

## **Appendix Z**

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# **Water Quality Monitoring Items**



# Town of Chatham

Department of

Health and Environment

Health Water Quality Laboratory Conservation

(508) 945-5165

(508) 945-5188

(508) 945-5164

TOWN ANNEX 261 GEORGE RYDER ROAD CHATHAM, MA 02633

FAX (508) 945-5163



April 23, 2009

Brian Howes, Ph.D., Manager  
Coastal Systems Program  
UMass Dartmouth  
706 Rodney French Blvd.  
New Bedford, MA 02744

RE: Chatham CWMP Alternative Scenario – Sulphur Springs  
Linked Watershed-Embayment Nitrogen Management Model



Dear ~~Dr. Howes~~:

The Town is requesting additional CWMP alternative scenarios as we continue to evaluate future conditions and appropriate loading factors. We request that you and your team run the Sulphur Springs System Estuary model for 2 additional scenarios to determine if the target threshold (0.38 mg/L TN) will be met.

Both scenarios would utilize the non-wastewater build-out N loads that were reported in the most recent Technical and TMDL reports for this estuary. The 2 scenarios differ in the amount of wastewater N load based on differences in sewer extension and recharge flow quantities of the treated water from the WWTF.

The wastewater N loads for the 2 scenarios are listed below:

- **Scenario H1330bRev1 - Future Conditions (buildout) in the watershed at the end of Phase 1 sewerage, with annual average recharge at the WWTF of 1.3 mgd, including:**
  - Sulphur Spring Septic System load = 22,500 gpd and 26.25 mg/L TN conc. = 4.9 lb/d
  - Recharge load (from WWTF recharge) through the cranberry bogs/ponds and into the southern portion of Sulphur Springs Estuary = 39,000 gpd (3% of 1.3 mgd recharge) @ 3 mg/l TN conc., and 50% nitrogen attenuation = 0.49 lb/d
  - Bucks Creek Septic System load = 12,000 gpd and 26.25 mg/L TN conc. = 2.6 lb/d
  - Cackle Cove Creek WWTF Recharge load = 624,000 gpd (48% of 1.3 mgd recharge) @ 3 mg/l TN conc., and 38% nitrogen attenuation = 9.7 lb/d

- **Scenario K1930bRev1 - Future Conditions (buildout) in the watershed at the end of Phase 2 sewerage, with annual average recharge at the WWTF of 1.9 mgd, including:**
  - Sulphur Spring Septic System load = 0 gpd = 0 lb/d
  - Direct Sulphur Spring WWTF Recharge load = 57,000 gpd (3% of 1.9 mgd recharge) @ 3 mg/L TN conc. = 1.4 lb/d
  - Recharge load (from WWTF Recharge) through the cranberry bogs/ponds and into southern portion of Sulphur Springs Estuary = 304,000 gpd (16% of 1.9 mgd recharge) @ 3 mg/l TN conc., and 50% nitrogen attenuation = 3.8 lb/d
  - Bucks Creek Septic System load = 0 gpd = 0 lb/d
  - Bucks Creek WWTF Recharge = 19,000 gpd (1% of 1.9 mgd recharge) @ 3 mg/L TN conc. = 0.48 lb/d
  - Cackle Cove Creek WWTF Recharge load = 817,000 gpd (43% of 1.9 mgd recharge) @ 3 mg/l TN conc., and 38% nitrogen attenuation = 12.7 lb/d

Attached are 2 particle track figures that illustrate the groundwater recharge of these 2 scenarios. Also attached is a table of the (groundwater) "*Model Predicted Fate of Treated Water Recharge As Percentage of Total Discharge*". We have estimated N attenuation (detailed in the bullets above) that is expected to occur as the recharge flows through the bogs, freshwater ponds, and Cackle Cove Creek as illustrated in the 2 figures and table. Also, following discussions with DEP, we have incorporated the findings of the groundwater model (detailed in the attached table) that indicates significant percentages of groundwater recharge from the WWTF flowing directly to Nantucket Sound in the future conditions.

These scenarios are funded under the existing contract between the Town and SMAST

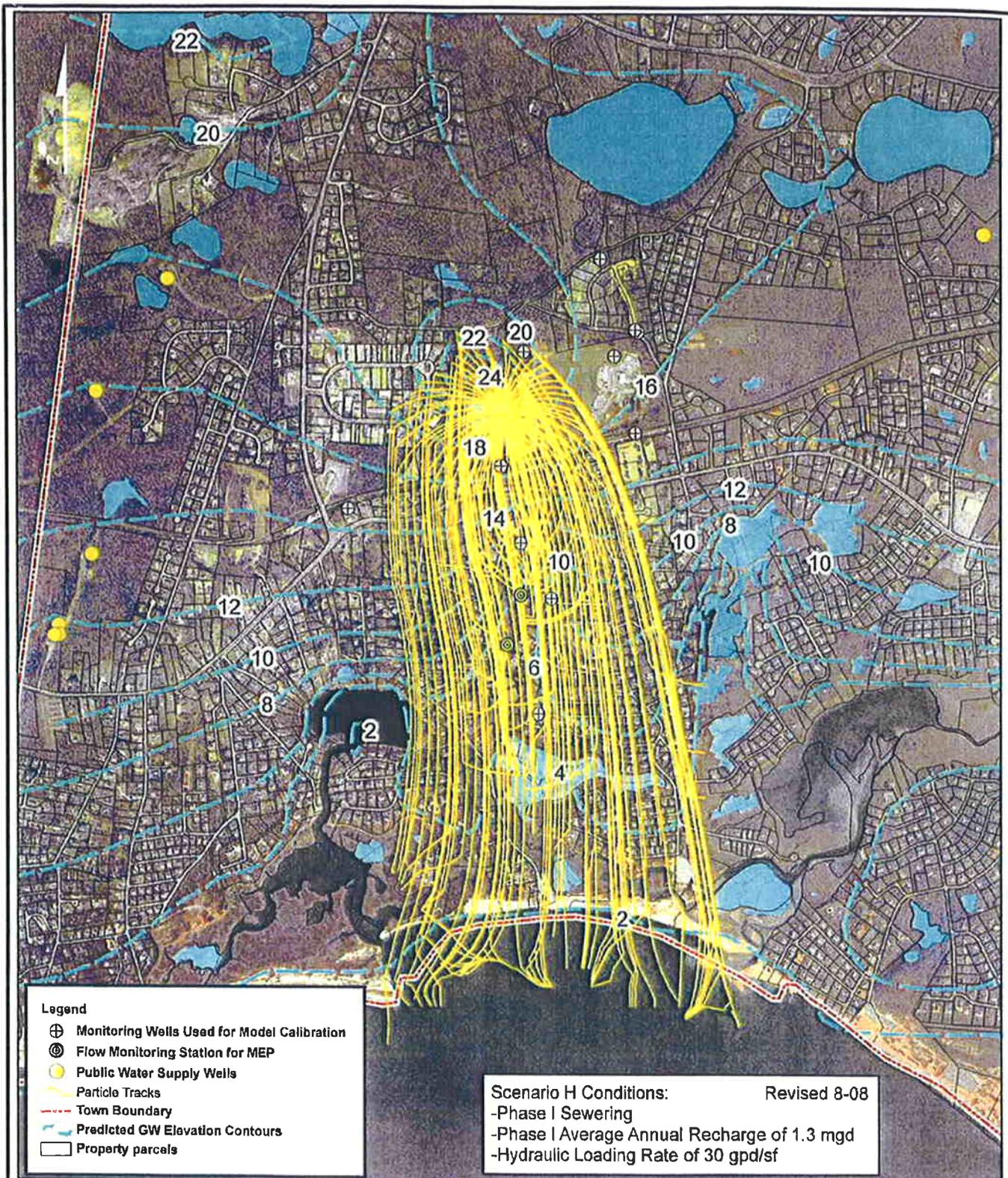
Please call me at (508) 945-5165, Mon. to Fri. from 8:00 am to 4:00 pm, or email ([rduncanson@chatham-ma.gov](mailto:rduncanson@chatham-ma.gov)) if you have any questions or comments on this request.

Best Regards,



Robert A. Duncanson, Ph.D.  
Director of Health & Environment

cc: Nate Weeks & Jeff Gregg, Stearns & Wheeler



**Legend**

- ⊕ Monitoring Wells Used for Model Calibration
- ⊙ Flow Monitoring Station for MEP
- Public Water Supply Wells
- Particle Tracks
- - - Town Boundary
- - - Predicted GW Elevation Contours
- Property parcels

Scenario H Conditions: Revised 8-08  
 -Phase I Sewering  
 -Phase I Average Annual Recharge of 1.3 mgd  
 -Hydraulic Loading Rate of 30 gpd/sf

Data Source: MassGIS/Town of Chatham

0 1,350 2,700 Feet  
 1 inch equals 1,350 feet

GIS File Location: J:\GIS\GIS  
 Project Folder: Job#1700001700981Treated Water Figures  
 5\_25\_07\70098F23.mxd



**STEARNS & WHEELER**  
 Environmental Engineers & Scientists

HYANNIS, MASSACHUSETTS

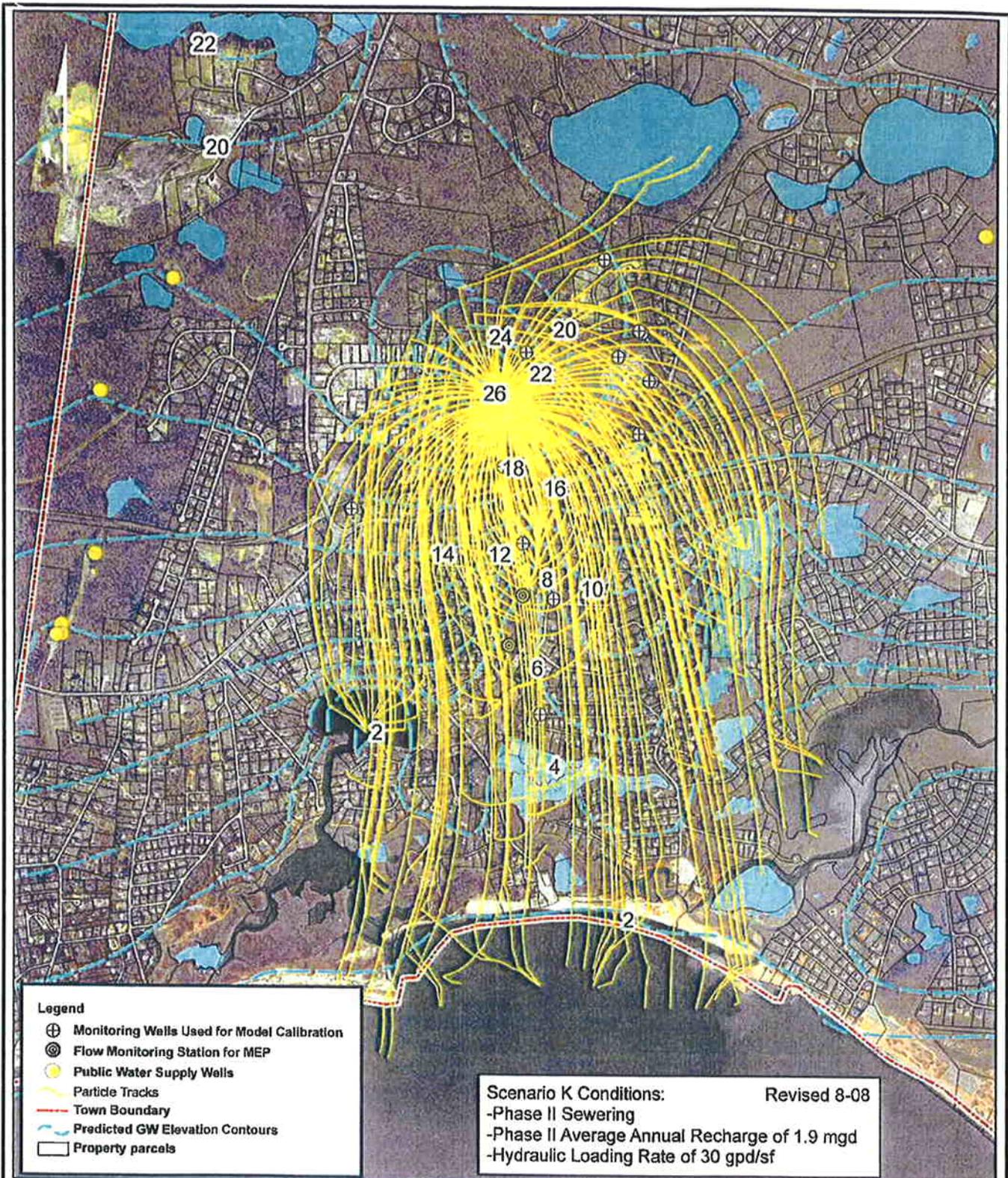
1501 Congress Road  
 Hyannis, MA 02601  
 Tel: 508.982.2200  
 Fax: 508.982.2268  
 Web: www.stearns-wheeler.com

