Plymouth Village Water & Sewer District
227 Old North Main Street, NH 03264
Tel: (603) 536-1733 Fax: (603) 536-1734

September 29, 2011

U.S. EPA
POTW GP Processing
Municipal Assistance Unit
5 Post Office Square-Suite 100
Boston, MA 02109-3912

Re: NPDES # NHG580242 – Notice of Intent

To Whom It May Concern:

This is a letter requesting authorization to discharge under the New Hampshire General Permit NHG580000, Part II.A, Discharges to Fresh Waters issued July 6, 2011. Please find attached a copy of the acknowledgement letter dated April 13, 2010 for our NOI application. Additionally please find a copy of section 3 of the draft Operation and Maintenance manual describing the wastewater treatment facility with its recent upgrades. Included also is section 3 of the preliminary design report with the present influent pumping configuration. The influent pumping is currently under a change order and is anticipated to be completed winter/spring of 2012. The complete Operation and Maintenance manual section 3 will be forwarded when complete which will include the upgrade to the influent pumping.

If you have any questions regarding this request, please call me at the treatment plant at (603) 536-2769.

Sincerely,

Kirk Young
WWTP Superintendent

cc: NHDES Water Division, Wastewater Engineering Bureau
Commissioners, Plymouth Village Water & Sewer District

SECTION 3

PLANT OPERATIONS AND CONTROL

3.0 INTRODUCTION

This section of the Operation and Maintenance (O&M) Manual deals with the operation and control of the Plymouth Wastewater Treatment Facility (WWTF) and describes the improvements implemented throughout this upgrade. In addition, the manufacturer's literature offers detailed information for the operation and maintenance for each specific piece of equipment and is to be used in conjunction with this O&M Manual.

3.0.1 Design Summary of Major Equipment

Table 3-1 lists the current (36-Month Average) and design (2028) flows and loads for the Plymouth WWTF. Table 3-2 lists the major equipment for the Plymouth WWTF. The current flows and loads are derived from actual flow data from July 2003 to June 2006.

TABLE 3-1
CURRENT AND DESIGN FLOWS AND LOADS
PLYMOUTH WWTF

Parameter	Current (36-Month Average) Loading Conditions	Design (2028) Loading Conditions
Influent (Raw)		
Average Flow Rate (mgd)	0.505	0.682
Maximum Month Flow Rate (mgd)	0.810	1.094
Peak Daily Flow Rate (mgd)	1.467	1.980
Peak Hourly Flow Rate (mgd)	>3.000	>4.050
BOD_5 Average Load (lbs/day)	1,560	2,106
BOD_5 Maximum Month Load (lbs/day)	2,578	3,480
BOD_5 Peak Daily (98th Percentile)	4,041	5,455
BOD_5 Peak Daily (100th Percentile)	5,203	7,024
TSS Average Load,(lbs/day)	1,287	1,737
TSS Maximum Month Load (lbs/day)	2,301	3,106
TSS Peak Daily Load (98th Percentile)	3,049	4,116
TSS Peak Daily (100th Percentile)	6,185	8,350

Parameter	Current (36-Month Average) Loading Conditions	Design (2028) Loading Conditions
Primary Clarifiers		
Detention Time (hrs)		
Average	5.30	4.00
Max Month	3.32	2.47
Overflow Rate (gdp/ft^2)		
Average	341	455
Max Month	542	729
Peak Daily	983	1,324
Peak Hourly	2,006	2,709
Primary Sludge Production (lbs/day)		
Average	970	1,300
Max Month	1,730	2,340
Peak Day	4,650	6,270
% Solids (Co-Thickened with WAS)	3.0	3.0
Rotating Biological Contactors		
Hydraulic Loading Rate (gpd/ft^2)		
Average	0.48	0.64
Max Month	0.76	1.02
Peak Daily	1.38	1.86
BOD_5 Loading (lbs BOD/1,000 ft^2/day)		
Average	1.20	1.62
Max Month	1.99	2.68
Peak Daily	3.98	5.50
RBC Blowers		
No. of Blowers	1	2
Capacity	133icfm @ 4 psi	500icfm @ 4psi
Secondary Clarifiers		
Detention Time (hrs)		
Average	10.00	7.40
Max Month	6.22	4.61
Overflow Rate (gdp/ft^2)		
Average	213	284
Max Month	338	455
Peak Daily	614	827
Peak Hourly	1,253	1,692
Secondary Sludge Production (lbs/day)		
Average	800	1,080
Max Month	1,330	1,800
Peak Daily	2,950	3,920
% Solids (Prior to Co-Thickened in primary)	0.4	0.4
Dewatering		
Sludge Production (lbs/day)		
Average	8,270	11,200
Max Month	14,140	19,100
Max Daily	39,570	50,300
% Solids (with ferric chloride addition)	25.4	25.4

TABLE 3-2

MAJOR EQUIPMENT LIST

Preliminary Treatment
Septage Receiving - Honey Monster receiving unit by JWC Environmental
Auger Screen with spray wash, Model SRS3200 - 400 gpm
(1) 5,500 gallon Wetwell
(1) Raw sewage transfer pump - 7.5 HP, 150 gpm
(1) Gravity Thickener
(2) Sludge Holding Tanks - Useable storage: 16,000 gal each
(1) Mechanical Bar Screen & Wash Press - width: 24 inch, bar spacing: 5/8 inch
(1) Vortex Grit Removal System - 3/4 HP, 2.5 mgd
(2) Influent Screw Pumps - Each 15 HP, 2.84 mgd
Primary Treatment
(2) Primary Clarifiers - Each 56,000 gal, 62.3 ft x 12 ft x 10 ft
(2) Primary Sludge Pumps - 3 HP, 40 gpm @ 80 TDH
(2) Primary Sludge Macerators - 7.5 HP, 120 gpm
Secondary Treatment System
(8) Rotating Biological Contactors (RBC) - 1,065,000 sf (total), 5 HP per shaft, 1.5 rpm
(2) RBC Blowers - 20 HP, Each 500 icfm @ 4 psi
(2) Secondary Clarifiers - Each 105,000 gal, 74.8 ft x 16 ft x 12 ft
(2) Secondary Sludge Pumps - Each 3 HP, 40 gpm @ 70 TDH
Disinfection System
(2) Chlorine Contact Chambers - Each 14,447 gal, 3 ft diameter x 280 feet
(3) Sodium Hypochlorite Tanks - Each 550 gal
(3) Metering pumps - Each 1/4 HP, 1.6 gph, based off flow at the dechlorination chamber
(2) Day Tanks - Each 225 gal
(2) Auxiliary Pumps - Each 4 gph
(1) Transfer Pump - 1/5 HP, 18 gpm
(3) Sodium Metabisulfite Storage Tanks - Each 225 gal
(1) Storage Tank Mixer - 1/2 HP
(1) Metering Pump - 1/4 HP, 0.34 to 208 gph
Plant Water Pumps
(3) Plant Water Pumps - (1) @ 40 gpm @ 200 TDH, (2) @ 175 gpm @ 200 TDH
Sludge Handling System
(2) Dewatering Feed Pumps - Each 70 gpm @ 70 ft TDH
(1) Gravity Thickener
(2) Sludge Holding Tanks - Useable storage: 16,000 gal each
(1) Rotary Press - 1,200 dry pounds per hour with 26 percent solids
Post Lime Stabilization of Dewatered Sludge (post lime addition not presently used)
Odor Control Biofilter for Gravity Thickener and Septage Receiving (OCF-1)
(1) Filter Media - XLD 83 cf & LWE 100 cf
(1) Fan - 1000 cfm
Odor Control Biofilter for Sludge Dewatering (OCF-2)
(1) Filter Media - XLD 83 cf & LWE 67 cf
(1) Fan - 1000 cfm

3.1 SEPTAGE RECEIVING FACILITIES

The Plymouth WWTF accepts septage from, and has agreements with, 24 surrounding communities, which are renewed on an annual basis. The septage receiving operation utilizes a Honey Monster septage receiving unit, manufactured by JWC Environmental, which was put into operation in August 2006. The septage discharges by gravity from the trucks to the septage receiving system through a quick connect fitting. An ultrasonic level sensor and modulating plug valve regulates flow into the system. The septage passes through an auger screen, and a spray wash helps remove soft organics and wastewater from the screenings. The septage system is a Model SRS3200 unit, which is designed for up to 400 GPM of septage. The unit also includes a keypad PIN security access and flow measurement system. This new unit provides improved screening and faster processing of the incoming septage loads.

The septage flows from the receiving unit to a 5,500-gallon concrete wetwell through an 8-inch ductile iron gravity line. New piping and valves in the basement of the Septage and Thickened Sludge Pumping Facility allow the flexibility to pump the septage to the new gravity thickener, the existing sludge storage tanks, or the influent sewer to the Headworks. This alleviates the need for a separate larger septage storage tank. As discussed further under the solids handling section (Section 3.7.1.1) the abandoned primary clarifier was converted to a new gravity thickener for primary and secondary solids as well as septage. The septage is pumped using a new Penn Valley double disk diaphragm solids handling septage transfer pump (SEP-2) which has a capacity of 150 gpm. The Septage and Thickened Sludge Pumping Facility also houses the new thickened sludge pump (TSP-1) for the gravity thickener. TSP-1 is also a Penn Valley double disk diaphragm pump which has the same capacity as SEP-2 and therefore these pumps are completely interchangeable. Both TSP-1 and SEP-2 are controlled by VFD's that are located The piping has been configured for a third standby pump (TSP-2) to be installed in the future which can be utilized as either a septage or sludge transfer pump.

FIGURE 3.1.1-1.

Picture of Septage Transfer Pump and Thickened Sludge Pump

3.2 HEADWORKS FACILITIES

3.2.1 Mechanical Bar Screen Functional Description

Wastewater gravity drains into the Headworks Building via a 24-inch diameter ductile iron sewer. Large solids, rags and debris are removed by the 24" wide newly installed Vulcan mechanical bar screen (SCR-1) with 5/8" bar spacing. The mechanical bar screen uses a chain and sprocket driven raking mechanism as shown in Figure 3.2.1-1. The chain and sprocket raking mechanism provides very high screenings removal capacity. Figure 3.2.1-2 shows the cross-section of the Headworks. Screenings are discharged into a Vulcan Wash Press, which is described in more detail in Section 3.2.2. A bypass channel with manual bar rack is also available by opening manual slide gates. The influent then passes through a 7-foot diameter Jones & Atwood vortex grit removal system. The grit slurry is pumped with a Wemco recessed-impeller pump to a Krebs cyclone grit separator. The grit removal system includes a newly installed plant water connection for water scour. Continuous influent flow measurement is provided by an ultrasonic level transducer, replaced in 2005, which measures the depth of flow over the 1.5' H-Flume.

FIGURE 3.2.1-1. Picture of Mechanical Bar Screen

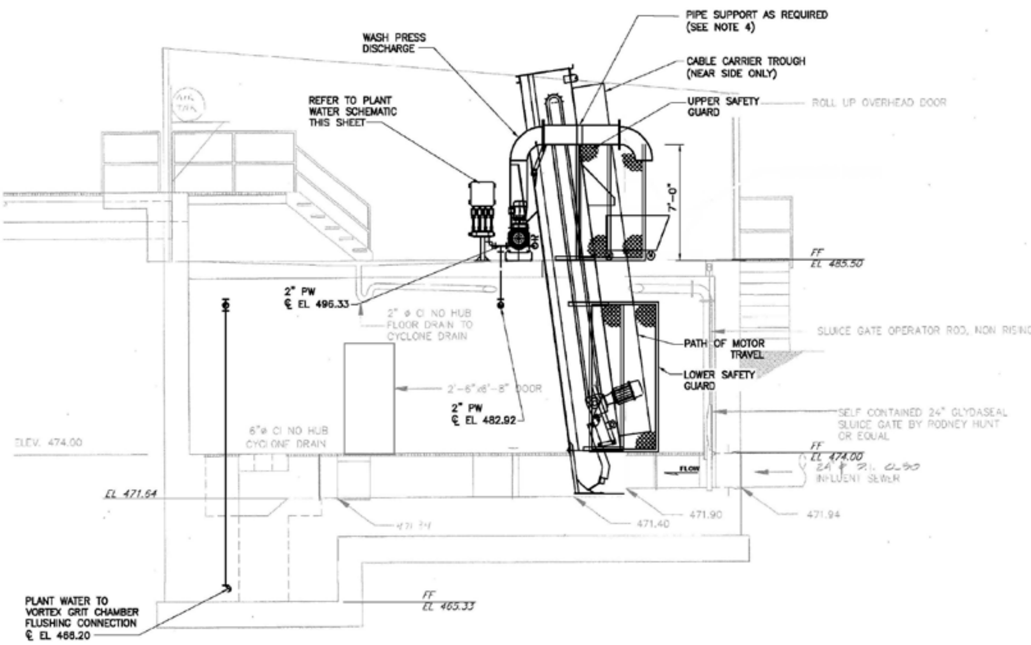

FIGURE 3.2.1-3. Schematic Cross-section of Headworks

3.2.2 Screenings Washpress Functional Description

The screenings are discharged from the newly installed Vulcan mechanical bar screen directly into the Vulcan wash press. The wash press removes 90% of the putrescible organic material and dewaters the screenings to less than 55% water content. This helps make the screenings more suitable for disposal, and reduces the cost by decreasing the overall volume and weight by 50%. The screenings are then released into an outside dumpster via a discharge chute and are ready for ultimate disposal.

