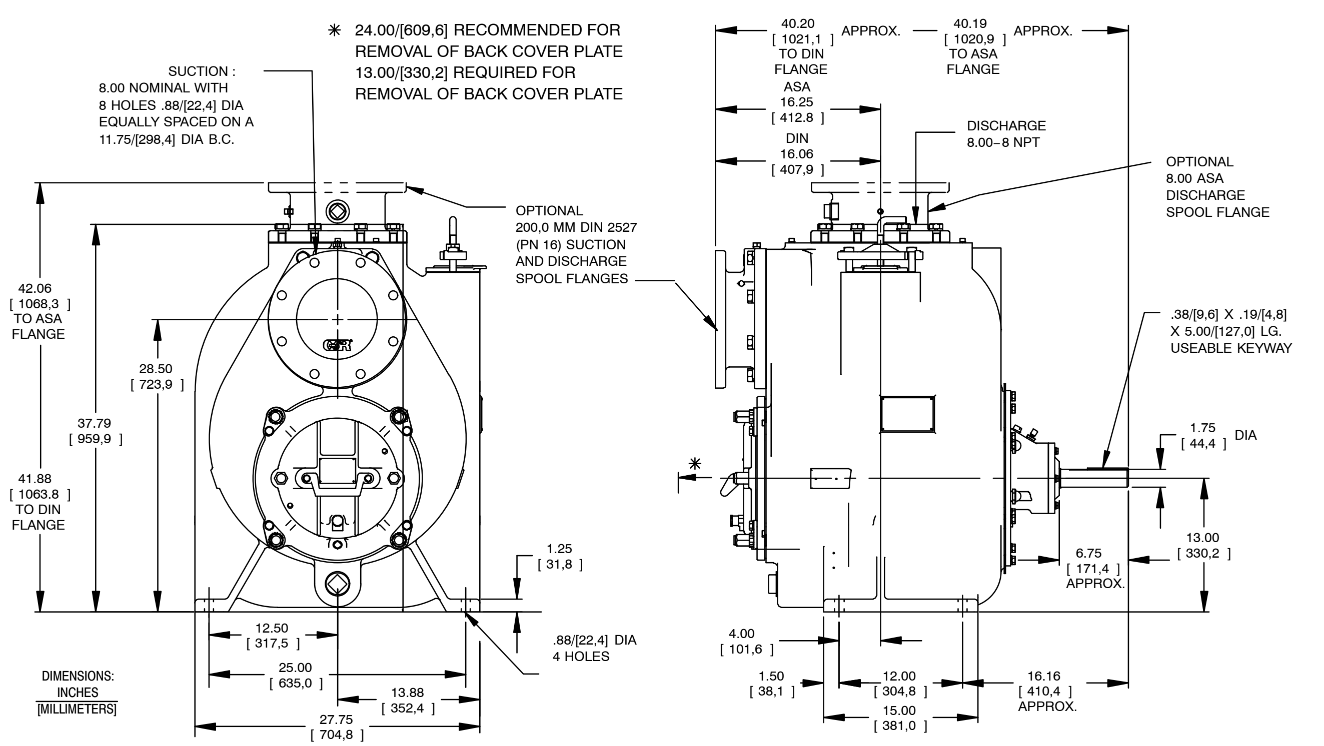
Specification Data

SECTION 55, PAGE 2300

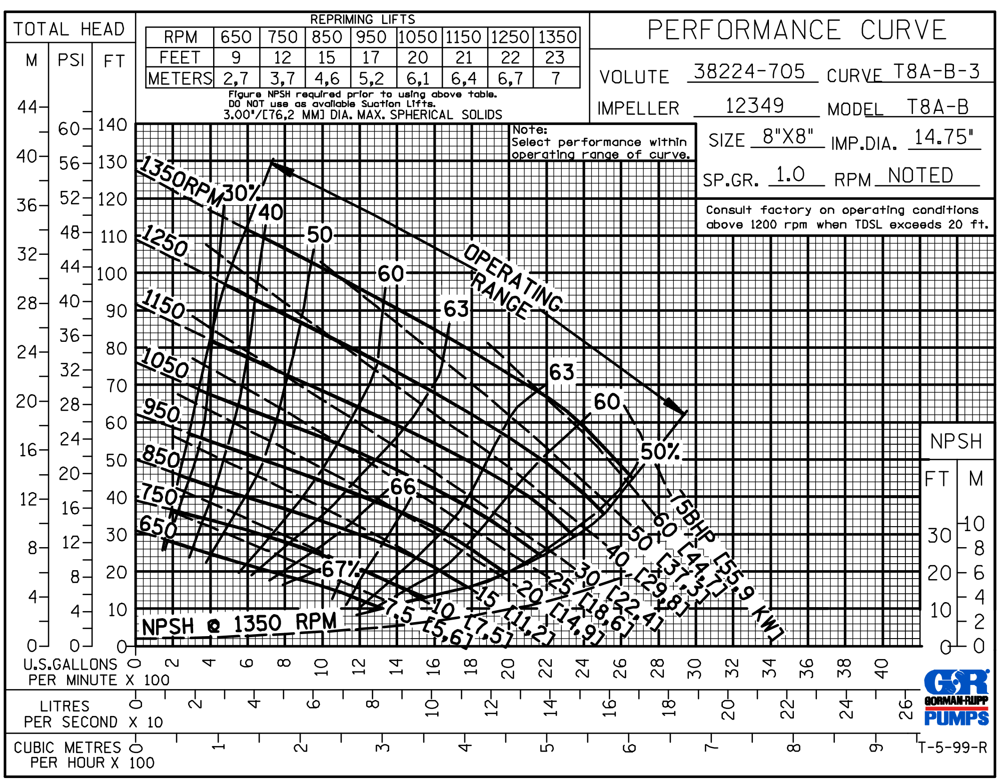
APPROXIMATE DIMENSIONS and WEIGHTS

NET WEIGHT:	**1295 LBS. (587 KG.)***
SHIPPING WEIGHT:	**1399 LBS. (635 KG.)***
EXPORT CRATE:	**47.9 CU. FT. (1,36 CU. M.)**

***ADD 35 LBS. (15,9 KG.) W/EACH SPOOL FLANGE**



OPTIONAL ASA OR DIN STANDARD SPOOL FLANGES AVAILABLE



REPRIMING LIFTS

RPM	650	750	850	950	1050	1150	1250	1350
FEET	9	12	15	17	20	21	22	23
METERS	2,7	3,7	4,6	5,2	6,1	6,4	6,7	7

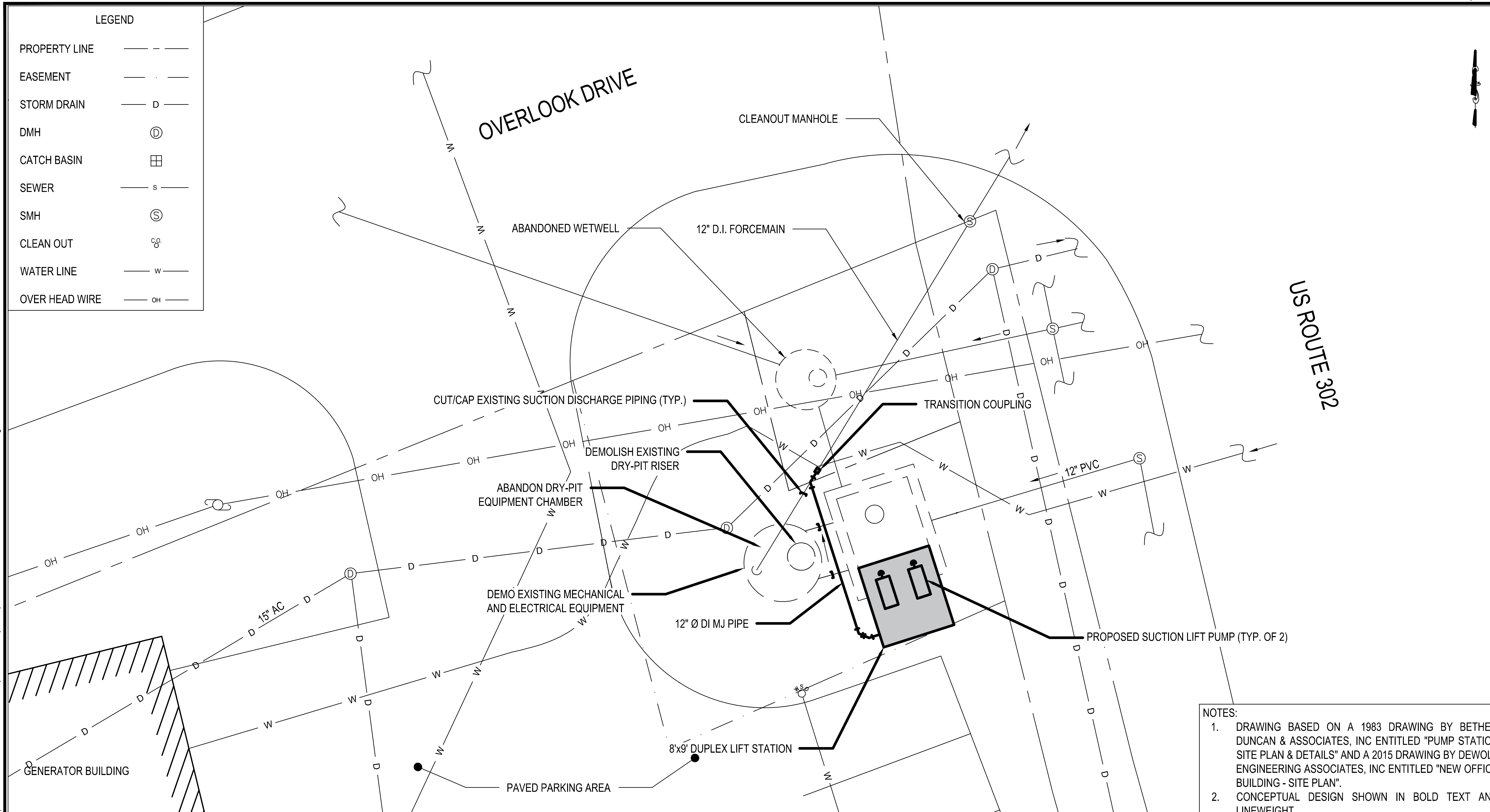
Figure NPSH required prior to using above table. DO NOT use as available Suction Lifts.
3.00"/[76,2 MM] DIA. MAX. SPHERICAL SOLIDS

GORMAN-RUPP PUMPS

www.grpumps.com

Specifications Subject to Change Without Notice

Printed in U.S.A.



NOTES:

1. DRAWING BASED ON A 1983 DRAWING BY BETHEL, DUNCAN & ASSOCIATES, INC ENTITLED "PUMP STATION SITE PLAN & DETAILS" AND A 2015 DRAWING BY DEWOLF ENGINEERING ASSOCIATES, INC ENTITLED "NEW OFFICE BUILDING - SITE PLAN".
2. CONCEPTUAL DESIGN SHOWN IN BOLD TEXT AND LINEWEIGHT.

10 5 0 10 20

SCALE: 1" = 10'

NO	DATE	BY	DESCRIPTION
-	-	-	-

DRAWN BY: REG | CHK'D BY: MAS | 01/06/2022

Weston & Sampson

TOWN OF BERLIN, VT

FIGURE D-4: PUMP STATION ALTERNATE 4

P:\VT\Berlin, VT\Route 302 Private Sewer Replacement\CAD\berlin – PS alternatives 2023 0110.dwg

Berlin, VT
PRELIMINARY OPINION OF CONSTRUCTION COST
Alternate 4 - Packaged Suction Lift Station

Item No.	Description	Unit	Est. Qty.	Cost/Unit	Total Cost
1	**Contractor's General Conditions**				
	Mobilization/Demobilization (5%)	L.S.	1	$ 4,600	$ 4,600
	Bonds and Insurance (8%)	L.S.	1	$ 7,360	$ 7,400
	General Conditions (5%)	L.S.	1	$ 4,600	$ 4,600
				General Conditions Total	**$ 17,000**
2	**Lift Station Package**				
	Gorman-Rupp Lift Station Package, 8x9, Duplex T8A3S 60 hp 460V 3P	L.S.	1	$ 272,500	$ 272,500
				Site Work Total	**$ 273,000**
3	**Site Work**				
	Site Preparation	L.S.	1	$ 1,000	$ 1,000
	Trenching	L.S.	1	$ 1,000	$ 1,000
	Connect to Existing 12" Sewage Force Main	L.S.	1	$ 5,471	$ 5,500
	12" Dia. Core Existing Wet-well	Ea.	2	$ 6,500	$ 13,000
	Cut & Cap Existing 8" Suction Piping	Ea.	2	$ 3,200	$ 6,400
	Install Buried Power from Gen. Building	L.F.	80	$ 7	$ 600
	Install Buried Communications from Gen. Building	L.F.	80	$ 17	$ 1,400
				Site Work Total	**$ 29,000**
4	**Structural**				
	18" Crushed Stone Bedding	C.Y.	10	$ 50	$ 500
	10' x 10' x 12" C.I.P. Foundation Slab	C.Y.	4	$ 650	$ 2,600
				Structural Total	**$ 4,000**
5	**Mechanical / Electrical**				
	6" D.I. Flanged Piping	L.F.	26	$ 70	$ 1,900
	6" D.I. Flanged Fittings	Ea.	2	$ 405	$ 900
	8" D.I. M.J. Suction Piping to Wetwell	L.F.	10	$ 76	$ 800
	8" D.I. Flanged Fittings	Ea.	4	$ 684	$ 2,800
	12" D.I. M.J. Discharge Piping to Existing F.M.	L.F.	30	$ 120	$ 3,600
	12" D.I. Flanged Fittings	Ea.	2	$ 1,246	$ 2,500
	4" Flanged Resilient Wedge Gate Valves	Ea.	4	$ 1,309	$ 5,300
	6" Flanged Check Valves	Ea.	2	$ 1,801	$ 3,700
	2" Sch. 40 PVC Sump Pump Discharge	L.F.	20	$ 28	$ 600
	2" Sch. 40 PVC Fittings	Ea.	6	$ 28	$ 200

