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Pease/Portsmouth and Pease Regional Evaluation Study

REPORT

June 2015

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Acronyms and Abbreviations

BOD5	Biochemical Oxygen Demand
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CEPT	Chemically Enhanced Primary Treatment
CHP	Combined Heat and Power
EPA	United States Environmental Protection Agency
FOG	Fats, Oils, and Grease
HSW	High Strength Waste
LEED	Leadership in Energy and Environmental Design
MGD	Million Gallons per Day
NHDES	New Hampshire Department of Environmental Services
NPDES	National Pollutant Discharge Elmination System
PAH	Polycyclic Aromatic Hydrocarbon
PS	Primary Sludge
RDT	Rotary Drum Thickening
SBR	Sequencing Batch Reactor
TKN	Total Kjeldahl Nitrogen
TN	Total Nitrogen
TPH	Total Petroleum Hydrocarbon
TPS	Thickened Primary Sludge
TSS	Total Suspended Solids
TWAS	Thickened Waste Activated Sludge
WAS	Waste Activated Sludge
WWTF	Wastewater Treatment Facility

1. Introduction

1.1 Purpose

The Pease/Portsmouth and Pease Regional Evaluation Study (Study) has been conducted to provide the City of Portsmouth, New Hampshire (City) with data to make informed decisions regarding how best to proceed with a wastewater solution for the City. The Study focused on development of costs for two wastewater treatment options (Options). The two Options are:

- **The Pease/Portsmouth Option:** This option would divert the City's sanitary wastewater to the Pease Wastewater Treatment Facility (WWTF) for treatment. The Pease WWTF would be upgraded to handle the additional flows, and the existing Peirce Island WWTF would be converted to a wet weather treatment unit to be operated only during wet weather events. The upgraded Pease WWTF would treat the flows currently conveyed to the Pease WWTF, plus the City of Portsmouth, New Castle, and portions of Greenland and Rye.
- **The Pease Regional Option:** This option would upgrade the Pease WWTF to treat the wastewater flows from the Pease/Portsmouth Option, plus the addition of wastewater flows from Exeter and Stratham.

On September 29, 2014, the City determined that it was "at a crossroads", realizing that changing conditions, regulatory changes, and regional service requests may impact costs and present additional risks with the present course to upgrade the Peirce Island WWTF.

On October 20, 2014, the City Council voted to pursue the Pease/Portsmouth and Pease Regional Evaluation Study to identify a potential long-term wastewater solution at Pease. This vote approved the first phase of the Study which included review and development of a new Pease WWTF site plan for each of the Options. An additional City Council vote on January 20, 2015 approved the second phase of the Study to develop life cycle costs.

1.2 Background and Previous Studies

The City operates and maintains two wastewater treatment facilities: the 4.8 MGD Pierce Island WWTF located on Peirce Island which receives flow from the City and the nearby community of Newcastle as well as portions of Greenland and Rye; and the 1.2

MGD Pease WWTF located on the former Pease Air Force base, now known as the Pease International Tradeport (Tradeport).

Portions of the City contain combined sewers where stormwater enters the combined system and is conveyed with sanitary sewer flows to the Peirce Island WWTF.

1.2.1 Peirce Island WWTF

The Peirce Island WWTF is a primary wastewater treatment plant, constructed in the mid-1960's. The aerated grit system, primary clarifiers, and filters were upgraded in 1990, in addition to improvements to the primary sludge thickening and dewatering processes. However, the filters did not perform well and after attempting to operate them for approximately ten years, the City stopped using filters and looked for alternatives to meet NPDES permit limits.

The City undertook a number of evaluations at the WWTF to find alternatives to the existing filtration system which would be more reliable at achieving the treatment efficiency necessary to maintain permit compliance. These evaluations included piloting of alternative filtration processes, piloting of chemically enhanced primary clarification, and additional plant sampling and analysis.

In an effort to meet BOD5 removal efficiency requirements, the City conducted a full scale chemically enhanced primary clarification pilot beginning in February 1999. The data showed that this system could consistently achieve a 40 percent BOD5 removal efficiency on average.

Chemically enhanced primary treatment (CEPT), using ferric chloride and polymer, was added in 2005 to achieve greater removal efficiencies.

The current treatment process consists of aerated grit chambers, CEPT, and chlorination/ dechlorination. Sludge is thickened in a gravity thickener and then temporarily stored in aerated sludge storage tanks before being dewatered by belt filter presses.

As part of a Consent Decree between the City and the United States Environmental Protection Agency (EPA) to provide secondary treatment of City flows, as discussed in Section 1.3, upgrades to this facility are currently being designed. The design includes biological aerated filtration (BAF) technology and increased design capacity.

Given its current location on the island, the footprint available for expanding to secondary treatment is limited. The City has expressed interested and placed a priority on not extending beyond the existing footprint of the Peirce Island WWTF. As such, the design modifications being planned for this facility have been kept within the current fence line. Based on the current configuration under design, there will be no potential for future expansion of the WWTF at this site without going outside the fence if the proposed Peirce Island facility is constructed.

This Study provides an alternative approach by assuming that the existing Pierce Island Plant would be configured to provide treatment of wet weather flows only and that normally, sanitary wastewater flow would be conveyed to an upgraded Pease WWTF for full secondary treatment and potential tertiary treatment for the removal of nitrogen.

1.2.2 Pease Wastewater Treatment Facility

The Pease WWTF is an activated sludge facility serving local domestic, commercial and industrial sewer users in the Pease International Tradeport (Tradeport) and is located on Corporate Drive. It began operating in 1954 and originally served the Pease Air Force Base. Several modifications have occurred since. The City of Portsmouth took over operations in the 1990's via inter-municipal agreement and is responsible for operating and maintaining the WWTF, the collection system, and pumping stations within the Tradeport. Today, the Pease Development Authority (PDA) oversees development within the Tradeport, and the Craft Brewer Alliance (Redhook Brewery) and Lonza Biologics (Lonza) contribute an estimated 50 percent of the flow and 60 percent of the load to the WWTF. Currently, this heavy industrial loading creates challenges to meeting permit limits at the existing Pease WWTF.

The existing Pease WWTF is shown on the Existing Conditions Site Plan (Figure 1) in Appendix A. Table 1 and the Existing Conditions Site Plan summarize the existing processes at the WWTF. Flow currently passes through a grinder and into an aerated grit chamber before being pumped to the two primary clarifiers. After primary settling has occurred, the flow is conveyed via gravity to the two sequencing batch reactors (SBRs), where the flow is aerated and settled in the same basins. Clarified wastewater is decanted from the top of the SBRs and pumped to the two chlorine contact tanks, where the flow is disinfected and dechlorinated prior to discharge to the Piscataqua River.

Table 1 Summary of Processes, Tanks, & Equipment at the Pease WWTF

Process	Tanks	Equipment
Septage Receiving	2 – Precast Concrete, 7,000-gal storage tanks	1 – Septage Screening Unit (Lakeside Model 31 SAP) 2 – Septage Transfer Pumps (Watson-Marlow hose pumps, 50 gpm at 15-ft TDH, 7.5 hp)
Preliminary Treatment (Headworks)	1 – Concrete, 5,964-gal aerated rectangular grit tank 1 – 6-inch Parshall flume	1- Channel Grinder (Muffin Monster, 3 hp) 1 – Bar Rack 1 – Influent flow meter (ultrasonic, up to 3.98 MGD) 1 – Coarse bubble diffuser system 2 – Grit Blowers (rotary lobe, 2-hp) 1 – Grit Classifier 1 – Grit Pump (centrifugal, non-clog, 100 gpm at 18-ft, 875 rpm, 5 hp, variable-speed)
Raw Sewage Pumping	---	3 – Raw Sewage Pumps (non-clog, centrifugal, 1,100 gpm, 15 hp, variable-speed) 1 – Air Bubbler System (5.0 SCFH air flow at 7 psi)
Primary Treatment	2 – circular clarifiers (center-feed; 40-ft dia.; 7-ft, 10-in depth; 73,562 gal	2 – collector units (center-drive, 0.75 hp)
Intermediate Pumping	---	3 – Intermediate Pumps (Gorman-Rupp self-priming non-clog, centrifugal, 1,300 gpm at 27-ft TDH, 20 hp, 1780 rpm, variable-speed) 1 – Air Bubbler System
Secondary Treatment	2 – 1.01 MG sequencing batch reactors (80-ft x 80-ft x 21.1-ft)	2 – Influent control valves 2 – Mixers (DDM floating downward pumping mixers, 30 hp, 880 rpm, 16500 gpm) 2 – Aeration diffuser grids (50 fine bubble tube diffusers each grid(4 – Air blowers (rotary lobe, 993 icfm at 10.7 psig, 1780 rpm, 75 hp) 2 – Air control Valves 2 – Effluent decanters 2 – Decant Control Valves 2 – Waste sludge pumps
Equalization	2 – circular tanks (50-ft dia. 8.5-ft depth; 124,775 gal	
Disinfection	2 – Chlorine contact tanks (48-ft x 15.5 –ft x 4.5-ft; 25,245 gal) 1 – 6,200 XLPE sodium hypochlorite storage tank.	1 – Sodium hypochlorite diffuser 1 – Mixer (top-mounted, foil impeller, 1 hp, 350 rpm, 14-in dia impeller) 3 – Simplex electromagnetic diaphragm pumps (0.9 gph at 30 psi, 15% sodium hypochlorite solution) Supplemental ammonia system for chloramine disinfection
Dechlorination	1 – 1,500 XLPE sodium bisulfite storage tank.	1 – Sodium bisulfite diffuser 1 – Mixer (top-mounted,, foil impeller, 1 hp, 350 rpm, 14-in dia impeller) 3 – Simplex electromagnetic diaphragm pumps (0-4.6 gph at 30 psi, 38% sodium bisulfite solution)

Previous studies (by others) indicate this facility is in need of upgrades, regardless of whether the City elects to proceed with a Pease/Portsmouth or Pease Regional option.

1.2.3 Previous Studies

Several local and regional studies have been conducted in recent years to assess current and future flows, loads, and treatment options. This Study included a review of the documents listed below, as well as historical knowledge provided by City staff.

- *Draft Wastewater Master Plan and Long Term Control Plan Update*, Weston & Sampson Engineers and Brown & Caldwell, June 1, 2010.
- *Final Submission Wastewater Master Plan,* Weston & Sampson Engineers and Brown & Caldwell, Nov 15, 2010.
- *Peirce Island WWTF Upgrade Design - 30% Final Design Report*, AECOM, July 2014.
- *Phase 2 Initial Piloting Technical Memorandum*, AECOM, September 2012.
- *Exeter / Stratham Intermunicipal Water and Wastewater Systems Evaluation Study Draft Report*, Kleinfelder, July 2012.
- *New Hampshire Seacoast Region Wastewater Management Feasibility Study Draft Alternatives Report*, Metcalf & Eddy, November 2007.
- *Exeter - Wastewater Facilities Planning Preliminary Analysis of Regional Options Memorandum*, Wright-Pierce, April 16, 2014.
- *Draft Pease Wastewater Treatment Facility Evaluation*, Underwood Engineers, Inc., January 2014.
- *Technical Memorandum regarding Lonza Flow and Load Scenario Changes*, Underwood Engineers, Inc., April 10, 2014.
- *Towns of Exeter and Stratham, NH Regional Wastewater Disposal Options Draft Report*, Underwood Engineers, Inc., November 21, 2014.

1.3 Regulatory Considerations

1.3.1 Peirce Island WWTF NPDES Permit

The Peirce Island WWTF operated under a 301(h) waiver granted by NHDES and United States Environmental Protection Agency (EPA) from 1985 until 2007 which allowed the discharge of treated effluent to marine waters that had been treated only by advanced primary treatment, which includes chemically enhanced primary treatment and disinfection processes. In 2007, a National Pollutant Discharge Elimination System (NPDES) permit requiring secondary treatment was issued to the City of Portsmouth for the Peirce Island WWTF. The EPA issued an Administrative Order to the City in August 2007 setting interim discharge limits for the Peirce Island WWTF while the City developed a Wastewater Management Plan / Long Term Control

Plan Update to identify how the City would achieve secondary treatment and to address combined sewer overflows (CSO). The City entered into a Consent Decree with EPA and NHDES in September 2009 to provide secondary treatment of flows conveyed to the Peirce Island WWTF.

1.3.2 Pease WWTF NPDES Permit

The Pease WWTF NPDES permit was issued in August of 2000 and allows for discharge of treated effluent to the Piscataqua River. The permit requires secondary treatment standards but does not contain total nitrogen or total phosphorus limits. The permit is based on an average monthly flow rate of 1.20 MGD but does not include a flow limit.

1.3.3 Future Permit Considerations

Total Nitrogen

The City was notified by letter from the EPA that the future NPDES permit for the Peirce Island WWTF will include limits for total nitrogen (TN), and it is likely that the future Pease WWTF permit will be similar. These future TN limits are expected to be 8 mg/L on a seasonal rolling average basis, with potential for a more stringent seasonal rolling average limit of 3 mg/L (the current limit of technology).

Shellfish Impacts and Anti-degradation

It is anticipated that any WWTF modifications that result in new or modified outfall(s) will result in NHDES and EPA review of the design to examine potential shellfish impacts and to require the City to meet anti-degradation limits.

Shellfish impacts involve review of nearby shellfish harvest areas, including but not limited to the Bellamy River, Dover Point, Little Bay and Spinney Creek in Eliot, Maine (depending on outfall location). In examining shellfish impacts, NHDES would likely look at both the travel time of effluent from the outfall to shellfish harvest areas in the event that WWTF effluent is not sufficiently diluted, as well as long-term impacts to the shellfish areas. Long-term impacts would be addressed by delineation of a “no harvest” protective zone around the outfall large enough to provide at least 1,000:1 dilution under steady state conditions for chlorine disinfected effluent. Additional CORMIX (a mixing zone model for point source discharges) and hydrodynamic modeling may be required, depending on location and type of outfall proposed.

Since the Piscataqua River and Great Bay are currently impaired waterbodies, it is anticipated that the City would be required to meet anti-degradation limits for effluent discharge to the Piscataqua River. NHDES has indicated that additional water quality sampling would be required for determination of such limits prior to outfall modifications being made.

A copy of correspondence with NHDES regarding shellfish impacts and anti-degradation as they relate to this Study, can be found in Appendix C.

2. Flows and Loads

Several previous studies were reviewed as part of this evaluation, as mentioned in Section 1.2, to determine appropriate existing and projected wastewater flows and organic loads for the City of Portsmouth, including the Pease International Tradeport and existing and potential regional contributors.

2.1 Existing Conditions

2.1.1 Wastewater Flows

Existing flows tributary to Peirce Island WWTF include the City of Portsmouth (combined sewers, excluding the Pease International Tradeport) as well as regional flows from Rye, Newcastle, and Greenland. The current average daily flow is 5.23 MGD.

Existing flows tributary to Pease WWTF include the Pease International Tradeport properties with primary contributors being Lonza and Redhook Brewery. The current average daily flow is 0.59 MGD.

2.1.2 Organic Loads

Existing organic loads to Peirce Island WWTF are presented in Table 2.

Table 2 Existing Flow & Organic Loads to Peirce Island WWTF

Parameter	Average Day[(1)]
Flow (MGD)	5.23
Influent TSS (mg/L)	201
Influent TSS (lb/d)	8,792
Influent BOD_5 (mg/L)	197
Influent BOD_5 (lb/d)	8,610
Influent TKN (mg/l)	29.5
Influent TKN (lb/d)	1,289

(1) As presented in the Peirce Island WWTF Upgrade Design, 30% Final Design Report by AECOM (July 2014). Average of all days in reporting period (2012) with wet weather days capped at the maximum parsed dry day flow of 7.73 MGD.

Existing organic loads to Pease WWTF are presented in Table 3.

Table 3 Existing Flow & Organic Loads to Pease WWTF

Parameter	**Existing Average Day(1)**
Influent Flow, MGD	0.6
BOD_5	311
TSS	269
TKN	40
Effluent, mg/L	
BOD_5	4
TSS	15
TKN	10

(1) As presented in the Draft Pease Wastewater Treatment Facility Evaluation by Underwood Engineers, Inc. (January 2014). Based on the 2010 through 2012 WWTF operating data.

2.1.3 Biosolids Generation

Existing biosolids information was described in the Wastewater Master Plan and the data are presented in Table 4.

Table 4 Existing Biosolids Generation

Sludge/Biosolids produced(1)	**Peirce Island WWTF**	**Pease WWTF**
Wet tons	2,815	860
Dry tons	845	155

(1) Data presented are biosolids produced in 2007 and can be found in Table 4-15 in the Wastewater Master Plan, 2010.

2.2 Future Conditions

2.2.1 Wastewater flows

Wastewater flows were developed for the purpose of this Study based on a compilation of projected 20 year flows presented in several previous studies for the City and other municipalities including Exeter and Stratham. Existing average flows, projected growth

for each facility, and projected 20 year average flows for the Study options evaluated are presented in Tables 5 and 6.

Table 5 Average Flow for Pease/Portsmouth Option

Facility	Current Average Flow (MGD)	Projected 20 Year Flow Increase (MGD)	Projected 20 Year Average Flow (MGD)
Peirce Island WWTF(1)	5.23	0.9	6.13
Regional growth for existing tributaries(2)		0.5	0.5
Pease WWTF(3)	0.59	0.76	1.35
Total	5.82	2.16	**7.98**

(1) Consistent with the AECOM 30% Design Report for City of Portsmouth combined sewers, regional flows from Rye, Newcastle, and Greenland.

(2) Includes treatment of wastewater from current municipality tributaries to the Peirce Island WWTF. Projected increase of 0.5 MGD is consistent with both the 2010 Master Plan and the AECOM 30% Design Report.

(3) Consistent with the Draft Pease Wastewater Treatment Facility Evaluation – Underwood Engineers, Inc. (January 2014).

Table 6 Average Flow for Pease Regional Option

Facility	Current Average Flow (MGD)	Projected 20 Year Flow Increase (MGD)	Projected 20 Year Average Flow (MGD)
Peirce Island WWTF(1)	5.23	0.9	6.13
Regional growth for existing tributaries(2)		0.5	0.5
Pease WWTF(3)	0.59	0.76	1.35
Additional Regional Flow (Exeter & Stratham) (4)	1.6	1.4	3
Total	7.42	3.56	**10.98**

(1) Consistent with the AECOM 30% Design Report for City of Portsmouth combined sewers, regional flows from Rye, Newcastle, and Greenland.

(2) Includes treatment of wastewater from current municipality tributaries to the Peirce Island WWTF. Projected increase of 0.5 MGD is consistent with both the 2010 Master Plan and the AECOM 30% Design Report.

(3) Consistent with the Draft Pease Wastewater Treatment Facility Evaluation – Underwood Engineers, Inc. (January 2014)

(4) Compares favorably with other sources, including the Regional Wastewater Disposal Options Draft Report identifying potential flows to Pease WWTF from Exeter and Stratham by Underwood Engineers, Inc. (November 2014).

Existing and projected peak flows for each facility and Study options evaluated are presented in Tables 7 and 8.

Table 7 Peak Hour Flow for Pease/Portsmouth Option

Facility	Current Peak Hour Flow (MGD)	Projected 20 Year Flow Increase (MGD)	Projected 20 Year Peak Hour Flow (MGD)
Peirce Island to Pease WWTF(1)	9	1.33	10.33
Regional growth for existing tributaries(2)		0.84	0.84
Pease WWTF(3)	2.45	2.39	4.84
Total	11.45	4.56	**16.01**

(1) Consistent with the Peirce Island WWTF Upgrade Design, AECOM 30% Design Report for City of Portsmouth combined sewers, regional flows from Rye, Newcastle, and Greenland.

(2) Prorated based on Peirce island average and peak hour flows.

(3) Consistent with the Draft Pease Wastewater Treatment Facility Evaluation – Underwood Engineers, Inc. (January 2014).

Table 8 Peak Hour Flow for Pease Regional Option

Facility	Current Peak Hour Flow (MGD)	Projected 20 Year Flow Increase (MGD)	Projected 20 Year Peak Hour Flow (MGD)
Peirce Island to Pease WWTF(1)	9	1.33	10.33
Regional growth for existing tributaries(2)		0.84	0.84
Pease WWTF(3)	2.45	2.39	4.84
Additional Regional Flow (Exeter & Stratham)(4)	1.6	1.4	3
Total	13.05	5.96	**19.01**

(1) Consistent with the Peirce Island WWTF Upgrade Design, AECOM 30% Design Report for City of Portsmouth combined sewers, regional flows from Rye, Newcastle, and Greenland.

(2) Prorated based on Peirce island average and peak hour flows.

(3) Consistent with the Draft Pease Wastewater Treatment Facility Evaluation – Underwood Engineers, Inc. (January 2014).

(4) Equalized as indicated in the Regional Wastewater Disposal Options Draft Report identifying potential flows to Pease WWTF from Exeter and Stratham by Underwood Engineers, Inc. (November 2014).

2.2.2 Organic Loads

Projected 20 Year TSS, BOD5 and TKN loads are presented in Tables 9 and 10.

Table 9 Organic Loads for Pease/Portsmouth Option

Facility	Projected 20 Year Influent TSS (lb/day)	Projected 20 Year Influent BOD_5 (lb/day)	Projected 20 Year Influent TKN (lb/day)
Peirce Island WWTF(1)	10,176	9,959	1,511
Regional growth for existing tributaries(2)	893	874	133
Pease WWTF(3)	4,607	7,004	620
Total	**15,676**	**17,837**	**2,264**

(1) Consistent with loads presented in the Phase 2 Initial Piloting Technical Memorandum – AECOM (September 2012).

(2) Loads for regional growth of existing tributaries are prorated based on reported Peirce Island WWTF concentrations for TSS, BOD_5, and TKN.

(3) TSS and TKN loads are consistent with loads presented in Draft Pease Wastewater Treatment Facility Evaluation – Underwood Engineers, Inc. (January 2014). BOD_5 Load is based on modified data for Lonza presented in Technical Memorandum regarding Lonza Flow and Load Scenario Changes – Underwood Engineers, Inc. (April 10, 2014) and was prorated for a 20 year projected flow of 1.35 MGD.

Table 10 Organic Loads for Pease Regional Option

Facility	Projected 20 Year Influent TSS (lb/day)	Projected 20 Year Influent BOD_5 (lb/day)	Projected 20 Year Influent TKN (lb/day)
Peirce Island WWTF(1)	10,176	9,959	1,511
Regional growth for existing tributaries(2)	893	874	133
Pease WWTF(3)	4,607	7,004	620
Additional Regional Flow (Exeter & Stratham)(4)	5,362	4,851	1,021
Total	**21,038**	**22,688**	**3,285**

(1) Consistent with loads presented in the Phase 2 Initial Piloting Technical Memorandum – AECOM (September 2012).

(2) Loads for regional growth of existing tributaries are prorated based on reported Peirce Island WWTF concentrations for TSS, BOD_5, and TKN.

(3) TSS and TKN loads are consistent with loads presented in Draft Pease Wastewater Treatment Facility Evaluation – Underwood Engineers, Inc. (January 2014). BOD5 Load is based on modified data for Lonza Technical Memorandum regarding Lonza Flow and Load Scenario Changes - Underwood Engineers, Inc. (April 10, 2014) and was prorated based on a 20 year projected flow from Lonza of 0.8 MGD.

(4) BOD_5, TSS, and TKN concentrations for Exeter and Stratham are based on untreated domestic wastewater concentrations from Metcalf and Eddy, 2003

2.2.3 Biosolids and Biogas Generation

Projected biosolids and potential biogas generation information is presented in the tables below.

Table 11 Projected 20 Year Biosolids & Potential Biogas Generation for Pease/Portsmouth Option

Digester Feed Sludge[1]	Annual Avg	Max Month	Digested Sludge[2]	Annual Avg	Max Month	Biogas[3]	Annual Avg	Max Month
Flow (gpd)	42,078	55,707	Flow (gpd)	42,078	55,707	Gas Production (Mcf/day)	87	117
Concentration (%TS)	5.0%	5.0%	Concentration (%TS)	3.2%	3.2%	Gas Production (scfm)	61	81
TS Load (lbs/day)	17,547	23,230	TS Load (lbs/day)	11,319	14,889	Gas Energy (mmBtu/day)	57	76
%VS	78%	78%	%VS	65%	65%	Gas Energy (mmBtu/hr)	2.4	3.2
VS Load	13,617	18,005	VS Load	7,389	9,664			

(1) Based on projected primary sludge and waste activated sludge (WAS) loads resulting from influent loads presented in Table 5

(2) Based on a volatile solids reduction (VSR) rate of 46%

(3) Based on a Gas Yield of 14 cubic feet/pound VSR and a Biogas heating value of 650 Btu/cf (HHV)

Table 12 Projected 20 Year Biosolids & Potential Biogas Generation for Pease Regional Option

Digester Feed Sludge[1]	Annual Avg	Max Month	Digested Sludge[2]	Annual Avg	Max Month	Biogas[3]	Annual Avg	Max Month
Flow (gpd)	53,987	71,268	Flow (gpd)	53,987	71,268	Gas Production (Mcf/day)	112	150
Concentration (%TS)	5.0%	5.0%	Concentration (%TS)	3.2%	3.2%	Gas Production (scfm)	78	104
TS Load (lbs/day)	22,513	29,719	TS Load (lbs/day)	14,486	19,028	Gas Energy (mmBtu/day)	73	97
%VS	78%	77%	%VS	65%	65%	Gas Energy (mmBtu/hr)	3.0	4.1
VS Load	17,462	23,030	VS Load	9,436	12,339			

(1) Based on projected primary sludge and waste activated sludge (WAS) loads resulting from influent loads presented in Table 5

(2) Based on a volatile solids reduction (VSR) rate of 46%

(3) Based on a Gas Yield of 14 cubic feet/pound VSR and a Biogas heating value of 650 Btu/cf (HHV)

Table 13 Projected 20 Year Biosolids & Potential Biogas Generation for Pease/Portsmouth Option with Imported Solids

Digester Feed Sludge[1]	Annual Avg	Max Month	Digested Sludge[2]	Annual Avg	Max Month	Biogas[3]	Annual Avg	Max Month
Flow (gpd)	86,858	100,487	Flow (gpd)	86,858	100,487	Gas Production (Mcf/day)	211	240
Concentration (%TS)	5.1%	5.1%	Concentration (%TS)	3.2%	3.2%	Gas Production (scfm)	146	167
TS Load (lbs/day)	37,304	42,987	TS Load (lbs/day)	23,004	26,575	Gas Energy (mmBtu/day)	137	156
%VS	78%	78%	%VS	64%	64%	Gas Energy (mmBtu/hr)	5.7	6.5
VS Load	29,091	33,479	VS Load	14,791	17,067			

(1) Based on projected primary sludge and waste activated sludge (WAS) loads resulting from influent loads presented in Table 5, Imported dewatered cake based on 50% projections from Table 4-16 of 2010 Wastewater Master plan and LTCP Update, FOG based on ARCADIS estimate from similar regions.

(2) Based on a volatile solids reduction (VSR) rate of 49%

(3) Based on a Gas Yield of 14 cubic feet/pound VSR and a Biogas heating value of 650 Btu/cf (HHV)

Table 14 Projected 20 Year Biosolids & Potential Biogas Generation for Pease Regional Option with Imported Solids

Digester Feed Sludge[1]	Annual Avg	Max Month	Digested Sludge[2]	Annual Avg	Max Month	Biogas[3]	Annual Avg	Max Month
Flow (gpd)	98,767	116,048	Flow (gpd)	98,767	116,048	Gas Production (Mcf/day)	236	273
Concentration (%TS)	5.1%	5.1%	Concentration (%TS)	3.2%	3.2%	Gas Production (scfm)	164	190
TS Load (lbs/day)	42,270	49,476	TS Load (lbs/day)	26,172	30,713	Gas Energy (mmBtu/day)	153	178
%VS	78%	78%	%VS	64%	64%	Gas Energy (mmBtu/hr)	6.4	7.4
VS Load	32,937	38,504	VS Load	16,838	19,742			

(1) Based on projected primary sludge and waste activated sludge (WAS) loads resulting from influent loads presented in Table 5, Imported dewatered cake based on 50% projections from Table 4-16 of 2010 Wastewater Master plan and LTCP Update, FOG based on ARCADIS estimate from similar regions.

(2) Based on a volatile solids reduction (VSR) rate of 49%

(3) Based on a Gas Yield of 14 cubic feet/pound VSR and a Biogas heating value of 650 Btu/cf (HHV)

2.3 Treatment Technologies Selection

The current configuration and capacity of the existing 1.2 MGD (design average daily flow) Pease WWTF is not capable of the significant expansion or upgrade to handle the flows required for the Pease/Portsmouth or Pease Regional Options. While sequencing batch reactors (SBR) are currently employed at the Pease WWTF for biological treatment, the SBR technology is better suited to smaller plants. With the necessary expansion in flow capacity and the need for nutrient removal, conventional activated sludge was chosen as the biological treatment process as it offers greater flexibility, both now and in the future, for addressing the treatment requirements.

This Study took into consideration how the new wastewater treatment system could be constructed at a Pease location while maintaining the operation of the existing facility. The existing WWTF configuration would remain in service until the new treatment facilities were complete, with the intent to reuse or repurpose some of the existing tanks and buildings to the extent practicable. Existing facilities identified for re-use/repurposing included the equalization tanks, primary clarifiers, waste sludge storage tank, gravity thickener, and laboratory/administration building and repurpose these structures as shown in the Demolition and Repurposing Plan (Figure 2) in Appendix A. Additional site plan configurations can be found in Appendix A, and site plan development is discussed in more detail in Section 3. The conceptual Process Flow Diagrams are presented in Figures 1 and 2.

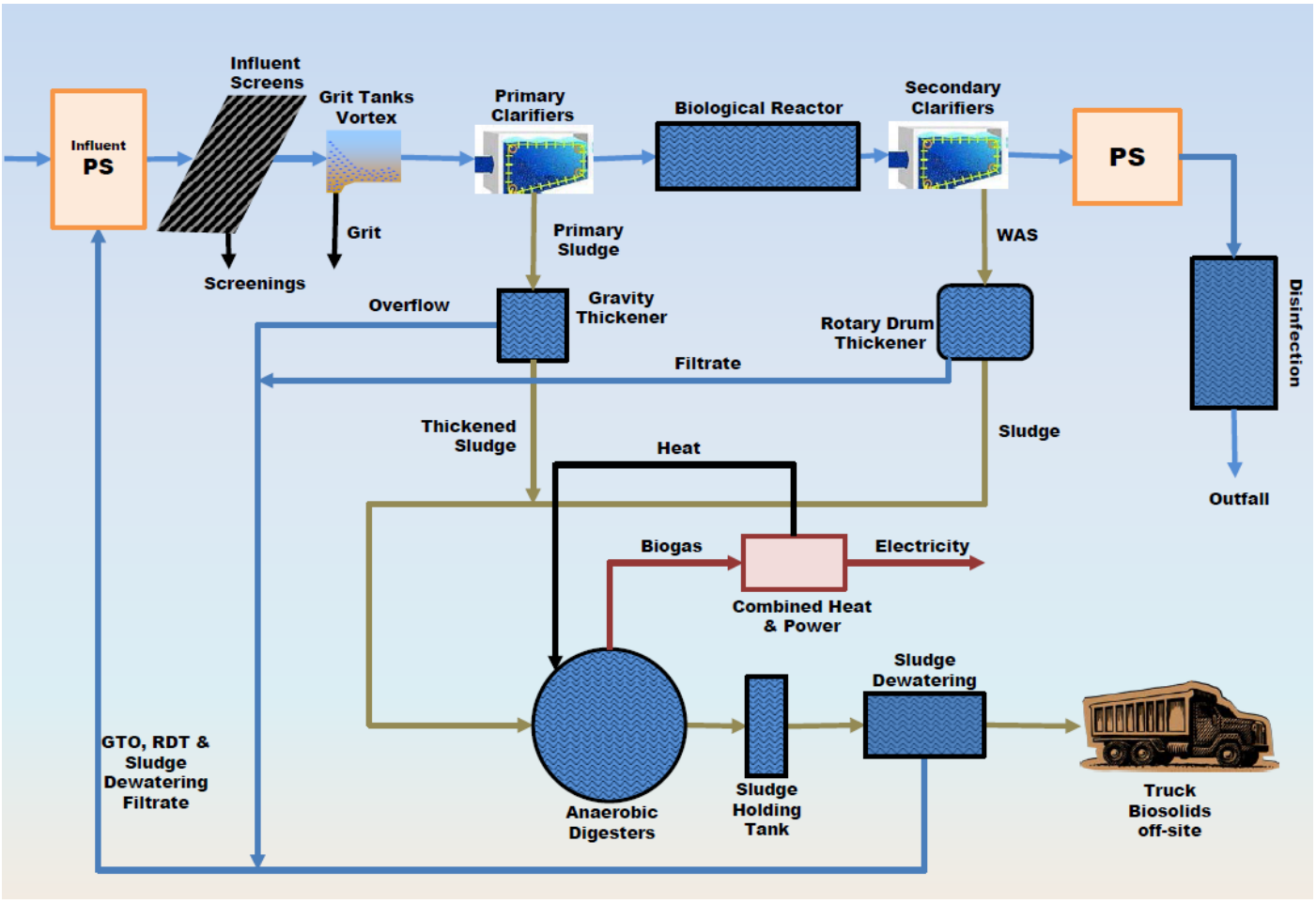


Figure 1: Process Flow Diagram for Pease/Portsmouth and Pease Regional Options, TN 8 mg/L

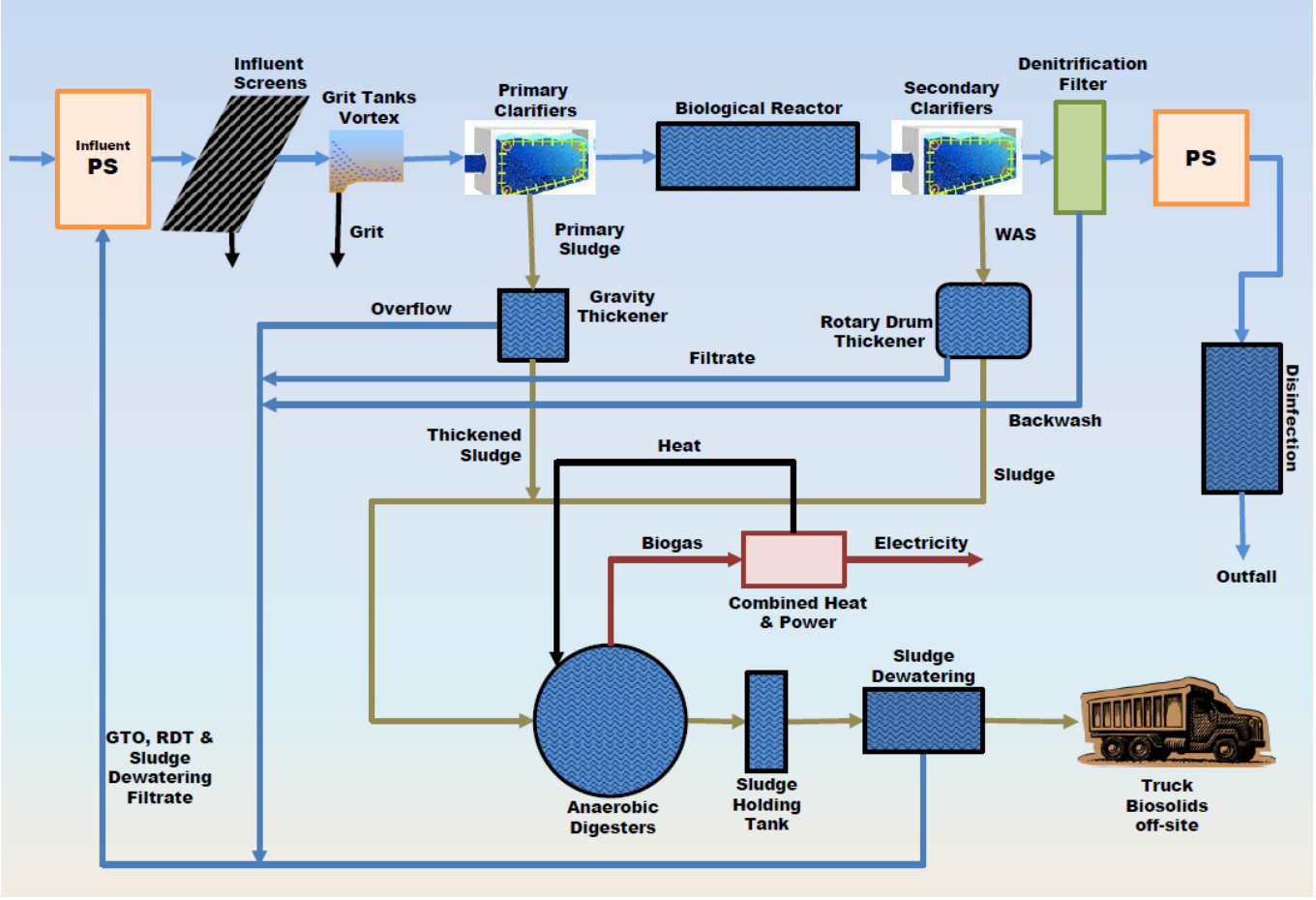


Figure 2: Process Flow Diagram for Pease/Portsmouth and Pease Regional Options, TN 3 mg/L

2.3.1 Liquid Stream Processes

Option 1: Pease WWTF Modifications for the Pease/Portsmouth Option

For the Pease/Portsmouth Option, the Pease WWTF would need to be upgraded to treat an average flow of 7.98 MGD. Based on the anticipated current and future regulatory requirements for nitrogen removal, two sub-alternatives were evaluated:

- Option 1A – Design the facility to achieve a seasonal rolling average TN concentration of 8 mg/L.
- Option 1B – Design the facility to achieve a more stringent seasonal rolling average TN concentration of 3 mg/L.

Site Plans for the Pease/Portsmouth Option are found in Appendix A (Figures 3 and 5).

Influent flow to the WWTF would enter the site from the collection system through the new headworks building. The headworks building would contain influent pumps, screening, and grit removal. The influent pumping station would pump influent flow and recirculated plant flows (such as the gravity thickener overflow, rotary drum thickener overflow and dewatering filtrate from the solids handling process) for treatment.

Mechanically-cleaned bar screens would remove larger solids from the waste stream that have the potential to damage equipment further downstream in the treatment process. A vortex grit system is recommended for the removal of smaller, sand-like particles prior to primary treatment. The vortex grit system is very efficient at removing significant quantities of solids, while using less energy than the more traditionally used aerated grit systems.

Following preliminary treatment within the headworks, influent wastewater would be conveyed by gravity flow to three rectangular primary clarifiers, where additional solids would be removed. Primary effluent would then be conveyed to four, plug flow, conventional activated sludge biological reactors and then into four rectangular secondary clarifiers.

The activated sludge biological reactors would be further divided into anaerobic, anoxic, and aerobic zones, as required to achieve biological removal of nitrogen and phosphorus. For the purposes of this evaluation, it was assumed that an anoxic zone would be created at the head of each aerobic reactor and an internal mixed liquor recycle (IMLR) installed to allow the plant to operate in the Modified Ludzack-Ettinger

(MLE) configuration. This configuration allows for BOD removal, nitrification (i.e., conversion of organic nitrogen and ammonia to nitrate), and denitrification (i.e., conversion of nitrate to nitrogen gas). It should be noted, however, that this configuration does not typically achieve lower levels of effluent nitrogen (i.e., lower than 4-5 mg/L TN). If regulatory requirements necessitate achieving lower levels of effluent nitrogen, additional improvements may be required.

A second pump station would be needed downstream of the secondary clarifiers prior to chlorine disinfection, dechlorination using sodium bisulfite, and discharge to the River.

The processes described above are necessary to achieve the required TSS and BOD removals, while providing an effluent total nitrogen concentration of 8 mg/L. However, if the facility needed to achieve a more stringent total nitrogen effluent limit of 3 mg/L, additional nutrient removal facilities would be required. While an activated sludge system with anoxic zones can treat to achieve a seasonal rolling average TN limit of 8 mg/L under most operating conditions, it is typically more difficult to remove nitrogen down to 3 mg/L without additional denitrification capabilities.

For the Pease/Portsmouth Option 1B, four deep-bed denitrification filters were selected downstream of the secondary clarifiers and upstream of the disinfection facilities. These filters would provide anoxic conditions for microorganisms to biologically convert the remaining nitrate (formed from ammonia during the nitrification process) to nitrogen gas, thereby reducing overall TN in the treated effluent to meet more stringent limits.

The microorganisms in the denitrification system may need to be supplemented with a carbon source for survival and growth. For these applications, methanol is typically used as the supplemental carbon source. Accordingly, the Pease facility would require methanol receiving, storage, and pumping facilities, along with associated equipment required for safe handling of methanol. The new methanol facilities would be located adjacent to the denitrification filters while also allowing adequate access for methanol delivery.

Table 15 summarizes the processes and conceptual sizing.

Table 15 Summary of Conceptual Liquid Processes and Tank Sizing

Process	Description
Headworks	3 - Influent pumps 2 - Course Screens 3 - Fine Screens 2 - Centrifugal Grit Units with Dewatering Screws
Primary Treatment	3 – 0.225 MG Rectangular Clarifiers Approximate Tank Dimensions (each): 25-ft wide, 100-ft long, 12-ft side water depth Weir length (each): 150-ft
Aeration Tanks / Biological Reactor	4 – 1.40 MG units Approximate Tank Dimensions (each): 34.2 ft wide, 274-ft long, 20-ft side water depth
Secondary Treatment	4 – 0.54 MG Rectangular Clarifiers Tank Dimensions (each): 30-ft wide, 150-ft long, 16-ft side water depth Weir length (each): 180-ft
Denitrification (only for TN < 3 mg/l)	4 – Deep Bed Denitrification Filters Tank dimensions (each): 12.5-ft wide, 80 ft long
Disinfection	3- Effluent Pumps 2 – 4,000 gallon Hypochlorite Storage Tanks. 1 - 3 pump Hypochlorite Feed Pump Skid Contact time provided for in effluent pipe (no chlorination tank) Precast dechlorination/effluent sampling structure with precast concrete building at outfall location 1 - Three pump Sodium Bisulfate Pump Skid (tote Mounted) at outfall location

Option 2: Pease WWTF Modifications for the Pease Regional Option

Option 2 for the Pease WWTF is the regional option that would include the additional 3 MGD from Exeter and Stratham. The treatment processes for this option would be similar to that proposed for Option 1, with treatment capacity of 10.98 MGD (design average daily flow) for the upgraded Pease WWTF.

As with Option 1, the new Pease WWTF could incorporate repurposing/reusing of some of the existing tanks and structures; and there were also sub-alternatives evaluated to account for the anticipated current and future regulatory requirements for nitrogen removal:

- Option 2A – Design the facility to achieve a seasonal rolling average TN concentration of 8 mg/L.

- Option 2B – Design the facility to achieve a more stringent seasonal rolling average TN concentration of 3 mg/L.

Site Plans for the Pease/Portsmouth Option are found in Appendix A (Figures 4 and 6).

The recommended treatment processes are the same as those described previously for Option 1, with the addition of the following to provide treatment for the increased flow capacity:

- One (1) additional primary clarifier
- One (1) additional biological treatment tank
- One (1) additional secondary clarifier
- One (1) additional denitrification filter (for regional Option 2B) to achieve the lower TN limits.

2.3.2 Solids Handling Processes

The selected treatment processes for solids handling include:

- Gravity Thickening for Primary Sludge (PS)
- Rotary Drum Thickening (RDT) for Waste Activated Sludge (WAS)
- Screw Press for Sludge Dewatering

Gravity Thickening

The gravity thickening process would receive primary sludge (PS) from new primary clarifiers and thicken the incoming PS by gravity settling to create thickened primary sludge (TPS) with approximately 5 percent total solids concentration. The TPS would then be blended with other sludges and be dewatered for trucking off site.

Gravity thickening was selected due to its low energy use, readily settling properties of PS, low maintenance and operations requirements, and because the existing tankage was available for this process. The two existing Pease primary clarifiers would be converted into gravity thickeners; and with two gravity thickeners available, this process would have 100 percent redundancy.

Rotary Drum Thickening (RDT)

Rotary Drum Thickening (RDT) was selected due to its relatively low space requirements and low capital cost when compared to other thickening technologies at this scale. The RDT system would be designed as two redundant units mounted in a single frame that can be independently fed and operated. The manufacturer packaged system would also include a polymer feed system, feed and discharge pumps, control panels and a discharge hopper.

This process would receive waste activated sludge (WAS) from new secondary clarifiers and use gravity settling to thicken incoming WAS to thickened waste activated sludge (TWAS) with approximately 5 percent total solids concentration. The TWAS would then be blended with other sludges and dewatered for trucking off site.

Screw Press Dewatering

A Screw Press dewatering system was selected due to its relatively low space requirements and low capital cost when compared to other dewatering technologies at this scale. The Screw Press system would be designed as two redundant units each designed for 100 gpm and 1,600 lbs/day loading. This equipment size could be reduced if accepting imported biosolids is not selected for implementation. Regional biosolids options are discussed in more detail in Section 7.1. The manufacturer's packaged Screw Press system would include a polymer feed system, feed pumps, and a control panel.

This process would receive sludge and dewater it into cake material for disposal which would be approximately 25 percent total solids concentration.

Additional Solids Handling alternatives evaluated are discussed in detail in Section 7.1 and include:

- Anaerobic Digestion
- Combined Heat and Power
- Imported Solids

Table 16 provides a summary of processes evaluated and conceptual sizing.

Table 16 Summary of Conceptual Solids Handling Processes and Tank Sizing

Process	Description
Gravity Thickeners	Thickens Primary Sludge 2 – Circular Tanks (converted from previous Primary Clarifiers) Approximate Tank Dimensions (each): 35-ft diameter, 8-ft side water depth Surface Area (each): 962-ft^2
Rotary Drum Thickeners	Thickens Waste Activated Sludge 2 – Rotary Drum Thickening (RDT) Units (mounted on a single frame) Design RDT Influent Flow Rate (each): 100-200 gpm Design RDT Influent Total Solids Concentration (%TS): 1.0-1.5%
Pre-Digestion Holding/Mixing Tank	Equalizes and Blends TPS and TWAS 1 – Rectangular Tank Approximate Volume: 90,000 gallons, 12,000 ft^3 Approximate Tank Dimensions: 32-ft wide, 32-ft long, 12-ft side water depth
Anaerobic Digesters	Digests Blended Sludge 2 – Rectangular Tanks (converted from previous SBRs) Approximate Volume (each): 910,000 gallons, 122,000 ft^3 Approximate Tank Dimensions (each): 80-ft wide, 80-ft long, 19-ft side water depth Steel Fixed Covers 3 Cover Mounted Linear Motion Mixers per Tank
Dewatering Screw Press	Dewaters Digested Sludge 2 – Screw Press Units Design Screw Press Influent Flow Rate (each): 100 gpm Design Screw Press Solids Loading Rate (each): 1,600 lbd/hr

The processes and tank sizing shown in the table include the optional anaerobic digestion and imported biosolids. These items are not included in the base costs presented in Section 8, but are discussed in detail in Section 7.1. If these options are not implemented, the screw press equipment footprint could be reduced.

