

R.I. TRANSPORTATION ASSETS VULNERABLE TO SEA LEVEL RISE

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Background & Project Purpose



Two Phases

- EXPOSURE phase: the potential future exposure of the transportation assets to sea level rise
 - ▣ 1, 3, 5-foot scenarios to match other RI projects
- VULNERABILITY phase: prioritizing state-owned assets to determine which will flood soonest, have the greatest impact (*next step*)

Data Sources

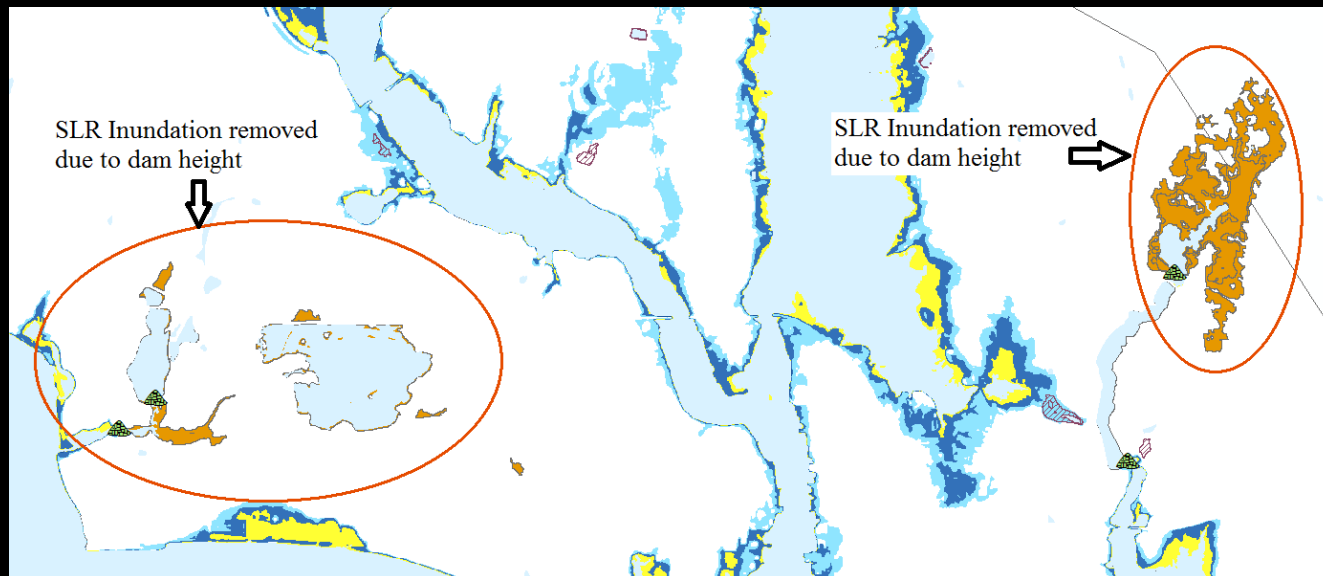
- LiDAR - USGS
 - Winter/Spring 2011
 - 1 meter nominal point spacing
 - Rivers at or below normal
- DEM - URI
 - 1 meter resolution
 - 15 cm vertical accuracy
- SLR Inundation – NOAA
 - Vdatum tidal surface model
 - Modified bathtub model – 0-6ft SLR
 - 5 meter resolution
- Bridge freeboard height – RIDOT
- All other datasets - RIGIS

Hydrologic Connections

- Low Lying Areas – Inundation Uncertainty
 - ▣ Placed into 4 categories
 - Connected (Streams, culverts, pipes)
 - Not Connected
 - Uncertain
 - Upstream from Dams

Hydrologic Connections

- Dams
 - 16 Dams
 - 8 feet or higher
 - SLR inundation/low-lying removed



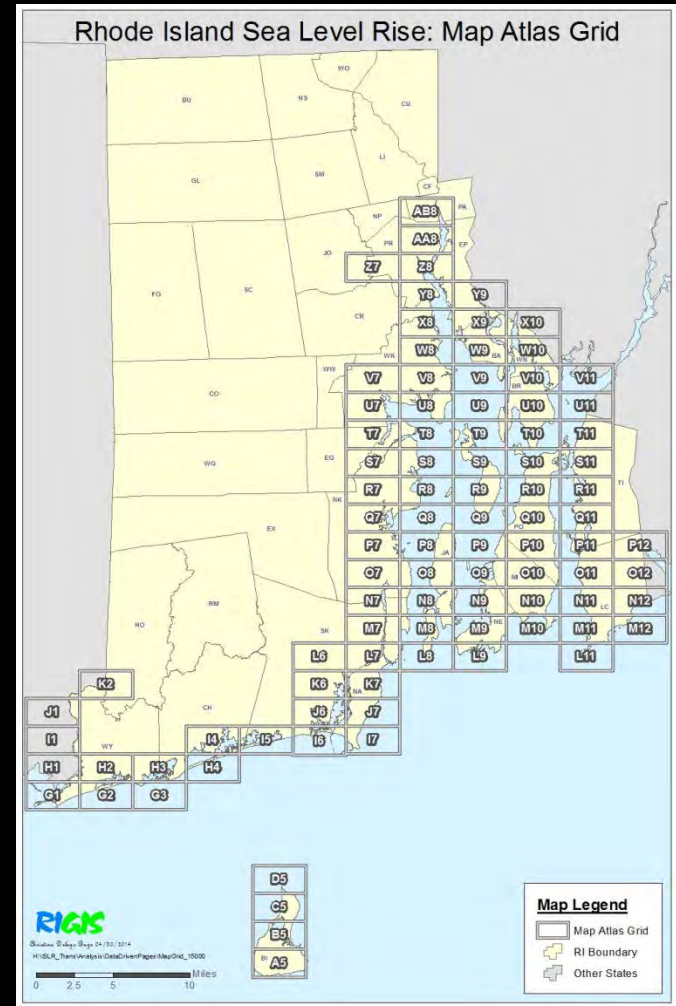
Bridge Analysis

- Freeboard Height (FBH)
 - ▣ RIDOT bridge inspection data sheets
 - ▣ FBH Threshold: 102 inches = 5 feet SLR (60in) + average tidal difference (42in)
 - ▣ Concern: Any bridge with FBH 102 inches or less

- Accessibility
 - ▣ Reviewed each bridge for road inundation preventing access on one or both sides

Study Area

- Coastal Inundation
 - 21 RI Municipalities
- Map Atlas Grid
 - 1:15,000 Scale
 - 93 Maps




Map Symbolology






SLR Inundation*

-  1 Foot
-  3 Feet
-  5 Feet







Connection Uncertain

-  MHHW, 1ft, 3ft, 5ft

Intermodal Hubs




-  Airport
-  Bus
-  Ferry
-  Train
-  Transfers

Transportation Infrastructure




-  Roads
-  Railroads
-  Bus Routes
-  Bike Paths
-  Airports
-  Ports & Harbors

Bridges









Freeboard (FB) Height

-  FB Concern
-  FB Unknown
-  No FB Concern

Accessibility

-  Not Accessible
-  Unknown
-  Accessible

Reference Features

-  Map Atlas Grid
-  Municipal Boundary
-  Dams
-  Streams
-  RI Ponds & MHHW**
-  wetland
-  RI Boundary***
-  Other States

