

Use of Reclaimed Water Expanded at Bayberry Hills Golf Course in Yarmouth, MA

Jeff Colby,
Yarmouth DPW Director

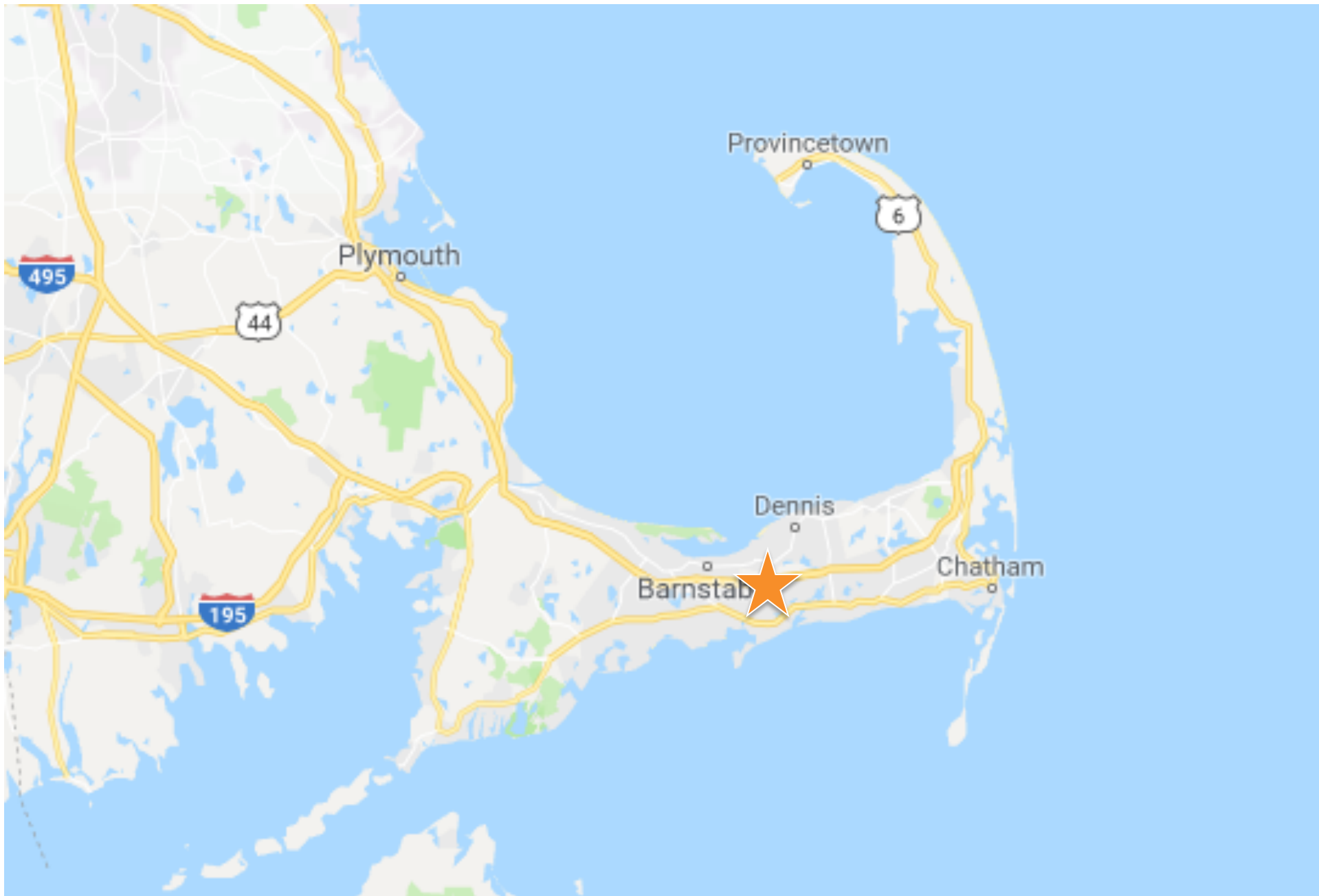
David Young, P.E.
Vice President at CDM Smith

