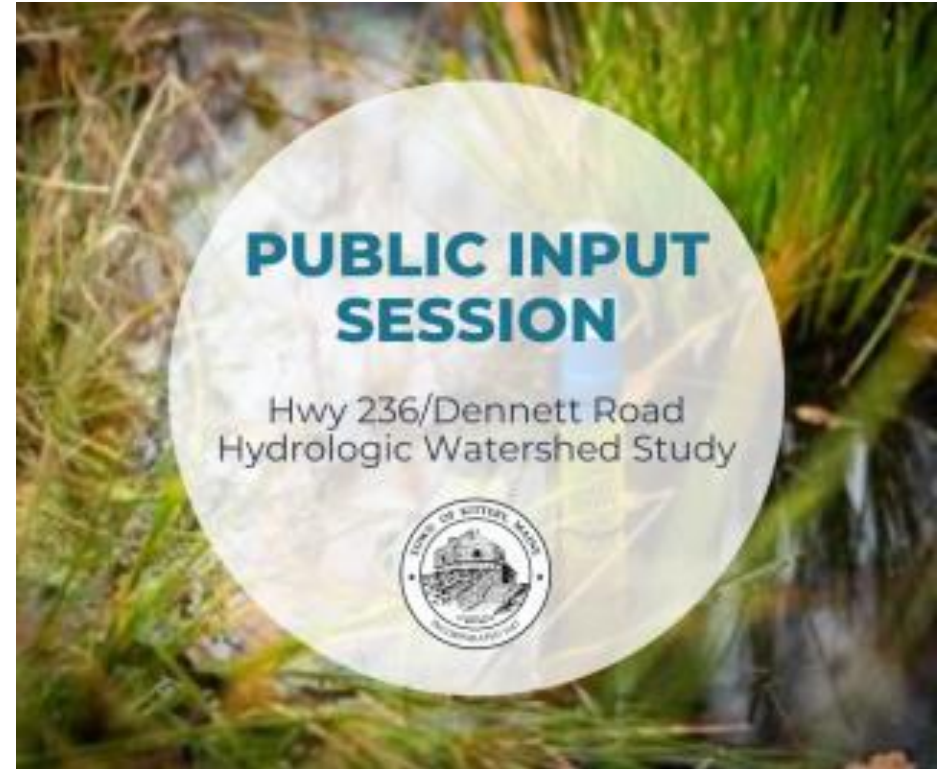




Town of Kittery Highway 236/Dennett Road Hydrologic Watershed Study

Agenda

- I. Project Recap / Progress Review
- II. Public Input Summary
- III. Preliminary Modeling Results
- IV. Nutrient Loading Overview
- V. Herb Parson Pond
- VI. Next Steps & Project Schedule



Project Recap



Project Team

- Town of Kittery
- Barton & Loguidice, D.P.C.
- Streamworks, PLLC
- FB Environmental Associates
- Stakeholders

Barton
& **Loguidice**

 **streamworks**



Project Goals

- I. Evaluate Existing Conditions / Areas of Concern

- II. Evaluate Potential Future Development

- III. Evaluate Mitigation Alternatives
 - I. Improve Existing Conditions
 - II. Evaluate Future Development Decisions



Progress Summary

Evaluate Existing Conditions

- Desktop Review
 - Drainage Patterns
 - Soil Types
 - Resource Identification

- Identify Existing Areas of Concern
 - Public outreach
 - Stakeholder input
 - (www.kitteryme.gov/watershedinputsession)

Evaluate Existing Conditions

- **Data Collection**
 - Inventory of Critical Drainage Infrastructure
 - Inventory of Known Flooding Locations
 - Inventory of Resources

Evaluate Existing Conditions

- **Field Reconnaissance**
 - Catalog Stormwater Infrastructure
 - Assessment of Known Flooding Locations
 - Refine Subwatershed Delineations
 - Wetland Mapping

Areas of Interest

Preliminary Areas of Interest



Preliminary Areas of Interest



Martin Rd / Hwy-236



Herb Parson Pond



Martin Rd / Hwy-236



Spruce Creek Wetlands



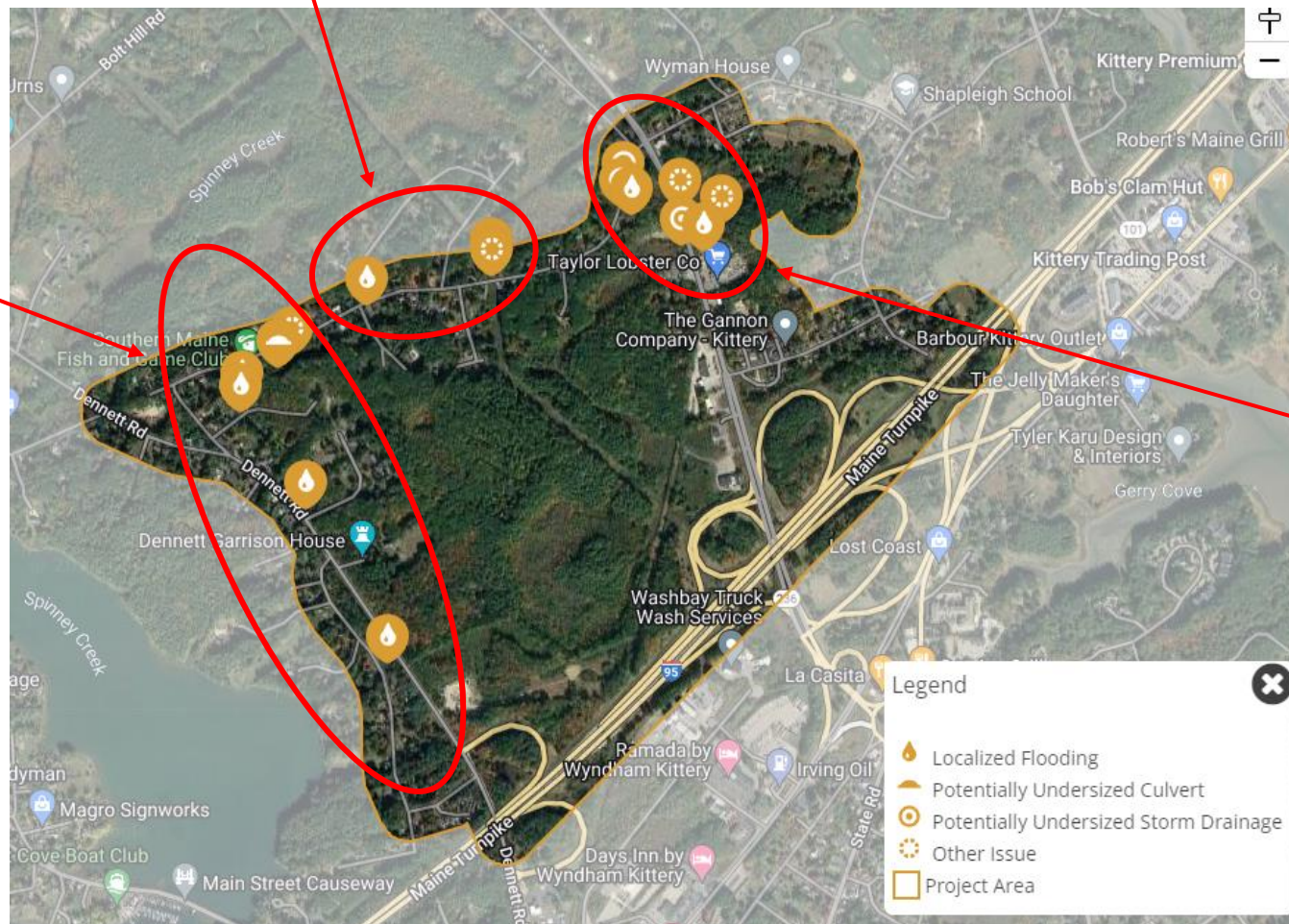
Central Study Area

Public Input Summary (To-Date)

Interactive Mapper – Results Overview

Pond History / Lack of Pond Inflow

History of Flooding



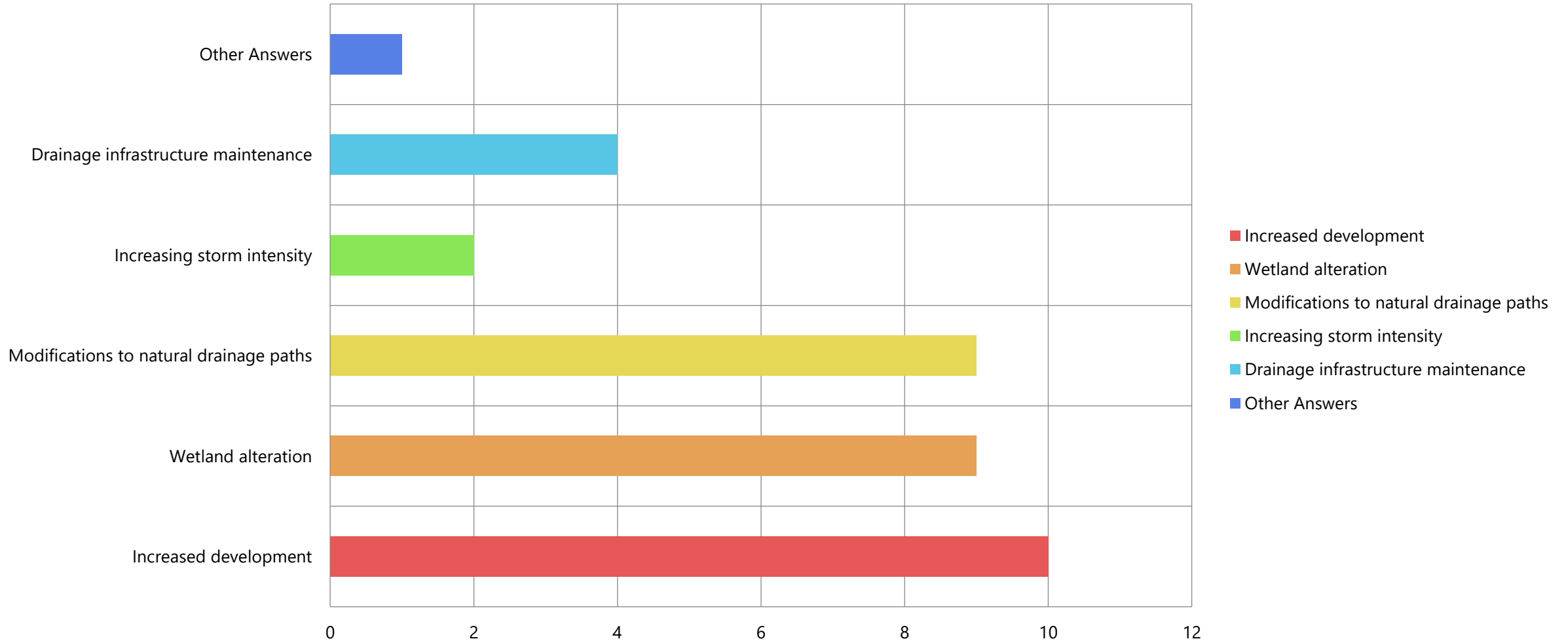
- History of Flooding
- High Water Table
- Beaver Dams
- Potentially Undersized Infrastructure

Community Survey – Summary & Takeaways

- Over ½ of respondents have experienced flooding at their property (62%)
 - Variability between start of flood occurrences
 - Combination of seasonal and ongoing flooding
 - Most residents identified Spring as most frequent flooding season
 - Multiple respondents indicated costs have been incurred related to residential flooding
 - 66% suspect flooding to be more groundwater related than surface water related
- Most respondents reside on Martin Road, followed by Dennett Road
- Most respondents indicated living in close proximity to a surface water resource (stream, wetland)

