Sea Level Rise Impacts on Groundwater levels and Water Quality: A Vulnerability and Planning Study in Durham, NH

Groundwater Modeling

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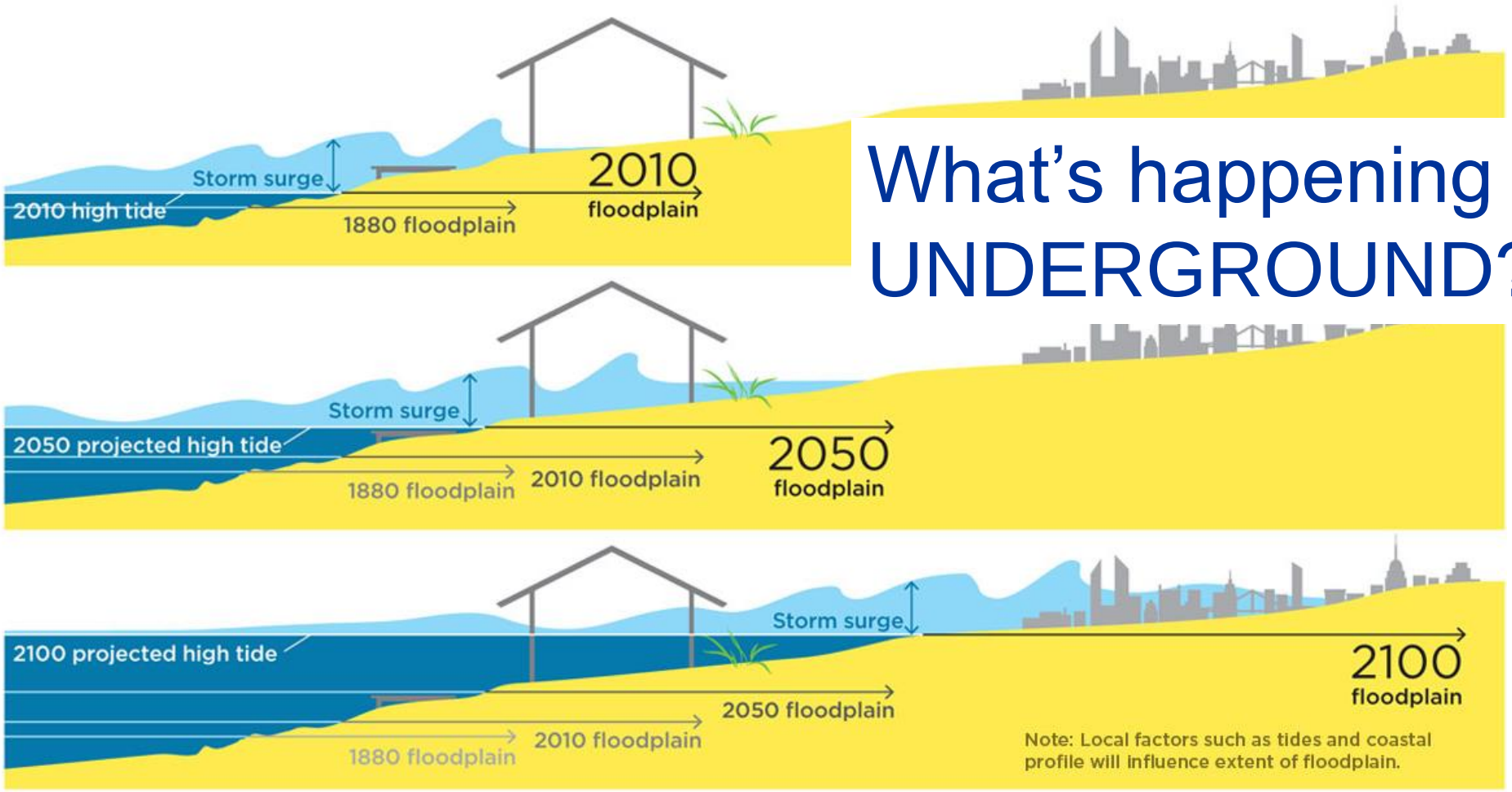
Kickoff Meeting –June 24, 2020

Outline

- Background
- Potential impacts of groundwater rise on infrastructure and water quality
- Previous studies
  - New Hampshire Seacoast east of Great Bay
  - Newmarket
- Durham study

