SHAKER LANDING
PUMP STATION O & M MANUAL
VOLUME I
OPERATIONAL AND MAINTENANCE NARRATIVE

LANDING ROAD

ROUTE 4A SEWER EXTENSION PROJECT
ENFIELD, NEW HAMPSHIRE
GRAFTON COUNTY
NHDES CWSRF PROJECT NUMBER CS-330167-04
USDA RURAL DEVELOPMENT PROJECT

DECEMBER 7, 2018
(Project No. 10068-05)

Prepared by

Pathways Consulting, LLC
Project No. 10068-05

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CHAPTER 1 – INTRODUCTION

1.1 PURPOSE OF MANUAL

This Operation and Maintenance (O&M) Manual is written specifically for the Town of Enfield (Town) Shaker Landing Pump Station located just off Landing Road in Enfield, New Hampshire. In this document the O&M Manual will be referred to as the manual, and the Shaker Landing Pump Station as the pump station. The purpose of this manual is to provide the Town Public Works Department personnel with information related to the design, equipment specification, operation, and maintenance of the pump station and related equipment systems.

The manual will facilitate the efficient operation of the pump station in compliance with the Town Municipal Sewer Ordinance, the New Hampshire Department of Environmental Services (NHDES) Code of Administrative Rules section Env-Wq 700 *Standards of Design and Construction for Sewerage and Wastewater Treatment Facilities*, and other applicable Environmental Protection Agency (EPA) requirements.

1.2 USE AND UPDATING INFORMATION FOR THIS MANUAL

The manual has been formatted to provide ready access to key information related to the pump station basis of design, the specific equipment design specifications and details, equipment supplier's recommended operation and maintenance procedures, monitoring and control systems, and other information related to safety, emergency response, and recordkeeping. The format complies with and generally follows the NHDES *Pump Station O and M Manual Review Checklist* and the requirements of NHDES Env-Wq 705.10 *Sewage Pumping Station Operation and Maintenance Manual.*

The manual is intended to be utilized by trained Town wastewater operators and maintenance personnel. It is recommended that these technical personnel read particular sections related to the operation of the pump station in detail, and become generally familiar with the information contained in the appendices and other reference sections. Where appropriate reduced size copies of design and construction documents are provided for reference, and photographs are included to identify specific equipment systems. This manual is not intended to replace installation, operation, maintenance, or troubleshooting guides provided specifically by equipment manufacturers or suppliers. This information is provided in the Appendices in Volume II and should be consulted by Town personnel.

This manual is intended to be a working document that allows amendment and modifications when equipment or operating parameters change. For this reason the manual is presented in a three-ring binder format to allow easy insertion of revised pages or other required information. The document is presented in three volumes with the first volume being the core operational and maintenance narrative; and the second volume containing reference materials such as drawings, specifications, forms, and product submittals; and the third volume containing manufacturer supplied operating and maintenance materials.

1.3 ABBREVIATIONS

The following abbreviations are used throughout this manual:

1Ø,3Ø	Single Phase Power, Three Phase Power
ADF	Average Daily Flow
CFM	Cubic Feet Per Minute, AR
EPA or USEPA	United States Environmental Protection Agency
FPS	Feet Per Second
GPH	Gallons Per Day
GPM	Gallons Per Minute
HP	Horsepower
I/I	Infiltration or Inflow
kW	Kilowatts of Power
LF	Linear Feet
NHDES	New Hampshire Department of Environmental Services
NPDES	National Pollutant Discharge Elimination System
PHF	Peak Hourly Flow or Peak Flow
SSO	Sanitary Sewer Overflow
SS	Stainless Steel
TDH	Total Dynamic Head
V	Volts

1.4 BASIS OF DESIGN SUMMARY

Table 1-1 summarizes the basis of design and construction for the pump station and associated equipment systems. The individual systems are described further in following sections of this manual.

Pump Station General Information			
Site and System ID	Shaker Landing Pump Station		
Location	Landing Road, Enfield, New Hampshire		
Site Operator	Town of Enfield Public Works Department		
Number of Connections	6 buildings, 3 units each, 3 bedrooms per unit (present) No planned future interconnections		
Average Daily Flow Rate	8,100 gallons per day		
Average Daily Flow Rate	5.6 gallons per minute (based on 24 hour operation)		
Design Peaking Factor	6.0		
Design Inflow Rate	34 gallons per minute		
Design Pump Flow Rate	120 gallons per minute (each pump in duplex system)		
Type of Operation	Continuous		
Pump Station and Related Equipment			
Description	**Size/Capacity**	**Quantity**	**Year Constructed**
Wet Well Pump Station	8'-0" x 6'-0" x 10'-4" deep precast concrete with removable aluminum inlet basket, mechanical ventilation, SS access hatch	1	2018
Solids Handling	EBARA Model 80DLMFU62.2	2	2018

Submersible Pumps, rail mounted with break away discharge flange	120 gpm at 29 feet TDH 3-inch discharge Impeller 7.40" 3 HP, 1800 RPM, 230V 3Φ		
Valve Vault	8'-0" x 6'-0" x 8'-0" deep precast concrete, mechanical ventilation, SS access hatch	1	2018
Valve Vault Sump Pump	Myers Model MS33T10,1-1/2-inch discharge; Max. 25 gpm at 14 feet TDH 1/3 HP, 115V, 1Φ	1	2018
Valve Vault Flow Meter	Foxboro Model 9300A 4-inch magnetic flowmeter rated for 55 to 1100 gpm flow range, output to pump station control enclosure	1	2018
Pump Controller	MPE Inc. Model SC100 Station Controller	1	2018
SCADA/Telemetry	No SCADA system installed; Local alarm light and horn and a Sensaphone Moel 1400 telephone installed.	1	2018
Emergency Generator	Generac QT Series, 25kW, propane fired, with transfer switch	1	2018
Gravity Sewers	8-inch SDR 35 PVC, with manholes	240 LF	2018
Force Main	4-inch SDR21 PVC, IPS	300 LF	2018

Table 1-1: Basis of Design Summary

1.5 PROJECT DESCRIPTION

Shaker Landing is a residential condominium development located off of Route 4A and accessed by Landing Road. It is located directly on the south central shore of Mascoma Lake with a total lake frontage of about 700 feet. Shaker Landing consists of six three-unit condominium buildings that was served by an existing gravity sewer collection system and pump station. As part of this project, the Shaker Landing pump station was replaced with a a system having upgraded capacity, emergency power backup, and updated monitoring and controls. A short extension of 8-inch diameter gravity sewer was connected at the former pump station location and routed to the new pump station wet well. A duplex pumping system transfers sewage from the development via a 4-inch force main to a connection point on the adjacent, existing municipal gravity sewer system. This existing gravity sewer system discharges into a Town-owned pump station located on N.H. Route 4A.

The system includes the following major components:

- Existing four-inch building connections, gravity collection sewer, and manholes providing collection of sanitary sewage flow from the six building locations;

- A new eight-inch gravity collection sewer, and manholes transferring flow from the former pump station location to the new Shaker Landing Pump Station;
- A pump station located at the northeast corner of the Shaker Landing complex consisting of a control and electrical enclosure, an emergency generator and fule tank, a duplex pump wet well structure, and a valve vault; and
- A four-inch force main that ties into the existing municipal gravity sewer collection system within the development.

Where it was feasible, the design utilized portions of existing gravity sewers within the Shaker Landing complex, tying these into the new sanitary sewer collection extensions to the new pump station and force main system. The existing on-site septic tanks, pump station, and force main were removed from service and abandoned in place after cleaning by filling with flowable fill.

The project is funded by the NHDES Clean Water State Revolving Loan Fund (CWSRF), USDA Rural Development loans and grants, and other funding agreements approved by the Town of Enfield. The NHDES CWSRF project identification number is CS-330167-04. The Town rebid this portion of the project in November 2017 and ultimately awarded the construction contract to Conkley Enterprises, Inc. Conkley Enterprises began construction in November 2017 with the project substantial completion in early 2018.

1.6 SITE LOCATION MAPS

The following figures are attached at the end of this chapter and portray the project on an overall USGS location plan and aerial photographs:

- Figure 1 USGS Location Map
- Figure 2 Shaker Landing Pump Station and Sewer Connection Plan

1.7 SERVICE AREA DESCRIPTIONS

The Shaker Landing pump station is intended to serve the existing 6 condominium buildings including a total of 18 units located within the Shaker Landing complex. Part of the existing and all of the new gravity collection system serving these buildings is shown on plan Sheet 11 in Appendix 2. The location of existing building service lines, existing and new sanitary manholes, and other structures is included on those plan sheets. The profile for the new gravity sewer is also shown on Sheet 11 included in Appendix 2. All current service connections are residential use.

At this time there are no other service areas connected into the gravity sewer collection system or force main. The existing site is fully developed and it is not anticipated that there will be any future increase in service connections. The force main plan and profile is shown on Sheet 11 in in Appendix 2.

1.8 DESIGN CRITERIA

The pump station was designed to provide transfer of sanitary sewage from the Shaker Landing complex. Currently this consists of 18 units in 6 buildings, with the current site

fully built out. Table 1-2 summarizes the design flow rates from the Shaker Landing complex and the design of the pump station. Unit flows are taken from recommended flow rates contained in the NHDES Env-Wq 700 as modified by historic site water usage metering. The pump flow rate is set at approximately three times the anticipated peak flow rate to allow standard cycling of pump and to achieve minimum flow velocities in force main for scouring.

Total Units	Flow Rate Per Unit	Total Flow Rate	Comment
18	450 gpd each	8,100 gpd	Average Daily Flow – Design
-----	-----	5.6 gpm	Based on ADF Current, 24 hrs/day
-----	-----	34 gpm	Peak Flow Rate Current, 6.0 peaking factor
-----	-----	**120 gpm**	**Pump Flow Design Rate, each pump**

Table 1-2: Pump Station Design Flow

Table 1-3 summarizes the design of the pump station wet well and the operation of the duplex pump system. The station is designed to run with one pump on line at a time, and to alternate pumps every required pumping cycle to subject each unit to approximately the same wear rate. The maximum design operating level of the wet well is to the bottom of the inlet gravity sewer line. If the level continues to rise above this, sewage will back up into the collection system. This is not anticipated to occur since the pumping station is equipped with an emergency generator and an automatic transfer switch that will maintain operation of the station during power outages. The generator system uses propane fuel supplied from a 1,000 gallon aboveground propane tank. At peak power output a full tank will allow about eight days of operation, and at 50% power output a full tank will provide almost 14 days of operation.

Wet Well Elevation	Wet Well Volume	Operating Mode	Comment
748.33	Empty	Pump Station Off Line	
749.33	247 gallons +/-	All Pumps Off – Override Controls	Low Water Alarm
750.33	539 gallons +/-	Normal Lead Pump Shutoff	Pump Off Setpoint
751.33	876 gallons +/-	Lead Pump On	Lead Pump On Setpoint
752.33	1,235 gallons +/-	Lag Pump On	Lag Pump On Setpoint High Level Alarm
753.33	1,594 gallons +/-	Wet Well Max. Operating Level	To Inlet Invert Elevation
758.66	3,508 gallons+/-	Wet Well Full	To Bottom of Cover Overflow Immanent

Table 1-3: Wet Well Design

The design operating point of the installed sewage pumps is 120 gallons per minute at 29.0 feet Total Dynamic Head (TDH). There is about 337 gallons of volume between the lead pump start depth and the lead pump stop depth. At the rated flow rate this will facilitate pump down in about 3 to 5 minutes at peak inlet flow. Typically the flow will be less during off peak hours and pump down will take less time. During peak flow hours the pump is designed to operate about 50% of the time, between three and four cycles per peak hour. It is important to maintain frequent emptying of the tank to minimize the potential for odor buildup since there is no odor control system installed.

The US EPA design guidelines for force mains recommends an operating velocity of six to nine feet per second. The NHDES Env-Wq 700 requires a minimum force main velocity of two feet per second to maintain scouring velocities, and a minimum diameter of four inches for the amount of units connected. Other design documents recommend a minimum flow velocity of three feet per second, with a maximum velocity of 10 fps. Above this velocity the friction loss in the piping contributes to significantly higher power costs to pump the sewage.

The force main from the pump station to the discharge manhole located along Landing Road is four-inch diameter, ductile iron pipe size (DIPS), SDR-21 wall thickness with an operating pressure rating of 200 psig. The force main has been sized for the current connected flow. This is summarized in Table 1-4.

Description	Total Units	Maximum Flow Rate	Calculated Velocity
Current Shaker Landing Complex – 6 Buildings	18	120 gpm	2.7 fps
EPA Recommended Velocity Range	-----	266 to 400 gpm	6.0 to 9.0 fps
Minimum Required Velocity for Scour	-----	89 to 133 gpm	2.0 to 3.0 fps
Maximum Design Velocity, Pressure Loss	-----	444 gpm	10.0 fps

Table 1-4: Force Main Design Velocities

1.9 CHAIN OF COMMAND STRUCTURE

The Shaker Landing pump station and force main is a municipally owned and operated system, managed and operated by the Town of Enfield Public Works Department. The normal chain of command and contact information is summarized below.

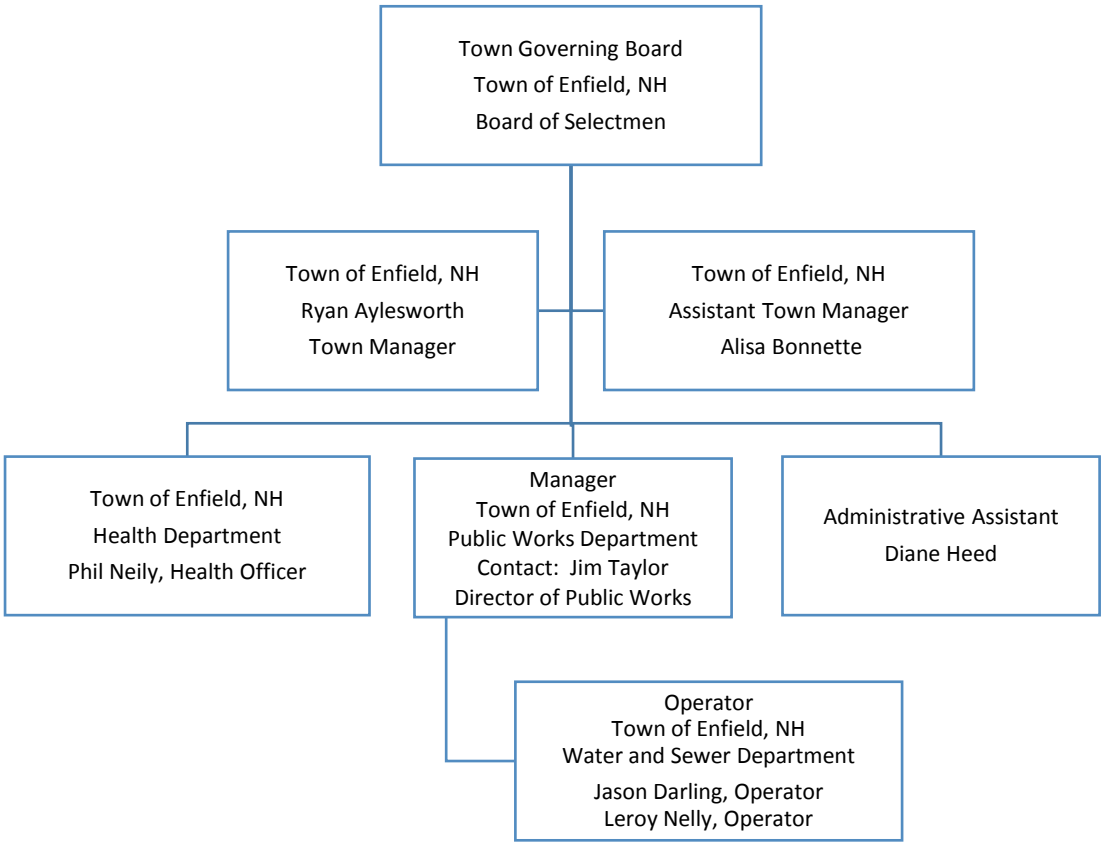
Owner:
Town of Enfield, New Hampshire
Town Offices
23 Main Street, Enfield, New Hampshire 03748
Ryan Aylesworth, Town Manager
(603) 632-5026 ext. 5405

Manager:
Town of Enfield, New Hampshire
Department of Public Works
74 Lockehaven Road, Enfield, New Hampshire 03748
Jim Taylor, Director of Public Works
(603) 632-4605

Operator:
Town of Enfield, New Hampshire
Water and Sewer Department
74 Lockehaven Road, Enfield, New Hampshire 03748
Jason Darling, Certified Operator
Leroy Neily, Certified Operator
(603) 632-4002 Extension 5421

Public Health: Town of Enfield, New Hampshire
Health Department
74 Lockehaven Road, Enfield, New Hampshire 03748
Philip Neily, Health Officer
(603) 632-4343

Refer to the attached organizational chart for a visual representation of the chain of command.



1.10 OWNER/MANAGER RESPONSIBILITIES

The Town of Enfield Board of Selectmen, operating through the Town Manager and the Director of Public Works is responsible for the following:

- Preparing and enforcing municipal ordinances related to sanitary sewage collection and disposal;
- Establishing an annual operating and maintenance budget that is adequate to properly operate the sanitary sewage systems;
- Developing a capital improvements and/or equipment replacement fund that provides for future equipment replacement, upgrade, or expansion;
- Establishing and collecting a connection fee and user rate fee to fund the annual budget requirements;

- Identifying staffing needs, preparing job descriptions, and hiring qualified and/or certified operators and maintenance workers;
- Providing operator and maintenance personnel training in equipment maintenance and operation, in personal safety, in compliance with NHDES regulations, in record keeping, and in safe work practices;
- Providing opportunities for regulatory or outside organizational training to facilitate required personal development hours for continued operator certification;
- Developing safe work practices and standard operating procedures to guide personnel in specific work tasks or methods;
- Maintaining the facilities and related equipment to provide a good and safe operating environment in compliance with Federal and State requirements;
- Providing personnel review and feedback and implementing a professional development and comprehensive salary administration and benefits program;
- Providing the required equipment, tools, administrative support, and other resources required to maintain efficient and effective operation and maintenance of the equipment systems;
- Facilitating communication between the Town and the community at large regarding system operation, ordinances, annual or monthly reporting, planned improvements, and budget and user fees;
- Functioning as the liaison between Federal and State regulatory agencies for compliance monitoring, permitting, and required reporting;
- Maintaining system operating and maintenance records in a readily accessible and up-to-date format as required by NHDES regulation or good business practice;
- Responding to changing environmental regulations, community utility needs, or availability of new or improving technology by implement appropriate managerial or supervisory methods; and
- Reviewing this O&M manual and the referenced procedures on at least an annual basis for completeness, and commissioning the revision or amendment of its content as required.

1.11 OPERATOR RESPONSIBLIITIES

The Town maintains certified operators, maintenance personnel, and other administrative or support personnel to allow for the continued operation and maintenance of the sewage systems in compliance with applicable NHDES regulations and in response to the needs of the Town of Enfield connected users. Its operating and maintenance staff are responsible for the following:

- Following established and proper operational and maintenance means and methods for various required work tasks:
- Seeking training or instruction in new work procedures, safety, or equipment operation to stay current with the requirements of the job and any required certifications;
- Observing all safety protocols to maintain personal safety while on the job and to avoid impacts to public health or the environment;
- Collecting and transmitting required operating data in an accurate and timely fashion for compliance monitoring or reporting;

- Contributing to financial accountability within the Water and Sewer Department by managing project work and expenditures within budget, providing copies of all subcontracted work or supplies invoices for payment, and following other established Town accounting protocol;
- Providing operation and maintenance during normal operational periods, providing response to emergency conditions to address issues as quickly as possible and avoid public health or environmental impact, and completing communication with Town supervisory personnel as situations require it;
- Completing system preventative maintenance, routine inspections, and monitoring of equipment condition and readiness;
- Coordinating the ordering with Town supervisory personnel of expendable supplies, spare parts, safety equipment, treatment chemicals, or generator fuel on an ongoing basis;
- Maintaining good housekeeping practices to keep all facilities and equipment in a clean, safe, and properly functioning condition; and
- Providing other operational or maintenance functions that may be required by the Town supervisory personnel.

1.12 ENGINEER AND CONSTRUCTION CONTRACTOR RESPONSIBILITIES

The design, permitting, and construction administration engineer for this project is:

Pathways Consulting, LLC
240 Mechanic Street, Suite 100
Lebanon, New Hampshire 03766
(603) 448-2200
Rodrick Finley, P.E., Director of Engineering Services
Jeffrey Durrell, Construction Engineer

The contractor for this project is:

Conkley Enterprises, LLC
146 Goose Pond Road
Canaan, New Hampshire 03741
(603) 632-5005
Art Conkley, President

Typical practice for the Construction Contractor and the Engineer is to provide a complete, operational system in substantial conformance to the system specifications and design and in compliance with applicable State regulations. Specific requirements contained within the Construction Contract Documents for Engineer and Construction Contractor are as follows:

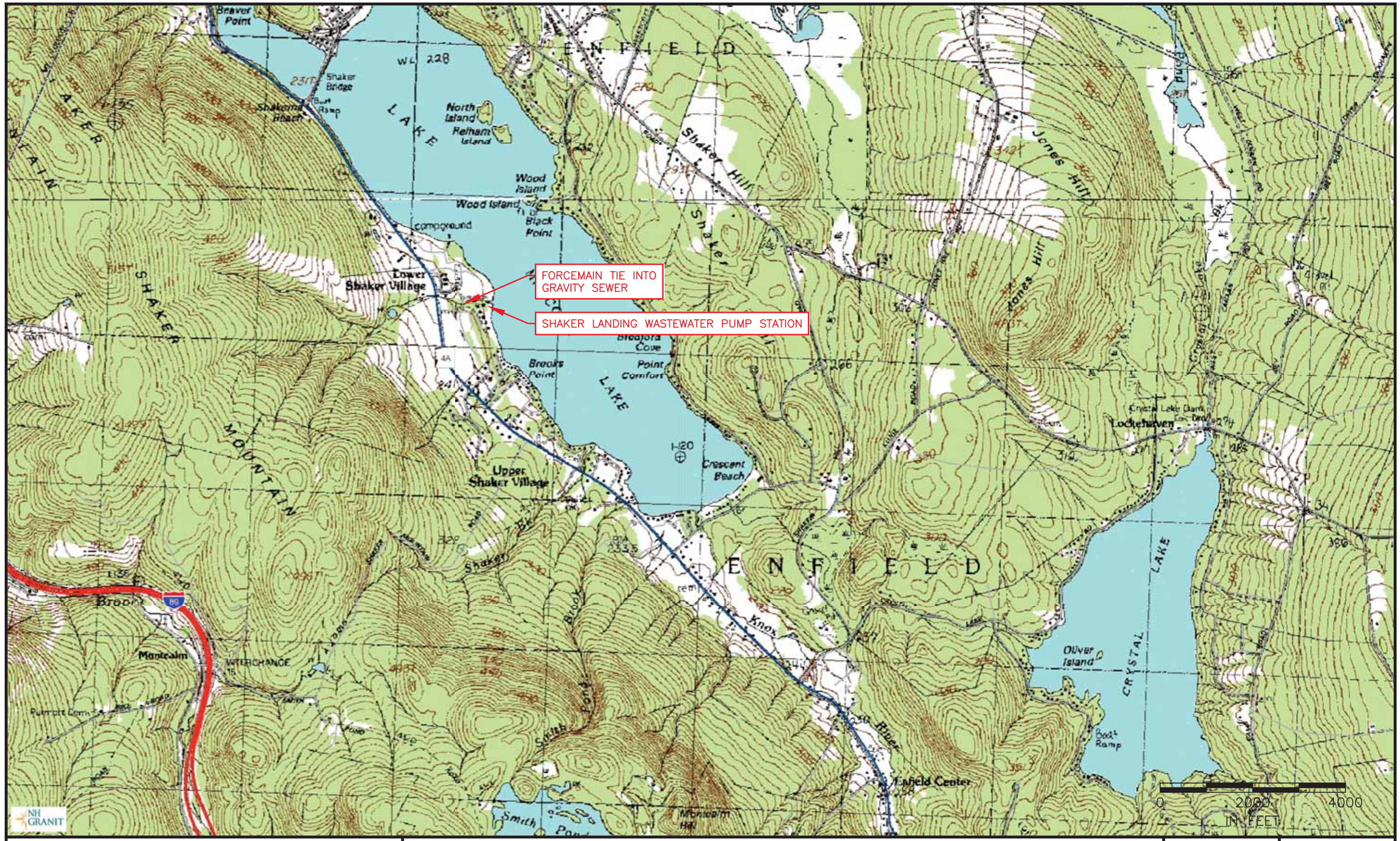
The Engineer is responsible for:

- Observation of construction activities and providing construction contract administration assistance to the Town;

- Assisting the Town in the initial permitting to allow NHDES approval of the design, funding agency signoff, and NHDES and NHDOT approval to construct;
- Completing a Substantial Completion review of the project, issuing a final punch list of items to be addressed by the contractor or Owner, and providing field assistance during equipment testing, startup and initial operation;
- Providing the Owner record drawings prepared from field notes, Contractor redlines, and submittal information;
- Assisting the Owner in any required documentation to the NHDES or the funding agencies involved in the project; and
- Preparing an O&M Manual for use by the project Owner, Manager, and Operator.