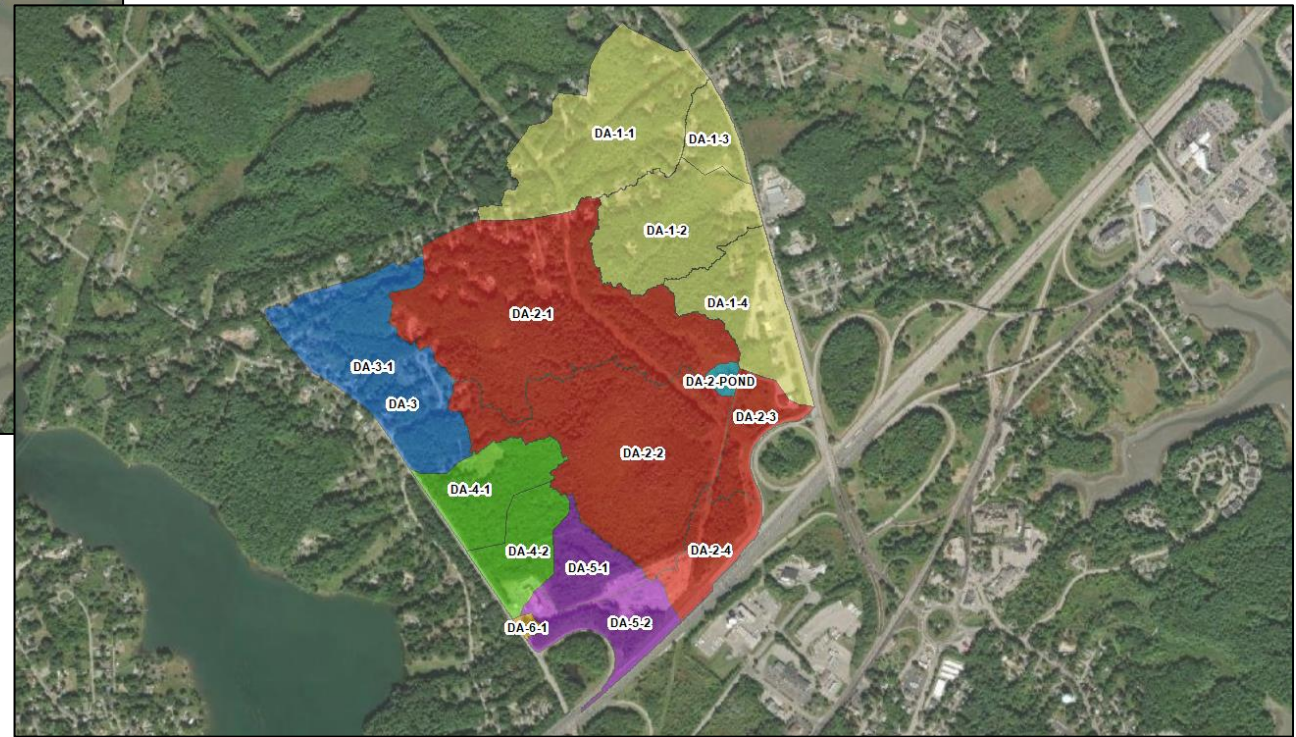
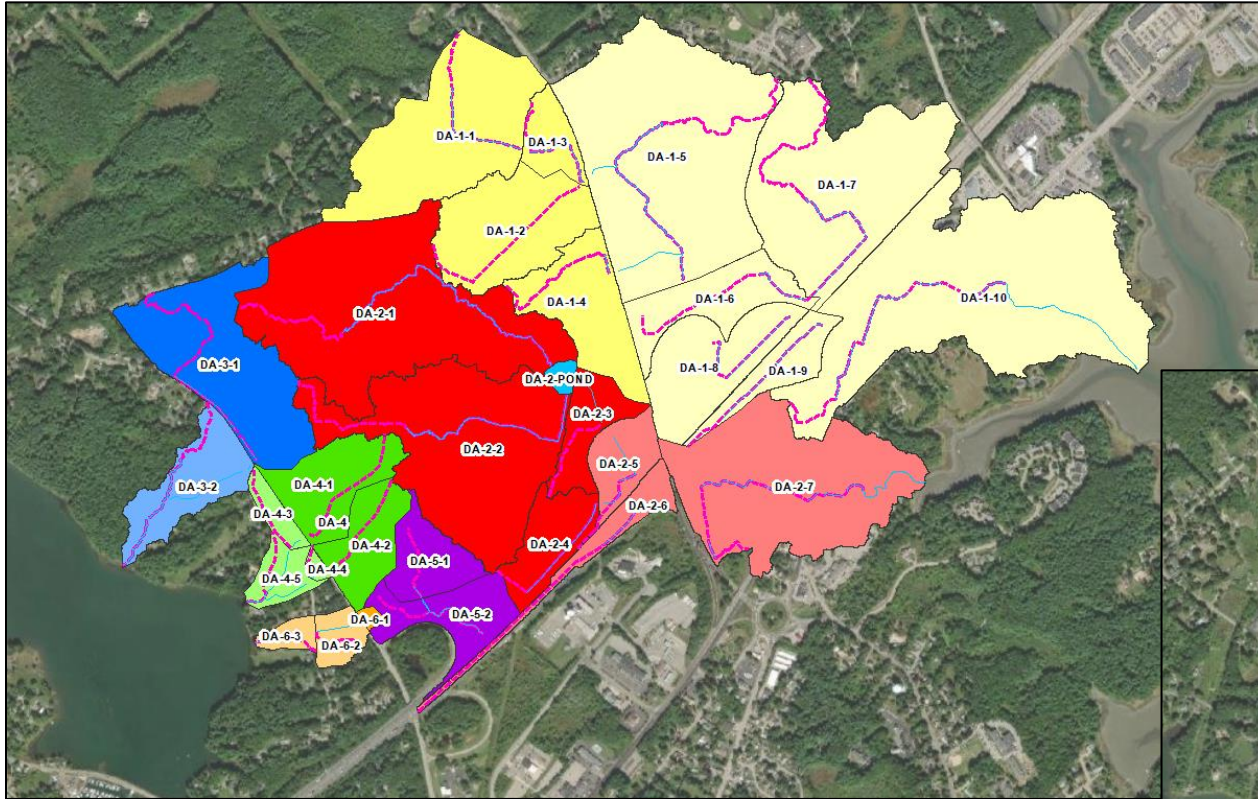
Community Survey – Summary & Takeaways

Question: What do you feel are the primary contributing factors to localized flooding that you have experienced?

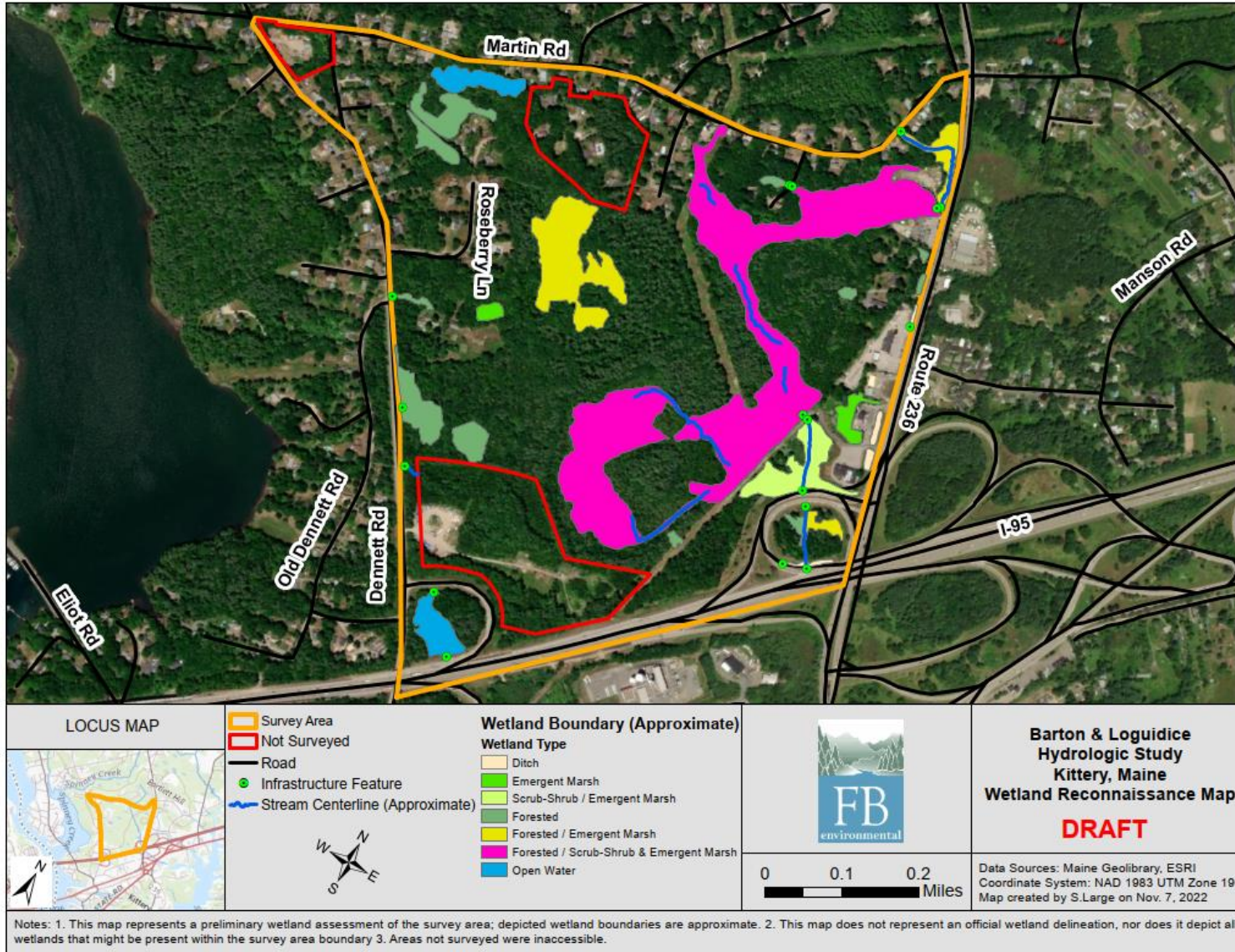


Environmental Setting

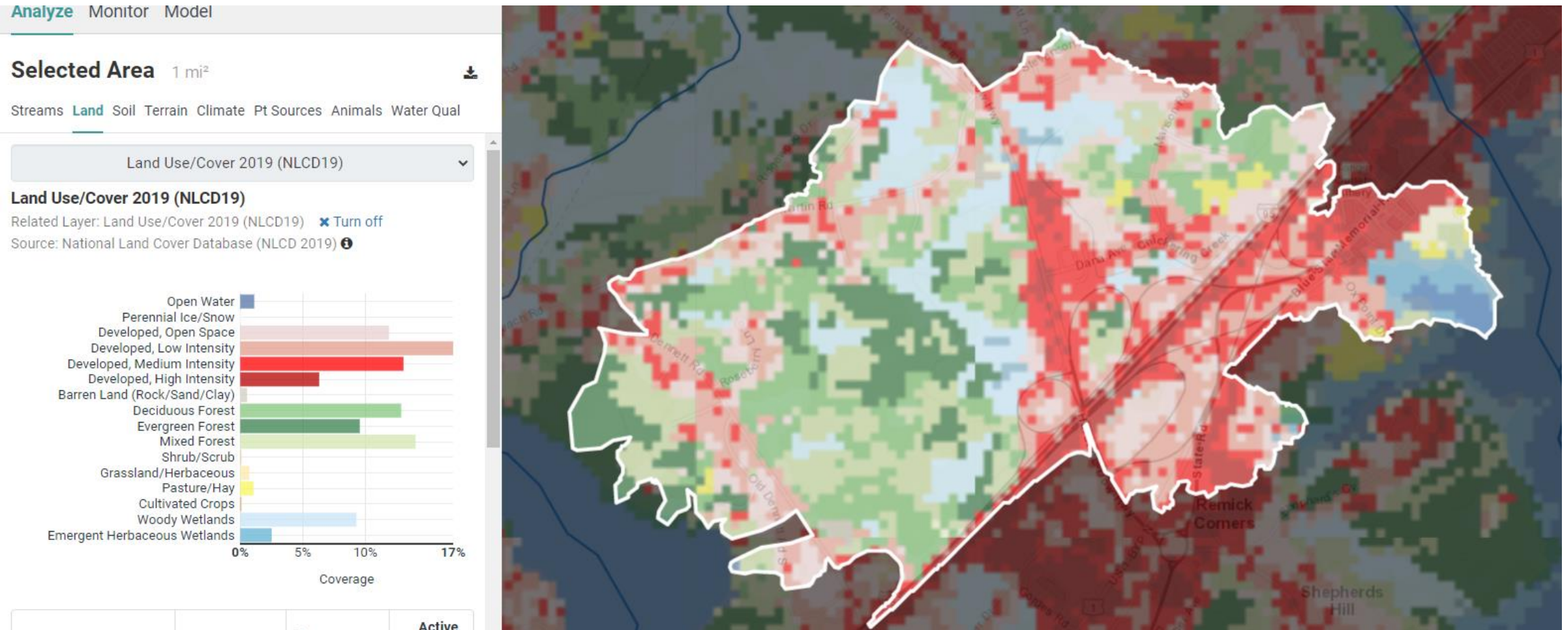
Full Study Area and Focus Study Area



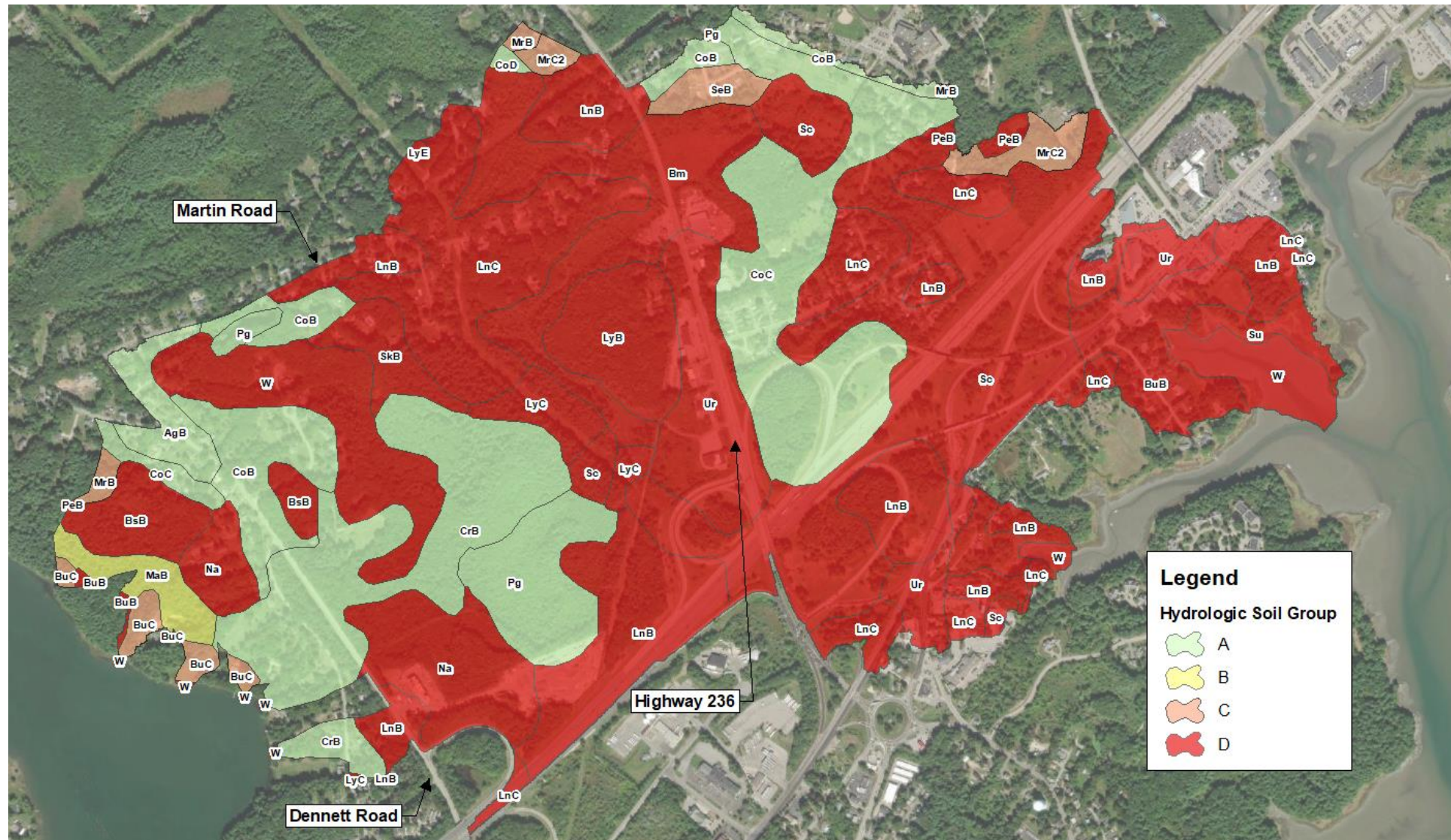
Environmental Setting –Resource Inventory