Hampton Beach – Flooding problems sometimes sneak in the back door

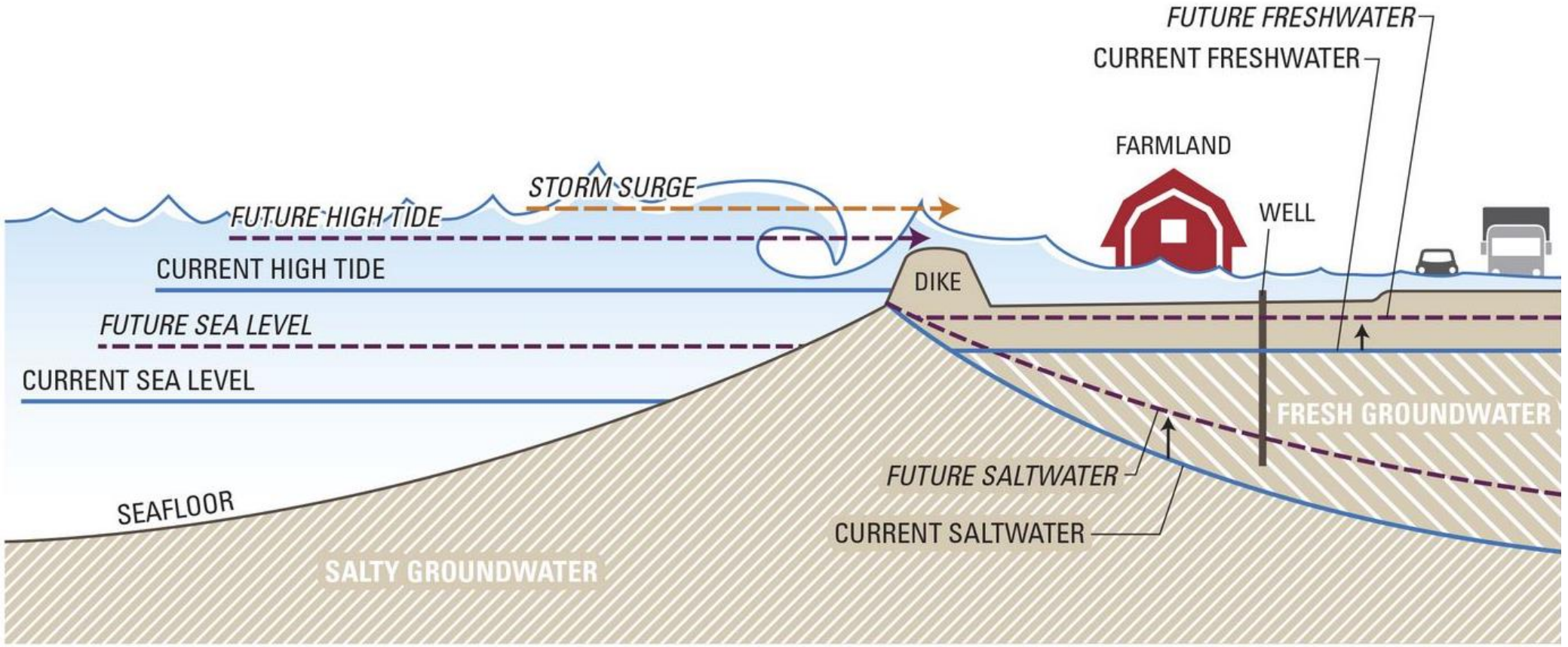
Surface water impacts of sea level rise



What's happening UNDERGROUND?

Union of Concerned Scientists, 2015; www.ucsusa.org/sealevelrisescience

A more complete picture

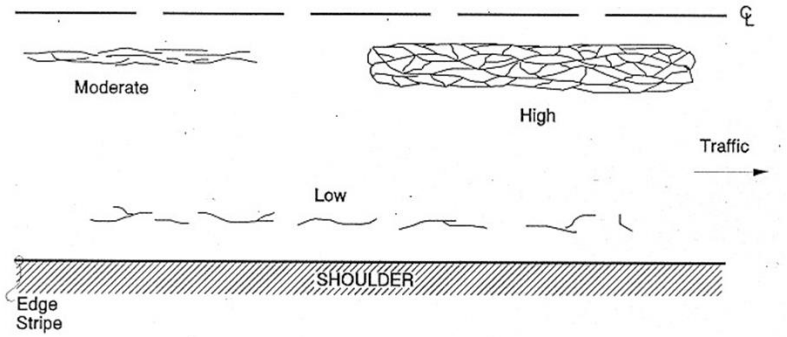


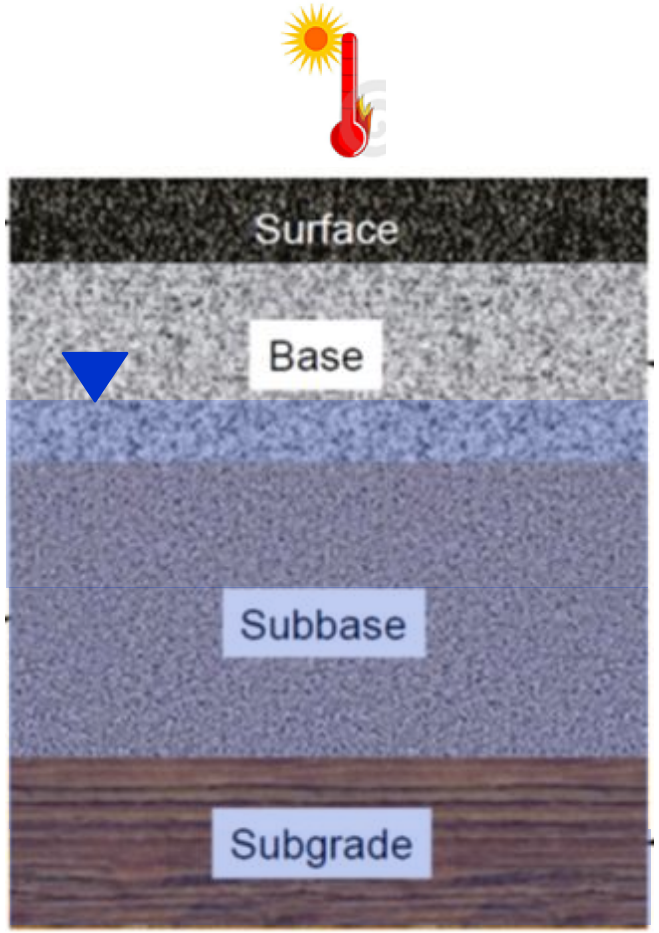
NOTE: Sea, tide, and storm surge levels, depth of groundwater, and location of saltwater lens are for illustrative purposes only and do not depict actual or projected levels.

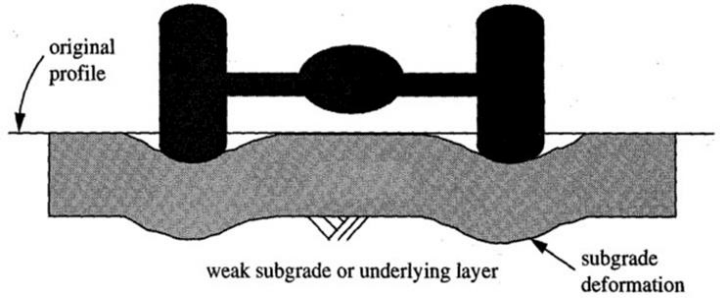
http://www.skagitclimatescience.org/skagit-impacts/sea-level-rise/

Seattle, Washington

Pavement life decreases when GW moves into the underlying layers and increased temperature weakens the AC