2.3.3 Facility Aesthetics

Odor control would likely be necessary for both Options. Technology has advanced in recent years, with facilities able to achieve removal efficiencies up to 99 percent. The exact type and arrangement would be determined during design.

The new Pease WWTF would include centralized administrative, laboratory, and maintenance buildings which would simplify operations for the City. The maintenance building would be a pre-engineered metal building with sloped roof and windows. All other buildings would have red brick exterior façades for architectural interest. Concrete tanks would be shielded from view by either buildings or landscaping. Design and construction of the facility would include significant landscaping improvements to soften the visual appearance of the WWTF from the road and abutter views.

2.4 Wet Weather Treatment Alternatives

Under both the Pease/Portsmouth and Pease Regional options, wastewater flows for the City would be directed to the upgraded Pease WWTF, and the Peirce Island WWTF would be converted to a wet weather treatment facility. All of the City's current dry weather flow and wet weather flow up to a maximum flow of 10.33 MGD would be sent to the new Pease WWTF for treatment, and the remaining wet weather flow (up to a peak flow of 22 MGD) would be treated at the Peirce Island WWTF. In order to utilize the full 22 MGD capacity of the converted Peirce Island WWTF, additional work will be required in the collection system to eliminate hydraulic restrictions. This work is discussed in more detail in Section 4.1. Conversion of Peirce Island WWTF to a wet weather treatment facility under this approach would provide an additional 10.33 MGD of total treatment capacity that could potentially offset future capital expenditures under the City's current LTCP.

Conversion of the Peirce Island WWTF would create a satellite treatment facility that would only be used during wet weather events. Start-up, monitoring and shut down of this facility would be automated to minimize the need for operator(s) at the facility during dry periods. It is anticipated that the Peirce Island wet weather facility would only be used about 10 to15 times per year.

Two wet weather treatment alternatives were considered for Pierce Island WWTF as part of this evaluation:

- Chemically Enhanced Primary Treatment (CEPT)
- High Rate Treatment (Ballasted Flocculation)

The use of either process is expected to achieve from 70% to 85% total suspended solids (TSS) removal, depending on the influent wastewater characteristics. Typically, higher TSS removal rates are accomplished at higher influent TSS concentrations

since these higher TSS concentrations consist of heavier solids that are washed from streets or resuspended/scoured in the conveyance system at higher flows. After the initial part of the wet weather event, the influent flow will consist of mostly rain water diluting the typical average dry weather loadings. The influent TSS concentration can be significantly lower than the daily influent TSS concentration and the overall percent removal of TSS during these periods can drop due to the lower influent TSS concentration.

The goal for CSO treatment is to reduce TSS and BOD concentration in the dilute combined sewer wastewater and disinfect prior to discharge. Studies performed as part of the State of Ohio Environmental Protection Agency consent orders with various municipalities have identified CEPT and Ballasted Flocculation as capable of achieving an effluent quality goal of 70% TSS removal at influent concentrations greater than 150 mg/l and able to achieve an effluent TSS concentration of 40 mg/l or less at influent concentrations < 150 mg/l.

2.4.1 Chemically Enhanced Primary Treatment with Dewatering Pump Station

The CEPT alternative would require minimal capital cost, and would make use of the existing preliminary treatment systems, chemically enhanced primary clarifiers, and disinfection systems already on site. CEPT effluent would be discharged via the existing Peirce Island outfall. The chemical storage and feed systems would need to be modified to accommodate longer storage periods and less frequent use, and a new dewatering pump station would be installed to convey the contents of the Peirce Island wet weather treatment system (including primary sludge) back to the Mechanic Street pump station once the wet weather flows subsided and capacity was available for treatment at the new Pease WWTF. Wet weather conversion of the Peirce Island Facility would also allow decommissioning of the existing solids handling facilities.

For the purposes of this Study, it was assumed that the existing Peirce Island solids handling, administration, and sand filter facilities would be mothballed and abandoned in place. However, the City could demolish these facilities in the future when additional funding or grant money became available.

Chemically Enhanced Primary Treatment (CEPT) for wet weather solids removal combines traditional, conventional primary settling with chemical coagulation and flocculation to increase the settleability rate of influent suspended solids, allowing for a higher hydraulic loading rate per square foot of tank area (gpd/sf) with higher suspended solids removal rates. The use of CEPT in conventional primary settling

tanks at wastewater treatment plants can achieve higher removal rates of particulate material in a smaller volume/surface area. The general concept is the same for CSO control. The use of chemicals within the primary treatment process has led to significantly higher removal of BOD, TSS, and bacteria, making it very effective when full treatment of the flow is not economically feasible, such as during wet weather events. The CEPT process also eliminates the need for maintaining a microbial population, especially for wet weather facilities that may be operated very infrequently.

For CEPT facilities, solids can be retained in the settling tanks for the duration of the storm and subsequently discharged for treatment. Unlike ballasted flocculated process, there is no need for continuous sludge removal for recirculation and wasting. As such, a separate solids management process (thickening and/or storage) is not necessary.

A unique benefit to the large tanks associated with CEPT is the ability to capture storm events. The treatment tanks will be empty during non-storm events, and storm events that are not large enough to fill all of the tankage will not cause a discharge to the River, thereby reducing the number of wet weather treatment discharge events.

Unlike other technologies that use smaller tanks, all storm event flows sent to the CEPT system will receive treatment, which minimizes the potential for permit violations. Treatment begins once the flow enters the facility, with no ramp-up time necessary; and the equipment can be configured to initiate start-up and shut down automatically. Dewatering can also start automatically to empty the tanks once storm flows subside. Additionally, although not desirable from an odor control perspective, should it be necessary, CEPT can also temporarily hold the liquid and solids while simultaneously being ready for the next event.

Given the number of moving components are relatively small, there is less equipment to maintain and the potential risk of process failure decreases. The mechanical equipment required is mostly outside the process tanks, minimizing the need for personnel to access the tanks. The instrumentation and control required for CEPT is minimal with only a few hydraulic control devices (overflow weirs and effluent launders) and largely chemical feed equipment. The head loss through the treatment process is approximately 1 to 2 feet, largely aided by the passive hydraulic control. If flow can enter the facility, some degree of treatment can occur, even with the loss of power or chemical feed.

2.4.2 High Rate Treatment

Ballasted flocculation refers to a general process by which coagulation chemical, typically ferric chloride (ferric) or aluminum sulfate (alum), and an anionic polymer flocculant are combined with a ballasting agent to enhance the formation of floc to remove influent suspended solids. Three (3) proprietary ballasted flocculation processes are marketed by wastewater equipment manufacturers for use in CSO control. All three manufacturers are expected to meet an effluent quality performance goal of 70% TSS removal when influent concentrations are greater than 150 mg/L, to less than 45 mg/L when influent concentrations are less than 150 mg/L.

The three manufactured systems available are:

- Sand-ballasted flocculation (Actiflo®)
- Sludge-ballasted high rate clarification (DensaDeg®)
- Magnetite-ballasted flocculation (CoMag™)

All ballasted flocculation systems require influent mechanical bar screens with ¼ inch (6 mm) to ½ inch (12 mm) openings. The bar spacing depends on the specific manufacturer's requirements for a given technology. Some of the ballasted flocculation technologies require more stringent screenings.

The existing primary settling tanks at Peirce Island WWTF should be able to be retrofitted to units suitable for ballasted flocculation. This would need to be confirmed with the process vendors. Additional support equipment in the case of ActiFlo® and CoMag™ would be required.

With the existing facilities already located at the Peirce Island WWTF, the only potential treatment benefit for the ballasted flocculation process is a slightly higher percent TSS removal. However, this comes at the cost of much higher metal salt and polymer addition as well as additional material handling in the case of the ActiFlo® and CoMag™ process. Disinfection should be similar with possibly a lower chlorine dose required for a ballasted flocculation process.

3. Site Plan Development

Site plans were developed for the Pease/Portsmouth and Pease Regional WWTF options and sub-alternatives for nitrogen removal, as discussed in Section 2.3. These site plans can be seen in Appendix A.

As shown it the site plans, the new Pease WWTF can fit on the existing site, with the largest build-out including capacity for a regional facility capable of treating up to 10.98 MGD at a seasonal rolling average TN of 3 mg/L. All site plans also show space for optional equipment such as anaerobic digesters and combined heat and power, which if added would require a larger total footprint.

3.1 Site Constraints and Challenges

The existing Pease WWTF is located on a physical footprint of approximately 4.5 acres bounded by the Spaulding Turnpike and a utility corridor to the northeast, Corporate Drive to the west, another utility corridor on the southeast side, and a vacant lot (developable) to the northwest. The recently dedicated Tony Rahn Park is located adjacent to the utility corridor on the southeast side. The City was interested in repurposing buildings on site and staying within the vicinity of the existing WWTF, if possible.

Wetlands exist on the site, and a larger treatment plant would necessitate work in the wetland areas. A tributary wetland for Hodgson Brook exists along Corporate Drive on the property and wetland areas extend to the northeast, as shown in the Existing Conditions Plan (Figure 1) in Appendix A. It is anticipated that these are a lower quality wetlands, primarily caused by poor drainage for runoff created by the Spaulding Turnpike. Wetlands mitigation to replace the existing wetlands removed by a new Pease WWTF construction would need to be replaced at 1.5 times the total disturbed area. The City would need to create these wetlands in other off-site areas tributary to Hodgson Brook or pay an offset fee to the NHDES Aquatic Resource Mitigation Fund. Paying in lieu of replacing wetlands would not necessarily represent a cost savings to the City, nor would the benefits of a wetlands restoration project necessarily be seen by the City.

Meetings with the Pease Development Authority (PDA) and the Pease Tenants Association indicated that primary concerns for expansion of the treatment plant were: aesthetics, construction traffic and noise, roadway conditions, odor, and site footprint. The City currently operates the WWTF under an inter-municipal agreement with the

PDA. The Pease WWTF site is located on land that has not been subdivided from the original Tradeport parcel. PDA has authority over subdivision and lease of the land for expansion.

3.2 Expandability

In developing site plans, the tanks for the Pease/Portsmouth Option were aligned with additional space to the inside of the site plan. This additional space, as shown on the Pease/Portsmouth Option Site Plan (Figure 3) in Appendix A, allows for expansion to accommodate regional flows. Additionally, the TN 8 mg/L site plans allow for expansion on the southern boundary to add a denitrification filter building and methanol building, should future permits require a seasonal rolling average TN limit of 3 mg/L.

3.3 Sustainability

The City of Portsmouth is an Eco-Municipality, a community that has adopted sustainable principles and committed to the American Planning Association's four sustainability objectives. This Study considered the City's commitment to sustainability and created opportunities within the conceptual design to build a more sustainable WWTF as part of the Pease options, including expandability, LEED/Envision goals, opportunities for reuse or repurposing of existing tanks and structures, electric load shedding and waste heat utilization.

As part of the design, several existing buildings and tanks would be repurposed, including the equalization tanks, primary clarifiers, waste sludge storage tank, gravity thickener, and laboratory/administration building. Additionally, if the City were to elect to include the optional anaerobic digesters at the new Pease WWTF, the two existing SBR tanks could be modified to construct the digesters within their existing footprint.

Optional waste to energy components are included in the design of the anaerobic digesters and generation of combined heat and power, as discussed in detail in Section 7.1. The generation, capture, and utilization of biogas resulting from anaerobic digestion of solids could be optimized and enhanced where possible to maximize onsite renewable energy sources. The Study also considered importing of biosolids from other nearby communities, which could increase biogas production at the Pease WWTF while minimizing the amount of sludge being landfilled.

The City would also have opportunities to incorporate Leadership in Energy and Environmental Design (LEED) and Envision Sustainable Infrastructure initiatives

including use of sustainable building materials, natural lighting, and energy efficient fixtures, and reuse and recycling efforts that would divert waste from landfills, reduce excavated materials taken off site, etc. Opportunities for green infrastructure stormwater and drainage improvements and landscaping around the WWTF and along conveyance routes could also be considered.

4. Collection System and Conveyance

In order to divert flow that is currently tributary to the Peirce Island WWTF to a new Pease WWTF, collection system and conveyance improvements will be necessary, including new force mains to convey flow to Pease and a potential new outfall for WWTF discharges. Figure 4 illustrates the potential force main and outfall alignment.

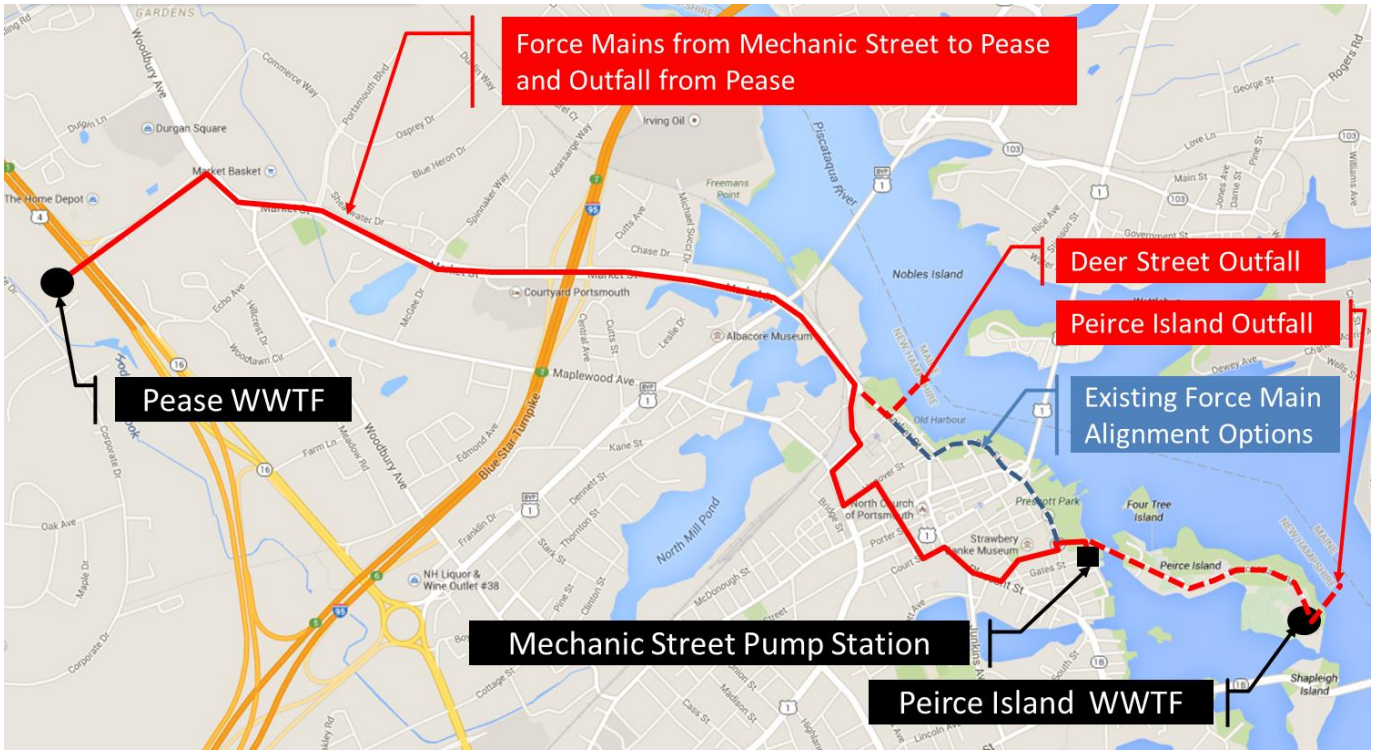


Figure 4: Potential Force Main and Outfall Alignment Options

The following sections describe the improvements considered and included in the costs as part of this Study.

4.1 Debottlenecking

The 2010 Master Plan identified a section of interceptor along Parrott Ave (near Mill Pond CSO) which is a bottle neck during wet weather, not allowing sewer flows to get to Mechanic Street to be treated. The existing 24 to 30-inch pipe was recommended to be increased to a 54-inch pipe in the 2010 Master Plan. The 2010 Master Plan

concept included redirecting pump stations directly to Pease WWTF and this Study concept did not. As a result, and considering the additional 10.33 MGD of wet weather treatment capacity made available at Peirce Island by diverting flows to Pease, ARCADIS and the City estimated that this "debottlenecking" pipe size should be increased to 60-inch and it would need to extend all the way to the Mechanic Street pump station.

4.2 Mechanic Street Pump Station

The current Mechanic Street pump station already receives a majority of the City's wastewater flows with the exception of the Tradeport and flows from Newcastle. To accommodate diverting flow to Pease, the Mechanic Street pump station would be upgraded to serve a dual purpose. During dry weather, the station would convey the City's sanitary flow to Pease WWTF. During wet weather events, up to 10.33 MGD would be sent to the new Pease WWTF. When storm flow from the combined sewer system exceeded the 10.33 MGD sanitary pumping capacity at the Mechanic Street pump station, the level of the wet well would rise until it overflowed a weir into a separate wet well for pumping up to 22 MGD of wet weather flow to the converted Pierce Island wet weather treatment facility. This approach would significantly increase the City's ability to treat wet weather flows and would minimize combined sewer overflows. To achieve conveyance of 22 MGD of wet weather flow to the Peirce Island wet weather treatment unit, the debottlenecking work described in Section 4.1 would be required.

The City currently has replacement of the Mechanic Street Pump Station on their Capital Improvements Plan (CIP), and have already purchased the property adjacent to the pump station to accommodate future replacement of this pump station to the portion of Prescott Park on the south side of the Peirce Island Road Bridge. The dual purpose pump station that would be needed to accommodate pumping sanitary flows to Pease and wet weather flows to Peirce Island will fit within this same planned location, and the superstructure for this facility could be equipped with state of the art odor control facilities and an architectural façade that integrates with the historic waterfront.

4.3 Force Mains

4.3.1 Newcastle Force Main Extension

In both the Pease/Portsmouth and Pease Regional Options, the existing 10-inch force main from Newcastle to Peirce Island would be extended to the new Mechanic Street pump station to convey Newcastle's wastewater flows for treatment at the new Pease WWTF.

4.3.2 Conveyance to Pease WWTF

In both the Pease/Portsmouth and Pease Regional Options, current wastewater flows treated at Peirce Island would need to be conveyed to the new Pease WWTF. Dual 20-inch force mains are recommended for conveying these flows. Conceptual design includes a minimum velocity of 2 ft/sec utilizing a pump configuration of 3 pumps including a dedicated pump to each force main and a redundant "swing" pump capable of pumping to either force main. Pumps would alternate during low flow periods to keep wastewater in the lines fresh and minimize odors.

A potential conveyance route was developed in coordination with City's DPW staff. This route is shown on Figure 4 and in more detail on the Conveyance Routes Map in Appendix A. Streets that would be impacted by this force main route construction include: Mechanic Street, Marcy Street, Hancock Street, Pleasant Street, State Street, Fleet Street, Hanover Street, Maplewood Avenue, Deer Street, Russell Street, Market Street, and Arthur Brady Drive. The downtown portion of the conveyance route was selected because many of these streets were already scheduled to be reconstructed, repaved, or had other public and private utility projects planned in the near future. Alternate routes through the City's downtown area were considered, but it was determined that they would be unlikely to reduce potential cost or impact during construction.

The majority of the 3.1 mile dual force main construction would be completed by conventional methods, however trenchless technology methods would be expected at the Mill Pond and Spaulding Turnpike crossings (likely directional drilling). Due to anticipated rock excavation, narrow streets, and coordination with existing utilities, construction of the dual force mains in the downtown area would be expected to progress at a slower rate than in the more open Market Street and Arthur Brady Drive areas.

4.4 Outfall Alternatives

Three outfall alternatives for the new Pease WWTF were evaluated for this Study:

1. Increase the size of the existing Pease WWTF outfall
2. Install a new outfall at Deer Street
3. Install a new outfall next to the existing Peirce Island WWTF outfall

The potential outfall locations are shown on the Conveyance Routes Map in Appendix A.

In either of the Study options, it was assumed that the treated effluent would be pumped to a 30-inch outfall pipe and discharged via a single port diffuser to the River. The pipe would extend approximately 500 feet into the River. Construction of the outfall for each of the options evaluated would use conventional open trench methods where appropriate and the outfall would likely be installed in a common trench with the dual force main installation to reduce construction impacts and disturbance, as well as minimize costs. Similar to the dual force main installation, trenchless technologies would be used to cross some areas. The outfall interface at the River would likely be installed using jack and bore techniques.

NHDES and EPA approval would be required for a new Pease WWTF outfall at any location. Regulatory requirements will determine where a new or expanded outfall can be located and where the Pease WWTF effluent may be discharged. There are shellfish beds located upstream and downstream of the Pease and Deer Street locations which have the potential to be affected by untreated discharges in the event of an emergency at the plant, as well as potential long-term effects which NHDES would need to examine prior to approval.

A preliminary meeting with NHDES and subsequent correspondence indicate that both shellfish impacts and anti-degradation requirements would need to be reviewed for any

of the outfall alternatives presented. Correspondence can be found in Appendix C of this report.

Based on the feedback from NHDES, it is unlikely that increasing the size of the outfall at the existing Pease WWTP outfall location will be accepted by the regulatory agencies. An outfall at Deer Street would likely be acceptable for the Pease/Portsmouth Option, but the acceptability of any option would require review of existing or new dye studies and sampling before making a decision. Additional hydrodynamic modeling of the Piscataqua River may be necessary to support a review and decision.

Base costs presented throughout the course of the Study have assumed a new Deer Street outfall for the Pease/Portsmouth Option (7.98 MGD) and a new Peirce Island outfall for the Pease Regional Option (10.98 MGD). If the regulatory agencies do not find the Deer Street outfall scenario acceptable for the Pease/Portsmouth Option, the City may need to extend the outfall to Peirce Island, an additional expense. The additional capital cost for a new outfall at Peirce Island is $6.3M.

Preliminary anti-degradation calculations by NHDES for a new outfall at Peirce Island indicate that the limits for ammonia and dissolved copper as presented to the City in November 2013 would need to be reduced. No new parameters are expected to require limits.

Additional concerns that the NHDES has asked the City to consider include lobster habitat, navigation, aesthetics (particularly at low tide), and benthic habitat.

5. Summary of Advantages and Disadvantages

5.1 WWTF Operations

The recommended options for a new Pease WWTF would provide a state of the art facility capable of providing secondary treatment and nitrogen removal for 100 percent of the wastewater flow during dry weather. Additionally, the Peirce Island WWTF conversion would provide an additional 10.33 MGD of CSO / Wet Weather treatment (for a total treatment capacity of 32.33 MGD with debottlenecking completed).

The new plant at the Pease location would optimize treatment to meet expected nitrogen permit limits and accommodate existing and future industrial flows and loads. Additional domestic sanitary flows would help balance out the heavy industrial loading at the plant. Expansion of types of commercial and industrial flows and loads that the current Pease WWTF can handle may be limited; however, a new WWTF would be able to support existing and future tenants at the Tradeport without limiting expansion or types of businesses, allowing for additional regional economic development and growth.

The plant would provide improved solids handling operations, as well. The conceptual design allows for future expansion, incorporation of potential future permit limits, and regional opportunities.

Utilizing the existing site would provide opportunities for sustainability and repurposing/reuse. Electric and natural gas utilities are readily available at this site. Additional opportunities for sustainability include anaerobic digestion, combined heat and power, and greener buildings, stormwater and landscaping techniques. Treatment of regional flows at a new Pease WWTF would also allow for improved water quality and support of the Great Bay ecosystem.

One WWTF for sanitary flows at the existing Pease site would provide a centralized location for staff, maintenance, administration, and the wastewater laboratory. This would also simplify wastewater treatment operations and maintenance for the City. Instead of operating two full treatment facilities, the City would be responsible for one plant and one wet weather treatment system that would only operate about 10 to 15 times per year.

5.2 Constructability

Construction of the new Pease WWTF adjacent to the existing WWTF would allow for minimal impact on maintenance of plant operations. The new Pease WWTF tanks and processes (headworks, primary clarifiers, biological reactors, secondary clarifiers, effluent pump station, and disinfection) would be constructed while the majority of the existing plant remained in operation. Once the new plant was complete and ready for start-up, the existing WWTP would be decommissioned to accommodate the

remainder of the new Pease WWTF construction (e.g. repurposing of existing tanks, addition of odor control equipment, and construction of the Maintenance and Administration Buildings).

Though a traffic impact study is needed, the number of truck trips per day during construction at Pease is not expected to be significantly different than what is currently anticipated for construction at Peirce Island, where the average day construction traffic expected is 18 to 56 trucks, with peak day construction traffic expected to be 26-79 trucks.

Most of the construction and post-construction traffic at Pease would be contained to the commercial and industrial streets in the Tradeport area. At the request of the PDA, the ARCADIS and the City evaluated Ashland Road from Corporate Drive to Spaulding Turnpike as a potential dedicated access for construction of the new Pease WWTF. The City contacted the New Hampshire Department of Transportation (NHDOT) and a formal response has been received indicating that Ashland Road could potentially serve as a temporary construction access route, but it would not be approved as a permanent dedicated access route to the WWTF. A copy of correspondence with NHDOT can be found in Appendix D of this report. It is likely that roadway improvements would also be necessary at Pease to mitigate construction impact (e.g. repaving Corporate Drive and other streets impacted by the construction). These potential costs were not included in the Opinion of Probable Project Cost discussed in Section 8 of this Report.

After construction of the new Pease WWTF, it is anticipated there would be increased operations traffic at the Pease location. However, minimal traffic would be expected for future operation and maintenance of a Peirce Island wet weather treatment facility, resulting in a significant decrease in vehicles accessing the Peirce Island site.

Construction for conveyance piping in City streets would involve close coordination, traffic planning, careful consideration for equipment and utilities, and in many places, the potential for significant rock excavation. In some cases, construction in City streets may require special excavation equipment with a tighter turning radius capable of accommodating work on narrow urban streets with tall buildings. The challenging constraints of construction in the downtown area would result in slower progress than construction in the streets closer to the Tradeport. The work could be completed and restored a few blocks at a time to help minimize impact on traffic and businesses along the proposed routes. The City could also consider work restrictions during the summer months to minimize the impact during the prime tourism season.

6. Permitting and Other Approvals

An upgraded treatment plant at Pease with expanded capacity would require a number of determinations and permits from various entities and regulatory agencies.

- Outfall Permitting and Approval: The NHDES and EPA would need to approve either an expanded outfall at Pease, a new outfall at Deer Street, or a new/additional outfall at Peirce Island next to the existing discharge location. Based on initial discussions with NHDES, an expanded outfall at the existing Pease discharge location seems unlikely. It is also expected that United States Army Corps of Engineers permits/approvals would be necessary for work in navigable waters.

- Modified Schedule: A modified Pease facility design and implementation schedule would require approval through the EPA. The time to design and construct a new Pease WWTF will likely exceed the already negotiated timeframes in place in the current Consent Decree to provide full secondary treatment for the City's wastewater flows.

- Wetlands permitting and mitigation would be required for construction in and nearby the wetland areas on site. Replacement of wetlands removed by construction of the new Pease plant would be required at 1.5 times the original total amount of disturbed area. The total disturbed area is estimated to be 2.35 acres for the Pease Regional Option (10.98 MGD) at TN of 3 mg/L. The estimated disturbed area reduces to 1.7 acres for the Pease/Portsmouth Option (7.98 MGD) at TN of 8 mg/L. Replacement of these wetlands in a separate location within the same watershed or payment in lieu of wetlands mitigation are the likely options, but add permitting challenges and costs to the project.

- Archaeological Review: It is likely that the entire project including both the WWTF site as well as the conveyance routes would require an archaeological review to identify any historically significant areas that will need to be accommodated in the design.

- The Pease Development Authority land use regulations and Federal Aviation Administration regulations would apply, and approvals from these authorities would be required. The conceptual WWTF design includes cost considerations for waterfowl deterrents, as this is an anticipated PDA and FAA concern.

- Construction Permits: The selected contractor would be required to obtain all construction-related permits.

7. Additional Alternatives Evaluated

During the course of the Study, three items were evaluated as additional alternatives: Solids Handling Alternatives, Alternate Pease Location Review, and Subaqueous Conveyance. These alternatives are discussed in detail in the sections that follow. Base WWTF and conveyance costs as presented in Section 8 do not include the cost of these additional alternatives.

7.1 Solids Handling Alternatives

In addition to the baseline option for solids handling described above (gravity thickening for TPS and rotary drum thickening for TWAS with screw presses for dewatering) the Study evaluated addition of anaerobic digestion with sub-alternatives for biogas utilization and supplementing the anaerobic digesters with imported solids handling. The anaerobic digesters would be constructed within the footprint of two existing SBR tanks, and the solids handling and dewatering facility would increase in size to accommodate these solids handling alternatives.

7.1.1 Biogas Utilization

The Study evaluated two options for capturing, processing and utilizing biogas generated from anaerobic digestion:

- Combusting Biogas in Boilers for Digester Heating
- Combusting Biogas in a Combined Heat and Power (CHP) System

Combusting Biogas for Digester Heating

Under this sub-alternative, biogas would be combusted directly in dedicated boilers with minimal gas treatment for the purpose of digester heating. The boilers would produce hot water at temperatures ranging from 150-175^{o}F for use in sludge heat exchangers. These heat exchangers would be located on a pumped digester recycle loop that would serve to heat and help mix the digester sludge.

The required digester heating demands were estimated based on having two digesters in service. The heating demands were also based on two influent loading scenarios of Pease Regional without Import Solids and Pease Regional with Import Solids to demonstrate heating needs under two solids handling conditions. It is noted that heat demands will vary by season, and that heating systems are typically designed for maximum day conditions. It was assumed that on the maximum day of sludge

production, the Pease WWTF could halt deliveries of imported solids. For this reason the heat demands for max day conditions are the same for both scenarios evaluated (with and without imported solids).

Based on the heating load analysis shown in Table 17, it is projected that there would be sufficient biogas supply to satisfy all digester heating demands. The selected boiler/heat exchanger units selected to provide digester heating was a pair of boiler/heat exchangers each rated for 1.5 mmBtu/hr of heat production and heat transfer with each unit servicing one digester. This equipment selection would be the same regardless of whether the City elected to import solids. A third redundant boiler (without a heat exchanger) would be provided in this scenario in the event that one duty boiler is out of service. All three boilers would have dual-fuel capabilities so they could be fired on natural gas or a mix of biogas and natural gas if needed.

Table 17 Estimated Digester Heating Demands

Parameter	Annual Average	Max Month	Max Day*
Pease Regional – No Import			
Total Digester Heating Demand in Summer (mmBtu/hr)	0.99	1.14	1.45
Total Heating Demand in Winter (mmBtu/hr)	1.65	1.86	**2.29**
Boiler Input Energy in Summer (mmBtu/hr)	1.24	1.43	1.81
Boiler Input Energy in Winter (mmBtu/hr)	2.06	2.33	2.86
Digester Gas Required for Heating in Summer (scfm)	35	40	51
Digester Gas Required for Heating in Winter (scfm)	58	65	80
Estimated Digester Gas Production (scfm)	78	104	151
Pease Regional – With Import			
Total Heating Demand in Summer (mmBtu/hr)	1.39	1.54	1.45
Total Heating Demand in Winter (mmBtu/hr)	2.20	2.42	2.29
Boiler Input Energy in Summer (mmBtu/hr)**	1.73	1.92	1.81
Boiler Input Energy in Winter (mmBtu/hr)**	2.75	**3.02**	2.86
Digester Gas Required for Heating in Summer (scfm)***	49	54	51
Digester Gas Required for Heating in Winter (scfm)***	77	85	80
Estimated Digester Gas Production (scfm)	164	190	151

* - assumes that no imported solids would be accepted during max day conditions
** - assumes 80% boiler efficiency ***- assumed biogas LHV of 595 Btu/cf

Combusting Biogas in a Combined Heat and Power (CHP) System

Under this sub-alternative, biogas would be combusted in an onsite engine generator CHP system. The engine system would convert approximately 33% of the biogas energy to electricity and could recover approximately 38% of the biogas energy as waste heat from the engine's jacket water and exhaust that could then be used to heat the digesters. It is noted that the pair of boiler/heat exchangers described in the previous section would still be required under this option (the boilers would serve as

backup heating when the engine(s) are down). Biogas treatment to remove hydrogen sulfide, siloxanes and excess moisture would be required prior to sending gas to the CHP system.

A full cycle CHP energy recovery and annual savings analysis was performed for the Pease Regional without Import Solids and Pease Regional with Import Solids. The details of these analyses are given in Tables 18 and 19 below.

Table 18 Full Cycle CHP Energy Recovery & Annual Savings – Pease Regional No Import Solids

	Units	Annual Avg	Max Month
Biogas Production	cf/day	112,368	149,667
Biogas Production	scfm	78	104
Biogas Heat Value (HHV)	Btu/cf	650	650
Biogas Energy (HHV)	mmBtu/day	73.0	97.3
Biogas Energy (HHV)	mmBtu/hr	3.04	4.05
Biogas Energy (LHV)	mmBtu/hr	2.78	3.71
Engine Electric Efficiency (LHV)	%	33%	33%
Btu/hr to kW	conversion	3,412	3,412
Estimated Power Output	kW	269	359
Estimated Engine Availability	%	95%	
Estimated Annual Electric Production	kWh/yr	2,241,295	
Assumed Power Cost	$/kWh	$0.10	
Estimated Electric Cost Savings	$/yr	$ 224,000	
Estimated Heat Recovery from Engine	%	37.6%	37.6%
Estimated Heat Recovery from Engine	mmBtu/hr	1.14	1.52
Digester Heat Demand Summer	mmBtu/hr	0.99	1.14
Digester Heat Demand Winter	mmBtu/hr	1.65	1.86
Usable Recovered Heat	mmBtu/yr	8,891	
Assumed NG Cost	$/mmBtu	$7	
Assumed Boiler Efficiency	%	80%	
Estimated NG Cost Savings	$/yr	$ 78,000	
Total Annual Cost Savings	**$/yr**	**$ 302,000**	

Table 19 Full Cycle CHP Energy Recovery & Annual Savings – Pease Regional with Import Solids

	Units	Annual Avg	Max Month
Biogas Production	cf/day	235,883	273,182
Biogas Production	scfm	164	190
Biogas Heat Value (HHV)	Btu/cf	650	650
Biogas Energy (HHV)	mmBtu/day	153.3	177.6
Biogas Energy (HHV)	mmBtu/hr	6.39	7.40
Biogas Energy (LHV)	mmBtu/hr	5.85	6.77
Engine Electric Efficiency (LHV)	%	33%	33%
Btu/hr to kW	conversion	3,412	3,412
Estimated Power Output	kW	565	655
Estimated Engine Availability	%	95%	
Estimated Annual Electric Production	kWh/yr	4,704,916	
Assumed Power Cost	$/kWh	$0.10	
Estimated Electric Cost Savings	$/yr	$ 470,000	
Estimated Heat Recovery from Engine	%	37.6%	37.6%
Estimated Heat Recovery from Engine	mmBtu/hr	2.40	2.78
Digester Heat Demand Summer	mmBtu/hr	1.39	1.54
Digester Heat Demand Winter	mmBtu/hr	2.20	2.42
Usable Recovered Heat	mmBtu/yr	14,940	
Assumed NG Cost	$/mmBtu	$7	
Assumed Boiler Efficiency	%	80%	
Estimated NG Cost Savings	$/yr	$ 131,000	
Total Annual Cost Savings	**$/yr**	**$ 601,000**	

Based on the CHP full cycle analysis, it was assumed that an engine generator with a 350 kW output capacity would be required in the case of no imported biosolids. With the projected import solids load, the biogas production at the plant is expected to roughly double, so the selected engine system would be a pair of 350 kW engines. The recovered heat from the engine jacket water and exhaust would be the main source of heating for the digesters. However, in the case of no imported biosolids, it is expected that supplemental heat would be needed in the winter in addition to the engine heat resulting from biogas fuel. Under these conditions the plant could blend natural gas fuel to the engines to increase heat output (and electric output) or fire natural gas in the boilers to supplement heating.

7.1.2 Importation of Dewatered Solids and Fats, Oils, and Grease (FOG)

As described in Section 7.1.1 the Study evaluated importing biosolids by receiving dewatered cake and FOG (and potentially high strength waste) from outlying communities to optimize the use of onsite digestion and maximize the generation of biogas that can be used as a renewable energy source.

Dewatered Cake Receiving Station

A dewatered cake receiving station would allow the new Pease WWTF to accept dewatered cake deliveries from outlying communities for processing and disposal. This cake would need to be "re-watered" back to a concentration of approximately 5% total solids for feeding into the anaerobic digesters. The recommended liquid for use in re-watering the imported cake is un-thickened WAS from the secondary clarifiers. The basic components of this system would be a receiving hopper, a re-watering tank, and a pair of re-watered sludge pumps.

The projected amount of available imported dewatered cake from the surrounding areas was estimated in a 2010 Master Plan and LTCP Update Study. The assumed load imported to the plant was 50% of this projected available cake which was 17,600 dry lbs/day or 8.8 dry tons/day. This cake was assumed to be arriving as 25% solids at an estimated volume of 42 cubic yards/day. Accordingly, the hopper size for the Pease WWTF would be 60 cubic yards (or ~ 1,600 ft^3) which would allow the facility to receive approximately 12.5 dry tons/day of dewatered cake at 25% total solids.

FOG Receiving Station

Addition of a FOG receiving station would allow the new Pease WWTF to accept another supplemental feedstock for the digesters. FOG would be a relatively small volume compared to the total digester feed, but would be highly concentrated in readily degradable organics which would significantly enhance the biogas production rate in the digesters. A FOG receiving station would consist of FRP tanks with a hot water jacket to keep the tank contents heated, a set of truck unloading/recirculation pumps, rock traps, a hot water heat exchanger, and digester feed pumps.

The amount of available FOG and potential high strength waste is highly dependent on a number of local variables including regulations on grease trap pumping, competing waste disposal outlets, and the nature of industries in close proximity to the plant. Accurate projections would require a site-specific study of these and other variables.

Based on previous experience in other communities, ARCADIS estimates that approximately 2,500 gallons/day of FOG could be delivered to the plant with potential for larger amounts, depending on local market conditions. It is also noted that FOG receiving most often will occur only on weekdays, so two days of storage is needed for the weekends if a consistent feed to the digesters is desired. The FOG receiving station assumed for the Pease WWTF would have two receiving tanks, each sized at 7,500 gallons which should provide redundancy and buffering capacity for fluctuations in weekly and seasonal FOG deliveries.

Table 20 summarizes the capital costs for the Solids Handling Alternatives discussed.

Table 20 Capital Costs for Solids Handling Alternatives

Pease WWTP Solids Handling Option	Capital Cost (Escalated to 2018 Dollars)	Net Increase in Capital Cost Over Baseline
No Digesters (Baseline)	$ 7,890,000	
Digesters for Plant Solids Only	$ 18,480,000	$ 10,590,000
Digesters with CHP for Plant Solids Only	$ 22,520,000	$ 14,630,000
Digesters with Plant Solids + Import	$ 25,050,000	$ 17,160,000
Digesters with CHP for Plant Solids + Import	$ 31,650,000	$ 23,760,000

Table 21 summarizes the Operation and Maintenance and Lifecycle costs for the Solids Handling Alternatives discussed.

Table 21 Operation & Maintenance and Lifecycle Costs for Solids Handling Alternatives

	Pease/Portsmouth Option (7.98 MGD)			Pease Regional Option (10.98 MGD)		
Pease WWTP Solids Handling Option	**O&M Cost ($/year)**	**Net Increase in O&M Cost Over Baseline**	**Net Increase in 20 Year Lifecycle Cost**	**O&M Cost ($/year)**	**Net Increase in O&M Cost Over Baseline**	**Net Increase in 20 Year Lifecycle Cost**
No Digesters (Baseline)	$ 590,000			$ 700,000		
Digesters for Plant Solids Only	$ 840,000	$ 250,000	$ 14,745,000	$ 920,000	$ 220,000	$ 14,246,400
Digesters with CHP for Plant Solids Only	$ 890,000	$ 300,000	$ 19,616,000	$ 910,000	$ 210,000	$ 18,120,200
Digesters with Plant Solids + Import	$ 970,000	$ 380,000	$ 23,475,600	$ 1,040,000	$ 340,000	$ 22,810,800
Digesters with CHP for Plant Solids + Import	$ 900,000	$ 310,000	$ 28,912,200	$ 920,000	$ 220,000	$ 27,416,400

7.2 Alternate Pease Location Review

The Pease Development Authority asked the City to review two alternate sites for the expanded Pease WWTF. The sites are located on the eastern end of the Tradeport property, and are known as:

- 255 Corporate Drive (former Jones School Site)
- Site 6 (Former Landfill)

There are several advantages and disadvantages to the City to utilize these sites. There would be significant additional cost involved to convey wastewater to the alternate sites and to return effluent to an outfall, as the conveyance routes would be farther from the Pierce Island WWTF. Building an expanded Pease WWTF on one of the new sites would not allow use of existing facilities, increasing costs for demolition

and providing no opportunity for repurposing or re-use of existing Pease WWTF buildings and infrastructure. There would be increased wetlands disturbance and subsequent requirement for restoration or mitigation at both sites. The wetlands at these sites are considered higher quality and of greater significance in the watershed. Both sites have Groundwater Management Zones due to contaminated groundwater, thus groundwater use restrictions are in place, posing potential risks and difficulties for construction (dewatering). The WWTF would also be closer to the flight path and end of the runway, potentially posing additional FAA-related concerns.

The Jones School site provides the potential for access via Ashland Road, with NHDOT approval. As discussed in Section 5.2, the NHDOT has indicated that it would not approve use of Ashland Road as an access route to a new WWTF permanently. It may approve Ashland Road as a temporary construction access route. See Appendix D for detailed correspondence on this matter. A new Pease WWTF would require a minimum of 7.5 buildable acres. The PDA website shows only about 3.2 out of 11.2 acres as buildable on the Jones School site. The arrangement of the site would make it difficult to meet PDA setbacks as required for the business/commercial zone. The City would also need to maintain future access to Sites 6 and Site 17 through the WWTF if the Jones School site were utilized.

Site 6 is a parcel that is not shown as available on PDA website and is located in the Natural Resource Protection Zone, a PDA zone in which wastewater treatment (governmental facilities) are not a permitted use. Site 6 is a former landfill that received domestic and industrial solid wastes through the 1970's, which may have included paint thinners and solvents. Primary contaminants identified included aromatic hydrocarbons (BTEX and dichlorobenzene), polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH), and metals. Most of the site is in the groundwater management zone and wetland protection zone, and may not be useable. It is also located in close proximity to a residential area. Permanent site access would be needed by way of Jones School Site, through Site 17 and then to Site 6, resulting in a long driveway with limited construction and long-term accessibility and limited space for layout and working areas. No geotechnical data was available during this Study, but given that it is surrounded by wetlands, it will likely need to be constructed on piles. Significant additional costs would be incurred for construction at this site.

Based on the findings of the alternative site reviews and preliminary opinion of probable construction cost, building a new WWTF at the Jones School site would add at least $8M to $10M to the total project capital cost. It is anticipated that costs would increase even more with a new WWTF at Site 6. At the City's direction, the costs for construction at Site 6 were not evaluated.

7.3 Subaqueous Conveyance

ARCADIS considered subaqueous conveyance in the Piscataqua River in lieu of a land route through the downtown area as part of the Study. Although this option would provide a shorter route with less impact to businesses and traffic in the downtown area, installing the force mains in the River was not recommended for a variety of reasons, as discussed below.

Constructability: Subaqueous construction requires specialty contractors, allowing for limited competition. Installation of the force mains in fast moving waters presents safety concerns for divers and other contractor employees. Subaqueous work in this area requires coordination with other cables and pipes already in the River. There will be limited access to the site, as well as restricted access and structural limitations anticipated at the Memorial Bridge and the Peirce Island Road Bridge. Air release valves for the force mains would likely be required in the River. All of these items result in greater contractor risk.

Navigation: The need to maintain commercial and recreational navigation complicates work in this area. A navigational channel would need to be maintained. Both public and private access is needed along the channel at places such as State Pier, tugboats, Granite State Materials (salt pile area), Prescott park docks, etc.

Environmental Concerns: A subaqueous installation would likely have a greater environmental impact during construction as well as create a long-term risk of potential for future leaks associated with pumping raw sewage through force mains in the River.

Multiple Regulatory Approvals: This type of installation would be an additional permitting effort for the City. It is anticipated that there would be seasonal work restrictions for fish spawning and other aquatic habitat issues. Regulatory approval would likely require periodic testing of the force main integrity, adding to lifecycle costs.

Maintenance: There would be little or no access for future maintenance of these force mains. The work cannot be done in-house by City staff and would require a specialty contractor, resulting in additional lifecycle costs.

At the City's request, ARCADIS developed a preliminary opinion of probable cost for installing dual 20-inch subaqueous force mains from the Mechanic Street pump station to Market Street at the State Pier. This preliminary estimate was prepared to determine whether there would be potential for cost savings that would warrant further evaluation of a subaqueous conveyance route. In order to develop the preliminary opinion of probable cost, ARCADIS assumed excavation by mechanical dredge and minimal rock quantities. The two 20-inch HDPE pipes would be installed in a common

underwater trench, secured in place, then backfilled with crushed stone and capped with rip-rap to provide stability and protection. This approach was selected because it provides an anticipated least cost for subaqueous force main installation to serve as a basis for comparing costs to the land route before making a decision whether or not to proceed with a more detailed evaluation of the subaqueous option. It is likely that the preliminary costs for subaqueous force main installation could increase upon more detailed evaluation due to the potential for additional regulatory requirements and other cost risks that would need to be better defined such as rock excavation quantities.

Based on the findings of the preliminary opinion of probable construction cost, subaqueous conveyance would not result in a cost savings. Installing the force mains in the River would be expected to add at least $2.9M to the total project capital cost, and the present worth lifecycle cost would also increase by approximately $4.1M.

8. Capital and Life Cycle Costs

Tables 22 through 30 present the base Pease/Portsmouth and Pease Regional Option WWTF Capital and Lifecycle Cost summaries as well as Conveyance cost summaries. Base costs presented do not include the alternatives discussed in Section 7 (solids handling alternatives, alternate PDA site, or subaqueous conveyance), or wetlands mitigation.

The following assumptions and references were used to develop the opinion of probable construction cost:

- Opinions of probable costs are at a conceptual level based on approximately 10 percent project definition.
- Estimates are consistent with AACE Class 4 construction cost estimate which are typically accurate between -15% and -30% to +20% and +50%.
- The Engineering News Record (ENR) 20-City construction cost index (CCI) was utilized for this Study. All unit costs are in 2015 dollars (ENR CCI of 10100). Escalation to mid-point of construction in January 2018 has been included on an item basis assuming an annual 2.5% inflation rate resulting in a projected ENR CCI of 10896.
- Project costs include an allowance of 18 percent for engineering and other associated project costs.
- Project costs include a contingency of 15 percent.
- Present Worth Lifecycle Cost are based on 2.5% inflation, 4.75% interest, 20 years.