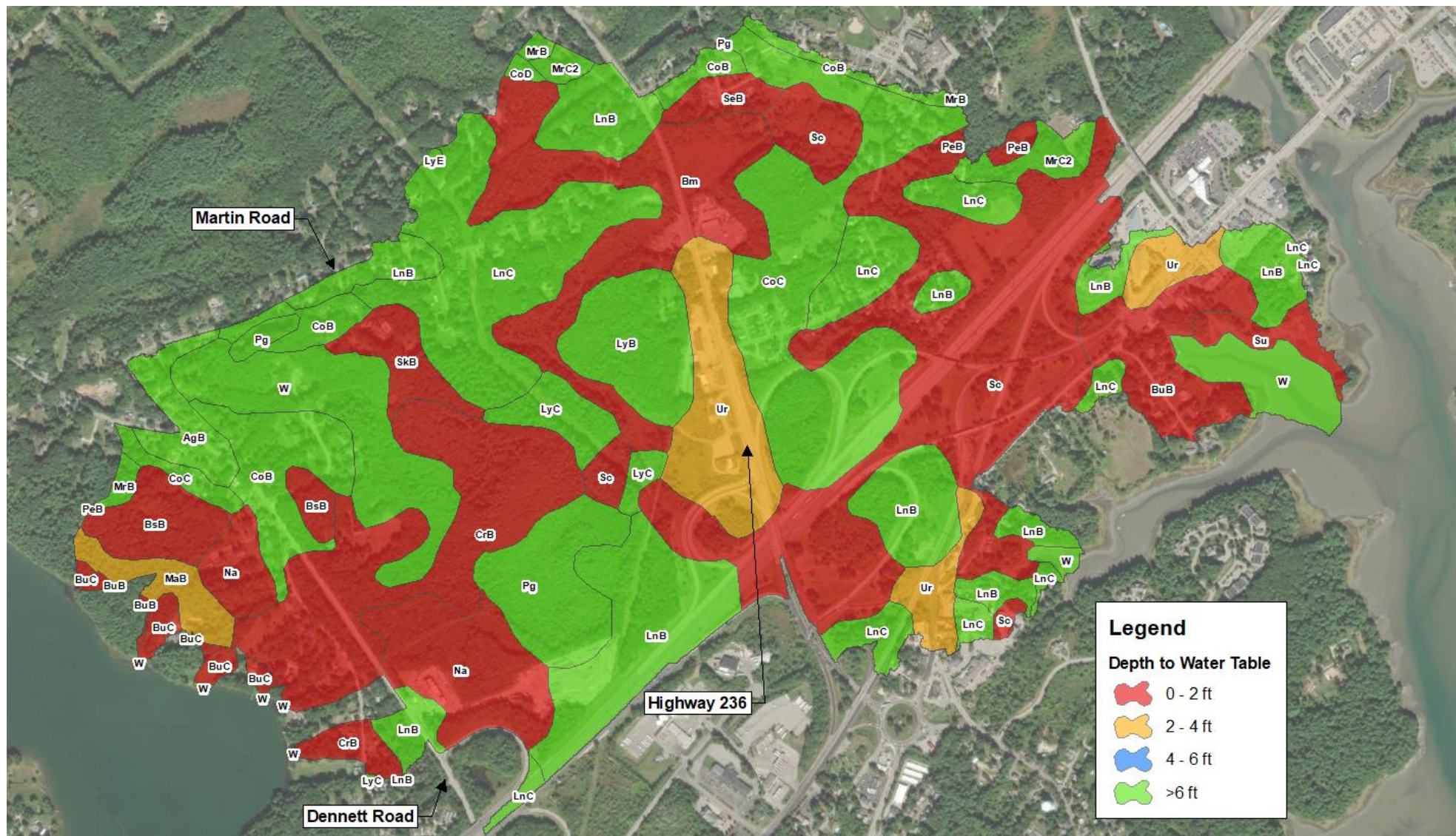
Environmental Setting – Land Cover (NLCD, 2019)



Environmental Setting – Hydrologic Soil Group



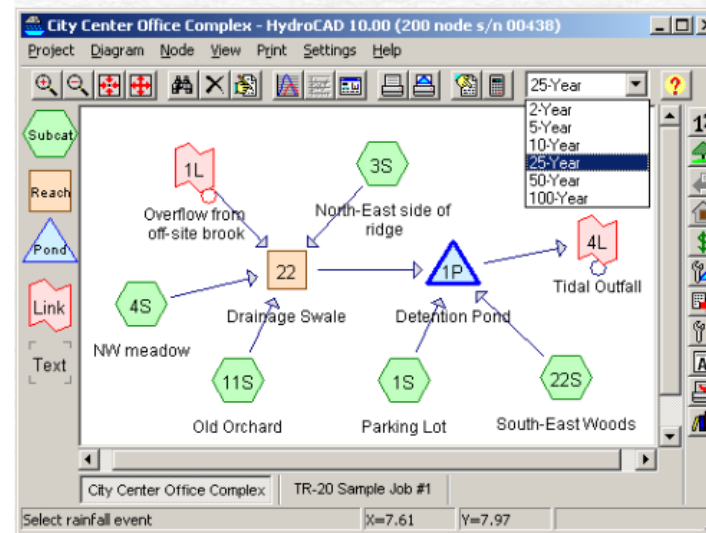
Environmental Setting – Depth to Water Table



HydroCAD Modeling Approach

HydroCAD Modeling Software

- HydroCAD is currently utilized by hundreds of municipal, regulatory, educational, and professional design organizations, including:
 - Maine Department of Environmental Protection
 - Maine Department of Transportation
 - U.S. Army Corps of Engineers
 - U.S. Department of Energy
 - University of New Hampshire



Search:

[HydroCAD-10.2 update](#) [Case studies](#) [More news...](#)

HydroCAD[®]

Stormwater
Modeling

The competitive edge in hydrology & hydraulics software ... since 1986

Hydrologic & Hydraulic Modeling

- **Model a range of flood intervals**
 - 1-Year (2.64")
 - › Anticipated on an annual basis
 - 10-Year (4.83")
 - › 10% annual chance
 - 100-Year, etc. (8.78")
 - › 1% annual chance

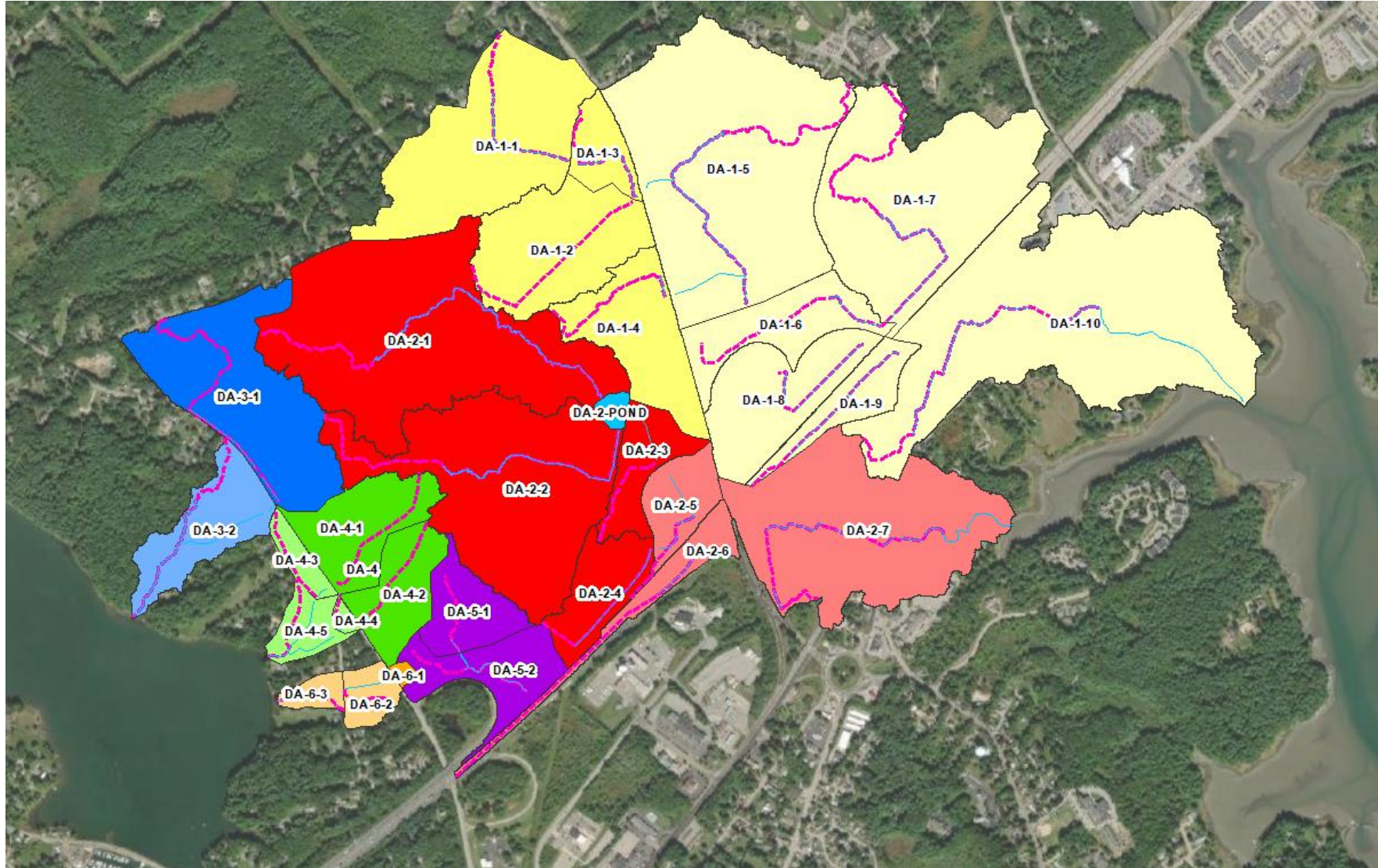
- **Model stormflow volumes, peak discharge rates, and timing**

Current and Future Hydrologic & Hydraulic Modeling Scenarios

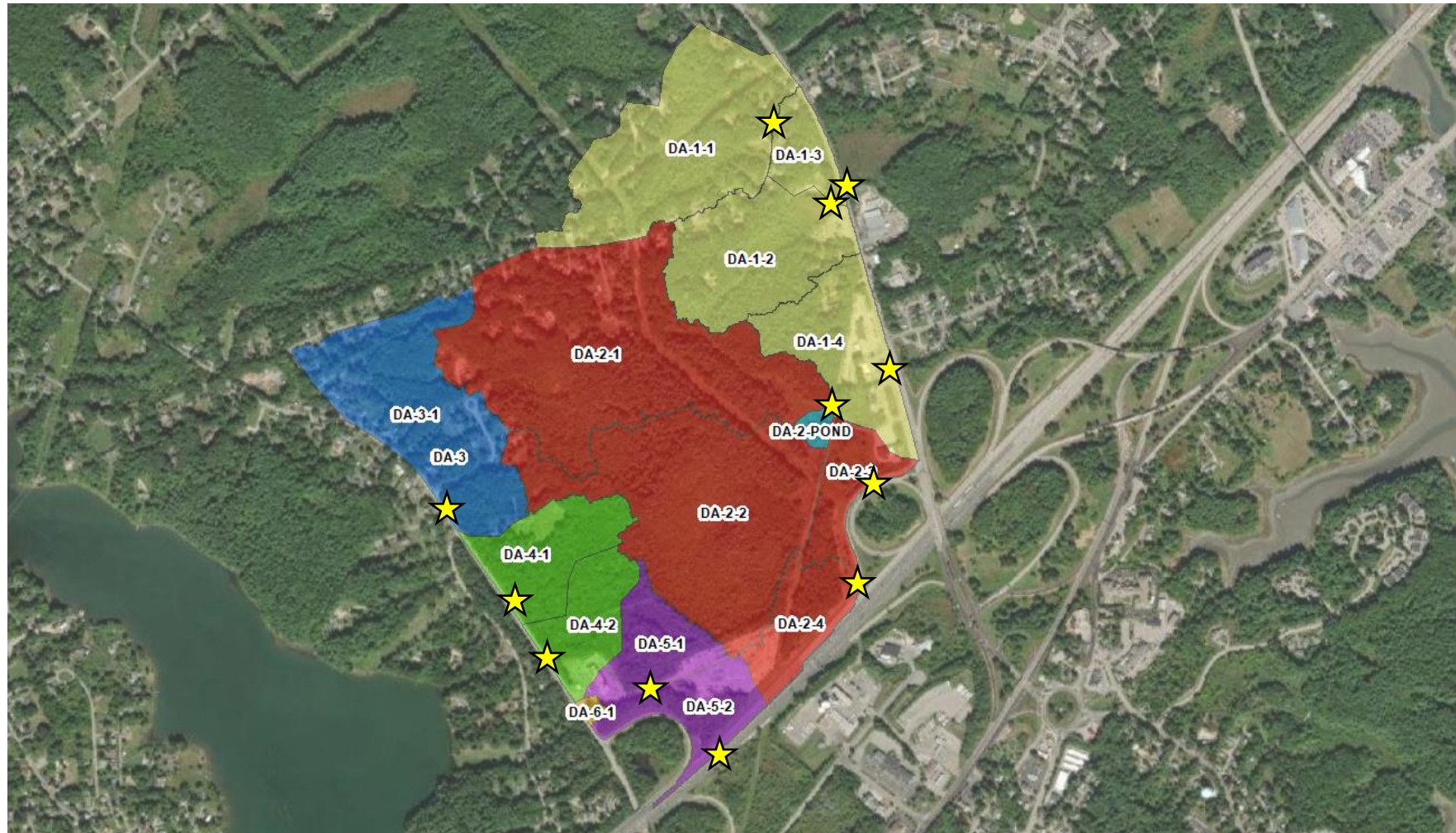
- **No Build Scenario**
 - (existing conditions)
- **50% Build Out**
- **100% Build Out**
- **Extreme Storm Event/Climate Change Scenarios (next meeting)**