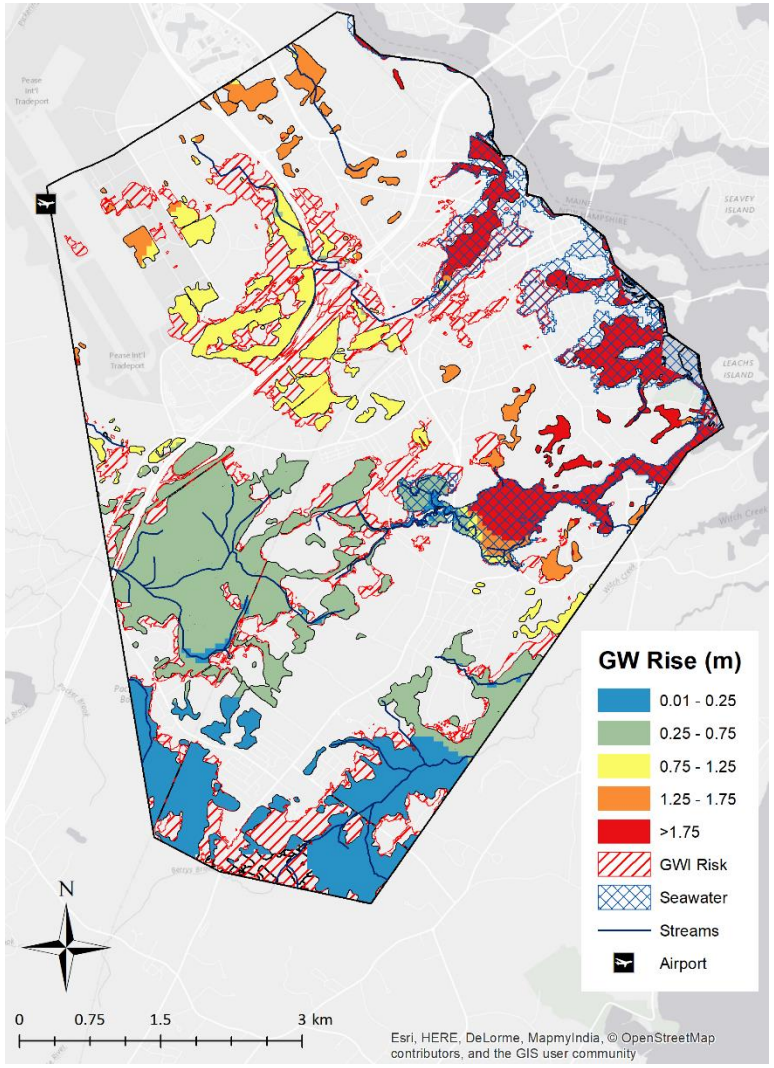
Fatigue cracking

Rutting

Where might rising groundwater impact marine and freshwater wetlands?

City of Portsmouth:

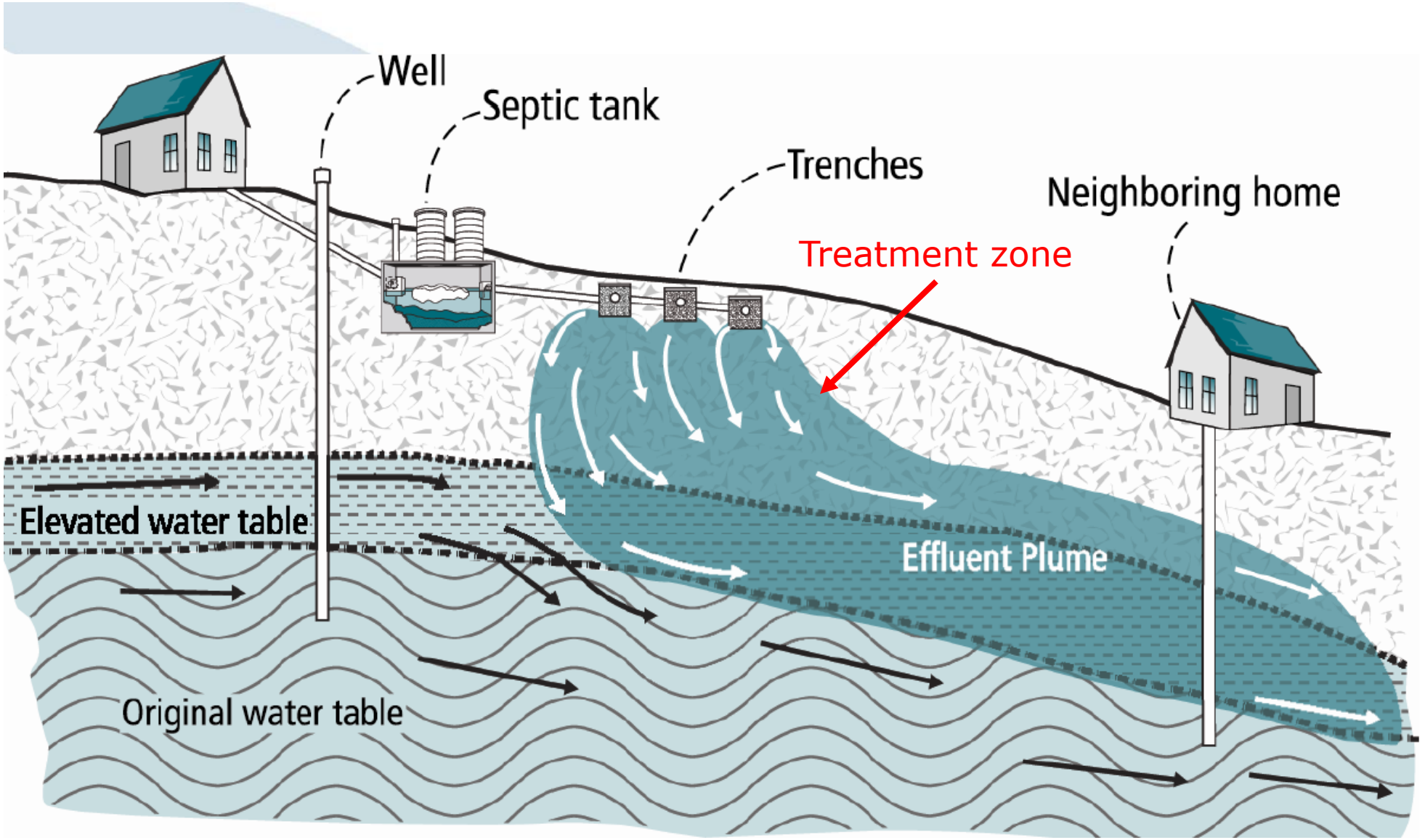
Approximately 9 km^2 (21%) is occupied by freshwater wetlands.