The Construction Contractor is responsible for:

- Providing a complete, operable system that is in substantial conformance to the approved Contract Documents;
- Providing final site restoration after construction work is complete;
- Providing a manufacturer's representative to provide one day of field testing, initial startup, and initial training of the Town operators for installed equipment, systems, and controls;
- Providing copies of all equipment and material submittals to the Engineer for transmittal to the Owner with the contract administration files;
- Providing manufacturer's operation and maintenance manuals, equipment cutsheets, and other factory information to assist in the preparation of the final O&M manual and to provide the Owner with required equipment specifications, manufacturer contacts, and design data;
- Providing Engineer with a set of redline construction drawings and specifications documenting record information related to installation, location, or any documented changes to the approved contract documents; and
- Guaranteeing the project construction against faulty materials or workmanship, or other supplied equipment defects for the period of one year from the date of Substantial Completion.



Pathways Consulting, LLC

240 Mechanic Street, Suite 100
Lebanon, New Hampshire 03766
(603) 448–2200 FAX: (603) 448–1221

USGS LOCATION MAP

SHAKER LANDING PUMP STATION

ROUTE 4A – ENFIELD NEW HAMPSHIRE

SCALE:	AS SHOWN
DESIGNED BY:	RWR
DRAWN BY:	CRM
CHECKED BY:	RWR
DATE:	12/04/18
PROJ. NO.	10068-05

EXHIBIT

1

Pathways Consulting, LLC

240 Mechanic Street, Suite 100
Lebanon, New Hampshire 03766
(603) 448–2200 FAX: (603) 448–1221

SHAKER LANDING SEWER CONNECTOR

SHAKER LANDING PUMP STATION

ROUTE 4A – ENFIELD NEW HAMPSHIRE

SCALE:	AS SHOWN
DESIGNED BY:	RWR
DRAWN BY:	CRM
CHECKED BY:	RWR
DATE:	12/04/18
PROJ. NO.	10068-05

EXHIBIT

2

Pathways Consulting, LLC

240 Mechanic Street, Suite 100
Lebanon, New Hampshire 03766
(603) 448–2200 FAX: (603) 448–1221

SHAKER LANDING SEWER CONNECTOR

LAKEVIEW CONDOMINIUMS AND PUMP STATION

ROUTE 4A – ENFIELD NEW HAMPSHIRE

SCALE:	AS SHOWN
DESIGNED BY:	RWR
DRAWN BY:	CRM
CHECKED BY:	RWR
DATE:	09/17/18
PROJ. NO.	10068-05

EXHIBIT

3

CHAPTER 2 – SYSTEM OPERATION AND CONTROL

2.1 SYSTEM OVERVIEW

The Shaker Landing pump station is located near the tree line just east of Building 33 of the Shaker Landing Condominium development. It is accessed via a gravel driveway connected to Landing road. The pump station is intended to serve 18 existing connections (6 buildings) located in the Shaker Landing complex.

The pump station was constructed by Conkley Enterprises beginning in November 2017 and reaching substantial completion in early 2018. The project was part of a Town agreement with the Lakeview Condominiums Association to provide a sewer extension from the Shaker Village gravity sewer system to the Lakeview complex. While completing the project the Town identified the need to upgrade and improve the Shaker Landing pump station to bring it into full compliance with the NHDES design guidelines. The project was funded by the USDA Rural Development program and the New Hampshire Clean Water State Revolving Loan Fund (CWSRF).

The project includes the following major components:

- Existing four-inch building connections, gravity collection sewer and manholes providing collection of sanitary sewage from six building locations;
- A new eight-inch gravity collection sewer with manholes that transfers the sewage flow from the former pump station location to the new Shaker Landing pump station;
- A 8' x 6' x 10'-4" precast concrete pump station wet well-constructed with a sloped bottom and equipped with mechanical ventilation, a 2'-6" x 4'-6" stainless steel (SS) pump access hatch and a 2'-6" x 2'-6" SS trash basket access hatch;
- Two EBARA Model 80DLMFU62.2 submersible, solids handling pumps mounted on a SS rail retrieval system with breakaway discharge flanges;
- Wet well level control provided by a level transducer and a lower water alarm and high water alarm secondary float switches;
- A separate 8' x 6' x 8' precast concrete valve pit equipped with mechanical ventilation, a 2'-6" x 2'-6" access hatch and access steps, a Myers Model MS33T10 sump pump discharging back into the wet well, an emergency pumping connection, pump station valving, and a total sewage flow meter.
- A MPE Inc. Model SC100 pump controller providing adjustable operation of the duplex pump system;
- A Sensaphone Model 1400 telephone dialer to provide alarm notification to a remote location;
- A 25kW, propane fired Generac QT Series emergency generator with automatic transfer switch capable of operating all equipment and control functions of the pump station; and
- Approximately 300 linear feet (LF) of four-inch DIPS SDR 21 PVC force main to the discharge sewer.

All flows within the Shaker Landing complex collection system are via gravity sewer into the pump station wet well. The eight-inch inlet line enters the wet well about 1 foot above the high water alarm set point. It discharges into an aluminum expanded metal bar trash basket that is mounted on guide rails with a galvanized steel lifting chain for basket removal and cleaning. The pump station is a duplex station with two rail-mounted pumps installed. The pumps are set above the bottom of the wet well floor which includes a 1:1 (45 degree) sloped section directing any solids towards the pump suction. **The pump station wet well is considered a Confined Space and no entry is allowed without following confined space entry protocols.** The pumps are equipped with three-inch diameter discharge breakaway flanges and a stainless steel lifting chains. The pumps, trash basket, and alarm floats can be removed from the wet well without entering the wet well.

The pumps are three HP and equipped with 1,800 RPM, 230V, three phase sealed motors. Each pump is rated for 120 gpm flow at a TDH of 29 feet. The motors are FM explosion proof, submersible systems mounted directly on the pumping unit. **The pump and motor system has a weight of about 200 pounds and must be removed from the wet well with a tripod and chain hoist system.**

The pumps are operated via a transducer control system with a low water and high water alarm float backup. The control panel is mounted inside a concrete pad mounted weather-proof enclosure located just north of the pump station wet well, and was custom assembled by Ohio electric Control, Inc. of Ashland, Ohio. The control panel is set up to handle the operation of both pumps and includes individual pump run hour meters, Hand-Off-Automatic (HOA) selector switches, pump energized lights, panel power light, high and low level alarm lights, pump variable frequency drive failure lights, motor seal failure and overheat alarm lights, a low ambient control room temperature alarm, a security alarm, and an auto/manual pump alternator system.

The pumps are programmed to operate in an alternating sequence. When the pump start relay is activated, the Lead pump will start and will continue to pump until the pump off relay is activated. During the next pumping cycle the former Lag pump will become Lead pump and will start. Should a high wet well level condition be sensed by the backup float, both the Lead pump and the Lag pump will be operated until the condition is addressed and operation returns to normal alternating.

Each pump discharges through a separate four-inch line that passes through a check valve and a plug valve before combining through a wye. The combined flow passes through a Foxboro four-inch magnetic flow meter and then a final plug valve. The force main changes from ductile iron within the valve vault to DIPS SDR-21 HDPE piping just outside the vault. One of the pump discharge connections is also provided with an emergency pumping quick connect port and plug valve for use during emergency conditions.

The four-inch diameter HDPE force main is down the pump station gravel access drive to a sanitary manhole just north of Landing road. The force main is uniformly sloped upward from the pump station to the manhole and requires no air release or cleanout connections. The receiving manhole is part of the existing Shaker Landing gravity sewer system that is

routed to the existing municipal pump station on NH Route 4A and ultimately to the City of Lebanon Wastewater Treatment Facility (WWTF).

The pump station, controls, force main, and gravity sewer interconnection are the maintenance and operating responsibility of the Town Public Works Department. The components and equipment systems briefly described above are discussed in further detail in later sections of this chapter.

2.2 SYSTEM COMPONENTS

Manufacturer's information for specific equipment systems are included in the Volume II Submittals section, and in the Volume II Manufacturer's O&M manuals. This section is intended to summarize the installed equipment and its operation.

2.2.1 Sewage Pumps and Motors

The pump station is a duplex pump station installed in a pre-cast concrete wet well, and is designed to handle sanitary sewage flow from the buildings located in the Shaker Landing development on a continuous basis. The system is intended to have a Lead Pump and a Lag pump operation with the Lead Pump pumping sewage with the Lag Pump on standby, and then alternative the pump operation on the next cycle of pumping. If the Lead Pump cannot keep up with the required sewage flow and the high wet well alarm condition is activated, the pump control will start the Lag Pump to pump down the wet well level, and will then resume alternate pumps on automatic control once the alarm condition is cleared. A condition of high water alarm in the wet well may indicated that the Lead Pump is plugged or operating at a lower flow capacity and may need visual inspection if the high wet well condition happens again.

The sewage pumps are EBARA Model 80DLMFU62.2. Each of the two installed pumps have the following design operating conditions:

- Design Flow Rate — 120 gallons per minute
- Design Total Dynamic Head — 29 feet
- Minimum Continuous Flow — 26 gallons per minute
- Maximum Shutoff Head — 43 feet
- Operating Speed — 1,800 rpm
- $NPSH_{REQ}$ — Not applicable, submersible pump
- Discharge Flange Size — 3-inch mating to 4-inch force main
- Impeller Diameter — 7.4 inches
- Passing Solids Diameter — 3-inch sphere

The pumps are generally cast iron housing and volute, stainless steel shafts, and equipped with tandem mechanical, oil lubricated seals. Each pump is equipped with an integral motor. The motors are 30 HP, 230 V, 3Φ units and are explosion proof submersible design meeting NEC Class I, Division I use requirements. The motor assembly is a squirrel cage induction

unit. Each motor is equipped with an oil lubricated double mechanical seal, a moisture float sensor to detect seal leakage into the motor chamber, and a temperature sensor to detect overheating in the motor windings and core. Seal failure or overheating will trigger and alarm and pump shutdown.

A copy of the pump operating curve is included in Volume II, Appendix 5 Submittals. Each pump is equipped with a self-sealing, break-away, non-sparking discharge flange that anchors the two two-inch stainless steel guide rails for each pump, maintains the proper separation distance between the bottom of the wet well and the pump suction, and provides a positive seal to the discharge piping. The pumps are connected to the pump station power through a flexible, submersible power cord that facilitates complete removal of the pumping unit from the wet well without disconnecting the power cord. Each pump is equipped with a SS lifting chain with intermediate larger links to allow insertion of a pinch bar during removal. **The pump and motor system has a weight of almost 200 pounds and must be removed from the wet well with a tripod and chain hoist system.**

2.2.2 Wet Well Systems

The wet well is a rectangular precast concrete structure approximately 8'-0" long x 6'-0" wide x 10'-4" deep. The structure has been sealed with a damp-proof coating. The wet well is considered a hazardous atmosphere due to the possibility of toxic or explosive gases being released from the sewage, and all electrical equipment and connections within the wet well are explosion proof. The bottom four feet of the wet well is equipped with a concrete surface sloped at a 45 degree angle towards the pump suction. This is part of the wet well self-cleaning design and is intended to move any settled solids towards the pump suction for removal. **Please note that the pump station wet well is considered a Confined Space and no entry is allowed without following confined space entry protocols.**

The pump station is equipped with a 8-inch diameter gravity, gooseneck vent with insect screen that will operate during normal fill and pump out cycles. The wet well is also equipped with a Greenheck Model GB 141-4 belt driven, centrifugal roof exhaust fan that is to be manually turned on whenever the wet well access hatches are opened for maintenance or observation. This exhaust fan is rated for 1,060 cubic feet per minute and will turn over the wet well air space two times per minute for safe maintenance access.

Access to the submersible pump rails, power cables, level transducer and alarm float cables is provided through a lockable, weather-tight stainless steel access door that is 2'-6" x 4'-6". Access to the trash basket lifting chain is provided through a lockable, weather-tight stainless steel access door that is 2'-6" x 2'-6".

The eight-inch gravity sewer inlet line discharges into the wet well through a Halliday Model B1B aluminum trash basket equipped with four solid rollers and mounted on a steel guiderail

system to allow removal and cleaning without entering the wet well. The trash basket has a working capacity of approximately three cubic feet, and will allow solids with a maximum dimension of two inches to pass into the wet well.

Sanitary sewage can produce noxious odors if allowed to sit too long within the collection system and wet well. This may occur during low flow periods. Any odors will be exhausted through the gravity free vent during normal operation. There is no installed odor control system should odors become problematic.

2.2.3 Controls and Alarms

The operation of the wet well is accomplished using a Dwyer Model PBLTX2-10-40 submersible level transducer. The transducer is suspended within the wet well and set at the low point of the wet well interior. It utilizes a sensing diaphragm to measures the hydrostatic head pressure above the level of the transducer. This head pressure can be related directly to wet well depth and is converted to a proportional 4-20 mA control signal utilized to start and start the sewage pumps. The transducer is rated for an operating range of 10 psi, or a depth of 0 to 23 feet, which covers the normal operating ranges of the wet well.

Wet well operation is controlled by a MPE, Inc. Station Controller Model SC100 Pump

Controller mounted in a NEMA 4X SS panel enclosure custom manufactured by Ohio Electric control Inc. The panel itself is mounted within a weather tight, SS control and power enclosure mounted adjacent to the wet well on a concrete pad. The pump controller provides a direct readout of the wet well level in feet as well as the ability to set the operating ranges (pump on and off) for the Lead and Lag pumps and the high and low water alarms. These can be adjusted by the operator based on historic sewage flows and operating conditions. The controller is able to directly communicate with the alarm dialer to allow remote monitoring of pump station alarms from the Public Works Department office. The pump control panel includes all required electrical and control devices for operation of the wet well. This includes surge protection for the electrical power, monitoring of pump motors for failure or seal leakage, control of variable frequency drives to limit power draw during pump start, monitoring of operating times for each pump, and providing local and remote alarm condition notification.

The control panel is equipped with the following components:

- a yellow light indicating normal power condition to controls and equipment
- Hand-Off-Auto selector switches for each pump
- an hour meter for each pump to record actual time the pump is energized and run
- a pump alternator switch to select which pump will be in Lead and Lag position
- a green pump running light for each pump indicating a pump is online

- a red VDF fault light for each pump indicating that the controller attempted to start a pump and it did not respond
- a reset button for each VFD fault condition
- a red pump seal failure light for each pump indicating that sewage has been detected in the motor enclosure of the pump
- a red pump motor over temperature light for each pump indicating motor pump overheating
- a red wet well low level alarm receiving a signal from the transducer
- a red wet well high level alarm receiving a signal from the transducer
- a red wet well low level alarm receiving a signal from a secondary float switch
- a red wet well high level alarm receiving a signal from a secondary float switch
- a reset switch for float backup alarms
- an alarm panel selector switch allowing silencing of alarms and test of all alarm lights

The pump operating setpoints and alarm conditions are summarized in Table 1-3 in Chapter 1 of this manual. Although the SC100 station controller has the ability to provide high and low alarm monitoring via the controller, separate float switches are installed to shut off the pumps when the controller fails to stop a pump and the wet well is at the lowest operating level where damage may occur to the pump due to the lack of sewage flow cooling, and to notify the operating staff that the wet well has reached an abnormal high operating level condition indicating that there may be pluggage or failure of the pumps. The low level alarm will shut down any running pump unit to prevent pump damage. The high level alarm will only indicate that an abnormal condition exists in the wet well and the operator must respond immediately. At typical sewage (normal to peak) flows it will take approximately 10 to 60 minutes from the time a high level alarm sounds and the invert of the inlet pipe is reached (possible sewer backup into collection system), and one to seven hours until the wet well is full.

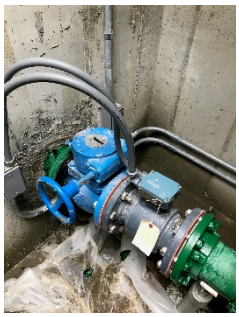
2.2.4 Wet well Valve Vault

The wet well valve vault is located directly west of the pump station is a rectangular precast concrete structure approximately 8'-0" long x 6'-0 wide x 8'-0" deep. The structure is equipped with insulation to prevent frost penetration. The valve vault is not typically considered a hazardous atmosphere since there is normally no sewage present in the structure. **Please note that the pump station valve vault is considered a Confined Space and no entry is allowed without following confined space entry protocols.**

The valve vault is equipped with an four-inch diameter gravity, gooseneck vent with insect screen and a Dayton PSC direct drive, centrifugal exhaust fan that is to be manually turned on whenever the valve vault access hatch is opened for maintenance, observation, or access. The switch is located just inside the access hatch. This exhaust fan is rated for 75 cubic feet per minute and will turn over the valve vault air space once in every five minutes for safe maintenance access.

The floor of the valve vault is sloped to a low point sump set in the floor to collect any condensation, minor leakage, or infiltration. A Myers Model MS33T10 sump pump rated for a maximum flow rate of 25 gallons per minute is set within the pump. The pump motor is 115 V, 1Φ with a 1.3 HP rating. The pump is equipped with an integral float switch to turn the pump on and off, and discharges through a 1½-inch diameter line through a combination check/isolation valve assembly back into the adjacent wet well. Operation is automatic and no other controls are associated with the pump.

The piping layout associated with the valve vault is shown on Sheet 28 in Appendix 1, Volume II of this manual. Each four-inch diameter pump discharge line enters the valve vault through a four-inch check valve and isolation plug valve equipped with hand wheel. The two discharge lines then wye together prior to the master sewage flow meter. There is a diaphragm protected pressure gauge on the combined pump discharge line and a final four-inch isolation plug after the flow meter. There is an emergency pumping connection installed on the pump discharge line just prior to the wye. This connection is equipped with a four-inch isolation plug valve and a quick connect coupling that allows a portable pumping unit to be connected at this location to empty the wet well as required for maintenance. All piping and valve connections within the valve vault are ductile iron flanged construction. The combined discharge line exits the valve vault and terminates in a four-inch to four-inch DI pipe to DR11 HDPE adaptor.



A Foxboro Model 9300A magnetic, inline flowmeter is installed in the combined pump discharge line. The unit is four-inch diameter and rated for a flow rate from 55 to 1,100 gpm. The meter is equipped with a four to 20 mA transmitter that sends a signal to an IMT25 transmitter and readout mounted in the power and control enclosure adjacent to the wet well. The flow meter has a polytetrafluoroethylene (PTFE) liner and two SS measurement electrodes. As noted above, the valve vault is not a rated hazardous electrical zone and the flowmeter is rated for normal locations. The wall mounted transmitter has a protected user interface that allows calibration, changes in readout

characteristics, and other advance user set points. Typically, the readout is set to display a totalizer value in gallons. There is the capacity to reset the totalizer as required by the operator.

2.2.5 Emergency Power Generator System

Backup power is provided by a Generac Series QT propane fired generator rated for 25kW. This output is sufficient to power the normally operating equipment, controls, alarms and related ancillary pump station systems. The system is equipped with a water tight acoustic enclosure providing noise attenuation. Cooling of the engine is provided by a pressured, closed recovery system with a radiator and fan that discharges through ductwork and a fixed louver to the outside of the acoustic enclosure. The generator system is connected into the main power panel through a Generac 100 amp automatic transfer switch. Fuel is provided by a 1,000-gallon, underground propane storage tank. Typically a full fuel tank will provide sufficient fuel to operate the generator at 100 per cent load for 70 to 75 hours. The generator controls include:

- monitoring of battery charge rate
- monitoring of oil pressure
- monitoring of cooling water temperature
- monitoring of utility voltage and generator output voltage
- adjustable timers utilized to set the time required for power interruption to start generator, time required to warm up the engine before imposing load, minimum run time for engine once request for start is initiated, time for returning load to incoming utility line, and time to allow engine cool-down when power is reestablished
- a built in timer function to allow an automatic engine and generator exerciser once each week to allow readiness testing
- an emergency generator shutdown button

The alarms and shutdowns associated with the generator set include:

- overvoltage alarm and shutdown on the generator output
- overspeed alarm and shutdown on the generator motor
- low oil pressure alarm and shutdown
- high coolant temperature alarm and shutdown
- low coolant level alarm and shutdown
- loss of utility power alarm
- failure of generator to supply power when started alarm

2.2.6 Pump Station Control Enclosure

The pump station control enclosure consists of an insulated NEMA 3R weather-tight SS enclosure mounted on a concrete pad immediately adjacent to the wet well. The enclosure is approximately 7'-6" tall by 6'-0" wide and 3'-0" deep. The enclosure includes the pump station control panel, a variable frequency drive controller for each of the sewage pumps, the transmitter and readout for the sewage flow meter in the valve vault, an electrical surge protector, and the alarm telephone dialer alarm system. The main incoming power disconnect switch, the pump station visual alarm light, and the pump station alarm horn are mounted on the outside eastern face of the enclosure. The Generac Automatic Transfer Switch is mounted on the outside western face of the enclosure. The enclosure is equipped with two access doors that provide full access to all components from the south side of the enclosure.

2.2.7 Force Main Systems

The force main consists of four-inch diameter SDR-21 PVC Iron Pipe Size (IPS) pipe and fittings installed by open excavation along the gravel access road to the Shaker Landing pump station and connecting to a discharge manhole on Landing Road.primarily by directional drilling along the western side of the NH Route 4A corridor and within the NHDOT right-of-way. Piping sections and fittings are equipped with gasketed, push-on joints, and the force main system has a maximum pressure rating of 200 psi. The force main is routed from just outside the pump station valve box to an existing gravity sewer manhole located adjacent to Landing Road. This manhole transitions from pressurized force main flow to the existing gravity collection system located on Landing Road at Shaker Landing. This transition is facilitated by providing a minimum 10-foot long section of eight-inch HDPE piping to reduce the incoming flow velocity at the manhole to less than three FPS. Because the force main and fittings are PVC, an extra high strength tracer wire with a green color is installed on top of the PVC force main piping to allow utility detection instruments to accurately locate the location of the piping from the ground surface.

The force main slopes uniformly upward from the pump station valve vault to the discharge manhole. Because of this no low point cleanouts or high point air release stations are required.

2.2.8 Product Information and Operating Manuals

The information contained within this manual is intended to provide required information that describes the equipment and control systems, provides detail on system operation, and provides limited information on troubleshooting and maintenance. The equipment and control manufacturer and suppliers manuals contain additional information include factory

service locations, parts list, detailed installation information, and additional troubleshooting and operational directions. The following supplemental reference information is provided in Volumes II and III of this manual and should be consulted as needed.

