Topics for Stakeholder Workshops
(Revised 25July2014)

1) Tri-Town Septage Business

The Tri-Town Septage Treatment Plant (Tri-Town) has operated as a single "product-line" business since about 1990. In recent years, the plant has processed about 10 million gallons of septage per year; revenues have not covered all costs and the plant requires significant capital investment to continue operations.

The current engineering study will evaluate options for Tri-Town site facility modifications including treatment of septage, sewage, oils, greases and fats, and food wastes and evaluating the potential use of these wastes to produce biofuel or electricity to generate additional revenue.

Included in the engineering work scope is a septage market study to evaluate regional septage process capacity, operating costs, pricing and the future septage pumping volumes on the Lower Cape. The purpose of the market study is to determine the long term return on investment, profitability and need for additional septage treatment capacity on the Lower Cape.

Three challenges or threats to the future septage market at the Tri-town location have been identified: (1) available septage capacity at the Chatham Sewage Treatment plant; (2) available future capacity at Yarmouth and other septage facilities; and (3) less frequent septic tank pumping rates. These challenges need to be discussed and evaluated jointly by the Stakeholders and the engineering contractor.

Discussion:

Paul R. Ammann, Orleans Citizens' Peer Review Panel
Reference Material: 25 SLIDES
Discussion Material: 4 to 5 SLIDES

Response/Comment:

John Kelly, Tri-Town Manager
Brewster Representative to Tri-Town Managers
Eastham Representative to Tri-Town Managers
Member of Orleans. Brewster and Eastham Boards of Health
Project Manager, Engineering Contractor
Mike Domenica, Stakeholder Manager and Consultant to Orleans
Gordon Smith, Orleans Taxpayers Association

2) "Downtown", Waterbodies and Water Quality. "Downtown" Revitalization and Who Pays

There is wide acceptance that some wastewater solution may be needed for "downtown" however that district is finally defined. There are four matters that need to be resolved before there can be a consensus on a "downtown" solution:

1. What is "downtown? What area is to be included in a "downtown" wastewater project?

2. Is there a master plan for "downtown"? In the economic revitalization of downtown, wastewater management is only *one element*. We should view wastewater management in the context of how it fits into a master plan.

3. Who benefits and who pays for a "downtown" wastewater management project and how are the capital and annual costs to be distributed among the beneficiaries?

   Downtown improvement will directly benefit business and property owners through increased business revenue, rents and property values. Although some may agree that a more vibrant downtown will provide some benefit to everyone in Orleans and other nearby towns, the cost must be shared equitably among the beneficiaries to be accepted by the town as a whole.

4. Discussions about a downtown wastewater management project have included its relationship to nitrogen driven water quality improvement. There have been attempts, particularly in the CWMP, to justify a downtown wastewater management project based on the need for nitrogen reduction and, therefore, distribute the cost over the entire tax base. These arguments do not appear to be supported by the facts and, at some point in the Stakeholder Panel process, before "downtown" solutions are discussed in earnest, the facts need to be laid out and discussed.

   The relationship between a "downtown" project and water quality issues in the watersheds impacted by the project need to be reviewed. "Downtown" proposals to date have related to four watersheds: Little Namskaket, Rock Harbor, Cedar Pond and Town Cove.

   - The 2008 MEP report on the Little Namskaket marsh system indicates the water quality in the marsh is acceptable and septic

nitrogen load reduction, even at buildout (buildout is a highly contentious matter), is not indicated.

- The 2008 MEP report on the Rock Harbor and Governor Prence marshes concluded that the marshes were healthy and not in need of nitrogen load reduction. However, in the same report, MEP concluded that impairment existed only at the Rock Harbor boat basin and that a significant reduction of septic nitrogen load in the watershed is required to achieve acceptable water quality and a healthy marine habitat.

  An independent analysis of the MEP report, and of all MEP data from 2001 through 2013, shows that a septic nitrogen load reduction is not going to restore the water quality or health of the marine habitat in the Rock Harbor boat basin. In 2013 the Boards of Selectmen of Eastham and Orleans voted unanimously to petition MassDEP for a reclassification of the boat basin.

- A review of the May 2012 MEP report for the Nauset Marsh/Town Cove system, and of the SMAST modeling, reveals that MEP assumed a single value for the nitrogen concentration in the incoming tidal flow from the Atlantic Ocean (based on data from Chatham) which is not representative of the ocean tidal waters entering the system. However, nitrogen concentrations measured by MEP in Nauset Inlet samples which were representative of the ocean tidal waters entering the system were on average much higher. However, in samples obtained in the Atlantic Ocean and at the Inlet to Nauset Marsh in 2002, 2003 and 2004 the nitrogen concentrations were on average much higher and very variable. Dr. Craig Swanson of Applied Science Associates of RI, a consultant hired by Orleans to review the 2012 MEP Report, commented that nitrogen concentrations in the Nauset Marsh/Town Cove system cannot be controlled by "engineering or regulatory" means. The ASA review suggests that nitrogen in the Town Cove/Nauset system cannot be controlled by reduction of land based nitrogen loading.

