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To	Mr. Brian Dudley – MassDEP SERO
CC	George Meservey, Town of Orleans Director of Planning & Community Development; Michael Domenica, PE, Town of Orleans Program Manager; Betsy Shreve, AICP, AECOM Project Director; Mark Owen, AECOM
Subject	**Town of Orleans, MA** **Water Quality and Wastewater Planning** **Proposed Hydrogeologic Site Evaluation** **Overland Way - Proposed Groundwater Discharge** **Orleans, Massachusetts**
Project Number	60476044
From	Thomas Parece, P.E., AECOM Project Manager
Date	December 15, 2016

1. Project Description

A hydrogeologic site evaluation is being proposed as part of the evaluation of a wastewater treatment and disposal facilities for sanitary sewage generated in the Downtown Area of Orleans, MA. Proposed treatment would take place at a new facility to be built on the site of the former Tri-Town Septage Treatment Facility (Tri-Town Facility) located in Orleans, Massachusetts (Figure 1).

a. Overview

As part of the required Ground Water Discharge Permit (GWDP) (314 CMR 5.00), a hydrogeologic site evaluation is required to evaluate the feasibility of the proposed treated effluent discharge. The findings of this proposed hydrogeologic evaluation will be submitted to the Massachusetts Department of Environmental Protection (MassDEP) prior to and eventually as part of the GWDP for the facility.

The design flow of the proposed Wastewater Treatment Facility (WWTF) at the Overland Way site is to be determined, but is expected to treat and discharge up to 360,000 gallons per day. The WWTF will serve businesses, residents, and other facilities in the Downtown and potentially the Meetinghouse Pond areas of Orleans.

As the design flow has not been determined, the proposed hydrogeologic evaluation will estimate the groundwater discharge capacity for the site.

Figure 1
Locus Map
Water Quality and Wastewater Planning
Overland Way
WWTF and Groundwater Discharge

0 150 300 600 Feet

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b. History and Background

The Town of Orleans developed a Comprehensive Wastewater Management Plan (CWMP) in 2010 to protect surface and groundwater from the nutrient loads associated with on-site wastewater systems, increased development and seasonal flux population. In 2012 the recommendations in the CWMP did not receive the required votes at Town Meeting to be implemented. The plan was brought before the town in 2013, but again there were insufficient votes to implement.

In 2014, the Town convened the Orleans Water Quality Advisory Panel (WQAP) to guide studies and assessments, and define preferred approaches for a customized, affordable water quality management plan for the Town of Orleans. In March 2015 the WQAP agreed on an Amended Water Quality Management Plan and Adaptive Management Plan (Consensus Plan) for improving water quality in Orleans' natural water systems to meet nitrogen reduction targets and other key requirements of local, regional, State and Federal regulations.

The Consensus Plan includes implementing a combination of traditional and non-traditional technologies. Non-traditional technologies proposed include aquaculture, floating constructed wetlands and permeable reactive barriers (PRBs). The Consensus Plan includes the construction of demonstration projects of each of these non-traditional technologies. These demonstration projects would be designed and built in order to test hypotheses of nitrogen reduction through the use of these alternative technologies, which can then be used to estimate full implementation size and costs. As such, the Consensus Plan minimizes the number of properties within Orleans to be sewered by maximizing the use of non-traditional technologies. A copy of the Consensus Plan showing the location of the proposed sewer and demonstration areas is provided in Appendix A.

The traditional approach proposed within the Consensus Plan delineates two areas within Orleans for sewer implementation:

Downtown Area - The Downtown Area, encompassing approximately 391 parcels, is estimated to generate approximately 250,000 gpd of domestic wastewater. The proposed facility will treat approximately 234,000 gpd of domestic wastewater, including an allowance for infiltration/inflow, and a septage flow of approximately 16,000 gpd. The proposed collection area is shown on Figure 2.