	Modify Existing Pump Control Panel	Hr.	4	$ 125	$ 500
	Pump Station Grounding	L.S.	1	$ 1,023	$ 1,100
				Mechanical / Electrical Total	**$ 24,000**
6	**Misc. Work and Clean-up**				
	Demolish/Dispose of Existing P.S. Internal Equipment	L.S.	1	$ 10,000	$ 10,000
	Cut Holes in Existing Dry-pit	Ea.	3	$ 6,500	$ 19,500
	Demolish Existing Dry-pit Access Tube	L.S.	1	$ 3,200	$ 3,200
	Fill Existing Dry-pit with Crushed Gravel	L.S.	1	$ 1,500	$ 1,500
				Misc. Work Total	**$ 35,000**
				Construction Total	**$ 382,000**
				Engineering and Project Development (23%)	$ 87,900
				Construction Contingencies (30%)	$ 141,000
				Legal and Admin.	$ 5,000
				TOTAL OPINION OF CONSTRUCTION COST	**$ 620,000**

Notes:

1. ENR CCI for January 2023 is 13175.03

2. Subtotal amounts have been rounded to the next $1,000

3. Overall anticipated project costs have been rounded to the next $10,000

4. Anticipated costs have been developed based on recent similar projects, manufacture's equipment costs, and RS Means database.

5. Project costs have been developed without the benefit of final design drawings. A 30% contingency should be carried.

6. Assumes re-use of Existing Generator, Control Pannel, Sampler, Flow Meter and Level Controls.

APPENDIX E

FY 2023 Sewer Budget

FY23 SEWER BUDGET	FY22	FY23	Daily Use in Gal	$ AnnualFixed/Gal	FY22	
	Actual	Budget	193,456	$ 2.6839		
				$ 0.6710	$ 0.6365	**5.42%**
Fixed Cost Billing	$ 496,800	$ 519,211	Annual Gallons	$Fixed/Gal		
Delinquent Assessment Interest	$ 3,168		70,611,440	$ 0.0074		
Delinquent Assessment Penalty	$ 4,117					
Usage Billing	$ 246,048	$ 291,797				
Interest on Bank Accounts	$ 257	$ -				
Allocated Not Connected	$ 25,358	$ 10,000				
Total Income	$ 775,748	$ 821,008				
			Esti Annual Gals	$Use/Gal		
			61,816,667	$ 0.0047	$ 0.0035	**34.87%**
Administrative Support	$ 19,351	$ 21,600				
FICA/Medicare	$ 1,295	$ 1,600				
Administrative Transfer	$ 4,500	$ 4,500				
Advertising	$ 909	$ 1,000				
Capital Construction & Reserve	$ 93,717	$ 150,000				
Collection System Maintenance	$ 4,603	$ 24,000				
Line Cleaning	$ 22,000	$ 22,000				
Insurance	$ 1,580	$ 2,200				
Maintenance Contract	$ 59,056	$ 62,000	FY22			
Montpelier Collection	$ 56,125	$ 82,135	$ 74,231	11%		
Montpelier Treatment	$ 117,913	$ 265,397	$ 200,355	32%		
River Street Debt	$ 16,189	$ 23,135	$ 27,753	-17%		
Office						
Office Expenses	$ 197	$ 600				
Postage/Misc	$ -	$ 300				
Billing	$ -	$ 2,500				
Audit	$ 1,500	$ 1,500				
Professional Fees						
Legal	$ 837	$ 2,000				
Consulting	$ 1,821	$ 6,500				
Pump Station Maintenance						
Emergency Answering Service	$ 306	$ 400				
Main						
Chemicals	$ 7,580	$ 8,000				
Electricity	$ 8,618	$ 12,500				
Maintenance	$ 38,834	$ 17,000				
Telephone	$ 1,414	$ 1,600				
Water	$ 1,339	$ 2,000				
Partridge Farms						
Electricity	$ 1,392	$ 1,800				
Maintenance	$ 105	$ 3,200				
Propane	$ -	$ 100				
PTN						
Electricity	$ 2,723	$ 3,500				
Maintenance	$ 642	$ 1,500				
Propane	$ -	$ 500				
Monitoring	$ 563	$ 700				
Tests & Inspections	$ 1,595	$ 4,500				
Paine Turnpike North Bond	$ 36,694	$ 90,742				
Total Expenses	$ 503,399	$ 821,008				
Variable Costs	$ 138,226	$ 291,797	$ 821,008			
FIXED Costs	**$365,173**	**$ 529,211**				

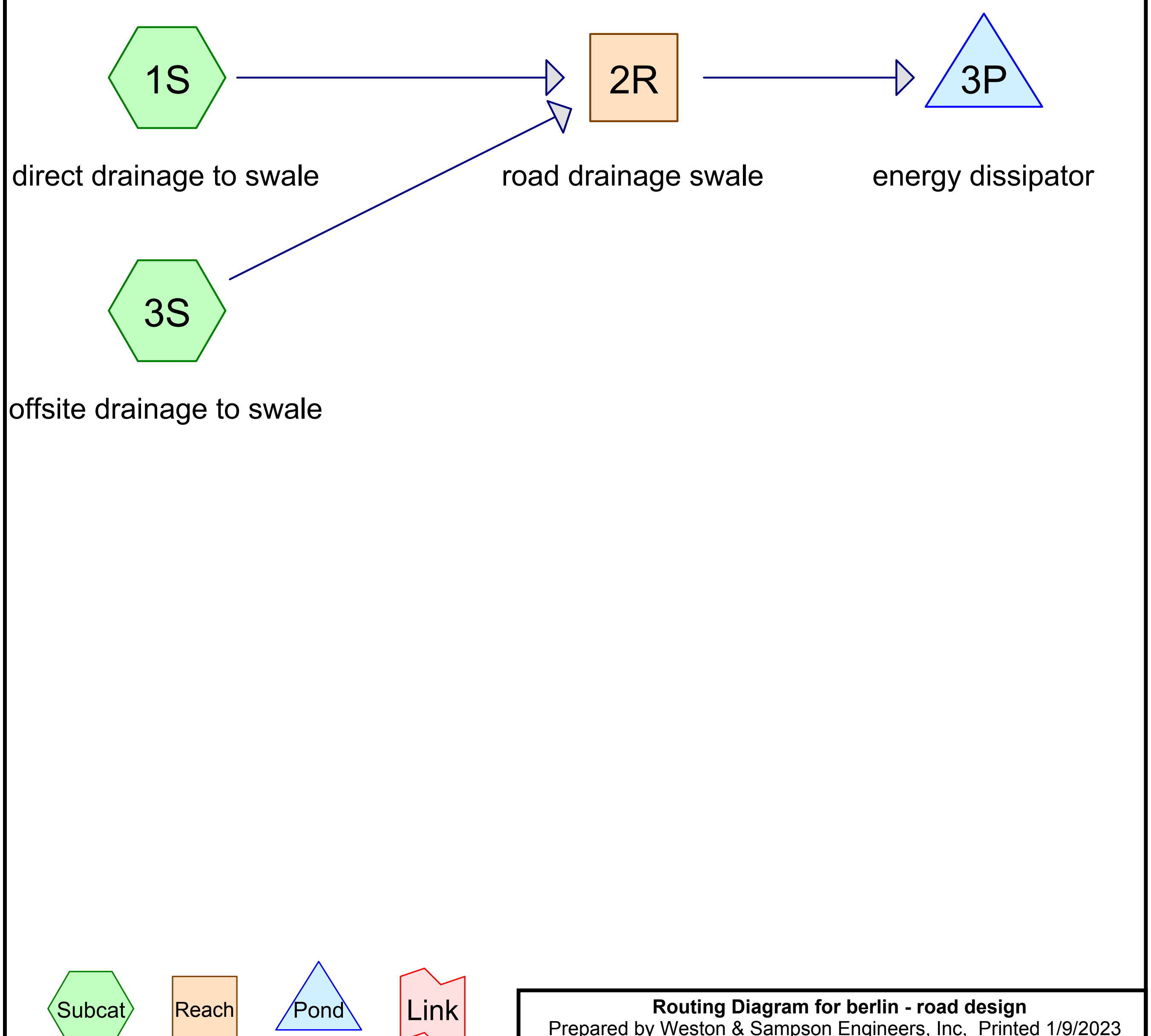
APPROVED 8.22.22

[signature] August 22, 2022

APPENDIX F

Hospital Hill Cross-country Sewer Access

Stormwater Calculations



Routing Diagram for berlin - road design

Prepared by Weston & Sampson Engineers, Inc, Printed 1/9/2023

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
10.360	80	>75% Grass cover, Good, HSG D (3S)
5.210	39	Pasture/grassland/range, Good, HSG A (3S)
0.740	98	Paved parking, HSG A (3S)
6.708	98	Paved parking, HSG D (1S, 3S)
23.100	77	Woods, Good, HSG D (1S, 3S)
46.118	**77**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
5.950	HSG A	3S
0.000	HSG B	
0.000	HSG C	
40.168	HSG D	1S, 3S
0.000	Other	
46.118		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	10.360	0.000	10.360	>75% Grass cover, Good	3S
5.210	0.000	0.000	0.000	0.000	5.210	Pasture/grassland/range, Good	3S
0.740	0.000	0.000	6.708	0.000	7.448	Paved parking	1S, 3S
0.000	0.000	0.000	23.100	0.000	23.100	Woods, Good	1S, 3S
5.950	**0.000**	**0.000**	**40.168**	**0.000**	**46.118**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: direct drainage to swale Runoff Area=9.748 ac 2.54% Impervious Runoff Depth=1.99"
Flow Length=1,132' Slope=0.2200 '/' Tc=8.0 min CN=78 Runoff=32.23 cfs 1.617 af

Subcatchment3S: offsite drainage to Runoff Area=36.370 ac 19.80% Impervious Runoff Depth=1.91"
Flow Length=2,374' Slope=0.1000 '/' Tc=22.0 min CN=77 Runoff=72.89 cfs 5.801 af

Reach 2R: road drainage swale Avg. Flow Depth=1.15' Max Vel=13.42 fps Inflow=84.09 cfs 7.419 af
n=0.022 L=1,200.0' S=0.0667 '/' Capacity=295.94 cfs Outflow=83.80 cfs 7.419 af

Pond 3P: energy dissipator Peak Elev=182.64' Storage=0.032 af Inflow=83.80 cfs 7.419 af
Outflow=83.80 cfs 7.412 af

Total Runoff Area = 46.118 ac Runoff Volume = 7.419 af Average Runoff Depth = 1.93"
83.85% Pervious = 38.670 ac 16.15% Impervious = 7.448 ac