January 22, 2018



**CDM
Smith**





**Effluent
Disposal**

**10.5 mg Storage
Tank**

**Septage
Treatment Plant**

**Links at Bayberry
Hills Golf Course**



Yarmouth Septage Treatment Plant

- 95 percent of Cape Cod is on septic systems
- Yarmouth has only remaining septage only treatment facility
- Four Cape Cod wastewater plants limit septage receiving
- Yarmouth facility permit increased in 2016 from 21 MG/YR to 28 MG/YR
- 23.5 MG of septage received in 2016
- 24.5 MG of effluent discharged in 2016 (April 1 to November 30)
 - 10.5 MG to Links at Bayberry Hills Golf Course
 - 14.0 MG to Buck Island Irrigation Field

Links at Bayberry Hills Golf Course –Yarmouth, MA (Holes 2 thru 8 permitted for use of Reclaimed Water since 2001)



Strategic and Financial Importance

- Septage facility now 25 years old and needs \$2 to \$3 Million in capital improvements.
- Financially facility needed support for operational and debt service payments.
- Recent closure of Tri-Town Septage Plant (Brewster, Eastham, Orleans) created a financial opportunity and need for effluent disposal capacity.
- Other 20 holes at Bayberry Hills Golf Course created an opportunity since Water Management Act issues needed to be addressed.



Septage Treatment Facility

Holes 2-8 - Area Permitted for Effluent Reuse




Area of Effluent Reuse Under Modified Permit

Pond

Pond

Pond

Town of Yarmouth
Bayberry Hills Golf Course
Proposed Modification for Use of Reclaimed Water

-  Irrigation Pump House
-  Approximate Boundary
-  Irrigation Pond



0 500 1,000
Ft

History of Links at Bayberry Hills Golf Course

- 57-acre municipal landfill capped in 2000 and included nine hole golf course expansion.
- Seven holes placed on top of former landfill.
- Landfill located in towns Aquifer Protection District.
- Golf course expansion needed source of irrigation water.
- 1996 to 2001 regulatory process to permit use of reclaimed water.
- Typically 12 to 16 MG/YR of reclaimed water applied to seven holes; remainder of effluent discharged to irrigation field at Buck Island Road site 3 miles away.
- Typically 10 mg/l nitrate nitrogen in reclaimed water applied and less than 3 mg/l nitrate nitrogen in lysimeter samples 2-ft below turf; above cap.

