

Town of Nantucket Sewer Action Plan



Massachusetts Estuaries Program Update

Workshop Number 3 Presentation
August 10, 2011



Wastewater Action Planning Project Team

Town of Nantucket

Board of Selectmen
Town Administration
Department of Public Works
Board of Health
Marine and Coastal Resources Department

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Massachusetts Estuaries Reports (MEP)

- Nantucket Harbor – Completed
 - Total Maximum Daily Load (TMDL) Established
 - Based on MEP Thresholds
- Sesachacha Pond – Completed
 - TMDL Established
 - Based on MEP Thresholds
- Madaket Harbor / Long Pond – Completed
 - TMDL In Process – Thresholds Established
 - Draft Report Released
 - Public Hearing



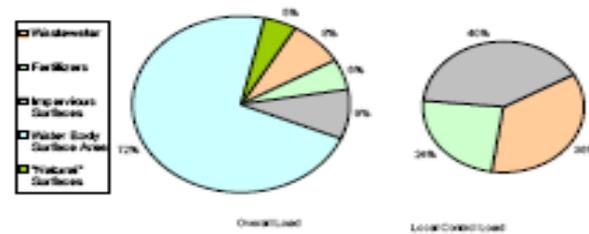
Nantucket Harbor MEP



Nantucket Harbor Delineations



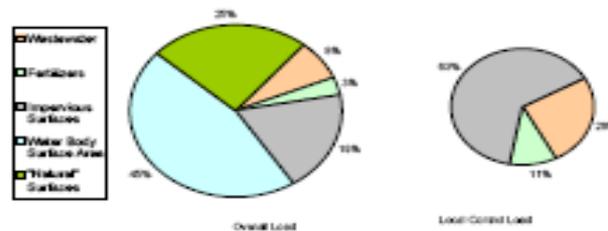
Nantucket Harbor Estuary System Nitrogen Load



a. Nantucket Harbor System Overall



b. Head of the Harbor Subwatershed



c. Polix Subwatershed



Model of Nantucket Harbor – Brant Point Tide Rotation

MASSACHUSETTS ESTUARIES PROJECT

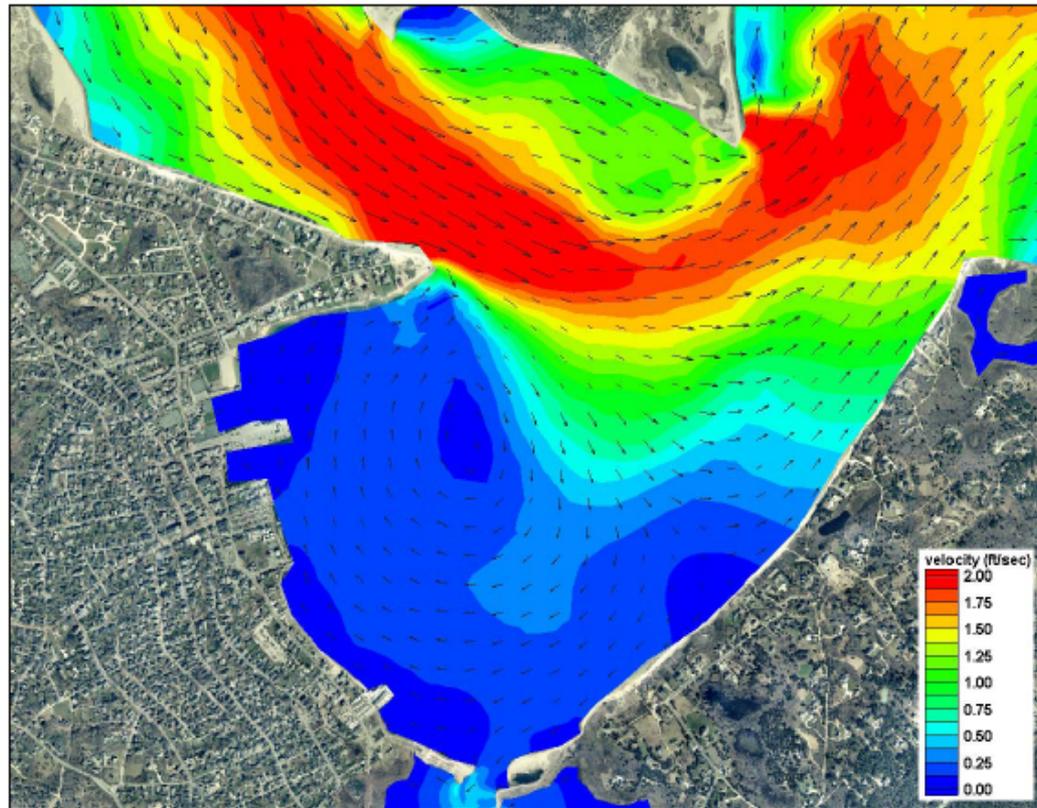


Figure V-26. Close-up of Nantucket Harbor, showing output from the hydrodynamic model at a single time step, where a recirculation eddy (or gyre) has set up on the south side of Brant Point.



