# Board of Selectmen
## Water Quality and Wastewater Planning

## Wastewater Plan Workshop

August 9, 2017

## Agenda

- **Groundwater Recharge Site Selection Follow-up**
- **Collection System Preliminary Design Results**
- **Wastewater and Septage Treatment Preliminary Design**
  - Cape Cod Commission Development of Regional Impact (DRI) Conditions Related to the Reuse Former Tri-Town Site
  - Reserve Capacity to Treat Sewage/Septage from Town of Brewster and Town of Eastham
- **Design–Build–Operate Project Implementation Decision**

Town of Orleans Massachusetts

# Groundwater Recharge Site Selection Follow-up

## Groundwater Recharge Site Selection Follow-up

- **Massachusetts Environmental Policy Act (MEPA) Consultation Meeting**
- **Massachusetts Department of Transportation (MassDOT) Meeting on Route 6 Exit 12 Cloverleaf Property**
- **Coordination with Governor's Office and State Legislators Regarding Use of Route 6 Exit 12 Cloverleaf Property**

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# Collection System Preliminary Design Results

## Collection System Preliminary Design Results

- **Regulatory Documents**
- **Collection System Basis of Design**
- **Collection System Recommendation**
- **Collection System Evaluations**



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## Regulatory Documents

- **"TR16, Guides for the Design of Wastewater Treatment Works" by New England Interstate Water Pollution Control Commission**
- **"Wastewater Engineering: Treatment, Disposal, and Reuse" by AECOM (Metcalf & Eddy)**
- **"Water Reuse: issues, Technologies, and Applications" by AECOM (Metcalf & Eddy)**
- **"Biological Wastewater Treatment" by Grady, Daigger, & Lim**
- **"Wastewater Treatment Plant Design: Manual of Practice (MOP 8)" by Water Environment Federation**
- **"Process Design Manual: Land Treatment of Municipal Wastewater – Supplement on Rapid Infiltration and Overland Flow" by United States EPA (EPA 625/1-81-013a)**



## Regulatory Documents (cont.)

- **"Process Design Manual: Land Treatment of Municipal Wastewater" by United States EPA (EPA 625/1-81-013)**
- **"310 CMR 15.00: The State Environmental Code Regulating Septic Systems (Title 5)" by MassDEP**
- **"Northeast Guide for Estimating Staffing at Publicly and Privately Owned Wastewater Treatment Plants" by the New England Interstate Water Pollution Control Commission**
- **"Guidelines for the Design, Construction, Operation, and Maintenance of Small Wastewater Treatment Facilities with Land Disposal" by MassDEP**

Words such as "should" and "recommended" used in the Documents are interpreted by MassDEP as "required" during their Review and approval of Contract Documents

## Collection System Basis of Design
## General

- **Sizing of a Wastewater Collection System (Initial, Design and Future)**
  - Minimum and Maximum Daily Flows
  - Maximum Hourly Flows
  - Seasonal Flows
  - Required Peaking Factors
- **Flow Types Impact the Sizing of Collection Lines including Gravity Sewers, Pressure Sewers and Force Mains**
- **Some Other Considerations**
  - Expansion
  - Change in Use
  - Zoning Changes
  - Utilities
  - Environmental
  - Historical



## Collection System Basis of Design (cont.)
## Gravity Sewers

- **Design Criteria**
  - Velocity: 2 to 12 Feet per Second
  - I/I Allowance: 200 to 500 gpd/inch diameter/mile
  - Minimum Cover: 4 feet
  - Minimum Size: Building Sewer = 4-inch; and Municipal Sewer = 8-inch
  - Materials: PVC, Ductile Iron, Reinforced Concrete or Other Material Approved by MassDEP
  - Location to Water Supplies: 10 feet Horizontally and 18-inches Vertically (Unless cased piping is used for necessary crossings)
- **Components**
  - Manholes
  - Drop Manholes
  - Chimneys
  - Cleanout/Check Valve at Property Line

## Collection System Basis of Design (cont.)
## General

- **Impacts of Improperly Designed Collection System**
  - Odors
  - Sewer Overflows
  - Excessive Operating Costs
  - Short Equipment Life and Excess Energy Costs Due to Equipment Operating Outside of their Normal Operating Range
  - Lack of Flexibility for Future Conditions



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## Collection System Basis of Design (cont.)
## Pressure Sewers (LPS and STEP)

