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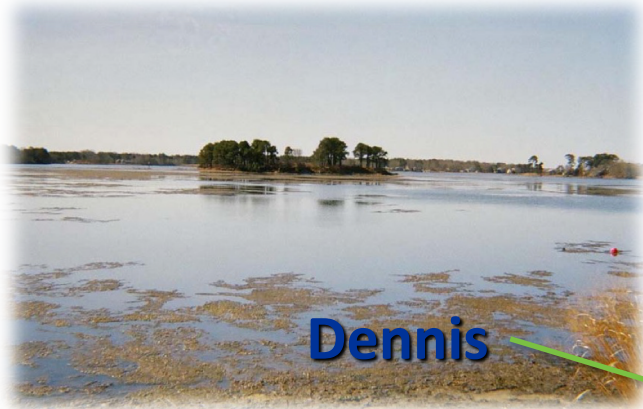
Acing the Aquifer:

Field Methods to Help Keep the Budget Under Par at
the Bass River Golf Course

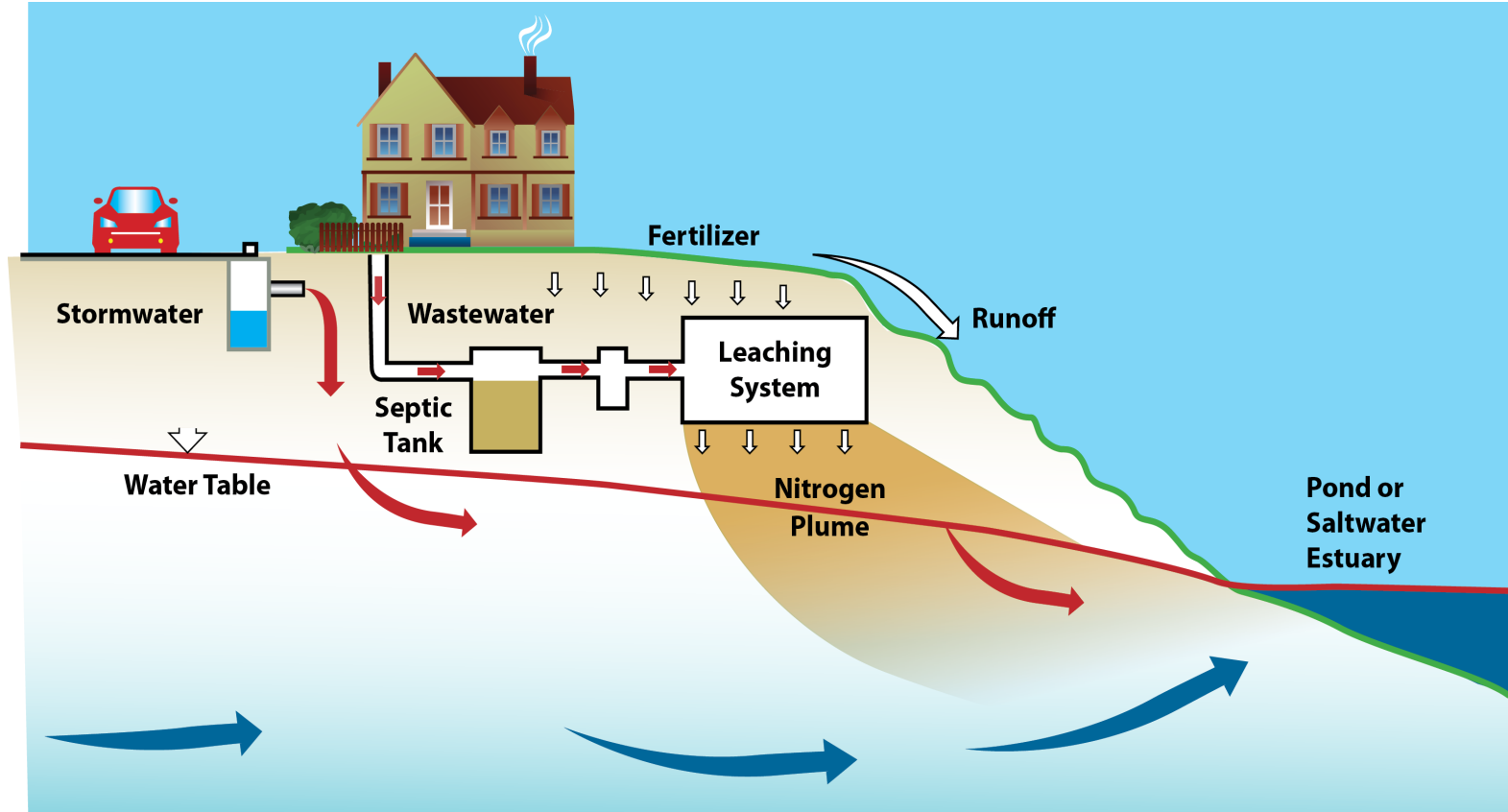


**CDM
Smith**

