NEWEA – Watershed Management
A Unique Approach to Implementation: Watershed Nitrogen Management Planning- Town of Mashpee, MA

J. Jefferson Gregg, P.E., BCEE
Annual Conference – January 23, 2017

Planning aspects that influenced implementation

Towns on the Cape have taken innovative approaches to wastewater and nutrient management planning and implementation.

Mashpee has put their own unique spin on planning and implementation:

- Watershed based approach
- Contracting with School for Marine Science and Technology (SMAST) predating Massachusetts Estuaries Project (MEP)
- Decentralized approach from the onset
- Incorporation of shellfish into the program with traditional “Plan B”
- Targeting a possible regional facility at Joint Base Cape Cod (JBCC)

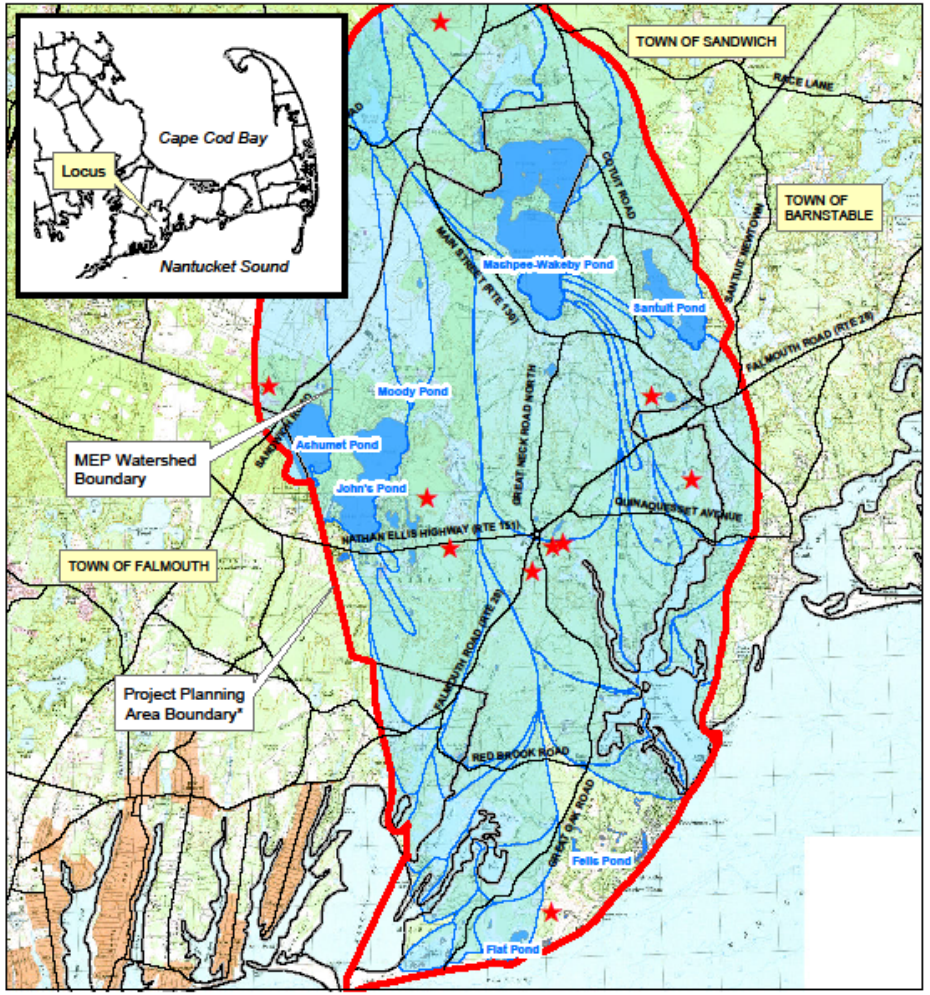
Introduction

- Project background and chronology
- Plan development
- Recommended Plan
- Implementation schedule
- Initial implementation summary
  - Watershed permit
  - Quashnet/Moonakis River
  - WWTF evaluation and SewerCAD
  - Shellfish

Background

<u>Project planning area</u>

- Town of Mashpee
- Waquoit Bay East Watershed
  - Including parts of Sandwich and Falmouth
- Popponesset Bay Watershed
  - Including parts of Sandwich and Barnstable



LEGEND

- WWTF Location
- MEP Watershed Boundary
- Major Roadway (for location reference)

*The Project Area is the combination of the entire Town of Mashpee and the watersheds of Popponesset Bay and Waquoit Bay-East as delineated by the Massachusetts Estuaries Project (MEP) extending into the Towns of Barnstable, Falmouth and Sandwich.

Paper Size ANSI A
0 0.375 0.75 1.5 Miles
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

LOCUS MAP

Job Number 86-12001
Revision A
Date 04 Mar 2014

Figure 1-1

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by jjobrien

Chronology

- 1999-2006
  - Project Contract and initial ENF Filing
  - Project Start and 3 years of MEP Sampling
  - Issuance of MEP Reports and TMDLs
- 2006-2013
  - Needs Assessment/Technology Screening and Alternatives Development
  - Additional TMDLs/Model Runs and Data Validation
- 2013-2015
  - Completion of Alternatives Analysis and Draft and Final Recommended Plan and Environmental Impact Reports
  - Final MEPA Certificate (July 2015)
  - CCC Consistency Letter (October 2015)
- 2016-Present
  - Implementation
  - CCC DRI Approval (in process)

Plan development

- Needs Assessment and Technology Screening
- Evaluation of Alternatives
- “No Action Alternative”
- Targeted Evaluations
  - Centralized vs. New Cluster Area Treatment Facilities
  - Regional Solutions (Joint Base Cape Cod - JBCC)
  - Existing Wastewater Treatment Facilities (WWTFs)
  - Traditional and Hybrid Solutions
    - Shellfish aquaculture
    - PRBs
    - Bog / Wetland restoration
    - Onsite systems

Matrix evaluation and summary of findings

- Development of evaluation matrix
- Each of the categories were assigned points
- most points, highest need

WASTEWATER GENERATION	Percent of flow existing vs. at future (weight)	5	30
	Est. Census Occupancy by planning area (% year round) (weight)	5	
	Existing Gal/Ac (Weight)	5	
	Future Gal/Ac (weight)	5	
	Est. Existing Attenuated load (kg/y per acre) (weight)	5	
	Est. Future attenuated load (kg/y per acre) (weight)	5	
DRINKING WATER	Percent of Subarea in Zone II (weight)	5	20
	Percent of Subarea in USGS Well Recharge Area (weight)	10	
	Estimated Percent on Private Wells (weight)	5	
WATERSHED	Watershed Attenuation (weight)	10	30
	In Subwatershed to Shellfish Propogation (weight)	5	
	Embayment Habitat Quality (weight)	10	
	Number of upgradient properties within 300ft Fresh Water (P) (weight)	5	
PROXIMITY TO INFRASTRUCTURE	Proximity to JBCC (weight)	3	20
	Proximity to "Closest" Existing WWTF (weight)	4	
	Proximity to "Closest" Potential New WWTF (weight)	3	
	Proximity to Potential Recharge - New Seabury (weight)	3	
	Proximity to Potential New Recharge - Back Road (weight)	2	
	Proximity to Potential New Recharge - Site 4 (weight)	2	
	Proximity to Potential New Recharge - Site 6 WWTF (weight)	1	
	Proximity to Potential New Recharge Willowbend (weight)	2	
BONUS	Subarea includes: Summerwood Condos, Sea Oaks Condos, Lake Side Estates, or South Cape Resort	+5	+10
	Subarea within Mashpee River Watershed	+5	

Matrix evaluation and summary of findings (cont.)