Meetinghouse Pond Area - The Meetinghouse Pond watershed area, encompassing approximately 360 parcels, is estimated to generate approximately 110,000 gallons per day (gpd) including an allowance for infiltration/inflow. The proposed collection area is shown on Figure 3. If wastewater from the Meetinghouse Pond Area is not treated at Overland Way, the location of the proposed discharge site, 223 Beach Road, is shown on Figure 4.

c. Site Description – Overland Way

The Overland Way site is a 26-acre site on Overland Way in the Town of Orleans (Figure 1). The treatment facility was built in the 1980's to serve the towns of Orleans, Brewster and Eastham, and receives septage from these as well as other Cape Cod towns. The Tri-Town Septage Treatment Facility is owned and operated by the Orleans-Brewster-Eastham Groundwater Protection District (Tri-Town District).

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Figure 2
Downtown Sewer Area
Water Quality and Wastewater Planning
Overland Way
WWTF and Groundwater Discharge

0 600 1,200 2,400 Feet

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Figure 3
Meetinghouse Sewer Area
Water Quality and Wastewater Planning
Overland Way
WWTF and Groundwater Discharge

0 600 1,200 2,400 Feet

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Figure 4

223 Beach Road
Groundwater Discharge Site

Water Quality and Wastewater Planning
Overland Way
WWTF and Groundwater Discharge

0 100 200 400 Feet

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The agreement of the three towns co-owning and operating the facility expired in May 2015, and the National Pollutant Discharge Elimination System (NPDES) permit for the wastewater disposal at the current treatment site expires in December 2016. Due to the high rehabilitation cost to bring the septage treatment facility up to current effluent standards, the Tri-Town District is planning to demolish the treatment facility in late 2017. A new facility is proposed to be constructed at this same site to treat the wastewater flow from the Downtown Area and potentially the Meetinghouse Pond Area. The facility will treat approximately 360,000 gpd. The new treatment facility will include tertiary treatment processes and is expected to have effluent concentrations of 10 mg/L of nitrate (N), 30 mg/L total suspended solids (TSS), and 30 mg/L biological oxygen demand (BOD). The method of treatment is being evaluated although a membrane bioreactor (MBR) facility is considered likely.

d. Proposed Discharge Area

The site and locations of the proposed WWTF and discharge area is shown on Figure 5. The discharge area is located within the cleared area of the former Tri-Town facility. The disposal facilities on this site would consist of subsurface leaching trenches, open sand beds, or a series of wicks. The discharge method selected will be based on the results of the hydrogeologic evaluation, final location of the WWTF and estimated WWTF effluent flows.

2. Proposed Hydrogeologic Evaluation

a. Test Pit Investigation

It is anticipated that six test pits will be excavated in the proposed discharge area (Figure 5). Percolation tests will be conducted by a Certified Soil Evaluator at each location. The MassDEP and the Town of Orleans Health Department will be contacted to schedule their availability for witnessing the excavation of the proposed test pits.

b. Soils Testing and Data Analysis

There have been numerous soil borings and monitoring wells installed at the site. However, additional information is needed in the vicinity of the existing compost shed. Approximately four soil borings are proposed to be drilled using direct push drilling methods. The soil borings will be advanced to a depth of approximately 10 to 15 feet below the water table with split spoon samples collected every five feet. At one or two locations, the soil boring will be extended to depths of 20 to 40 feet below the ground surface to further evaluate the subsurface soils. If refusal occurs prior to reaching the desired depth, the borehole will be abandoned and a new location 5 to 10 feet from the proposed location will be drilled. The soil borings will be drilled in accordance with MassDEP's "Standard References for Monitoring Wells".

All of the soil borings will be converted to monitoring wells by installing 2-inch diameter PVC well casing with ten feet of 10-slot well screen at the base. The bottom of the well screen will be installed a maximum of 15 feet below the water table. The wells will serve to collect water level data, collect water samples, conduct pneumatic slug tests and potentially as up or downgradient monitoring wells.

Each monitoring well will be surveyed for location and elevation (NGVD). Water levels will be measured and recorded at each location to determine the groundwater elevation, flow direction and horizontal gradient across the discharge area.

