

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

Town of Durham  
Conservation Commission Meeting  
July 27, 2020, 7:00 p.m.

# *Presentation Outline*

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

# *Project Overview*

## Project Administration: Strafford Regional Planning Commission

- Coordination between project team and the technical advisory committee
- Project meetings, reporting, and invoicing

## Project Team:

- Strafford Regional Planning Commission, Kyle Pimental, Principal Regional Planner
- JFK Environmental Services LLC, Jayne F. Knott, Ph.D.
- University of New Hampshire, Jennifer M. Jacobs, Ph.D.

## Technical Advisory Committee:

- Durham staff (Town Administrator, Town Planner, Public Works, Codes/Health Officer, Conservation Commission member)
- NHCWA and NHDES

## Funding:

- State of New Hampshire Water Pollution Control Revolving Loan Fund Program. The principal sum is \$75,000 with 100% principal forgiveness.

# Scope of Work

## Groundwater Modeling

- JFK Environmental Services LLC, Jayne F. Knott, Ph.D., Principal
- University of New Hampshire, Department of Civil and Environmental Engineering, Jennifer M. Jacobs, Ph.D.

### Tasks:

- Data collection, evaluation, and preparation
- Model construction
- Model scenarios
- Identify vulnerable areas in Durham
- Create a technical report on model development and findings

## Vulnerability Assessment and Planning Recommendations

- Strafford Regional Planning Commission, Kyle Pimental, Principal Regional Planner

### Tasks:

- Provide assistance with GIS data gaps
- Map vulnerable areas in Durham
- Develop strategies and recommendations and publish in a final report
- Communicate the modeling results in a user-friendly way and highlight next steps

