

Flood Damage and Cost Avoidance Analysis for Community Resilience

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Dr. Cameron Wake, PhD, University of New Hampshire

Acknowledgement

This study was funded by:



Study conducted in cooperation with:

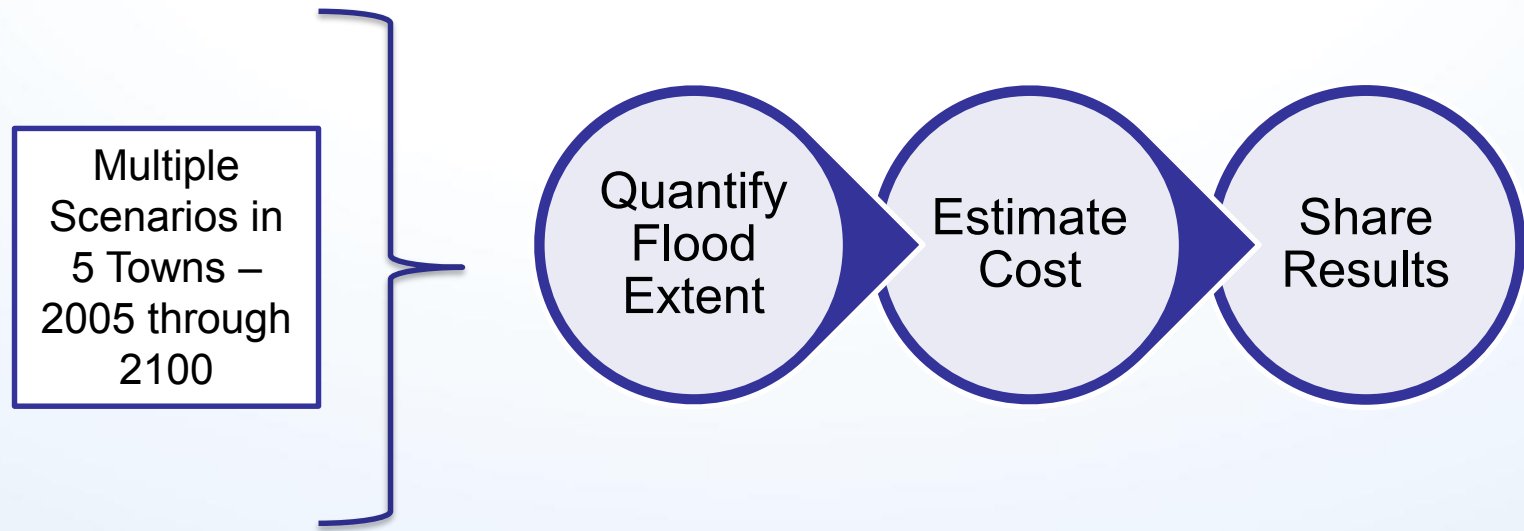


Project Location



Study Objectives

- ✓ **Objective 1:** Estimate flood damage and cost due to changes in land use and climate.
- ✓ **Objective 2:** Share findings with communities and stakeholders



Scenarios

Scenario Year	Return Period	Climate profile
2005	5-, 10-, 25-, 50-, 100-yr	Current
2050	5-, 10-, 25-, 50-, 100-yr	Future
2100	5-, 10-, 25-, 50-, 100-yr	Future