Summary for Subcatchment 1S: direct drainage to swale

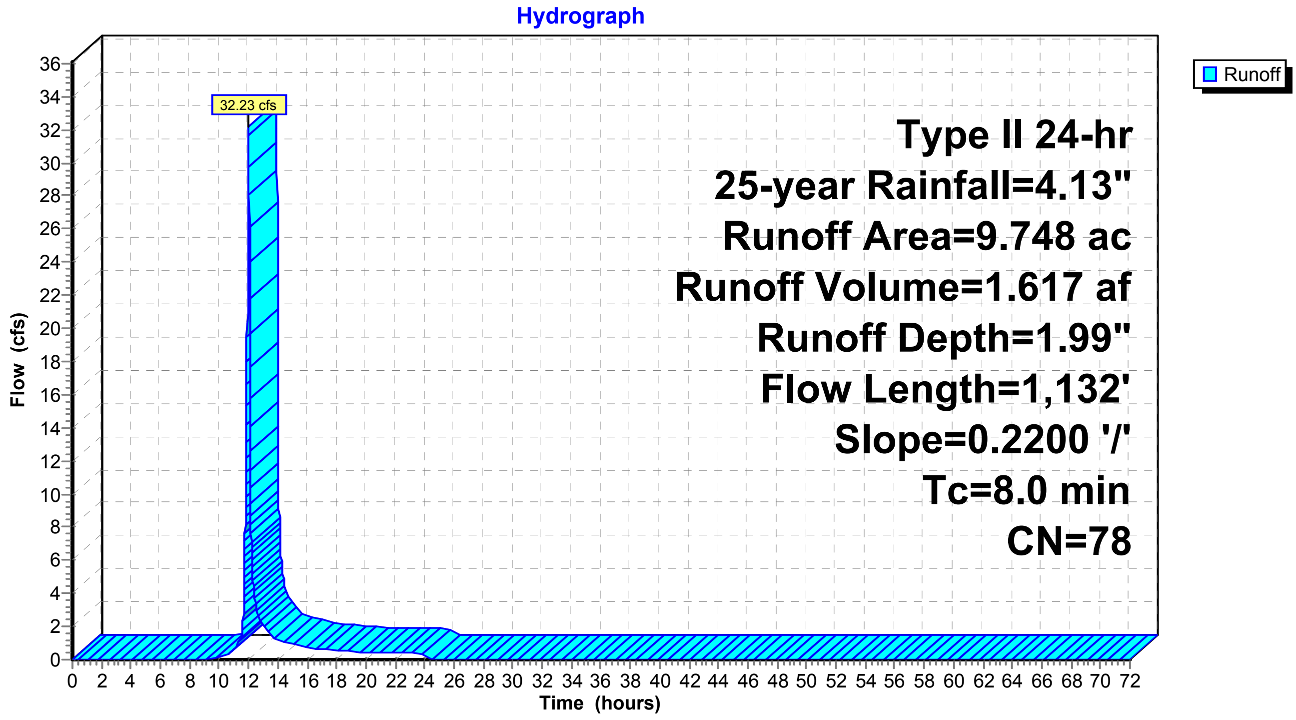
Runoff = 32.23 cfs @ 12.00 hrs, Volume= 1.617 af, Depth= 1.99"
Routed to Reach 2R : road drainage swale

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-year Rainfall=4.13"

Area (ac)	CN	Description
9.500	77	Woods, Good, HSG D
0.248	98	Paved parking, HSG D
9.748	78	Weighted Average
9.500		97.46% Pervious Area
0.248		2.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	1,132	0.2200	2.37		**Lag/CN Method,**

Subcatchment 1S: direct drainage to swale



Summary for Subcatchment 3S: offsite drainage to swale

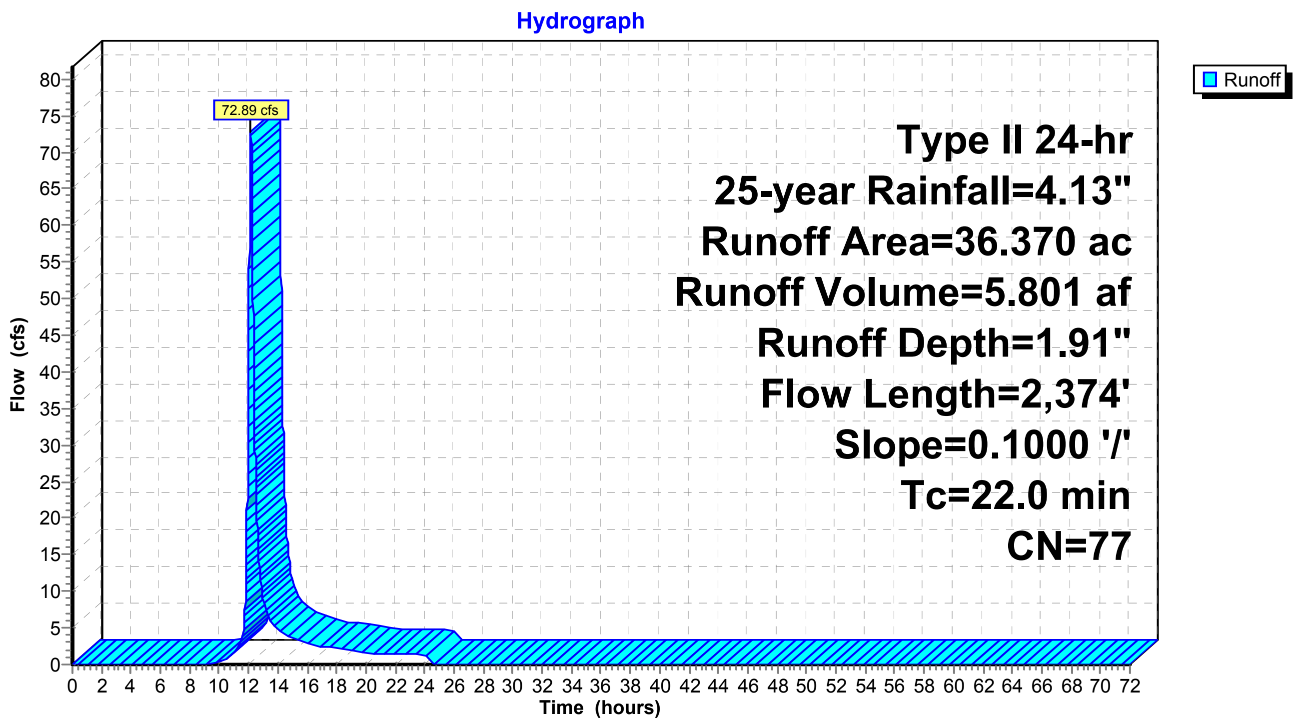
Runoff = 72.89 cfs @ 12.15 hrs, Volume= 5.801 af, Depth= 1.91"
Routed to Reach 2R : road drainage swale

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-year Rainfall=4.13"

Area (ac)	CN	Description
10.360	80	>75% Grass cover, Good, HSG D
6.460	98	Paved parking, HSG D
13.600	77	Woods, Good, HSG D
0.740	98	Paved parking, HSG A
5.210	39	Pasture/grassland/range, Good, HSG A
36.370	77	Weighted Average
29.170		80.20% Pervious Area
7.200		19.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.0	2,374	0.1000	1.80		**Lag/CN Method,**

Subcatchment 3S: offsite drainage to swale



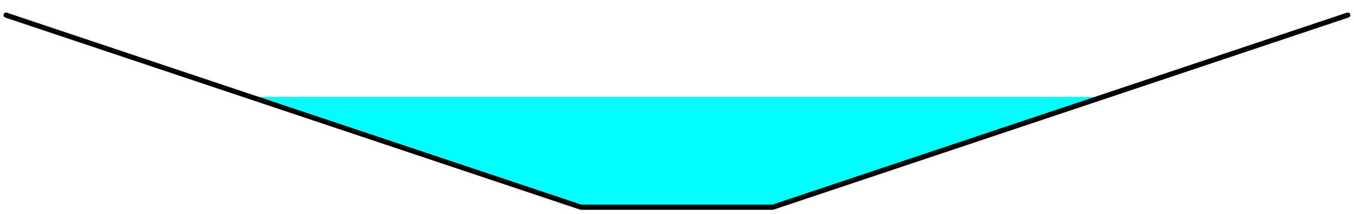
Summary for Reach 2R: road drainage swale

Inflow Area = 46.118 ac, 16.15% Impervious, Inflow Depth = 1.93" for 25-year event
Inflow = 84.09 cfs @ 12.10 hrs, Volume= 7.419 af
Outflow = 83.80 cfs @ 12.11 hrs, Volume= 7.419 af, Atten= 0%, Lag= 0.8 min
Routed to Pond 3P : energy dissipator

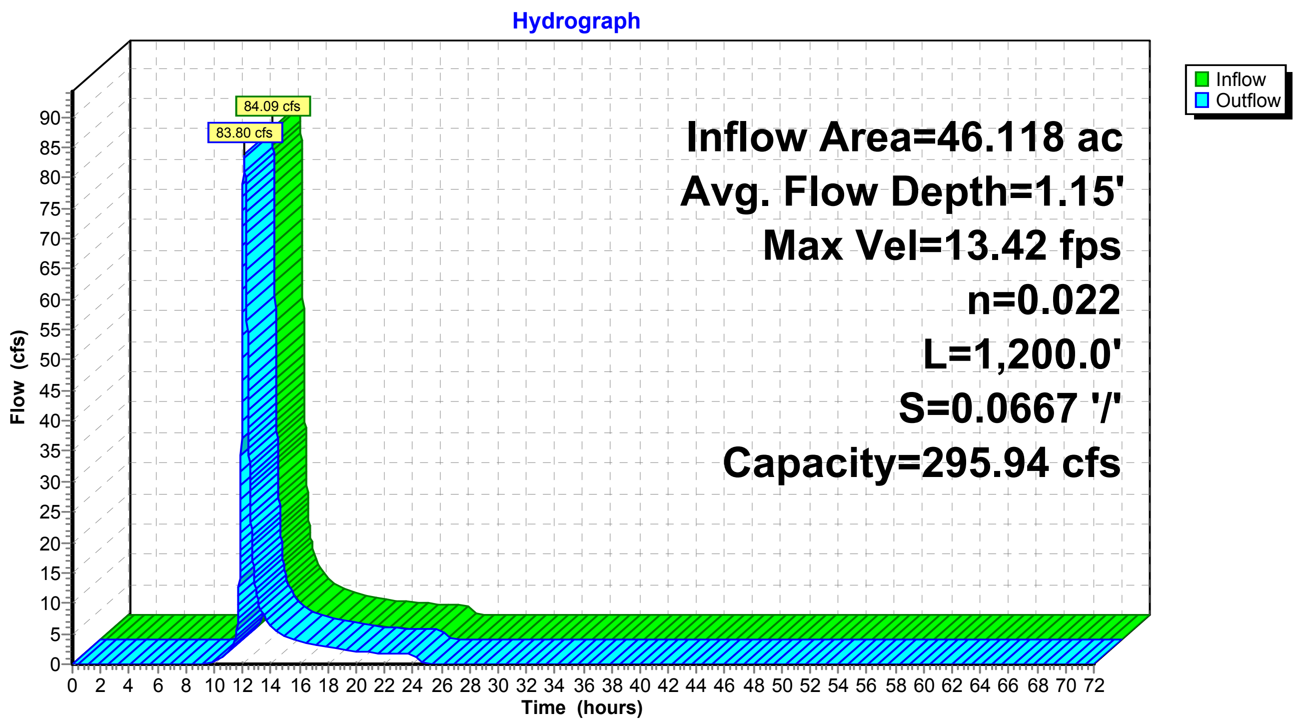
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 13.42 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 4.86 fps, Avg. Travel Time= 4.1 min

Peak Storage= 7,496 cf @ 12.11 hrs
Average Depth at Peak Storage= 1.15' , Surface Width= 8.89'
Bank-Full Depth= 2.00' Flow Area= 16.0 sf, Capacity= 295.94 cfs

2.00' x 2.00' deep channel, n= 0.022 Earth, clean & straight
Side Slope Z-value= 3.0 '/' Top Width= 14.00'
Length= 1,200.0' Slope= 0.0667 '/'
Inlet Invert= 260.00', Outlet Invert= 180.00'



Reach 2R: road drainage swale



Summary for Pond 3P: energy dissipator

[62] Hint: Exceeded Reach 2R OUTLET depth by 1.49' @ 12.12 hrs

Inflow Area = 46.118 ac, 16.15% Impervious, Inflow Depth = 1.93" for 25-year event
Inflow = 83.80 cfs @ 12.11 hrs, Volume= 7.419 af
Outflow = 83.80 cfs @ 12.11 hrs, Volume= 7.412 af, Atten= 0%, Lag= 0.2 min
Primary = 83.80 cfs @ 12.11 hrs, Volume= 7.412 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 182.64' @ 12.11 hrs Surf.Area= 0.021 ac Storage= 0.032 af

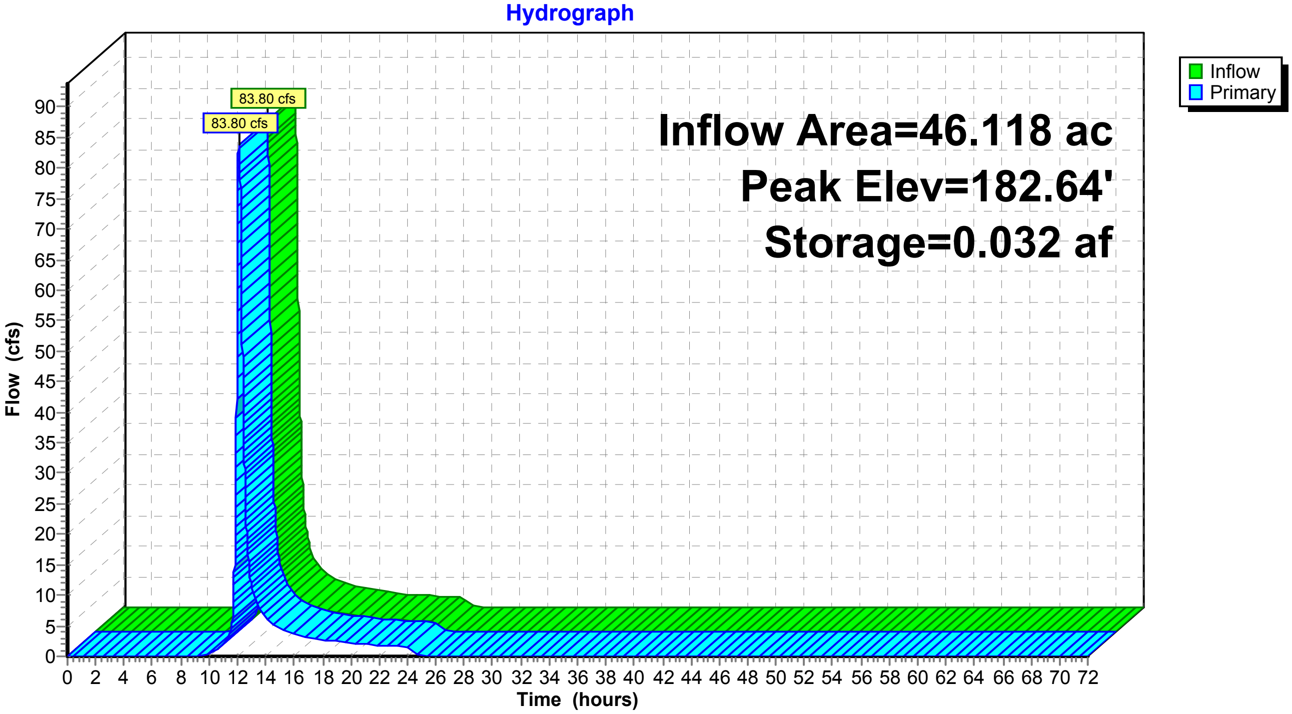
Plug-Flow detention time= 1.2 min calculated for 7.411 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (850.2 - 849.6)