Nantucket Harbor Total Nitrogen Concentrations – MEP Report

MASSACHUSETTS ESTUARIES PROJECT

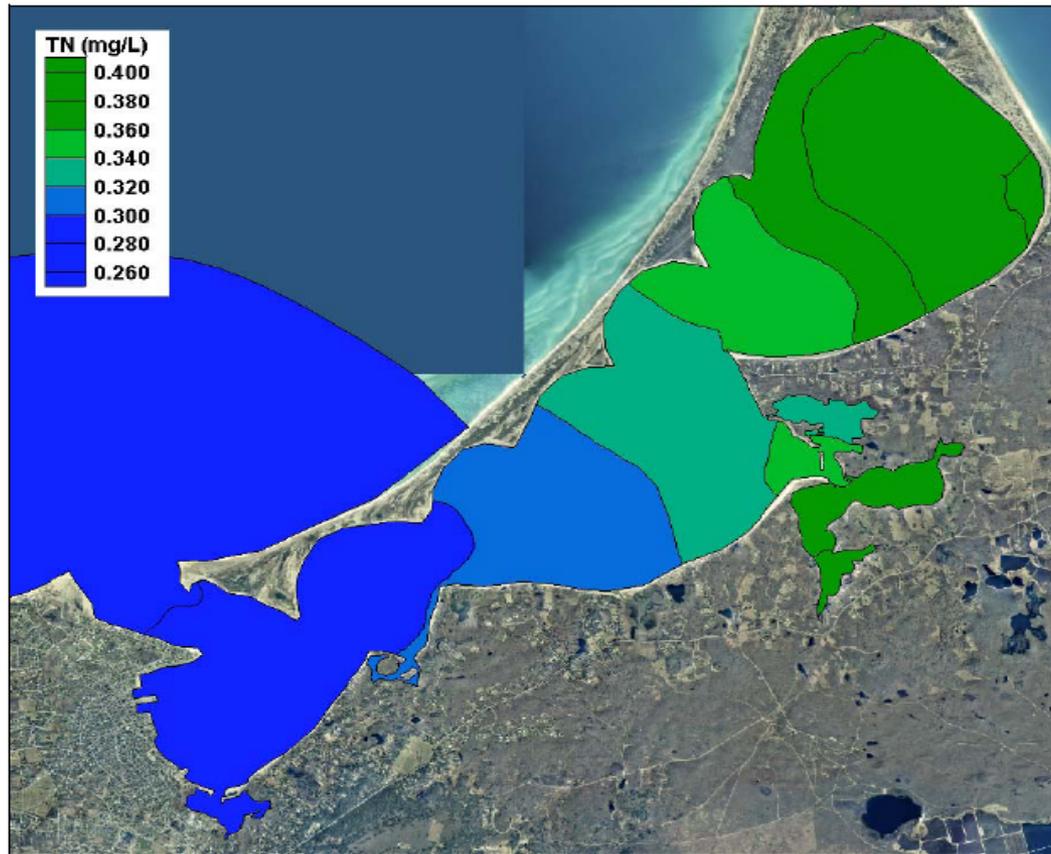


Figure VI-8. Contour plot of modeled total nitrogen concentrations (mg/L) in the Nantucket Harbor system, for projected build-out scenario "A" loading conditions.



Nantucket Harbor Nitrogen Load Rates, Thresholds and Targets

Embayments	Present Watershed Load kg/day	Target Threshold Watershed Load kg/day	Difference
Head of Harbor	1.86	0.79	1.07
Quaise Basin	2.12	1.14	0.98
Town Basin	12.22	10.71	1.51
Polpis Harbor	3.52	2.18	1.34
Total	19.72 kg/day	14.89 kg/day	4.9 kg/day



Nantucket Harbor Septic Thresholds

MEP REPORT THRESHOLDS – SEPTIC LOADS

Table VIII-2. Comparison of sub-embayment watershed **septic loads** (attenuated) used for modeling of present and threshold loading scenarios of the Nantucket Harbor system. These loads do not include direct atmospheric deposition (onto the sub-embayment surface), benthic flux, runoff, or fertilizer loading terms.

sub-embayment	present septic load (kg/day)	threshold "A" septic load (kg/day)	Threshold "A" septic load % change	threshold "B" septic load (kg/day)	Threshold "B" septic load % change
Head of the Harbor	0.705	0.141	-80.0%	0.000	-100.0%
Polpis Harbor	0.435	0.087	-80.0%	0.000	-100.0%
Quaise Basin	0.392	0.078	-80.0%	0.000	-100.0%
Town Basin	5.194	0.000	-100.0%	0.000	-100.0%
System Total	6.726	0.306	-95.4%	0.000	-100.0%



Final MEP Recommendations

- 2004 CWMP Update to Incorporate
- Nantucket Harbor TMDL
 - Plan to Meet Thresholds
- Sesachacha Pond TMDL
 - Plan to Meet Thresholds
- Madaket Harbor / Long Pond TMDL
 - Once Completed, Plan to Meet Thresholds



What's Next?

- Incorporate the MEP Supplemental Data to CWMP Update
- Review Soon to be Released Madaket Harbor and Long Pond TMDL From MEP
- Develop Plans to Meet Thresholds – Incorporate in CWMP update