Methodology

Review existing hydrologic and hydraulic models



Develop precipitation inputs for each scenario



Modify existing hydrologic and hydraulic models

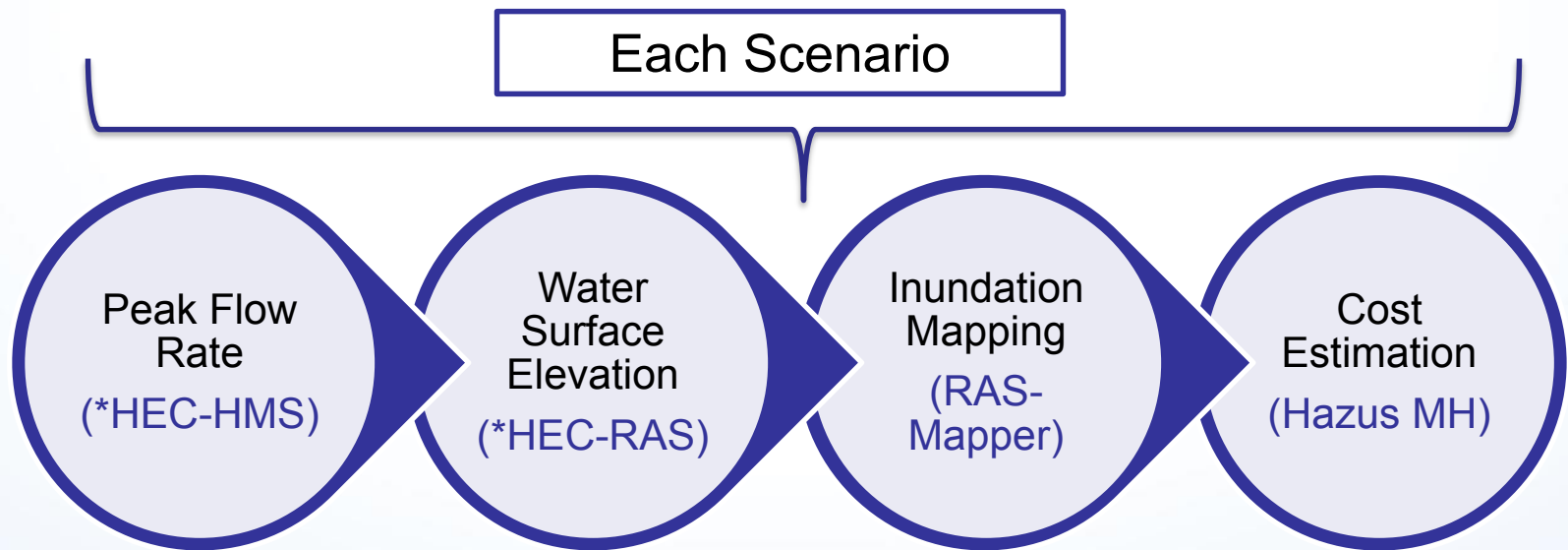


Simulate peak flow, water surface elevation, and inundation extent



Update data inventory and perform Level 1 and Level 2 damage scenarios

Modeling Methods

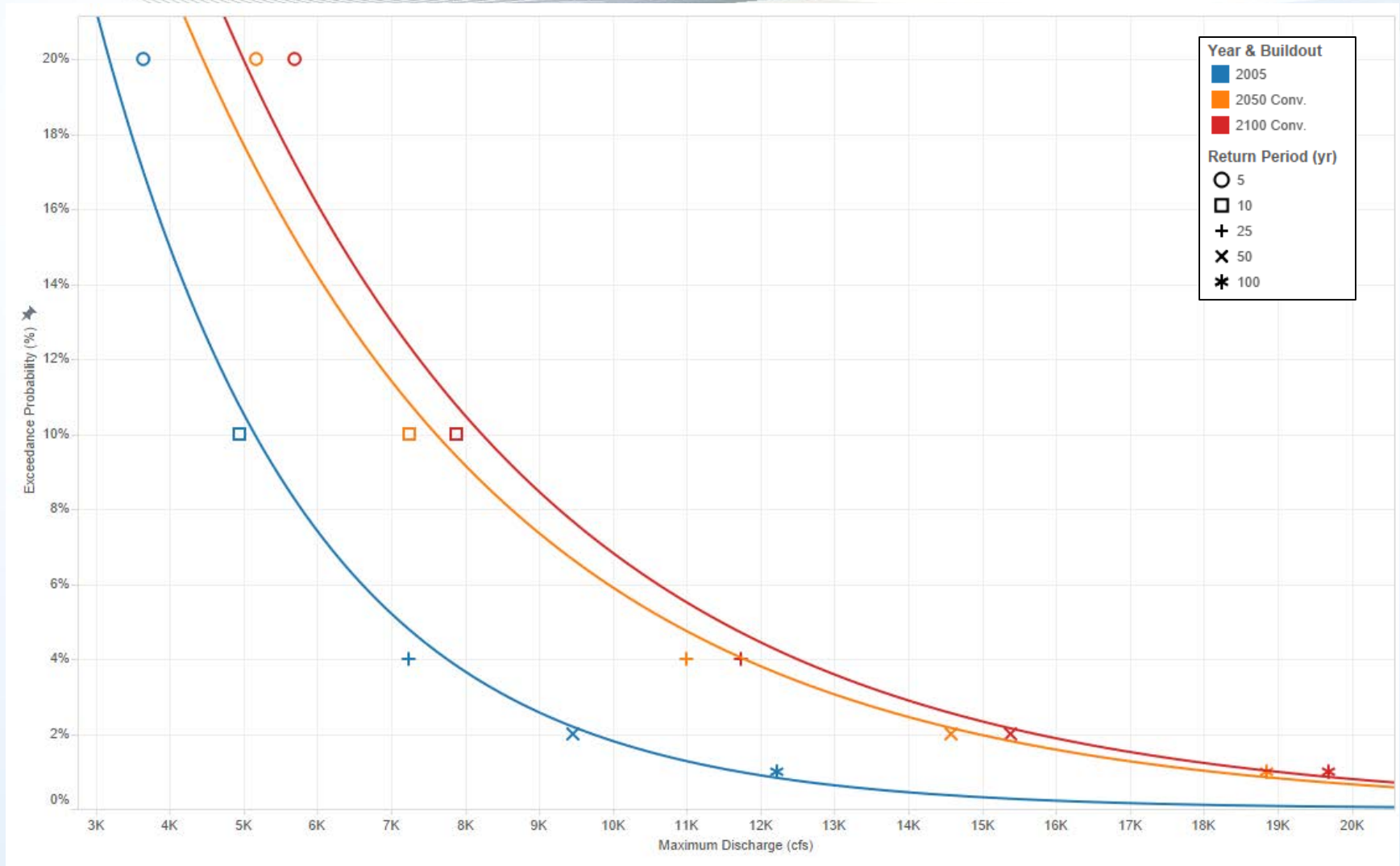


*HEC-HMS & RAS models
developed by UNH

Rainfall Depth

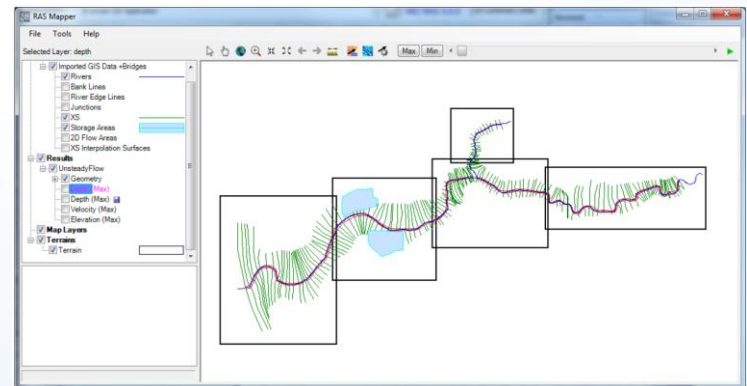
Return period	Current Depth (in)	Future Depth (in)
5-yr	3.9	4.5
10-yr	4.7	5.6
25-yr	6	7.5
50-yr	7.1	9.3
100-yr	8.5	11.5

Maximum Discharges at XS10



Inundation Mapping

- RAS Mapper
- Inundation Raster
 - Maps generated for all scenarios
 - Geospatially referenced
 - DEM derived from 2m LIDAR Data



Loss Estimation – Hazus MH

- What is Hazus?

