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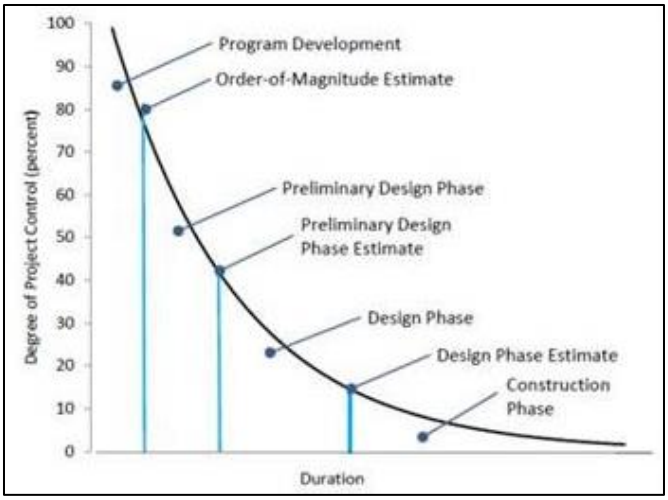
Memorandum

To	George Meservey, Director of Planning & Community Development Michael Domenica, PE, Program Manager
CC	Betsy Shreve, AICP, AECOM Project Director Reggie Donahue, P.E.
Subject	**Town of Orleans, MA** **Water Quality and Wastewater Planning** **Task Number 8 – Financial Modeling Analysis** **Deliverable 8.3.2.A – Final Technical Memorandum on Collection System Technologies (GS, LPS, STEG, STEP, and VS) Capital and O&M Cost Update**
Project Number	60476644
From	Thomas Parece, P.E., AECOM Project Manager
Date	10/14/16

1. Background

The purpose of this Collection System Technology and Evaluation Technical Memorandum is to update the project costs for each of the technologies in order to help develop a cost-effective alternative for the proposed Downtown Area and Meetinghouse Pond Area wastewater collection areas of Orleans. The Collection System Technologies include: (a) Gravity Sewers (GS); (b) Low Pressure Sewers (LPS); (c) Septic Tank Effluent Gravity (STEG); (d) Septic Tank Effluent Pumping (STEP); and (e) Vacuum Sewers (VS) since the 05/21/16 Technical Memorandum.



2. Development of Program Costs

Cost estimating is a critical component of a project evaluation in the early stages of planning and concept design, before selection of a definitive plan and commitment of any funds. As part of the development of this document, order-of-magnitude Program Cost estimates were developed for the collection system technologies:

- Gravity Sewers;
- Low Pressure Sewers;
- Septic Tank Effluent Gravity;
- Septic Tank Effluent Pumping; and
- Vacuum Sewers.

The Program Costs were developed with our in-house specialists who prepare cost estimates for construction and operation using industry standards for materials and labor as well as actual bid tabs from a library of projects. Supplemented with information obtained from the Project's interactive workshops and a collaborative process to fully understand the cost implications of the various alternatives, these comprehensive costs allow for informed decision making.

The Program Costs include Capital Costs, Annual Operation and Maintenance Costs, Replacement Costs and Monitoring Costs. These costs obviously vary with the specific design considerations and layout configuration ultimately selected for each collection system technology. Nonetheless, it is possible to put together an estimate that can be used for Life-Cycle Cost Analysis to determine of the most cost effective technology or combination of technologies.

The Program Costs presented are planning level costs and should be refined as additional informational details are identified and/or determined. This refinement to the project scope includes topographic survey, subsurface exploration, types of equipment, redundancy, and types of control systems. In addition, project constraints, project schedule, and overall project complexity will impact Program Costs. It is recommended that planning level Program Costs be updated just prior to appropriation of funding for design and construction.

The Program Costs are preliminary in nature and contain construction cost, construction contingencies, administrative, legal, construction engineering, environmental and regulatory permitting related costs. The Class 3 opinion of probable construction costs were developed in accordance with "AACE International Recommended Practice No. 18R-97 - Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries" as prepared by the Association for the Advancement of Cost Estimating (AACE) International (www.aacei.org) dated February 2, 2005. Refer to Table 1 for the AACE International Cost Estimating classification system.