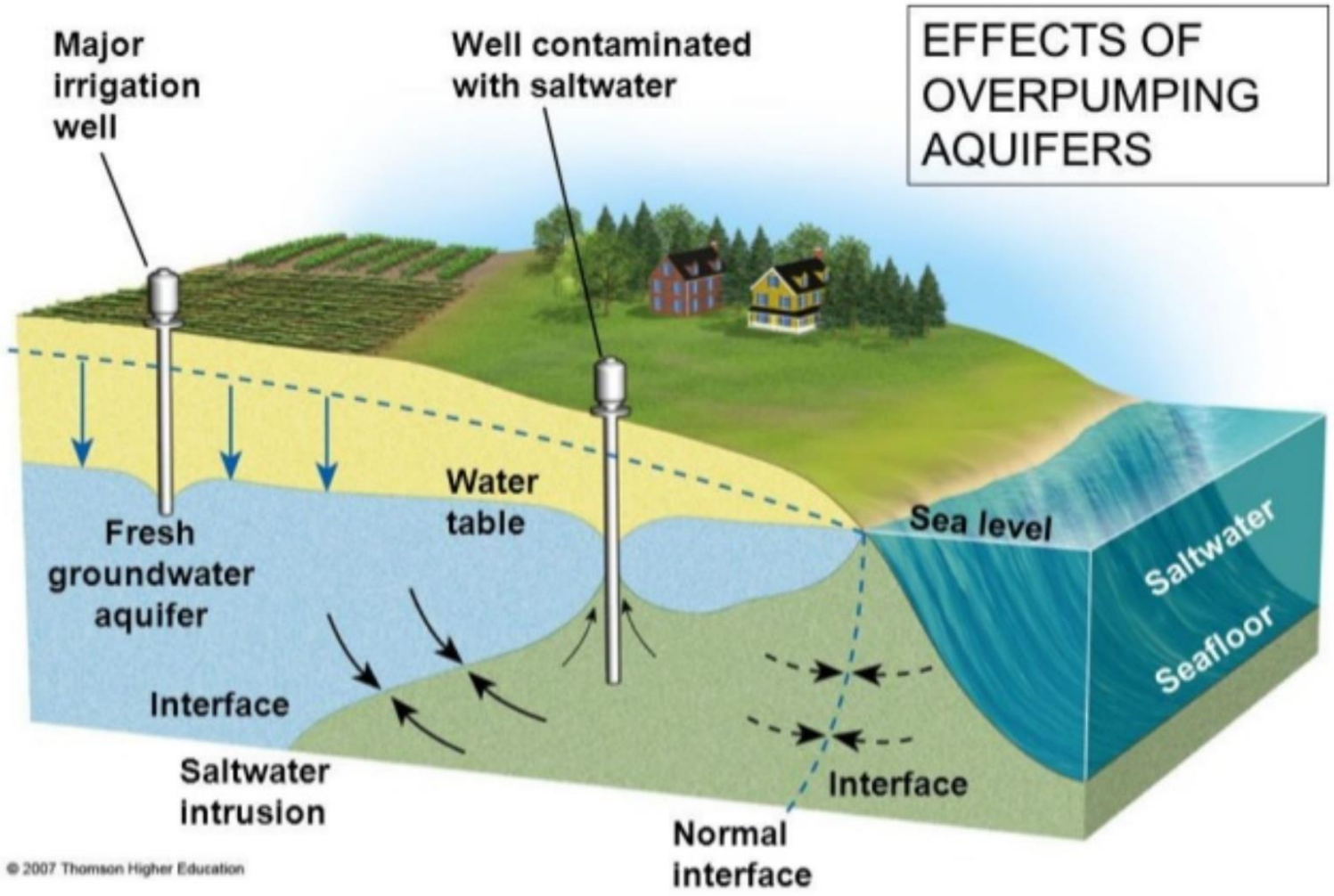
Freshwater wetland area will increase:

- 3% by 2030;
- 10% by mid-century;
- 19 to 25% by the end of century.