3.2.3 Design Data

Mechanical Bar Screens

Location	Headworks
Function	Screen raw wastewater
Manufacturer	Vulcan Industries, Inc.
Model Number	FT-24-SB
Screening Capacity	450 ft^3/hr
Motor	3/4 Hp
Electrical Service	460 V / 3 ph / 60 Hz
Electrical Classification	Class 1, Division 1, Group D
Channel Size	2.0' wide × 4.5' deep
Downstream Water Depth	4.0'
Bar Screen Clear Opening	5/8"
Angle of Setting	82°

Wash Press

Location	Headworks
Function	Wash and compact screenings from raw wastewater
Manufacturer	Vulcan Industries, Inc.
Model Number	EWP 250 - 600
Continuous Capacity (per unit)	33 ft^3/hr (batch) & 99 ft^3/hr (continuous)
Organic Removal Rate	90%
Volume Reduction	50%
Weight Reduction	50%
Finished Moisture Content	<55%
Motor	5 hp
Electrical Service	460 V / 3 ph / 60 Hz

Electrical Classification	Class 1, Division 1, Group D
Wash water supply pressure	40 to 100 psig (minimum to maximum)
Wash Water Flow Rate	19 to 30 gpm

3.2.4 Control System

The mechanical bar screen and screenings wash press are controlled by the Programmable Logic Controller at the Main Control Panel (PLC-MCP) via a remote I/O module (RIO-SCR). RIO-SCR will be located in the Screenings Remote Control Panel (RCP-SCR), which will also house the motor starters for the mechanical bar screen and screenings wash press. Local hand controls for the mechanical bar screen and wash press are located at local control stations by each piece of equipment.

The mechanical bar screen has a HAND-OFF-AUTO selector switch, a FORWARD-NEUTRAL-REVERSE selector switch, an ALARM RESET button and an EMERGENCY STOP (E-Stop) mushroom switch located on the RCP-SCR. In the HAND position, the raking mechanism for the bar screens will run continuously and the operator will be able to manually select the direction of operation for the raking mechanism (forward, neutral, or reverse). In the OFF position, the raking mechanism for the bar screens will not run. In the AUTO position, control is transferred to the PLC-MCP and one of three following modes can be utilized to control the screen. In Timer mode, the screen cleaning cycles are controlled by a repeat cycle timer controller which can be set by the operator from 0 to 12 hours. In the Differential Level mode, the screen cleaning cycles are controlled on an operator adjustable High Differential Level across the screen. Level transducers are installed upstream and downstream from the screen to monitor the differential water level. In the Timer and Differential Level mode, the screen cleaning cycles are controlled by both the Timer and Differential Level modes as described above.

In any of the three modes, if the Channel Level High-High Level Float is activated, the PLC-MCP will operate the screen cleaning cycles continuously. The mechanical bar screen will be software interlocked in the PLC programming and shut down under the following conditions if the equipment is running in the LOCAL or AUTO mode. Over

Rotate; Motor High Torque, which shall be reset via an output from RIO-SCR when the RESET button is pressed at the PLC-MCP and Motor High Temperature, where an output from RIO-SCR shall be interlocked to deactivate the motor and break heaters during a motor high temperature condition. Each software interlock will be latching in the PLC and will only unlatch when the operator presses the RESET button at the PLC-MCP. An alarm will be activated at the PLC-MCP and SCADA for each condition.

The screenings wash press has a HAND-OFF-AUTO selector switch, a FORWARD-NEUTRAL-REVERSE selector switch, a MOMENTARY INITIATE CYCLE button and an EMERGENCY STOP (E-Stop) mushroom switch located on the RCP-SCR. In HAND position, the wash press will operate in forward continuously with the spray wash solenoid valves 1 and 4 energized continuously. In the OFF position, the wash press shall not operate. In the AUTO position, the operator can select one of two modes, Batch Mode or Continuous Operation Mode. When the MOMENTARY INITIATE CYCLE button is pressed, the wash press will run one complete cycle in the Screen Cycles mode.

In Batch mode, the wash press will be started based on the Screen Cycles Start Setpoint. The PLC-MCP will count number of times the mechanical bar screen cleaning cycle has run by counting the number of times the screen reaches the Home Position. When the screen cycle counter reaches the Screen Cycle Start Setpoint the wash press will be run for one complete cycle. In the Continuous Mode, the wash press will be run in continuous operation. The screw shall run in the forward direction, reversing for 3 seconds of every 45 seconds of run time. All four solenoid valves are energized continuously during continuous operation. In either mode, when the Channel Level High-High Level Float is activated, the wash press will be run in Continuous Mode.

The wash press over-torque safety feature operates as follows. If the current sensing relay trips due to a heavy load or jam condition, the drive motor shall stop due to the software interlock in the PLC-MCP programming. The PLC-MCP shall then reset the current sensing relay alarm and the drive motor shall restart in reverse for 3 seconds to attempt to clear the screw. The wash press will then restart in Auto Mode. If the cause of the trip was cleared, the wash press will continue normal operation in Auto Mode. If the current relay trips again, it will be reset by the PLC-MCP again and the drive motor shall restart in reverse for 3 seconds. Then the wash press will restart in Auto Mode again and upon the third successive trip an alarm signal will be generated and the motor will not restart. The wash press will be software interlocked in the PLC programming and shut down under Motor High Torque as described above or Motor High Temperature if the equipment is running in the LOCAL or AUTO mode. Each software interlock will be latching in the PLC and will only unlatch when the operator presses the RESET button at the PLC-MCP. An alarm will be activated at the PLC-MCP and SCADA for each condition.

3.2.5 SCADA System Control Screens

3.2.6 Normal Operation

The mechanical bar screen will normally operate switched to the AUTO position in the Timer and Differential Level Mode, which is described above in Section 3.2.4. The screenings wash press will normally operate switched to the AUTO position in the Batch Mode, which is described above in Section 3.2.4.

3.2.7 Alternate Operation

The mechanical bar screen can alternately operate switched to the HAND position or switched to the AUTO position in the Timer Mode or the Differential Level Mode, which are described above in Section 3.2.4. The screenings wash press can alternately operate switched to the HAND position or switched to the AUTO position in the Continuous Mode, which is described above in Section 3.2.4.

3.2.8 Maintenance

Please refer to Section 4 of the Vulcan Industries, Inc. Mechanical Bar Screen Installation, Operation & Maintenance Manual for the following maintenance guidelines.

- General Safety Precautions
- List of Required Tools
- Lubrication Schedule
- Daily Preventative Maintenance

- Monthly Preventative Maintenance
- Semi Annual Preventative Maintenance
- Corrective Maintenance

Please refer to Section 5 of the Vulcan Industries, Inc. Wash Press Installation, Operation & Maintenance Manual for the following maintenance guidelines.

- Daily Maintenance
- Weekly Maintenance
- Monthly Maintenance
- Semi Annual Maintenance
- Maintenance of Gear Reducer and Drive Motor
- Removing and Installing the Spiral, Drive Motor and Bearing Unit
- Replacing the Cleaning Brush
- Lubrication Schedule

3.3 INFLUENT PUMPING (Estimated Upgrade Completion Winter/Spring 2012)

3.3.1 Functional Description

3.3.2 Design Data

3.3.3 Control System

3.3.4 SCADA System Control Screens

3.3.5 Normal Operation

3.3.6 Alternate Operation

3.3.7 Maintenance

3.4 PRIMARY CLARIFIERS

3.4.1 Functional Description

Wastewater flows from the discharge of the influent pumps to a flow splitter structure which distributes flow to the two 20" diameter influent header pipes going to the two rectangular primary settling tanks (clarifiers). The primary settling tanks are 62'-4" long, 12' wide by 10' deep with two baffle walls installed to help facilitate settling and prevent short circuiting. The influent piping has three 8" diameter inlet ports to each tank for a total of six. Each clarifier is equipped with a manually rotated scum trough, a chain and flight sludge and scum removal mechanism, and a cross screw collector to transport sludge to the suction sump of the primary sludge pumps. Primary sludge is pumped to the sludge holding tanks for dewatering. The two primary sludge pumps, located in the Sludge Pumping Facility, are progressive cavity pumps with a capacity of 8 to 40 GPM at 70' TDH. Each pump is equipped with a 7.5 HP macerator. Scum is removed via the manually rotated scum trough to the scum removal box, where it is manually raked on the beach and then into a hopper for disposal.

As a part of this upgrade, the chain and flight and the sludge cross screw collector gear boxes, drive motors and clutches have all been replaced. Also, baffles were installed in the primary clarifiers to help with sedimentation of the primary sludge.

3.4.2 Design Data

Primary Clarifiers

Overflow rate (Average)	455 gpd/sq. ft.
Overflow rate (Max Month)	729 gpd/sq. ft.
Overflow rate (Peak Daily)	1,324 gpd/sq. ft.
Overflow rate (Peak Hourly)	2,709 gpd/sq. ft.
Detention time (Average)	4.00 hours
Detention time (Max Month)	2.47 hour
Drive size	0.5 Hp

Primary Sludge Pumps

Number of units	2
Type	Progressive Cavity Pumps with Variable Frequency Drives
Design Capacity	8 - 40 gpm @ 80 TDH
Motor size	3 Hp
Speed	44 - 220 rpm

Primary Clarifiers

Number of units	2
Length	62.3 feet
Width	12 feet
Depth	10 feet
Surface area per tank	748 sq. ft.
Tank volume (one tank)	56,000 gal.
Tank volume (two tanks)	112,000 gal.

3.4.3 Control System

A new local control station is located at each Primary Clarifier Cross Collector drive, which provides an Emergency Stop (E-Stop) mushroom switch. Each Main Control Center (MCC) has the Primary Clarifier 1 & 2 Cross Collector Run Lights, Elapsed Time Meters and HAND-OFF-AUTO (HOA) Switches. Each MCC will report to the PLC-MCP Run status, Motor Overload and HOA switch is in Auto. When the HOA switch is in the HAND position, the respective Clarifier Cross Collector will run continuously. When the HOA switch is in the OFF position, the respective Clarifier Cross Collector will not run. When the HOA switch is in the AUTO position, control is transferred to the PLC-MCP.

Each Primary Clarifier Cross Collector shall be displayed as Enabled / Not in Remote based on the HOA switch position at the MCC. Each Primary Clarifier Cross Collector shall be controlled by a virtual HOA switch at the PLC-MCP and SCADA. In the HAND position the Cross Collector will run continuously. In the OFF position the Cross Collector will not operate, except for the HOA switch at the MCC. When the selected Cross Collector virtual HOA switch is in the AUTO position it will run when either Primary Sludge Pump is called to run. However, the cross collector drives are NOT interlock hardwired to operate when the respective Sludge Pump is run in HAND by the HOA switch at the MCC.

Each Primary Clarifier Cross Collector drive will shut down by a latching hardwire High Torque interlock at MCP. The ~~high~~ High T~~t~~orque interlock will illuminate the alarm light at MCP and send a High Torque alarm to PLC-MCP. The interlock will be reset by pressing the Reset button at MCP. Each Primary Clarifier Cross Collector drive will shut down by a latching hardwire Motor High Temp interlock at MCP. The Motor High Temp interlock will illuminate the alarm light at MCP and send a Motor High Temp alarm to PLC-MCP. The interlock will be reset by pressing the Reset button at MCP. PLC-MCP will activate a Primary Clarifier 1 & 2 Cross Collector High Torque alarm at OIT-MCP and SCADA. PLC-MCP will activate a Primary Clarifier 1 & 2 Cross Collector Motor High Temp alarm at OIT-MCP and SCADA.

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A new local control station is located at each Primary Clarifier Chain and Flight drives, which provides an Emergency Stop (E-Stop) mushroom switch. Each (MCC) has the Primary Clarifier 1 & 2 Chain and Flight Run Lights, Elapsed Time Meters and HAND-OFF-AUTO (HOA) Switches. Each MCC will report to the PLC-MCP Run status and Motor Overload. In the HAND position the Chain and Flight will run continuously. In the OFF position the Chain and Flight will not operate. The AUTO position will not be used for control and therefore the PLC-MCP will provide no control for the Chain and Flight Drives.