AECOM has no control over costs of labor, materials, competitive bidding environments and procedures, unidentified field conditions, financial and/or market conditions or other factors likely to affect the opinion of probable project costs all of which are and will unavoidably remain in a state of change. It is further understood that the probable project costs are a "snapshot in time" and that the reliability of this opinion of probable project costs will inherently degrade over time. The probable project costs need to be indexed on a common "baseline". The construction industry uses the Engineering News Record (ENR) Construction Cost Index (www.enr.com) that is based on construction and materials costs throughout the United States. Therefore, the probable project costs contained herein are based on an ENR Construction Cost Index of 10404 for September 2016.

A. Capital Costs

Capital Costs are those to construct any type of wastewater treatment system including non-traditional and traditional technologies. Capital Costs are generally financed through a loan or bond program. This provides up front funding for construction, with principal and interest payments spread out over time. Estimates have been developed to show Capital Costs by each type of system component. Defining costs by individual system component is essential given the eligibility requirements of different financing programs and revenue sources. Included in the Capital Costs were land purchases, at $250,000 per acre, required for locations of pumping stations that are not proposed on existing municipally owned land.

Table 1 - AACE International Cost Estimating Classification System

Estimate Class	Primary Classification	Secondary Classification			
	Level of Project Definition[1]	End Usage[2]	Methodology[3]	Expected Accuracy Range[4]	Preparation Effort[5]
5	0 to 2 percent	Concept Screening	Capacity Factored, Parametric Models, Judgment or Analogy	L: -20 to -50 percent H: +30 to +100 percent	1
4	1 to 15 percent	Study or Feasibility	Equipment Factored or Parametric Models	L: -15 to -30 percent H: +20 to +50 percent	2 to 4
3	10 to 40 percent	Budget Authorization or Control	Semi-Detailed Unit Costs with Assembly Level Line Items	L: -10 to -20 percent H: +10 to +30 percent	3 to 10
2	30 to 70 percent	Control or Bid Tender	Detailed Unit Cost with Forced Detailed Take-off	L: -5 to -15 percent H: +50 to +20 percent	4 to 20
1	50 to 100 percent	Check Estimate or Bid Tender	Detailed Unit Cost with Detailed Take-off	L: -3 to -10 percent H: +3 to +5 percent	5 to 100

Notes:

1 Expressed as percent of Complete Definition

2 Typical Purpose of Estimate

3 Typical Estimating Method

4 Variation of Low and High Ranges. The state of process technology and availability of applicable reference costs data affect the range market. The +/- value represents percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50 percent level of confidence) for given scope.

5 Typical Degree of Effort Relative to Least Cost Index of 1. If the range index value of "1" represents 0.005 percent of project costs, then an index value of "100" represents 0.5 percent. Estimate preparation effort is highly dependent upon the size of the project and the quality of estimating data and tools.

B. Operation and Maintenance Costs

Operations and Maintenance (O&M) Costs relate to the day-to-day running and upkeep of the non-traditional and traditional technologies. O&M Costs include items such as labor, utilities, chemicals, etc. In order to achieve maximum asset life and reduce O&M costs, the establishment of standardized O&M procedures is critical. Standardized procedures helps personnel operate all assets within acceptable operational levels and ensures that each person is following the same routines. Lack of regular maintenance may result in the deterioration of the system components and result in rapid failure and reduced nitrogen removal from the environment as well as the ability to meet operating permits. O&M Costs are an annual cost generally paid through fee or tax revenues as costs accrue. O&M Costs will vary greatly by technology solution and have been estimated on a technology-by-technology basis.