5. The construction of a "sewer infrastructure" would allow businessmen and property owners in the "downtown area" to develop new revitalization opportunities such as:

   a. 2nd floor apartments
   b. Affordable housing

c. Buried utilities
d. A “walking” village center
e. A cultural center.

All good concepts but an overall plan has not been developed and agreed upon.

Discussion of “Downtown Master Plan”:

Orleans Community Partnership

Orleans Chamber of Commerce

Discussion of “Downtown” and Relationship to Water Quality:

Paul R. Ammann, Orleans Citizens’ Peer Review Panel. [“Downtown” wastewater management project connection to “Water Quality” and distribution or allocation of capital and operating costs, only.]

Reference Material: 2 SLIDES

Discussion Material: 2 SLIDES

Response/Comment:

Orleans Stakeholders

Mike Domenica

3) Septic Tank Effluent (STE) and I/A Systems.

The Orleans CWMP and a June 2012 study by Weston & Sampson have suggested that conventional gravity sewer systems are the most effective approach for managing wastewater in Orleans. Other professional engineers and consultants, and actual large and small project demonstrations, have shown through experience that there are alternative technologies that are equally effective and significantly more affordable in applications not dissimilar to those in the town of Orleans.

There are many STE systems in the U. S. that have been operating successfully for many years, in both northern states (Michigan, Washington, Alaska) and southern states, and that have demonstrated the potential to serve the future needs of Orleans to reduce nutrient discharge at a significantly lower cost than that conventional gravity sewer technologies. In addition there is at least one I/A system in Orleans that serves approximately 41 living units and has consistently demonstrated nitrogen in the treated effluent at less than 5 to7 ppm over 6 years. Even lower concentrations effluents have been demonstrated.

The stated goal of the Stakeholders Panel is to achieve a ***"customized, affordable water quality management plan".*** To this end, the Panel should review all available information on established performance of STE and I/A systems and consider viable, low-cost option for Orleans.

Possible Discussion Team:

Paul R. Ammann, Orleans Citizens' Peer Review Panel

Reference Material: 33 SLIDES

Discussion Material: 5 SLIDES

Engineering Contractor Project Manager
Orenco Representative
Member of the Orleans Water & Sewer Commission
Manager of Sewer Authority, SW Barry, MI
Representative of the Mayo Peninsula, MD, STE system
Dr. Kevin D. White, Ph.D., P.E., for the S.T.E.P. SYSTEM REVIEW, SOUTH ALABAMA UTILITIES, UNIVERSITY OF SOUTH ALABAMA.

4) Namskaket Marsh: Restoration of Natural Water and Ecological Systems vs Tri-Town Discharge of Treated Effluent

The Commonwealth of Massachusetts designated Namskaket Marsh as part of Inner Cape Cod Bay Area of Critical Environmental Concern (ACEC). Its ACEC designation confers a duty and responsibility on state and local authorities of protecting and preserving the natural water and ecological systems of the marsh.

Background: The Tri-Town Septage Treatment Facility (Tri-Town) abuts the Namskaket Marsh and has processed septage collected in lower Cape towns since approximately 1990 and treated effluent from Tri-Town has been discharged into Rapid Infiltration Beds (RIBs). The principle or theory behind the decision to discharge effluent to the RIBs located adjacent to the ACEC was that the marsh has the capacity to absorb nutrients (primarily nitrogen) into its plant life and it has been assumed that the effluent discharges would not harm the marsh system or its ecosystems.

The 2010 Orleans Comprehensive Wastewater Management Plan (CWMP) proposes construction of a sewage treatment plant on the Tri-Town site which could ultimately discharge an average of 640,000 gallons, and up to 1,400,000, gallons of treated effluent to RIBs on the site. Alternative plans have been discussed for a somewhat smaller sewage treatment plant with effluent discharges in the range of 100,000 to 500,000 gallons per day.

Although the practice of effluent discharge to the RIBs adjacent to the Namskaket Marsh and ACEC has been going on for nearly 24 years, it is not clear that it is sound environmental practice or that it meets our duty and responsibilities to preserve and protect the ACEC natural systems. The decision to discharge at Tri-Town failed to consider three facts that are as true today as they were more than 20 years ago:

1. There is no empirical data (real world measurements) which establishes definitively the fate of effluent discharged into the existing or proposed RIBs. The fact is that we have only hydrological models of the water flows which provide a “best guess” or “estimate” of the path the effluent “might” take, and these models have not been validated.

2. There has been no consideration or direct measurement of the impact of any effluent that could enter the marsh through the margins (area where the upland intersects with the marsh) may have on the salinity balance and the ecological systems in the marsh (the mixes of plants

and animals) as a result of the predominantly “fresh” water nature of the effluent.

3. The impact of treated effluent on the marsh has been approached only on the basis of the impact when “averaged” over the entire marsh area. Such analysis is myopic and misleading since the effluent discharged to the RIBs will have a far greater impact on the marsh in areas nearer to the RIBs.