Regional options would provide potential for cost sharing (3/11ths based on flow allocation) between the City and the municipalities of Exeter and Stratham. The City would need to negotiate cost-sharing, sewer rates, and other items with Exeter and Stratham and execute an inter-municipal agreement should a regional option move forward.

Table 22 Costs for Pease WWTF Modifications for the Pease/Portsmouth Option, 7.98 MGD, TN 8

Description	Capital Cost	Annual O&M Cost	Total Lifecycle Cost
Headworks	$ 17,900,000	$ 223,800	$ 21,620,000
Primary Clarifiers	$ 6,550,000	$ 66,100	$ 7,650,000
Biological Reactor Tanks	$ 17,900,000	$ 724,400	$ 29,940,000
Secondary Clarifiers	$ 13,980,000	$ 163,800	$ 16,710,000
Effluent Pump Station and Disinfection	$ 6,760,000	$ 245,000	$ 10,840,000
Thickening and Dewatering	$ 7,324,000	$ 545,000	$ 16,390,000
Electrical Distribution	$ 2,490,000	$ 90,200	$ 3,990,000
Allowance for Waterfowl Deterrents	$ 250,000	$ 5,000	$ 340,000
Odor Control Facilities	$ 4,080,000	$ 104,800	$ 5,830,000
Administration Building	$ 2,587,000	$ 55,870	$ 3,520,000
Maintenance Building	$ 1,366,000	$ 34,660	$ 1,950,000
Laboratory Modifications	$ 1,875,000	$ 48,750	$ 2,690,000
Total Opinion of Probable Project Cost	**$ 83,060,000**	**$ 2,310,000**	**$ 121,470,000**
Total Opinion of Probable Project Cost Escalated to Construction Mid-Point in 2018	**$ 89,450,000**	**$ 2,490,000**	**$ 130,810,000**

Table 23 Costs for Pease WWTF Modifications for the Pease/Portsmouth Option, 7.98 MGD, TN 3

Description	Capital Cost	Annual O&M Cost	Total Lifecycle Cost
Headworks	$ 17,900,000	$ 223,800	$ 21,620,000
Primary Clarifiers	$ 6,550,000	$ 66,100	$ 7,650,000
Biological Reactor Tanks	$ 17,900,000	$ 724,400	$ 29,940,000
Secondary Clarifiers	$ 13,980,000	$ 163,800	$ 16,710,000
Effluent Pump Station and Disinfection	$ 6,760,000	$ 245,000	$ 10,840,000
Thickening and Dewatering	$ 7,324,000	$ 545,000	$ 16,390,000
Denitrification Filters and Methanol	$ 14,580,000	$ 463,500	$ 22,290,000
Electrical Distribution	$ 2,490,000	$ 90,200	$ 3,990,000
Allowance for Waterfowl Deterrents	$ 250,000	$ 5,000	$ 340,000
Odor Control Facilities	$ 4,080,000	$ 104,800	$ 5,830,000
Administration Building	$ 2,587,000	$ 55,870	$ 3,520,000
Maintenance Building	$ 1,366,000	$ 34,660	$ 1,950,000
Laboratory Modifications	$ 1,875,000	$ 48,750	$ 2,690,000
Total Opinion of Probable Project Cost	**$ 97,640,000**	**$ 2,770,000**	**$ 143,760,000**
Total Opinion of Probable Project Cost Escalated to Construction Mid-Point in 2018	**$ 105,150,000**	**$ 2,980,000**	**$ 154,820,000**

Table 24 Costs for Pease WWTF Modifications for the Pease Regional Option, 10.98 MGD, TN8

Description	Capital Cost	Annual O&M Cost	Total Lifecycle Cost
Headworks	$ 17,750,000	$ 233,000	$ 21,630,000
Primary Clarifiers	$ 7,690,000	$ 72,000	$ 8,890,000
Biological Reactor Tanks	$ 21,770,000	$ 862,000	$ 36,100,000
Secondary Clarifiers	$ 15,920,000	$ 190,000	$ 19,080,000
Effluent Pump Station and Disinfection	$ 6,760,000	$ 245,000	$ 10,840,000
Thickening and Dewatering	$ 7,324,000	$ 651,000	$ 18,150,000
Electrical Distribution	$ 2,490,000	$ 95,000	$ 4,070,000
Allowance for Waterfowl Deterrents	$ 250,000	$ 5,000	$ 340,000
Odor Control Facilities	$ 4,080,000	$ 105,000	$ 5,830,000
Administration Building	$ 2,587,000	$ 55,870	$ 3,520,000
Maintenance Building	$ 1,366,000	$ 34,660	$ 1,950,000
Laboratory Modifications	$ 1,875,000	$ 48,750	$ 2,690,000
Total Opinion of Probable Project Cost	**$ 89,860,000**	**$ 2,600,000**	**$ 133,090,000**
Total Opinion of Probable Project Cost Escalated to Construction Mid-Point in 2018	**$ 96,770,000**	**$ 2,800,000**	**$ 143,320,000**

Table 25 Costs for Pease WWTF Modifications for the Pease Regional Option, 10.98 MGD, TN3

Description	Capital Cost	Annual O&M Cost	Total Lifecycle Cost
Headworks	$ 17,750,000	$ 233,000	$ 21,630,000
Primary Clarifiers	$ 7,690,000	$ 72,000	$ 8,890,000
Biological Reactor Tanks	$ 21,770,000	$ 862,000	$ 36,100,000
Secondary Clarifiers	$ 15,920,000	$ 190,000	$ 19,080,000
Effluent Pump Station and Disinfection	$ 15,910,000	$ 614,000	$ 26,120,000
Thickening and Dewatering	$ 6,760,000	$ 245,000	$ 10,840,000
Denitrification Filters and Methanol	$ 7,324,000	$ 651,000	$ 18,150,000
Electrical Distribution	$ 2,490,000	$ 95,000	$ 4,070,000
Allowance for Waterfowl Deterrents	$ 250,000	$ 5,000	$ 340,000
Odor Control Facilities	$ 4,080,000	$ 105,000	$ 5,830,000
Administration Building	$ 2,587,000	$ 55,870	$ 3,520,000
Maintenance Building	$ 1,366,000	$ 34,660	$ 1,950,000
Laboratory Modifications	$ 1,875,000	$ 48,750	$ 2,690,000
Total Opinion of Probable Project Cost	**$ 105,770,000**	**$ 3,210,000**	**$ 159,210,000**
Total Opinion of Probable Project Cost Escalated to Construction Mid-Point in 2018	**$ 113,900,000**	**$ 3,460,000**	**$ 171,450,000**

Table 26 Costs for Conveyance and Outfall Modifications for Pease WWTF for the Pease/Portsmouth and Pease Regional Options

Description	Capital Cost	Annual O&M Cost	Total Lifecycle Cost
Debottlenecking	$ 6,930,000	$ 69,300	$ 8,090,000
Force Mains	$ 18,290,000	$ 182,900	$ 21,330,000
Outfall – Deer Street Location, for 7.98 MGD flow only	$ 7,980,000	$ 79,800	$ 9,310,000
Outfall – Peirce Island Location, for 10.98 MGD flow only	$ 14,320,000	$ 143,200	$ 16,700,000
Mechanic Street Pump Station(1)	$ 11,269,000	$ 7,598	$ 11,400,000
Peirce Island Dewatering Pump Station(1)	$ 740,000	$ -	$ 740,000
Chemically Enhanced Primary Treatment for Wet Weather (Peirce Island)	$ 680,960	$ 269,178	$ 5,160,000
Total Opinion of Probable Project Cost, 7.98 MGD	**$ 45,890,000**	**$ 610,000**	**$ 56,030,000**
Total Opinion of Probable Project Cost Escalated to Construction Mid-Point in 2018, 7.98 MGD	**$ 49,420,000**	**$ 660,000**	**$ 60,340,000**
Total Opinion of Probable Project Cost, 10.98 MGD	**$ 52,230,000**	**$ 670,000**	**$ 63,420,000**
Total Opinion of Probable Project Cost Escalated to Construction Mid-Point in 2018, 10.98 MGD	**$ 56,250,000**	**$ 720,000**	**$ 68,300,000**

(1) O&M Costs for these facilities represent the NET increase/decrease in O&M costs over existing operations.

Table 27 Cost Summary for Pease/Portsmouth Option, 7.98 MGD, TN8

Description	Capital Cost	Total Lifecycle Cost
New Pease WWTF	$ 89,450,000	$ 130,810,000
Collection System & Conveyance	$ 40,820,000	$ 50,310,000
Outfall at Deer Street location	$ 8,590,000	$ 10,030,000
Total Opinion of Probable Project Cost (Escalated to Construction Mid-Point in 2018)	**$ 138,860,000**	**$ 191,150,000**

(1) All costs are escalated to Construction Mid-Point in 2018.

Table 28 Cost Summary for Pease/Portsmouth Option, 7.98 MGD, TN3

Description	Capital Cost	Total Lifecycle Cost
New Pease WWTF	$ 105,150,000	$ 154,820,000
Collection System & Conveyance	$ 40,820,000	$ 50,310,000
Outfall at Deer Street location	$ 8,590,000	$ 10,030,000
Total Opinion of Probable Project Cost (Escalated to Construction Mid-Point in 2018)	**$ 154,560,000**	**$ 215,160,000**

(1) All costs are escalated to Construction Mid-Point in 2018.

Table 29 Cost Summary for Pease Regional Option, 10.98 MGD, TN8

Description	Capital Cost	Total Lifecycle Cost
New Pease WWTF	$ 96,770,000	$ 143,320,000
Collection System & Conveyance	$ 40,820,000	$ 50,310,000
Outfall at Peirce Island location	$ 15,420,000	$ 17,980,000
Total Opinion of Probable Project Cost (Escalated to Construction Mid-Point in 2018)	**$ 153,010,000**	**$ 211,610,000**

(1) All costs are escalated to Construction Mid-Point in 2018.

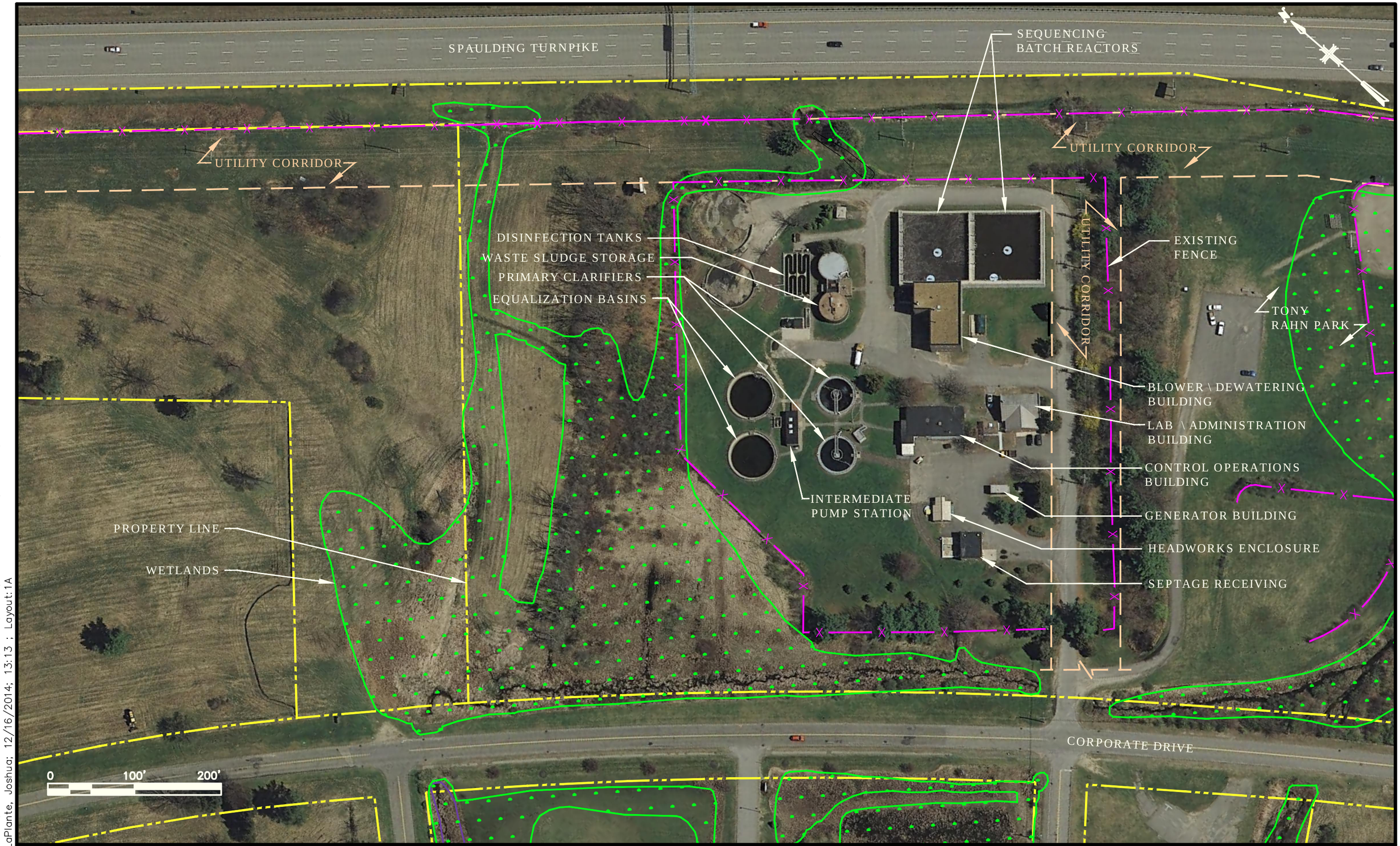
Table 30 Cost Summary for Pease Regional Option, 10.98 MGD, TN3

Description	Capital Cost	Total Lifecycle Cost
New Pease WWTF	$ 113,900,000	$ 171,450,000
Collection System & Conveyance	$ 40,820,000	$ 50,310,000
Outfall at Peirce Island location	$ 15,420,000	$ 17,980,000
Total Opinion of Probable Project Cost (Escalated to Construction Mid-Point in 2018)	**$ 170,140,000**	**$ 239,740,000**

(1) All costs are escalated to Construction Mid-Point in 2018.

Appendix A

Site Plans and Conveyance Routes Map



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CITY OF PORTSMOUTH, NEW HAMPSHIRE

PEASE/PORTSMOUTH AND PEASE REGIONAL EVALUATION STUDY

PEASE WASTEWATER TREATMENT FACILITY

EXISTING CONDITIONS

SCALE: AS SHOWN

DECEMBER 2014

FIGURE 1

User:LAPLANTE Spec:PIRNIE STANDARD File:G:\ACAD\PROJ\26850002.0000\FIGURES\FIG 1.DWG Scale:1:1 SavedDate:12/16/2014 Time:11:30
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PEASE/PORTSMOUTH AND PEASE REGIONAL EVALUATION STUDY

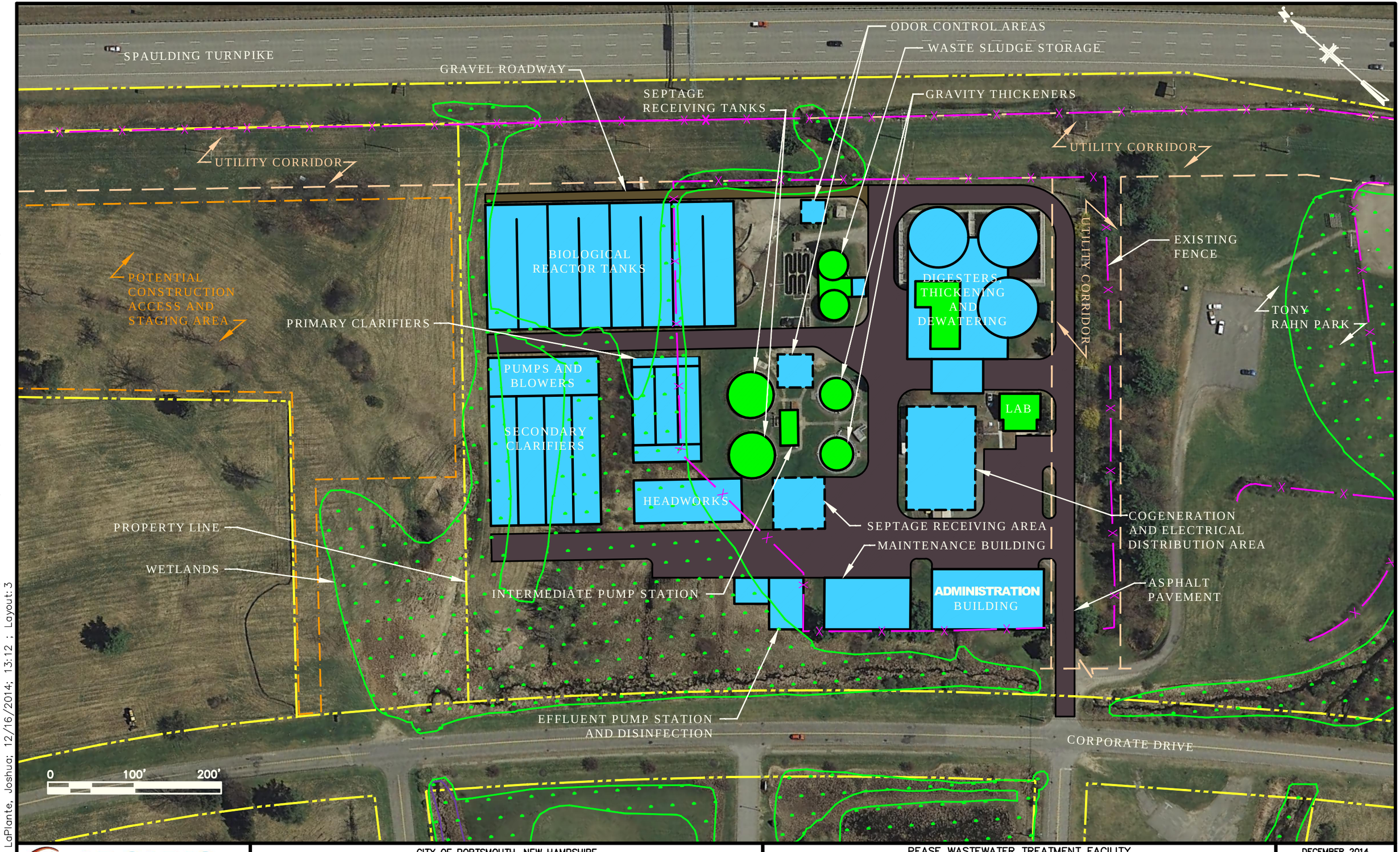
PEASE WASTEWATER TREATMENT FACILITY

DEMOLITION AND REPURPOSING PLAN

SCALE: AS SHOWN

DECEMBER 2014

FIGURE 2



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CITY OF PORTSMOUTH, NEW HAMPSHIRE

PEASE/PORTSMOUTH AND PEASE REGIONAL EVALUATION STUDY

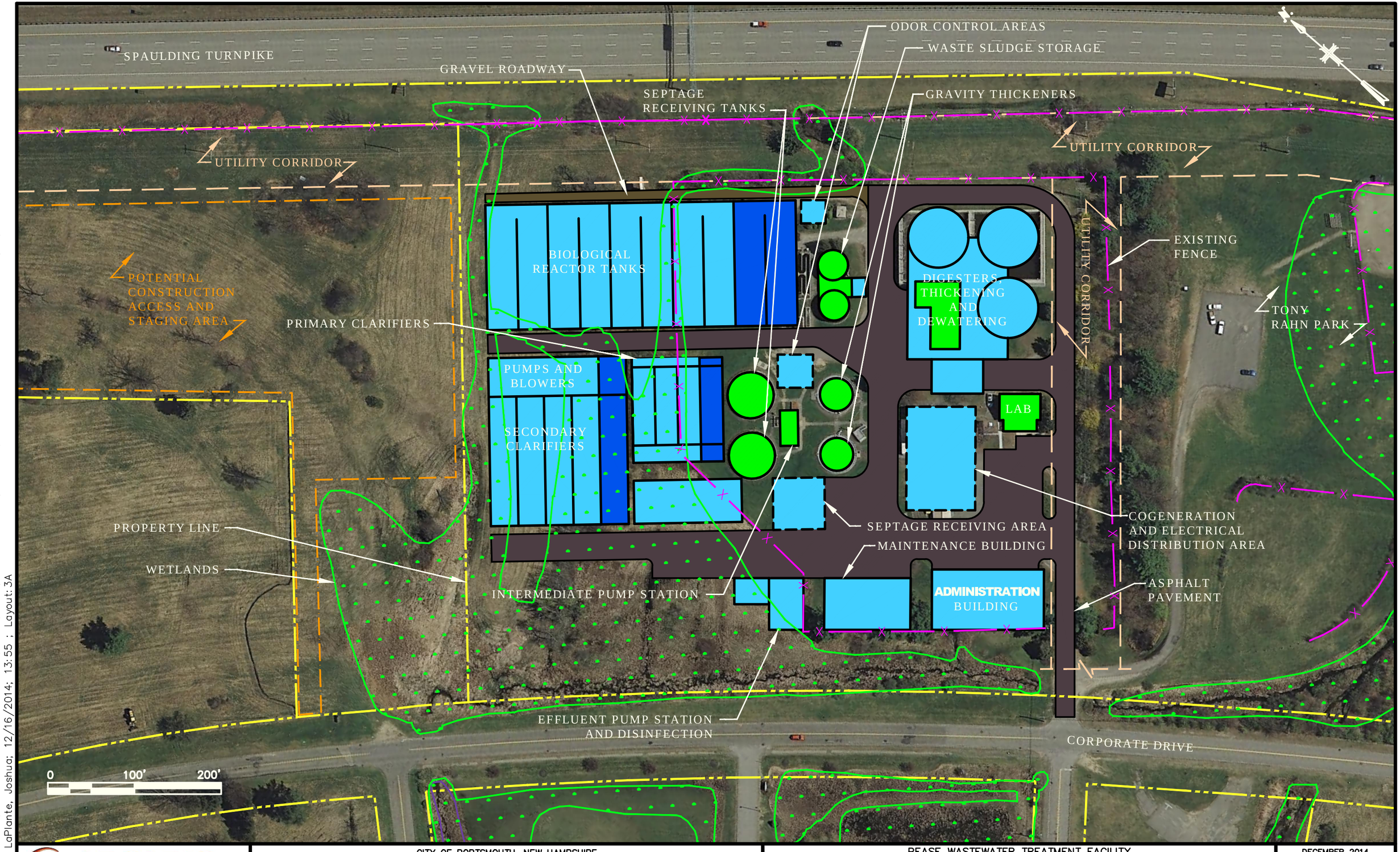
PEASE WASTEWATER TREATMENT FACILITY

TN8 PEASE/PORTSMOUTH OPTION (7.98 MGD AVG FLOW) DRAFT SITE PLAN

SCALE: AS SHOWN

DECEMBER 2014

FIGURE 3



User:LAPLANTE Spec:PIRNIE STANDARD File:G:\ACAD\PROJ\26850002.0000\FIGURES\FIG 4.DWG Scale:1:1 SavedDate:12/16/2014 Time:11:46
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CITY OF PORTSMOUTH, NEW HAMPSHIRE

PEASE/PORTSMOUTH AND PEASE REGIONAL EVALUATION STUDY

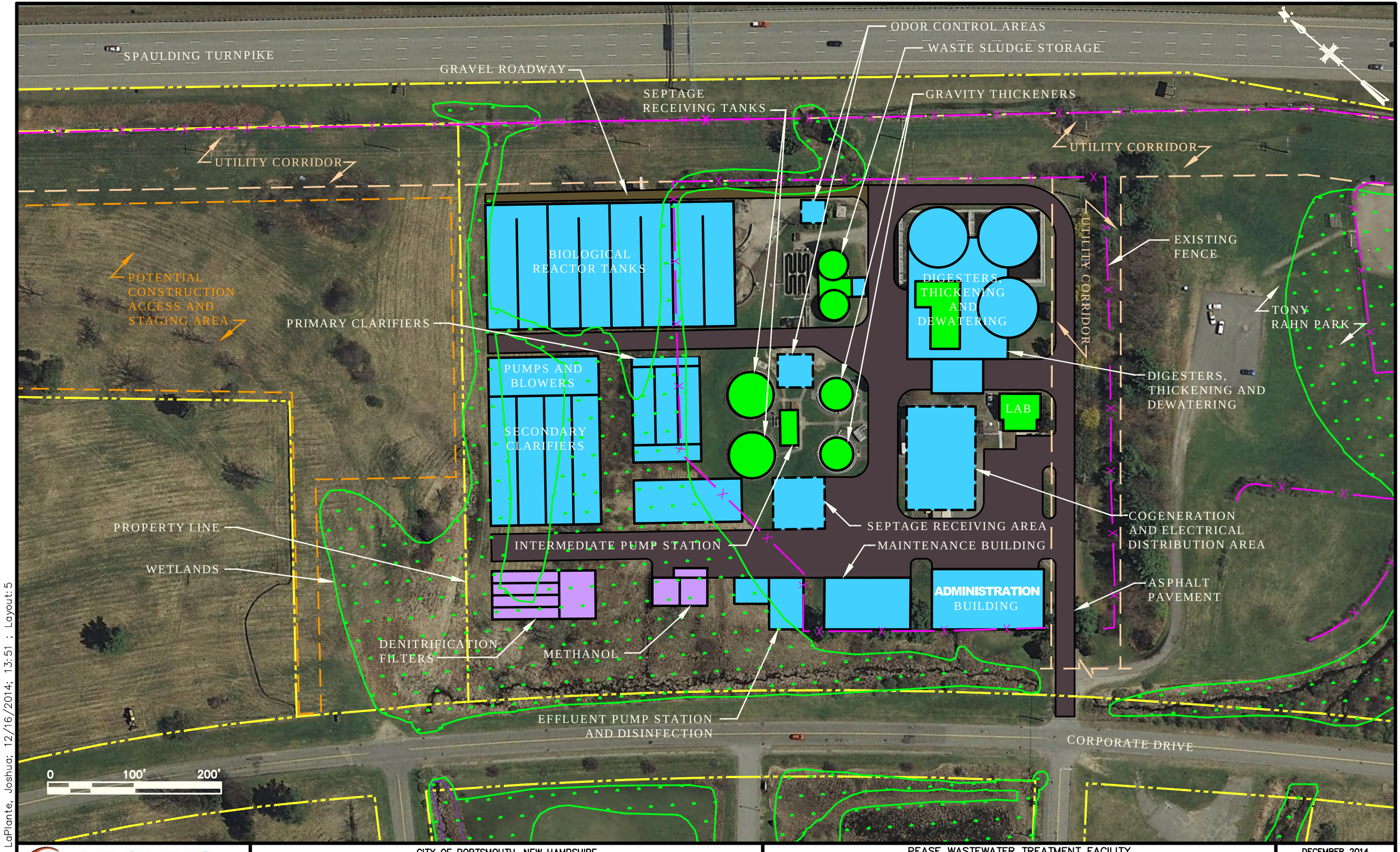
PEASE WASTEWATER TREATMENT FACILITY

TN8 PEASE REGIONAL OPTION (10.98 MGD AVG. FLOW) DRAFT SITE PLAN

SCALE: AS SHOWN

DECEMBER 2014

FIGURE 4



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CITY OF PORTSMOUTH, NEW HAMPSHIRE

PEASE/PORTSMOUTH AND PEASE REGIONAL EVALUATION STUDY

PEASE WASTEWATER TREATMENT FACILITY

TN3 PEASE/PORTSMOUTH OPTION (7.98 MGD AVG. FLOW) DRAFT SITE PLAN

SCALE: AS SHOWN

DECEMBER 2014

FIGURE 5

User:LAPLANTE Spec:PIRNIE STANDARD File:G:\ACAD\PROJ\26850002.0000\FIGURES\FIG 5.DWG Scale:1:1 SavedDate:12/16/2014 Time:11:27
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SPAULDING TURNPIKE

GRAVEL ROADWAY

ODOR CONTROL AREAS

WASTE SLUDGE STORAGE

SEPTAGE RECEIVING TANKS

GRAVITY THICKENERS

UTILITY CORRIDOR

UTILITY CORRIDOR

POTENTIAL CONSTRUCTION ACCESS AND STAGING AREA

BIOLOGICAL REACTOR TANKS

DIGESTERS, THICKENING AND DEWATERING

UTILITY CORRIDOR

EXISTING FENCE

TONY RAHN PARK

PRIMARY CLARIFIERS

PUMPS AND BLOWERS

SECONDARY CLARIFIERS

LAB

DIGESTERS, THICKENING AND DEWATERING

PROPERTY LINE

WETLANDS

INTERMEDIATE PUMP STATION

SEPTAGE RECEIVING AREA

MAINTENANCE BUILDING

COGENERATION AND ELECTRICAL DISTRIBUTION AREA

ADMINISTRATION BUILDING

ASPHALT PAVEMENT

DENITRIFICATION FILTERS

METHANOL

EFFLUENT PUMP STATION AND DISINFECTION

CORPORATE DRIVE

0 100' 200'

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CITY OF PORTSMOUTH, NEW HAMPSHIRE

PEASE/PORTSMOUTH AND PEASE REGIONAL EVALUATION STUDY

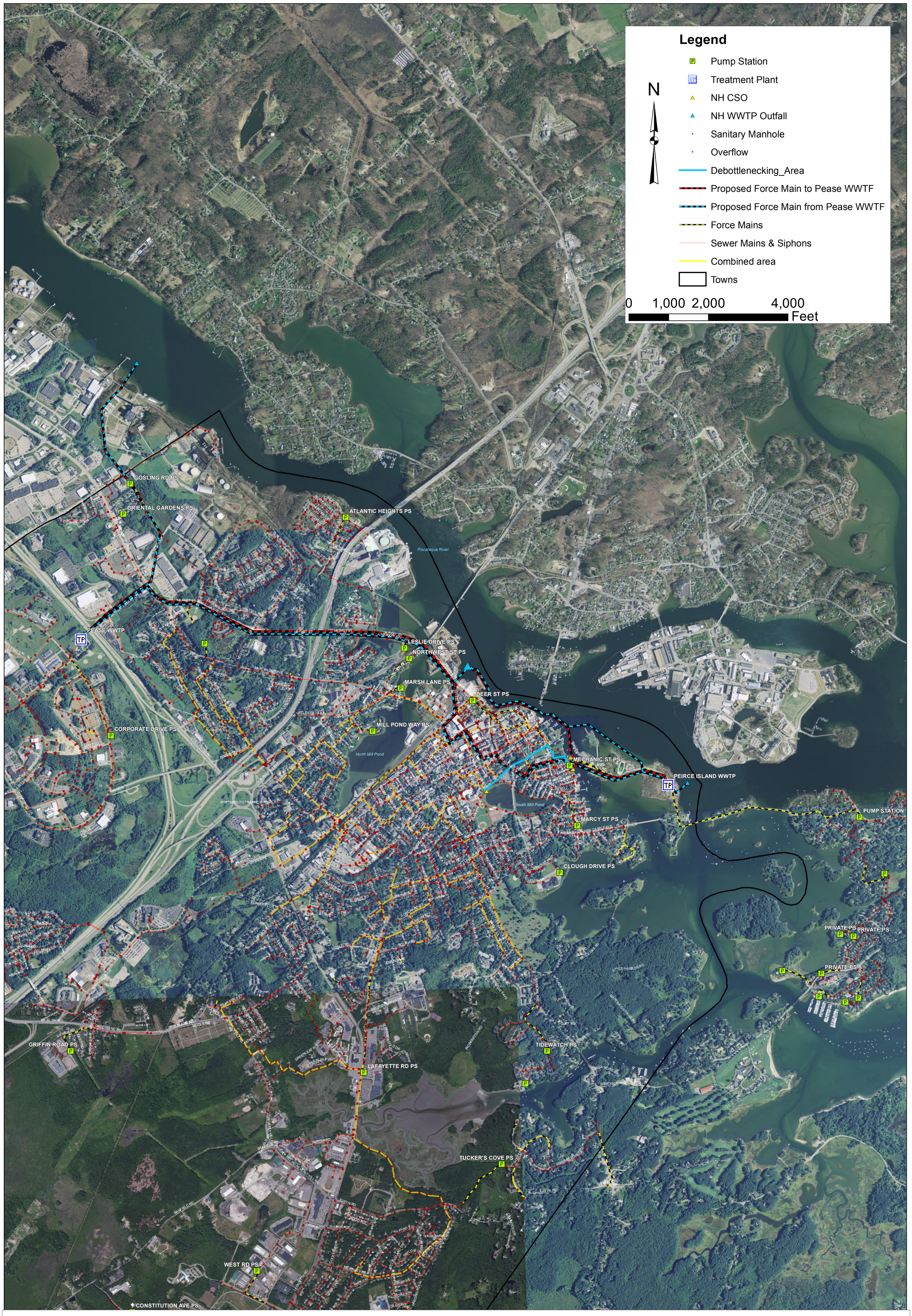
PEASE WASTEWATER TREATMENT FACILITY

TN3 PEASE REGIONAL OPTION (10.98 MGD AVG. FLOW) DRAFT SITE PLAN

SCALE: AS SHOWN

DECEMBER 2014

FIGURE 6



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City of Portsmouth, New Hampshire
Pease/Portsmouth and Pease Regional Evaluation Study
DRAFT REPORT
MAY 2015

APPENDIX A
CONVEYANCE ROUTES MAP

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Appendix B

Detailed Costs

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City of Portsmouth New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth Option (7.98 MGD Average Flow TN 8)
Project Summary

DESCRIPTION	OPINION OF PROBABLE PROJECT COST				Annual O&M Cost	Total Lifecycle Cost
	QTY.	UNIT	UNIT COST	TOTAL		
Pease WWTF Treatment Facilities						
Headworks	1	LS	$17,900,000	$ 17,900,000	$ 223,800	$ 21,620,000
Primary Clarifiers	1	LS	$6,550,000	$ 6,550,000	$ 66,100	$ 7,650,000
Biological Reactor Tanks	1	LS	$17,900,000	$ 17,900,000	$ 724,400	$ 29,940,000
Secondary Clarifiers	1	LS	$13,980,000	$ 13,980,000	$ 163,800	$ 16,710,000
Effluent Pump Station and Disinfection	1	LS	$6,760,000	$ 6,760,000	$ 245,000	$ 10,840,000
Thickening and Dewatering	1	LS	$7,324,000	$ 7,324,000	$ 545,000	$ 16,390,000
Electrical Distribution	1	LS	$2,490,000	$ 2,490,000	$ 90,200	$ 3,990,000
Subtotal				**$ 72,904,000**	**$ 2,058,300**	**$ 107,140,000**
Pease WWTF Additional Improvements Plan						
Allowance for Waterfowl Deterents	1	LS	$250,000	$ 250,000	$ 5,000	$ 340,000
Odor Control Facilities	1	LS	$4,080,000	$ 4,080,000	$ 104,800	$ 5,830,000
Administration Building	9,100	SF	$284	$ 2,587,000	$ 55,870	$ 3,520,000
Maintenance Building	6,000	SF	$228	$ 1,366,000	$ 34,660	$ 1,950,000
Laboratory Modifications	1,500	SF	$1,250	$ 1,875,000	$ 48,750	$ 2,690,000
Subtotal				**$ 10,158,000**	$ 249,080	**$ 14,330,000**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 83,060,000**	**$ 2,310,000**	**$ 121,470,000**
TOTAL OPINION OF PROBABLE PROJECT COST (LOW RANGE ESTIMATE -30%)				**$ 58,140,000**	**$ 1,620,000**	**$ 85,030,000**
TOTAL OPINION OF PROBABLE PROJECT COST (HIGH RANGE ESTIMATE +50%)				**$ 124,590,000**	**$ 3,470,000**	**$ 182,210,000**
TOTAL OPINION OF PROBABLE PROJECT COST				**$ 83,060,000**	**$ 2,310,000**	**$ 121,470,000**
TOTAL OPINION OF PROBABLE CONSTRUCTION COSTS ESCALATED TO CONSTRUCTION MID-POINT IN 2018 USD				**$ 89,450,000**	**$ 2,490,000**	**$ 130,810,000**

The following assumptions and references were used to develop the opinion of probable construction cost

1 Opinions of probable costs are at a conceptual level based on 10 % project definition.

2 Estimates are consistent with AACE Class 4 construction cost estimate which are typically accurate between -15% and -30% to +20% and +50%.

3 All unit costs are in 2015 dollars. Escalation has been on an item basis assuming an annual 2.5% inflation rate- projected ENR CCI of 10896

4 Project costs include allowance of 18% for Engineering and Other Associated Project

5 Project costs include a contingency of 15% Contingency

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City of Portsmouth New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth Option (7.98 MGD Average Flow TN 3)
Project Summary

DESCRIPTION	OPINION OF PROBABLE PROJECT COST QTY.	UNIT	UNIT COST	TOTAL	Annual O&M Cost	Total Lifecycle Cost
Pease WWTF Treatment Facilities						
Headworks	1	LS	$17,900,000	$ 17,900,000	$ 223,800	$ 21,620,000
Primary Clarifiers	1	LS	$6,550,000	$ 6,550,000	$ 66,100	$ 7,650,000
Biological Reactor Tanks	1	LS	$17,900,000	$ 17,900,000	$ 724,400	$ 29,940,000
Secondary Clarifiers	1	LS	$13,980,000	$ 13,980,000	$ 163,800	$ 16,710,000
Effluent Pump Station and Disinfection	1	LS	$6,760,000	$ 6,760,000	$ 245,000	$ 10,840,000
Thickening and Dewatering	1	LS	$7,324,000	$ 7,324,000	$ 545,000	$ 16,390,000
Denitrification Filters and Methanol	1	LS	$14,580,000	$ 14,580,000	$ 463,500	$ 22,290,000
Electrical Distribution	1	LS	$2,490,000	$ 2,490,000	$ 90,200	$ 3,990,000
Subtotal				**$ 87,484,000**	**$ 2,521,800**	**$ 129,430,000**
Pease WWTF Additional Improvements Plan						
Allowance for Waterfowl Deterents	1	LS	$250,000	$ 250,000	$ 5,000	$ 340,000
Odor Control Facilities	1	LS	$4,080,000	$ 4,080,000	$ 104,800	$ 5,830,000
Administration Building	9,100	SF	$284	$ 2,587,000	$ 55,870	$ 3,520,000
Maintenance Building	6,000	SF	$228	$ 1,366,000	$ 34,660	$ 1,950,000
Laboratory Modifications	1,500	SF	$1,250	$ 1,875,000	$ 48,750	$ 2,690,000
Subtotal				**$ 10,158,000**	$ 249,080	**$ 14,330,000**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 97,640,000**	**$ 2,770,000**	**$ 143,760,000**
TOTAL OPINION OF PROBABLE PROJECT COST (LOW RANGE ESTIMATE -30%)				**$ 68,350,000**	**$ 1,940,000**	**$ 100,630,000**
TOTAL OPINION OF PROBABLE PROJECT COST (HIGH RANGE ESTIMATE +20%)				**$ 146,460,000**	**$ 4,160,000**	**$ 215,640,000**
TOTAL OPINION OF PROBABLE PROJECT COST				**$ 97,640,000**	**$ 2,770,000**	**$ 143,760,000**
TOTAL OPINION OF PROBABLE CONSTRUCTION COSTS ESCALATED TO CONSTRUCTION MID-POINT IN 2018 USD				**$ 105,150,000**	**$ 2,980,000**	**$ 154,820,000**

The following assumptions and references were used to develop the opinion of probable construction cost

1 Opinions of probable costs are at a conceptual level based on 10 % project definition.
2 Estimates are consistent with AACE Class 4 construction cost estimate which are typically accurate between -15% and -30% to +20% and +50%.
3 All unit costs are in 2015 dollars. Escalation has been on an item basis assuming an annual 2.5% inflation rate- projected ENR CCI of 10896
4 Project costs include allowance of 18% for Engineering and Other Associated Project Costs
5 Project costs include a contingency of 15% Contingency

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City of Portsmouth New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth Option (7.98 MGD Average Flow TN 8)
Additional Costs to Add Digester and Combined Heat and Power

DESCRIPTION	OPINION OF PROBABLE PROJECT COST				Annual O&M Cost	Total Lifecycle Cost
	QTY.	UNIT	UNIT COST	TOTAL		
Point Estimates Based on 2015 Estimates						
Baseline-Thicken and Dewater Only	1	LS	$7,324,000	$ 7,324,000	$ 545,000	$ 16,390,000
With Digester	1	LS	$17,161,000	$ 17,161,000	$ 778,000	$ 30,100,000
With Digester and Combined Heat and Power	1	LS	$20,908,000	$ 20,908,000	$ 828,600	$ 34,680,000
With Regional Digester	1	LS	$23,259,000	$ 23,259,000	$ 897,000	$ 38,170,000
With Regional Digester with Combined Heat and Power	1	LS	$29,390,000	$ 29,390,000	$ 839,800	$ 43,350,000
Point Estimates Escalated to 2018						
Baseline-Thicken and Dewater Only	1	LS	$7,890,000	$ 7,890,000	$ 590,000	$ 17,700,000
With Digester	1	LS	$18,480,000	$ 18,480,000	$ 840,000	$ 32,450,000
With Digester and Combined Heat and Power	1	LS	$22,520,000	$ 22,520,000	$ 890,000	$ 37,320,000
With Regional Digester	1	LS	$25,050,000	$ 25,050,000	$ 970,000	$ 41,180,000
With Regional Digester with Combined Heat and Power	1	LS	$31,650,000	$ 31,650,000	$ 900,000	$ 46,610,000

The following assumptions and references were used to develop the opinion of probable construction cost

1 Opinions of probable costs are at a conceptual level based on 10 % project definition.
2 Estimates are consistent with AACE Class 4 construction cost estimate which are typically accurate between -15% and -30% to +20% and +50%.
3 All unit costs are in 2015 dollars. Escalation has been on an item basis assuming an annual 2.5% inflation rate- projected ENR CCI of 10896
4 Project costs include allowance of 18% for Engineering and Other Associated Project Costs
5 Project costs include a contingency of 15% Contingency

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City of Portsmouth New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth Option (7.98 MGD Average Flow)
Headworks

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Treatment Facilities				
Division 01 General Requirements				
General Conditions	10%	%	$ 11,203,600	$ 1,120,400
Bond	3%	%	$ 12,324,000	$ 369,700
Insurance	1%	%	$ 12,693,700	$ 126,900
Profit	5%	%	$ 12,820,600	$ 641,000
Division 02 Existing Conditions				
Miscellaneous/Undefined	8%	%	$ 10,373,700	$ 829,900
Division 03 Concrete				
Concrete Base Slab	877	CY	$ 250	$ 219,300
Concrete Walls	3,067	CY	$ 685	$ 2,100,900
Elevated Slabs	889	CY	$ 855	$ 760,000
Channels	400	CY	$ 930	$ 372,000
Division 04 Masonry				
Division 05 Metals				
Grating and Handrail	1	LS	$ 120,000	$ 120,000
Miscellaneous Metals	1	LS	$ 80,000	$ 80,000
Division 06 Woods, Plastics and Composites				
Division 07 Thermal and Moisture Protection				
Above Grade Building	6,000	SF	$ 185	$ 1,110,000
Division 08 Openings				
Division 09 Finishes				
Division 10 Specialties				
Division 22 Plumbing				
Plumbing	1	LS	$ 250,000	$ 250,000
Division 23 HVAC				
HVAC	1	LS	$ 1,150,000	$ 1,150,000
Division 26 Electrical				
Electrical Work	12%	%	$ 9,262,200	$ 1,111,500
Division 27 Communications				
Division 31 Earthworks				
Excavation	560	CY	$ 4	$ 2,000
Rock Blasting	8,018	CY	$ 20	$ 160,400
Rock Moving	8,018	CY	$ 6	$ 50,300
Stone Sub base	4,149	CY	$ 21	$ 86,000
Backfill and Compact	4,107	CY	$ 4	$ 16,300
Dewatering	8	MO	$ 20,000	$ 160,000
Division 32 Exterior Improvements				
Division 33 Utilities				
Division 40 Process Integration				
Piping and Valves	1	LS	$ 450,000	$ 450,000
Slide Gates	14	EA.	$ 35,000	$ 490,000
Instrumentation/Controls	1	LS	$ 180,000	$ 180,000
Division 41 Material Processing and Handling Equipment				
Conveyors	1	LS	$ 180,000	$ 180,000
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Influent Pumps	3	EA.	$ 120,000	$ 360,000
Division 46 Water and Wastewater Equipment				
Course Screens	2	EA.	$ 215,000	$ 430,000
Fine Screens	3	EA.	$ 115,000	$ 345,000
Grit Removal	2	EA.	$ 95,000	$ 190,000
CONSTRUCTION SUBTOTAL				**$ 13,461,600**
Engineering and Other Associated Project Costs			**18%**	**$ 2,423,088.00**
Contingency			**15%**	**$ 2,019,240.00**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 17,900,000**

City of Portsmouth New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease/Portsmouth Option (7.98 MGD Average Flow)
Electrical Distribution

Electricity

Description	Estimated Power Use	Units	Hours/day	Days/year	kWh/year	Cost per year
Influent Pumps	100	HP	2	365	54436.1	$ 7,076.69
Grit Equipment	2	HP	24	365	13064.664	$ 1,698.41
Course Screens	2	HP	4	365	2177.444	$ 283.07
Fine Screens	3	HP	4	365	3266.166	$ 424.60
Conveyors	3	HP	6	365	4899.249	$ 636.90
Lighting/Miscellaneous	5	HP	24	365	32661.66	$ 4,246.02
Total						$ 14,365.69

Electricity cost based on $ 0.13 per Kwh

Heating/Generator Fuel

Description	Quantity	Units	Unit Cost	Cost per Year
Natural Gas Heating	8000	MBTU	$ 4.00	$ 32,000.00
Total				$ 32,000.00

Operations Labor

Description	Labor	Units	Labor Rate ($/hour)	Cost per Year
Operations	1560	hr./year	$ 43.00	$ 67,080.00
Total				$ 67,080.00

Maintenance Labor

Description	Labor (hours/year)	Units	Labor Rate ($/hour)	Cost per Year
General Maintenance	208	hr./year	$ 43.00	$ 8,944.00
Total				$ 8,944.00