- Excerpt of the Matrix Evaluation Table

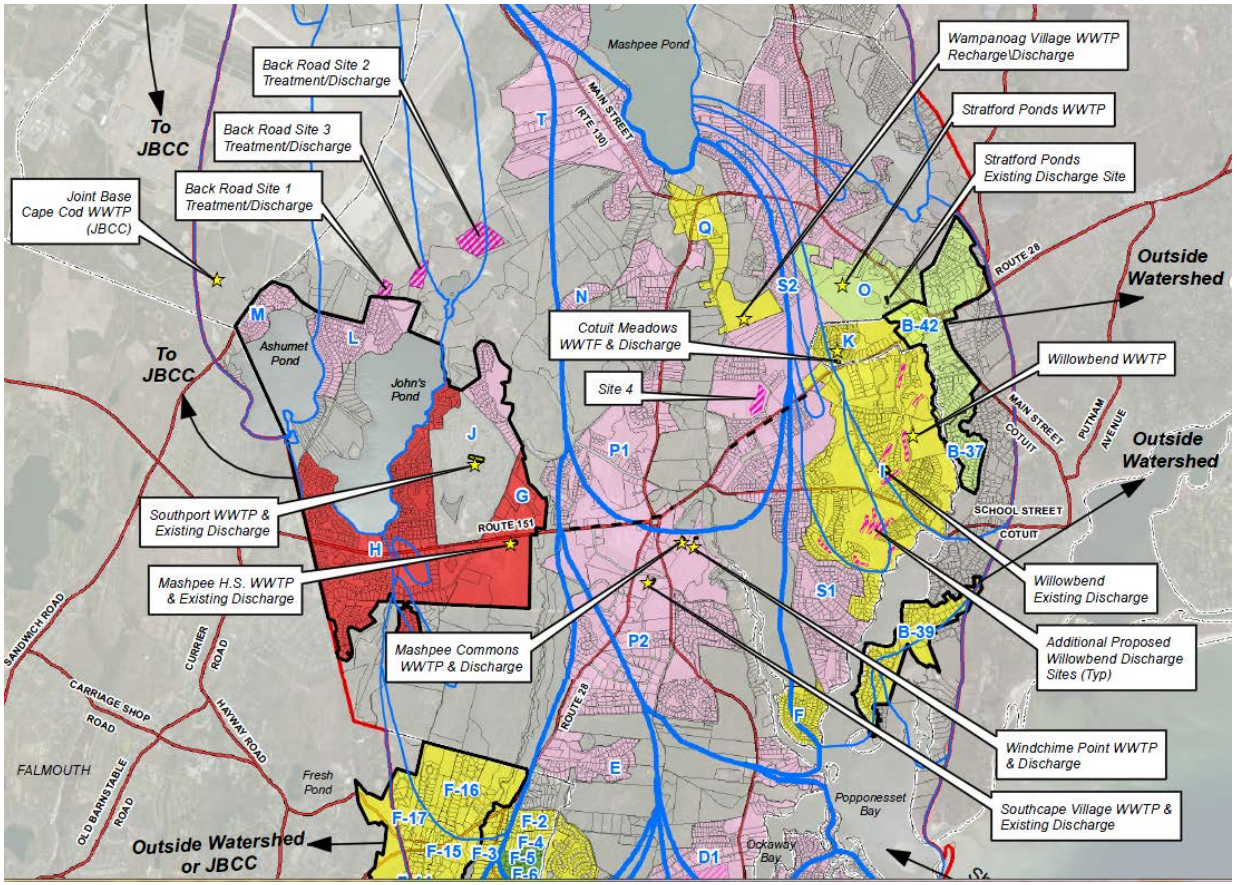
TABLE 4-22: MATRIX RANKING (ROUNDED)

GENERAL INFORMATION									WASTEWATER GENERATION						DRINKING WATER SUPPLY			WATERSHED				PROXIMITY TO INFRASTRUCTURE								OTHER		
Subarea ID	Subarea Description	Primary MEP Watershed	Subarea Size (acres)	Existing gpd	Future gpd	Total number of parcels	Number "existing" developed	Number of developed / developable parcels	Percent of flow existing vs. at future (weight)	Est. Census Occupancy by planning area (% year round) (weight)	Existing Gal/Ac (Weight)	Future Gal/Ac (weight)	Est. Existing Attenuated load (kg/y per acre) (weight)	Est. Future attenuated load (kg/y per acre) (weight)	Percent of Subarea in Zone II (weight)	Percent of Subarea in USGS Well Recharge Area (weight)	Estimated Percent on Private Wells (weight)	Watershed Attenuation (weight)	In Subwatershed to Shellfish Propogation (weight)	Embayment Habitat Quality (weight)	Number of upgradient properties within 300ft Fresh Water (P) (weight)	Proximity to JBCC (weight)	Proximity to "Closest" Existing WWTF (weight)	Proximity to "Closest" Potential New WWTF (weight)	Proximity to Potential Recharge - New Seabury (weight)	Proximity to Potential New Recharge - Back Road (weight)	Proximity to Potential New Recharge - Site 4 (weight)	Proximity to Potential New Recharge - Site 6 WWTF (weight)	Proximity to Potential New Recharge W Falmouth (weight)	BONUS (Within Mashpee River Watershed up to +5, Summerwood Condos, etc +5)	VALUE TOTAL	RANK
							Points per Category		5	5	5	5	5	5	5	10	5	10	5	10	5	3	4	3	3	2	2	1	2	up to 10+	100	
GENERAL INFORMATION									WASTEWATER GENERATION						WATER SUPPLY			WATERSHED				INFRASTRUCTURE								OTHER		
{alpha#}	{Desc.}	{Poppy / Waquiot / Both}	{#}	{#}	{#}	{#}	{#}	{#}	WEIGHT						WEIGHT			WEIGHT				WEIGHT								WEIGHT	RANK	
H -Only	H. Without HS or MC or I/A	Waquoit	350	71,000	120,000	570	450	530	3	5	2	3	2	2	5	1	1	10	5	10	1	2	4	3	0	1	1	0	0	5	66	1
G	G. Mashpee Village	Waquoit	30	13,000	20,000	0	0	0	4	5	3	4	3	5	2	0	0	10	5	10	0	2	4	2	0	1	1	0	1	0	62	2
H	H. Areas south of Johns Pond including the High School	Waquoit	540	73,000	140,000	580	450	540	3	5	1	2	0	0	5	1	1	10	5	10	1	2	4	3	0	1	1	0	0	5	60	3
S	S. West of Santuit Pond (south picking up neighborhoods west and south of Willowbend)	Popponessett	1,260	200,000	260,000	1,900	1,400	1,700	4	5	2	2	1	2	3	1	1	8	0	7	1	1	4	3	0	0	2	0	1	6	54	4
P-only	P Without Mashpee Commons/South Cape/Windchime Point/I/A	Both	840	130,000	220,000	700	480	650	3	4	2	2	2	2	2	0	1	10	0	8	0	2	4	3	1	1	1	1	1	4	54	4
P1	Subset of P (north of Nathan Ellis)	Popponessett	420	72,100	110,000	330	220	320	4	4	2	2	2	2	1	0	1	9	0	9	0	1	4	3	0	1	2	0	1	5	53	6
J-only	J. Without Southport	Waquoit	80	140	50,000	10	0	10	1	3	1	5	1	5	0	0	0	10	5	10	0	2	4	3	0	2	1	0	0	0	53	6
S1	Subset of S (south of Falmouth Rd)	Popponessett	400	67,000	89,000	630	430	540	4	4	2	2	2	2	1	0	1	10	0	7	0	0	3	3	1	0	2	0	2	6	52	8
N	N. Steeplechase	Popponessett	20	4,200	4,100	30	30	30	5	5	2	2	2	2	4	0	0	7	0	9	0	2	2	2	0	1	1	0	1	5	52	8
P	P. Area around Mashpee Rotary north along Great Neck Road	Both	1,130	190,000	370,000	730	490	670	3	3	2	3	0	0	2	0	1	10	0	8	0	2	4	3	1	1	1	1	1	4	50	10

Matrix evaluation and summary of findings (cont.)

