

CITY OF PORTSMOUTH, NEW HAMPSHIRE
WASTEWATER MASTER PLAN AND LONG TERM CONTROL
PLAN UPDATE

FINAL SUPPLEMENT TO WASTEWATER MASTER PLAN AND
LONG TERM CONTROL PLAN UPDATE

1.1 Purpose of Final Supplement

On November 8, 2010, the Portsmouth City Council, at its regularly scheduled meeting, authorized the City Manager to submit this Final Supplement. The purpose of this Final Supplement to the Wastewater Master Plan and Long Term Control Plan (WMP/LTCP) Update is to address concerns expressed by the Environment Protection Agency (EPA) and the New Hampshire Department of Environmental Services (NHDES) with the implementation schedule included in the Draft WMP/LTCP Update submitted on June 4, 2010.

This Final Supplement will outline the City of Portsmouth's revised strategy to come into compliance with its Consent Decree, specifically as it relates to meeting requirements of the current Peirce Island NPDES Permit #NH0100234. This permit requires Peirce Island wastewater flows be treated to secondary treatment standards prior to discharge and meet the effluent characteristics shown in Table 1.1 below:

Table 1.1 Peirce Island NPDES Permit #NH0100234 Discharge Limits

Effluent Characteristic	Discharge Limitations		
	Average Monthly	Average Weekly	Maximum Daily
Flow, MGD	Report	--	Report
BOD ₅ , Effluent, mg/l (lbs/day)	30 (1201)	45 (1801)	50 (2002)
BOD ₅ , Influent, mg/l	Report	--	--
TSS, Effluent, mg/l (lbs/day)	30 (1201)	45 (1801)	50 (2002)
TSS, Influent, mg/l	Report	--	--
pH Range, Standard Units	6.0 - 8.0		
Total Residual Chlorine, mg/l	0.33	--	0.57
Fecal Coliform, %	--	--	Report
Fecal Coliform, MPN/100 ml	14	--	--
Enterococci Bacteria, Colonies/100 ml	Report	--	Report
Whole Effluent Toxicity, LC50, % Effluent	--	--	Report
Ammonia Nitrogen as Nitrogen; mg/l	--	--	Report
Total Recoverable Aluminum; mg/l	--	--	Report
Total Recoverable Cadmium; mg/l	--	--	Report
Total Recoverable Chromium; mg/l	--	--	Report

The table shows typical secondary effluent concentration limits of 30 mg/L for BOD₅ and TSS and mass based limits of 1,201 lb/d BOD₅ and TSS based on the concentration limits and plant design capacity of 4.8 MGD Average Daily Flow (ADF).

1.1.1 Development of Compliance Strategy

The Compliance Strategy put forth in this supplemental document has been developed since the submission of the Draft WMP/LTCP Update to the Environment Protection Agency (EPA) and the New Hampshire Department of Environmental Services (NHDES) on June 4, 2010. Pursuant to the consent decree, this final submission was due on September 1, 2010. By agreement of the parties the deadline for the final submission was extended to November 15, 2010.

1.1.1.1 Draft WMP/LTCP Update, June 4, 2010

The Draft WMP/LTCP Update was developed to address the requirements of the City's current consent decree while also taking into consideration the long term needs of the City's wastewater treatment system with respect to projections of wastewater flows, organic loads, ongoing sewer separation efforts, CSO mitigation and future permit limits. At the direction of EPA and NHDES, the future permit limits under consideration in the WMP were based on achieving an effluent total nitrogen (TN) concentration in the range of 8 to 3 mg/l. These parameters were used to develop the wastewater treatment facility (WWTF) alternatives presented in the Draft WMP/LTCP Update. The two final alternatives presented were an expansion of the Pease Sequencing Batch Reactor (SBR) WWTF or an upgrade of the Peirce Island WWTF with a High Rate Treatment (HRT) process such as Membrane Biological Reactors (MBR). Because there were outstanding unresolved regulatory issues potentially impacting both of these alternatives, neither could be selected as of June 4, 2010 or September 1, 2010.

The WWTF alternatives were evaluated using criteria which reflected original project goals including meeting existing and potential regulatory limits, protecting community interests, benefiting the environment and maintaining affordability. The result of this evaluation was the recommendation of a preferred alternative involving an expansion of the Pease WWTF for treatment of sanitary flow and conversion of the Peirce Island WWTF to a CSO treatment facility. The preferred alternative was subject to a number of unresolved regulatory questions which were included with the Draft WMP/LTCP Update. Based on the outcome of these regulatory questions, the preferred alternative was subject to change.

One of the most compelling reasons for the recommendation of an expansion of the Pease WWTF was its ability to be implemented in a phased construction schedule. The phased schedule was beneficial not only from an affordability standpoint, but also because it allows the City to use a "build and measure" approach at the Pease facility, with flexibility to address basis of design changes due to ongoing sewer separation projects and pending nutrient limits. However, shifting sanitary flow to Pease for treatment on a phased schedule required maintaining a primary discharge from the Peirce Island treatment plant for the remaining flow until such time that the Pease facility reached a capacity to treat all sanitary flow. The schedule included with the Draft WMP/LTCP indicated all sanitary flow would be treated at Pease between 2025 and 2028 depending on the outcome of pilot testing various treatment technologies. The implementation schedule presented was adopted, in part, to spread the projected project cost over time to prevent the cost from having an unmanageable impact on user rates.