Calculates
Economic Loss
from Physical
Damage

Nationally
Applicable
Standardized
Methodology

- Levels of Analysis

Level 1 –
Simplest
Analysis

Built in
Hydrologic
Model

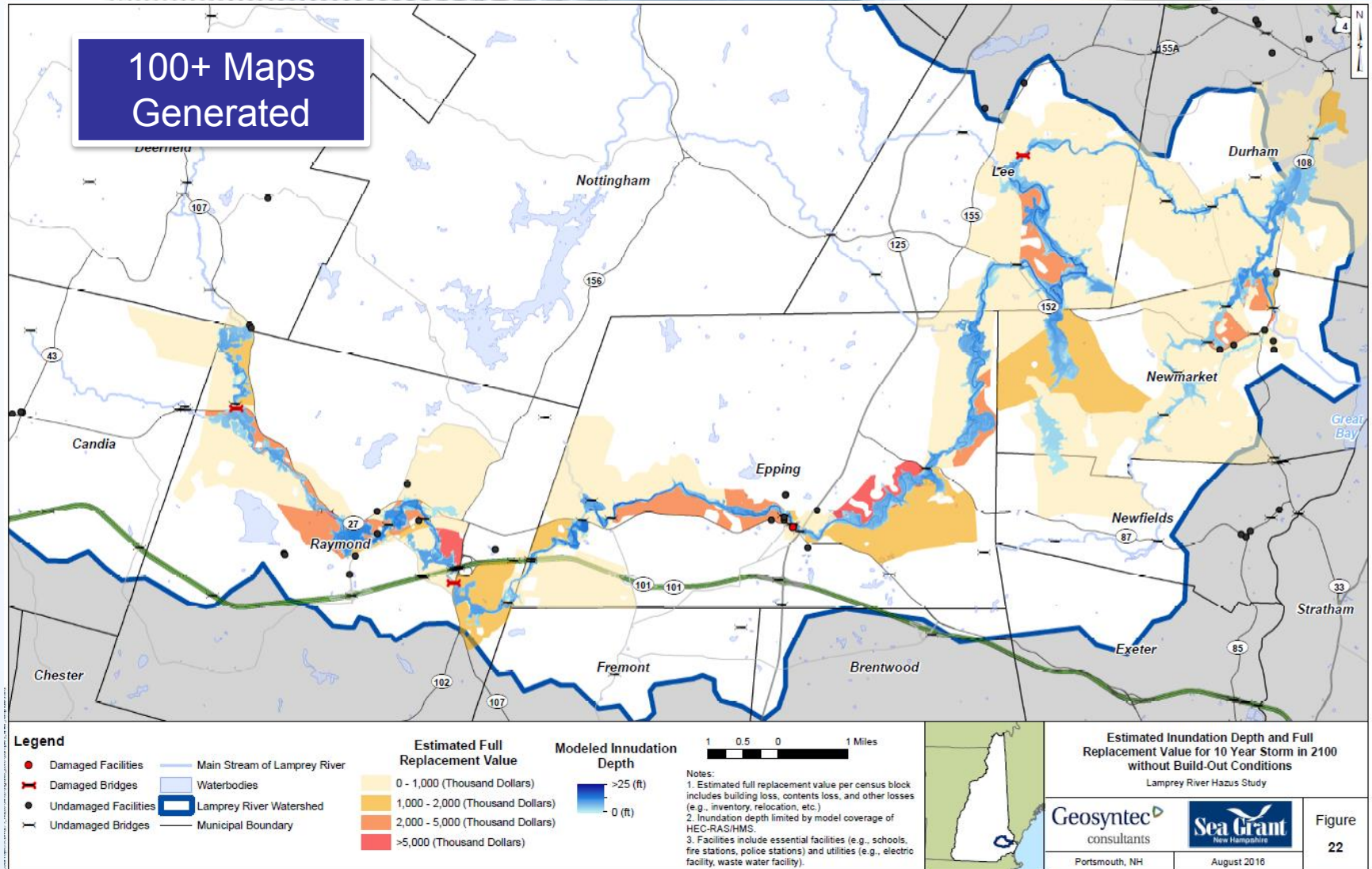
Levels 2&3 –
More
Complex

External