DATE: 03/09/07

**TOWN OF CHATHAM CWMP**

**SCENARIO H: PREDICTED GROUNDWATER ELEVATIONS AND PARTICLE TRACKS**

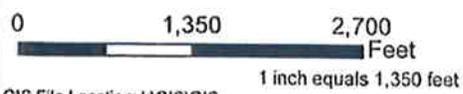
**FIGURE 23**



- Legend**
- ⊕ Monitoring Wells Used for Model Calibration
  - ⊙ Flow Monitoring Station for MEP
  - Public Water Supply Wells
  - Particle Tracks
  - - - Town Boundary
  - - - Predicted GW Elevation Contours
  - Property parcels

**Scenario K Conditions:** Revised 8-08  
 -Phase II Sewering  
 -Phase II Average Annual Recharge of 1.9 mgd  
 -Hydraulic Loading Rate of 30 gpd/sf

Data Source: MassGIS/Town of Chatham



GIS File Location: J:\GIS\GIS  
 Project Folder\Job#\700001\700981\Treated Water Figures  
 5\_25\_07\70098F24.mxd

**STEARNS & WHEELER**  
 Environmental Engineers & Scientists  
 HYANNIS, MASSACHUSETTS

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 WWW: stearnswheler.com

DATE: 06/08/07

**TOWN OF CHATHAM CWMP**

**SCENARIO K: PREDICTED GROUNDWATER ELEVATIONS AND PARTICLE TRACKS**

**FIGURE 24**

Revised Chatham Discharges					
Model-Predicted Fate of Treated Water Recharge As Percent of Total Discharge					
Scenario	1330a	1330b		1930b	1930c
Total recharge (mgd)	1.3	1.3		1.9	1.9
Loading rate (gpd/SF)	30	30		30	15
Flow to Cockle Cove Creek (%)	33	48		43	39
Flow to Taylor's Pond/Mill Creek (%)**	0	0/5		9/10	4/8
Flow to bogs (%)	20	3		16	17
Flow to Nantucket Sound (%)	32	44		25	21
Flow to Muddy Creek (%)	12	0		2	11
Flow to Bucks Creek	3	0	0	1	4
Flow to Sulphur Springs Estuary/Bucks Creek		0		3	
% Totals		100		100	

\*\* Upper number represents flow to pond and upper creek, lower number is total flow to pond, upper creek and lower creek.

1330a = Discharge to northeast beds

1330b = Discharge to southern beds (1 and 2)

1930b = Discharge to southern beds (1,2, and 3)

1930c = Discharge to southern and northeastern beds at half loading rate



\*\*\*\*\* MEP Technical Memorandum \*\*\*\*\*

**To: Robert Duncanson, Director of Health and Environment - Town of Chatham**  
**CC: Fred Jensen, Chair of CAC, William Hinchey, Judith Giorgio, Kevin McDonald, Linda Smulligan, William Redfield, Colleen Furber.**  
**From: Brian Howes, Director Coastal Systems Program SMAST**  
**Sean Kelley, Applied Coastal Research and Engineering**  
**Ed Eichner, Coastal Systems Program, SMAST**  
**RE: Sulphur Springs/Bucks Creek/Cockle Cove: Sewering Scenarios H1330 & K1930**  
**Date: January 15, 2009, Comments February 5, 2009, Revised Final February 20, 2009**

\*\*\*\*\*

The present Technical Memorandum summarizes the results of two (2) CWMP Alternative Scenarios (H1330b & K1930b) related to sewerage plans for the Town of Chatham and increased recharge of treated effluent at the present WWTF location. The work was conducted under a contract between the Town of Chatham and the University of Massachusetts-Dartmouth, as finalized on October 8, 2008. As indicated in previous email correspondence this Technical Memorandum is being delivered to the Town by January 15, 2009 rather than December 31, 2008, due to University closure relating to the Commonwealth's budget cuts. We apologize for the delay.

Comments were received on the January 15, 2009 Technical Memorandum, which have been incorporated into this revised Technical Memorandum and which are addressed in an Addendum to this document.

The scenario was evaluated using the Linked Watershed-Embayment Nutrient Management Modeling Approach developed by the Massachusetts Estuaries Project Technical Team for the Sulphur Springs-Bucks Creek-Cockle Cove Estuarine System in 2003 and updated for the Town in February 2007. The scenarios are as finalized by the Town in November 24, 2008 by email. Relevant sewerage systems associated with these scenarios were provided by the Town and are shown in Figures 1 and 2 below.

**The key components of the Town's wastewater management scenario are as follows:**

**Scenario H1330b - Future Conditions (buildout) in the watershed at the end of Phase 1 Sewering:**

- Non-wastewater/septic N loads are to be based upon the Build-Out Nitrogen Load (fertilizer, impermeable areas, etc), as specified in the February 2007 updated Nutrient Technical Report
- All treated wastewater (100%) is treated and discharged at existing WWTF site
- Annual average recharge at the WWTF = 1.3 MGD (million gallons per day)
- Sulphur Spring Septic System load = 22,500 gpd @ 26.25 mg/L TN conc. = 4.93 lb/d
- Sulphur Spring WWTF Recharge load = 39,000 gpd (@ 3% of 1.3 MGD recharge) @ 3 mg/L TN conc. = 0.98 lb/d.
- Bucks Creek Septic System load = 12,000 gpd and 26.25 mg/L TN conc. = 2.63 lb/d
- Bucks Creek WWTF Recharge load = 0 gpd = 0 lb/d
- Cockle Cove Creek WWTF Recharge load = 1.2 MGD (92% of 1.3 MGD recharge) and 3 mg/l TN conc. = 29.94 lb/d
- Attenuation of N by Cockle Cove Creek is 38% as used in the updated analysis (MEP Tech Memo February 2007)

**Scenario K1930b** - Future Conditions (buildout) in the watershed at the end of Phase 2 Sewering:

- Non-wastewater/septic N loads are to be based upon the Build-Out Nitrogen Load (fertilizer, impermeable areas, etc), as specified in the updated Nutrient Technical Report of February 2007
- All treated wastewater (100%) is treated and discharged at existing WWTF site
- Annual average recharge at the WWTF of 1.9 MGD
- Sulphur Spring Septic System load = 0 gpd = 0 lb/d
- Sulphur Spring WWTF Recharge load = 361,000 gpd (19% of 1.9 MGD recharge) @ 3 mg/L TN conc. = 9.03 lb/d
- Bucks Creek Septic System load = 0 gpd = 0 lb/d
- Bucks Creek WWTF Recharge = 19,000 gpd (@1% of 1.9 MGD recharge) @ 3 mg/L TN= 0.48 lb/d
- Cockle Cove Creek WWTF Recharge load = 1.3 MGD (68% of 1.9 MGD recharge) @ 3 mg/L TN conc. = 32.35 lb/d
- Attenuation of N by Cockle Cove Creek is 38% as used in the updated analysis (MEP Tech Memo February 2007)

All information as to changes in nitrogen loading were developed by the Town of Chatham and presented to the MEP Technical Team. It is important relative to Scenario K1930b to note that 88% of the WWTF recharge enters the Sulphur Springs System, the remainder discharging to other of Chatham's estuaries, which is outside of the scope of this scenario run. To the extent that some WWTF recharge potentially underflows the estuaries, these scenarios might overestimate future loading to the estuaries, hence TN levels. However, there is presently no direct evidence that this underflow of treated effluent will likely occur. Therefore, to ensure the restoration of these estuarine systems it was determined that for planning purposes that all WWTF recharge would discharge to these estuarine systems rather than having a portion discharge to offshore waters. It might be useful for the referenced USGS data and a description of how the effluent was apportioned to each sub-embayment to be available with this document.

The above scenario data were used to develop the total nitrogen loads to the three main basins to determine changes in watercolumn TN levels from those determined by the existing Linked Watershed-Embayment Nutrient Management Model of February 2007 (Table VIII-5). The results were then compared to both the present conditions throughout the system and specifically how the TN levels would relate to the threshold at the Sentinel Station (CM-8) in Bucks Creek (in the narrows between upper Bucks Creek and the Sulphur Springs sub-basin) and at the mid station in Cockle Cove Creek. The threshold nitrogen level at the Sentinel Station was previously determined to be 0.380 mg TN L<sup>-1</sup> and the most conservative level for Cockle Cove Creek level was determined to be 2.0 mg TN L<sup>-1</sup>.

**The results of Wastewater Scenarios H1330 and K1930b indicate that the threshold level at the Sentinel Station (0.38 mg TN L<sup>-1</sup>) was not achieved, while the secondary check TN levels (2.00 mg TN L<sup>-1</sup>) within Cockle Cove were very close to being acceptable. Scenarios H1330 and K1930b resulted in TN levels at the Sentinel Station (CM-8) in Bucks Creek of 0.40 and 0.42 mg TN L<sup>-1</sup>, respectively (Table 4), while the check station midway in Cockle Cove Creek had TN levels of 2.04 and 2.18 mg TN L<sup>-1</sup>, respectively. Based upon the wastewater effluent nitrogen load provided by the Town of Chatham, these management alternatives would not meet the nitrogen threshold for the Sulphur Springs System. However, it is notable that the resulting TN level in Bucks Creek (lower station) is very low, which suggests that excess load reduction to this basin may have been produced. A more detailed assessment of the specific sites of entry of the recharged groundwater within Cockle Cove Creek for inclusion into the**

MEP water quality model might result in the check station (mid- Cockle Cove Creek) level being lower than portrayed here. Similarly, a reconfiguration of the Cockle Cove portion of the water quality model to better include freshwater mixing would also likely lower the TN level at the secondary check station. Therefore, it is very likely that both scenarios will meet the check station target. However, the finding that the Sentinel Station TN exceeds the Threshold level will remain. A discussion with SMAST and the Town might provide a way forward as to meeting the threshold level at the Sentinel Station (CM-8) without significant alteration of Scenarios H1330 and K1930b.