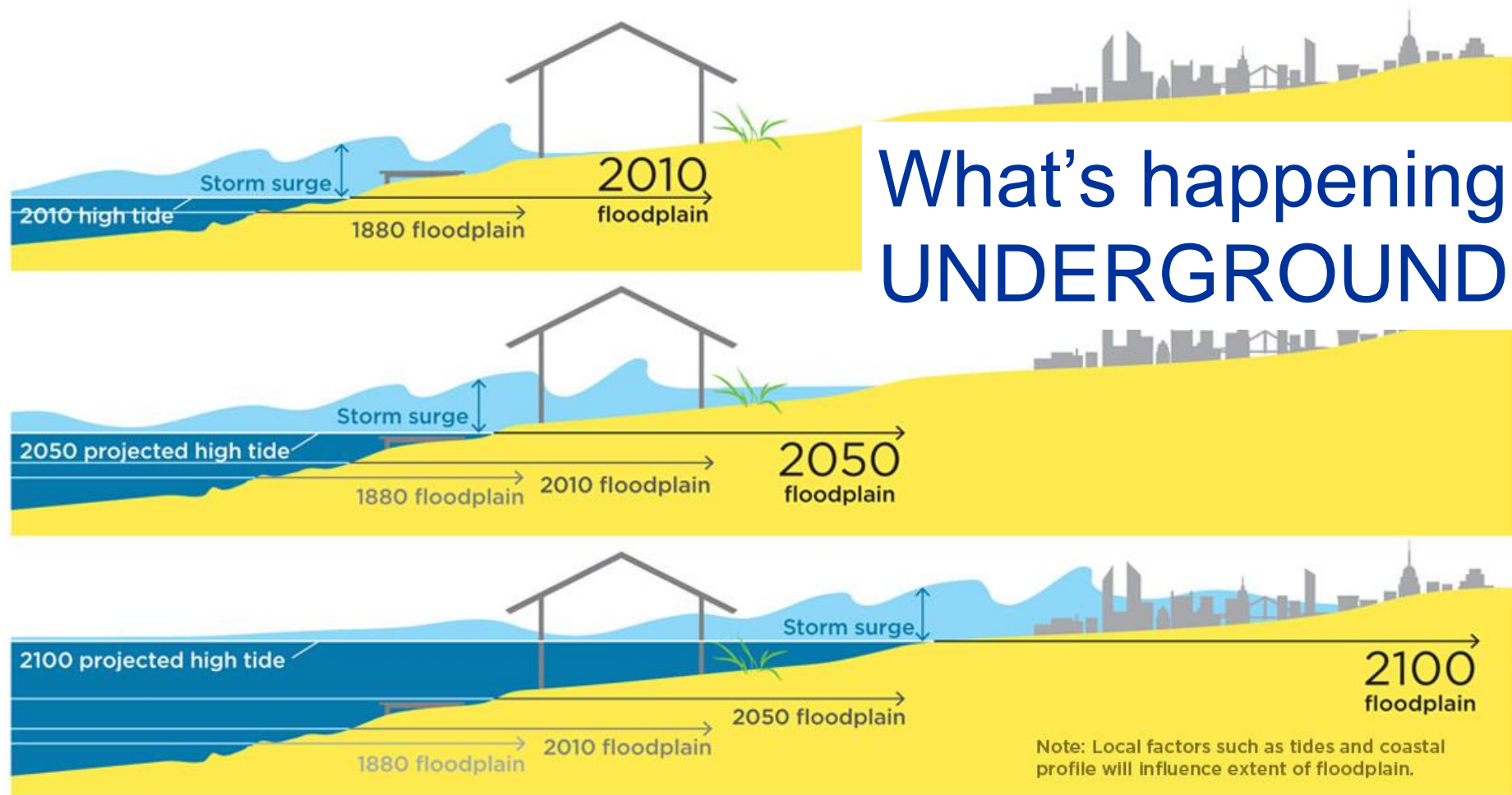
# ***Background***

# *Hampton Beach – Flooding problems sometimes sneak in the back door*



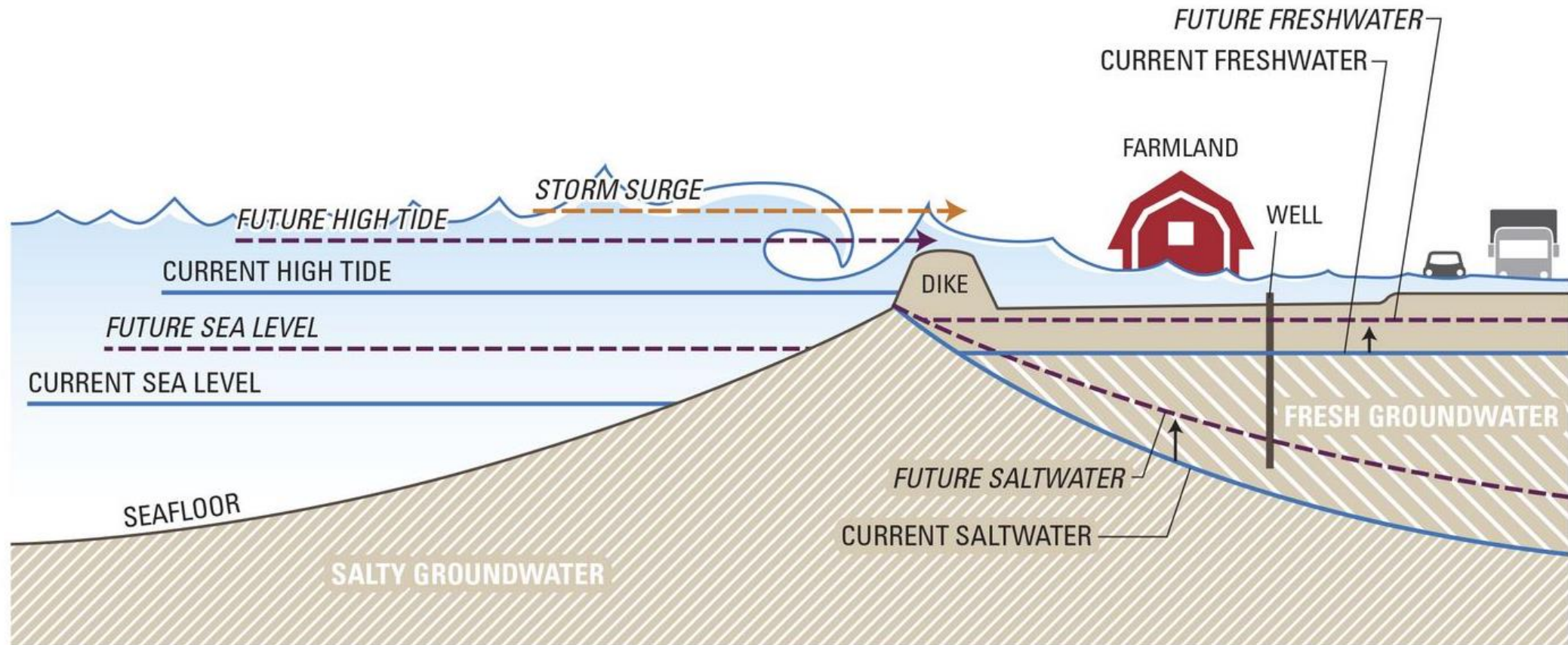
*Photo: Will Brown (2017)*

# Surface water impacts of sea level rise



## What's happening UNDERGROUND?

# A more complete picture



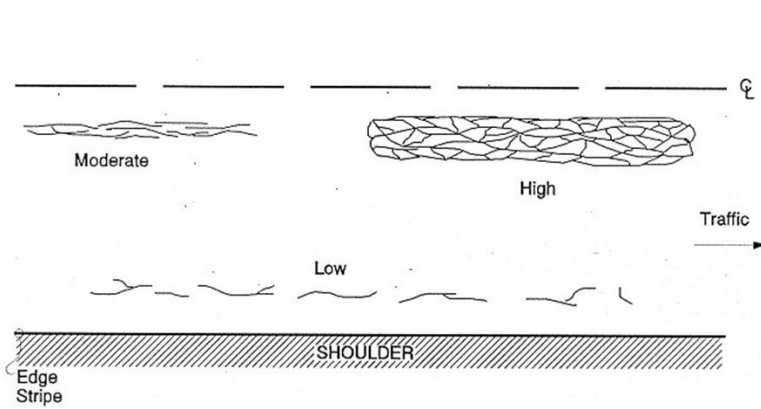
NOTE: Sea, tide, and storm surge levels, depth of groundwater, and location of saltwater lens are for illustrative purposes only and do not depict actual or projected levels.

<http://www.skagitclimatescience.org/skagit-impacts/sea-level-rise/>  
Seattle, Washington

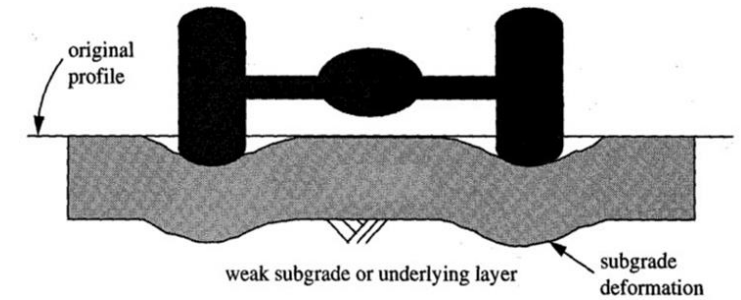
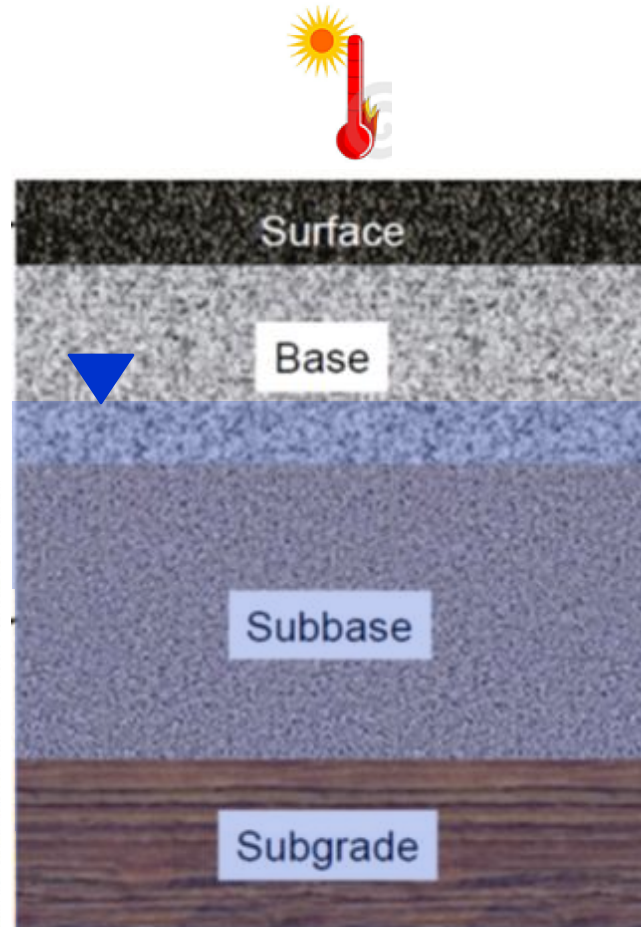


# ***Potential Impacts***

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



*Fatigue cracking*

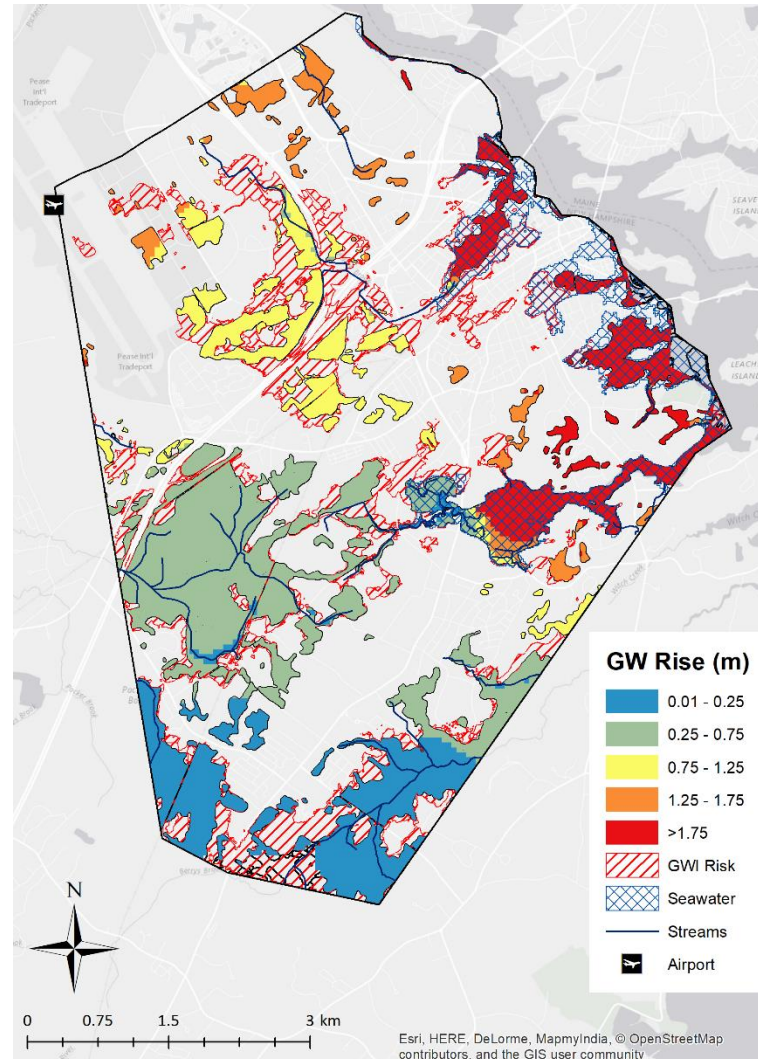


*Rutting*

# Where might rising groundwater impact marine and freshwater wetlands?

City of  
Portsmouth:

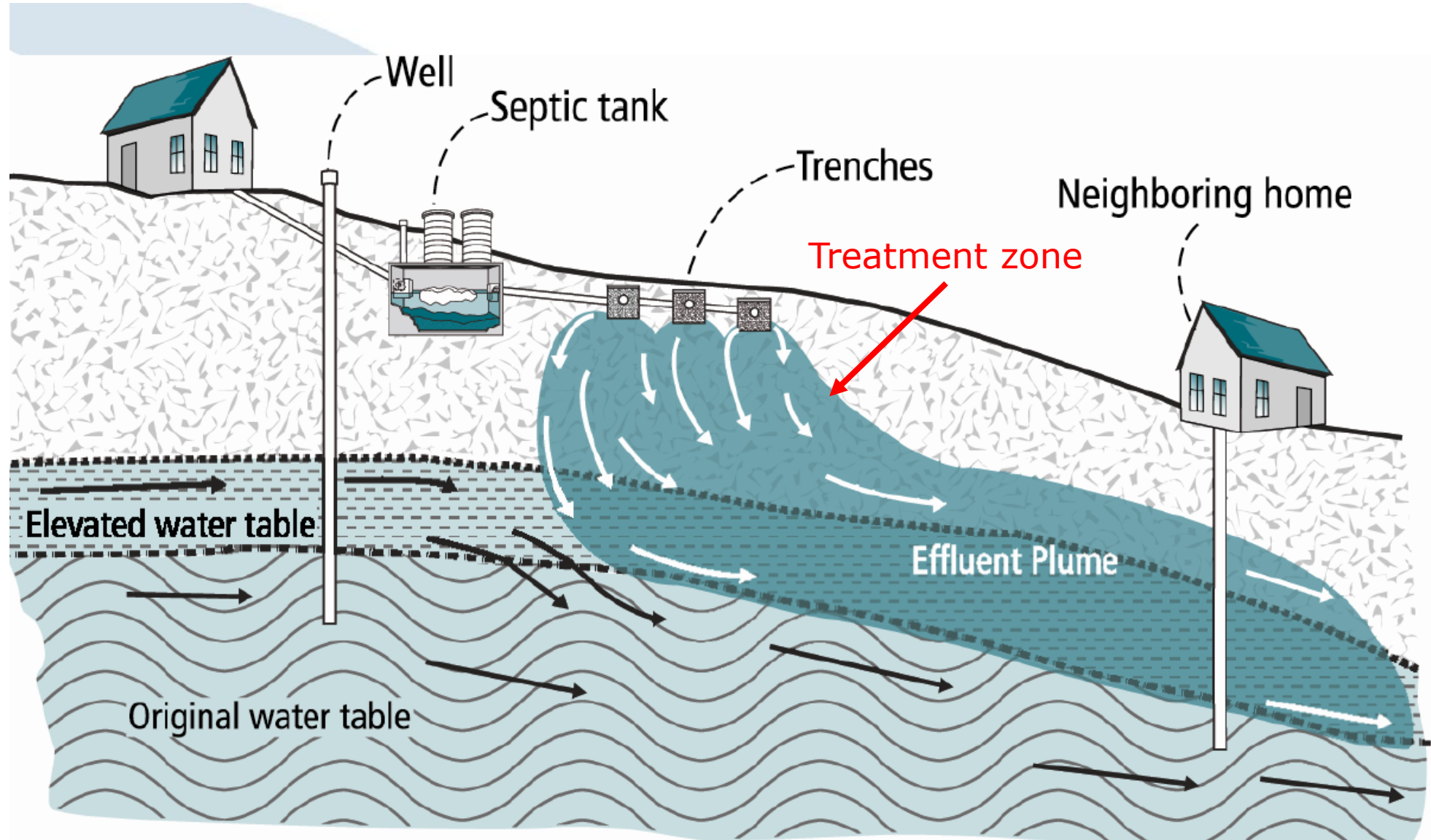
Approximately 9  
km<sup>2</sup> (21%) is  
occupied by  
freshwater  
wetlands.



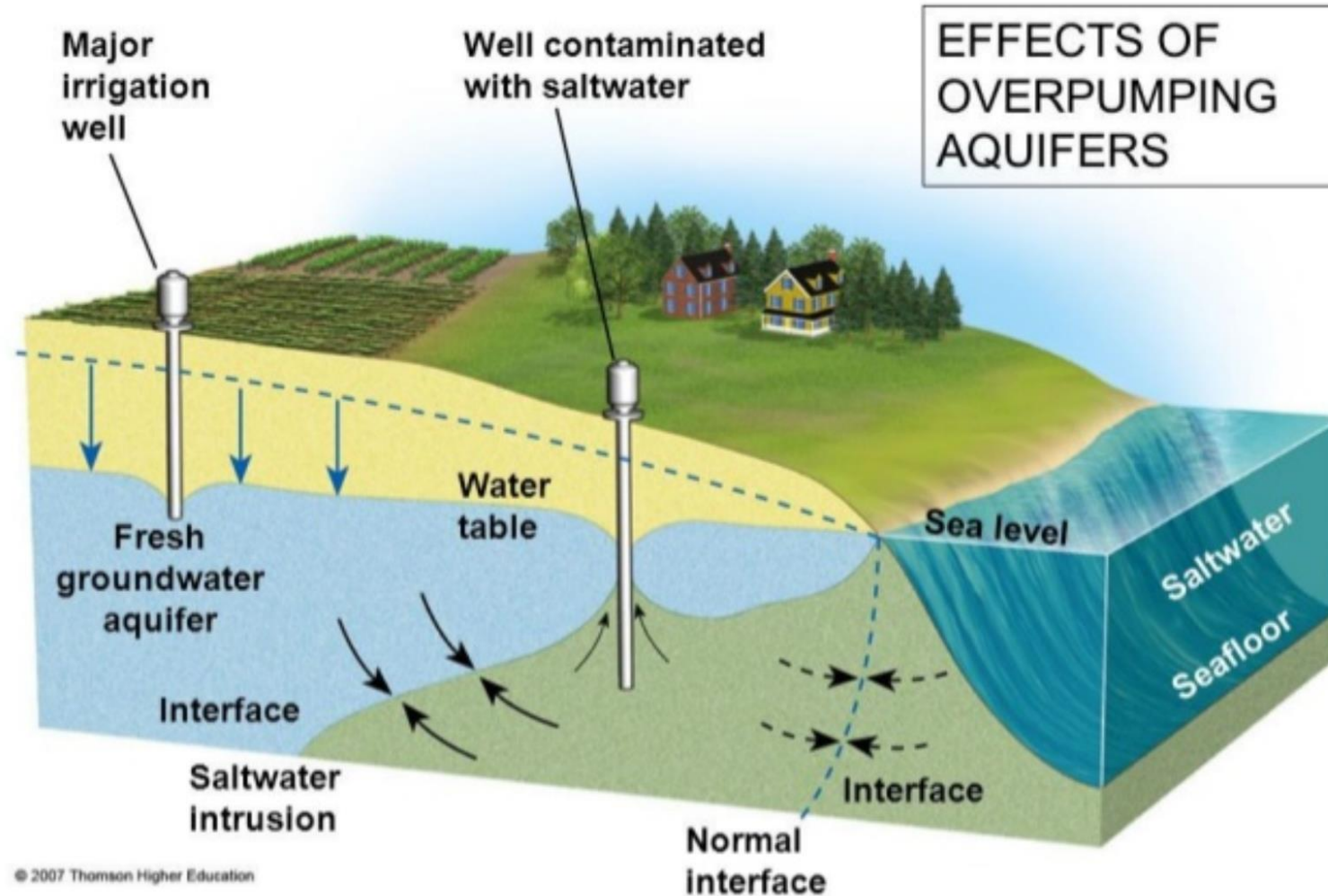
Freshwater wetland  
area will increase:

- 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*



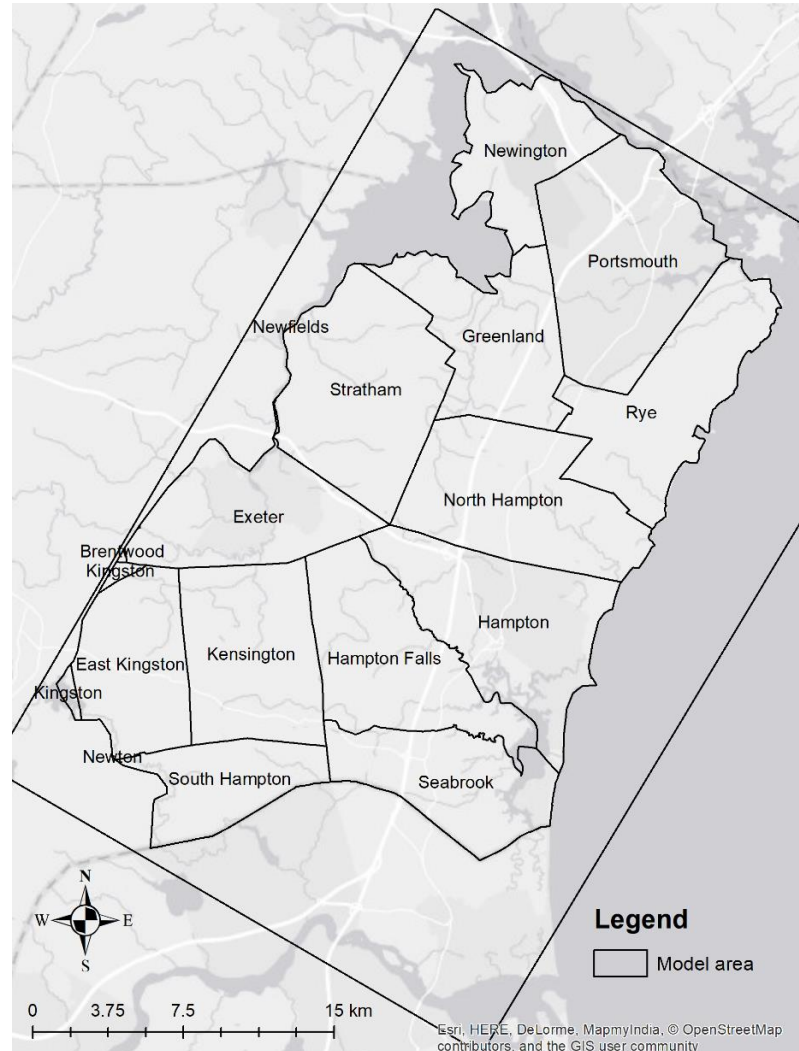
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<https://www.slideshare.net/prashantpkatti/sea-water-intrusion>

# ***Previous Studies in New Hampshire***

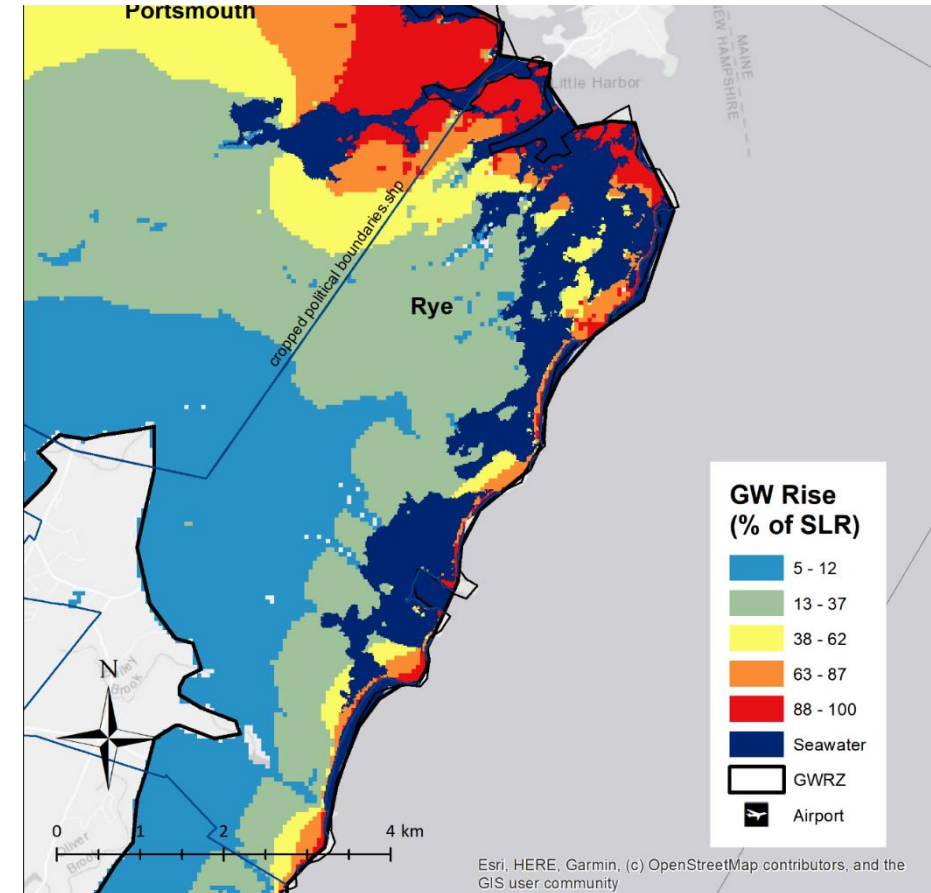
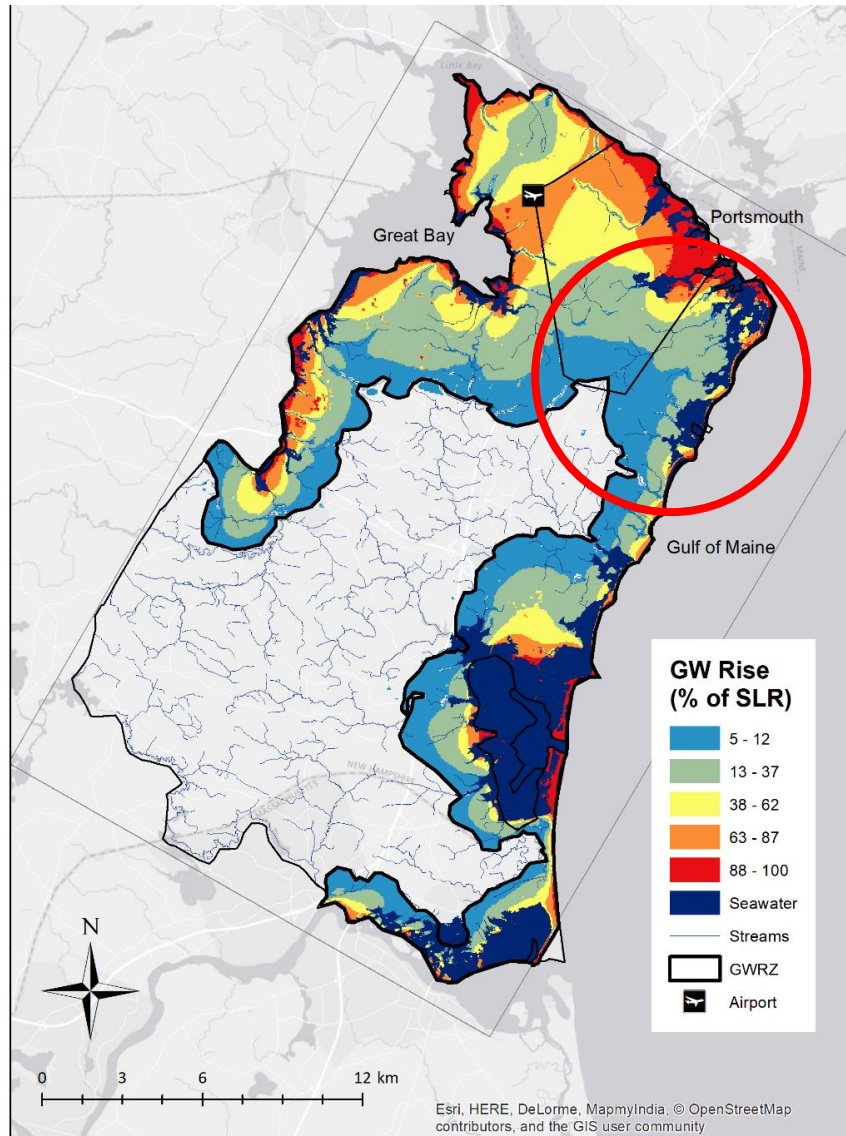
# *New Hampshire Seacoast*