C. Replacement Costs

In addition to O&M Costs, system components will malfunction or fail and therefore Replacement Costs, including Repair Costs, become a necessary part of the overall costs of the wastewater collection system. Replacement Costs are used to replace components and/or equipment that have failed or malfunctioned such as; failed ejector pumps from LPS or STEP sewer systems, or pump bearings, mixers or control valves installed at conveyance pumping stations. As part of an Asset Management Program, a schedule of assets with their useful life should be developed since understanding the costs for partial replacement and full replacement of an asset will become necessary for sound financial planning. If more funding is spent on a repair to an asset, there will be a decreased need for the replacement of the asset. However, if greater funding is spent to replace the asset, there will be a decreased need for repairs to an asset. Overall there is a balance between how much to fund in each category in order to achieve the most efficient system. Like Capital Costs, Replacement Costs are generally financed through a loan or bond program. This provides up front funding for construction, with principal and interest payments spread out over time. Estimates have been developed to show Replacement Costs by each type of system component. Defining costs by individual system component is essential given the eligibility requirements of different financing programs and revenue sources.

D. Monitoring Costs

Monitoring of the non-traditional and traditional technologies is an essential component of adaptive management. Monitoring will assess the effectiveness of implementing the different collection system technologies. The results of monitoring will indicate which technologies are preferred based on long-term performance and which are less successful. This allows adjustments in the phased approach to improve overall performance of the solution. Like O&M Costs, Monitoring Costs are an annual cost generally paid through fee or tax revenues as costs accrue. Monitoring Costs will vary greatly by technology solution and have been estimated on a technology-by-technology basis.

3. Development and Assumptions of Program Costs

A. Capital Costs

Capital Costs for wastewater collection systems for both public property and private property installation were estimated by compiling typical unit costs for gravity sewers, vacuum sewers, low pressure sewers, septic tank effluent pumping/gravity and septic tank effluent pumping and, as applicable, pumping stations and force mains. Table 2 presents a Menu of Collection System Construction Unit Costs. Table 3 presents a Menu of Other Collection System Unit Costs required as part of the Project Costs. The Unit Costs are based on a municipal design-bid-construct process and include the costs for paying minimum wage rates per Massachusetts Prevailing Wage Law for public works projects G.L. c. 149, §§ 26 - 27 ("The Prevailing Wage Law") which establishes minimum wage rates for workers on public construction projects. In addition, review of actual construction costs for other similar projects was reviewed, adjusted for local bidding costs, and utilized to develop these unit costs.

Table 2 - Menu of Collection System Construction Unit Costs

Description	Unit	Unit Cost
Custom Pump Station	Each	$585,000
Force Main	L.F.	$120
Gravity Sewer	L.F.	$125
Gravity Sewer - Private Property	Each	$7,800
Low Pressure Sewer	L.F.	$100
Low Pressure Sewer - Private Property	Each	$12,000
STEG - Private Property	Each	$7,800
STEG Sewer	L.F.	$125
STEP - Private Property	Each	$10,750
STEP Force Main	L.F.	$100
Submersible Pump Station	Each	$275,000
Vacuum Collection/Transmission Station	Each	$860,000
Vacuum Sewer	L.F.	$110
Vacuum Sewer - Private Property	Each	$10,250
Wet Pit /Dry Pit Pump Station	Each	$470,000

Table 3 - Menu of Other Collection System Costs

Description	Unit	Unit Cost
Overhead and Profit	Percent	22.00
Contingency	Percent	25.00
Project Services	Percent	35.00
Planning/Consultation	Percent	5.00
Design Engineering	Percent	10.00
Construction Engineering	Percent	15.00
Town Administrative	Percent	5.00

B. Operation and Maintenance Costs

- 1 full time employee for administration, operation and maintenance of each type of technology (Gravity Sewers; Low Pressure Sewers; Septic Tank Effluent Gravity; Septic Tank Effluent Pumping; and Vacuum Sewers) including Private Property Components such as pumps, valves, and vaults/tanks;
- A minimum of 260 hours per year for each type of Pump Station (Custom Pump Station; Submersible Pump Station; Vacuum Pump Station; and Wet Pit /Dry Pit Pump Station);
- Utilities, chemicals, etc. per each type of Pump Station (Custom Pump Station; Submersible Pump Station; Vacuum Pump Station; and Wet Pit /Dry Pit Pump Station) based on 25 horsepower pumps each running an average of 15 minutes per day at $0.15 per kWh; miscellaneous supplies (i.e. fuses, lamps, filters, grease, etc.); and chemicals for odor control.
- Clean and TV 25 percent of sewers per year for Gravity Sewer and STEG technologies;
- Clean 25 percent of pressure/vacuum pipes per year for Low Pressure Sewer, STEP and Vacuum Sewer technologies as well as force mains; and

- Pump-out Septic Tanks Every 3 Years for STEP and STEG technologies in order to avoid septic conditions and plugging of pumps.
- Power costs for private pumps for LPS, or STEP systems based on 0.5-1 HP and 250 hours per year (350 gal/home/45 gal) x (8 pump outs x 5 min = 0.67 hours/day) x 356 d = 250 hours/yr.).