Table 1. Present sub-embayment loads used for total nitrogen modeling of the Sulphur Springs embayment system, with total watershed N loads, atmospheric N loads, and benthic flux.<sup>A</sup>

Sub-embayment	Present Watershed Load (kg/day)	Atmospheric Deposition (kg/day)	Benthic Flux (kg/day)
Sulphur Springs	9.529	0.378	-3.756
Bucks Creek	3.362	0.132	2.910
Cockle Cove Creek	8.427 <sup>B</sup>	0.060	na <sup>C</sup>
System Total	21.318	0.570	-1.423

A - Based upon updated data of February 2007 Technical Memo  
 B - value does not include attenuation by salt marsh  
 C - a 38% attenuation within the Creek was used in the modeling

Table 2. **Scenario H1330** N loading for the sub-embayments of the Sulphur Springs/Bucks Creek/Cockle Cove Creek system. Watershed loads include N loads from the WWTF<sup>A</sup>.

sub-embayment	Scenario Watershed Load (kg/day)	Atmospheric Deposition (kg/day)	Benthic Flux (kg/day)
Sulphur Springs	5.101	0.378	-2.864
Bucks Creek	1.959	0.132	2.742
Cockle Cove Creek	14.636 <sup>B</sup>	0.060	na
System total	21.696	0.570	

A - Based on updated data Technical Memo (February 2007) & Town Scenario  
 B - value does not include attenuation by salt marsh

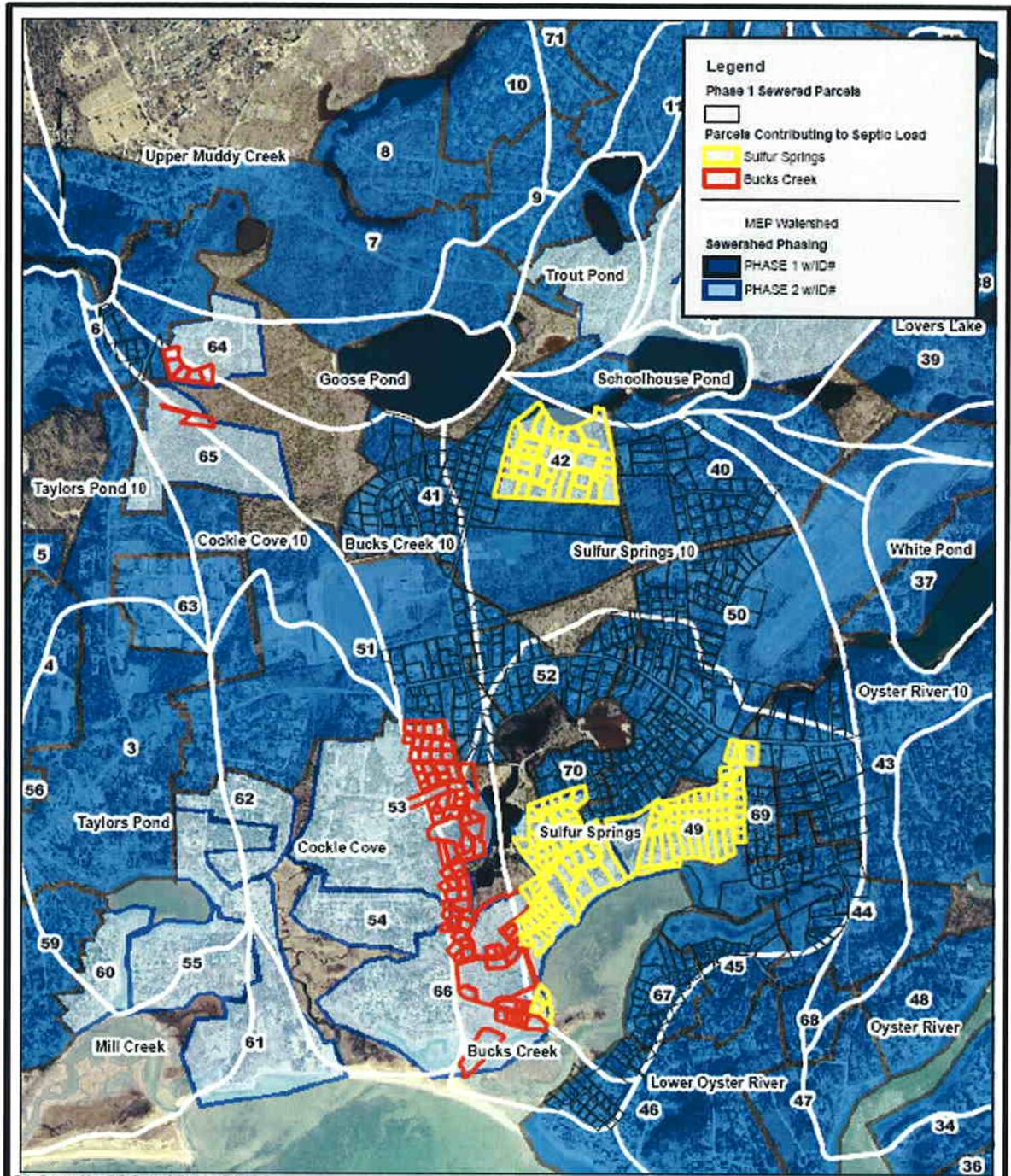
Table 3. **Scenario K1930b** N loading for the sub-embayments of the Sulphur Springs/Bucks Creek/Cockle Cove Creek system. Watershed loads include N loads from the WWTF.

sub-embayment	watershed load (kg/day)	atmospheric deposition (kg/day)	benthic flux (kg/day)
Sulphur Springs	6.523	0.378	-3.151
Bucks Creek	0.981	0.132	2.837
Cockle Cove Creek	15.726	0.060	na
System total	23.230	0.570	

Table 4. Comparison of tidally averaged total N concentrations from present loading and sewerage **Scenarios H1330 and K1930b**, with percent change from existing conditions, for the Sulphur Springs embayment system. The threshold level at the Sentinel Station, CM-8, in Bucks Creek is 0.380 mg TN/L.

sub-embayment	present (mg/L)	H1330 (mg/L)	% change <sup>A</sup>	K1930b (mg/L)	% change <sup>A</sup>
Cockle Cove Cr. – mid	1.373	2.046	+85.1%	2.182	+97.9%
Cockle Cove Cr. – low	0.410	0.515	+25.6%	0.533	+29.8%
Bucks Creek (lower)	0.347	0.334	-3.7%	0.341	-1.6%
Bucks Creek (upper) (CM-8 Sentinel)	0.452	0.401	-11.3%	0.424	-6.2%

A - change in watercolumn TN concentration



**Legend**

Phase 1 Sewered Parcels  
 [White Box]

Parcels Contributing to Septic Load  
 [Yellow Box] Sulfur Springs  
 [Red Box] Bucks Creek

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MEP Watershed  
 Sewershed Phasing  
 [Dark Blue Box] PHASE 1 WID#  
 [Light Blue Box] PHASE 2 WID#

Data Source: MassGIS, Town of Chatham GIS Dept

Figure 1. Sewer Plan for Sulphur Springs Estuarine System

2009 Figures-Sewer Phasing Figures-Sulfur Springs

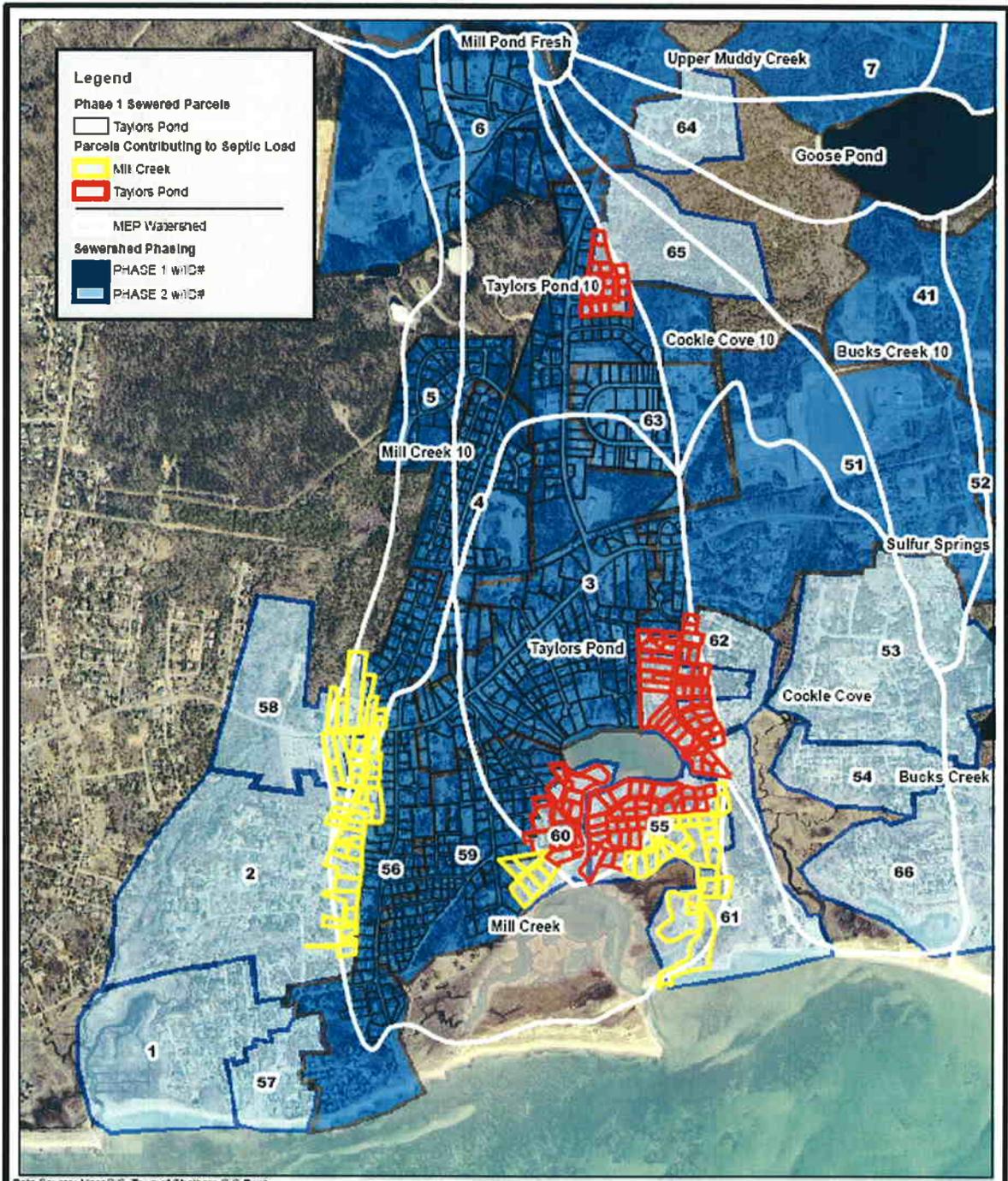
**STEARNS & WHELER**  
 Environmental Engineers & Scientists  
 OFFICE LOCATION

PROJECT NO.: DATE:

TOWN OF CHATHAM, MASSACHUSETTS

SEWERSHED PHASING

SULFUR SPRINGS SCENARIOS



Data Source: MassGIS, Town of Chatham GIS Dept.

Figure 2. Sewer Plan for Taylor's Pond Estuarine System

2008 Figures/Sewer Phasing Figures

**STEARNS & WHEELER**  
 Environmental Engineers & Scientists  
 OFFICE LOCATION  
 PROJECT NO.: \_\_\_\_\_ DATE: \_\_\_\_\_

TOWN OF CHATHAM, MASSACHUSETTS
SEWERSHED PHASING
TAYLORS POND SCENARIOS

## **Addendum**

Response to Sulphur Springs/Bucks Creek Comments Provided by Dr. Robert Duncanson, Chatham Director of Health and Environment in a February 5, 2009 letter regarding the MEP Technical Memorandum of January 15, 2009.

a. 2<sup>nd</sup> para.: *The scenario was finalized on November 24 versus November 14.*

Response: corrected

b. 3<sup>rd</sup> para., 5<sup>th</sup> bullet: "...39,000 gpd (@ 3% of 1.3 MGD recharge)...".