## *What is coastal and what is inland?*



# Previous Study: New Hampshire Seacoast

## Groundwater Rise Zone - GWRZ

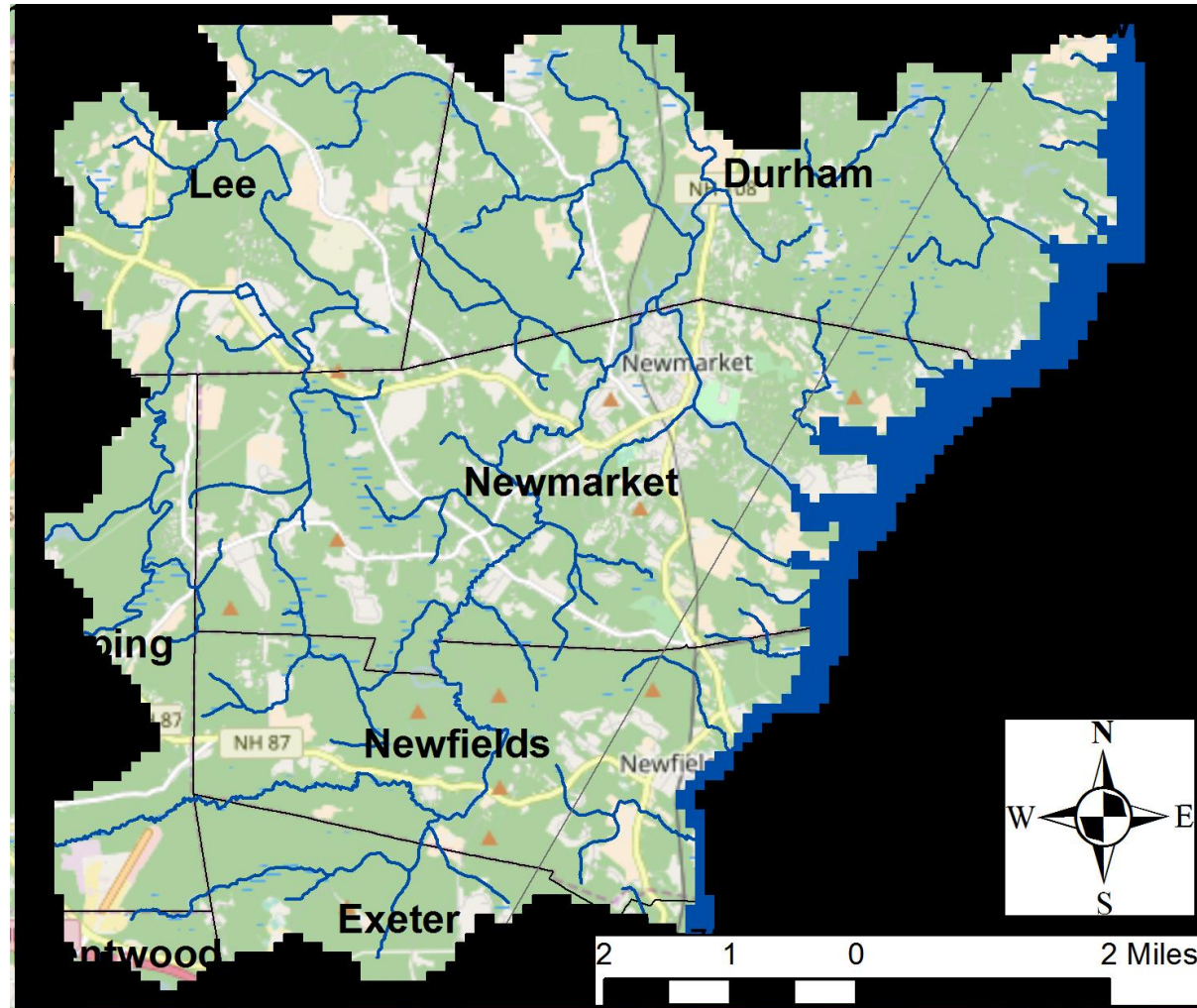




# Previous Study - Newmarket Study Area

## Boundary conditions

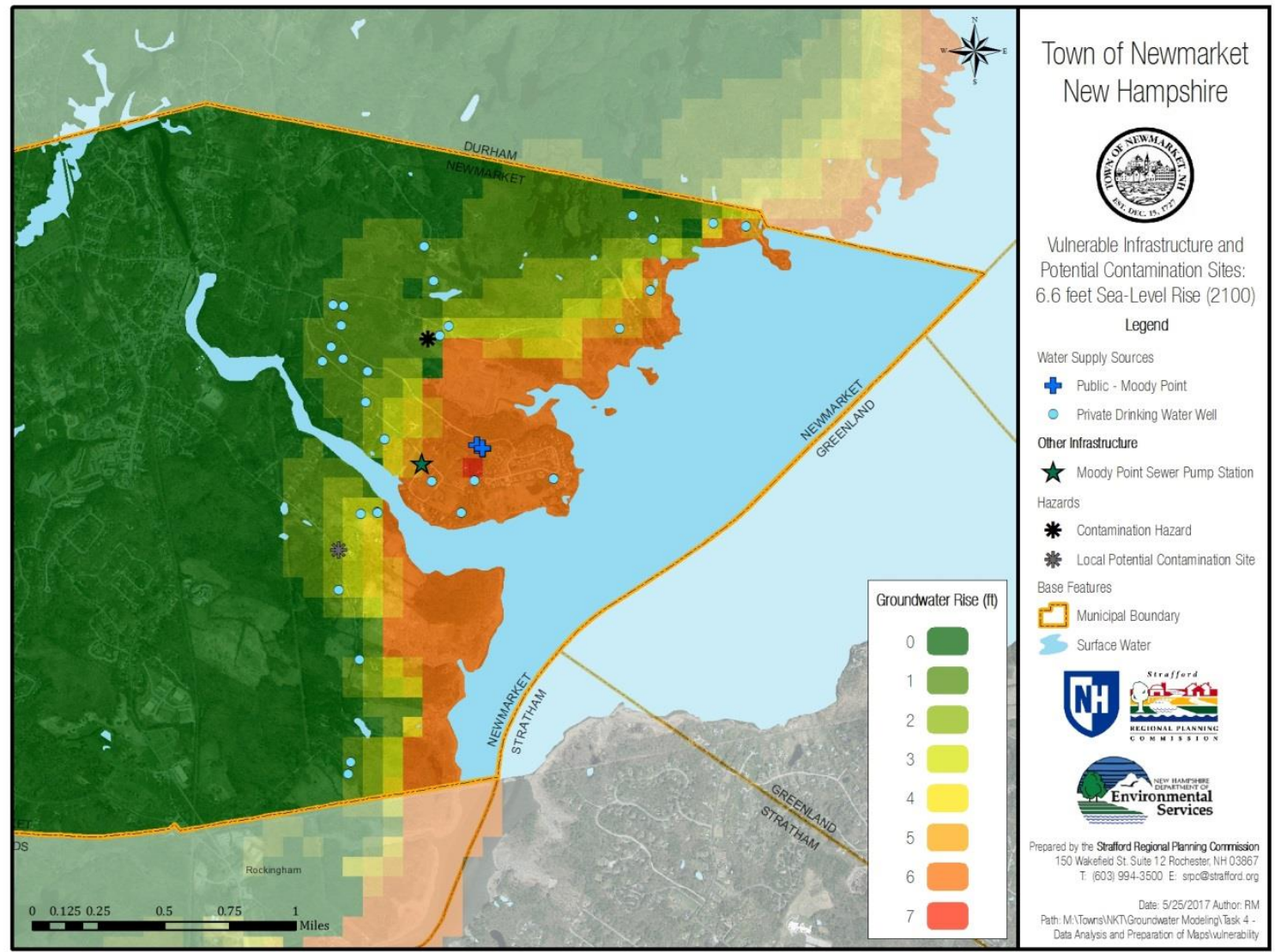
- Rivers – head dependent
- Constant head boundaries – Great Bay and Squamscott R.
- No flow boundaries – drainage divides