Each Primary Chain and Flight drive will shut down by a latching hardwire High Torque interlock at MCP. The High Torque interlock will illuminate the alarm light at MCP and send a High Torque alarm to PLC-MCP. The interlock will be reset by pressing the Reset button at MCP. Each Primary Clarifier Chain and Flight drive will shut down by a latching hardwire Motor High Temp interlock at MCP. The Motor High Temp interlock will illuminate the alarm light at MCP and send a Motor High Temp alarm to the PLC-MCP. The interlock will be reset by pressing the Reset button at MCP. ~~Each Clarifier Chain and Flight drive will shut down by a latching hardwire interlock at MCP. The high torque interlock will illuminate the alarm light at MCP and send a high torque signal to the PLC at MCP. The interlock will be reset by pressing the Reset button at MCP.~~ PLC-MCP will activate a Primary Clarifier 1 & 2 Chain and Flight Drive High Torque alarm at

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OIT-MCP and SCADA. PLC-MCP will activate a Primary Clarifier 1 & 2 Chain and Flight Motor High Temp alarm at OIT-MCP and SCADA.

3.4.4 SCADA System Control Screens

3.4.5 Normal Operation

The Primary Clarifier Cross Collector Drives will normally operate in the AUTO position at the MCC and at the PLC-MCP as described above in Section 3.4.3. The Primary Clarifier Chain Flight Drives will normally operate in the AUTO position at the MCC as described above in Section 3.4.3.

3.4.6 Alternate Operation

The Primary Clarifier Cross Collector Drives can be alternately operated with the HOA switch in the HAND position as described above in Section 3.4.3. The Primary Clarifier Chain Flight Drives can also be alternately operated with the HOA switch in the HAND position as described above in Section 3.4.3.

3.4.7 Maintenance

Please refer to Section 2 and 3 of the Allied-Locke Industries Installation, Operation & Maintenance Manual for the following maintenance guidelines.

- Inspection and maintenance intervals
- Lubricant change intervals
- Inspection and maintenance of the gear unit
- Inspection and maintenance of AM / AQA adapters
- Inspection and maintenance of AD adapters
- Malfunctions
- Technical Notes
- Lubrication Schedule

3.5 ROTATING BIOLOGICAL CONTACTORS

3.5.1 Functional Description

Secondary treatment is provided by rotating biological contactors (RBC) each consisting of a series of 11'-10" diameter plastic discs (media) mounted on a common 26' foot long shaft. The discs provide a surface area for the microorganisms to attach and grow, and provides secondary treatment of the wastewater as it flows perpendicular or axially to the shaft. The facility has a total of eight RBCs in two trains of four. Wastewater flows from the discharge of the primaries to a flow splitter structure which distributes flow to the two 20" diameter influent header pipes going to the RBCs. The influent header piping has eight 6" diameter inlet ports to each train of RBCs for a total of sixteen. The Supplemental air can be provided to the first stage of Trains A and B via two 5 hp positive displacement blowers and diffusers.

3.5.2 Design Data

<u>Rotating Biological Contactors</u>

Number of units	8
Number of trains	2
Disc Diameter	11' - 10"
Hp per Shaft	5
Speed (rpm)	1.5
Size (ft^2)	4 @ 120,000 each
	2 @ 150,000 each
	2 @ 142,500 each
Total Area (ft^2)	1,065,000
Total Area per Train (ft^2)	532,500
First Stage Area per Train (ft^2)	240,000
Number of units operating	8
Hydraulic Loading (gpd/ft^2)	
Average	0.64
Max Month	1.02
Peak Daily	1.86
Total BOD Loading (lbs BOD/1,000 ft^2 / day)	
Average	1.62
Max Month	2.68

Peak Daily	5.50
First Stage BOD Loading (lbs BOD/1,000 ft^2 / day)	
Average	3.60
Max Month	5.95
Peak Daily	12.20
RBC Blowers	
Number of Blowers	2
Capacity	500 icfm @ 4 psi
Hp	20

3.5.3 Control System

New local control stations are located at each of the eight RBCs and provide an Emergency Stop (E-Stop) mushroom switch. The MCCs for each of the RBCs provide a RBC Run Indication Light, RBC Elapsed Time Meter and a HAND-OFF-AUTO (HOA) Switch. In the Hand position the RBC will run continuously. In the OFF position the RBC will not operate. The AUTO position will not be used for control. Each MCC will report RBC Run Indication and RBC Motor Overload back to the PLC-MCP. PLC-MCP will provide to control for the RBCs. OIT and SCADA will show RBC Run Indication, RBC Elapsed Time Meter and RBC Motor Overload.

New local control stations are located at each of the two RBC Blowers and provide an Emergency Stop (E-Stop) mushroom switch. Each RBC Blower VFD provides a RBC Blower Run Indication Light, a RBC Blower Elapsed Time Meter, a RBC Blower HAND-OFF-AUTO (HOA) Switch, a RBC Blower VFD Fault Light and a RBC Blower Speed Potentiometer. Each RBC VFD will report the RBC Blower Run Status, RBC Blower Speed, VFD Fault and HOA Switch in Auto to the PLC-MCP.

The automatic operation of the RBC Blowers will be displayed, controlled and configured through the OIT-MCP and SCADA. Each RBC Blower will be displayed as Enabled/Not in Remote when the HOA switch is in the AUTO position at the VFD. Each RBC Blower shall be controlled by a virtual On-Off control switch at OIT-MCP and SCADA. In the On mode the selected blower will run continuously and the operator will enter a speed setpoint at OIT-MCP and SCADA. In the Off mode the selected blower will not operate, except when the HOA switch at the VFD in the ON position.

3.5.4 SCADA System Control Screens

3.5.5 Normal Operation

The RBC Blowers will normally operate with the HOA switch at the VFD in the AUTO position. The virtual ON-OFF control switch at the OIT-MCP and SCADA will be in the ON position as described above in 3.5.3.

3.5.6 Alternate Operation

The RBC Blowers can be alternately operated with the HOA switch at the VFD in the HAND position as described above in Section 3.5.2. The Primary Clarifier Chain Flight Drives can be alternately operated in the HAND position as described above in Section 3.4.2.

3.5.7 Maintenance

3.6 SECONDARY CLARIFIERS

3.6.1 Functional Description

Wastewater flows from the discharge of the RBCs to the flow splitter structure which distributes flow to two 20" diameter influent header pipes going to the two rectangular secondary settling tanks (clarifiers). The secondary settling tanks are 74'-10" long, 16' wide by 12' deep with two baffle walls installed to help facilitate settling and prevent short circuiting. The influent header piping has three 8" diameter inlet ports to each tank for a total of six. Similar to the primary clarifiers, the secondary clarifiers are equipped with a chain and flight sludge and scum mechanism, a manually rotated scum trough and a cross screw collector to transport sludge to a sump. Secondary sludge can also be diverted directly to the sludge holding tanks using the secondary sludge pumps. The two secondary sludge pumps, located in the Sludge Pumping Facility, are progressive cavity pumps with a capacity of 8 to 40 GPM at 70' TDH. These pumps have experienced very little use due to the facility's operational practice of transferring the waste secondary sludge by gravity to the influent wetwell for co-settling, but they will be used once this upgrade is complete to pump secondary sludge to the new gravity thickener.

3.6.2 Design Data

Secondary Clarifiers

Overflow rate (Average)	284 gpd/sq. ft.
Overflow rate (Max Month)	455 gpd/sq. ft.
Overflow rate (Peak Daily)	827 gpd/sq. ft.
Overflow rate (Peak Hourly)	1,692 gpd/sq. ft.
Detention time (Average)	7.40 hours
Detention time (Max Month)	4.61 hour
Drive size	0.5 Hp

Secondary Sludge Pumps

Number of units	2
Type	Progressive Cavity Pumps with Variable Frequency Drives
Design Capacity	8 - 40 gpm @ 80 TDH
Motor size	3 Hp
Speed	44 - 220 rpm

Secondary Clarifiers

Number of units	2
Length	74.8 feet
Width	16 feet
Depth	12 feet
Surface area per tank	1,197 sq. ft.
Tank volume (one tank)	105,000 gal.
Tank volume (two tanks)	210,000 gal.

3.6.3 Control System

A new local control station is located at each Secondary Clarifier Cross Collector drive, which provides an Emergency Stop (E-Stop) mushroom switch. Each Main Control Center (MCC) has the Secondary Clarifier 1 & 2 Cross Collector Run Lights, Elapsed Time Meters and HAND-OFF-AUTO (HOA) Switches. Each MCC will report to the PLC-MCP Run status, Motor Overload and HOA switch is in Auto. When the HOA switch is in the HAND position, the respective Clarifier Cross Collector will run continuously. When the HOA switch is in the OFF position, the respective Clarifier Cross Collector will not run. When the HOA switch is in the AUTO position, control is transferred to the PLC-MCP.

Each Secondary Clarifier Cross Collector shall be displayed as Enabled / Not in Remote based on the HOA switch position at the MCC. Each Secondary Clarifier Cross Collector shall be controlled by a virtual HOA switch at the PLC-MCP and SCADA. In the HAND position the Cross Collector will run continuously. In the OFF position the Cross Collector will not operate, except for the HOA switch at the MCC. When the selected Cross Collector virtual HOA switch is in the AUTO position it will run when either Secondary Sludge Pump is called to run. However, the cross collector drives are NOT interlock hardwired to operate when the respective Sludge Pump is run in HAND by the HOA switch at the MCC.

Each Secondary Clarifier Cross Collector drive will shut down by a latching hardwire High Torque interlock at MCP. The ~~high~~ High T~~t~~orque interlock will illuminate the alarm light at MCP and send a High Torque alarm to PLC-MCP. The interlock will be reset by pressing the Reset button at MCP. Each Secondary Clarifier Cross Collector drive will shut down by a latching hardwire Motor High Temp interlock at MCP. The Motor High Temp interlock will illuminate the alarm light at MCP and send a Motor High Temp alarm to PLC-MCP. The interlock will be reset by pressing the Reset button at MCP. PLC-MCP will activate a Secondary Clarifier 1 & 2 Cross Collector High Torque alarm at OIT-MCP and SCADA. PLC-MCP will activate a Secondary Clarifier 1 & 2 Cross Collector Motor High Temp alarm at OIT-MCP and SCADA.

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A new local control station is located at each Secondary Clarifier Chain and Flight drives, which provides an Emergency Stop (E-Stop) mushroom switch. Each (MCC) has the Secondary Clarifier 1 & 2 Chain and Flight Run Lights, Elapsed Time Meters and HAND-OFF-AUTO (HOA) Switches. Each MCC will report to the PLC-MCP Run status and Motor Overload. In the HAND position the Chain and Flight will run continuously. In the OFF position the Chain and Flight will not operate. The AUTO position will not be used for control and therefore the PLC-MCP will provide no control for the Chain and Flight Drives.

Each Secondary Chain and Flight drive will shut down by a latching hardwire High Torque interlock at MCP. The High Torque interlock will illuminate the alarm light at MCP and send a High Torque alarm to PLC-MCP. The interlock will be reset by pressing the Reset button at MCP. Each Secondary Clarifier Chain and Flight drive will shut down by a latching hardwire Motor High Temp interlock at MCP. The Motor High Temp interlock will illuminate the alarm light at MCP and send a Motor High Temp alarm to the PLC-MCP. The interlock will be reset by pressing the Reset button at MCP. ~~Each Clarifier Chain and Flight drive will shut down by a latching hardwire interlock at MCP. The high torque interlock will illuminate the alarm light at MCP and send a high torque signal to the PLC at MCP. The interlock will be reset by pressing the Reset button at MCP.~~ PLC-MCP will activate a Secondary Clarifier 1 & 2 Chain and Flight Drive High Torque alarm at OIT-MCP and SCADA. PLC-MCP will activate a Secondary Clarifier 1 & 2 Chain and Flight Motor High Temp alarm at OIT-MCP and SCADA.

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3.6.4 SCADA System Control Screens

3.6.5 Normal Operation

The Secondary Clarifier Cross Collector Drives will normally operate in the AUTO position at the MCC and at the PLC-MCP as described above in Section 3.6.3. The Secondary Clarifier Chain Flight Drives will normally operate in the AUTO position at the MCC as described above in Section 3.6.3.

3.6.6 Alternate Operation

The Secondary Clarifier Cross Collector Drives can be alternately operated in the HAND position as described above in Section 3.6.3. The Secondary Clarifier Chain Flight Drives can be alternately operated in the HAND position as described above in Section 3.6.3.

3.6.7 Maintenance

Please refer to Section 2 and 3 of the Allied-Locke Industries Installation, Operation & Maintenance Manual for the following maintenance guidelines.

- Inspection and maintenance intervals
- Lubricant change intervals
- Inspection and maintenance of the gear unit
- Inspection and maintenance of AM / AQA adapters
- Inspection and maintenance of AD adapters
- Malfunctions
- Technical Notes
- Lubrication Schedule

3.7 SLUDGE HANDLING

3.7.1 Functional Description

3.7.1.1 Gravity Thickener

With the need to eliminate co-settling in the primary clarifiers in order to handle increasing flows and loads and the District's desire to eliminate bottlenecks in septage receiving a gravity thickener manufactured by Clear Stream Environmental was installed to thicken both septage and waste activated sludge (WAS). The abandoned 1969 primary clarifier was rehabilitated as a gravity thickener for combined thickening of septage, primary and secondary sludge. The combination of storage in the new gravity thickener and the existing sludge storage tanks is adequate overall sludge and septage storage capacity for the design condition. With a 9-foot blanket level, the gravity thickener will provide two times the storage time of the existing sludge holding tanks.