C. Replacement Costs

- Equipment (i.e. pumps or pump parts - impellers and bearings) for each type of Pump Station (Custom Pump Station; Submersible Pump Station; Vacuum Pump Station; and Wet Pit /Dry Pit Pump Station) at 1 percent of original Capital Cost of the Pump Station per year; and
- Equipment (ie. pumps and valves) located on Private Property for Low Pressure Sewer, STEP and Vacuum Sewer technologies at 5 percent of total number connections per year.

D. Monitoring Costs

- Calibration of monitoring equipment at each type of Pump Station (Custom Pump Station; Submersible Pump Station; Vacuum Pump Station; and Wet Pit /Dry Pit Pump Station) at $2,500 per year; and
- Monitoring of Private Property Components (i.e. pumps, valves, and vaults/tanks) to verify system integrity estimated at 8 hours per connection per year.

The Updated Estimated Program Costs as shown on Table 4. In addition, Table 5 presents the estimated savings from reducing the number of wastewater treatment facilities from two to one.

4. Recommendations

A. Develop 25 percent planning documents for the Downtown Area and Meetinghouse Pond Area Collection Systems consisting of the following:

1) Conduct Topographical Survey (combination of aerial mapping and on the ground field survey);

2) Conduct a Subsurface Investigation that will consist of performing Drilling and Sampling used to identify soils types and depth to groundwater;

3) Perform a Cultural Resource Evaluation consisting of a review of local geography, ecology, soils, and Native American Groups to develop cultural contexts and predictive statements for archaeological resources that may be present;

4) Update the preliminary system layout (plan and profiles) for developed for the Downtown Area and Meetinghouse Pond Area based on the detailed topographic survey and subsurface investigations;

5) Update the proposed system phasing as wells as confirm/modify the recommended collection system configuration; and

6) Update the Preliminary cost estimates (Project Costs; Annual O&M Costs; Replacement Costs; and Annual Monitoring Costs) based on the updated preliminary system layouts.

B. Determine the preferred method of implementation – design-bid-construction; design-build, etc.

C. Utilize the updated information to engage in Public-Private-Partnerships negotiations.

D. Utilize the updated information to prepare funding applications in order to obtain grants and loans.

E. In addition, as part of the inputs to the Financial Model, the Program Costs need to be inflated to the year anticipated for implementation. The ENR's Cost Index History Tables can be used for estimating inflation on future cost projections that are then used for development of Capital Improvement Plans and Financing Plans.