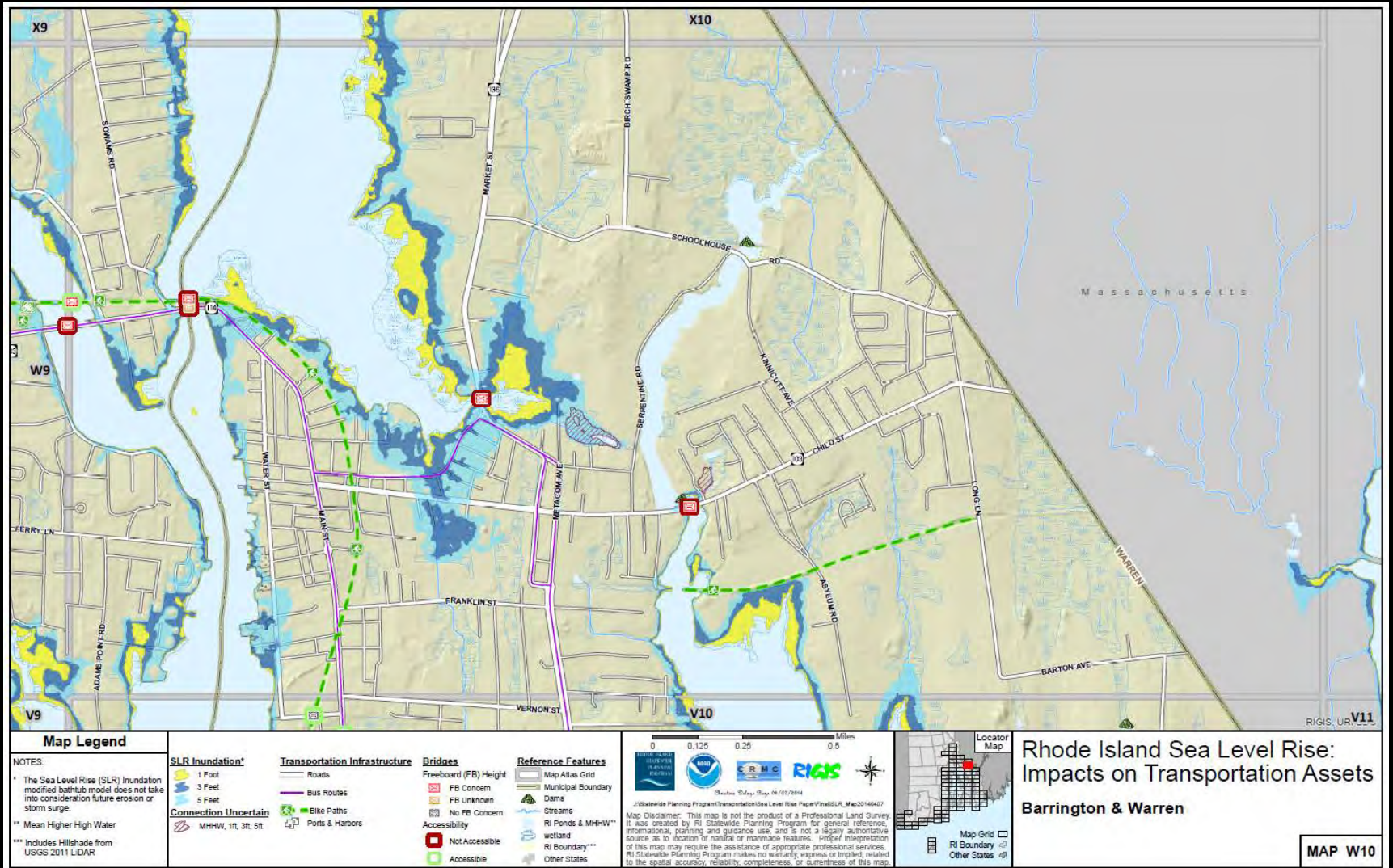
NOTES:

* The Sea Level Rise (SLR) Inundation modified bathtub model does not take into consideration future erosion or storm surge.