Type of Document	Description
Volume II Operating and Maintenance Manual Appendices	
Appendix 1 Drawings	Pump Station Layout Drawing, Partial Collection System, Force Main Plan and Profile, Sheets 5, 11, and 27
Appendix 2 Drawings	Sewer Components, Sheet 32 Sewer Details
Appendix 3 Drawings	Electrical, Control, Lighting Details, Sheet 28, Electrical Layout, Sheet 29 Electrical Plan, and Sheets 30 to 31, Electrical Details
Appendix 4 Submittals	Pump Station Components
	Piping, Valves, Sewer Components
	Sewer Manholes
	Misc. Electrical Components and Wire
	Force Main Pipe and Fittings
	Wet Well and Valve Vault Structural
	Wet Well Mechanical Ventilator
	Pipe, Valves, and Gauges
	Standby Generator and Automatic Transfer Switch
	Pump Controls
	Other Components are in Shaker Landing Pump Station O&M
Volume III Manufacturer's Operating and Maintenance Manual	
O&M Manual	EBARA Sewage Pumps and Rails
O&M Manual	Gauges
O&M Manual	Pump Station Control Systems
O&M Manual	Foxboro Flow Meter
O&M Manual	Myers Sump Pump (Valve Vault)
O&M Manual	Plug Valves
O&M Manual	Liquid Level Control
O&M Manual	Pipe Supports
O&M Manual	Strainer Basket (Wet Well)
O&M Manual	Quick Connect Fittings
O&M Manual	Generac Generator Set
O&M Manual	Generac Automatic Transfer Switch

Table 2-1 List of Drawings, Submittals and Manufacturer's Data

2.3 OPERATING PROCEDURES

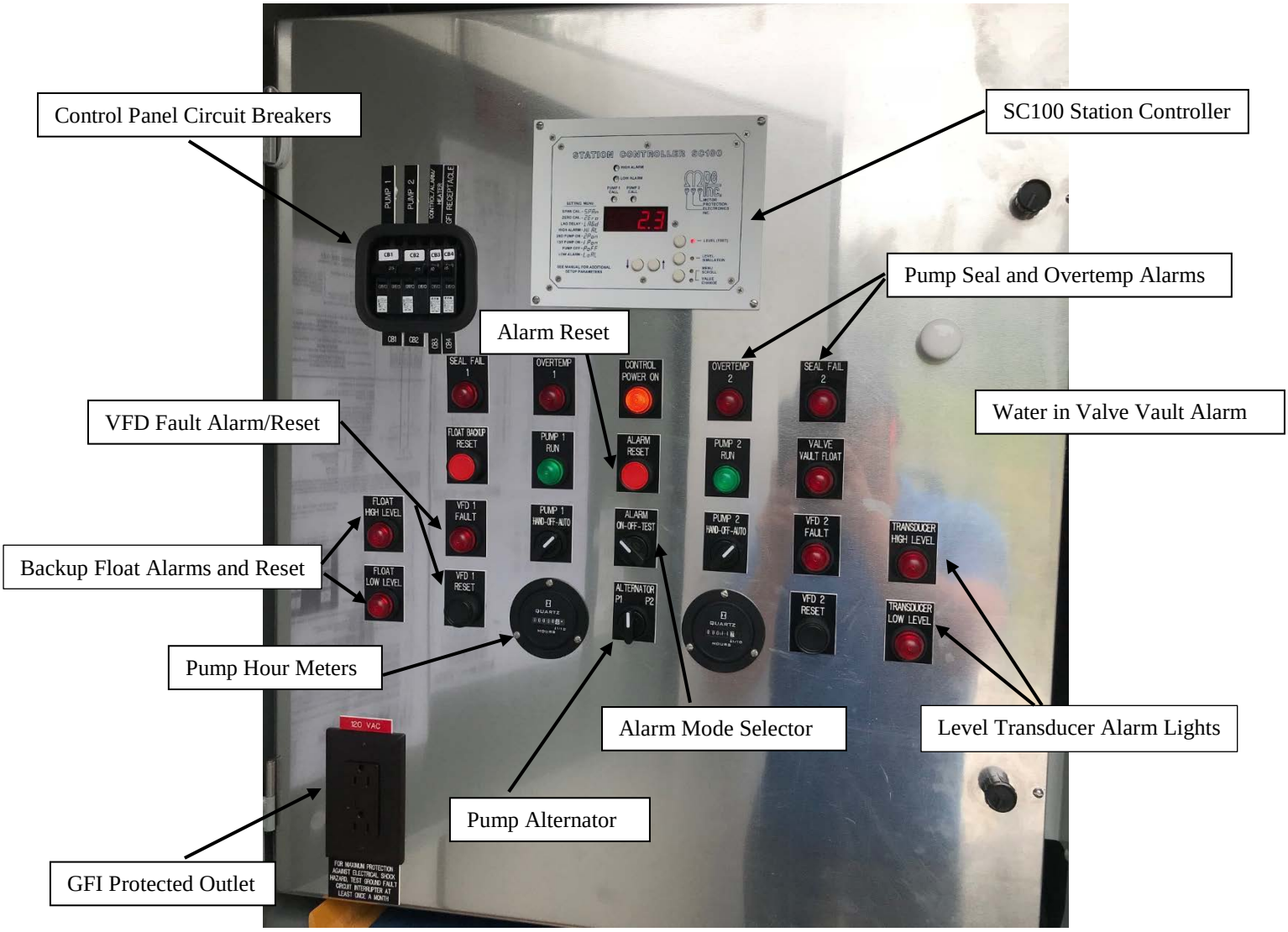
It is not the intent of this volume of the manual to reproduce in detail every operating feature or function of a particular operating system. This information is included in the manufacturer's O&M manuals in Volume III. This section will describe basic operating and control functions associated with each system.

2.3.1 Wet Well Sewage Pumps

The pump station is a duplex pump station designed to have a Lead Pump and a Lag Pump operational mode with the Lead Pump on line, and the Lag Pump on standby in case the Lead Pump fails, or the controller alternates pump operation on the next pump-down cycle. The controller is designed to typically operate only one pump at a time. Should the wet well level build up to a high alarm condition (indicating that the Lead Pump is not operating as designed), the controller will start the Lag Pump. When the alarm condition is cleared, the controller will return operation to alternating cycles. However, the condition may require the original Lead Pump to be inspected to determine why it was not capable of maintaining proper flow.

The sewage pumps are typically operated in Automatic mode relying on the level transducer and pump controller to set operations. However, the pumps can be manually shut-off using the Off Mode to allow the pump to be removed from the wet well for observation or maintenance. **Please note that if a pump is to be inspected or maintained, the main power disconnect mounted on the outside west side of the control enclosure must be shut off and locked out before the pump is removed from the wet well. This will effectively power down the entire pump station system.** The pumps can also be manually operated using the Hand Mode. This mode is typically used after a pump is pulled from the wet well for inspection or maintenance and the operability and sealing of the pump to the discharge flange needs to be confirmed before returning it to active service. Refer to the picture below for location of key operational controls.

To place the pump station in operation, confirm that the main incoming power disconnect is energized and that the yellow control power light is lit. Push the two VFD fault reset buttons and the float backup alarm reset button to clear any previous alarm conditions. Test the alarm panel with the alarm test switch to confirm that all alarm lights are operational. Resent and silence the alarm test. Select the pump that you want to operate first in automatic control by using the Pump Alternator selection switch to the desired position. If required, check the pump on, pump off, and alarm set points using the Station Controller user interface. Adjust as required. **Before initiation pump operation, confirm that there is a typical operating level of fluid in the wet well. The submersible pumps depend upon surrounding fluid for cooling and should not be operated dry.** Turn both Pump 1 and Pump 2 selector switches from the Off position to the Auto position. At this point, the pump station controller will start the Lead Pump once the minimum operating level is established and will then continue automatic alternate cycles for the two pumps.



During operation, if the controller indicates an alarm condition observe the panel to determine the condition and use the alarm acknowledge stich in the center of the panel to silence the alarm horn. Take action to correct the alarm condition based on the alarm light lit. This includes:

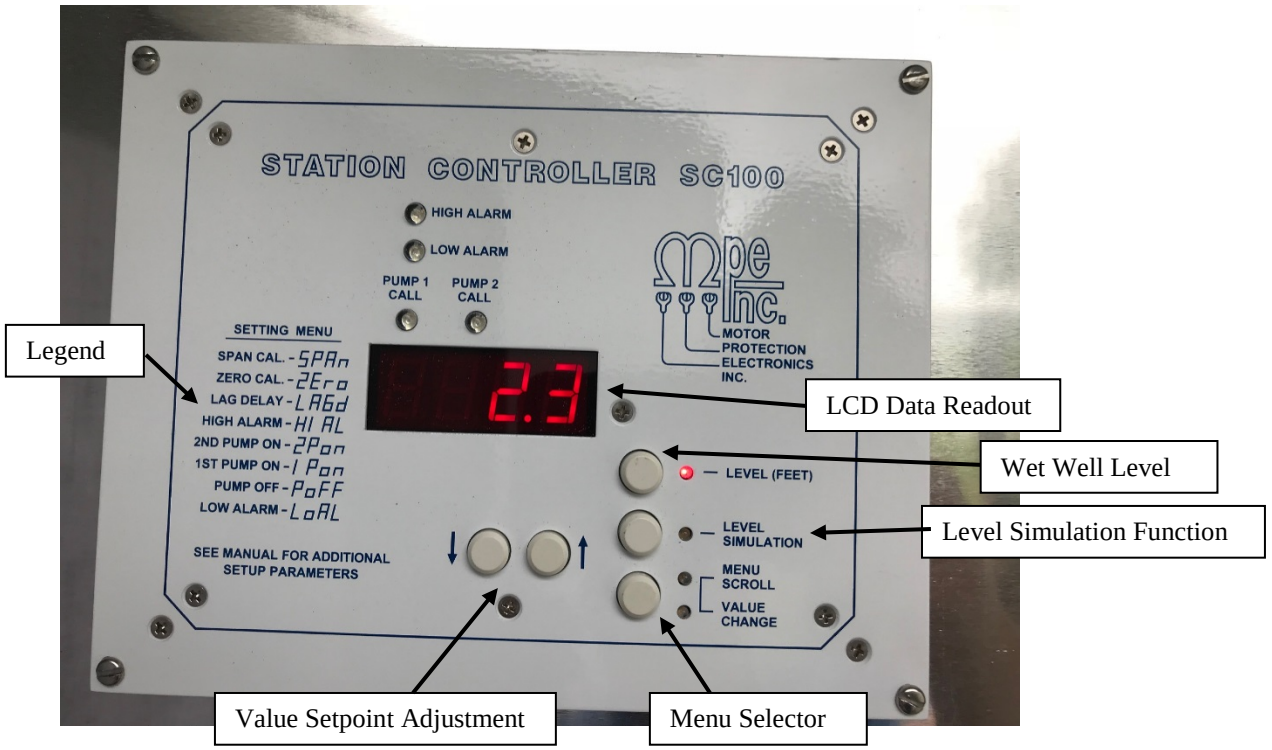
- Pump VFD Fault (Red) – The pump controllers are equipped with a variable frequency drive that limits the load on the pump motor as the unit is brought up to speed. If the pump fails to start this light will be illuminated and the pump will need to be checked prior to resetting the alarm condition.
- Pump Motor Over Temperature (Red) – The pump will be shut down on motor over-temperature to prevent permanent damage to the motor. If an over temperature occurs first confirm that there is liquid in the wet well and that the pumps have not pumped the wet well down to the point where suction and flow is lost. It is likely that some internal damage has occurred to the pump and motor driver and that inspection and maintenance will be required before putting it back in service.

- Pump Seal Failure (Red) – The pump will be shut down on pump seal failure since the float switch is mounted at the bottom of the motor compartment and fluid at this location indicates both mechanical seals have failed. The pump will require seal maintenance before being returned to service.
- High Wet Well Level (Red) – This alarm will sound if the Lead pump is not keeping up with the wet well flow. When this activation point is reached, the controller will start the LAG pump to pump down the wet well. The condition indicates that the Lead pump may be plugged and will need to be removed from the wet well for observation and clearing. Once it is reinstalled, you will need to reset the pump lockout before returning it to operation. The primary alarm is from the transducer with a backup alarm from a high level float switch.
- Low Wet Well Level (Red) – This alarm will sound if the level in the wet well drops below the safe operating level for startup of the sewage pumps. It will indicate that a pump has continued to operate after the signal to stop has been sent. Confirm the operation of the floats and the setpoint in the pump controller, allow liquid to build up in the wet well to the normal operating point, reset the pumps and place them back in operation. Observe the operation and if the alarm condition persists, further troubleshooting of the controller is indicated. The primary alarm is from the transducer with a backup alarm from a low level float switch.
- Pump Run Light (Green) – Whenever the pump controller successfully starts a pump and the motor is energized and running, the green pump run light will be lit. You can utilize these lights to confirm which pump is in operation, and that the controller is alternating the pump after each cycle.

Alarm conditions will clear from the control panel once the alarm condition is no longer present. The operation of all of the alarm lights can be confirmed by use of the alarm test switch. The pump motor power circuit breakers are located in the upper left portion of the pump control panel.

2.3.2 Level Controls – Transducer and Controller

The wet well level controls include the MPE, Inc. Station Controller SC100 panel mounted on the pump control panel, the Dwyer Series PBLT2 submersible level transducer, and the backup float switches. There are no daily operational controls required for this controller since it is hard wired into the pump control panel and is operating automatically once it is placed in operation. The Operator Interface (OI) allows quick and easy indication of system status and the adjustment of set points. The process variables including wet well real time operating level, and the start/stop and alarm conditions for the pumps can be read directly on the OI. These can be readily adjusted from the panel using the up/down arrow buttons associated with each operating set point. There is also a feature on this controller that allows the operator to simulate the wet well levels to check operation and alternation of the pumping units. Additional information on programming, display, and data retrieval are included in the specific manufacturer's O&M Manual in Volume III of this manual.



2.3.3 SCADA System

There is no SCADA system associated with the Shaker Landing pump station due to the limited building connections, the lower flow rate, and the simplicity of the system operation. A Sensaphone Model 1400 telephone dialer was installed in the pump control and power enclosure located adjacent to the wet well. The dialer is equipped with a redundant battery backup. The pump control panel monitors the alarm conditions and will send an alarm signal via the dialer to the Town of Enfield Public Works Department if actuation of any alarm occurs. Personnel from the Public Works Department must respond to the site in order to obtain additional information regarding why the alarm sounded, and take measures to correct the problem and restore the system. There is no capability at the present time to monitor pump operation, wet well level, or set points from a remote location. Alarm notification is over a hard utility telephone line, and the dialer can be programmed for multiple phone number notifications. The following alarms are monitored:

- Transducer low wet well level
- Float switch low wet well level
- Transducer high wet well level
- Float switch high wet well level
- Pump No. 1 seal failure
- Pump No. 2 seal failure
- Pump No. 1 Over Temperature

- Pump No. 2 Over Temperature
- Pump No. 1 VFD Failure to Start
- Pump No. 2 VFD Failure to Start
- Valve Vault Flood Alarm
- Control Panel Power Failure

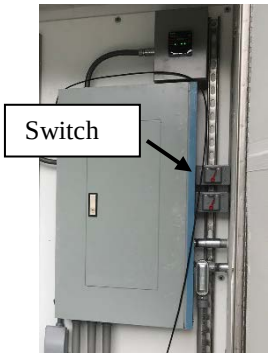
There are no daily operational adjustments required for the alarm communication system. All operation of the pump station occurs locally via the pump control panel.

2.3.4 Sewage Flow Measurement

The magnetic inline flow meter monitors flows through the force main automatically. The unit should be operational at all times that the pumps are operating. The Foxboro Model 9300A flowmeter is installed in the combined sewage pump discharge line in the Valve Vault. The unit is a 4-inch diameter unit rated for a flow of 55 to 1,100 gpm. The meter is equipped with a sensor that provides a 4 to 20 mA output to the transmitter and readout mounted in the control and power enclosure adjacent to the wet well. The unit is field calibrated during installation to provide a readout in gallons, and is calibrated and set to the sensor pipe size. The system is capable of running calibration diagnostics, providing alternate flow units, and starting, stopping, and resetting the flow totalization. These and other changes or data collection can take place through the local operator interface located on the wall mounted transmitter assembly. Refer to the manufacturer's supplied O&M Manual in Volume III for additional information on programming features. Power for the flow sensor and transmitter are provided by a circuit located in the power panel installed in the pump control and power enclosure.

2.3.5 Wet Well and Valve Vault Ventilation Systems

The pump station wet well is equipped with an eight-inch diameter gooseneck gravity vent with an insect screen. This vent allows air to enter or exit the wet well as the sewage levels varies. When the pump station access hatches need to be opened to allow observation of operation, removal of sewage pumps, adjustment of float switches, or other maintenance or cleaning operations, a forced ventilation system is activated. The activation switch is mounted on the side of the power panel inside the pump control and power enclosure and controls a Greenheck Model GB 141-4 belt driven, centrifugal roof exhaust fan that is rated for 1,060 cubic feet of air flow per minute and is capable of turning over the air space within the wet well one to two times per minute for safe access. Because of the



possibility of sewage vapors, the wet well is considered a hazardous area and utilizes explosion proof electrical equipment.

The valve vault is equipped with a four-inch diameter gooseneck gravity vent with an insect screen that allows normal air exchange during system operation. When access to the valve vault valving, piping, or other systems is required, a forced ventilation system is activated. The activation switch is mounted just inside the access hatch (with dual lockout switch at the fan unit) and controls a Dayton PSC direct drive, centrifugal exhaust fan rated for 75 cubic feet of air flow per minute and capable of turning over the air space in the valve vault every five minutes for safe access. The fan is a single speed fan and there are no other controls associated with the fan. The valve vault is not a hazardous area and requires no special electrical equipment.

Power for the ventilation fan is taken from the power panel installed in the pump control and power enclosure adjacent to the wet well.

2.3.6 Valve Vault Sump Pump

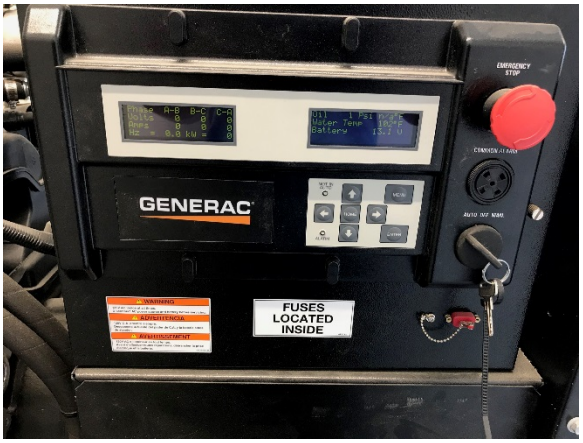
The valve vault has a sloped concrete floor that discharges into a sump set into the floor. This sump is intended to collect minor piping leakage, structure infiltration, or condensation drippage over time. A Myers Model MS33T10 submersible sump pump is set in the sump. This pump is rated for a maximum flow rate of 25 gallons per minute. The pump is equipped with an integral float that turns the pump on and off. The pump discharge line is equipped with a check valve and isolation valve, and discharges directly into the adjacent wet well. The pump motor is a fractional horsepower motor operating on 110V power. The pump is hard wired directly into a junction box. A GFI protected outlet is provided within the Valve Vault to allow portable, temporary lighting to be used during nigh access. Power for the sump pump and GFI outlet are taken from the power panel installed in the pump control and power enclosure adjacent to the wet well. A separate high water level float switch alarm is provided to notify personnel in the event of a valve vault flooding event.

2.3.7 Emergency Power Generator

The pump station is equipped with a 20kW, propane fired Generac Model QTA-2.4L emergency generator that is located north of the pump control and power enclosure and controlled through a Generac H-100 Control Panel Interface mounted directly on the unit and accessed via a removable front access panel. The unit is installed in a water-tight, acoustic enclosure that is mounted on a concrete pad. The generator unit is designed to operate automatically and will start whenever the main electrical power is lost. It will provide power

capable of operating one sewage pump, the pump and level controls, and other related power, lighting, and control requirements for three to five operating days if the propane tank is full.

The Control Panel has several control features that include:



- An emergency stop button used to immediately shutdown the generator if some operational problem occurs. If this button is used, it must be manually reset by turning the key switch to off, and then selecting auto or manual mode of operation.
- A key switch used to select the mode of operation. It has three positions, auto (generator automatically starts when the transfer switch senses a loss of available utility power), off (shuts down the generator and prevents it from automatically starting) and manual (immediately starts the generator).
- The left display window can be configured to display different menus. Normally the window displays volts, amps, frequency, hertz, and kilowatts while the unit is operating.
- The right display window typically displays alarm information or basic engine information such as oil pressure, oil temperature, and water temperature or battery voltage. The menu function can be used to select alarms, engine operation, status and service history, generator information, and to run diagnostics. The menu display is selected using the arrow key pad.

The emergency power system is equipped with a Generac automatic transfer switch that

senses the available utility power. When the transfer switch senses a utility failure or loss of power, it will provide a start command to the generator, the generator will start, and the transfer switch will transfer power to the load from the generator. The transfer switch is equipped with a control and display panel that can be accessed at the transfer switch and that allows monitoring of the incoming utility conditions, programming of start delay to prevent the generator from starting in a momentary power dip, programmable run times to allow engine cooldown after power is restored, programmable exercise schedules for the generator to insure readiness, and other features. Consult the manufacturer's O&M manual for additional access and program instructions.

The key switch on the generator should remain in the auto position to allow the transfer switch to start the generator when it is required. The key switch should be turned to the off position during scheduled maintenance of the generator. When this occurs, the main line

circuit breaker for the generator should also be shut off to disconnect the generator set from the transfer switch.

There are three types of alarms that will trigger the common alarm horn. Most of the alarm conditions can be cleared locally at the panel, but some may require a qualified repair technician. Some alarms are warnings, the lowest level of alarm, and alert the operator that an operating condition has change and may require action or inspection. These warning alarms can be locally cleared once they are no longer active. Some alarms are non-shutdown alarms and indicate a more urgent condition requiring review. These alarms occur when an operating condition has exceeded a safe operating limit or is approaching that limit. These alarms will clear once the condition is no longer active. Shutdown alarms protect the generator from damage and indicate a system fault that would, without immediate correction, damage the unit if it continued to run. Shutdown alarms are cleared only when they are no longer active and the key switch has been turned to the off position. When an alarm sounds, press the enter key on the control pad to acknowledge the alarm and silence the horn. Read each line of the alarm warning page to determine the condition present, determine the corrective action, and clear the condition.

The generator engine is supplied fuel from a 1,000-gallon underground propane tank. No normal maintenance tasks are typically required for the propane tank, but the tank inventory should be checked on a frequent basis to ensure that the generator will not operate with low fuel inventory.

2.4 OPERATIONAL PROBLEMS – TROUBLESHOOTING GUIDES

2.4.1 Sewage Pumps

Before beginning pump troubleshooting, verify the following conditions:

- Power is supplied to the main pump control panel as indicated by the yellow light being lit
- The Hand-Off-Auto pump control switches are not in the off position
- Power to the pump motors is in the On condition and no breakers or disconnects are open.

Also review the pump control panel and the Station Controller SC100 to identify current operating level in the wet well, which pump is scheduled to operate, and if any alarm conditions are present.

The following table presents information from the manufacturer that may be useful in troubleshooting pump operational conditions. Consult the manufacturer's O&M manuals in Volume III of this manual for additional information.