Chemicals

Chemical	Units/day	Units	Unit Cost	Cost per Year
None	0		$ -	$ -
Total				$ -

Parts & Replacement

Description	Replacement Parts	Units	Capital Cost	Replacement Costs
Conveyors	1%	%	$ 180,000.00	$ 1,800.00
Influent Pumps	2%	%	$ 360,000.00	$ 7,200.00
Course Screens	2%	%	$ 430,000.00	$ 8,600.00
Fine Screens	2%	%	$ 345,000.00	$ 6,900.00
Grit Removal	10%	%	$ 190,000.00	$ 19,000.00
Gates and Valves	1%	%	$ 940,000.00	$ 9,400.00
Instruments and Controls	1%	%	$ 180,000.00	$ 1,800.00
Total				$ 54,700.00

Sludge Hauling & Disposal

Description	Quantity	Units	Unit Cost	Annual Cost
Tipping fee- Screenings	520	Tons	$ 67.00	$ 34,840.00
Trucking	3120	Miles	$ 1.40	$ 4,368.00
Total				$ 39,208.00

Other Miscellaneous

Description	Quantity	Units	Unit Cost	Annual Cost
Miscellaneous/Contingency	5%	%	$ 149,217.69	$ 7,460.88
Total				$ 7,460.88

Total $ 223,800.00

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City of Portsmouth New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth Option (7.98 MGD Average Flow)
Primary Clarifiers

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Treatment Facilities				
Division 01 General Requirements				
General Conditions	10%	%	$ 3,642,800	$ 364,300
Bond	1%	%	$ 4,007,100	$ 40,100
Insurance	3%	%	$ 4,047,200	$ 121,400
Profit	5%	%	$ 4,168,600	$ 208,400
Division 02 Existing Conditions				
Miscellaneous/Undefined	10%	%	$ 3,806,900	$ 380,700
Division 03 Concrete				
Concrete Base Slab	842	CY	$ 275	$ 231,600
Concrete Walls	739	CY	$ 718	$ 530,600
Pump Station Slab	364	CY	$ 409	$ 148,900
Pump Station Walls	364	CY	$ 718	$ 261,400
Pump Station Elevated Slab	143	CY	$ 855	$ 122,400
Channels	150	CY	$ 930	$ 139,500
Division 04 Masonry				
Pump Station Stairwell/Electrical Room	1,200	LS	$ 200	$ 240,000
Division 05 Metals				
Miscellaneous Metals	3	EA.	$ 15,000	$ 45,000
Pump Station Metals	1	LS	$ 30,000	$ 30,000
Railings	3	EA.	$ 50,000	$ 150,000
Division 06 Woods, Plastics and Composites				
Grating	3	EA.	$ 20,000	$ 60,000
Division 07 Thermal and Moisture Protection				
Division 08 Openings				
Doors	4	EA.	$ 2,500	$ 10,000
Windows	2	EA.	$ 1,500	$ 3,000
Division 09 Finishes				
Coatings	1	LS	$ 40,000	$ 40,000
Division 10 Specialties				
Division 22 Plumbing				
Plumbing	1	LS	$ 20,000	$ 20,000
Division 23 HVAC				
Heat and Ventilation	1	LS	$ 120,000	$ 120,000
Division 26 Electrical				
Electrical Work	8%	%	$ 3,020,500	$ 241,600
Division 31 Earthworks				
Excavation	1,838	CY	$ 3.57	$ 6,600
Rock Blasting	187	CY	$ 20.00	$ 3,700
Rock Moving	187	CY	$ 6.27	$ 1,200
Stone Sub base	781	CY	$ 20.74	$ 16,200
Backfill and Compact	1,391	CY	$ 3.96	$ 5,500
Dewatering	4	MO	$ 20,000	$ 80,000
Division 32 Exterior Improvements				
Fine Grade and Seed	3,090	SF	$ 4	$ 12,400
Plantings	20	EA.	$ 500	$ 10,000
Division 33 Utilities				
Influent Piping (24 inch)	100	LF	$ 300	$ 30,000
Effluent Piping (24 inch)	50	LF	$ 300	$ 15,000
Buried Sludge Piping (6 inch)	300	LF	$ 180	$ 54,000
Division 40 Process Integration				
Interior Process Piping (4" and 6" scum and Sludge Pumps	1	LS	$ 200,000	$ 200,000
Slide Gates	6	EA.	$ 45,000	$ 270,000
Instrumentation/Control	1	LS	$ 60,000	$ 60,000
Division 41 Material Processing and Handling Equipment				
Miscellaneous Hoists	3	EA.	$ 2,500	$ 7,500
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Sludge Pumps	4	EA.	$ 18,000	$ 72,000
Scum Pumps	2	EA.	$ 12,000	$ 24,000
Division 46 Water and Wastewater Equipment				
Clarifier Mechanisms	3	EA.	$ 146,600	$ 439,800
Troughs and Weirs	3	EA.	$ 35,000	$ 105,000
CONSTRUCTION SUBTOTAL				**$ 4,921,800**
Engineering and Other Associated Project Costs			**18%**	**$ 885,924**
Contingency			**15%**	**$ 738,270**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 6,550,000**

City of Portsmouth New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease/Portsmouth Option (7.98 MGD Average Flow)
Primary Clarifier

Electricity

Description	Estimated Power Use	Units	Hours/day	Days/year	kWh/year	Cost per year
Drives	3	HP	24	365	19596.996	$ 2,547.61
Scum Pumps	10	HP	4	365	10887.22	$ 1,415.34
Sludge Pumps	10	HP	6	365	16330.83	$ 2,123.01
Lighting/Miscellaneous	2	HP	24	365	13064.664	$ 1,698.41
Total						$ 7,784.36

Electricity cost based on $ 0.13 per Kwh

Heating/Generator Fuel

Description	Quantity	Units	Unit Cost	Cost per Year
Natural Gas Heating	800	MBTU	$ 4.00	$ 3,200.00
Total				$ 3,200.00

Operations Labor

Description	Labor	Units	Labor Rate ($/hour)	Cost per Year
Operations	520	hr./year	$ 43.00	$ 22,360.00
Total				$ 22,360.00

Maintenance Labor

Description	Labor (hours/year)	Units	Labor Rate ($/hour)	Cost per Year
General Maintenance	208	hr./year	$ 43.00	$ 8,944.00
Total				$ 8,944.00

Chemicals

Chemical	Units/day	Units	Unit Cost	Cost per Year
None	0		$ -	$ -
Total				$ -

Parts & Replacement

Description	Replacement Parts	Units	Capital Cost	Replacement Costs
Slide Gates	1%	%	$ 270,000.00	$ 2,700.00
Drive/Collector	2%	%	$ 439,800.00	$ 8,796.00
Scum Pumps	10%	%	$ 24,000.00	$ 2,400.00
Sludge Pumps	10%	%	$ 72,000.00	$ 7,200.00
Instruments and Controls	1%	%	$ 60,000.00	$ 600.00
Total				$ 21,696.00

Sludge Hauling & Disposal

Description	Quantity	Units	Unit Cost	Annual Cost
Tipping fee- Screenings	0	Tons	$ 67.00	$ -
Trucking	0	Miles	$ 1.40	$ -
Total				$ -

Other Miscellaneous

Description	Quantity	Units	Unit Cost	Annual Cost
Miscellaneous/Contingency	5%	%	$ 41,624.36	$ 2,081.22
Total				$ 2,081.22

Total $ 66,100.00

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City of Portsmouth New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth Option (7.98 MGD Average Flow)
Biological Reactor Tanks

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Treatment Facilities				
Division 01 General Requirements				
General Conditions	10%	%	$ 10,804,100	$ 1,080,400
Bond	1%	%	$ 11,884,500	$ 118,800
Insurance	3%	%	$ 12,003,300	$ 360,100
Profit	5%	%	$ 12,363,400	$ 618,200
Division 02 Existing Conditions				
Miscellaneous/Undefined	10%	%	$ 10,256,400	$ 1,025,600
Division 03 Concrete				
Concrete Base Slab	4,625	CY	$ 356	$ 1,646,500
Concrete Walls	3,679	CY	$ 585	$ 2,152,200
Elevated Walkways	307	CY	$ 855	$ 262,800
Concrete Stairs	112	CY	$ 1,250	$ 140,000
Division 04 Masonry				
Blower Building (built on Secondary Pump Station)	2,500	SF	$ 250	$ 625,000
Division 05 Metals				
Miscellaneous Metals	4	EA.	$ 45,000	$ 180,000
Railings	2,189	LF	$ 135	$ 295,500
Division 06 Woods, Plastics and Composites				
Division 07 Thermal and Moisture Protection				
Division 08 Openings				
Division 09 Finishes				
Coatings	1	LS	$ 15,000	$ 15,000
Division 10 Specialties				
Division 22 Plumbing				
Plumbing	1	LS	$ 50,000	$ 50,000
Division 23 HVAC				
Heat and Ventilation	1	LS	$ 120,000	$ 120,000
Division 26 Electrical				
Electrical Work	12%	%	$ 8,730,800	$ 1,047,700
Division 27 Communications				
Division 31 Earthworks				
Excavation	12,521	CY	$ 3.57	$ 44,700
Rock Blasting	15,874	CY	$ 20.00	$ 317,500
Rock Moving	15,874	CY	$ 6.27	$ 99,500
Stone Sub base	2,506	CY	$ 20.74	$ 52,000
Backfill and Compact	5,980	CY	$ 3.96	$ 23,700
Dewatering	10	MO	$ 20,000.00	$ 200,000
Place and Compact Berm	33,067	CY	$ 2.50	$ 82,700
Dispose of Excess Spoil	1,770	CY	$ 18.00	$ 31,900
Division 32 Exterior Improvements				
Fine Grade and Seed	11,065	SF	$ 4	$ 44,300
Division 33 Utilities				
Division 40 Process Integration				
Process Piping	1	LS	$ 650,000	$ 650,000
Instrumentation and Controls	1	LS	$ 250,000	$ 250,000
Air Control Valves/Meters	24	EA.	$ 25,000	$ 600,000
Division 41 Material Processing and Handling Equipment				
Miscellaneous Hoists	3	EA.	$ 2,500	$ 7,500
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Blowers	4	EA.	$ 175,000	$ 700,000
Submersible IMLR Pumps	4	EA.	$ 35,000	$ 140,000
Division 46 Water and Wastewater Equipment				
Diffusers	5,000	EA.	$ 60	$ 297,900
Submersible Mixers	12	EA.	$ 15,000	$ 180,000
SUBTOTAL				
CONSTRUCTION SUBTOTAL				**$ 13,459,500**
Engineering and Other Associated Project Costs			**18%**	**$ 2,422,710.00**
Contingency			**15%**	**$ 2,018,925.00**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 17,900,000**

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City of Portsmouth New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease/Portsmouth Option (7.98 MGD Average Flow)
Biological Reactors

Electricity

Description	Estimated Power Use	Units	Hours/day	Days/year	kWh/year	Cost per year
Blowers	500	HP	24	365	3,266,166.00	$ 424,601.58
IMLR	40	HP	24	365	261,293.28	$ 33,968.13
Miters	80	HP	24	365	522,586.56	$ 67,936.25
					-	$ -
Lighting/Miscellaneous	5	HP	24	365	32,661.66	$ 4,246.02
Total						$ 530,751.98

Electricity cost based on $ 0.13 per Kwh

Heating/Generator Fuel

Description	Quantity	Units	Unit Cost	Cost per Year
Natural Gas Heating	1000	MBTU	$ 4.00	$ 4,000.00
Total				$ 4,000.00

Operations Labor

Description	Labor	Units	Labor Rate ($/hour)	Cost per Year
Operations	1040	hr./year	$ 43.00	$ 44,720.00
Total				$ 44,720.00

Maintenance Labor

Description	Labor (hours/year)	Units	Labor Rate ($/hour)	Cost per Year
General Maintenance	416	hr./year	$ 43.00	$ 17,888.00
Total				$ 17,888.00

Chemicals

Chemical	Units/day	Units	Unit Cost	Cost per Year
None	0		$ -	$ -
Total				$ -

Parts & Replacement

Description	Replacement Parts	Units	Capital Cost	Replacement Costs
Air Valves	2%	%	$ 600,000.00	$ 12,000.00
Blowers	2%	%	$ 700,000.00	$ 14,000.00
IMLR Pumps	2%	%	$ 140,000.00	$ 60,000.00
Diffusers	2%	%	$ 297,900.00	
Mixers	2%	%	$ 180,000.00	$ 3,600.00
Instruments and Controls	2%	%	$ 250,000.00	$ 5,000.00
Total				$ 94,600.00

Sludge Hauling & Disposal

Description	Quantity	Units	Unit Cost	Annual Cost
Tipping fee- Screenings	0	Tons	$ 67.00	$ -
Trucking	0	Miles	$ 1.40	$ -
Total				$ -

Other Miscellaneous

Description	Quantity	Units	Unit Cost	Annual Cost
Miscellaneous/Contingency	5%	%	$ 647,239.98	$ 32,362.00
Total				$ 32,362.00

Total $ 724,400.00

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City of Portsmouth New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth Option (7.98 MGD Average Flow)
Secondary Clarifiers

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Treatment Facilities				
Division 01 General Requirements				
General Conditions	10%	%	$ 8,215,200	$ 821,500
Bond	1%	%	$ 9,036,700	$ 90,400
Insurance	3%	%	$ 9,127,100	$ 273,800
Profit	5%	%	$ 9,400,900	$ 470,000
Division 02 Existing Conditions				
Miscellaneous/Undefined	10%	%	$ 8,050,900	$ 805,100
Division 03 Concrete				
Splitter Box	100	CY	$ 855	$ 85,500
Concrete Base Slab	2,294	CY	$ 275	$ 630,900
Concrete Walls	1,837	CY	$ 718	$ 1,319,000
Pump Station Slab	937	CY	$ 275	$ 257,700
Pump Station Walls	937	CY	$ 650	$ 609,100
Pump Station Elevated Slab	234	CY	$ 855	$ 199,900
Elevated Walkways	128	CY	$ 855	$ 109,000
Division 04 Masonry				
Pump Station Stairwell/Electrical Room	1	LS	$ 30,000	$ 30,000
Division 05 Metals				
Miscellaneous Metals	4	EA.	$ 15,000	$ 60,000
Pump Station Metals	1	LS	$ 150,000	$ 150,000
Railings	4	EA.	$ 50,000	$ 200,000
Splitter weirs	4	EA.	$ 10,000	$ 40,000
Division 06 Woods, Plastics and Composites				
Grating	4	EA.	$ 20,000	$ 80,000
Division 07 Thermal and Moisture Protection				
Above Grade Building (Electric and stair)	900		$ 225	$ 202,500
Division 08 Openings				
Division 09 Finishes				
Coatings	1	LS	$ 35,000	$ 35,000
Division 10 Specialties				
Division 22 Plumbing				
Plumbing	1	LS	$ 150,000	$ 150,000
Division 23 HVAC				
Heat and Ventilation	1	LS	$ 500,000	$ 500,000
Division 26 Electrical				
Electrical Work	12%	%	$ 6,616,200	$ 793,900
Division 27 Communications				
Division 31 Earthworks				
Excavation	2,161	CY	$ 4	$ 7,700
Rock Blasting	7,028	CY	$ 20	$ 140,600
Rock Moving	7,028	CY	$ 6	$ 44,100
Stone Sub base	1,044	CY	$ 21	$ 21,700
Backfill and Compact	3,922	CY	$ 4	$ 15,500
Dewatering	6	MO	$ 20,000	$ 120,000
Division 32 Exterior Improvements				
Fine Grade and Seed	5,120	SF	$ 4	$ 20,500
Division 33 Utilities				
RAS Main	300	LF	$ 225	$ 67,500
Feed Piping	100	LF	$ 400	$ 40,000
Division 40 Process Integration				
Process Piping	1	LS	$ 750,000	$ 750,000
Gates	8	EA.	$ 25,000	$ 200,000
WAS Control Valve and Meter	4	EA.	$ 20,000	$ 80,000
Controls and Instrumentation	1	EA.	$ 80,000	$ 80,000
Division 41 Material Processing and Handling Equipment				
Miscellaneous Hoists	4	EA.	$ 25,000	$ 100,000
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
RAS Pumps	6	EA.	$ 35,000	$ 210,000
Scum Pumps	4	EA.	$ 15,000	$ 60,000
Division 46 Water and Wastewater Equipment				
Mechanisms	4	EA.	$ 125,200	$ 500,800
Troughs and Weirs	4	EA.	$ 35,000	$ 140,000
SUBTOTAL				
CONSTRUCTION SUBTOTAL				**$ 10,511,700**
Engineering and Other Associated Project Costs			**18%**	**$ 1,892,106.00**
Contingency			**15%**	**$ 1,576,755.00**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 13,980,000**

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City of Portsmouth New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease/Portsmouth Option (7.98 MGD Average Flow)
Secondary Clarifier

Electricity

Description	Estimated Power Use	Units	Hours/day	Days/year	kWh/year	Cost per year
Drives	3	HP	24	365	19596.996	$ 2,547.61
Scum Pumps	10	HP	4	365	10887.22	$ 1,415.34
RAS Pumps	20	HP	24	365	130646.64	$ 16,984.06
Lighting/Miscellaneous	2	HP	24	365	13064.664	$ 1,698.41
Total						$ 22,645.42

Electricity cost based on $ 0.13 per Kwh

Heating/Generator Fuel

Description	Quantity	Units	Unit Cost	Cost per Year
Natural Gas Heating	1000	MBTU	$ 4.00	$ 4,000.00
Total				$ 4,000.00

Operations Labor

Description	Labor	Units	Labor Rate ($/hour)	Cost per Year
Operations	1040	hr./year	$ 43.00	$ 44,720.00
Total				$ 44,720.00

Maintenance Labor

Description	Labor (hours/year)	Units	Labor Rate ($/hour)	Cost per Year
General Maintenance	208	hr./year	$ 43.00	$ 8,944.00
Total				$ 8,944.00

Chemicals

Chemical	Units/day	Units	Unit Cost	Cost per Year
None	0		$ -	$ -
Total				$ -

Parts & Replacement

Description	Replacement Parts	Units	Capital Cost	Replacement Costs
Slide Gates	1%	%	$ 200,000.00	$ 2,000.00
Drive/Collector	2%	%	$ 500,800.00	$ 10,016.00
Scum Pumps	10%	%	$ 60,000.00	$ 60,000.00
RAS Pumps	2%	%	$ 210,000.00	$ 4,200.00
Instruments and Controls	1%	%	$ 160,000.00	$ 1,600.00
Total				$ 77,816.00

Sludge Hauling & Disposal

Description	Quantity	Units	Unit Cost	Annual Cost
Tipping fee- Screenings	0	Tons	$ 67.00	$ -
Trucking	0	Miles	$ 1.40	$ -
Total				$ -

Other Miscellaneous

Description	Quantity	Units	Unit Cost	Annual Cost
Miscellaneous/Contingency	5%	%	$ 113,405.42	$ 5,670.27
Total				$ 5,670.27

Total $ 163,800.00

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City of Portsmouth New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth Option (7.98 MGD Average Flow)
Denitrification Filters(including Methanol Storage)

DESCRIPTION	QTY.	UNIT	UNIT COST	TOTAL
			OPINION OF PROBABLE CONSTRUCTION COST	
Pease WWTF Treatment Facilities				
Division 01 General Requirements				
General Conditions	10%	%	$ 9,126,100	$ 912,600
Bond	1%	%	$ 10,038,700	$ 100,400
Insurance	3%	%	$ 10,139,100	$ 304,200
Profit	5%	%	$ 10,443,300	$ 522,200
Division 02 Existing Conditions				
Miscellaneous/Undefined	20%	%	$ 8,227,922	$ 1,645,600
Division 03 Concrete				
Concrete Base Slab	908	CY	$ 275	$ 249,700
Concrete Walls	1,690	CY	$ 718	$ 1,213,400
Elevated Slabs	374	CY	$ 855	$ 320,000
Elevated Walkways/Channels	220	CY	$ 855	$ 188,100
Division 04 Masonry				
Division 05 Metals				
Miscellaneous Metals	3	EA.	$15,000	$ 45,000
Pump Station Metals	1	LS	$30,000	$ 30,000
Railings	3	EA.	$50,000	$ 150,000
				$ -
Division 06 Woods, Plastics and Composites				$ -
Grating	3	EA.	$20,000	$ 60,000
				$ -
Division 07 Thermal and Moisture Protection				$ -
Methanol Building	1,200	SF	$350	$ 420,000
Filter Above Grade Building	1,400	SF	$350	$ 490,000
Division 08 Openings				
Division 09 Finishes				
Coatings	1	LS	$15,000	$ 15,000
Division 10 Specialties				
Division 22 Plumbing				
Methanol Plumbing (Includes Foam Fire Suppression)	1	LS	$350,000	$ 350,000
Filter Plumbing	1	LS	$200,000	$ 200,000
Division 23 HVAC				
Heat and Ventilation Methanol	1	LS	$170,000	$ 170,000
Heat and Ventilation Filter	1	LS	$285,000	$ 285,000
Division 26 Electrical				
Electrical Work	18%	%	$ 5,661,400	$ 1,019,100
Division 27 Communications				
Division 31 Earthworks				
Excavation	872	CY	$ 4	$ 3,100
Rock Blasting	3,260	CY	$ 20	$ 65,200
Rock Moving	3,260	CY	$ 6	$ 20,400
Stone Sub base	414	CY	$ 21	$ 8,600
Backfill and Compact	2,285	CY	$ 8	$ 18,300
Dewatering	6	MO	$ 20,000	$ 120,000
Division 32 Exterior Improvements				
Fine Grade and Seed	2,400	SF	$ 4	$ 9,600
Division 33 Utilities				
Influent Piping	200	LF	$ 350	$ 70,000
Effluent Piping	100	LF	$ 350	$ 35,000
Wastewater Sewer	250	LF	$ 500	$ 125,000
Division 40 Process Integration				
Methanol Piping	1	LS	$ 100,000	$ 100,000
Filter Piping	1	LS	$ 600,000	$ 600,000
Division 41 Material Processing and Handling Equipment				
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Methanol Tanks	2	EA.	$ 150,000	$ 300,000
Division 46 Water and Wastewater Equipment				
Filter Equipment	4	EA.	$ 200,000	$ 800,000
SUBTOTAL				
			CONSTRUCTION SUBTOTAL	**$ 10,965,500**
			Engineering and Other Associated Project Costs 18%	**$ 1,973,790.00**
			Contingency 15%	**$ 1,644,825.00**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 14,580,000**

City of Portsmouth New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease/Portsmouth Option (7.98 MGD Average Flow)
Denitrification Filter

Electricity

Description	Estimated Power Use	Units	Hours/day	Days/year	kWh/year	Cost per year
Backwash Pumps	60	HP	1	365	16,331	$ 2,123.01
Chemical Feed Pumps	2	HP	24	365	13,065	$ 1,698.41
Lighting/Miscellaneous	2	HP	24	365	13,065	$ 1,698.41
Total						$ 5,519.82

Electricity cost based on $ 0.13 per Kwh

Heating/Generator Fuel

Description	Quantity	Units	Unit Cost	Cost per Year
Natural Gas Heating	1600	MBTU	$ 4.00	$ 6,400.00
Total				$ 6,400.00

Operations Labor

Description	Labor	Units	Labor Rate ($/hour)	Cost per Year
Operations	520	hr./year	$ 43.00	$ 22,360.00
Total				$ 22,360.00

Maintenance Labor

Description	Labor (hours/year)	Units	Labor Rate ($/hour)	Cost per Year
General Maintenance	208	hr./year	$ 43.00	$ 8,944.00
Total				$ 8,944.00

Chemicals

Chemical	Units/day	Units	Unit Cost	Cost per Year
Methanol	700	gal	$ 1.50	$ 383,250.00
Total				$ 383,250.00

Parts & Replacement

Description	Replacement Parts	Units	Capital Cost	Replacement Costs
Blowers	2%	%	$ 150,000.00	$ 3,000.00
Backwash Pumps	10%	%	$ 110,000.00	$ 11,000.00
Gates and Valves	1%	%	$ 120,000.00	$ 1,200.00
Instruments and Controls	1%	%	$ 80,000.00	$ 800.00
Total				$ 16,000.00

Sludge Hauling & Disposal

Description	Quantity	Units	Unit Cost	Annual Cost
				$ -
				$ -
Total				$ -

Other Miscellaneous

Description	Quantity	Units	Unit Cost	Annual Cost
Miscellaneous/Contingency	5%	%	$ 420,113.82	$ 21,005.69
Total				$ 21,005.69

Total $ 463,500.00

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City of Portsmouth New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth Option (7.98 MGD Average Flow)
Effluent Pump Station and Disinfection

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Treatment Facilities				
Division 01 General Requirements				
General Conditions	10%	%	$ 4,229,500	$ 423,000
Bond	1%	%	$ 4,652,500	$ 46,500
Insurance	3%	%	$ 4,699,000	$ 141,000
Profit	5%	%	$ 4,840,000	$ 242,000
Division 02 Existing Conditions				
Miscellaneous/Undefined	10%	%	$ 3,845,000	$ 384,500
Division 03 Concrete				
Pump Station Slab	119	CY	$ 409	$ 48,500
Pump Station Walls	444	CY	$ 718	$ 319,100
Pump Station Elevated Slab	74	CY	$ 855	$ 63,300
Miscellaneous Fill	150	CY	$ 930	$ 139,500
Precast De-chlorination & Sampling Structure	1	LS	$ 120,000	$ 120,000
Division 04 Masonry				
Division 05 Metals				
Miscellaneous Metals	3	EA.	$ 15,000	$ 45,000
Pump Station Metals	1	LS	$ 30,000	$ 30,000
Railings	3	EA.	$ 50,000	$ 150,000
Division 06 Woods, Plastics and Composites				
Grating	3	EA.	$ 20,000	$ 60,000
Division 07 Thermal and Moisture Protection				
Hypochlorite Building	1,800	SF	$ 425	$ 765,000
De-chlorination Building	300	SF	$ 425	$ 127,500
Division 08 Openings				
Division 09 Finishes				
Coatings	1	LS	$ 15,000	$ 15,000
Division 10 Specialties				
Division 22 Plumbing				
Plumbing	1	LS	$ 50,000	$ 50,000
Division 23 HVAC				
Heat and Ventilation	1	LS	$ 250,000	$ 250,000
Division 26 Electrical				
Electrical Work	12%	%	$ 3,200,900	$ 384,100
Division 27 Communications				
Division 31 Earthworks				
Excavation	218	CY	$ 3.57	$ 800
Rock Blasting	2,730	CY	$ 20.00	$ 54,600
Rock Moving	2,730	CY	$ 6.27	$ 17,100
Stone Sub base	101	CY	$ 20.74	$ 2,100
Backfill and Compact	270	CY	$ 3.96	$ 1,100
Dewatering	4	MO	$ 20,000	$ 80,000
De-chlorination Excavation and Backfill	125	CY	$ 220	$ 27,500
De-chlorination Dewatering	2	MO	$ 40,000	$ 80,000
Division 32 Exterior Improvements				
Fine Grade and Seed	2,400	SF	$ 2	$ 4,800
Division 33 Utilities				
Influent Pipe	200	LF	$ 450	$ 90,000
Division 40 Process Integration				
Interior Piping	1	LS	$ 200,000	$ 200,000
Gates and Valves	1	LS	$ 120,000	$ 120,000
Chemical Feed Piping	1	LS	$ 60,000	$ 60,000
Pipe for Effluent Pumps	1	LS	$ 150,000	$ 150,000
Controls and Integration	1	LS	$ 80,000	$ 80,000
Division 41 Material Processing and Handling Equipment				
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Hypochlorite Storage Tanks	2	EA.	$ 25,000	$ 50,000
Division 46 Water and Wastewater Equipment				
Effluent Pumps	3	EA.	$ 50,000	$ 150,000
Hypochlorite Feed Skid	1	LS	$ 80,000	$ 80,000
De-chlorination Skid	1	LS	$ 30,000	$ 30,000
SUBTOTAL				
CONSTRUCTION SUBTOTAL				**$ 5,082,000**
Engineering and Other Associated Project Costs			**18%**	**$ 914,760.00**
Contingency			**15%**	**$ 762,300.00**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 6,760,000**

City of Portsmouth New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease/Portsmouth Option (7.98 MGD Average Flow)
Effluent Pump Station

Electricity

Description	Estimated Power Use	Units	Hours/day	Days/year	kWh/year	Cost per year
Effluent Pumps	100	HP	4	365	108,872	$ 14,153.39
Chemical Feed Pumps	2	HP	24	365	13,065	$ 1,698.41
Lighting/Miscellaneous	2	HP	24	365	13,065	$ 1,698.41
Total						$ 17,550.20

Electricity cost based on $ 0.13 per Kwh

Heating/Generator Fuel

Description	Quantity	Units	Unit Cost	Cost per Year
Natural Gas Heating	1200	MBTU	$ 4.00	$ 4,800.00
Total				$ 4,800.00

Operations Labor

Description	Labor	Units	Labor Rate ($/hour)	Cost per Year
Operations	520	hr./year	$ 43.00	$ 22,360.00
Total				$ 22,360.00

Maintenance Labor

Description	Labor (hours/year)	Units	Labor Rate ($/hour)	Cost per Year
General Maintenance	208	hr./year	$ 43.00	$ 8,944.00
Total				$ 8,944.00

Chemicals

Chemical	Units/day	Units	Unit Cost	Cost per Year
Sodium Hypochlorite	416.4	gal	$ 0.65	$ 98,790.90
Sodium Bisulfite	130.8	gal	1.38	$ 65,883.96
Total				$ 164,674.86

Parts & Replacement

Description	Replacement Parts	Units	Capital Cost	Replacement Costs
Effluent Pumps	2%	%	$ 150,000.00	$ 3,000.00
Chemical Skids	10%	%	$ 110,000.00	$ 11,000.00
Gates and Valves	1%	%	$ 120,000.00	$ 1,200.00
Instruments and Controls	1%	%	$ 80,000.00	$ 800.00
Total				$ 16,000.00

Sludge Hauling & Disposal

Description	Quantity	Units	Unit Cost	Annual Cost
				$ -
				$ -
Total				$ -

Other Miscellaneous

Description	Quantity	Units	Unit Cost	Annual Cost
Miscellaneous/Contingency	5%	%	$ 211,969.06	$ 10,598.45
Total				$ 10,598.45

Total $ 245,000.00

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth Option (7.98 MGD Average Flow)
Solids Thickening, Digestion and Digester Heating, Solids Dewatering Without Imported Solids Option

DESCRIPTION	UNITS		MATERIALS		LABOR/EQUIPMENT		TOTAL COST
	Quantity	Units	Unit $	Materials Cost	Unit $	Labor Cost	
Soft Costs							
Division 1							$ 1,528,000
Soft Costs							**$1,528,000**
Site Civil							
Site Work							
Excavation	100	CY	$ -	$ -	$ 50	$ 5,000	$ 5,000
Backfill	50	CY	$ -	$ -	$ 50	$ 2,500	$ 2,500
Digesters, Thickening, and Dewatering Building	4,800	SF	$ 175	$ 840,000	$ 175	$ 840,000	$ 1,680,000
Gravity Thickeners mechanism, cover and miscellaneous impro	2	EA.	$ 400,000	$ 800,000	$ 150,000	$ 300,000	$ 1,100,000
Concrete							
Concrete work to fill in SBR corners	1	LS	$ 900,000	$ 900,000	$ -	$ -	$ 900,000
Modification to EQ Tanks and Intermediate Pump Station	1	LS	$ 500,000	$ 500,000	$ -	$ -	$ 500,000
Boiler and Heat Exchanger Building	1000	SF	$ 300	$ 300,000		$ -	$ 300,000
Site Civil							**$4,488,000**
Process / Mechanical							
Major Equipment							
Rotary Drum Thickeners	1	EA.	$ 287,000	$ 287,000	$ 143,500	$ 143,500	$ 431,000
Dewatering Screw Press	2	EA.	$ 443,700	$ 887,400	$ 221,850	$ 443,700	$ 1,332,000
Modification of Existing SBRs to convert to Digesters	1	LS	$ 150,000	$ 150,000	$ -	$ -	$ 150,000
Digester Fixed Steel Covers (2 - 1 per tank)	2	EA.	$ 397,500	$ 795,000	$ 198,750	$ 397,500	$ 1,193,000
Digester Top Mounted Linear Motion Mixers (6 - 3 per tank)	2	EA.	$ 299,600	$ 599,200	$ 149,800	$ 299,600	$ 899,000
Combination Digester HW Heating Boiler and HEX (1.5 mmBtu/	2	EA.	$ 160,000	$ 320,000	$80,000	$ 160,000	$ 480,000
Redundant Digester Heating Boiler	1	EA.	$ 130,000	$ 130,000	$65,000	$ 65,000	$ 195,000
HW Circulation Pumps	2	EA.	$ 5,000	$ 10,000	$2,500	$ 5,000	$ 15,000
Ancillary Boiler Equipment (Deaerator, Water Conditioning, etc.	1	LS	$ 50,000	$ 50,000	$0	$ -	$ 50,000
Flare System	1	EA.	$ 20,000	$ 20,000	$ 10,000	$ 10,000	$ 30,000
Digester Gas Compressors	3	EA.	$ 10,000	$ 30,000	$ 5,000	$ 15,000	$ 45,000
Condensate Traps and Biogas Moisture Removal System	1	LS	$ 50,000	$ 50,000	$ -	$ -	$ 50,000
Flame Arrestor and PRV assemblies	2	EA.	$ 10,000	$ 20,000	$ 5,000	$ 10,000	$ 30,000
Piping Systems							
Thickened Primary Sludge (TPS) Pumps to EQ Tanks	3	EA.	$ 10,000	$ 30,000	$ 5,000	$ 15,000	$ 45,000
TPS Piping to EQ Tanks	150	LF	$ 60	$ 9,000	$ 30	$ 4,500	$ 14,000
TWAS Pumps to EQ Tanks			$ -	$ -	$ -	$ -	$ -
TWAS Piping to EQ Tanks	100	LF	$ 60	$ 6,000	$ 30	$ 3,000	$ 9,000
EQ Tanks to Intermediate Pump Station Piping	100	LF	$ 60	$ 6,000	$ 30	$ 3,000	$ 9,000
Digester Feed Pumps	3	EA.	$ 15,000	$ 45,000	$ 7,500	$ 22,500	$ 68,000
Digester Feed Piping	400	LF	$ -	$ -	$ -	$ -	$ -
Digester Recirculation/Mixing Pumps	3	EA.	$ 10,000	$ 30,000	$ 5,000	$ 15,000	$ 45,000
Digester Recirculation/Mixing Piping	100	LF	$ 60	$ 6,000	$ 30	$ 3,000	$ 9,000
Digester Draw Pumps	3	EA.	$ -	$ -	$ -	$ -	$ -
Digester Draw Piping	100	LF	$ 60	$ 6,000	$ 30	$ 3,000	$ 9,000
Biogas Piping to Boilers	200	LF	$ 90	$ 18,000	$ 45	$ 9,000	$ 27,000
Process Mechanical Sub-Total							**$5,135,000**
ELECTRICAL							
							$ 770,250
Electrical Sub-Total							**$ 771,000**
INSTRUMENTATION AND CONTROLS							
							$ 513,500
Instrumentation and Controls Sub-Total							**$ 514,000**
Capital Cost Subtotal							**$12,436,000**
						Construction Contingency	$ 1,865,000
						Engineering and Associated Project Costs	$ 2,238,000
						Contractor's Overhead and Profit (5%)	$ 622,000
						Engineer's Opinion of Probable Construction Cost	**$17,161,000**

City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease/Portsmouth Option (7.98 MGD Average Flow)

Solids Handling and Digestion Operations and Maintenance, No Digestion

DESCRIPTION	UNITS		ANNUAL COST	
	Quantity	Units	Unit $	Total Cost
Septage Receiving Station				
Electricity	-	kWh	$0.10	$ -
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	-	HR	$43	$ -
Maintenance Labor	-	HR	$43	$ -
Chemicals	-	LB		$ -
Parts and Replacement	-	LS	$2,000	$ -
Sludge Hauling and Disposal	-	dry ton		
Septage Receiving Operation and Maintenance Sub-Total				**$0**
FOG Receiving Station				
Electricity	-	kWh	$0.10	$ -
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	-	HR	$43	$ -
Maintenance Labor	-	HR	$43	$ -
Chemicals	-	LB		$ -
Parts and Replacement	-	LS	$2,000	$ -
Sludge Hauling and Disposal	-	Wet Ton		
FOG Receiving Operation and Maintenance Sub-Total				**$0**
Cake Receiving Station				
Electricity	-	kWh	$0.10	$ -
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	-	HR	$43	$ -
Maintenance Labor	-	HR	$43	$ -
Chemicals	-	LB		$ -
Parts and Replacement	-	LS	$6,000	$ -
Sludge Hauling and Disposal	-	dry ton		
Cake Receiving Operation and Maintenance Sub-Total				**$0**
Primary Sludge Thickening (Gravity Thickeners)				
Electricity	156,839	kWh	$0.10	$ 16,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals	-	LB		$ -
Parts and Replacement	1	LS	$2,000	$ 2,000
Sludge Hauling and Disposal	-	dry ton		
PS Thickening Operation and Maintenance Sub-Total				**$29,000**
WAS Thickening (RDTs)				
Electricity	178,690	kWh	$0.10	$ 18,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	365	HR	$43	$ 16,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals (Polymer)	8,770	LB	$1.5	$ 14,000
Parts and Replacement	1	LS	$5,000	$ 5,000
Sludge Hauling and Disposal	-	dry ton		
WAS Thickening Operation and Maintenance Sub-Total				**$56,000**
ANAEROBIC DIGESTERS				
Electricity	-	kWh	$0.10	$ -
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	-	HR	$43	$ -
Maintenance Labor	-	HR	$43	$ -
Chemicals	-	LB	$2	$ -
Parts and Replacement	-	LS	$2,500	$ -
Sludge Hauling and Disposal	-	dry ton		$ -
Digesters Operation and Maintenance Sub-Total				**$0**
DIGESTER HEATING BOILERS				
Electricity	-	kWh	$0.10	$ -
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	-	HR	$43	$ -
Maintenance Labor	-	HR	$43	$ -
Chemicals		LB		$ -
Parts and Replacement	-	LS	$200	$ -
Sludge Hauling and Disposal	-	dry ton		$ -
Boilers Operation and Maintenance Sub-Total				**$0**
DIGESTED SLUDGE DEWATERING (Screw Press)				
Electricity	85,106	kWh	$0.10	$ 9,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	1,460	HR	$43	$ 63,000
Maintenance Labor	365	HR	$43	$ 16,000
Chemicals (Polymer)	64,047	LB	$1.5	$ 97,000
Parts and Replacement	1	LS	$5,000	$ 5,000
Sludge Hauling and Disposal		dry ton		$ -
Dewatering Operation and Maintenance Sub-Total				**$190,000**
DEWATERED CAKE DISPOSAL				
Sludge Hauling and Disposal	3,202	dry ton	$70	$ 225,000
Sludge Hauling and Disposal Sub-Total				**$225,000**
			Miscellaneous /Contingency	$ 45,000
Engineer's Opinion of Probable O&M Cost per Year				**$545,000**

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth Option (7.98 MGD Average Flow)
Digestion of Plant Generated Solids Only

DESCRIPTION	UNITS		ANNUAL COST	
	Quantity	Units	Unit $	Total Cost
Septage Receiving Station				
Electricity	-	kWh	$0.10	$ -
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	-	HR	$43	$ -
Maintenance Labor	-	HR	$43	$ -
Chemicals	-	LB		$ -
Parts and Replacement	-	LS	$2,000	$ -
Sludge Hauling and Disposal	-	dry ton		
Septage Receiving Operation and Maintenance Sub-Total				**$0**
FOG Receiving Station				
Electricity	-	kWh	$0.10	$ -
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	-	HR	$43	$ -
Maintenance Labor	-	HR	$43	$ -
Chemicals	-	LB		$ -
Parts and Replacement	-	LS	$2,000	$ -
Sludge Hauling and Disposal	-	Wet Ton		
FOG Receiving Operation and Maintenance Sub-Total				**$0**
Cake Receiving Station				
Electricity	-	kWh	$0.10	$ -
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	-	HR	$43	$ -
Maintenance Labor	-	HR	$43	$ -
Chemicals	-	LB		$ -
Parts and Replacement	-	LS	$6,000	$ -
Sludge Hauling and Disposal	-	dry ton		
Cake Receiving Operation and Maintenance Sub-Total				**$0**
Primary Sludge Thickening (Gravity Thickeners)				
Electricity	156,839	kWh	$0.10	$ 16,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals	-	LB		$ -
Parts and Replacement	1	LS	$2,000	$ 2,000
Sludge Hauling and Disposal	-	dry ton		
PS Thickening Operation and Maintenance Sub-Total				**$29,000**
WAS Thickening (RDTs)				
Electricity	178,690	kWh	$0.10	$ 18,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	365	HR	$43	$ 16,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals (Polymer)	8,770	LB	$1.5	$ 14,000
Parts and Replacement	1	LS	$5,000	$ 5,000
Sludge Hauling and Disposal	-	dry ton		
WAS Thickening Operation and Maintenance Sub-Total				**$56,000**
ANAEROBIC DIGESTERS				
Electricity	490,122	kWh	$0.10	$ 50,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	4,380	HR	$43	$ 189,000
Maintenance Labor	1,460	HR	$43	$ 63,000
Chemicals	-	LB	$2	$ -
Parts and Replacement	1	LS	$2,500	$ 3,000
Sludge Hauling and Disposal	-	dry ton		$ -
Digesters Operation and Maintenance Sub-Total				**$305,000**
DIGESTER HEATING BOILERS				
Electricity	22,100	kWh	$0.10	$ 3,000
Heating/Generator Fuel	1,971	mmBtu	$6	$ 12,000
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals		LB		$ -
Parts and Replacement	1	LS	$200	$ 1,000
Sludge Hauling and Disposal	-	dry ton		$ -
Boilers Operation and Maintenance Sub-Total				**$27,000**
DIGESTED SLUDGE DEWATERING (Screw Press)				
Electricity	54,899	kWh	$0.10	$ 6,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	1,460	HR	$43	$ 63,000
Maintenance Labor	365	HR	$43	$ 16,000
Chemicals (Polymer)	41,314	LB	$1.5	$ 62,000
Parts and Replacement	1	LS	$5,000	$ 5,000
Sludge Hauling and Disposal		dry ton		$ -
Dewatering Operation and Maintenance Sub-Total				**$152,000**
DEWATERED CAKE DISPOSAL				
Sludge Hauling and Disposal	2,066	dry ton	$70	$ 145,000
Sludge Hauling and Disposal Sub-Total				**$145,000**
			Miscellaneous /Contingency	$ 64,000
Engineer's Opinion of Probable O&M Cost per Year				**$778,000**

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City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease/Portsmouth Option (7.98 MGD Average Flow)
Adding Combined Heat & Power to Biogas from Digesting only Plant Solids

DESCRIPTION	UNITS		MATERIALS		LABOR/EQUIPMEN		TOTAL COST
	Quantity	Units	Unit $	Materials Cost	Unit $	Labor Cost	
Combined Heat & Power (CHP)							
Electricity	159,600	kWh	$0.10	$ 16,000	$0	$ -	$ 16,000
Total vendor-provided O&M	8,322	OPH	$17.83	$ 148,400	$0	$ -	$ 149,000
Heating/Generator Fuel (incl. in vendor O&M package)							$ -
Operations Labor (incl. in vendor O&M package)							$ -
Maintenance Labor (incl. in vendor O&M package)							$ -
Chemicals (incl. in vendor O&M package)							$ -
Parts and Replacement (incl. in vendor O&M package)							$ -
Sludge Hauling and Disposal	-	wtpd	$0	$ -	$0	$ -	$ -
CHP Operation and Maintenance Sub-Total							**$165,000**
GAS CONDITIONING							
Electricity	62,082	kWh	$0.10	$ 6,300	$0	$ -	$ 7,000
Operations Labor	365	HR			$43	$ 15,700	$ 16,000
Maintenance Labor	183	HR			$43	$ 7,900	$ 8,000
Chemicals		LB					
Parts and Replacement	1	LS	$1,000	$ 1,000	$0	$ -	$ 1,000
Media Replacement	1	LS	$50,000	$ 50,000		$ -	$ 50,000
Sludge Hauling and Disposal							
Gas Conditioning Operation and Maintenance Sub-Total							**$82,000**
						ESTIMATED BOILER SAVINGS	-$27,000
						ESTIMATED ELECTRIC SAVINGS	-$174,000
						Miscellaneous /Contingency	$ 4,600
						Engineer's Opinion of Probable O&M Cost per Year	**$50,600**

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Portsmouth New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease/Portsmouth Option (7.98 MGD Average Flow)
Digesting Plant and Import Solids

DESCRIPTION	UNITS		ANNUAL COST	
	Quantity	Units	Unit $	Total Cost
Septage Receiving Station				
Electricity	21,783	kWh	$0.10	$ 3,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals	-	LB		$ -
Parts and Replacement	1	LS	$2,000	$ 2,000
Sludge Hauling and Disposal	-	dry ton		
Septage Receiving Operation and Maintenance Sub-Total				**$16,000**
FOG Receiving Station				
Electricity	32,675	kWh	$0.10	$ 4,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	120	HR	$43	$ 6,000
Chemicals	-	LB		$ -
Parts and Replacement	1	LS	$2,000	$ 2,000
Sludge Hauling and Disposal	-	Wet Ton		
FOG Receiving Operation and Maintenance Sub-Total				**$20,000**
Cake Receiving Station				
Electricity	108,916	kWh	$0.10	$ 11,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	365	HR	$43	$ 16,000
Maintenance Labor	180	HR	$43	$ 8,000
Chemicals	-	LB		$ -
Parts and Replacement	1	LS	$6,000	$ 6,000
Sludge Hauling and Disposal	-	dry ton		
Cake Receiving Operation and Maintenance Sub-Total				**$41,000**
Primary Sludge Thickening (Gravity Thickeners)				
Electricity	156,839	kWh	$0.10	$ 16,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals	-	LB		$ -
Parts and Replacement	1	LS	$2,000	$ 2,000
Sludge Hauling and Disposal	-	dry ton		
PS Thickening Operation and Maintenance Sub-Total				**$29,000**
WAS Thickening (RDTs)				
Electricity	178,690	kWh	$0.10	$ 18,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	365	HR	$43	$ 16,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals (Polymer)	8,770	LB	$1.5	$ 14,000
Parts and Replacement	1	LS	$5,000	$ 5,000
Sludge Hauling and Disposal	-	dry ton		
WAS Thickening Operation and Maintenance Sub-Total				**$56,000**
ANAEROBIC DIGESTERS				
Electricity	490,122	kWh	$0.10	$ 50,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	4,380	HR	$43	$ 189,000
Maintenance Labor	1,460	HR	$43	$ 63,000
Chemicals	-	LB	$2	$ -
Parts and Replacement	1	LS	$2,500	$ 3,000
Sludge Hauling and Disposal	-	dry ton		$ -
Digesters Operation and Maintenance Sub-Total				**$305,000**
DIGESTER HEATING BOILERS				
Electricity	22,100	kWh	$0.10	$ 3,000
Heating/Generator Fuel	1,971	mmBtu	$6	$ 12,000
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals		LB		$ -
Parts and Replacement	1	LS	$200	$ 1,000
Sludge Hauling and Disposal	-	dry ton		$ -
Boilers Operation and Maintenance Sub-Total				**$27,000**
DIGESTED SLUDGE DEWATERING (Screw Press)				
Electricity	112,340	kWh	$0.10	$ 12,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	1,460	HR	$43	$ 63,000
Maintenance Labor	365	HR	$43	$ 16,000
Chemicals (Polymer)	83,965	LB	$1.5	$ 126,000
Parts and Replacement	1	LS	$5,000	$ 5,000
Sludge Hauling and Disposal		dry ton		$ -
Dewatering Operation and Maintenance Sub-Total				**$222,000**
DEWATERED CAKE DISPOSAL				
Sludge Hauling and Disposal	4,198	dry ton	$70	$ 294,000
Sludge Hauling and Disposal Sub-Total				**$294,000**
IMPORTED SOLIDS TIPPING FEES (REVENUE)				
Tipping Fee on Cake Drop Off	3,210	dry ton	$25	$ (81,000)
Tipping Fee for FOG	949,000	gal	$0.05	$ (48,000)
Sludge Hauling and Disposal Sub-Total				**-$129,000**
			Miscellaneous /Contingency	$ 16,000
			Engineer's Opinion of Probable O&M Cost per Year	**$897,000**