Links at Bayberry Hills Golf Course – 8th Fairway



MassDEP Permit Regulations

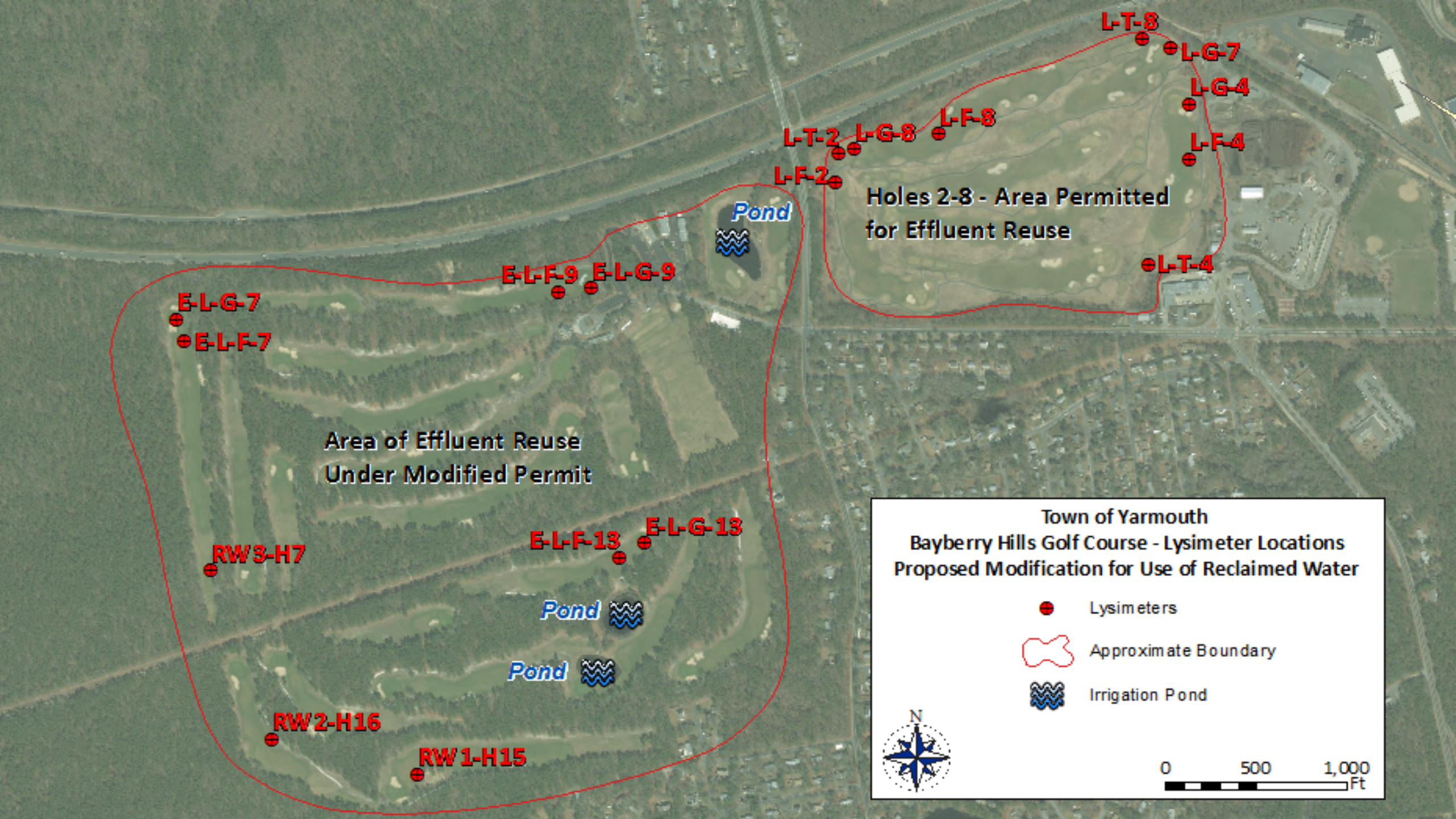
- Permitted the initial reclaimed water use via Guidelines within the Groundwater Discharge Permit Regulations (314 CMR 5.00) as there were no reclaimed water regulations in Massachusetts in 2001.
- State created Reclaimed Water Permit Program and Standards (314 CMR 20.00) in 2009.
- Reclaimed water regulations added a Total Organic Carbon (TOC) permit parameter if recharging within a Zone II area (groundwater contributes to municipal well under drought conditions). Surrogate for tracking Contaminants of Emerging Concern (CECs).

Comparison of Effluent Limits

Effluent Characteristics	Buck Island Discharge Limitations	Bayberry Hills Golf Course Discharge Limitations
Oil and Grease	15 mg/l	15 mg/l
Total Suspended Solids (TSS)	30 mg/l	5.0 mg/l
Biochemical Oxygen Demand, 5-day @20°C (BOD ₅)	30 mg/l	10 mg/l
Total Nitrogen (NO ₂ +NO ₃ +TKN)	10 mg/l	14 mg/l annual average, not to exceed 30 mg/l in any one sampling period
Nitrate Nitrogen	10 mg/l	10 mg/l
Turbidity	--	Not to exceed an average of 2 NTU in a 24-hour period, 5 NTU more than 5% of the time in a 24-hour period or 10 NTU at any time
Fecal Coliform Bacteria	200/100 ml	Media ND (7 day sample) with non > 14/100 ml

Regulatory Hurdles to Expand Reclaimed Water Use

- Three Bayberry Hills golf holes located in Zone II to Yarmouth municipal wells.
- Total Organic Carbon added to reclaimed water regulations.
- Disposal versus agronomic application rate.

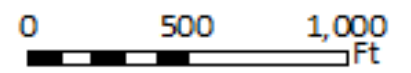


Holes 2-8 - Area Permitted for Effluent Reuse

Area of Effluent Reuse Under Modified Permit

Town of Yarmouth
Bayberry Hills Golf Course - Lysimeter Locations
Proposed Modification for Use of Reclaimed Water