Problem	Possible Cause	Corrections
Pump fails to pump	Pump not primed	Verify the level in the wet well to make sure sufficient level is present to submerge pump
	Plugged suction	Lockout pump, remove from wet well, clean suction and impeller, return to wet well
	Discharge valve closed	Check the operation of the discharge check valve in the valve pit and the position of the discharge isolation valve
Pump delivers insufficient capacity and high wet well alarm is present	Obstruction in suction or impeller	Lockout pump, remove from wet well, clean suction and impeller, return to wet well
	Pump not seated properly on discharge fan.	Shut pump off, lift partially from operating position, lower into operating position and check seating at discharge flange.
	Worn impeller or wear ring	Replace pump parts as required
Pump does not turn off	Operating level controller set incorrectly	Verify set points for pump operation
	Float switches restricted	Confirm that the flow switches are free to move and not restrained
	Excessive in flow	Verify that sewage flow has not increased beyond capacity of pump
Pump cycles too frequently for flow	Excessive in flow	Verify that sewage flow has not increased, that there is no infiltration into wet well, or that water using fixtures are not malfunctioning
	Operating level setpoints are incorrectly set	Check that the operating level setpoints are set based on current flow design
	Pump check valve not seating when pumps are off	Check the check valve positions in the valve vault to confirm that they are seating properly when the pump shuts off
Pump operates noisily or with excess vibration	Worn bearings or damaged motor shaft	Replace as required
	Misalignment after factory or field repair	Align all rotating parts; this may require consultation with service representative
	Pump mounting brackets are loose or broken	Examine pump guide rails, discharge flange, and other structural systems associated with pump position in wet well
	Debris lodged in impeller or broken impeller	Lockout pump, remove from wet well, inspect suction and impeller, repair or clean as required, return to wet well

Table 2-2: Sewage Pump Troubleshooting Table

2.4.2 Sewage Flow Metering

Problems with the magnetic flow meter system are usually indicated by inconsistent output readings, error messages, or failed calibration or tests. Typical error messages may include electronics failures, coil open circuit, auto zero failure, auto trim failure, flow rate high, empty pipe, reverse flow, and others. Further troubleshooting will require advanced diagnostics using the transmitter user interface, and/or checking electrical and instrument connections. Consult the manufacturer's operating and maintenance manual for both the flow meter and the transmitter included in Volume III of this manual for detailed instruction on troubleshooting individual alarms or failure messages.

2.4.3 SCADA System

There is no SCADA system associated with the Shaker Landing pump station, only a hard wired telephone dialer. If problems occur with the telephone dialer communicating with the remote telephone communication points, verify the following items:

- Power is present at the pump control panel as evidence by yellow power light being lit
- Power is present at the Sensaphone telephone dialer and the power on switch is engaged
- Verify that telephone service is not interrupted by contacting the serviced provider
- Verify that the telephone cable is plugged into the receptacle and is not damaged.

Consult the manufacturer's operating and maintenance manual for the existing telephone alarm dialer in Volume III for other detailed instructions on troubleshooting. If this is not sufficient to address the problem, Sensaphone has a technical support line that can be called for further assistance.

2.4.4 Emergency Generator Set

The emergency generator is monitored and controlled primarily from the H-100 generator control panel and operator interface, and secondarily at the automatic transfer switch output display. Consult the manufacturer's operating and maintenance manual in Volume III for detailed troubleshooting or factory service requirements. The following table summarizes basic operating troubleshooting for the unit operation.

Problem	Possible Cause	Corrections
Engine fails to crank when start sequence is called for during power outage	Unit not connected to Automatic Transfer Switch	Verify that the Automatic Transfer Switch is powered and operational, and that the circuit breaker between the ATS and the generator is not open.
	Generator control mode not set to Automatic	Check position of operating switch for auto start.
	Loose or corroded	Check battery charge level and condition

	battery cables, defective starter contactor, defective starter motor, dead or defective battery	of battery cables. If starter or contactor is bad, install replacement parts and coordinate with authorized dealership.
	Defective fuses	Open generator control panel and verify condition of fuses on each output line.
Engine cranks but fails to start	Fuel system empty or obstructed	Check inventory in underground propane tank, check regulator operation, check isolation valve position, and confirm any fuel line solenoids are operational.
	Engine mechanical problem	Contact authorized factory dealership for assistance.
	Alarm interlock preventing starting	Review control panel to identify alarm condition that will prevent engine from starting and running.
Engine starts and shuts down immediately	Alarm interlock preventing operation	Verify status of engine oil level, engine temperature, and engine coolant level for proper operating levels. Correct as needed.
	Defective alarm switches	Check operation of low oil pressure switch, coolant temperature switch, coolant low level switch, and control circuit board module.
No AC output from generator	Main line circuit breaker, generator circuit breaker or fuses open	Reset circuit breakers as required and verify condition of individual line fuses.
	Transfer switch not properly set	Verify transfer switch is set to generator input once generator is on line.

Table 2-3: Emergency Generator Basic Troubleshooting Table

2.4.5 Emergency Operations

The sewage pumping station is equipped with redundancy and emergency backup power. Should a massive failure occur that prevents the operation of the pump systems, there is an emergency connection provided on the pump discharge line in the valve vault that could allow either the wet well to be pumped out using a vacuum truck on a recurring basis until operation is restored, or a temporary bypass pump set up and discharging into that connection point to transfer sewage on a manual or simple automatic float switch operation until full station operation can be reestablished. These means are considered emergency backup measures and require full time observations and operation if they become necessary.

2.5 DIAGRAMS AND ILLUSTRATIONS

The following sections describe the diagrams and exhibits that have been included to portray the layout, interconnection, and operation of the various systems previously described. Because of the simplicity of the piping and valving system, no valve identification numbers have been assigned to the various piping components. Operating levels, setpoints, alarm conditions, and other control points have been previously discussed, and pictures of important system components shown. The following sections describe both the pump station components, and the service area collection system and force main transmission system.

2.5.1 Piping, Valving, Pumps, and Sewage Structures

The following drawings are included in Volume II Appendix 1 and illustrate the arrangement of sewage pumping units, piping, valving, and controls:

- Sheet 27 Pump Station Site Plan
- Sheet 28 Pump Station Mechanical Detail

2.5.2 Sewage Gravity Collection System Plans and Profiles

The following drawings are included in Volume II Appendix 1and illustrate the arrangement of the revisions to the gravity collection system within the Shaker Landing development:

- Sheet 11 Partial Collection System Site Plan and Profile

2.5.3 Force Main Plans and Profiles

The following drawings are included in Volume II Appendix 1 and illustrate the arrangement of the force main system plan and profiles:

- Sheet 5 Sewer Extension Plan Station 0+00S to 20+50S, force main discharge
- Sheet 11 Force Main Plan and Profile

2.5.4 Sewer Components

The following drawing is included in Volume II Appendix 2 and illustrate the arrangement of the various structures and maintenance points located in the gravity and force main system, as well as ancillary systems needed for operation:

- Sheet 23 Sewer Details and Notes

2.5.5 Electrical and Control Systems

The following drawings are included in Volume II Appendix 3 and illustrate the electrical, lighting, power, and control details and layout:

- Sheet 29 Electrical Site Plan
- Sheet 30 Electrical Plan and Details
- Sheet 31 One Line Drawings and Details

2.6 OTHER OPERATING CONSIDERATIONS

The on-site gravity collection system and other related equipment is owned and operated by the Shaker Landing Condominium Association. The Association utilizes a variety of certified engineering and mechanical contractors to review collection system condition and operation, and provide service as required. There is no established monitoring frequency for the non-mechanical systems.

The pump station and the force main are owned and operated by the Town of Enfield Public Works Department and will be maintained and inspected on a frequency established by the Director and further discussed in Chapter 3 of this manual.

There are no laboratory testing or other monitoring required for the proper operation of the sewage collection system.

CHAPTER 3 – MAINTENANCE

3.1 ROUTINE PREVENTATIVE MAINTENANCE PRACTICES

Each piece of operating equipment, instrumentation, control panels, structures, or buildings requires a certain level of preventative maintenance. This type of maintenance is intended to observe, maintain, and repair systems before a failure occurs leading to an emergency response or replacement. Most preventative maintenance can be performed by the maintenance and operating personnel of the Town Public Works Department, but there will be times when a specialized subcontractor may be required for electrical, control, programming, or other related work. The following sections summarize key preventative maintenance practices for each equipment system. Refer also to other specific schedules and factory contacts located in the manufacturer's operation and maintenance information included in Volume III of this manual.

As previously noted, the Town responsibilities for operation and maintenance beginning with the pump station. The on-site collection system, including building connections, gravity sewer piping, manholes, and other individual building systems are the responsibility of the Shaker Landing Condominium Association. It is imperative, however, that the Town coordinate directly with the Association to ensure that proper collection system observation, cleaning, and operation are performed to avoid overloading of the pump station and force main with excess flow, excess solids, or prohibited discharges to the municipal system.

3.1.1 Sewage Pump Station

The wet well structure is a precast concrete, rectangular structure that is designed to collect gravity flow from the Shaker Landing development, screen coarse solids or stringy materials that may enter the sewer system, provide an operating volume to allow design cycling of the sewage pumps to transfer sewage, provide limited emergency volume in case of short term pump malfunction, and to minimize solids collection within the wet well sump. The precast concrete structure consists of an anti-flotation base slab, two riser segments with ship lap joints, and a top slab. Each joint is sealed with a double seal and the exterior concrete surface is coated with dampproofing to protect it.

The wet well is considered a NEC hazardous atmosphere and all electrical components and systems installed within the wet well are explosion proof. The wet well is also a confined space and is not to be entered without following the Town confined space protocols. Raw sewage can produce, under certain conditions, toxic or corrosive gases. The wet well systems and components are designed to withstand this aggressive atmosphere.

The wet well is equipped with two access points, a pump and control instrument access and removal hatch, and a smaller inspection access hatch that also allows removal of the coarse trash basket installed on the inlet sewer line. These access hatches are mounted on a curb to prevent precipitation infiltration, and constructed of insulated stainless steel, and are

equipped with a locking mechanism. Normal ventilation of the pump station as it fills and pumps down is provided by an eight-inch diameter gooseneck gravity vent equipped with an insect screen. When the pump station access hatches are to be opened, a mechanical ventilator is provided to prevent a hazardous atmosphere from exiting the station at the opened hatch. The pump station is a duplex pump station with each pump sized to handle the peak flow rates. Because of this it is possible to operate the pump station under a short term condition using only one pump while the other pump is being repaired or replaced. Each pump is equipped with a stainless steel guide rail system and a sealing discharge flange that allows it to be removed from the wet well. Control sensors installed in the wet well include the primary level transducer and two float switches mounted on stainless steel mounting brackets.

The pump station is designed for automated control and does not require a continuous on-site operator presence. However, frequent inspections are recommended to ensure normal operation and to detect potential problems. Typically, the pump station components will be reviewed on a weekly basis for proper operation, with a more detailed monthly inspection and operational documentation prepared. All alarm conditions can be monitored at the remote Public Works Department via a telephone dialer, and any emergency operating conditions will be reported as soon as they occur via this system. The following tables summarize the maintenance and operational checks that should be performed on the pump station systems.

Please note that all electrical equipment must be shut down and locked out at the main instrument disconnect before performing opening or removing equipment for access and performing any maintenance. Some electrical equipment may be hot from operation and care should be used when touching surfaces. Wetted surfaces may have bacterial or other contamination present and proper personnel protective equipment must be utilized during maintenance or access.

System Component	Frequency	Action Required
Wet Well Structure	Weekly	Check insect screen on gravity vent for blockage or icing (winter conditions); Operate mechanical ventilator and confirm free flow through gravity vent.
	Weekly	Open small access hatch and visually check coarse trash basket for accumulation of debris; Review pump station for signs of infiltration at joints or openings; Observe sewage for signs of oil and grease accumulation.
	Monthly	Open pump access hatch and visually check condition of pump removal rails and pump discharge flange.
	Monthly	Inspect two access hatches for general condition and operation including locking latches, hinges, opening spring actuator, hold open devise, and weather tightness.
	Monthly	Remove coarse trash basket, clean of debris, and reinstall.
	Annually	Pump down wet well, remove any grease accumulation on

		side walls and any soils accumulation in pump sump.
	Annually	Inspect belt on mechanical ventilator, tighten or replace.
	Annually	Grease bearings on mechanical ventilator using grease type and volume recommended by manufacturer.
	Annually	Confirm free operation of inlet damper on mechanical ventilator and operation over full range of motion.
Wet Well Control Instruments	Monthly	Open pump access hatch and inspect condition of instrument hangers and cables for liquid level transducer and two float switches.
	Annually	Confirm operation of float switches by manually activating in wet well.
	-----	The wet well level transducer and float switches are sealed systems and do not require routine maintenance. They are repaired or replaced on an as-needed basis.
Sewage Pumps	Weekly	Observe one pump cycle to confirm operation and identify any excessive noise or vibration during operation.
	Semi-Annually	Remove pump and inspect impeller and body for excessive buildup, erosion, or other damage.
	Annually	Remove pump and check outer shaft seal for alignment, wear, or damage.
	Annually	Check motor for proper amperage draw while operating.
	-----	The sewage pumps are oil filled and do not require routine lubrication or maintenance. They are repaired on an as-needed basis.
Pump Station Control Panels located in Pump Station Building	Weekly	Check SC100 pump controller for operating setpoints, alarm indications, and other data via operator interface.
	Weekly	Observe one pump control cycle to confirm operation, cycle time, and pump alternation.
	Weekly	Test panel alarm lights and horns using test and reset button provided on panel.
	Monthly	Check pump operational data using operator interface including total pump run time, total number of starts, maximum hourly starts, average starts per day, and calculated average flow rate for each pump. Compare to typical design and operating parameters.
	Monthly	Record the readings on the pump hour meters and the flow meter totalizer reading for sewage flow.

Table 3-1 Pump Station Preventative and Normal Maintenance

3.1.2 Wet Well Valve Vault

The wet well valve vault structure is a precast concrete, rectangular structure that is designed to make a transition from the wet well pump discharge lines into a single force main line, to provide for a maintenance accessible location for the individual pump isolation and check valves, to provide for direct sewage flow monitoring, and to provide a location for

emergency connection to allow pumping of the wet well. The valve vault is located directly adjacent to the wet well, and consists of a bottom slab and riser section with an installed water stop and a top slab. All joints are sealed with a single seal and the exterior concrete surface is coated with dampproofing to protect it.

The valve vault is NOT considered a hazardous atmosphere, but is considered a confined space and is not to be entered without following the Town confined space protocols.

The valve vault is equipped with one access point equipped with an access ladder and access extension. The access hatch is mounted on a curb to prevent precipitation infiltration, constructed of insulated stainless steel, and is equipped with a locking mechanism. Normal ventilation of the valve vault is provided by a four-inch diameter gooseneck gravity vent equipped with an insect screen. When the valve vault is to be accessed, a mechanical ventilator is provided to provide fresh air exchange. The valve vault houses the pump discharge valves, the inline sewage flow meter, an emergency pumping connection, and a sump pump.

System Component	Frequency	Action Required
Valve Vault Structure	Weekly	Check insect screen on gravity vent for blockage or icing (winter conditions); Operate mechanical ventilator and confirm free flow through gravity vent.
	Weekly	Open access hatch and confirm that the floor is dry and that there is no unusual accumulation of water or condensation.
	Monthly	Observe pressure gauge when one of the sewage pumps is on line and compare to design head calculations.
	Monthly	Confirm the operation of the sump pump by introducing sufficient water into the sump to cycle the pump on and off. Check operation of isolation valve and check valve.
	Quarterly	Exercise all isolation valves over their full range of operating using the hand wheels provided. Confirm the free operation of the pump check valves and that they close completely when the pump goes off line.
	-----	There are no lubrication requirements for the mechanical ventilator and no preventative maintenance activities for the valving or piping systems.
Sump Pump	Annually	Clean sump and check that level float switch and alarm are free and that no pump maintenance is required.
Foxboro Inline Flow Meter	Monthly	Inspect for signs of leakage. Flow transmitter is wall mounted in pump control building, and there are no other observation points available in valve vault.

Table 3-2 Valve Vault Preventative and Normal Maintenance

3.1.3 Emergency Power Generator System

Backup power is provided by a propane-fired generator set rated for 25kW output installed in a weather-tight acoustic enclosure immediately north of the pump control and power enclosure. The automatic transfer switch for the generator is mounted on the eastern side of the pump control and power enclosure panel. Fuel is provided by a 1,000-gallon, underground propane storage tank buried north of the emergency generator. Detailed check lists have been provided in the manufacturer's operation and maintenance manual, and should be copied and filled out at the intervals recommended and be placed in the permanent facility files. The following tables summarize the key preventative maintenance protocols.

System Component	Frequency	Action Required
Oil and Oil Filter	Every 250 hours	Change oil and filter after every 250 hours of operation, or at least annually.
Coolant Quality	Annually	Check coolant annually for breakdown. Drain, flush, and refill system with fresh coolant on a two-year cycle.
Flexible Hoses	Every 2 Years	Change coolant, fuel, oil, air, block heater, or other flexible joints every two years regardless of operating hours.
Accessory Drive Belts	Every 2 Years	Change accessory drive belts every two years regardless of operating hours. Check operation of belt tensioner and replace if indicated.
Magnetic Pickup on Flywheel	Every 2 Years	Remove, clean, inspect, and reset magnetic pickups to the correct operational output voltage every two years regardless of operating hours.
Other System Components	Monthly	Inspect for cleanliness, tightness, and signs of damage.

Table 3-3 Emergency Generator Overall Maintenance Schedule

System Component	Frequency	Action Required
Emergency Generator and Ancillary Systems	Weekly	Automatic exercising of the emergency generator is programmed to occur weekly through the Automatic Transfer Switch user interface panel. An operator should be on site during every exercise event to review system startup, operation under load, and shutdown. Record pertinent operating data for future reference.
	Weekly	Confirm proper operation of intake air and exhaust air louvers during weekly exercise of unit. Louvers should fully open during operation of generator and should fully close when generator shuts down. Check screen for debris or blockage.
	Weekly	Check and record propane tank inventory. If inventory

		reaches reorder level, notify the Public Works Department to order.
	Weekly	Check operation of room ventilation fan and louver system. This unit is thermostat controlled, and is a sealed, direct drive motor system that requires no lubrication. Insure weather hood and inlet screen is free of debris.
	Monthly (or every 24 operating hours)	Disable unit from operating. Check engine oil level, engine coolant level, battery electrolyte level and condition of battery terminals, operation of battery charger, inlet and outlet air dampers for operation and blockage, and any logs of alarm conditions. Return unit to operational condition.
	Semi-Annually (or every 125 operating hours)	Disable unit from operating. In addition to monthly checks, check the engine accessory drive belts and fan coupling for wear and tension, check all hoses, piping, and connections for tightness or leaks, load test the battery or test charge. Return unit to operational condition.
	Annual (or every 250 operating hours)	Disable unit from operating. In addition to monthly and semi-annual tasks, change the engine oil and filter, inspect the air filter and replace as necessary, inspect and check gap on spark plugs, inspect ignition wires for deterioration, check accessory drive belts and replace as required, visually inspect the radiator and charge air core and clean, check coolant levels and condition, check all wiring connections for tightness. Return unit to operational condition.
	Every Two Years	Disable unit from operating. In addition to other checks, adjust engine as required, replace engine air filter, replace and regap spark plugs, drain and flush the cooling system and refill with fresh coolant, replace all flexible hoses, replace fuel filter, remove and clean magnetic flywheel pickups. Return unit to operational condition.
Automatic Transfer Switch	Weekly	Check that switch is monitoring utility line voltage and frequency, and observe operation of transfer switch during weekly exercising of the emergency generator set.

Table 3-4 Emergency Generator Preventative and Normal Maintenance Checks

3.1.4 Force Main Systems

The force main consists of four-inch diameter PVC pressure pipe and fittings installed from the outlet of the wet well valve vault to an existing manhole located off Landing Road at Shaker Landing. The force main is designed to be self-cleaning by maintaining a minimum flow velocity of three feet per second. It is expected to operate reasonably free of problems. The force main slopes uniformly upward from the valve vault to the discharge manhole and

is therefore self-venting. The force main could be drained back to the valve vault if it needed to be repaired. There are no future interconnections, high point air releases, or low point cleanouts provided on the system, and only the discharge manhole should be reviewed on the frequency summarized below.

The discharge manhole is considered a hazardous atmosphere and a confined space and is not to be entered without following the Town confined space protocols. Note that there is a possibility of toxic or oxygen depleted conditions in the manhole due to the presence of sewage gases. Use proper monitoring and ventilation practices for confined space entry.

System Component	Frequency	Action Required
Existing Discharge Manhole	Town Schedule	Inspect manhole bench, channel, walls, frame and cover. Clean manhole as required.

Table 3-5 Force Main Preventative and Normal Maintenance

3.1.5 General Maintenance Practices and Procedures

The Town Public Works Department has a series of safe work practices, maintenance procedures, work documentation methods, and other protocols that are intended to maintain the operating equipment systems in good repair and allow observation, testing, repair, or replacement of system components in a safe manner. Employee safety is the primary concern when planning and executing any work order for repair. The following items summarize key items previously discussed that must be considered when planning work:

- Much of the equipment described above is designed to operate automatically. Operating personnel should be aware that equipment may start up unexpectedly when they are conducting equipment checks, observation or data gathering.
- Rotating equipment is typically protected by OSHA approved guards, but operating or maintenance personnel should avoid loose or dangling clothing when in close proximity to such equipment.
- If equipment is to be removed, opened, or repaired, ensure that the equipment is disengaged from the control system and further confirm that the local electrical disconnect is locked out and tagged, and that any remote start panels are clearly tagged indicating maintenance is being performed.
- Any electrical work except minor work tasks such as resetting breakers, changing fuses, or collecting operating data needs to be performed by a licensed electrician who is aware of all code requirements. However, any and all operation on or in an electrical or control panel must be performed by qualified and trained personnel and in observance of the Arc Flash and Shock Hazard Personal Protective Equipment requirements outlined in NFPA 70E.
- Almost all structures associated with the sewage collection and pumping system are considered confined spaces, and entry into these spaces must be in accordance with

the Town protocols. Please be aware that the hazards associated with each space vary based on the equipment installed within the space, the presence of forced ventilation, and the likelihood of toxic or flammable gases accumulating.

- The wet well is considered a hazardous atmosphere due to the potential flammability of released sewer gases. All electrical equipment within this space is rated for explosion proof operation. Operators should utilize intrinsically safe monitoring and ventilating equipment when opening and observing these spaces and should use non-sparking tools and intrinsically safe illumination systems.
- Raw sewage contains bacterial and other contaminants that can pose a danger to the health and safety of operators coming in contact with those liquids. All operating and maintenance personnel will utilize proper personnel protection equipment including safety glasses or face shield, hard hat if head impact potential exists, suitable gloves, splash protection, ear protection as required, and ventilation.

3.2 TOOLS AND SPARE PARTS

3.2.1 Tools and Disposable Supplies

The Town Public Works Department maintains a vehicle and maintenance garage that is centrally located to the facilities that they are responsible to observe, operate and maintain. The required mechanical and electrical maintenance tools, lubricants and oils, cleaning supplies, replacement parts (such as light bulbs) are stored at this location and available to workers scheduled to complete maintenance.

The Town also stores emergency equipment at this location including portable generators, portable bypass pumps and hose, and similar items. No special tools are required for the operation and maintenance of the Shaker Landing Pump Station. It should be noted that the only specialized piece of equipment that will be routinely required is a tripod and chain hoist system that will be required to remove submersible sewage pumps from the wet well for inspection, cleaning, or repair.

The Operator should carry required personnel protective equipment within the service vehicle they normally use so that it is readily available at the pump station when observation, data gathering, or other operating activities are taking place.

The Operator should store replacement electrical items such as fuses within or on the electrical or instrument panel in which they are used. Some basic cleaning supplies and liquid absorbent pads should be stored at the Pump Station Control Building to allow small water leaks or minor chemical spills to be cleaned up immediately after being discovered.