Volume	Invert	Avail.Storage	Storage Description
#1	180.00'	0.040 af	**20.00'W x 10.00'L x 3.00'H Prismatoid Z=3.0**

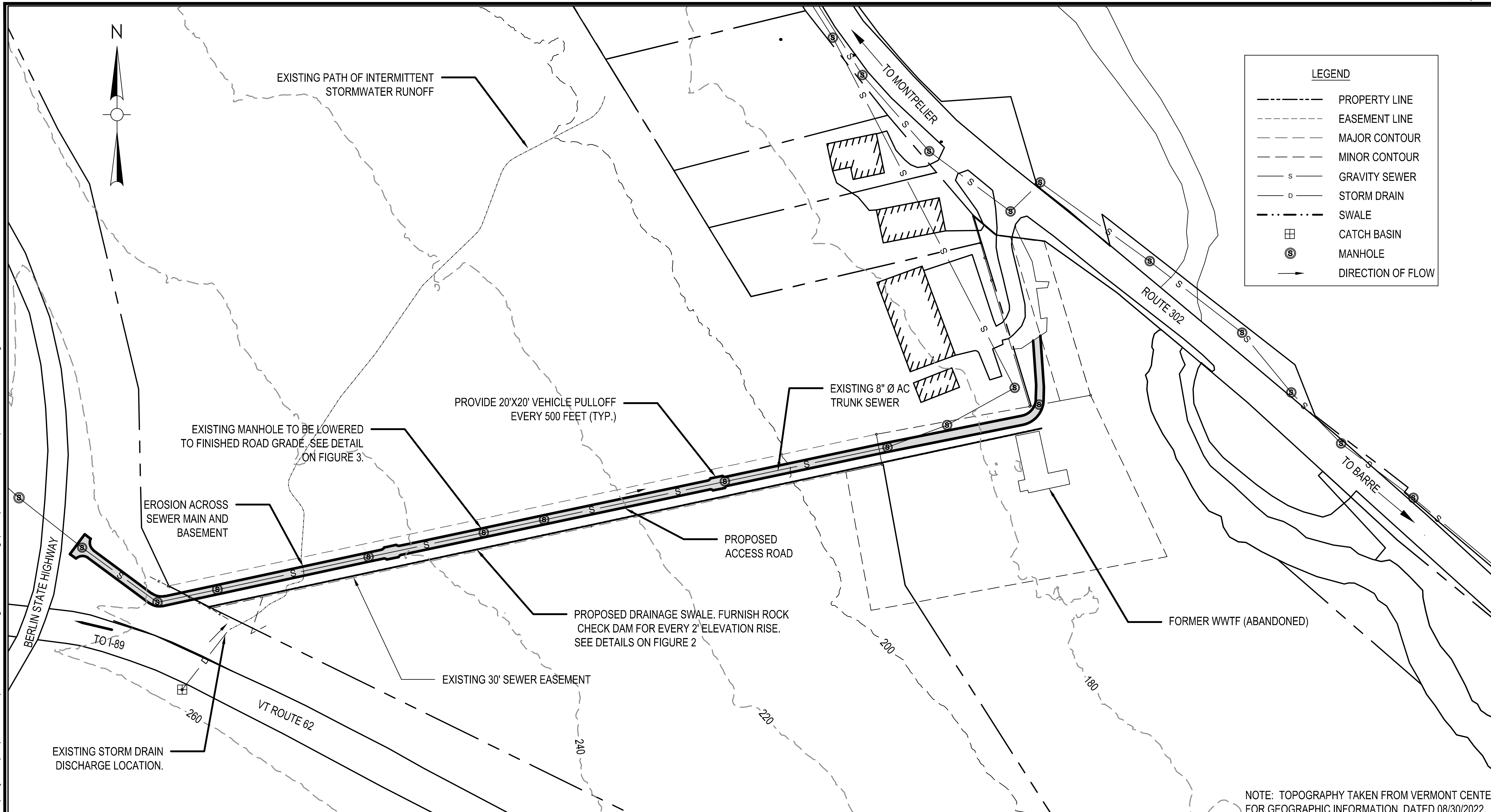
Device	Routing	Invert	Outlet Devices
#1	Primary	181.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=83.78 cfs @ 12.11 hrs HW=182.64' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 83.78 cfs @ 3.41 fps)

Pond 3P: energy dissipator



Access Road Details



NOTE: TOPOGRAPHY TAKEN FROM VERMONT CENTER FOR GEOGRAPHIC INFORMATION, DATED 08/30/2022.

150 75 0 150 300

SCALE: 1"=150'

NO	DATE	BY	DESCRIPTION
-	-	-	-

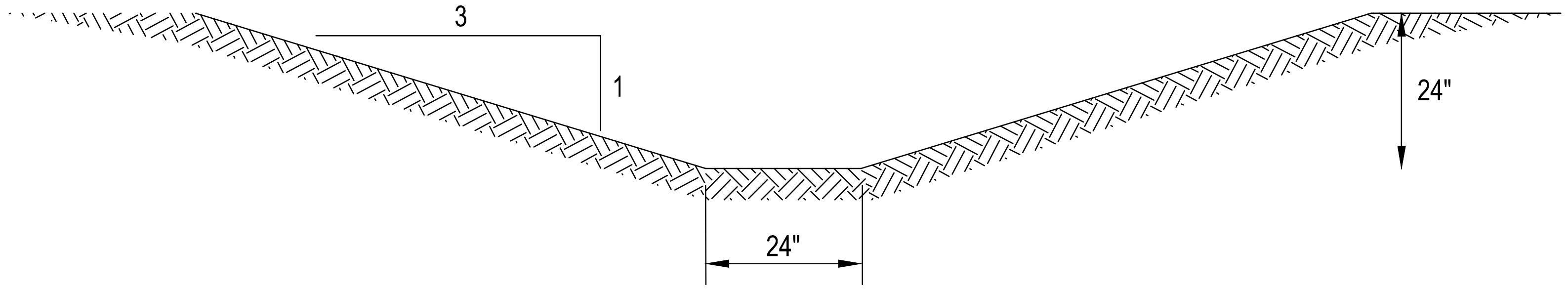
DRAWN BY: REG | CHK'D BY: SMM | 08/30/2022

Weston & Sampson

TOWN OF BERLIN, VT

FIGURE F-1: SEWER ACCESS ROAD

\\wse03.local\WSE\Projects\VT\Berlin, VT\2021 Asset Management Planning\CAD\berlin – swale repair 2021 0929.dwg

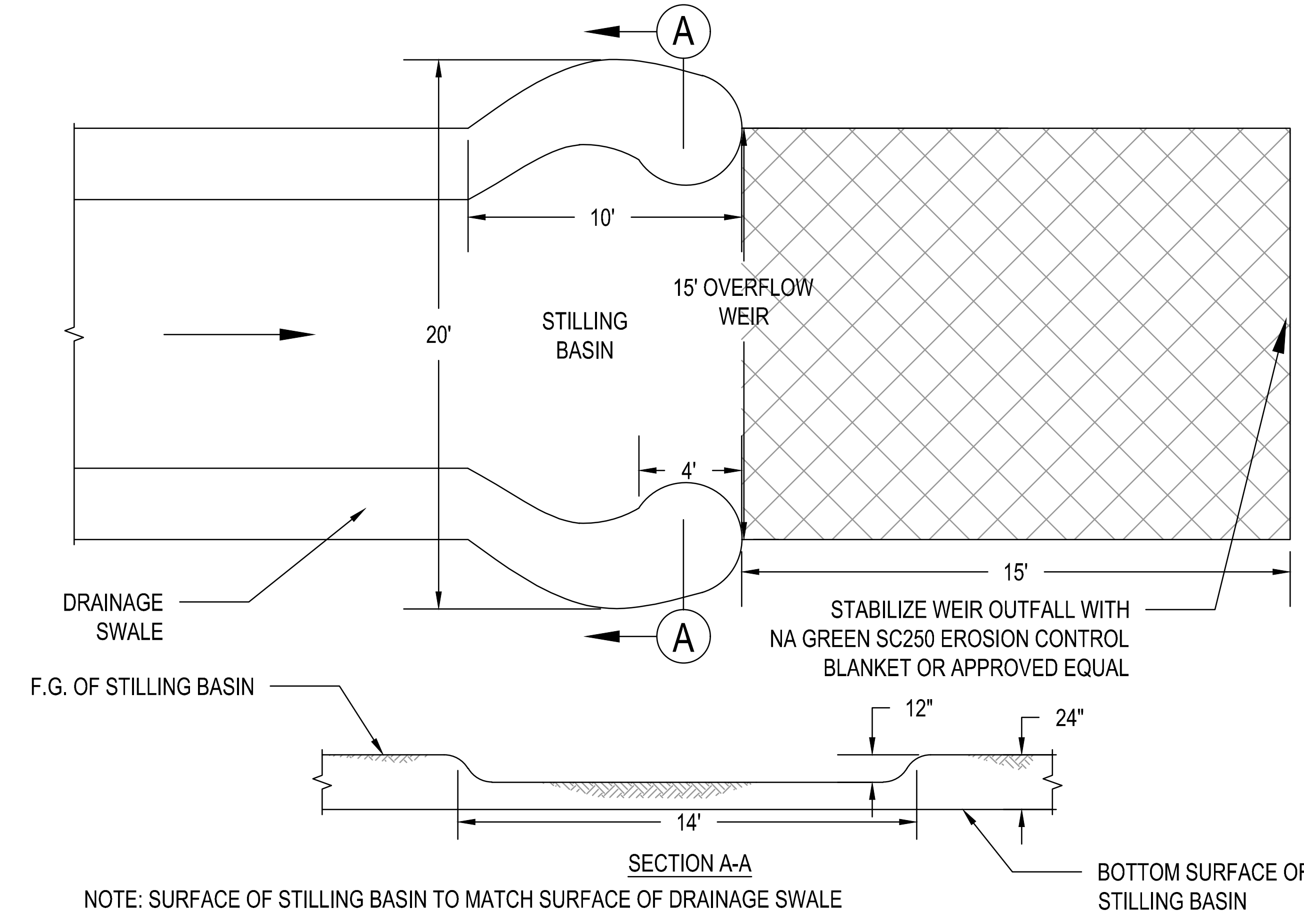


NOTES:

1. PROVIDE 6 INCHES (MIN) TOPSOIL TO SWALE.
2. INSTALL TURF REINFORCEMENT MAT (NORTH AMERICAN GREEN SC250 OR APPROVED EQUAL) ACCORDING TO MANUFACTURER'S INSTRUCTIONS.
3. USE TWIST ANCHORS TO SECURE MAT TO GROUND SURFACE.
4. SEED USING LD OLIVER CONSERVATION MIX (OR APPROVED EQUAL) AT A RATE OF 5 LBS/1,000 SF.