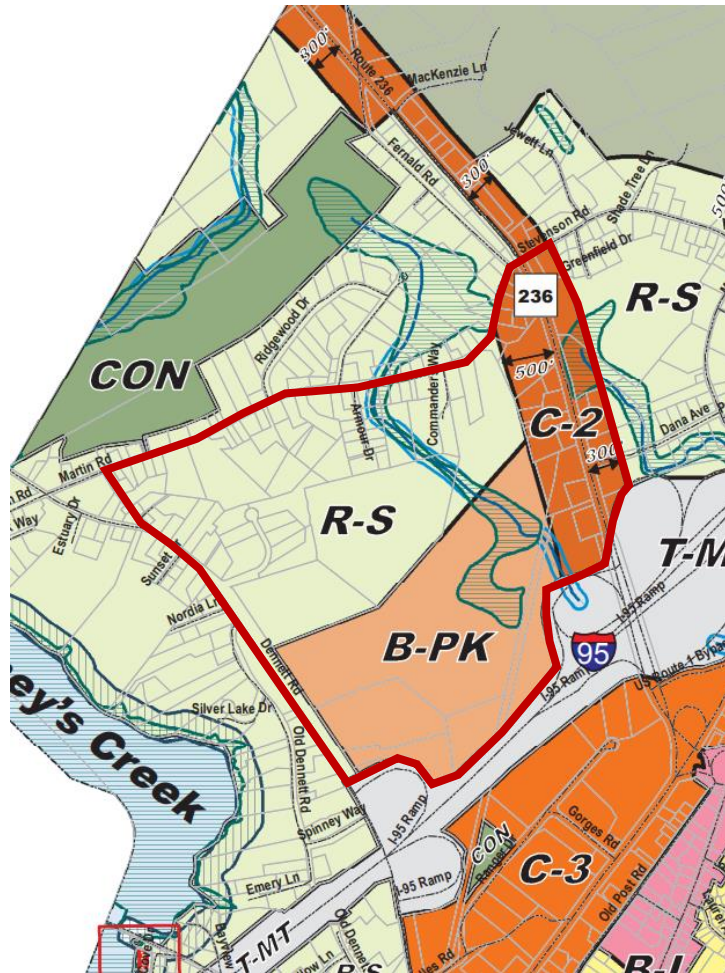
HydroCAD Base Model – Full Study Area



HydroCAD Base Model – Focus Study Area



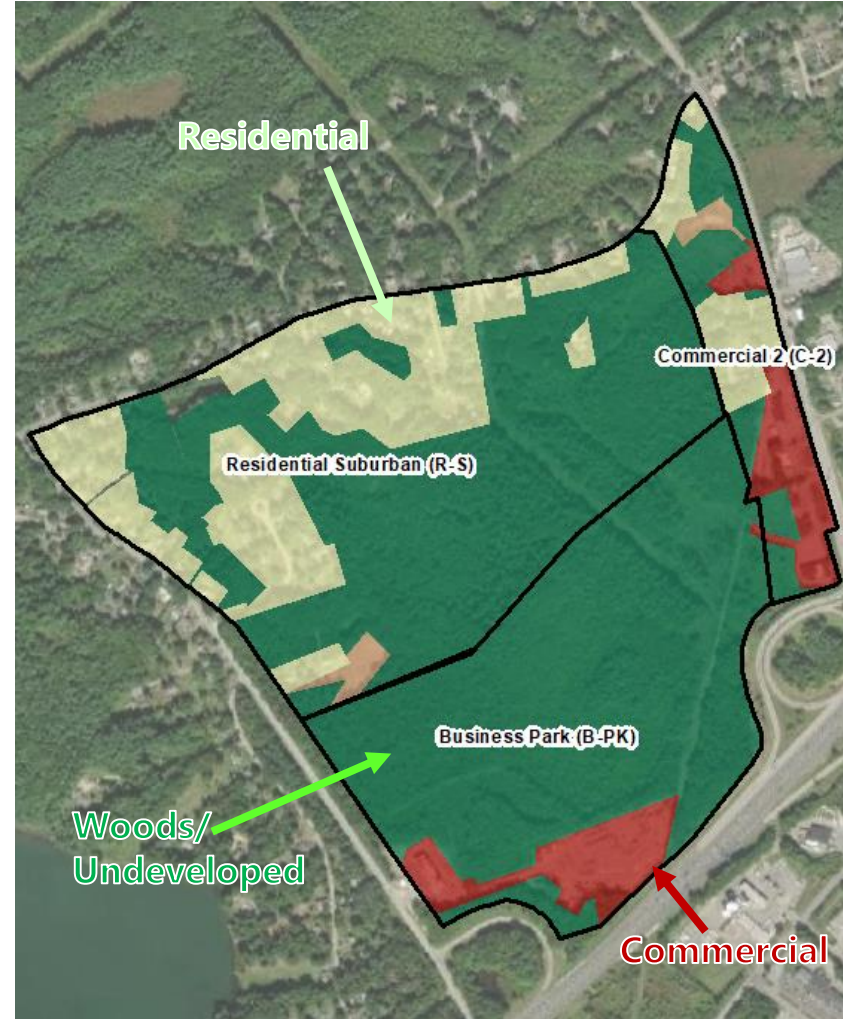
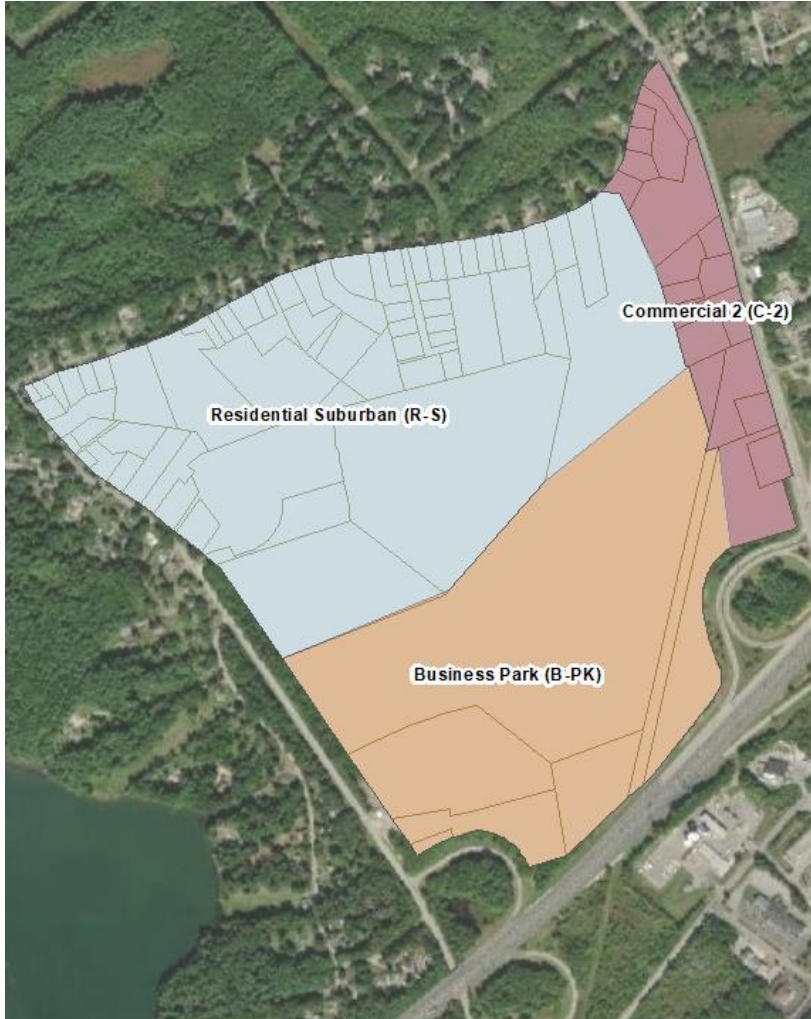
Town of Kittery Zoning



Base Zones

Residential - Village (R-V)	Commercial 1 (C-1)	Mixed Use - Kittery Foreside (MU-KF)
Residential - Urban (R-U)	Commercial 2 (C-2)	Mixed Use (MU)
Residential - Kittery Point Village (R-KPV)	Commercial 3 (C-3)	Mixed Use - Badgers Island (MU-BI)
Residential - Suburban (R-S)	Industrial (IND)	Conservation (CON)
Residential - Rural (R-RL)	Business - Local 1 (B-L1)	Transportation - Maine Turnpike (T-MT)
Residential - Rural Conservation (R-RLC)	Business - Local (B-L)	
	Business - Park (B-PK)	

Zoning and Existing Build Out

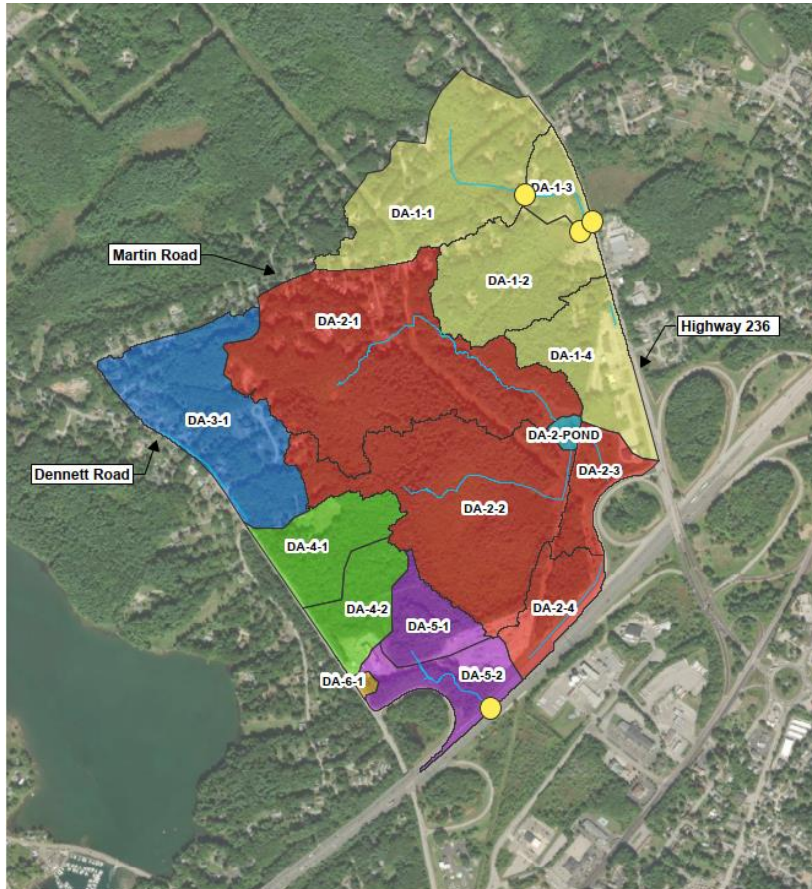


Preliminary Modeling Results

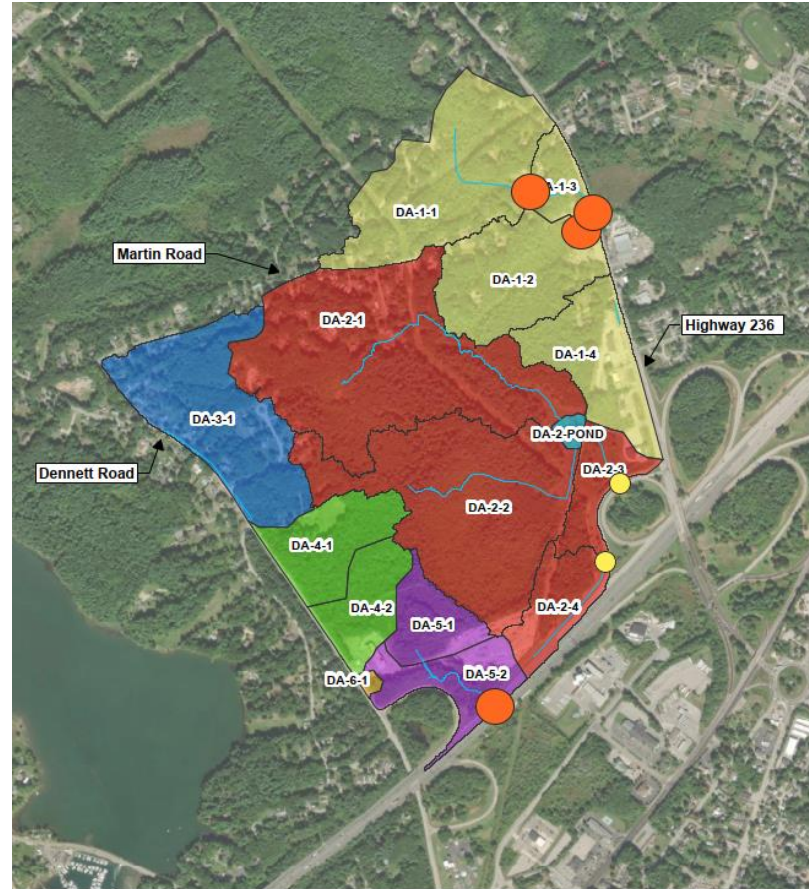
NOTE: Build out scenarios do NOT currently incorporate stormwater mitigation associated with future development