3.2.2 Spare Parts

Because of different design and operating parameters, much of the equipment located at the Shaker Landing Pump Station is not interchangeable or compatible with other Town sewage

handling facilities. The following equipment is identical to other equipment or systems utilized in Town pump stations and it is not necessary to duplicate spare parts:

- Most power and lighting panels, circuit breakers, and fuses
- Float switches and cabling
- Buttons, lights, switches, hour meters used in pump control panel
- Generac H-100 Control Panel for emergency power systems
- Some pipe, fittings, and components

Because the sewage pump station is a duplex pump system designed for single pump operation, some extended period of operating the system with only one pump available can be tolerated provided that routine and preventative maintenance and checks have been completed.

- It is not recommended that an on-the-shelf spare sewage pump be maintained since factory repair can be expedited if a pump fails.
- It is not recommended that sewage pump bearings or seals be maintained since failure of these elements will require factory inspection and service to insure continued reliability of pump unit.
- It is not recommended that normal power or control items such as circuit breakers, motor starters, control relays, circuit boards, or other similar electrical and control components be maintained since these are readily available on an expedited basis.

However, the following replaceable or wearing parts are recommended to be on hand at the Town Public Works Department:

- Pump Control Board (one for common pump station controllers)
- Submersible Level Transducer (one for common pump station controls)
- Float Switches and Cables (two for common pump station controls)
- Necessary control and power panel fuses.
- Belt for mechanical ventilator (one of each size or type based on equipment)
- Filter set for emergency generator

If specialty parts are required for a particular piece of equipment, consult the manufacturer's operation and maintenance manual located in Volume III of this manual for parts listings and ordering information.

3.3 OTHER MAINTENANCE ITEMS

3.3.1 Record Keeping and Inventory

The Town maintains a standardized computer database that contains information on equipment and system components, maintenance or replacement dates, description of repairs, equipment checks and observation, and spare parts inventory.

The Operator or Maintenance personnel should consult the work order for any repair or maintenance activities and complete the required report forms when equipment is placed back in service. It is the responsibility of the Town Public Works Department to ensure that the equipment operating and maintenance records are kept up to date.

3.3.2 Equipment System Provider Contact

The following manufacturer's or supplier's contact information is provided should factory services, warranty services, consultation, or spare parts ordering be required.

System Component	Designation	Contact Information
Submersible Sewage Pump	Supplier	Pump Systems Incorporated Post Office Box 6101 West Franklin, New Hampshire 03235 (603) 934-7100
	Manufacturer	EBARA Fluid Handling (803) 327-5005
Pump Station Controller	Supplier	Pump Systems Incorporated Post Office Box 6101 West Franklin, New Hampshire 03235 (603) 934-7100
	Manufacturer	Ohio Electric Control, Ashland, Ohio (419)289-1553
Magnetic Sewage Flowmeter	Supplier	Pump Systems Incorporated Post Office Box 6101 West Franklin, New Hampshire 03235 (603) 934-7100
	Manufacturer	Foxboro 33 Commercial Street Foxboro, Massachusetts 02035 (866) 746-6477
Exhaust Fans	Supplier	Buckley Associates, Inc. 55 Buckley Circle Manchester, New Hampshire 03109 (603) 669-3566
Emergency Generator and Automatic Transfer Switch	Generator and ATS Supplier	Yankee Generator, Inc. Post Office Box 21 Lunenburg, Vermont 05906 (802) 892-1348
	Manufacturer	Generac Power Systems, Inc. S45 W29290 Highway 59 Waukesha, Wisconsin 53189 (262) 544-4811

Table 3-6 Manufacturer and Supplier Contact Information

CHAPTER 4 – PERSONNEL

4.1 PERSONNEL REQUIREMENTS

The wastewater operations within the Town of Enfield falls under the direction of the Public Works Department Director. He is considered the direct manager of the system and has a variety of staff available for specific project or operating needs. Currently the Town Public Works Department has separate operating departments for:

- Highway;
- Buildings and Grounds;
- Sanitation (solid waste); and
- Water and Sewer.

The various operating departments within the Public Works Department have a common administrative assistance and share space in Town municipal facilities. Currently the Water and Sewer Department has two full time operators that oversee the municipal public water system and the sanitary collection and pumping facilities associated with the limited sewer service area. Depending upon specific maintenance or operating requirements, the Public Works Department can provide other personnel for general facility maintenance, excavation, transportation, or system emergency repair.

The Town currently operates six existing pump stations and the Shaker Landing pump station covered by this manual. These systems are designed to operate automatically and are equipped with emergency power sources. Typically the pump station components will be reviewed on a weekly basis for proper operation, with a more detailed monthly inspection and operational documentation prepared by the operating staff. All control, alarm, and flow conditions can be monitored at the remote Public Works Department computer terminal, and any emergency operating conditions will be reported as soon as they occur via this system. Completion of scheduled preventative and normal maintenance operations will be completed in accordance with the Public Works Department master work schedule.

The Town sanitary sewer system is not considered a treatment plant because it primarily consists of gravity collection systems and pump stations and force mains that ultimately transfer the sanitary sewage to the City of Lebanon Wastewater Treatment Facility. The Town operates the system primarily under an Intermunicipal Agreement with the City of Lebanon that contains basic definition of sewage flow rates and contaminant levels. There is no primary, secondary, or tertiary treatment that significantly occurs in the Town sewer systems and the system is not considered a wastewater treatment facility requiring its own permit. However, the Town of Enfield is named as a co-permittee with the City of Lebanon under the National Pollutant Discharge Elimination System (NPDES) Permit No. NH0100366. A copy of this permit is included in Volume II, Appendix 7 of this manual for reference. As a co-permittee, the Town is responsible for meeting the requirements contained in Part I.B (Unauthorized Discharges), Part I.C (Operation and Maintenance of the Sewer System), and Part I.D (Alternate Power source) of that City of Lebanon permit.

Because the municipal sewer portion of the Town is simple and limited, the Town relies on contract services for specialized electrical, mechanical, or control work. This subcontracted work is overseen by the water and sewer department operators. The Public Works Department will operate and maintain the Shaker Landing pump station utilizing its existing staff. No additional staff requirements are anticipated.

4.2 JOB DESCRIPTIONS

4.2.1 Public Works Department Director, System Manager

The Town Public Works Department Director is considered the responsible party and operator for the Town wastewater systems. They function primarily as the manager of the system, and their duties include:

- Ensuring maintenance and operation of the municipal sewer system in full compliance with applicable Federal and State requirements;
- Providing documentation of system operation, management, and maintenance;
- Developing personnel and staffing requirements, preparing job descriptions, facilitating the hiring of required personnel, and maintaining an overall organizational chart showing personnel assignments;
- Ensuring adequate working conditions, availability of safety equipment, and proper tools and work practices for employees;
- Establishing and implementing an initial and ongoing operator and maintenance personnel training program;
- Identifying capital budget improvements that may be required for system upgrade or expansion and advising the Town through its annual meeting of such needs;
- Developing an annual operating and maintenance budget, and assisting in the establishment of connection and user fees to fund current expenses and planned capital improvements; and
- Reviewing compliance with applicable Federal and State work practices, environmental standards and regulations, and permitting requirements.

The Public Works Department Director is assisted in carrying out their duties by the other public works and Town administrative and public works staff.

4.2.2 Operating Staff

Operating staff for the Shaker Landing pump station includes a properly trained operator, an assistant operator, and required public works and maintenance staff. The operating staff are expected to be familiar with the operating equipment and systems in the pump station, safe work protocols, preventative and normal maintenance, and emergency response. The operator's duties can include the following representative tasks for this position:

- Participates in the daily operation, observation, and maintenance of the pump station;
- Observes related equipment systems, control, and data collection systems on a

frequency required to document efficient operation of the facility;

- Operates equipment, valving, and other controls required to regulate sewage flow from the pump station;
- Carries out work orders for preventative and normal maintenance, weekly or monthly inspections, and other facility housekeeping needs;
- Maintains operating documents and records to record hour meters readings, flow measurements, alarms and shutdown histories, and other pertinent system operational characteristics;
- Coordinates with the Shaker Landing Condominium Association on items that relate to their collection system that impact pump station operations;
- Performs routine maintenance duties such as lubrication, leakage control, belt changes, system cleaning, and building maintenance;
- Reports on items needed contract service or repair and oversees field work by subcontracted services; and
- Maintains required level of training and knowledge to perform assigned duties.

The types of knowledge, skill, ability or experience required for an operator position include such items as:

- Familiarity with specific equipment systems that are utilized in the pump station;
- Ability to perform work safely and efficiently;
- Basic mathematical ability to perform calculations required for some wastewater reporting or operating;
- Ability to interpret meter and gauge readings, operating run times, and other operating data to adjust and optimize pump station operation;
- Basic writing and communication skills to prepare written reports, log entries, compliance reporting, or other forms;
- A high level of accuracy in maintaining operating records and reporting data;
- Ability to work effectively with other Town personnel, and to direct and observe work performed by subcontracted services;
- Exercising judgment when responding to alarm, shutdown, or emergency conditions and ability to make decisions and carry out notifications to minimize outages;
- Ability to use typical hand and power tools for routine maintenance, as well as specialized tools for lifting or equipment handling;
- Understanding of basic computer use, spreadsheet and database manipulation, and other basic control functions used in programming and operating pump station; and
- Other specialized training that may be added to their job description.

The Town Public Works Department maintains a vehicle and maintenance garage that is centrally located to the facilities that they are responsible to observe, operate and maintain. The required mechanical and electrical maintenance tools, lubricants and oils, cleaning supplies, replacement parts (such as light bulbs) are stored at this location and available to workers scheduled to complete maintenance.

The Town also stores emergency equipment at this location including portable generators, portable bypass pumps and hose, and similar items. No special tools are required for the operation and maintenance of the Shaker Landing Pump Station. It should be noted that the only specialized piece of equipment that will be routinely required is a tripod and chain hoist system that will be required to remove submersible sewage pumps from the wet well for inspection, cleaning, or repair.

The Operator should carry required personnel protective equipment within the service vehicle they normally use so that it is readily available at the pump station when observation, data gathering, or other operating activities are taking place.

The Operator should store replacement electrical items such as fuses within or on the electrical or instrument panel in which they are used. Some basic cleaning supplies and liquid absorbent pads should be stored at the Pump Station Control Building to allow small water leaks or minor chemical spills to be cleaned up immediately after being discovered.

4.2.3 Organizational Structure

The organizational structure has already been discussed in some detail in Chapter 1 of this manual, but is summarized here for reference. The following personnel are actively involved in the proper operation and maintenance of the Shaker Landing pump station in compliance with its design and regulatory requirements:

- Town Selectmen: This governing body of the Town is responsible ultimately for the overall implementation of this O&M Manual, and for providing funding, personnel, and resources required for continued operation of the sewage collections systems for the end users on behalf of the Town.
- Town Manager: The Town of Enfield functions with a Town Manager that carries out the directions of the governing body and functions as chief Town administrator. The Town Manager answers directly to the Board of Selectmen and is responsible for overseeing the Public Works Department Director.
- Public Works Department Director: The Director is responsible for the overall operation and maintenance of the Town's sanitary sewer system including collection systems, pumping stations, and related facilities.
- Operating Staff: The operating staff are part of the Public Works Department Water and Sewer group and have responsibility for the day to day operations of the pump station and related systems. Their primary duties are observations of pump station operations, completing required changes to maintain proper operation, ensuring proper maintenance is completed in a timely fashion, and responding to emergency conditions.
- Maintenance Staff and Contract Service Provides: The town maintenance staff reports to the operating staff to complete certain work orders related to the sanitary sewer system and provide skill, expertise, and equipment operation required to assist the operating staff in maintaining or repairing the systems.

4.3 CERTIFICATION AND TRAINING

4.3.1 NHDES Wastewater Operator Certification

Section Env-Wq304 "Certification of Wastewater Treatment Plan Operators" does not currently apply to the existing Town sanitary sewer systems because they contain collection and pumping systems only, and no treatment or disinfection processes. Currently the Town does not have any wastewater operating staff that are certified under any level with the NHDES.

The Town operates the collection and pump systems under an Intermunicipal Agreement with the City of Lebanon. There are no requirements within that document that require trained or certified personnel.

However, the New England Water Environment Association (NEWEA) offers training and voluntary certification programs for wastewater collection systems personnel in the New England States and may be a program of professional development and recognition that the Town may wish to pursue with their operating staff. The program seeks to improve the quality of wastewater collection systems operations; improve the status of wastewater collection systems personnel; promote safety conditions for wastewater collection systems personnel; provide a roster of qualified personnel; and provide a means whereby those responsible for employment of wastewater collection systems personnel can readily determine the qualifications which are considered desirable in such personnel.

4.3.2 Other Certification or Specialized Training

Although there are no formal NHDES requirements for certification to operate the pump station facilities, there are other specialized training and/or certifications that should be pursued by all operating personnel. These include:

- Competent Person Training and Certification: This training program must be completed by all operating and maintenance staff annually to ensure that they are knowledgeable of the various OSHA standards that apply to their workplace, that they are capable of identifying or predicting workplace hazards related to specific work practices; and that they are affirmed by the Town in their responsibility to correct hazards related to the operation of the facilities.
- Confined Space Entry: The wet well structure, valve vaults, sanitary sewer manholes, interconnection manholes, air release manholes, and cleanout/drain manholes are all considered confined spaces and subject to the Federal regulatory requirements. All operating and maintenance personnel should receive initial training, and an annual refresher in the Town's confined space protocols, the OSHA regulations related to "permitted space" entry, the OSHA regulations regarding trench safety as it relates to confined spaces, and the forms and procedures used to document proper entry into such spaces.

- Basic First Aid and Cardio Pulmonary Resuscitation (CPR): Many of the facilities are located in remote areas, and the types of activities can cause injury or life-threatening conditions. All operating and maintenance personnel should receive initial training in basic first aid, CPR, and accident reporting with annual refreshers offered.
- Excavation and Trenching: All operators of heavy excavation equipment should receive proper classroom and field training to ensure proper licensing or use of the equipment. All personnel involved in operating or maintenance should receive basic training in the OSHA construction standards related to trenching operations, excavation safety, and transportation of equipment.
- Electrical Lock Out/Tag Out: All operators and maintenance staff should receive basic electrical training especially the proper use of a Lock Out and Tag Out program when working on any previously energized electrical equipment. All staff will also receive basic training in electrical safety, electrical arc flash, and protocols to be used whenever control or power panels or other electrical equipment are opened for observation or maintenance.

CHAPTER 5 – ALARM AND NOTIFICATION SYSTEMS

5.1 OVERVIEW

The Shaker Landing Pump Station is equipped with various local operating alarms, shutdowns, and indicators that activate warning lights, master trouble light, or alarm horn within or outside of the Pump Station Operating Building. Any alarm condition should be further observed in the field and troubleshooting carried out to determine the cause and the remedy. Because the pump station is designed for automated operation and is not designed for a full time, on-premise operator, the station is also equipped with a Sensaphone telephone dialer that can provide notification of up to eight phone numbers if an alarm condition is noted at the pump station.

5.1.1 System Alarm Summary

The following table summarizes the various pieces of operating equipment and the alarms and shutdowns that are provided.

Operating System	Alarm Type	Indication Type	Location	Condition Indicated
Sewage Pump Station	VFD Start Failure Alarm	Red Light	Pump Control Panel	Control panel called for pump start and pump failed to come online.
	Seal Failure Alarm	Red Light	Pump Control Panel	Primary and secondary mechanical seal failure in the pump whose warning light is lit. Pump will be shut down until repaired.
	Pump Motor High Temperature Shutdown	Red Light	Pump Control Panel	Motor winding temperature is high and motor damage is imminent. This is a pump shutdown alarm condition.
	Wet Well Low Level Alarm	Red Light	Pump Control Panel	The alarm indicates that the pump has continued to run after the pump controller called for a pump stop. Prolonged pump operation with no liquid level can damage pump. Primary alarm is from transducer signal, secondary backup alarm is from float switch.
	Wet Well High Level Alarm	Red Light	Pump Control Panel	The alarm indicates that a high level in the wet well exists. The pump control should have locked out the lead pump and attempted to start the lag pump. Action must be taken to avoid sewage backup or overflow. Primary alarm is from transducer signal, secondary backup alarm is from float switch.
Emergency Generator	Overvoltage Alarm and Shutdown	Generator Alarm	Generator Control Panel	If an overvoltage condition is detected while the generator is operating, the control panel will initiate shutdown.
	Overspeed Alarm and Shutdown	Generator Alarm	Generator Control Panel	If an engine overspeed condition is detected while the generator is operating, the control panel will initiate shutdown.

	Low Oil Pressure Alarm and Shutdown	Generator Alarm	Generator Control Panel	If there is an indication of loss of lubricating oil pressure while the generator is operating, the control panel will initiate shutdown.
	High Coolant Temperature Alarm and shutdown	Generator Alarm	Generator Control Panel	If there is an indication of high temperature in the coolant system while the generator is operating, the control panel will initiate shutdown.
	Low Coolant Level Alarm and Shutdown	Generator Alarm	Generator Control Panel	If there is an indication of loss of coolant level in the coolant system while the generator is operating, the control panel will initiate shutdown.
	Failure to Supply Power Alarm	Generator Alarm	Generator Control Panel	If the generator is operating and fails to supply the proper level of power to the operating system, an alarm will activate.
	Overcrank Alarm and Shutdown	Generator Alarm	Generator Control Panel	If the control panel calls for the generator to start and three start-up attempts are completed without success, the system will be locked out.
	RPM Loss Alarm and Shutdown	Generator Alarm	Generator Control Panel	If the RPM sensor fails while the generator is operating, the control panel will initiate shutdown.
	Operating Condition Warnings	Generator Display	Generator Control Panel	Certain operating conditions will provide warning messages on the User Interface if normal conditions are exceeded and require action. These warnings will automatically clear when the condition is no longer present.

Table 5-1 Alarm and Shutdown Conditions

5.1.2 Alarm Display and Operator Notification

Table 5-1 above indicates the various alarms that are associated with the operating equipment, and indicates the location where the alarms will be indicated. The pump station has the following locations to review warning, alarm, or shutdown conditions.

- The main pump control panel is located within the pump control and power enclosure located adjacent to the wet well and includes alarm or failure indications for the two sewage pumps and the wet well operations. These conditions are primarily indicated by red alarm or shutdown lights on the panel, and an enclosure mounted alarm horn and red alarm light.
- There is a user interface on the Station Controller SC-100 pump controller that is mounted in the panel that allows the operator to review operating set points or to test the various alarm functions.
- The Foxboro sewage flow meter is equipped with a user interface on the transmitter mounted in the pump station control building that allows the operator to review sewage flow conditions, perform diagnostics, and monitor alarm history or conditions. The sewage flow meter does not alarm through the main control panel or the alarm telephone dialer.

- The generator control panel is equipped with a user interface that allows operating conditions and alarm history to be reviewed from the panel. No specific alarm conditions are sent to the alarm telephone dialer, but a common trouble alarm signal indicating possible malfunction is sent. The generator control panel is equipped with a common alarm horn that activates locally when any alarm or shutdown condition is detected.
- The generator automatic transfer switch is equipped with a user interface that allows monitoring of the utility or generator line voltage and status of emergency power system. Other programming controls are available for automatic exercising of the generator system. No alarm conditions are sent to the alarm telephone dialer.

5.2 ALARM RESPONSE

Because the pump station is generally unmanned during normal, automatic operating conditions, it is important to dispatch an operator to the station within ten minutes of a priority alarm or shutdown. These priority conditions typically involve high or low wet well levels, sewage pump start failures, or generator start indication.

5.2.1 Wet Well and Pumping System

The following summarizes a general response to alarm or shutdown conditions involving the wet well or sewage pump station:

- Confirm that no emergency condition exists at the pump station once on-site (i.e. fire, electrical shorts, or sewage overflow).
- Acknowledge the alarm on the main pump control panel and note the alarm condition, which pump was running at the time of the alarm, and the current pump station status.
- Use the operator interface on the pump controller to quickly monitor the wet well operating level. If levels are high or low, confirm visually by opening the access hatch and observing the wet well conditions.
- Attempt to reset the pumps and control panel to automatic operating mode. Observe one cycle of both pumps being brought on line and taken off line, and the operating levels in the wet well at which this occurs.
- If a pump continues to alarm due to failure to start, it may be necessary to isolate the pump from the control system, de-energize the pump at the main disconnect, and pull the pump out of the wet well for observation or cleaning. After taking a pump off-line, confirm that the control system continues to operate the pump station automatically on the one remaining pump.
- During pump operation, monitor the flow rate at the Foxboro flow transmitter to confirm that the pump is delivering the normal operating flow. If flow conditions appear to be restricted, perform an inspection of the adjacent valve vault isolation valves and check valves to insure proper operation, and monitor the discharge pressure at the force main during pump operation, and when the pump shuts off.

- If a high level persists in the wet well and cannot be corrected by operation of the pumping system, immediately notify supervisory personnel of a high level emergency so that backup services (such as vacuum truck pumping, or emergency bypass pumping) can be ordered and implemented before significant sewage backup occurs within the system or overflow conditions are imminent.
- Utilize other troubleshooting and operating tables in Chapter 2 of this manual to isolate particular system operating problems and take corrective action.
- After all alarm or shutdown conditions are addressed, observe the pump station through one complete cycle of operating both pumps to confirm that operation has returned to normal and no further on-site monitoring is required. Perform other housekeeping, cleaning, or site restoration items that may be necessary based on the actions taken.

5.2.2 Emergency Generator System

The following summarizes a general response to alarm or shutdown conditions involving the emergency generator system:

- Confirm that no emergency condition exists at the pump station once on-site (i.e. fire, electrical shorts, or sewage overflow).
- Acknowledge the alarm on the main generator control panel, and using the user interface identify the alarm condition and operating condition of the generator system.
- Confirm proper operation of ancillary systems including inlet and exhaust louver systems, and propane fuel system.
- Use the operator interface on the automatic transfer switch in the pump control room to verify the source of electrical power (utility or generator) and the electrical operating conditions.
- Use the operator interface on the emergency generator control panel to identify the alarm condition. Once this is identified verify that the alarm condition exists, and take steps to address it.
- If the primary utility power is unavailable and emergency power is required, reset the emergency generator using the control panel and attempt to restart the generator in automatic mode via the automatic transfer switch. If successful, observe the operation of the generator and pump station to verify that the system is working properly.
- If the primary utility power is unavailable, confirm with the provider that an outage has occurred in the service area, and attempt to determine how long the outage is expected.
- If proper emergency generation operation cannot be initiated after correcting alarm condition, immediately notify supervisory personnel of the need for emergency backup services to prevent sewage backup or overflow. Contact manufacturer's representative for immediate service for the generator system.
- Utilize other troubleshooting and operating tables in Chapter 2 of this manual to isolate particular system operating problems and take corrective action.

- After all alarm or shutdown conditions are addressed, observe the emergency generator operation until utility power is restored and the generator system has cycled down to a standby position. Perform other housekeeping, cleaning, or site restoration items that may be necessary based on the actions taken.

5.3 TESTING OF ALARM SYSTEMS

Each of the main control panels has an alarm test button and acknowledge button. Every time that the pump station is visited, the alarm function should be tested by:

- Notify supervisory personnel that a test is about to be performed and to ignore any immediate alarms that may come in over the automatic alarm telephone dialer.
- Push the test button, verifying that all alarm or warning lights are activated, and that the horn and/or alarm light operate.
- Acknowledge the test and reset the panel.
- Replace any bulbs that do not activated during the test and make any required adjustments to alarm horn or light.
- Verify that the alarm telephone dialer is operational by consulting the manufacturer's O&M manual and verifying that alarm notification has been received at the programmed call numbers.
- Use the operator interface panels on the Foxboro flow transmitter, the automatic transfer switch, the SC-100 station pump controller, and the emergency generator panel to review operating and alarm history for any action that may need to be taken.