1.1.1.2 Regulatory Input on Draft WMP/LTCP Update

To date, no official written approval or disapproval of the Draft WMP/LTCP Update has been provided to the City by EPA or NHDES. However, two meetings were held with both agencies at Portsmouth City Hall following the June 4, 2010 submittal. The purpose of these meetings was to discuss the unresolved regulatory questions submitted by the City with the Draft WMP/LTCP update and to address the regulators' concerns with the phased implementation schedule presented for the preferred alternative.

Meeting 1 (7/23/2010)

The first meeting between the City and EPA/NHDES focused on the unresolved regulatory questions submitted with the Draft WMP/LTCP update. The representatives of EPA/NHDES present concurred that until some or all of the questions were answered it would be impractical for the City to make its final selection of a preferred alternative or to finalize the WMP/LTCP Update by September 1, 2010. The topics and questions discussed at the meeting included:

- When would a total nitrogen (TN) limit be issued for both of the City's WWTFs, and what would the limit be?
 - EPA and NHDES were unable to answer definitively what the limits would be for either outfall location, but stated that the City should still consider meeting a TN limit as low as 3 mg/l in upcoming permits.
- Would any expansion of the Pease WWTF Outfall be acceptable?
 - Of primary concern to the NHDES was that the expansion would contribute to a projected increase in bacteria load in the event of a complete failure of the Pease disinfection system, which would require closure of Dover Point Shellfish beds due to FDA's notification requirements. This would constitute a "loss of use" of the Dover Point Shellfish beds which is impermissible under EPA regulations. The City expressed doubt that closure of the shellfish beds in question should be considered "loss of use". The shellfish beds do not appear to be a viable use under the current State and FDA standards due to their proximity to both the Dover WWTF and Pease WWTF outfalls, and due to the actual pre-disinfection fecal coliform bacteria counts measured at the Pease WWTF.
 - Increased nutrient loads to Great Bay from the Pease outfall were also of concern to NHDES.
- Would a wet-weather bypass be considered acceptable on Peirce Island?
 - The City was concerned that a recent EPA briefing would restrict their ability to bypass wet weather flows around a secondary process at Peirce Island if it was selected as the final preferred alternative. EPA indicated that the recent briefing on this subject was a pre-proposed rulemaking item geared toward SSO communities and implementation of CMOM programs. EPA stated that bypassing wet weather flows as proposed for Peirce Island was common practice for CSO communities

(citing Manchester, NH and the MWRA) and that, as such, Portsmouth was unlikely to be affected by any pending regulation.

- Should a total phosphorus (TP) limit be expected at either WWTF:
 - EPA/NHDES indicated that phosphorus is mainly a concern in brackish water and therefore Portsmouth should not expect a TP limit any time in the near future.
- When would complete secondary standards need to be met:
 - EPA was unclear from the Draft WMP/LTCP when all sanitary flow was expected to receive secondary treatment, based on the phased implementation schedule presented. The City explained that the schedule was created for achieving both secondary and BNR standards, and had 100% of the projected sanitary flow being treated by 2028.
 - The City also indicated that this schedule could potentially be shortened to year 2025 if BioMag was deemed feasible through piloting. EPA indicated that getting to secondary treatment was the primary concern and that it was unlikely that a schedule where secondary limits would not be met within the next five to seven years would be acceptable to them.

EPA/NHDES were concerned with the amount of time included in the implementation schedule to resolve regulatory issues necessary to finalize the selection of a preferred alternative. In order to determine actual time constraints, EPA/NHDES requested the City develop a complete list of questions that needed to be addressed and what, if any, scientific evidence needed to be gathered before the questions could be answered. They also asked that a flow chart of the required actions be prepared and a schedule for resolving them be submitted so as to determine an appropriate extension for the final WMP/LTCP Update submission.

Submissions of Questions Affecting Final WMP Decision (8/16/2010)

As requested the City prepared a list of unresolved regulatory and technical questions affecting the final decision on the selection of a preferred alternative and submitted them to EPA/NHDES for their review. The questions and the related flow chart submitted have been attached as Appendix A.

Two of the questions submitted were developed to look into the possibility of constructing a secondary treatment process on Peirce Island in the existing filter building in order to bring the WWTF into compliance with its secondary permit as expeditiously as practicable, as desired by the EPA. A follow up meeting was scheduled for August 20, 2010 to discuss the questions submitted to the EPA and NH DES.

Meeting 2 (8/20/2010)

At the August 20, 2010 meeting with EPA and NH DES the August 16, 2010 submission of regulatory questions and the flow chart developed to address the regulatory questions were reviewed. The key points of that meeting were:

- Are the Dover Point shellfish beds a legitimate use under current regulations?