In order to meet our duty and responsibility to preserve and restore the ACEC natural water and ecological system functions and to ensure that our use of the Tri-Town site will not be detrimental to those functions, we need to review what we know...the facts backed up by real world data, what we don’t know and the risks to the Namskaket Marsh natural systems.

The May 2014 Town Meeting approved funding for convening a panel of scientists and engineers to conduct a critical review of Namskaket Marsh history and condition and to make recommendations for preserving and restoring the marsh’s natural water and ecological functions and systems. The panel should include both those who have studied or investigated the marsh’s ecological and hydrological functions in the past and members with expertise in the restoration of natural water and ecological systems; a list of suitable candidates are provided below.

A panel of scientists and engineers should be assembled to offer critical technical discussion on various aspects of this topic. The experts listed below would bring a wide range of expertise and views on the important challenge to the future of wastewater management in Orleans.

Possible Panel Candidates:

Dr. Brian Howes, UMass-Dartmouth
Dr. Peter Weiskel, US Geological Service
Jesse Schwalbaum, hydrologist and hydrological modeling consultant to Wright-Pierce and the Orleans CWMP
Wendi Goldsmith, Bioengineering Group, Boston, - http://www.bioengineering.com/people/wendi/wendi.php Goldsmith's work includes the use of green infrastructure in the cleanup of Boston harbor and restoring natural water system functions after hurricane Katrina.
Patrick Lucey, Aquatex (Aquatic Ecologist) http://www.aqua-tex.ca/index.php?id=2&press=1&draw_column=1:1:2. In addition to his practice of natural system restoration and creating developments that maintain and enhance natural water flows and functions, Lucey

was a member of the CCC 208 plan Technology Panel and supervises graduate students in aquatic ecology at the University of Victoria.

Linda Deegan, Ecosystems Center, Marine Biological Laboratory, Senior Scientist http://www.mbl.edu/ecosystems/faculty/deegan/Deegan wrote an article on work she and others did on the impact of excess nitrogen on salt marshes - in essence, her team found that nitrogen stimulation of foliage growth at the expense of root development can weaken marsh grasses.

Jennifer Bowen, Professor of Biology, UMass-Boston UMass Boston Faculty - http://faculty.www.umb.edu/jennifer.bowen/home.php Bowen's area of interest includes human impacts on the environmental and nitrogen cycling bacteria, particularly in salt marshes

Mark Bertness, Brown University Faculty - http://bertnesslab.com/html/people/Mark.html Bertness's area of interest is in the natural processes that contribute to the health and development of ecological systems. Recent work included studies of Cape Cod salt marsh die-off and its impact on salt marsh health and structure.

Annamarija Frankic, UMass Boston Faculty - http://faculty.umb.edu/anamarija.frankic/frankic.html Franckic was a member of the CCC 208 plan Technology Panel and is advising in Wellfleet on ecosystem restoration including recreation of oyster reefs. In addition, Frankic created the Green Harbors Project (GHP) to restore natural processes and functions in Boston Harbor.

Dr. John Portnoy, Ecologist, National Park Service, Wellfleet, MA. jp.wellfleet@gmail.com See background: http://www.doi.gov/greening/awards/2006/portnoy.cfm
Dr. Portnoy conducted extensive research and was responsible for preparing a step-wise plan for the restoration of Herring River Saltmarsh.

Paul R. Ammann, Consulting Engineer and Resident of Orleans. Mr. Ammann has examined the historic operation of the Tri-Town Plant, the disposal of treated wastewater in the infiltration beds and data obtained in the marsh and at the site.

5) Rock Harbor Boat Basin and Cedar Pond

The Orleans CWMP was based on the MEP reports for the Rock Harbor, Namskaket and Little Namskaket Marsh Systems which in turn were based on data collected in just four years from 2001 through 2005.

The MEP reports on the Namskaket and Little Namskaket marsh systems found that both meet water quality standards and have healthy benthic habitats and can assimilate more nitrogen. In its December 2008 Report on the Rock Harbor Marsh System, MEP determined that the Rock Harbor marsh system is healthy but the Rock Harbor boat basin is impaired due to excess nitrogen loading from land based sources. The boat basin degradation was attributed to excess nitrogen concentrations measured from 2001 through 2005. Since 2005 additional water quality data has been obtained.

A new study was completed on Cedar Pond by the Coastal Systems Group School for Marine Science and Technology University of Massachusetts Dartmouth in July 2013. This report indicated that Cedar Pond is degraded and that the primary causes were (1) the nutrients discharged into the pond by hundreds of cormorants that congregate on the power lines during the summer and fall and (2) the organic-rich sediments release nitrogen into the pond waters in early summer and absorb nutrients from the pond waters during other months.