Response: corrected

c. 4<sup>th</sup> para., 8<sup>th</sup> bullet: "...= 1.3 MGD (68% of 1.9 MGD recharge)...".

Response: text added.

d. 5<sup>th</sup> para.: *The last sentence is unclear in its reference to "...referenced USGS data and a description of how the effluent was apportioned to each subembayment to be available with this document." This statement is unclear as the scenario presented the loads from septic and treated water recharge to the various subembayments in both gpd and lb/d.*

Response: The statement refers to a description of how the effluent apportionment was derived, so as to increase understanding. Also, it should be noted that the Town of Chatham derived the new watershed nitrogen loads and that the scenarios were run using these Town derived values, so some description of how these loads were developed might be of aid to outside readers. It is acknowledged that the loads from septic and treated water are given in both gpd and lb/d.

e. 6<sup>th</sup> para.: *The 1<sup>st</sup> sentence makes reference to Tables IX-1 and IX-2 from the 2007 MEP Report. These references would appear to be incorrect as these Tables have to do with the impact of a 2<sup>nd</sup> inlet into Stage Harbor.*

Response: reference corrected

f. 7<sup>th</sup> para.: *The discussion needs clarification:*

- i. *The discussion indicates that the threshold level at the Sentinel Station "was not achieved." In the discussion the Sentinel Station is presented as being Sulphur Springs, however, in the 2007 Re-evaluated MEP Report the Sentinel Station is identified as station CM-8 in Bucks Creek (page 63). There is no monitoring station in Sulphur Springs as Sulphur Springs, similar to Cockle Cove Creek, drains almost completely at low tide and is transitioning into a wetland. Station CM-8 in Bucks Creek is the nearest station to Sulphur Springs but is several hundred feet downstream of the mouth of Sulphur Springs.*

Response: The Sentinel Station refers to station CM-8. This has been clarified in Table 4 and in the summary text. Station CM-8 was the Sentinel Station used in the 2007 revised MEP analysis for this system. The station is in the narrows between Sulphur Springs and upper Bucks Creek; we have modified the text to refer to it as "Bucks Creek" to be consistent with the 2007 report.

- ii. *If the Sentinel Station is properly located as being at Station CM-8 in Bucks Creek then the threshold level in both scenarios would be met.*

Response: As indicated above, the Sentinel Station that was used in the January 15, 2009 technical analysis was CM-8, just as in the 2007 Revised MEP analysis. The results presented in the Technical Memorandum were for CM-8 as the Sentinel Station.

- iii. *The discussion indicates that the threshold level at the Sentinel Station “was not achieved” but that the secondary check TN levels in Cockle Cove Creek “were very close to being acceptable.” When the difference(s) between the threshold level and the secondary check level are compared to their respective model results the differences at the Sentinel Station are actually smaller than that for the secondary check station, i.e. the Sentinel Station results are actually closer to the threshold than the values for Cockle Cove Creek. This is opposite of what is implied in the discussion.*

Response: The secondary check station in Cockle Cove Creek is very close to being acceptable because (a) 2.00 mg TN/L is conservative, as noted in the text, (b) the level of TN concentration reduction compared to background in each of the scenarios is smaller than the needed reduction at the Sentinel Station. In addition the statement in the Tech Memo takes into account the value of the threshold level and the absolute difference between the projected TN level and the threshold. Equally important is that the 2 thresholds are very different, in that the Cockle Cove TN level can be significantly controlled by the concentration of the discharged treated effluent, while the Bucks Creek (CM-8) station is controlled primarily by managing nitrogen load.

- iv. *The discussion does not acknowledge that the scenario is extremely conservative in not allowing any credit for underflow to Nantucket Sound, such underflow being shown in both the USGS and sub-regional groundwater modeling results. Nor does the discussion acknowledge that the MEP model is not providing attenuation for that portion of the recharge flow that is shown to be intercepted by the bogs/ponds located between the recharge site and Sulphur Springs as shown by the more detailed sub-regional groundwater model.*

Response: (a) Text was added to the description section that noted distribution of load. The issue is over the ability of the models to accurately predict underflow with validation. Since this is outside of the present effort, note that USGS has supported other MEP scenarios where it was agreed that the best approach at present is to exclude underflow. (b) The load to Cockle Cove Creek was not attenuated, as Cockle Cove Creek is salt water and there is no information. However, there is significant attenuation within Cockle Cove Creek prior to discharge to Bucks Creek that was used in the scenarios.

- v. *The discussion does not acknowledge the Town’s original scenario request took into account underflow to Nantucket Sound as shown by the subregional groundwater model and requested attenuation of the recharge by the intercepting bogs/ponds but that the scenario was modified at the request of the MEP team resulting in an extremely conservative, worst-case scenario.*

Response: The MEP team noted that prior scenarios had not included underflow for the reasons noted above and others discussed with USGS and MassDEP. The requested attenuation of recharge in freshwater ponds requires some information that is not available to the MEP team and is different than the watershed configuration approved in the MEP Tech Report. Yet it was noted that the

Cockle Cove Creek attenuation, which is significant, is included. Without information on the magnitude of attenuation by bog/pond and evidence of underflow, it is not possible to comment on "extremely conservative, worst-case", but it is clear that if management can meet the thresholds under these scenarios, then the estuaries will be restored. It should be reiterated that better freshwater entry and mixing data and evaluation of Bucks Creek, may allow these scenarios to meet the threshold with minor refinement (as noted in the Tech Memo).

*g. Table 1.: The value shown for Sulphur Springs Present Watershed Load (kg/day) of 9.529 needs clarification/confirmation. In the 2007 Re-evaluated MEP Report this load is shown as 9.093 kg/day in Tables VI-2 (pg 45) and VI-4 (pg 53) while the value of 9.529 kg/day appears in Table VIII-3 (pg 67). It should be noted that the values for Bucks Creek and cockle Cove Creek are consistent across the 3 tables referenced.*

Response: The present day load of 9.529 kg/d is correct. Table VI-2 presents the present day watershed load with the atmospheric load on the surface of the estuary in a separate column, while Table VIII-3 in the MEP Report and Table 1 in the Technical Memorandum show the combined watershed and atmospheric load of 9.529 kg/d.



\*\*\*\*\* MEP Technical Memorandum \*\*\*\*\*

**To: Robert Duncanson, Director of Health and Environment - Town of Chatham**  
**CC: Fred Jensen, Chair of CAC, William Hinchey, Judith Giorgio, Kevin McDonald, Linda Smulligan, William Redfield, Colleen Furber.**  
**From: Brian Howes, Director Coastal Systems Program SMAST**  
**Sean Kelley, Applied Coastal Research and Engineering**  
**Ed Eichner, Coastal Systems Program, SMAST**  
**RE: Taylor's Pond: Sewering Scenarios H1330 & K1930**

**Date: January 20, 2009, Comments February 5, 2009, Revised Final February 20, 2009**

\*\*\*\*\*

The present Technical Memorandum summarizes the results of two (2) CWMP Alternative Scenarios (H1330b & K1930b) related to sewerage plans for the Town of Chatham and increased recharge of treated effluent at the present WWTF location. The work was conducted under the extended contract between the Town of Chatham and the University of Massachusetts-Dartmouth, as finalized on July 31, 2007.

Comments were received on the January 15, 2009 Technical Memorandum, which have been incorporated into this revised Technical Memorandum and which are addressed in an Addendum to this document.

The scenario was evaluated using the Linked Watershed-Embayment Nutrient Management Modeling Approach developed by the Massachusetts Estuaries Project Technical Team for the Taylor's Pond Estuarine System in 2003 and updated for the Town in February 2007. The scenarios are as finalized by the Town in October 20, 2008 and November 14, 2008 by email. Groundwater modeling results used to develop nitrogen loads from future WWTF recharge are presented in Figures 1 and 2, while relevant sewersheds associated with these scenarios were provided by the Town and are shown in Figures 3 and 4, below. The key components of the Town's wastewater management scenario are as follows:

**Scenario H1330b - Future Conditions (buildout) in the watershed at the end of Phase 1 Sewering:**

- Non-wastewater/septic N loads are to be based upon the Build-Out Nitrogen Load (fertilizer, impermeable areas, etc), as specified in the February 2007 updated Nutrient Technical Report
- All treated wastewater (100%) is treated and discharged at existing WWTF site
- Annual average recharge at the WWTF = 1.3 MGD (million gallons per day)
- Taylor's Pond Septic System N load = 19,000 gpd @ 26.25 mg/L TN conc. = 4.16 lb/d
- Taylor's Pond WWTF Recharge N load = 0 gpd @ 3 mg/L TN conc. = 0 lb/d.
- Mill Creek Septic System N load = 13,000 gpd and 26.25 mg/L TN conc. = 2.85 lb/d
- Mill Creek WWTF Recharge N load = 65,000 gpd (5% of 1.3 MGD recharge) @ 3 mg/L TN conc. = 1.63 lb/d

**Scenario K1930b - Future Conditions (buildout) in the watershed at the end of Phase 2 Sewering:**

- Non-wastewater/septic N loads are to be based upon the Build-Out Nitrogen Load (fertilizer, impermeable areas, etc), as specified in the updated Nutrient Technical Report of February 2007
- All treated wastewater (100%) is treated and discharged at existing WWTF site
- Annual average recharge at the WWTF of 1.9 MGD

- Taylors Pond Septic System N load = 0 gpd @ 26.25 mg/L TN conc. = 0 lb/d
- Taylors Pond WWTF Recharge N load = 170,000 gpd (9% of 1.9 MGD recharge) @ 3 mg/L TN conc. = 4.28 lb/d.
- Mill Creek Septic System N load = 0 gpd @ 26.25 mg/L TN conc. = 0 lb/d
- Mill Creek WWTF Recharge N load = 19,000 gpd (1% of 1.9 MGD) @ 3 mg/L TN = 0.48 lb/d

All information as to changes in nitrogen loading were developed by the Town of Chatham and presented to the MEP Technical Team, specifically changes in septic system loads and from recharge of treated effluent at the WWTF. It is assumed that watershed N loads passing through the freshwater ponds have been attenuated and included in the septic loads provided (for Taylors Pond System, Mill Pond fresh and for Sulphur Springs System, Mill Pond fresh and Goose Pond). In addition, it would be useful for a description of how the effluent was apportioned to each sub-embayment to be available with this document.

Nitrogen loading scenarios H1330 and K1930 were modeled using the TN water quality model of the Taylors Pond system, developed for the 2007 MEP Chatham South Shore embayments analysis. Tables 1, 2 and 3 show the N loading inputs to the model, for Present conditions and for the two proposed scenarios. The benthic flux loading terms used in the scenario model runs was determined using the method outlined in the 2007 MEP report, for the development of non-anthropogenic and build-out benthic nutrient loading. The scenario data were used to develop the total nitrogen loads to the main basins to determine changes in watercolumn TN levels from those determined by the existing Linked Watershed-Embayment Nutrient Management Model of February 2007 (Table VIII-5). The results were then compared to both the present conditions throughout the system and specifically how the TN levels would relate to the threshold at the Sentinel Station in Taylors Pond. The threshold nitrogen level at the Sentinel Station was previously determined to be  $0.380 \text{ mg TN L}^{-1}$ .