The gravity thickener floor slope was changed to a 3:12 slope, which was accomplished by placing new concrete fill over the existing floor for the desired slope. The new sludge withdrawal pipe at the bottom of the gravity thickener was installed on top of the existing structure floor and embedded in the concrete fill of the new sloped floor. The center well area was formed in accordance to gravity thickener equipment manufacturer recommendations for their center column and sludge scraper arms. To provide flood protection the walls of the tank were extended 5-feet up to elevation 486.0'. In order to construct the gravity thickener to the correct depth the new launder was installed at elevation 478.65. This provided the recommended design side water depth of 12-feet, which allows for a maximum recommended sludge blanket level of 9-feet. In order to control odors and limit off-site odor emissions, the tank was covered and ventilated to odor control. The exhaust from the new gravity thickener and the existing septage wet well are treated in a BIOREM Mytilus Air Pollution Control System located on the abandoned headworks structure foundation.

For transfer of the thickened sludge from the gravity thickener to either the sludge storage tanks or directly to dewatering, new piping and valves were installed below grade and within the Thickened Sludge Pumping room. Two new 150 gpm Penn Valley rotary lobe solids handling pumps were also installed. One is to be primarily used for pumping the septage and the other will be used for pumping the thickened sludge. However, the new piping installed allows for both new pumps to be interchangeable and an additional pump connection has been provided for future use. Both of the new pumps are controlled by VFDs to accommodate use for dewatering feed.

3.7.1.2 Sludge Pumping

The two primary sludge pumps, located in the basement level of the Sludge Pumping and Holding Facility, are Moyno progressive cavity pumps with a capacity equipped with newly installed macerators and VFDs. The two secondary sludge pumps are also located in the basement level of the Sludge Pumping and

Holding Facility and are also Moyno progressive cavity pumps with newly installed VFDs.

3.7.1.3 Polymer System

Two new translucent HPDE polymer tanks have been installed during this upgrade. Both are installed with Philadelphia Mixers and are to be used with the sludge dewatering system.

3.7.1.4 Sludge Dewatering

A new Fournier Rotary Press was installed to be used for sludge dewatering in conjunction with the new polymer system. The sludge dewatering system consists of a flocculator, where the polymer is mixed in with the sludge and six rotary press channels. During the first phase of the dewatering process, water leaves the channel through the filtering elements and this is referred to as the filtration zone. Throughout the second phase or pressing zone, the channel's moving wheel drives the sludge forward by the force of friction while the restrictor at the channel outlet generates an opposite force. The sludge thus thickens gradually to become cake. The pressure increases exponentially as the cake moves toward the discharge outlet and the cake is subject to sliding and shearing forces. The time spent in the filtration zone and pressing zone depends on the speed of the wheel, the sludge feed pressure, the discharge pressure and the nature of the sludge being treated. The third and final zone is the restriction zone, where the cake is compacted through a final channel by the force of the cake behind it imparted by the well pushing up against a restrictor just before it exits.

3.7.1.5 Sludge Conveying

The new sludge dewatering system utilizes several shaft-less screw conveyors described below, which were designed and manufactured by Bulk Conveyor Specialist, Incorporated. The shaft-less sludge collection screw conveyor is used to gather the cake which is discharged from all six channels of the new Fournier Screw Press. The sludge collection screw conveyor then transports the cake to the shaft-less sludge transfer screw conveyor where it is carried from the Sludge

Stabilization Area to the Sludge Stabilization Truck Bay. Once in the Truck Bay, the cake is ejected into the sludge / lime mixer inlet hopper where the shaft-less lime conveyor is also adding lime from the new lime silo. The sludge / lime mixer then discharges the mixed cake and lime into the shaft-less screw sludge trailer loading conveyor where four electric slide gate valves feed the mixture into the waiting flatbed trailer below.

3.7.1.6 Lime Storage and Feed

The lime storage and feed system is comprised of a lime storage silo, a volumetric screw feeder and a lime transfer screw conveyor which are designed and manufactured by Bulk Conveyor Specialist, Incorporated. The purpose of this system is to store, transfer and feed dry hydrated lime to the sludge / lime mixer inlet hoper in the Sludge Stabilization Truck Bay.

3.7.1.7 Sludge / Lime Mixing

The sludge / lime mixing system consists of a dual paddle pug mill which is designed and manufactured by Bulk Conveyor Specialist, Incorporated. The mixer is devised to produce a granular product of sludge thoroughly mixed with hydrated lime resulting in a homogenized blend of lime and sludge.

3.7.1.8 Stabilized Sludge Conveying and Disposal

The new Sludge Stabilization Truck Bay has been constructed large enough to house a 42-foot belt conveyor sludge disposal trailer with a 62.8 cubic yard capacity. Once the trailer is completely filled, the lime stabilized sludge will be trucked to field storage sites. The trailer is expected to have about a one week storage capacity during peak operation.

3.7.2 Design Data

Gravity Thickener

Tank Configuration

Diameter (ft)	35
Depth (ft)	12.5

Surface Area (sf)	963	
Volume (cf)	12,025	
Volume (gal)	90,000	
Volume @ 9' sludge blanket (gal)	65,000	
Flows and Loads		
Septage	Current	Design (2028)
Max Month Flow (gal/day)	12,760	17,130
% Solids	0.5	0.5
Max Month Load (lbs/day)	530	720
Primary Sludge	Current	Design (2028)
Max Month Flow (gal/day)	6,920	9,360
% Solids	3.0 - 5.0	3.0 - 5.0
Max Month Load (lbs/day)	1,730	2,340
Secondary Sludge	Current	Design (2028)
Max Month Flow (gal/day)	39,870	53,960
% Solids	0.4	0.4
Max Month Load (lbs/day)	1,330	1,800
Sludge Storage Detention Times	Current	Design (2028)
Gravity Thickener (9' blanket depth)		
Avg Load (days)	4.7	3.5
Max Month Load (days)	2.7	2.0
Peak Day (days)	1.0	0.8
Existing Sludge Storage	Current	Design (2028)
Avg Load (days)	2.3	1.7
Max Month Load (days)	1.3	1.0
Peak Day (days)	0.5	0.4
Combined Storage Capacity	Current	Design (2028)
Avg Load (days)	7.0	5.2
Max Month Load (days)	4.0	3.0
Peak Day (days)	1.5	1.2
Hydraulic Loading (gpd/sf)	62	84
Solids Loading (lbs/sf/day)	4.2	5.6

Assumed % Solids Capture	85	85
Assumed % Thickened Sludge	3.5 (2 - 10)	3.5 (2 - 10)
Thickened Sludge Flow (gpd)	12,000	16,200
Septage Transfer Pump / Thickened Sludge Transfer Pump		
No. of Pumps	2	
Capacity (gpm)	150	
Hp	7.5	
Time to empty Wet Well (min)	37	
Wet Well Size (gal)	5,500	

Sludge Pumping	
Primary Sludge Pumps	
No. of Pumps	2
Pump Capacity	8 - 40 gpm @ 80 TDH
Hp	3
Speed (rpm)	44 - 220
Primary Sludge Macerators	
No. of Macerators	2
Capacity (gpm)	120
Hp	7.5
Secondary Sludge Pumps	
No. of Pumps	2
Pump Capacity	8 - 40 gpm @ 80 TDH
Hp	3
Speed (rpm)	44 - 220

Polymer System

3.7.3 Control System

3.7.4 SCADA System Control Screens

3.7.5 Normal Operation

3.7.6 Alternate Operation

3.7.7 Maintenance

3.8 EFFLUENT DISINFECTION SYSTEM

3.8.1 Functional Description

3.8.1.1 Chlorination

The disinfection system consists of a Sodium Hypochlorite feed system and two chlorine addition boxes. Detention time is provided in two, parallel pipes, each 3 feet in diameter and 280 feet long. The three storage tanks, piping and metering pumps were installed as part of this upgrade. The tanks are located in the basement of the Control/Dewatering Building within the newly separated chemical room and are surrounded by a concrete block containment area, which provides adequate secondary containment for the combined 1,635 gallon chemical storage capacity.

3.8.1.2 Dechlorination

The Plymouth facility also has a Sodium Metabisulfite system for dechlorination of the plant effluent. A new storage tank, piping and metering pump have also been installed during this plant upgrade. The tank is also located in the basement of the Control/Dewatering Building within the newly separated Chemical Room and is surrounded by a concrete block containment area, which provides adequate secondary containment for the 330 gallon chemical storage capacity.

3.8.2 Design Data

Chlorination System

Contact Chamber

Number of Tanks	2
Type	Pipe
Size	
Diameter (ft)	3
Length (ft)	280
Unit Volume (gal)	14,447
Total Volume (gal)	28,894

Detention Time (min)	
Average	82
Max Month	51
Peak Daily	28
Peak Hourly	14
Metering Pumps	
Number of Pumps	3
Type	Diaphragm
Capacity (gph)	1.6
Hp	1/4
Transfer Pump	
Number of Pumps	1
Capacity (gpm)	18
Hp	1/5
Sodium Hypochlorite Storage Tanks	
Number of Tanks	3
Volume (gal)	545
Auxiliary Pumps	
Number of Pumps	2
Type	Diaphragm
Capacity (gph)	4

<u>Dechlorination System</u>

Metering Pumps	
Number of Pumps	1
Type	Diaphragm
Capacity (gph)	0.34 to 208
Hp	1/4
Sodium Metabisulfite Storage Tanks	
Number of Tanks	1
Volume (gal)	330
Storage Tank Mixer	

Number of Mixers	1
Hp	1/2

3.8.3 Control System

Each chemical storage tank has an ultrasonic level transmitter which sends a level signal in feet of chemical above the bottom of the storage tank to the PLC-MCP via RIO-AB. Storage tank level is displayed at the OIT-AB and SCADA in feet and percent full, which is shown graphically. The PLC-MCP will activate a low level warning for each chemical storage tank at the OIT-AB and SCADA.

A chemical fill panel is located outdoors at the Sodium Hypochlorite fill station and provides visual level indication for filing each sodium hypochlorite storage tank respective to each tank's floor. Each tank has an amber Tank Full indicator light. A common High Level alarm will sound an audible horn, illuminate a strobe light and send a signal to the PLC-MCP via RIO-AB. An On-Silence-Test Hand Switch controls the High Level alarm. In the On position the audible alarm will sound and the strobe will be powered, in the Silence position the audible alarm will be silenced and the strobe will be allowed to illuminate and in the Test position the audible alarm and strobe shall be powered continuously. A High Level float switch monitors the chlorine secondary containment area and the PLC will activate an alarm at OIT-AB and SCADA.

The final effluent form the secondary clarifiers are chlorinated using two new Sodium Hypochlorite feed pumps prior to the chlorine contact tubes. The pumps feed Sodium Hypochlorite into the final effluent based on the flow signal from the Effluent Flow Meter. The chemical dosage rate will be determined using the chlorine residual analyzer signal. Two new dechlorination pumps feed Sodium Metabisulfite into the effluent at the end of the chlorine contact tubes and are paced from the effluent flow signal.

Each Sodium Hypochlorite LMI solenoid dosing pump includes a Local-Off-Remote (LOR) switch, RUN light, Speed Control knob and stroke length adjustment. When the LOR switch is in the Local position the operator can control the pump speed manually, when in the OFF position the pump will not run and when in the Remote position the pump will be controlled by the PLC-MCP. At the PLC-MCP the pump will have a virtual Hand-Off-Auto (HOA) control and a Lead/Standby switch and status. When the HOA control is in Hand mode the pump will run and the operator will be able to vary the speed manually, in the OFF mode the pump will not run and in the Auto mode the Lead pump will run and be automatically paced by the PLC-MCP via RIO-AB proportional to the Effluent Flow Rate. The speed of the pump will be determined by the proportional signal multiplied by the chlorine Pacing Signal Adjuster (PSA) which the operator can manually adjust form 1% to 100%. The PLC-MCP uses the chlorine residual to automatically adjust the chlorine PSA so that the measured residual will be maintained at a consistent Residual Setpoint from 0.00 to 5.00 mg/L, initially set at 1.5 mg/L. The operator is able to adjust the setpoint, dead-band, delay (between control changes) and gain for the proportional function. When the PLC automatically adjusts the PSA the value is updated at OIT-AB and SCADA. The operator is capable of Enabling/Disabling Residual Trim. A Minimum Effluent Flow Rate will be adjusted by the operator form 0 to 500 gpm and initially set at 50 gpm. The pump pacing signal will be zero if the measure flow rate is less than the above minimum flowrate.

