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Authors: Jacob Anderson, Rudolph Hon, Amanda Duggan, Peter Dillon, Jack McInnis

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Contamination of a Public Water Supply from Road De-Icers



Anderson, Jacob¹, Hon, Rudolph¹, Duggan, Amanda¹, Dillon, Peter², McInnis, Jack²
 (1) Department of Earth and Environmental Sciences, Boston College, Chestnut Hill, MA
 (2) Norwell Water Department, 345 Main St, Norwell, MA 02061

Introduction

In the Northern United States, Canada, and Northern Europe, water quality is degraded by the application road de-icers.² Driving conditions are improved, resulting in reduced vehicle accidents, reduced delays, and improved accessibility.³ However, the side effect is that brine enters surface and groundwater, which has negative effects on vegetation, marine life, and water quality.⁴

This study focuses on infiltration, transport, and storage mechanisms of chloride from road salt in an unconfined aquifer. Previous work has shown that sodium concentrations have been significantly higher than the state maximum near Norwell public water wells.^{5, 6}

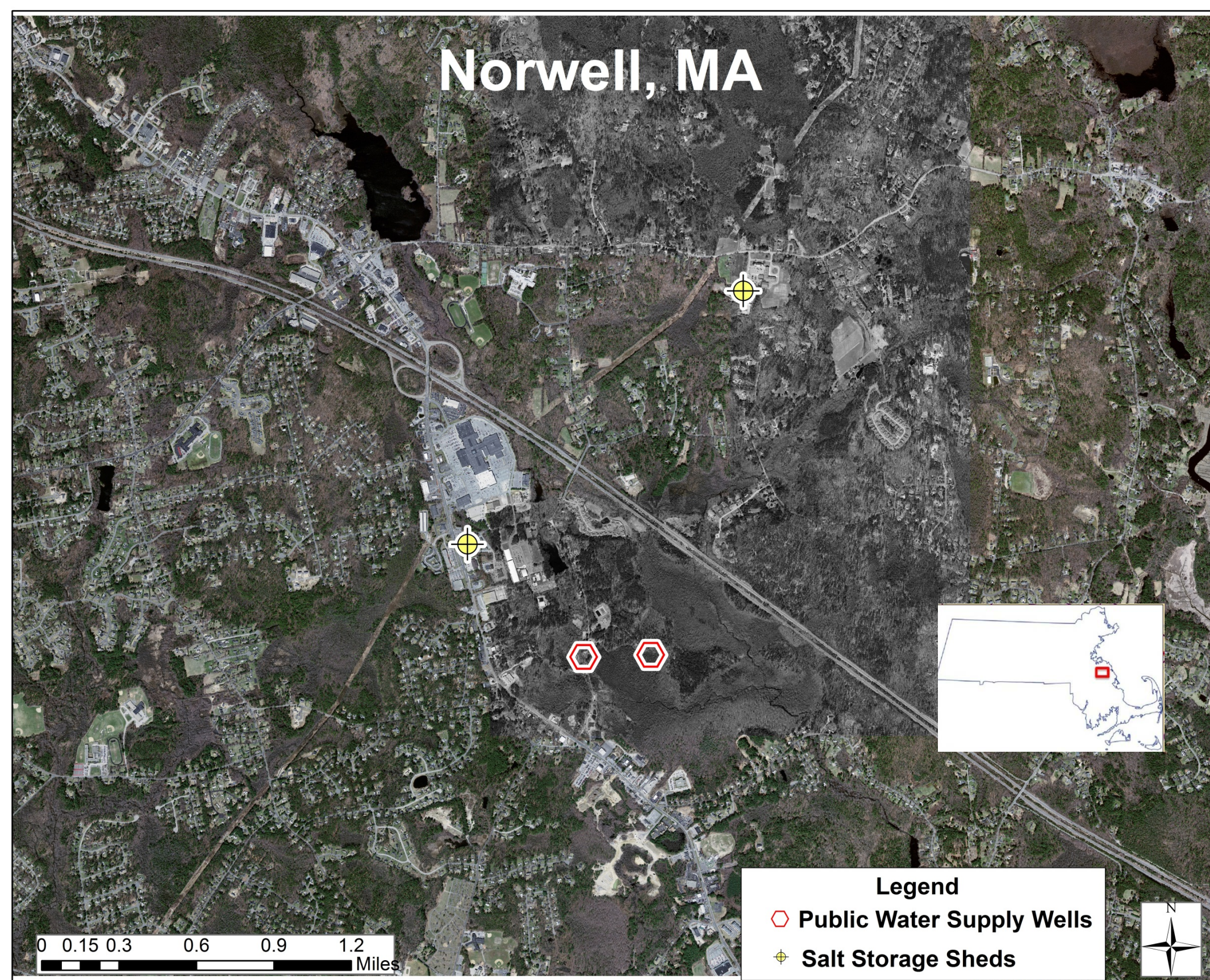


Fig 1. Locations of salt storage sheds and public water supply wells in Norwell, MA.