**The results of both Wastewater Scenarios H1330b and K1930b indicate that the threshold level at the Sentinel Station ( $0.38 \text{ mg TN L}^{-1}$ ) is achieved for the Taylors Pond System.** Model output for the two scenario runs is presented in Table 4. It is important relative to Scenarios H1330b and K1930b to note that the hydrodynamics of the Taylors Pond System were based upon the updated MEP analysis as discussed in the MEP Technical Memorandum of 2007. The underlying hydrodynamics, therefore, were based upon a relatively open inlet channel. However, the coast in the region of the Taylors Pond and Sulphur Springs/Bucks Creek tidal inlets is highly dynamic. As a result of dynamic coastal processes, a sand bar has been forming in region of the Taylors Pond inlet. The Town of Chatham is considering dredging to maintain the tidal channel in this area. However, if the bar occludes the tidal inlet (compared to the ~2000 conditions used herein), then the tidal flows will be reduced and the present scenarios may fail to meet the nitrogen Threshold.

Table 1. **Present conditions** N loading for the sub-embayments of the Taylors Pond system used for total nitrogen modeling<sup>A</sup>.

sub-embayment	Watershed N load (kg/day)	Atmospheric Deposition (kg/day)	Benthic Flux (kg/day)
Mill Creek	4.559	0.167	-0.061
Taylors Pond	6.219	0.186	1.424
System total	10.778	0.353	1.363

A - Based upon updated data of February 2007 Technical Memo, the present WWTF recharge does not discharge to the Taylors Pond System.

Table 2. **Scenario H1330b.** N loading for the sub-embayments of the Taylors Pond System<sup>A</sup>. Watershed N loads include the WWTF.

sub-embayment	Watershed N Load (kg/day)	Atmospheric Deposition (kg/day)	Benthic Flux (kg/day)
Mill Creek	3.167	0.167	-0.051
Taylors Pond	3.351	0.186	1.012
System total	6.518	0.353	0.961

A - Based on updated data Technical Memo (February 2007), with septic N loading and N load from increased recharge of treated effluent (1.3 MGD) at the WWTF provided by the Town of Chatham.

Table 3. **Scenario K1930b** N loading for the sub-embayments of the Taylors Pond system<sup>A</sup>. Watershed loads include the WWTF.

sub-embayment	Watershed N Load (kg/day)	Atmospheric Deposition (kg/day)	Benthic Flux (kg/day)
Mill Creek	1.540	0.167	-0.038
Taylors Pond	3.573	0.186	1.044
System total	5.112	0.353	1.005

A - Based on updated data Technical Memo (February 2007), with septic N loading and N load from increased recharge of treated effluent (1.9 MGD) at the WWTF provided by the Town of Chatham.

Table 4. Comparison of tidally averaged total N concentrations from present loading and sewerage **Scenarios H1330b and K1930b**, with percent change from existing conditions, for the Taylors Pond embayment system. The threshold level at the Sentinel Station in Taylors Pond is 0.380 mg TN/L.

sub-embayment	present (mg/L)	H1330b (mg/L)	% change <sup>A</sup>	K1930b (mg/L)	% change <sup>A</sup>
Mill Creek	0.329	0.315	-4.2%	0.303	-7.9%
Taylors Pond	0.455	0.384	-15.5%	0.384	-15.4%

A - change in watercolumn TN concentration

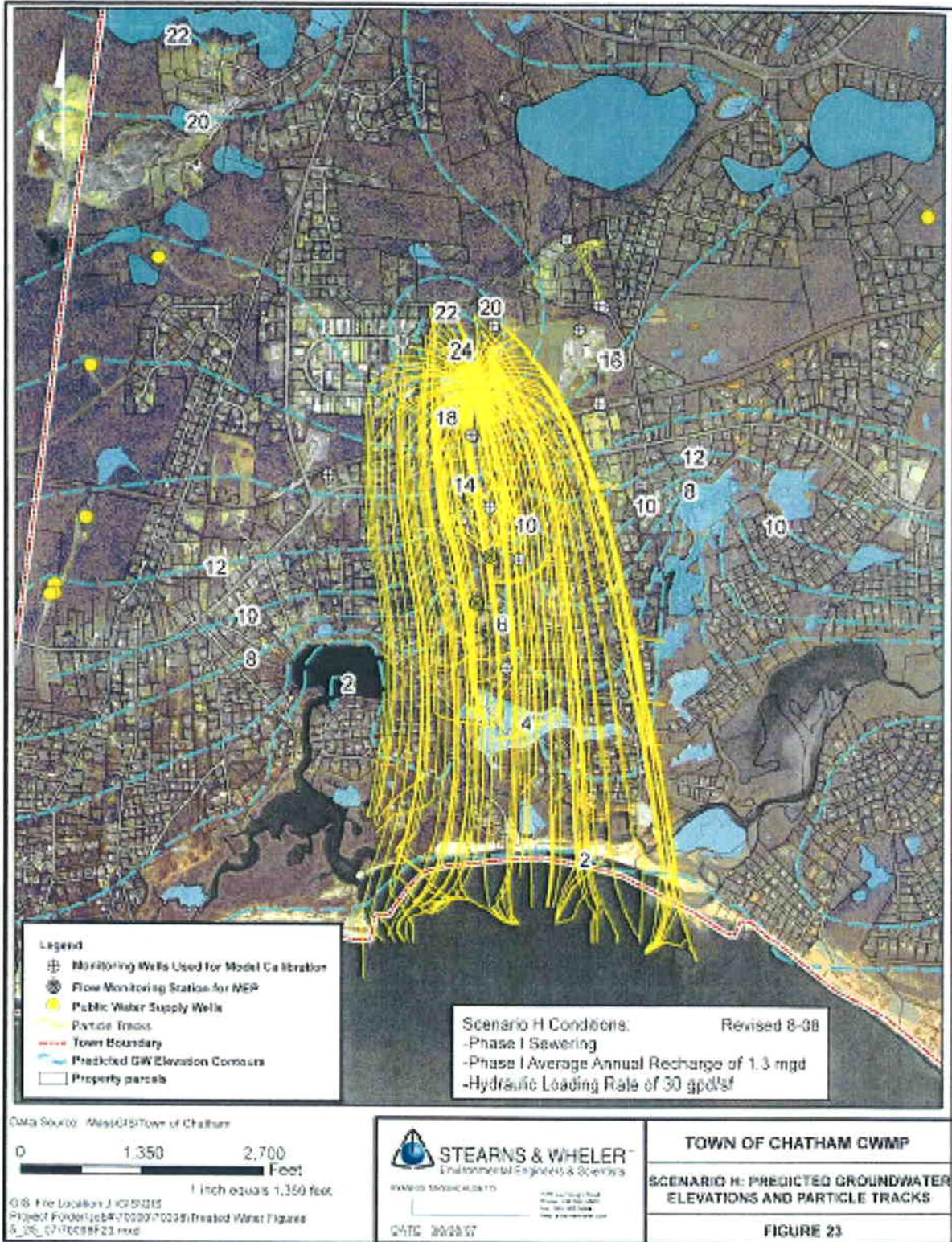


Figure 1. Flow path of 1.3 MGD of treated effluent recharged at Chatham WWTF. Discharge to Nantucket Sound would only be if groundwater by-passes the intervening estuaries; this needs supporting hydrogeological evidence (presently unavailable).

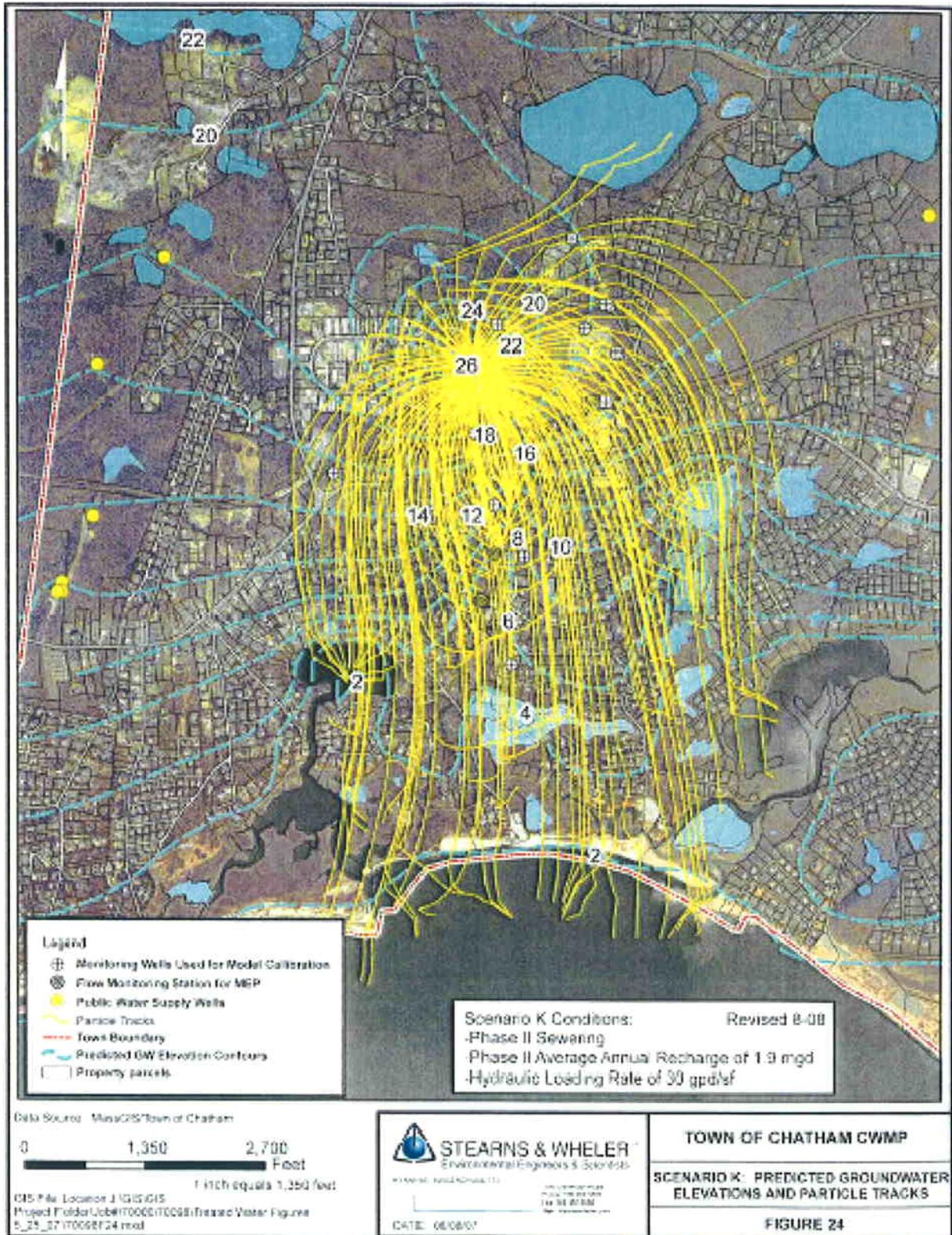
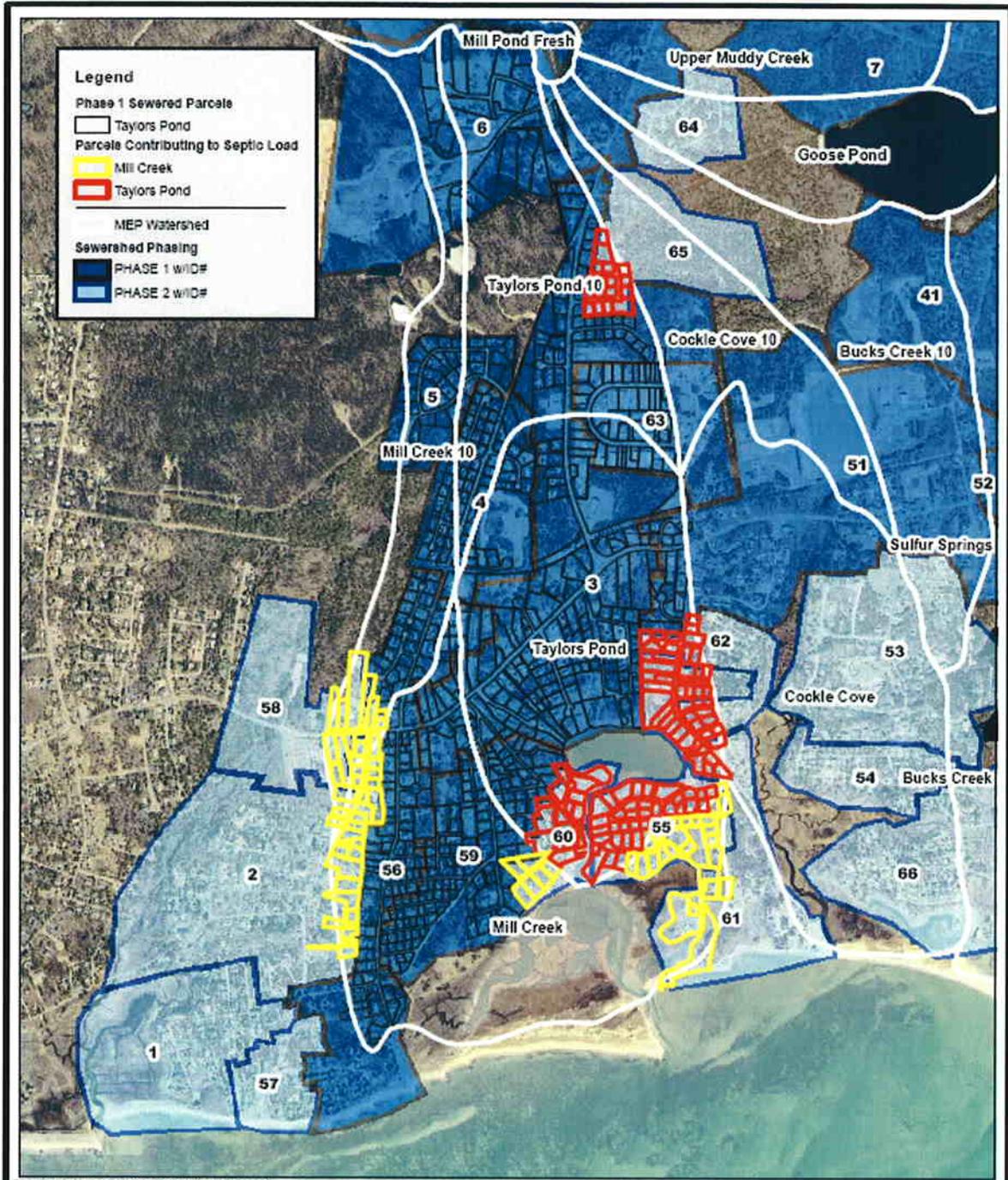