# Vulnerable Infrastructure and Potential Contamination Sites

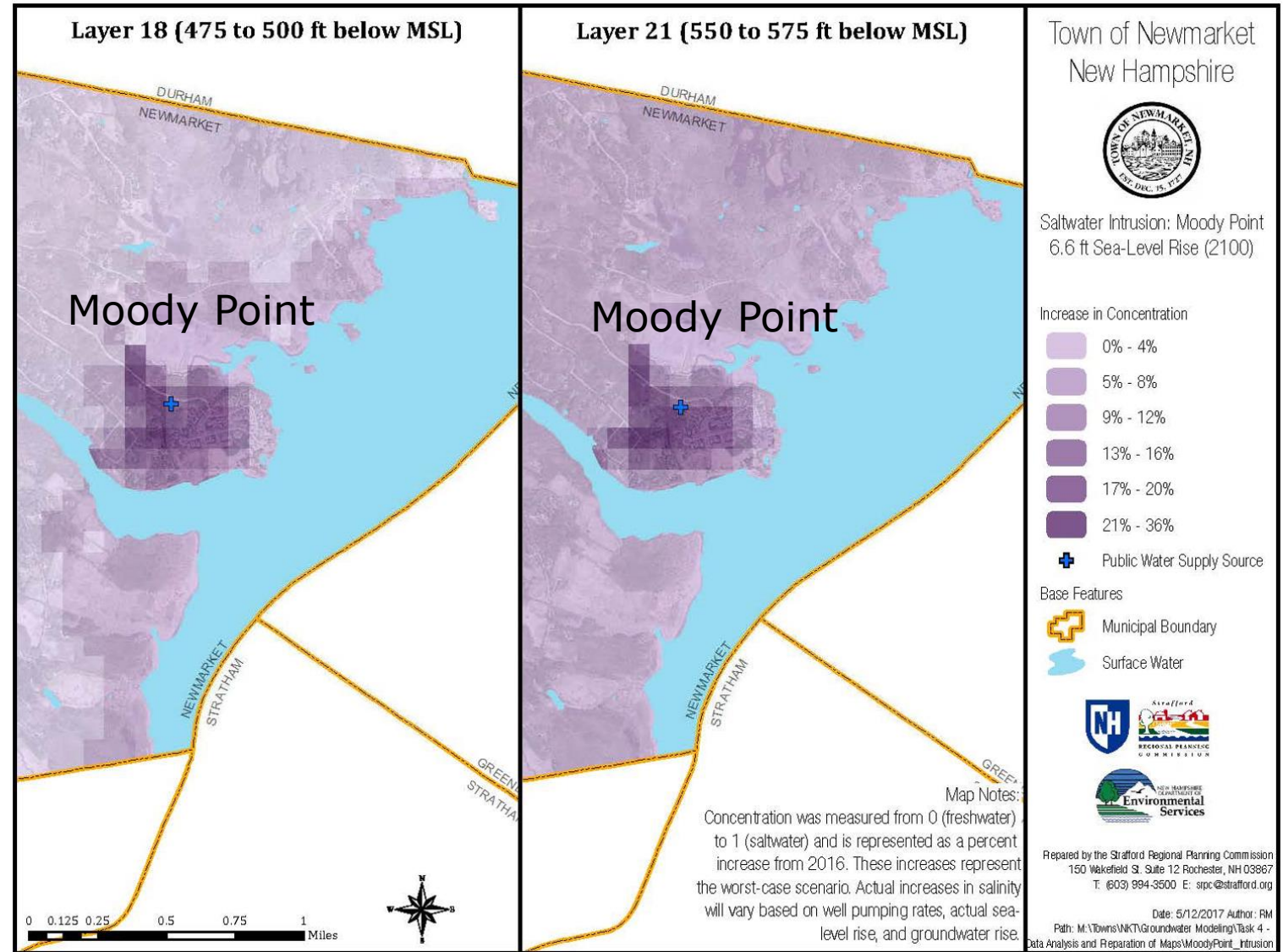
## Within the GWRZ:

- 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



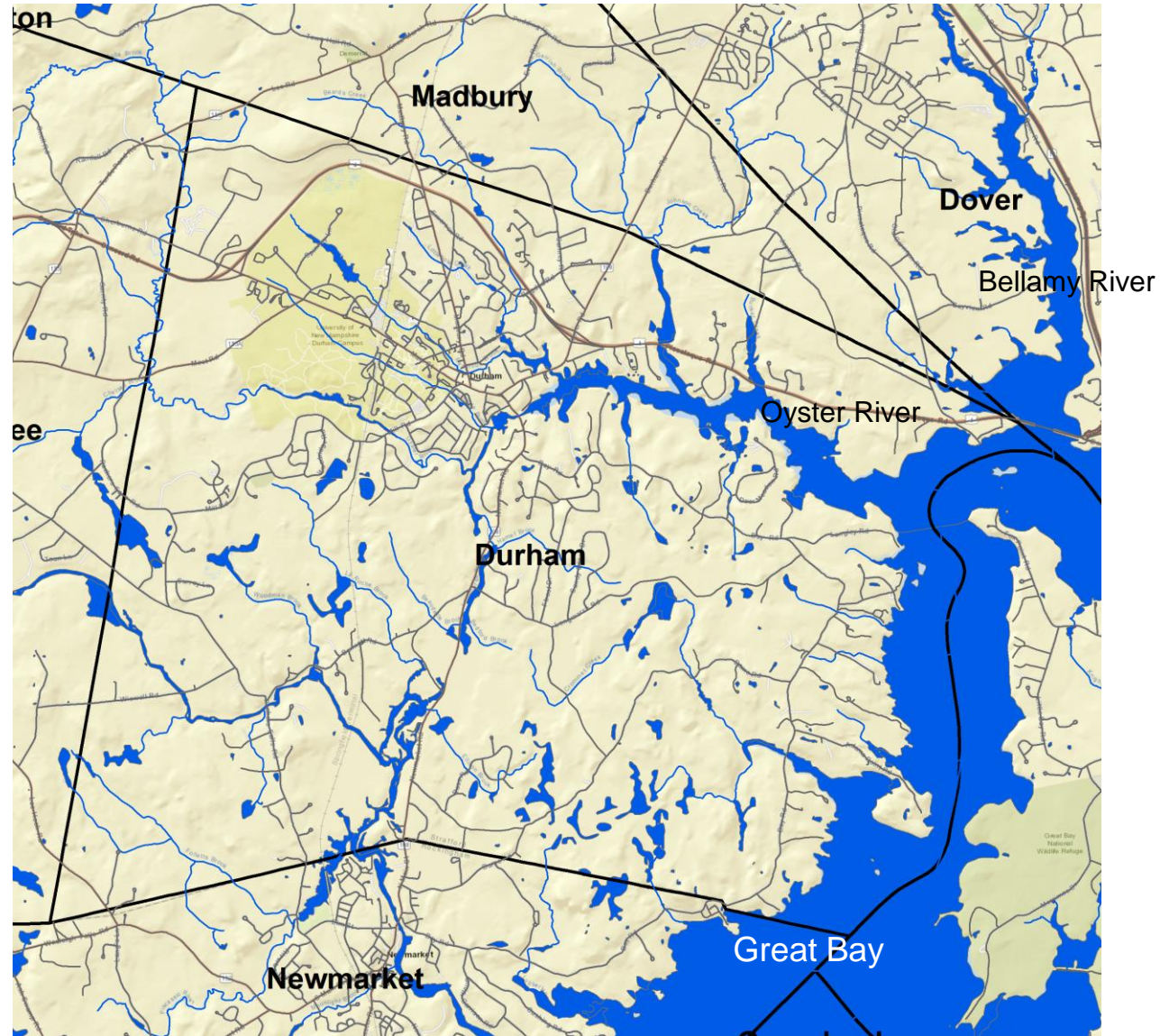
# Projected salt concentration increase with 6.6 ft SLR