Massachusetts Estuaries Program Update



Questions and Answers



Massachusetts Estuaries Program Update



Supplemental Slides



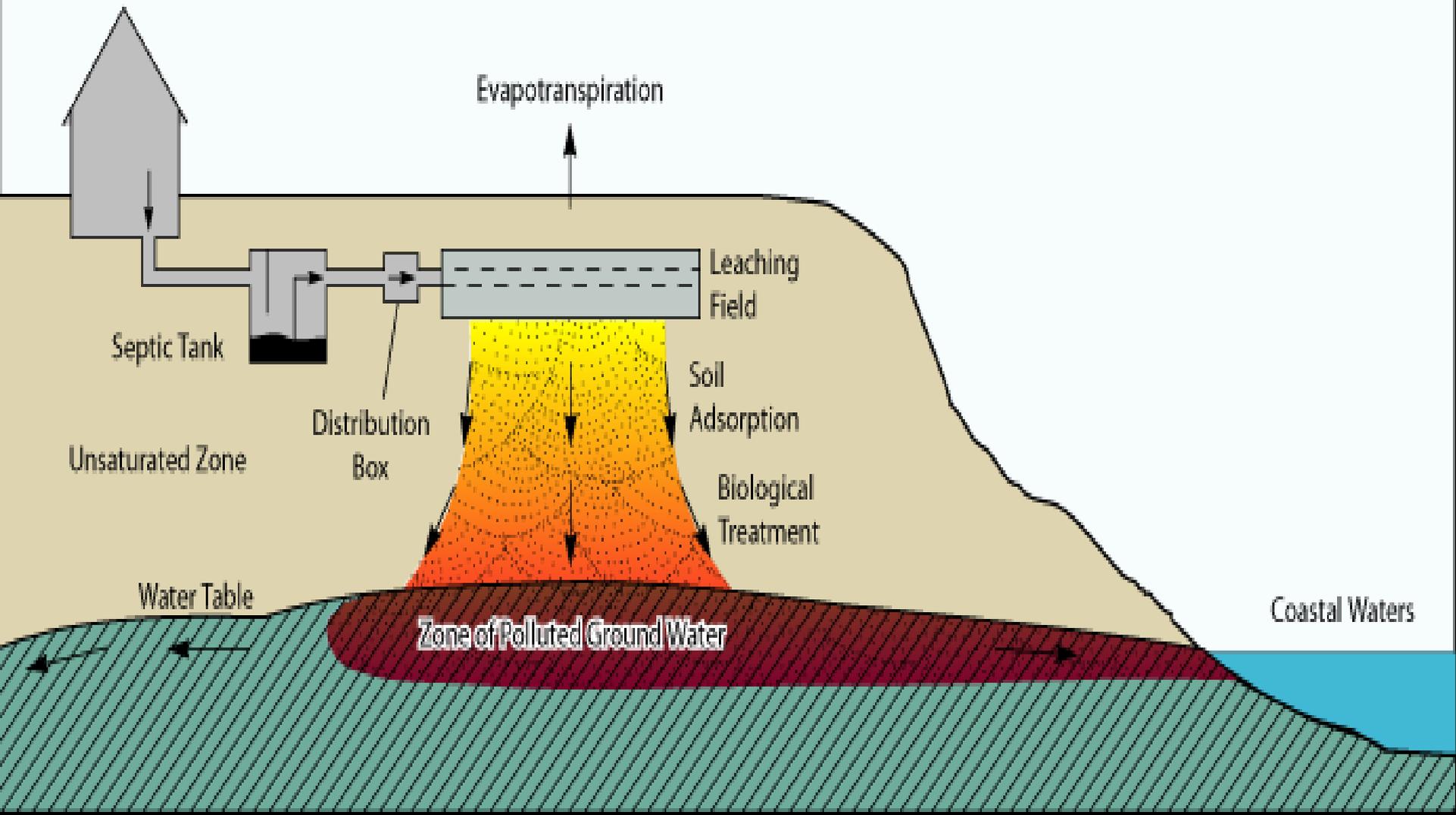


2 Total Nitrogen TMDLs

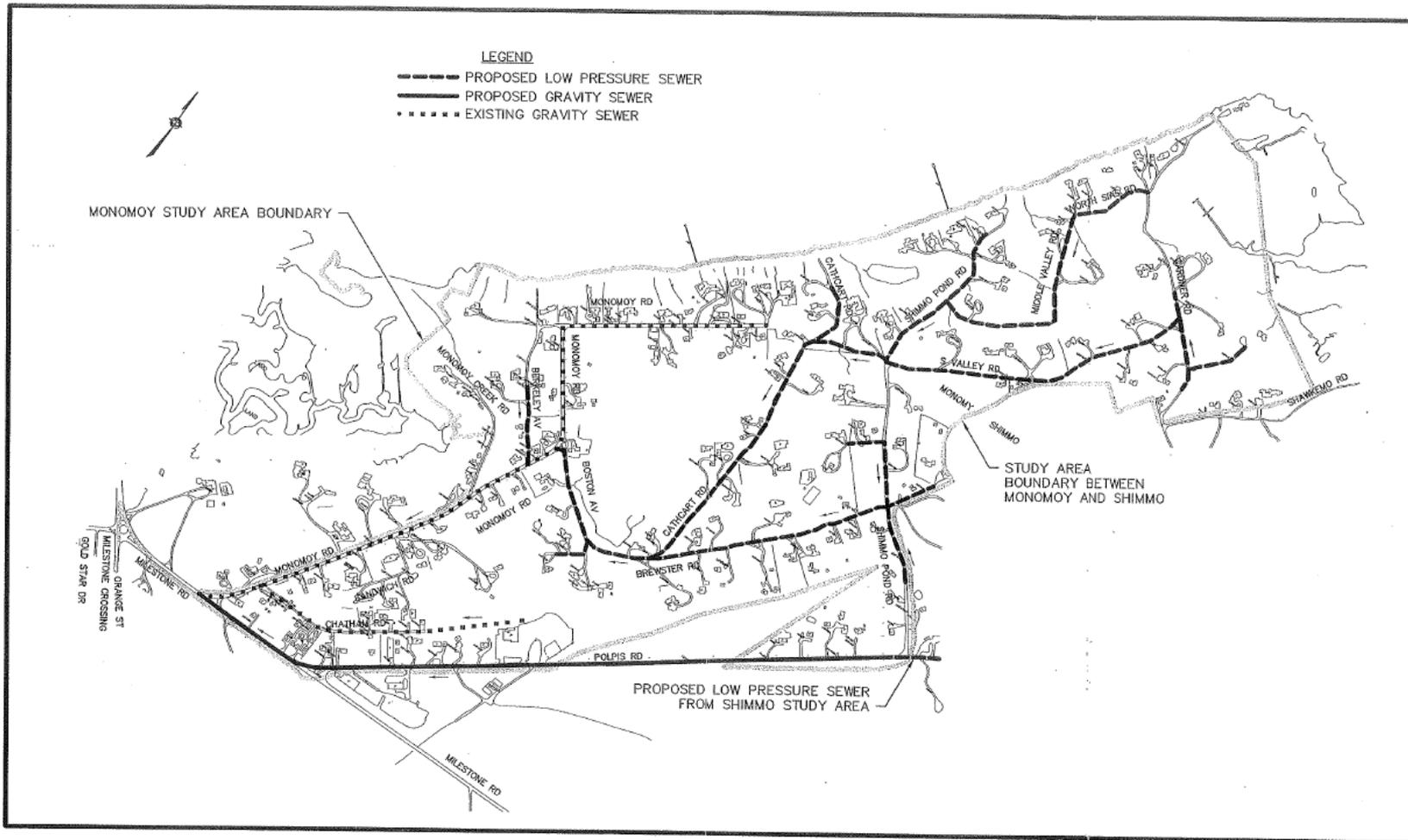
Embayment	Description	Sub-Embayment	TMDL (kg/day)
Nantucket Harbor Water Body Segment # MA97-01_2004	Determined to be impaired for nutrients, pathogens, and noxious aquatic plants by MassDEP.	Head of Harbor	23
		Quaise Basin	64
		Town Basin	25
Polpis Harbor Water Body Segment # MA97-26_2004	Determined to be impaired for nutrients, other habitat alterations, and pathogens by MassDEP.		31