Background

When salt comes in contact with snow or ice, brine is formed and flows into surface and groundwater.³ The percentage of brine from road salt that infiltrates into groundwater may be 76% in urban watersheds, and up to 99% in rural watersheds.⁶

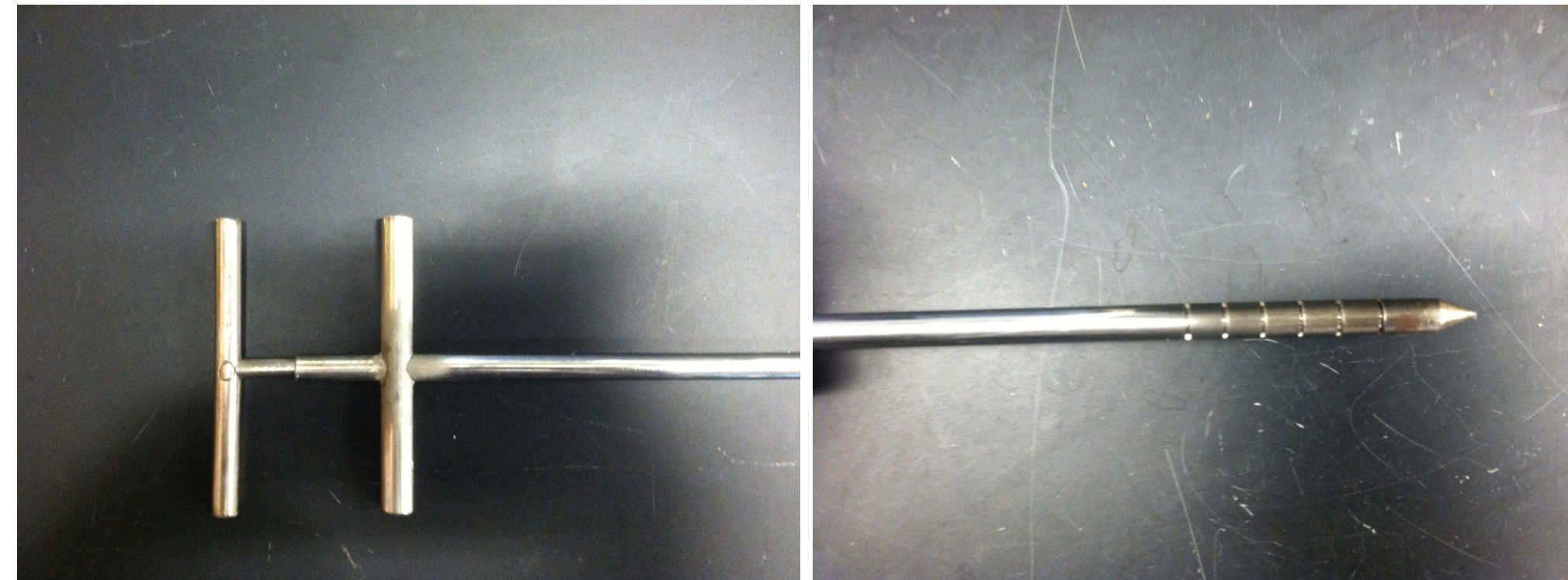


Fig 2. Photos of a 'Pushpoint Sampler's handle and guard rod (left) and slotted screen tip (right).

Methods

Pushpoint sampling is a quick way of measuring groundwater properties along a streambed.⁷ The probe is inserted 10 – 60cm below the stream and a syringe pump connected to the tube allows for sample collection at the surface. (Fig 4) A study by the USGS suggests that specific conductance has very low contamination from surface water or the sampling procedure.⁷