Flood Data

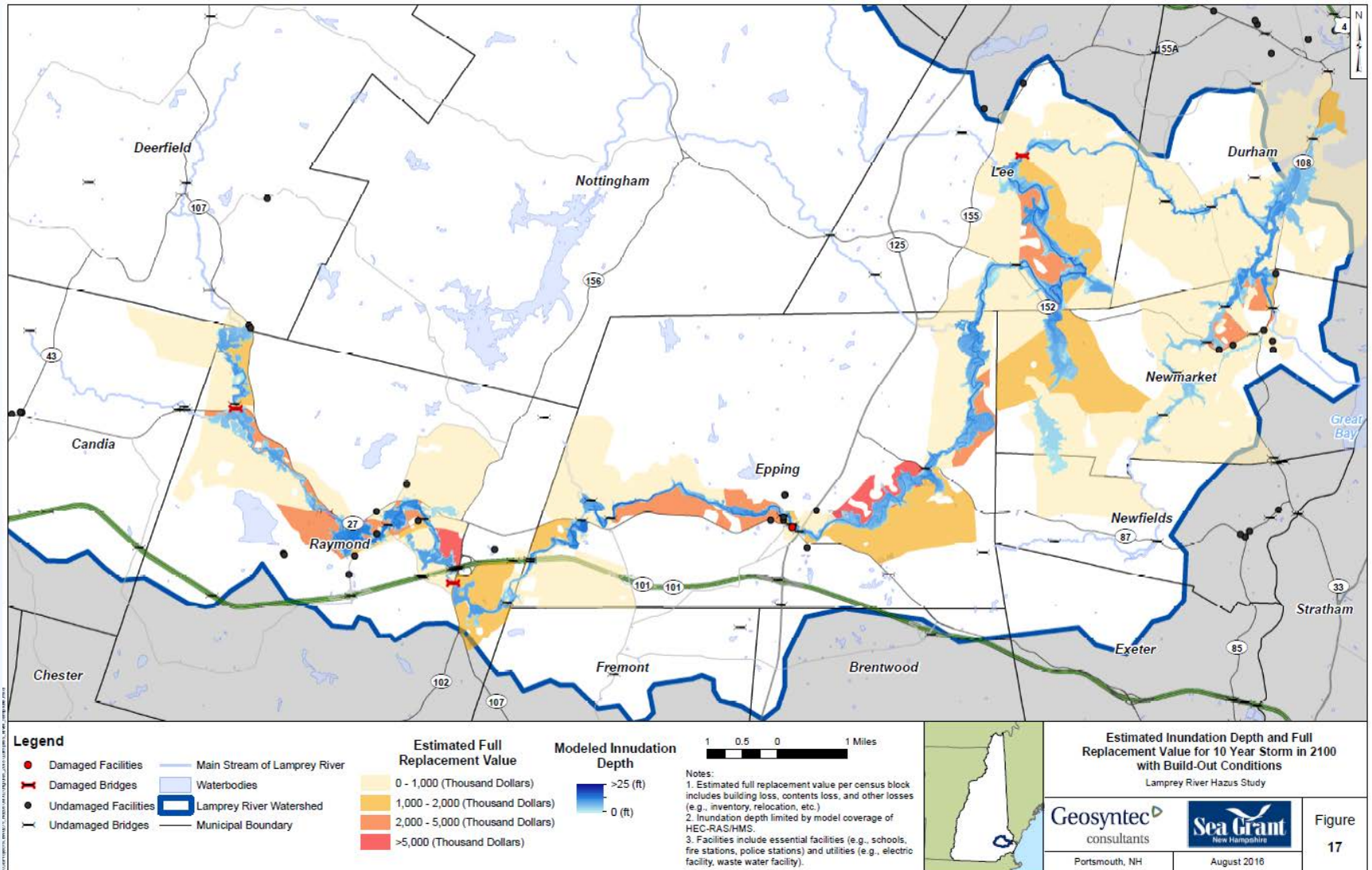


Hazards U.S. – Multi Hazard,
Developed by FEMA

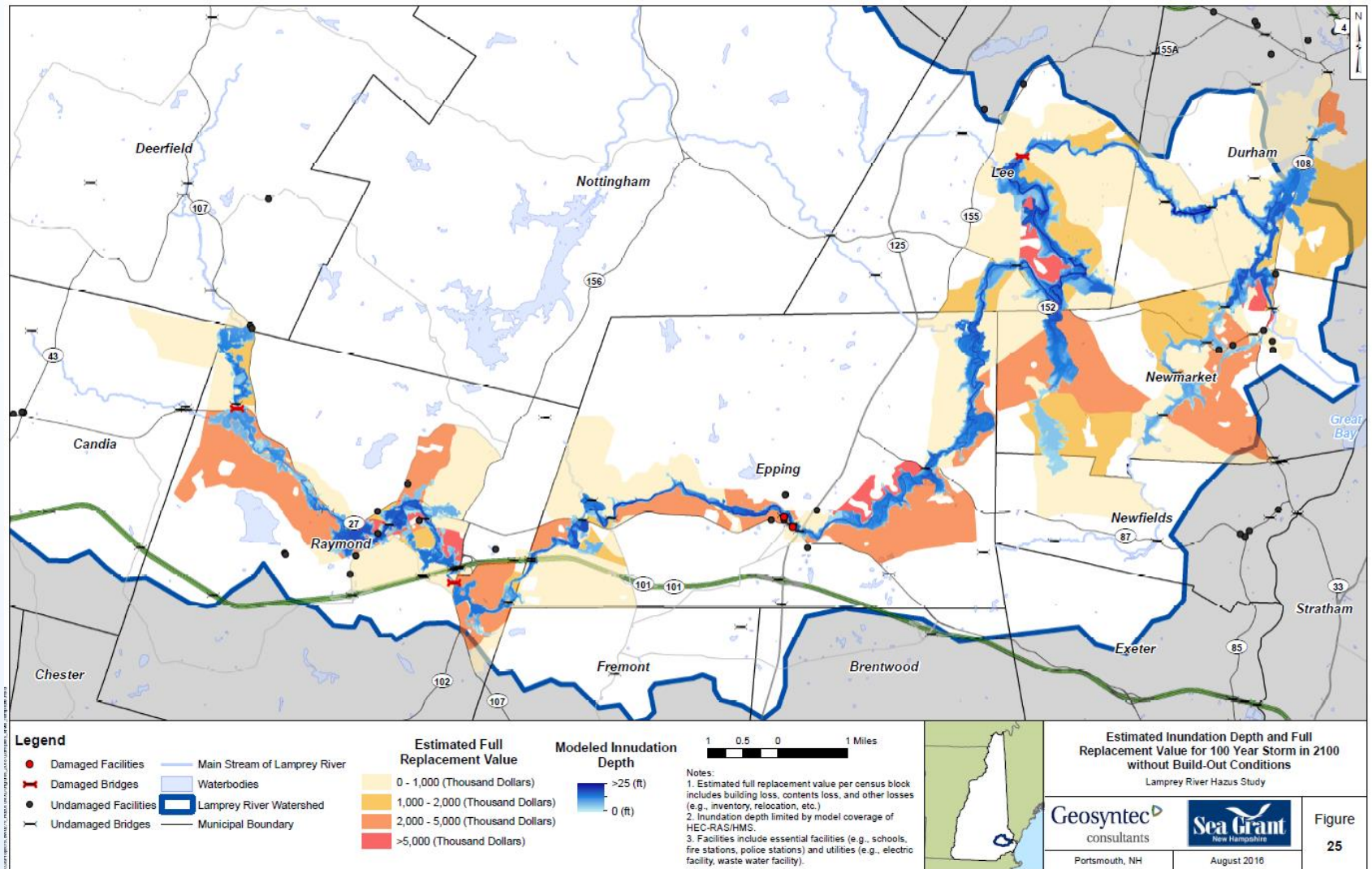
Study Results – Static



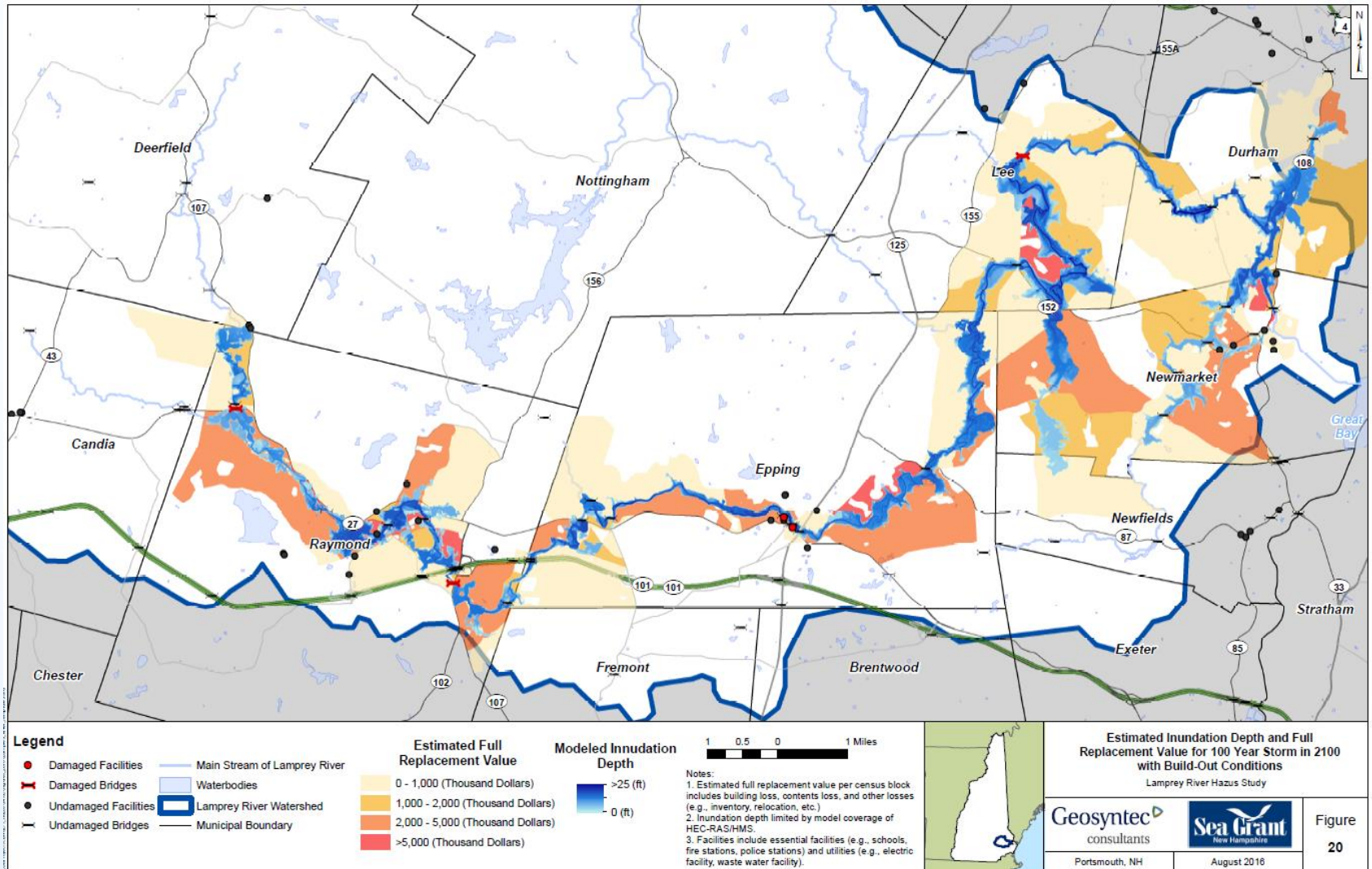
Study Results – Static



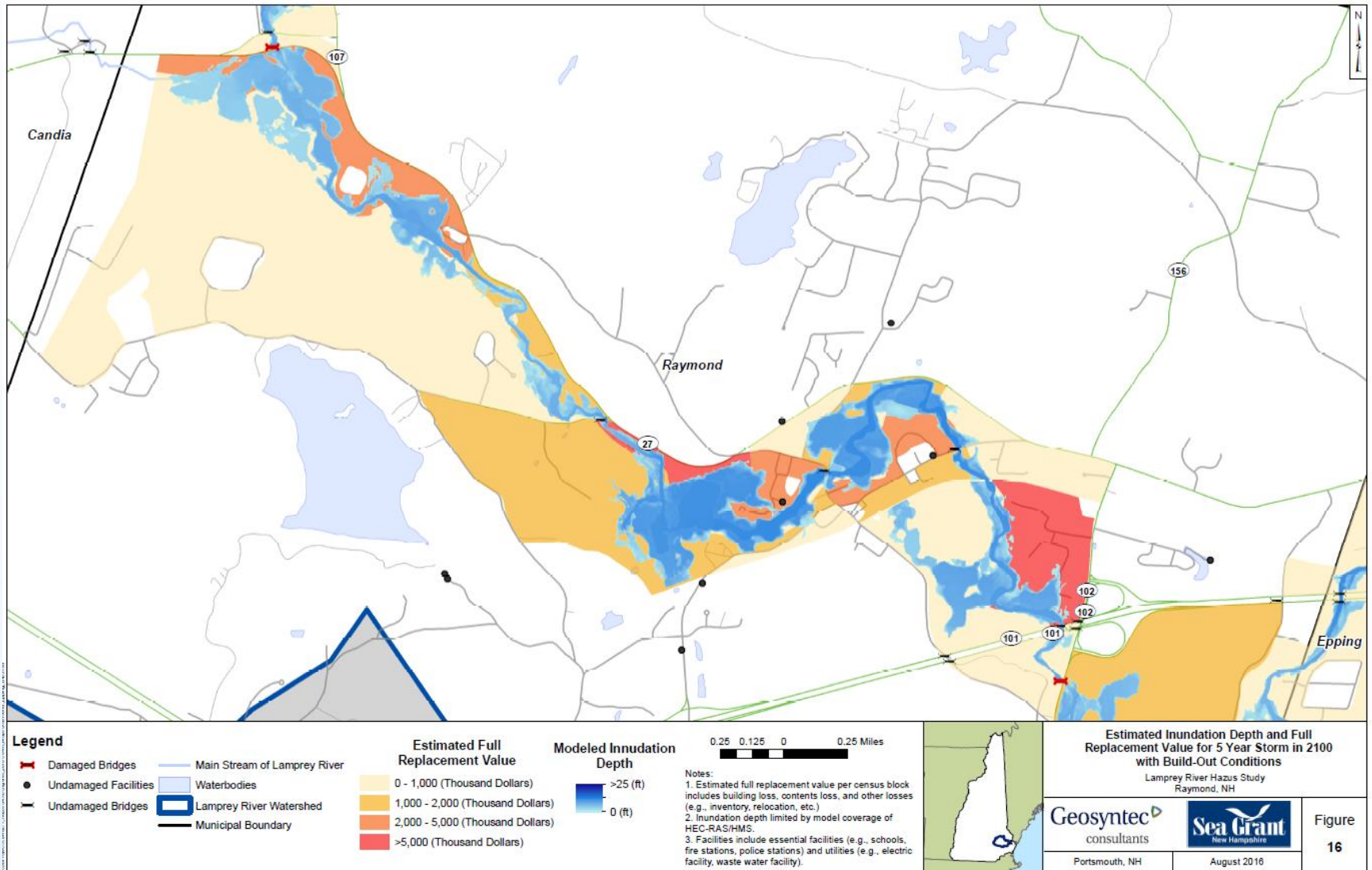