- It is the City's opinion that if the shellfish beds should not be open in the first place for reasons unrelated to modifications of the Pease outfall, then it should not be considered legitimate use under the regulations. Therefore impacts to these shellfish beds from modifications to the Pease outfall could not be considered a "loss of use" and this should be a non-issue when evaluating the viability of increasing flow at the Pease Outfall.
- The NH DES believes the beds are required to be viewed as a legitimate use. To determine the impact of the Pease WWTF, a dye study or hydrodynamic model will be required. The City is currently contracted with Applied Science Associates to facilitate the hydrodynamic modeling (Bellamy Model). The results of this modeling will be made available upon receipt. The NH DES stated that they would facilitate discussions with the Food and Drug Administration (FDA) once the modeling is complete.
- What are the regulatory parameters which determine whether the shellfish beds must be closed?
- There were discrepancies on the actual length of notification required time by the FDA in the event of a complete disinfection system failure at the Pease WWTF. At times NHDES indicated that the length would be 4-hours, at others a 9-hour notification time was referred to. Regardless of the specific time requirement, the City wanted to know if it is possible to reduce the time with advanced technical solutions which are clearly available. The decision to allow this would be made by the State of New Hampshire, but the FDA would need to concur. Redundant disinfection systems would not be considered a technical solution. Using a reverse 911 system or automated signage at the shell fishing beds may be acceptable. NH DES will need to determine such systems would be acceptable and whether the Dover Point shellfish beds could be designated for this approach, or if the FDA would view this as a statewide approach.

Both of these issues will need to be addressed before it can be concluded that the existing Pease WWTF outfall location is a viable option for the WMP/LTCP Update preferred alternative.

- The EPA will require that the City achieve secondary treatment for Peirce Island WWTF sanitary flows as expeditiously as practicable.
- The EPA will require that pilot testing of wastewater treatment technologies begin no later than July 1, 2011. The City will need to re-allocate funding from other projects to accomplish this. EPA concurred that it was desirable to re-allocate funds from LTCP related sewer separation funds and postpone the CSO reduction work in favor of getting pilots online by July 2011. Unresolved regulatory and technical questions must be answered by the end of the pilot study, which should be completed by September of 2012.
- EPA permitting officials stated that nitrogen limits may be included in the next NPDES permit renewal for both the Pease WWTF and Peirce Island WWTF, and the nitrogen limit could be the limit of technology (3 mg/L total nitrogen).

After these meetings a letter was issued by the EPA to reiterate the expressed concerns with the phased implementation schedule. The letter also encouraged the City to pursue a revised compliance strategy where secondary treatment was achieved for Peirce Island flows in the next 5-7 years. This letter has been attached as Appendix B.

1.1.1.3 Evaluation of Secondary Treatment Capacity of Existing Peirce Island Filter Building

Based on the directive of the EPA that the City needs to achieve secondary treatment for Peirce Island wastewater flows more expeditiously than presented in the June 4, 2010 draft report, the City requested that in lieu of finalizing the Value Engineering evaluation of the WMP/LTCP Update, the value engineering consultant (AECOM) focus its efforts on an evaluation of the unused filter building on the Peirce Island WWTF site. Their revised assignment was to determine the potential secondary treatment capacity that could be achieved by retrofitting the existing filter building at the Peirce Island WWTF. The findings of their evaluation are included as Appendix C.

The results of their evaluation were based on vendor quotes which indicated that approximately 5 MGD ADF and 7.5 MGD Maximum Day could be treated to secondary standards within the existing filter building using a High Rate Treatment (HRT) process such as Biologically Aerated Filters (BAF), Moving Bed Biofilm Reactors (MBBR) or the previously discussed MBRs. Because the potential to use MBRs on Peirce Island had been discussed in the Draft WMP/LTCP update, AECOM's evaluation focused primarily on compiling vendor information for the BAF and MBBR processes. The results of their evaluation indicated that achieving secondary treatment standards could potentially be accomplished within the footprint of the existing filter building.

The Draft WMP/LTCP Update had previously identified the BioMag® process as an optional HRT process. The potential for using this process at the Peirce Island WWTF was evaluated by the WMP/LTCP Update team and was shown to also have merit.

1.2 Compliance Strategy

1.2.1 Concept

The revised Compliance Strategy will become the first phase of the WPM implementation and is intended to satisfy the requirements of the current Consent Decree such that all subsequent phases outlined in the June 4, 2010 draft WMP/LTCP Update will be implemented only when deemed necessary and affordable by the City. The City has developed its revised Compliance Strategy in part based upon the verbal comments received from EPA and NHDES, and the feasibility of implementing secondary treatment on Peirce Island by utilizing the unused filter building on that site. Staying within the current footprint of the Peirce Island WWTF is important for two reasons. First, interference with the adjacent revolutionary war fort, Fort Washington, may cause permitting concerns under the Historic Preservation Act, Section 106 review process. Second, the Portsmouth community is strongly adverse to the WWTF having a greater impact on Peirce Island.