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City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease/Portsmouth Option (7.98 MGD Average Flow)

Combined Heat & Power (CHP) on Biogas from Plant and Import Digested Solids

DESCRIPTION	UNITS		MATERIALS		LABOR/EQUIPMENT		TOTAL COST
	Quantity	Units	Unit $	Materials Cost	Unit $	Labor Cost	
Combined Heat & Power (CHP)							
Electricity	159,600	kWh	$0.10	$ 16,000	$0	$ -	$ 16,000
Total vendor-provided O&M	16,644	OPH	$17.83	$ 296,800	$0	$ -	$ 297,000
Heating/Generator Fuel (incl. in vendor O&M package)							$ -
Operations Labor (incl. in vendor O&M package)							$ -
Maintenance Labor (incl. in vendor O&M package)							$ -
Chemicals (incl. in vendor O&M package)							$ -
Parts and Replacement (incl. in vendor O&M package)							$ -
Sludge Hauling and Disposal	-	wtpd	$0	$ -	$0	$ -	$ -
CHP Operation and Maintenance Sub-Total							**$313,000**
GAS CONDITIONING							
Electricity	62,082	kWh	$0.10	$ 6,300	$0	$ -	$ 7,000
Operations Labor	365	HR			$43	$ 15,700	$ 16,000
Maintenance Labor	183	HR			$43	$ 7,900	$ 8,000
Chemicals		LB					
Parts and Replacement	1	LS	$1,000	$ 1,000	$0	$ -	$ 1,000
Media Replacement	1	LS	$50,000	$ 50,000		$ -	$ 50,000
Sludge Hauling and Disposal							
Gas Conditioning Operation and Maintenance Sub-Total							**$82,000**
						ESTIMATED BOILER SAVINGS	-$27,000
						ESTIMATED ELECTRIC SAVINGS	-$420,000
						Miscellaneous /Contingency	$ (5,200)
						Engineer's Opinion of Probable O&M Cost per Year	**-$57,200**

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City of Portsmouth New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease/Portsmouth Option (7.98 MGD Average Flow)
Solids Handling, No Imported Solids Option

DESCRIPTION	UNITS		ANNUAL COST	
	Quantity	Units	Unit $	Total Cost
Primary Sludge Thickening (Gravity Thickeners)				
Electricity	124,164	kWh	$0.10	$ 13,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals	-	LB		$ -
Parts and Replacement	1	LS	$2,000	$ 2,000
Sludge Hauling and Disposal	-	Wet Ton		
PS Thickening Operation and Maintenance Sub-Total				**$26,000**
WAS Thickening (RDTs)				
Electricity	277,736	kWh	$0.10	$ 28,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	365	HR	$43	$ 16,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals (Polymer)	10,530	LB	$1.5	$ 16,000
Parts and Replacement	1	LS	$5,000	$ 5,000
Sludge Hauling and Disposal	-	Wet Ton		
WAS Thickening Operation and Maintenance Sub-Total				**$68,000**
ANAEROBIC DIGESTERS				
Electricity	490,122	kWh	$0.10	$ 50,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	4,380	HR	$43	$ 189,000
Maintenance Labor	1,460	HR	$43	$ 63,000
Chemicals	-	LB	$2	$ -
Parts and Replacement	1	LS	$2,500	$ 3,000
Sludge Hauling and Disposal	-	Wet Ton		$ -
Digesters Operation and Maintenance Sub-Total				**$305,000**
DIGESTER HEATING BOILERS				
Electricity	22,100	kWh	$0.10	$ 3,000
Heating/Generator Fuel	1,456	mmBtu	$6	$ 9,000
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals		LB		$ -
Parts and Replacement	1	LS	$200	$ 1,000
Sludge Hauling and Disposal	-	Wet Ton		$ -
Boilers Operation and Maintenance Sub-Total				**$24,000**
DIGESTED SLUDGE DEWATERING (Screw Press)				
Electricity	356,155	kWh	$0.10	$ 36,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	1,460	HR	$43	$ 63,000
Maintenance Labor	365	HR	$43	$ 16,000
Chemicals (Polymer)	52,852	LB	$1.5	$ 80,000
Parts and Replacement	1	LS	$5,000	$ 5,000
Sludge Hauling and Disposal	-	Wet Ton		$ -
Dewatering Operation and Maintenance Sub-Total				**$200,000**
DEWATERED CAKE DISPOSAL				
Sludge Hauling and Disposal	2,643	dry ton	$70	$ 185,000
Sludge Hauling and Disposal Sub-Total				**$185,000**
Engineer's Opinion of Probable O&M Cost per Year				**$808,000**

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City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease/Portsmouth Option (7.98 MGD Average Flow)
Solids Handling Without Imported Solids Option

DESCRIPTION	UNITS		MATERIALS		LABOR/EQUIPMENT		TOTAL COST
	Quantity	Units	Unit $	Materials Cost	Unit $	Labor Cost	
Soft Costs							
Division 1							$ 652,000
Soft Costs							**$652,000**
Site Civil							
Site Work							
Excavation	100	CY	$ -	$ -	$ 50	$ 5,000	$ 5,000
Backfill	50	CY	$ -	$ -	$ 50	$ 2,500	$ 2,500
Digesters, Thickening, and Dewatering Building	1,600	SF	$ 175	$ 280,000	$ 175	$ 280,000	$ 560,000
Gravity Thickeners mechanism, cover and miscellaneous improvements	2	EA.	$ 400,000	$ 800,000	$ 150,000	$ 300,000	$ 1,100,000
Concrete							
Concrete work to fill in SBR corners	-	LS	$ 900,000	$ -	$ -	$ -	$ -
Modification to EQ Tanks and Intermediate Pump Station	1	LS	$500,000	$ 500,000	$ -	$ -	$ 500,000
Boiler and Heat Exchanger Building	0	SF	$ 300	$ -		$ -	$ -
Site Civil							**$2,168,000**
Process / Mechanical							
Major Equipment							
Rotary Drum Thickeners	1	EA.	$287,000	$ 287,000	$ 143,500	$ 143,500	$ 431,000
Dewatering Screw Press	2	EA.	$443,700	$ 887,400	$ 221,850	$ 443,700	$ 1,332,000
Modification of Existing SBRs to convert to Digesters	1	LS	$150,000	$ 150,000	$ -	$ -	$ 150,000
Digester Fixed Steel Covers (2 - 1 per tank)	0	EA.	$397,500	$ -	$ 198,750	$ -	$ -
Digester Top Mounted Linear Motion Mixers (6 - 3 per tank)	0	EA.	$299,600	$ -	$ 149,800	$ -	$ -
Combination Digester HW Heating Boiler and HEX (1.5 mmBtu/hr. capacity)	0	EA.	$160,000	$ -	$80,000	$ -	$ -
Redundant Digester Heating Boiler	0	EA.	$130,000	$ -	$65,000	$ -	$ -
HW Circulation Pumps	-	EA.	$ 5,000	$ -	$2,500	$ -	$ -
Ancillary Boiler Equipment (Deaerator, Water Conditioning, etc.)	-	LS	$ 50,000	$ -	$0	$ -	$ -
Flare System	0	EA.	$ 20,000	$ -	$ 10,000	$ -	$ -
Digester Gas Compressors	0	EA.	$ 10,000	$ -	$ 5,000	$ -	$ -
Condensate Traps and Biogas Moisture Removal System	0	LS	$ 50,000	$ -	$ -	$ -	$ -
Flame Arrestor and PRV assemblies	0	EA.	$ 10,000	$ -	$ 5,000	$ -	$ -
Piping Systems							
Thickened Primary Sludge (TPS) Pumps to EQ Tanks	3	EA.	$ 10,000	$ 30,000	$ 5,000	$ 15,000	$ 45,000
TPS Piping to EQ Tanks	150	LF	$ 60	$ 9,000	$ 30	$ 4,500	$ 14,000
TWAS Pumps to EQ Tanks			$ -	$ -	$ -	$ -	$ -
TWAS Piping to EQ Tanks	100	LF	$ 60	$ 6,000	$ 30	$ 3,000	$ 9,000
EQ Tanks to Intermediate Pump Station Piping	100	LF	$ 60	$ 6,000	$ 30	$ 3,000	$ 9,000
Digester Feed Pumps	0	EA.	$ 15,000	$ -	$ 7,500	$ -	$ -
Digester Feed Piping	0	LF	$ -	$ -	$ -	$ -	$ -
Digester Recirculation/Mixing Pumps	0	EA.	$ 10,000	$ -	$ 5,000	$ -	$ -
Digester Recirculation/Mixing Piping	0	LF	$ 60	$ -	$ 30	$ -	$ -
Digester Draw Pumps	0	EA.	$ -	$ -	$ -	$ -	$ -
Digester Draw Piping	0	LF	$ 60	$ -	$ 30	$ -	$ -
Biogas Piping to Boilers	0	LF	$ 90	$ -	$ 45	$ -	$ -
Process Mechanical Sub-Total							**$1,990,000**
ELECTRICAL							
							$ 298,500
Electrical Sub-Total							**$ 299,000**
INSTRUMENTATION AND CONTROLS							
							$ 199,000
Instrumentation and Controls Sub-Total							**$ 199,000**
Capital Cost Subtotal							**$ 5,308,000**
						Construction Contingency	$ 796,000
						Engineering and Associated Project Costs	$ 955,000
						Contractor's Overhead and Profit (5%)	$ 265,000
						Engineer's Opinion of Probable Construction Cost	**$7,324,000**

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City of Portsmouth New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease/Portsmouth Option (7.98 MGD Average Flow)
Solids Handling, No Digestion, No Imported Solids Option

DESCRIPTION	UNITS		ANNUAL COST	
	Quantity	Units	Unit $	Total Cost
Primary Sludge Thickening (Gravity Thickeners)				
Electricity	124,164	kWh	$0.10	$ 13,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals	-	LB		$ -
Parts and Replacement	1	LS	$2,000	$ 2,000
Sludge Hauling and Disposal	-	Wet Ton		
PS Thickening Operation and Maintenance Sub-Total				**$26,000**
WAS Thickening (RDTs)				
Electricity	277,736	kWh	$0.10	$ 28,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	365	HR	$43	$ 16,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals (Polymer)	10,530	LB	$1.5	$ 16,000
Parts and Replacement	1	LS	$5,000	$ 5,000
Sludge Hauling and Disposal	-	Wet Ton		
WAS Thickening Operation and Maintenance Sub-Total				**$68,000**
ANAEROBIC DIGESTERS				
Electricity	-	kWh	$0.10	$ -
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	-	HR	$43	$ -
Maintenance Labor	-	HR	$43	$ -
Chemicals	-	LB	$2	$ -
Parts and Replacement	-	LS	$2,500	$ -
Sludge Hauling and Disposal	-	Wet Ton		$ -
Digesters Operation and Maintenance Sub-Total				**$0**
DIGESTER HEATING BOILERS				
Electricity	-	kWh	$0.10	$ -
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	-	HR	$43	$ -
Maintenance Labor	-	HR	$43	$ -
Chemicals		LB		$ -
Parts and Replacement	-	LS	$200	$ -
Sludge Hauling and Disposal	-	Wet Ton		$ -
Boilers Operation and Maintenance Sub-Total				**$0**
DIGESTED SLUDGE DEWATERING (Screw Press)				
Electricity	498,617	kWh	$0.14	$ 70,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	2,044	HR	$43	$ 88,000
Maintenance Labor	511	HR	$43	$ 22,000
Chemicals (Polymer)	73,993	LB	$1.5	$ 111,000
Parts and Replacement	1	LS	$5,000	$ 7,000
Sludge Hauling and Disposal	-	Wet Ton		$ -
Dewatering Operation and Maintenance Sub-Total				**$298,000**
DEWATERED CAKE DISPOSAL				
Sludge Hauling and Disposal	3,700	dry ton	$70	$ 259,000
Sludge Hauling and Disposal Sub-Total				**$259,000**
Engineer's Opinion of Probable O&M Cost per Year				**$651,000**

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City of Portsmouth New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth Option (7.98 MGD Average Flow)
Combined Heat and Power (CHP) System Without Imported Solids Option

DESCRIPTION	UNITS		MATERIALS		LABOR/EQUIPMENT		TOTAL COST
	Quantity	Units	Unit $	Materials Cost	Unit $	Labor Cost	
Soft Costs							
Division 1 (14% of subtotal)	1	LS					$ 334,000
Air Permitting	1	LS			$25,000	$ 25,000	$ 25,000
Site Civil							**$359,000**
Site Civil							
Cogeneration, and Electrical Distribution Building	500	SF	$300	$ 150,000		$ -	$ 150,000
Concrete Slab for Biogas Conditioning (assume 1 ft. thick)	17	CY	$350	$ 5,950		$ -	$ 6,000
Site Civil							**$156,000**
PROCESS/MECHANICAL							
Major Equipment							
Biogas Conditioning Skid (200 scfm capacity)	1	EA.	$500,000	$ 500,000	$250,000	$ 250,000	$ 750,000
Engine Generator w HW Heat Recovery (550 kW capacity)	1	EA.	$789,900	$ 789,900	$394,950	$ 394,950	$ 1,185,000
Jacket water heater (included with engine)			$ -	$ -	$ -	$ -	$ -
Jacket water plate and frame heat exchanger (included with engine)			$ -	$ -	$ -	$ -	$ -
Stacked core heat dump horizontal type radiator (included with engine)			$ -	$ -	$ -	$ -	$ -
Digester Gas Train (included with engine)			$ -	$ -	$ -	$ -	$ -
Exhaust Heat Exchanger	1	EA.	$30,000	$ 30,000	$15,000	$ 15,000	$ 45,000
HW Circulation Pumps	2	EA.	$5,000	$ 10,000	$2,500	$ 5,000	$ 15,000
Plate and Frame Heat Exchangers between Engine and HW Loop	1	EA.	$7,500	$ 7,500	$3,750	$ 3,750	$ 12,000
Redundant Digester Heating Boiler (credit, not needed with CHP)	1	EA.	$(130,000.00)	$ (130,000)	$ -	$ -	$ (130,000)
Piping							
Additional HWS and HWR Piping and Valves	100	LF	$60	$ 6,000	$30	$3,000	$ 9,000
Additional Biogas Process Piping and Valves	100	LF	$90	$ 9,000	$45	$4,500	$ 14,000
Process Mechanical Sub-Total							**$1,900,000**
ELECTRICAL							
Switchgear and Electrical Connection to Plant Grid (included with engine)							$ -
General Electrical	1	LS	$200,000	$ 200,000	0%	$ -	$ 200,000
Electrical Sub-Total							**$ 200,000**
INSTRUMENTATION AND CONTROLS							
Instrumentation and Controls Lump Sum	1	LS	$100,000	$ 100,000		$ -	$ 100,000
Engine/Generator control panel and alarms (included with engine)							$ -
Instrumentation and Controls Sub-Total							**$ 100,000**
Capital Cost Subtotal							**$ 2,715,000**
Construction Contingency							$ 407,000
Engineering and Associated Project Costs							$ 489,000
Contractor's Overhead and Profit (5%)							$ 136,000
Engineer's Opinion of Probable Construction Cost							**$3,747,000**

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City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease/Portsmouth Option (7.98 MGD Average Flow)
Imported Processing Option

DESCRIPTION	UNITS		MATERIALS		LABOR/EQUIPMENT		TOTAL COST
	Quantity	Units	Unit $	Materials Cost	Unit $	Labor Cost	
Combined Heat & Power (CHP)							
Electricity	159,600	kWh	$0.10	$ 16,000	$0	$ -	$ 16,000
Total vendor-provided O&M	8,322	OPH	$17.83	$ 148,400	$0	$ -	$ 149,000
Heating/Generator Fuel (incl. in vendor O&M package)							$ -
Operations Labor (incl. in vendor O&M package)							$ -
Maintenance Labor (incl. in vendor O&M package)							$ -
Chemicals (incl. in vendor O&M package)							$ -
Parts and Replacement (incl. in vendor O&M package)							$ -
Sludge Hauling and Disposal	-	wtpd	$0	$ -	$0	$ -	$ -
CHP Operation and Maintenance Sub-Total							**$165,000**
GAS CONDITIONING							
Electricity	62,100	kWh	$0.10	$ 6,300	$0	$ -	$ 7,000
Operations Labor	365	HR	$43	$ 15,700	$0	$ -	$ 16,000
Maintenance Labor	183	HR	$43	$ 7,900	$0	$ -	$ 8,000
Chemicals		LB					
Parts and Replacement	1	LS	$1,000	$ 1,000	$0	$ -	$ 1,000
Media Replacement	1	LS	$50,000	$ 50,000		$ -	$ 50,000
Sludge Hauling and Disposal							
Gas Conditioning Operation and Maintenance Sub-Total							**$82,000**
						ESTIMATED BOILER SAVINGS	-$24,000
						ESTIMATED ELECTRIC SAVINGS	-$302,000
						Engineer's Opinion of Probable O&M Cost per Year	**-$79,000**

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth Option (7.98 MGD Average Flow)
Electrical Distribution

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Treatment Facilities				
Division 01 General Requirements				
General Conditions	10%	%	$ 1,560,000	$ 156,000
Bond	1%	%	$ 1,716,000	$ 17,200
Insurance	3%	%	$ 1,733,200	$ 52,000
Profit	5%	%	$ 1,785,200	$ 89,300
Division 02 Existing Conditions				
Miscellaneous/Undefined	20%	%	$ 1,300,000	$ 260,000
Division 03 Concrete				
Division 04 Masonry				
Division 05 Metals				
Division 06 Woods, Plastics and Composites				
Division 07 Thermal and Moisture Protection				
Division 08 Openings				
Division 09 Finishes				
Division 10 Specialties				
Division 22 Plumbing				
Division 23 HVAC				
Division 26 Electrical				
Generators	2	EA.	$ 400,000	$ 800,000
Main Switch Gear	1	EA.	$ 380,000	$ 380,000
Main Service	1	EA.	$ 120,000	$ 120,000
Division 27 Communications				
Division 31 Earthworks				
Division 32 Exterior Improvements				
Division 33 Utilities				
Division 40 Process Integration				
Division 41 Material Processing and Handling Equipment				
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Division 46 Water and Wastewater Equipment				
SUBTOTAL				
			CONSTRUCTION SUBTOTAL	**$ 1,874,500**
			Engineering and Other Associated Project Costs 18%	**$ 337,410.00**
			Contingency 15%	**$ 281,175.00**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 2,490,000**

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City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease/Portsmouth Option (7.98 MGD Average Flow)
Electrical Distribution

Electricity

Description	Estimated Power Use	Units	Hours/day	Days/year	kWh/year	Cost per year
Use calculated for each proces	0	HP	0	0		$ -
Total						$ -

Electricity cost based on $ 0.13 per Kwh

Heating/Generator Fuel

Description	Quantity	Units	Unit Cost	Cost per Year
Generator Fuel	16400	gallons	$ 4.08	$ 66,912.00
Total				$ 66,912.00

Operations Labor

Description	Labor	Units	Labor Rate ($/hour)	Cost per Year
Exercise Generator	24	hr./year	$ 43.00	$ 1,032.00
Total				$ 1,032.00

Maintenance Labor

Description	Labor (hours/year)	Units	Labor Rate ($/hour)	Cost per Year
General Maintenance	80	hr./year	$ 43.00	$ 3,440.00
Total				$ 3,440.00

Chemicals

Chemical	Units/day		Unit Cost	Cost per Year
None	0		$ -	$ -
Total				$ -

Parts & Replacement

Description	Replacement Parts		Capital Cost	Replacement Costs
Generators	1%		$ 1,874,500.00	$ 18,745.00
Switchgear				
Total				$ 18,745.00

Sludge Hauling & Disposal

Description	Quantity	Units	Unit Cost	Annual Cost
Tipping fee	0	Tons	$ 67.00	$ -
Trucking	0	Miles	$ 1.40	$ -
Total				$ -

Other Miscellaneous

Description	Quantity	Units	Unit Cost	Annual Cost
Miscellaneous/Contingency	5%	%	$ 89,097.00	$ 4,454.85
Total				$ 4,454.85

Total $ 90,200.00

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth Option (7.98 MGD Average Flow)
Additional Treatment Plant Costs for Alternate Sites

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Treatment Facilities				
Division 01 General Requirements				
General Conditions	10%	%	$ 5,060,500	$ 506,100
Bond	1%	%	$ 5,566,600	$ 55,700
Insurance	3%	%	$ 5,622,300	$ 168,700
Profit	5%	%	$ 5,791,000	$ 289,600
Division 02 Existing Conditions				
Miscellaneous/Undefined	25%	%	$ 4,048,400	$ 1,012,100
Decomission Existing Pease Site	1	LS	$ 200,000	$ 200,000
Division 03 Concrete				
Digester slabs	419	CY	$ 525	$ 219,800
Digester Walls	1,026	CY	$ 800	$ 820,600
Digester Grout/ Miscelaneous	70	CY	$ 930	$ 64,900
Gravity Thickener Slabs	105	CY	$ 525	$ 55,000
Gravity Thickener Walls	209	CY	$ 800	$ 167,500
Gravity Thickener Grout/ Miscelaneous	31	CY	$ 930	$ 29,200
Division 04 Masonry				
Division 05 Metals				
Miscellaneous Metals	5	EA.	$ 30,000	$ 150,000
Division 06 Woods, Plastics and Composites				
Grating	3	EA.	$ 20,000	$ 60,000
Division 07 Thermal and Moisture Protection				
Solids Handling Building (Additional costs only)	1,000	SF	$ 350	$ 350,000
		SF		$ -
Division 08 Openings				
Division 09 Finishes				
Coatings	1	LS	$ 15,000	$ 15,000
Division 10 Specialties				
Division 22 Plumbing				
Plumbing	1	LS	$ 50,000	$ 50,000
Division 23 HVAC				
Heat and Ventilation	1	LS	$ 250,000	$ 250,000
Division 26 Electrical				
Electrical Work	12%	%	$ 2,453,900	$ 294,500
Division 27 Communications				
Division 31 Earthworks				
Excavation	2,977	CY	$ 3.57	$ 10,600
Rock Blasting	3,908	CY	$ 20.00	$ 78,200
Rock Moving	3,908	CY	$ 6.27	$ 24,500
Stone Sub base	651	CY	$ 20.74	$ 13,500
Backfill and Compact	1,377	CY	$ 3.96	$ 5,500
Dewatering	4	MO	$ 20,000	$ 80,000
Division 32 Exterior Improvements				
Fine Grade and Seed	2,400	SF	$ 4	$ 9,600
Division 33 Utilities				
Division 40 Process Integration				
Division 41 Material Processing and Handling Equipment				
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Division 46 Water and Wastewater Equipment				
1.35 MGD pump Station	1	EA.	$ 1,100,000	$ 1,100,000
SUBTOTAL				
CONSTRUCTION SUBTOTAL				**$ 6,080,600**
Engineering and Other Associated Project Costs			**18%**	**$ 1,094,508.00**
Contingency			**15%**	**$ 912,090.00**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 8,090,000**

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City of Portsmouth New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth Option (7.98 MGD Average Flow)
Tank Covers

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Treatment Facilities				
Division 01 General Requirements				
General Conditions	10%	%	$ 4,908,200	$ 490,820
Bond	3%	%	$ 5,399,020	$ 161,971
Insurance	1%	%	$ 5,560,991	$ 55,610
Profit	5%	%	$ 5,616,601	$ 280,830
Division 02 Existing Conditions				
Miscellaneous/Undefined	15%	%	$ 4,268,000	$ 640,200
Division 03 Concrete				
Division 04 Masonry				
Division 05 Metals				
Miscellaneous Metals	1	LS	$ 80,000	$ 80,000
Division 06 Woods, Plastics and Composites				
Division 07 Thermal and Moisture Protection				
Division 08 Openings				
Division 09 Finishes				
Division 10 Specialties				
Primary Clarifier Aluminum Cover	7,500		$ 80	$ 600,000
Secondary Clarifier Fabric Cover	18,000		$ 65	$ 1,170,000
Aeration Tank Fabric Cover	37,200		$ 65	$ 2,418,000
Division 22 Plumbing				
Division 23 HVAC				
Division 26 Electrical				
Division 27 Communications				
Division 31 Earthworks				
Division 32 Exterior Improvements				
Division 33 Utilities				
Division 40 Process Integration				
Division 41 Material Processing and Handling Equipment				
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Division 46 Water and Wastewater Equipment				
CONSTRUCTION SUBTOTAL				**$ 5,897,431**
Engineering and Other Associated Project Costs			**18%**	**$ 1,061,537.50**
Contingency			**15%**	**$ 884,614.58**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 7,840,000**

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City of Portsmouth New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth Option (7.98 MGD Average Flow)
Odor Control

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Treatment Facilities				
Division 01 General Requirements				
General Conditions	10%	%	$ 2,555,300	$ 255,500
Bond	3%	%	$ 2,810,800	$ 84,300
Insurance	1%	%	$ 2,895,100	$ 29,000
Profit	5%	%	$ 2,924,100	$ 146,200
Division 02 Existing Conditions				
Miscellaneous/Undefined	20%	%	$ 2,129,400	$ 425,900
Division 03 Concrete				
Division 04 Masonry				
Division 05 Metals				
Miscellaneous Metals	1	LS	$ 80,000	$ 80,000
Division 06 Woods, Plastics and Composites				
Division 07 Thermal and Moisture Protection				
Division 08 Openings				
Division 09 Finishes				
Division 10 Specialties				
Division 22 Plumbing				
Division 23 HVAC				
Division 26 Electrical				
Division 27 Communications				
Division 31 Earthworks				
Division 32 Exterior Improvements				
Division 33 Utilities				
Division 40 Process Integration				
Division 41 Material Processing and Handling Equipment				
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Carbon Tower for Headworks	27,000	CFM	$ 24	$ 651,700
Biological Tower for Solids Handling	32,000	CFM	$ 44	$ 1,397,700
Division 46 Water and Wastewater Equipment				
CONSTRUCTION SUBTOTAL				**$ 3,070,300**
Engineering and Other Associated Project Costs			**18%**	**$ 552,654.00**
Contingency			**15%**	**$ 460,545.00**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 4,080,000**

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City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease/Portsmouth Option (7.98 MGD Average Flow)
Odor Control

Electricity

Description	Estimated Power Use	Units	Hours/day	Days/year	kWh/year	Cost per year
Blowers	50	HP	24	7		$ -
Total						$ -

Electricity cost based on $ 0.13 per Kwh

Heating/Generator Fuel

Description	Quantity	Units	Unit Cost	Cost per Year
Generator Fuel	0	gallons	$ 4.08	$ -
Total				$ -

Operations Labor

Description	Labor	Units	Labor Rate ($/hour)	Cost per Year
Operation	260	hr./year	$ 43.00	$ 11,180.00
Total				$ 11,180.00

Maintenance Labor

Description	Labor (hours/year)	Units	Labor Rate ($/hour)	Cost per Year
General Maintenance	80	hr./year	$ 43.00	$ 3,440.00
Total				$ 3,440.00

Chemicals

Chemical	Units/day		Unit Cost	Cost per Year
	0		$ -	$ -
Total				$ -

Parts & Replacement

Description	Replacement Parts		Capital Cost	Replacement Costs
Odor Control	1%		$ 2,049,400	$ 20,494.00
Carbon Replacment	20%		$ 325,850	$ 65,170.00
Total				$ 85,664.00

Sludge Hauling & Disposal

Description	Quantity	Units	Unit Cost	Annual Cost
Tipping fee	0	Tons	$ 67.00	$ -
Trucking	0	Miles	$ 1.40	$ -
Total				$ -

Other Miscellaneous

Description	Quantity	Units	Unit Cost	Annual Cost
Miscellaneous/Contingency	5%	%	$ 89,104.00	$ 4,455.20
Total				$ 4,455.20

Total $ 104,800.00

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease Regional Option (10.98 MGD Average Flow TN 8)
Project Summary

DESCRIPTION	OPINION OF PROBABLE PROJECT COST QTY.	UNIT	UNIT COST	TOTAL	Annual O&M Cost	Total Lifecycle Cost
Pease WWTF Treatment Facilities						
Headworks	1	LS	$17,750,000	$ 17,750,000	$ 233,000	$ 21,630,000
Primary Clarifiers	1	LS	$7,690,000	$ 7,690,000	$ 72,000	$ 8,890,000
Biological Reactor Tanks	1	LS	$21,770,000	$ 21,770,000	$ 862,000	$ 36,100,000
Secondary Clarifiers	1	LS	$15,920,000	$ 15,920,000	$ 190,000	$ 19,080,000
Effluent Pump Station and Disinfection	1	LS	$6,760,000	$ 6,760,000	$ 245,000	$ 10,840,000
Thickening and Dewatering	1	LS	$7,324,000	$ 7,324,000	$ 651,000	$ 18,150,000
Electrical Distribution	1	LS	$2,490,000	$ 2,490,000	$ 95,000	$ 4,070,000
Subtotal				**$ 79,704,000**	**$ 2,348,000**	**$ 118,760,000**
Pease WWTF Additional Improvements Plan						
Allowance for Waterfowl Deterrents	1	LS	$250,000	$ 250,000	$ 5,000	$ 340,000
Odor Control Facilities	1	LS	$4,080,000	$ 4,080,000	$ 105,000	$ 5,830,000
Administration Building	9,100	SF	$284	$ 2,587,000	$ 55,870	$ 3,520,000
Maintenance Building	6,000	SF	$228	$ 1,366,000	$ 34,660	$ 1,950,000
Laboratory Modifications	1,500	SF	$1,250	$ 1,875,000	$ 48,750	$ 2,690,000
Subtotal				**$ 10,158,000**	$ 249,280	**$ 14,330,000**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 89,860,000**	**$ 2,600,000**	**$ 133,090,000**
TOTAL OPINION OF PROBABLE PROJECT COST (LOW RANGE ESTIMATE -30%)				**$ 62,900,000**	**$ 1,820,000**	**$ 93,160,000**
TOTAL OPINION OF PROBABLE PROJECT COST (HIGH RANGE ESTIMATE +50%)				**$ 134,790,000**	**$ 3,900,000**	**$ 199,640,000**
TOTAL OPINION OF PROBABLE PROJECT COST				**$ 89,860,000**	**$ 2,600,000**	**$ 133,090,000**
TOTAL OPINION OF PROBABLE CONSTRUCTION COSTS ESCALATED TO CONSTRUCTION MID-POINT IN 2018 USD				**$ 96,770,000**	**$ 2,800,000**	**$ 143,320,000**

The following assumptions and references were used to develop the opinion of probable construction cost

1 Opinions of probable costs are at a conceptual level based on 10 % project definition.

2 Estimates are consistent with AACE Class 4 construction cost estimate which are typically accurate between -15% and -30% to +20% and +50%.

3 All unit costs are in 2015 dollars. Escalation has been on an item basis assuming an annual 2.5% inflation rate- projected ENR CCI of 10896

4 Project costs include allowance of 18% for Engineering and Other Associated Project

5 Project costs include a contingency of 15% Contingency

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease Regional Option (10.98 MGD Average Flow TN 3)
Project Summary

DESCRIPTION	OPINION OF PROBABLE PROJECT COST				Annual O&M Cost	Total Lifecycle Cost
	QTY.	UNIT	UNIT COST	TOTAL		
Pease WWTF Treatment Facilities						
Headworks	1	LS	$17,750,000	$ 17,750,000	$ 233,000	$ 21,630,000
Primary Clarifiers	1	LS	$7,690,000	$ 7,690,000	$ 72,000	$ 8,890,000
Biological Reactor Tanks	1	LS	$21,770,000	$ 21,770,000	$ 862,000	$ 36,100,000
Secondary Clarifiers	1	LS	$15,920,000	$ 15,920,000	$ 190,000	$ 19,080,000
Denitrification Filters and Methanol	1	LS	$15,910,000	$ 15,910,000	$ 614,000	$ 26,120,000
Effluent Pump Station and Disinfection	1	LS	$6,760,000	$ 6,760,000	$ 245,000	$ 10,840,000
Thickening and Dewatering	1	LS	$7,324,000	$ 7,324,000	$ 651,000	$ 18,150,000
Electrical Distribution	1	LS	$2,490,000	$ 2,490,000	$ 95,000	$ 4,070,000
Subtotal				**$ 95,614,000**	**$ 2,962,000**	**$ 144,880,000**
Pease WWTF Additional Improvements Plan						
Allowance for Waterfowl Deterrents	1	LS	$250,000	$ 250,000	$ 5,000	$ 340,000
Odor Control Facilities	1	LS	$4,080,000	$ 4,080,000	$ 105,000	$ 5,830,000
Administration Building	9,100	SF	$284	$ 2,587,000	$ 55,870	$ 3,520,000
Maintenance Building	6,000	SF	$228	$ 1,366,000	$ 34,660	$ 1,950,000
Laboratory Modifications	1,500	SF	$1,250	$ 1,875,000	$ 48,750	$ 2,690,000
Subtotal				**$ 10,158,000**	$ 249,280	**$ 14,330,000**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 105,770,000**	**$ 3,210,000**	**$ 159,210,000**
TOTAL OPINION OF PROBABLE PROJECT COST (LOW RANGE ESTIMATE -30%)				**$ 74,040,000**	**$ 2,250,000**	**$ 111,450,000**
TOTAL OPINION OF PROBABLE PROJECT COST (HIGH RANGE ESTIMATE +20%)				**$ 158,660,000**	**$ 4,820,000**	**$ 238,820,000**
TOTAL OPINION OF PROBABLE PROJECT COST				**$ 105,770,000**	**$ 3,210,000**	**$ 159,210,000**
TOTAL OPINION OF PROBABLE CONSTRUCTION COSTS ESCALATED TO CONSTRUCTION MID-POINT IN 2018 USD				**$ 113,900,000**	**$ 3,460,000**	**$ 171,450,000**

The following assumptions and references were used to develop the opinion of probable construction cost

1 Opinions of probable costs are at a conceptual level based on 10 % project definition.

2 Estimates are consistent with AACE Class 4 construction cost estimate which are typically accurate between -15% and -30% to +20% and +50%.

3 All unit costs are in 2015 dollars. Escalation has been on an item basis assuming an annual 2.5% inflation rate- projected ENR CCI of 10896

4 Project costs include allowance of 18% for Engineering and Other Associated Project

5 Project costs include a contingency of 15% Contingency

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City of Portsmouth New Hampshire
Conceptual Opinion of Probable Project Cost
Pease Regional Option (10.98 MGD Average Flow TN 8)
Additional Costs to Add Digester and Combined Heat and Power

DESCRIPTION	OPINION OF PROBABLE PROJECT COST				Annual O&M Cost	Total Lifecycle Cost
	QTY.	UNIT	UNIT COST	TOTAL		
Point Estimates Based on 2015 Estimates						
Baseline-Thicken and Dewater Only	1	LS	$7,324,000	$ 7,324,000	$ 651,000	$ 18,150,000
With Digester	1	LS	$17,161,000	$ 17,161,000	$ 852,000	$ 31,330,000
With Digester and Combined Heat and Power	1	LS	$20,908,000	$ 20,908,000	$ 847,600	$ 35,000,000
With Regional Digester	1	LS	$23,259,000	$ 23,259,000	$ 964,000	$ 39,290,000
With Regional Digester with Combined Heat and Power	1	LS	$29,390,000	$ 29,390,000	$ 851,800	$ 43,550,000
Point Estimates Escalated to 2018						
Baseline-Thicken and Dewater Only	1	LS	$7,890,000	$ 7,890,000	$ 700,000	$ 19,530,000
With Digester	1	LS	$18,480,000	$ 18,480,000	$ 920,000	$ 33,780,000
With Digester and Combined Heat and Power	1	LS	$22,520,000	$ 22,520,000	$ 910,000	$ 37,650,000
With Regional Digester	1	LS	$25,050,000	$ 25,050,000	$ 1,040,000	$ 42,340,000
With Regional Digester with Combined Heat and Power	1	LS	$31,650,000	$ 31,650,000	$ 920,000	$ 46,950,000

The following assumptions and references were used to develop the opinion of probable construction cost

1 Opinions of probable costs are at a conceptual level based on 10 % project definition.
2 Estimates are consistent with AACE Class 4 construction cost estimate which are typically accurate between -15% and -30% to +20% and +50%.
3 All unit costs are in 2015 dollars. Escalation has been on an item basis assuming an annual 2.5% inflation rate- projected ENR CCI of 10896
4 Project costs include allowance of 18% for Engineering and Other Associated Project Costs
5 Project costs include a contingency of 15% Contingency

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease Regional Option (10.98 MGD Average Flow)
Headworks

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Treatment Facilities				
Division 01 General Requirements				
General Conditions	10%	%	$ 11,106,300	$ 1,110,600
Bond	3%	%	$ 12,216,900	$ 366,500
Insurance	1%	%	$ 12,583,400	$ 125,800
Profit	5%	%	$ 12,709,200	$ 635,500
Digesters, Thickening and Dewatering				
Division 02 Existing Conditions				
Miscellaneous/Undefined	8%	%	$ 10,283,600	$ 822,700
Division 03 Concrete				
Concrete Base Slab	877	CY	$ 250	$ 219,300
Concrete Walls	3,067	CY	$ 685	$ 2,100,900
Elevated Slabs	889	CY	$ 855	$ 760,000
Channels	400	CY	$ 930	$ 372,000
Division 04 Masonry				
Division 05 Metals				
Grating and Handrail	1	LS	$ 120,000	$ 120,000
Miscellaneous Metals	1	LS	$ 80,000	$ 80,000
Division 06 Woods, Plastics and Composites				
Division 07 Thermal and Moisture Protection				
Above Grade Building	6,000	SF	$ 185	$ 1,110,000
Division 08 Openings				
Division 09 Finishes				
Division 10 Specialties				
Division 22 Plumbing				
Plumbing	1	LS	$ 250,000	$ 250,000
Division 23 HVAC				
HVAC	1	LS	$ 1,150,000	$ 1,150,000
Division 26 Electrical				
Electrical Work	12%	%	$ 9,181,800	$ 1,101,800
Division 27 Communications				
Division 31 Earthworks				
Excavation	560	CY	$ 4	$ 2,000
Rock Blasting	8,018	CY	$ 20	$ 160,400
Rock Moving	8,018	CY	$ 6	$ 50,300
Stone Sub base	267	CY	$ 21	$ 5,500
Backfill and Compact	4,149	CY	$ 4	$ 16,400
Dewatering	8	MO	$ 20,000	$ 160,000
Division 32 Exterior Improvements				
Division 33 Utilities				
Division 40 Process Integration				
Piping and Valves	1	LS	$ 450,000	$ 450,000
Slide Gates	14	EA.	$ 35,000	$ 490,000
Instrumentation/Controls	1	LS	$ 180,000	$ 180,000
Division 41 Material Processing and Handling Equipment				
Conveyors	1	LS	$ 180,000	$ 180,000
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Influent Pumps	3	EA.	$ 120,000	$ 360,000
Division 46 Water and Wastewater Equipment				
Course Screens	2	EA.	$ 215,000	$ 430,000
Fine Screens	3	EA.	$ 115,000	$ 345,000
Grit Removal	2	EA.	$ 95,000	$ 190,000
CONSTRUCTION SUBTOTAL				**$ 13,344,700**
Engineering and other Associated Project Costs			**18%**	**$ 2,402,046.00**
Contingency			**15%**	**$ 2,001,705.00**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 17,750,000**

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City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease Regional Option (10.98 MGD Average Flow)
Electrical Distribution

Electricity

Description	Estimated Power Use	Units	Hours/day	Days/year	kWh/year	Cost per year
Influent Pumps	100	HP	2.5	365	68045.125	$ 8,845.87
Grit Equipment	2	HP	24	365	13064.664	$ 1,698.41
Course Screens	2	HP	4	365	2177.444	$ 283.07
Digesters, Thickening and Dew	3	HP	4	365	3266.166	$ 424.60
Conveyors	3	HP	6	365	4899.249	$ 636.90
Lighting/Miscellaneous	5	HP	24	365	32661.66	$ 4,246.02
Total						$ 16,134.86

Electricity cost based on $ 0.13 per Kwh

Heating/Generator Fuel

Description	Quantity	Units	Unit Cost	Cost per Year
Natural Gas Heating	8000	MBTU	$ 4.00	$ 32,000.00
Total				$ 32,000.00

Operations Labor

Description	Labor	Units	Labor Rate ($/hour)	Cost per Year
Operations	1560	hr./year	$ 43.00	$ 67,080.00
Total				$ 67,080.00

Maintenance Labor

Description	Labor (hours/year)	Units	Labor Rate ($/hour)	Cost per Year
General Maintenance	208	hr./year	$ 43.00	$ 8,944.00
Total				$ 8,944.00

Chemicals

Chemical	Units/day	Units	Unit Cost	Cost per Year
None	0		$ -	$ -
Total				$ -

Parts & Replacement

Description	Replacement Parts	Units	Capital Cost	Replacement Costs
Conveyors	1%	%	$ 180,000.00	$ 1,800.00
Influent Pumps	2%	%	$ 360,000.00	$ 7,200.00
Course Screens	2%	%	$ 430,000.00	$ 8,600.00
Fine Screens	2%	%	$ 345,000.00	$ 6,900.00
Grit Removal	10%	%	$ 190,000.00	$ 19,000.00
Gates and Valves	1%	%	$ 940,000.00	$ 9,400.00
Instruments and Controls	1%	%	$ 180,000.00	$ 1,800.00
Total				$ 54,700.00

Sludge Hauling & Disposal

Description	Quantity	Units	Unit Cost	Annual Cost
Tipping fee- Screenings	624	Tons	$ 67.00	$ 41,808.00
Trucking	3120	Miles	$ 1.40	$ 4,368.00
Total				$ 46,176.00

Other Miscellaneous

Description	Quantity	Units	Unit Cost	Annual Cost
Miscellaneous/Contingency	5%	%	$ 157,954.86	$ 7,897.74
Total				$ 7,897.74

Total $ 233,000.00

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease Regional Option (10.98 MGD Average Flow)
Primary Clarifiers

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Treatment Facilities				
Division 01 General Requirements				
General Conditions	10%	%	$ 4,210,300	$ 421,000
Bond	1%	%	$ 4,631,300	$ 46,300
Insurance	3%	%	$ 4,677,600	$ 140,300
Profit	5%	%	$ 4,817,900	$ 240,900
Digesters, Thickening and Dewatering				
Division 02 Existing Conditions				
Miscellaneous/Undefined	10%	%	$ 4,487,900	$ 448,800
Division 03 Concrete				
Concrete Base Slab	1,105	CY	$ 275	$ 303,900
Concrete Walls	933	CY	$ 718	$ 669,900
Pump Station Slab	470	CY	$ 409	$ 192,200
Pump Station Walls	470	CY	$ 718	$ 337,500
Pump Station Elevated Slab	188	CY	$ 855	$ 161,000
Channels	150	CY	$ 930	$ 139,500
Division 04 Masonry				
Pump Station Stairwell/Electrical Room	1,200	LS	$ 200	$ 240,000
Division 05 Metals				
Miscellaneous Metals	4	EA.	$ 15,000	$ 60,000
Pump Station Metals	1	LS	$ 30,000	$ 30,000
Railings	4	EA.	$ 50,000	$ 200,000
Division 06 Woods, Plastics and Composites				
Grating	4	EA.	$ 20,000	$ 80,000
Division 07 Thermal and Moisture Protection				
Division 08 Openings				
Doors	4	EA.	$ 2,500	$ 10,000
Windows	2	EA.	$ 1,500	$ 3,000
Division 09 Finishes				
Coatings	1	LS	$ 40,000	$ 40,000
Division 10 Specialties				
Division 22 Plumbing				
Plumbing	1	LS	$ 20,000	$ 20,000
Division 23 HVAC				
Heat and Ventilation	1	LS	$ 120,000	$ 120,000
Division 26 Electrical				
Electrical Work	8%	%	$ 3,482,900	$ 278,600
Division 31 Earthworks				
Excavation	2,338	CY	$ 3.57	$ 8,300
Rock Blasting	238	CY	$ 20.00	$ 4,800
Rock Moving	238	CY	$ 6.27	$ 1,500
Stone Sub base	1,001	CY	$ 20.74	$ 20,800
Backfill and Compact	1,407	CY	$ 3.96	$ 5,600
Dewatering	4	MO	$ 20,000	$ 80,000
Division 32 Exterior Improvements				
Fine Grade and Seed	3,090	SF	$ 4	$ 12,400
Plantings	20	EA.	$ 500	$ 10,000
Division 33 Utilities				
Influent Piping (24 inch)	100	LF	$ 300	$ 30,000
Effluent Piping (24 inch)	50	LF	$ 300	$ 15,000
Buried Sludge Piping (6 inch)	300	LF	$ 180	$ 54,000
Division 40 Process Integration				
Interior Process Piping (4" and 6" scum and Sludge Pumps	1	LS	$ 200,000	$ 200,000
Slide Gates	6	EA.	$ 45,000	$ 270,000
Instrumentation/Control	1	LS	$ 60,000	$ 60,000
Division 41 Material Processing and Handling Equipment				
Miscellaneous Hoists	3	EA.	$ 2,500	$ 7,500
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Sludge Pumps	4	EA.	$ 18,000	$ 72,000
Scum Pumps	2	EA.	$ 12,000	$ 24,000
Division 46 Water and Wastewater Equipment				
Clarifier Mechanisms	4	EA.	$ 146,600	$ 586,400
Troughs and Weirs	4	EA.	$ 35,000	$ 140,000
CONSTRUCTION SUBTOTAL				**$ 5,785,200**
Engineering and other Associated Project Costs			**18%**	**$ 1,041,336**
Contingency			**15%**	**$ 867,780**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 7,690,000**