TYPICAL ON-SITE HARBOR WATERSHED WASTEWATER DISPOSAL SYSTEM



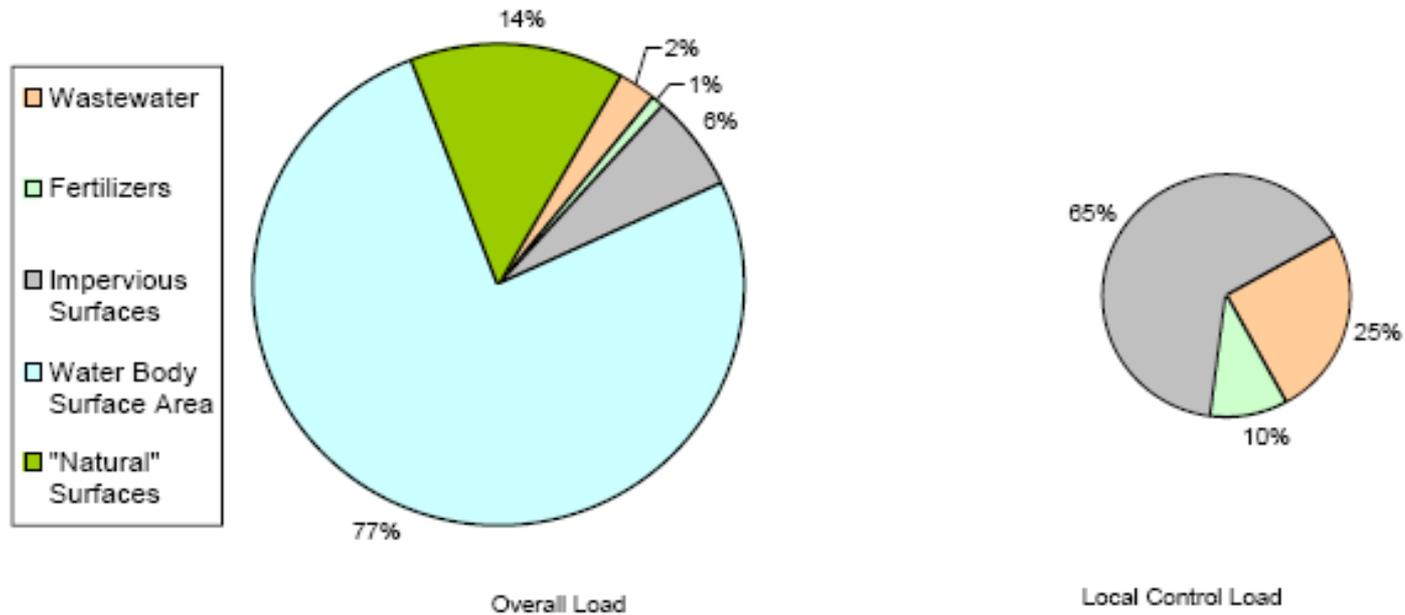
Nantucket Harbor MEP



Sesachacha Pond MEP



Sesachacha Pond Estuary System Nitrogen Load



Sesachacha Pond TMDL

A similar improvement in the TN concentration in the following year was found, with the simulated spring level set to 0.82 mg/L. This starting concentration was derived using the difference in the TN concentrations computed at the end of the 2003 simulations with and without the mid-summer breach. This difference was determined to be 0.42 mg/L, and was assumed to carry through to the simulated 2004 spring. This 0.42mg/L difference was subtracted from the measured 2003 pre-breach concentration of 1.24 mg/L to arrive at the modified starting concentration of 0.82 mg/L.. Simulation results from the second consecutive year with a mid-summer breach show that the TN concentration never rises above 1.00 mg/L, and that the average TN concentration is 0.64, which is a 0.13 mg/L improvement over average conditions computed for the 2003 season without a mid-summer breach.

Model results indicate that water quality improvements that may provide more stable environment for flora and fauna is possible with the addition of a successful mid-summer breach. Data indicate that openings as short as six days are sufficient to provide sufficient tidal flushing and raise salinity levels near 30 ppt. Pond salinity is a useful indicator of breach success, as opposed to the duration of the opening. With the mid-summer breach, it should be possible to maintain salinities above 25 ppt and TN concentrations below 1.00 mg/L.

A significant improvement in the nitrogen related health of Sesachacha Pond infaunal animal habitat would result from the above modeled addition of a mid summer opening. It would be possible to use the monthly monitoring data to indicate when the mid-summer breach should occur. The primary indicator would be when the pond salinity drops below 25 ppt. The secondary indicator would be when the pond TN concentration rises above 0.95 mg/L. If this strategy is followed in the future, the result would be year-round salinities above 22 ppt and TN concentrations below 1.00 mg/L. It is important to note that the modeled maximum and average TN levels are likely conservative estimates as they do not include potential reductions in the rate of sediment nitrogen regeneration often associated with the lowering of nitrogen enrichment of embayment waters.