A sample is continuously pumped from the chlorine contact chamber to a Hach CL17 Chlorine Meter to monitor the total chlorine residual and the results are sent to the PLC-MCP via RIO-AB. The chlorine residual will be indicated at OIT-AB from 0.00 to 5.00 mg/L and the analog signal is sent to the Chlorine Residual Indicating Recorder. A Low Chlorine Residual Alarm will be activated by the PLC-MCP if the residual drops below an adjustable setpoint form 0.00 to 5.00 mg/L, initially set at 0.25 mg/L for a delay period of 0 to 60 minutes, initially set at 5 minutes. A High Chlorine Residual Alarm will be activated by PLC-MCP if the residual rises above an adjustable setpoint from 0.00 to 5.00 mg/L, initially set at 2.00 mg/L for a delay period of 0 to 60 minutes, initially set at 5 minutes.

The operator enters a Maximum Calibrated Pumping Rate for each chemical pump and the PLC totalizes the amount of chemical through the pumps using the signal speed of the pumps. The pumps flowrates and totalized flowrate are monitored and recorded by the

PLC and displayed at OIT-AB and SCADA. The operator is able to reset the combined totalized values through the OIT-AB or SCADA.

The Metabisulfite Dechlorination Chemical Metering Pumps are controlled similar to the Hypochlorite Chemical Metering Pumps except without a chlorine residual trim function or a Lead/Standby switch. Dry Sodium Metabisulfite is manually mixed with water I the storage tank via an On/Off Selector Switch. The PLC-MCP will monitor the run status for the chemical mixer via RIO-AB and will display on the OIT-MCP and SCADA with an elapsed time meter.

3.8.4 SCADA System Control Screens

3.8.5 Normal Operation

The Sodium Hypochlorite Chemical Metering Pumps normally operate with the LOR switch in REMOTE and the virtual HOA control in the AUTO mode, therefore having the PLC-MCP control the dosing rate based on the effluent flowrate.

The Sodium Bisulfate Chemical Metering Pumps normal operates with the LOR switch in REMOTE and the virtual HOA control in the AUTO mode, also having the PLC-MCP control the dosing rate based on the effluent flowrate.

3.8.6 Alternate Operation

Both the Sodium Hypochlorite Chemical Metering Pumps and the Sodium Bisulfate Chemical Metering Pumps can alternately operate with the LOR switch in REMOTE and the virtual HOA control in the HAND mode or with the LOR switch in Local, which would allow the operator to control the dosing rates manually. Both of these systems are operated with the backup generator in the event of a normal power failure.

Sodium Hypochlorite is also available for use at the septage receiving facility, plant influent, Rotating Biological Contactors and Sludge Holding Tanks for odor control if necessary.

3.8.7 Maintenance

The Chlorination and Dechlorination System should be inspected on a daily basis for proper operation and for any signs of operating problems.

3.9 PLANT WATER SYSTEM

3.9.1 Functional Description

The plant water system is a new package triplex system manufactured by SyncroFlo and rated for 0 gpm to 175 gpm while maintaining 60 psi and 100 psi system pressure. The triplex system includes one 5 hp jockey pump rated at 40 gpm, and two larger 20 hp pumps rated at 175 gpm each. The package system has a dedicated control panel that sends status and alarm signals to the PLC-MCP.

3.9.2 Design Data

Number of Pumps	3
Type	Centrifugal
Capacity	
PW-1	1 @ 40 gpm at 300 TDH
PW-2 & PW-3	2 @ 175 gpm at 300 TDH
Hp	
PW-1	1 @ 5 Hp
PW-2 & PW-3	2 @ 20 Hp

3.9.3 Control System

The SyncroFlo triplex package system includes a stand alone PLC based control panel. The control panel consists of a main disconnect switch, an operator interface terminal, individual pump run lights (green), a control power light (white), an alarm condition light (yellow), individual pump elapsed run time meters and individual pump HAND-OFF-AUTO (HOA) switches. In the HAND position the pumps will run continuously, in the OFF position the pumps will not run and in the AUTO position the PLC will control the operation of the pumps. Individual Emergency Stops (E-Stops) and disconnects are provided for each pump mounted at the front of the triplex skid.

The automated control of the pumps is described as follows. During low flow conditions, the jockey pump (PW-1) Variable Frequency Drive (VFD) starts and gradually ramps up the system pressure to the desired set point of 100 psi. As flow demand increases beyond the capacity of PW-1 and system pressure drops, PW-2 VFD starts and gradually ramps up the system pressure back up to the desired set point of 100 psi and PW-1 shuts down. PW-2 pump speed is modulated to hold a constant discharge pressure of 100 psi. As the flow rate increases beyond the capacity of PW-2 and system pressure can not be maintained at 100 psi, PW-3 VFD starts and gradually ramps up the system pressure back up to the desired set point of 100 psi. At this time an algorithm accurately equalizes both PW-2 and PW-3 VFDs so that no pressure surges are generated during the transition. Both pumps speed are identical as they maintain the desired system pressure of 100 psi. As the system flow rate decreases within the capacity of one pump, PW-3 VFD will be shut down. As the system flow rate decreases within the capacity of the jockey pump, PW-1 VFD starts and PW-2 VFD will be shut down. To maintain equal runtime PW-2 and PW-3 will switch between Lead and Lag pumps automatically.

The Plant Water System will alarm locally as well as to SCADA and will then shutdown on low discharge pressure, phase reversal and individual motor overload / phase loss. The Plant Water System will alarm locally as well as to SCADA, shutdown and attempt to restart on high discharge pressure, low suction pressure, phase loss, low voltage and phase unbalance. Three unsuccessful restarts in a 15 minute period results in a hard shutdown. Individual motor phase failure and low voltage safety circuitry will retire any pump that experiences low voltage, phase failure or phase unbalance as monitored at the load-side of each pump motor contactor. Each pump motor contains an individual protective device and time delay to allow for transient low voltage during motor starting providing maximum motor protection. Separate main phase failure and low voltage safety circuit are provided to retire the pumping system if it experiences low voltage, phase failure or phase reversal as monitored at load-side of main disconnect. A phase monitor contains a time delay to allow for transient low voltage during motor starting and provides maximum motor protection. The Operator interface terminal mounted in the enclosure door, signals phase failure for any affected pump. The individual pumps or pumping system shall not operate until the voltage problem has been corrected and alarm has been manually reset. Single incoming phase monitor safety circuit is not acceptable. The local alarm consists of a yellow general alarm light to indicate any alarm condition and specific alarm conditions along with procedures for correction shall be displayed on the operator interface display.

3.9.4 SCADA System Control Screens

3.9.5 Normal Operation

The plant water system will normally operate with all three pump HOA switches in the AUTO position.

3.9.6 Alternate Operation

The plant water system can alternately be operated by having any of the three pumps HOA switches in the HAND position.

3.9.7 Maintenance

Daily - Record all pressure gauge readings, clean and switch the suction strainer basket and check the mechanical seals for leaks.

Weekly - Cycle all pumps that have not been operated within the last week for approximately 10 minutes.

Monthly - Check motor bearings and lubricate if necessary. Test all alarms and check all indicating lights on the control panel.

Yearly - Check the sequencing of the system by generating sufficient flow in the system to automatically activate flow sensing devices. Clean the pressure reducing valve.

3.10 ODOR CONTROL

3.10.1 Functional Description

The new gravity thickener and existing septage receiving facilities share a common BIOREM Mytilus Air Pollution Control System located on the abandoned headworks structure foundation. The BIOREM unit is designed to remove 99% of the inlet H_2S concentration with average H_2S inlet concentrations of 20 ppm (summertime maximum month) and peak concentrations of 50 ppm. The BIOREM unit is sized for a 30 second detention time. The exhaust air rate is based on 12 air changes per hour above the water surface. The new gravity thickener requires approximately 1,500 CFM and the existing septage receiving requires approximately 500 CFM, for a total system capacity of 2,000 CFM. The BIOREM unit includes two fiberglass media compartments, an odor control blower and an irrigation water system. The odor control blower is driven by a VFD to allow for air flow turn down in the winter. All above grade irrigation water and drain piping are heat traced and insulated. The odor control system has its own control panel which will send status and alarm signals to the PLC.

The sludge dewatering area has a separate BIOREM Mytilus Air Pollution Control System also located on the abandoned headworks structure foundation. The BIOREM unit is designed to remove 99% of the inlet H_2S concentration with average H_2S inlet concentrations of 1 - 2 ppm and peak concentrations of 10 ppm. The biofilter unit is sized for a 30 second detention time. The dewatering area requires a ventilation rate of 6 air changes per hour or approximately 1,000 CFM. The new package system includes a fiberglass media compartment, an odor control blower and an irrigation water system. The odor control blower is driven by a VFD to allow for air flow turn down in the winter. All above grade irrigation water and drain piping are heat traced and insulated. The odor control system has its own control panel which will send status and alarm signals to the PLC.

3.10.2 Design Data

OCF-1: Gravity Thickener and Septage Receiving

Flow Rate	1,000 cfm
Inlet Air Temperature	32 - 110 F
Average Inlet Relative Humidity	30 - 100 %
Average H_2S Concentration	20 ppm
Peak H_2S Concentration	25 - 50 ppm
H_2S Concentration Removal	99 %
Organic Sulfides	0.3 ppm
Organic Sulfides Removal	90%
System EBRT	6 sec
Stage 1 LWE Media Volume	100 cf
Stage 1 LWE Media Height	3.5 ft

Stage 2 XLD Media Volume	83 cf
Stage 2 XLD Media Height	3.0 ft
Total Design Pressure Drop	<2 in WC
Water Recirculation Flowrate	20 gpm
Water Consumption	367 gpd
Leachate pH (to drain)	1 - 3
Electrical	460 VAC / 3 Phase / 60 Hz
Fan	5 HP
Recirculation Pump	1.5 HP

OCF-2: Sludge Dewatering

Flow Rate	1,000 cfm
Inlet Air Temperature	32 - 110 F
Average Inlet Relative Humidity	30 - 100 %
Average H_2S Concentration	2 ppm
Peak H_2S Concentration	5 - 10 ppm
H_2S Concentration Removal	99 %
Organic Sulfides	0.3 ppm
Organic Sulfides Removal	90%
System EBRT	4 sec
Stage 1 LWE Media Volume	67 cf
Stage 1 LWE Media Height	2.4 ft
Stage 2 XLD Media Volume	83 cf
Stage 2 XLD Media Height	3.0 ft
Total Design Pressure Drop	<2 in WC
Water Recirculation Flowrate	20 gpm
Water Consumption	223 gpd
Leachate pH (to drain)	1 - 3
Electrical	460 VAC / 3 Phase / 60 Hz
Fan	5 HP
Recirculation Pump	1.5 HP

3.10.3 Control System

Each BIOREM unit has a separate control panel with an identical set of controls; therefore the Control System description below describes the operation of both systems.

The exhaust fan has a HAND - OFF - AUTO (HOA) switch. When the HOA switch is in the HAND position the fan will continuously run and when in the OFF position the fan will not run. When the HOA switch is in the AUTO position then the system will operate automatically with all rotating equipment and devices being controlled without operator intervention, provided the Emergency Stop (E-Stop) is not activated.

The recirculation pump has a HAND - OFF - AUTO (HOA) switch. When the HOA switch is in the HAND position the recirculation pump will continuously run and when in the OFF position the recirculation pump will not run. When the HOA switch is in the AUTO position then the recirculation pump will run provided the exhaust fan is running and a low discharge pressure alarm is not activated. The sump level is controlled by a ball float valve and fed from the plant water system when low.

The immersion heater has an ON - OFF switch and will run in the ON position provided there is not a low sump level, set at 8-inchs above the floor of the unit. In the OFF position the immersion heater will not run.

3.10.4 SCADA System Control Screens

3.10.5 Normal Operation

The BIOREM units will normally operate with the exhaust fan and recirculation pump in the AUTO positions and with the immersion heaters ON.

3.10.6 Alternate Operation

The BIORM units can be alternately operated with the exhaust fan and recirculation pump in the ON positions and with the immersion heaters ON, but this should only be done for the purpose of maintenance.

3.10.7 Maintenance

The exhaust fan should be inspected monthly for proper operation and should include appropriate V-belt tension and greasing the motor bearing as outlined in the Lubrication Guide in Section M03 of the BIOREM Operation and Maintenance Manual.

The recirculation pump should be inspected monthly for proper operation within the required performance parameters and the motor bearings should be greased in accordance with the Motor Lubrication Schedule in Section M04 of the BIOREM Operation and Maintenance Manual.

SECTION 3

PROJECT DESCRIPTION

This section provides a summary of the existing unit processes affected by the WWTF upgrade and describes the proposed modifications. Specific unit process design and sizing data are presented in Section 4. Where necessary, references have been made to Section 6 to describe specific design considerations related to the Architectural, Structural, HVAC / Plumbing, and Electrical and Instrumentation disciplines. A preliminary equipment list summarizing new equipment to be provided and existing equipment to remain as part of the upgrade is presented in Appendix C.