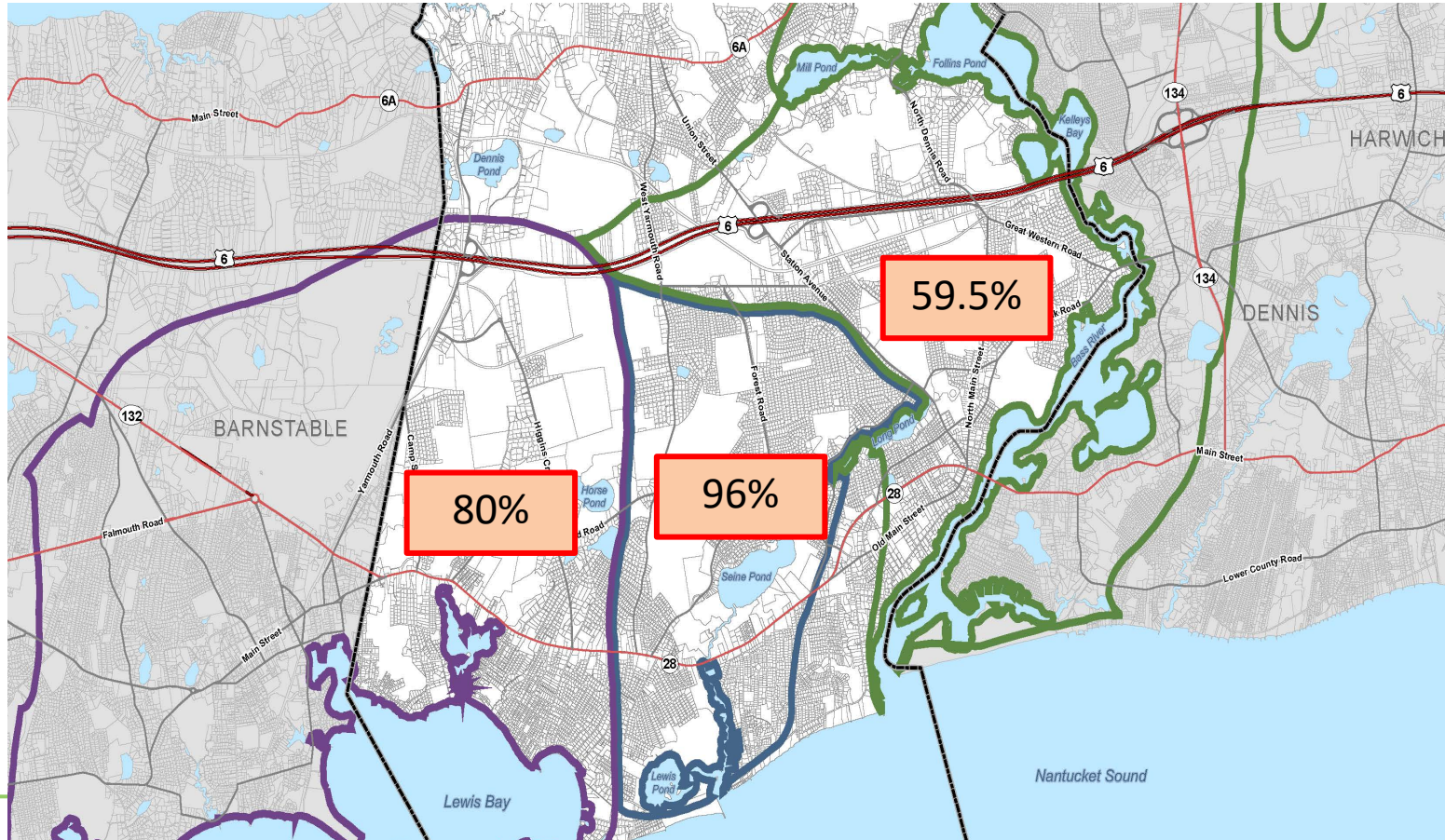
The Problem: Nutrient Enrichment



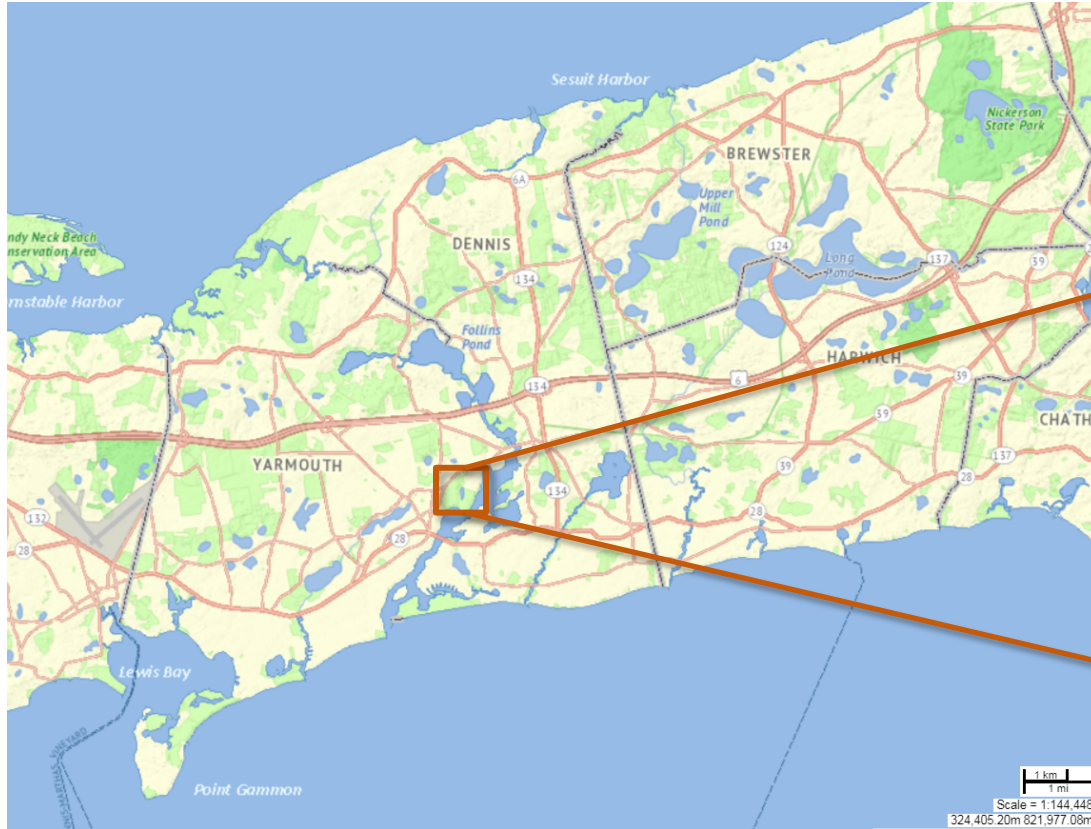
The Source: Nitrogen in Groundwater

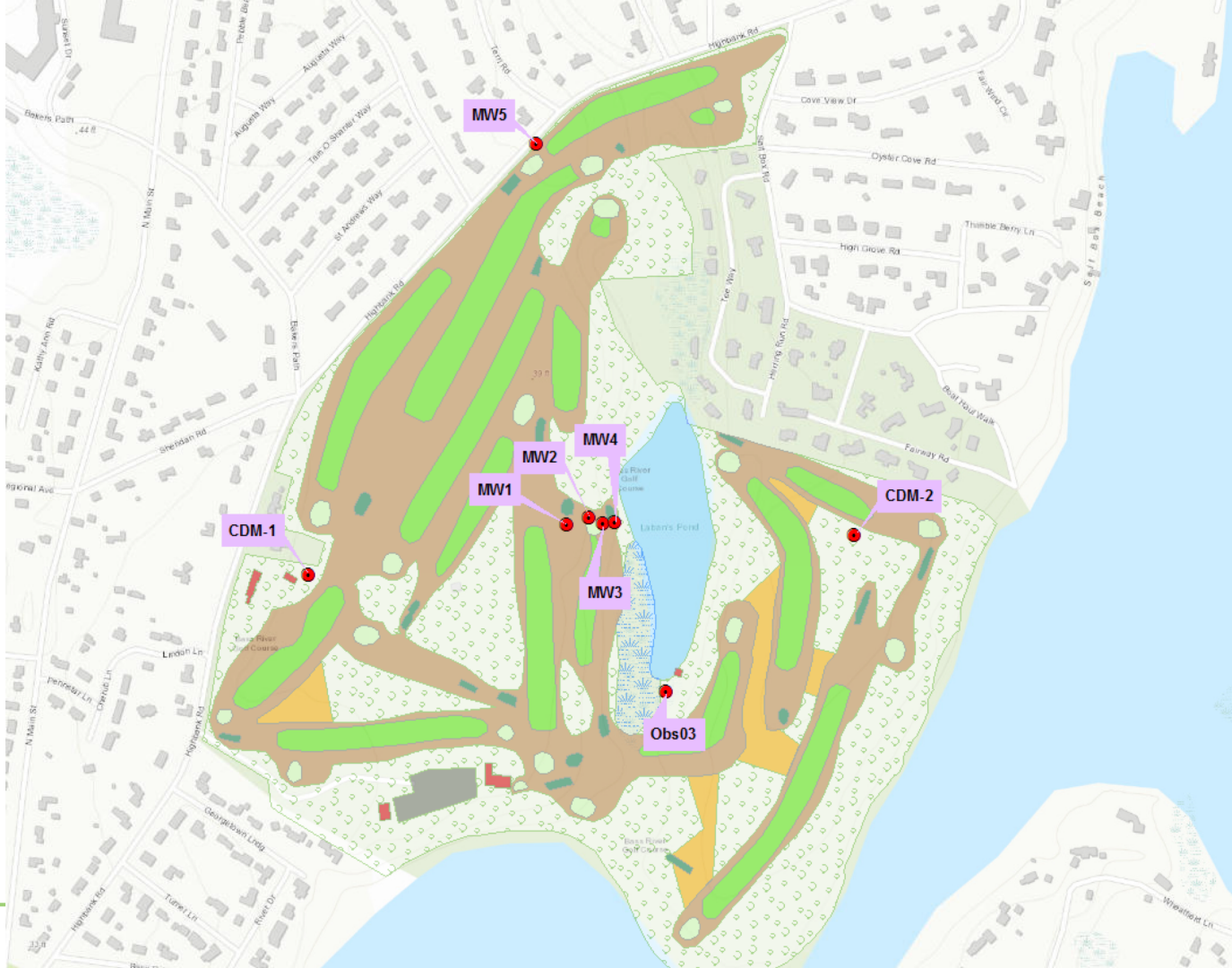


Septic System Nitrogen Removal Required to Restore Water Quality