The goal of the revised Compliance Strategy is to use the existing filter building on Peirce Island to achieve secondary treatment per the requirements of NPDES Permit #NH0100234. This revised

Compliance Strategy is a possible solution for meeting the secondary treatment requirements of the current Consent Decree. It does not take into account meeting future Total Nitrogen Limits, the affordability issues associated with meeting future permit limits, or the City's previously expressed goal of removing sanitary treatment from Peirce Island as these issues were already addressed as part of the WMP/LTCP Update.

1.2.2 Hydraulic Capacity Evaluation

The annual wastewater flow to the Peirce Island WWTF averaged 4.99 MGD from 1993 to 2007, due to wet weather influences on the combined collection system. Based on flow projections developed in the WMP/LTCP Update and additional data provided to the EPA and NH DES in June of 2010 the projected average annual dry weather flow at year 2017 to the Peirce Island WWTF is expected to be 3.5 MGD.

The capital investment represented by the revised Compliance Strategy is such that the secondary treatment plant is intended to be in use for at least the next 20 years. Assuming that ongoing and future sewer separation projects meet their desired goals, the projected average annual dry weather flows to the Peirce Island WWTF will be 4.0 MGD in year 2027. Using the 80% factor dictated in the NPDES permit, a secondary design flow of 5.0 MGD will provide sufficient capacity to meet year 2027 projected average annual dry weather flows of 4.0 MGD. It is anticipated that wet weather bypasses around the secondary process will be approved by the EPA for all flows in excess of the 7.5 MGD maximum day capacity estimated during the evaluation of the existing filter building's secondary treatment capacity.

1.2.3 High Rate Treatment Options

The existing filter building has eight (8) filters each 16 feet by 30 feet and 12 feet deep. Below the filters are filter effluent collection chambers which are interconnected to the effluent pump station. If the floor below the filter building and above the effluent wetwell is removed the filter depth can be increased to 20 feet providing a maximum 18.5 foot side water depth. A clearwell below the north pipe gallery provides water for backwash. It is the goal of the revised compliance Strategy to install a high rate treatment process to meet secondary standards within the area occupied by the existing filters without modifying the footprint of the filter building.

The following is a description of the four high rate processes which are now under consideration. Following these descriptions is Table 1.2 summarizes the volume required and treatment capacity available for each option to meet secondary limits.

1.2.3.1 BAF

The Biologically Aerated Filter (BAF) system is a fixed-film process where primary effluent flows up or down (depending on the manufacturer) through a filter bed packed with media. The submerged media provides growth sites for fixed-film microbes to thrive and develop biofilms. The filter bed consists of multiple tanks or cells filled with plastic or sand media. Fine screening (< 2mm) is required upstream of the BAF to prevent fouling of the filter bed and media. Fats, oils and grease are also a concern and must be managed prior to introduction of influent to the BAF. Secondary clarifiers are not required. Instead, periodic backwashing the filters will remove the fixed-film that sloughs from the media.

BAFs can meet secondary standards. Nitrification performance is vendor specific and can be achieved within the same BAF tank or with a downstream nitrifying BAF. In either case, the footprint of the BAF system to provide nitrification will increase over that required for only secondary treatment. Denitrification would require additional unit processes. The leading BAF system manufacturers are Kruger and Infilco Degremont.

1.2.3.2 BioMag

The BioMag system is an emerging biological treatment technology that incorporates magnetite ballast into biological floc to increase specific gravity and improve settling of the biological floc as compared to traditional suspended growth/activated sludge processes. The magnetite ballast is recovered and reused using shearing and magnetic separation equipment. This equipment includes an in-line shear mixer and magnetite recovery drum. The system is patented and produced by a single manufacturer, Cambridge Water Technologies (CWT).

Initially, the system was designed to allow significantly higher solids loading and MLSS concentrations in a conventional activated sludge system within the same process footprint to increase WWTF hydraulic and/or organic capacity within the same footprint. Pilot testing has indicated potential enhancements to nitrogen removal, which is being confirmed by the manufacturer through a variety of full scale operational tests which are currently ongoing throughout the country.

Although developed for nutrient removal purposes, a BioMag system can be operated specifically to meet secondary standards. Fats, oils and grease are not a significant concern. Secondary clarifiers are required, unless the SBR treatment process is used. The sizing of the secondary clarifiers can be reduced from standard design requirements since the mixed liquor settling rate is significantly higher. Overflow rates of up to 2800 gpm/sf for clarifiers are expected, which would significantly reduce the clarifier size needed.

The BioMag technology, combined with an SBR, was considered a viable option and was the preferred option in the draft WMP/LTCP Update, if constructed at the Pease WWTF site.

1.2.3.3 MBBR

Moving Bed Biofilm Reactors (MBBR) can meet secondary standards. The MBBR process is a hybrid process that combines a suspended growth activated sludge system with a fixed film system. The MBBR process would consist of multiple tanks or cells to create aeration basins, with plastic media suspended and mixed in the aeration basins of the activated sludge process. The media's high surface area provides growth sites for microorganisms which are maintained as a biofilm. A secondary clarification step is required. This can be done with a standard clarifier, dissolved air floatation, or ballasted settling. The leading MBBR systems are manufactured by Anox Kaldnes and Infilco Degremont.