Study Results – Static



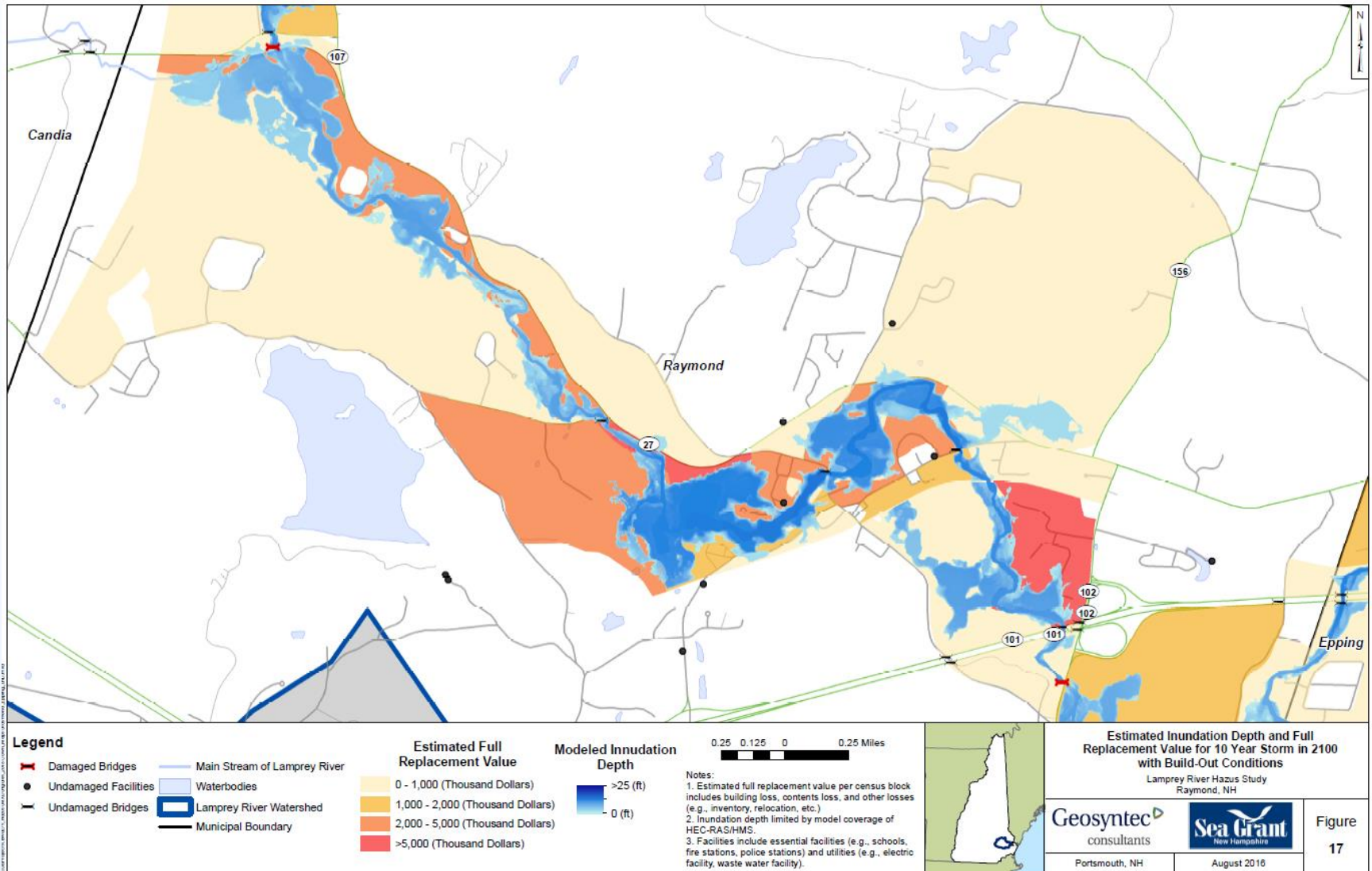
Study Results – Static



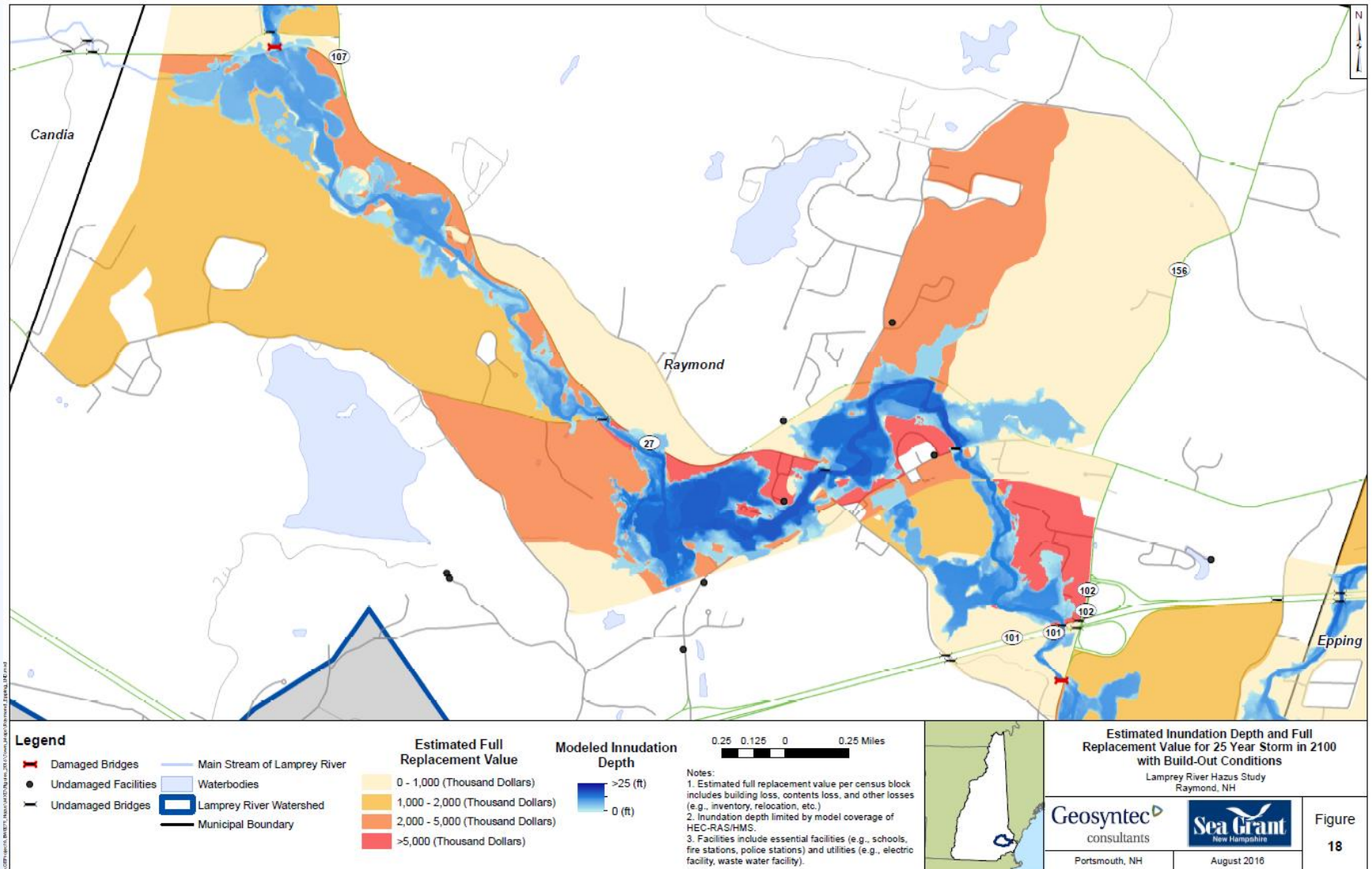
Study Results – Static



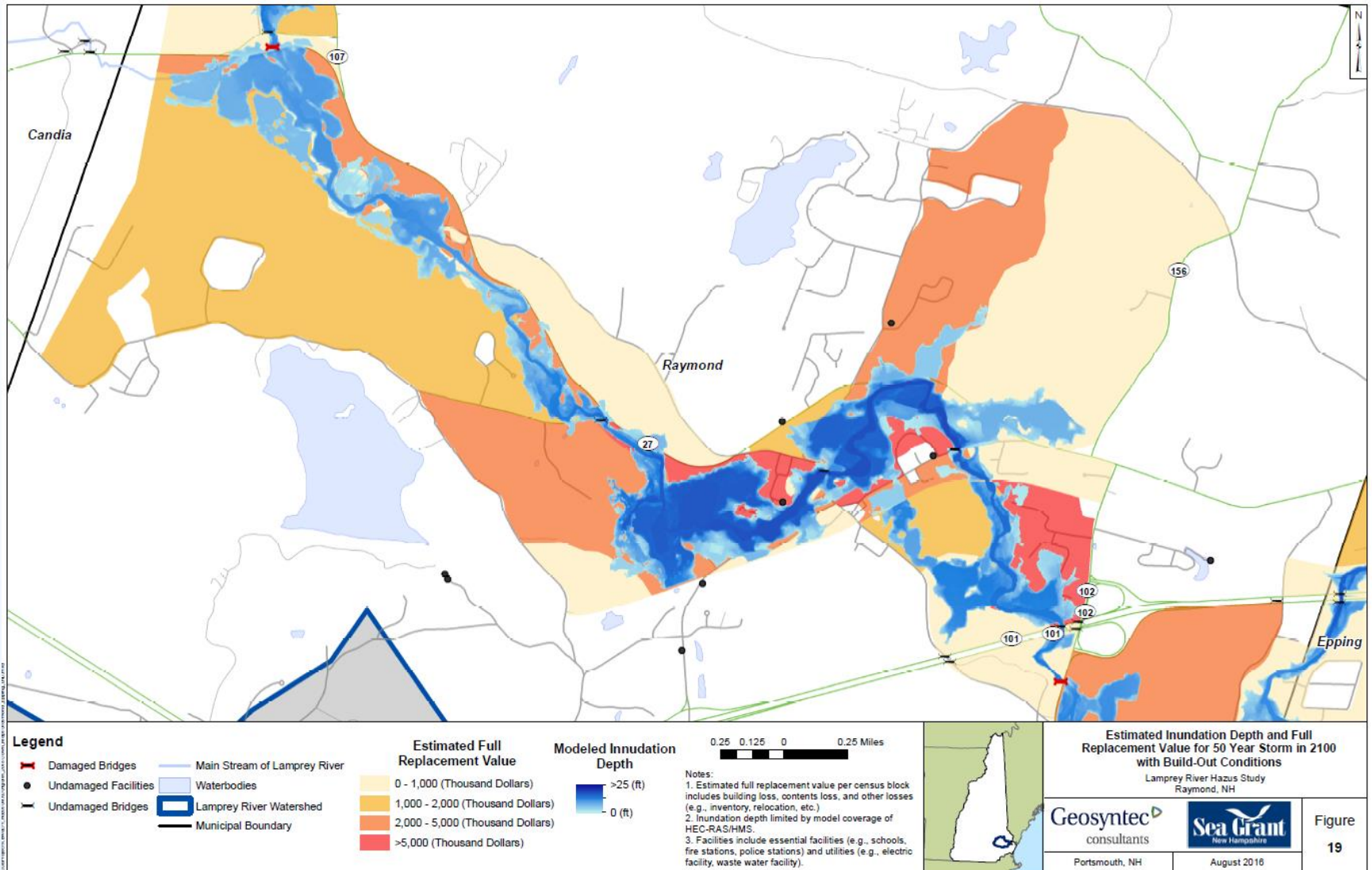
Study Results – Static