CHAPTER 6 – RECORDKEEPING

6.1 IMPORTANCE OF RECORD KEEPING

Proper recordkeeping is essential to the successful implementation of this O&M manual and for the proper operation of the sewage pump station and collection/transfer system over the long term. Record keeping:

- Provides information on each piece of equipment or control system in a readily retrievable format;
- References manufacturer's data including spare parts list and order, manufacturer's representatives contact information, and certified factory service locations;
- Maintains a record of when a piece of equipment was first purchased or installed, the historic repairs or replacements that have occurred since the first installation, and the date that it was taken out of service;
- Identifies specific repairs made or failures encountered to allow tracking of recurring problems;
- Summarizes preventative and normal maintenance that should take place and dates that it is actually implemented;
- Lists specific lubricants, fluids, filters, or repair kits that are required for proper maintenance and operation of equipment systems;
- Documents compliance with NHDES regulations;
- Tracks operating hours, total flows handled, and other key operating parameters to allow prediction of future maintenance requirements or operational changes; and
- Compares actual maintenance and operating costs against annual budgets to allow for capital improvement planning, user charge implementation, and annual Town reporting.

6.2 LOCATION OF EQUIPMENT RECORDS

The maintenance, equipment, and operating records for the Shaker Landing Pump Station are maintained by the Administrative Assistant for the Town Public Works Department, and are available at the Town Public Works Department garage and office located at 74 Lockehaven Road, Enfield, New Hampshire. These records may be available as either data entered into a computer tracking database, or hard copy files of drawings, manuals, and other information placed in filing cabinets in the office. All required operating, maintenance, and equipment files for the Shaker Landing Pump Station will be formatted and filed by the Administrative Assistant in accordance with the current Town standard.

A copy of Volume I of this O&M Manual will be placed in a protected location within the pump control and power enclosure at the Shaker Landing Pump Station.

6.3 RECORD KEEPING AND REPORTING PROCEDURE

It is the responsibility of the Public Works Director to oversee the documentation of NHDES compliance, historic pump station operation, and equipment maintenance and replacement. The Public Works Department will issue work orders for preventative or normal maintenance activities or equipment repair or upgrade, and these work orders will be carried out by operating and maintenance staff. The Public Works Director, in coordination with the Town Manager, will interface with regulatory agencies, the Shaker Landing Condominium Association, or the City of Lebanon Wastewater Treatment Facility staff as required.

It is the responsibility of the operating and maintenance staff to document preventative maintenance completed, system repair or emergency maintenance, emergency occurrences or accidents at the pump station, lubricants or spare parts utilized in maintenance operations, operating conditions such as flow and run times, and general records of the condition of the pump station facilities. These records will be prepared and filed on the existing forms that are currently utilized by the Public Works Department and available at the office and garage.

It is the responsibility of the Administrative Assistant to supervise the timely and accessible filing or data entry of the documents provided during operation or maintenance.

6.4 TYPES OF RECORDS

The Town Public Works Department currently maintains the following records for its sewage pumping facilities, including the Shaker Landing Pump Station.

6.4.1 Equipment Identification

The following information should be maintained for each piece of operating equipment, instrument, or control system:

- Name given to equipment, and inventory number if applicable;
- Model number, serial number, type and size;
- Initial cost and installation date;
- Name of manufacturer or supplier;
- Contact number for ordering parts or factory maintenance; and
- Required spare parts lists (belts, lubricants, seals, etc.).

6.4.2 Preventative and Normal Maintenance

The following information should be maintained for each piece of operating equipment, instrument, or control system:

- Schedule of preventative maintenance including inspection, lubrication, filter change, belt change, or other required action;
- Work orders, if applicable, for preventative and normal maintenance performed;

- Records of actual maintenance completed including parts installed, repairs completed, adjustments or calibrations required, and other actions;
- Any follow-up observation or measurement required after maintenance is completed; and
- Spare parts utilized or parts needed in inventory for next event.

6.4.3 System Inspection Records

The following information should be maintained for the various operating systems for the Shaker Landing Pump Station collection system, sewage pumping system, and force main:

- Manhole inspections, including observations, photographs, and recommended repairs (scheduled on a multi-year rotating basis);
- Pump Station monthly detailed inspection and walkthrough;
- Isolation valve exercise dates;
- Flow meter or control instrument calibration or diagnostic check results; and
- Repairs or maintenance completed on building structures, operating yard area, and landscaping;

6.4.4 Federal, State and Local Compliance

Currently, the operation of the pump station is not regulated under State or Federal regulations. The NHDES was required to review the design of the system as part of the installation, but no National Pollutant Discharge Elimination System (NPDES) permit is issued for the facility since there is no direct discharge to the environment. The pump station will operate under a local inter-municipal agreement with the City of Lebanon, who is the ultimate recipient, treatment facility, and permitted discharger for the sanitary sewage. This local agreement may contain requirements for scheduled reporting of flow data, and some sampling and analysis of the typical discharge sewage to determine if there are any pollutants present that have stricter limits (i.e. high biological oxygen demand, metals, oil and grease, and similar items).

The following information should be maintained for the Shaker Landing Pump Station on at least a monthly basis:

- Run time hours for each sewage pump;
- End of the month totalizer readings for the total sewage pumps;
- Volume of propane available in the underground storage tank;
- Alarm conditions, their date of occurrence, and action taken to correct;
- Laboratory result reports for any required sewage testing;
- Records of weekly emergency generator exercising; and
- Narrative description of any unusual or emergency conditions (high wet well level, force main leakage, equipment failure, or release of sewage to environment) and the actions taken.

6.4.5 Cost and Budget Information

The following information should be maintained for the Shaker Landing Pump Station. This information may be maintained in the Public Works Department office, or the main Town office.

- Copies of current operating budget with monthly tracking of expenditures or revenues to date;
- Copies of monthly utility meter readings and billings for electricity related to the Shaker Landing Pump Station;
- Copies of any propane fuel delivery records for the emergency generator system;
- Updated capital improvement plans identifying schedule and anticipated cost, including any quotations, for equipment replacement or upgrade;
- Copies of purchase orders or invoices for parts, factory repair or calibration, or emergency subcontractor services; and
- Operating and maintenance department records regarding activities and level of effort, recommended changes for next year's operating budget, and other similar items required for annual planning and budgeting.

6.4.6 Personnel Training

The following information should be maintained for the operating and maintenance staff that have responsibility for the Shaker Landing Pump Station. This information may be maintained in the Public Works Department office, or the main Town office.

- Copies of employee training completed by the Town regarding policies, procedures, and job performance;
- Copies of special training events for use of personal protective equipment, health and safety during job performance, emergency response, first aid, equipment lock out and tag out procedures, confined space entry, safe work practices for energized electrical equipment, and related personnel training.
- Copies of any certifications or outside training courses completed by members of the operating or maintenance staff; and
- Copies of any emergency response training to conditions that could impact the proper operation of the Shaker Landing Pump Station.

6.5 ACCIDENT OR RELEASE REPORTING

6.5.1 Accident Reporting

Accidents involving vehicle or property damage, or personnel injury must be immediately reported to the Public Works Department Director. The reporting and documentation required under accident reporting is the responsibility of the Town Manager and the Public Works Department Director, and will be completed in accordance with existing Town protocols. No additional responsibility under this O&M manual is required.

6.5.2 Release Reporting

The Shaker Landing Pump Station and the force main are within the protected shoreland buffer for Mascoma Lake, a sensitive environmental receptor. The NHDES requires a telephone notification within 24 hours from the time that the Town operating staff becomes aware of a non-compliance condition. Reporting must occur to both the Federal EPA and the NHDES. Non-compliance is any event that may endanger public health or the environment. For a pump station, collection system, or force main system this includes any system overflows or other releases to the environment. It is the responsibility of the Town Manager or the Public Works Director to contact the following agencies:

U.S. Environmental Protection Agency – Region 1 (New England)
Joy Hilton (617) 918-1877

NHDES Water Division, Wastewater Engineering Bureau, Permits and Compliance Section
(603) 271-2001

Because of the local public health threat, the Town Health Department Health Officer should also be contacted in case local response or notification is required.

CHAPTER 7 – SAFETY

7.1 MANAGEMENT AND OPERATOR RESPONSIBILITIES

7.1.1 Town Management Responsibilities

The Town of Enfield Board of Selectmen, operating through the Town Manager and the Director of Public Works is responsible for the following safety related issues:

- Identifying staffing needs, preparing job descriptions, and hiring qualified and/or certified operators and maintenance workers sufficient to properly operate the pump station systems in compliance with NHDES regulations and without undue stress on workers due to staffing levels, work hours, and time off;
- Providing operator and maintenance personnel training in equipment maintenance and operation, in personal safety, in compliance with NHDES regulations, in record keeping, and in safe work practices;
- Developing safe work practices and standard operating procedures to guide personnel in specific work tasks or methods;
- Providing workers with the required personnel protective equipment to allow them to safely monitor, access, operate, and maintain the facilities;
- Maintaining the facilities and related equipment to provide a good and safe operating environment in compliance with Federal and State requirements; and
- Providing the required equipment, tools, administrative support, and other resources required to maintain efficient and effective operation and maintenance of the equipment systems;

7.1.2 Operator Responsibilities

The Town Public Works Department sewage system operators are responsible for the following safety related issues:

- Following established and proper operational and maintenance means and methods for various required work tasks:
- Seeking training or instruction in new work procedures, safety, or equipment operation to stay current with the requirements of the job and any required certifications;
- Observing all safety protocols to maintain personal safety while on the job and to avoid impacts to public health or the environment;
- Checking the available safety equipment that is available at the pump station or other Public Works Department facilities including fire extinguishers, first aid kits, confined space equipment, atmospheric monitoring equipment, and other safety related supplies to ensure that they are in good working condition and readily accessible;
- Maintaining good housekeeping practices to keep all facilities and equipment in a clean, safe, and properly functioning condition; and

- Responding to emergency conditions by notifying the proper authorities or responsible providers.

NOTE: Under the scope of the Occupational Safety and Hazards Act, the primary responsibility for personal safety lies with each operator. Do not place yourself in harm's way if you cannot respond to an operating or maintenance problem safely. Stop work immediately, assess the situation more fully, and implement procedures for making the area and equipment safe before entering.

7.2 HAZARD ANALYSIS

The following hazards may be present while observing, operating, or maintaining the various equipment and related systems at the Shaker Landing Pump Station. When beginning any type of activity within the pump station, consider the setting, assess the hazards, and utilize proper controls or methods to minimize risk or exposure.

7.2.1 Sewer Hazards

All sewer structures including sanitary gravity sewer manholes, wet wells, valve vaults, and force main access or operating manholes are considered confined spaces even if they are equipped with access steps, permanent entry ladders, or gravity and mechanical ventilation systems. No structure should be entered without following the Town Confined Space Entry protocols. At a minimum this includes:

- Defining type of work to be performed and length of time required;
- Monitoring atmospheric conditions within structure to ensure it is a safe work environment;
- Completing a hazard analysis to identify potential hazards;
- Implementing engineering controls to minimize or remove hazards;
- Providing isolation on certain valves or access points to prevent liquid, solid or gaseous material from entering work space;
- Providing proper safety equipment to personnel completing work;
- Providing backup personnel to observe workers and to respond to emergency situations;
- Providing a safe means to retrieve injured or affected personnel without subjecting other personnel to risk;
- Maintaining safety response equipment at the work site to allow immediate response while awaiting additional emergency response help, including retrieval devices, fire extinguishers, first aid kits, and similar equipment; and
- Completing all work procedures in accordance with accepted protocols and best practice standards.

Sanitary sewage contains biological organisms that assist in the breakdown of solids and contaminants. In the process of this biological activity, sewer gases can be released that include hydrogen sulfide, methane, other toxic gases, or gases that may displace oxygen and

functions as an asphyxiant. Ongoing monitoring and proper ventilation must be implemented during operations to insure that the initial entry is safe, and that the atmosphere in the working space does not deteriorate due to the work or lapse of time.

Additionally, many sewer gases are explosive or flammable and many of the operating structures are identified as a potentially hazardous atmosphere in which non-sparking tools and other intrinsically safe equipment must be utilized.

Finally, proper protective equipment and work procedures must be utilized to prevent contact with sanitary sewage and the bacteria or toxins it may contains. This includes eye protection proper gloves and hand protection, and protection against splashing or the absorption of sanitary sewage into clothing.

7.2.2 Mechanical Hazards

Although all equipment should be designed with proper guarding, screening, or enclosures, all mechanical rotating equipment has the potential to catch clothing or loose hair, to pinch hands or fingers, to pull an operator or maintenance personnel further into the equipment, or cause other forms of injury. Some of the equipment is also mounted in a hard to reach place or is excessively heavy. Removal of or access to this equipment often requires special lifting or maintenance jacks or supports.

Any equipment that is electrically or automatically started or operated must be completely disengages from the automatic control systems and must have its motor drivers, control power, or instrument connections properly de-energized and protected against accidental start of energizing through the rigorous observance of lock out and tag out procedures. Do not rely on another person's lock and tag to protect you, obtain and place your own lock and tag before doing any work on equipment.

Another potential mechanical hazard exists when using power operated tools (jacks, saws, lifts) or mechanical excavating or lifting equipment. Always be aware of clearances required when using any equipment or powered tools.

7.2.3 Electrical Hazards

Almost every piece of equipment, control panel, and instrumentation has some level of electrical power associated with it. Several levels of power are utilized at the site with the main incoming line consisting of 230V 3 phase power. This incoming power is stepped down to 120V single phase power for use in equipment operation, and lighting and power systems. Some power is stepped down further via transformers to supply lower voltage control or instrument power. All energized equipment or systems have the capability of causing personal harm through electrocution, shocking, inadvertent tool grounding, or arc flash. Most electrical work, except for common duties such as changing out light bulbs, control lamps, or fuses must be done by a certified electrician.

No electrical or control panels should be opened without proper training, without proper safety equipment, and without proper isolation to prevent contact with live circuitry.

As noted above, the most common hazard will involve operating or maintaining energized equipment. As previously noted, rigorously observe lock out and tag out procedures before performing such work.

7.2.4 Chemical Hazards

No treatment chemicals are utilized at the Shaker Valley Pump Station.

Please be aware that other normal compounds used in lubricating equipment, cleaning equipment, maintaining landscaping, or cleaning control room surfaces may also have other limited health effects. Read all of the labels on the compound containers before using to become aware of potential safety hazards, recommended personal protection, and proper disposal.

Any chemical, industrial or household, that has hazardous constituents or the potential for health impacts is required to have a Safety Data Sheet (SDS). The Public Works Department compiles a master booklet of SDS sheets for all lubricants, cleaning supplies, chemicals, and other substances used in the operation or maintenance of its facilities. A SDS sheet for the sodium permanganate solution is protected in a plastic holder and placed on the chemical drum in the control building for ready reference.

7.2.5 Tripping and Falling Hazards

During normal operation of equipment systems, there is a small likelihood of tripping hazards being present as long as proper snow removal, housekeeping, and facility maintenance is completed. However, whenever an underground structure is opened, there is a chance for tripping while entering or exiting, or falling uncontrolled into the structure. Exercise due diligence when working around open structures (hatches open, manhole covers removed, etc.), be aware of your surroundings, and erect warning and fixed barriers around the opening to prevent inadvertent entry.

There are limited opportunities to walk on a surface that is more than six feet off the ground but it is possible when doing building maintenance. OSHA requires that a body harness with anchor and shock absorber be supplied when working at heights six feet or above to limits the chances of falling or injury should a fall occur. Also, be aware that OSHA has standards for stairways, ladders, and scaffolding that should be consulted if this type of system is required for maintenance activities.

Finally, be aware of falling dangers when working around any excavation. OSHA requires protection of any open trench that is greater than four feet in depth, and access into and out of the trench is further detailed in the standards.

7.2.6 Trenching Hazards

Typically trenching hazards are limited during normal operation and maintenance of the Shaker Landing pump station. However there may be times when gravity sewer, force main, or other underground components must be accessed and repaired, OSHA has a complete standard regarding trenching safety and this must be rigorously followed. Some key items include:

- Any excavation greater than four feet where a hazardous atmosphere may be present should be tested and monitored.
- Any excavation greater than five feet deep requires shoring or other protection that may include benching or side slopes.
- Any excavation greater than four feet deep requires a means of access (ladder, steps, etc.) for entry and exit, and this must be placed within 25 feet of the location where work is taking place.

Consult the OSHA standard for further trenching controls and protocols. Also, note that any excavation must have a DigSafe review prior to excavation.

7.2.7 Road Hazard and Traffic Controls

Most of the operation and maintenance work will take place within the pump station yard area. However, the force main and its discharge manhole are located along Landing Road. Any repairs or observations of these systems may necessitate closing one lane of traffic when performing excavation within the road corridor or when accessing any of the structures for maintenance.

Two principles cover doing work within the road right-of-way, visibility and separation. It is vital to alert drivers of a work zone well in advance of entering it, providing them with directions regarding traversing the work zone, and clearly indicating their lane of travel to provide maximum separation between moving vehicles and equipment or personnel. The following should be considerations when doing any road access or excavation related to the system:

- Four-foot high orange warning signs should be erected at a suitable distance from the work zone to warn drivers to be vigilant and to slow down. The U.S. Department of Transportation Manual on Uniform Traffic Control Devices has specific recommendations based on road conditions and vehicle speed.
- Clearly delineate the work zone with traffic cones, barrel-type barriers, or other more weighty barriers if there is an increased risk to personnel. The work safety zone will always include warning signs, a transition area indicated by signs, flaggers to control traffic flow, and a safety buffer at the work zone.
- Ensure that all work is supervised at the surface by a foreman who is monitoring traffic and work conditions and making adjustments to minimize potential risks and provide for worker safety.

- Never leave open excavations or structures overnight without onsite supervision present. Use fill material and temporary surfaces if work will continue or other steel plates or other systems to allow traffic flow during non-working hours. Maintain warning signs and lighting to alert vehicles as to the location of ongoing work.

7.3 PERSONNAL HYGIENE

Operating personnel may be exposed to sanitary sewage during operation or maintenance of equipment systems. Personal hygiene is the most effective way to prevent infection or injury due to the presence of toxins or disease producing bacteria. Good work practices identify a hierarchy of controls to minimize hazards and limit exposure. These include:

- Eliminating the hazard where possible by doing away with a hazardous chemical, changing equipment types or design, and finding a way to completely remove the hazard from the site.
- Substituting materials or equipment to eliminate a more significant hazard, reduce exposure potential, and minimize risk.
- Installing engineering controls to minimize personnel exposure, such as increasing ventilation, providing easy to use sampling points, providing easy access and ample work spaces.
- Instituting administrative controls by changing work descriptions, job tasks, or the way certain jobs are done to reduce exposure.
- Providing personnel protective equipment to protect personnel from exposure (to be used as a last resort protective measure).

Operating and maintenance personnel should utilize proper personal protective equipment including safety glasses or face shields, splash protection or protective outwear to minimize liquid contact, protective gloves to minimize contact, safety shoes to prevent heavy equipment damage, and hard hats when overhead hazards exist. Once work is completed, all soiled personal protective equipment should be removed, cleaned or disposed of, and all skin surfaces washed well with soap and water.

Personnel should also use other common sense work practices such as:

- Not eating or consuming beverages within the operating or work space to avoid ingestion of contaminants or bacteria;
- Maintaining good housekeeping to clean up spills or stains as soon as practical;
- Disposing of damaged or dirty protective equipment; and
- Being aware of potential safety or exposure hazards while completing maintenance or operating tasks.

7.4 SAFETY EQUIPMENT

The operating and maintenance staff should be aware that there is no safety, rescue, or emergency response equipment permanently located or stored at the Shaker Landing Pump

Station control building. The Public Works Department maintains a store of equipment at its main garage and office. Personnel who are intending to complete a simple site walkaround, collect accessible data, or monitor the condition of the pump station do not require any special safety equipment.

However, if maintenance activities involving equipment removal, cleaning, repair, or replacement is planned, the operator should identify specific tools, safety and monitoring equipment, and equipment that needs to be moved to the site. In general, the following safety equipment should always be brought to the site and available at the work area:

- Properly rated and sized fire extinguisher;
- Any atmospheric monitoring equipment needed to verify safe work conditions;
- Any special bracing or lifting tools that have the proper load rating for the work to be completed;
- Required grounding protection mats, breaker actuators, or other electrical monitoring equipment for energized equipment access;
- A basic first aid kit;
- Cleaning materials to perform site restoration and housekeeping once work activities are completed; and
- Personal protective equipment and personal hygiene products to minimize exposure to operating and maintenance fluids.

7.5 TRAINING AND SAFETY POLICIES

7.5.1 Training

It is the responsibility of the Public Works Department Director to ensure that all operating or maintenance personnel receive the required training to safety and effectively do their jobs. Not all personnel will receive the same training, but, as previously noted, the following training should be given to as many personnel involved in the day to day operation and maintenance of the site as possible.

- Competent Person Training and Certification: OSHA defines a competent person as "one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them." All supervisory or chief operating staff should receive this training, but all workers should be given training in hazard identification and reporting.
- Confined Space Entry: The wet well structure, valve vaults, sanitary sewer manholes, interconnection manholes, air release manholes, and cleanout/drain manholes are all considered confined spaces and subject to the Federal regulatory requirements. All operating and maintenance personnel should receive initial training, and an annual refresher in the Town's confined space protocols, the OSHA regulations related to "permitted space" entry, the OSHA regulations regarding trench safety as it relates to confined spaces, and the forms and procedures used to document proper entry into

such spaces.

- Basic First Aid and Cardio Pulmonary Resuscitation (CPR): Many of the facilities are located in remote areas, and the types of activities can cause injury or life-threatening conditions. All operating and maintenance personnel should receive initial training in basic first aid, CPR, and accident reporting with annual refreshers offered.
- Excavation and Trenching: All operators of heavy excavation equipment should receive proper classroom and field training to ensure proper licensing or use of the equipment. All personnel involved in operating or maintenance should receive basic training in the OSHA construction standards related to trenching operations, excavation safety, and transportation of equipment.
- Electrical Lock Out/Tag Out: All operators and maintenance staff should receive basic electrical training especially the proper use of a Lock Out and Tag Out program when working on any previously energized electrical equipment. All staff will also receive basic training in electrical safety, electrical arc flash, and protocols to be used whenever control or power panels or other electrical equipment are opened for observation or maintenance.
- Emergency Notification: All operators and maintenance staff should receive training on emergency notification when dealing with pump station alarms or shutdowns, sewage release, fires, accidents, or personal injury. They should also be given training in whatever means of mobile communication are utilized when completing field work including radios and other devices.
- Chemical Safety Training: All operators should receive training on the safe use, cleanup, and disposal of any maintenance or housekeeping chemicals used in the operation of the pump station. This should include a review of the SDS sheet, reporting or responding to chemical spills or releases, and proper containment, mitigation, and cleanup techniques.
- Equipment Maintenance Procedures: All operating and maintenance personnel should receive training in any specialized work protocols that may need to be followed during the course of their normal working day. This could include instruction on lifting, cleaning, and replacing the sewage wet well trash basket; removing a sewage pump from the wet well; changing electrical fuses or resetting breakers; and operation of any specialized tools or equipment.

7.5.2 Safety Policies and Procedures

Copies of the following existing Town policies and procedures are included in Volume II Appendix 6 of this manual.

- Confined Space Entry Policy and Procedures
- Electrical Lock Out and Tag Out Policy and Procedures

The operating staff should familiarize themselves with the content of these two key policy documents.