A VEGETATIVE SWALE DETAIL

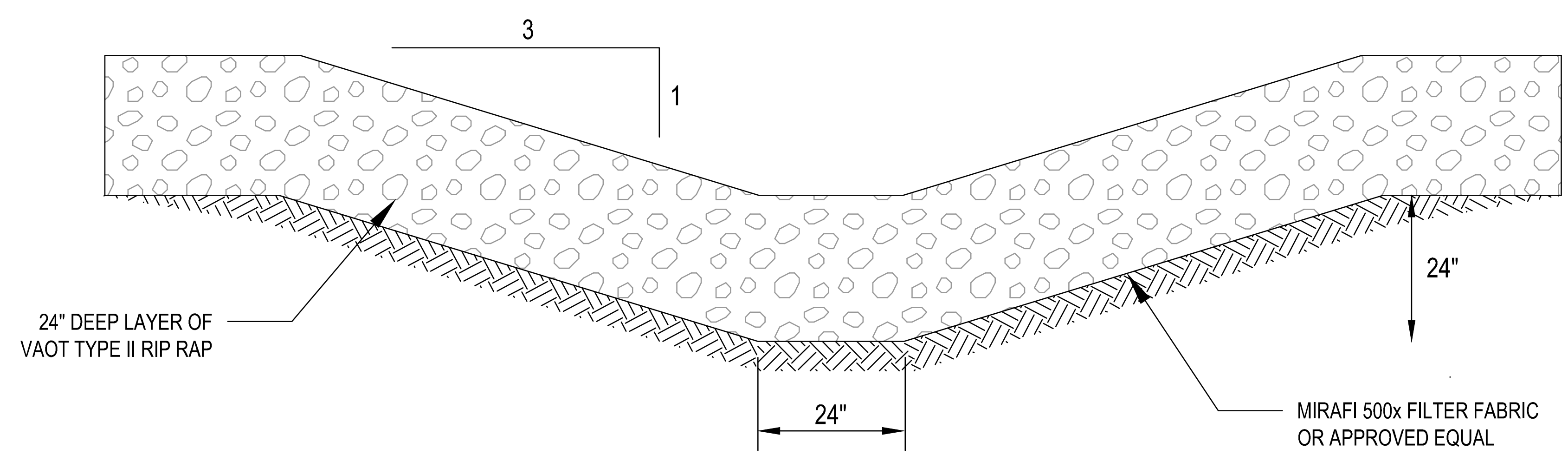
SCALE: N.T.S.



NOTE: SURFACE OF STILLING BASIN TO MATCH SURFACE OF DRAINAGE SWALE

C STORMWATER DISSIPATION DETAIL

SCALE: N.T.S.



B RIP RAP SWALE DETAIL

SCALE: N.T.S.

SCALE: N.T.S

NO	DATE	BY	DESCRIPTION
-	-	-	-

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TOWN OF BERLIN, VT

FIGURE F-2: STORMWATER DETAILS

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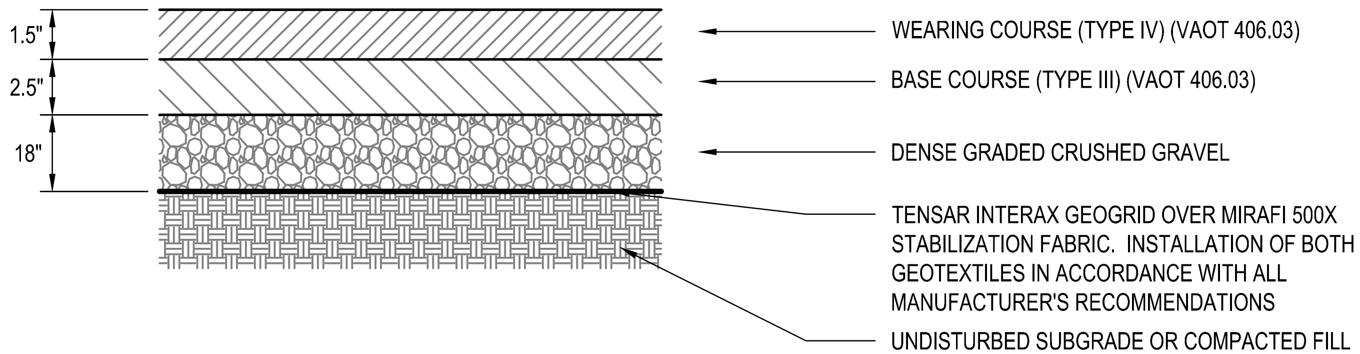
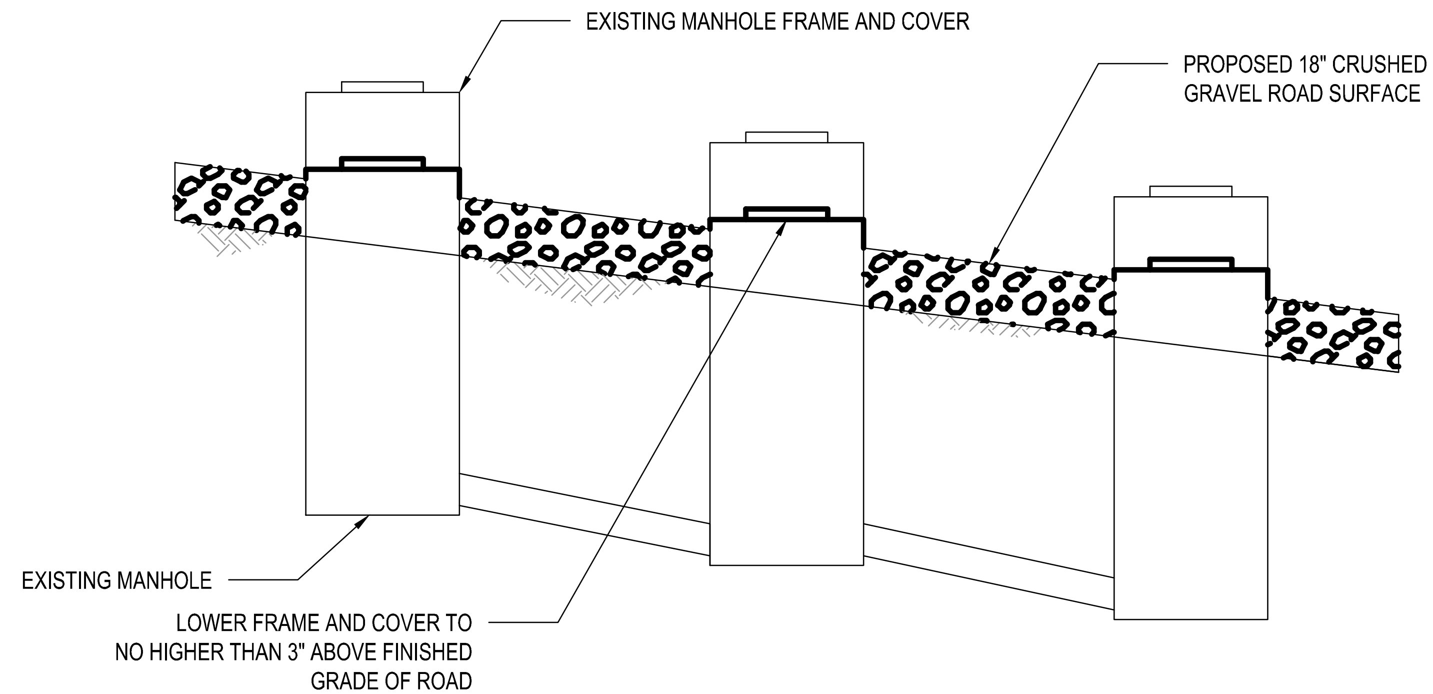
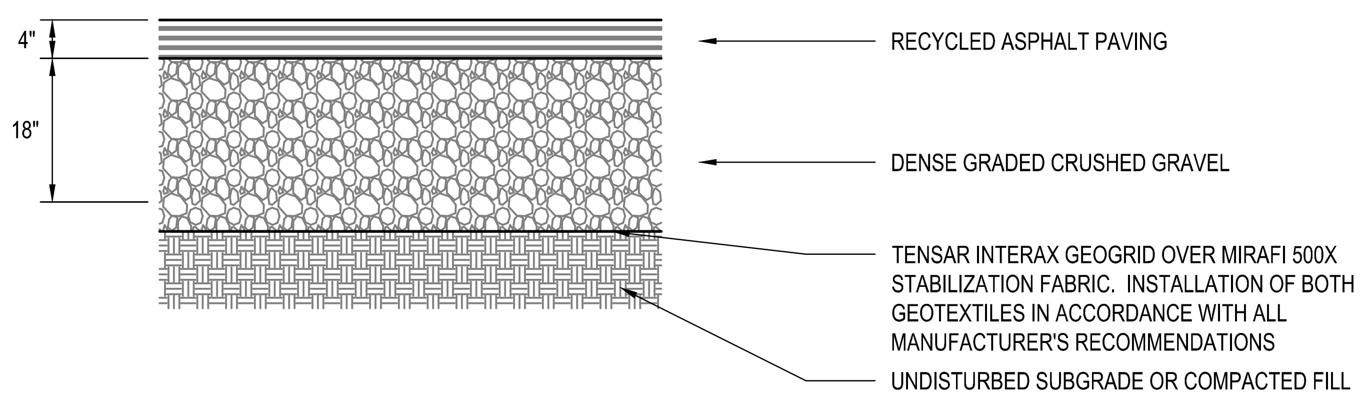


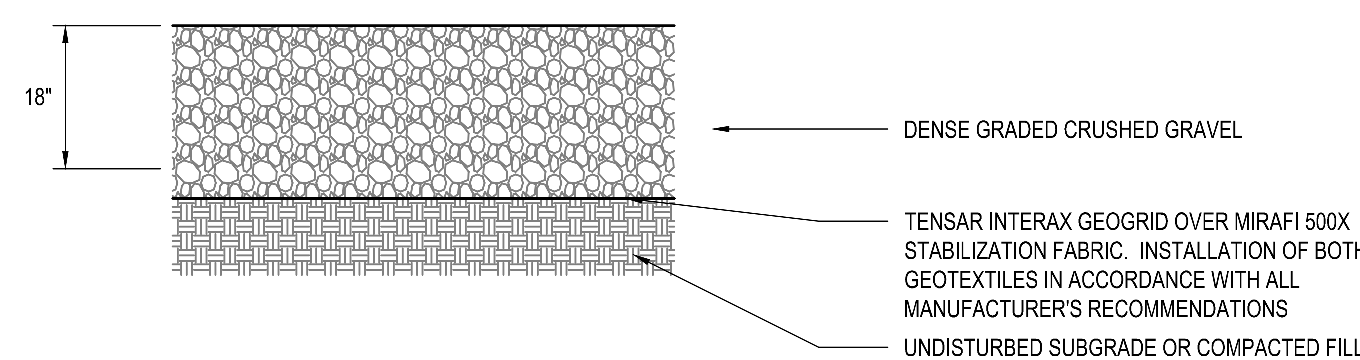
A TYPICAL BITUMIUNOUS PAVEMENT
SCALE: N.T.S.



D MNAHOLE MODIFICATION DETAIL
SCALE: N.T.S.



B TYPICAL RECYCLED ASPHALT PAVEMENT
SCALE: N.T.S.



C TYPICAL GRAVEL DRIVE
SCALE: N.T.S.

SCALE: N.T.S

NO	DATE	BY	DESCRIPTION
-	-	-	-

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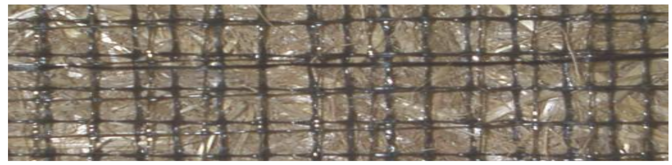
TOWN OF BERLIN, VT

FIGURE F-3:
ROAD DETAILS

Stormwater Management

ROLLMAX™
ROLLED EROSION CONTROL

Specification Sheet
VMax® SC250® Turf Reinforcement Mat



DESCRIPTION

The composite turf reinforcement mat (C-TRM) shall be a machine-produced mat of 70% straw and 30% coconut fiber matrix incorporated into permanent three-dimensional turf reinforcement matting. The matrix shall be evenly distributed across the entire width of the matting and stitch bonded between a heavy duty UV stabilized nettings with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings, an ultra heavy UV stabilized, dramatically corrugated (crimped) intermediate netting with 0.5 x 0.5 inch (1.27 x 1.27 cm) openings, and covered by an heavy duty UV stabilized nettings with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings. The middle corrugated netting shall form prominent closely spaced ridges across the entire width of the mat. The three nettings shall be stitched together on 1.50 inch (3.81cm) centers with UV stabilized polypropylene thread to form permanent three-dimensional turf reinforcement matting. All mats shall be manufactured with a colored thread stitched along both outer edges as an overlap guide for adjacent mats.