When the water table rises the unsaturated treatment zone shrinks

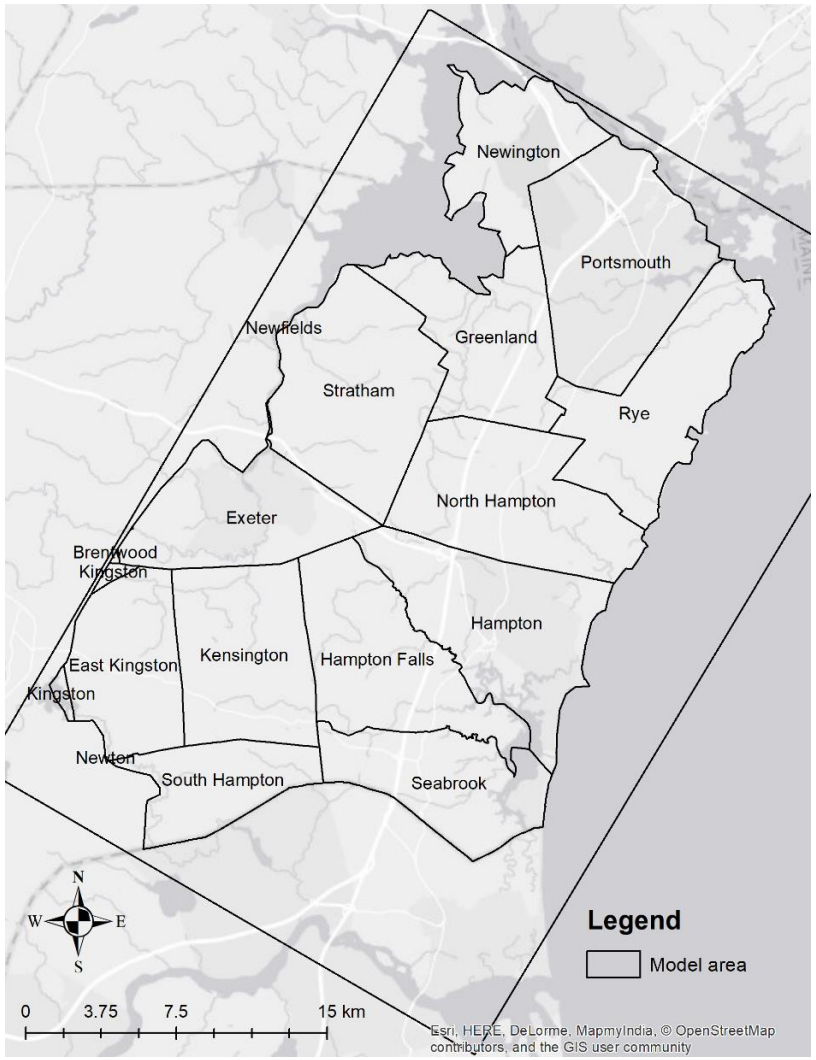


Saltwater Intrusion into Drinking Water Wells



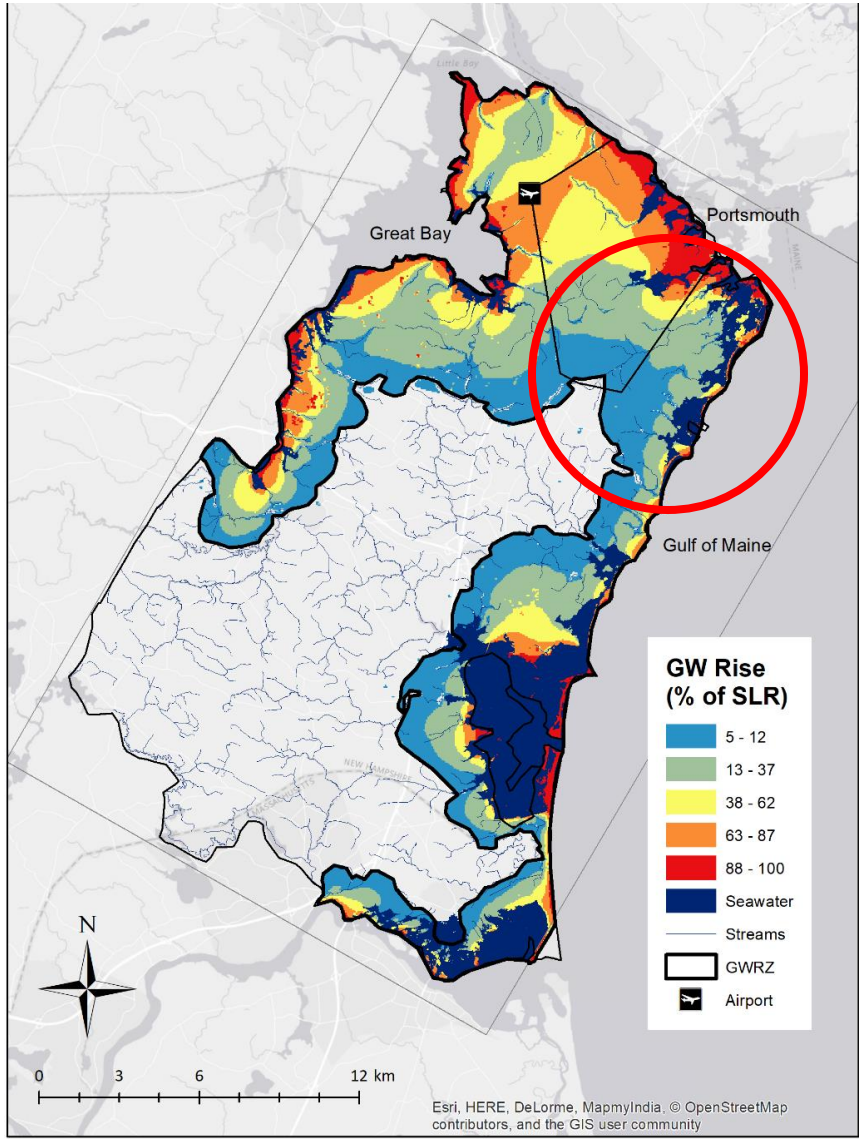
2007 Thompson Higher Education;
https://www.slideshare.net/prashantpkatti/sea-water-intrusion

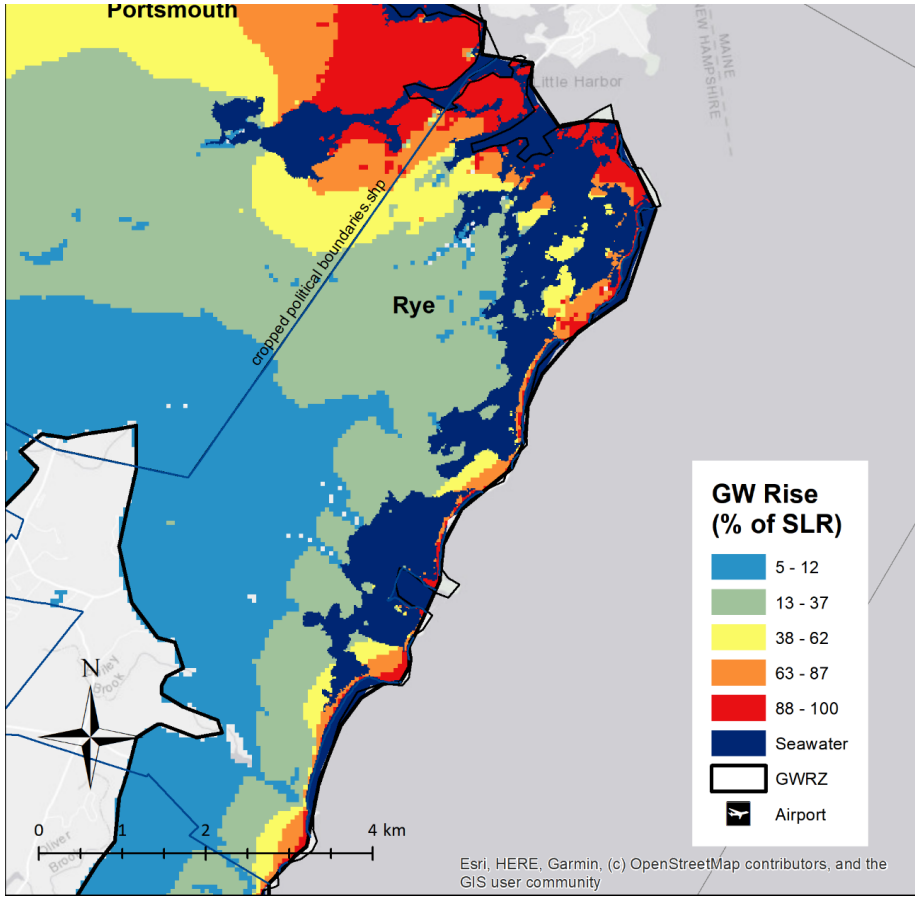
New Hampshire Seacoast
What is coastal and what is inland?