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Legend

- Existing Monitoring Well
- Proposed Soil Boring/Monitoring Well
- Proposed Test Pit

0 125 250 500 Feet

Figure 5

Locus Map

Water Quality and Wastewater Planning

Overland Way
WWTF and Groundwater Discharge

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c. Slug Testing and Data Analysis

Slug tests consist of measuring the recovery of water levels in a monitoring well after a near-instantaneous change in head. AECOM proposes to perform pneumatic slug tests by using air pressure to depress the water table "slug" in the well. A submersible pressure transducer and data logger will be used to record the water level response over time. Pneumatic slug tests will be performed on each of the newly installed monitoring wells as well as several additional existing wells.

d. Baseline Water Quality Analysis

A round of groundwater samples will be collected from each of the proposed monitoring wells to provide baseline water quality data. Groundwater samples will be sent to a MassDEP approved laboratory and will be analyzed for pH, specific conductance, temperature, total nitrate, nitrate, nitrite, ammonia, phosphorus, orthophosphate, chloride, sodium and volatile organic compounds (VOCs).

e. Estimate of High Water Table

Once installed, a water level will be measured at the wells at the site as well as at USGS monitoring well OSW-22. The USGS well was installed in similar aquifer material, has over 40 years of historical water level data, and is located in the Town of Orleans approximately 1.5 miles east of the Overland Way site. The water table elevations measured at the site will then be adjusted to reflect the historic high water table conditions at the USGS well. Once the high water table elevations have been estimated, the values obtained from the groundwater mounding calculations will be added, resulting in groundwater mound elevations across the site during high water table conditions.

f. Estimated Groundwater Mounding

Groundwater modeling will be performed as a part of the hydrogeologic evaluation. The purpose of the groundwater modeling will be to evaluate the potential impacts of the groundwater discharge on ambient groundwater flow and water levels, to estimate the ultimate location of the effluent being discharged at Overland Way, assess potential impacts to sensitive receptors and evaluate the discharge capacity of the site

AECOM proposes to use the USGS Monomoy Lens (USGS, 2004) regional three-dimensional groundwater flow model of the. The USGS model will be modified and calibrated based on site and local hydrogeologic conditions evaluated by AECOM and others.

g. Final Report

A Hydrogeological Evaluation Report will be prepared which will summarize the results of the field investigations, data analysis, laboratory results, groundwater mounding analysis, numerical model documentation, and potential impacts to sensitive receptors. Included will be USGS topographic and surficial geology maps, pertinent USGS geologic and hydrogeologic data, estimated depth to bedrock, the location of existing and proposed water supply wells within a half-mile of the site, water supply protection areas, and pertinent subsurface investigations conducted at nearby sites. The report will also identify watershed recharge areas and boundaries, assess potential impacts of nitrogen and/or phosphorus to receiving water bodies, and perform a nutrient load analysis of the watershed(s). The groundwater model results will include the lateral extent of the groundwater discharge, separation between the base of the discharge and the mounded water table under high water table conditions, groundwater travel times, and potential impacts on watershed(s), infrastructure, and potential sensitive receptors. The final report will include a groundwater monitoring plan and will be submitted with permit application BRP WP 83

"Hydrogeologic Evaluation Report" at the conclusion of the evaluation in support of a Groundwater Discharge Permit.

APPENDIX A

Town of Orleans

Consensus Plan

Orleans Water Quality Advisory Panel
Consensus Agreement of the OWQAP
March 11, 2015*

The Orleans Water Quality Advisory Panel, or OWQAP, was convened to guide studies and assessments, define preferred approaches, seek consensus and build widespread community support for a customized, affordable water quality management plan for the Town of Orleans. The panel consists of **stakeholder representatives** (Orleans Selectmen and representatives of engaged citizen constituencies), and **liaisons** from key town boards and commissions, organizations, neighboring towns, and regional, state, and federal partners. It is staffed and assisted by Water Resources Associates, Stantec and its consultants, and the Consensus Building Institute (CBI).

The OWQAP has met for twelve half-day meetings since July 2014, all of which were open to public attendance and comment. After examining a broad range of options, the Panel has reached agreement on a set of principles and some key elements of an Amended Water Quality Management Plan (the Plan) and associated Adaptive Management Plan[1]. This Agreement includes and requires successful completion of the steps described here to resolve uncertainties and confirm key elements, such as treatment and disposal site suitability and availability, development of demonstration sites for non-traditional (NT) technologies, and further work to find an equitable distribution of costs necessary to the development of an acceptable and executable engineering plan that adheres to the key elements.