- **Design Criteria**
  - Minimum Velocity: 3 Feet per Second
  - Minimum Cover: 4 feet
  - Minimum Size: 1-1/4-inch
  - Materials: Class 200 PVC, Ductile Iron, HDPE
  - Location to Water Supplies: 10 feet Horizontally and 18-inches Vertically (Unless cased piping is used for necessary crossings)
- **Components**
  - Isolation Valves
  - Air Release Valves
  - Cleanouts
  - Check Valve at Property Line
  - Electrical – Pumps, Control Panels, Transfer Switches
  - Septic Tank (1,500 gallon) - STEP



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## Collection System Basis of Design (cont.)
## Force Mains

- **Design Criteria**
  - Minimum Velocity: 3 Feet per Second
  - Minimum Cover: 4 feet
  - Minimum Size: 3-inch
  - Materials: PVC, Ductile Iron, HDPE
  - Location to Water Supplies: 10 feet Horizontally and 18-inches Vertically (Unless cased piping is used for necessary crossings)
- **Components**
  - Isolation Valves
  - Air Release Valves
  - Cleanouts



## Collection System Recommendation

- **Recommendation**
  - Hybrid Collection System - Gravity Sewers and Low Pressure Sewers
- **Input**
  - OWQAP
  - Collection System Workgroup (12/20/16, 01/05/17 and 03/09/17)
  - Data/Information Collected/Received – Manufacturers, Individuals, etc.
  - Municipalities
- **Rationale**
  - Incorporated All Massachusetts Regulatory Documents Requirements
  - Considered Input from Various Groups and Individuals
  - Considered All Costs - Capital and O&M
  - More Familiarity of System Components by General Contractors, Contract Operators and Design-Built-Operate Teams = Reduced Costs
  - Provides Flexibility - Phased Implementation and Potential Future Expansion

## Collection System Evaluations
## Cape Cod Communities

| Municipality and Project | Engineering Firm | Collection System Technologies Evaluated | Recommendation / Conclusion |
|---|---|---|---|
| Barnstable, MA<br><br>CWMP 2011 | GHD<br>(fka Stearns & Wheler) | • Gravity Sewers<br>• Low Pressure Sewers<br>• STEP/STEG Systems<br>• Vacuum Sewers | • Gravity Sewers<br>• Low Pressure Sewers<br>• Vacuum Sewers |
| Chatham, MA<br><br>CWMP 2009 | Stearns & Wheler | • Gravity Sewers<br>• Low Pressure Sewers<br>• STEP/STEG Systems<br>• Vacuum Sewers | • Gravity Sewers<br>• Low Pressure Sewers |
| Provincetown, MA<br><br>DBO | AECOM | • Gravity Sewers<br>• Low Pressure Sewers<br>• STEP/STEG Systems<br>• Vacuum Sewers | • Gravity Sewers<br>• Low Pressure Sewers<br>• Vacuum Sewers |



## Collection System Evaluations (cont.)
## Cape Cod Communities

| Municipality and Project | Engineering Firm | Collection System Technologies Evaluated | Recommendation / Conclusion |
|---|---|---|---|
| Harwich, MA<br><br>CWMP 2016 | CDMSmith | • Gravity Sewers<br>• Low Pressure Sewers<br>• STEP/STEG Sewers<br>• Vacuum Sewers | • Gravity Sewers<br>• Low Pressure Sewers |
| Dennis, MA<br><br>CWMP | CDMSmith | • Gravity Sewers<br>• Low Pressure Sewers<br>• STEP/STEG Systems<br>• Vacuum Sewers | • Gravity Sewers<br>• Low Pressure Sewers |
| Falmouth, MA<br><br>Little Pond | GHD<br>(fka Stearns & Wheler) | • Hybrid Systems | • Low Pressure Sewers |
| Falmouth, MA<br><br>CWMP - 2013 | GHD<br>(fka Stearns & Wheler) | • Hybrid Systems | • Gravity Sewers<br>• Low Pressure Sewers |

## Collection System Evaluations (cont.)
## Orleans, MA

| Project | Engineering Firm | Collection System Technologies Evaluated | Recommendation / Conclusion |
|---|---|---|---|
| Mid-1980s | LEA | | • Gravity Sewers<br>• Low Pressure Sewers |
| CWMP<br>2010 | Wright-Pierce | • Gravity Sewers<br>• Low Pressure Sewers<br>• STEP/STEG Systems<br>• Vacuum Sewers | • Gravity Sewers<br>• Low Pressure Sewers |
| Technical Review and Cost Analysis of CWMP Options<br>2012 | Weston & Sampson | • Gravity Sewers<br>• Low Pressure Sewers<br>• STEP/STEG Systems | • Gravity Sewers and STEP/STEG Similar in Costs |
| Consensus Planning<br>2015 | Stantec | • Gravity Sewers<br>• Low Pressure Sewers<br>• STEP/STEG<br>• Vacuum Sewers | • Gravity Sewers<br>• Low Pressure Sewers |