Previous Study: New Hampshire Seacoast

Groundwater Rise Zone - GWRZ

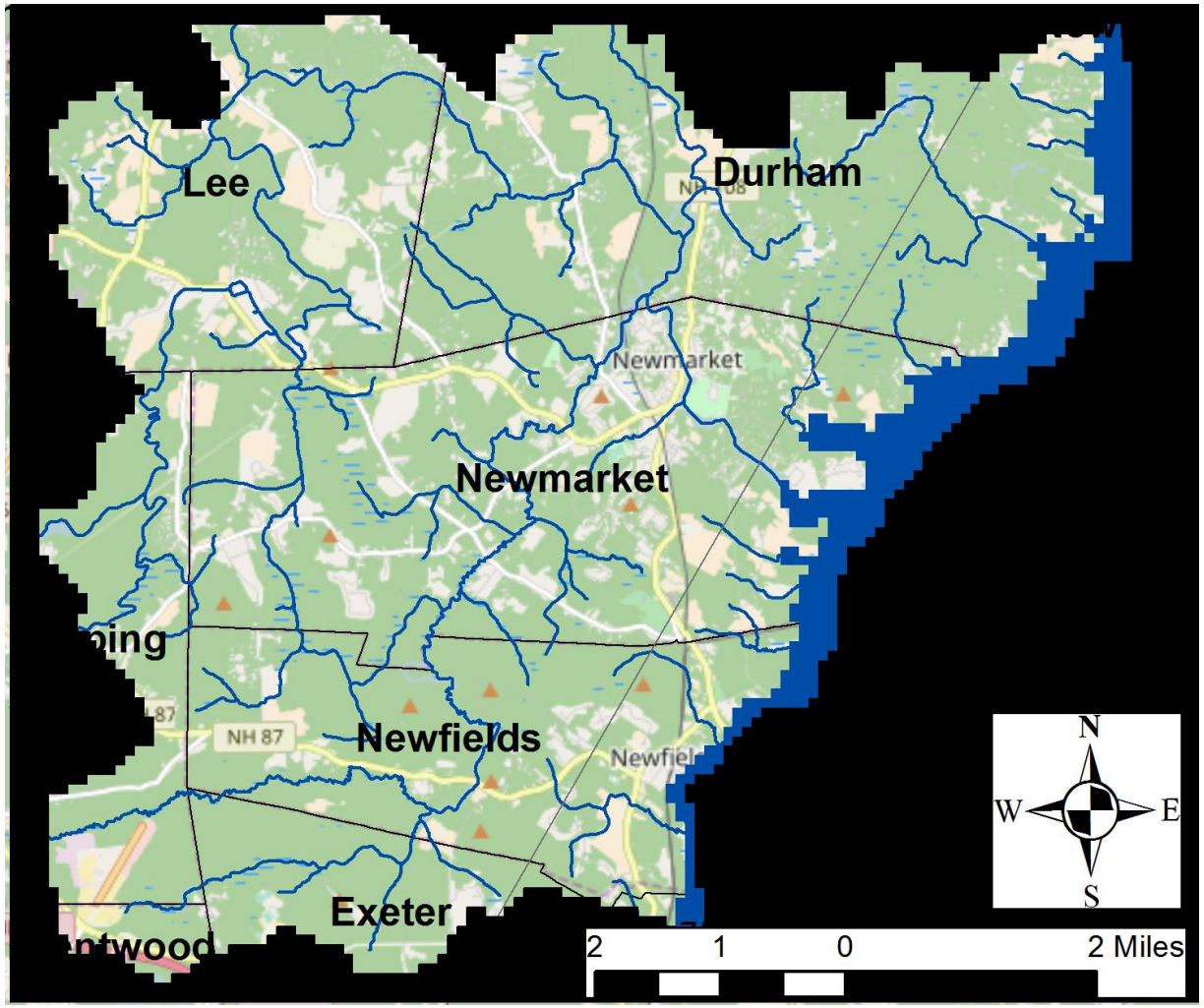




Previous Study - Newmarket Study Area

Boundary conditions

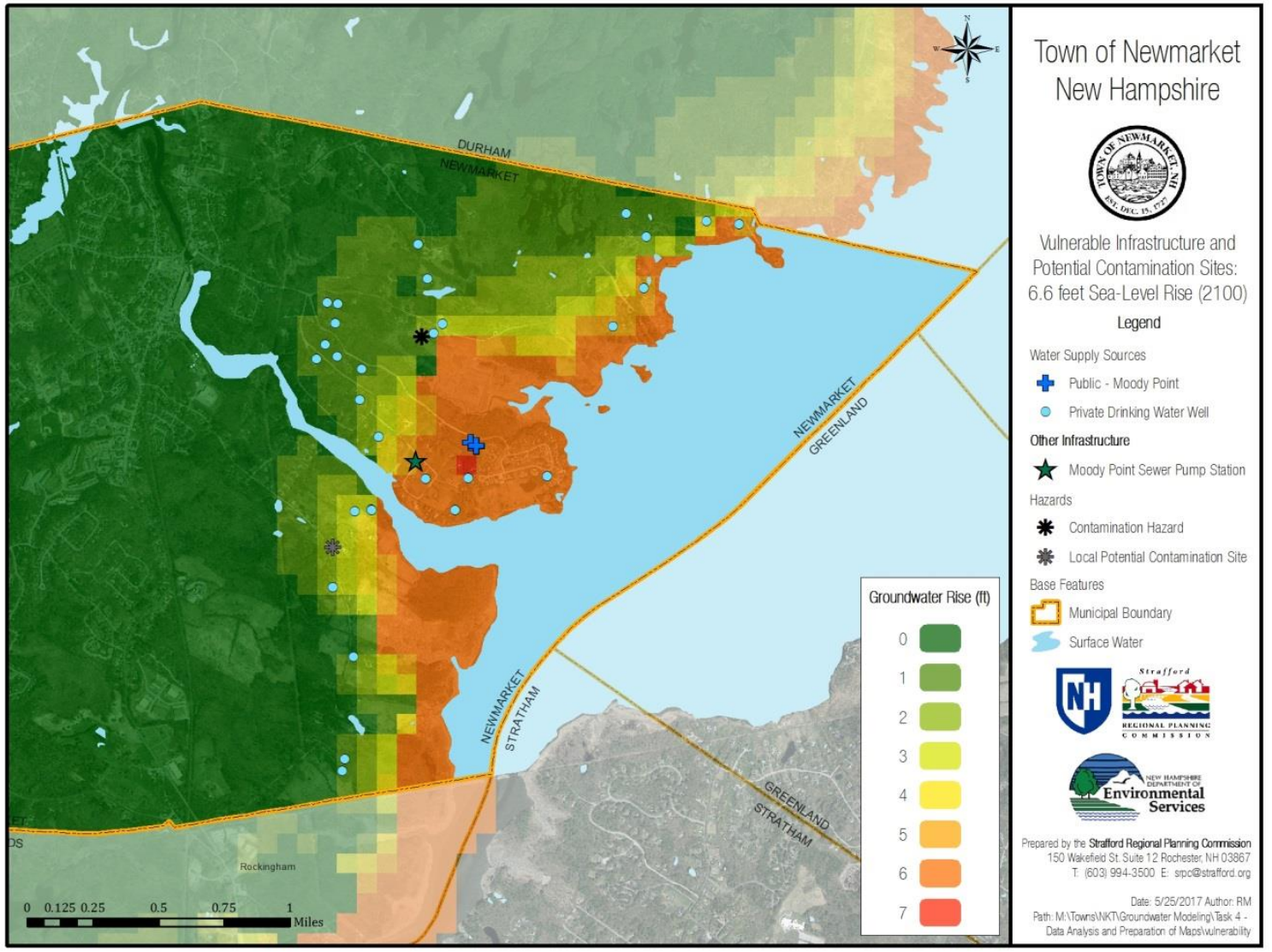
- Rivers – head dependent