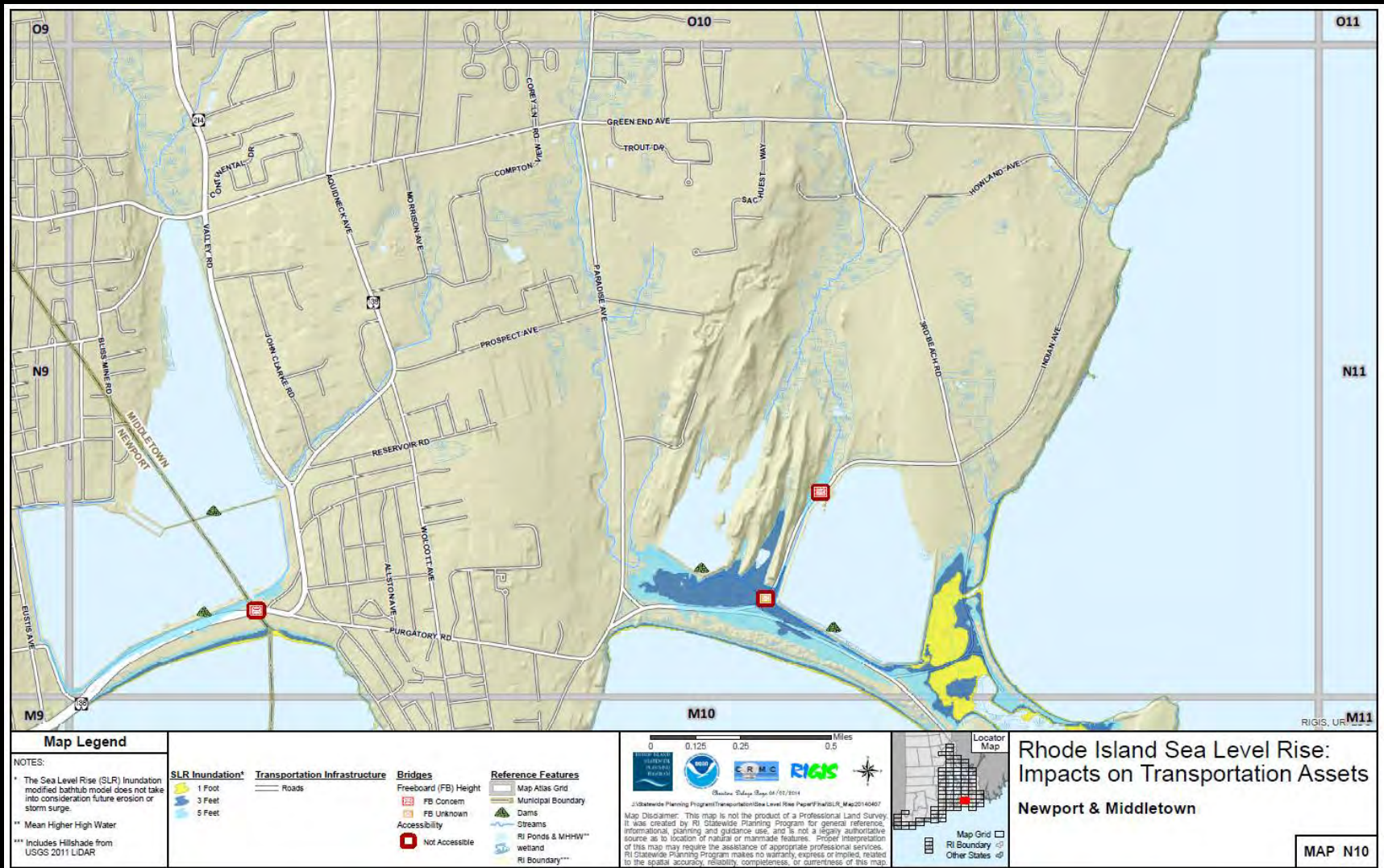
** Mean Higher High Water

*** Includes Hillshade from
USGS 2011 LiDAR

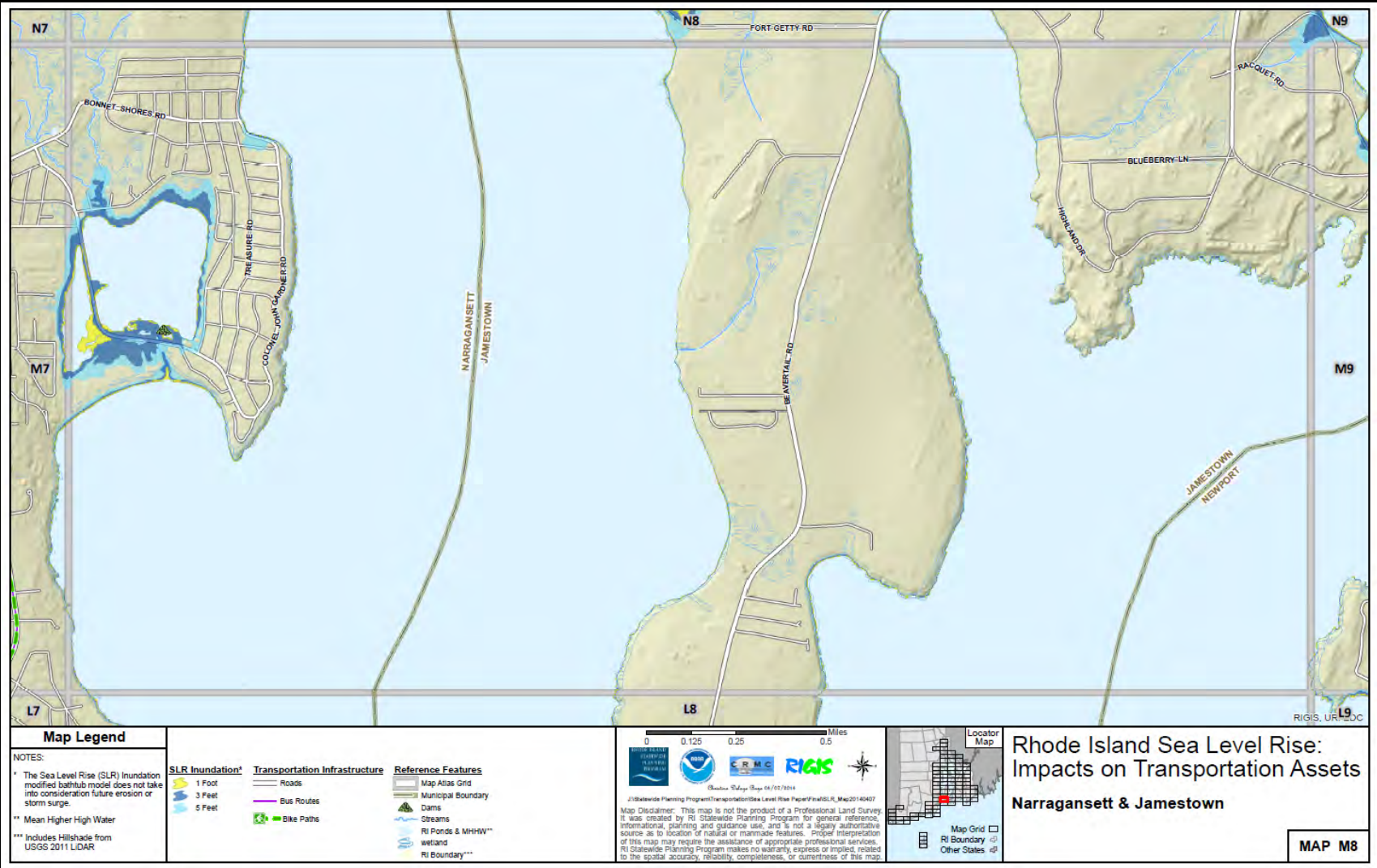