Table 4 – Updated Estimated Program Costs

Components	Capital Cost	Annual O&M Cost	Annual Replacement Cost	Annual Monitoring Cost
Traditional Technologies				
Downtown Area				
Collection System - Downtown Area	$ 24,888,600	$ 261,400	$ 41,700	$ 11,900
Wastewater Treatment Facility - Downtown Area (Overland Way)	$ 17,079,600	$ 952,600	$ 256,300	$ 16,900
Effluent Disposal - Downtown Area (Overland Way - Parcel 1/1A)	$ 2,702,200	$ 11,300	$ -	$ 10,800
	$ 44,670,400	$ 1,225,300	$ 298,000	$ 39,600
Meetinghouse Pond Area				
Collection System - Meetinghouse Pond	$ 21,203,300	$ 166,800	$ 34,600	$ 3,000
Wastewater Treatment Facility - Meetinghouse Pond (223 Beach Road)	$ 8,003,100	$ 284,300	$ 112,700	$ 16,900
Effluent Disposal - Meetinghouse Pond (223 Beach Road)	$ 1,189,000	$ 11,300	$ -	$ 10,800
	$ 30,395,400	$ 462,400	$ 147,300	$ 30,700
Non-Traditional Technologies				
Nitrogen Removing Biofilter				
Nitrogen Removing Biofilter - Demonstration 1	$ 178,900	$ 700	$ -	$ 28,500
Nitrogen Removing Biofilter - Demonstration 2	$ -	$ -	$ -	$ -
Nitrogen Removing Biofilter - Site 1	$ 5,501,800	$ 25,500	$ -	$ 89,100
Nitrogen Removing Biofilter - Site 2	$ 6,712,200	$ 25,500	$ -	$ 89,100
Nitrogen Removing Biofilter - Site 3	$ -	$ -	$ -	$ -
Nitrogen Removing Biofilter - Site 4	$ -	$ -	$ -	$ -
Nitrogen Removing Biofilter - Site 5	$ -	$ -	$ -	$ -
Aquaculture/Shellfish Propagation				
Aquaculture/Shellfish Propagation - Demonstration 1 - Terminal Pond Oyster Bed	$ 126,900	$ 143,800	$ -	$ -
Aquaculture/Shellfish Propagation - Demonstration 2 - Quanset Pond Oyster Bed	$ 49,900	$ 216,400	$ -	$ 54,700
Aquaculture/Shellfish Propagation - Demonstration 3 - Shellfish Extension Program	$ 76,900	$ -	$ 512,500	$ 58,900
Aquaculture/Shellfish Propagation - Demonstration 4 - Quahog Inventory	$ 50,800	$ -	$ -	$ -
Aquaculture/Shellfish Propagation - Site 1 - Shellfish Extension Program	$ 432,300	$ 283,300	$ 409,900	$ 58,900
Aquaculture/Shellfish Propagation - Demonstration 2 - Quanset Pond Oyster Bed (2nd Year)	$ 756,700	$ -	$ -	$ 59,500
Aquaculture/Shellfish Propagation - Full Scale Location TBD	$ 1,080,800	$ 56,700	$ 153,700	$ 59,500
Permeable Reactive Barriers				
Permeable Reactive Barriers - Demonstration 1 - Landfill Focused Injection Test	$ 164,100	$ -	$ 8,700	$ 116,200
Permeable Reactive Barriers - Demonstration 2 (Eldredge Park South Main St. Area)	$ 593,800	$ -	$ 17,100	$ 244,300
Permeable Reactive Barriers - Site 1 - Landfill (550 L.F.)	$ 526,000	$ -	$ 70,040	$ 117,500
Permeable Reactive Barriers - Site 2 Eldredge Park (3,500 L.F.)	$ 2,934,800	$ -	$ 71,896	$ 433,700
Permeable Reactive Barriers - Site 3	$ -	$ -	$ -	$ -
Permeable Reactive Barriers - Site 4	$ -	$ -	$ -	$ -
Permeable Reactive Barriers - Site 5	$ -	$ -	$ -	$ -
	$ 19,185,900	$ 751,900	$ 1,243,836	$ 1,409,900
Other Program Components				
Adaptive Management Implementation	$ -	$ 157,025	$ -	$ -
Program Management	$ -	$ 92,948	$ -	$ -
Miscellaneous	$ -	$ 5,313	$ -	$ -
	$ -	$ 255,285	$ -	$ -
Totals	**$ 94,251,700**	**$ 2,694,885**	**$ 1,689,136**	**$ 1,480,200**

On-Site Ownership Cost (Per year per On-Site System)	On-Site System Type: Conventional	On-Site System Type: I/A	Wastewater Flow (gpd): Range	Wastewater Flow (gpd): Average
Low Wastewater User	$ 1,100	$ 2,120	0 to 300	150
Medium Wastewater User	$ 1,640	$ 3,020	300 to 1,000	650
High Wastewater User	$ 3,220	$ 5,160	>1,000	1,000

Engineering News Record (ENR) = 10404 (Sep. 2016)

Table 5 – Estimated Savings from Reducing from Two Wastewater Treatment Facilities to One Wastewater Treatment Facility