The SC250 shall meet Type 5A, 5B, and 5C specification requirements established by the Erosion Control Technology Council (ECTC) and Federal Highway Administration's (FHWA) FP-03 Section 713.18

Material Content		
Matrix	70% Straw Fiber	0.35 lb/sq yd (0.19 kg/sm)
	30% Coconut Fiber	0.15 lbs/sq yd (0.08 kg/sm)
Netting	Top and Bottom, UV-Stabilized Polypropylene	5 lb/1000 sq ft (2.44 kg/100 sm)
	Middle, Corrugated UV-Stabilized Polypropylene	24 lb/1000 sf (11.7 kg/100 sm)
Thread	Polypropylene, UV Stable	

Standard Roll Sizes		
Width	6.5 ft (2.0 m)	8 ft (2.44m)
Length	55.5 ft (16.9 m)	90 ft (27.4 m)
Weight ± 10%	34 lbs (15.42 kg)	70 lbs (31.8 kg)
Area	40 sq yd (33.4 sm)	80 sq. yd. (66.8 sm)

Index Property	Test Method	Typical
Thickness	ASTM D6525	0.62 in. (15.75 mm)
Resiliency	ASTM 6524	95.2%
Density	ASTM D792	0.891 g/cm³
Mass/Unit Area	ASTM 6566	16.13 oz/sy (548 g/sm)
UV Stability	ASTM D4355/ 1000 HR	80%
Porosity	ECTC Guidelines	99%
Stiffness	ASTM D1388	222.65 oz-in.
Light Penetration	ASTM D6567	4.1%
Tensile Strength – MD	ASTM D6818	709 lbs/ft (10.51 kN/m)
Elongation – MD	ASTM D6818	23.9%
Tensile Strength – TD	ASTM D6818	712 lbs/ft (10.56 kN/m)
Elongation – TD	ASTM D6818	36.9%
Biomass Improvement	ASTM D7322	441%

Design Permissible Shear Stress		
	Short Duration	**Long Duration**
Phase 1: Unvegetated	3.0 psf (144 Pa)	2.5 psf (120 Pa)
Phase 2: Partially Veg.	8.0 psf (383 Pa)	8.0 psf (383 Pa)
Phase 3: Fully Veg.	10.0 psf (480 Pa)	8.0 psf (383 Pa)
Unvegetated Velocity	9.5 fps (2.9 m/s)	
Vegetated Velocity	15 fps (4.6 m/s)	

Slope Design Data: C Factors			
	Slope Gradients (S)		
Slope Length (L)	≤ 3:1	3:1 – 2.1	≥ 2:1
≤ 20 ft (6 m)	0.0010	0.0209	0.0507
20-50 ft	0.0081	0.0266	0.0574
≥ 50 ft (15.2 m)	0.0455	0.0555	0.081

Roughness Coefficients – Unveg.	
Flow Depth	Manning's n
≤ 0.50 ft (0.15 m)	0.040
0.50 – 2.0 ft	0.040-0.012
≥ 2.0 ft (0.60 m)	0.011

NORTH AMERICAN GREEN®

Western Green
4609 E. Boonville-New Harmony Rd.
Evansville, IN 47725

nagreen.com
800-772-2040

Anticipated Costs

Berlin, Vermont - Sewer Access Road

Engineer's Opinion of Probable Cost - Option 2 (Rip Rap)

1/9/2023

Item No.	Description	Unit	Est. Qty.	Cost/Unit	Total Cost
1	General				
	Mobilization/Demobilization (5%)	L.S.	1	$ 15,000	$ 15,000
	Bonds & Insurance (8%)	L.S.	1	$ 24,000	$ 24,000
	General Conditions (5%)	L.S.	1	$ 15,000	$ 15,000
				General	$54,000
2	Site Work				
	Clearing/Site Prep	L.S.	1	$ 15,000	$ 15,000
	Rough Grading	C.Y.	5,730	$ 10	$ 57,000
	Gravel subbase	Ton	1,651	$ 35	$ 58,000
	Geotextile Fabric	S.F.	28,000	$ 0.50	$ 14,000
	Rip Rap	C.Y.	1,429	$ 75	$ 107,000
	Manhole Modification	Ea.	3,000	$ 8	$ 24,000
	Site Restoration & Erosion Control	L.S.	1	$ 25,000	$ 25,000
				Site Work	$300,000
	Construction Subtotal				$354,000
	Construction Contingency (30%)				$106,000
	Engineering (23%)				$81,000
	TOTAL OPINION OF PROJECT COST				$541,000

Notes:

1- *Engineering New Record (ENR) Construction Cost Index (CCI) for January 2021 is 11698.53*

2- *Subtotal amounts have been rounded to the next $1,000.*

3- *Overall anticipated project cost has been rounded to the next $10,000.*

4- *Anticipated costs have been developed based on similar recent projects, and equipment manufacturer's cost data.*

5- *Contractor's OH&P are included in the unit prices.*

6- *Project Costs do not include land acquisition, legal, or engineering fees*

7- *Project Costs do not include improvements to the existing access roads that need to be widened to accommodate the site's needs*

8- *Permit application fees are approximate based on current understanding of project scope*

Berlin, Vermont - Sewer Access Road

Engineer's Opinion of Probable Cost - Option 3 (ECB)

1/9/2023

Item No.	Description	Unit	Est. Qty.	Cost/Unit	Total Cost
1	General				
	Mobilization/Demobilization (5%)	L.S.	1	$ 6,800	$ 7,000
	Bonds & Insurance (8%)	L.S.	1	$ 10,880	$ 11,000
	General Conditions (5%)	L.S.	1	$ 6,800	$ 7,000
				General	$25,000
2	Site Work				
	Clearing/Site Prep	L.S.	1	$ 15,000	$ 15,000
	Rough Grading	C.Y.	5,730	$ 10	$ 57,000
	Gravel subbase	Ton	1,651	$ 35	$ 58,000
	Geotextile Fabric	S.F.	28,000	$ 0.50	$ 14,000
	Erosion Control Blanket	S.Y.	2,144	$ 4	$ 9,000
	Manhole Modification	Ea.	3,000	$ 8	$ 24,000
	Seeding	S.Y.	2,144	$ 2.80	$ 6,000
	Site Restoration & Erosion Control	L.S.	1	$ 25,000	$ 25,000
				Site Work	$136,000
	Construction Subtotal				$161,000
	Construction Contingency (30%)				$48,000
	Engineering (23%)				$37,000
	TOTAL OPINION OF PROJECT COST				$246,000

Notes:

1- *Engineering New Record (ENR) Construction Cost Index (CCI) for January 2021 is 11698.53*

2- *Subtotal amounts have been rounded to the next $1,000.*

3- *Overall anticipated project cost has been rounded to the next $10,000.*

4- *Anticipated costs have been developed based on similar recent projects, and equipment manufacturer's cost data.*

5- *Contractor's OH&P are included in the unit prices.*

6- *Project Costs do not include land acquisition, legal, or engineering fees*

7- *Project Costs do not include improvements to the existing access roads that need to be widened to accommodate the site's needs*

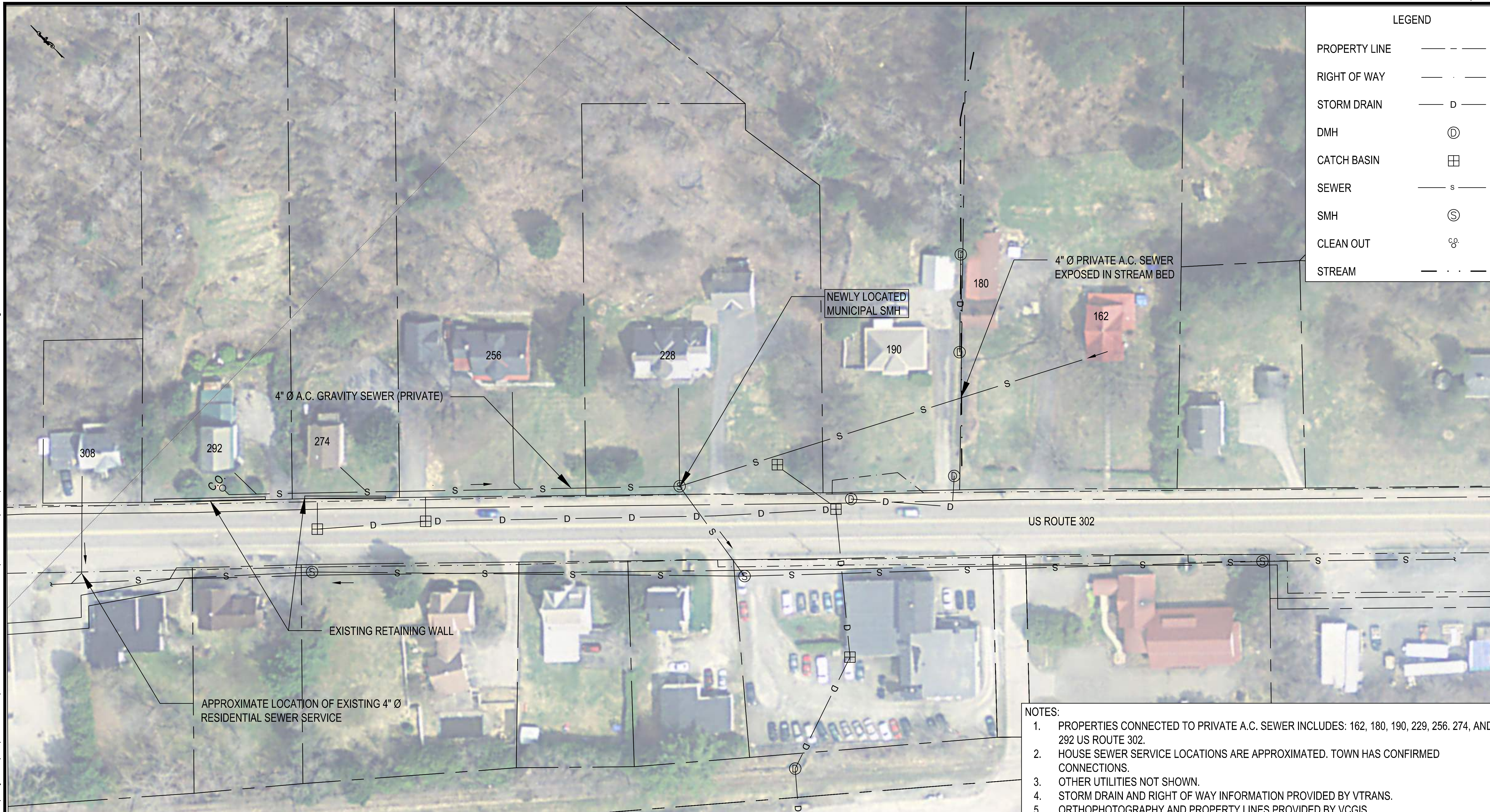
8- *Permit application fees are approximate based on current understanding of project scope*

APPENDIX G

Route 302 Sewerage Options

EXISTING CONDITIONS

Weston & Sampson



NOTES:

1. PROPERTIES CONNECTED TO PRIVATE A.C. SEWER INCLUDES: 162, 180, 190, 229, 256. 274, AND 292 US ROUTE 302.
2. HOUSE SEWER SERVICE LOCATIONS ARE APPROXIMATED. TOWN HAS CONFIRMED CONNECTIONS.
3. OTHER UTILITIES NOT SHOWN.
4. STORM DRAIN AND RIGHT OF WAY INFORMATION PROVIDED BY VTRANS.
5. ORTHOPHOTOGRAPHY AND PROPERTY LINES PROVIDED BY VCGIS.

70 35 0 70 140

SCALE: 1" = 70'

NO	DATE	BY	DESCRIPTION
-	-	-	-

DRAWN BY: REG | CHK'D BY: MAS | 01/06/2022

Weston & Sampson

TOWN OF BERLIN, VT

FIGURE G-1: ROUTE 302 EXISTING CONDITIONS PLAN

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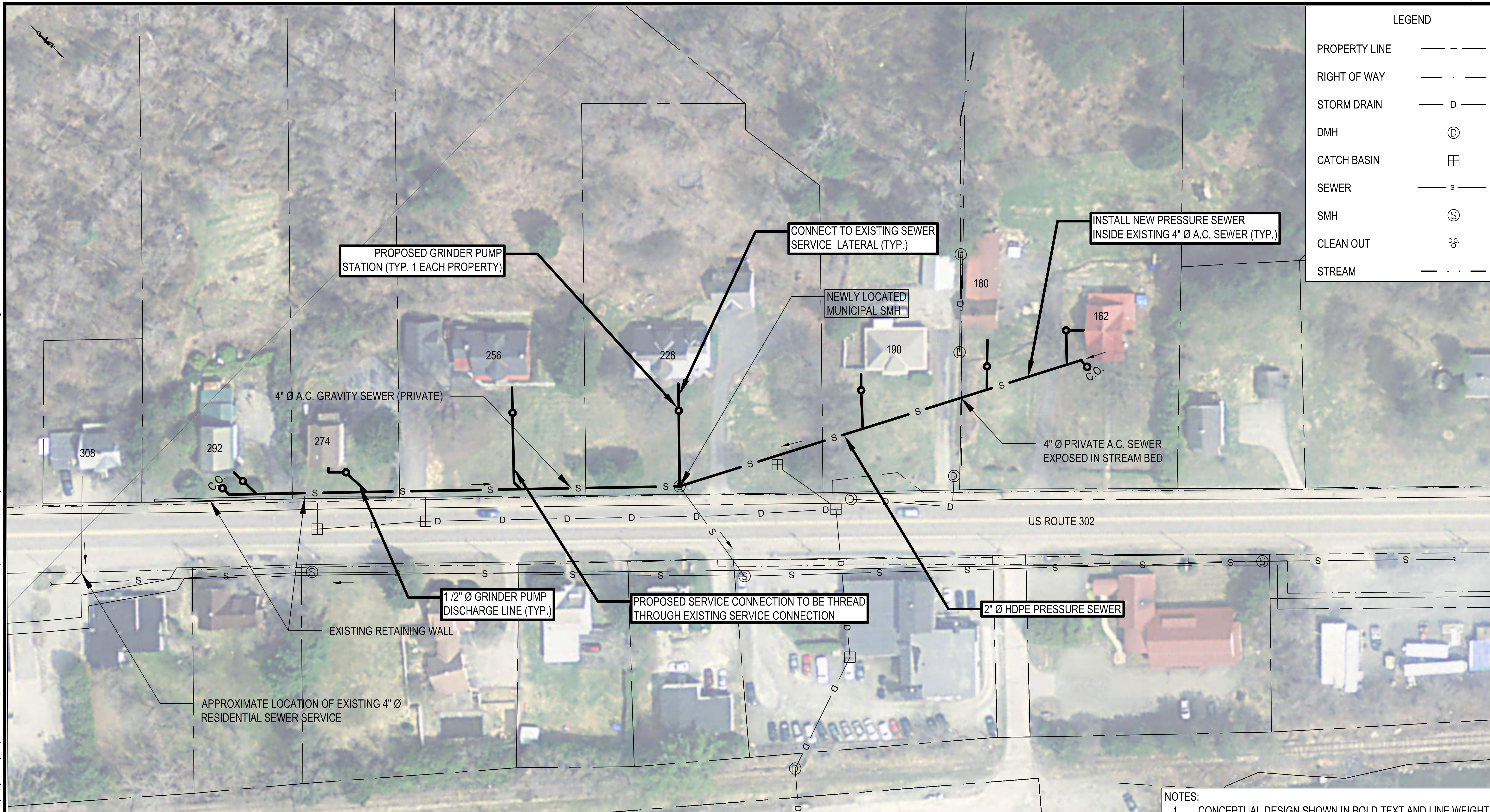
ALTERNATE 1