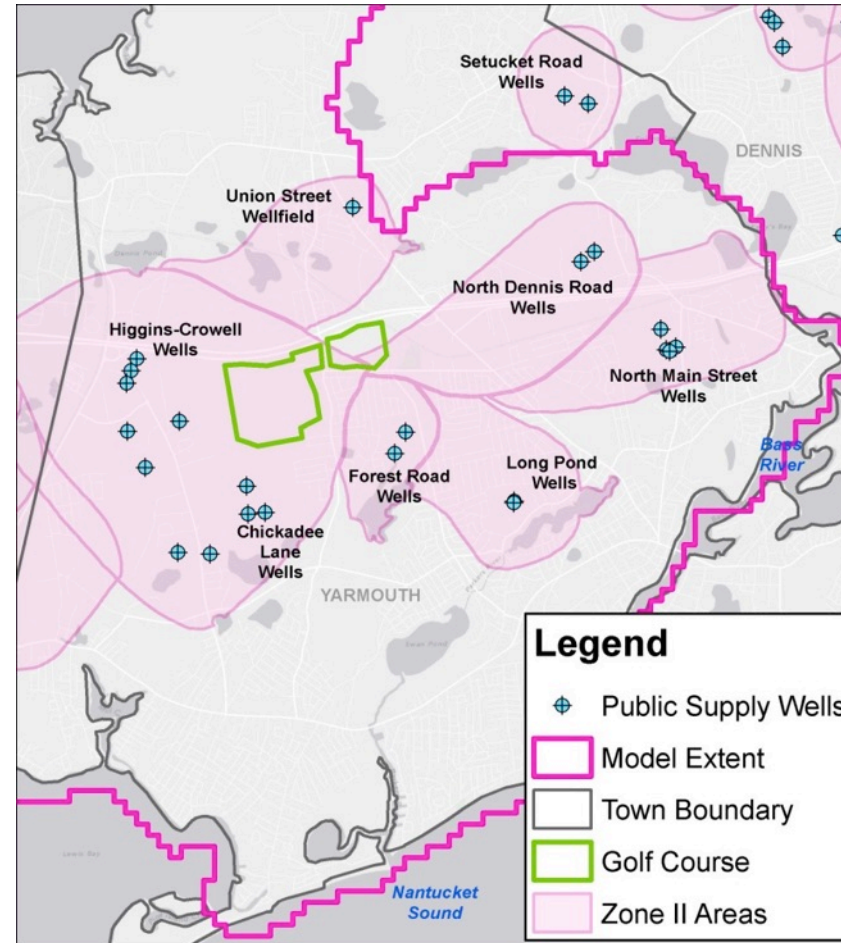
- Lysimeters
- Approximate Boundary
- ☞ Irrigation Pond