1.2.3.4 MBR

The Membrane Biological Reactor (MBR) system is an activated sludge process in which a membrane filter (ultrafilter or microfilter) is used in place of a secondary clarifier for solid-liquid separation downstream of the aeration process. As with the BioMag process, MLSS concentrations

in MBR systems are significantly greater than in conventional activated sludge systems because of the greater solid-liquid separation capability. Fine screening is necessary to prevent clogging of membranes; typical screen sizes for MBRs are 1 to 2 mm spacing.

MBRs can meet secondary standards, but nitrification is required to maintain trans-membrane pressures. Nitrification performance is dependent upon tank volume, and the filter building provides sufficient volume to nitrify with MBR systems. The MBR process was identified as a viable alternative for the Peirce Island WWTF in the Draft WMP/LTCP Update because of the limited foot print required. The leading MBR systems are manufactured by General Electric and Siemens.

Table 1.2 summarizes the projected flow capacities that can be housed in the existing filter building for the proposed technologies. The information presented in Table 1.2 is based primarily on vendor information and will need to be verified through pilot testing.

Table 1.2 Comparison of Treatment Capacities for High Rate Processes

Technology Option	Flow Capacity for Secondary Treatment		Filter Bays Required	Potential Additional Process Tankage	Opinion of Capital Cost ^(e)
	Average Day	Maximum Day			
BAF ^(a)	5.0 MGD	7.5 MGD	8	Wash Water Tanks	\$30,000,000
BioMag ^(b)	5.0 MGD	Pilot to Determine	8	Secondary Clarifiers	\$27,000,000
MBBR w/ Ballasted Settlement ^(c)	5.3 MGD	8.85 MGD	8		\$33,000,000
MBR ^(d)	5.0 MGD	7.5 MGD	8	Membrane Tanks	\$ 30,500,000

(a) Based on the Kruger BIOSTYR process. All data presented has been developed by AECOM.

(b) Based on a conventional activated sludge process. All data presented has been developed by the WMP/LTCP Update consulting team.

(c) Based on the Infilco Degremont process w/ Actiflo Clarification. All data presented has been developed by AECOM.

(d) Based on the General Electric ZeeWeed process. All data presented has been developed by the WMP/LTCP Update consulting team. Cost data presented by AECOM for an MBR system in Appendix C was adapted from the MBR option presented in the Draft WMP/LTCP Update and did not reflect appropriate parameters for the revised Compliance Strategy. The MBR cost presented in appendix C has therefore been replaced with that shown in Appendix D.

(e) Opinion of cost generated by both consultants include all appurtenant information necessary for a complete system, including dewatering system upgrades, a sludge holding tank, an intermediate pump station and new headworks screening structure.

1.2.4 Piloting

Determining which of the technologies described above is appropriate for implementation of the revised Compliance Strategy will be achieved through a pilot effort. The pilot effort will include a wastewater characterization to define the load the technologies will be required to treat. The pilot studies will begin at a bench scale to determine whether or not a specific technology should be evaluated further. Those technologies which show promise during the bench scale testing can then be compared side by side with onsite trailer mounted pilots. Depending on the outcome of the trailer comparison one or more technologies or manufacturers may be selected for demonstration level testing within the filter building. The onsite pilot studies will need to be run for a period of no

less than 12 months to ensure candidate treatment processes have been exposed to the full range of seasonal variations in flows and loads.

1.2.4.1 Peirce Island Pilot

The city intends to pilot test the proposed high rate treatment technologies to determine the most applicable technology for use on Peirce Island in the revised Compliance Strategy.

The purpose of the pilot test programs is to:

- Identify the space requirements of various technologies that can meet the secondary effluent standards of 30 mg/L BOD and 30 mg/L TSS
- Determine average daily, maximum day, and peak instantaneous flow rates that each system can achieve while meeting the required secondary standards
- Determine the ability of each technology to treat to applicable permit limits
- Estimate the anticipated life cycle (both capital and operating) costs associated with each of the technologies that are evaluated during the pilot test program
- Establish justification for sole source procurement if necessary

Based on the outcome of these evaluations the City intends to select the most appropriate technology to implement as part of the revised Compliance Strategy.

1.2.4.2 Pease Pilot

As was recommended in the draft WMP/LTCP Update, the City is considering pilot testing of the BioMag process at the Pease WWTF concurrently with the piloting program at the Peirce Island WWTF. This will allow the City to determine the effectiveness of the BioMag process in an SBR that is treating a combination of industrial and sanitary wastewater. It will also allow the City to determine the capacity increase that can be achieved at Pease without building additional structures. In the event that piloting of the high rate treatment options at Peirce Island shows not all existing flow can be accommodated on site within the existing filter building, the remaining flow may need to be redirected to Pease for treatment. Options for rerouting flow to Pease have been discussed as part of the WMP/LTCP Update.