Components	Separate Facilities		Combined Facilities		Difference	Remarks/Notes
	Downtown Area	Meetinghouse Pond Area	Downtown Area	Meetinghouse Pond Area		
Collection System						
Estimated Capital Costs	$ 24,888,600	$ 21,203,300	$ 24,888,600	$ 19,582,200	$ (1,621,100)	Receives wastewater flow from Meetinghouse Pond Area
Estimated Annual Operation and Maintenance Costs	$ 261,400	$ 166,800	$ 261,400	$ 166,800	$ -	
Estimated Annual Replacement Costs	$ 41,700	$ 34,600	$ 41,700	$ 34,600	$ -	
Estimated Annual Monitoring Costs	$ 11,900	$ 3,000	$ 11,900	$ 3,000	$ -	
Wastewater Treatment Facility						
Estimated Capital Costs	$ 17,079,600	$ 8,003,100	$ 21,839,800	$ -	$ (3,242,900)	Assumes on ly one WWTF
Estimated Annual Operation and Maintenance Costs	$ 952,600	$ 284,300	$ 1,079,900	$ -	$ (157,000)	Assumes WWTF located at Overland Way
Estimated Annual Replacement Costs	$ 256,300	$ 112,700	$ 334,500	$ -	$ (34,500)	
Estimated Annual Monitoring Costs	$ 16,900	$ 16,900	$ 16,900	$ -	$ (16,900)	
Effluent Disposal						
Estimated Capital Costs	$ 2,702,200	$ 1,189,000	$ 3,891,000	$ -	$ (200)	Assumes only one Effluent Disposal Site
Estimated Annual Operation and Maintenance Costs	$ 11,300	$ 11,300	$ 11,300	$ -	$ (11,300)	Assumes located at Site 1/1A
Estimated Annual Replacement Costs	$ -	$ -	$ -	$ -	$ -	
Estimated Annual Monitoring Costs	$ 10,800	$ 10,800	$ 10,800	$ -	$ (10,800)	
Totals						
Estimated Capital Costs	$ 44,670,400	$ 30,395,400	$ 50,619,400	$ 19,582,200	$ (4,864,200)	
Estimated Annual Operation and Maintenance Costs	$ 1,225,300	$ 462,400	$ 1,352,600	$ 166,800	$ (168,300)	
Estimated Annual Replacement Costs	$ 298,000	$ 147,300	$ 376,200	$ 34,600	$ (34,500)	
Estimated Annual Monitoring Costs	$ 39,600	$ 30,700	$ 39,600	$ 3,000	$ (27,700)	
Engineering News Record (ENR) = 10404 (Sep. 2016)				Estimated Present Worth	$ (8,293,200)	
Present Worth Factors:	Rate:	3.0%	No. of Periods:	20		

5. Project Schedule

A preliminary program phasing schedule has been developed. See Appendix. Note that the project schedule is subject to change based on available information and as the project evolves through the Adaptive Management process.

6. Next Steps

The next steps after Town Meeting has voted to appropriate funds to move forward with the Comprehensive Wastewater Management Plans are to prepare a Preliminary Design Report (25%) for the Downtown Area that includes the following items: (a) Topographic Survey; (b) Subsurface investigation; (c) Cultural Resource Evaluation; (d) Update Collection System Type Evaluation and Preliminary System Configuration; (e) Update WWTF Process Selection; (f) Prepare Design Data; and (g) Program Cost Estimate Update.

A. Topographic Survey

- **Description**: Conduct research, data accumulation using a combination of on the ground survey and aerial mapping, office computations, CAD drafting services, professional oversight and coordination, and preparation of data accumulation plans showing the roadways in the Downtown Area and the adjacent areas pertinent to the design and permitting of the proposed wastewater collection system.
- **Subtasks**
  - Conduct topographic survey of approximately 40,000 linear feet of roadway.
  - Conduct a Real Time Kinetic (RTK) GPS survey to locate and establish elevations of the 20 photo identifiable points needed to provide control for the aerial topographic survey.
  - Establish survey baselines to commence the conventional on the ground survey.
  - Conduct research of Town Assessor's records, Barnstable Registry of Deeds records, and Town GIS data necessary for compilation of the roadways.
  - Conduct the aerial mapping of the subject area.