- Constant head boundaries – Great Bay and Squamscott R.
- No flow boundaries – drainage divides



Vulnerable Infrastructure and Potential Contamination Sites

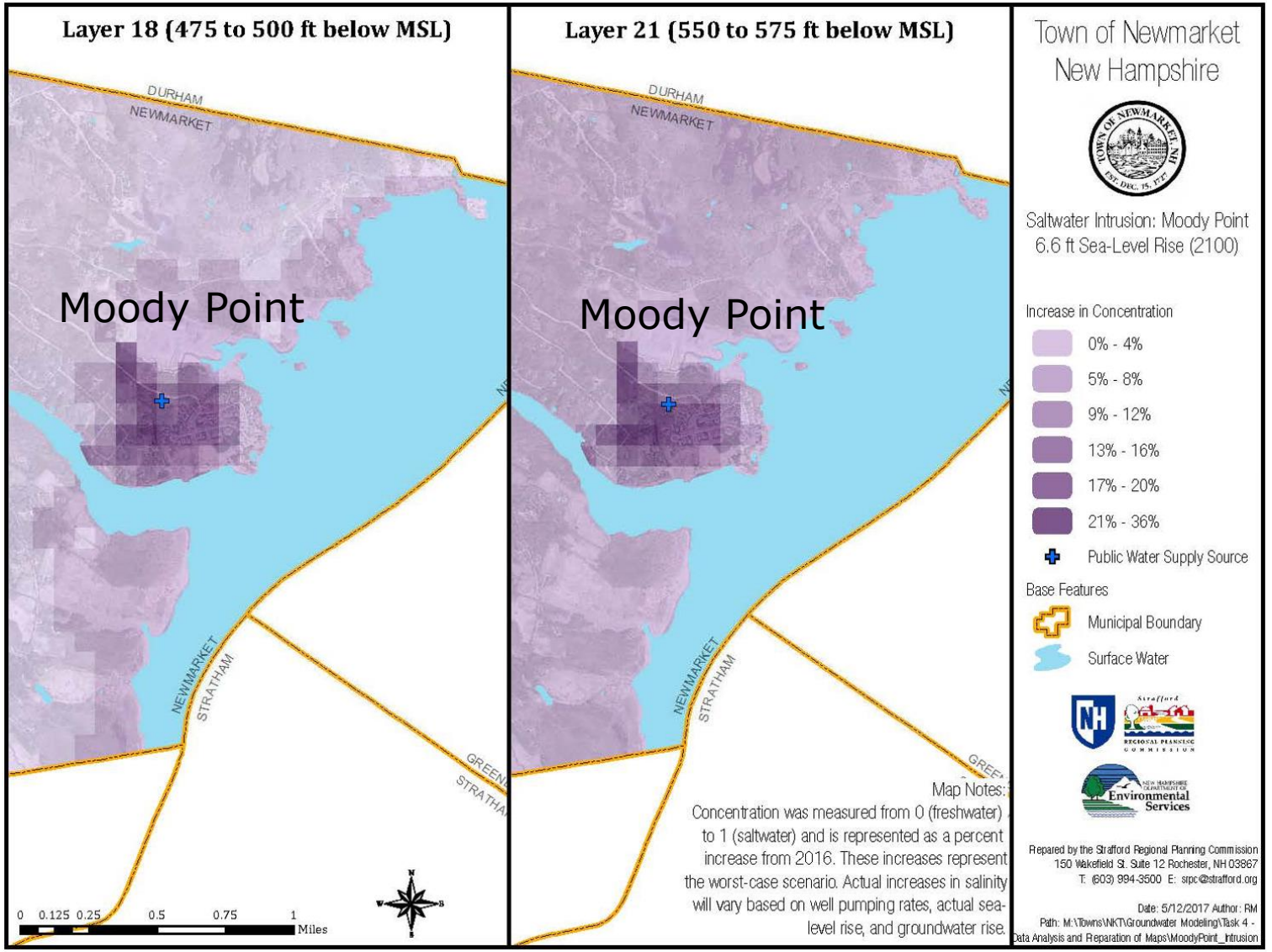
Within the GWRZ:

- GW rise: 1 to ~6 feet (0.8 miles inland)
- 2 potential contamination sites
- 1 sewer pump station on Moody Point
- 30 private drinking water wells



Projected salt concentration increase with 6.6 ft SLR

- Model predicts up to 16% increase in groundwater salinity
- Pumping rate is assumed constant
- Moody Point –already experiencing elevated total dissolved solids (TSD)

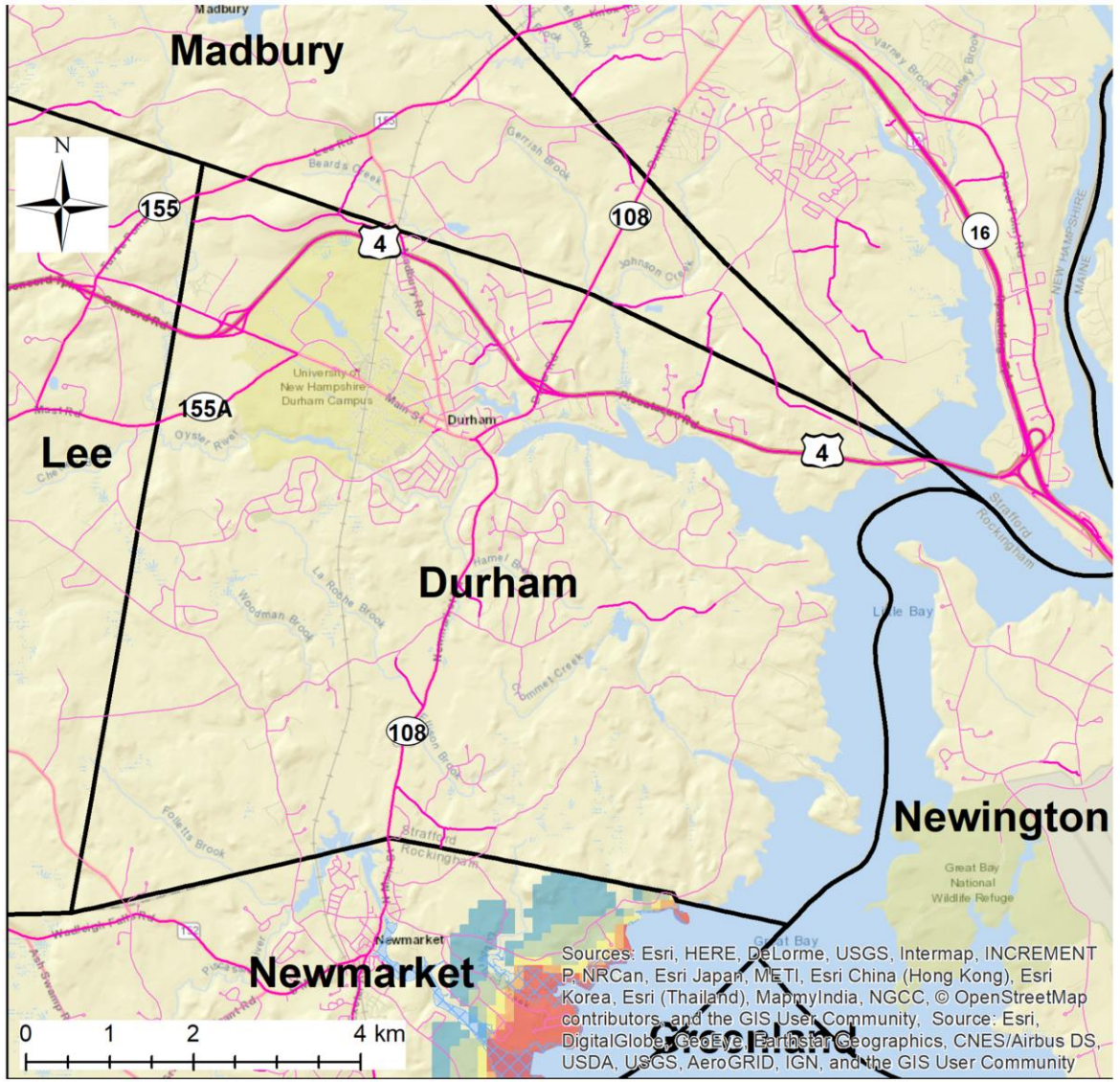


475 to 500 ft below MSL 550 to 575 ft below MSL

Town of Durham

Boundary conditions

- Rivers – head dependent (Oyster River and Lamprey River)
- Constant head boundaries (Great Bay, Little Bay, Bellamy River)
- No flow boundaries – drainage divides



Groundwater Modeling for Durham

- Data collection, evaluation and preparation
- Model construction
- Decide on model scenarios
- Run simulations
- Identify vulnerabilities within the GWRZ
- Final technical report and project wrap up

Thank you

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