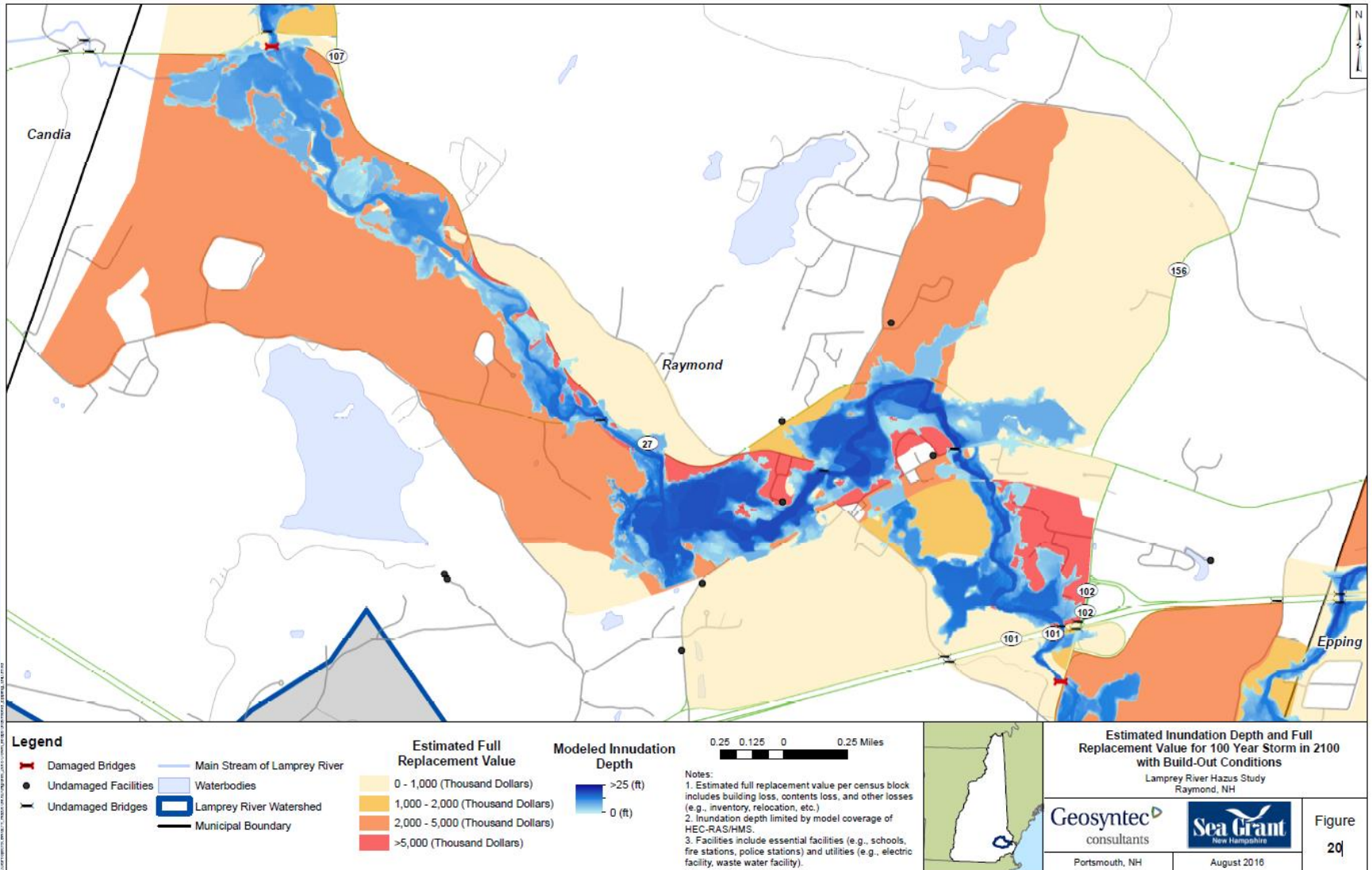
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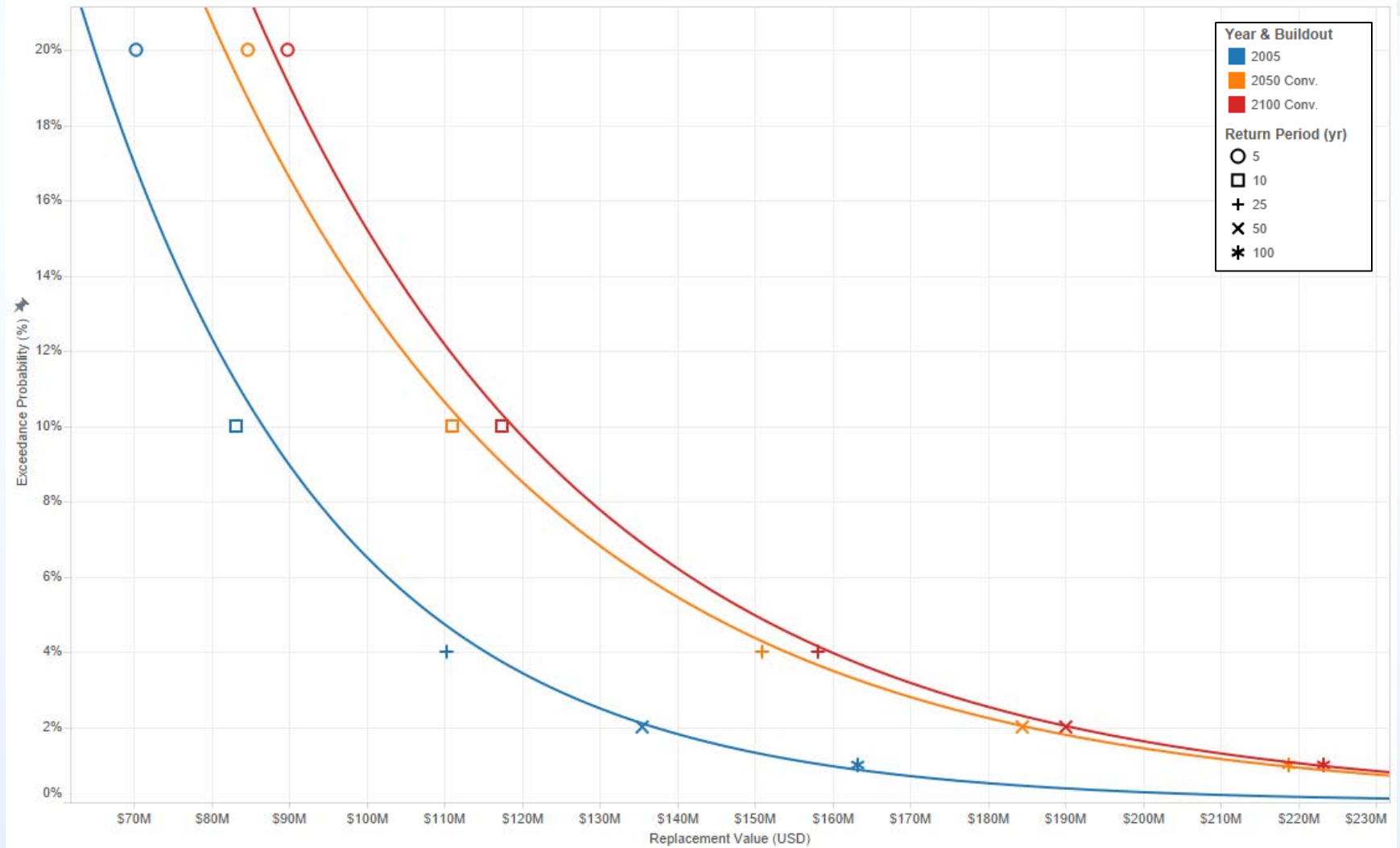
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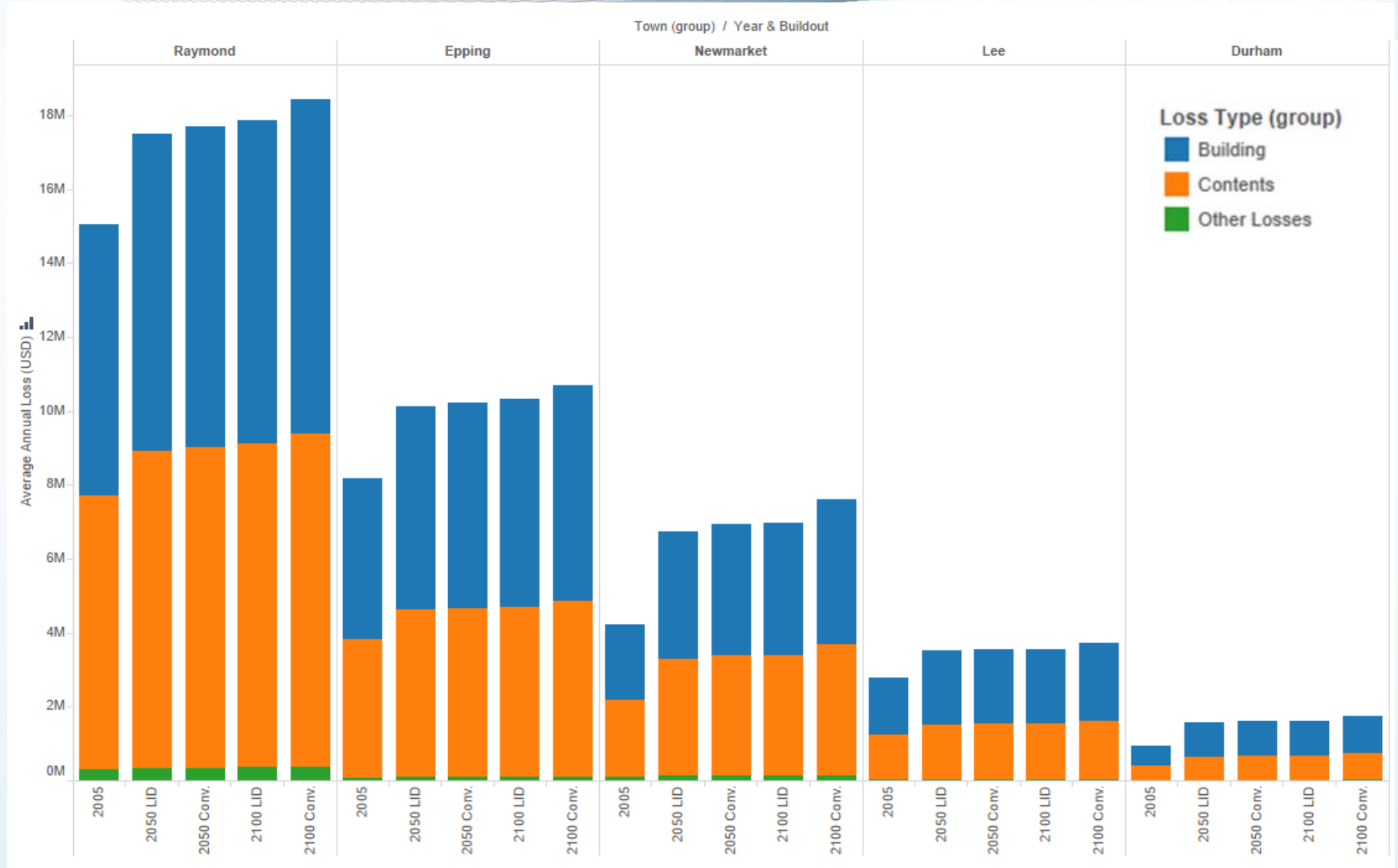
Full Replacement Cost (All Towns)