Low Pressure Sewer

Weston & Sampson



NOTES:
1. CONCEPTUAL DESIGN SHOWN IN BOLD TEXT AND LINE WEIGHT

70 35 0 70 140

SCALE: 1" = 70'

NO	DATE	BY	DESCRIPTION
-	-	-	-

DRAWN BY: REG | CHK'D BY: MAS | 01/06/2022

Weston & Sampson

TOWN OF BERLIN, VT

FIGURE G-2: ROUTE 302 ALTERNATE 1 LOW PRESSURE SEWER

\\wse03.local\WSE\Projects\VT\Berlin, VT\Route 302 Private Sewer Replacement\CAD\berlin - PS alternatives 2023 0110.dwg

Berlin, VT
PRELIMINARY OPINION OF CONSTRUCTION COST
Alternate 1 - Low-pressure Sewer

Item No.	Description	Unit	Est. Qty	Cost/Unit	Total Cost
1	**Contractor's General Conditions**				
	Mobilization/Demobilization (5%)	L.S.	1	$ 6,700.00	$ 6,700
	Bonds and Insurance (8%)	L.S.	1	$ 10,720.00	$ 10,800
	General Conditions (5%)	L.S.	1	$ 6,700.00	$ 6,700
				General Conditions Total	**$ 25,000**
2	**Grinder Pump Station**				
	Grinder Pump Station	Ea.	7	$ 1,500.00	$ 10,500
	Grinder Pump Station Install	Ea.	7	$ 3,500.00	$ 24,500
	Connection to Existing Service Laterals	Ea.	7	$ 250.00	$ 1,750
	Wiring and Controls	Ea.	7	$ 1,500.00	$ 10,500
	Excavation, Backfill and Compaction	Ea.	7	$ 2,000.00	$ 14,000
				Grinder Pump Station Total	**$ 62,000**
3	**Pressure Sewer**				
	2" HDPE Pressure Sewer Installed	L.F.	1,500	$ 12.00	$ 18,000
	1.5" Grinder Pump Discharge Line	L.F.	600	$ 10.00	$ 6,000
	Trenching for Discharge Lines	L.F.	600	$ 15.00	$ 9,000
	Excavation and Service Connection	Ea.	7	$ 3,000.00	$ 21,000
	Clean-outs	Ea.	2	$ 1,700.00	$ 3,400
	Interconnect to Existing Sewer MH	Ea.	2	$ 1,500.00	$ 3,000
				Pressure Sewer Total	**$ 61,000**
4	**Miscellaneous Site Work**				
	Armor Pressure Sewer Stream Crossing	L.S.	1	$ 6,500.00	$ 6,500
	Restoration of Growth	MSF	5.5	$ 200.00	$ 1,100
	Dispose of Broken Sections of AC Pipe	L.S.	1	$ 1,500.00	$ 1,500
	Patch Driveway Asphalt	S.F.	15	$ 120.00	$ 1,800
				Miscellaneous Site Work Total	**$ 11,000**
				Construction Total	**$159,000**
				Engineering and Project Development (23%)	$36,600
				Construction Contingencies (30%)	$58,700
				Obtain Easements	$35,000
				Legal and Admin.	$5,000
				TOTAL OPINION OF CONSTRUCTION COST	**$300,000**

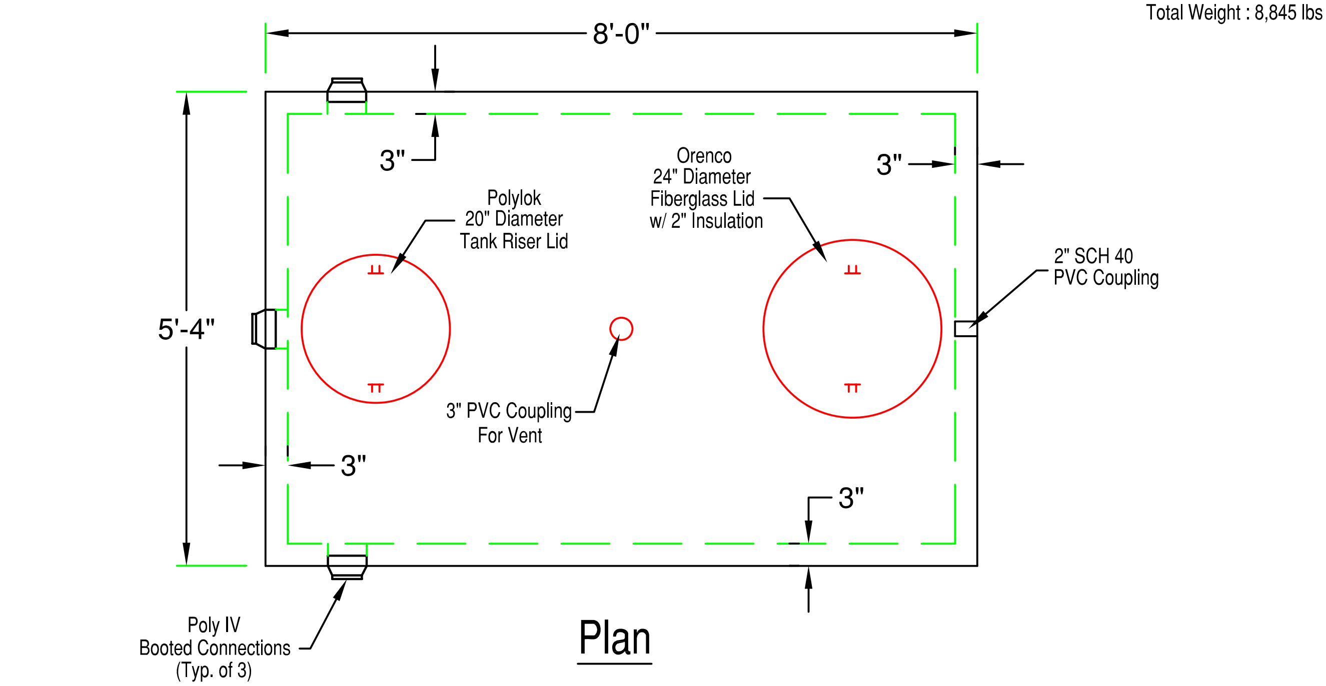
Notes:
1. ENR CCI for January 2023 is 13175.03
2. Subtotal amounts have been rounded to the next $1,000
3. Overall anticipated project costs have been rounded to the next $10,000
4. Anticipated costs have been developed based on recent similar projects, manufacture's equpiment costs, and RS Means database.
5. Project costs have been developed without the benefit of final design drawings. A 30% contingency should be carried.
6. Power costs covered by user.

ALTERNATE 2
Septic Tank Effluent Pump (STEP)

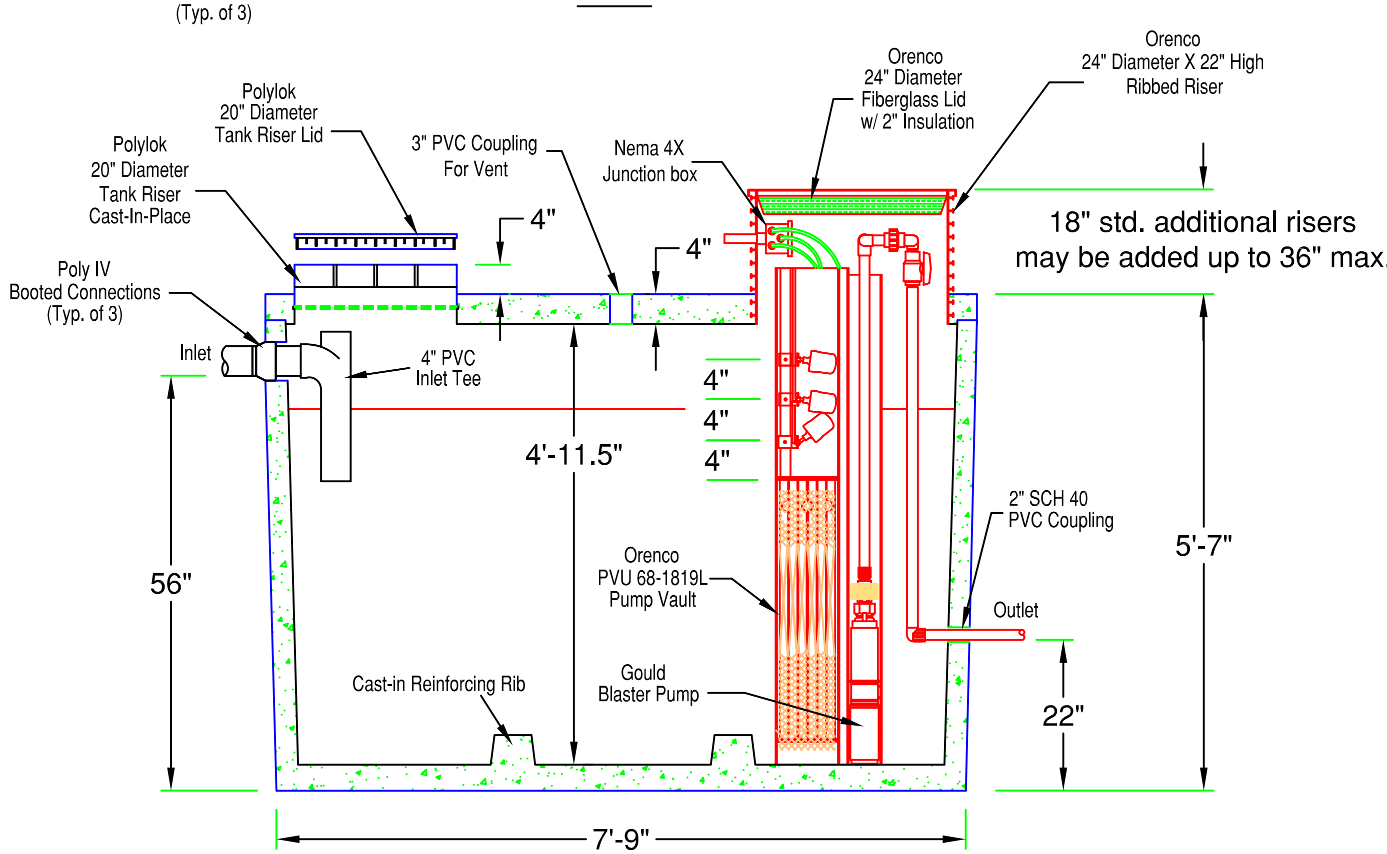
1000 Gallon (Single Compartment) Step

Seamless Step / Pump Tank (1000Step)

Total Weight : 8,845 lbs



Plan



Section

SPECIFICATIONS:

- Concrete Minimum Strength 5000psi @ 28 days
- Steel Reinforcement Grade 60
- Poly IV Booted Connections
- Top Seam Construction
- Weights Subject to Variation