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# Wastewater and Septage Treatment Preliminary Design

## Wastewater and Septage Treatment Preliminary Design

- **Cape Cod Commission Development of Regional Impact (DRI) Conditions Related to the Reuse Former Tri-Town Site**
- **Reserve Capacity to Treat Sewage/Septage from Town of Brewster and Town of Eastham**



## Wastewater Treatment Facility

- **Process Selection**
  - Identify the Design Basis for the Facility
  - Evaluate Various Unit Processes
  - Recommend Technologies for Selection – Sequencing Batch Reactors
  - Present Preliminary Design Information
- **Flows and Loading**
  - Constructed in Two Phases
    - First Phase: Downtown Area (Phase 1 and Phase 2) and Meetinghouse Pond Area (Phase 1)
    - Second Phase: Downtown Area (Phase 3 and Phase 4) and Meetinghouse Pond Area (Phase 2)
  - Projected “High-End” Septage Loading of 6 Million Gallons Annually, or 16,000 gpd

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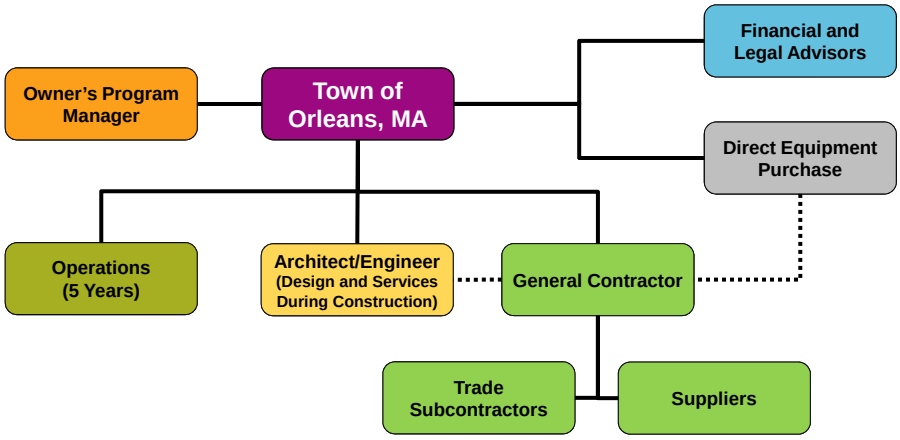
# Design–Build–Operate Project Implementation Decision

## Design–Build–Operate Project Implementation Decision

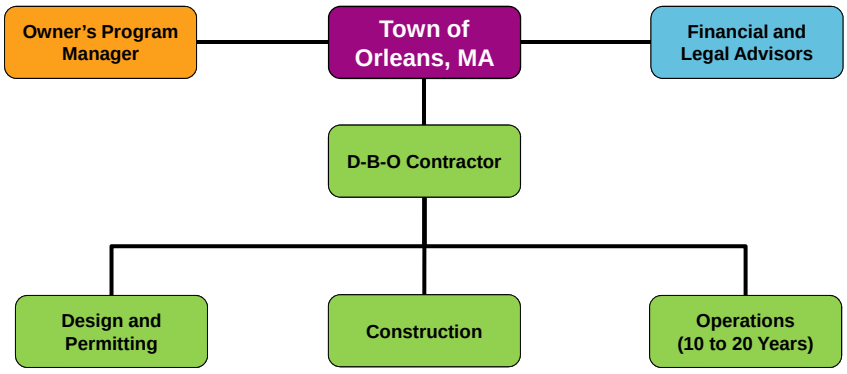
- **Summary Overview of Design-Bid-Build and Design-Build/Operate Procurement Methods**
- **Advantages and Disadvantages for Orleans Wastewater Collection, Treatment and Disposal Program**
- **Additional Issues and Risks**
- **Schedule and Decisions to Be Made**