A second study was conducted by the Provincetown Center for Coastal Studies; the report was issued in January 2014. The report concludes that the concentrations of nitrogen and pollutants increase from the inlet to the boat basin to the upper reaches of the creek and marsh and into Cedar Pond. The report also draws on the 2008 MEP Report and the 2013 UMass-Dartmouth Report that Cedar Pond contributes to worse3ning conditions in the boat basin.

A discussion is needed on the future remediation of Cedar Pond and on the causes of degradation in the Rock Harbor boat basin.

Suggestions for Discussion Team:

Technical Panel

Amy Costa, PhD., *"A Study of Cedar Pond and the Rock Harbor Estuary"*, Submitted to: Orleans Pond Coalition, Center for Coastal Studies, Hiebert Marine Laboratory, 5 Holway Avenue, Provincetown, MA 02657, January 2014

Ed Eichner, *"Cedar Pond, Water Quality Management Plan, FINAL REPORT, July 2013"*, for the Town of Orleans, by Coastal Systems Group, School for Marine Science and Technology, University of

Massachusetts Dartmouth. 706 South Rodney French Blvd, New Bedford, MA 02744-1221

Carolyn Kennedy, Orleans Water Quality Task Force

EPA Expert on Water Quality and aquatic health in Harbors and Marinas

MassDEP representative

Mark Fiegel, Orleans Citizens' Peer Review Panel and Statistician

Paul R. Ammann, Orleans Citizens' Peer Review Panel [SLIDES]

Dr. Craig Swanson, Applied Science Associates, RI, [Modeling Expertise]

Jennifer Bowen, Wendi Goldsmith, EXPERT ON SALTMARSHES:

Dr. Brian Howes, UMass-Dartmouth, MEP Project Manager

Commercial/Business Panel

Representative of the Orleans Chamber of Commerce

Representative of the Orleans Community Partnership

Gordon Smith or Dale Fuller, Orleans Tax payers Association

Gary Furst, Orleans Water Alliance

Others

6) CCC 208 Process: Item #1. Stormwater

The Technical Panel that assisted the Cape Cod Commission in developing its 208 Plan has determined that surface water runoff and the installation of storm drains represent "low hanging fruit" with respect to the reduction of nutrient and pollutant discharge into coastal waters and freshwater ponds.

According to the Scope-of-Work for the engineering contract, the consultant will develop a plan for the Town of Orleans to implement stormwater (runoff) management in the future. The responsibility for contractor in this matter is described in the SOW.

1.4.1 ***"Stormwater management activities including the planning and management activities currently being undertaken by the Town under separate contract. The Consultant will summarize the current program, the goals, methods of analyses, stormwater management alternatives considered, estimates of nitrogen and/or phosphorus reduction that could be achieved, and recommendations for future stormwater management actions in Orleans watersheds. The Consultant shall recommend measures to integrate the current stormwater management program into the Adaptive Management Plan. This information will be summarized in a draft Technical Memorandum."***

The Stakeholders should request the following information to determine for each location, where surface runoff flows into coastal waters or freshwater pond or into stormwater facilities that may impact such water bodies, the schedule for completion of the controls as required under the Clean Water Act and obtain an estimate of the amounts of nutrients and pollutants that will be eliminated from each water body:

- The annual quantity of runoff that is or will be collected by storm water runoff controls,
- The estimated annual amounts of nutrients and pollutants contained in the runoff at each location,
- The estimated timing for the installation of the controls at each location, if not completed by 2014,
- The estimated cost for completion of the controls at each location,
- A year-by-year estimate of capital expenditures and annual operating costs.

The engineering contractor and the Highway Department should describe their conclusions and recommendations to the Stakeholders Panel.

7) CCC 208 Process: Item #2. Fertilizer

The CCC 208 Technical Panel identified fertilizer runoff as “low hanging fruit” with respect to reducing nitrogen (and phosphorous) infiltration into groundwater and runoff into surface water systems. Although perhaps small in quantity relative to septic systems, reduced use of fertilizer is a low cost means of nutrient reduction in natural water systems.

A program to reduce fertilizer use in Orleans would have to be coordinated by the County or the Cape Cod Commission.

The engineering contractor has been given the responsibility to gather information and evaluate possibilities to implement fertilizer reduction in Section 1.4.1

The Stakeholder Panel should invite the CCC 208 Technical Panel to inform it of the current status of the County-wide program to reduce fertilizer use and MEP should provide the calculations to provide an estimate of the quantitative impact on the local coastal waters and freshwater ponds.

8) CCC 208 Process: Item #3. Oyster Reefs and Aquaculture

A large body of information has been published that demonstrates the capability of oyster reefs and aquaculture to remove nitrogen and improve overall water and sediment quality in coastal waters.

Orleans has issued a few licenses in Peasant Bay for aquaculture operations. The CCC 208 Technical Panel identified oyster reefs and aquaculture as relatively low cost technologies for achieving overall water and sediment quality improvement and removing nitrogen in the process.