Agreed Goals and Objectives:

1) The Plan seeks to improve water quality in Orleans' natural water systems, meet nitrogen reduction targets and other key requirements of local, regional, State and Federal regulators, including finalized and preliminary TMDLs, while supporting updating of the analysis of current water quality conditions and MEP model runs. The Plan includes flexibility within an adaptive management framework to allow changes in the implementation plan to respond to any new findings from these updated analyses and resolution of other uncertainties.

2) In addition to needed nitrogen reduction, the Plan seeks to control phosphorous impacts on freshwater systems, address sanitary requirements, and respond to commercial and residential wastewater needs. The Plan also seeks to restore natural ecosystem services[2] using in-situ NT water quality solutions that offer rapid restoration, improve water and sediment quality, and restore habitat health.

3) The Plan also seeks affordability and fairness in its distribution of costs, by developing a detailed Financial Plan for allocations of costs, as well as a commitment to working together to identify and pursue all sources of grants and other financial support.

Agreed Plan Approach and Key Elements:

4) Given the potential benefits of NT technologies for removing nitrogen and phosphorous and providing valuable ecosystem services with more rapid results and at lower cost than traditional collection systems, the intent of the Plan is to maximize the use of Coastal Habitat Restoration[3] (CHR), Aquaculture[4], Floating Constructed Wetlands[5] (FCW), Permeable Reactive

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[1] This Plan will amend the approved CWMP approved by the Cape Cod Commission and MassDEP in 2011.

[2] Natural symbiotic processes conducted by one species and benefitting other(s).

[3] Creating habitats including shellfish reefs (such as the oyster reefs created in Wellfleet) that restore natural ecosystem services in the water body. The shellfish remove nitrogen from the water, and a bio-diverse ecosystem of many other species also contribute to nitrogen reduction. The reefs support young fish, crabs and other bottom dwelling animals, and sustain or restore the submerged aquatic vegetation (SAV) and benthic conditions necessary for natural habitat functions.

Barriers[6] (PRBs) and other approaches (e.g., inlet management) as strategies for meeting water quality goals. While there are risks and much to learn about these technologies, the *Conceptual Approach to Meet Orleans Water Quality Goals Map* estimates technologies and sizes within each watershed that could reasonably be implemented to help meet TMDLs and water quality needs. If fully successful, this could include realizing up to two-thirds of the Town's nitrogen reduction using NT technologies. A first phase of work to further evaluate the effectiveness, costs, risks, and opportunities for these NTs will be to select, design, and implement a series of demonstration projects. The findings from demonstration projects will be used to determine locations and areal extents of NT solutions, as well as their expected costs and contributions to nitrogen and phosphorous removal goals.

5) The Plan reduces the sewered footprint (area of town and number of properties to be sewered) to a minimum by maximizing the use of the non-traditional technologies referenced above. The Conceptual Approach delineates two footprints within Orleans for implementation of sewers. These areas include 1) ~280 parcels encompassing Downtown Orleans (~100,000 GPD), to be treated at a new treatment plant located at the Tri-Town site and disposed at one of several prospective sites nearby (potentially also using a reclaimed water system), and 2) ~360 parcels within the Meetinghouse Pond sub-watershed (~50,000 GPD), to be treated at a satellite treatment facility and disposal area to be identified. These areas were designated for wastewater collection and treatment because their nitrogen reduction requirements and wastewater needs could not be met using only NT technologies. The Downtown area includes numerous properties with aging and/or non-compliant systems and inadequate nitrogen reduction, which cannot be cost effectively retrofitted to meet current wastewater needs. Certain newer facilities may be "grandfathered" for some limited period of time. Options utilizing small cluster plants downtown were found not to have an economic advantage and the additional complexity involved in ownership, operation and maintenance of several small plants was a significant disincentive. Satellite or cluster treatment plants are valid wastewater treatment options in the appropriate circumstances and will be evaluated for other locations within Orleans.