Figure 2. Flow path of 1.9 MGD of treated effluent recharged at Chatham WWTF. Discharge to Nantucket Sound would only be if the groundwater by-passes the intervening estuaries; this needs supporting hydrogeological evidence (presently unavailable).



Data Source: MassGIS, Town of Chatham GIS Dept

Figure 3. Sewer Plan for Taylor's Pond Estuarine System

2008 Figures: Sewer Phasing Figures



**STEARNS & WHEELER**  
Environmental Engineers & Scientists  
OFFICE LOCATION

PROJECT NO.:

DATE:

TOWN OF CHATHAM, MASSACHUSETTS

SEWERHED PHASING

TAYLORS POND SCENARIOS

## Addendum

Response to Taylors Pond Comments Provided by Dr. Robert Duncanson, Chatham Director of Health and Environment in a February 5, 2009 letter regarding the MEP Technical Memorandum of January 15, 2009.

a. 2<sup>nd</sup> para.: *The scenario provided by the Town on Oct. 1, 2008 was unchanged; the Oct. 20<sup>th</sup> email merely provided additional information on the fate of treated water recharge not accounted for in the requested scenario.*

Response: While the scenario presented on Oct 1, 2009 was not changed, the questions and data provided on October 20, 2008 were needed before the modeling could proceed. Therefore, the scenario was "finalized" based upon the provided information.

b. 2<sup>nd</sup> para.: *The figure reference for the sewersheds should be figure 3; figures 1 and 2 are the particle tracks.*

Response: Reference to Figures 1 & 2 added and reference to figures 3 &4 adjusted accordingly.

c. 5<sup>th</sup> para.: *The following statement is made: "It is assumed that watershed N loads passing through the freshwater ponds have been attenuated and included in the septic loads provided (for Taylors Pond System, Mill Pond fresh and for Sulphur Springs System), Mill Pond Fresh and Goose Pond)." This would seem to be the role of the model, to account for attenuation which is built into the model.*

Response: The MEP watershed loading model was provided to the Town and our understanding is that it was used by the Town to develop the new septic N loads presented for the scenario runs. The loading model accounts for any nitrogen loads passing through upgradient ponds, such as Mill Pond. The scenario loads were presented as new loads to each estuarine basin, either Taylors Pond or Mill Creek, without any clarification about loads within each of the sub-watershed designations (as appropriate for loading to a basin).

d. 5<sup>th</sup> para.: *The following statement is made: "In addition, it would be useful for a description of how the effluent was apportioned to each subembayment to be available with this document." This statement is unclear as the scenario presented the loads from septic and treated water recharge to the various subembayments in both gpd and lb/d.*

Response: As with the response directly above, this statement suggests that a description of how the basin nitrogen loads were derived would be helpful to increase understanding for any outside readers. It is acknowledged that the loads from septic and treated water are given in both gpd and lb/d.

e. 6<sup>th</sup> para.: *The 3<sup>rd</sup> from the last sentence makes reference to Tables IX-1 and IX-2 from the 2007 MEP Report. These references would appear to be incorrect as these Tables have to do with the impact of a 2<sup>nd</sup> inlet into Stage Harbor.*

Response: reference corrected

f. *The reference in the caption of Figures 1 and 2 relative to underflow to Nantucket Sound as lacking supporting evidence is opinion. Both the USGS and the more detailed sub-regional groundwater models indicate some amount of underflow to Nantucket Sound.*

Response: It should be noted that underflow to these estuaries has not been included in the original, approved MEP model configurations or any subsequent scenarios based upon discussions USGS, MassDEP and others. As previously noted, these discussions resulted in agreement that there is no direct evidence of underflow occurring and that assuming all flow is captured by the estuaries would be consistent with conservative principles built into the MEP analyses. The note in the caption confirms that there is a need for validation and hydrogeologic evidence (not modeling) to support underflow. It is not the MEP Team's decision to include or not to include underflow in any specific scenario. It should also be noted that water balance in other systems has not supported discernable underflow, not to say that it can't happen under specific geologic conditions.



# Town of Chatham

## Department of Health and Environment

Health      Water Quality Laboratory      Conservation

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TOWN ANNEX    261 GEORGE RYDER ROAD    CHATHAM, MA 02633

FAX (508) 945-5183



February 5, 2009

Brian Howes, Ph.D., Manager  
Coastal Systems Program  
UMass Dartmouth  
706 Rodney French Blvd.  
New Bedford, MA 02744

RE: Chatham CWMP Alternative Scenarios  
Linked Watershed-Embayment Nitrogen Management Model

  
Dear Dr. Howes:

The Town of Chatham (Town) has reviewed the MEP Technical Memoranda provided for Sulphur Springs/Bucks Creek, dated January 15, 2009, and Taylors Pond, dated January 20, 2009, and has the following comments/questions/clarifications:

1. Sulphur Springs/Bucks Creek

- a. 2<sup>nd</sup> para.: The scenario was finalized on November 24 versus November 14.
- b. 3<sup>rd</sup> para., 5<sup>th</sup> bullet: "... 39,000 gpd (@ 3% of 1.3 MGD recharge)...".
- c. 4<sup>th</sup> para., 8<sup>th</sup> bullet: "... = 1.3 MGD (68% of 1.9 MGD recharge)...".
- d. 5<sup>th</sup> para.: The last sentence is unclear in its reference to "... *referenced USGS data and a description of how the effluent was apportioned to each subembayment to be available with this document.*" This statement is unclear as the scenario presented the loads from septic and treated water recharge to the various subembayments in both gpd and lb/d.
- e. 6<sup>th</sup> para.: The 1<sup>st</sup> sentence makes reference to Tables IX-1 and IX-2 from the 2007 MEP Report. These references would appear to be incorrect as these Tables have to do with the impact of a 2<sup>nd</sup> inlet into Stage Harbor.
- f. 7<sup>th</sup> para.: The discussion needs clarification:
  - i. The discussion indicates that the threshold level at the Sentinel Station "was not achieved." In the discussion the Sentinel Station is presented as

being Sulphur Springs, however, in the 2007 Re-evaluated MEP Report the Sentinel Station is identified as station CM-8 in Bucks Creek (page 63). There is no monitoring station in Sulphur Springs as Sulphur Springs, similar to Cockle Cove Creek, drains almost completely at low tide and is transitioning into a wetland. Station CM-8 in Bucks Creek is the nearest station to Sulphur Springs but is several hundred feet downstream of the mouth of Sulphur Springs.

- ii. If the Sentinel Station is properly located as being at Station CM-8 in Bucks Creek then the threshold level in both scenarios would be met.
- iii. The discussion indicates that the threshold level at the Sentinel Station “was not achieved” but that the secondary check TN levels in Cockle Cove Creek “were very close to being acceptable.” When the difference(s) between the threshold level and the secondary check level are compared to their respective model results the differences at the Sentinel Station are actually smaller than that for the secondary check station, i.e. the Sentinel Station results are actually closer to the threshold than the values for Cockle Cove Creek. This is opposite of what is implied in the discussion.
- iv. The discussion does not acknowledge that the scenario is extremely conservative in not allowing any credit for underflow to Nantucket Sound, such underflow being shown in both the USGS and sub-regional groundwater modeling results. Nor does the discussion acknowledge that the MEP model is not providing attenuation for that portion of the recharge flow that is shown to be intercepted by the bogs/ponds located between the recharge site and Sulphur Springs as shown by the more detailed sub-regional groundwater model.
- v. The discussion does not acknowledge the Town’s original scenario request took into account underflow to Nantucket Sound as shown by the subregional groundwater model and requested attenuation of the recharge by the intercepting bogs/ponds but that the scenario was modified at the request of the MEP team resulting in an extremely conservative, worst-case scenario.
- g. Table 1.: The value shown for Sulphur Springs Present Watershed Load (kg/day) of 9.529 needs clarification/confirmation. In the 2007 Re-evaluated MEP Report this load is shown as 9.093 kg/day in Tables VI-2 (pg 45) and VI-4 (pg 53) while the value of 9.529 kg/day appears in Table VIII-3 (pg 67). It should be noted that the values for Bucks Creek and cockle Cove Creek are consistent across the 3 tables referenced.