Although the City's proposed Compliance Strategy is focused on meeting requirements of the current Peirce Island NPDES permit as required by the current Consent Decree, it recognizes that the current Pease NPDES permit has expired and is due to be reissued. Due to the Pease outfall's closer proximity to Great Bay, there is the potential that a TN limit will be included when the permit is reissued. Piloting BioMag at Pease, to determine its ability to increase the SBR capacity and remove nutrients, concurrently with the Peirce Island pilot effort project will provide the City with system wide information which will allow for flexibility to make informed decisions on its wastewater treatment program at the conclusion of the pilot effort.

1.2.5 Compliance Strategy Schedule

The following is the schedule proposed for implementing the revised Compliance Strategy outlined above.

Select Engineer for Piloting – October 2010 to January 2011

A Request for Qualifications for Engineering Services related to the Wastewater Master Plan - Piloting Effort was published by the City in late September of 2010. The Qualifications Packages were received by the City by October 14th 2010. The selection process is expected to be complete by January of 2011.

Pilot Coordination – January 1, 2011 to April 30, 2011

The Engineer selected for the Piloting Program will use this time to refine the selection of technologies to pilot, schedule the pilot units for on-site evaluation, develop the protocols for each treatment technology and identify space and infrastructure needs for the pilot test trailers. Infrastructure improvements necessary to support the pilot units will be designed and constructed during this time period.

Pilots Online – May 1, 2011 to July 1, 2011

Pilot units will arrive and be set up on site. This time will be used to establish steady state operations of the pilot units, which is required before the pilot study and data collection can begin.

Pilots Study and Report Preparation – July 1, 2011 to September 30, 2012

A minimum period of 12 months of data collection is required to ensure the candidate treatment processes have been exposed to a complete year of seasonal variations in flows and loads. This time will be used to establish the capacity of the piloted technologies to treat to secondary standards. A report on the outcome of the pilot studies will be prepared at the time of its completion, and will identify the treatment technology the City proposes to move forward with in design. Specifically, the selected process will be judged by its capacity to meet the requirements of the City's Consent Decree, and particularly as it relates to meeting the requirements of the current Peirce Island NPDES Permit #NH0100234.

Review and Approval by EPA/NHDES - October 1, 2012 to January 31, 2013

The final Pilot Study report identifying the City's selected treatment technology will be submitted for review and approval to EPA/NHDES.

Permitting – February 1, 2013 to April 1, 2013

Time included for determining additional permitting requirements such as the Historic Preservation Act (Section 106 review process), and a review of the Comprehensive Shoreland Protection Act setback requirements.

Preliminary Design/Vendor Selection – April 1, 2013 to June 30, 2013

Once approval is received from EPA/NHDES for the City to move forward with its selected process technology, preliminary design of the system will commence. If the technology is produced by more than one vendor, additional piloting may be performed to select a preferred vendor package around which design, particularly of the required structural modifications to the filter building, can be standardized.

Final Design – July 1, 2013 to August 31, 2014

The final design process will involve the City's consultant designing the improvements identified during the preliminary design phase. Milestones will include 50%, 75%, 90% and 100% design documents. The 90% and 100% design documents will be reviewed by a VE and submitted to the NH DES for review (90%) and approval (100%).

Bidding – September 1, 2014 to October 31, 2014

When the 100% design documents are completed and approved by the City and NH DES, bids will be solicited from qualified contractors to construct the improvements. The bidding effort will include advertising the project for bid, distributing design documents, receiving questions from potential bidders, a pre-bid meeting, receipt of the bids, bid opening and a recommendation to and notice of award.

Construction – November 1, 2014 to May 31, 2016

The construction period will include a preconstruction meeting, monthly progress meetings, shop drawing review and approvals and monitoring of the contractor's progress.

Startup – June 1, 2016 to August 31, 2016

Startup of all new equipment and processes will commence once substantial completion has been reached. All electrical and control systems will be tested for powered equipment, and all equipment will be tested to confirm that the specified operating conditions have been met.

Compliance – September 1, 2016 to November 30, 2016

Following startup, the new treatment systems will be commissioned, placed into operation and monitored to evaluate compliance with the NPDES permit. Modifications to the operating parameters and/or strategies will be evaluated to allow the new systems to operate efficiently and effectively.

1.2.6 Compliance Strategy Costs**1.2.6.1 Pilot Effort Costs**

In order to have the Pilot Study up and running before the City's 2011 fiscal year budget approval on July 1, 2011 the City Council will need to reallocate funds from the Cass Street (Islington #2) sewer separation project. The Cass Street project is included in the City's LTCP and was scheduled to begin construction in the spring of 2011 for a 2012 completion. At the August 20, 2010 meeting with EPA and NHDES, both agencies indicated that they would support postponing the separation work in favor of moving the secondary treatment compliance process forward and getting the Pilot Study up and running before July 2011. To date \$2.5M has been identified for the Pilot Effort. If additional funds are deemed necessary during Pilot Coordination it will be addressed at that time. The City understands that the Consent Decree requirements will be modified accordingly.