Preliminary Modeling Results: No Build Scenario

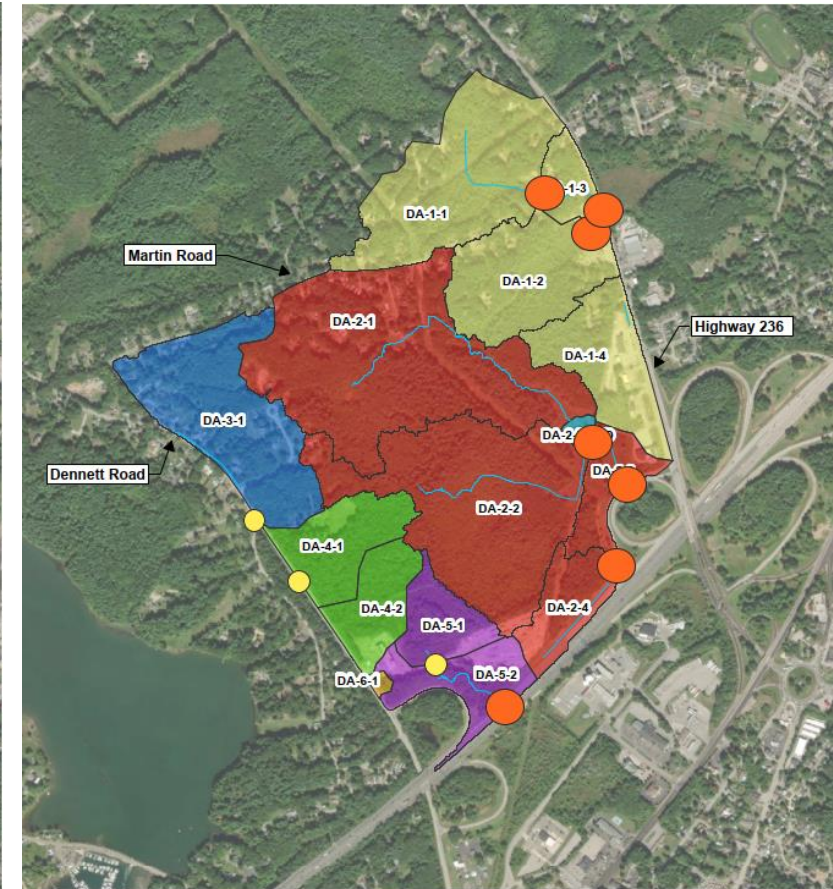
1-Year Storm (2.64" Rainfall)



10-Year Storm (4.83" Rainfall)

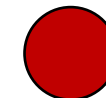


100-Year Storm (8.78" Rainfall)



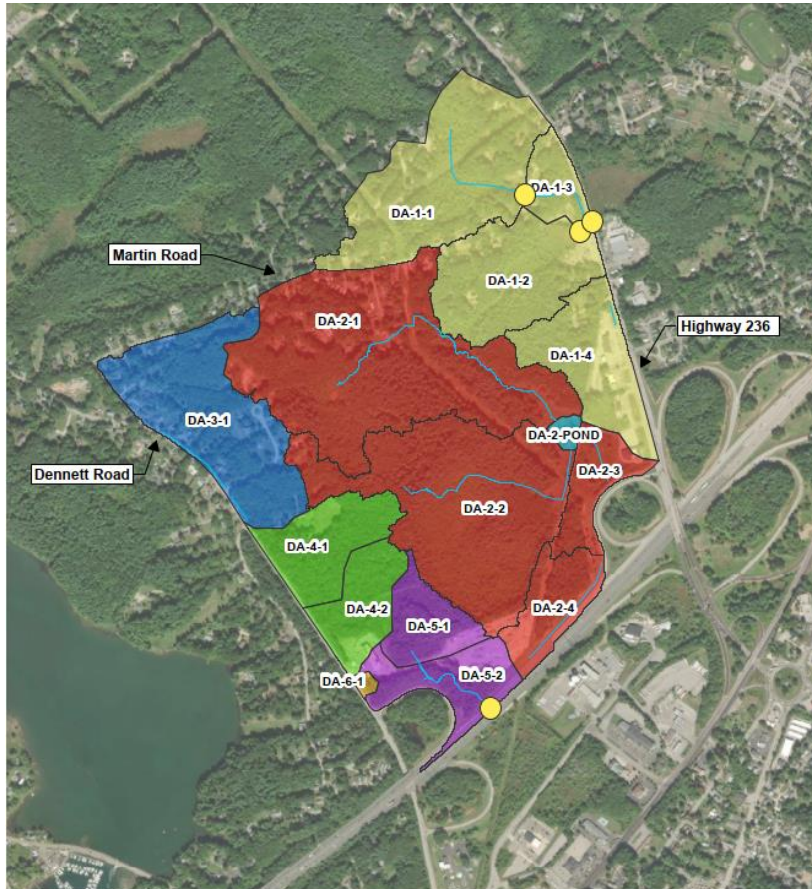
 Flood Risk

 Moderate Flood Risk

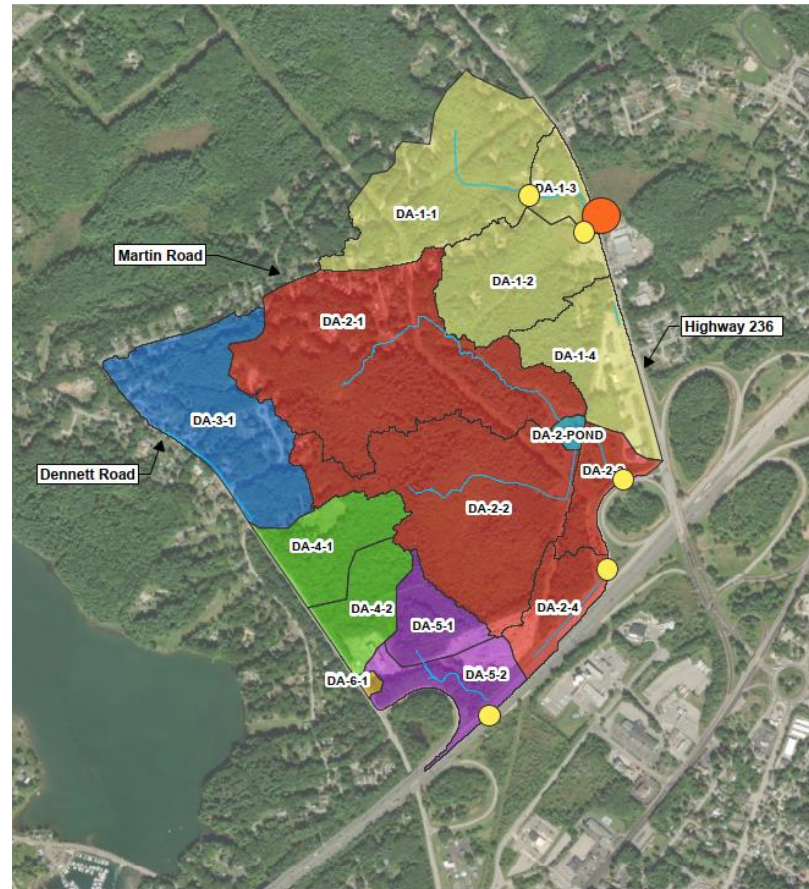
 Significant Flood Risk

Preliminary Modeling Results: 1-Year Storm (2.64" Rainfall)

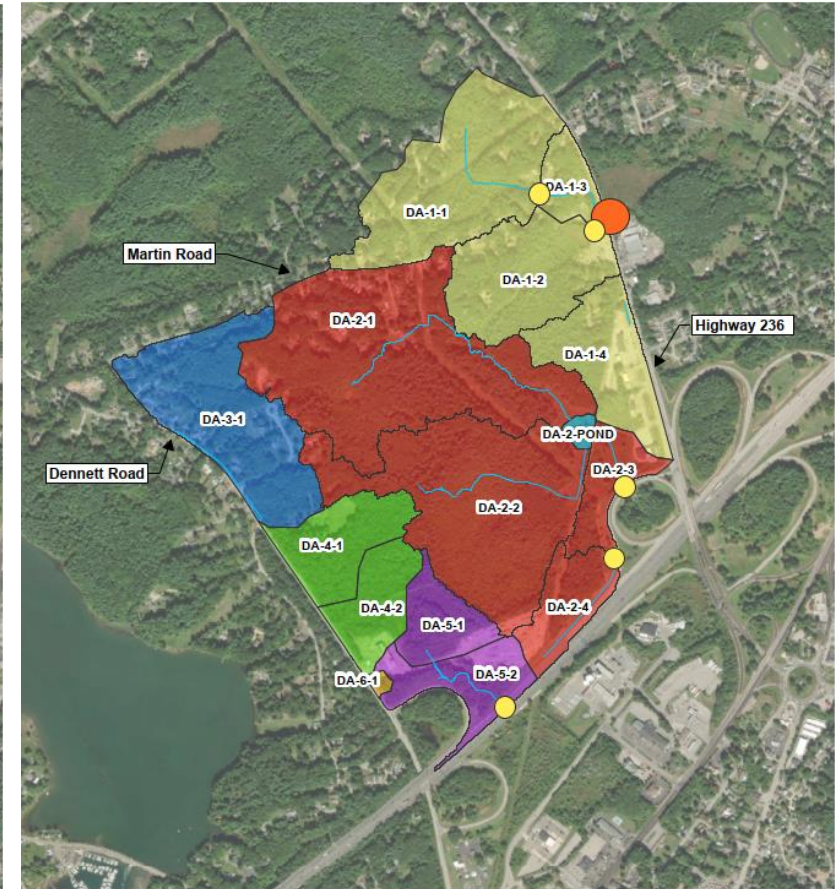
NO BUILD



50% BUILD OUT



100% BUILD OUT



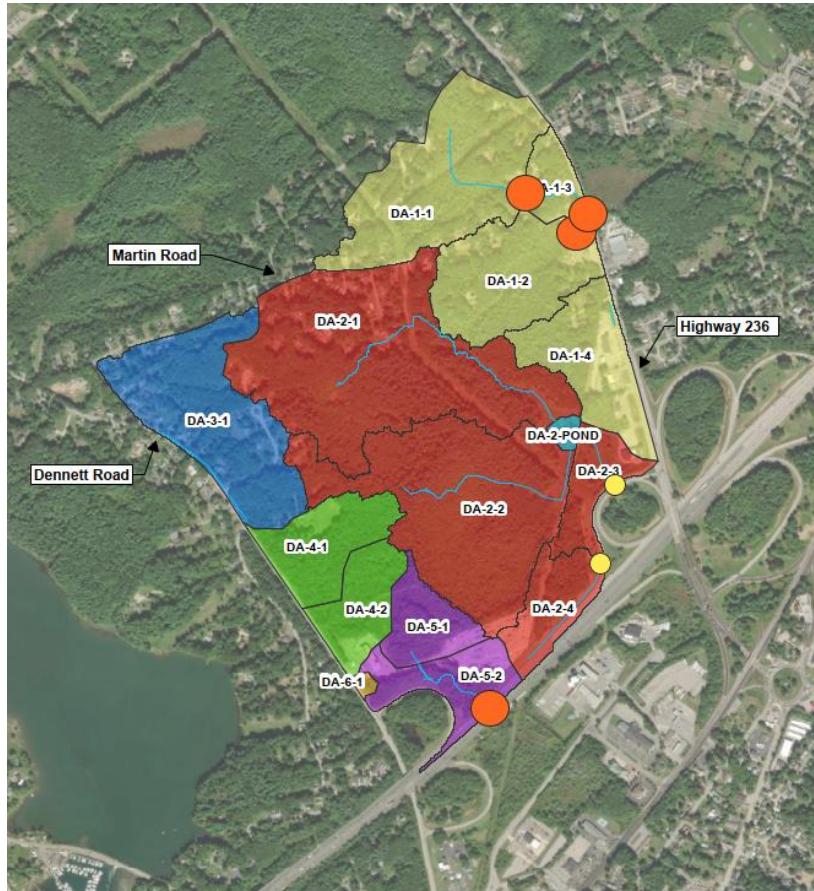
● Flood Risk

● Moderate Flood Risk

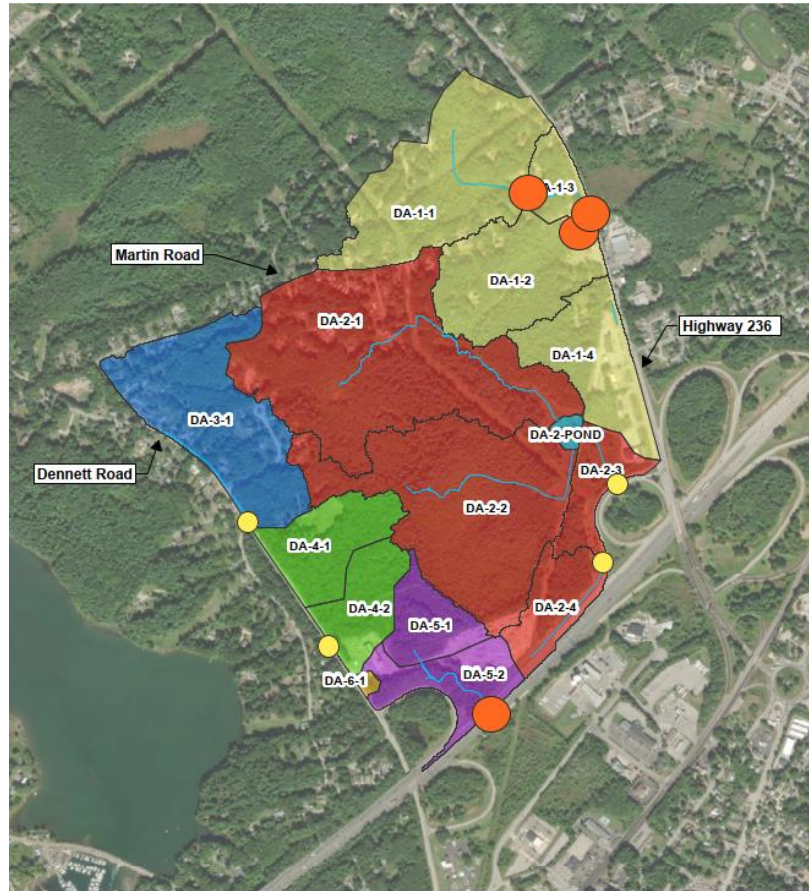
● Significant Flood Risk

Preliminary Modeling Results: 10-Year Storm (4.83" Rainfall)