## 2. Taylors Pond

- a. 2<sup>nd</sup> para.: The scenario provided by the Town on Oct. 1, 2008 was unchanged; the Oct. 20<sup>th</sup> email merely provided additional information on the fate of treated water recharge not accounted for in the requested scenario.
- b. 2<sup>nd</sup> para.: The figure reference for the sewersheds should be figure 3; figures 1 and 2 are the particle tracks.
- c. 5<sup>th</sup> para.: The following statement is made: *"It is assumed that watershed N loads passing through the freshwater ponds have been attenuated and included in the septic loads provided (for Taylors Pond System, Mill Pond fresh and for Sulphur Springs System), Mill Pond Fresh and Goose Pond)." This would seem to be the role of the model, to account for attenuation which is built into the model.*
- d. 5<sup>th</sup> para.: The following statement is made: *"In addition, it would be useful for a description of how the effluent was apportioned to each subembayment to be available with this document."* This statement is unclear as the scenario presented the loads from septic and treated water recharge to the various subembayments in both gpd and lb/d.
- e. 6<sup>th</sup> para.: The 3<sup>rd</sup> from the last sentence makes reference to Tables IX-1 and IX-2 from the 2007 MEP Report. These references would appear to be incorrect as these Tables have to do with the impact of a 2<sup>nd</sup> inlet into Stage Harbor.
- f. The reference in the caption of Figures 1 and 2 relative to underflow to Nantucket Sound as lacking supporting evidence is opinion. Both the USGS and the more detailed sub-regional groundwater models indicate some amount of underflow to Nantucket Sound.

On a general note the TechMemos should not reference an extended contract between the Town and UMassD as finalized on July 31, 2007. The original contract providing for wastewater scenarios was closed by UMassD sometime in early 2008 without notice; as a result the Town and UMassD had to enter into a new contract dated October 8, 2008 following submittal of the Taylors Pond scenario request on October 1, 2008.

If you have any questions I can be reached via email at [rduncanson@chatham-ma.gov](mailto:rduncanson@chatham-ma.gov).

Sincerely yours,



Robert A. Duncanson, Ph.D.  
Director of Health & Environment

cc: William Hinchey, Town Manager  
Nate Weeks/Jeff Gregg, Stearns & Wheeler

Brian Dudley, MA DEP Hyannis  
Ed Eichner  
Roland Samimy, SMAST

November 24, 2008

Brian Howes, Ph.D., Manager  
Coastal Systems Program  
UMass Dartmouth  
706 Rodney French Blvd.  
New Bedford, MA 02744

RE: Second REVISED Chatham CWMP Alternative Scenario – Sulphur Springs  
Linked Watershed-Embayment Nitrogen Management Model

Dear Dr. Howes:

Based on conversation with Ed Eichner the Town of Chatham is submitting this second revision to the wastewater management scenario for the Sulphur Springs System. This revision is intended to address the consolidation of recharge loads into the Sulphur Springs system.

Ed has indicated that model is unable to distinguish between loads entering directly into the Sulphur Springs system and those that enter the system after passing through the cranberry bogs/ponds, and thus may be subjected to some natural attenuation, due to the watershed delineations. To address this issue the parameters of the scenarios have been modified to combine the two previously separate Sulphur Springs WWTF recharge loads.

Therefore, the revised wastewater N loads for the 2 scenarios are listed below:

- Scenario H1330b - Future Conditions (buildout) in the watershed at the end of Phase 1 sewerage, with annual average recharge at the WWTF of 1.3 mgd, including:
  - Sulphur Spring Septic System load = 22,500 gpd and 26.25 mg/L TN conc. = 4.9 lb/d
  - Sulphur Spring WWTF Recharge load = 39,000 gpd (@ 3% of 1.3 mgd recharge) and 3 mg/L TN conc. = 0.98 lb/d.
  - Bucks Creek Septic System load = 12,000 gpd and 26.25 mg/L TN conc. = 2.6 lb/d
  - Bucks Creek WWTF Recharge load = 0 gpd = 0 lb/d
  - Cockle Cove Creek WWTF Recharge load = 1.2 mgd (92% of 1.3 mgd recharge) and 3 mg/l TN conc. = 30 lb/d

- Scenario K1930b - Future Conditions (buildout) in the watershed at the end of Phase 2 sewerage, with annual average recharge at the WWTF of 1.9 mgd, including:
  - Sulphur Spring Septic System load = 0 gpd = 0 lb/d
  - Sulphur Spring WWTF Recharge load = 361,000 gpd (19% of 1.9 mgd recharge) and 3 mg/L TN conc. = 9.03 lb/d
  - Bucks Creek Septic System load = 0 gpd = 0 lb/d
  - Bucks Creek WWTF Recharge = 19,000 gpd (@1% of 1.9 mgd recharge) and 3 mg/L TN conc. = 0.48 lb/d
  - Cackle Cove Creek WWTF Recharge load = 1.3 mgd (68% of 1.9 mgd recharge) and 3 mg/l TN conc. = 32 lb/d

We request that you and your team run the Sulphur Springs System Estuary model for these revised scenarios to determine if the target threshold (0.38 mg/L TN) will be met.

Please call me at (508) 945-5165, Mon. to Fri. from 8:00 am to 4:00 pm, or email ([rduncanson@chatham-ma.gov](mailto:rduncanson@chatham-ma.gov)) if you have any questions or comments on this request.

Best Regards,

Robert A. Duncanson, Ph.D.  
Director of Health & Environment

cc: Nate Weeks & Jeff Gregg, Stearns & Wheler

File 70098.5



# Town of Chatham

Department of  
*Health and Environment*



*Health*      *Water Quality Laboratory*      *Conservation*

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TOWN ANNEX    261 GEORGE RYDER ROAD    CHATHAM, MA 02633

FAX (508) 945-5163

October 29, 2008

Brian Howes, Ph.D., Manager  
Coastal Systems Program  
UMass Dartmouth  
706 Rodney French Blvd.  
New Bedford, MA 02744

RE: REVISED Chatham CWMP Alternative Scenario – Sulphur Springs  
Linked Watershed-Embayment Nitrogen Management Model

  
Dear Dr. Howes:

On October 21<sup>st</sup> the Town of Chatham forwarded to you a request for modeling of several wastewater management scenarios in the Sulphur Springs System. Subsequent to that request Ed Eichner of your team requested clarification of the scenario parameters relative to the way that WWTF recharge flow, depicted in the groundwater modeling results as entering Nantucket Sound, is addressed.

Attached are 2 particle track figures (same as provided with the Oct. 21st Sulphur Springs System scenario request) that illustrate the groundwater recharge and ultimate fate of the particle tracks. You will notice that the model output indicates that a significant portion of the recharge flows subsurface to Nantucket Sound. Based on discussions with Ed we have revised the scenarios to assume that all of the WWTF recharge flow depicted as flowing to Nantucket Sound surfaces into Cackle Cove Creek and ultimately flows through the southern portion of the Sulphur Springs estuary. This assumption is consistent with the scenario parameters made in the Bucks Creek CWMP scenario modeled in 2007. Ed indicated that this is a conservative assumption and should be used for the water quality modeling.

Both scenarios would utilize the non-wastewater build-out N loads that were reported in the most recent Technical and TMDL reports for this estuary. The 2 scenarios differ in the amount of wastewater N load based on differences in sewer extension and recharge flow quantities of the treated water from the WWTF.

Therefore, the revised wastewater N loads for the 2 scenarios are listed below:

- Scenario H1330b - Future Conditions (buildout) in the watershed at the end of Phase 1 sewerage, with annual average recharge at the WWTF of 1.3 mgd, including:
  - Sulphur Spring Septic System load = 22,500 gpd and 26.25 mg/L TN conc. = 4.9 lb/d
  - Recharge load (from WWTF recharge) through the cranberry bogs/ponds and into the southern portion of Sulphur Springs Estuary = 39,000 gpd (@ 3% of 1.3 mgd recharge) and 3 mg/l TN conc. = 0.98 lb/d
  - Sulphur Spring WWTF Recharge load = 0 gpd = 0 lb/d
  - Bucks Creek Septic System load = 12,000 gpd and 26.25 mg/L TN conc. = 2.6 lb/d
  - Bucks Creek WWTF Recharge load = 0 gpd = 0 lb/d
  - Cackle Cove Creek WWTF Recharge load = 1.2 mgd (92% of 1.3 mgd recharge) and 3 mg/l TN conc. = 30 lb/d
  
- Scenario K1930b - Future Conditions (buildout) in the watershed at the end of Phase 2 sewerage, with annual average recharge at the WWTF of 1.9 mgd, including:
  - Sulphur Spring Septic System load = 0 gpd = 0 lb/d
  - Sulphur Spring WWTF Recharge load = 57,000 gpd (3% of 1.9 mgd recharge) and 3 mg/L TN conc. = 1.4 lb/d
  - Recharge load (from WWTF Recharge) through the cranberry bogs/ponds and into southern portion of Sulphur Springs Estuary = 304,000 gpd (@ 16% of 1.9 mgd recharge) and 3 mg/l TN conc. = 7.6 lb/d
  - Bucks Creek Septic System load = 0 gpd = 0 lb/d
  - Bucks Creek WWTF Recharge = 19,000 gpd (@1% of 1.9 mgd recharge) and 3 mg/L TN conc. = 0.48 lb/d
  - Cackle Cove Creek WWTF Recharge load = 1.3 mgd (68% of 1.9 mgd recharge) and 3 mg/l TN conc. = 32 lb/d

We request that you and your team run the Sulphur Springs System Estuary model for these revised scenarios to determine if the target threshold (0.38 mg/L TN) will be met.

Please consider potential N attenuation that is expected to occur as the recharge flows through the bogs and associated freshwater ponds, and salt marsh as illustrated in the 2 figures.

These scenario evaluations would be conducted under the recently signed contract between the Town and SMAST for *Technical Support for Chatham CWMP N Management Scenarios*. Please provide an expected date for delivery of the Technical Memo.

Please call me at (508) 945-5165, Mon. to Fri. from 8:00 am to 4:00 pm, or email ([rduncanson@chatham-ma.gov](mailto:rduncanson@chatham-ma.gov)) if you have any questions or comments on this request.

Best Regards,



Robert A. Duncanson, Ph.D.  
Director of Health & Environment

cc: Nate Weeks & Jeff Gregg, Stearns & Wheler



# Town of Chatham

Department of  
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Health Water Quality Laboratory Conservation

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TOWN ANNEX 261 GEORGE RYDER ROAD CHATHAM, MA 02633

FAX (508) 945-5163



→ 2008.5

October 21, 2008

Brian Howes, Ph.D., Manager  
Coastal Systems Program  
UMass Dartmouth  
706 Rodney French Blvd.  
New Bedford, MA 02744



RE: Chatham CWMP Alternative Scenario – Sulphur Springs  
Linked Watershed-Embayment Nitrogen Management Model

*Brian*

Dear Dr. Howes:

The Town is requesting additional CWMP alternative scenarios as we continue to address comments on the Draft Chatham CWMP/EIR. We request that you and your team run the Sulphur Springs System Estuary model for 2 additional scenarios to determine if the target threshold (0.38 mg/L TN) will be met.

Both scenarios would utilize the non-wastewater build-out N loads that were reported in the most recent Technical and TMDL reports for this estuary. The 2 scenarios differ in the amount of wastewater N load based on differences in sewer extension and recharge flow quantities of the treated water from the WWTF.