In Section 1.4.2 of the Scope-of-Work the engineering contractor has been charged with developing the following information:

> ***"Alternative technologies for nutrient and water quality management including non-traditional technologies such as aquaculture, oyster reefs, permeable reactive barriers and other promising technologies. The Consultant will gather and summarize information being developed by other pilot programs on Cape Cod, as well as relevant literature from other studies and applications in similar locations. For each technology the performance history, range of expected installation cost, operational logistics, significant risks, implementation timeframes and timeframes for expected water quality improvements shall be estimated based on best available information. Locations in Orleans where such technologies may be applicable shall be identified.***
>
> ***The following technologies will be evaluated with evaluations summarized in draft Technical Memoranda:***
>
> - ***Intensive oyster aquaculture***
> - ***Oyster reefs"***

There is an extensive amount of information available on oyster reefs and aquaculture on Cape Cod and in New England and the Orleans Stakeholders should learn from the established pilot projects in Wellfleet, Falmouth, Truro and Provincetown. In addition to the contractor task, the Stakeholder Panel should explore the potential to for oyster reefs and aquaculture for water and sediment quality improvement as well the management of nitrogen levels in Pleasant Bay, Town Cove and Cape Cod Bay by meeting with a Panel of experts who can provide actual experience in relevant projects along with total year-by-year costs and provide a baseline for planning future oyster reefs and aquaculture in local waters.

It should be noted that there a very large projects underway to install oyster reefs in Maryland and in New York for improving water and sediment quality, achieving biodiversity and resiliency as well as nitrogen removal.

Suggested Experts / Resources:

Mr. Curt Felix, Project Manager, Oyster Reefs, Wellfleet
Annamarija Frankic, UMass Boston Faculty - http://faculty.umb.edu/anamarija.frankic/frankic.html Frankic is a member of the CCC 208 plan Technology Panel and is advising in Wellfleet on ecosystem restoration including recreation of oyster reefs. In addition, Frankić created the Green Harbors Project (GHP) to restore natural processes and functions in Boston Harbor.
Ron Zweig (Oyster Project Manager), Falmouth
Wendi Goldsmith, Bioengineering Group, Boston, - http://www.bioengineering.com/people/wendi/wendi.php Goldsmith's work includes the use of green infrastructure in the cleanup of Boston harbor and restoring natural water system functions after hurricane Katrina.
Jeffrey Cornwell, Professor, University of Maryland, http://www.umces.edu/hpl/story/2013/apr/29/new-study-finds-oyster-restoration-can-help-clean-bay
Ray Grizzle, Professor, University of New Hampshire, http://marine.unh.edu/faculty-member/ray-grizzle

9) Town Cove and Nauset Marsh Strategy

AECOM , a consultant to the Cape Cod Commission 208 project and a experienced international construction company with extensive wastewater experience, recently presented a conceptual study to the Nauset /Town Cove Stakeholder Group that illustrated how alternate technologies including oysters and PRB's could reduce the cost of achieving the TMDL in the Cove by 80%. This is a prime example of how Eastham and Orleans, that share a common water body, might benefit from use of alternate technologies. It addresses cost, the driver that determines acceptance of any plan by each town's residents.

Many stakeholders have not heard this study presentation. Yet it demonstrates the concept of how adjacent communities could cooperate and improve water quality in a common water body.

This study exemplifies how regional cooperation, strongly recommended by the CCC, might be supported by a low cost solution for both towns.

Presenter:

Mark Owen, AECOM

Possible Discussion Group:

John Hodgson, Orleans Selectman
Selectman from Eastham
Tom Cambereri, Cape Cod Commission
Patty Daly, Cape Cod Commission
Jim Robertson, Orleans Pond Coalition
Ed Daly, Orleans Citizens Peer Review Panel
Dale Fuller, Orleans Taxpayers Association
Engineering Contractor Representative

10) Permeable Reactive Barriers (PRBs)

PRBs offer the potential to remove most nutrients (nitrogen and phosphorous) from groundwater before it enters coastal waters or freshwater ponds. This technology has been demonstrated for decades in groundwater cleanups of heavy metals and solvents at industrial and Superfund sites. Pilot tests of the PRB technology for the effective removal of nitrogen from groundwater have been underway in Falmouth and Waquoit Bay.

In 2007 Drs. Joseph Vallino and Kenneth Foreman of the Marine Biological Laboratory conducted two pilot studies of the PRB technology on a 50-foot barrier beach and on a private lot in the Waquoit watershed. The pilot projects demonstrated the capability of the PRBs to reduce nitrogen concentrations in the groundwater but identified both design and operating issues that needed further investigation.