CHAPTER 8 – EMERGENCY OPERATING PLANS AND PROCEDURES

8.1 VULNERABILITY ANALYSIS

Any mechanical system relying on instrument signals and controllers to operate automatically has the potential to fail due to a variety of causes. Even gravity collection sewer systems can experience leakage, blockage, or overflow under emergency operating conditions. For this reason it is necessary to have an emergency response plan in place that operating and maintenance staff are trained to follow. Such a plan contains procedures for notification, reporting of failures or releases, corrective actions to implement, and additional resources that may be available. Each plan, however, begins with an assessment of the types of risk, their probability to occur, and the vulnerability of the operating systems to such an occurrence. Once these risks are identified, a proper response and contingency plan can be prepared. The following sections discuss various emergency conditions that might occur in a system such as the Shaker Landing Pumping Station and emergency responses to be implemented to prevent a risk to public health or the environment. Section 8.2 of this manual then summarizes in tabular form the likelihood of the various emergency conditions, methods to reduce vulnerability to an occurrence, and the emergency response for each should it occur.

8.1.1 Power Outages

Liberty Utilities is the primary electrical power supplier to the Town. Based on their historical operating data for the last five years, a long term outage defined as an outage involving one or more customers for more than four hours is expected to occur one to two times per year. Their operating history suggests that they can reasonably be expected to restore isolated outages in less than four hours. The longest recorded outage of customers in the service area is 48 hours and was caused by a widespread storm event with multiple customers affected.

Regardless of the frequency or the duration, the Shaker Landing Pump Station has been designed and constructed to continue operation during short term or extended outages. The following systems or design features are incorporated into the Shaker Landing Pump Station:

- An emergency generator system and automatic transfer switch is available to operate the pump station equipment and control systems indefinitely during a power outage. The system is designed to sense a loss of incoming utility electric power supply and to initiate automatic startup of the emergency generator and transfer of power load from the utility to the generator system. When power is restored, the system will automatically transfer load to the utility and cycle down the generator.
- The generator system is equipped with an underground propane tank that supplies fuel. If the tank is operating at normal levels of 80% full, there is enough fuel in the tank to operate the system at 100% load demand for eight days. Since the pump station does not operate continuously at 100% load, the propane tank will typically have enough fuel for two weeks. This allows sufficient time to receive additional propane deliveries if the outage is extended beyond this range.

- Should the electrical power go out AND the generator fail to start, the wet well is designed to store approximately two hours of the average daily flow rate from the connected users until the gravity collection system starts to back up, and approximately four to five hours before the pump station is full and an overflow is imminent. This provides enough time to immediately troubleshoot the emergency generator and bring it on line, or to subcontract a bypass pump or vacuum truck to handle the sewage flow until power is restored.

During an extended power outage where the emergency generators is brought on line automatically, increased observation of pump station operation and wet well level will be required until power is restored. Operators should monitor pump operation, sewage flow rates, wet well levels, propane fuel levels, and other operational parameters more frequently during the outage. **It is important to remember that the Shaker Landing Pump Station transfers sewage via a force main system to another gravity sewer that flows into the main pump station transferring flow to the City of Lebanon Wastewater Treatment Facility. Unless the power outage is localized, multiple pump stations are probably affected and emergency response must take into account the conditions at each pump station location.**

If the emergency generator does not automatically come on line and requires troubleshooting or manual operations, it is important to make arrangements for emergency pumping. The Town Public Works Department maintains portable gas powered pumps at the Town garage. These pumps can be used to bypass the wastewater pumps in the wet well by introducing a suction hose directly to the bottom of the wet well and connecting the discharge hose via the quick connection in the adjacent valve vault. The operator should be aware that the portable pumps may not provide the flow rate that the installed sewage pumps do and the wet well level will need to be closely watched.

At the time of the complete power outage the operating staff should also begin notifying licensed septic haulers with vacuum trucks for emergency removal of accumulated sewage. Because of the travel distance this option must be initiated as soon as it becomes apparent that utility power or emergency generator power is not going to be available in the short term.

8.1.2 Equipment Outages

Unexpected mechanical failures create the potential for system backup and for sanitary sewer overflows (SSOs). The loss of sewage handling systems can also be the result of a failure in the monitoring or control circuitry. Regardless of the failure that occurs, the Shaker Landing Pump Station has been designed with some backup system capacity. The following systems or design features are incorporated into the Shaker Landing Pump Station:

- The pump station is designed as a duplex system with a primary pump rated for the peak design flows, and a secondary pump that alternates with the primary pump but that can also be started in the event of a primary pump failure. The pump station will sense a condition where the primary pump is not keeping up with the flow (indicating

a failure or possible blockage in the pump), or the failure of a pump to start when the control system requires it. Should this condition occur, the pump controller will start the second pump and continue to operate it as the sole pump until the primary pump can be reviewed, repaired, or cleaned prior to being returned to service.

- The pump station can be operated in manual mode should the pump controller fail, or the automatic start and stop functions based on wet well level fail. This mode of operation requires continuous operator presence and is only a stop gap measure until full automatic control can be restored.
- Should multiple equipment and control outages occur simultaneously (unlikely), it is important to make immediate arrangements for emergency pumping. The Town Public Works Department maintains portable gas powered pumps at the Town garage. These pumps can be used to bypass the wastewater pump station by introducing a suction hose directly to the bottom of the wet well and connecting the discharge hose via the quick connection in the adjacent valve vault. The operator should be aware that the portable pumps may not provide the flow rate that the installed sewage pumps do and the wet well level will need to be closely watched.

If an equipment outage appears to be turning into an extended outage, the operator may need to arrange for certified septage haulers to be on call for emergency pumping of the wet well if bypass pumping is not effective. Manual operation of the pump station, or bypass pumping of the wet well will require continuous operator presence at the station to monitoring equipment, replenish fuel, and observe wet well levels for impending backup or overflow.

8.1.3 Natural Disasters

Common natural disasters that are often part of an emergency response plan or a contingency plan include flooding, hurricane or high winds, earthquake, freezing conditions, forest fires, or other similar occurrences that cannot be controlled, and often cannot be reliably predicted. Most of these occurrences, however, are not totally unexpected and there is always some warning time frame given before they occur.

- ***Flooding:*** The Shaker Landing Pump Station is not within the 100-year flood plain for Lake Mascoma. Lake Mascoma is a dam-controlled lake and its water level, even under extreme precipitation events, would not threaten the pump station location. Localized flooding under extreme precipitation events is possible, due to the higher elevations south and southwest of the station location, but has not occurred even during the peak precipitation events triggered by tropical storm Irene in 2011.
- ***Hurricane or High Winds:*** The central portion of New Hampshire in the Upper Connecticut River Valley is not prone to hurricanes. However there have been significant storm events accompanied by high winds that have caused localized and wide-spread damage. It is unlikely that high winds will directly damage the pump station except if it is struck by wind-borne debris, but because the electrical and communications utilities are all above-ground and pole mounted there is a higher potential for power outages due to tree limbs falling onto these utility lines. A power outage will be addressed as outlined in a previous section.

- ***Earthquake:*** Since monitoring has begun in New Hampshire, approximately 260 earthquake events have been measured within the State. Most of the earthquakes have been relatively minor, with only a few registering with a magnitude rated as strong. Despite the occurrences of earthquake events, no major damage has ever been reported. While there may be a chance for a damaging earthquake to occur, the probability is very low, and due to the simplicity and construction of the sewage systems it is unlikely that significant damage would occur during such an event. The pump station control building and structures are designed for the appropriate earthquake zone. The primary damage that may occur would be caused by the shifting of piping associated with the gravity sewer collection system resulting in pipe separation and leakage.
- ***Freezing Conditions:*** The majority of the sewer collection or force main systems are installed underground and are below the maximum frost penetration zone for New Hampshire. Where portions of a structure or building are above ground, additional insulation is installed to protect against frost or cold infiltration. No operational problems are anticipated during extreme cold or winter storm conditions. However the operating and access areas need to be protected and kept free from snow and ice buildup to allow access in normal or emergency operating conditions.
- ***Other Conditions:*** Other natural disasters that occur in various locations in the United States such as forest fire, mud slide, or similar event are unlikely for the location of the pump station and do not require emergency planning. Most responses to such events will be covered under other planning.

8.1.4 Hydraulic Overloading

Hydraulic overloading is considered to be a volume of flow that exceeds the design capacity of the plant to effectively collect, treat, or transfer that amount of flow. There are several likely causes for hydraulic overloading. These include:

- ***Infiltration and Inflow (I/I):*** Infiltration is the entry of groundwater into the collection system through leakage in pipe joints, manhole structure joints, or other penetrations. Inflow is the entry of water into the system through improper connections of items such as sump pumps or roof drains, or through surface water entering manhole structures due to high water conditions. The gravity collection system and the sanitary sewage pump station were constructed in 2017 and 2018, and at this time it is unlikely that significant I/I is present in the system. However, as the system ages, the amount of I/I is likely to increase and should be monitored. Typically an allowance for I/I is incorporated into the design calculations for the pump station to ensure that it has adequate flow capacity to avoid hydraulic overloading due to I/I.
- ***Excessive User Flows:*** Short term hydraulic overloading can occur as the result of failed plumbing fixtures resulting in continuous leakage flow into the plumbing system, the use of high flow fixtures, or poor user practices associated with the connected sewer system. The operator should monitor the sewage flow over time and if an increasing total flow trend is noted by an increase in flow meter totalizer readings, or high pump run time hours, the cause of the increased flow should be

evaluated. This can be done by inspecting flow in individual manholes at various connection or junction points and gradually isolating increased flow conditions to one connected unit or portion of the condominium complex.

- ***Weather or Seasonal Condition:*** The probability of hydraulic overloading increases during spring snow melt or during prolonged storm events. During these particular time periods increased observation of the pump station operating condition can alert the operator to increased flows and allow action to be taken.

8.1.5 Sewer Ruptures or Blockages

Blockages and sewer line leakage can occur at any time. Typically blockage is related to the introduction of a foreign object into the sewer system that becomes lodged, the accumulation of grease/oil buildups that restrict flow area, valve failure, the penetration of tree root systems into pipe joints of a gravity collection system, or the collection and buildup of solids that reduce flow area. Ruptures can occur because of wear in piping systems, a flaw in the piping material or an installation that was faulty and unnoticed at the time of construction, unplanned excavation that damages piping, valve leakage, or other similar occurrences.

Blockage will quickly lead to backup in collection sewers and into connected users if it is allowed to go on undetected for a long time. The location of blockage can be roughly defined by checking sewage levels within the collection manholes and identifying those areas where it is backed up into the manhole. The type of blockage that occurs will dictate the corrective means, but most commonly having a power cleaner brought on site to push through and remove the blockage will be required. Follow-up sewer camera work may be required to determine if there is piping damage, root infiltration, or other piping displacement present that is allowing the blockage to occur. As part of ongoing normal preventative maintenance, gravity sewer systems will need to be inspected via flow testing, or camera inspection on an ongoing basis.

It is unlikely that blockage will occur within the force main system since the design flows are high enough to maintain a scouring velocity that should remove any accumulated settled solids. However should it appear that the discharge pressure on the sewage pumps is increasing and that total flow is decreasing, it is likely that a valve has failed closed, that blockage has occurred, or that other damage has occurred to the force main piping. The blocked section can be isolated by using the high point air release and low point cleanout manholes to install pressure gauges to try to isolate where the blockage or damage may be present. Corrective action can then be planned.

Leakage can also occur within the force main system due to failure of an air release valve that no longer seals, due to gasket failures at isolation valve flanges, or due to leakage through isolation valves that are normally closed liquid tight. The presence of raw sewage in an intermediary force main manhole will indicate that leakage is occurring.

8.1.6 Bypass Pumping

Previous sections have already identified bypass pumping operations that are possible at the wet well and valve vault. However, if a section of the force main fails and requires excavation and repair, the section can be isolated using valving installed in the intermediate force main manholes. While it is possible to arrange bypass pumping of this section of force main, it is judged to be too difficult to easily set up, control, and monitor. If the force main must be taken out of service for any length of time the Town should immediately arranges for certified septage haulers to be on call for emergency pumping of the wet well on a short term basis while the force main is repaired.

8.1.7 Fires or Explosions

It is unlikely that there will be advance warning of a fire or explosion. However, most of these occurrences will be caused by electrical shorts, motor overloads or failures, or failure of some other heat producing equipment. Sometimes unusual humming in transformers or electrical gear, or panels or equipment noticeably hot to the touch can identify a potential fire condition.

Any response to a fire or explosion should have four goals in mind. First, to prevent continued combustion by interrupting the sources of fuel, heat or oxygen. Second, to protect personnel from injury. Third to minimize property or equipment damage. And fourth, to ensure continuity of sewage plant pump station operation, if possible. Fire prevention through observant and trained operators remains the best way to minimize fire or explosion potential.

As previously noted, there are no fire detection systems in the pump station (i.e. smoke or heat detectors), and no fire-fighting equipment such as fire extinguishers. The operator should keep a fire extinguisher in the truck while doing inspections of the various pump station sites. The use of a fire extinguisher presupposes that an operator is present when a fire begins and that it can be controlled by immediate action. Since the pump station is typically unmanned, the usual response to the evidence of a fire or explosion is to dial 9-1-1 and mobile emergency response units.

8.1.8 Entry of Petroleum, Toxics, or Hazardous Chemicals into Sewer System

The introduction of oil or toxic/hazardous chemicals into the sewer system will most likely occur at one of the user connections and results from someone flushing unused products, oil, or other chemicals into the building plumbing. Most chemicals will not have sufficient concentration or characteristics to be visibly detectable. The presence of oil can be detected by sheens and odor. Should such an entry into the sewer system be detected, the operator should take action to prevent its spread throughout the system. One likely means to accomplish this is to place an inflatable plug in the collection sewer line within a manhole where such contamination has been detected. A certified subcontractor can then be hired to remove the chemical from the sewer system and performing cleaning if indicated.

The Town, in cooperation with the Shaker Landing Condominium Association, should complete ongoing education of the connected users explaining what should not be introduced or flushed down the plumbing systems.

8.1.9 Loss of Alarm System

The Shaker Landing pump station relies on automation of monitoring and control to operate efficiently without the presence of an on-site operators. Although the level control and alarm system, and the pump control system is very simple in terms of using proven technology and mechanical systems, like any other electrical system is possible that complete failure can occur. The impacts of such a failure can be minimized if the pump station output is monitored on a daily basis from the Public Works Department alarm phone numbers. The automatic telephone dialer connection can be verified and the presence of alarm conditions noted. This should alert operating personnel within a 24-hour period of the failure of one or more components of the Alarm system.

As previously noted, a complete pump station walk around should occur on a least a weekly basis. During this walk around the alarm system should be tested, the operation of the automatic alarm telephone dialer verified, and other key components of the operating system visually inspected.

8.1.10 Staffing Issues

The Town Public Works Department has two operators on its staff to insure that there is coverage of key operating systems even if one operator is on vacation, sick, or unavailable for a time. The Town also cross trains its workers to allow short term fill-in should both operators become unavailable.

If long term shortages of operating staff become imminent, the Town Public Works Director will make arrangements to hire a certified wastewater operating subcontractor to monitor the operation and maintenance of the pump station system. This is considered a short term solution only due to the cost, and steps should be taken to hire or train additional operating staff.

8.1.11 Personnel Injury

All injuries associated with the operation or maintenance of the pump station components require medical attention, even if it is only basic first aid or personal hygiene. This is due to the increased likelihood of infection due to the presence of toxins and bacteria in the sewage.

All injuries or equipment damage, no matter how minor, must be reported to the Town Public Works Department for follow-up and recording. If serious injury occurs to on-site staff, the operator should immediately notify 9-1-1 for emergency response services.

8.1.12 Vandalism or Security Threats

All threats to equipment or personnel security should be taken seriously. These can take the form of an armed confrontation, threatening phone calls or emails, environmental activism, bomb threats, or threats of vandalism or trespassing. The operating staff is not qualified to deal with these threats and must immediately report them to the Town Public Works Director who will notify the proper authority or emergency responder to address the issue.

All building and structural systems associated with the pump station are secure and locked, and are protected by night site lighting and fencing. Should any sign of forced entry attempt to any of the facilities be detected by the operating staff it should be immediately reported. They should also carefully examine the exposed systems and identify damage or unusual conditions that may require further review by trained professionals.

8.2 REDUCING VULNERABILITY AND IMMEDIATE EMERGENCY RESPONSE

8.2.1 Evaluating and Responding to Hazards

The following hazards may be present while observing, operating, or maintaining the various equipment and related systems at the Shaker Landing Pump Station. When beginning any type of activity within the pump station, consider the setting, assess the hazards, and utilize proper controls or methods to minimize risk or exposure. The following table summarizes hazards that may be encountered during the operation of the pump station, steps to reduce vulnerability to a particular hazard, and steps to be taken in response to an emergency. Please note that this is not intended to be a full evaluation or response to a particular hazards. For additional information refer to other Town emergency response plans and the NHDES Emergency Response Planning Guide included in Volume II Appendix 8 of this manual.

Hazard	Probability of Occurrence	Steps to Avoid Vulnerability	Emergency Response
Loss of Primary Utility Power	Moderate	• Coordinate with power company to maintain overhead utilities	• Start emergency generator • Use wet well bypass pumping • Subcontract septage hauler to pump wet well
Loss of Power with Emergency Generator Failure	Slight	• Complete preventative maintenance on emergency generator • Monitor and test operation of ATS • Complete weekly tests of emergency generator under load	• Start emergency generator • Use wet well bypass pumping • Subcontract septage hauler to pump wet well

		• Maintain generator fuel at normal operating level	
Sewage Pump Failure	Slight	• Monitor pump operation weekly • Complete preventative maintenance on pumps • Maintain factory service contact for emergency repair coordination	• Operate standby pump until other unit can be repaired • Use wet well bypass pumping • Subcontract septage hauler to pump wet well
Pump Controller or Level Instrument Failure	Minimal	• Complete weekly check of all electrical and control panels • Complete weekly check of level floats and transducer	• Operate pump station in manual mode • Use wet well bypass pumping • Subcontract septage hauler to pump wet well
Flooding	Negligible	• Inspect manholes and structures for condition and tightness of cover • Maintain on-site drainage courses and systems • Check force main manholes for water accumulation • Monitor weather forecasts	• Action required depends on systems impacted
Hurricane or High Winds	Moderate	• Maintain structures in good state of repair • Trim on-site trees that are near to electrical service lines • Monitor weather forecasts	• Action required depends on systems impacted
Earthquake	Negligible	• No action can be taken to plan for earthquake occurrence	• Action required depends on systems impacted
Freezing Conditions	Moderate	• Perform preventative maintenance on heaters • Set thermostat to higher setting during extreme weather • Maintain insulation on structures • Keep control room doors and louvers closed during winter operation • Monitor weather forecasts	• Action required depends on systems impacted
Hydraulic Overloading	Minimal	• Monitor sewer manholes during low flow periods for evidence of I/I. • Coordinate with Shaker Landing Condominium Association to check	• Maintain sewer collection system in good condition to avoid inflow • Change the operating parameters of pump station during high flow

		plumbing fixtures • Monitor for non-sewer inflow • Track sewage flow volumes for unexpected increases	conditions • Subcontract septage hauler to pump wet well
Sewer Rupture or Blockage	Minimal	• Inspect and clean gravity sewers and manholes on rotating frequency • Educate connected users on forbidden discharge materials • Maintain air release valves • Confirm operation of isolation and check valves • Do not excavate without DigSafe coordination	• Contain sewage overflows or releases to prevent public health or environmental impacts • Report any SSOs as required by the NHDES and Federal EPA • Complete repairs to minimize outage and restore operations as quickly as practical • Subcontract with septage hauler to pump wet well during outage duration
Fires or Explosions	Minimal	• Monitor the condition of all electrical panels and connections • Monitor all heaters and heat producing devices • Exercise proper housekeeping to keep combustibles from being stored in control building	• If present at start of event, use portable fire extinguisher to control fire • Contact 9-1-1 immediately even if attempting to self-extinguish • Protect personnel as top priority
Oil, Toxics or Hazardous Chemicals in Sewer	Minimal	• Educate connected users regarding what cannot be introduced into plumbing • Monitor wet well for oil sheens or odors • Maintain all chemicals used at site in proper containers and storage locations	• Notify City of Lebanon of potential contamination immediately • Contain contaminant by isolating manholes below point of detection • Monitor the wet well for the presence of chemicals or oils and take steps to absorb them or remove them with a vacuum truck • Complete follow up sewer inspection and cleaning as needed

Loss of Alarm or SCADA System	Minimal	• Perform preventative maintenance checks on alarms and telephone dialer system • Complete weekly observations of operating conditions and test all alarms	• Operate pump station in a manual or a monitored automatic mode with more frequent observation • Repair or replace faulty alarms or telephone dialer components as needed
Staffing Issues	Minimal	• Coordinate vacation and time off schedules to maintain at least one operator available • Cross train other personnel to provide coverage on short term basis • Maintain staffing levels as needed to operate municipal wastewater systems	• Cover operator unavailability with other trained staff • Subcontract a certified wastewater operational subcontractor to cover short term personnel shortages
Personnel Injury	Moderate	• Properly train all personnel in operating and maintenance procedures • Maintain facilities in safe and clean conditions • Maintain first aid and other response supplies • Have an emergency notification procedure in place in case emergency services are needed	• Respond to minor injuries with self or staff administered first aid • Respond to major injuries by calling 9-1-1 for emergency services • Report all injuries, however minor
Vandalism or Security Threats	Minimal	• Maintain all doors and access structures in a locked condition when personnel are not on site • Report all threats received to proper authorities • Complete weekly site inspections to confirm security and identify vandalism or attempted trespass	• Personnel protection must be the primary concern • Immediately report threat or ongoing trespassing to proper authorities by dialing 9-1-1 • Evacuate to safe location, complete notification, monitor situation until authorities arrive • Restore operations as quickly as possible once threat is resolved

Table 8-1 Vulnerability Analysis Summary

8.2.2 Follow-up Investigation and Prevention Plan

After every alarm, facility operating interruption, or response, the Public Works Department Director will convene an investigation committee consisting of the person involved in the incident, themselves, the Town Health Officer, and an administrative assistant to document the event, identify the response taken and results obtained, and identify preventative measures that could have been taken to avoid the incident or improve the response. Specific recommendations will be developed and implemented in the near term time frame. Personnel will be trained in the new procedures, equipment, or other controls put in place.

Other tasks that must be completed after an incident include:

- Completing all emergency repairs, equipment replacement, or system upgrades
- Inventorying spare parts and disposal supplies and replacing as needed;
- Documenting the event and recovery actions for inclusion in NHDES required operating reports;
- Identifying subcontractors utilized in response and updating contact records;
- Maintaining record of all invoices, subcontracted services, and payments to allow disaster relief to be applied for; and
- Restoring pump station operations to full automatic mode with all systems intact and functioning to capacity.

8.3 EMERGENCY NOTIFICATIONS

8.3.1 Sanitary Sewer Overflow Reporting Procedure

A copy of the Federal EPA NPDES and NHDES Reporting of Non-Compliance guidelines and reporting form is included in Volume II Appendix 9 of this manual for reference. In summary:

- A telephone call must be made within 24 hours from the time that the Town operating or maintenance staff becomes aware of and sewage overflow or release. These telephone calls must be made to the USEPA Region 1 coordinator, and the NHDES Wastewater Bureau Permits and Compliance Section. The caller should be ready to describe the initial event, its location, the volume released, whether it is an ongoing release, the time and method of discovery, and the emergency procedures being taken to mitigate the release.
- A written report needs to be filed as part of the required monthly operating record. It should include more detailed information on the location and cause of the overflow, the receiving waters, an estimate of the volume released, an approximately schedule of when the release began, was discovered, and was stopped, steps taken to reduce the likelihood of reoccurrence, and any planned improvements to upgrade long term system integrity.

The immediate and follow-up reporting is the responsibility of the Public Works Department Director. Other local, media, or public notifications may also be warranted and can be handled by the Town Manager or the Town Health Officer.