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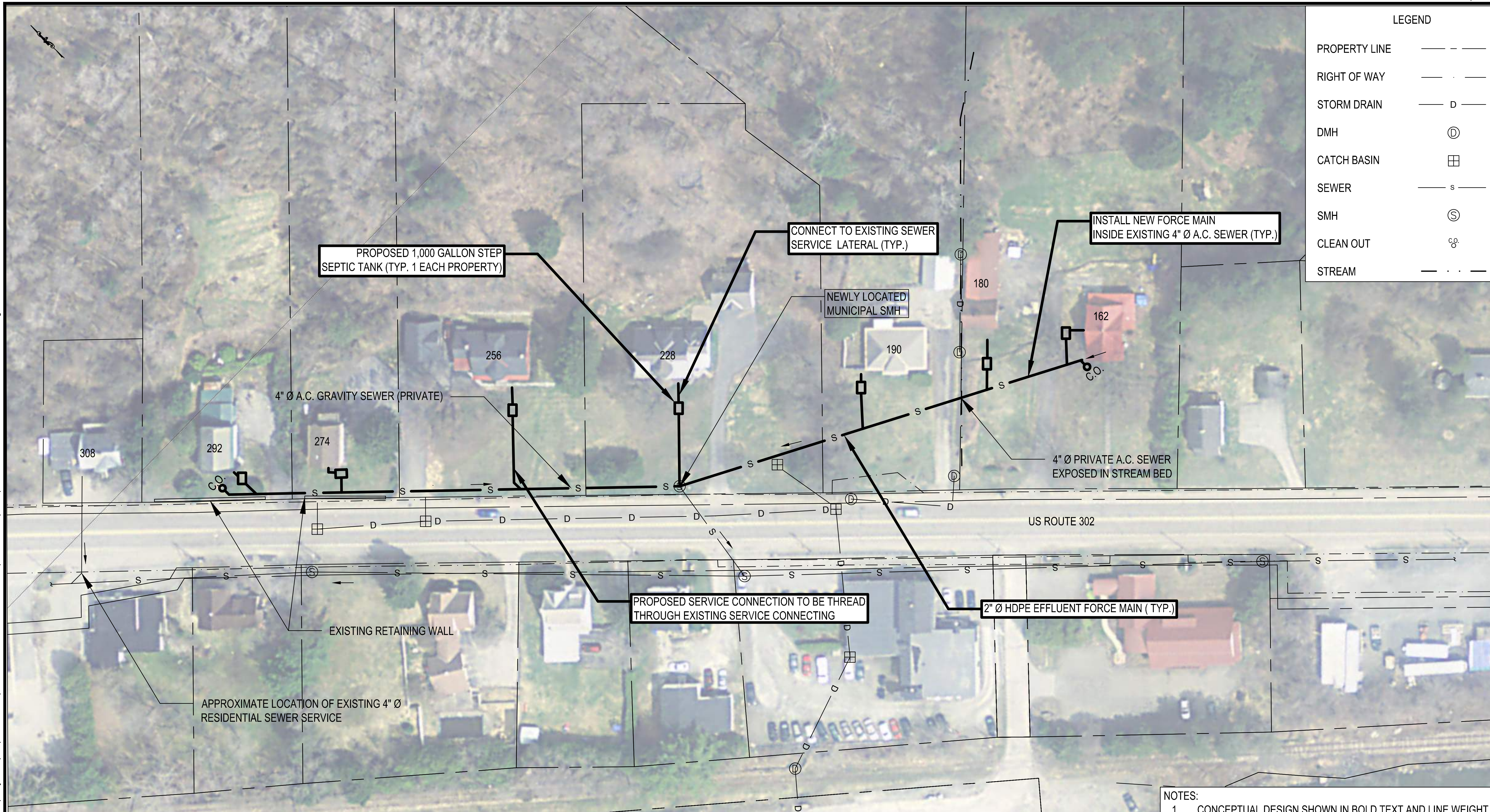

NOTES:
1. CONCEPTUAL DESIGN SHOWN IN BOLD TEXT AND LINE WEIGHT

70 35 0 70 140

SCALE: 1" = 70'

NO	DATE	BY	DESCRIPTION
-	-	-	-

DRAWN BY: REG | CHK'D BY: MAS | 01/06/2022

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TOWN OF BERLIN, VT

FIGURE G-3: ROUTE 302
ALTERNATE 2
SEPTIC TANK EFFLUENT PUMPING

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Berlin, VT
PRELIMINARY OPINION OF CONSTRUCTION COST
Alternate 2 - Septic Tank Effluent Pumping (STEP) System

Item No.	Description	Unit	Est. Qty	Cost/Unit	Total Cost
1	**Contractor's General Conditions**				
	Mobilization/Demobilization (5%)	L.S.	1	$ 7,500.00	$ 7,500
	Bonds and Insurance (8%)	L.S.	1	$ 12,000.00	$ 12,000
	General Conditions (5%)	L.S.	1	$ 7,500.00	$ 7,500
				General Conditions Total	**$ 27,000**
2	**STEP System**				
	1,000 gallon single compartment STEP	Ea.	7	$ 5,000	$ 35,000
	Connection to Existing Service Laterals	Ea.	7	$ 250.00	$ 1,750
	Wiring and Controls	Ea.	7	$ 1,500.00	$ 10,500
	Excavation, Backfill and Compaction	Ea.	7	$ 4,700.00	$ 32,900
				STEP System Total	**$ 81,000**
3	**Septic Tank Effluent Force Main**				
	2" HDPE Force Main Installed	L.F.	1,500	$ 12.00	$ 18,000
	1.5" STEP Discharge Line	L.F.	500	$ 10.00	$ 5,000
	Trenching for Discharge Lines	L.F.	500	$ 15.00	$ 7,500
	Excavation and Service Connection	Ea.	7	$ 3,000.00	$ 21,000
	Clean-outs	Ea.	2	$ 1,700.00	$ 3,400
	Interconnect to Existing Sewer MH	Ea.	2	$ 1,500.00	$ 3,000
				Septic Tank Effluent Force Main Total	**$ 58,000**
4	**Miscellaneous Site Work**				
	Armor Force Main Stream Crossing	L.S.	1	$ 6,500.00	$ 6,500
	Restoration of Growth	MSF	6	$ 200.00	$ 1,200
	Dispose of Broken Sections of AC Pipe	L.S.	1	$ 1,500.00	$ 1,500
	Patch Driveway Asphalt	S.F.	15	$ 120.00	$ 1,800
				Miscellaneous Site Work Total	**$ 11,000**
				Construction Total	**$177,000**
				Engineering and Project Development (23%)	$40,700
				Construction Contingencies (30%)	$65,300
				Obtain Easements	$35,000
				Legal and Admin.	$5,000
				TOTAL OPINION OF CONSTRUCTION COST	**$330,000**

Notes:

1. *ENR CCI for January 2023 is 13175.03*
2. *Subtotal amounts have been rounded to the next $1,000*
3. Overall anticipated project costs have been rounded to the next $10,000
4. *Anticipated costs have been developed based on recent similar projects, manufacture's equpiment costs, and RS Means database.*
5. *Project costs have been developed without the benefit of final design drawings. A 30% contingency should be carried.*
6. *Power costs covered by user.*

ALTERNATE 3

Conventional Gravity Sewer

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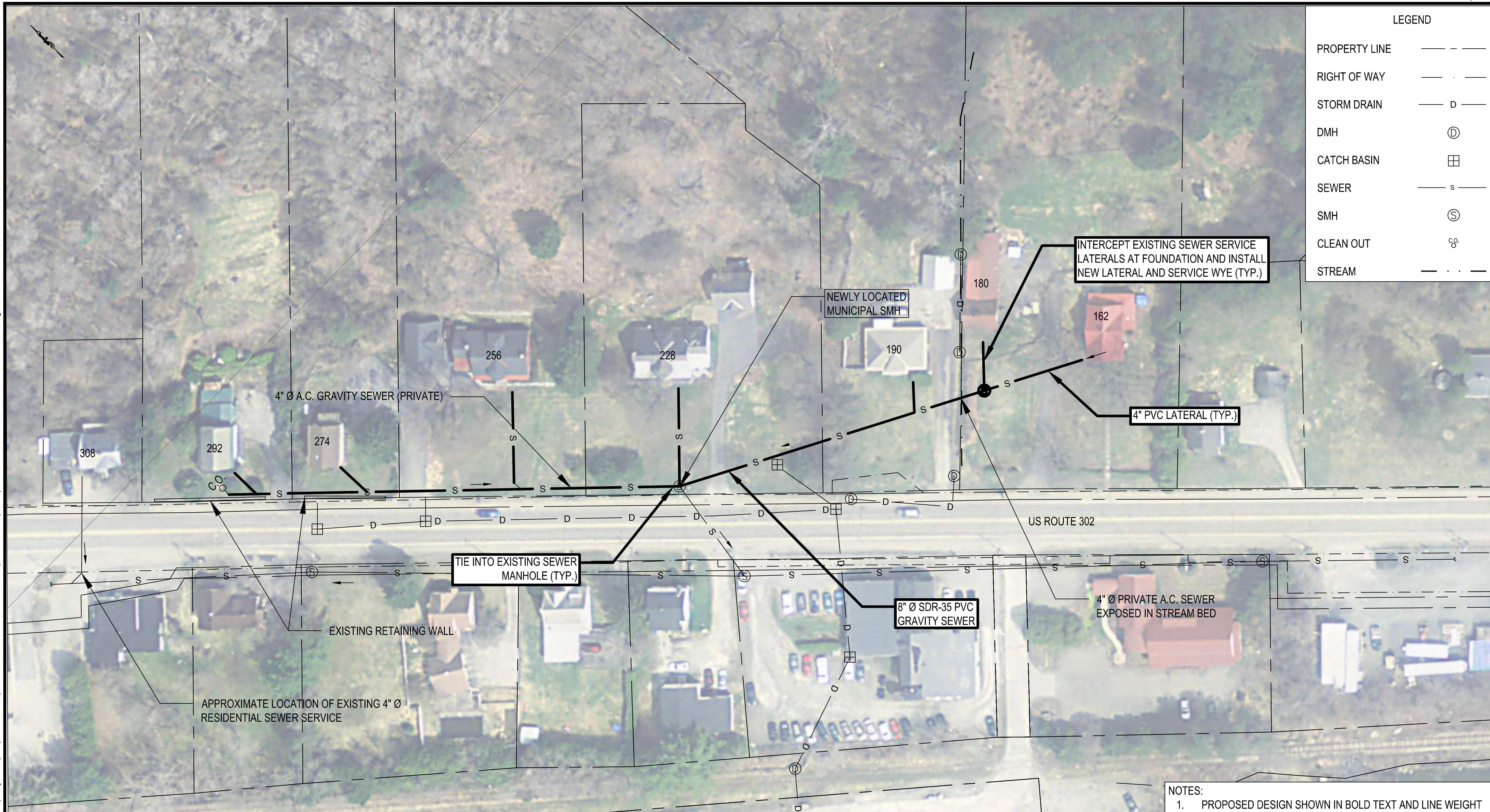

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70 35 0 70 140

SCALE: 1" = 70'

NO	DATE	BY	DESCRIPTION
-	-	-	-

DRAWN BY: REG | CHK'D BY: MAS | 01/06/2022

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TOWN OF BERLIN, VT

FIGURE G-4: ROUTE 302
ALTERNATE 3
GRAVITY SEWER

Berlin, VT
PRELIMINARY OPINION OF CONSTRUCTION COST
Alternate 3 - Conventional Gravity Sewer

Item No.	Description	Unit	Est. Qty	Cost/Unit	Total Cost
1	**Contractor's General Conditions**				
	Mobilization/Demobilization (5%)	L.S.	1	$ 28,050.00	$ 28,100
	Bonds and Insurance (8%)	L.S.	1	$ 44,880.00	$ 44,900
	General Conditions (5%)	L.S.	1	$ 28,050.00	$ 28,100
				General Conditions Total	**$ 102,000**
2	**Gravity Sewer**				
	8" SDR-35 PVC Gravity Sewer Line	L.F.	1,300	$ 80	$ 104,000
	4" SDR-35 PVC House Service Laterals	L.F.	750	$ 65	$ 48,800
	Connection to Existing Service Laterals	Ea.	7	$ 250.00	$ 1,750
	4' Pre-cast Concrete Sewer MH	Ea.	3	$ 6,500.00	$ 19,500
	Connect to Existing Sewer MH	Ea.	2	$ 3,200.00	$ 6,400
	Excavation, Backfill and Compaction	Ea.	7	$ 4,700.00	$ 32,900
	Armor Stream Crossing	L.S.	1	$ 6,500.00	$ 6,500
				Gravity Sewer Total	**$ 220,000**
3	**Miscellaneous Site Work**				
	Remove/Store/Replace Granite Curb	L.F.	750	$ 25.00	$ 18,750
	Remove/Store/Reconstruct Granite Wall	L.F.	225	$ 650.00	$ 146,250
	Construct New CIP Concrete Footer for Wall	C.Y.	120	$ 850.00	$ 102,000
	Patch Driveway Asphalt	S.F.	15	$ 120.00	$ 1,800
	Restoration of Growth	MSF	5.5	$ 200.00	$ 1,100
	Dispose of all Existing AC Pipe	Ton	4.7	$ 1,000.00	$ 4,700
	Patch Route 302 Shoulder Asphalt	S.Y.	250	$ 120.00	$ 30,000
	Line Striping	L.F.	10	$ 250.00	$ 2,500
	Traffic Control	Day	1,100	$ 30.00	$ 33,000
				Miscellaneous Site Work Total	**$ 341,000**

Construction Total	**$663,000**
Engineering and Project Development (23%)	$152,500
Construction Contingencies (30%)	$244,700
Obtain Easements	$35,000
Legal and Admin.	$5,000
TOTAL OPINION OF CONSTRUCTION COST	**$1,110,000**

Notes:

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3. Overall anticipated project costs have been rounded to the next $10,000

4. Anticipated costs have been developed based on recent similar projects, manufacture's equpiment costs, and RS Means database.

5. Project costs have been developed without the benefit of final design drawings. A 30% contingency should be carried.