Inundation Area by Town

Return Period	Time Period	Buildout	Inundation Area (Square Miles)						
			Epping	Raymond	Newmarket	Lee	Durham	Other Towns	Total
100-yr	2100	Conv.	1.68	1.72	1.21	1.47	0.99	0.08	7.14
	2050	Conv.	1.68	1.70	1.20	1.45	0.98	0.08	7.08
	2005	N/A	1.48	1.54	1.06	1.24	0.88	0.07	6.27
50-yr	2100	Conv.	1.55	1.67	1.14	1.38	0.94	0.07	6.75
	2050	Conv.	1.53	1.59	1.13	1.36	0.94	0.07	6.61
	2005	N/A	1.41	1.42	0.99	1.09	0.82	0.07	5.80
25-yr	2100	Conv.	1.46	1.51	1.06	1.19	0.87	0.07	6.15
	2050	Conv.	1.44	1.48	1.04	1.16	0.85	0.07	6.05
	2005	N/A	1.36	1.28	0.91	0.98	0.76	0.06	5.36
10-yr	2100	Conv.	1.37	1.30	0.95	1.00	0.78	0.06	5.46
	2050	Conv.	1.36	1.27	0.93	0.97	0.76	0.06	5.35
	2005	N/A	1.40	1.11	0.80	0.85	0.69	0.06	4.90
5-yr	2100	Conv.	1.43	1.13	0.86	0.87	0.71	0.06	5.06
	2050	Conv.	1.41	1.11	0.84	0.85	0.69	0.06	4.95
	2005	N/A	1.34	1.05	0.74	0.75	0.61	0.05	4.53

Study Results – Avg. Annual Losses



Study Results - Interactive

ArcGIS Story Maps

- Interactively communicate complex project findings to clients
- <http://arcg.is/2en4DUK>

Inundation Study Results - Interactive

Flood Damage Analysis in New Hampshire - 2005 (left) vs 2100 (right)

Inundation Damages

Geosyntec Consultants assisted the University of New Hampshire on a study titled "Analysis and Communication of Flood Damage Cost Avoidance in the Lamprey River Watershed of New Hampshire". The primary purpose of the study is to build upon previous research regarding flood risk in the Lamprey River watershed to build community resilience to future freshwater flooding by: (1) estimating potential flood damage and cost avoidance resulting from different land use management strategies in the Lamprey River watershed; (2) training municipal officials and regional planners; and (3) developing and implementing an innovative communication effort to broadly disseminate results to key audiences within the watershed.

This interactive visualization provides a comparison of inundation and estimated census block damage between a 2005, 5-year flooding condition and a 2100, 100-year flooding condition. Results from this study are intended to be used at the planning level to assess and communicate general possible conditions within the greater Lamprey River watershed as a result of climate change and should be used with suitable caution.

Legend

Damaged Facilities

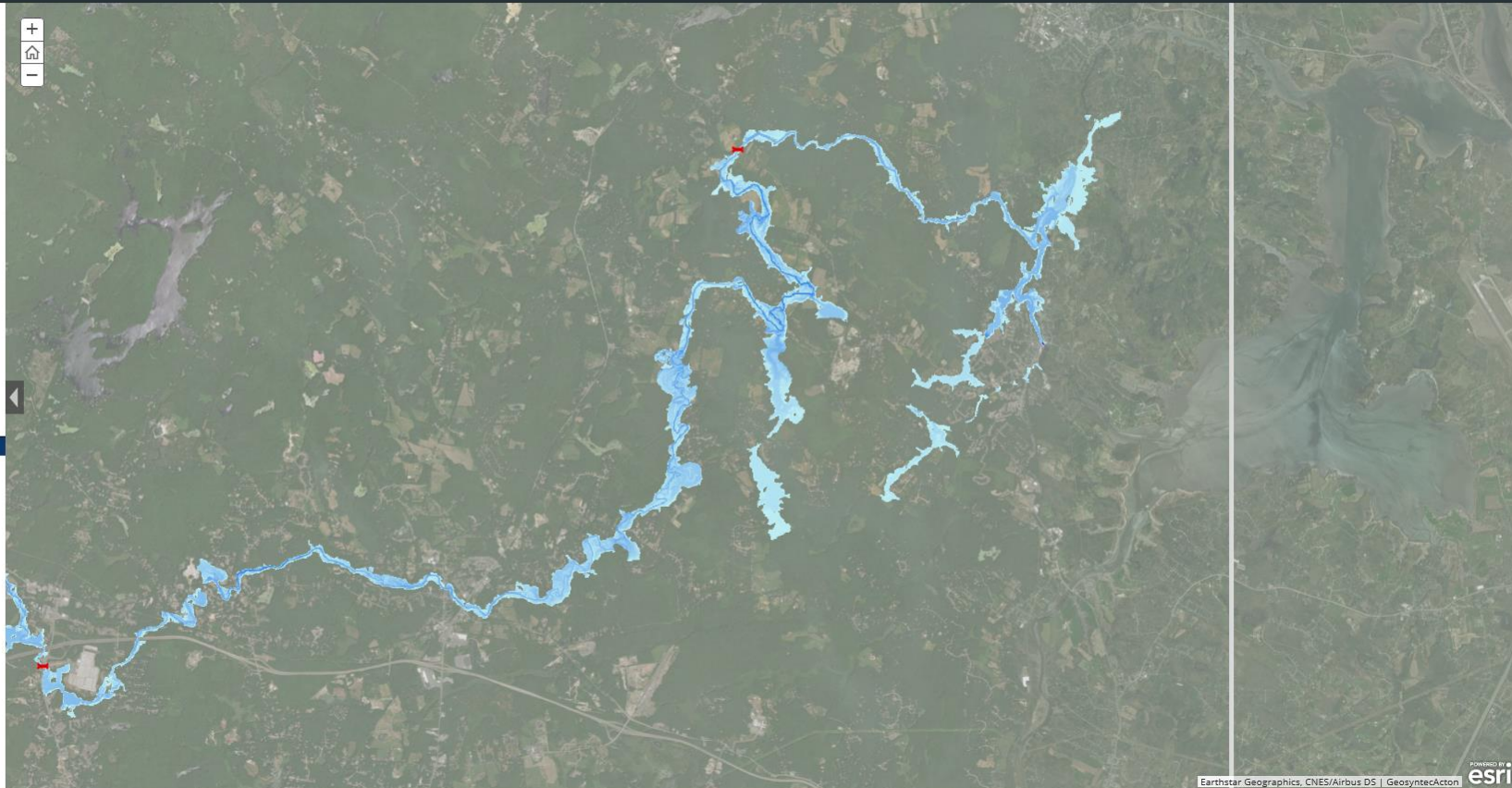
- Damaged Facilities

Damaged Bridges

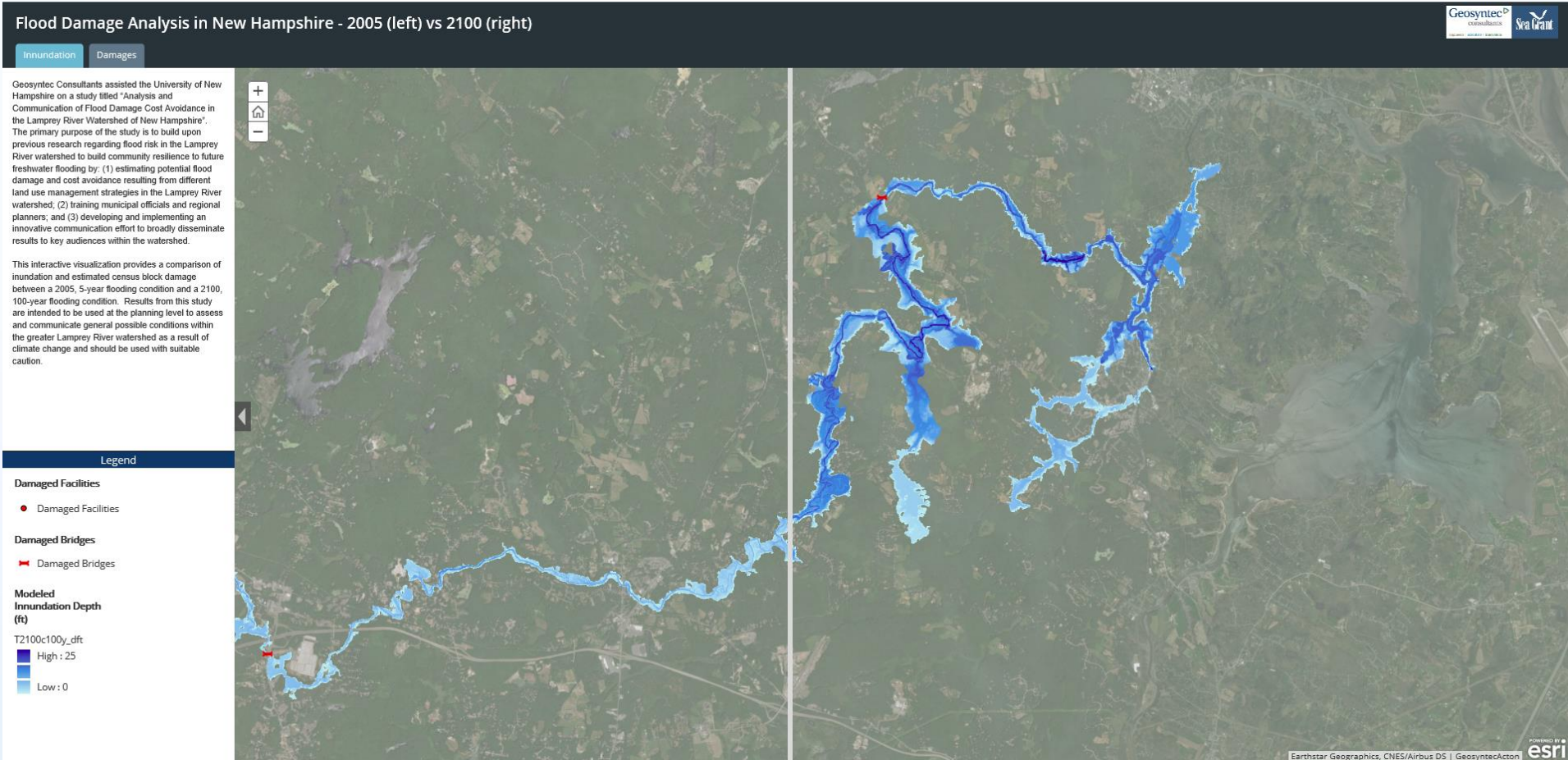
- Damaged Bridges

Modeled Inundation Depth (ft)