Maps



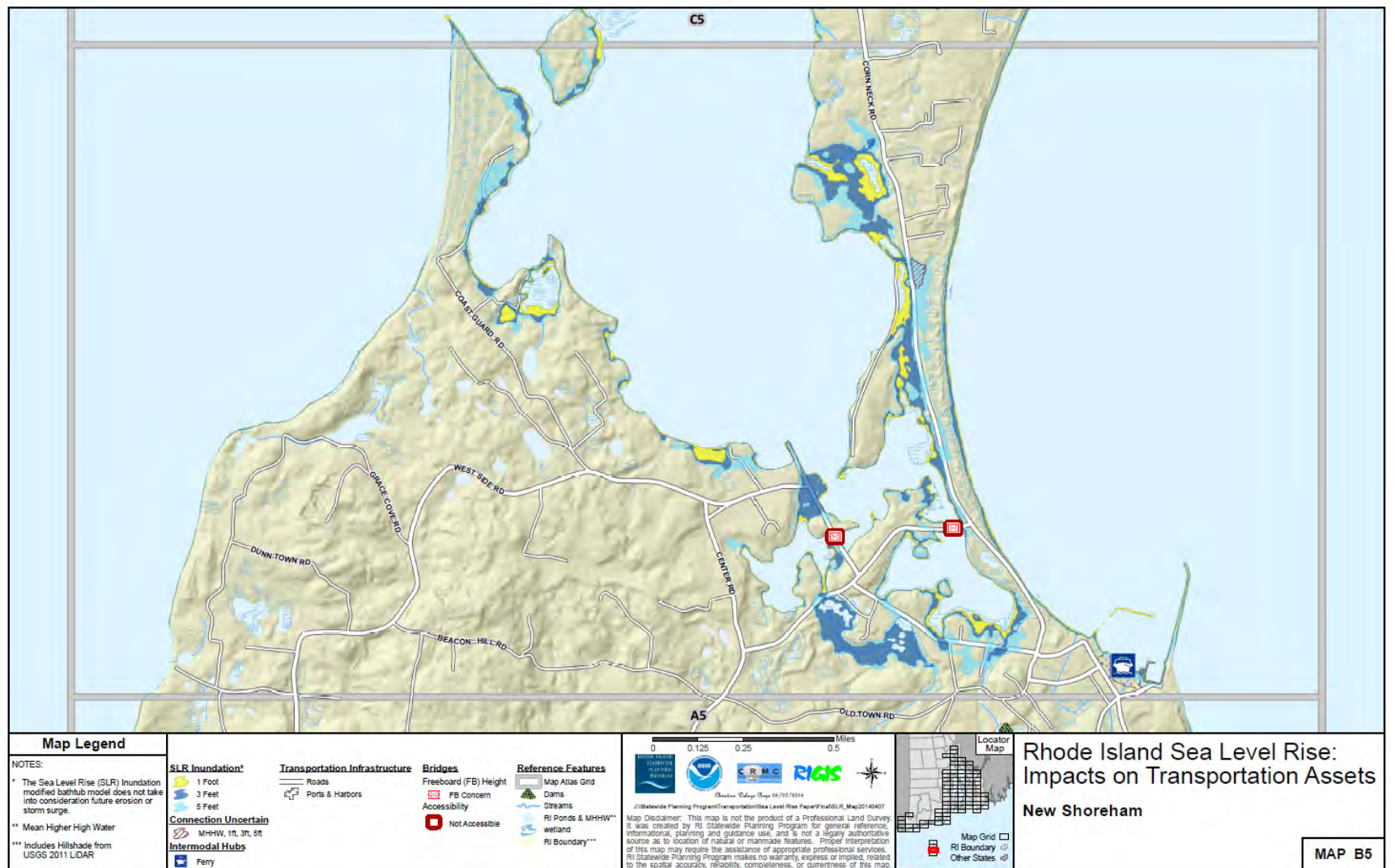
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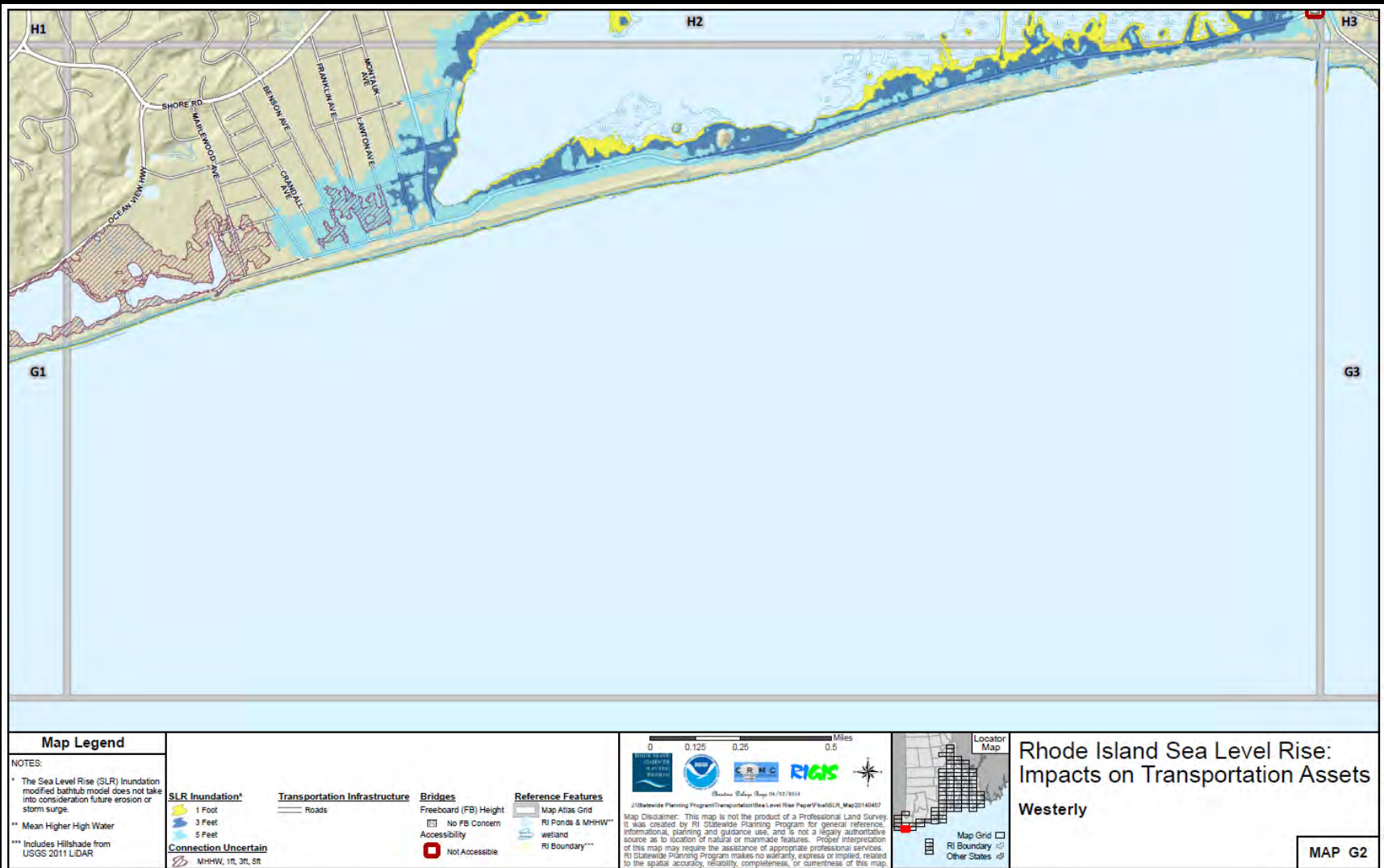
Maps