1.2.6.2 Opinion of Compliance Strategy Capital Costs

Four High Rate Treatment technologies have been identified as having potential to be implemented at the Peirce Island WWTF to achieve secondary treatment standards; namely BAF, BioMag, MBBR

and MBR. Based on vendor information received through the WMP and VE exercise, opinions of capital costs for implementing each of these technologies have been developed and were presented previously in Table 1.2. Backup for each of these capital costs is included in Appendix C and D.

The opinions of cost developed for the draft WMP/LTCP Update distinguished between Consent Decree (CD) improvements and work related to the Capital Improvements Plan (CIP). The CD improvements included those measures necessary to meet the secondary treatment and CSO abatement requirements of the City's CD, as well as the measures which would be required to meet future TN limits ranging from 8 to 3 mg/l as advised by EPA/NHDES. The CIP costs encompassed work that was not mandated by the current Consent Decree but is either currently identified and budgeted for in the City's CIP or was considered important to keep the wastewater treatment systems functioning and in compliance over the next 20 years.

At the direction of the City, the opinions of cost for the Compliance Strategy presented in Table 1.2 of this Supplement include only the work necessary to bring the Peirce Island WWTF into compliance with NPDES Permit # NH0100234 and the costs already included and budgeted for in the City's CIP. Unlike the costs presented in the draft WPM/LTCP Update, the Compliance Strategy opinions of cost do not include costs associated with expansion of the City's two WWTF's for future flow projections, meeting future nutrient limits, CSO reduction (other than that already budgeted), or work related to the CIP. These costs will be deferred until the revised Compliance Strategy is in place, and incurred when necessary and affordable.

1.2.6.3 Affordability Analysis

As discussed in the draft WMP/LTCP a critical component to any wastewater project is determining the financial impact that its implementation will have on the City and the community. In order for a project to be considered a viable solution, it must also be affordable. To address this concern, the WMP/LTCP team has performed another iteration of the EPA's Financial Capability Assessment with the opinions of cost generated for the revised Compliance Strategy.

The most current iteration was based on an average capital cost of \$30 M for the potential technologies being spent between 2012 and 2016 per the revised Compliance Strategy schedule discussed above, and an average O&M cost estimate of \$1M/ yr being spent each year following the completion of construction over the project life.

There are two Phases of the EPA Financial Capability Assessment. Phase 1, the **residential indicator**, measures the financial impact of the current and proposed capital and O&M costs on the statistical median residential users in the service area. Phase 2, the **financial capability** of the community, is determined by three categories of indicators: Debt, Socioeconomic and Financial Management.

Definition of the Service area's median residential user is critical to this type of affordability analysis. There are a number of ways to determine the number of households in the service area including, census information, number of sewer bills and the number of equivalent dwelling units (EDU). For this WMP/LTCP Update evaluation the City used EDUs based on an average household water use as defined by the New Hampshire Department of Environmental Services (NHDES). This approach is consistent with how the City currently sets its sewer use rates. This determination of EDU was deemed more appropriate than the method used in the original submission of the City's

LTCP in 2005. Upon further investigation through the WMP/LTCP Update process, it was determined that the method based on the number of residential sewer bills used in the original LTCP was subjective and did not accurately reflect the number of residential households. The original LTCP excluded large family and multi dwelling units in an attempt to focus on the “average user” and therefore did not capture the actual residential flow and therefore the impact to the average residential user of sewer related capital, operation and maintenance costs.

For a complete description the EPA’s Financial Capability Assessment and how it was tailored to the City of Portsmouth’s specific characteristics please refer to Section 7.2 of the WMP/LTCP Update

U.S. EPA guidelines establish three levels for the residential indicator (RI) measure.

- *Low* – Average score of below 1 percent
- *Medium* – Average score between 1 and 2 percent
- *High* – Average score above 2 percent

The alternatives presented in the draft WMP/LTCP Update showed residential indicators ranging from 2.8 percent for the phased expansion of Pease to 3.3 percent for the Peirce Island Upgrade based on cost opinions that included both CD and CIP related work. The Compliance Strategy presented herein produces a residential indicator of approximately 2.66 percent which is still considered in the High Impact range.

EPA guidelines establish three levels for the financial capability measure.

- *Weak* – Average score of below 1.5
- *Mid Range* – Average score between 1.5 and 2.5
- *Strong* – Average score above 2.5

The average score for Portsmouth is 2.8 which rates “strong” in U.S. EPA guidelines.

EPA’s matrix combines the residential indicator and the financial capability indicator as shown in Table 1.3. For Portsmouth, the financial capability rating is “strong.” The residential indicator is “high impact” for the alternatives. Therefore, the program is classified as “medium burden.” Nevertheless, the data indicates that average annual sewer rates will rise from the 2010 level of \$600 to approximately \$1,200 in 2017. This is not only a dramatic increase for the average residential user, but will translate into even more significant increases for the City’s commercial and industrial user which make up approximately 60% of the City’s ratepayers.