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City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease Regional Option (10.98 MGD Average Flow)
Primary Clarifier

Electricity

Description	Estimated Power Use	Units	Hours/day	Days/year	kWh/year	Cost per year
Drives	4	HP	24	365	26129.328	$ 3,396.81
Scum Pumps	10	HP	6	365	16330.83	$ 2,123.01
Sludge Pumps	10	HP	8	365	21774.44	$ 2,830.68
Digesters, Thickening and Dewa	2	HP	24	365	13064.664	$ 1,698.41
Total						$ 10,048.90

Electricity cost based on $ 0.13 per Kwh

Heating/Generator Fuel

Description	Quantity	Units	Unit Cost	Cost per Year
Natural Gas Heating	800	MBTU	$ 4.00	$ 3,200.00
Total				$ 3,200.00

Operations Labor

Description	Labor	Units	Labor Rate ($/hour)	Cost per Year
Operations	520	hr./year	$ 43.00	$ 22,360.00
Total				$ 22,360.00

Maintenance Labor

Description	Labor (hours/year)	Units	Labor Rate ($/hour)	Cost per Year
General Maintenance	208	hr./year	$ 43.00	$ 8,944.00
Total				$ 8,944.00

Chemicals

Chemical	Units/day	Units	Unit Cost	Cost per Year
None	0		$ -	$ -
Total				$ -

Parts & Replacement

Description	Replacement Parts	Units	Capital Cost	Replacement Costs
Slide Gates	1%	%	$ 270,000.00	$ 2,700.00
Drive/Collector	2%	%	$ 586,400.00	$ 11,728.00
Scum Pumps	10%	%	$ 24,000.00	$ 2,400.00
Sludge Pumps	10%	%	$ 72,000.00	$ 7,200.00
Instruments and Controls	1%	%	$ 60,000.00	$ 600.00
Total				$ 24,628.00

Sludge Hauling & Disposal

Description	Quantity	Units	Unit Cost	Annual Cost
Tipping fee- Screenings	0	Tons	$ 67.00	$ -
Trucking	0	Miles	$ 1.40	$ -
Total				$ -

Other Miscellaneous

Description	Quantity	Units	Unit Cost	Annual Cost
Miscellaneous/Contingency	5%	%	$ 46,820.90	$ 2,341.05
Total				$ 2,341.05

Total $ 72,000.00

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Portsmouth New Hampshire
Conceptual Opinion of Probable Project Cost
Pease Regional Option (10.98 MGD Average Flow)
Biological Reactor Tanks

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Treatment Facilities				
Division 01 General Requirements				
General Conditions	10%	%	$ 13,123,300	$ 1,312,300
Bond	1%	%	$ 14,435,600	$ 144,400
Insurance	3%	%	$ 14,580,000	$ 437,400
Profit	5%	%	$ 15,017,400	$ 750,900
Digesters, Thickening and Dewatering				
Division 02 Existing Conditions				
Miscellaneous/Undefined	10%	%	$ 12,473,300	$ 1,247,300
Division 03 Concrete				
Concrete Base Slab	5,738	CY	$ 356	$ 2,042,700
Concrete Walls	4,431	CY	$ 585	$ 2,592,100
Elevated Walkways	384	CY	$ 855	$ 328,500
Concrete Stairs	112	CY	$ 1,250	$ 140,000
Division 04 Masonry				
Blower Building (built on Secondary Pump Station)	2,500	SF	$ 250	$ 625,000
Division 05 Metals				
Miscellaneous Metals	5	EA.	$ 45,000	$ 225,000
Railings	2,736	LF	$ 135	$ 369,400
Division 06 Woods, Plastics and Composites				
Division 07 Thermal and Moisture Protection				
Division 08 Openings				
Division 09 Finishes				
Coatings	1	LS	$ 15,000	$ 15,000
Division 10 Specialties				
Division 22 Plumbing				
Plumbing	1	LS	$ 50,000	$ 50,000
Division 23 HVAC				
Heat and Ventilation	1	LS	$ 120,000	$ 120,000
Division 26 Electrical				
Electrical Work	12%	%	$ 10,603,600	$ 1,272,400
Division 27 Communications				
Division 31 Earthworks				
Excavation	15,258	CY	$ 3.57	$ 54,500
Rock Blasting	19,500	CY	$ 20.00	$ 390,000
Rock Moving	19,500	CY	$ 6.27	$ 122,300
Stone Sub base	3,079	CY	$ 20.74	$ 63,900
Backfill and Compact	6,268	CY	$ 3.96	$ 24,800
Dewatering	10	MO	$ 20,000.00	$ 200,000
Place and Compact Berm	33,067	CY	$ 2.50	$ 82,700
Dispose of Excess Spoil	10,052	CY	$ 18.00	$ 180,900
Division 32 Exterior Improvements				
Fine Grade and Seed	11,065	SF	$ 4	$ 44,300
Division 33 Utilities				
Division 40 Process Integration				
Process Piping	1	LS	$ 812,500	$ 812,500
Instrumentation and Controls	1	LS	$ 312,500	$ 312,500
Air Control Valves/Meters	30	EA.	$ 25,000	$ 750,000
Division 41 Material Processing and Handling Equipment				
Miscellaneous Hoists	3	EA.	$ 2,500	$ 7,500
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Blowers	5	EA.	$ 175,000	$ 875,000
Submersible IMLR Pumps	5	EA.	$ 35,000	$ 175,000
Division 46 Water and Wastewater Equipment				
Diffusers	6,250	EA.	$ 60	$ 372,300
Submersible Mixers	15	EA.	$ 15,000	$ 225,000
SUBTOTAL				
CONSTRUCTION SUBTOTAL				**$ 16,365,600**
Engineering and other Associated Project Costs			**18%**	**$ 2,945,808.00**
Contingency			**15%**	**$ 2,454,840.00**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 21,770,000**

ARCADIS
Infrastructure · Water · Environment · Buildings

City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease Regional Option (10.98 MGD Average Flow)
Biological Reactors

Electricity

Description	Estimated Power Use	Units	Hours/day	Days/year	kWh/year	Cost per year
Blowers	600	HP	24	365	3,919,399.20	$ 509,521.90
IMLR	50	HP	24	365	326,616.60	$ 42,460.16
Miters	96	HP	24	365	627,103.87	$ 81,523.50
Digesters, Thickening and Dewatering					-	$ -
Lighting/Miscellaneous	5	HP	24	365	32,661.66	$ 4,246.02
Total						$ 637,751.57

Electricity cost based on $ 0.13 per Kwh

Heating/Generator Fuel

Description	Quantity	Units	Unit Cost	Cost per Year
Natural Gas Heating	1000	MBTU	$ 4.00	$ 4,000.00
Total				$ 4,000.00

Operations Labor

Description	Labor	Units	Labor Rate ($/hour)	Cost per Year
Operations	1040	hr./year	$ 43.00	$ 44,720.00
Total				$ 44,720.00

Maintenance Labor

Description	Labor (hours/year)	Units	Labor Rate ($/hour)	Cost per Year
General Maintenance	416	hr./year	$ 43.00	$ 17,888.00
Total				$ 17,888.00

Chemicals

Chemical	Units/day	Units	Unit Cost	Cost per Year
None	0		$ -	$ -
Total				$ -

Parts & Replacement

Description	Replacement Parts	Units	Capital Cost	Replacement Costs
Air Valves	2%	%	$ 750,000.00	$ 15,000.00
Blowers	2%	%	$ 875,000.00	$ 17,500.00
IMLR Pumps	2%	%	$ 175,000.00	$ 75,000.00
Diffusers	2%	%	$ 372,300.00	
Mixers	2%	%	$ 225,000.00	$ 4,500.00
Instruments and Controls	2%	%	$ 312,500.00	$ 6,250.00
Total				$ 118,250.00

Sludge Hauling & Disposal

Description	Quantity	Units	Unit Cost	Annual Cost
Tipping fee- Screenings	0	Tons	$ 67.00	$ -
Trucking	0	Miles	$ 1.40	$ -
Total				$ -

Other Miscellaneous

Description	Quantity	Units	Unit Cost	Annual Cost
Miscellaneous/Contingency	5%	%	$ 777,889.57	$ 38,894.48
Total				$ 38,894.48

Total $ 862,000.00

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease Regional Option (10.98 MGD Average Flow)
Secondary Clarifiers

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Treatment Facilities				
Division 01 General Requirements				
General Conditions	10%	%	$ 9,295,800	$ 929,600
Bond	1%	%	$ 10,225,400	$ 102,300
Insurance	3%	%	$ 10,327,700	$ 309,800
Profit	5%	%	$ 10,637,500	$ 531,900
Digesters, Thickening and Dewatering				
Division 02 Existing Conditions				
Miscellaneous/Undefined	10%	%	$ 9,178,900	$ 917,900
Division 03 Concrete				
Splitter Box	100	CY	$ 855	$ 85,500
Concrete Base Slab	2,843	CY	$ 275	$ 781,800
Concrete Walls	2,217	CY	$ 718	$ 1,591,800
Pump Station Slab	1,152	CY	$ 275	$ 316,800
Pump Station Walls	1,152	CY	$ 650	$ 748,800
Pump Station Elevated Slab	290	CY	$ 855	$ 247,800
Elevated Walkways	170	CY	$ 855	$ 145,400
Division 04 Masonry				
Pump Station Stairwell/Electrical Room	1	LS	$ 30,000	$ 30,000
Division 05 Metals				
Miscellaneous Metals	5	EA.	$ 15,000	$ 75,000
Pump Station Metals	1	LS	$ 150,000	$ 150,000
Railings	5	EA.	$ 50,000	$ 250,000
Splitter weirs	5	EA.	$ 10,000	$ 50,000
Division 06 Woods, Plastics and Composites				
Grating	5	EA.	$ 20,000	$ 100,000
Division 07 Thermal and Moisture Protection				
Above Grade Building (Electric and stair)	900		$ 225	$ 202,500
Division 08 Openings				
Division 09 Finishes				
Coatings	1	LS	$ 35,000	$ 35,000
Division 10 Specialties				
Division 22 Plumbing				
Plumbing	1	LS	$ 150,000	$ 150,000
Division 23 HVAC				
Heat and Ventilation	1	LS	$ 500,000	$ 500,000
Division 26 Electrical				
Electrical Work	12%	%	$ 7,480,300	$ 897,600
Division 27 Communications				
Division 31 Earthworks				
Excavation	2,638	CY	$ 4	$ 9,400
Rock Blasting	8,603	CY	$ 20	$ 172,100
Rock Moving	8,603	CY	$ 6	$ 53,900
Stone Sub base	1,278	CY	$ 21	$ 26,500
Backfill and Compact	4,412	CY	$ 4	$ 17,500
Dewatering	6	MO	$ 20,000	$ 120,000
Division 32 Exterior Improvements				
Fine Grade and Seed	5,750	SF	$ 4	$ 23,000
Division 33 Utilities				
RAS Main	300	LF	$ 225	$ 67,500
Feed Piping				
Division 40 Process Integration				
Process Piping	1	LS	$ 750,000	$ 750,000
Gates	10	EA.	$ 25,000	$ 250,000
WAS Control Valve and Meter	1	EA.	$ 20,000	$ 20,000
Controls and Instrumentation	1	EA.	$ 80,000	$ 80,000
Division 41 Material Processing and Handling Equipment				
Miscellaneous Hoists	3	EA.	$ 25,000	$ 75,000
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
RAS Pumps	8	EA.	$ 35,000	$ 280,000
Scum Pumps	5	EA.	$ 15,000	$ 75,000
Division 46 Water and Wastewater Equipment				
Mechanisms	5	EA.	$ 125,200	$ 626,000
Troughs and Weirs	5	EA.	$ 35,000	$ 175,000
SUBTOTAL				
CONSTRUCTION SUBTOTAL				**$ 11,970,400**
Engineering and other Associated Project Costs			**18%**	**$ 2,154,672.00**
Contingency			**15%**	**$ 1,795,560.00**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 15,920,000**

ARCADIS
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City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease Regional Option (10.98 MGD Average Flow)
Secondary Clarifier

Electricity

Description	Estimated Power Use	Units	Hours/day	Days/year	kWh/year	Cost per year
Drives	5	HP	24	365	32661.66	$ 4,246.02
Scum Pumps	12	HP	4	365	13064.664	$ 1,698.41
RAS Pumps	24	HP	24	365	156775.968	$ 20,380.88
Digesters, Thickening and Dew	2	HP	24	365	13064.664	$ 1,698.41
Total						$ 28,023.70

Electricity cost based on $ 0.13 per Kwh

Heating/Generator Fuel

Description	Quantity	Units	Unit Cost	Cost per Year
Natural Gas Heating	1000	MBTU	$ 4.00	$ 4,000.00
Total				$ 4,000.00

Operations Labor

Description	Labor	Units	Labor Rate ($/hour)	Cost per Year
Operations	1040	hr./year	$ 43.00	$ 44,720.00
Total				$ 44,720.00

Maintenance Labor

Description	Labor (hours/year)	Units	Labor Rate ($/hour)	Cost per Year
General Maintenance	208	hr./year	$ 43.00	$ 8,944.00
Total				$ 8,944.00

Chemicals

Chemical	Units/day	Units	Unit Cost	Cost per Year
None	0		$ -	$ -
Total				$ -

Parts & Replacement

Description	Replacement Parts	Units	Capital Cost	Replacement Costs
Slide Gates	1%	%	$ 250,000.00	$ 2,500.00
Drive/Collector	2%	%	$ 626,000.00	$ 12,520.00
Scum Pumps	10%	%	$ 75,000.00	$ 75,000.00
RAS Pumps	2%	%	$ 280,000.00	$ 5,600.00
Instruments and Controls	1%	%	$ 100,000.00	$ 1,000.00
Total				$ 96,620.00

Sludge Hauling & Disposal

Description	Quantity	Units	Unit Cost	Annual Cost
Tipping fee- Screenings	0	Tons	$ 67.00	$ -
Trucking	0	Miles	$ 1.40	$ -
Total				$ -

Other Miscellaneous

Description	Quantity	Units	Unit Cost	Annual Cost
Miscellaneous/Contingency	5%	%	$ 137,587.70	$ 6,879.39
Total				$ 6,879.39

Total $ 190,000.00

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease Regional Option (10.98 MGD Average Flow)
Denitrification Filters(including Methanol Storage)

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Treatment Facilities				
Division 01 General Requirements				
General Conditions	10%	%	$ 9,954,600	$ 995,500
Bond	1%	%	$ 10,950,100	$ 109,500
Insurance	3%	%	$ 11,059,600	$ 331,800
Profit	5%	%	$ 11,391,400	$ 569,600
Digesters, Thickening and Dewatering				
Division 02 Existing Conditions				
Miscellaneous/Undefined	20%	%	$ 8,227,922	$ 1,645,600
Division 03 Concrete				
Concrete Base Slab	1,043	CY	$ 275	$ 286,800
Concrete Walls	1,886	CY	$ 718	$ 1,354,100
Elevated Slabs	402	CY	$ 855	$ 344,100
Elevated Walkways/Channels	220	CY	$ 855	$ 188,100
Division 04 Masonry				
Division 05 Metals				
Miscellaneous Metals	5	EA.	$15,000	$ 75,000
Pump Station Metals	1	LS	$30,000	$ 30,000
Railings	5	EA.	$50,000	$ 250,000
Division 06 Woods, Plastics and Composites				
Grating	5	EA.	$20,000	$ 100,000
Division 07 Thermal and Moisture Protection				
Methanol Building	1,200	SF	$350	$ 420,000
Filter Above Grade Building	1,400	SF	$350	$ 490,000
Division 08 Openings				
Division 09 Finishes				
Coatings	1	LS	$15,000	$ 15,000
Division 10 Specialties				
Division 22 Plumbing				
Methanol Plumbing (Includes Foam Fire Suppression)	1	LS	$350,000	$ 350,000
Filter Plumbing	1	LS	$200,000	$ 200,000
Division 23 HVAC				
Heat and Ventilation Methanol	1	LS	$170,000	$ 170,000
Heat and Ventilation Filter	1	LS	$285,000	$ 285,000
Division 26 Electrical				
Electrical Work	18%	%	$ 6,194,100	$ 1,114,900
Division 27 Communications				
Division 31 Earthworks				
Excavation	973	CY	$ 4	$ 3,500
Rock Blasting	3,604	CY	$ 20	$ 72,100
Rock Moving	3,604	CY	$ 6	$ 22,600
Stone Sub base	463	CY	$ 21	$ 9,600
Backfill and Compact	2,330	CY	$ 8	$ 18,600
Dewatering	6	MO	$ 20,000	$ 120,000
Division 32 Exterior Improvements				
Fine Grade and Seed	2,400	SF	$ 4	$ 9,600
Division 33 Utilities				
Influent Piping	200	LF	$ 350	$ 70,000
Effluent Piping	100	LF	$ 350	$ 35,000
Wastewater Sewer	250	LF	$ 500	$ 125,000
Division 40 Process Integration				
Methanol Piping	1	LS	$ 100,000	$ 100,000
Filter Piping	1	LS	$ 750,000	$ 750,000
Division 41 Material Processing and Handling Equipment				
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Methanol Tanks	2	EA.	$ 150,000	$ 300,000
Division 46 Water and Wastewater Equipment				
Filter Equipment	5	EA.	$ 200,000	$ 1,000,000
SUBTOTAL				
			CONSTRUCTION SUBTOTAL	**$ 11,961,000**
			Engineering and other Associated Project Costs 18%	**$ 2,152,980.00**
			Contingency 15%	**$ 1,794,150.00**
			TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)	**$ 15,910,000**

City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease Regional Option (10.98 MGD Average Flow)
Denitrification Filter

Electricity

Description	Estimated Power Use	Units	Hours/day	Days/year	kWh/year	Cost per year
Backwash Pumps	60	HP	1.2	365	19,597	$ 2,547.61
Chemical Feed Pumps	2	HP	24	365	13,065	$ 1,698.41
Lighting/Miscellaneous	2	HP	24	365	13,065	$ 1,698.41
Digesters, Thickening and Dewatering						
Total						$ 5,944.42

Electricity cost based on $ 0.13 per Kwh

Heating/Generator Fuel

Description	Quantity	Units	Unit Cost	Cost per Year
Natural Gas Heating	1600	MBTU	$ 4.00	$ 6,400.00
Total				$ 6,400.00

Operations Labor

Description	Labor	Units	Labor Rate ($/hour)	Cost per Year
Operations	520	hr./year	$ 43.00	$ 22,360.00
Total				$ 22,360.00

Maintenance Labor

Description	Labor (hours/year)	Units	Labor Rate ($/hour)	Cost per Year
General Maintenance	208	hr./year	$ 43.00	$ 8,944.00
Total				$ 8,944.00

Chemicals

Chemical	Units/day	Units	Unit Cost	Cost per Year
Methanol	960	gal	$ 1.50	$ 525,600.00
Total				$ 525,600.00

Parts & Replacement

Description	Replacement Parts	Units	Capital Cost	Replacement Costs
Blowers	2%	%	$ 150,000.00	$ 3,000.00
Backwash Pumps	10%	%	$ 110,000.00	$ 11,000.00
Gates and Valves	1%	%	$ 120,000.00	$ 1,200.00
Instruments and Controls	1%	%	$ 80,000.00	$ 800.00
Total				$ 16,000.00

Sludge Hauling & Disposal

Description	Quantity	Units	Unit Cost	Annual Cost
				$ -
				$ -
Total				$ -

Other Miscellaneous

Description	Quantity	Units	Unit Cost	Annual Cost
Miscellaneous/Contingency	5%	%	$ 562,888.42	$ 28,144.42
Total				$ 28,144.42

Total $ 614,000.00

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease Regional Option (10.98 MGD Average Flow)
Effluent Pump Station and Disinfection

DESCRIPTION	QTY.	UNIT	UNIT COST	TOTAL
			OPINION OF PROBABLE CONSTRUCTION COST	
Pease WWTF Treatment Facilities				
Division 01 General Requirements				
General Conditions	10%	%	$ 4,229,500	$ 423,000
Bond	1%	%	$ 4,652,500	$ 46,500
Insurance	3%	%	$ 4,699,000	$ 141,000
Profit	5%	%	$ 4,840,000	$ 242,000
Digesters, Thickening and Dewatering				
Division 02 Existing Conditions				
Miscellaneous/Undefined	10%	%	$ 3,845,000	$ 384,500
Division 03 Concrete				
Pump Station Slab	119	CY	$ 409	$ 48,500
Pump Station Walls	444	CY	$ 718	$ 319,100
Pump Station Elevated Slab	74	CY	$ 855	$ 63,300
Miscellaneous Fill	150	CY	$ 930	$ 139,500
Precast De-chlorination Structure	1	LS	$ 120,000	$ 120,000
Division 04 Masonry				
Division 05 Metals				
Miscellaneous Metals	3	EA.	$ 15,000	$ 45,000
Pump Station Metals	1	LS	$ 30,000	$ 30,000
Railings	3	EA.	$ 50,000	$ 150,000
Division 06 Woods, Plastics and Composites				
Grating	3	EA.	$ 20,000	$ 60,000
Division 07 Thermal and Moisture Protection				
Hypochlorite Building	1,800	SF	$ 425	$ 765,000
De-chlorination Building	300	SF	$ 425	$ 127,500
Division 08 Openings				
Division 09 Finishes				
Coatings	1	LS	$ 15,000	$ 15,000
Division 10 Specialties				
Division 22 Plumbing				
Plumbing	1	LS	$ 50,000	$ 50,000
Division 23 HVAC				
Heat and Ventilation	1	LS	$ 250,000	$ 250,000
Division 26 Electrical				
Electrical Work	12%	%	$ 3,200,900	$ 384,100
Division 27 Communications				
Division 31 Earthworks				
Excavation	218	CY	$ 3.57	$ 800
Rock Blasting	2,730	CY	$ 20.00	$ 54,600
Rock Moving	2,730	CY	$ 6.27	$ 17,100
Stone Sub base	101	CY	$ 20.74	$ 2,100
Backfill and Compact	270	CY	$ 3.96	$ 1,100
Dewatering	4	MO	$ 20,000	$ 80,000
De-chlorination Excavation and Backfill	125	CY	$ 220	$ 27,500
De-chlorination Dewatering	2	MO	$ 40,000	$ 80,000
Division 32 Exterior Improvements				
Fine Grade and Seed	2,400	SF	$ 2	$ 4,800
Division 33 Utilities				
Influent Pipe	200	LF	$ 450	$ 90,000
Division 40 Process Integration				
Interior Piping	1	LS	$ 200,000	$ 200,000
Gates and Valves	1	LS	$ 120,000	$ 120,000
Chemical Feed Piping	1	LS	$ 60,000	$ 60,000
Pipe for Effluent Pumps	1	LS	$ 150,000	$ 150,000
Controls and Integration	1	LS	$ 80,000	$ 80,000
Division 41 Material Processing and Handling Equipment				
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Hypochlorite Storage Tanks	2	EA.	$ 25,000	$ 50,000
Division 46 Water and Wastewater Equipment				
Effluent Pumps	3	EA.	$ 50,000	$ 150,000
Hypochlorite Feed Skid	1	LS	$ 80,000	$ 80,000
De-chlorination Skid	1	LS	$ 30,000	$ 30,000
SUBTOTAL				
			CONSTRUCTION SUBTOTAL	**$ 5,082,000**
			Engineering and other Associated Project Costs 18%	**$ 914,760.00**
			Contingency 15%	**$ 762,300.00**
			TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)	**$ 6,760,000**

ARCADIS
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City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease Regional Option (10.98 MGD Average Flow)
Effluent Pump Station

Electricity

Description	Estimated Power Use	Units	Hours/day	Days/year	kWh/year	Cost per year
Effluent Pumps	100	HP	4	365	108,872	$ 14,153.39
Chemical Feed Pumps	2	HP	24	365	13,065	$ 1,698.41
Lighting/Miscellaneous	2	HP	24	365	13,065	$ 1,698.41
Digesters, Thickening and Dewatering						
Total						$ 17,550.20

Electricity cost based on $ 0.13 per Kwh

Heating/Generator Fuel

Description	Quantity	Units	Unit Cost	Cost per Year
Natural Gas Heating	1200	MBTU	$ 4.00	$ 4,800.00
Total				$ 4,800.00

Operations Labor

Description	Labor	Units	Labor Rate ($/hour)	Cost per Year
Operations	520	hr./year	$ 43.00	$ 22,360.00
Total				$ 22,360.00

Maintenance Labor

Description	Labor (hours/year)	Units	Labor Rate ($/hour)	Cost per Year
General Maintenance	208	hr./year	$ 43.00	$ 8,944.00
Total				$ 8,944.00

Chemicals

Chemical	Units/day	Units	Unit Cost	Cost per Year
Sodium Hypochlorite	416.4	gal	$ 0.65	$ 98,790.90
Sodium Bisulfite	130.8	gal	1.38	$ 65,883.96
Total				$ 164,674.86

Parts & Replacement

Description	Replacement Parts	Units	Capital Cost	Replacement Costs
Effluent Pumps	2%	%	$ 150,000.00	$ 3,000.00
Chemical Skids	10%	%	$ 110,000.00	$ 11,000.00
Gates and Valves	1%	%	$ 120,000.00	$ 1,200.00
Instruments and Controls	1%	%	$ 80,000.00	$ 800.00
Total				$ 16,000.00

Sludge Hauling & Disposal

Description	Quantity	Units	Unit Cost	Annual Cost
				$ -
				$ -
Total				$ -

Other Miscellaneous

Description	Quantity	Units	Unit Cost	Annual Cost
Miscellaneous/Contingency	5%	%	$ 211,969.06	$ 10,598.45
Total				$ 10,598.45

Total $ 245,000.00

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease Regional Option (10.98 MGD Average Flow)
Solids Thickening, Digestion and Digester Heating, Solids Dewatering - With Imported Solids Option

DESCRIPTION	UNITS		MATERIALS		LABOR/EQUIPMENT		TOTAL COST
	Quantity	Units	Unit $	Materials Cost	Unit $	Labor Cost	
Soft Costs							
Division 1							$ 2,070,000
Soft Costs							**$2,070,000**
Site Civil							
Site Work							
Excavation	100	CY	$ -	$ -	$ 50	$ 5,000	$ 5,000
Digesters, Thickening and Dewatering	50	CY	$ -	$ -	$ 50	$ 2,500	$ 2,500
Digesters, Thickening, and Dewatering Building	4,800	SF	$ 175	$ 840,000	$ 175	$ 840,000	$ 1,680,000
Gravity Thickeners mechanism, cover and miscellaneous improvements	2	EA.	$ 400,000	$ 800,000	$ 150,000	$ 300,000	$ 1,100,000
Concrete							
Concrete work to fill in SBR corners	1	LS	$ 900,000	$ 900,000	$ -	$ -	$ 900,000
Modification to EQ Tanks and Intermediate Pump Station	1	LS	$ 500,000	$ 500,000	$ -	$ -	$ 500,000
Boiler and Heat Exchanger Building	1000	SF	$ 300	$ 300,000		$ -	$ 300,000
Site Civil							**$4,488,000**
Process / Mechanical							
Major Equipment/Modifications							
Septage Receiving Station	1	EA.	$ 500,000	$ 500,000	$250,000	$ 250,000	$ 750,000
FOG Receiving Station	1	LS	$ 750,000	$ 750,000	$ -	$ -	$ 750,000
Cake Receiving Station	1	LS	$1,500,000	$ 1,500,000	$ -	$ -	$ 1,500,000
Rotary Drum Thickeners	1	EA.	$ 287,000	$ 287,000	$143,500	$ 143,500	$ 431,000
Dewatering Screw Press	2	EA.	$ 443,700	$ 887,400	$221,850	$ 443,700	$ 1,332,000
Modification of Existing SBRs to convert to Digesters	1	LS	$ 150,000	$ 150,000	$ -	$ -	$ 150,000
Digester Fixed Steel Covers (2 - 1 per tank)	2	EA.	$ 397,500	$ 795,000	$198,750	$ 397,500	$ 1,193,000
Digester Top Mounted Linear Motion Mixers (6 - 3 per tank)	2	EA.	$ 299,600	$ 599,200	$149,800	$ 299,600	$ 899,000
Combination Digester HW Heating Boiler and HEX (1.5 mmBtu/hr capacity)	2	EA.	$ 160,000	$ 320,000	$80,000	$ 160,000	$ 480,000
Redundant Digester Heating Boiler	1	EA.	$ 130,000	$ 130,000	$65,000	$ 65,000	$ 195,000
HW Circulation Pumps	2	EA.	$ 5,000	$ 10,000	$2,500	$ 5,000	$ 15,000
Ancillary Boiler Equipment (Deaerator, Water Conditioning, etc.)	1	LS	$ 50,000	$ 50,000	$0	$ -	$ 50,000
Flare System	1	EA.	$ 20,000	$ 20,000	$ 10,000	$ 10,000	$ 30,000
Digester Gas Compressors	3	EA.	$ 10,000	$ 30,000	$ 5,000	$ 15,000	$ 45,000
Condensate Traps and Biogas Moisture Removal System	1	LS	$ 50,000	$ 50,000	$ -	$ -	$ 50,000
Flame Arrestor and PRV assemblies	2	EA.	$ 10,000	$ 20,000	$ 5,000	$ 10,000	$ 30,000
Pumping and Piping Systems							
Thickened Primary Sludge (TPS) Pumps to EQ Tanks	3	EA.	$ 10,000	$ 30,000	$ 5,000	$ 15,000	$ 45,000
TPS Piping to EQ Tanks	150	LF	$ 60	$ 9,000	$ 30	$ 4,500	$ 14,000
TWAS Pumps to EQ Tanks			$ -	$ -	$ -	$ -	$ -
TWAS Piping to EQ Tanks	100	LF	$ 60	$ 6,000	$ 30	$ 3,000	$ 9,000
Septage Pumps to EQ Tanks	2	EA.	$ 8,000	$ 16,000	$ 4,000	$ 8,000	$ 24,000
Septage Piping to EQ Tanks	100	LF	$ 100	$ 10,000	$ 50	$ 5,000	$ 15,000
FOG Pumps to EQ Tanks			$ -	$ -	$ -	$ -	$ -
FOG Piping to EQ Tanks	100	LF	$ 100	$ 10,000	$ 50	$ 5,000	$ 15,000
Cake Pumps to EQ Tanks	2	EA.	$ 8,000	$ 16,000	$ 4,000	$ 8,000	$ 24,000
Cake Piping to EQ Tanks	100	LF	$ 150	$ 15,000	$ 75	$ 7,500	$ 23,000
EQ Tanks to Intermediate Pump Station Piping	100	LF	$ 60	$ 6,000	$ 30	$ 3,000	$ 9,000
Digester Feed Pumps	3	EA.	$ 15,000	$ 45,000	$ 7,500	$ 22,500	$ 68,000
Digester Feed Piping	400	LF	$ -	$ -	$ -	$ -	$ -
Digester Recirculation/Mixing Pumps	3	EA.	$ 10,000	$ 30,000	$ 5,000	$ 15,000	$ 45,000
Digester Recirculation/Mixing Piping	100	LF	$ 60	$ 6,000	$ 30	$ 3,000	$ 9,000
Digester Draw Pumps	3	EA.	$ -	$ -	$ -	$ -	$ -
Digester Draw Piping	100	LF	$ 60	$ 6,000	$ 30	$ 3,000	$ 9,000
Biogas Piping to Boilers	200	LF	$ 90	$ 18,000	$ 45	$ 9,000	$ 27,000
Process Mechanical Sub-Total							**$8,236,000**
ELECTRICAL							
							$ 1,235,400
Electrical Sub-Total							**$ 1,236,000**
INSTRUMENTATION AND CONTROLS							
		LS	$ -	$ -		$ -	$ 823,600
Instrumentation and Controls Sub-Total							**$ 824,000**
Capital Cost Subtotal							**$16,854,000**
					Construction Contingency		$ 2,528,000
				Engineering and other Associated Project Costs			$ 3,034,000
				Contractor's Overhead and Profit (5%)			$ 843,000
Engineer's Opinion of Probable Construction Cost							**$23,259,000**

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City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease Regional Option (10.98 MGD Average Flow)
Solids Handling, No Digestion

DESCRIPTION	UNITS		ANNUAL COST	
	Quantity	Units	Unit $	Total Cost
Septage Receiving Station				
Electricity	-	kWh	$0.10	$ -
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	-	HR	$43	$ -
Maintenance Labor	-	HR	$43	$ -
Chemicals	-	LB		$ -
Parts and Replacement	-	LS	$2,000	$ -
Sludge Hauling and Disposal	-	dry ton		
Septage Receiving Operation and Maintenance Sub-Total				**$0**
FOG Receiving Station				
Electricity	-	kWh	$0.10	$ -
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	-	HR	$43	$ -
Maintenance Labor	-	HR	$43	$ -
Chemicals	-	LB		$ -
Parts and Replacement	-	LS	$2,000	$ -
Sludge Hauling and Disposal	-	Wet Ton		
FOG Receiving Operation and Maintenance Sub-Total				**$0**
Cake Receiving Station				
Electricity	-	kWh	$0.10	$ -
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	-	HR	$43	$ -
Maintenance Labor	-	HR	$43	$ -
Chemicals	-	LB		$ -
Parts and Replacement	-	LS	$6,000	$ -
Sludge Hauling and Disposal	-	dry ton		
Cake Receiving Operation and Maintenance Sub-Total				**$0**
Primary Sludge Thickening (Gravity Thickeners)				
Electricity	#######	kWh	$0.10	$ 16,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals	-	LB		$ -
Parts and Replacement	1	LS	$2,000	$ 2,000
Sludge Hauling and Disposal	-	dry ton		
PS Thickening Operation and Maintenance Sub-Total				**$29,000**
WAS Thickening (RDTs)				
Electricity	#######	kWh	$0.10	$ 23,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	365	HR	$43	$ 16,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals (Polymer)	10,539	LB	$1.5	$ 16,000
Parts and Replacement	1	LS	$5,000	$ 5,000
Sludge Hauling and Disposal	-	dry ton		
WAS Thickening Operation and Maintenance Sub-Total				**$63,000**
ANAEROBIC DIGESTERS				
Electricity	-	kWh	$0.10	$ -
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	-	HR	$43	$ -
Maintenance Labor	-	HR	$43	$ -
Chemicals	-	LB	$2	$ -
Parts and Replacement	-	LS	$2,500	$ -
Sludge Hauling and Disposal	-	dry ton		$ -
Digesters Operation and Maintenance Sub-Total				**$0**
DIGESTER HEATING BOILERS				
Electricity	-	kWh	$0.10	$ -
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	-	HR	$43	$ -
Maintenance Labor	-	HR	$43	$ -
Chemicals		LB		$ -
Parts and Replacement	-	LS	$200	$ -
Sludge Hauling and Disposal	-	dry ton		$ -
Boilers Operation and Maintenance Sub-Total				**$0**
DIGESTED SLUDGE DEWATERING (Screw Press)				
Electricity	85,106	kWh	$0.10	$ 9,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	1,460	HR	$43	$ 63,000
Maintenance Labor	365	HR	$43	$ 16,000
Chemicals (Polymer)	82,172	LB	$1.5	#######
Parts and Replacement	1	LS	$5,000	$ 5,000
Sludge Hauling and Disposal		dry ton		$ -
Dewatering Operation and Maintenance Sub-Total				**$217,000**
DEWATERED CAKE DISPOSAL				
Sludge Hauling and Disposal	4,109	dry ton	$70	#######
Sludge Hauling and Disposal Sub-Total				**$288,000**
			Miscellaneous /Contingency	$ 54,000
			Engineer's Opinion of Probable O&M Cost per Year	#######

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City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease Regional Option (10.98 MGD Average Flow)
Digestion of Plant Generated Solids

DESCRIPTION	UNITS		ANNUAL COST	
	Quantity	Units	Unit $	Total Cost
Septage Receiving Station				
Electricity	-	kWh	$0.10	$ -
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	-	HR	$43	$ -
Maintenance Labor	-	HR	$43	$ -
Chemicals	-	LB		$ -
Parts and Replacement	-	LS	$2,000	$ -
Sludge Hauling and Disposal	-	dry ton		
Septage Receiving Operation and Maintenance Sub-Total				**$0**
FOG Receiving Station				
Electricity	-	kWh	$0.10	$ -
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	-	HR	$43	$ -
Maintenance Labor	-	HR	$43	$ -
Chemicals	-	LB		$ -
Parts and Replacement	-	LS	$2,000	$ -
Sludge Hauling and Disposal	-	Wet Ton		
FOG Receiving Operation and Maintenance Sub-Total				**$0**
Cake Receiving Station				
Electricity	-	kWh	$0.10	$ -
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	-	HR	$43	$ -
Maintenance Labor	-	HR	$43	$ -
Chemicals	-	LB		$ -
Parts and Replacement	-	LS	$6,000	$ -
Sludge Hauling and Disposal	-	dry ton		
Cake Receiving Operation and Maintenance Sub-Total				**$0**
Primary Sludge Thickening (Gravity Thickeners)				
Electricity	156,839	kWh	$0.10	$ 16,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals	-	LB		$ -
Parts and Replacement	1	LS	$2,000	$ 2,000
Sludge Hauling and Disposal	-	dry ton		
PS Thickening Operation and Maintenance Sub-Total				**$29,000**
WAS Thickening (RDTs)				
Electricity	226,341	kWh	$0.10	$ 23,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	365	HR	$43	$ 16,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals (Polymer)	10,539	LB	$1.5	$ 16,000
Parts and Replacement	1	LS	$5,000	$ 5,000
Sludge Hauling and Disposal	-	dry ton		
WAS Thickening Operation and Maintenance Sub-Total				**$63,000**
ANAEROBIC DIGESTERS				
Electricity	490,122	kWh	$0.10	$ 50,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	4,380	HR	$43	$ 189,000
Maintenance Labor	1,460	HR	$43	$ 63,000
Chemicals	-	LB	$2	$ -
Parts and Replacement	1	LS	$2,500	$ 3,000
Sludge Hauling and Disposal	-	dry ton		$ -
Digesters Operation and Maintenance Sub-Total				**$305,000**
DIGESTER HEATING BOILERS				
Electricity	22,100	kWh	$0.10	$ 3,000
Heating/Generator Fuel	1,971	mmBtu	$6	$ 12,000
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals		LB		$ -
Parts and Replacement	1	LS	$200	$ 1,000
Sludge Hauling and Disposal	-	dry ton		$ -
Boilers Operation and Maintenance Sub-Total				**$27,000**
DIGESTED SLUDGE DEWATERING (Screw Press)				
Electricity	70,259	kWh	$0.10	$ 8,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	1,460	HR	$43	$ 63,000
Maintenance Labor	365	HR	$43	$ 16,000
Chemicals (Polymer)	52,874	LB	$1.5	$ 80,000
Parts and Replacement	1	LS	$5,000	$ 5,000
Sludge Hauling and Disposal		dry ton		$ -
Dewatering Operation and Maintenance Sub-Total				**$172,000**
DEWATERED CAKE DISPOSAL				
Sludge Hauling and Disposal	2,644	dry ton	$70	$ 186,000
Sludge Hauling and Disposal Sub-Total				**$186,000**
Miscellaneous /Contingency				$ 70,000
Engineer's Opinion of Probable O&M Cost per Year				**$852,000**

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City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease Regional Option (10.98 MGD Average Flow)
Combined Heat & Power on Biogas from Plant Generated Solids

DESCRIPTION	UNITS		MATERIALS		LABOR/EQUIPMENT		TOTAL COST
	Quantity	Units	Unit $	Materials Cost	Unit $	Labor Cost	
Combined Heat & Power (CHP)							
Electricity	#######	kWh	$0.10	$ 16,000	$0	$ -	$ 16,000
Total vendor-provided O&M	8,322	OPH	$17.83	#######	$0	$ -	$ 149,000
Heating/Generator Fuel (incl. in vendor O&M package)							$ -
Operations Labor (incl. in vendor O&M package)							$ -
Maintenance Labor (incl. in vendor O&M package)							$ -
Chemicals (incl. in vendor O&M package)							$ -
Parts and Replacement (incl. in vendor O&M package)							$ -
Sludge Hauling and Disposal	-	wtpd	$0	$ -	$0	$ -	$ -
CHP Operation and Maintenance Sub-Total							**$165,000**
GAS CONDITIONING							
Electricity	62,082	kWh	$0.10	$ 6,300	$0	$ -	$ 7,000
Operations Labor	365	HR			$43	$ 15,700	$ 16,000
Maintenance Labor	183	HR			$43	$ 7,900	$ 8,000
Chemicals		LB					
Parts and Replacement	1	LS	$1,000	$ 1,000	$0	$ -	$ 1,000
Media Replacement	1	LS	$50,000	$ 50,000		$ -	$ 50,000
Sludge Hauling and Disposal							
Gas Conditioning Operation and Maintenance Sub-Total							**$82,000**
ESTIMATED BOILER SAVINGS							-$27,000
ESTIMATED ELECTRIC SAVINGS							-$224,000
Miscellaneous /Contingency							$ (400)
Engineer's Opinion of Probable O&M Cost per Year							**-$4,400**

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City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease Regional Option (10.98 MGD Average Flow)
Digestion of Plant and Import Solids

DESCRIPTION	UNITS		ANNUAL COST	
	Quantity	Units	Unit $	Total Cost
Septage Receiving Station				
Electricity	21,783	kWh	$0.10	$ 3,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals	-	LB		$ -
Parts and Replacement	1	LS	$2,000	$ 2,000
Sludge Hauling and Disposal	-	dry ton		
Septage Receiving Operation and Maintenance Sub-Total				**$16,000**
FOG Receiving Station				
Electricity	32,675	kWh	$0.10	$ 4,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	120	HR	$43	$ 6,000
Chemicals	-	LB		$ -
Parts and Replacement	1	LS	$2,000	$ 2,000
Sludge Hauling and Disposal	-	Wet Ton		
FOG Receiving Operation and Maintenance Sub-Total				**$20,000**
Cake Receiving Station				
Electricity	108,916	kWh	$0.10	$ 11,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	365	HR	$43	$ 16,000
Maintenance Labor	180	HR	$43	$ 8,000
Chemicals	-	LB		$ -
Parts and Replacement	1	LS	$6,000	$ 6,000
Sludge Hauling and Disposal	-	dry ton		
Cake Receiving Operation and Maintenance Sub-Total				**$41,000**
Primary Sludge Thickening (Gravity Thickeners)				
Electricity	156,839	kWh	$0.10	$ 16,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals	-	LB		$ -
Parts and Replacement	1	LS	$2,000	$ 2,000
Sludge Hauling and Disposal	-	dry ton		
PS Thickening Operation and Maintenance Sub-Total				**$29,000**
WAS Thickening (RDTs)				
Electricity	226,341	kWh	$0.10	$ 23,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	365	HR	$43	$ 16,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals (Polymer)	10,539	LB	$1.5	$ 16,000
Parts and Replacement	1	LS	$5,000	$ 5,000
Sludge Hauling and Disposal	-	dry ton		
WAS Thickening Operation and Maintenance Sub-Total				**$63,000**
ANAEROBIC DIGESTERS				
Electricity	490,122	kWh	$0.10	$ 50,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	4,380	HR	$43	$ 189,000
Maintenance Labor	1,460	HR	$43	$ 63,000
Chemicals	-	LB	$2	$ -
Parts and Replacement	1	LS	$2,500	$ 3,000
Sludge Hauling and Disposal	-	dry ton		$ -
Digesters Operation and Maintenance Sub-Total				**$305,000**
DIGESTER HEATING BOILERS				
Electricity	22,100	kWh	$0.10	$ 3,000
Heating/Generator Fuel	1,971	mmBtu	$6	$ 12,000
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals		LB		$ -
Parts and Replacement	1	LS	$200	$ 1,000
Sludge Hauling and Disposal	-	dry ton		$ -
Boilers Operation and Maintenance Sub-Total				**$27,000**
DIGESTED SLUDGE DEWATERING (Screw Press)				
Electricity	127,743	kWh	$0.10	$ 13,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	1,460	HR	$43	$ 63,000
Maintenance Labor	365	HR	$43	$ 16,000
Chemicals (Polymer)	95,528	LB	$1.5	$ 144,000
Parts and Replacement	1	LS	$5,000	$ 5,000
Sludge Hauling and Disposal		dry ton		$ -
Dewatering Operation and Maintenance Sub-Total				**$241,000**
DEWATERED CAKE DISPOSAL				
Sludge Hauling and Disposal	4,776	dry ton	$70	$ 335,000
Sludge Hauling and Disposal Sub-Total				**$335,000**
IMPORTED SOLIDS TIPPING FEES (REVENUE)				
Tipping Fee on Cake Drop Off	3,210	dry ton	$25	$ (81,000)
Tipping Fee for FOG	949,000	gal	$0.05	$ (48,000)
Sludge Hauling and Disposal Sub-Total				**-$129,000**
			Miscellaneous /Contingency	$ 16,000
			Engineer's Opinion of Probable O&M Cost per Year	**$964,000**

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City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease Regional Option (10.98 MGD Average Flow)
Combined Heat & Power on Biogas from Plant and Import Solids

DESCRIPTION	UNITS		MATERIALS		LABOR/EQUIPME		TOTAL COST
	Quantity	Units	Unit $	Materials Cost	Unit $	Labor Cost	
Combined Heat & Power (CHP)							
Electricity	159,600	kWh	$0.10	$ 16,000	$0	$ -	$ 16,000
Total vendor-provided O&M	16,644	OPH	$17.83	$296,800	$0	$ -	$ 297,000
Heating/Generator Fuel (incl. in vendor O&M package)							$ -
Operations Labor (incl. in vendor O&M package)							$ -
Maintenance Labor (incl. in vendor O&M package)							$ -
Chemicals (incl. in vendor O&M package)							$ -
Parts and Replacement (incl. in vendor O&M package)							$ -
Sludge Hauling and Disposal	-	wtpd	$0	$ -	$0	$ -	$ -
CHP Operation and Maintenance Sub-Total							**$313,000**
GAS CONDITIONING							
Electricity	62,082	kWh	$0.10	$ 6,300	$0	$ -	$ 7,000
Operations Labor	365	HR			$43	$ 15,700	$ 16,000
Maintenance Labor	183	HR			$43	$ 7,900	$ 8,000
Chemicals		LB					
Parts and Replacement	1	LS	$1,000	$ 1,000	$0	$ -	$ 1,000
Media Replacement	1	LS	$50,000	$ 50,000		$ -	$ 50,000
Sludge Hauling and Disposal							
Gas Conditioning Operation and Maintenance Sub-Total							**$82,000**
						ESTIMATED BOILER SAVINGS	-$27,000
						ESTIMATED ELECTRIC SAVINGS	-$470,000
						Miscellaneous /Contingency	$ (10,200)
						Engineer's Opinion of Probable O&M Cost per Year	**-$112,200**