Madaket Harbor MEP



Madaket Harbor Estuary System Nitrogen Load

MASSACHUSETTS ESTUARIES PROJECT

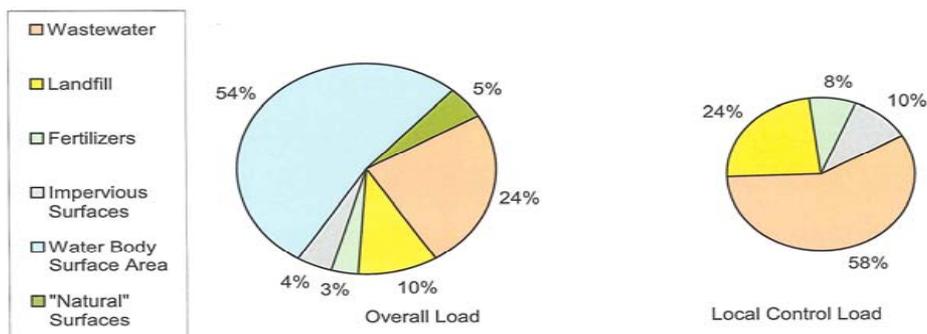


Figure IV-6. Land use-specific unattenuated nitrogen load (by percent) to the overall Madaket Harbor System watershed. "Overall Load" is the total nitrogen input within the watershed including atmospheric deposition to the estuary and nitrogen from natural surfaces (forests, grassland, etc), while the "Local Control Load" represents those nitrogen sources that could potentially be under local regulatory control.

Madaket Harbor and Long Pond Thresholds

Table VIII-2. Comparison of sub-embayment watershed septic loads (attenuated) used for modeling of present and threshold loading scenarios of the Madaket Harbor System. These loads do not include direct atmospheric deposition (onto the sub-embayment surface), benthic flux, runoff, or fertilizer loading terms.

sub-embayment	present septic load (kg/day)	threshold septic load (kg/day)	threshold septic load % change
Madaket Harbor	0.384	0.384	0.0%
Hither Creek	2.907	0.000	-100.0%
Madaket Ditch	1.510	1.510	0.0%
North Head Long Pond	0.071	0.071	0.0%
Long Pond	0.342	0.342	0.0%
System Total	5.214	2.307	-55.8%

Madaket Harbor and Long Pond TMDL - TBD



CWMP Needs Areas Matrix

TABLE 2D-2
CWMP/ESR
TOWN OF NANTUCKET, MASSACHUSETTS
RATING CRITERIA

CRITERIA NAME	DESCRIPTION	Madaket		Waters Landing		Coco		Somerset		Miscellaneous		Surfside		Tom Nevers Hill - Density	
		Number	Points	Number	Points	Number	Points	Number	Points	Number	Points	Number	Points	Number	Points
CRITERIA POINTS	Total Number of Lots	854		99		204		206		127		419		350	
Actual Failure 4	Total Number of Developed Lots	435		69		143		161		101		281		255	
Imminent Failure 3	Total Number of Unsewered Developed Lots	435		69		143		161		101		281		255	
High Likelihood of Imminent Failure 2	Number of Resales since 3/31/95	70		19		27		30		15		44		26	
Health/ Water Quality Issue 1	Number of Acres per Study Area	354		49		105		103		151		295		129	
	Number of Acre Feet for Developed Lots	232		26		143		103		197		363		63	
	No. of Acres of Severe Groundwater Limitation	117		10		27		7		8		49		28	
	Number of Acres of Severe Soil Limitation	86		26		178		96		149		112		61	
Actual Failure	3/31/95 to 1/99	31	124	4	16	8	32	21	84	8	32	21	84	2	8
	1972 to 3/31/95	74	296	2	8	10	40	8	32	6	24	27	108		0
	Adjusted Total based on Developed/Unsewered Developed Ratio	105	420	6	24	18	72	29	116	14	56	48	192	2	8
Imminent Failure	System within Zone 1 Aquifer Recharge Area	9	27		0	8	18	1	3		0	11	33		0
	System within 50 feet of Private Drinking Water Well	0	0		0		0		0		0	0	0		0
	System within 100 feet of Public Drinking Water Supply	0	0		0		0		0		0	0	0		0
	Developed Lots with Less than 1,000 sq. ft. of area per Bedrock	280	780	69	198	105	315	152	456	0	0	0	0	110	330
		289	807	69	198	111	333	153	459	0	0	11	33	110	330
High Likelihood of Imminent Failure	Lots with Severe Groundwater Limitation	130	260	14	28	11	22	8	16	3	6	20	40	54	108
	Systems Built before 1978 (Title 5)	281	962	1	2	43	96	13	26	15	30	72	144	2	4
	Lot Size less than or equal to 1/2 acre	249	498	62	124	34	68	100	200	2	4	52	104	67	134
	Lots with Severe Soil Limitation	95	190	39	78	72	144	103	206	51	102	46	92	121	242
	Pumpouts Greater than 2 times per year	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		752	1,504	113	226	160	320	224	448	71	142	190	380	274	548
Health/ Water Quality Issue	Density of Systems Greater Than 2 per Acre	435	435	69	69	0	0	161	161	0	0	0	0	255	255
	System within 100 feet of Surface Water Body, Wetlands or Streams	0	0	0	0	7	7	8	8	3	3	3	3	0	0
	System located within 100 Year Flood Plain	53	53	0	0	8	8	0	0	0	0	0	0	0	0
	System within Zone 8 Aquifer Recharge Area	0	0	0	0	0	0	0	0	0	0	28	28	0	0
	System within Harbor Watershed Line or 3,600' of Madaket Hill	435	435	34	34							31	31	255	255
		523	523	102	102	13	13	169	169	3	3	31	31	255	255
	Total Criteria Points for Study Area	3,654		690		738		1,162		201		636		1,141	
	Rating Criteria Points Per Developed Lot	8.40		8.09		5.16		7.40		1.59		2.26		4.67	
	RECOMMENDED AS A NEED AREA	YES		YES		NO		YES		NO		NO		NO	
	(Conventional Title 5 Systems Not Feasible for Majority of Study Area)														