- Matrix Evaluations:
  - High Priority Areas in **RED** and **PINK**
  - Medium Priority Areas in **YELLOW**
  - Lower Priority Areas in Greens (**LIGHT** and **DARK**)

- With and without shellfish



Recommended plan components

Source Removal	Direct Environmental Mitigation	Land Management Strategies

• Wastewater Management
  • Regional facilities (JBCC)
  • New facilities
  • Improvements to existing private WWTF
  • Onsite systems
• Stormwater Management
  • BMPs
• Fertilizer Management
  • Bylaws
	• Shellfish Aquaculture
	  • Popponesset Bay (and associated embayments)
	  • Jehu Pond
	  • Hamblin Pond (including Great and Little River)
	• Other adaptive approaches
		• Landuse /zoning
		• Open space
		• Recharge and water resource sites
		• Seasonal/Year round use

Summary of Recommended Plan approach

Plan Components

- Shellfish
- New WWTF
  - Site 4 (treatment and recharge)
- Existing WWTFs
  - Mashpee Commons and Wampanoag WWTF
  - Joint Base Cape Cod (JBCC)
- Quashnet/Moonakis River evaluation
- Long-term monitoring, modeling and reporting of water quality

Balance of TMDL compliance depends on shellfish performance.

- Potential new WWTF (Site 6) and recharge sites (New Seabury/Willowbend)
- Improvements/modifications (Existing WWTFs)
- Continued Town coordination (Sandwich, Falmouth, Barnstable)
- Maintain a level of existing onsite systems
- Cape Cod Commission 208 planning and adaptive management

Implementation schedule

The implementation is envisioned in the following three categories:

•**Short-Term Initiatives**: 2015-2016

•**Phase 1 Implementation (5 Year):** approximately 2017 to 2021

•**Long-Term Implementation and Adaptive Management:** 2022 to 2041 and beyond

Plan outlines five “major” phases

Implementation

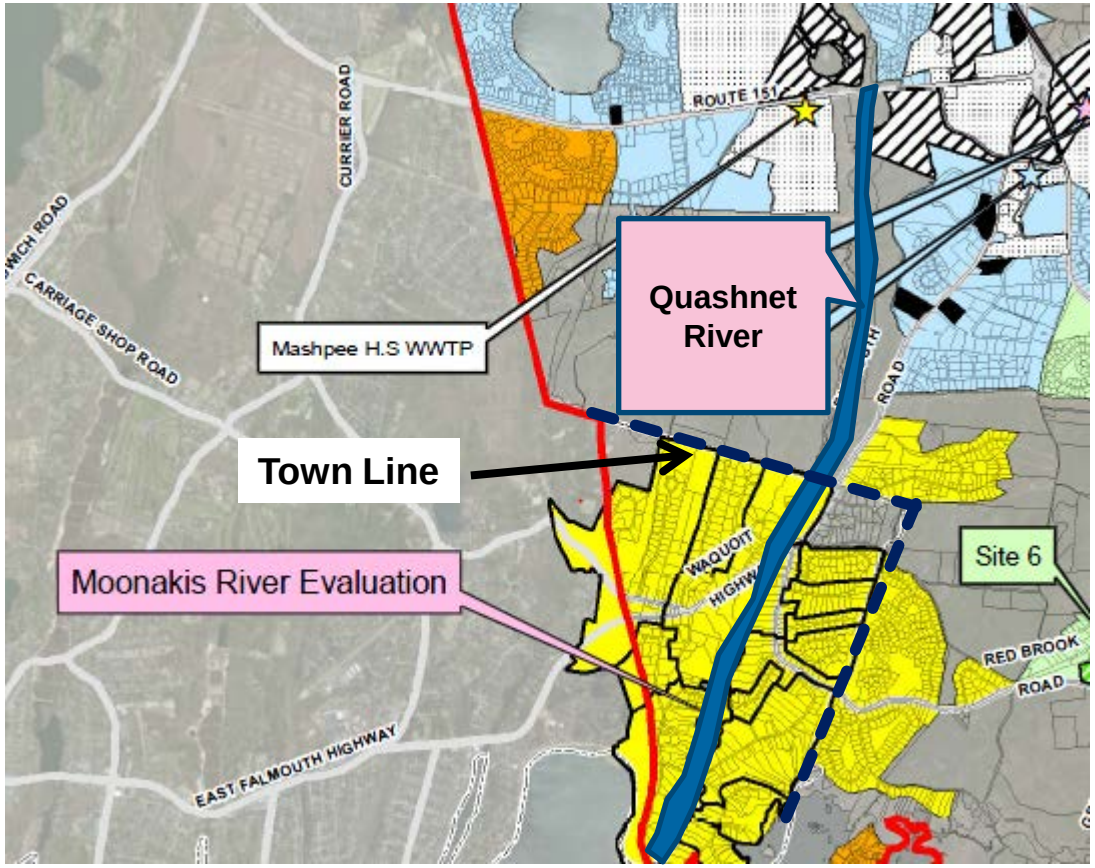
- Short term and start of Phase 1
  - Watershed permit(s)/ MOU/IMAs with neighbors
  - Feasibility studies
    - Quashnet/Moonakis River
    - WWTFs
  - Shellfish aquaculture/propagation/restoration

Implementation watershed permit

- Development of draft watershed permit
  - Discussions with Sandwich and Barnstable on potential (MOUs/IMAs)
  - Nitrogen load allocation
    - Pilot Project method
    - CCC 208 method
    - WNMP method
    - Comparison of each
  - Nitrogen trading potential
  - Sharing of resources