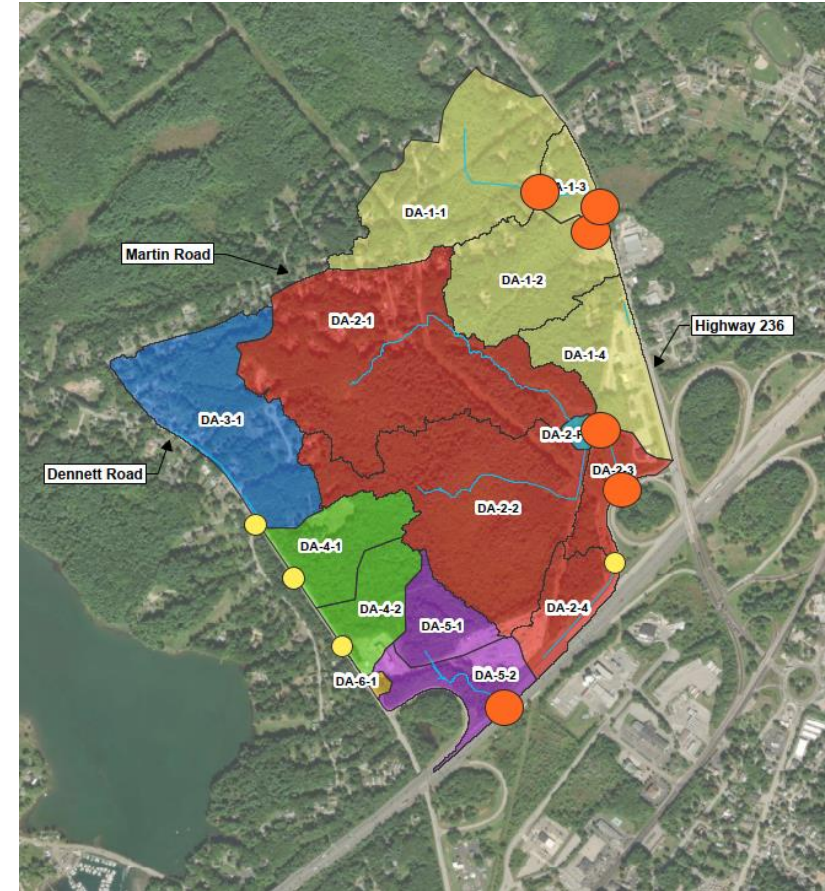
NO BUILD



50% BUILD OUT



100% BUILD OUT



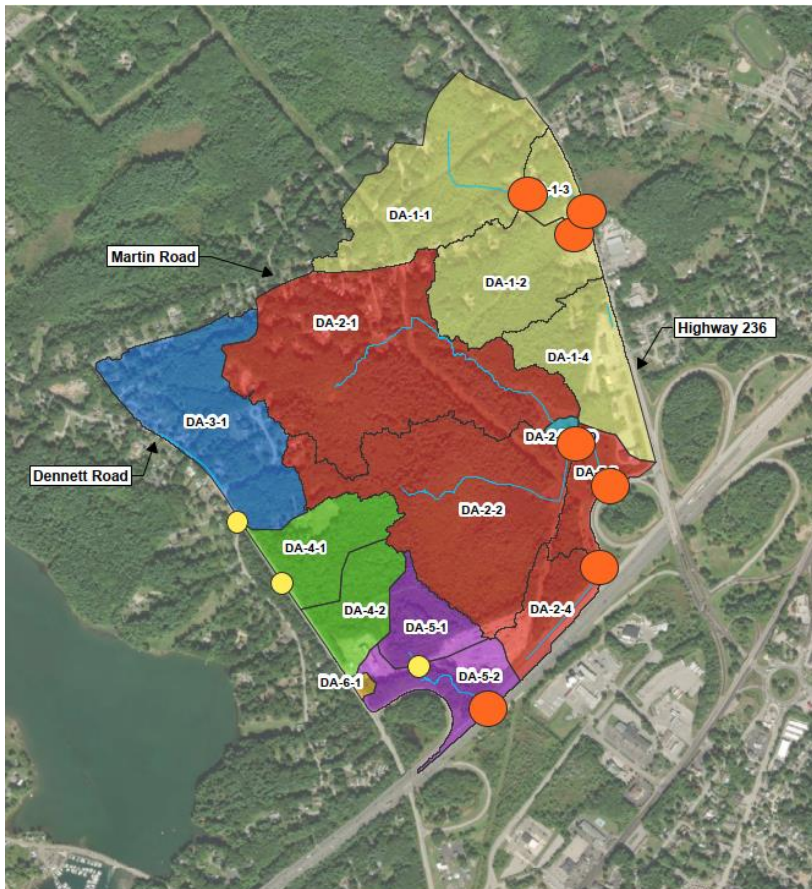
● Flood Risk

● Moderate Flood Risk

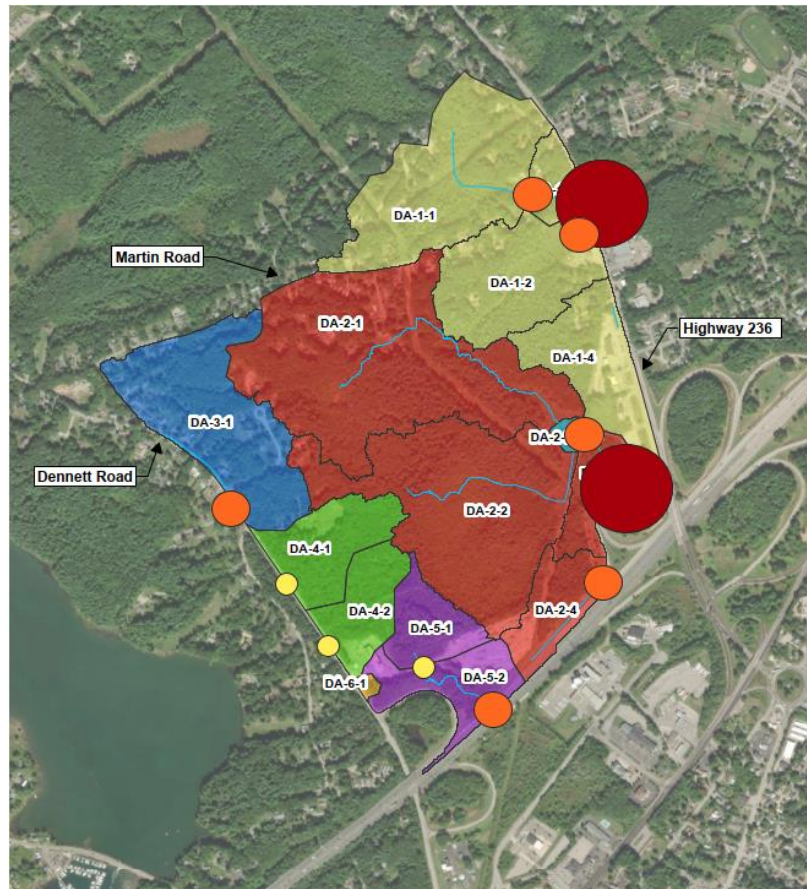
● Significant Flood Risk

Preliminary Modeling Results: 100-Year Storm (8.78" Rainfall)

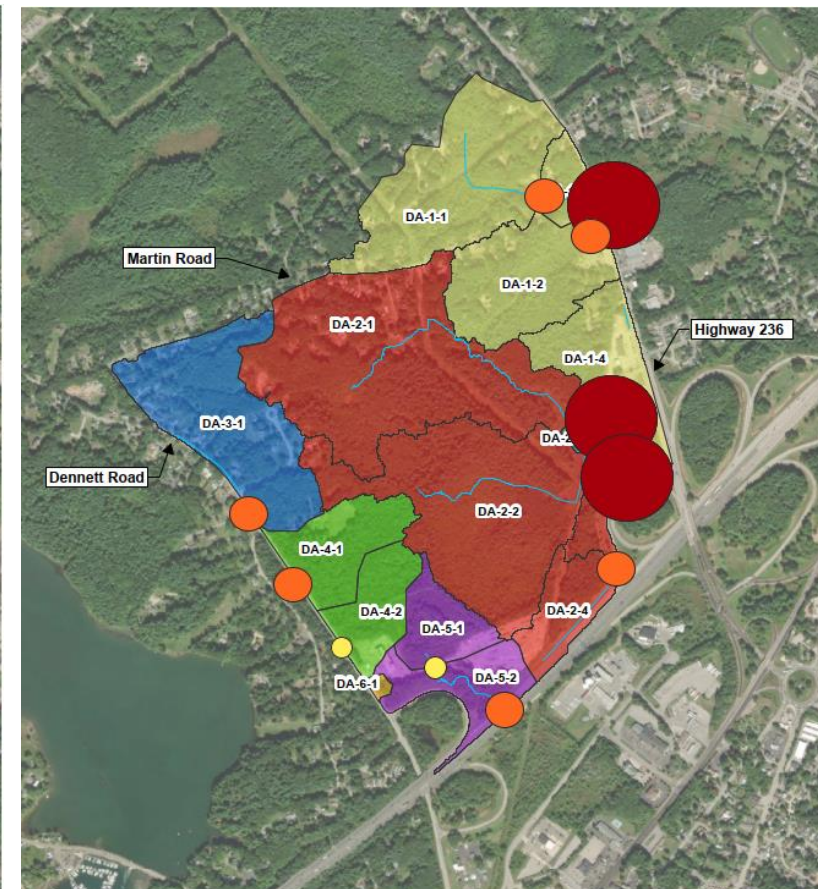
NO BUILD



50% BUILD OUT



100% BUILD OUT



● Flood Risk

● Moderate Flood Risk

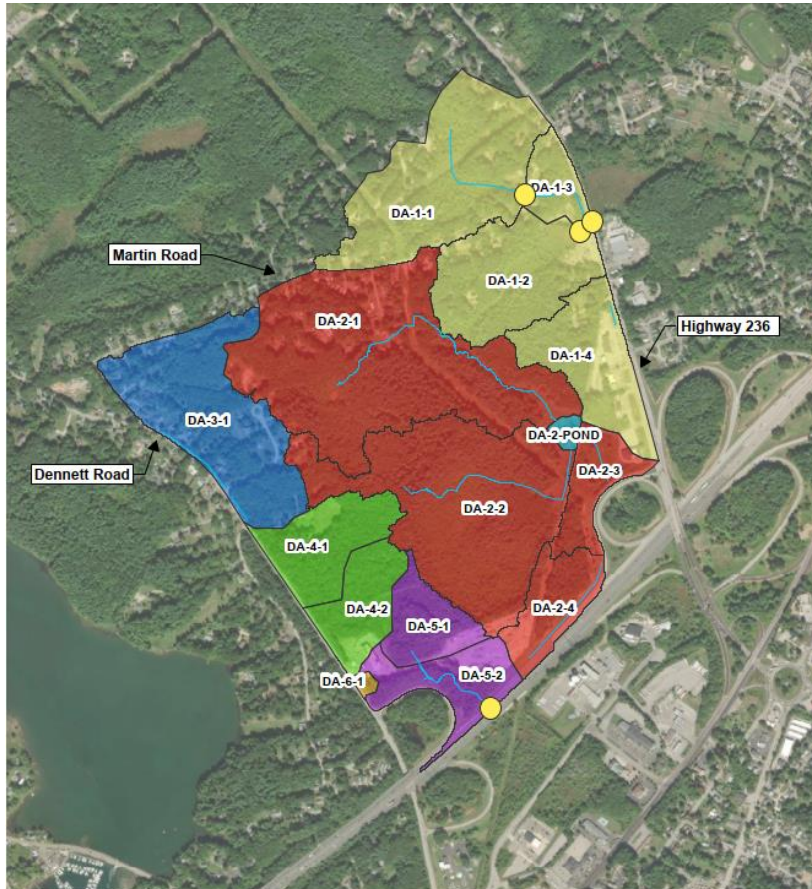
● Significant Flood Risk

- **No Build Scenario**

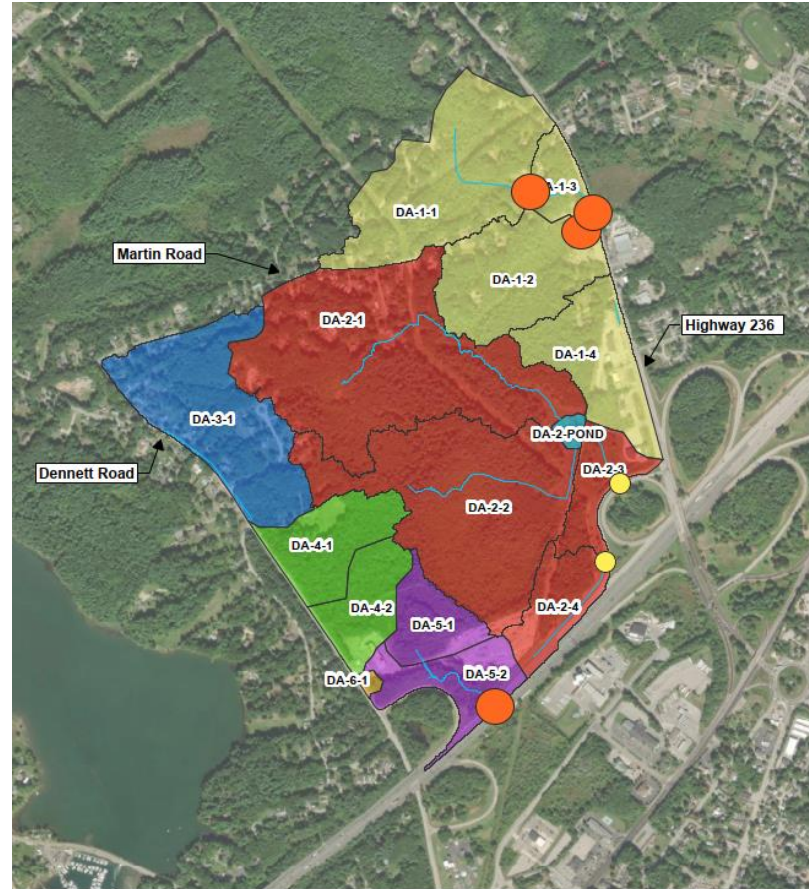
- Indicators of localized stormwater-related flood risk during 1-year storm event
- Moderate risk of stormwater-related flooding during 10- and 100-year storm events
- Eastern and southern extents of project area most vulnerable during high intensity precipitation events