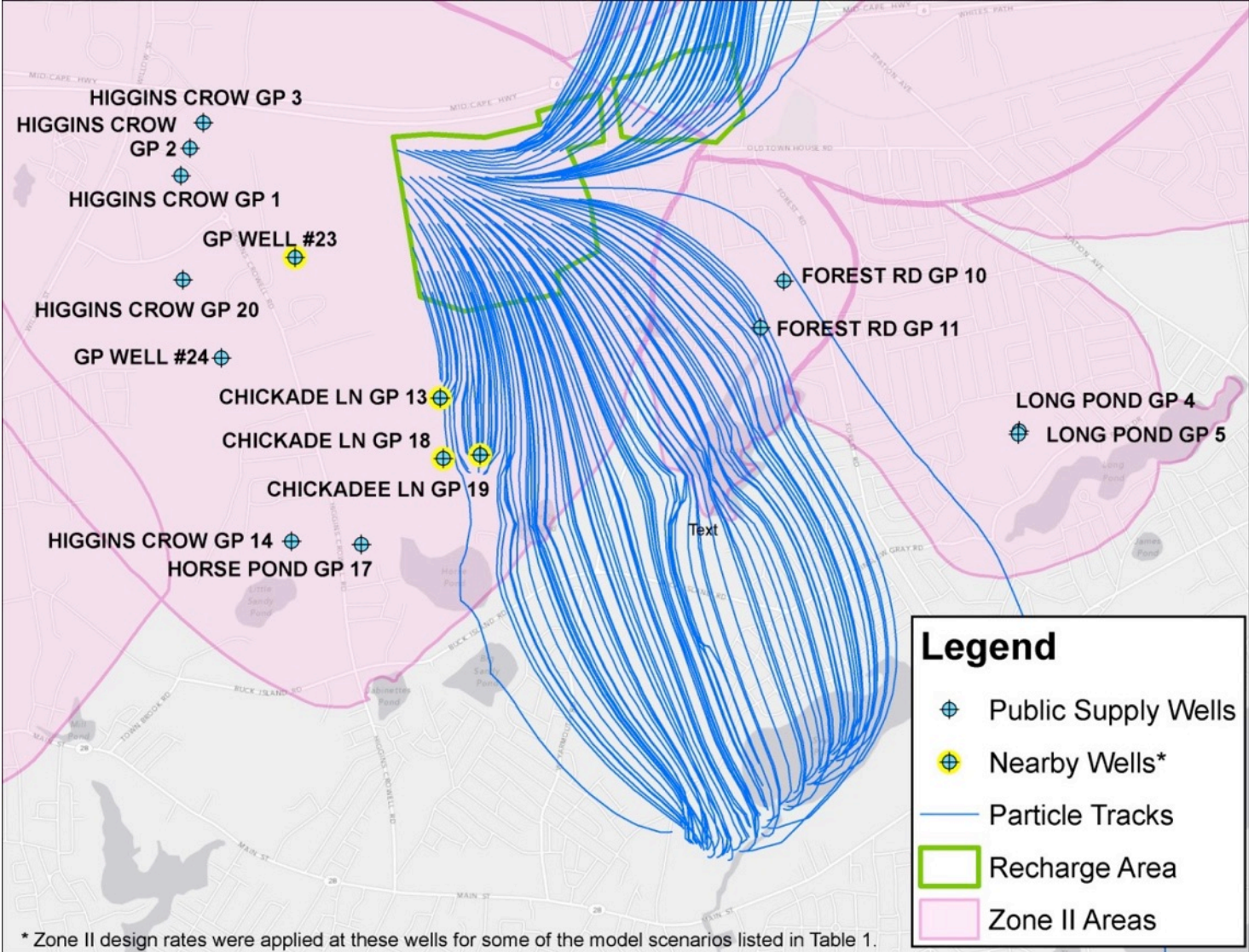
Hydraulic Modeling of Zone II Area

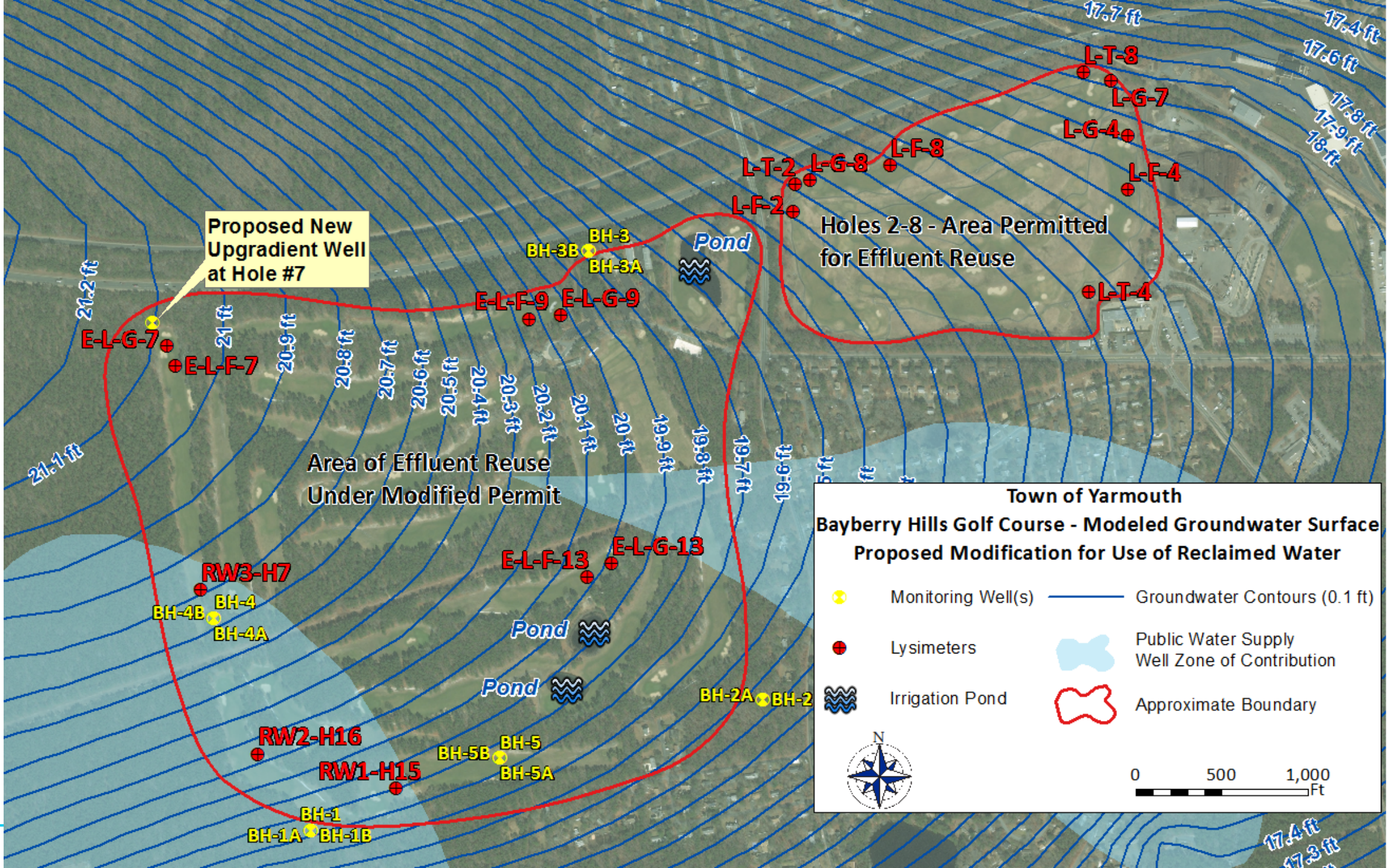
- Average town water pumping rate used = 3.2 mgd
- Permitted Zone II pumping rate = 10.03 mgd
- Travel time to nearest well at average pumping rate = 5 years
- Travel time to nearest well at permitted pumping rate = 3 years