Maps



Maps



Preliminary Findings - Roads

	Flooded at 1 foot SLR (feet)	Flooded at 3 feet SLR (additional feet)	Flooded at 5 feet SLR (additional feet)
ALL ROADS	8,792	136,310	297,346
Local Roads	6,896	97,350	213,443

Preliminary Findings - Roads

□ Basin Road, Narragansett

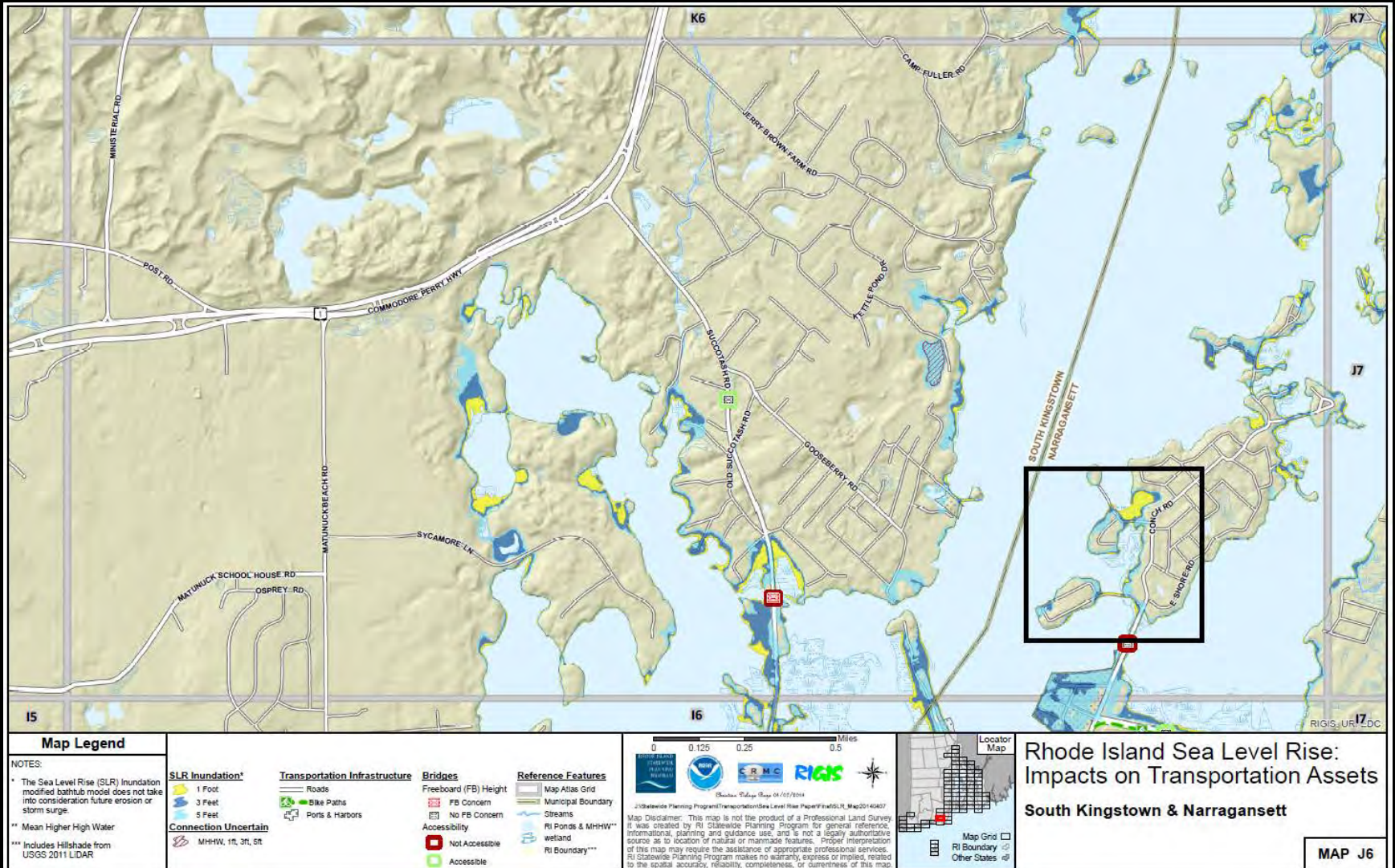


2-26 Basin Rd
Narragansett, RI 02882 - approximate address
STREET VIEW