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City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease Regional Option (10.98 MGD Average Flow)
Solids Handling and Digestion With Imported Solids Option

DESCRIPTION	UNITS		ANNUAL COST	
	Quantity	Units	Unit $	Total Cost
Septage Receiving Station				
Electricity	21,783	kWh	$0.13	$ 3,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals	-	LB		$ -
Parts and Replacement	1	LS	$2,000	$ 2,000
Digesters, Thickening and Dewatering	-	dry ton		
Septage Receiving Operation and Maintenance Sub-Total				**$16,000**
FOG Receiving Station				
Electricity	32,675	kWh	$0.13	$ 5,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	120	HR	$43	$ 6,000
Chemicals	-	LB		$ -
Parts and Replacement	1	LS	$2,000	$ 2,000
Sludge Hauling and Disposal	-	Wet Ton		
FOG Receiving Operation and Maintenance Sub-Total				**$21,000**
Cake Receiving Station				
Electricity	108,916	kWh	$0.13	$ 15,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	365	HR	$43	$ 16,000
Maintenance Labor	180	HR	$43	$ 8,000
Chemicals	-	LB		$ -
Parts and Replacement	1	LS	$6,000	$ 6,000
Sludge Hauling and Disposal	-	dry ton		
Cake Receiving Operation and Maintenance Sub-Total				**$45,000**
Primary Sludge Thickening (Gravity Thickeners)				
Electricity	156,839	kWh	$0.13	$ 21,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals	-	LB		$ -
Parts and Replacement	1	LS	$2,000	$ 2,000
Sludge Hauling and Disposal	-	dry ton		
PS Thickening Operation and Maintenance Sub-Total				**$34,000**
WAS Thickening (RDTs)				
Electricity	343,085	kWh	$0.13	$ 45,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	365	HR	$43	$ 16,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals (Polymer)	10,530	LB	$1.5	$ 16,000
Parts and Replacement	1	LS	$5,000	$ 5,000
Sludge Hauling and Disposal	-	dry ton		
WAS Thickening Operation and Maintenance Sub-Total				**$85,000**
ANAEROBIC DIGESTERS				
Electricity	490,122	kWh	$0.10	$ 50,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	4,380	HR	$43	$ 189,000
Maintenance Labor	1,460	HR	$43	$ 63,000
Chemicals	-	LB	$2	$ -
Parts and Replacement	1	LS	$2,500	$ 3,000
Sludge Hauling and Disposal	-	dry ton		$ -
Digesters Operation and Maintenance Sub-Total				**$305,000**
DIGESTER HEATING BOILERS				
Electricity	22,100	kWh	$0.10	$ 3,000
Heating/Generator Fuel	1,971	mmBtu	$6	$ 12,000
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals		LB		$ -
Parts and Replacement	1	LS	$200	$ 1,000
Sludge Hauling and Disposal	-	dry ton		$ -
Boilers Operation and Maintenance Sub-Total				**$27,000**
DIGESTED SLUDGE DEWATERING (Screw Press)				
Electricity	356,155	kWh	$0.10	$ 36,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	1,460	HR	$43	$ 63,000
Maintenance Labor	365	HR	$43	$ 16,000
Chemicals (Polymer)	95,484	LB	$1.5	$ 144,000
Parts and Replacement	1	LS	$5,000	$ 5,000
Sludge Hauling and Disposal		dry ton		$ -
Dewatering Operation and Maintenance Sub-Total				**$264,000**
DEWATERED CAKE DISPOSAL				
Sludge Hauling and Disposal	4,774	dry ton	$70	$ 335,000
Sludge Hauling and Disposal Sub-Total				**$335,000**
Engineer's Opinion of Probable O&M Cost per Year				**$1,132,000**

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease Regional Option (10.98 MGD Average Flow)
Solids Thickening, Digestion and Digester Heating, Solids Dewatering Without Imported Solids Option

DESCRIPTION	UNITS		MATERIALS		LABOR/EQUIPMENT		TOTAL COST
	Quantity	Units	Unit $	Materials Cost	Unit $	Labor Cost	
Soft Costs							
Division 1							$ 652,000
Soft Costs							**$652,000**
Site Civil							
Site Work							
Excavation	100	CY	$ -	$ -	$ 50	$ 5,000	$ 5,000
Backfill	50	CY	$ -	$ -	$ 50	$ 2,500	$ 2,500
Digesters, Thickening, and Dewatering Building	1,600	SF	$ 175	$ 280,000	$ 175	$ 280,000	$ 560,000
Gravity Thickeners mechanism, cover and miscellaneous improvements	2	EA.	$ 400,000	$ 800,000	$ 150,000	$ 300,000	$ 1,100,000
Concrete							
Concrete work to fill in SBR corners	-	LS	$ 900,000	$ -	$ -	$ -	$ -
Modification to EQ Tanks and Intermediate Pump Station	1	LS	#######	$ 500,000	$ -	$ -	$ 500,000
Boiler and Heat Exchanger Building	0	SF	$ 300	$ -		$ -	$ -
Site Civil							**$2,168,000**
Process / Mechanical							
Major Equipment							
Rotary Drum Thickeners	1	EA.	#######	$ 287,000	$143,500	$ 143,500	$ 431,000
Dewatering Screw Press	2	EA.	#######	$ 887,400	$221,850	$ 443,700	$ 1,332,000
Modification of Existing SBRs to convert to Digesters	1	LS	#######	$ 150,000	$ -	$ -	$ 150,000
Digester Fixed Steel Covers (2 - 1 per tank)	0	EA.	#######	$ -	$198,750	$ -	$ -
Digester Top Mounted Linear Motion Mixers (6 - 3 per tank)	0	EA.	#######	$ -	$149,800	$ -	$ -
Combination Digester HW Heating Boiler and HEX (1.5 mmBtu/hr. capacity)	0	EA.	#######	$ -	$80,000	$ -	$ -
Redundant Digester Heating Boiler	0	EA.	#######	$ -	$65,000	$ -	$ -
HW Circulation Pumps	-	EA.	$ 5,000	$ -	$2,500	$ -	$ -
Ancillary Boiler Equipment (Deaerator, Water Conditioning, etc.)	-	LS	$ 50,000	$ -	$0	$ -	$ -
Flare System	0	EA.	$ 20,000	$ -	$ 10,000	$ -	$ -
Digester Gas Compressors	0	EA.	$ 10,000	$ -	$ 5,000	$ -	$ -
Condensate Traps and Biogas Moisture Removal System	0	LS	$ 50,000	$ -	$ -	$ -	$ -
Flame Arrestor and PRV assemblies	0	EA.	$ 10,000	$ -	$ 5,000	$ -	$ -
Piping Systems							
Thickened Primary Sludge (TPS) Pumps to EQ Tanks	3	EA.	$ 10,000	$ 30,000	$ 5,000	$ 15,000	$ 45,000
TPS Piping to EQ Tanks	150	LF	$ 60	$ 9,000	$ 30	$ 4,500	$ 14,000
TWAS Pumps to EQ Tanks			$ -	$ -	$ -	$ -	$ -
TWAS Piping to EQ Tanks	100	LF	$ 60	$ 6,000	$ 30	$ 3,000	$ 9,000
EQ Tanks to Intermediate Pump Station Piping	100	LF	$ 60	$ 6,000	$ 30	$ 3,000	$ 9,000
Digester Feed Pumps	0	EA.	$ 15,000	$ -	$ 7,500	$ -	$ -
Digester Feed Piping	0	LF	$ -	$ -	$ -	$ -	$ -
Digester Recirculation/Mixing Pumps	0	EA.	$ 10,000	$ -	$ 5,000	$ -	$ -
Digester Recirculation/Mixing Piping	0	LF	$ 60	$ -	$ 30	$ -	$ -
Digester Draw Pumps	0	EA.	$ -	$ -	$ -	$ -	$ -
Digester Draw Piping	0	LF	$ 60	$ -	$ 30	$ -	$ -
Biogas Piping to Boilers	0	LF	$ 90	$ -	$ 45	$ -	$ -
Process Mechanical Sub-Total							**$1,990,000**
ELECTRICAL							
							$ 298,500
Electrical Sub-Total							**$ 299,000**
INSTRUMENTATION AND CONTROLS							
							$ 199,000
Instrumentation and Controls Sub-Total							**$ 199,000**
Capital Cost Subtotal							**$ 5,308,000**
						Construction Contingency	$ 796,000
						Engineering and Associated Project Costs	$ 955,000
						Contractor's Overhead and Profit (5%)	$ 265,000
						Engineer's Opinion of Probable Construction Cost	**$7,324,000**

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City of Portsmouth New Hampshire
Estimated Annual Operations and Maintenance Costs
Portsmouth Regional Option (10.98 MGD Average Flow)
Solids Handling, No Digestion, No Imported Solids Option

DESCRIPTION	UNITS		ANNUAL COST	
	Quantity	Units	Unit $	Total Cost
Primary Sludge Thickening (Gravity Thickeners)				
Electricity	124,164	kWh	$0.10	$ 13,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	183	HR	$43	$ 8,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals	-	LB		$ -
Parts and Replacement	1	LS	$2,000	$ 2,000
Sludge Hauling and Disposal	-	Wet Ton		
PS Thickening Operation and Maintenance Sub-Total				**$26,000**
WAS Thickening (RDTs)				
Electricity	277,736	kWh	$0.10	$ 28,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	365	HR	$43	$ 16,000
Maintenance Labor	52	HR	$43	$ 3,000
Chemicals (Polymer)	10,530	LB	$1.5	$ 16,000
Parts and Replacement	1	LS	$5,000	$ 5,000
Sludge Hauling and Disposal	-	Wet Ton		
WAS Thickening Operation and Maintenance Sub-Total				**$68,000**
ANAEROBIC DIGESTERS				
Electricity	-	kWh	$0.10	$ -
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	-	HR	$43	$ -
Maintenance Labor	-	HR	$43	$ -
Chemicals	-	LB	$2	$ -
Parts and Replacement	-	LS	$2,500	$ -
Sludge Hauling and Disposal	-	Wet Ton		$ -
Digesters Operation and Maintenance Sub-Total				**$0**
DIGESTER HEATING BOILERS				
Electricity	-	kWh	$0.10	$ -
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	-	HR	$43	$ -
Maintenance Labor	-	HR	$43	$ -
Chemicals		LB		$ -
Parts and Replacement	-	LS	$200	$ -
Sludge Hauling and Disposal	-	Wet Ton		$ -
Boilers Operation and Maintenance Sub-Total				**$0**
DIGESTED SLUDGE DEWATERING (Screw Press)				
Electricity	498,617	kWh	$0.14	$ 70,000
Heating/Generator Fuel	-	mmBtu	$6	$ -
Operations Labor	2,044	HR	$43	$ 88,000
Maintenance Labor	511	HR	$43	$ 22,000
Chemicals (Polymer)	73,993	LB	$1.5	$ 111,000
Parts and Replacement	1	LS	$5,000	$ 7,000
Sludge Hauling and Disposal	-	Wet Ton		$ -
Dewatering Operation and Maintenance Sub-Total				**$298,000**
DEWATERED CAKE DISPOSAL				
Sludge Hauling and Disposal	3,700	dry ton	$70	$ 259,000
Sludge Hauling and Disposal Sub-Total				**$259,000**
Engineer's Opinion of Probable O&M Cost per Year				**$651,000**

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease Regional Option (10.98 MGD Average Flow)
Combined Heat and Power (CHP) System With Imported Solids Option

DESCRIPTION	UNITS		MATERIALS		LABOR/EQUIPMENT		TOTAL COST
	Quantity	Units	Unit $	Materials Cost	Unit $	Labor Cost	
Soft Costs							
Division 1 (14% of subtotal)	1	LS					$ 546,000
Air Permitting	1	LS			$25,000	$ 25,000	$ 25,000
Site Civil							**$571,000**
Site Civil							
Cogeneration, and Electrical Distribution Building	700	SF	$300	$ 210,000		$ -	$ 210,000
Digesters, Thickening and Dewatering	20	CY	$350	$ 7,000		$ -	$ 7,000
Site Civil							**$217,000**
PROCESS/MECHANICAL							
Major Equipment							
Biogas Conditioning Skid (200 scfm capacity)	1	EA.	$500,000	$ 500,000	$250,000	$ 250,000	$ 750,000
Engine Generator w HOW Heat Recovery (550 kW capacity)	2	EA.	$789,900	$ 1,579,800	$394,950	$ 789,900	$ 2,370,000
Jacket water heater (included with engine)			$ -	$ -	$ -	$ -	$ -
Jacket water plate and frame heat exchanger (included with engine)			$ -	$ -	$ -	$ -	$ -
Stacked core heat dump horizontal type radiator (included with engine)			$ -	$ -	$ -	$ -	$ -
Digester Gas Train (included with engine)			$ -	$ -	$ -	$ -	$ -
Exhaust Heat Exchanger	2	EA.	$30,000	$ 60,000	$15,000	$ 30,000	$ 90,000
HOW Circulation Pumps	3	EA.	$5,000	$ 15,000	$2,500	$ 7,500	$ 23,000
Plate and Frame Heat Exchangers between Engine and HOW Loop	2	EA.	$7,500	$ 15,000	$3,750	$ 7,500	$ 23,000
Piping							
Additional HWS and HWR Piping and Valves	125	LF	$60	$ 7,500	$30	$3,750	$ 12,000
Additional Biogas Process Piping and Valves	125	LF	$90	$ 11,300	$45	$5,650	$ 17,000
Process Mechanical Sub-Total							**$3,285,000**
ELECTRICAL							
Switchgear and Electrical Connection to Plant Grid (included with engine)							$ -
General Electrical	1	LS	$250,000	$ 250,000	0%	$ -	$ 250,000
Electrical Sub-Total							**$ 250,000**
INSTRUMENTATION AND CONTROLS							
Instrumentation and Controls Lump Sum	1	LS	$120,000	$ 120,000		$ -	$ 120,000
Engine/Generator control panel and alarms (included with engine)							$ -
Instrumentation and Controls Sub-Total							**$ 120,000**
Capital Cost Subtotal							**$ 4,443,000**
Construction Contingency							$ 666,000
Engineering and other Associated Project Costs							$ 800,000
Contractor's Overhead and Profit (5%)							$ 222,000
Engineer's Opinion of Probable Construction Cost							**$6,131,000**

City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease Regional Option (10.98 MGD Average Flow)
Combined Heat & Power With Imported Solids Option

DESCRIPTION	UNITS		MATERIALS		LABOR/EQUIPMENT		TOTAL COST
	Quantity	Units	Unit $	Materials Cost	Unit $	Labor Cost	
Combined Heat & Power (CHP)							
Electricity	159,600	kWh	$0.13	$ 20,800	$0	$ -	$ 21,000
Total vendor-provided O&M	16,644	OPH	$17.83	$ 296,800	$0	$ -	$ 297,000
Heating/Generator Fuel (incl. in vendor O&M package)							$ -
Operations Labor (incl. in vendor O&M package)							$ -
Maintenance Labor (incl. in vendor O&M package)							$ -
Chemicals (incl. in vendor O&M package)							$ -
Digesters, Thickening and Dewatering							$ -
Sludge Hauling and Disposal	-	wtpd	$0	$ -	$0	$ -	$ -
CHP Operation and Maintenance Sub-Total							**$318,000**
GAS CONDITIONING							
Electricity	62,100	kWh	$0.13	$ 8,100	$0	$ -	$ 9,000
Operations Labor	365	HR	$43	$ 15,700	$0	$ -	$ 16,000
Maintenance Labor	183	HR	$43	$ 7,900	$0	$ -	$ 8,000
Chemicals		LB					
Parts and Replacement	1	LS	$1,000	$ 1,000	$0	$ -	$ 1,000
Media Replacement	1	LS	$100,000	$ 100,000		$ -	$ 100,000
Sludge Hauling and Disposal							
Total							**$134,000**
						ESTIMATED BOILER SAVINGS	-$27,000
						ESTIMATED ELECTRIC SAVINGS	-$601,000
						Engineer's Opinion of Probable O&M Cost per Year	**-$176,000**

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease Regional Option (10.98 MGD Average Flow)
Electrical Distribution

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Treatment Facilities				
Division 01 General Requirements				
General Conditions	10%	%	$ 1,560,000	$ 156,000
Bond	1%	%	$ 1,716,000	$ 17,200
Insurance	3%	%	$ 1,733,200	$ 52,000
Profit	5%	%	$ 1,785,200	$ 89,300
Digesters, Thickening and Dewatering				
Division 02 Existing Conditions				
Miscellaneous/Undefined	20%	%	$ 1,300,000	$ 260,000
Division 03 Concrete				
Division 04 Masonry				
Division 05 Metals				
Division 06 Woods, Plastics and Composites				
Division 07 Thermal and Moisture Protection				
Division 08 Openings				
Division 09 Finishes				
Division 10 Specialties				
Division 22 Plumbing				
Division 23 HVAC				
Division 26 Electrical				
Generators	2	EA.	$ 400,000	$ 800,000
Main Switch Gear	1	EA.	$ 380,000	$ 380,000
Main Service	1	EA.	$ 120,000	$ 120,000
Division 27 Communications				
Division 31 Earthworks				
Division 32 Exterior Improvements				
Division 33 Utilities				
Division 40 Process Integration				
Division 41 Material Processing and Handling Equipment				
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Division 46 Water and Wastewater Equipment				
SUBTOTAL				
			CONSTRUCTION SUBTOTAL	**$ 1,874,500**
			Engineering and other Associated Project Costs 18%	**$ 337,410.00**
			Contingency 15%	**$ 281,175.00**
			TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)	**$ 2,490,000**

City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease Regional Option (10.98 MGD Average Flow)
Electrical Distribution

Electricity

Description	Estimated Power Use	Units	Hours/day	Days/year	kWh/year	Cost per year
Use calculated for each proces	0	HP	0	0		$ -
Digesters, Thickening and Dewatering						$ -

Electricity cost based on $ 0.13 per Kwh

Heating/Generator Fuel

Description	Quantity	Units	Labor Rate ($/hour)	Cost per Year
Generator Fuel	16400	gallons	$ 4.08	$ 66,912.00
Total				$ 66,912.00

Operations Labor

Description	Labor	Units	Labor Rate ($/hour)	Cost per Year
Exercise Generator	24	hr./year	$ 43.00	$ 1,032.00
Total				$ 1,032.00

Maintenance Labor

Description	Labor (hours/year)	Units	Labor Rate ($/hour)	Cost per Year
General Maintenance	80	hr./year	$ 43.00	$ 3,440.00
Total				$ 3,440.00

Chemicals

Chemical	Units/day		Unit Cost	Cost per Year
None	0		$ -	$ -
Total				$ -

Parts & Replacement

Description	Replacement Parts		Capital Cost	Replacement Costs
Generators	1%		$ 1,874,500.00	$ 18,745.00
Switchgear				
Total				$ 18,745.00

Sludge Hauling & Disposal

Description	Quantity	Units	Unit Cost	Annual Cost
Tipping fee	0	Tons	$ 67.00	$ -
Trucking	0	Miles	$ 1.40	$ -
Total				$ -

Other Miscellaneous

Description	Quantity	Units	Unit Cost	Annual Cost
Miscellaneous/Contingency	5%	%	$ 89,097.00	$ 4,454.85
Total				$ 4,454.85

Total $ 95,000.00

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City of Portsmouth New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth Option (10.98 MGD Average Flow)
Additional Treatment Plant Costs for Alternate Sites

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Treatment Facilities				
Division 01 General Requirements				
General Conditions	10%	%	$ 5,060,500	$ 506,100
Bond	1%	%	$ 5,566,600	$ 55,700
Insurance	3%	%	$ 5,622,300	$ 168,700
Profit	5%	%	$ 5,791,000	$ 289,600
Division 02 Existing Conditions				
Miscellaneous/Undefined	25%	%	$ 4,048,400	$ 1,012,100
Decomission Existing Pease Site	1	LS	$ 200,000	$ 200,000
Division 03 Concrete				
Digester slabs	419	CY	$ 525	$ 219,800
Digester Walls	1,026	CY	$ 800	$ 820,600
Digester Grout/ Miscelaneous	70	CY	$ 930	$ 64,900
Gravity Thickener Slabs	105	CY	$ 525	$ 55,000
Gravity Thickener Walls	209	CY	$ 800	$ 167,500
Gravity Thickener Grout/ Miscelaneous	31	CY	$ 930	$ 29,200
Division 04 Masonry				
Division 05 Metals				
Miscellaneous Metals	5	EA.	$ 30,000	$ 150,000
Division 06 Woods, Plastics and Composites				
Grating	3	EA.	$ 20,000	$ 60,000
Division 07 Thermal and Moisture Protection				
Solids Handling Building (Additional costs only)	1,000	SF	$ 350	$ 350,000
		SF		$ -
Division 08 Openings				
Division 09 Finishes				
Coatings	1	LS	$ 15,000	$ 15,000
Division 10 Specialties				
Division 22 Plumbing				
Plumbing	1	LS	$ 50,000	$ 50,000
Division 23 HVAC				
Heat and Ventilation	1	LS	$ 250,000	$ 250,000
Division 26 Electrical				
Electrical Work	12%	%	$ 2,453,900	$ 294,500
Division 27 Communications				
Division 31 Earthworks				
Excavation	2,977	CY	$ 3.57	$ 10,600
Rock Blasting	3,908	CY	$ 20.00	$ 78,200
Rock Moving	3,908	CY	$ 6.27	$ 24,500
Stone Sub base	651	CY	$ 20.74	$ 13,500
Backfill and Compact	1,377	CY	$ 3.96	$ 5,500
Dewatering	4	MO	$ 20,000	$ 80,000
Division 32 Exterior Improvements				
Fine Grade and Seed	2,400	SF	$ 4	$ 9,600
Division 33 Utilities				
Division 40 Process Integration				
Division 41 Material Processing and Handling Equipment				
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Division 46 Water and Wastewater Equipment				
1.35 MGD pump Station	1	EA.	$ 1,100,000	$ 1,100,000
SUBTOTAL				
CONSTRUCTION SUBTOTAL				**$ 6,080,600**
Engineering and Other Associated Project Costs			**18%**	**$ 1,094,508.00**
Contingency			**15%**	**$ 912,090.00**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 8,090,000**

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease Regional Option (10.98 MGD Average Flow)
Odor Control

DESCRIPTION	QTY.	UNIT	UNIT COST	TOTAL
			OPINION OF PROBABLE CONSTRUCTION COST	
Pease WWTF Treatment Facilities				
Division 01 General Requirements				
General Conditions	10%	%	$ 2,555,300	$ 255,500
Bond	3%	%	$ 2,810,800	$ 84,300
Insurance	1%	%	$ 2,895,100	$ 29,000
Profit	5%	%	$ 2,924,100	$ 146,200
Digesters, Thickening and Dewatering				
Division 02 Existing Conditions				
Miscellaneous/Undefined	20%	%	$ 2,129,400	$ 425,900
Division 03 Concrete				
Division 04 Masonry				
Division 05 Metals				
Miscellaneous Metals	1	LS	$ 80,000	$ 80,000
Division 06 Woods, Plastics and Composites				
Division 07 Thermal and Moisture Protection				
Division 08 Openings				
Division 09 Finishes				
Division 10 Specialties				
Division 22 Plumbing				
Division 23 HVAC				
Division 26 Electrical				
Division 27 Communications				
Division 31 Earthworks				
Division 32 Exterior Improvements				
Division 33 Utilities				
Division 40 Process Integration				
Division 41 Material Processing and Handling Equipment				
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Carbon Tower for Headworks	27,000	CFM	$ 24	$ 651,700
Biological Tower for Solids Handling	32,000	CFM	$ 44	$ 1,397,700
Division 46 Water and Wastewater Equipment				
			CONSTRUCTION SUBTOTAL	**$ 3,070,300**
			Engineering and other Associated Project Costs 18%	**$ 552,654.00**
			Contingency 15%	**$ 460,545.00**
			TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)	**$ 4,080,000**

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City of Portsmouth, New Hampshire
Estimated Annual Operations and Maintenance Costs
Pease Regional Option (10.98 MGD Average Flow)
Odor Control

Electricity

Description	Estimated Power Use	Units	Hours/day	Days/year	kWh/year	Cost per year
Blowers	50	HP	24	7		$ -
Digesters, Thickening and Dewatering						$ -

Electricity cost based on $ 0.13 per Kwh

Heating/Generator Fuel

Description	Quantity	Units	Unit Cost	Cost per Year
Generator Fuel	0	gallons	$ 4.08	$ -
Total				$ -

Operations Labor

Description	Labor	Units	Labor Rate ($/hour)	Cost per Year
Operation	260	hr./year	$ 43.00	$ 11,180.00
Total				$ 11,180.00

Maintenance Labor

Description	Labor (hours/year)	Units	Labor Rate ($/hour)	Cost per Year
General Maintenance	80	hr./year	$ 43.00	$ 3,440.00
Total				$ 3,440.00

Chemicals

Chemical	Units/day		Unit Cost	Cost per Year
None	0		$ -	$ -
Total				$ -

Parts & Replacement

Description	Replacement Parts		Capital Cost	Replacement Costs
Odor Contrl Equipment	1%		$2,049,400	$ 20,494
Carbon replacement	20%		$ 325,850	$ 65,170
Total				$ 85,664.00

Sludge Hauling & Disposal

Description	Quantity	Units	Unit Cost	Annual Cost
Tipping fee	0	Tons	$ 67.00	$ -
Trucking	0	Miles	$ 1.40	$ -
Total				$ -

Other Miscellaneous

Description	Quantity	Units	Unit Cost	Annual Cost
Miscellaneous/Contingency	5%	%	$89,104.00	$ 4,455.20
Total				$ 4,455.20

Total $ 105,000.00

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City of Portsmouth New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth and Pease Regional Options
Project Summary

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST				Annual O&M Cost	Total Lifecycle Cost
	QTY.	UNIT	UNIT COST	TOTAL		
Pease WWTF Conveyance and Collection						
Debottlenecking	1	LS	$ 6,930,000	$ 6,930,000	$ 69,300	$ 8,090,000
Force Mains	1	LS	$ 18,290,000	$ 18,290,000	$ 182,900	$ 21,330,000
Outfall - Deer Street Location	1	LS	$ 7,980,000	$ 7,980,000	$ 79,800	$ 9,310,000
Mechanic Street Pump Station[4]	1	LS	$ 11,269,000	$ 11,269,000	$ 7,598	$ 11,400,000
Peirce Island Dewatering Pump Station[4]	1	LS	$ 740,000	$ 740,000	$ -	$ 740,000
Chemically Enhanced Primary Treatment for Wet Weather (Peirce Island)	1	LS	$ 680,960	$ 680,960	$ 269,178	$ 5,160,000
Subtotal						
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 45,890,000**	**$ 610,000**	**$ 56,030,000**
TOTAL OPINION OF PROBABLE PROJECT COST (LOW RANGE ESTIMATE -30%)				**$ 32,120,000**	**$ 430,000**	**$ 39,220,000**
TOTAL OPINION OF PROBABLE PROJECT COST (HIGH RANGE ESTIMATE +50%)				**$ 68,840,000**	**$ 920,000**	**$ 84,050,000**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 45,890,000**	**$ 610,000**	**$ 56,030,000**
TOTAL OPINION OF PROBABLE CONSTRUCTION COSTS ESCALATED TO CONSTRUCTION MID-POINT IN 2018 USD				**$ 49,420,000**	**$660,000**	**$60,340,000**

The following assumptions and references were used to develop the opinion of probable construction cost

1 Opinions of probable costs are at a conceptual level based on 10 % project definition.
2 Estimates are consistent with AACE Class 4 construction cost estimate which are typically accurate between -10% and -30% to +20% and
3 All unit costs are in 2015 dollars. Escalation has been on an item basis assuming an annual 2.5% inflation rate- projected ENR CCI of 10896
4 O&M costs for these facilities represent the NET increase/decrease in O&M costs over existing operations.

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth and Pease Regional Options
Debottlenecking (Richards Ave. to Marcy St.)

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Conveyance and Collection				
Division 01 General Requirements				
General Conditions	10%	LS	$ 4,131,013	$ 413,101
Bond	1%	LS	$ 4,544,114	$ 45,441
Insurance	3%	LS	$ 4,589,555	$ 137,687
Profit	5%	LS	$ 4,727,242	$ 236,362
Mobilization / Demobilization	5%	LS	$ 4,963,604	$ 248,180
Erosion and Sediment Control (Temporary Controls)	5,762	LF	$ 5	$ 28,811
M&P of Vehicle / Pedestrian Traffic	58	DAY	$ 1,600	$ 92,194
Bypass Pumping / Flow Maintenance	58	DAY	$ 1,500	$ 86,431.50
Division 02 Existing Conditions				
Division 03 Concrete				
Division 04 Masonry				
Division 05 Metals				
Division 06 Woods, Plastics and Composites				
Division 07 Thermal and Moisture Protection				
Division 08 Openings				
Division 09 Finishes				
Division 10 Specialties				
Division 22 Plumbing				
Division 23 HVAC				
Division 26 Electrical				
Division 27 Communications				
Division 31 Earthworks				
Excavation	4,802	BCY	$ 8	$ 38,414
Pipe Bedding	5,495	CY	$ 25	$ 137,383
General Backfill	8,003	LCY	$ 8	$ 64,023
Select Backfill	3,201	LCY	$ 23	$ 73,627
Compaction	7,469	BCY	$ 3	$ 24,500
Off-Site Disposal of Excess Materials		LCY	$ 20	$ -
Rock Excavation	11,204	CY	$ 225	$ 2,520,919
Restoration	3,841	SY	$ 35	$ 134,449
Division 32 Exterior Improvements				
Division 33 Utilities				
Utility Coordination and Relocation	1	LS	$ 60,000	$ 60,000
Precast Concrete Structures	150	VF	$ 1,000	$ 150,000
60" Concrete Pipe	2,881	LF	$ 250	$ 720,263
Division 40 Process Integration				
Division 41 Material Processing and Handling Equipment				
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Division 46 Water and Wastewater Equipment				
SUBTOTAL			**CONSTRUCTION SUBTOTAL**	**$ 5,211,784**
			ENGINEERING 18%	**$ 938,121**
			CONTINGENCY 15%	**$ 781,768**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 6,930,000**
Annual O&M COSTS 1%				**$ 69,300**

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City of Portsmouth New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth and Pease Regional Options
Force Mains

Type 1: New Castle FM Extension and Peirce Island to Mechanic Street PS (2,677 LF)
Type 2: Dual_ FM to Pease - Downtown Corridor (5,695 LF)
Type 3: Dual_ FM to Pease - Market Street Corridor (8,573 LF)
Type 4: Dual_ FM to Pease - Arthur F. Brady Drive (1,940 LF)

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Conveyance and Collection				
Division 01 General Requirements				
General Conditions	10%	LS	$ 10,380,817	$ 1,038,082
Bond	1%	LS	$ 11,418,899	$ 114,189
Insurance	3%	LS	$ 11,533,088	$ 345,993
Profit	5%	LS	$ 11,879,080	$ 593,954
Mobilization / Demobilization	5%	LS	$ 12,473,034	$ 623,652
Type 1 - Erosion and Sedimentation Control (Temporary Controls)	2,677	LF	$ 5	$ 13,386
Type 2 - Erosion and Sedimentation Control (Temporary Controls)	5,695	LF	$ 5	$ 28,474
Type 3 - Erosion and Sedimentation Control (Temporary Controls)	8,573	LF	$ 5	$ 42,866
Type 4 - Erosion and Sedimentation Control (Temporary Controls)	1,940	LF	$ 5	$ 9,700
Type 1 - M&P of Vehicle / Pedestrian Traffic	27	DAY	$ 1,600	$ 42,836
Type 2 - M&P of Vehicle / Pedestrian Traffic	114	DAY	$ 1,600	$ 182,240
Type 3 - M&P of Vehicle / Pedestrian Traffic	171	DAY	$ 1,600	$ 274,336
Type 4 - M&P of Vehicle / Pedestrian Traffic	39	DAY	$ 1,600	$ 62,080
Division 02 Existing Conditions				
Division 03 Concrete				
Division 04 Masonry				
Division 05 Metals				
Division 06 Woods, Plastics and Composites				
Division 07 Thermal and Moisture Protection				
Division 08 Openings				
Division 09 Finishes				
Division 10 Specialties				
Division 22 Plumbing				
Division 23 HVAC				
Division 26 Electrical				
Division 27 Communications				
Division 31 Earthworks				
Type 1 - Excavation	2,356	BCY	$ 8	$ 18,848
Type 2 - Excavation	4,177	BCY	$ 8	$ 33,415
Type 3 - Excavation	18,861	BCY	$ 8	$ 150,887
Type 4 - Excavation	4,268	BCY	$ 8	$ 34,144
Type 1 - Pipe Bedding	1,969	CY	$ 25	$ 49,232
Type 2 - Pipe Bedding	6,897	CY	$ 25	$ 172,425
Type 3 - Pipe Bedding	10,383	CY	$ 25	$ 259,576
Type 4 - Pipe Bedding	2,350	CY	$ 25	$ 58,739
Type 1 - General Backfill	1,666	LCY	$ 8	$ 13,327
Type 2 - General Backfill	8,859	LCY	$ 8	$ 70,868
Type 3 - General Backfill	13,336	LCY	$ 8	$ 106,688
Type 4 - General Backfill	3,018	LCY	$ 8	$ 24,142
Type 1 - Select Backfill	416	LCY	$ 23	$ 9,579
Type 2 - Select Backfill	2,215	LCY	$ 23	$ 50,936
Type 3 - Select Backfill	3,334	LCY	$ 23	$ 76,682
Type 4 - Select Backfill	754	LCY	$ 23	$ 17,352
Type 1 - Compaction	2,618	BCY	$ 3	$ 8,586
Type 2 - Compaction	13,923	BCY	$ 3	$ 45,667
Type 3 - Compaction	20,957	BCY	$ 3	$ 68,738
Type 4 - Compaction	4,742	BCY	$ 3	$ 15,554
Type 1 - Off-Site Disposal of Excess Materials	416	LCY	$ 20	$ 8,329
Type 2 - Off-Site Disposal of Excess Materials	2,215	LCY	$ 20	$ 44,293
Type 3 - Off-Site Disposal of Excess Materials	3,334	LCY	$ 20	$ 66,680
Type 4 - Off-Site Disposal of Excess Materials	754	LCY	$ 20	$ 15,089
Type 1 - Rock Excavation	262	CY	$ 225	$ 58,900
Type 2 - Rock Excavation	9,746	CY	$ 225	$ 2,192,868
Type 3 - Rock Excavation	2,096	CY	$ 225	$ 471,523
Type 4 - Rock Excavation	474	CY	$ 225	$ 106,700
Type 1 - Restoration	1,190	SY	$ 25	$ 29,748
Type 2 - Restoration	3,797	SY	$ 30	$ 113,915
Type 3 - Restoration	5,715	SY	$ 25	$ 142,886
Type 4 - Restoration	1,293	SY	$ 25	$ 32,333
Division 32 Exterior Improvements				
Division 33 Utilities				
Utility Coordination and Relocation	1	EA	$ 200,000	$ 200,000
Type 1 - Pre-cast Concrete Structures (Air Release Manhole)	9	EA	$ 8,000	$ 71,394
Type 2 - Pre-cast Concrete Structures (Air Release Manhole)	38	EA	$ 8,000	$ 303,733
Type 3 - Pre-cast Concrete Structures (Air Release Manhole)	57	EA	$ 8,000	$ 457,227
Type 4 - Pre-cast Concrete Structures (Air Release Manhole)	13	EA	$ 8,000	$ 103,467
Type 1 - HDPE Pipe (including Fittings and Clean-Outs)	2,677	LF	$ 120	$ 321,274
Type 2 - HDPE Pipe (including Fittings and Clean-Outs)	11,390	LF	$ 120	$ 1,366,800
Type 3 - HDPE Pipe (including Fittings and Clean-Outs)	17,146	LF	$ 120	$ 2,057,520
Type 4 - HDPE Pipe (including Fittings and Clean-Outs)	3,880	LF	$ 120	$ 465,600
Type 1 - Peirce Island Road Bridge Crossing (Insulated Pipe)	278	LF	$ 220	$ 61,153
Type 3 - Mill Pond Crossing (Directional Drilling)	452	LF	$ 500	$ 226,000
Type 3 - I-95 Underpass Increase	1	LS	$ 50,000	$ 50,000
Type 4 - Spaulding Turnpike Crossing (Directional Drilling)	256	LF	$ 500	$ 128,000
Division 40 Process Integration				
Division 41 Material Processing and Handling Equipment				
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Division 46 Water and Wastewater Equipment				
SUBTOTAL				
CONSTRUCTION SUBTOTAL				**$ 13,752,604**
ENGINEERING			**18%**	**$ 2,475,469**
CONTINGENCY			**15%**	**$ 2,062,891**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 18,290,000**
Annual O&M COSTS			**1%**	**$ 182,900**

Escallation to 2018 dollars
$19,700,000
20 year Present Worth Lifecycle Cost
$21,600,000

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City of Portsmouth New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth and Pease Regional Options
Subaqueous Force Main Option

Type 1: New Castle FM Extension and Peirce Island to Mechanic Street PS (2,677 LF)
Type 2: Dual_ FM to Pease - Subaqueous Mechanic Street to Deer Street (4,200 LF)
Type 3: Dual_ FM to Pease - Market Street Corridor (8,573 LF)
Type 4: Dual_ FM to Pease - Arthur F. Brady Drive (1,940 LF)

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Conveyance and Collection				
Division 01 General Requirements				
General Conditions	10%	LS	$ 11,160,531	$ 1,116,053
Bond	1%	LS	$ 12,276,584	$ 122,766
Insurance	3%	LS	$ 12,399,350	$ 371,980
Profit	5%	LS	$ 12,771,330	$ 638,567
Mobilization / Demobilization	5%	LS	$ 13,409,897	$ 670,495
Type 1 - Erosion and Sedimentation Control (Temporary Controls)	2,677	LF	$ 5	$ 13,386
Type 2 - Erosion and Sedimentation Control (Temp. Cont. - Turbidity Curtain)	4,200	LF	$ 300	$ 1,260,000
Type 3 - Erosion and Sedimentation Control (Temporary Controls)	8,573	LF	$ 5	$ 42,866
Type 4 - Erosion and Sedimentation Control (Temporary Controls)	1,940	LF	$ 5	$ 9,700
Type 1 - M&P of Vehicle / Pedestrian Traffic	27	DAY	$ 1,600	$ 42,836
Type 2 - M&P of Vehicle / Pedestrian Traffic	1	LS	$ 10,000	$ 10,000
Type 3 - M&P of Vehicle / Pedestrian Traffic	171	DAY	$ 1,600	$ 274,336
Type 4 - M&P of Vehicle / Pedestrian Traffic	39	DAY	$ 1,600	$ 62,080
Division 31 Earthworks				
Type 1 - Excavation	2,356	BCY	$ 8	$ 18,848
Type 2 - Excavation - Mechanical Dredge, Disposal at Sea	23,030	CY	$ 30	$ 690,900
Type 3 - Excavation	18,861	BCY	$ 8	$ 150,887
Type 4 - Excavation	4,268	BCY	$ 8	$ 34,144
Type 1 - Pipe Bedding	1,969	CY	$ 25	$ 49,232
Type 2 - Pipe Bedding	13,711	CY	$ 35	$ 479,873
Type 3 - Pipe Bedding	10,383	CY	$ 25	$ 259,576
Type 4 - Pipe Bedding	2,350	CY	$ 25	$ 58,739
Type 1 - General Backfill	1,666	LCY	$ 8	$ 13,327
Type 3 - General Backfill	13,336	LCY	$ 8	$ 106,688
Type 4 - General Backfill	3,018	LCY	$ 8	$ 24,142
Type 1 - Select Backfill	416	LCY	$ 23	$ 9,579
Type 2 - Select Backfill (Rip-Rap Protection)	5,763	CY	$ 50	$ 288,167
Type 3 - Select Backfill	3,334	LCY	$ 23	$ 76,682
Type 4 - Select Backfill	754	LCY	$ 23	$ 17,352
Type 1 - Compaction	2,618	BCY	$ 3	$ 8,586
Type 3 - Compaction	20,957	BCY	$ 3	$ 68,738
Type 4 - Compaction	4,742	BCY	$ 3	$ 15,554
Type 1 - Off-Site Disposal of Excess Materials	416	LCY	$ 20	$ 8,329
Type 3 - Off-Site Disposal of Excess Materials	3,334	LCY	$ 20	$ 66,680
Type 4 - Off-Site Disposal of Excess Materials	754	LCY	$ 20	$ 15,089
Type 1 - Rock Excavation	262	CY	$ 225	$ 58,900
Type 2 - Rock Excavation	2,559	CY	$ 500	$ 1,279,444
Type 3 - Rock Excavation	2,096	CY	$ 225	$ 471,523
Type 4 - Rock Excavation	474	CY	$ 225	$ 106,700
Type 1 - Restoration	1,190	SY	$ 25	$ 29,748
Type 2 - Restoration	450	SY	$ 25	$ 11,250
Type 3 - Restoration	5,715	SY	$ 25	$ 142,886
Type 4 - Restoration	1,293	SY	$ 25	$ 32,333
Division 32 Exterior Improvements				
Division 33 Utilities				
Utility Coordination and Relocation	1	EA	$ 175,000	$ 175,000
Type 1 - Pre-cast Concrete Structures (Air Release Manhole)	9	EA	$ 8,000	$ 71,394
Type 2 - Pre-cast Concrete Structures (Air Release Manhole)	20	EA	$ 8,000	$ 160,000
Type 3 - Pre-cast Concrete Structures (Air Release Manhole)	57	EA	$ 8,000	$ 457,227
Type 4 - Pre-cast Concrete Structures (Air Release Manhole)	13	EA	$ 8,000	$ 103,467
Type 1 - HDPE Pipe (including Fittings and Clean-Outs)	2,677	LF	$ 120	$ 321,274
Type 2 - HDPE Pipe (including Fittings)	8,400	LF	$ 150	$ 1,260,000
Type 3 - HDPE Pipe (including Fittings and Clean-Outs)	17,146	LF	$ 120	$ 2,057,520
Type 4 - HDPE Pipe (including Fittings and Clean-Outs)	3,880	LF	$ 120	$ 465,600
Type 1 - Peirce Island Road Bridge Crossing (Insulated Pipe)	278	LF	$ 220	$ 61,153
Type 2 - Enter/Exit Water at Mechanic Street and Deer Street	4	EA	$ 200,000	$ 800,000
Type 2 - Peirce Island Bridge Adder	1	LS	$ 50,000	$ 50,000
Type 2 - Recreational Navigation/Dock Access	1	LS	$ 30,000	$ 30,000
Type 2 - Memorial Bridge Adder	1	LS	$ 75,000	$ 75,000
Type 2 - Commercial Navigation/Dock Access	1	LS	$ 75,000	$ 75,000
Type 3 - Mill Pond Crossing (Directional Drilling)	452	LF	$ 500	$ 226,000
Type 3 - I-95 Underpass Increase	1	LS	$ 50,000	$ 50,000
Type 4 - Spaulding Turnpike Crossing (Directional Drilling)	256	LF	$ 500	$ 128,000
Division 40 Process Integration				
Division 41 Material Processing and Handling Equipment				
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Division 46 Water and Wastewater Equipment				
SUBTOTAL				
CONSTRUCTION SUBTOTAL				**$ 15,795,596**
ENGINEERING			**18%**	**$ 2,843,207**
CONTINGENCY			**15%**	**$ 2,369,339**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 21,010,000**

Annual O&M COSTS	**1.25%**	**$ 262,625**

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City of Portsmouth New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth and Pease Regional Options
Outfall Option 1 - Upgrade Current Pease Outfall
Type 1: Pease - Arthur F. Brady Drive (1,940 LF)
Type 2: Commercial / Industrial Segment to River (6,382 LF)

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Conveyance and Collection				
Division 01 General Requirements				
General Conditions	10%	LS	$ 3,676,259	$ 367,626
Bond	1%	LS	$ 4,043,885	$ 40,439
Insurance	3%	LS	$ 4,084,324	$ 122,530
Profit	5%	LS	$ 4,206,853	$ 210,343
Mobilization / Demobilization	5%	LS	$ 4,417,196	$ 220,860
Type 2 - Erosion and Sediment Control (Temporary Controls)	6,382	LF	$ 5	$ 31,911
Type 2 - M&P of Vehicle / Pedestrian Traffic	64	DAY	$ 1,600	$ 102,114
Division 02 Existing Conditions				
Division 03 Concrete				
Division 04 Masonry				
Division 05 Metals				
Division 06 Woods, Plastics and Composites				
Division 07 Thermal and Moisture Protection				
Division 08 Openings				
Division 09 Finishes				
Division 10 Specialties				
Division 22 Plumbing				
Division 23 HVAC				
Division 26 Electrical				
Division 27 Communications				
Division 31 Earthworks				
Type 1 - Excavation	2,845	BCY	$ 8	$ 22,763
Type 1 - Pipe Bedding	2,420	CY	$ 25	$ 60,499
Type 1 - General Backfill	2,012	LCY	$ 8	$ 16,095
Type 1 - Select Backfill	503	LCY	$ 23	$ 11,568
Type 1 - Compaction	3,161	BCY	$ 3	$ 10,370
Type 1 - Off-Site Disposal of Excess Materials	503	LCY	$ 20	$ 10,059
Type 1 - Rock Excavation	316	CY	$ 225	$ 71,133
Type 1 - Restoration	862	SY	$ 25	$ 21,556
Type 2 - Excavation	14,041	BCY	$ 5	$ 75,398
Type 2 - Pipe Bedding	4,515	CY	$ 25	$ 112,869
Type 2 - General Backfill	9,928	LCY	$ 8	$ 79,422
Type 2 - Select Backfill	2,482	LCY	$ 23	$ 57,084
Type 2 - Compaction	15,601	BCY	$ 3	$ 51,170
Type 2 - Off-Site Disposal of Excess Materials	2,482	LCY	$ 20	$ 49,639
Type 2 - Rock Excavation	1,560	CY	$ 225	$ 351,016
Type 2 - Restoration	323	SY	$ 25	$ 8,084
Division 32 Exterior Improvements				
Division 33 Utilities				
Type 1 - Cleanouts	3	EA	$ 310	$ 1,002
Type 2 - Cleanouts	11	EA	$ 310	$ 3,297
Type 1 - Ductile Iron Pipe	1,940	LF	$ 200	$ 388,000
Type 2 - Ductile Iron Pipe	6,382	LF	$ 200	$ 1,276,420
Type 1 - Spaulding Turnpike Crossing (Directional Drilling)	178	LF	$ 500	$ 88,815
Type 2 - Outfall in Piscataqua River (Jack and Bore)	1	LS	$ 850,000	$ 850,000
Type 2 - Outfall in Piscataqua River (Turbidity Curtains)	1	LS	$ 60,000	$ 60,000
Division 40 Process Integration				
Division 41 Material Processing and Handling Equipment				
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Division 46 Water and Wastewater Equipment				
SUBTOTAL				
CONSTRUCTION SUBTOTAL				**$ 4,772,080**
ENGINEERING			**18%**	**$ 858,974**
CONTINGENCY			**15%**	**$ 715,812**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 6,350,000**