3.1 SEPTAGE RECEIVING FACILITIES

3.1.1 Existing Conditions

The Plymouth WWTF accepts septage from, and has agreements with, 24 surrounding communities. The agreements are renewed on an annual basis. The septage receiving operation utilizes a Honey Monster septage receiving unit, manufactured by JWC Environmental, which was put into operation in August 2006. The septage discharges by gravity from the trucks to the septage receiving system through a quick connect fitting. An ultrasonic level sensor and modulating plug valve regulates flow into the system. The septage passes through an auger screen, and a spray wash helps remove soft organics and wastewater from the screenings. The septage system is a Model SRS3200 unit, which is designed for up to 400 GPM of septage. The unit also includes a keypad PIN security access and flow measurement system. This new unit provides improved screening and faster processing of the incoming septage loads.

The septage flows from the receiving unit to a 5,500-gallon concrete wetwell through an 8-inch ductile iron gravity line. From there, the septage may be pumped to the influent sewer to flow by gravity to the Headworks Building or to the sludge holding tanks. The septage is pumped with a 2-hp, Model KS-9 Komline-Sanderson plunger pump located in the Septage Pumping Building and originally rated for 45 gpm.

The Komline-Sanderson pump was installed as part of the 1991 plant upgrade. A new motor was installed in 2004 and the pump was rebuilt at the end of 2005. With the new motor and settings, the pump now operates at 77 gallons per minute (approximately 4,600 gallons per hour), but still requires over an hour to empty the 5,500 gallon septage holding tank. The septage volume received at the Plymouth facility has increased the daily running time from three hours to six to eight hours, increasing the wear and required maintenance. During the three-year evaluation period, the average septage volume was 10,111 gallons per day, with a maximum day of 32,500 gallons. The limited size of the receiving tank and the limited pumping capacity of the plunger pumps has created a delay for septage delivery trucks as they must wait for the holding tank level to go down before discharging. The storage capacity in the existing sludge storage tanks is also limited, and requires the dewatering operation to be closely coordinated with septage receiving activity.

3.1.2 Recommended Improvements

As discussed further under the solids handling section (Section 3.9) the abandoned primary clarifier will be converted to a new gravity thickener for primary and secondary solids as well as septage. This alleviates the need for a separate larger septage storage tank. New piping and valves in the basement of the Thickened Sludge Pumping Facility (formally the Septage Pumping Facility) will allow the flexibility to pump the septage to the new gravity thickener, the existing sludge storage tanks, or the influent sewer to headworks.

The existing plunger pump will be replaced with a larger capacity solids handling pump. It is recommended that a minimum capacity of 150 gpm be provided. This will allow the existing septage wetwell to be pumped down much quicker thus allowing less time between septage truck deliveries. The current average day septage volume of 10,000 gallons could be pumped to the new gravity thickener or the sludge storage tanks in just over an hour and the maximum day volume of 32,500 in approximately 3.5 hours.

The Thickened Sludge Pumping Facility will also house the new thickened sludge pumps for the gravity thickener. Because the thickened sludge pump will have the same capacity of the septage pump, it is recommended to install the same model pump for both applications with a third standby pump that could be utilized as either the septage or sludge transfer pump. A sludge and septage pumping schematic and a layout drawing for the septage pumping facility are shown in the 30% drawings in Appendix D

The District expressed the interest of designing around Penn Valley double disk diaphragm pumps to be consistent with the direction they are going in replacing all their sludge pumps in the sludge pumping facility. This style of pump was evaluated for the septage and thickened sludge transfer pumps, but the size of the pumps would not even allow for the installation of two pumps in the existing septage pumping facility. A rotary lobe style solids handling pump was also evaluated for its small footprint and good reputation in pumping thickened sludge. Three 4-inch, 7.5 hp rotary lobe pump manufactured by Vogelsang are recommended. The primary advantage compared to the double disk pump is the capability of installing three units in the existing septage pumping facility. There will be a new access hatch cut into the floor of the septage pumping facilities upper level to allow for the pumps to be accessed from above for removal or installation. The new pumps will have Local-Off-Remote control, remote status and alarm signals at the PLC. Remote control will allow for On-Off operation from the PLC.

3.2 HEADWORKS FACILITIES

3.2.1 Existing Conditions

Wastewater enters the Headworks Building via a 24-inch diameter ductile iron sewer where large solids, rags and debris are removed by a vertical Schloss mechanical bar screen with 5/8" bar spacing. Operation of the screen is based on a bubble-type differential pressure control system. Screenings are transported out of the channel and into a self-dumping screenings cart for disposal. A bypass channel with manual bar rack is also available by opening manual slide gates. The influent then passes through a 7-foot diameter Jones & Atwood vortex grit removal system. The grit slurry is pumped with a Wemco recessed-impeller pump to a Krebs cyclone grit separator. The grit removal system includes an air scour line, but the compressor and air line is severely corroded and is no longer operable. Continuous influent flow measurement is provided by an ultrasonic level transducer, replaced in 2005, which measures the depth of flow over a 1.5' H-Flume.

3.2.2 Recommended Improvements

The following improvements are recommended for the headworks facilities as part of the immediate phase of improvements:

- Replace corroded metal wall panels with insulated metal sandwich panels.
- Cover the influent channels and screw pump wetwell with aluminum plating or rubber mats over the existing grating and draw air from the influent channel to a new carbon odor control system. The headworks odor control system will be discussed in greater detail in Section 3.10.
- Ventilation improvements including replacement of the existing supply fan and exhaust louver will be discussed further in Section 6 under the HVAC design memorandum.
- Recalibrate the influent flow meter to increase the maximum set point to at least 4.5 MGD in order to record the true peak flows. Maintaining the effluent flow meters existing flow measurement range will allow for accurate readings during typical flow conditions.
- Relocate the influent sampler to a non-explosion-proof rated area. The recommended location is an upstream manhole prior to the introduction of return flows such as manhole 2 or the upstream part of manhole 3.
- Replace the air scour line to the vortex grit unit with a plant water line for water scour.

The following improvements are recommended as part of the long-term improvements and are not addressed any further in this report:

- Replace mechanical bar screen in ten years. A "climber" style unit is recommended for the replacement with ½" bar spacing.
- Replace components of the grit removal system: Repairs or replacement of the grit removal system components need to be part of the capital improvement plan, but are not a priority for the short term. The grit system components are expected to reach the end of their useful life in ten to fifteen years.

3.3 INFLUENT PUMPING

3.3.1 Existing Conditions

Following the Headworks, wastewater flows to an open wetwell from which two, 36-inch diameter, variable-speed screw pumps lift all wastewater flow 20'-3" to the influent channel of the two rectangular primary settling tanks. The pumps have a maximum capacity of 2.84 mgd each. The sludge holding tank drain/supernatant decant and the waste secondary sludge can discharge by gravity to the screw pump wet well, downstream of the influent flow measurement flume.

3.3.2 Facility Plan and Conceptual Design Recommendations

The facilities plan noted that the existing screw pumps operate adequately and may not need replacement during the 20-year design period. However, current and future peak flow conditions require additional pumping capacity if full pumping redundancy is to be maintained. A submersible pump installed within the existing wet well was the recommended option for additional and redundant influent pumping capacity.

The facilities plan noted that there were twelve stormwater catch basins in town that were identified in a 2004 smoke testing report as being connected to the wastewater collection system. Wright-Pierce and the District conducted smoke testing in December 2008 and confirmed that six of the catch basins are directly tied in to the sanitary sewer (See Smoke Testing Technical Memorandum in Appendix H. These catch basins are a major contributor to the inflow and infiltration (I/I) problem that is causing peak flows to exceed design capacity.

There are also several other know or suspected areas of significant I/I contributions. There are several buildings along Main Street that have been identified to have roof leaders connected to the sanitary sewer system. Plymouth State University has many large buildings with flat roofs. The District may want to conduct additional testing in the area of the University to help identify other potential I/I sources.

Prior to any upgrades involving an increase influent pumping capacity to handle high instantaneous peak flows to the wastewater treatment facility, the known catch basins should be separated from the sanitary collection system as well as the roof leaders along Main Street. It is recommended to implement the I/I removal work as a separate construction project from the WWTF improvements. If there are any I/I sources identified in the area of the University, those sources should be separated as well. This level of I/I removal has the potential to significantly reduce the peak instantaneous flows to the wastewater treatment facility, potentially such that no influent pumping capacity increases may be necessary.

One other option to consider for providing additional and redundant influent pumping capacity is a portable, trailer mounted, self priming, suction lift pump. This pump could be provided by the Contractor to assist in bypass pumping during construction, and retained by the District after the completion of the project for redundant influent pumping capacity. The trailer mounted unit would also serve as back-up emergency pumping for any of the pump stations in town.

3.4 PRIMARY CLARIFIERS

3.4.1 Existing Conditions

Wastewater flows from the discharge of the screw pumps to a flow splitter structure which distributes flow to the influent channels of two rectangular primary settling tanks (clarifiers). The primary settling tanks are 62'-4" long, 12' wide by 10' deep. The influent channel has multiple 6-inch diameter inlet ports to each tank. Each clarifier is equipped with a chain and flight sludge and scum removal mechanism, a manually rotated scum trough, and a cross screw collector to transport sludge to the suction sump of the primary sludge pumps. Primary sludge is pumped to the sludge holding tanks for dewatering. The two (2) primary sludge pumps, located in the Sludge Pumping Facility, are progressive cavity pumps with a capacity of 8 to 40 GPM at 70' TDH. Each pump is equipped with a 7.5 HP macerator. Scum is removed via the manually rotated scum trough to the scum removal box, where it is manually raked on the beach and then into a hopper for disposal.

3.4.2 Recommended Improvements

With the installation of a new gravity thickener for primary sludge, secondary sludge and septage, the co-settling operation in the primary clarifiers can be abandoned. This will allow for higher overflow rates in the primary clarifiers and eliminate the need for additional clarifiers.

The most significant performance concern is the influent channel to the primary clarifiers which has overflowed (or at least splashed over the walls) during high flow conditions. The flow approaches the primary clarifiers through a single open channel which ends at a 90 degree tee. A diversion plate was installed to induce additional headloss to provide better flow split. The headloss through this causes the increased water surface in the channel and is exacerbated by the rags which frequently collect on the flow splitter plate. The hydraulics are discussed further in Section 2. In addition there is evidence of cracks, spalls, and leakage around the junction of channel and the primary clarifiers. This was most likely caused by differential movement between the structures, and water seeping into the expansion joint/construction joints and freezing. Some repairs were made using a surface applied cementitious mortar, but they are considered temporary repairs. In addition there are several cracks in the above grade portion of the concrete walls. The walls are covered with a cementitious overlay (such as Thoroseal). As discussed in Section 2, it is recommended that the existing influent channels be replaced with wider channels, and the elevated channel from the screw pumps to the influent channels be replaced with an inverted siphon pipe to alleviate both hydraulic and structural issues. It is also recommended to increase the size of the eight primary clarifier inlet ports from 6-inch to 8-inch, or to core an additional eight 6-inch ports.

In addition to a new influent channel, it is recommended to replace the gear boxes, drive motor and clutches for the sludge cross collector drives and the chain and flight drives.

3.5 ROTATING BIOLOGICAL CONTACTORS

3.5.1 Existing Conditions

Secondary treatment is provided by rotating biological contactors (RBC) each consisting of a series of 11'-10" diameter plastic discs (media) mounted on a common 26' foot long shaft. The discs provide a surface area for the microorganisms to attach and grow, and provides secondary treatment of the wastewater as it flows perpendicular or axially to the shaft. The facility has a total of eight RBCs in two trains of four. Supplemental air can be provided to the first stage of Trains A and B via a single 5 hp positive displacement blower and diffusers.

3.5.2 Recommended Improvements

The facilities plan recommended a full inspection of the RBC equipment and a structural inspection of the concrete tanks. The RBC equipment inspection was performed by RBC Services, Inc., and the structural inspection was performed by Wright-Pierce. The inspections were summarized in the Conceptual Design Technical Memorandum (Appendix I) and the Structural Preliminary Design Memorandum included in Section 6. In general, the RBC units were observed to be in very good working condition. One modification that was recommended by RBC Services is the RBC aeration system. Aeration in the RBC tanks can improve BOD removal; create better settling biological floc for improved solids capture in the secondary clarifiers; maintain a thinner biomass which prolongs equipment life; and helps control odors. Mooers Products, Inc manufactures the "sidecar" aeration system consisting of aeration headers and coarse bubble diffusers, that is specially designed for easy placement and removal with the RBC in position and no underwater attachments or anchors. It is recommended to design for air flows of approximately 5 SCFM / ft of RBC media length or 125 SCFM per RBC. This can be accomplished with two new 20 hp, 500 SCFM vortex, regenerative blowers located in the walkway area between the RBC trains. Each RBC will have a dedicated air lateral with a manual butterfly valve for isolation. The blowers will be VFD driven to allow the operators the ability to vary the air flow rate and will have Local-Off-Remote control, remote status and alarm signals at the PLC. Remote control will allow for On-Off operation of each blower from the PLC.

