City of Portsmouth

Department of Public Works

MEMORANDUM

TO: Terry Desmarais, PE, City Engineer

FROM: Patrick Wiley, PhD, Wastewater Operations Manager

DATE: January 13, 2020

SUBJECT: Summary of Conceptual Anaerobic Digester Facility Feasibility Study
Pease Wastewater Treatment Facility

The City of Portsmouth contracted with Brown and Caldwell Engineers (BCE) to evaluate the technical and financial feasibility of constructing an anaerobic digester facility adjacent to the Pease Wastewater Treatment Facility (WWTF). Anaerobic digestion is a processing technology that employs microbes to degrade biosolids and produce an energy rich biogas. This process is advantageous because the biogas can be combusted onsite to produce usable electricity and heat that offsets utility purchase costs. Additionally, anaerobic digestion reduces solids mass, creating less material to be managed, and stabilizes the solids reducing the odor generation potential.

The scope of the BCE effort used the following information summarized in a series of technical memoranda as the basis for their final recommendation:

1. **Flows and Loads Evaluation –** This component of the study assessed the volume of biosolids produced by the City of Portsmouth and 12 neighboring communities that would serve as the anaerobic digester feedstock. This is needed to size the conceptual facility and estimate biogas production.
2. **Conceptual Digestion Facilities Sizing and Configuration –** The configuration presented was sized to serve as a regional facility and uses a thermal hydrolysis pretreatment process to liquefy the biosolids prior to entering the anaerobic digesters. Other components of the system include a feedstock receiving station, sludge blending tank, biogas utilization facility, sludge storage tanks and a dewatering facility. BCE was able to locate all these facilities on the land adjacent to the Pease WWTF (Figure 1). It should be noted that the area proposed for the anaerobic digestion facilities is an existing wetland and would require potentially significant mitigation as a result of this work.

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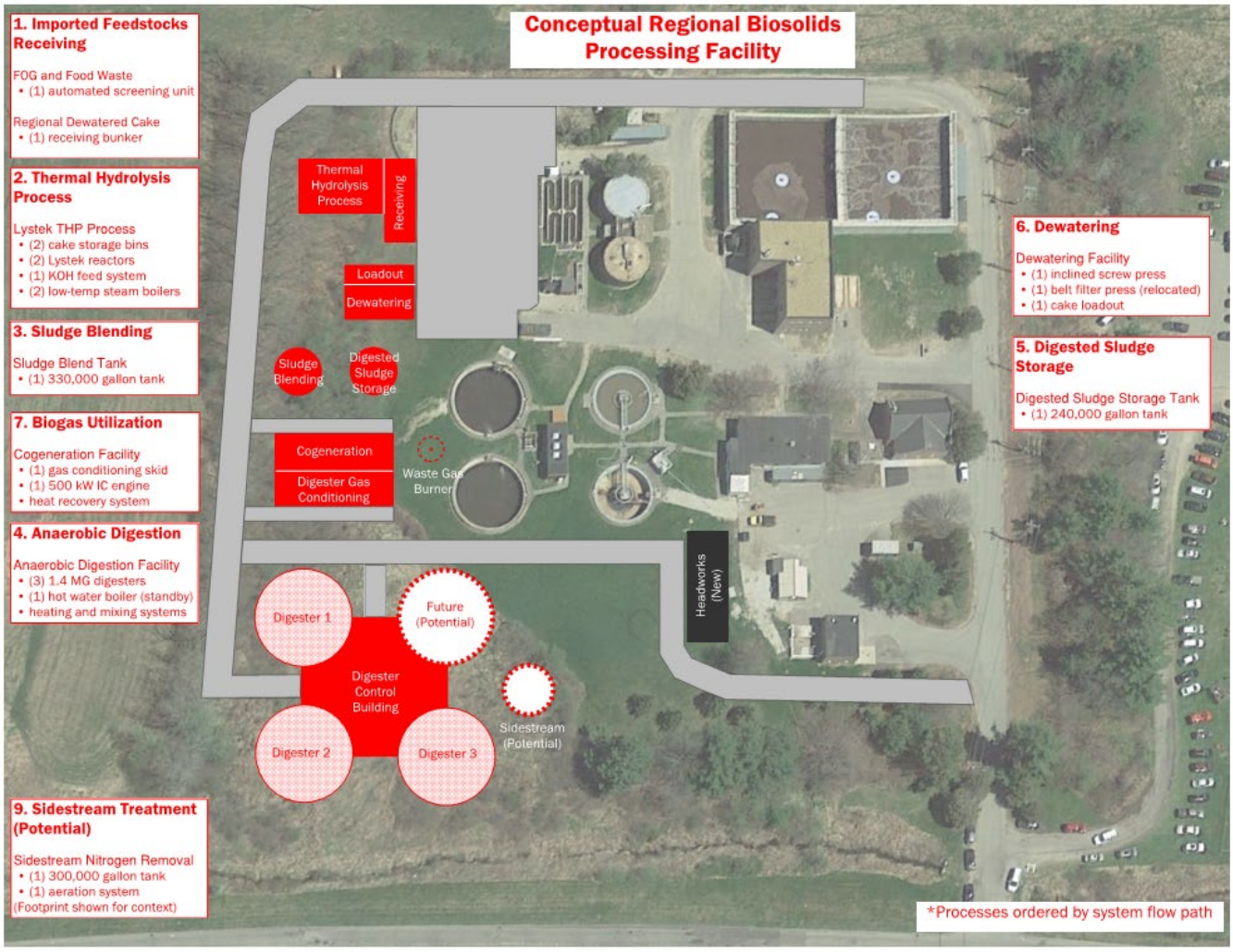

Figure 1. The conceptual layout of the facilities needed to construct a regional biosolids processing facility adjacent to the Pease WWTF.

3. **Energy Systems Evaluation –** A benefit of the anaerobic digester facility is that it will generate renewable biogas used to produce usable electricity and heat. This analysis estimated heat and power production and compared equipment needed to condition, clean, and combust the biogas. Operational and permitting costs were compared to energy credits and revenues.

4. **Financial Model Evaluation –** The financial model compared the life-cycle cost of two alternatives: (A1) a facility size to only serve the Pease and Peirce Island Facilities, and (A2) a facility sized to serve the region. This comparison was performed to determine if facility size strongly influenced investment payback. Based on current conditions and financial parameters, addition of digesters at Pease WWTF is not financially advantageous. The project lifecycle costs represent an additional $34M and $61M in lifecycle cost for alternatives 1 and 2, respectively. Addition of digesters does reduce the

annual operational and maintenance costs, however the significant capital cost results in a simple payback of 80 years for Alternative 1 and 60 years for Alternative 2.

5. **Procurement and Planning –** The final technical memo discussed the advantages and disadvantage of several procurement structures if the City of Portsmouth were to consider constructing the facility.

The results from this feasibility study conclude that the capital and operation costs of an anaerobic digester at the Pease WWTF are prohibitively high and do not have an acceptable payback period. Copies of the Technical Memoranda prepared by BCE are located on the City's wastewater web page under Resources for further reference.

During the course of these studies, there were a number of alternative sludge processing technologies that could reduce overall volume of material for disposal. It is my recommendation that these technologies be considered in future upgrades of the treatment plant.