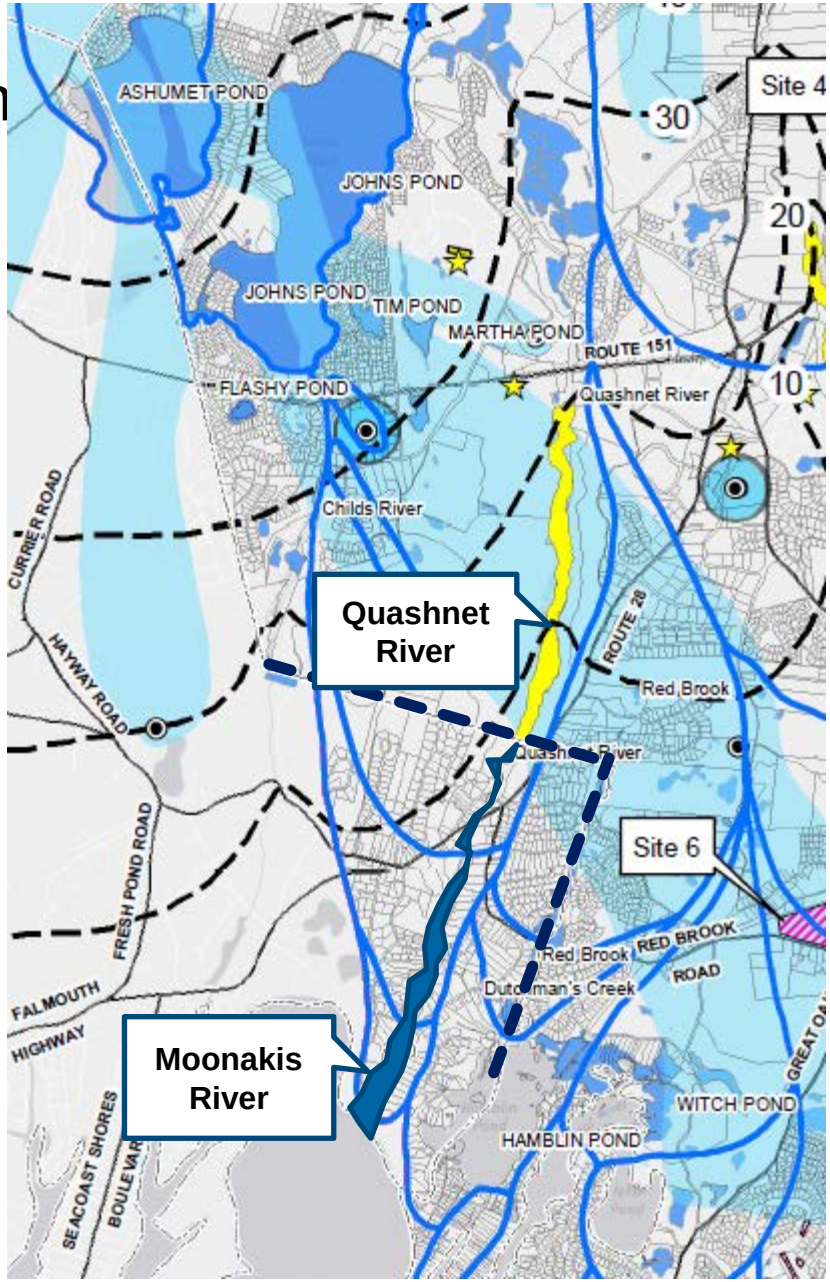
Quashnet Moonakis Evaluation

- SMAST Project
  - Joint funding (Falmouth and Mashpee)
- Quashnet/Moonakis River flushing
  - Improved flushing to reduce nitrogen
  - Parallel evaluation to consider shellfish and finfish restoration
- Data currently has been collected
- Final report anticipated Spring 2017



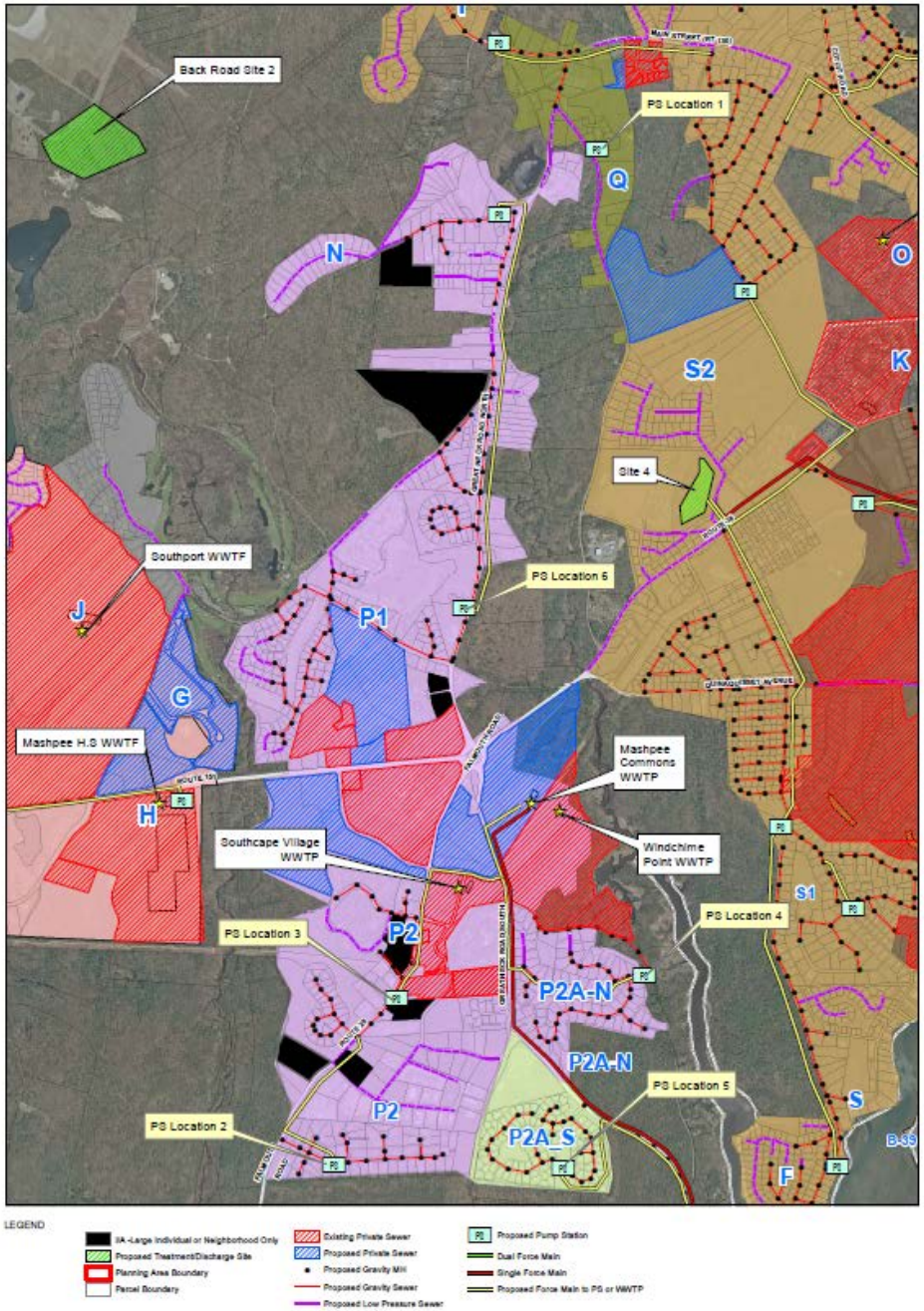
Quashnet Moonakis Evaluation

- Tide gages for volume/hydrodynamic confirmation
  - 6 gages at 4 locations
  - Lunar cycle
- Water quality sampling
  - 3 times (June, July, August)
  - Tidal nutrient flux between pond and estuary
- Tidal volume
  - 6 months (summer to fall)
- Sediment cores
  - 12 cores (summer)
- Bathymetric survey