- Conduct on the ground data accumulation survey to supplement the aerial mapping data and set project bench marks.
- Office computations and CAD drafting services for plotting of field data and merging the aerial mapping data with the field survey and prepare electronic files and data accumulation plans.

B. Subsurface investigation

- **Description:** Conduct a Subsurface Investigation that will consist of performing Drilling and Sampling of subsurface materials along approximately 40,000 linear feet of roadway in the Downtown Area.
- **Subtasks**
  - Review of preliminary plans and determination of boring locations.
  - Premark drilling sites and contact Dig Safe for utility marking prior to drilling.
  - Prepare permits required for conducting subsurface investigations (Town and MassDOT).
  - Phase (1) Drilling and Sampling – Hollow Stem Auger.
  - Phase (2) Drilling Without Sampling in Soil (Probes).

C. Cultural Resource Evaluation

- **Description:** Conduct a Cultural Resource Evaluation within the proposed Downtown Area. The Cultural Resource Evaluation shall be conducted in two phases: (1) Research; and (2) Field Survey. The Cultural Resource Evaluation shall be performed under the direction of a Principal Investigator meeting the qualifications set by the National Park Service (36 CFR Part 66, Appendix C) for direction of archaeological projects.
- **Subtasks**
  - Research will encompass a review of local geography, ecology, soils, and Native American Groups to develop cultural contexts and predictive statements for historic and archaeological resources that may be present within the project area.
  - Prepare a technical proposal for an archaeological survey for submission to the Massachusetts Historical Commission with a State Archaeologist's permit application.

D. Update Collection System Type Evaluation and Preliminary System Configuration

- **Description:** Update the evaluation of the Collection System type to be utilized to update the Preliminary System Configuration Update and Program Cost Estimate Update for the Downtown Area using information obtained including the Topographic Survey and Subsurface Investigations.
- **Subtasks**
  - The collection system evaluation update will include the following: (a) gravity sewer, (b) low pressure sewer, (c) septic tank effluent gravity; (d) septic tank effluent pump; (e) vacuum sewer; and (f) hybrid (combination of the other collection system types).
  - Update the Downtown Area collection system conceptual layout (plan and profiles) using information obtained including the collection system evaluation update, the topographic survey, and subsurface investigations.
  - Utilize existing documents prepared by AECOM to Update Collection System Type Evaluation and Preliminary System Configuration.