The influent channel to the RBCs experiences more severe hydraulic problems at the flow splitter than the primary clarifier influent channel, and the tank walls have been overtopped on a number of occasions. As discussed in Section 2, it is recommended that the existing influent channels be replaced with wider channels, and the elevated channel from the primary clarifiers to the influent channels be replaced with an inverted siphon pipe to alleviate both hydraulic and structural issues, as well as increasing the height of the influent channel walls by one foot. It is also recommended to increase the size of the sixteen RBC inlet ports from 4-inch to 6-inch, or to core an additional sixteen 4-inch ports.

Other structural improvements include:

- Resurface the top 12 inches of the interior face of the walls and the edges of the walkway slabs with a cementitious overlay.
- Provide various concrete and crack repairs. The best way to do this is to provide estimated quantities of crack and concrete repairs to the general contractor and point out the specific repairs during construction.
- Remove all vegetation within the tank.
- Reseal all of the deficient expansion joints.

The following improvements are recommended as part of the long-term improvements, but are not addressed any further in this report:

- Replace RBCs with new media. Based on the RBC inspection, it is expected that the replacement should not be necessary for at least 10 years.

3.6 SECONDARY CLARIFIERS

3.6.1 Existing Conditions

Wastewater exits the effluent channel of the RBCs and flows to the flow splitter structure of the secondary clarifiers. The splitter structure distributes flow to the influent channels of two, 74'-10" long, 16' wide by 12' deep secondary clarifiers. Similar to the primary clarifiers, the secondary clarifiers are equipped with a chain and flight sludge and scum mechanism, a manually rotated scum trough and a cross screw collector to transport sludge to a sump. Secondary sludge can also be diverted directly to the sludge holding tanks using the secondary sludge pumps. The two secondary sludge pumps, located in the Sludge Pumping Facility, are progressive cavity pumps with a capacity of 8 to 40 GPM at 70' TDH. These pumps have experienced very little use due to the facility's operational practice of transferring the waste secondary sludge by gravity to the influent wetwell for co-settling, but they will be used once this upgrade is complete to pump secondary sludge to the new gravity thickener.

3.6.2 Recommended Improvements

The influent channel to the secondary clarifiers experiences the same hydraulic problems as described in the primary clarifier influent channel. As discussed in Section 2, it is recommended that the existing influent channels be replaced with wider channels, and the elevated channel from the RBCs to the influent channels be replaced with an inverted siphon pipe to alleviate both hydraulic and structural issues. It is also recommended to increase the size of the eight secondary clarifier inlet ports from 6-inch to 8-inch, or to core an additional eight 6-inch ports.

In addition to a new influent channel, it is recommended to replace the gear boxes, drive motor and clutches for the sludge cross collector drives and the chain and flight drives, and the effluent launders due to corrosion. New baffles will be installed in the first third of the clarifiers to help improve settling and removal performance.

3.7 FERRIC CHLORIDE SYSTEM

3.7.1 Existing Conditions

In 2003, the operations staff began a pilot study of ferric chloride addition to the belt filter press sludge feed to control odors in the dewatering room. This practice has substantially reduced the odors within the Control Building. An evaluation was conducted in the April 2004 Odor Control and Septage Receiving Evaluation of the cost of ferric chloride versus potassium permanganate and sodium carbonate peroxyhydrate. While utilizing ferric chloride was the highest odor control cost alternative, it has the additional benefits of increasing the dewatered cake solids, clarifying the filtrate recycle from the belt filter press back to the Headworks Building, reducing polymer usage and also reduced odors from compost mixing. It was recommended that the District continue utilizing ferric chloride in the feed sludge to the belt filter press.

The current method of chemical handling and addition is labor intensive and presents safety risks to the operations staff. A temporary ferric chloride feed system is located in the Pump Room of the Sludge Pumping Facility. Drums are lowered into the basement level of the building. Ferric chloride is a highly corrosive compound and this method of handling could be dangerous to the operations staff.

A phosphorus limit is expected to be imposed by the NHDES on the Plymouth discharge flows to the Pemigewasset within the next five to ten years (one or two permit cycles). The NHDES has indicated that limits are expected to be in the 1 mg/l range, and not significantly lower. This phosphorus limit could likely be met with the addition of ferric chloride ($FeCl_3$) to the influent of the secondary clarifiers. The addition of ferric chloride at the secondary clarifiers would require increased chemical storage capacity, feed pumps, and piping to the secondary clarifiers.

3.7.2 Recommended Improvements

It is recommended that a new ferric chloride feed system be installed adjacent to the Sludge Pumping and Holding Facility. A separate masonry building would be constructed with chemical containment, bulk storage tank, exterior chemical loading connection, chemical metering pumps and ventilation system. The building will be designed for flood protection from the 100-year flood elevation of 485'. The new chemical feed system would be designed with a future phosphorus limit in mind when sizing the chemical storage footprint and containment area. The best price for ferric chloride can be obtained by receiving full truck loads as opposed to partial loads or smaller volumes. In order to accommodate a full truck load of ferric chloride, a new storage tank, with approximately 5,000 gallons of storage capacity, would be required. The new storage tank will have an ultrasonic level measuring instrument that will provide level indication and high and low alarm indication back to the PLC. The chemical pumps will have Local-Off-Remote control, remote status and alarm signals at the PLC. Remote control will allow for On-Off operation from the PLC. The containment area will have a high level indicating alarm reporting back to the PLC.

3.8 PLANT SUPPORT

3.8.1 Plant Water

3.8.1.1 Existing Conditions

The existing plant water system, located in the basement of the Control Building, consists of four, constant speed centrifugal pumps that operate to maintain a setpoint pressure within the distribution system. Designed for a maximum pressure of 87 psi, two of the pumps are 10 HP, 50 gpm pumps, while the remaining two are 15 HP, 100 gpm pumps. The pumps currently operate continuously.

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The plant water system is located within the same space as the sodium hypochlorite and sodium metabisulfite tanks. Because of the lack of adequate ventilation, the plant water pumps and controls have experienced accelerated corrosion.

3.8.1.2 Recommended Improvements

As part of the upgrade, the existing plant water system and piping will be demolished and a new skid mounted plant water system installed, and piping system replaced in-kind. The new plant water system will be a package plant water pump station rated for 5 gpm to 150 gpm at 125 psi and will include three pumps with VFDs, one 3 hp jockey pump rated for 15 gpm, and two larger 15 hp pumps rated for 75 gpm each. The new plant water system will be similar to the "JT Series" manufactured by SyncroFlo. The package system will have a dedicated control panel that will send status and alarm signals to the PLC.

The plant water system is in the same area as the oil storage tanks. Due to code issues and corrosion issues, there will be a new CMU wall constructed to separate this area from the chemical storage area. The new area will have separate ventilation from the chemical area.

3.8.2 Effluent Disinfection

The disinfection system consists of a sodium hypochlorite feed system and two chlorine addition boxes. Detention time is provided in two, parallel pipes, each 3 feet in diameter and 280 feet long. The storage tanks and metering pumps are housed in the basement of the Control/Dewatering Building and were installed as part of the 1991 plant upgrade. The storage tanks are surrounded by a concrete block containment area which provides adequate secondary containment for the combined 1,650 gallon storage capacity of the three tanks. The Plymouth facility also has a sodium metabisulfite system for dechlorination of the plant effluent. This system is also housed in the basement of the Control/Dewatering Building and was installed as part of the 1991 upgrade.

The following improvements to the chemical room are recommended as part of the immediate improvements project:

- Recoat the secondary containment concrete isolation walls.
- Provide ventilation improvements.

The following improvements are recommended as part of the long term improvements and will not be further addressed in this report:

- Replace the sodium hypochlorite and sodium metabisulfite tanks and pumps.

3.9 SLUDGE HANDLING

The existing sludge handling facilities include sludge holding tanks for septage and co-settled primary and secondary sludge, a belt filter press and a composting facility. As part of the WWTF improvements and as described in more detail below, co-settling will be abandoned, a new gravity thickener will be utilized for sludge thickening prior to dewatering and the dewatered sludge will be stabilized and trucked off site for land application. The last construction phase of the contract will be to demolish the existing composting facility.

3.9.1 Gravity Thickener

With the need to eliminate co-settling in the primary clarifiers to handle increasing flows and loads, and the District's desire to eliminate bottlenecks in septage receiving, the facilities plan recommended that a thickening device(s) be installed that could be utilized to thicken both septage and WAS.

As noted in the facilities plan, the abandoned, 1969 primary clarifier appeared to be suitable for rehabilitation as a gravity thickener for combined thickening of septage, primary and secondary sludge. Utilization of the abandoned primary clarifier would be more cost effective than the construction of a new storage tank or new sludge thickening facilities. The inspection of the primary clarifier is described in the Conceptual Design Technical Memorandum in Appendix I, and determined that the tank is suitable for reuse.

The existing clarifier tank size was checked against typical design standards for gravity thickening of combined septage, primary and secondary sludge. The projected solids loading rate indicate that the existing primary clarifier is of sufficient size to meet current design criteria for a gravity thickener handling both primary and secondary solids. The combination of the storage in the gravity thickener and the existing sludge storage tanks would be expected to provide adequate overall sludge and septage storage capacity for the design condition. With a 9-foot blanket level, the gravity thickener will provide two times the storage time of the existing sludge holding tanks.

The slope of the floor in the existing clarifier is 1:12. The recommended floor slope for gravity thickeners is between 2:12 to 3:12. This change in floor slope can be accomplished by placing new concrete fill over the existing floor for the desired slope. The new sludge withdrawal pipe at the bottom of the gravity thickener would be installed on top of the existing structure floor and be embedded in the concrete fill of the new sloped floor. The center well area would be formed in accordance to gravity thickener equipment manufacturer recommendations for their center column and sludge scraper arms.

The top of the existing clarifier walls are at elevation 481.0', which is below the 100-year flood elevation of 485.0'. To provide flood protection in accordance with current design standards, the walls of the tank will need to be extended 5 feet to elevation 486.0'.

The recommended depth for a gravity thickener is between 10 to 13 feet. With the newly sloped floor and the height of the existing overflow launder, the sidewall depth would only be 6-½ feet. In order to construct the gravity thickener to the correct depth, the existing launder will need to be demolished and a new launder installed at a higher level. The recommended design is for a 12-foot side water depth, which would allow a maximum recommended sludge blanket level of 9 feet.

The four pressure relief valves in the existing clarifier walls are severely corroded and inoperable. In order to reuse this tank as a gravity thickener, new pressure relief valves will need to be installed. It is recommended that the existing valves be cored out of the wall and replace with new valves grouted in place.

For transfer of the thickened sludge from the gravity thickener to either the sludge storage tanks or directly to dewatering, new piping and valves need to be installed below grade and within the Thickened Sludge Pumping Facility (formerly Septage Pumping Facility), and new solids handling pumps need to be installed adjacent to the septage pump. It is recommended that a minimum capacity of 150 gpm be provided. Because the thickened sludge pumps will have the same capacity of the septage pump, it is recommended to install the same model pump for both pumps (rotary lobe) with a third standby pump that could be utilized as either the septage or thickened sludge pump. At 150 gpm, the maximum rotational speed of the rotary lobe pump is 330 rpm. The thickened sludge pump and standby will be VFD driven to accommodate use for dewatering feed. A schematic and layout drawing illustrating the proposed sludge handling facilities are shown in the 30% drawings in Appendix C.

The existing scum pit has been filled in with concrete and is no longer usable. The proposed piping layout shows the gravity thickener overflow piping discharging to the plant influent line. Since this location is upstream of the primary clarifier scum collection point, it is recommended to not include any means of scum removal from the new gravity thickener, and allow any scum that is discharged back to the headworks to be handled in the primary clarifiers.

In order to control odors and limit off-site odor emissions, the tank will need to be covered and ventilated to odor control. With the installation of a cover, the interior concrete surfaces need to be coated with a sulfide-resistant coating. The exhaust from the new gravity thickener and the existing septage wet well will be treated a common packaged biofilter located on the foundation of the abandoned headworks structure. The biofilter unit will be sized for a 30 second detention time at an exhaust rate that provides 12 air changes per hour above the water surface.

The new septage and thickened sludge pumps and the gravity thickener mechanism will have Local-Off-Remote control, remote status and alarm signals at the PLC. Remote control will allow for On-Off operation from the PLC.

3.9.2 Sludge Holding Tanks

3.9.2.1 Existing Conditions

The two existing sludge holding tanks, located at the Sludge Pumping Facility, are each approximately 24-feet long by 10-feet wide by 13-feet deep. This equates to a total tank volume of approximately 46,600 gallons with a total approximate available volume of 32,000 gallons. The tanks are divided by a concrete wall into Cell No. 1 and Cell No. 2. However, the operations staff refers to each tank as the north or south tank. The floor of each cell is sloped at 2" per 12" toward the suction piping of the sludge dewatering pumps. When the liquid level is greater than 10'-6" deep, supernatant overflows the tanks through an adjustable decant pipe to the wet well of the screw pumps.