The engineering contractor has a task [1.4.2] to evaluate the application of PRBs:

> ***"Alternative technologies for nutrient and water quality management including non-traditional technologies such as … permeable reactive barriers and other promising technologies. The Consultant will gather and summarize information being developed by other pilot programs on Cape Cod, as well as relevant literature from other studies and applications in similar locations. For each technology the performance history, range of expected installation cost, operational logistics, significant risks, implementation timeframes and timeframes for expected water quality improvements shall be estimated based on best available information. Locations in Orleans where such technologies may be applicable shall be identified.***
>
> ***The following technologies will be evaluated with evaluations summarized in draft Technical Memoranda:***
>
> - ***Permeable Reactive Barriers (PRBs)"***

The Orleans Stakeholders should obtain current information related to the actual field demonstration of nitrogen removal from groundwater by PRBs and the parameters that define the construction and operating costs by inviting project managers with direct experience to speak directly with the Panel.

Possible Resources:

EPA Region I Project Manager
The Engineering Contractor Project Manager

11) CCC 208 Technology Matrix

The Orleans Stakeholders should encourage a discussion and examination of the range of alternative technologies in the technology matrix developed by the 208 Tech Panel. The purpose would be to *d*etermine which of these technologies Orleans should develop as pilot projects to prove efficacy and costs. There may be technologies other than oyster reefs, aquaculture and PRBs that may be good choices for a pilot demonstration. Suggest looking first at the in-situ alternatives as they would have the most immediate impact on water quality.

This needs to be supported by technical people who can assist in identifying the most appropriate alternatives. Additional technical support will be needed to identify the best locations for pilot projects.

Potential Resource:

Scott Horsley, Cape Cod Commission Technology Panel
Others from Cape Cod Commission Technology Panel
Mark Owen, AECOM
..others needed

12) MEP Linked Model, Monitoring Water Quality and Health of Marine Environment and Data Analysis

One of the requirements imposed by MassDEP in the TMDL regulatory document is that extensive monitoring be conducted of water quality and the health of the marine habitats of coastal waters. There is also a requirement for ecological monitoring/habitat assessment. The purpose is to demonstrate the efficacy of remedial actions in improving water quality and habitat health; such environmental monitoring and proof of efficacy is required for ALL remedial actions employed. Nearly nine years have passed by since these data were initially obtained and analyzed. The water quality data obtained in both the Nauset Marsh/Town Cove and the Pleasant Bay Embayment Systems since 2006 have shown significant departures from the earlier data. Consequently, subsequent data have not supported the analyses on which the MEP Reports are based.

Furthermore, neither MEP nor the town of Orleans or its neighboring towns have conducted any studies of the benthic habitats since 2003. MassDEP has made measurements of eelgrass coverage periodically.

As part of its 208 Process, the Cape Cod Commission also recognized that environmental monitoring and analysis of water quality and the ecology/habitat needs a significant amount of attention. Consequently it is in the process of assembling a team of specialists to study the needs and establish a set of guidelines for Towns to follow as it tries to satisfy future requirements contained in the TMDLs and related regulations.

There are three aspects of this Workshop:

- Review of 12 years of data collected by the Orleans Water Quality Task Force and the Pleasant Bay Alliance,
- Review of the MEP Reports for the Pleasant Bay, Nauset Marsh/Town Cove, and Rock Harbor embayment systems, and
- The development of a plan for future data collection with an annual budget.

The Orleans Water Quality Task Force and the Pleasant Bay Alliance have direct experience in data collection and the deployment of volunteer samplers.

Mark Fiegel of the Orleans Citizens' Peer Review Panel (OCPRP) has analyzed all of the available water quality obtained by the Town of Orleans and the

Pleasant Bay Alliance in the years covering 2001 through 2013. The problem needs to be approached by:

1. Identifying the questions we will need to answer in the future regarding: efficacy, habitat health, water quality standard compliance, etc.

2. Determining the analytic methods, sample number, frequency and sample locations needed to answer the questions; and

3. Designing environmental monitoring protocols and sampling programs that will support answering the questions.

Possible Resources:

Carolyn Kennedy, Orleans Water Quality Taskforce
Carol Ridley, Pleasant Bay Alliance
Mark Fiegel, Local fisherman, boater, Orleans Resident and professional statistician
Paul R. Ammann, OCPRP. Analysis of Nauset Marsh/Town Cove Data and MEP Report
Jeffrey Eagles, OCPRP. Analysis of Pleasant Bay Data and MEP Report
Dr. Brian Howes, UMass-Dartmouth, MEP Project Manager
Dr. Craig Swanson, Applied Science Associates, RI, [Modeling Expertise]
Cape Cod Commission Technical Panelist
MassDEP Representative
Other