8.3.2 Notification of Downstream Users

The City of Lebanon wastewater treatment facility superintendent and the water system superintendent should be notified of any release or operating problem resulting in an unusual discharge or condition. The City Wastewater Treatment Facility is the ultimate receiving site for treatment of the incoming sewage and must be prepared to deal with any unusual operating conditions regarding sewage flow or contaminants. The City Water Treatment Facility draws its water for public consumption from the Mascoma River, the likely point of release for any sewage overflows or releases. They must also be notified so that they can properly monitor incoming water quality.

Notification of other land owners that are adjacent or immediately downgradient of a release point may also occur to minimize public health hazards. This can include door-to-door canvassing, press releases to local media, and use of any email list servers that the Town may utilized. Follow-up monitoring of recreational facilities or swimming beach locations on Mascoma Lake may be required depending on the point of release. Posting or closure of these locations may be warranted based on the type and extent of release.

8.3.3 Emergency Notification System

The Public Works Department Director, Town Manager, and Town Health Officer will identify other potentially affected people or organizations. This may include residents not served by municipal or public water, local fire and police departments, NHDES watershed management personnel, local fish and wildlife officers, and local watershed associations. The Town should plan to notify these potentially affected persons or groups via email, telephone, or written letter within 24 to 48 hours of a SSO. Priority will be given to notifying landowners who abut the release zone. The following table contains immediate emergency contacts that can be utilized in the event of an SSO.

Emergency Contact	Name/Condition	Phone
Enfield Fire	Emergency Condition Non-Emergency Condition	9-1-1 (603) 643-2222 (Dispatch)
Enfield Ambulance	Emergency Condition Non-Emergency Condition	9-1-1 (603) 632-5200
State Police Troop F	Emergency Condition Non-Emergency Condition	9-1-1 (603) 846-3333
Enfield Police	Emergency Condition Non-Emergency Condition	9-1-1 (603) 643-2222 (Dispatch)
Grafton County Sheriff	All Calls	(603) 787-2111
Wastewater System Operator	Town of Enfield	(603) 632-4605
Public Works Department Director	Jim Taylor	(603) 632-4605
Electrical Utility	Liberty Utilities	(855) 349-9455

Propane Distributor	Dead River Company	(802) 457-1610
Telephone Company	Fairpoint Communications	(866) 984-3001
Excavation Locating Hotline	DigSafe	(800) 344-7233
Enfield Public Health Officer	Phil Neily	(603) 632-4343
US Environmental Protection Agency	New England Call Center	(888) 372-7341
New Hampshire Department of Environmental Services	Permit Compliance Section	(603) 271-3503
New Hampshire Department of Environmental Services	Oil Spill Response	(603) 271-3899 (normal hours) (603) 223-4381 (nights/weekends)
City of Lebanon	Wastewater Treatment Facility	(603) 298-5986
City of Lebanon	Water Treatment Facility	(603) 448-2514
Electrical Subcontractor	Watts Up Electric, Inc.	(802) 674-5561
Plumbing Subcontractor	Martin's Mechanical	(603) 632-5862
Certified Septage hauler	Stern's Septic Service	(603) 279-4063
Certified Analytical Laboratory	Eastern Analytical	(603) 446-3322
Pump Control Supplier	Champlin Associates	(802) 879-7136
Emergency Generator Supplier	Brookfield Service, LLC	(603) 345-9615
Other Important Numbers		

Table 8-2 Emergency Contacts Summary

8.4 RESPONSE EQUIPMENT AND TRAINING

8.4.1 Emergency Equipment Inventory and Location

All emergency response equipment including fire extinguishers, first aid kits, emergency lighting, bypass pumping equipment, emergency spare parts, and other tools or heavy equipment are stored at the Town garage.

The equipment is not dedicated specifically to the Shaker Landing Pump Station, but is maintained for use within any of the Town operated pump stations, gravity collection systems, or force main systems.

8.4.2 Personnel Training

The Town of Enfield shall complete emergency sanitary sewage overflow training on an annual basis with all operating and maintenance personnel that may be assigned to the Shaker Landing Pump Station. The training will include the location of available emergency

equipment, system emergency shut down procedures, implementation of emergency bypass pumping, and notification procedures to secure additional response resources or subcontractors.

8.4.3 Coordination of Town and Emergency Response Personnel

The Town operating staff has primary responsibility for the operation and maintenance of the pump station, and will assume responsibility for directing emergency response activities related to restoring operations.

In an emergency condition where emergency response providers have been called, the Town operating staff will secure the location to prevent unauthorized entry, and will turn over the emergency response to the operating officer of the response organization (fire chief, police chief, EMT, etc.). Town employees may assist emergency response providers by providing access to emergency sites and identifying system operation or locations. **However, Town employees shall not provide assistance or response in areas where specific training or certification has not been provided, such as firefighting, emergency first aid, or public evacuation or crowd control.**

CHAPTER 9 – UTILITIES

9.1 UTILITY SYSTEMS AND SUPPLIERS

9.1.1 Electrical Power

Electrical power is supplied by Liberty Utilities via overhead utility lines mounted on poles and underground service within the Shaker Landing development. Secondary power is routed to the pump station control and power enclosure at the wet well underground from the service panel in Building 33. There is no separate metering provided for the Shaker Landing pump station. An underground electrical service line enters the pump station control and power enclosure from a penetration in the concrete slab. A main electrical disconnect is mounted on the west side of the pump control and power panel. **This exterior disconnect will shut down all incoming electrical power to the pump station without the need to enter the enclosure.**

Company Name	Telephone
Liberty Utilities	(855) 349-9455
Watts Up Electric, Inc.	(802) 674-5561

Table 9-1: Electrical Suppliers and Subcontractors

9.1.2 Telecommunications

Telecommunications is supplied by Fairpoint Communications via a hard wired telephone line that is routed from the communications board in Building 33 underground to the pump station control and power enclosure.

Company Name	Telephone
Fairpoint Communications	(866) 984-3001
Telephone Alarm System Manufacturer Sensaphone	(877) 373-0222

Table 9-2: Telecommunications Suppliers and Subcontractors

9.1.3 Propane

Propane fuel is stored in a 1,000-gallon underground storage tank located to the east of the pump operating yard fence. Typical operating levels in the underground propane tank are 800 gallons. During operation, the tank should not be allowed to drop below 500 gallons of fuel. Propane is delivered to the site via an over-the-road propane tank truck. The gas line from the tank dome is routed underground to a pressure controller mounted at the generator engine. The gas line enters the enclosure at the northeast corner of the enclosure. **At this location is an installed quarter turn isolation valve**

located on the main gas supply line that allows the propane fuel to be shut off to the generator without entering the enclosure.

Company Name	Telephone
Dead River Company Propane Supplier	(802) 457-1510
Martin's Mechanical Plumbing and Mechanical Contractor	(603) 632-5862

Table 9-3: Propane Suppliers and Subcontractors

9.1.4 Water

Water is provided by the Lower Shaker Village community water system, NHDES PWS ID 0753030. Water services has been routed to all of the condominium buildings within the Shaker Landing development. No water connection is provided at the Shaker Landing Pump Station. If water is required at this location a temporary hose will need to be run from the nearest building, Building 33, to supply it

Company Name	Telephone
Shaker Landing Condominium Association	(603) 632-3410
James Taylor, Certified Operator	(603) 398-2094
Martin's Mechanical Plumbing and Mechanical Contractor	(603) 632-5862

Table 9-4: Water System Operator and and Subcontractors

9.2 ONSITE STORAGE TANKS

There is only one on-site storage tanks associated with the Shaker Landing Pump Station, a 1,000-gallon underground propane storage tank located immediately north of the emergency generator. This tank system has been designed and installed in accordance with the NFPA 58 Liquefied Petroleum Gas Code and it is equipped with pressure relief valves, fill and vent ports, and liquid level gauges. Propane is not regulated as a petroleum product and no secondary containment or other protective systems are required for its storage and use.

9.3 SPILL PREVENTION CONTAINMENT AND CONTROL PLAN

The underground propane tank is installed in compliance with applicable standards and regulations and no spill prevention containment or control plan is required for this installation. There are no other storage tanks that would require the preparation of a Spill Prevent Control and Countermeasures (SPCC) Plan. Overflow or release of sewage is covered in separate sections of the manual.

CHAPTER 10 – ELECTRICAL AND CONTROL SYSTEMS

10.1 ELECTRICAL POWER SYSTEM

10.1.1 Electrical Power Service and Distribution

Electrical power is supplied by Liberty Utilities via overhead utility lines mounted on poles and underground service within the Shaker Landing development. Secondary power is routed to the pump station control and power enclosure at the wet well underground from the service panel in Building 33. There is no separate metering provided for the Shaker Landing pump station. An underground electrical service line enters the pump station control and power enclosure from a penetration in the concrete slab. A main electrical disconnect is mounted on the west side of the pump control and power panel. **This exterior disconnect will shut down all incoming electrical power to the pump station without the need to enter the any enclosure or structure.**

The power supplied to the pump station control building is 230V, 1Φ power, and enters the station through the external electrical disconnect described above. Power is routed in the pump control and power enclosure to the Automatic Transfer Switch associated with the emergency generator. A 70A main line circuit breaker is installed in the ATS panel. Power is then routed from the ATS to the Power Panel mounted in the pump control and power enclosure. Several field changes were made to the Power Panel as well as the addition of the emergency power system, and it is not as depicted on Drawing Sheet 33. The panel now has the following circuits as shown in the photographs that follow:

- a 30A two-pole breaker (Circuits 1, 3) routed to the surge protector mounted adjacent to the panel;
- a 20A single-pole breaker (Circuit 2) routed to the wet well exhaust fan;
- a 20A single-pole spare breaker (Circuit 4) routed to the valve vault exhaust fan;
- a 60A two-pole breaker (Circuits 5, 7) routed to the pump control panel;
- a 20A single-pole breaker (Circuit 6) routed to the emergency generator battery charger;
- a 20A single-pole breaker (Circuit 9) routed to the sewage flow meter;
- a 20A single-pole breaker (Circuit 11) routed to the valve vault service receptacle;
- a 20A single-pole breaker (Circuit 13) routed to the valve vault sump pump;
- a 20A single-pole breaker (Circuit 15) routed to the valve vault lighting;
- a 20A single-pole breaker (Circuit 17) routed to the valve vault as a spare;
- a 20A single-pole breaker (Circuit 19) routed to a service receptacle within the pump control and power enclosure

Surge Protector

- four 20A and 3 15A single-pole breakers (Circuits 8, 10, 12, 14, 16, 18, 20) installed in the power panel but unconnected; and
- ten unbreakered spare spaces (Circuits 21 to 30).

The pump control panel is equipped with several power control features. The pump contains a circuit breaker insert that has the following circuits:

- a 25A two-pole breaker (Circuit Breaker 1) providing power to sewage pump No. 1;
- a 25A two-pole breaker (Circuit Breaker 2) providing power to sewage pump No. 2;
- a 10A single-pole breaker (Circuit Breaker 3) providing power to the internal pump control panel heater; and
- a 15A single-pole breaker (Circuit Breaker 4) providing power to the pump control enclosure GFI protected service receptacle.

The power to each of the sewage pumps is controlled by a Yaskawa Variable Frequency Drive controller. The controller functions as a phase converter, changing the single phase input power to three phase output power for the sewage pump motors. Each unit comes factory pre-set for the intended operation with field adjustments made by the factory representative during initial pump station startup and testing. For additional information regarding the adjustment capability and troubleshooting for these VFD/Phase Converters, refer to the manufacturer's operational manual in Volume 3. This manual is only a partial printout of the installation, operating, and troubleshooting guides supplied by the manufacturer. The entire manual is available on a compact disk at the Public Works Department office.

10.1.2 Emergency Power

The pump station is equipped with a 20kW, propane fired Generac Model QTA-2.4L emergency generator that is located in a weather-tight acoustic enclosure immediately north of the pump station control and power enclosure. It is controlled by a Generac H-100 Control Panel Interface mounted directly on the unit. The generator unit is designed to operate automatically and will start whenever the main electrical power is lost. It will provide power capable of operating one sewage pump, the pump and level controls, and other related power, lighting, and control requirements for seven to fourteen operating days if the propane tank is full.

Power to the pump station is monitored by a Generac automatic transfer switch. The ATS monitors incoming line voltage and will detect a utility failure or loss of power and provide a start command to the generator. The generator will be brought up to operating speed and then the ATS will transfer power to the electrical demand load from the generator. The transfer switch is equipped with a control and display panel that allows monitoring of the

incoming utility conditions, programming of start delay to prevent the generator from starting in a momentary power dip, programmable run times to allow engine cooldown after power is restored, programmable exercise schedules for the generator to insure readiness, and other features. Consult the manufacturer's O&M manual for additional access and program instructions. Operation of the emergency generator system is described in more detail in Volume I, Chapters 2 and 3 of this manual.

10.1.3 Electrical Plans and Schematics

The following design plans are included in Volume II Appendix 3 and illustrate the electrical, lighting, power, and control details and layout:

Sheet ID	Sheet Title	Details Included
Sheet 29	Electrical Site Plan	• General site plan layout • Incoming power location
Sheet 30	Electrical Details	• Control and power enclosure layout • Junction box details • Pump Station electrical plan • Location of electrical users • Lighting plan
Sheet 31	Electrical Details	• Pump Station one line diagram • Pump control and power panel layout • Flow meter interconnection diagram • Pump control panel interconnection diagram • Exhaust fan(s) interconnection diagrams • Signal junction box in valve vault • Power junction box in valve vault • Alarm interconnection diagram

Table 10-1 Electrical Plans and Details

10.2 CONTROL SYSTEMS

10.2.1 Pump Station Control Systems

There are four primary control panels associated with different parts of the pump station operating system. These include:

- Pump Control Panel with MPE Station Controller SC100
- Foxboro Sewage Flow Transmitter
- Electrical Power Automatic Transfer Switch
- Emergency Generator Control Panel

The **Pump Control Panel** is a custom fabricated by Ohio Electric Control and is mounted in a separate stainless steel NEMA 3R enclosure mounted in the pump control and power enclosure. It includes the following components:

- a filtered exhaust fan for temperature control;
- pump and control circuit breakers;
- surge protector device;
- Yaskawa P1000 Variable Frequency Drives/Phase Converters for sewage pumps;
- MPE Station Controller SC100;
- electrical power monitoring relays;
- timing and control relays;
- signal conditioner;
- hour run meters;
- alarm indicators, horn and light;
- output connection to telephone alarm dialer; and
- enclosure heater with thermostat control

Details on each system component is included in Volume II Appendix 4 Submittals, and Volume III Manufacturer's Operation and Maintenance Manuals. A complete wiring diagram of the pump control panel is also included in each location.

The entire operation of the wet well pumping system is controlled from this panel. The system is designed to monitor the operating level in the wet well, automatically start and stop

sewage pumps, alternate sewage pumps for even run time between cycles, and monitor and report alarms. The operation of the systems are discussed in more detail in Volume 1 Chapter 2 of this manual. The control panel is intended to operate only one sewage pump at a time. If the lead pump fails to start, the controller will start the lag pump to regain control of wet well level, but does not lock out any of the pump functions. When the wet well level is restored, the pump control will return to normal, alternating operation. Wet well operating levels and alarm positions can be monitored or adjusted using the Station Controller SC100 mounted in the panel. The user interface has a place to input new set points, test the wet well pump start and alarm controls, and monitor wet well levels. Alarm outputs from the panel are routed to a Sensaphone telephone dialer that allows alarm notification to remote locations to ensure response.

The **Foxboro Transmitter** is mounted adjacent to the Pump Control panel in the pump control and power enclosure. It is equipped with a user interface that allows direct readout in gallons of flow, and is provided with automatic calibration software, calibration diagnostics, and other control functions that allow the operator to determine how flow data will be collected. The transmitter also monitors operation of the Foxboro 9300

inline magnetic flowmeter is installed in the Valve Vault, and will detect empty pipe conditions, low flow conditions, readings out of calibration range, and other advanced alarm conditions if desired. Details on the transmitter, programming options, and output selections are included in Volume II Appendix 4 Submittals, and Volume III Manufacturer's Operation and Maintenance Manuals.

The emergency generator is monitored and controlled by the **Automatic Transfer Switch** that is rated for 100 amp service and provides ongoing monitoring of the primary utility line voltage and availability, calls for the emergency generator startup in case of primary power failure, and transfers load to the generator output once it is on line. The ATS is mounted on the outside west wall of the pump control and power enclosure. The ATS is equipped with a user interface that allows the following items to be controlled:

- an adjustable engine start delay to override momentary power dips or surges
- unloaded engine run time delay to allow engine cooldown prior to shutdown
- programmable engine and generator exerciser with seven preprogrammed routines
- adjustable load disconnect time delay
- running of factory diagnostics
- monitoring and adjustment of alarm conditions and set points

The **Emergency Generator Control Panel** provides monitoring and control through the H-100 User Interface Panel mounted directly on the generator set. This control panel allows:

- an emergency stop of the generator should serious operating conditions occur that are not being recognized and acted on by the generator control panel
- the ability to operate the generator in manual as well as automatic modes
- continuous monitoring of the power quality output including volts, amps, frequency, and power
- full monitoring of operating conditions including coolant levels and temperature, and engine oil pressure
- the ability to run system diagnostics

10.2.2 Control Schematics and Manuals

The following design information is included in Volume III Manufacturer's Operation and Maintenance Manual and provides additional information on the control systems wiring and operation.

- MPE Station Controller SC100 Users Manual
- Pump Control Panel Wiring Diagrams
- Foxboro Flow Meter and Flow Meter Reader Manual

- Sensaphone Automatic Alarm Telephone Dialer Manual
- VFD P1000 Variable Frequency Drives/Phase Converters Manual
- Generac Automatic Transfer Switch Wiring Diagrams and Operation Manual
- General Generator Set Operation Manual

CHAPTER 11 – SCADA SYSTEM

The Shaker Landing Pump Station pump control panel is connected to a Sensaphone automatic alarm telephone dialer system. There **is no** installed Supervisory Control and Data Acquisition (SCADA) system at this pump station due to the relative simplicity of the system and the limited number of connected sewage sources. The Sensaphone dialer will allow a pump station alarm to be transmitted to up to eight separate telephone numbers when an alarm or shutdown condition occurs in any of the connection equipment or control panels. Notification of common alarm is the only function available through this system and there is no ongoing data collection or remote monitoring possible.

Currently only the pump station is connected to the alarm dialer. The only alarms that are inputed to the dialer are:

- Wet well high level;
- Wet well low leve;
- Pump No. 1 seal failure;
- Pump No. 2 seal failure;
- Pump No. 1 overtemperature;
- Pump No. 2 overtemperature;
- Pump No. 1 failure to start;
- Pump No. 2 failure to start; and
- Valve pit high water alarm.

There are no alarm inputs from other system control panels including the Automatic Transfer Switch, the Emergency Generator Control Panel, or the Foxboro Sewage Flow Meter transmitter.

The system can be configured for operation via a user interface keypad, and compatible alarm inputs include normally open or closed contacts, temperature sensors, or 4 to 20 mA transducers. Upon detection of any alarm or status change, the system begins dialing telephone numbers and delivering an alarm message in a digitized human voice. The telephone dialer will continue to call telephone numbers in succession until a positive acknowledgement of the alarm condition is received. Alarm acknowledgement can be established by depressing tone keys from the called telephone, or by calling the system back within a programmed time period. The system can also receive incoming telephone calls, and upon answering the system will recite a status report and can allow access for limited remote input via the telephone interconnection.

The system also monitors itself for primary electrical power failure and is equipped with electrical surge protection and a backup battery allowing up to 24 hours of operation. The following programmable features are available within the system via the user interface panel:

- Dialing method, pulse or tone;
- Message repetitions (1 to 10);

- Maximum number of calls (0 to 255);
- Call delay time (0 to 60 minutes); and
- Intercall delay time (0 to 60 minutes)

The system has the ability to record, store, and reproduce voice messages and to use those messages to articulate the location and status of the monitored zones. Message length can be up to five seconds per zone and eight seconds for the identification message. The system is designed to automatically seize control of the phone line it is connected to in order to make an alarm phone call when such a condition occurs. All other calls, including incoming calls, will disconnect until the alarm is acknowledged.

The system has limited remote monitoring functions including:

- Enabling or disabling alarm zones or power monitoring;
- Reciting or setting high and low alarm limits;
- Reciting or setting telephone numbers to be contacted;
- Recording or playing custom voice messages;
- Reciting or setting relay outputs;
- Reciting status report; and
- Reciting alarm history.

The system is equipped with separate LED indicator lights that will indicate the alarm and the acknowledgement of that alarm from any of the monitored zones for field review during an alarm conditions. Refer to the Sensaphone user's manual in Volume III of this manual for additional information regarding programming functions, monitoring, troubleshooting and maintenance. Refer to the attached layout image for the user interface control panel for general orientation on input capabilities or alarm function monitoring.

LAYOUT

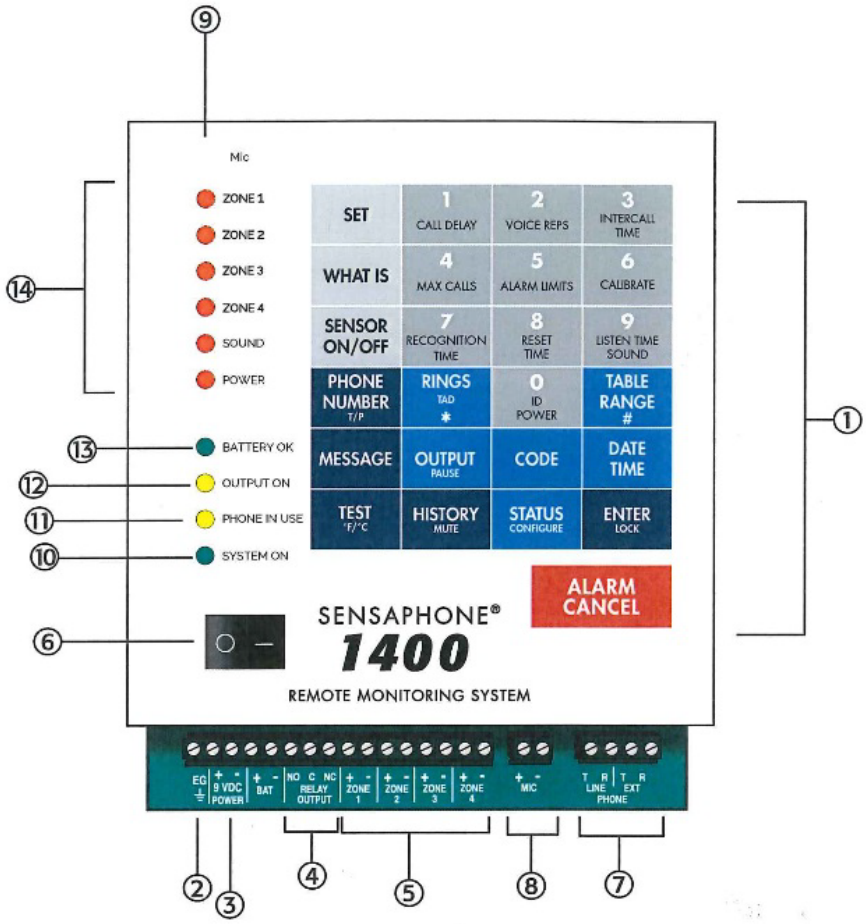


Figure 1: 1400 diagram

1. Programming Keypad
2. Grounding Terminal
3. 9-12VDC Power Terminals
4. N.O./N.C. Relay Output Terminals
5. 4 Zone Terminals
6. Power Button
7. Phone Network/Extension Terminals
8. External Mic Terminals
9. Built-in Condenser Mic
10. System On LED
11. Phone-in-use LED
12. Output On LED
13. Battery OK LED
14. Zone Alarm LEDs