6) In Meetinghouse Pond watershed, 100% nitrogen removal is required. Technology performance limitations and land use constraints in Meetinghouse Pond prevent deployment of sufficient NT solutions to meet those needs. The Plan includes siting a satellite treatment plant for the Meetinghouse Pond watershed.

7) The new treatment facility will be designed to treat septage from the towns currently served by the existing Tri-Town Septage Treatment Plant, as well as the wastewater from the downtown Orleans area only. Septage storage and treatment capacities will be evaluated for appropriate sizing, to avoid competition based on tipping fee / price. This will allow the town to continue to meet the septage treatment needs of the businesses and residents of Orleans and the Lower/Outer Cape, while generating net positive revenue that will lower customer rates in Orleans. Revenues from septage treatment will be allocated to those parties who contribute to the capital cost and Orleans will seek compensation for providing nitrogen treatment and disposal for flows from out-of-town customers.

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[4] Shellfish farming: the shellfish are filter feeders that remove nitrogen form the water system. The shellfish are harvested for market.

[5] Floating structures filled with plants that use nitrogen and other nutrients from the water to grow.

[6] PRBs intercept groundwater before it reaches the coastal water system and provide the necessary conditions for the conversion of nitrogen compounds to harmless nitrogen gas. The process is called denitrification.

8) The Plan includes an Adaptive Management Plan (AMP), which will provide a detailed approach to monitoring the success and efficacy of each component of the Plan and a framework and methodology for evaluating and adjusting solutions over time, with back-up technologies (including possibly additional sewering) to ensure compliance with regulatory requirements for water quality. The AMP will also provide for continued coordination with regulatory agencies to confirm compliance of the Plan with monitoring standards and water quality requirements, and continued monitoring of the financial and economic impacts of the plan on residents and businesses of Orleans. The AMP will also provide a framework for selecting, implementing and evaluating NT demonstration projects to refine initial assumptions about effectiveness, cost, and other implementation considerations. The *Conceptual Approach to Meet Orleans Water Quality Goals* will be updated and refined based on information developed through demonstration projects and other studies and analyses.

9) The Plan and AMP will seek to capitalize upon opportunities for potential management synergies and cost savings through cooperation with Orleans' neighboring towns of Eastham and Brewster.

OWQAP Commitment:

10) By agreeing to these principles and key features of an Amended Water Quality Management Plan, OWQAP Stakeholder Representatives endorse the goals, objectives, approach, and key elements as described above, and commit to support Warrant Articles, By-laws, and other Town measures to pursue and implement the Plan and its underlying principles. Representatives also agree to inform and engage their full stakeholder groups and related constituencies about these components and principles.

11) OWQAP Stakeholders also agree to work to refine and implement Adaptive Management in a manner consistent with these principles and with the Plan, and to work collaboratively to address challenges encountered in the process of resolving uncertainties in the Plan and to work collaboratively to finalize an executable engineering plan that is consistent with the principles of the Plan.