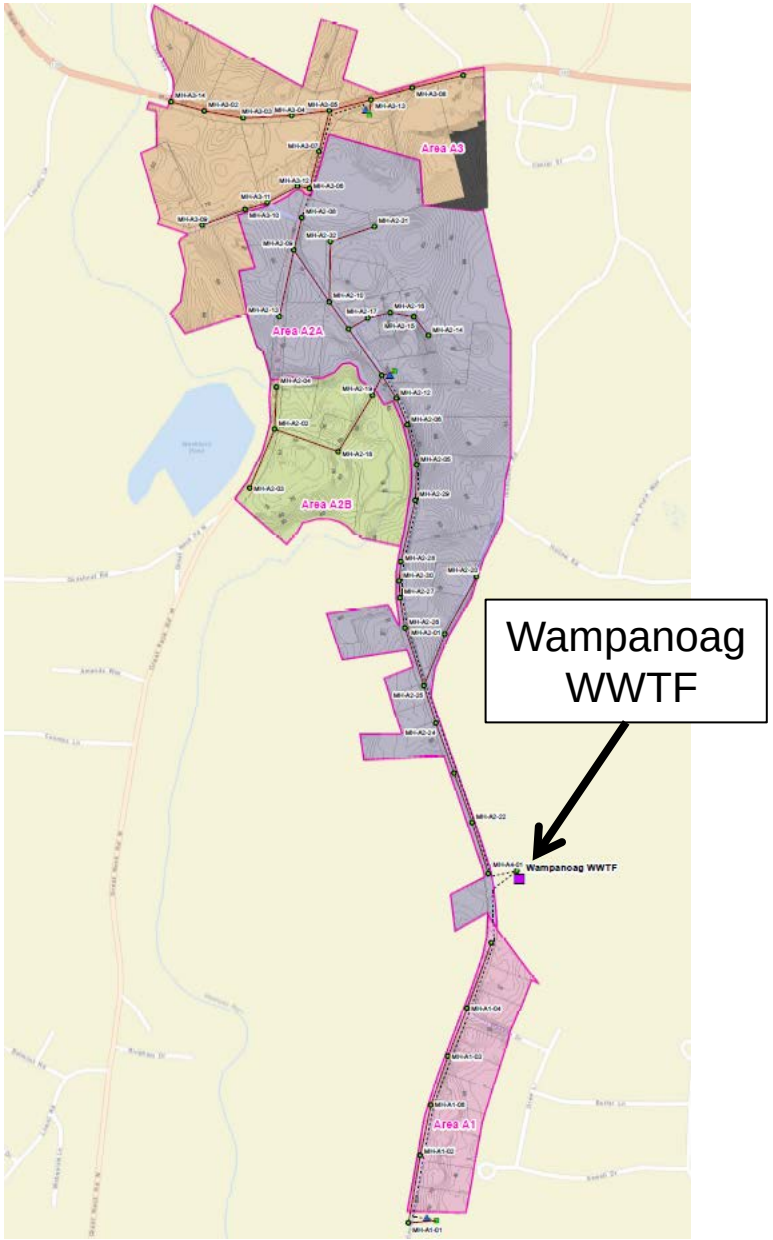
WWTF evaluations

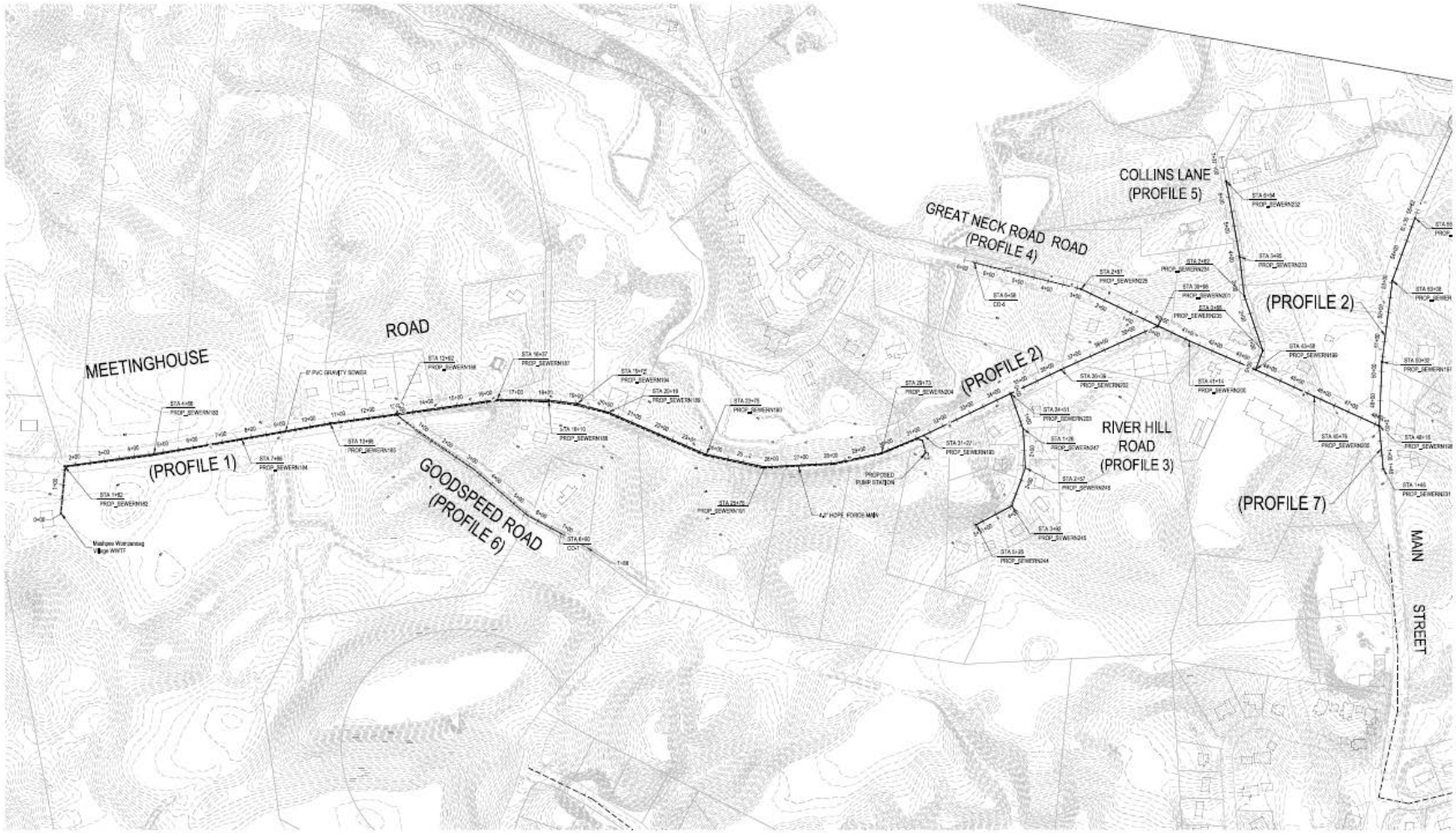
- Treatment capacity evaluations
  - Wampanoag WWTF
  - Mashpee Commons WWTF
- Collection system capacity and routing
- Pumping station locations
- Review of nitrogen impacts



Wampanoag

- Private facility – constructed during ARRA program (2011)
- Initially planned for 2 phases
- Constructed full plant
- Currently no connections
- WWTF
  - 39,999 gpd design
  - RBC with denitrification
  - Subsurface leaching
  - 30/30/10 permit
  - Nitrogen offset capacity 25,000 gpd





MEETINGHOUSE ROAD- KEY PLAN

SCALE 1" = 150'

No	Revision	Drawn	Job Manager	Project Director	Date
0	FOR CONSTRUCTION	JJO	JJG		

Note: * indicates signatures on original issue of drawing or last revision of drawing.

SCALE 1"=5' AT ORIGINAL SIZE — SCALE 1"=20' AT ORIGINAL SIZE

NOTES: UNDERGROUND FACILITIES, STRUCTURES, AND UTILITIES HAVE BEEN PLOTTED FROM AVAILABLE SURVEYS AND RECORDS, AND THEREFORE THEIR LOCATIONS MUST BE CONSIDERED APPROXIMATE ONLY. THERE MAY BE OTHERS, THE EXISTENCE OF WHICH IS PRESENTLY NOT KNOWN. ANYONE USING UTILITY INFORMATION AND DATA PROVIDED HEREIN SHALL CALL DIG SAFE AT 811 SEVENTY TWO (72) HOURS, 3 BUSINESS DAYS IN ADVANCE TO VERIFY THE LOCATION OF UTILITIES PRIOR TO START OF CONSTRUCTION.

GHD Inc.
1545 Iyannough Road, Hyannis Massachusetts 02601 USA
T 1 774 470 1630 F 1 774 470 1631
E hyannis@ghd.com W www.ghd.com