Preliminary Modeling Results: No Build Scenario

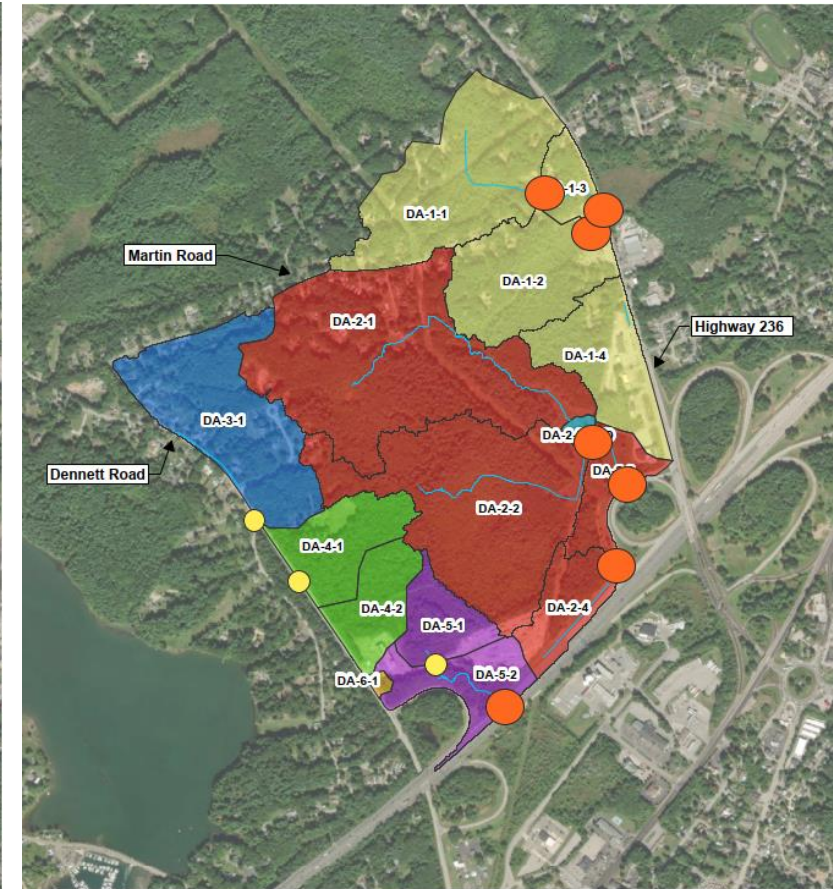
1-Year Storm (2.64" Rainfall)



10-Year Storm (4.83" Rainfall)



100-Year Storm (8.78" Rainfall)



● Flood Risk

● Moderate Flood Risk

● Significant Flood Risk

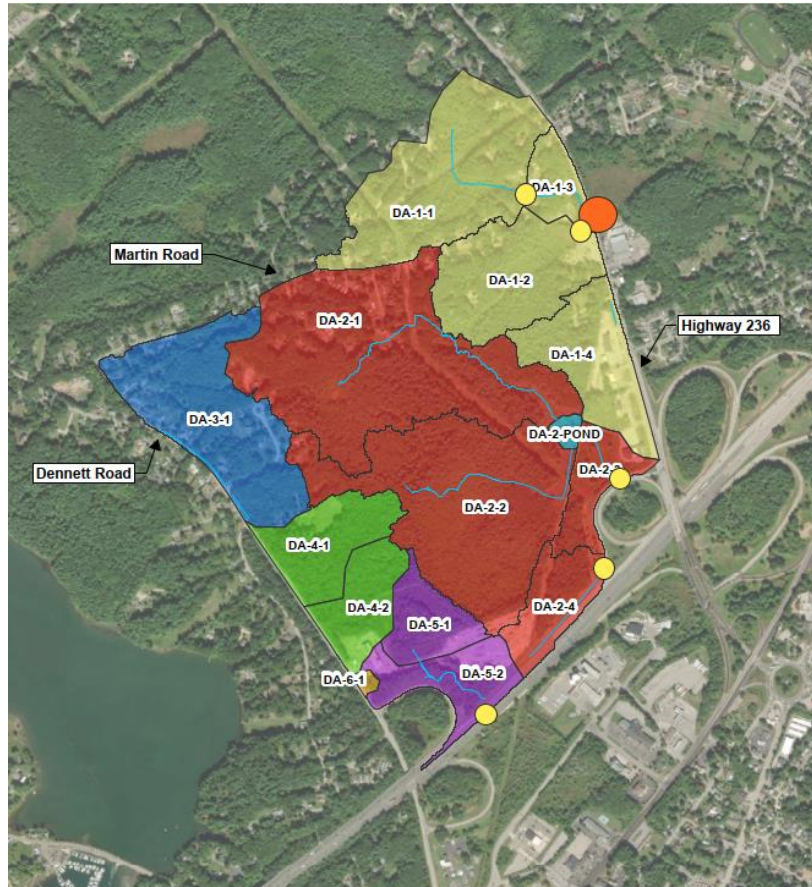
- **50% Build Out Scenario**

- Potential moderate risk of stormwater-related flooding during 1-year storm event
- Moderate risk of stormwater-related flooding during 10-year storm event (similar to No Build Scenario)
- Increased flood risk potential along Dennett Road (10-year and 100-year events)
- Significant risk of stormwater-related flooding near Highway 236 / Martin Road intersection during 100-year event

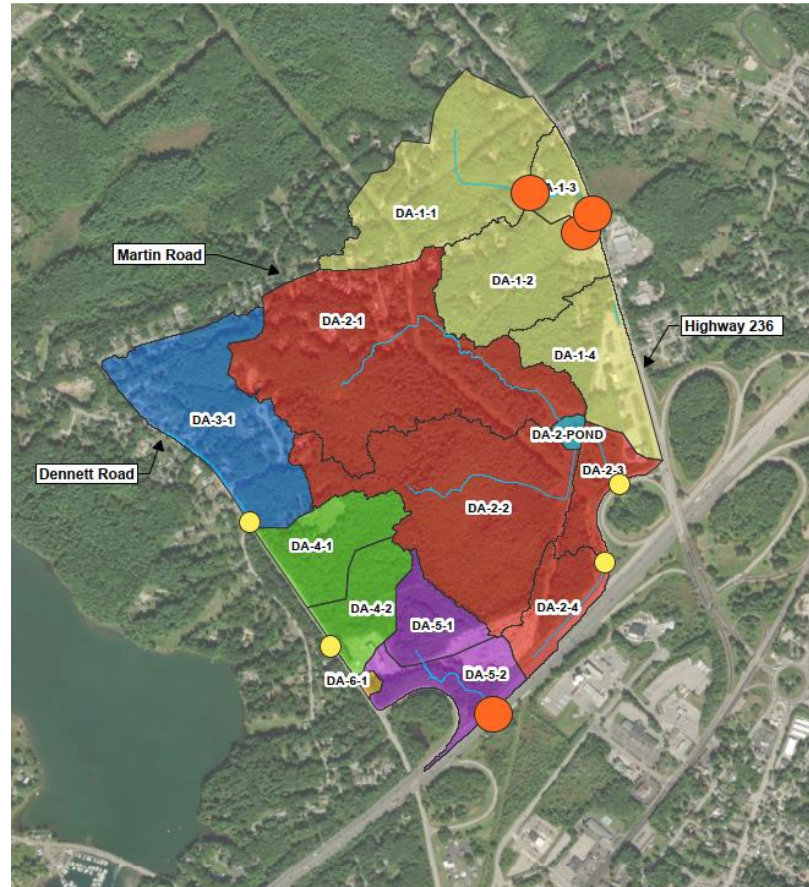
NOTE: Build out scenarios do NOT currently incorporate stormwater mitigation associated with future development

Preliminary Modeling Results: 50% Build Out Scenario

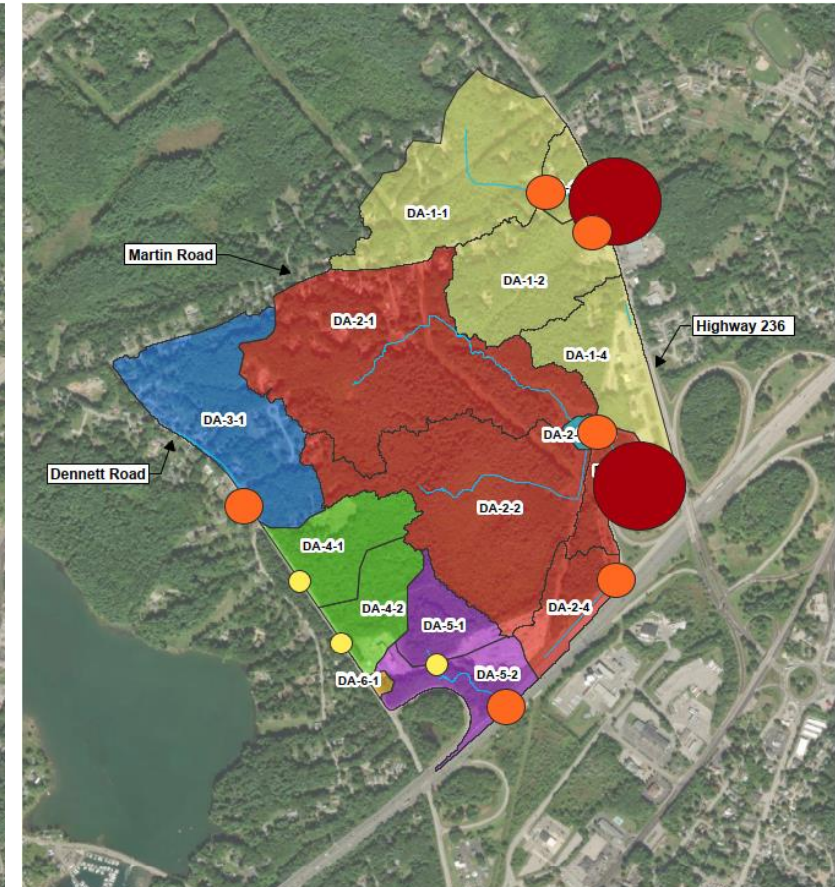
1-Year Storm (2.64" Rainfall)



10-Year Storm (4.83" Rainfall)



100-Year Storm (8.78" Rainfall)



● Flood Risk

● Moderate Flood Risk

● Significant Flood Risk

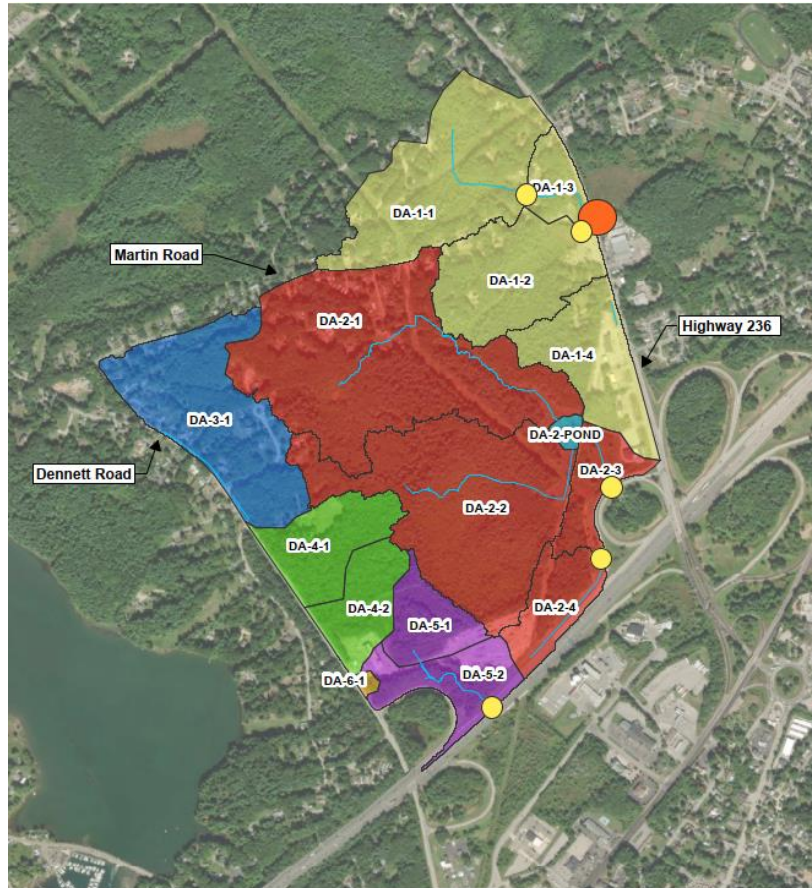
- **100% Build Out Scenario**

- Similar to 50% Build Out Scenario results, however with increased indicators of flood risk at discharge points along I-95 and Highway 236