CWMP Needs Areas Matrix

TABLE 2B-2 (Continued)
 CWMP/SEIR
 TOWN OF NANTUCKET, MASSACHUSETTS
 RATING CRITERIA

CRITERIA NAME	DESCRIPTION	In Newer, Low-Density		Seasonal		Outfall		Wastewater		Pocosmo		Polyps		Town	
		Number	Points	Number	Points	Number	Points	Number	Points	Number	Points	Number	Points	Number	Points
CRITERIA POINTS	Total Number of Lots	195		1,049		77		68		140		100		4,741	
Actual Failure	Total Number of Developed Lots	1,222		854		45		50		81		59		3,943	
Imminent Failure	Total Number of Unsewered/Developed Lots	1,222		1,227		45		50		81		59		890	
High Likelihood of Imminent Failure	Number of Rescues since 3/31/05	48		27		9		3		11		10		103	
Health / Water Quality Issue	Number of Acres per Study Area	653		1,012		68		61		45.7		583		1,922	
	Number of Net Acres for Developed Lots	3.74		349		45		5.1		29.7		395		1,333	
	No. of Acres of Severe Groundwater Limitation	31		291		22		2.9		16.2		324		41.9	
	Number of Acres of Severe Soil Limitation	295		479		19		9		16.3		371		1,076	
Actual Failure	3.0 19.5 to 19.99	13	52	3	1.2	7	28	3	1.2	6	24	10	40	43	172
	19.92 to 30.1 19.9	15	60	1.5	6.0	13	52	1.1	4.4	9	36	12	48	169	396
	Adjusted Total based on Developed/Unsewered/Developed Ratio	28	112	1.8	7.2	20	80	1.4	5.6	15	60	22	88	142.2	593
			1.12		376		80		5.6		60		88		2,516
Imminent Failure	System within Zone I Aquifer Recharge Area	0	0	2	6	0	0	2.8	8.4	0	0	0	0	0	0
	System within 50 feet of Private Drinking Water Well	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	System within 100 feet of Public Drinking Water Supply	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Developed Lots with Less than 10,000 sq. ft. of septic per Bedroom	0	0	2	6	21	83	2.1	8.3	6	24	6	18	60	180
								4.9	14.7		24		18		180
High Likelihood of Imminent Failure	Lots with Severe Groundwater Limitation	6	12	191	382	15	30	2.4	4.8	29	58	33	66	35.9	1,178
	Systems Still before 1978 (Title 5)	42	84	491	982	30	60	4.2	8.4	41	82	40	80	24.39	4,878
	Lot Size less than or equal to 1/2 acre	37	74	512	1,024	22	44	1.6	3.2	8	16	10	20	3,018	6,116
	Lots with Severe Soil Limitation	53	106	61	120	12	24	1.6	3.2	29	58	38	76	45.8	1,995
	Pumpouts Greater than 2 times per year	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		138	276	1,234	2,468	79	158	8.2	16.4	10.7	21.4	121	242	6,894	13,788
Health / Water Quality Issue	Density of Systems Greater Than 2 per Acre	0	0	127	127	0	0	0	0	0	0	0	0	89.0	890
	System within 100 feet of Surface Water Body, Wetlands or 34	5	5	2.9	2.9	28	28	3.3	3.3	27	27	80	80	44.7	447
	System located within 100 Year Flood Plain	2	2	1	1	1	1	1.3	1.3	8	8	16	16	65	65
	System within Zone II Aquifer Recharge Area	0	0	1.3	1.3	0	0	0	0	0	0	0	0	14.1	141
	System within Harbor Watershed Line or 3,000' of Nantucket Harbor	7	0	0	0	0	0	5.0	5.0	81	81	59	59	1,972	1,972
			7	170	170	29	29	9.6	9.6	11.6	11.6	135	135	3,535	3,535
	Total Criteria Points for Study Area		395		3,000		330		463		414		483		20,019
	Rating Criteria Points Per Developed Lot		3.24		4.52		7.33		9.26		5.11		8.19		5.09
	RECOMMENDED AS A NEED AREA		NO		NO		YES		YES		NO		YES		NO

(Conventional Title 5 System Not Feasible for Majority of Study Area)