Two (2) 150 ICFM positive displacement (PD) blowers provide mixing air via coarse bubble diffusers to the two tanks. The existing blowers are in good condition. Mixing aeration for sludge holding tanks typically would be designed for 35 SCFM per 1,000 cubic feet of storage tank volume. At 32,000 gallons, the mixing requirements at 35 SCFM per 1,000 cubic feet would be approximately 150 SCFM. Therefore, the existing PD blowers appear to be adequately sized for the existing storage volume of the sludge holding tanks. However, District staff has indicated that there are times, when sludge concentrations in the tank are high, that the blowers have difficulty in achieving uniformity in the tank. This results in a greater concentration of solids at the beginning of a dewatering run than at the end. Insufficient mixing may also be due to the reduction in mixing efficiency as the tank water level drops and aeration mixing is ineffective.

3.9.2.2 Recommended Improvements

With the addition of the gravity thickener, the existing sludge holding tanks will remain in service as a batching tank before feeding the sludge dewatering equipment and for sludge storage capacity when the gravity thickener needs to be taken off-line for maintenance.

With the desire for increased mixing in the existing sludge storage tanks and the tanks being used to hold thickened sludge from the gravity thickener before dewatering, it is recommended to install a new 4 hp submersible mixer in each tank and leave the existing blowers and coarse bubble aeration in service. The potential for ragging in the tanks is reduced because they would be exposed to screened septage (1/4" perforations) and WAS, which should not contain high amounts of stringy material. However the mixers will still have the potential for ragging due to contact with primary sludge. The mixers will be installed on slide rails so that they can be easily removed for maintenance. A new access hatch for each mixer needs to be installed in the tank's FRP cover to allow for mixer access and a davit crane needs to be installed on the concrete wall to hoist the mixer up and down for maintenance.

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The new mixers will have Local-Off-Remote control, remote status and alarm signals at the PLC. Remote control will allow for On-Off operation from the PLC. It is also recommended to install a new low-level float switch in each tank that will send an alarm back to the PLC when the tanks are empty, and a float switch that will shut the mixers down at a minimum level of submergence in order to prevent an unbalanced condition. Ultimately, the mixers will not provide any improvements to the sludge tank mixing at low tank levels.

3.9.3 Sludge Pumping

3.9.3.1 Primary Sludge Pumps

The two primary sludge pumps, located in the basement level of the Sludge Pumping and Holding Facility, are 3 HP, VFD driven Moyno progressive cavity pumps with a capacity of 8 to 40 gpm at 70 feet total dynamic head (TDH) each.

The primary sludge pumps appear adequately sized for the current and future primary sludge quantities expected over the next 20 years. The operations staff has indicated that, due to the low removal efficiency of the vortex grit removal system, there is a higher amount of grit in the primary sludge than desired. The staff indicated that they replace rotors and stators every two to three years on average, which is fairly typical for moderately abrasive material.

Each pump is equipped with a 7.5 HP macerator. Due to the grit accumulation in the primary clarifiers, the grinders experience a high degree of wear and are reaching the end of their useful life.

It is recommended to replace the two primary macerators with identical models as the new sludge dewatering pump macerator for continuity of spare parts. Due to the age of the existing VFDs, it is recommended to install two new VFDs for the two existing primary sludge pumps.

The new macerators will have Hand-Off-Auto control. In the Auto mode, the units will be powered whenever the primary sludge pumps are in operation. Macerator status and alarms will be sent back to the PLC.

3.9.3.2 Secondary Sludge Pumps

The two secondary sludge pumps, located in the basement level of the Sludge Pumping and Holding Facility, are 3 HP, VFD driven, Moyno progressive cavity pumps with a capacity of 8 to 40 gpm at 70 feet TDH each.

The secondary sludge pumps appear adequately sized for the current and future secondary sludge quantities expected over the next 20 years, and no improvements to the pumps are recommended at this time. Due to the age of the existing VFDs, it is recommended to install two new VFDs for the two existing primary sludge pumps.

3.9.3.3 Dewatering Feed Pumps

Sludge is pumped from the sludge holding tanks to the belt filter press in the Dewatering Room of the Control Building via two VFD driven Moyno progressive cavity pumps, each rated for 14 to 70 GPM at 70' TDH. One 7.5 HP macerator is provided on the common suction line for the pumps.

The District has recently purchased a new Moyno macerator which they will be installing in the near future and a new Penn Valley double disc diaphragm pump which is temporarily piped to the existing suction and discharge piping. It is recommended to install a second Penn Valley pump and permanently connect both pumps to the existing piping. Both new pumps will be controlled with new VFDs.

It should be noted that alternate dewatering technologies will be evaluated under a separate technical memorandum issued to the District between preliminary design and final design. The recommendations from the evaluation may have impacts on the type and capacity of the new dewatering feed pumps.

3.9.4 Sludge Dewatering

3.9.4.1 Existing Conditions

The 1.25-meter belt filter press, manufactured by PCL, is rated for a maximum capacity of 1,000 lbs./hour. The press includes three dewatering zones: the gravity drainage section, a low pressure wedge zone and a high pressure zone. The press is driven by a 4 HP motor and variable speed drive. Sludge enters the gravity dewatering section of the press via a flocculation tank and is distributed evenly onto the gravity section of the filter press. In the flocculation tank, sludge and polymer are mixed to ensure proper dewatering of the sludge. In the gravity section, water drains from the sludge. A belt wash system consists of wash bars, a wash header tank and a high pressure wash pump. The original The 5.5-HP high pressure wash pump has a capacity of (32 GPM at 111 psi) was removed from service in 1998. Currently, plant water is supplied at a maximum of 85 psi to the belt wash. A 2-HP belt conveyor conveys dewatered sludge to the adjacent truck loading area.

3.9.4.2 Recommended Improvements

The operations staff has done an excellent job maintaining the belt filter press and it is in good physical condition. However, due to its age and the manufacturer, it is becoming harder and harder to obtain the necessary parts for routine maintenance. Under current conditions, the belt filter press is undersized to be able to handle the current maximum monthly solids loading conditions, which occurs at the end of summer when the University is back in session and the septage quantities are at daily peaks. The addition of the gravity thickener will help the exiting belt filter press process maximum monthly solids loading conditions, but future design maximum month conditions will approach a full eight hour work day, five days per week.

It is recommended to replace the belt filter press at this time with either a larger sized belt filter press or an alternate dewatering technology such as a Fournier rotary press, a screw press or centrifuge. The dewatering alternative will be evaluated under a separate technical memorandum issued to the District between preliminary design and final design.

The new sludge dewatering system will have its own PLC based control panel and will include the sludge stabilization equipment described in the next section.

3.9.5 Sludge Stabilization

The Facilities Plan identified off-site disposal of raw dewatered sludge as the low cost sludge management option. At the time, Resource Management, Inc. (RMI) was the low cost option, and proposed stabilizing the raw sludge at their New Hampton facility followed by land application. Since the completion of the Facilities Plan, the options for raw cake disposal have changed substantially with RMI unable to accept additional sludge at New Hampton during warm weather conditions and the pending closure of the Merrimack composting facility. These issues came to a head when the District closed its composting operation due to equipment failures. In the short term, the District has been mixing their dewatered sludge with wood ash in the existing compost facility mixing area, but the sensitivity of the public to sludge odors and the limited area for batch mixing does not make this a viable long-term solution.

Given the changes in the sludge disposal market, it appears prudent for the District to install alkaline stabilization facilities. Class A and B land application continue to be viable options, and alkaline stabilization is sometimes required by landfills as well. Modifications and an expansion to the existing sludge truck bay are recommended in order to provide on-site alkaline stabilization of the dewatered sludge. These modifications include:

- An extension to the existing truck bay, large enough for a 42-foot belt conveyor sludge disposal trailer;
- A bulk lime silo and conveying system;
- A pugmill mixer to mix the dewatered sludge with quick lime;
- A belt or screw conveyor to convey the stabilized sludge to the sludge disposal trailer; and
- 42-foot belt conveyor sludge disposal trailer with 62.8 cubic yard capacity.

The stabilized sludge would be trucked to field storage sites after the trailer is completely filled. The trailer is expected to have about a one week storage capacity. The trucking services would be contracted and scheduled for minimal interference with the dewatering schedule.

Status, control and alarms of the lime system and conveyors will be tied into the new sludge dewatering control panel.

3.10 ODOR CONTROL

3.10.1 Gravity Thickener Odor Control

The new gravity thickener and existing septage receiving facilities will share a common packaged biofilter located on the abandoned headworks structure foundation. The biofilter unit will be designed to remove 99% of the inlet H_2S concentration with average H_2S inlet concentrations of 20 ppm (summertime maximum month) and peak concentrations of 50 ppm. The biofilter unit will be sized for a 30 second detention time. The exhaust air rate will be based on 12 air changes per hour above the water surface. The new gravity thickener will require approximately 1,500 CFM and the existing septage receiving will require between 300 - 500 CFM, for a total system capacity of 2,000 CFM. The gravity thickener will be covered but will have air leakage points at the access hatch and around the mechanism shaft penetration. Once the cover system has been designed, the odor control system air flow rate will be checked to account for any air leakage. The new package system will include two fiberglass media compartments, an odor control blower, an irrigation water system, and a nutrient addition system. The odor control blower will be driven by a VFD to allow for air flow turn down in the winter. All above grade irrigation water and drain piping will be heat traced and insulated. The odor control system will have its own control panel which will send status and alarm signals to the PLC.

3.10.2 Sludge Dewatering Odor Control

The existing sludge dewatering area will have a separate packaged bifilter located along the fence line adjacent to the effluent sampling structure. The biofilter unit will be designed to remove 99% of the inlet H_2S concentration with average H_2S inlet concentrations of 1 - 2 ppm and peak concentrations of 10 ppm. The biofilter unit will be sized for a 30 second detention time. The dewatering area will require a ventilation rate of 6 air changes per hour or approximately 1,000 CFM. The new package system will include a fiberglass media compartment, an odor control blower, an irrigation water system, and a nutrient addition system. The odor control blower will be driven by a VFD to allow for air flow turn down in the winter. All above grade irrigation water and drain piping will be heat traced and insulated. The odor control system will have its own control panel which will send status and alarm signals to the PLC.

The exhaust from the sludge stabilization area and truck bay will not be a part of the sludge dewatering odor control, but will be roof ventilated directly to the atmosphere. The sludge stabilization process creates a high ammonia concentration which would inhibit biological growth within the biofilter, making the biofilter ineffective in treating the air stream. The ammonia from the sludge stabilization will be quickly dissipated in the atmosphere.

3.10.3 Existing Sludge Holding Tanks Odor Control

The existing sludge holding tanks will have a separate packaged bifilter located to the west of the storage tanks. The biofilter unit will be designed to remove 99% of the inlet H_2S concentration with average H_2S inlet concentrations of 20 ppm (summertime maximum month) and peak concentrations of 50 ppm. The biofilter unit will be sized for a 30 second detention time. The exhaust air rate will be based on 12 air changes per hour above the water surface. The sludge holding tanks will require a flow rate of approximately 600 CFM. The new package system will include a fiberglass media compartment, an odor control blower, an irrigation water system, and a nutrient addition system. The odor control blower will be driven by a VFD to allow for air flow turn down in the winter. All above grade irrigation water and drain piping will be heat traced and insulated. The odor control system will have its own control panel which will send status and alarm signals to the PLC.

3.10.4 Headworks Odor Control

The influent channels within the headworks building and the screw pump wetwell will be covered for odor control and the exhaust air will be conveyed to a new activated carbon odor control system located just outside the headworks building. The carbon unit will be designed to remove 99% of the inlet H_2S concentration with average H_2S inlet concentrations of 2 ppm maximum month and peak concentrations of 10 ppm. The activated carbon will be specified to be the new high capacity type. The influent channels and wetwell will require a flow rate of approximately 200 - 400 CFM. The odor control blower will be driven by a VFD to allow for air flow turn down in the winter. The new package odor control system will have its own control panel which will send status and alarm signals to the PLC.

3.11 CONSTRUCTION SEQUENCING

Construction of the proposed treatment facility improvements will disrupt the existing treatment facility structures and operations. To maintain treatment and to minimize disruption, the construction must be divided into phases or sequenced appropriately. The construction sequencing must allow the facility to maintain treatment as outlined in the discharge permit.

The largest interruption of the treatment facility operation will be the replacement work of the primary clarifier, RBC, and secondary treatment flow split and influent channels. Construction of the new influent channels will require bypass pumping and piping for significant durations. One of the options to consider for providing additional and redundant influent pumping capacity under the Influent Pumping section is a portable, trailer-mounted, self-priming, suction-lift pump. This pump could be provided by the Contractor to assist in bypass pumping during construction and retained by the District after the completion of the project for redundant influent pumping capacity.

The existing compost facility will be demolished as part of the proposed improvements project. The compost facility currently is used for dewatered sludge staging and mixing with wood ash before being transported off-site. Demolition of the compost facility cannot start until the sludge stabilization portion of the project has reached substantial completion.