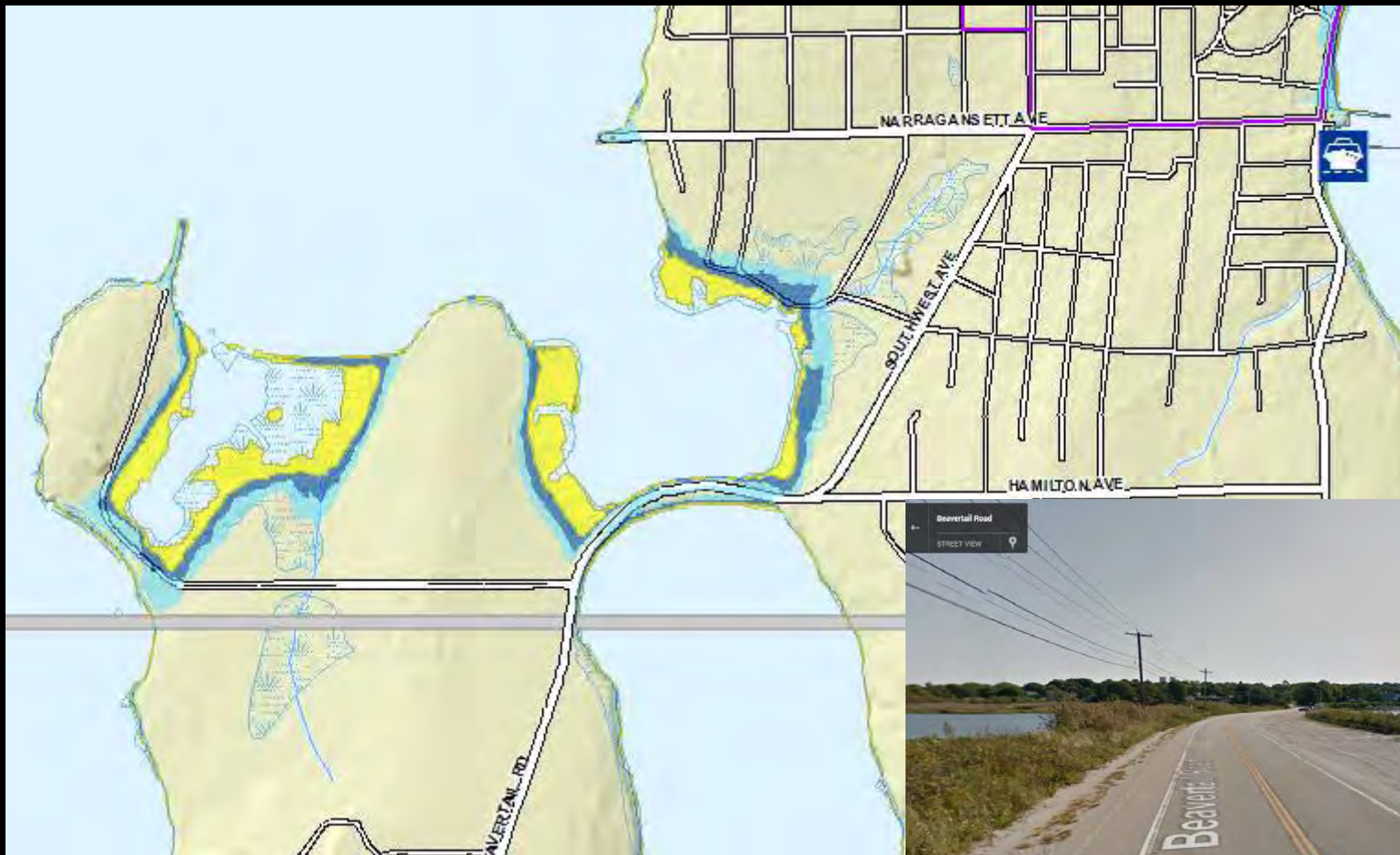
Google

Preliminary Findings - Roads

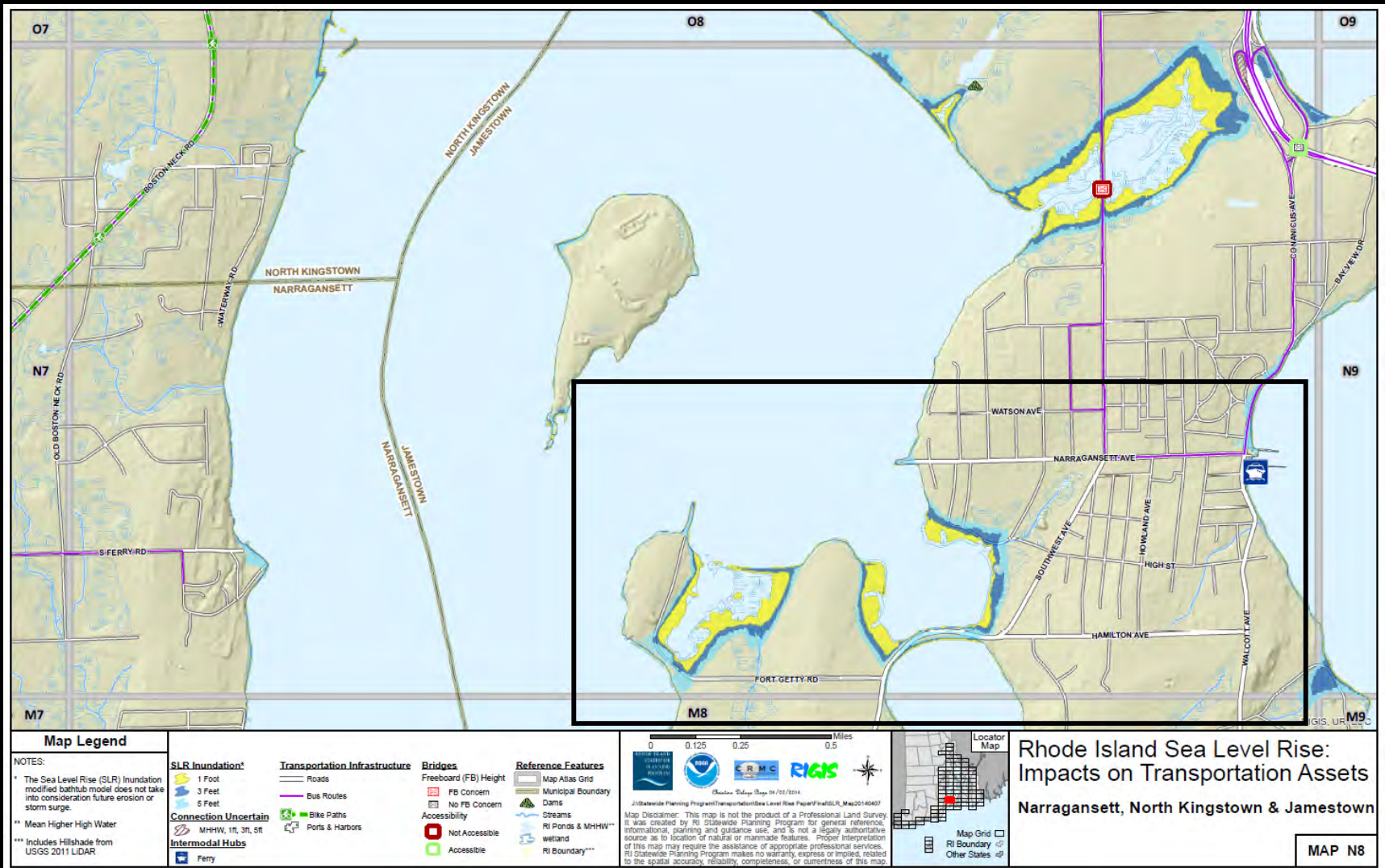


Preliminary Findings - Roads

□ Mackerel Cove, Jamestown

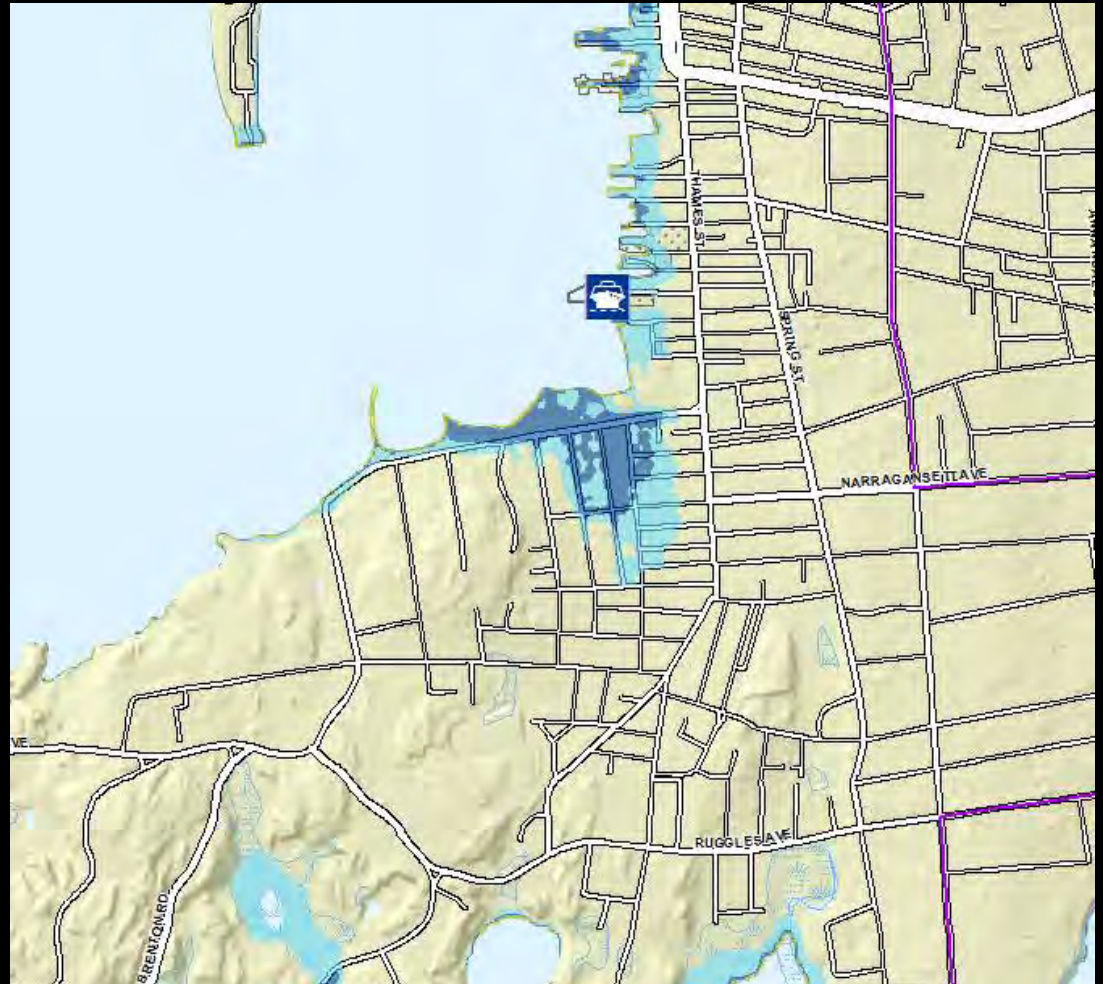


Preliminary Findings - Roads

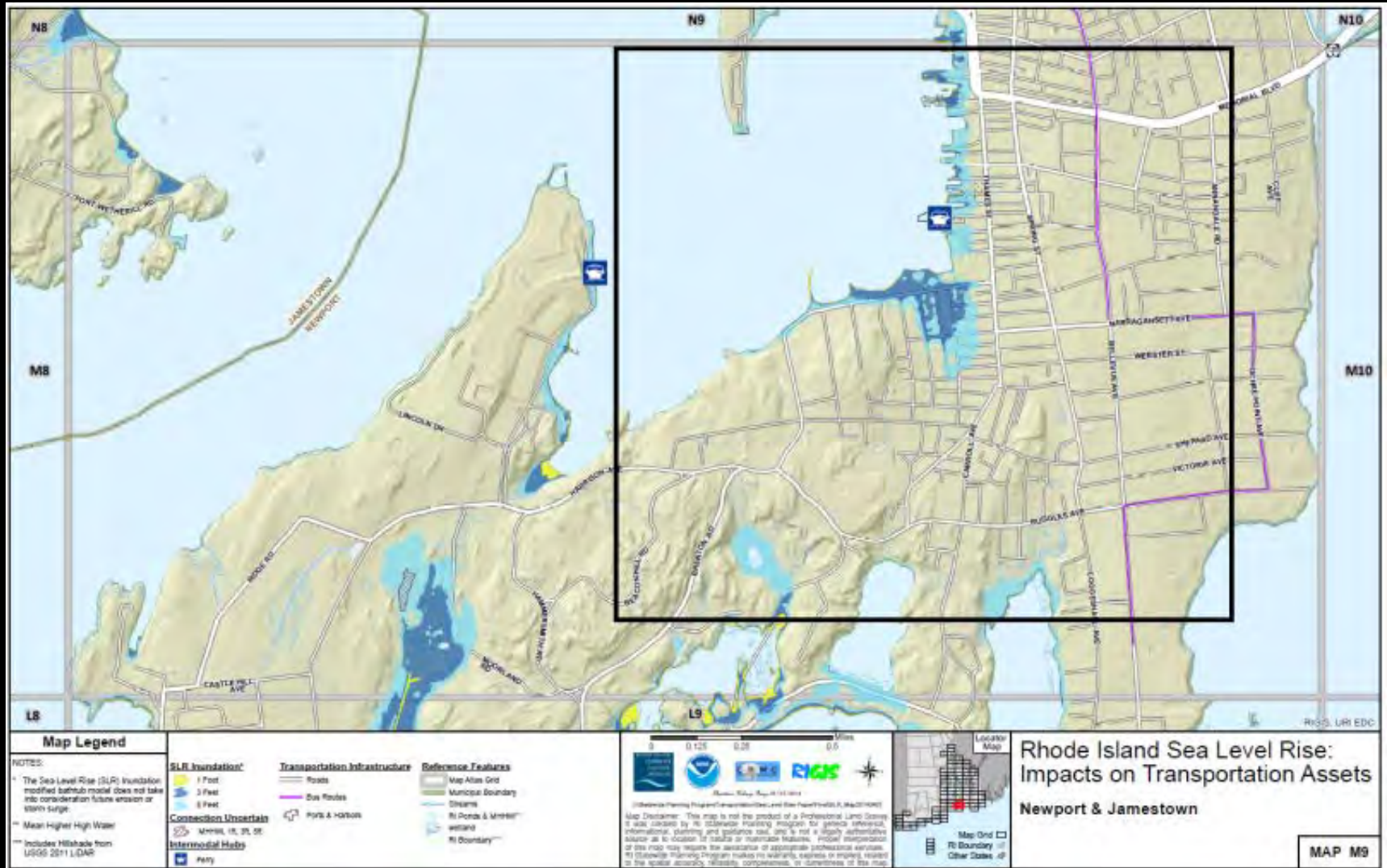


Preliminary Findings - Roads

- Lower Thames St - Wellington Ave, Newport
- Inundated at 3'