Bass River Golf Course (BRGC)





Field Methods



Grain Size Distribution Analysis



Slug Testing



Aquifer Pumping Test



Pond Hydraulic Test



Long-Term Monitoring



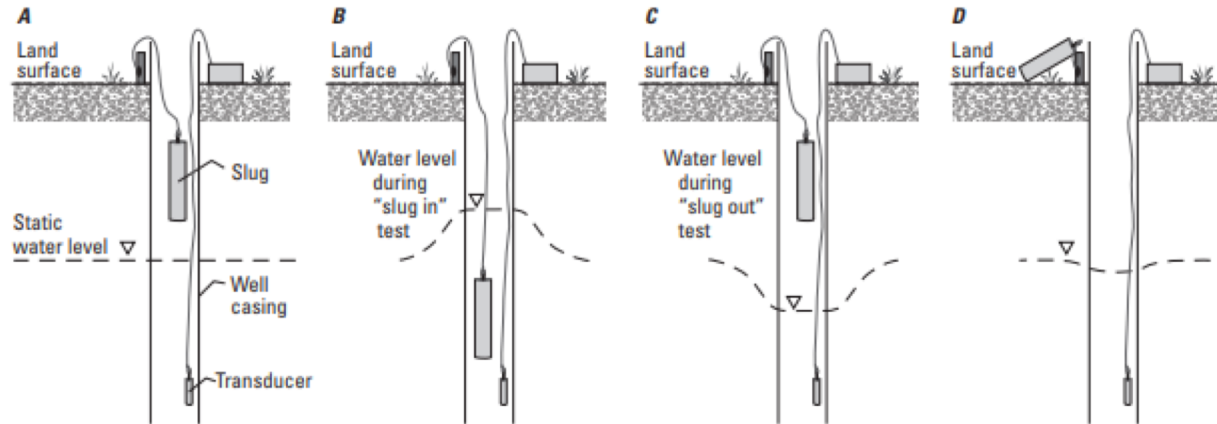
Small-Scale Load Test

Grain Size Distribution Analysis



Benefits	Cons	Distance/Influence	Cost
<ul style="list-style-type: none">• Easy to collect, analyze & interpret	<ul style="list-style-type: none">• Limited spatial influence	Wellbore	\$