Table 1.3 Financial Burden Matrix

		Residential Indicator		
		Low Impact (<1 percent)	Mid-Range Impact (1-2 percent)	High Impact (>2 percent)
Financial Capability	Weak <1.5 percent	Medium Burden	High Burden	High Burden
	Mid-Range	Low Burden	Medium Burden	High Burden
	Strong >2.5 percent	Low Burden	Low Burden	Medium Burden

1.3 Relationship between Compliance Strategy and the LTCP Update

As discussed, the revised Compliance Strategy presented herein is the City's alternative Phase 1 plan designed to gain compliance with its Consent Decree as it relates to meeting requirements of the current Peirce Island NPDES Permit #NH0100234. The LTCP related work put forth in the June 4, 2010 submission of the WMP/LTCP remains the recommendation for a long-term solution for the City's stormwater collection system.

In order to meet the EPA's request that the pilot studies of the potential treatment technologies discussed above are online by July of 2011, the City will need to reallocate funds prior to its 2011 fiscal year budget approval on July 1. In order to make funds available the City has decided to postpone one LTCP related sewer separation projects. This approach was approved verbally by EPA/NHDES at the August 20th meeting held at City Hall. In addition the City is requesting an adjustment to the Consent Decree's sewer separation schedule due to construction related delays including ledge and contractor difficulties. Table 1.4 shows the revised completion dates for those projects which will need to be shifted to accommodate the WMP Pilot effort and construction delays.

In order to reduce the number of CSOs occurring in the collection system, a wet weather bypass of the secondary treatment process at the Peirce Island WWTF will be necessary. Wet weather flows in excess of the secondary process' peak design capacity will continue to receive chemically enhanced primary treatment and disinfection, as currently occurs.

It is possible that the secondary treatment process at the Peirce Island WWTF will gradually be abandoned over the next 20 years if nutrient limits are imposed in a future Peirce Island NPDES permit and sanitary flow is shifted to Pease per the recommendations of the WMP/LTCP Update. One of the LTCP Update related recommendations was to reconfigure Peirce Island to provide wet weather treatment as a "plus project" once sanitary flow had been removed from the Island. The ability to convert the proposed secondary treatment process at the Peirce Island WWTF to a CSO treatment facility should be taken into consideration during the piloting and preliminary design phase of the Compliance Strategy in order to maintain a Peirce Island CSO treatment facility as a viable LTCP plus project.

The City will not commit to implementing any LTCP plus project work until the current separation projects shown in Table 1.4, the Post Construction Monitoring Program, and the implementation of the revised Compliance Strategy have been completed.

Table 1.4 Requested Revisions to LTCP Projects Completion Dates

Planning area I.D.	Contract I.D.	Project Status	Consent Decree Project Completion Dates	Requested Project Completion Date
Lincoln 3A	Phase I	In Construction	10/1/2011	6/1/2012
Lincoln 3B	Phase II	In Design	10/1/2012	6/1/2013
Lincoln 3C	Phase III	In Design	10/1/2013	6/1/2014
Court/State	Court #3	Near Completion	1/1/2012	1/1/2012
Islington	Islington #1	Near Completion	10/1/2010	11/19/2010
Islington	Islington #2	In Design	1/1/2012	11/1/2013

1.4 Conclusions

The Compliance Strategy has been adopted by the City to address the concerns of EPA/NHDES with the phased implementation schedule put forth in the draft WMP/LTCP Update on June 4, 2010. The phased implementation schedule included in the draft submission was recommended to address the requirements of the City’s current Consent Decree while also taking into consideration the long term needs of the City’s wastewater treatment system with respect to projections of flows and loads, ongoing sewer separation efforts, CSO mitigation and potential future nutrient limits. At the meetings held with the EPA and NHDES subsequent to the draft submission, EPA representatives indicated that their primary goal was to see the City achieve the Consent Decree required secondary treatment for Peirce Island WWTF sanitary flows within the next 5-7 years.

The revised Compliance Strategy will become the first phase of the WMP implementation and is intended to satisfy the requirements of the current Consent Decree such that all subsequent phases outlined in the June 4, 2010 draft will be implemented only when deemed necessary and affordable by the City. The revised Compliance Strategy was therefore developed to come into compliance with the Consent Decree, specifically as it relates to meeting requirements of the current Peirce Island NPDES Permit #NH0100234. The preferred alternative put forth in the June 4, 2010 draft of the WMP/LTCP remains the recommendation for a long-term solution for wastewater and stormwater collection, treatment and disposal in the City of Portsmouth.

The Compliance Strategy is considered adequate by the City to meet the wastewater treatment requirements of the Consent Decree. Therefore the Compliance Strategy schedule included in this Final Supplement shall replace that included with the draft WMP/LTCP Update as the compliance schedule required by the WMP work plan that was included in the Consent Decree.

The capital investment represented by the revised Compliance Strategy is such that the secondary treatment plant is intended to be in use for at least the next 20 years. The City will not commit to implementing any additional wastewater treatment related capital investments until the current sewer separation projects, the Post Construction Monitoring Program, and the implementation of the revised Compliance Strategy have been completed.