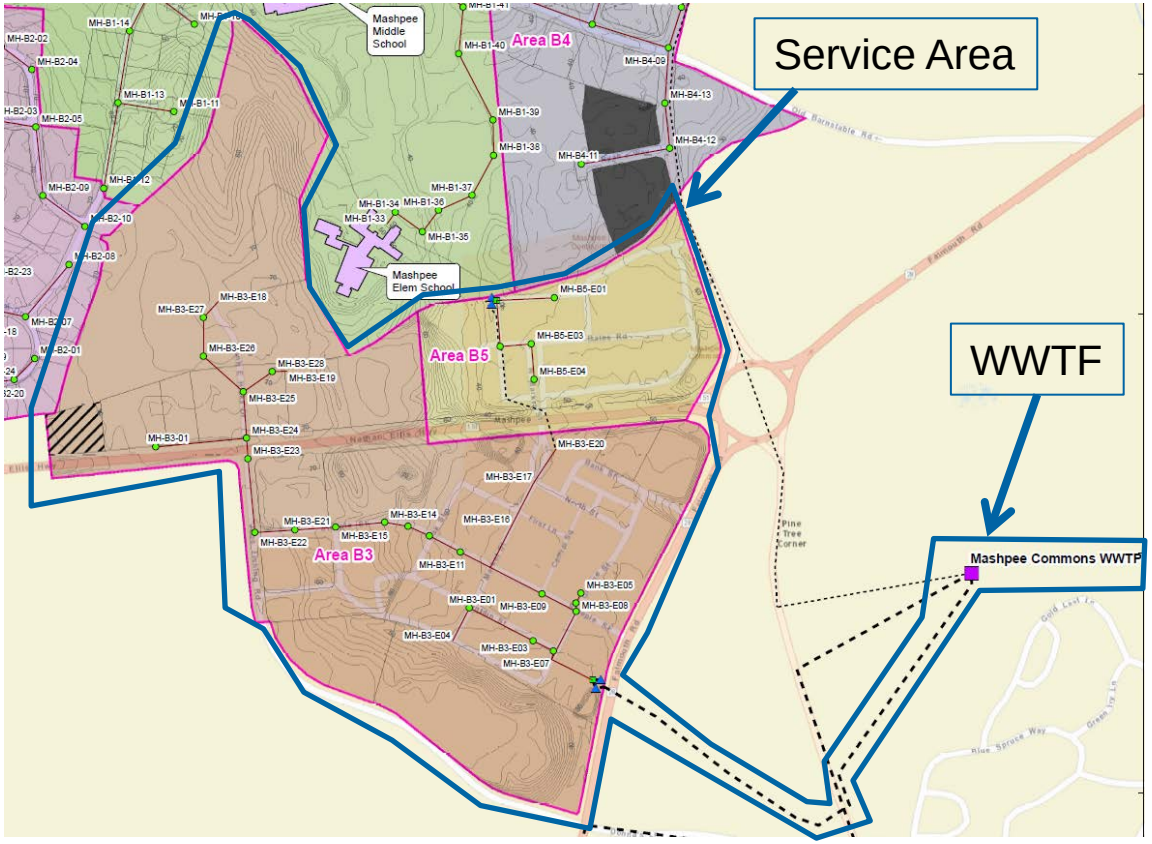
Drawn	J. O'BRIEN	Designer	J. O'BRIEN
Drafting Check	JDF	Design Check	JJG
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing shall not be used for Construction unless Signed and Sealed For Construction	

Client: TOWN OF MASHPEE, MASSACHUSETTS
Project: POPPONESSETT BAY EVALUATION
Title: KEY PLAN
Contract No.
Original Size: Arch D
Drawing No: 111-10987-C25
Rev: 0

Mashpee Commons

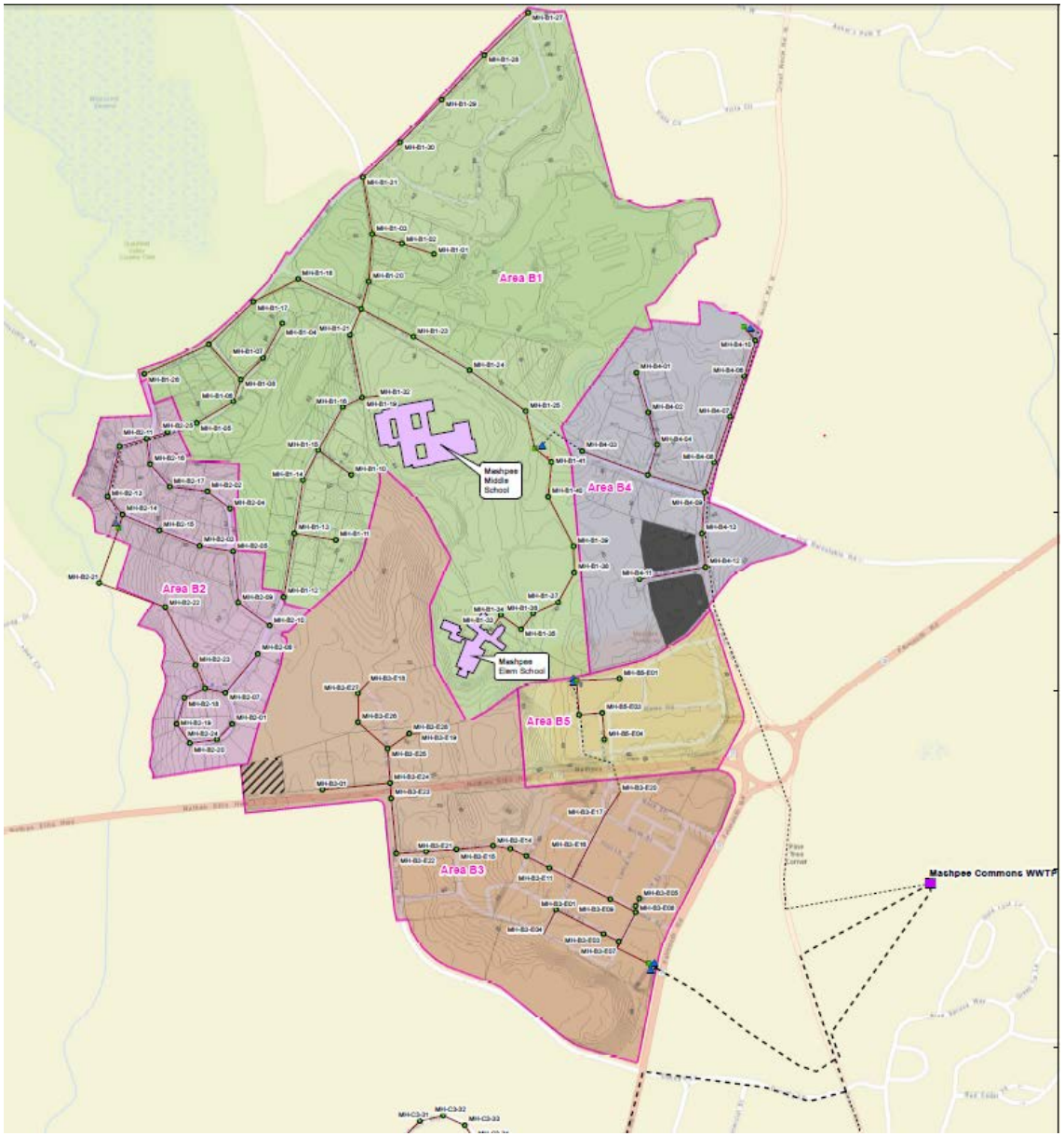
- Private facility – recently upgraded
- Initially planned for 4 phases
- Currently serves Mashpee Commons and several Town buildings

- WWTF
  - 180,000 gpd design
  - MBR with denitrification
  - open sand beds
  - 30/30/10 permit