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

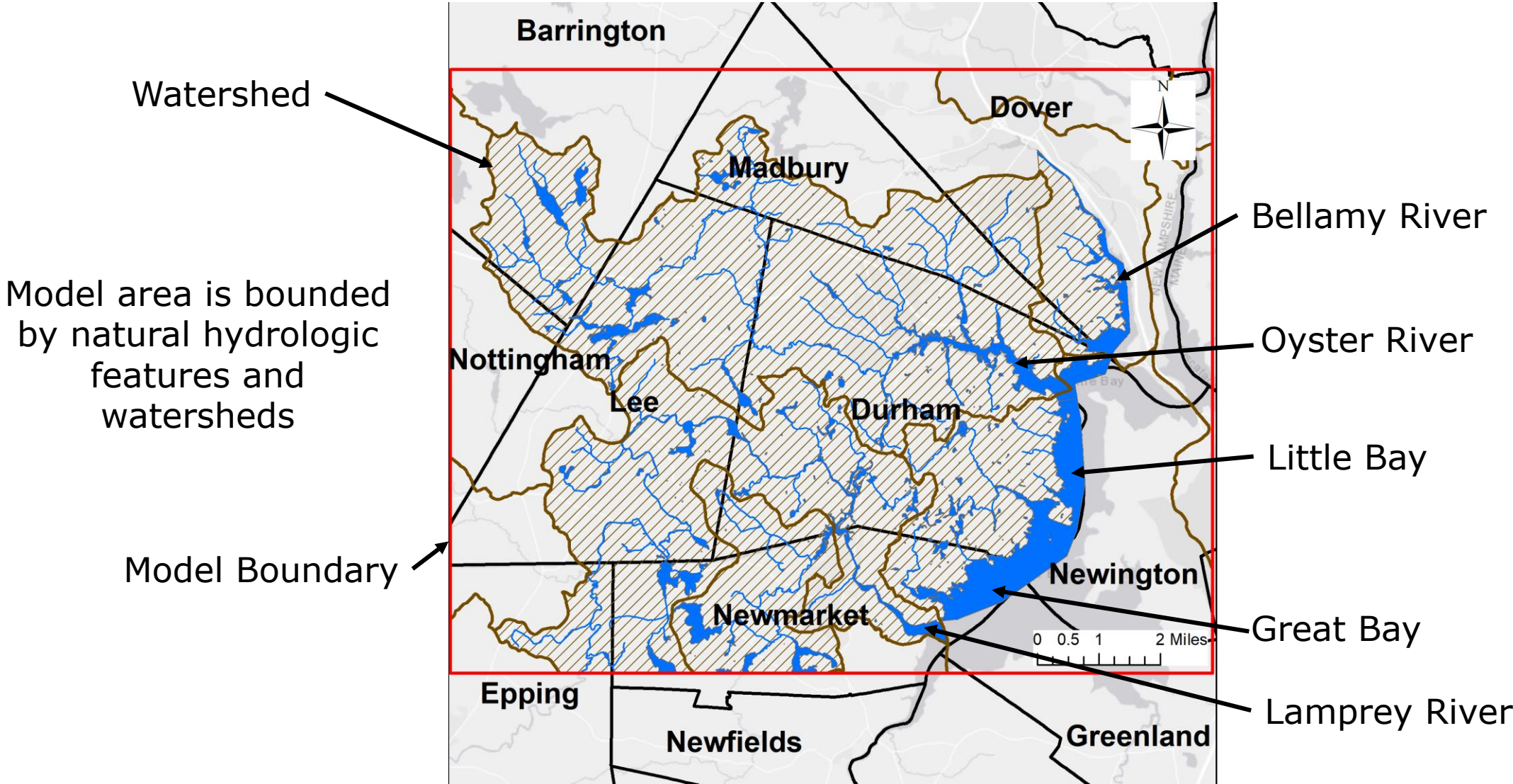


# ***Town of Durham Study***

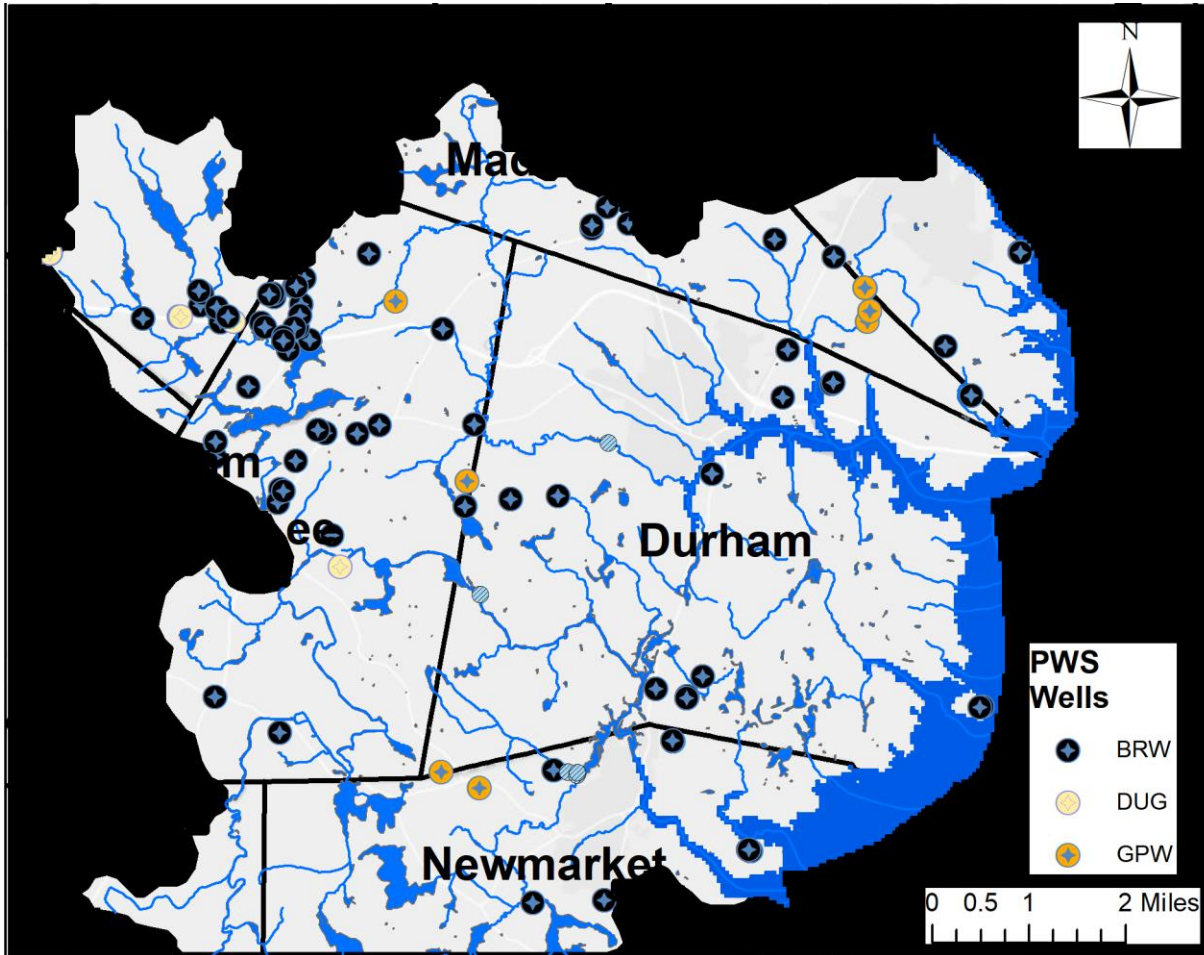
# Town of Durham



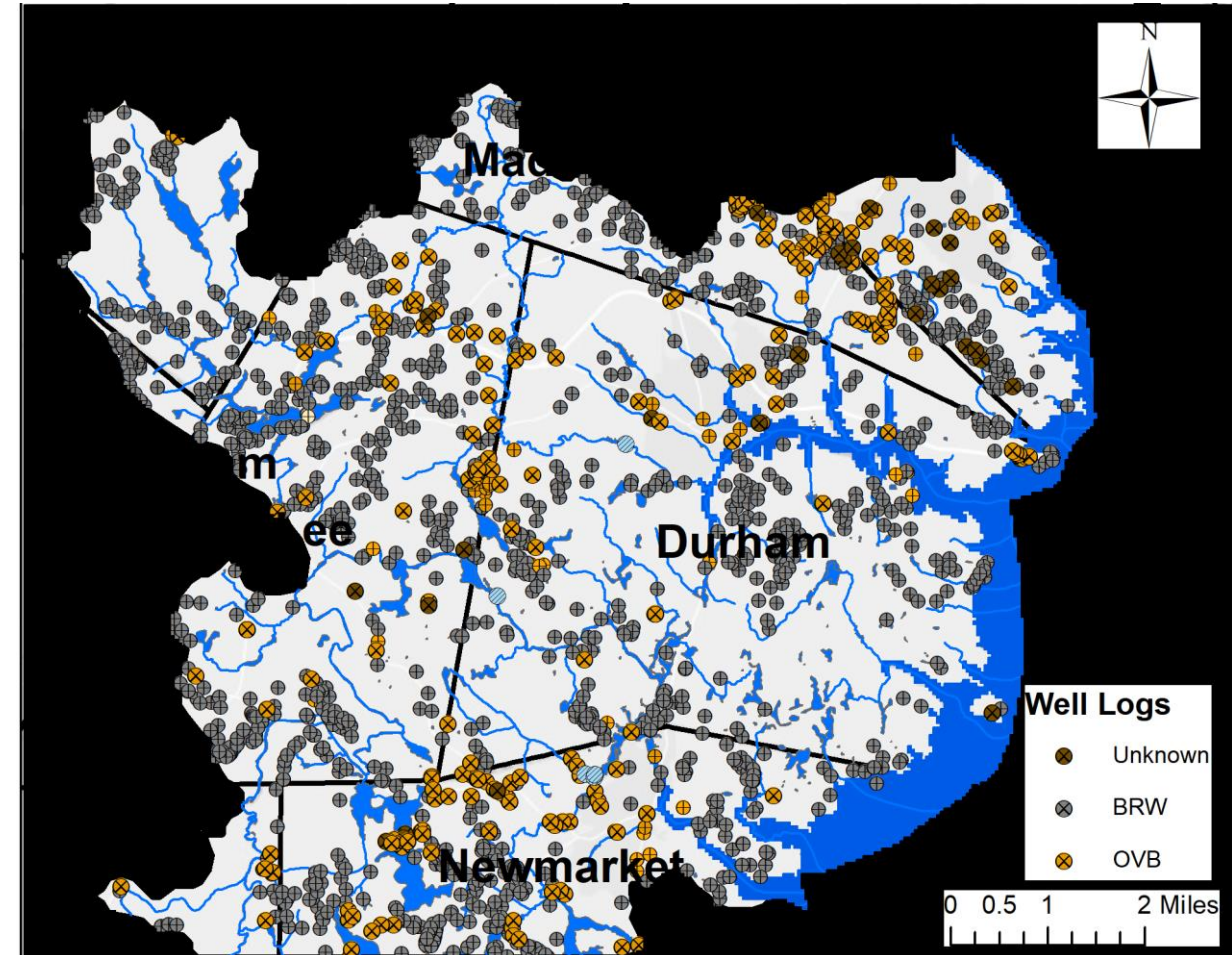
# Town of Durham – Development of Model Grid



# Town of Durham - Wells



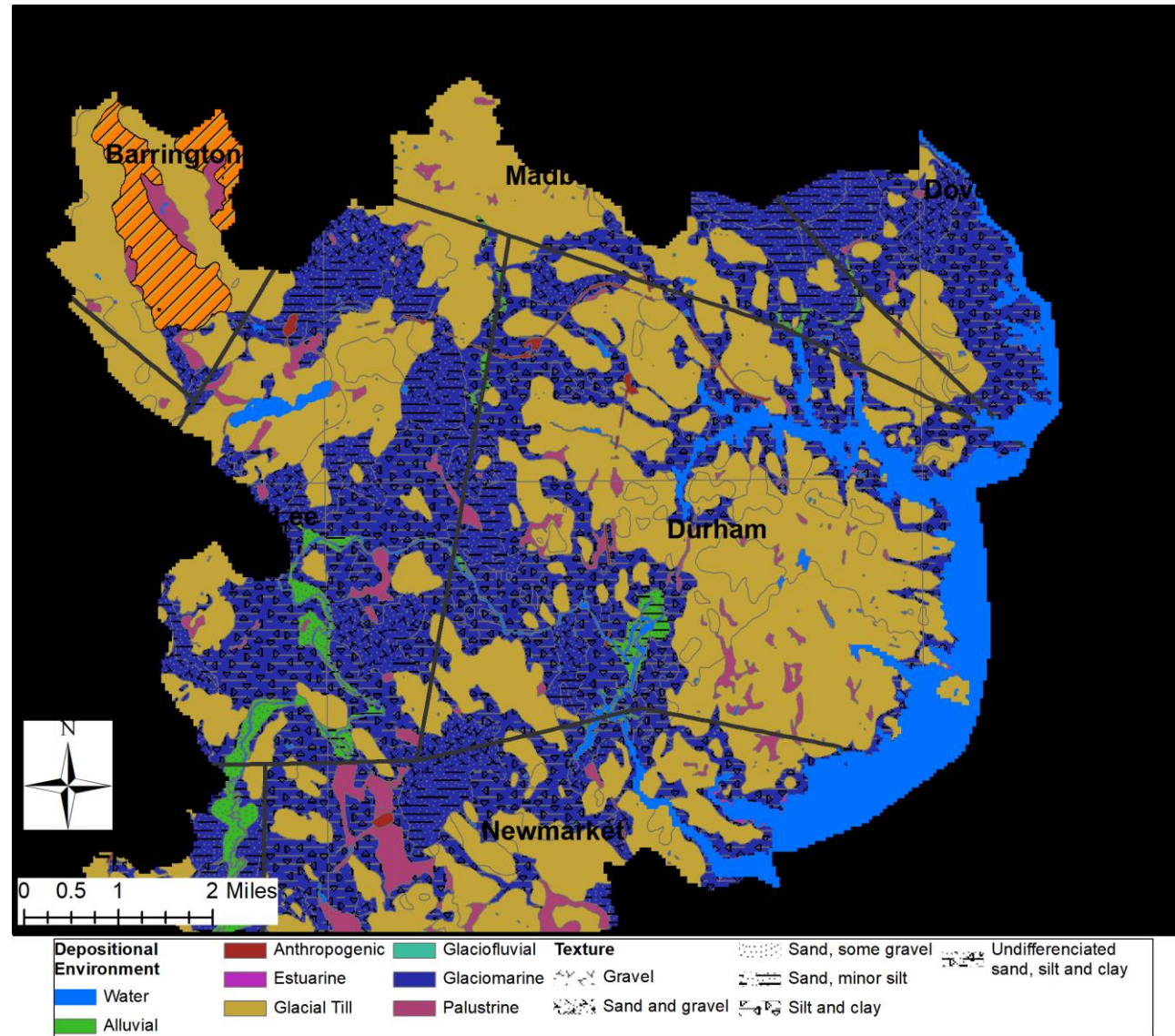
Hydrography and public water supply wells in the model area (NHDES)



These well logs are from the geologs and the water well inventory databases from NHDES and NH Geological Survey

# Town of Durham – Surficial Geology

The surficial geology is used to determine the aquifer properties



The nature of the bedrock is also considered for the lower layers



# We need to work together...

- A model is only as good as the data used to construct the model
- We have good data from NH Granit, NHDES, and NH Geological Survey
- The Town of Durham can also help with data and in identify problem areas:
  - vulnerable to flooding or infrastructure damage
  - vulnerable to saltwater intrusion
  - water quality problems
  - water supply problems
  - stressed natural resources

# Thank you

## Contact:

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