E. Update WWTF Process Selection

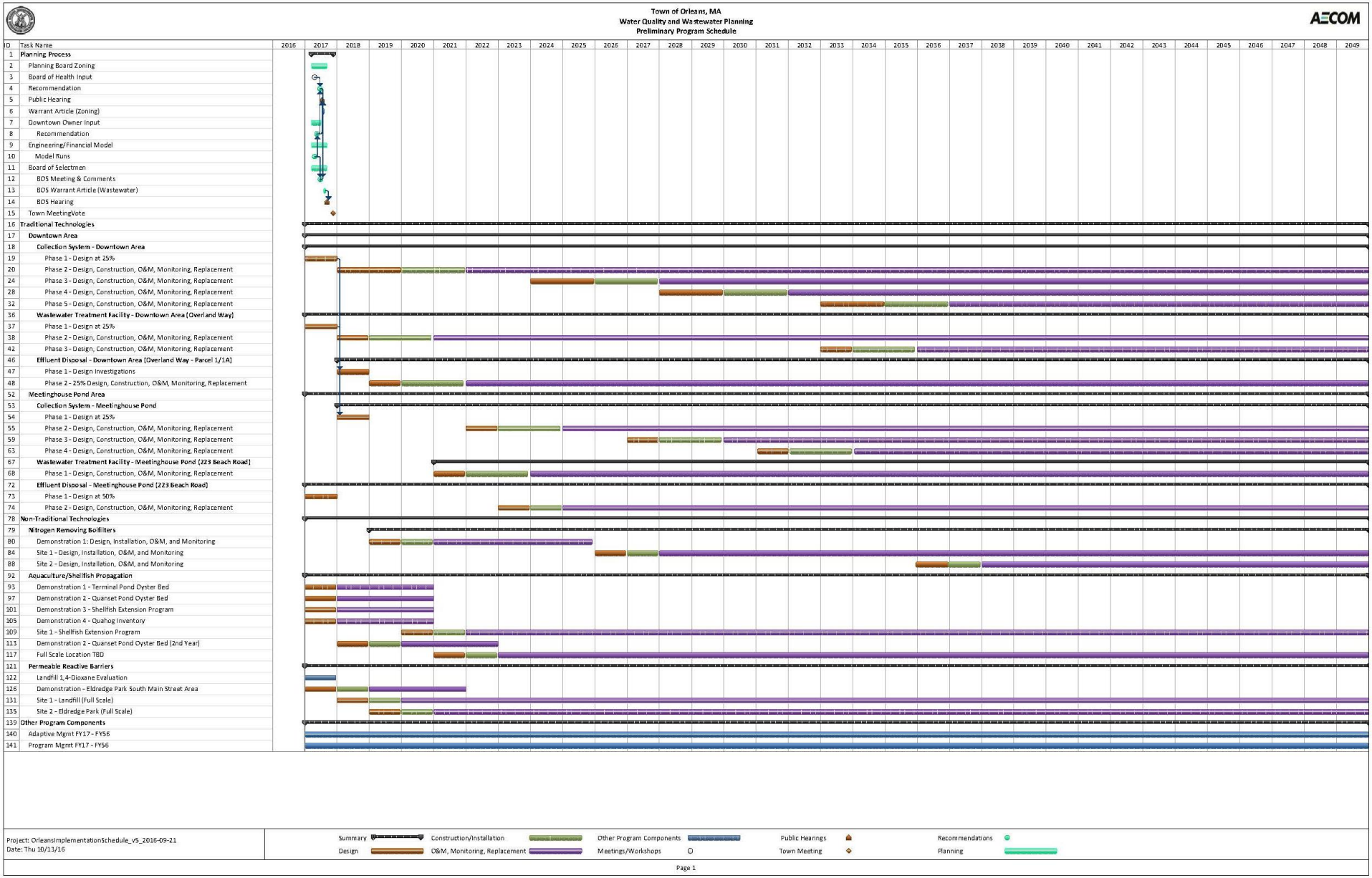
- **Description:** Update the WWTF Process Selection based on currently available information and sites, and information from the collection system evaluation.
- **Subtasks**
  - Based on the previously completed tasks, and updated design data, update the WWTF process selection using the requirements of TR-16: Guides for the Design of Wastewater Treatment `Works, prepared by the New England Interstate Water Pollution Control Commission and MassDEP requirements as a basis.
  - Update the Downtown Area conceptual layout (plan and profiles) using information obtained including the collection system evaluation update, the topographic survey, and subsurface investigations.

F. Prepare Design Data

- **Description:** Based on the previously completed tasks, prepare design data documents that will summarize the Collection System design components (sizes, materials of construction, etc.) using the requirements of TR-16: Guides for the Design of Wastewater Treatment Works, prepared by the New England Interstate Water Pollution Control Commission and MassDEP requirements as a basis.
- **Subtasks**
  - Review data from completed tasks.
  - Prepare a Design Data Report that will summarize the Collection System design components.

G. Program Cost Estimate Update

- **Description:** Update the existing Program Cost Estimate for the Downtown Area.
- **Subtasks**
  - Update the existing Program Cost Estimate for the Downtown Area that includes a 10 percent construction cost contingency, as well as Town administration costs (Town Administration, Legal, and Design, Bid and Construction Engineering Services).


Town of Orleans, MA
Water Quality and Wastewater Planning
Preliminary Program Schedule
AECOM
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141 Program Mgmt FY17 - FY56
2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049
Project: OrleansImplementationSchedule_v5_2016-09-21
Date: Thu 10/13/16
Summary
Design
Construction/Installation
O&M, Monitoring, Replacement
Other Program Components
Meetings/Workshops
Public Hearings
Town Meeting
Recommendations
Planning
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