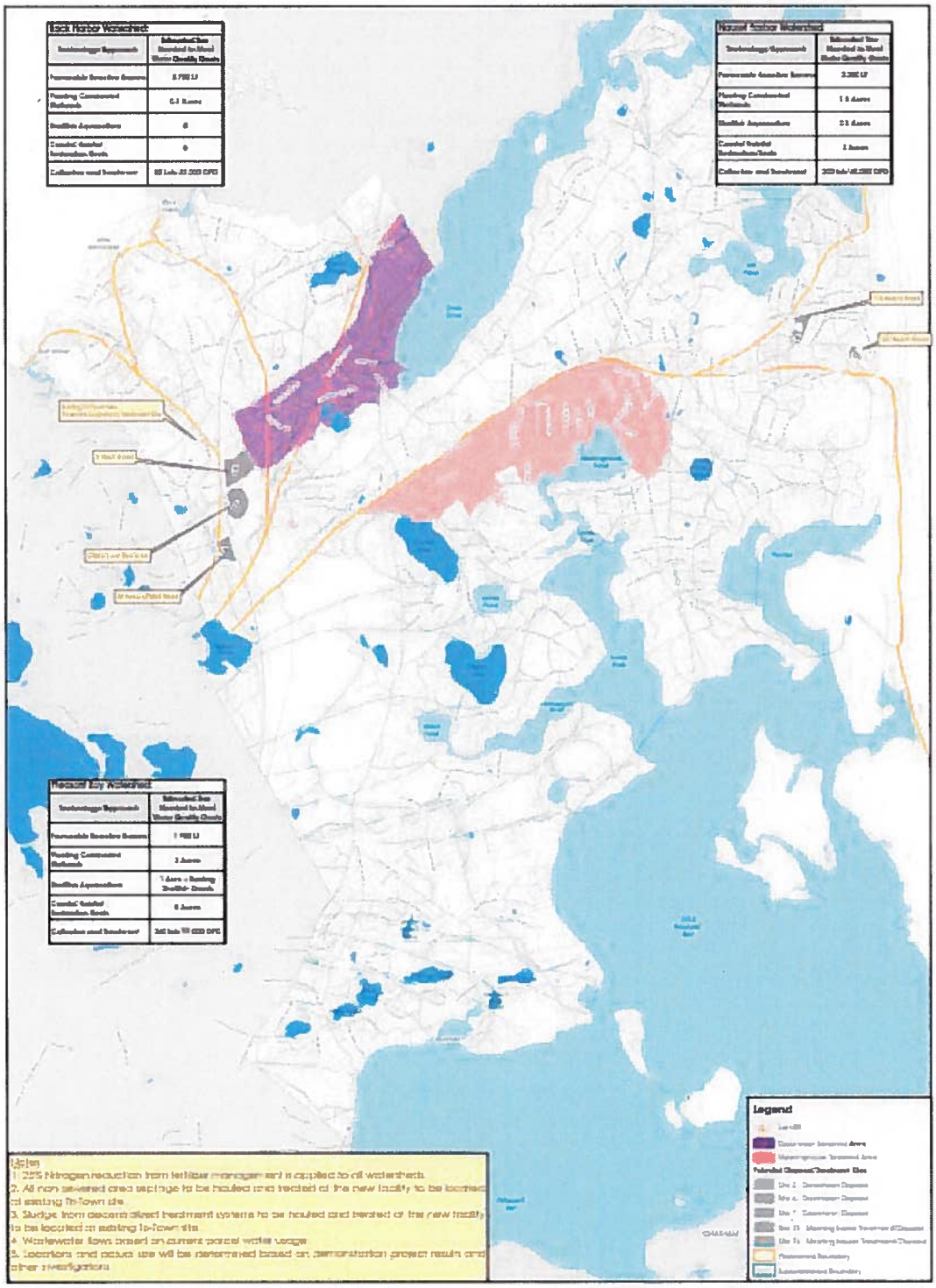
CONSENSUS of the Orleans Water Quality Advisory Panel is defined in their approved Operating Protocols as unanimous concurrence of the Stakeholder Representatives, representing their constituencies. Members may also "abstain." Abstaining means not offering consent or endorsement, but also not blocking an agreement. Abstaining members are not counted in determining if consensus has been reached.

Sims McGrath, Orleans Selectman
Alan McClennen, Orleans Selectman
David Dunford, Orleans Selectman
Jon Fuller, Orleans Selectman (in absentia)
Judith Bruce, on behalf of the Former CWMP Committee
Dale Fuller, on behalf of the Orleans Taxpayers Association
Jim McCauley, on behalf of the Orleans Pond Coalition
Sid Snow, on behalf of the Orleans Chamber of Commerce
Jeff Eagles, on behalf of the Orleans Water Alliance
Doug Fromm, on behalf of Orleans CAN
Peter Haig, on behalf of the Orleans Community Partnership
Abstention by Mark Fiegel, on behalf of the Citizens Peer Review Committee

Stantec

CONCEPTUAL APPROACH TO MEET ORLEANS WATER QUALITY GOALS

TOWN OF ORLEANS
MASSACHUSETTS

MARCH, 2015

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