CWMP Needs Areas Matrix

TABLE 2D-2 (Continued)
 CWMP 2030
 TOWN OF NANTUCKET, MASSACHUSETTS
 RATING CRITERIA

CRITERIA NAME	DESCRIPTION	Town - WPZ		Shimmo		Monomoy		Other		Number	Points	Number	Points	Number	Points	
		Number	Points	Number	Points	Number	Points	Number	Points							
CRITERIA POINTS	Total Number of Lots	743	284	284	284	283	283	2,539		0	0	0	0	0	0	
Actual Failure	Total Number of Developed Lots	524	137	137	137	134	134	818		0	0	0	0	0	0	
Imminent Failure	Total Number of Unsewered Developed Lots	315	137	137	137	149	149	812		0	0	0	0	0	0	
High Likelihood of Imminent Failure	Number of Resales since 3/31/95	37	21	21	21	19	19	154								
Health / Water Quality Issue	Number of Acres per Study Area	744	881	881	881	276	276	21,823		0	0	0	0	0	0	
	Number of Net Acres for Developed Lots	313	380	380	380	218	218	5,422		0	0	0	0	0	0	
	No. of Acres of Severe Groundwater Limitation	7	171	171	171	44	44	5,263		0	0	0	0	0	0	
	Number of Acres of Severe Soil Limitation	321	290	290	290	150	150	7,538		0	0	0	0	0	0	
Actual Failure	3/31/95 to 1999	23	92	9	36	17	68	60	240		0	0	0	0	0	
	1992 to 3/31/95	24	98	17	68	30	120	110	440		0	0	0	0	0	
	Adjusted Total based on Developed/Unsewered Developed Ratio	47	190	26	104	47	188	170	680	0	0	0	0	0	0	
			313		104		154		688		0		0		0	
Imminent Failure	System within Zone I Aquifer Recharge Area	0	0	0	0	0	0	10	30		0	0	0	0	0	
	System within 50 feet of Private Drinking Water Well	0	0	0	0	0	0	0	0		0	0	0	0	0	
	System within 100 feet of Public Drinking Water Supply	0	0	0	0	0	0	0	0		0	0	0	0	0	
	Developed Lots with Less than 10,000 sq. ft. of area per Bedrock	137	411	33	99	37	111	10	30	0	0	0	0	0	0	
			411		99		111		30		0		0		0	
High Likelihood of Imminent Failure	Lots with Severe Groundwater Limitation	5	10	27	54	29	58	197	394	0	0	0	0	0	0	
	Systems Built before 1978 (Title 5)	74	148	40	80	108	216	337	674		0	0	0	0	0	
	Lot Size less than or equal to 1/2 acre	229	458	4	8	29	58	73	146		0	0	0	0	0	
	Lots with Severe Soil Limitation	136	272	34	72	57	114	200	390	0	0	0	0	0	0	
	Pumpouts Greater than 2 times per year	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		444	888	107	214	263	526	487	974	0	0	0	0	0	0	
Health / Water Quality Issue	Density of Systems Greater Than 2 per Acre	315	315	0	0	0	0	0	0	0	0	0	0	0	0	
	System within 100 feet of Surface Water Body, Wetlands or Stream	9	9	43	43	0	0	206	206		0	0	0	0	0	
	System located within 100 Year Flood Plain	0	0	5	5	4	4	72	72		0	0	0	0	0	
	System within Zone II Aquifer Recharge Area	473	473	3	3	116	116	117	117	0	0	0	0	0	0	
	System within Harbor Watershed Line or 3,600' of Madaket Harbor	0	0	103	103	184	184	181	181	0	0	0	0	0	0	
		797	797	154	154	304	304	554	554	0	0	0	0	0	0	
	Total Criteria Points for Study Area	2,409	571	571	571	1,125	1,125	3,043	3,043	0	0	0	0	0	0	
	Rating Criteria Points Per Developed Lot	4.60	4.17	4.17	4.17	6.17	6.17	3.72	3.72	0.00	0.00	0.00	0.00	0.00	0.00	
	RECOMMENDED AS A NEED AREA			NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
				(Conventional Title 5 System Not Feasible for Majority of Study Area)												



Monomoy Build Out Analysis

Monomoy Build Out Analysis
 Prepared by Nantucket Planning Office Revised Feb 16, 2011

	1 Unit	2 Unit	3 or more Units	Total Units
Existing Dwelling	44	120	14	178
Flow	@ 385 = 16,940 g/d	@ 605 = 72,600 g/d	@ 715 = 10,010 g/d	99,550 g/d
Future Dwelling	44	56	0	100
Flow	* = 9,680 g/d	** = 30,800 g/d	0 g/d	40,480 g/d
Total	88 26,620 g/d	176 103,400g/d	14 10,010 g/d	278 140,030 g/d

Key:

g/d= gallons per day

- * 44 second dwellings on existing lots @ 220/unit = 9,680 g/d
- ** 36 units 16 vacant lots;
20 units on newly created lots: @ 550/unit = 30,800 g/d

- Flow based on 110 gallons per bedroom per day
- 1 unit assumed at 3.5 bedrooms
- 2 units assumed at 2 bedrooms



Shimmo Build Out Analysis

Shimmo Build Out Analysis
Prepared by Nantucket Planning Office Revised Feb 16, 2011

	1 Unit	2 Unit	3 or more Units	Total Units
Existing Dwelling	76	112	28	216
Flow	@ 385 = 29,260 g/d	@ 605 = 67,760 g/d	@ 715 = 20,020 g/d	117,040 g/d
Future Dwelling	67	118	0	185
Flow	* = 14,740 g/d	** = 64,900 g/d	0 g/d	79,640 g/d
Total	143 44,000 g/d	230 132,660 g/d	28 20,020 g/d	401 196,680 g/d

Key:

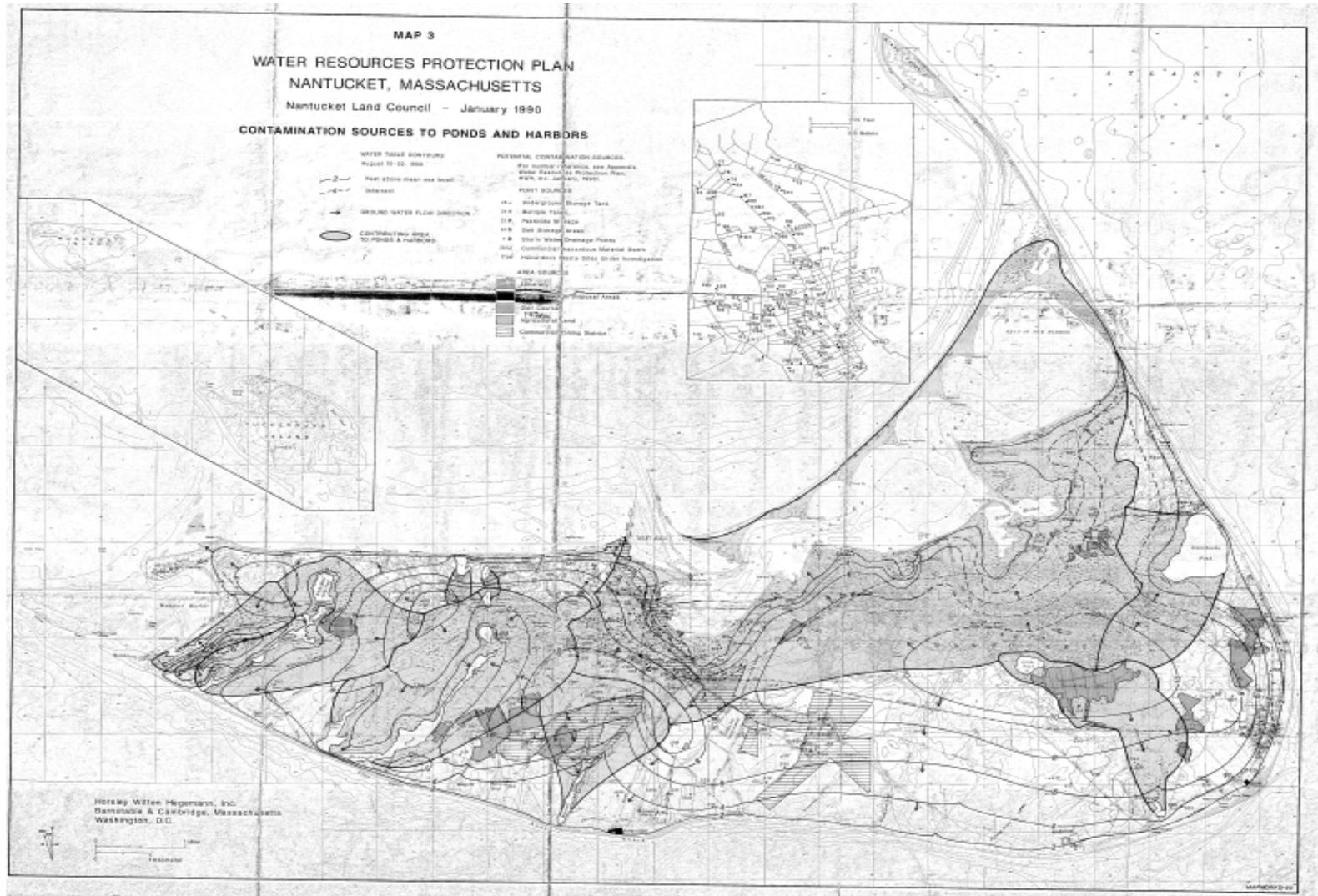
g/d = gallons per day

- * 67 second dwellings on accessory lots @ 220/unit = 14,740 g/d
- ** 34 units 17 vacant lots: @ 550/unit = 18,700 g/d
 84 units on newly created lots: @ 550/unit = 46,200 g/d
 Total = 64,900 g/d

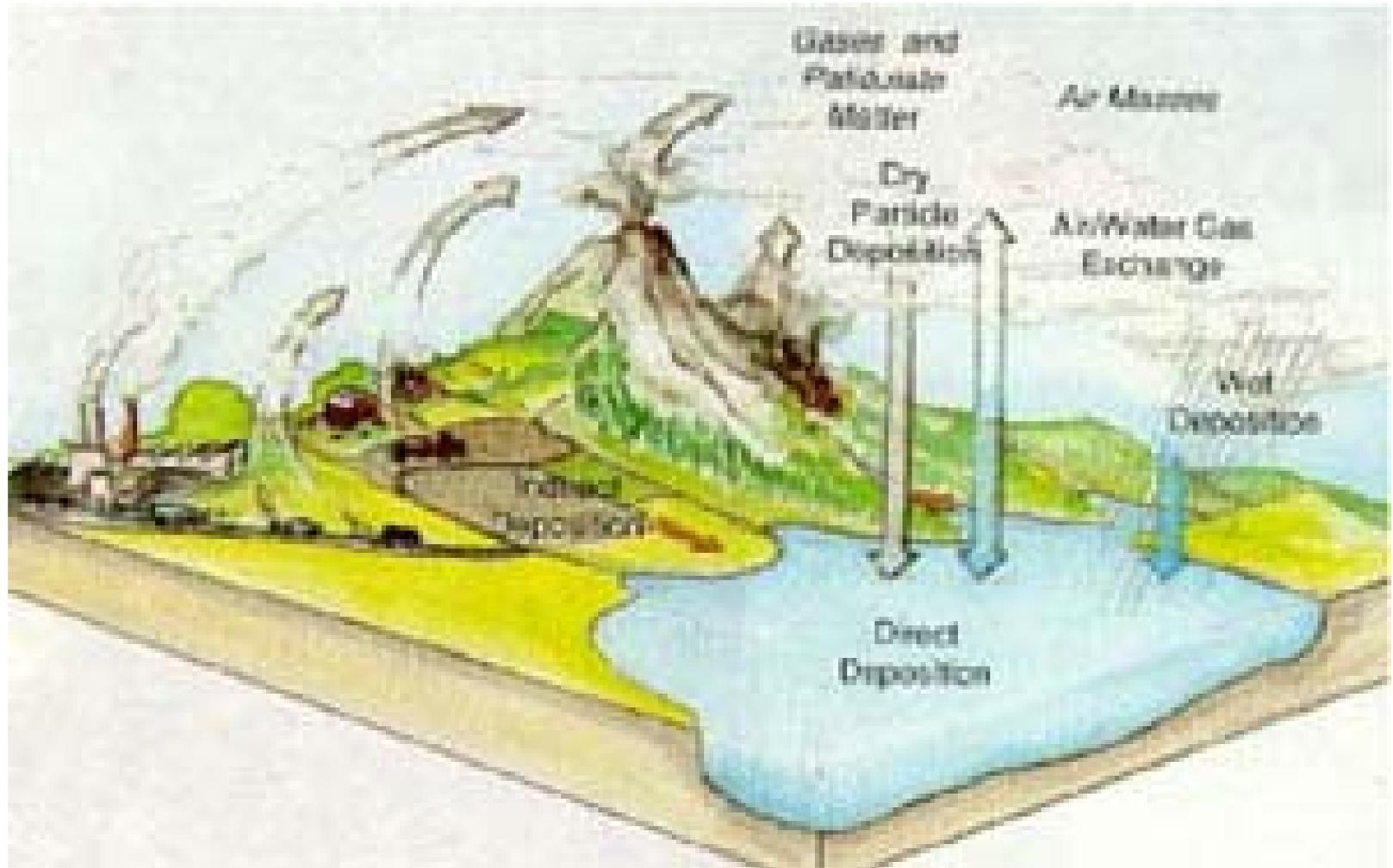
- Flow based on 110 gallons per bedroom per day
- 1 unit assumed at 3.5 bedrooms
- 2 units assumed at 2 bedrooms



Nantucket Groundwater Flow Directions



Atmospheric Deposition (USEPA)



Benthic Flux Sample (USGS)

Processes Regulating Benthic Flux