13) Water Resource Restoration and Water Quality Improvement

The restoration of our water resources including water quality improvement starts with a identifying all of the human impacts that interfere with natural system water flows and ecosystem functions. The Rock Harbor Marsh system is part of the same Inner Cape Cod Bay Area of Critical Environmental Concern (ACEC) that includes Namskaket Marsh. In the Rock Harbor system, for example, man has modified the water flows and introduced changes that have impacted water quality in several ways:

a. Building of roadways have filled in a portion of Cedar Pond and wetlands from Cedar Pond to the Route 6 rotary and modified natural water flows;

b. Dykes and culverts created to control or limit natural flows;

c. Development of buildings, lawns and gardens have encroached on the wetlands and marsh system and contributed runoff and pollutants to the system;

d. Runoff from roads and buildings has interfered with natural water flows and directed pollutants into the systems;

e. Septic systems in watersheds have contributed nitrogen and other pollutants to groundwater flowing into the system;

f. Storm drains have modified natural water flows in the watershed and caused pollutant to discharge into the system;

g. Creation of a dredged boat basin and construction of harbor facilities at the mouth of the salt marsh creek has contributed pollutants to the system, modified the natural water flows and has resulted a settling sump for organic materials draining from the marsh above and brought in from Cape Cod Bay on tidal flows. All of these contribute to degradation of water quality in the boat basin and in the creek system;

h. Operation of an intense harbor/marina facility in the boat basin and periodic dredging contribute pollutants and result in reduced water quality in the system.

Although seemingly of little consequence at the time, each of these incremental changes has, over more than 100 years, contributed to a Rock Harbor system which functions very differently than it did in its natural state….a sort of “death by a thousand cuts.” The result is a system in which functions and functionality has been changed or diminished in significant ways.

To create a plan for improving water quality water system functions, a holistic examination is needed of all the human impacts to assess how the combination has altered the system functionality and to decide what solutions will be most effective and affordable in improving water quality and restoring natural functions.

The US Environmental Protection Agency (EPA) tool for conducting this examination is “Recovery Potential Screening” which accomplishes the following tasks:

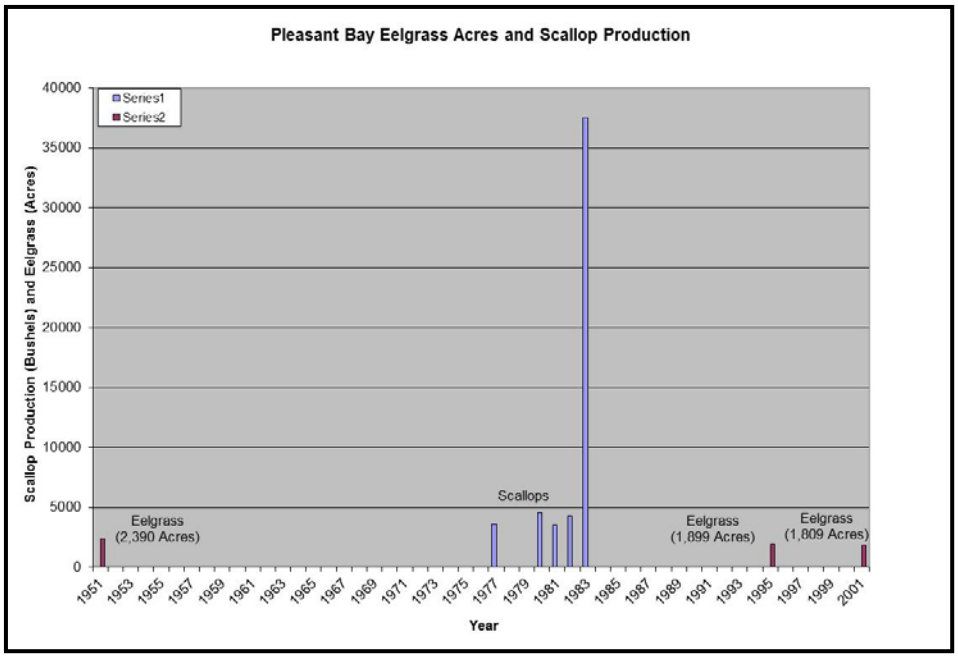
a. Identify the major environmental stressors - the root causes of water quality, habitat and water balance problems;
b. Use empirical data to assess the impact of the stressors - determine what is going on in the water system and why;
c. Rank the stressors - based on their impact on water quality, habitat and water balance problems;
d. Assesse solutions to address the highest impact stressors and the problems caused by them;
    i. Identify solutions/actions that will improve water quality and habitat health
    ii. Estimate the expected efficacy of solutions/actions

    Deliverable: Develop an action plan for improving water quality, habitat health and other natural water system functions.

A workshop supported by EPA and technical experts with natural water system restoration experience, such as Wendi Goldsmith, Patrick Lucey or Annamarija Frankic, would gather existing information, begin to identify stressors and system dysfunctions and develop a plan for conducting the Rock Harbor System Recovery Potential Screening. With the Rock Harbor system, including Cedar Pond, as a model, other high impact water systems would be similarly examined.