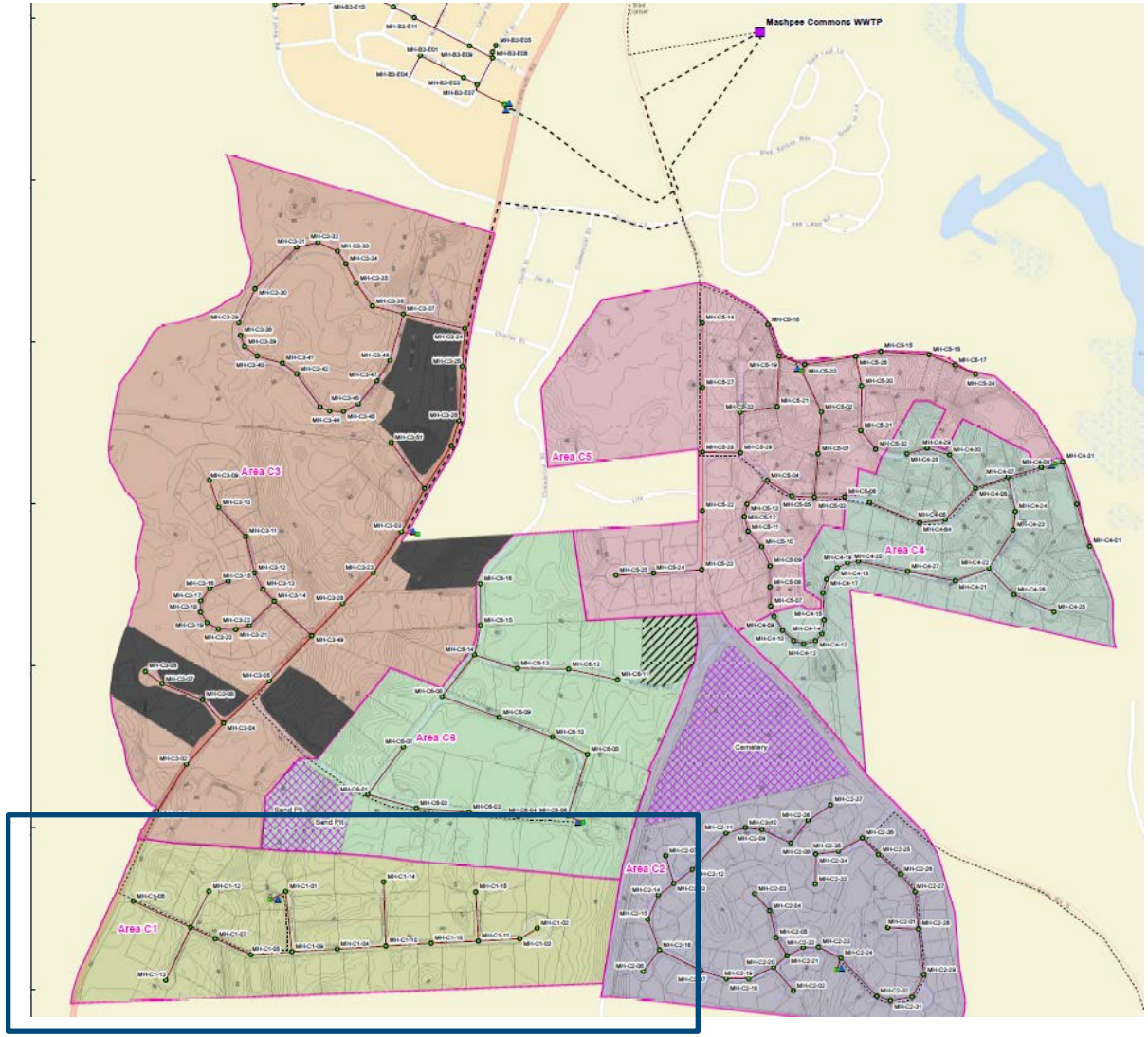


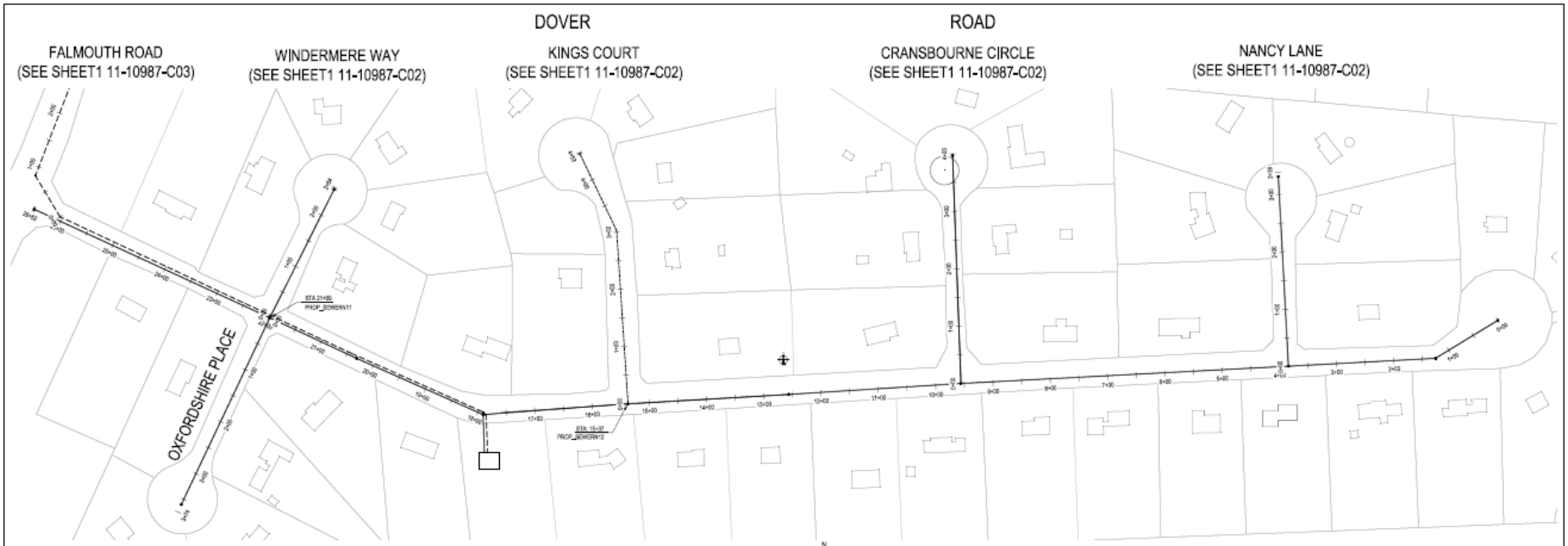
Extensions

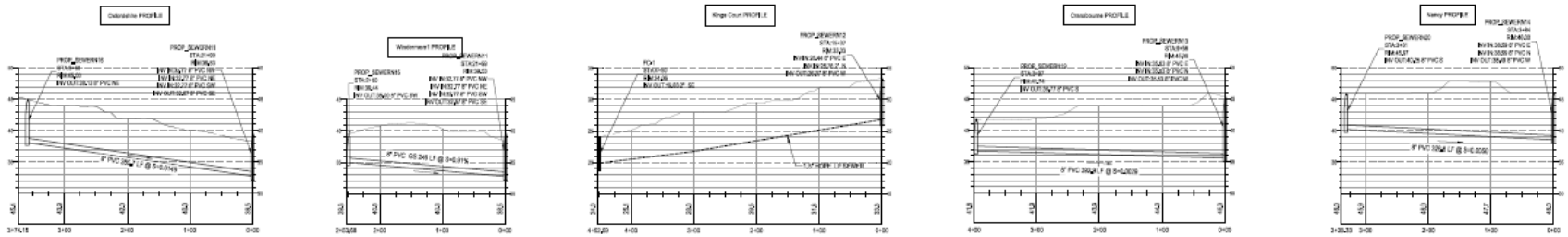
- Evaluating
  - Connection of 2 schools
  - Adjacent property connections
- Phased development of Mashpee Commons
  - Existing system with two pumping stations
  - Currently serving several municipal facilities



Development of plans and profiles







DOVER ROAD - PROFILE

SCALE HOR: 1" = 80'
VERT: 1" = 5'

0	FOR CONSTRUCTION	JJO	JJG		
No	Revision Note * Indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date

SCALE 1"=5' AT ORIGINAL SIZE

SCALE 1"=20' AT ORIGINAL SIZE

NOTES: UNDERGROUND FACILITIES, STRUCTURES, AND UTILITIES HAVE BEEN PLOTTED FROM AVAILABLE SURVEYS AND RECORDS, AND THEREFORE THEIR LOCATIONS MUST BE CONSIDERED APPROXIMATE ONLY. THERE MAY BE OTHERS, THE EXISTENCE OF WHICH IS PRESENTLY NOT KNOWN. ANYONE USING UTILITY INFORMATION AND DATA PROVIDED HEREIN SHALL CALL DIG SAFE AT 811 SEVENTY TWO (72) HOURS, 3 BUSINESS DAYS IN ADVANCE TO VERIFY THE LOCATION OF UTILITIES PRIOR TO START OF CONSTRUCTION.