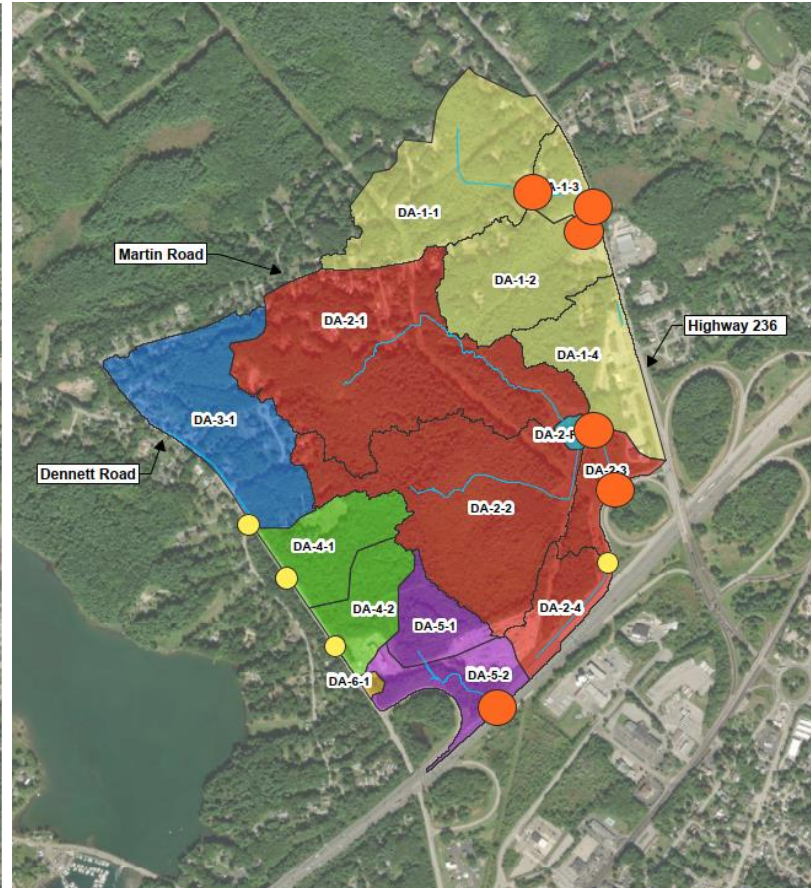
NOTE: Build out scenarios do NOT currently incorporate stormwater mitigation associated with future development

Preliminary Modeling Results: 100% Build Out Scenario

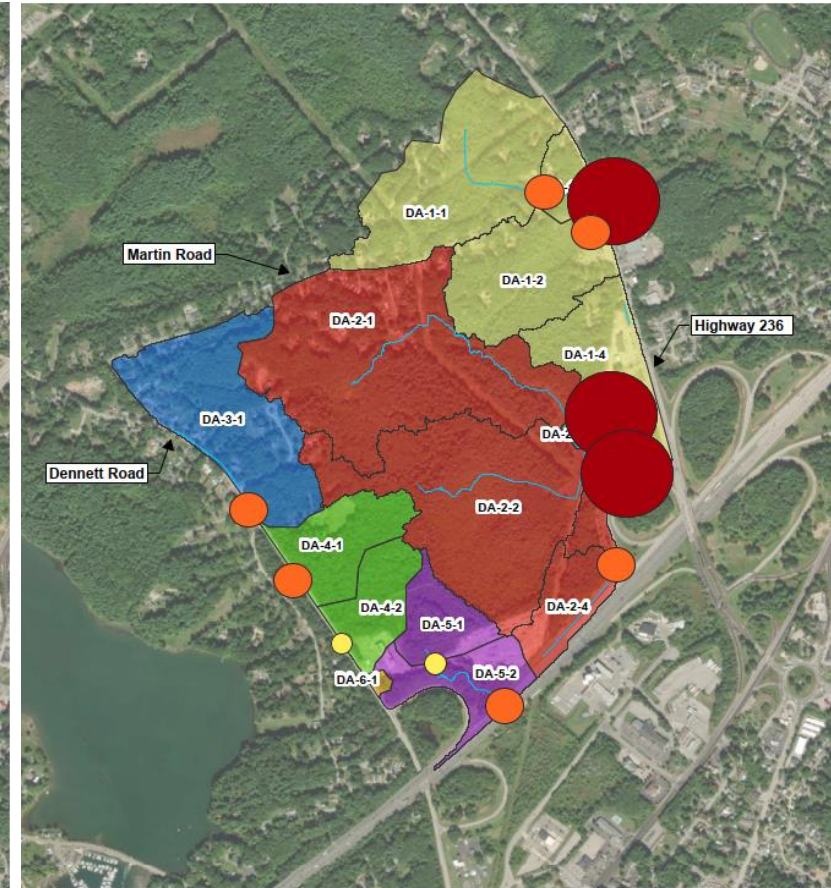
1-Year Storm (2.64" Rainfall)



10-Year Storm (4.83" Rainfall)



100-Year Storm (8.78" Rainfall)



● Flood Risk

● Moderate Flood Risk

● Significant Flood Risk

Nutrient Loading Analysis

Nutrient Pollutant Loading Analysis – Study Area Overview



- Study will also evaluate water quality in addition to quantity
- Average nutrient loads were modeled under existing conditions
- Will be evaluated with build out scenarios to advise selection of mitigation alternatives with water quality treatment benefits (co-benefits)

Average annual loads from 30-years of daily fluxes

Related Layer: Weather Stations used in this model. Turn on

Weather Source: USEPA National Climate Data ⓘ

Simulated by the GWLF-E (MapShed) model ⓘ

Sources	Sediment	Total Nitrogen	Total Phosphorus
Total Loads (lb)	81,453.1	1,418.3	86.7
Loading Rates (lb/ac)	112.35	1.96	0.12
Mean Annual Concentration (mg/L)	26.86	0.47	0.03
Mean Low-Flow Concentration (mg/L)	56.12	2.00	0.21

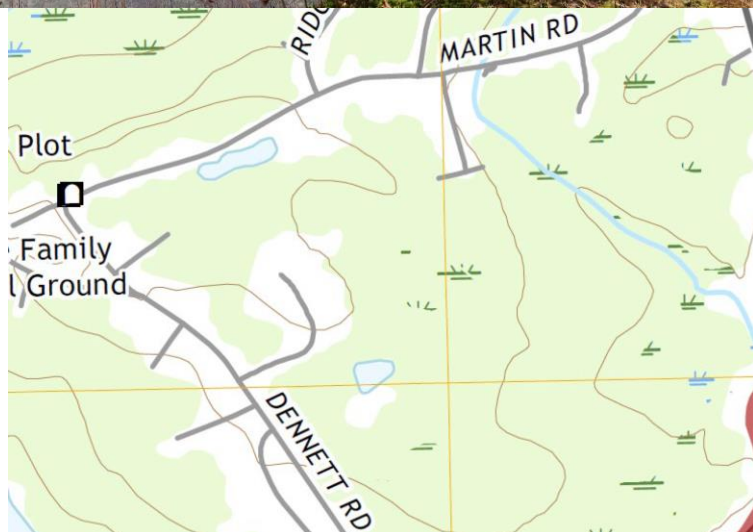
Mean Flow: 48,584,899 (ft³/year) and 1.54 (ft³/s)

Herb Parson Pond

Herb Parson Pond Evaluation



- Historical Overview
 - Gravel pit per USDA Soil Survey
 - History of high groundwater (raised-bed septic systems)
 - Lower water level observed as compared to recent history
 - Water quality concerns



Herb Parson Pond Evaluation



- Site Visits 11/15/23 (B&L and Streamworks) and 1/14/23 (Streamworks)
 - Low water level observed
 - Locally high-ground and limited drainage area
 - Underlain by well-draining gravelly, sandy loams



KEY TAKEAWAYS

- Limited inflows; no discernible outflow
- Pond levels reflective of local groundwater elevations
 - Expected higher in spring (after snowmelt plus spring rains)
 - Expected lower in summer (drier, less rainfall)
 - No discernible change in seasonal stain lines (ordinary high water)
- Development unlikely to have affected pond levels – impervious cover likely diverts water that otherwise would have infiltrated to groundwater
- Modifying overall groundwater levels likely infeasible; but could be managed at the property scales

Initial Findings and Key Takeaways

Initial Findings and Key Takeaways

- Soils are key
- Role of, and interaction between, surface runoff and groundwater
- Herb Parsons Pond – Former gravel pit with water levels driven by groundwater
- Flood indicators from preliminary modeling:
 - Corner of Martin Road / Highway 236 – greatest potential need for mitigation **under no build scenario** based on preliminary modeling indicators
 - Build out scenarios indicate increased flood risk without incorporation of stormwater mitigation practices



Project Schedule & Next Steps

Next Steps

- Refine Model
- Evaluate Mitigation Alternatives
- Draft Report

Potential Mitigation Alternatives

- Modifications to the Existing Drainage System
- Installation of Stormwater Detention
- Flood Damage Protection and Planning
- Structural Projects
- Homeowner flood-proofing
- Groundwater interception trench
- Evaluation of Land Use Planning and Zoning
- Water Quality Treatment Practices
- Natural Resource Protection / Conservation Opportunities
- Installation of Green Infrastructure Stormwater Retrofits

RANKING

- Stormwater Benefits (total 55 out of 100 points)
 - Flood reduction (45 points)
 - Nutrient reduction – water quality benefit (10 points)
- Constructability (total 20 out of 100 points)
 - Ownership: public or private (10 points)
 - Known constraints (5 points)
 - Permitting (5 points)
- Cost (total 20 out of 100 points)
 - Construction Cost – (10 points)
 - Maintenance Cost (5 points)
 - Fundability (5 points)
- Co-Benefits (total 5 out of 100 points)
 - Energy and air quality impacts (1 point)
 - Habitat and biodiversity (1 point)
 - Community and aesthetic benefits (1 point)
 - Human health benefits (1 point)
 - Educational opportunities/visibility (1 point)

Priorities

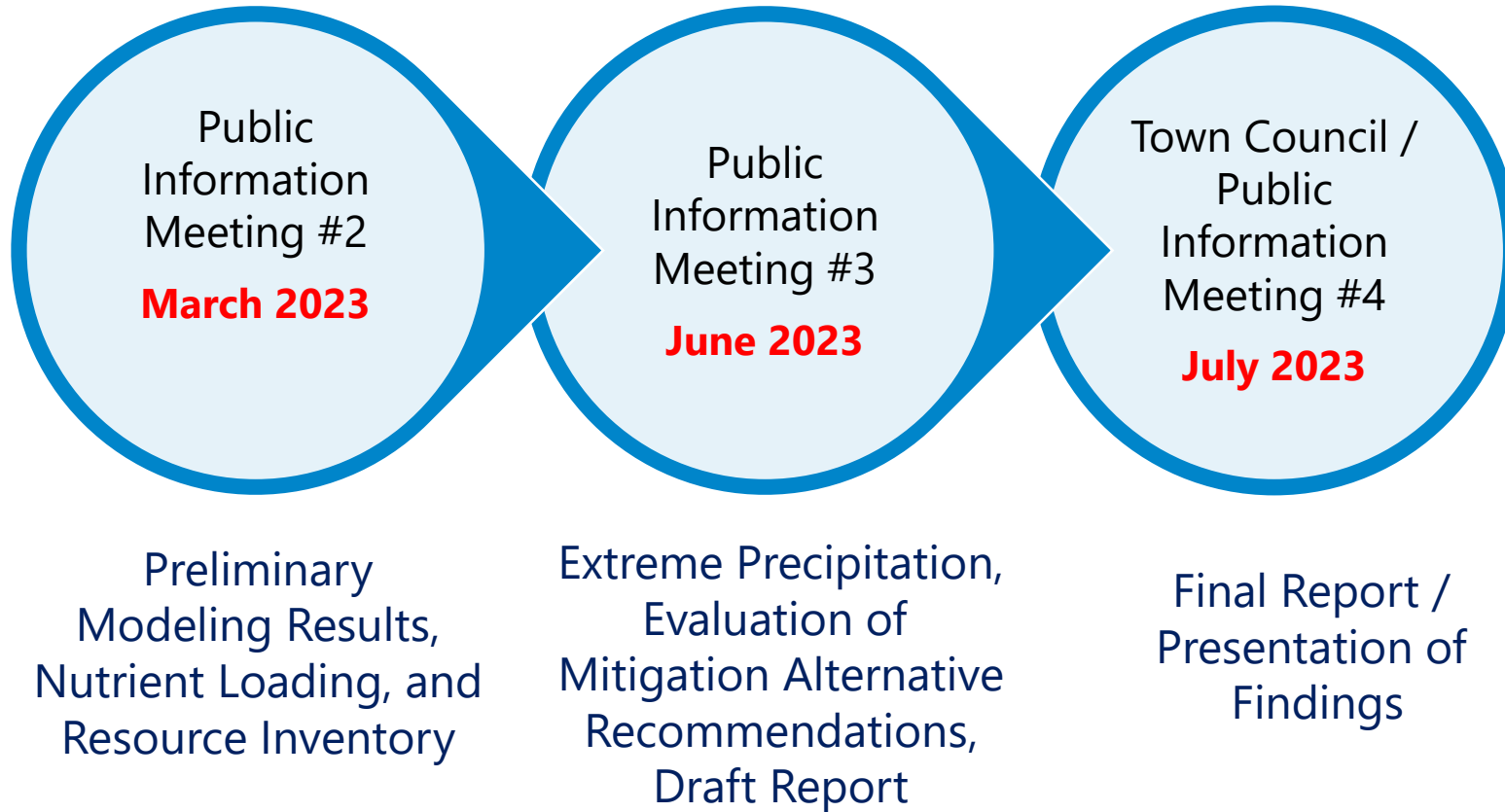
①

②

③



Project Schedule



Presenter Contact Information

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Dr. Thomas Ballestero, Streamworks, P.L.L.C.
Tom.Ballestero@unh.edu

Project Information



Project Information (Survey and Interactive Mapper)

www.kitteryme.gov/watershedinputsession

Questions & Open Discussion?



Project Information

(Survey and Interactive Mapper)

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