The wastewater N loads for the 2 scenarios are listed below:

- Scenario H1330b - Future Conditions (buildout) in the watershed at the end of Phase 1 sewerage, with annual average recharge at the WWTF of 1.3 mgd, including:
  - Sulphur Spring Septic System load = 22,500 gpd and 26.25 mg/L TN conc. = 4.9 lb/d
  - Recharge load (from WWTF recharge) through the cranberry bogs/ponds and into the southern portion of Sulphur Springs Estuary = 39,000 gpd (@ 3% of 1.3 mgd recharge) and 3 mg/l TN conc. = 0.98 lb/d
  - Sulphur Spring WWTF Recharge load = 0 gpd = 0 lb/d
  - Bucks Creek Septic System load = 12,000 gpd and 26.25 mg/L TN conc. = 2.6 lb/d
  - Bucks Creek WWTF Recharge load = 0 gpd = 0 lb/d

- Cockle Cove Creek WWTF Recharge load = 624,000 gpd (48% of 1.3 mgd recharge) and 3 mg/l TN conc. = 15.6 lb/d
- Scenario K1930b - Future Conditions (buildout) in the watershed at the end of Phase 2 sewerage, with annual average recharge at the WWTF of 1.9 mgd, including:
  - Sulphur Spring Septic System load = 0 gpd = 0 lb/d
  - Sulphur Spring WWTF Recharge load = 57,000 gpd (3% of 1.9 mgd recharge) and 3 mg/L TN conc. = 1.4 lb/d
  - Recharge load (from WWTF Recharge) through the cranberry bogs/ponds and into southern portion of Sulphur Springs Estuary = 304,000 gpd (@ 16% of 1.9 mgd recharge) and 3 mg/l TN conc. = 7.6 lb/d
  - Bucks Creek Septic System load = 0 gpd = 0 lb/d
  - Bucks Creek WWTF Recharge = 19,000 gpd (@1% of 1.9 mgd recharge) and 3 mg/L TN conc. = 0.48 lb/d
  - Cockle Cove Creek WWTF Recharge load = 817,000 gpd (43% of 1.9 mgd recharge) and 3 mg/l TN conc. = 20.5 lb/d

Attached are 2 particle track figures (same as provided with the Oct. 1 Taylors Pond scenario request) that illustrate the groundwater recharge of these 2 scenarios. Please consider potential N attenuation that is expected to occur as the recharge flows through the bogs and associated freshwater ponds, and salt marsh as illustrated in the 2 figures.

These scenario evaluations would be conducted under the recently signed contract between the Town and SMAST for *Technical Support for Chatham CWMP N Management Scenarios*. Please provide an expected date for delivery of the Technical Memo.

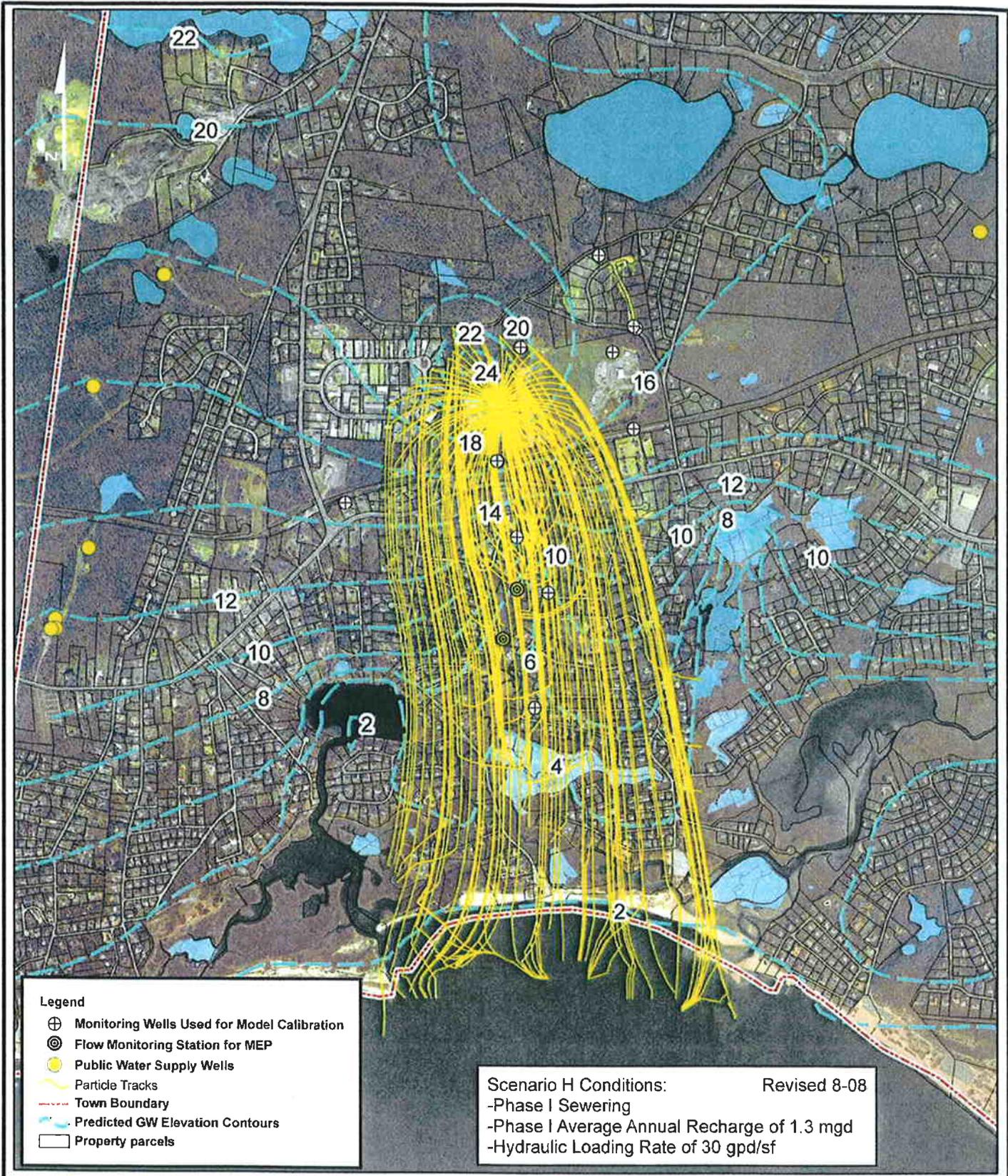
Please call me at (508) 945-5165, Mon. to Fri. from 8:00 am to 4:00 pm, or email ([rduncanson@chatham-ma.gov](mailto:rduncanson@chatham-ma.gov)) if you have any questions or comments on this request.

Best Regards,



Robert A. Duncanson, Ph.D.  
Director of Health & Environment

cc: Nate Weeks & Jeff Gregg, Stearns & Wheler



**Legend**

- ⊕ Monitoring Wells Used for Model Calibration
- ⊙ Flow Monitoring Station for MEP
- Public Water Supply Wells
- Particle Tracks
- - - Town Boundary
- Predicted GW Elevation Contours
- Property parcels

Scenario H Conditions: Revised 8-08  
 -Phase I Sewering  
 -Phase I Average Annual Recharge of 1.3 mgd  
 -Hydraulic Loading Rate of 30 gpd/sf

Data Source: MassGIS/Town of Chatham



GIS File Location: J:\GIS\GIS  
 Project Folder\Job#\70000\70098\Treated Water Figures  
 5\_25\_07\70098F23.mxd

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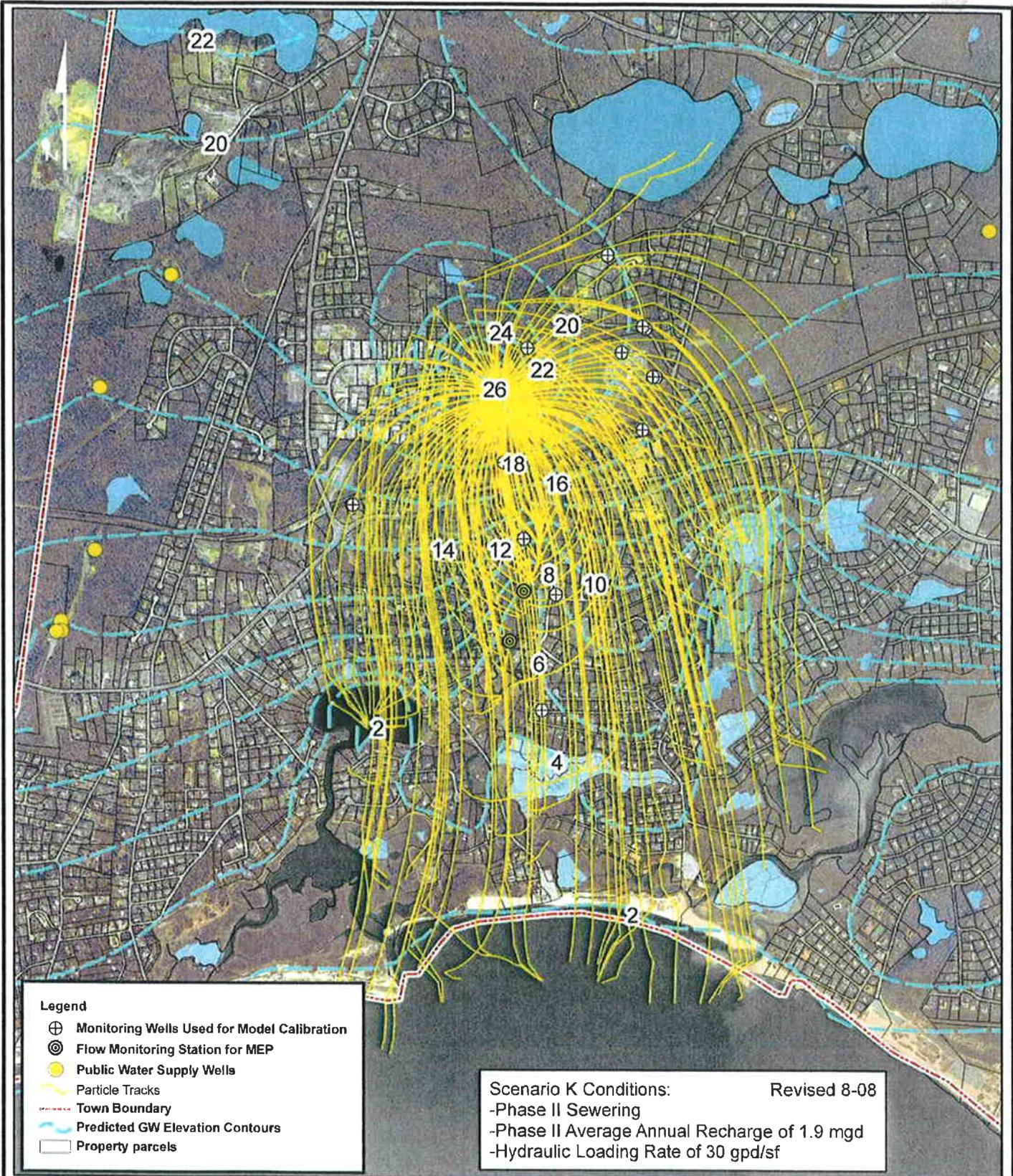
1545 Iya Inough Road  
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 Fax: 508 382-5694  
 Web: stearns-wheeler.com

DATE: 06/08/07

**TOWN OF CHATHAM CWMP**

**SCENARIO H: PREDICTED GROUNDWATER ELEVATIONS AND PARTICLE TRACKS**

**FIGURE 23**



**Legend**

- ⊕ Monitoring Wells Used for Model Calibration
- ⊙ Flow Monitoring Station for MEP
- Public Water Supply Wells
- Particle Tracks
- Town Boundary
- - - Predicted GW Elevation Contours
- Property parcels

Scenario K Conditions: Revised 8-08  
 -Phase II Sewering  
 -Phase II Average Annual Recharge of 1.9 mgd  
 -Hydraulic Loading Rate of 30 gpd/sf

Data Source: MassGIS/Town of Chatham



GIS File Location: J:\GIS\GIS  
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**TOWN OF CHATHAM CWMP**

**SCENARIO K: PREDICTED GROUNDWATER ELEVATIONS AND PARTICLE TRACKS**

**FIGURE 24**