Yarmouth Municipal Wells and Zone II Areas



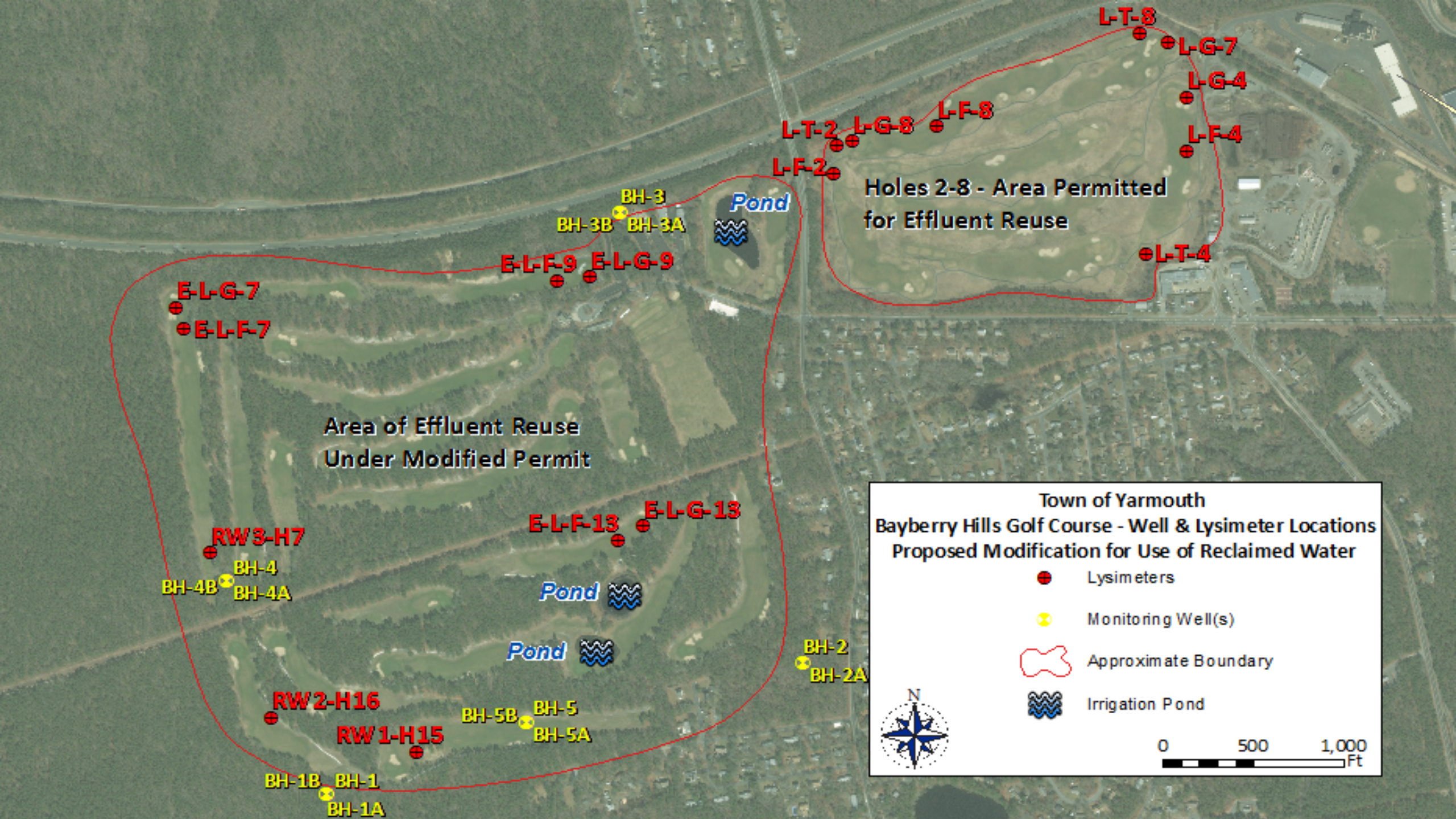
Hydrogeologic Modeling of Applied Reclaimed Water