Slug Testing



Benefits	Cons	Distance/Influence	Cost
<ul style="list-style-type: none"> Few equipment needs Quick 	<ul style="list-style-type: none"> Requires wells 	Wellbore	\$

Hydraulic Test – Laban’s Pond



Benefits	Cons	Distance/Influence	Cost
<ul style="list-style-type: none">• Few equipment needs• Large spatial influence	<ul style="list-style-type: none">• Time• Requires waterbody	Partial Site	\$\$

Aquifer Pumping Test



Benefits	Cons	Distance/Influence	Cost
<ul style="list-style-type: none">• Yields additional aquifer information	<ul style="list-style-type: none">• Equipment requirements	Partial Site	\$\$

Long-Term Monitoring



Benefits	Cons	Distance/Influence	Cost
<ul style="list-style-type: none">• Low effort• Captures response to rain events	<ul style="list-style-type: none">• Time	Site-wide	\$-\$\$

Small-Scale Load Test



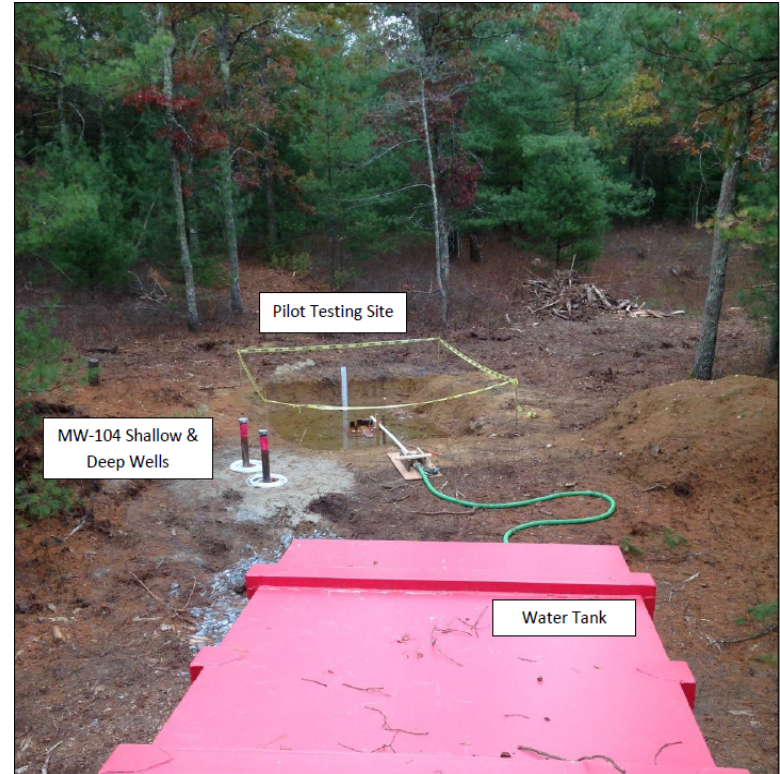
Benefits	Cons	Distance/Influence	Cost
<ul style="list-style-type: none">Wider scale of influence	<ul style="list-style-type: none">SpaceWater Source	Partial Site	\$\$

Summary

Method	Benefits	Distance/Influence	General Costs
Grain Size Distribution Analysis	<ul style="list-style-type: none">• Easy to collect and analyze	Wellbore	\$
Slug Test	<ul style="list-style-type: none">• Quick to perform	Wellbore	\$
Aquifer Pumping Test	<ul style="list-style-type: none">• Yields additional information	Partial site	\$\$
Pond Hydraulic Test	<ul style="list-style-type: none">• Large spatial influence	Partial site	\$\$
Long-term Monitoring	<ul style="list-style-type: none">• Low effort	Site-wide	\$ - \$\$
Small-Scale Load Test	<ul style="list-style-type: none">• Large spatial influence	Partial site	\$\$
Large-Scale Load Test	<ul style="list-style-type: none">• Large spatial influence	Site-wide	\$\$\$

Key Points

- Start small
- Tailor methods to site
- Spatial coverage
- Variety of methods leads to greater confidence
- Emphasize long-term monitoring



Acknowledgements

- Bass River Golf Course
 - Scott Gilmore (BRGC Superintendent)
- Town of Yarmouth
- CDM Smith Team