Preliminary Findings - Roads

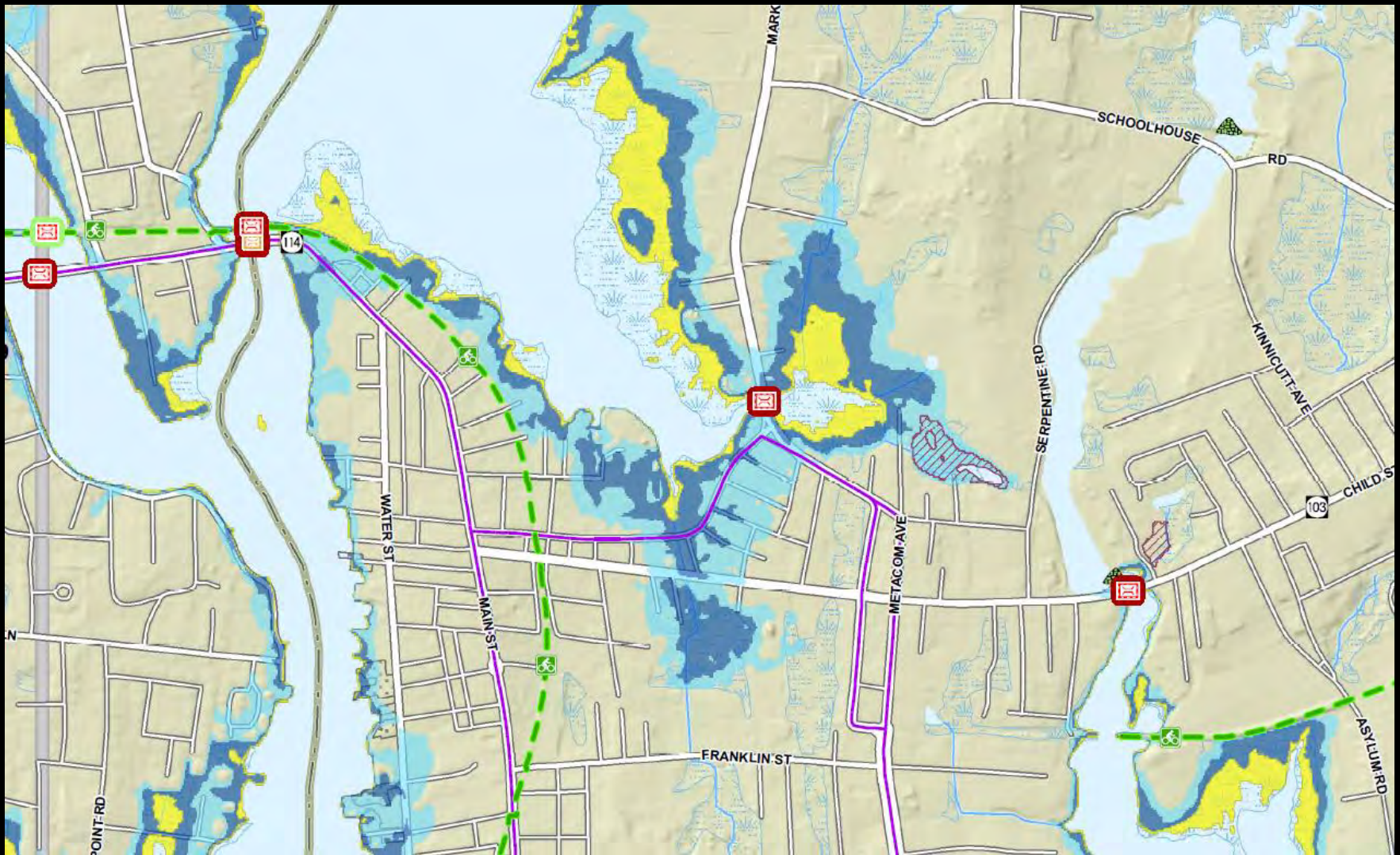


Preliminary Findings - Bridges

- ❑ 66 bridges cause concern with 5 feet or less SLR
 - ❑ 49 bridges have low freeboard heights
 - ❑ 46 bridges will have accessibility issues



Preliminary Findings

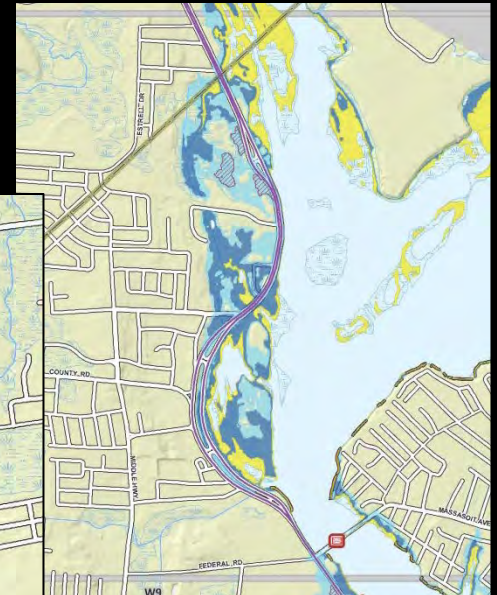
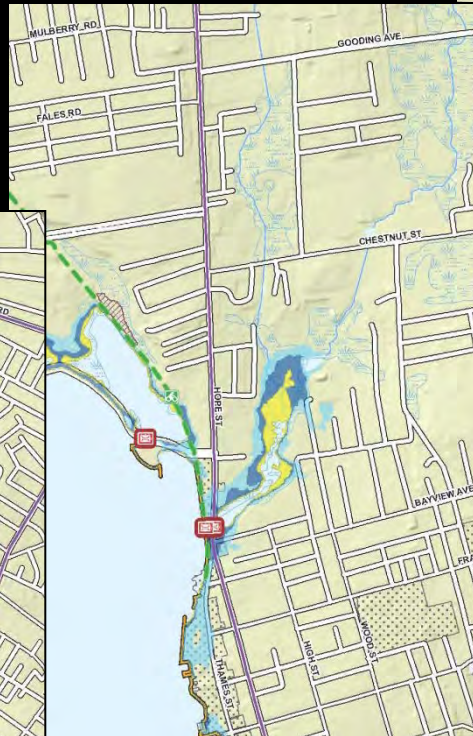


Preliminary Findings - Other Assets

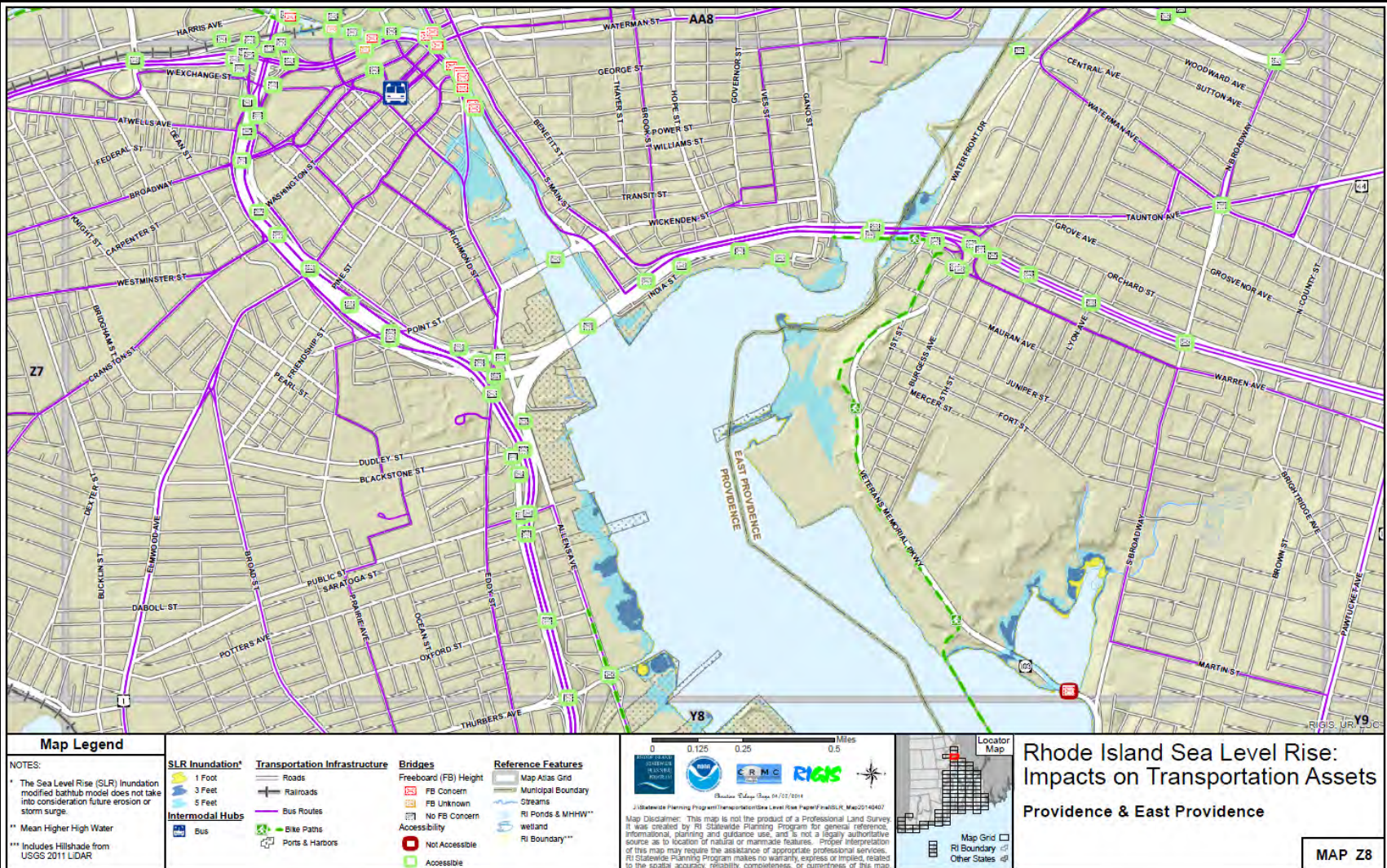
	Flooded at 1 foot SLR	Flooded at 3 feet SLR (add. feet)	Flooded at 5 feet SLR (add. feet)
RIPTA routes	639	13,097	49,293
Rail	17	274	3,644