Annual O&M COSTS	**1%**	**$ 63,500**

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City of Portsmouth New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth and Pease Regional Options
Outfall Option 2 - Deer Street Outfall
Type 1: Pease - Arthur F. Brady Drive (1,940 LF)
Type 2: Market Street Corridor (9,058 LF)

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Conveyance and Collection				
Division 01 General Requirements				
General Conditions	10%	LS	$ 4,638,558	$ 463,856
Bond	1%	LS	$ 5,102,414	$ 51,024
Insurance	3%	LS	$ 5,153,438	$ 154,603
Profit	5%	LS	$ 5,308,041	$ 265,402
Mobilization / Demobilization	5%	LS	$ 5,573,443	$ 278,672
Type 2 - Erosion and Sediment Control (Temporary Controls)	485	LF	$ 5	$ 2,425
Type 2 - M&P of Vehicle / Pedestrian Traffic	91	DAY	$ 1,600	$ 144,931
Division 02 Existing Conditions				
Division 03 Concrete				
Division 04 Masonry				
Division 05 Metals				
Division 06 Woods, Plastics and Composites				
Division 07 Thermal and Moisture Protection				
Division 08 Openings				
Division 09 Finishes				
Division 10 Specialties				
Division 22 Plumbing				
Division 23 HVAC				
Division 26 Electrical				
Division 27 Communications				
Division 31 Earthworks				
Type 1 - Excavation	2,845	BCY	$ 5	$ 15,279
Type 1 - Pipe Bedding	2,420	CY	$ 25	$ 60,499
Type 1 - Off-Site Disposal of Excess Materials	2,012	LCY	$ 20	$ 40,237
Type 1 - General Backfill	503	LCY	$ 8	$ 4,024
Type 1 - Select Backfill	3,161	LCY	$ 23	$ 72,714
Type 1 - Compaction	503	BCY	$ 3	$ 1,650
Type 1 - Rock Excavation	316	CY	$ 225	$ 71,133
Type 1 - Restoration	862	SY	$ 25	$ 21,556
Type 2 - Excavation	13,641	BCY	$ 5	$ 73,253
Type 2 - Pipe Bedding	11,037	CY	$ 25	$ 275,929
Type 2 - Off-Site Disposal of Excess Materials	2,411	LCY	$ 20	$ 48,225
Type 2 - General Backfill	9,645	LCY	$ 8	$ 77,160
Type 2 - Select Backfill	2,411	LCY	$ 23	$ 55,459
Type 2 - Compaction	15,157	BCY	$ 3	$ 49,714
Type 2 - Rock Excavation	1,516	CY	$ 225	$ 341,027
Type 2 - Restoration	4,134	SY	$ 25	$ 103,341
Division 32 Exterior Improvements				
Division 33 Utilities				
Type 1 - Cleanouts	3	EA	$ 310	$ 1,002
Type 2 - Cleanouts	15	EA	$ 310	$ 4,680
Type 1 - Ductile Iron Pipe	1,940	LF	$ 200	$ 388,000
Type 2 - Ductile Iron Pipe	9,058	LF	$ 200	$ 1,811,640
Type 1 - Spaulding Turnpike Crossing (Jack and Bore)	178	LF	$ 500	$ 88,815
Type 2 - Mill Pond Crossing (Jack and Bore)	246	LF	$ 500	$ 123,220
Type 2 - Outfall in Piscataqua River (Jack and Bore)	1	LS	$ 850,000	$ 850,000
Type 2 - Outfall in Piscataqua River (Turbidity Curtains)	1	LS	$ 60,000	$ 60,000
Division 40 Process Integration				
Division 41 Material Processing and Handling Equipment				
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Division 46 Water and Wastewater Equipment				
SUBTOTAL				
CONSTRUCTION SUBTOTAL				**$ 5,999,472**
ENGINEERING			**18%**	**$ 1,079,905**
CONTINGENCY			**15%**	**$ 899,921**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 7,980,000**

Annual O&M COSTS	**1%**	**$ 79,800**

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth and Pease Regional Options
Outfall Option 3 - Peirce Island Outfall
Type 1: Pease - Arthur F. Brady Drive (1,940 LF)
Type 2: Market Street Corridor (8,573 LF)
Type 3: Downtown Corridor (5,695 LF)
Type 4: Peirce Island (2,677)

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Conveyance and Collection				
Division 01 General Requirements				
General Conditions	10%	LS	$ 8,496,971	$ 849,697
Bond	1%	LS	$ 9,346,668	$ 93,467
Insurance	3%	LS	$ 9,440,135	$ 283,204
Profit	5%	LS	$ 9,723,339	$ 486,167
Mobilization / Demobilization	5%	LS	$ 10,209,506	$ 510,475
Type 4 - Erosion and Sediment Control (Temporary	582	LF	$ 5	$ 3,000
Type 4 - M&P of Vehicle / Pedestrian Traffic	27	DAY	$ 1,600	$ 43,000
Division 02 Existing Conditions				
Division 03 Concrete				
Division 04 Masonry				
Division 05 Metals				
Division 06 Woods, Plastics and Composites				
Division 07 Thermal and Moisture Protection				
Division 08 Openings				
Division 09 Finishes				
Division 10 Specialties				
Division 22 Plumbing				
Division 23 HVAC				
Division 26 Electrical				
Division 27 Communications				
Division 31 Earthworks				
Type 1 - Excavation	2,845	BCY	$ 5	$ 15,279
Type 1 - Pipe Bedding	2,420	CY	$ 25	$ 60,499
Type 1 - Off-Site Disposal of Excess Materials	2,012	LCY	$ 20	$ 40,237
Type 1 - General Backfill	503	LCY	$ 8	$ 4,024
Type 1 - Select Backfill	3,161	LCY	$ 23	$ 72,714
Type 1 - Compaction	503	BCY	$ 3	$ 1,650
Type 1 - Rock Excavation	316	CY	$ 225	$ 71,133
Type 1 - Restoration	862	SY	$ 25	$ 21,556
Type 2 - Excavation	12,574	BCY	$ 5	$ 67,522
Type 2 - Pipe Bedding	10,694	CY	$ 25	$ 267,351
Type 2 - Off-Site Disposal of Excess Materials	2,223	LCY	$ 20	$ 44,453
Type 2 - General Backfill	8,891	LCY	$ 8	$ 71,124
Type 2 - Select Backfill	2,223	LCY	$ 23	$ 51,120
Type 2 - Compaction	13,971	BCY	$ 3	$ 45,825
Type 2 - Rock Excavation	1,397	CY	$ 225	$ 314,348
Type 2 - Restoration	3,810	SY	$ 25	$ 95,257
Type 3 - Excavation	2,785	BCY	$ 5	$ 14,953
Type 3 - Pipe Bedding	7,104	CY	$ 25	$ 177,600
Type 3 - Off-Site Disposal of Excess Materials	1,476	LCY	$ 20	$ 29,530
Type 3 - General Backfill	5,906	LCY	$ 8	$ 47,247
Type 3 - Select Backfill	1,476	LCY	$ 23	$ 33,959
Type 3 - Compaction	9,282	BCY	$ 3	$ 30,445
Type 3 - Rock Excavation	6,497	CY	$ 225	$ 1,461,912
Type 3 - Restoration	2,531	SY	$ 25	$ 63,286
Type 4 - Excavation	4,813	BCY	$ 5	$ 26,000
Type 4 - Pipe Bedding	2,301	CY	$ 25	$ 58,000
Type 4 - General Backfill	3,403	LCY	$ 8	$ 27,225
Type 4 - Select Backfill	851	LCY	$ 23	$ 19,568
Type 4 - Compaction	5,348	BCY	$ 3	$ 17,542
Type 4 - Off-Site Disposal of Excess Materials	851	LCY	$ 20	$ 17,000
Type 4 - Rock Excavation	535	CY	$ 225	$ 120,000
Type 4 - Restoration	2,173	SY	$ 25	$ 54,000
Division 32 Exterior Improvements				
Division 33 Utilities				
Type 1 - Cleanouts	3	EA	$ 310	$ 1,000
Type 2 - Cleanouts	14	EA	$ 310	$ 4,000
Type 3 - Cleanouts	9	EA	$ 310	$ 3,000
Type 4 - Cleanouts	4	EA	$ 310	$ 1,000
Type 1 - Ductile Iron Pipe	1,940	LF	$ 200	$ 388,000
Type 2 - Ductile Iron Pipe	9,058	LF	$ 200	$ 1,812,000
Type 3 - Ductile Iron Pipe	5,791	LF	$ 200	$ 1,158,000
Type 4 - Ductile Iron Pipe	2,677	LF	$ 200	$ 535,000
Type 1 - Spaulding Turnpike Crossing	178	LF	$ 500	$ 88,815
Type 2 - Mill Pond Crossing	246	LF	$ 500	$ 123,220
Type 4 - River Crossing to Peirce Island (Insulated Pipe)	278	LF	$ 110	$ 30,577
Type 4 - Outfall in Piscataqua River (Jack and Bore)	1	LS	$ 850,000	$ 850,000
Type 4 - Outfall in Piscataqua River (Turbidity Curtains)	1	LS	$ 60,000	$ 60,000
Division 40 Process Integration				
Division 41 Material Processing and Handling Equipment				
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Division 46 Water and Wastewater Equipment				
SUBTOTAL				
CONSTRUCTION SUBTOTAL				**$ 10,765,981**
ENGINEERING			**18%**	**$ 1,937,877**
CONTINGENCY			**15%**	**$ 1,614,897**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 14,320,000**

Annual O&M COSTS	**1%**	**$ 143,200**

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth and Pease Regional Options
Outfall Option 4 - Subaqueous to Peirce Island Outfall
Type 1: Pease - Arthur F. Brady Drive (1,940 LF)
Type 2: Market Street Corridor (8,573 LF)
Type 3: Subaqueous with Force Mains (3,100 LF)
Type 4: Subaqueous to Peirce Island (2,330 LF)
Type 5: Peirce Island Outfall (1,350 LF)

	OPINION OF PROBABLE CONSTRUCTION COST			
DESCRIPTION	**QTY.**	**UNIT**	**UNIT COST**	**TOTAL**
Pease WWTF Conveyance and Collection				
Division 01 General Requirements				
General Conditions	10%	LS	$ 8,560,133	$ 856,013
Bond	1%	LS	$ 9,416,147	$ 94,161
Insurance	3%	LS	$ 9,510,308	$ 285,309
Profit	5%	LS	$ 9,795,618	$ 489,781
Mobilization / Demobilization	5%	LS	$ 10,285,398	$ 514,270
Type 4 - Erosion and Sedimentation Control (Temp. Cont. - Turbidity Curtain)	2,300	LF	$ 300	$ 690,000
Type 5 - Erosion and Sedimentation Control	1,000	LF	$ 5	$ 5,000
Type 4&5 - M&P of Vehicle / Pedestrian Traffic	1	LS	$ 15,000	$ 15,000
Division 02 Existing Conditions				
Division 03 Concrete				
Division 04 Masonry				
Division 05 Metals				
Division 06 Woods, Plastics and Composites				
Division 07 Thermal and Moisture Protection				
Division 08 Openings				
Division 09 Finishes				
Division 10 Specialties				
Division 22 Plumbing				
Division 23 HVAC				
Division 26 Electrical				
Division 27 Communications				
Division 31 Earthworks				
Type 1 - Excavation	2,845	BCY	$ 5	$ 15,279
Type 1 - Pipe Bedding	2,420	CY	$ 25	$ 60,499
Type 1 - Off-Site Disposal of Excess Materials	2,012	LCY	$ 20	$ 40,237
Type 1 - General Backfill	503	LCY	$ 8	$ 4,024
Type 1 - Select Backfill	3,161	LCY	$ 23	$ 72,714
Type 1 - Compaction	503	BCY	$ 3	$ 1,650
Type 1 - Rock Excavation	316	CY	$ 225	$ 71,133
Type 1 - Restoration	862	SY	$ 25	$ 21,556
Type 2 - Excavation	12,574	BCY	$ 5	$ 67,522
Type 2 - Pipe Bedding	10,694	CY	$ 25	$ 267,351
Type 2 - Off-Site Disposal of Excess Materials	2,223	LCY	$ 20	$ 44,453
Type 2 - General Backfill	8,891	LCY	$ 8	$ 71,124
Type 2 - Select Backfill	2,223	LCY	$ 23	$ 51,120
Type 2 - Compaction	13,971	BCY	$ 3	$ 45,825
Type 2 - Rock Excavation	1,397	CY	$ 225	$ 314,348
Type 2 - Restoration	3,810	SY	$ 25	$ 95,257
Type 3 - Excavation - Mechanical Dredge, Disposal at Sea	1,948	CY	$ 30	$ 58,429
Type 3 - Pipe Bedding	79	CY	$ 35	$ 2,748
Type 3 - Select Backfill (Rip-Rap Protection)	574	CY	$ 50	$ 28,704
Type 3 - Rock Excavation	216	CY	$ 500	$ 108,201
Type 4 - Excavation - Mechanical Dredge, Disposal at Sea	10,465	CY	$ 30	$ 314,000
Type 4 - Pipe Bedding	5,971	CY	$ 35	$ 209,000
Type 4 - Select Backfill (Rip-Rap Protection)	4,076	CY	$ 50	$ 203,806
Type 4 - Rock Excavation	1,163	CY	$ 500	$ 581,000
Type 4 - Restoration	1	LS	$ 10,000	$ 10,000
Type 5 - Excavation	2,200	CY	$ 5	$ 12,000
Type 5 - Pipe Bedding	707	CY	$ 25	$ 18,000
Type 5 - General Backfill	1,311	CY	$ 8	$ 10,489
Type 5 - Select Backfill	244	CY	$ 23	$ 5,612
Type 5 - Compaction	2,444	CY	$ 3	$ 8,018
Type 5 - Off-Site Disposal of Excess Materials	389	LCY	$ 20	$ 8,000
Type 5 - Rock Excavation	244	CY	$ 225	$ 55,000
Type 5 - Restoration	667	SY	$ 25	$ 17,000
Division 32 Exterior Improvements				
Division 33 Utilities				
Type 1 - Cleanouts	3	EA	$ 310	$ 1,000
Type 2 - Cleanouts	14	EA	$ 310	$ 4,000
Type 5 - Cleanouts	2	EA	$ 310	$ 1,000
Type 1 - Ductile Iron Pipe	1,940	LF	$ 200	$ 388,000
Type 2 - Ductile Iron Pipe	8,573	LF	$ 200	$ 1,715,000
Type 3 - HDPE Pipe	3,100	LF	$ 325	$ 1,008,000
Type 4 - HDPE Pipe	2,330	LF	$ 325	$ 757,000
Type 5 - Ductile Iron Pipe	1,350	LF	$ 200	$ 270,000
Type 1 - Spaulding Turnpike Crossing	178	LF	$ 500	$ 88,815
Type 2 - Mill Pond Crossing	246	LF	$ 500	$ 123,220
Type 3 - Enter the River	1	EA	$ 200,000	$ 200,000
Type 4 - Exit the River at Peirce Island	1	EA	$ 200,000	$ 200,000
Type 5 - Outfall in Piscataqua River (Jack and Bore)	1	LS	$ 850,000	$ 850,000
Type 5- Outfall in Piscataqua River (Turbidity Curtains)	1	LS	$ 60,000	$ 60,000
Division 40 Process Integration				
Division 41 Material Processing and Handling Equipment				
Division 42 Process Gas and Liquid Handling, Purification and Storage Equipment				
Division 46 Water and Wastewater Equipment				
SUBTOTAL				
			CONSTRUCTION SUBTOTAL	**$ 11,509,668**
			ENGINEERING 18%	**$ 2,071,740**
			CONTINGENCY 15%	**$ 1,726,450**
			TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)	**$ 15,310,000**
			Annual O&M COSTS 1%	**$ 153,100**

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth and Pease Regional Options
Mechanic Street Pump Station

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Conveyance and Collection				
Division 01 General Requirements				
General Conditions	20%	LS	$ 5,406,461	$ 1,081,292
Bond	1%	LS	$ 6,487,754	$ 78,502
Insurance	3%	LS	$ 6,566,256	$ 196,988
Profit	6%	LS	$ 6,763,243	$ 405,795
Mobilization / Demobilization	6%	LS	$ 7,169,038	$ 430,142
Superintendent	16	MO	$ 6,000	$ 96,000
Manager	16	MO	$ 6,500	$ 104,000
Contractor Vehicles/Transportation	16	MO	$ 1,000	$ 16,000
Field Offices (contractor trailers)	16	MO	$ 2,500	$ 40,000
Office Supplies and Equipment/Postage	16	MO	$ 200	$ 3,200
Temporary Utilities	16	MO	$ 750	$ 12,000
Temporary Dewatering Pumping	20	WKS	$ 4,000	$ 80,000
Traffic Control	10	MO	$ 5,500	$ 55,000
Health and Safety Program	16	MO	$ 1,000	$ 16,000
Cleaning and Waste Management	16	MO	$ 750	$ 12,000
Photographic Documentation	16	MO	$ 250	$ 4,000
Coordination with Owner's Operations	1	LS	$ 30,000	$ 30,000
Testing Laboratory Services	1	LS	$ 5,500	$ 5,500
Record Documents	1	LS	$ 3,000	$ 3,000
Division 02 Existing Conditions				
Apartment Building - Above grade	52,500	CF	$ 0.35	$ 18,375
Apartment Building - Basement Walls	1,760	SF	$ 1	$ 1,320
Apartment Building - Basement Slab	3,200	SF	$ 1	$ 2,720
Apartment Building - Hauling & Disposal	500	CY	$ 26	$ 13,000
Existing Pumping Station - Above Grade	10,800	CF	$ 0.45	$ 4,860
Existing Pumping Station - Walls/Slab	1	LS	$ 30,000	$ 30,000
Existing Pumping Station - Hauling & Disposal	1,500	CY	$ 26	$ 39,000
Buried Piping	500	LF	$ 11	$ 5,500
Pump Demolition	2	EA	$ 4,000	$ 8,000
Piping and Valve Demolition	1	LS	$ 12,000	$ 12,000
Division 03 Concrete				
Base Slab	194	CY	$ 461	$ 89,444
Substracture Exterior Walls	362	CY	$ 685	$ 248,122
Substructure Internal Walls	111	CY	$ 686	$ 76,111
Elevated Slab over Wet Wells and Channels	97	CY	$ 629	$ 61,056
Miscellaneous Concrete	25	CY	$ 460	$ 11,500
Division 04 Masonry				
Division 05 Metals				
Steel Standing Seam Metal Roofing	3,938	SF	$ 5	$ 19,688
Access Stairs	120	RISERS	$ 555	$ 66,600
Division 06 Woods, Plastics and Composites				
Wood Slat Siding	2,640	SF	$ 4	$ 9,900
Miscellaneous Architectural Detail	1	LS	$ 9,000	$ 9,000
Decorative Architetural Fencing	1	LS	$ 7,000	$ 7,000
Division 07 Thermal and Moisture Protection				
Division 08 Openings				
Overhead coiling door	1	EA	$ 3,250	$ 3,250
Single mandoor	2	EA	$ 975	$ 1,950
Double mandoor	1	EA	$ 1,300	$ 1,300
Division 09 Finishes				
Painting - Mechanical	1	LS	$ 5,500	$ 5,500
Painting - Structural	1	LS	$ 2,000	$ 2,000
Division 10 Specialties				
Division 13 Special Construction				
Above ground PS structure (basic structure)	2,625	CF	$ 130	$ 341,250
Division 22 Plumbing				
Plumbing	1	LS	$ 80,000	$ 80,000
Division 23 HVAC				
Building HVAC	1	LS	$ 350,000	$ 350,000
Odor Control	1	LS	$ 450,000	$ 450,000
Division 26 Electrical				
Electric Work	1	LS	$ 618,602	$ 618,602
Relocation of Existing Generator	1	LS	$ 30,000	$ 30,000
Division 27 Communications				
Division 31 Earthworks				
Excavation/Backfill/Compaction	1,275	CY	$ 80	$ 102,000
Rock Excavation	5,100	CY	$ 275	$ 1,402,500
Select Backfill	2,486	CY	$ 40	$ 99,444
Backfill for Existing Structures	2,111	CY	$ 30	$ 63,333
Topsoil	150	CY	$ 60	$ 9,000
Hauling and Disposal of Excess Excavate	4,264	CY	$ 35	$ 149,236
Temporary Shoring	5,000	SF	$ 20	$ 100,000
Division 32 Exterior Improvements				
Flexible Pavement - 6" Base Course	240	SY	$ 85	$ 20,400
Flexible Pavement - 3" Bituminous Binder	240	SY	$ 80	$ 19,200
Gravel Subbase	240	SY	$ 50	$ 12,000
General Landscaping	1	LS	$ 14,000	$ 14,000
Division 33 Utilities				
Division 40 Process Integration				
24" Plug Valve	6	EA	$ 27,200	$ 163,200
20" Plug Valve	6	EA	$ 23,200	$ 139,200
24" x 16" Reducer - DI, Glass Lined, Class 150lb	6	EA	$ 3,200	$ 19,200
24" DI Pipe	90	LF	$ 215	$ 19,350
30" DI Pipe	100	LF	$ 267	$ 26,700
24" Swing Check Valve	6	EA	$ 7,000	$ 42,000
24"-90 deg. Elbow - DI	6	EA	$ 2,400	$ 14,400
30"-90 deg. Elbow-DI	3	EA	$ 3,800	$ 11,400
30"X24" Reducing Tee	3	EA	$ 4,200	$ 12,600
24" Harnessed Flexible Coupling	12	EA	$ 3,800	$ 45,600
30" Harnessed Flexible Coupling	6	EA	$ 4,300	$ 25,800
Fire Protection (Dry Well and Wet Well)	1	LS	$ 126,000	$ 126,000
Instrumentation and Controls	1	LS	$ 100,000	$ 100,000
Division 41 Material Processing and Handling Equipment				
Division 43 Process Gas and Liquid Handling, Purification and Storage Equipment				
Sanitary Pumps (6 MGD) with VFD	3	EA	$ 60,000	$ 180,000
Storm Pumps (11 MGD) with VFD	3	EA	$ 90,000	$ 270,000
Division 46 Water and Wastewater Equipment				
SUBTOTAL				
CONSTRUCTION SUBTOTAL				**$ 8,473,030**
ENGINEERING			**18%**	**$ 1,525,145.42**
CONTINGENCY			**15%**	**$ 1,270,955**
TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)				**$ 11,269,000**

Annual O&M COSTS	**$ 7,598**

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City of Portsmouth, New Hampshire
Conceptual Opinion of Probable Project Cost
Pease/Portsmouth and Pease Regional Options
Peirce Island Dewatering Pump Station

DESCRIPTION	OPINION OF PROBABLE CONSTRUCTION COST			
	QTY.	UNIT	UNIT COST	TOTAL
Pease WWTF Conveyance and Collection				
Division 01 General Requirements				
General Conditions	7%	LS	$ 374,995	$ 26,250
Bond	1%	LS	$ 401,245	$ 4,012
Insurance	1%	LS	$ 405,257	$ 4,053
Profit	3%	LS	$ 409,310	$ 12,279
Mobilization / Demobilization	3%	LS	$ 421,589	$ 12,648
Superintendent	3	MO	$ 6,000	$ 18,000
Manager	3	MO	$ 6,500	$ 19,500
Contractor Vehicles/Transportation	3	MO	$ 1,000	$ 3,000
Field Offices (contractor trailers)	3	MO	$ 2,500	$ 7,500
Office Supplies and Equipment/Postage	3	MO	$ 200	$ 600
Temporary Utilities	3	MO	$ 750	$ 2,250
Temporary Dewatering Pumping	1	WKS	$ 4,000	$ 4,000
Health and Safety Program	3	MO	$ 1,000	$ 3,000
Cleaning and Waste Management	3	MO	$ 750	$ 2,250
Photographic Documentation	3	MO	$ 250	$ 750
Coordination with Owner's Operations	1	LS	$ 7,500	$ 7,500
Testing Laboratory Services	1	LS	$ 1,750	$ 1,750
Record Documents	1	LS	$ 750	$ 750
Division 02 Existing Conditions				
Buried Piping Demolition	500	LF	$ 11	$ 5,500
Abandon Existing Buildings	1	LS	$ 20,000	$ 20,000
Miscellenous Demolition	1	LS	$ 4,000	$ 4,000
Division 03 Concrete				
Base Slab	7	CY	$ 460	$ 3,407
Substracture Walls	30	CY	$ 685	$ 20,296
Elevated Slab over Wet Wells and Channels	6	CY	$ 628	$ 3,721
Miscellaneous Concrete	4	CY	$ 460	$ 1,976
Division 04 Masonry				
Division 05 Metals				
Access Hatches	2	EA	$ 5,000	$ 10,000
Access Ladder	20	VLF	$ 158	$ 3,160
Division 06 Woods, Plastics and Composites				
Division 07 Thermal and Moisture Protection				
Division 08 Openings				
Division 09 Finishes				
Painting - Mechanical	1	LS	$ 1,000	$ 1,000
Division 10 Specialties				
Division 13 Special Construction				
Division 22 Plumbing				
Division 23 HVAC				
Activated Carbon Filter Odor Control	1	LS	$ 55,000	$ 55,000
Division 26 Electrical				
Electric Work	1	LS	$ 42,498	$ 42,498
Relocation of Existing Generator	1	LS	$ 30,000	$ 30,000
Division 27 Communications				
Division 31 Earthworks				
Excavation/Backfill/Compaction	46	CY	$ 80	$ 3,704
Excavation in Rock	46	CY	$ 275	$ 12,731
Select Backfill	19	CY	$ 40	$ 741
Topsoil	15	CY	$ 60	$ 900
Hauling and Disposal of Excess Excavate	23	CY	$ 35	$ 810
Temporary Shoring	2,500	SF	$ 20	$ 50,000
Division 32 Exterior Improvements				
Flexible Pavement	1	LS	$ 10,000	$ 10,000
Misc. Restoration	1	LS	$ 2,000	$ 2,000
Division 33 Utilities				
Division 40 Process Integration				
4" Plug Valve	2	EA	$ 2,750	$ 5,500
6" DI Pipe	150	LF	$ 78	$ 11,700
4" Swing Check Valve	2	EA	$ 2,750	$ 5,500
Miscellaneous Fittings	1	LS	$ 27,500	$ 27,500
Instrumentation and Controls	1	LS	$ 35,000	$ 35,000
Division 41 Material Processing and Handling Equipment				
Division 43 Process Gas and Liquid Handling, Purification and Storage Equipment				
Submersible Pumps (11 MGD each) with VFD	2	EA	$ 30,000	$ 60,000
Division 46 Water and Wastewater Equipment				
SUBTOTAL				
			CONSTRUCTION SUBTOTAL	**$ 556,737**
			ENGINEERING 18%	**$ 100,212.66**
			CONTINGENCY 15%	**$ 83,511**
			TOTAL OPINION OF PROBABLE PROJECT COST (POINT ESTIMATE)	**$ 740,000**

Annual O&M COSTS	**$ 269,178**

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Appendix C

City and NHDES Correspondence
Regarding Outfall Location

PUBLIC WORKS DEPARTMENT

CITY OF PORTSMOUTH
680 Peverly Hill Road
Portsmouth N.H. 03801
(603) 427-1530 FAX (603) 427-1539

February 12, 2015

VIA EMAIL
Vicki Quiram
Assistant Commissioner
NH Department of Environmental Services
PO Box 95, 29 Hazen Drive
Concord, NH 03302

RE: Follow-up to 2/9/15 Conference Call
Pease/Portsmouth and Pease Regional Evaluation
City of Portsmouth, New Hampshire

Dear Ms. Quiram:

We want to thank you and your staff for the opportunity to discuss the status of the referenced evaluation and to field our questions. This letter is provided as a brief follow-up on the key points of the discussion and to reiterate the importance of a prompt response to the City's questions. The City Council will be asked to make a decision to select a wastewater option for the City in early May and the New Hampshire Department of Environmental Services' (DES) input on key items will likely have a significant impact on this decision.

As you will recall from our discussion, the evaluation focuses on expanding the City's existing 1.2 million gallon per day (MGD) Pease Wastewater Treatment Facility (WWTF) to accommodate all of the City's existing flow and possibly regional flow from Exeter and Stratham. The City recently completed the first phase of the study that included site plans of the proposed layouts at the Pease WWTF. Site plans were developed for an 8 million gallon per day (MGD) and 11 MGD (regional flow) conventional activated sludge WWTF at treatment levels of 8 milligrams per liter (mg/L) and 3 mg/L. One of the most critical items that will have impact on the evaluation is the proposed outfall for the treated effluent from this location. During the meeting the City described four options as outlined below. In all conditions, it is anticipated the existing Peirce Island WWTF will be converted to a wet weather treatment unit for combined sewage and the existing outfall will be maintained.

Outfall Option 1: Discharge all treated effluent from the Pease WWTF site to a new outfall at the Peirce Island WWTF site with a new outfall constructed in the Piscataqua River adjacent to the existing Peirce Island WWTF outfall.
Outfall Option 2: Discharge all treated effluent from the Pease WWTF site to a new outfall in the Piscataqua River near the Deer Street Pump Station.
Outfall Option 3: Discharge all treated effluent out an upgraded outfall at the location of the existing Pease WWTF outfall to the Piscataqua River in Newington.
Outfall Option 4: Split the discharge of the treated effluent with 1.2 MGD (average day) discharged out the existing Pease WWTF outfall to the Piscataqua River in Newington and the remainder of the treated wastewater to be discharged to a new outfall near Deer Street Pump Station or to a new outfall adjacent to the existing Peirce Island WWTF outfall location.

The City is looking for input from the DES on the outfall options as it relates to the DES's interpretation and application of its anti-degradation regulations and impact on shellfish harvesting areas. The City understands that the DES' input may not be based on the traditional approach that uses field data (water quality sampling and dye studies) to make a determination. The traditional approach of gathering field data and performing the analysis is not possible at this time so we understand DES' input would be based on available data and other tools.

To that end, the City is prepared to assist in whatever means possible, whether by use of the hydro dynamic model or providing other data and opinions that can be rendered in the short term, to assist in DES' analysis. In addition, the City reiterates its willingness to work with DES' shellfish program to provide immediate notification of any disinfection failure and to otherwise employ modern technological and communication resources to limit shellfish harvesting impacts.

We also asked the DES to consider how to apply the environmental benefits of moving Exeter's (and Stratham's) discharge from the Squamscott River to the Piscataqua River. We believe this is worthy of significant credit since this would effectively reduce the number of wastewater outfalls from 3 (Peirce Island WWTF, Pease WWTF and Exeter WWTF) to one ("Pease/Portsmouth Regional WWTF") and move Exeter and Stratham's effluent from Great Bay to near Portsmouth Harbor.

The City is committed to work together with the DES to obtain the crucial input requested in order to make a decision on the future of our wastewater facilities. We look forward to working with you on this project.

Sincerely,
CITY OF PORTSMOUTH

Terry Desmarais, P.E.
City Engineer Water and Sewer Divisions

cc: Brian Goetz, Deputy Director of Public Works
Suzanne Woodland, Deputy City Attorney
Eugene Forbes, DES
Ted Diers, DES
Sturge Spanos, DES
Mike Kosier, ARCADIS

The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES

Thomas S. Burack, Commissioner

March 6, 2015

Terry Desmarais
City Engineer, Water and Sewer Divisions
680 Peverly Hills Road
Portsmouth, NH 03801

Re. Follow up to Pease/Portsmouth and Pease Regional Evaluation

Dear Mr. Desmarais,

This letter is in response to your letter dated February 12, 2015 regarding follow up on a 2/9/15 conference call between the City of Portsmouth and NHDES. In that call, you presented a number of options for a regional treatment plant and the evaluation that the city has currently underway.

As we understand from that call and subsequent conversations, there are three outfall locations being considered relative to a regional or consolidated wastewater water treatment plant with flows of 11 mgd and 8 mgd respectively. Those options are:

A. All flow discharged from the existing (or redesigned) Peirce Island outfall;
B. All flow discharged to a new outfall near the Deer Street pump station;
C. All flow discharged to the existing (or redesigned) Pease outfall; and,
D. Flow split between Pease outfall (at current flow of 1.2 mgd) with the remainder to either Deer Street or Peirce Island.

The two major issues that DES and EPA will likely examine relative to these outfall proposals are antidegradation and shellfish impacts. Shellfish impacts are examined as two separate issues. The first issue involves the effects of a lapse in disinfection from the facility, specifically, the time of travel of insufficiently diluted effluent from the outfall to shellfish harvest areas. The second issue involves the chronic, long term effects of viral loading from a modern secondary treatment facility functioning under normal operating conditions (i.e., operating within its design parameters, with no adverse conditions such as hydraulic overloading or other problems). The question that must be addressed for this second issue is the delineation of a "no harvest" protective zone around the outfall. This zone must be large enough to provide for at least 1,000:1 dilution under steady state conditions (assuming chlorine disinfection). Other issues, especially related to the construction of a new outfall, would be benthic habitat impacts, eelgrass habitat, lobstering, impacts to navigation, and aesthetic issues. Below I describe the current status and data needs of each of the issues for each outfall option.

Option A – Peirce Island outfall

Antidegradation -- For the existing Peirce Island outfall, DES can generate another antidegradation letter, similar to the November 14, 2013 letter, by adjusting the design flow to

10.98 mgd. DES has the outfall data (single port outfall) the discharge location data (bathymetry, critical velocities, salinity), effluent data, and ambient water quality data that was collected during worst-case critical tidal condition. DES has repeated the antidegradation calculations for a proposed design flow increase at the Peirce Island wastewater treatment facility, but using the new higher design flow of 10.98 mgd (instead of the previously requested 6.13 mgd). The results of the calculations show that no new parameters would require limits based on a reasonable potential analysis. However, the limits that were deemed necessary for ammonia and dissolved copper in the previous analysis would need to be reduced. For ammonia, the "antidegradation based limit" (see ammonia discussion in the DES' letter to John Bohenko dated November 14, 2013) would be reduced from 40 mg/l to 29.5 mg/l and, for dissolved copper, the necessary limit would be reduced from 32 ug/l to 23.7 ug/l. Modifications to the outfall configuration could allow for increased mixing and less stringent limits. A consultant could be retained if the city is interested in seeing what dilutions can be achieved by modifying the outfall configuration. This would require more time and CORMIX expertise than DES can provide at this time.

Shellfish – In December 2012, the FDA with help from DES and EPA, conducted a dye study of the Peirce Island outfall. That study simulated a 12 hour continuous release of undisinfected effluent. The study showed rapid transport of insufficiently diluted effluent from the Peirce Island facility to points upstream and downstream of the outfall. As a result, new recreational shellfish harvesting restrictions were implemented for the Bellamy River and for Little Bay. DES also closed some shellfish beds near the outfall, namely in the Little Harbor area and offshore near Odiorne State Park, because Peirce island is a primary treatment facility and the 1,000:1 dilution standard for long-term exposure to effluent is applicable only to secondary treatment facilities operating within design standards. The public health risks of viral loading to these areas from a primary treatment facility are not well-understood and there are no existing standards to use to evaluate the risks. The December 2012 study produced data needed to estimate the upstream extent of the 1000:1 dilution line for current Peirce Island flows, but did not produce data needed to estimate the downstream extent of the 1000:1 dilution area. Additional work will be needed to assess the location of that line. DES has spoken with FDA about using the 2012 data to assess effects of a change in WWTF flow on the issues of areas affected by a disinfection failure, and the size of the 1000:1 dilution area. FDA will attempt to assess those changes using flow values of 8 mgd and 11 mgd over the next few weeks.

Option B — Deer Street outfall

Antidegradation -- There is no existing outfall at the proposed Deer Street outfall location. Portsmouth will be starting from scratch in evaluating whether or not to put the outfall at this location, and what kind of outfall it should be. Before any work can begin, a more precise location of the outfall would need to be located, including location along the shoreline and distance into the river. The bathymetry of the river and the restrictions of the active shipping channel may narrow the City's options. The City will then need to obtain data for input into the CORMIX model (e.g. river depths, velocities, salinities) collected during 1% occurrence low spring and neap tides so that the critical tidal conditions can be determined. It would then be possible for a consultant to iteratively run the CORMIX model to optimize, evaluate the cost effectiveness of options and ultimately select the design of the outfall. Portsmouth will then need to obtain ambient water quality data (four sampling events) in the vicinity of the proposed outfall location and collected during the worst-case critical tidal condition identified above so that DES can perform an antidegradation review for the new discharge. In the short run, it may be possible for a consultant to run an analysis by selecting a likely site in the river for the outfall

and running the Hydroqual model to get the various river hydraulics to enter as speculative parameters into the CORMIX model. Then, the data collected in 2013 for the Peirce Island outfall study could be used to preliminarily determine numbers for antidegradation analysis if a safety factor were added (eg. 1.5 times the background water quality). We suggest that you work with a consultant to create a scope of work to which DES will provide comments. This would NOT be a conclusive study. If the modeled effluent ends up close to water quality standards, that would be informative as "red flag". If the Deer Street location is chosen as a preferred option, the city would need to move quickly to generate the required data, as noted above, to support the antidegradation analysis.

The City should also consult current and historic eelgrass maps to determine if that habitat would be impacted by a new outfall. It is also important to communicate with Maine DEP about the eelgrass habitat on the Maine side of the river. See map below.

Shellfish –The location of this potential outfall is about 1.5 miles upriver from the Peirce Island outfall. Given the complexity of flows and currents in the Piscataqua River, it may not be possible to apply the information from the dye study to this location. DES is currently discussing the potential with FDA. FDA will explore developing distance-dilution curves from the 2012 Peirce Island study; however, extrapolating these curves to location such as Deer Street may not give an accurate picture of dilution under present or future flow scenarios (one reason is that flow from the Peirce outfall on the flood tide was split between the Piscataqua River and the Back Channel area. At Deer Street, presumably all of effluent would be in the Piscataqua River). It may be possible to simulate a dye study using the hydrodynamic model of the estuary but that study has not yet been calibrated against the Peirce Island dye study. Creating an outfall with larger flows and moving it closer to important harvest areas such as Little Bay (and Spinney Creek in Eliot Maine) could endanger harvest opportunities in these areas if they are enveloped by a future 1000:1 dilution area sized for the new flows. For that reason, the city may also want to explore the option of UV treatment which has the potential for smaller dilution areas.

Option C – Pease outfall

Antidegradation -- For the existing Pease outfall, DES can generate an antidegradation letter after Portsmouth provides us with four rounds of ambient water quality data collected during the worst-case critical tidal condition. Being an estuarine water, sampling the ambient water during the worst-case critical tidal condition is imperative. DES has the outfall data, the discharge location data, and the effluent data. If, after the antidegradation results are available, Portsmouth is interested in seeing what dilutions can be achieved by modifying the outfall configuration, they should hire a consultant to run CORMIX to evaluate the cost effectiveness of any outfall modification, making sure that the current dilution rates are retained at a higher flow.

Shellfish – Shellfish is a primary concern for a larger outfall in this area. In particular, the time of travel for an upset at the facility could be a major issue that may require an expansion of recreational harvest restrictions into additional areas such as Great Bay. Various combinations of flow values and assumed bacterial concentration in undisinfected effluent would need to be evaluated. As with the Deer Street option, creating an outfall with larger flows and moving it closer to significant shellfish harvest areas such as Little Bay (and Spinney Creek in Eliot Maine) could endanger harvest opportunities in these areas if they are enveloped by a future 1000:1 dilution area sized for the new flows.

Option D – Combination outfall

Antidegradation – If the outfall at Pease were to continue at its present location and same flows, no additional work would be needed. If the remainder were sent to Deer Street, all of the issues outlined above relative to Deer Street would apply, regardless of flow quantity. If the additional flow were sent to Peirce Island (with an outfall in approximately the same location as the current outfall), the antidegradation calculations would be straightforward and DES would run the CORMIX model for that option.

Shellfish – Similarly to the antidegradation discussion above, no change at Pease and flows to Peirce Island would be a straightforward analysis. There is very little information about the Deer Street hydrodynamics.

Below is summary of information that will ultimately be needed to be evaluate the shellfish issues from each the potential outfall locations and flow scenarios being considered:

1. Need to know 1000:1 steady state dilution area for 8mgd flow and 11mgd flow for all three locations.
2. If more than one discharge location is used, DES would need to know the flow at each location and the 1000:1 dilution area for the specified flow at each outfall
3. Consider quantifying a 400:1 dilution area, in case the city decides to build UV treatment and can demonstrate consistently low MSC in finished effluent.
4. For disinfection failure beginning at slack low tide, need time of travel and dilution info for plume on flooding tide (for the different proposed outfall locations), time of arrival at specific locations (e.g., Dover Point, Fox Point, Adams Point, Scammel Bridge, etc.), and location and dilution of upstream extent of dye.
5. Repeat #4 for ebbing tide, using the landmarks from the December 2012 study (Sagamore, UNH aquaculture site, Little Harbor, Atlantic Ocean south of Odiorne, etc.)
6. Typical range of fecal coliform in undisinfected effluent from the new facility
7. Typical range of male specific coliphage in undisinfected and in final effluent from the new facility
8. Develop dilution-distance curves for the outfalls
9. Need to understand when/where stormwater discharge would occur, expected volume of discharges, and expected discharge quality (bacterial and viral).
10. Length of travel time of potentially undisinfected effluent from the different treatment options to each of the perspective outfall locations.

Other Information needs:

- Lobster – When the subject of extending the Peirce outfall farther into the river, adding a diffuser, or other options came up the last time, some of the lobstermen were concerned that changing the introduction of fresh water from the outfall to the river might be detrimental to lobster migration. It would make sense to discuss this issue with the Fish and Game Department, Marine Fisheries Division.
- Navigation – Activity in the federal channel or anywhere in the navigable section of the river will likely require review by the Coast Guard and Army Corps relative to any navigation concerns.

- Aesthetic concerns -- At low tide and in shallow water, it may possible to see the discharge from a new outfall location. This needs to be taken into account.
- Benthic habitat – For a new or redesigned outfall, the impact (temporary and permanent) to benthic habitat will likely be a concern with NOAA. Essential Fish Habitat designations should also be mapped and considered.

Please let me know if you require additional information.

Sincerely,

Eugene Forbes for

Vicki Quiram
Assistant Commissioner

cc. Brain Goetz, Deputy Director of Public Works
Suzanne Woodland, Deputy City Attorney
Eugene Forbes, DES
Ted Diers, DES
Stergios Spanos, DES
Mike Kosier, ARCADIS

Historic Eelgrass Habitat in the Piscataqua River

Source: DES, 2015

ARCADIS

Appendix D

City and NHDOT Correspondence
Regarding Ashland Road

PUBLIC WORKS DEPARTMENT

CITY OF PORTSMOUTH
680 Peverly Hill Road
Portsmouth N.H. 03801
(603) 427-1530 FAX (603) 427-1539

March 23, 2015

Jeff Brillhart, P.E.
Assistant Commissioner, Chief Engineer
Department of Transportation
PO Box 483, 7 Hazen Drive, Room 199
Concord, NH 03302

Subject: Ashland Road from Corporate Drive to Route 16/95 Interchange
Requirements for Re-opening

Dear Mr. Brillhart,

The City of Portsmouth is evaluating wastewater treatment system options. One of the options in this evaluation includes constructing a larger wastewater treatment facility at a site at the Pease International Tradeport. The City is considering a number of candidate sites including the existing wastewater treatment facility located at 135 Corporate Drive, 225 Corporate Drive (the old Jones School Site) and another site to the south of 225 Corporate Drive. See attached map.

In recent discussion with the Pease Development Authority staff, they have requested the City investigate re-opening Ashland Road which connects from Corporate Drive to the southbound Route 16 entrance to the Portsmouth traffic circle. We understand the Pease Development Authority has made this request to the City in order to minimize construction and/or long term impacts of traffic on Pease tenants and roadways.

The City is in the process of developing a list of advantages and disadvantages for each site in the study and cost estimates that will have impact on the Pease Development Authority and City Council decisions. In order to better understand the implications of this request, the City is formally requesting the Department of Transportation's position on this request and any requirements (e.g. paving, maintenance, bridge, etc.) that may be levied to grant this request. Further, we are seeking clarification on the use of this roadway as a temporary access during construction (anticipated to be approximately 3 years in duration) and potentially as a dedicated route to the wastewater facility if one of the sites nearest Ashland Road is the selected final location.

We look forward to discussing this with you and reviewing the Department of Transportation's positon on this request. Please call me at 603-766-1420 to discuss this matter further.

Sincerely,

Brian Goetz
Deputy Director of Public Works

cc: John Bohenko, City Manager
Peter H. Rice, P.E., Director of Public Works
Terry Desmarais, P.E., City Engineer
David Mullen, Executive Director, Pease Development Authority

WWTP Alternate Location Plan

0 200 400 600 800 Feet

1 " = 800 '

N

Map Prepared by Portsmouth Department of Public Works

Printed: 03/24/2015

New Hampshire DOT
Department of Transportation

THE STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION

William Cass, P.E.
Assistant Commissioner

April 24, 2015

Mr. Brian Goetz
Public Works Department
City of Portsmouth
680 Peverly Hill Road
Portsmouth, NH 03801

RE: **Ashland Road from Corporate Drive to Spaulding Turnpike (NH 16)**

Dear Mr. Goetz:

As requested in the letter dated March 23, 2015, to then Acting Commissioner David Brillhart, the New Hampshire Department of Transportation (DOT) has reviewed the request to use Ashland Road to support construction operations and the potential for long term access to a wastewater treatment facility on Corporate Drive.

Historically, Ashland Road was built exclusively as an emergency access road to Pease Air Force Base and now serves the redeveloped area in the same manner. While the impetus behind this request for long term access is understood, the Department does not support a permanent use as a dedicated route to a potential wastewater facility site. This is due to safety and operational concerns with such a use and introducing an egress point onto a highway segment which has a significant accident history.

This permanent use would conflict with traffic queuing during peak hour timeframes on a daily basis and would affect the ability for proper lane alignment for appropriate progression through the Portsmouth Traffic Circle. The existing geometry does not lend itself to safe permanent operation, especially with the traffic queuing from the circle and the challenges it presents.

The Department, however, is open to further discussion regarding the potential use of Ashland Road as a temporary access during construction. Additional information regarding the frequency and times of use, proposed traffic control at the egress point on NH 16 and protection of the road and bridge assets would need to be discussed.

For further discussion and coordination in this regard, please call Christopher Waszczuk, Administrator for the Bureau of Turnpikes, at (603) 485-3806.

Sincerely,

William Cass, P.E.
Assistant Commissioner

cc: Patrick McKenna, NHDOT-Deputy Commissioner
Christopher Waszczuk, NHDOT- Administrator Turnpikes