- T2100c100y_dft
- High : 25
- Low : 0



Inundation Study Results - Interactive



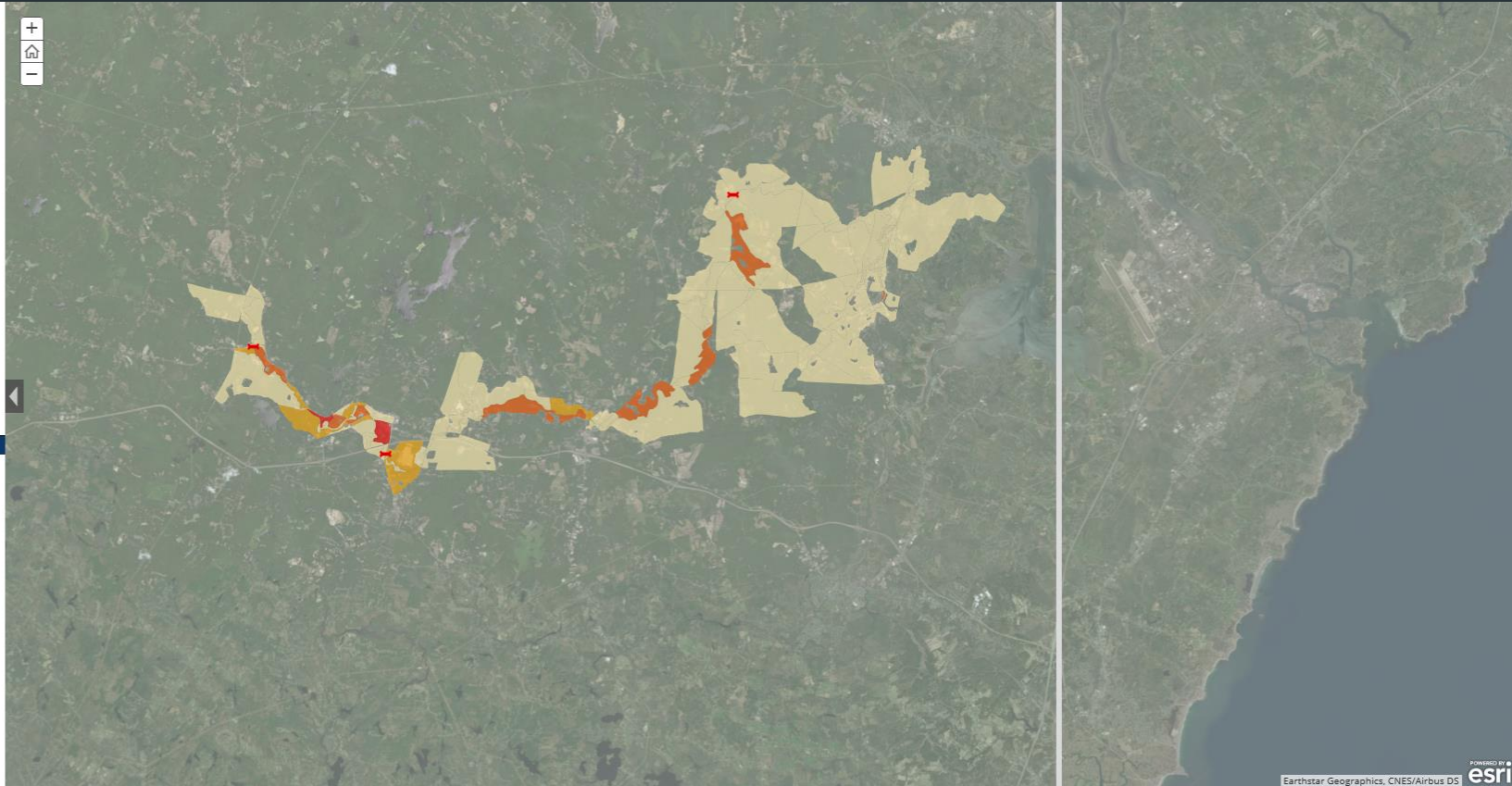
Study Results - Interactive

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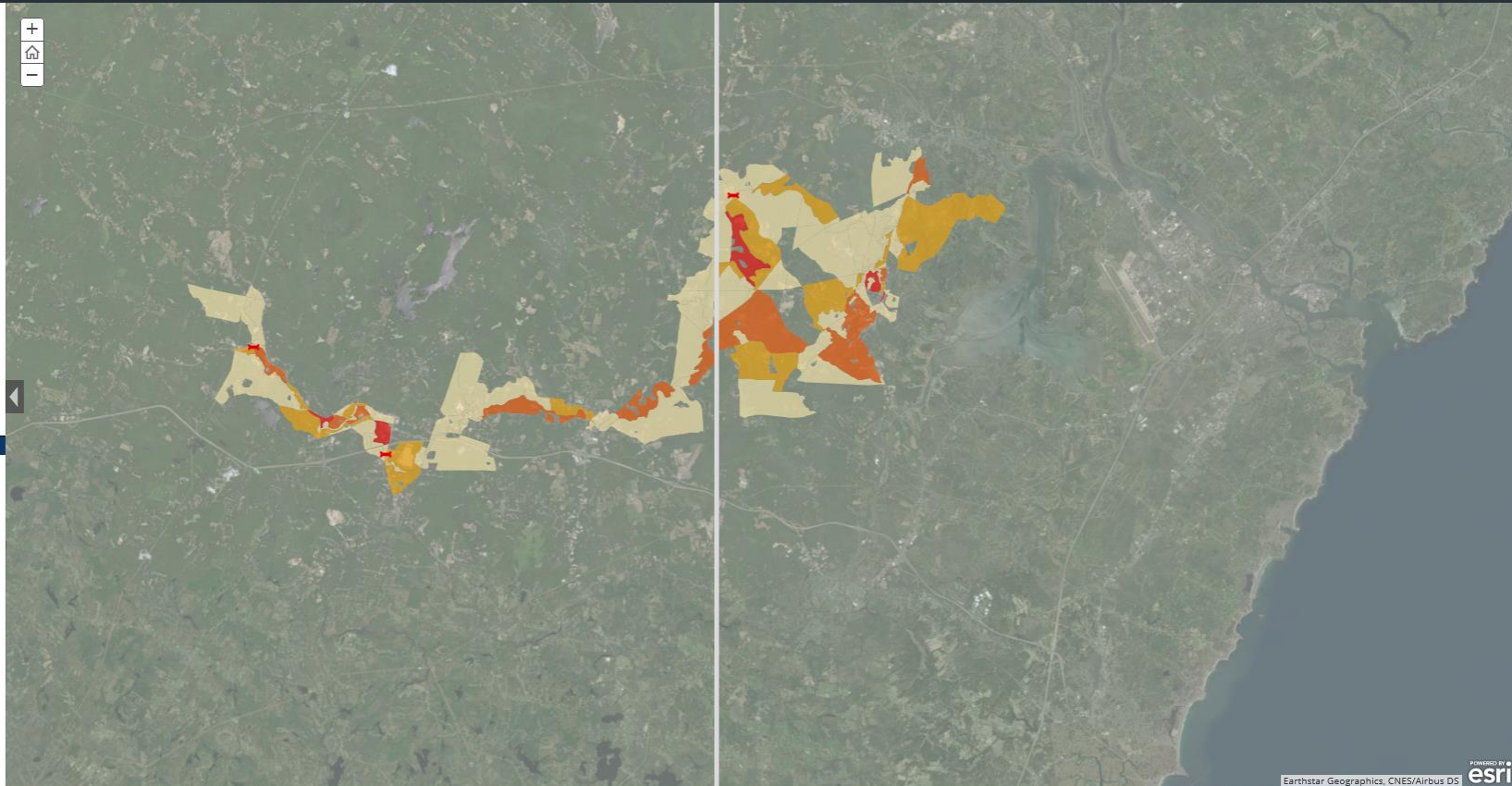
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Costs Avoided - Town of Lee, NH

- Expand this work toward costs avoided analysis
- Create inundation maps for Lamprey River and tributaries
- 100-Yr floodplain in 2050, built-out conditions
- Amend Lee ordinance/requirements
- Restrict development within the 2050 floodplain
- Future additional development avoided
- Costs of damages are avoided

The End

Thank you!

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