GHD Inc.

1545 Iyannough Road, Hyannis Massachusetts 02601 USA
T 1 774 470 1530 F 1 774 470 1531
E hyannis@ghd.com W www.ghd.com

Drawn	J. O'BRIEN	Designer	J. O'BRIEN
Drafting Check	JDF	Design Check	JJG
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing shall not be used for Construction unless Signed and Sealed For Construction	

Client: TOWN OF MASHPEE, MASSACHUSETTS
Project: POPPONESSETT BAY EVALUATION
Title: DOVER ROAD - PLAN & PROFILE 2
Contract No.
Original Size: Arch D
Drawing No: 1116-10987-C02
Rev: 0

(SEE DWG 08-15251-C04)

Goals

- Identification of available capacity relative existing performance
- Preliminary design of service areas
- Nitrogen loading impacts based on adjustments in collection areas
- Suggestions on maximizing use of existing facilities

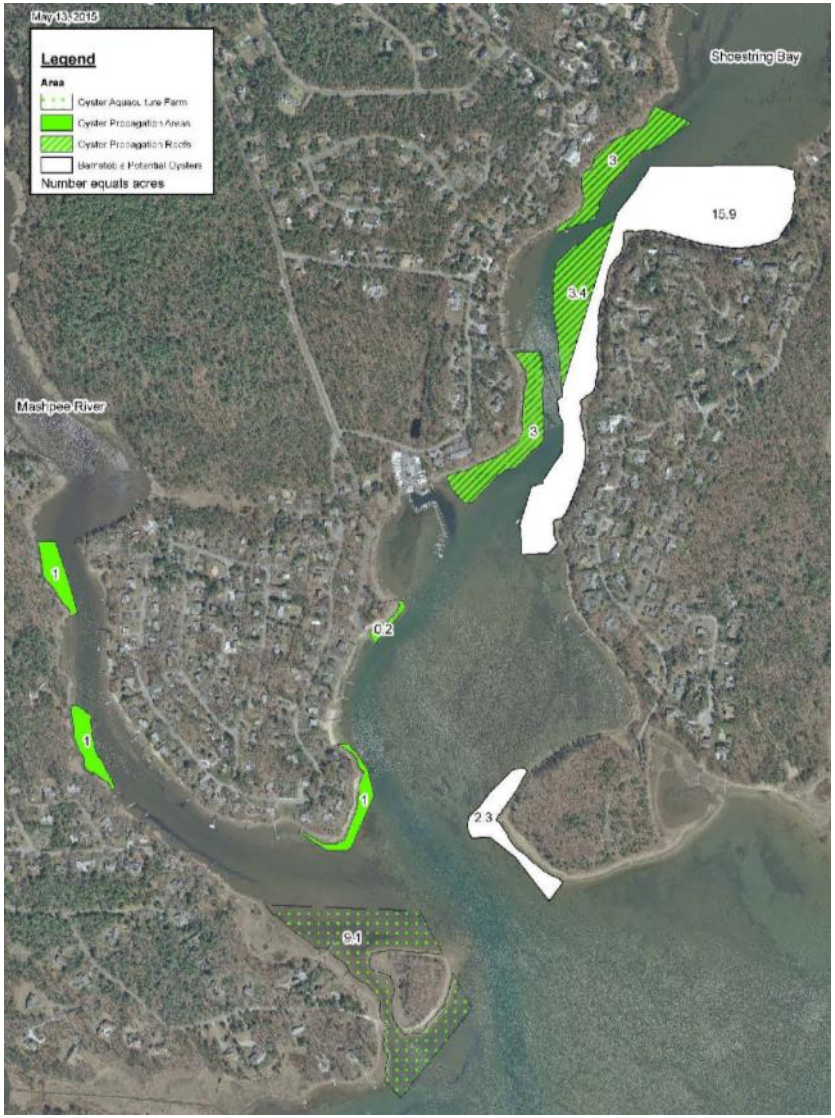
Implementation shellfish

- Oysters
  - Mashpee River
  - Shoestring Bay
- Quahogs
  - Little River/Hamblin Pond
  - Great River/Jehu Pond
  - Ockway Bay/Popponesset Bay

Implementation shellfish – oysters

- Mashpee River/Shoestring Bay
  - ~ 4,500 bags of oyster seed ordered
  - 2,500 bags grown in trays
  - Joint funding effort Town and Tribe
- Oyster bed restoration – Shoestring Bay – 2,000 bags (Wampanoag)
- Conservation Commission approval of oyster bed restoration

SC20 oyster propagation areas



Implementation shellfish - quahogs

- Great River/Jehu Pond/Little River/Hamblin Pond
  - 10 million quahog seed (2mm) – transitioned to grow from smaller seed
  - Reconstruction of Little River Town Dock with seed upwellers
  - 2 upwellers
  - 1 inch growth (change from purchase to grown)
    - Avoid possible disease in Cape Cod Bay
    - Cost savings

SC16 & SC19
quahog restoration areas

Implementation shellfish - future

- 2017 Goals
  - Increase facilities and seeding
  - Town funding approved for 2017
  - Wampanoag USEPA funding
- 2018 Goals
  - Full implementation of program

Implementation shellfish - staffing

- Department and Personnel
  - Reconfigured existing structure
  - New Natural Resources Department
  - Hiring new staff
    - Shellfish and water quality technician
    - Waterways assistant
    - Staff goal of 5+

Implementation shellfish - controls

- Predators
  - Green crabs
- Area management
  - Closed area rotation
  - 3 year periods
  - Annual harvests
  - BOS approvals required

Implementation shellfish - monitoring

- Monitoring
  - Collaborative effort with Town, Wampanoag Tribe and Umass Dartmouth/SMAST
  - Summer sampling protocols used as part of MEP
  - Deployed meters in Little River/ Mashpee River and Popponesset Bay in addition to new meter for Shoestring Bay (funded by Tribe)
  - Water samples collected monthly for lab analysis

Additional Information

- Available at: www.mashpeewaters.com

hat's New

etings & News

anning Area Communities

vn of Mashpee
vn of Barnstable
vn of Falmouth
vn of Sandwich

nks

shpee Environmental Coalition
pe Cod Commission
quoit Bay Reserve
pe Cod Groundwater Guardian
ssachusetts Estuary Project
ssDEP TMDLs

Mashpee
Watershed Nitrogen Management Plan

Welcome to the Town of Mashpee's **Watershed Nitrogen Management Plan (WNMP)** webs
As a community, we treasure Mashpee's beautiful coastal ponds and ***estuaries***, yet we
responsible for their poor water quality. Excess ***nutrients*** – ***nitrogen*** , in particular – come fr
septic systems and wastewater treatment plants, surface runoff after rain storms or snow m
lawn fertilizer, stormwater drainage system discharges, and other sources. Nitrogen is presen
the environment naturally; however, in excess, it is considered a pollutant.

In response to long-standing concerns regarding nitrogen, Mashpee initiated the WNMP in 19
The project will provide an environmentally and economically sound plan for nitrogen reduction
wastewater treatment. It will recommend areas appropriate for discharging treated wastewater
the ground. The project will culminate in a recommended plan to reduce the Town's nitro
contributions - and those of its neighbors in the Popponesset Bay and Waquoit Bay ***watershe***
to coastal waters and to evaluate options for restoring these wonderful resources. By proacti
addressing nutrient issues on its own, the Town hopes to avoid regulatory enforcement actions
state or county agencies or the courts.

To learn more about the problem with nutrients and how you both contribute to it and can be
of the solution, please visit the **What's the Problem** page. Links are provided throughout the
to the **Documents & Resources** page where you can find definitions of commonly used wo
and acronyms.

We hope you find this website helpful and look forward to your participation in the Town's planr

Questions & Discussion