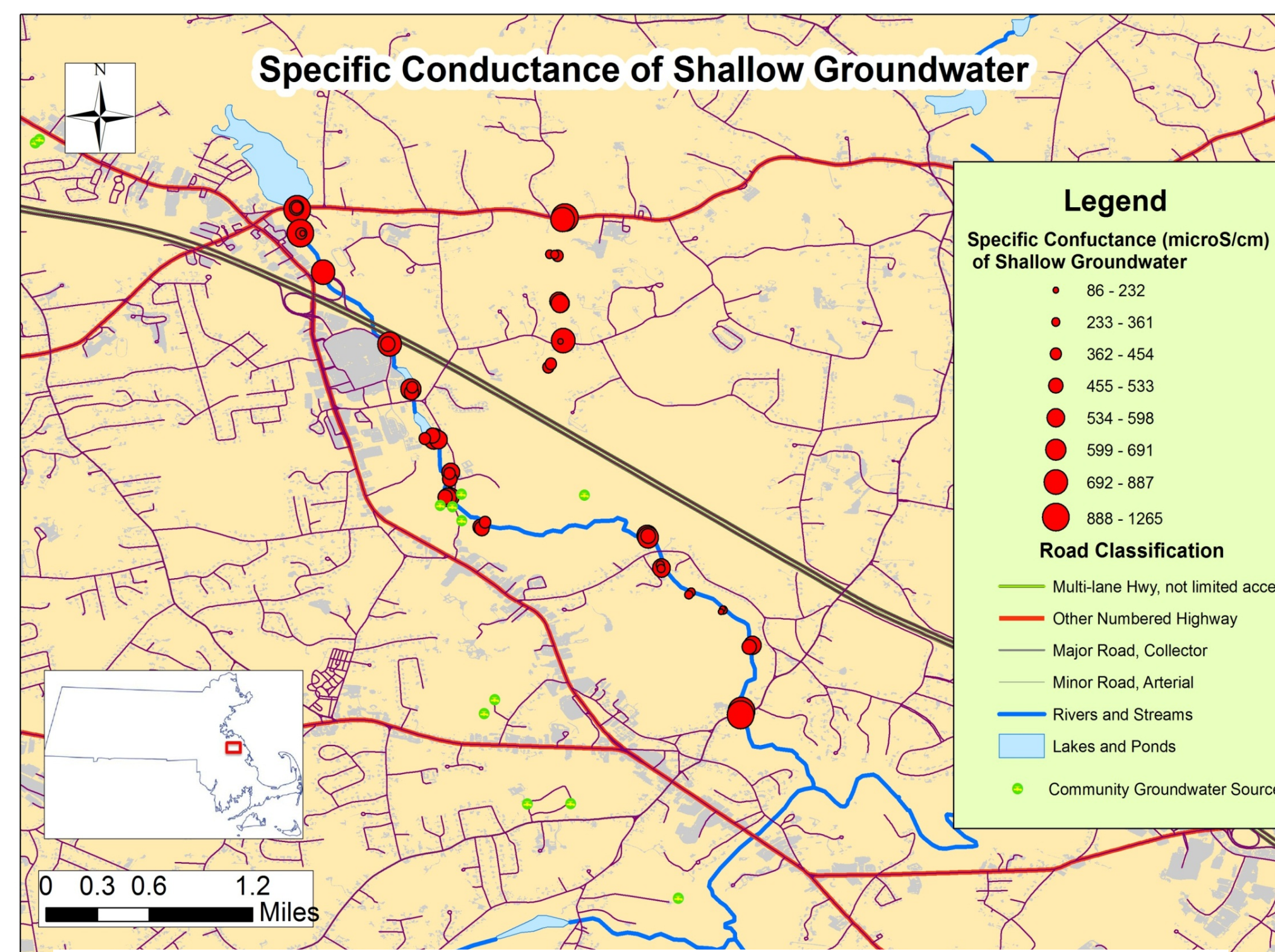


Fig 3. Shallow groundwater specific conductance ($\mu\text{S}/\text{cm}$) along two streams in the well field.

Preliminary Results

Preliminary results from pushpoint sampling suggest that road salt quickly infiltrates into groundwater and is retained in the watershed.

In March 2012, near-surface groundwater samples were taken using the pushpoint method along two major streams in Norwell, MA. (Fig 3)

Preliminary Results (cont'd)

A trend in the specific conductance of groundwater water samples is that values are higher near major roadways and the shopping mall while more rural areas have lower measurements.



Fig 4. Photo of groundwater being extracted using the pushpoint sampler.

Future Work

The current salt levels in Norwell, MA and Hanover, MA are much higher than the state recommended maximum. This study focuses on understanding how salt enters into Norwell aquifers and is transported to pumping water wells. Previous work suggests that road salt can be retained in the unsaturated zone and aquifers for decades.^{2,3} These conclusions imply that salt may increase even if road salt application were terminated. Salt loading has negative impact on vegetation, animals, and human health.³

References

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Acknowledgements

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