Existing TOC Results

- Bayberry Hills Golf Course
 - Four monitoring well clusters around perimeter of 20 holes – TOC less than 5.0 mg/l
 - Six lysimeters within golf course (3-fairways; 3 greens) – TOC range of 25 to 48 mg/l
- Links at Bayberry Hills Golf Course
 - Reclaimed water (effluent) applied to seven holes – TOC range of 11 to 14 mg/l
 - Nine lysimeters within golf course (3 tees; 3 fairways; 3 greens) – TOC range of 15 to 58 mg/l
- Conclusion
 - TOC increases as it passes through the soil to permit compliance point.
 - TOC is not a good compliance parameter



Area of Effluent Reuse
Under Modified Permit

Holes 2-8 - Area Permitted
for Effluent Reuse

Town of Yarmouth
Bayberry Hills Golf Course - Well & Lysimeter Locations
Proposed Modification for Use of Reclaimed Water

- Lysimeters
- Monitoring Well(s)
- Approximate Boundary
- ☞ Irrigation Pond

0 500 1,000
Ft

MassDEP may allow a discharge in a Zone II

314 CMR 5.10(4A)e allows a discharge in a Zone II if:

- Discharge was authorized by permit prior to March 20, 2009;
- Discharge is from a publicly owned treatment plant;
- Effluent limits are at least as stringent as those in 2009;
- Discharge will not violate surface water quality standards;
- Discharge will not impair groundwater as potential source of drinking water; and
- Discharge is outside the six-month time of travel to the public drinking water well.

Redundancy Factors

- Dilution in ponds is about 4 to 1 (TOC applied about 3 mg/l)
- Buck Island Road site still available
- 10.5 MG storage tank if source water not needed or out of compliance
- Septage facility can be closed for short periods of time

Disposal Versus Agronomic Application

- Regulations assume disposal rates or XYZ gallons discharged every day.
- Reclaimed water as irrigation source water is applied at agronomic rates or as the vegetation needs the water.
- Agronomic application results in minimal impact to the groundwater as the lysimeters 2-ft beneath the turf often have insufficient liquid for sampling.

Revised Permit Issued

- It took more than five years to convince MassDEP to modify the permit.
- On July 14, 2017, Yarmouth was issued a Modified Groundwater Discharge Permit which allows for use of reclaimed water on all 27 holes at Bayberry Hills Golf Course between April 1st and November 30th.
- Conditions in permit:
 - Monitor TOC in lysimeters three months prior to use to develop a baseline.
 - Apply reclaimed water at an agronomic rate sufficient to sustain the turf.
 - Application is prohibited on three holes (7, 15, 16) during rain events.

Summary

- Highly treated effluent should be considered a resource.
- Yarmouth needed to find additional uses for its 28 MG of effluent in order to make the septage treatment facility financially viable.
- Yarmouth Water Department supported this project after reviewing the hydrogeologic modeling results.
- Acceptance of applying reclaimed water at an agronomic rate versus disposal was critical.
- Use of TOC as a surrogate CEC tracer needs to be re-evaluated.

Contact us!



David Young

CDM Smith

617-452-6544

youngdf@cdmsmith.com

Jeff Colby

Yarmouth DPW Director

508-398-8223 x1291

jcolby@yarmouth.ma.us

Find more insights through our water partnership
at cdmsmith.com/water and [@CDMSmith](https://twitter.com/CDMSmith)