14) Pleasant Bay MEP Report - Section IX

Section IX of the MEP report discusses the Pleasant Bay inlet configuration prior to the new inlet created in April 1987. MEP presents modeling results for 1987 prior to the new inlet which show that nitrogen concentrations in the Orleans portion of Pleasant Bay were 40 to 60% higher in early 1987 than they were in the 2000 to 2005 period. This conflicts with the CWMP/DEP scenario that has been accepted by most Orleans residents that connects development over the last 60 plus years with a steady rise in Pleasant Bay nitrogen concentrations and along with it a steady degradation of water quality and habitat health. The MEP report reinforces the CWMP/DEP scenario; particularly in Section VII when MEP uses unreliable 1951 eelgrass data (unreliable because of poor quality low resolution images examined 50 years later and lacking field verification). On page 188, MEP states "Over the 50 year period (1951-2001), the Pleasant Bay System has lost ~583 acres of eelgrass habitat. Interestingly, the rate of loss has been relatively constant at ~11 acres per year. This loss has occurred as watershed nitrogen loading rates gradually increased several fold due to changes in land use within the Pleasant Bay watershed."



Eelgrass areal coverage is held up as the crucial indicator of the health of the Pleasant Bay system. However, we have no measurements of whether or how much eelgrass area was gained or lost since 1950. No indication of whether the loss or gain occurred due to changes in currents, disease or inlet movements. We do know that scallops depend on eelgrass for development. We do know that in the mid-1980's that nitrogen was 40-60% higher than in

2000-2005. We do know that there was a record harvest of scallops in 1983.

Why were there so many scallops when the nitrogen was much higher than it is today? Why is there anecdotal evidence of lush eelgrass in Pleasant Bay in the 1960's and 70's? Why is there no anecdotal evidence of poor water quality from the early 1980's when nitrogen was much higher than it is today? The conditions of the mid-1980's in terms of inlet configuration and high nitrogen due to limited flushing would have occurred in past inlet movement cycles. During those past times, did Pleasant Bay contain tens of millions of oysters in reefs (as existed in Wellfleet harbor) that controlled the nitrogen concentration when flushing was not sufficient?

Discussion team…who?

15) Nitrogen Mass Balance

A fundamental scientific tool for understanding any system including a water system is a mass balance. A mass balance is similar to balancing a check book. In the case of a water system like Pleasant Bay, a nitrogen mass balance is an accounting for all the sources of nitrogen coming into the system and all the nitrogen sinks, nitrogen that leaves the system.

While it is true that there is a nitrogen balance within the MEP modeling system, it considers only the land-based nitrogen sources that MEP measured. Several sources and sinks are simply not included in the MEP model. With respect to the Pleasant Bay water system, the model's balance is incomplete. Furthermore, as explained by the Barnstable Peer Review Panel, the MEP has created a "static model", that is, one that does not account for changes in a system from year-to-year.

When Woods Hole Group reviewed the Pleasant Bay MEP report in 2008, Dr. Jeffrey Cornwell (University of Maryland) was concerned because MEP had not conducted a mass balance encompassing all nitrogen sources and sinks when it analyzed the behavior of sediment samples and he pointed out some factors that MEP ignored in conducting its laboratory experiments. The MEP nitrogen analysis is entirely focused on the land-side; for instance, MEP ignores the ocean and marine life, such as seals, seals as sources and it ignores nitrogen that is lost from the system by burial in sediments.

Discussion team: Need experts in conducting mass balances in natural water systems. Jeffrey Cornwell is a candidate.

16) Water Quality Improvement

It is essential to the operation of the Orleans Water Quality Advisory Panel that we share a common understanding of what "water quality" is and what it means to improve water quality.

The fact that the group has been named "Orleans *Water Quality* Advisory Panel" is a step in the right direction. However, some panel members seem to be unfamiliar with the meaning of "*water quality*."

Many people and some panel members understand nitrogen to be a measure of water quality and believe that improving water quality means removing nitrogen. Nitrogen is not a measure of water quality; it is an indicator of possible nutrient imbalance and can be the source of water quality degradation. Other "pollutants" or environmental stressors also cause water quality degradation.

Water quality is defined by Massachusetts Law which is overseen by the U.S. EPA through the Clean Water Act. All Cape Cod coastal waters are classified as Class SA water bodies which are defined by a water quality standard in terms of limits on parameters, such as, solids content, dissolved oxygen, clarity (turbidity), odor, taste, color and bacterial content.

Water quality improvement requires remedial actions targeted to bring coastal waters...or fresh water ponds (Class A water bodies)...into compliance with the respective SA or A classification. The first step in doing so requires an understanding of the causes of water quality degradation and the likelihood of solution options to correct the degradation.

Wastewater (and associated nitrogen) discharge into groundwater contribute to water quality degradation by promoting the formation of algae. However, reducing wastewater or nitrogen is not the objective; restoring water bodies to meet SA or A class water quality standards and restoring the health of infaunal, faunal and floral habitats is the objective. The regulators will require the efficacy of any and all remedial solutions/actions employed to be verified by measurement (environmental monitoring) of their impact in terms of achieving SA or A water quality standards and improving habitat health.

It is suggested that suitable candidates for discussing what water quality is and what it means to improve water quality are Kenneth Moraff or Johanna Hunter, both of EPA Region 1. We need a balanced, fact based discussion of water quality. Past experience has shown that DEP has been biased in their presentations and their discussions of the topic such that MassDEP would not be acceptable to conduct a workshop on water quality.