Preliminary Findings – RIPTA

- RIPTA 60 Bus
 - Nearly 3,000 passengers per day



Preliminary Findings – RIPTA

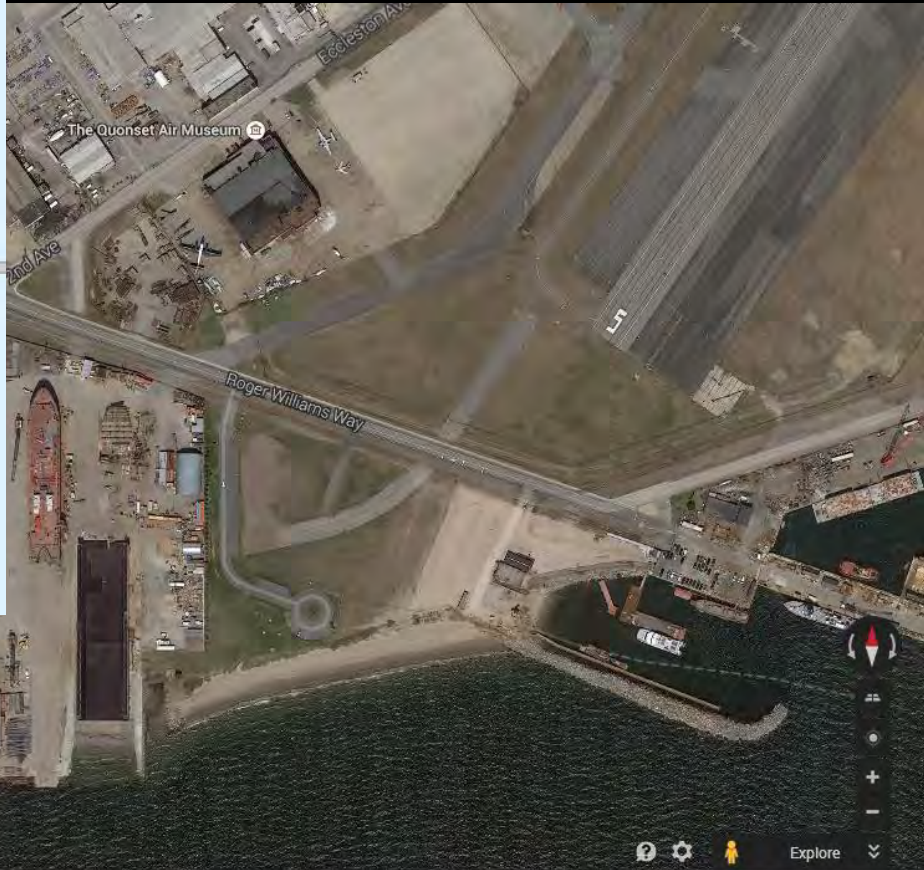
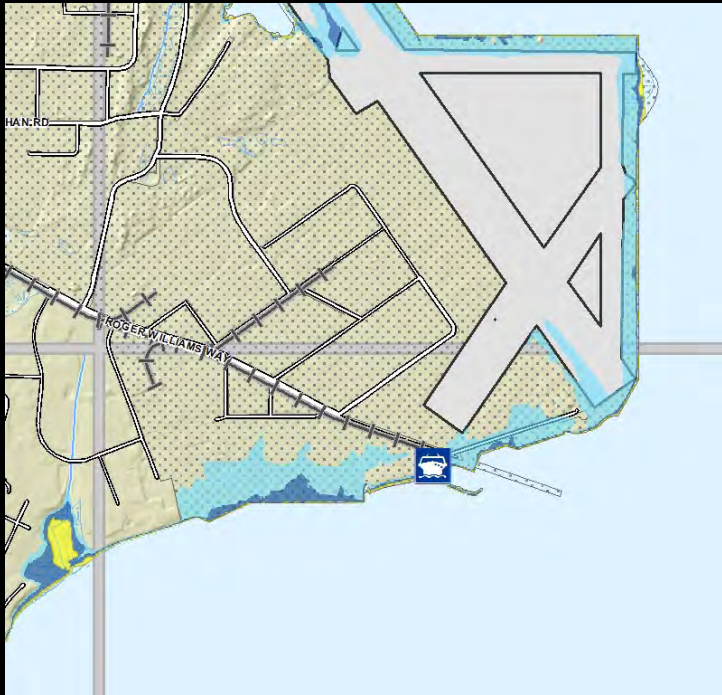


Preliminary Findings - Bike

- East Bay Bike Path
- Many on-street bike routes



Preliminary Findings – Ports & Harbors



Overall Findings



- Impacts in every coastal community
- Three and five feet of SLR much greater impact than one foot

Next Step – Prioritization Exercise

- Key Questions
 - ▣ IMPACT: Which are most crucial to our transportation network?
 - ▣ URGENCY: Which will flood first?
- End result: Understanding of where to start with more technical work

How Will This Project Be Useful?



- Overall understanding of key transportation system exposures
- Resources for state DOT and local DPWs
- Local comprehensive plans, hazard mitigation plans, and prioritization of capital improvement projects
- Move conversation on how we prioritize efforts to manage sea level rise

Final Products

□ EXPOSURE PHASE

- ▣ Statewide map
- ▣ Municipal map books
- ▣ Calculations, e.g. linear feet of road exposed
- ▣ Inventory of roads exposed to SLR

□ VULNERABILITY PHASE (Next Step)

- ▣ Results of vulnerability prioritization

□ FINAL REPORT

- ▣ All of above, plus general adaptation strategies, with case studies

Adaptation Examples

- Protect
 - ▣ Enhancing natural protections or armor (ex. Sea walls)
- Accommodate
 - ▣ Increasing size of culverts, enhance bridge scour, or elevate entire roadbed
- Retreat
 - ▣ Accommodate periodic flooding or accept loss of roadway and identify alternate route
- Do Nothing

Disclaimer



All numbers reported in this presentation are draft findings. Please do not cite without permission. The final report will be available later in 2014.

More Info

- NOAA SLR mapping methodology and SLR Viewer
 - ▣ http://csc.noaa.gov/slr/viewer/assets/pdfs/Inundation_Methods.pdf
 - ▣ <http://www.csc.noaa.gov/digitalcoast/tools/slrviewer/>

- ArcGIS Online Maps - Search 'RI SLR'
 - ▣ "Rhode Island Sea Level Rise: Impacts on Transportation Assets"
 - ▣ "DRAFT – Comparing Rhode Island Sea Level Rise Models"

Coming Soon – Early Fall

- ❑ RI Division of Planning SLR webpage
 - ❑ Technical Report
 - ❑ PDFs organized by municipality with linkable map grid
 - ❑ Inundated road index

<http://www.planning.ri.gov/statewideplanning/transportation/>

Inundated Roads Index											
LITTLE COMPTON				NARRAGANSETT				NARRAGANSETT			
Road Name	Ft of SLR		Map Name(s)	Road Name	Ft of SLR		Map Name(s)	Road Name	Ft of SLR		Map Name(s)
OREGON RD		3 5	M11	FLORENCE RD		3 5	J6	W BAY DR		3 5	M7
PENNSYLVANIA RD		3 5	M11	FODDERING FARM RD		3 5	K6, K7	WAYLAND TRL		5	M7
RHODE ISLAND RD			5 M11	FOSTER RD		3 5	I6	WEST BOULEVARD ACCESS RD		5	I6
ROUND POND RD	1	3 5	M11	FRANKS NECK RD		3 5	J6	WHEATFIELD COVE RD		3 5	K6
SAKONNET POINT RD		3 5	M11	GALILEE CONNECTOR RD		3 5	I6	WILD GOOSE LN	1	3 5	J6
SHORE RD			5 P11	GALILEE ESCAPE RD			5 I6	WILSON DR	1	3 5	N7

Questions?

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