## Summary Overview of Procurement Methods
## Traditional Delivery Method: Design-Bid-Build-Operate (DBB)






## Summary Overview of Procurement Methods
## Alternative Delivery Method: Design-Build-Operate (DBO)



## Examples of Massachusetts Design-Build-Operate Projects

| Entity | Type of Project | Capital Cost | DBO Team |
|---|---|---|---|
| Gardner, MA | Water and Wastewater | $10 M | AECOM/SUEZ |
| Holyoke, MA | CSO | $24 M | AECOM/SUEZ |
| Provincetown, MA | Wastewater | $40 M | AECOM |
| Taunton, MA | Wastewater | $10.3 M | Professional Services Group |



## Delivery Method Evaluation and Comparison Matrix for Orleans Wastewater Collection, Treatment and Disposal

**Key Evaluation and Comparison Categories**

- **Procurement Method (Including Phasing Implications)**
- **Capital Cost**
- **O&M Cost**
- **Schedule**
- **Other**

## Delivery Method Evaluation and Comparison Matrix for Orleans WW Collection, Treatment and Disposal (cont.)

| Comparison or Risk Area | Design-Bid-Build (Separate Contract Operations) | Design-Build-Operate |
|---|---|---|
| **Procurement Method** | | |
| Size of Bidder Pool | ★★ | ★ |
| Procurement Schedule | ★ | ★ |
| SRF Eligibility | ★★ | ★★ |
| Transaction Costs (Legal, Owner Engineer) | ★★ | ★★ |
| Ease of Multi-Phased Implementation | ★★ | ★★ |



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## Delivery Method Evaluation and Comparison Matrix for Orleans WW Collection, Treatment and Disposal (cont.)

| Comparison or Risk Area | Design-Bid-Build (Separate Contract Operations) | Design-Build-Operate |
|---|---|---|
| **Capital Cost** | | |
| Potential for Initial Capital Cost Savings | ★ | ★★ |
| Capital Cost Growth | ★ | ★★ |
| Early Capital Cost Certainty | ★★ | ★★ |
| Contractor Innovation Potential | ★ | ★★ |



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## Delivery Method Evaluation and Comparison Matrix for Orleans WW Collection, Treatment and Disposal (cont.)

| Comparison or Risk Area | Design-Bid-Build (Separate Contract Operations) | Design-Build-Operate |
|---|---|---|
| **Operation and Maintenance Costs** | | |
| Initial O&M Cost | ★★ | ★★ |
| Risk of O&M Cost Growth | ★★ | ★★ |
| **Schedule** | | |
| Design and Construction | ★ | ★★ |
| Risk of Schedule Growth | ★ | ★★ |



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## Delivery Method Evaluation and Comparison Matrix for Orleans WW Collection, Treatment and Disposal (cont.)

| Comparison or Risk Area | Design-Bid-Build (Separate Contract Operations) | Design-Build-Operate |
|---|---|---|
| **Other** | | |
| Points of Accountability | ★ | ★★ |
| Design Issues during Construction | ★ | ★★ |
| Risk of Design Issues During O&M | ★ | ★★ |
| Performance Guaranties | ★ | ★★ |



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## Schedule Components

### Design-Bid-Build

- RFQ - Owner's Project Manager
- RFQ - Engineering Services
- Design Phase
- Bid Phase
- Construction Phase
- SRF

### Design-Build-Operate

- RFQ - Owner's Project Manager
- RFQ – D-B-O
- Design-Build Phase
- SRF



## Additional Issues & Risks with D/B/O for Orleans

- **Legal Issues and Costs**
  - Outside legal services to develop and negotiate contract required
  - Overrun of legal costs not uncommon
- **Certainty of Cost & Schedule**
  - Only certain on costs of work in initial contract: Phase 1 of Downtown
  - No guaranteed cost on Meetinghouse Pond
  - No guaranteed cost on future phases of Downtown
  - Changes in requirements reopens contract terms & conditions:
    - Effluent requirements
    - Disposal site changes or addition
    - Changes in flows and influent strength
    - Changes required due to Non-Traditional performance
    - Changes required due to landfill nitrogen load
  - D/B/O schedule is probably longer than Design – Bid - Build
  - Risk of one proposal after extended procurement i.e. no competitive prices

## Additional Issues & Risks with D/B/O (cont.)

- **Experience of Orleans**
  - Town has understanding & success with traditional D-B-B process
  - Police Station, Tri-Town Plant Demolition, Town Hall, DPW Facility
- **Control of Process and Outcomes**
  - Town gives up control of program
  - Contract becomes binding document for 20-year term; Changes generally benefit contractor in sole-source situation



Town of Orleans Massachusetts

# Thank You