



Scarborough Flood Vulnerability Assessment Project Meeting #2/3

November 25th, 2024

Meeting Agenda

Agenda:

1. Welcome

2. Task 2 Updates:

- Data Review Memo
- GIS Data Updates
- Pump Station Fieldwork Overview
- Draft Vulnerability Assessment Results Memo
- Initial Prioritization Methodology and Next Steps

3. Task 3 Updates: Drone Survey TBD

4. Task 4 Updates

5. Task 5 Updates:

- Pilot Project Selections

6. Task 6 Updates:

- Public Meeting Recap
- Higgins Beach Meeting Recap
- Pine Point Beach Meeting Recap

7. Task 7 Updates:

- StoryMap update

8. Discuss overall project schedule, including:

- Next Deliverables
- Next Community Event
- Next Project Meeting

Adjourn

Task 2: Data Review & Collection

Task 2 is bulk of flood vulnerability work:

- Data review (GIS assets, flood levels, etc.)
- Field work
- Flood vulnerability results

Ultimate work product will be an ArcGIS StoryMap.

Interim memos submitted along the way for work documentation and review.



Task 2: Data Review & Collection

Draft Data Review Memo:

- Memo summarizing data sources used in study.
- Submitted as draft July 16, 2024
- Comments received – will be incorporated and resubmitted as Final in December



Memo

5 Milk Street • Portland, ME 04101 • 207.797.8901

Via Email: jfitch@scarboroughmaine.org

To: Jami Fitch, Town of Scarborough

From: Leila Pike, P.E. (GEI), Ilan Gasko, E.I. (GEI)

Date: July 16, 2024

Re: DRAFT Data Review Memo
Flood Vulnerability Assessment
Scarborough, Maine

Project No.: 2403961

GEI Consultants, Inc. presents this draft memo summarizing data reviewed that will be used to evaluate flood risk as part of the flood vulnerability assessment for the Town of Scarborough, Cumberland County, Maine (the "Town") (Figure 1). This work was based on Task 2.1 of our proposal dated April 1, 2024.

The flood vulnerability assessment will evaluate flood risk to assets (i.e., roads, pump station, structures, etc.) based on flood inundation boundaries that represent a range of coastal storm surge and sea level rise scenarios. The inundation extents will be created using a digital elevation model (DEM) representing the topography of the Town and water levels representing flood scenarios that will be included in the study. The risk of flood exposure for the assets included in the study will be based on their elevation and location relative to the inundation boundaries. Additional flood exposure due to inland flooding from heavy precipitation events and wave action during coastal storm scenarios will be considered for this study to the extent that existing data is available.

Data sources reviewed as part of the flood vulnerability assessment to develop the DEM, water levels, and GIS data include information from the National Oceanic and Atmospheric Agency (NOAA), the United States Geological Survey (USGS), the Federal Emergency Management Agency (FEMA), the Maine Climate Council (MCC) Scientific and Technical Subcommittee, readily available GIS data from Maine government websites and the Town of Scarborough, past flood inundation studies, and historical flood observations. These sources were consulted to develop flood scenarios and inundation boundaries for the flood vulnerability assessment.

Elevations in this report are referenced to the North American Vertical Datum of 1988 (NAVD88) in feet unless otherwise specified.

1. Topography Data

The latest readily available Light Detection and Ranging (LiDAR) data for the Town of Scarborough is the USGS South Coastal Maine dataset (USGS, 2020). The data for this study was collected between May 17 and June 10, 2020. Changes to the topography in Scarborough that occurred after these dates, such as to dune profiles (either through erosion or restoration work) or to shoreline infrastructure (i.e. new



Task 2: Data Review & Collection

GIS data updates:

- Refined Pump Station elevations with field work (discussed in a couple of slides)
- Estimated parcels with septic tanks



Task 2: Data Review & Collection

Transportation Infrastructure

- Roads
- Rail Lines
- Sidewalks
- Bridges

Sewer Utilities

- Manholes
- Sewer Pump Stations
- Treatment Plant
- Septic Tanks

Buildings/Structures/Parcels

- Structures (buildings, etc.)
- Municipal Property
- Parcels

Public Health & Safety

- DEP Remediation Sites
- Fire Hydrants
- Fire Stations
- Hospitals
- DEP Registered Tanks
- Police Stations
- Wells
- Evacuation Routes
- Light poles/streetlights

Conservation and Recreation

- Beaches
- Parks and Open Spaces
- Sand Dunes
- Walking Trails
- Wetlands

Drainage Utilities

- Dams
- Catch Basins
- Culverts
- Outfalls
- Outlet Control Structures

Coastal Structures

- Boat Ramps
- Coastal Structures



Task 2: Data Review & Collection

Field Survey – October 23, 2024:

- Spot elevations and photographs of 15 vulnerable public pump stations
- Elevations collected representing when pump stations would be impacted (damaged, inundated)
- Refined vulnerability results tables



Task 2: Data Review & Collection

Draft Flood Vulnerability Assessment Memo:

- Summary of vulnerability assessment methods
- Tables of results
- Submitted draft for comment by the Working Group this week

Table 5: Beach Flood Exposure Summary

Scenario	1	2	3	4	5	6	7	8	9	10	Area in Study
Area Inundated above HAT, acres	5	9	13	16	19	21	22	25	28	29	29

Notes: Asset information (location, area, etc.) from the Beach Shoreline Types and Dry Beach Width GIS layers (Maine DACF, 2023c,d). Approximate beach areas estimated using polyline boundaries. Area inundated represents acres inundated above present-day HAT.

Table 6: Parks and Open Spaces Flood Exposure Summary

Scenario	1	2	3	4	5	6	7	8	9	10	Area in Study
Area Inundated above HAT, acres	3	8	15	21	26	29	33	112	117	134	3,771

Notes: Asset information (location, area, etc.) from the Protected Properties GIS layer, excluding municipal properties (Scarborough, 2024). Area inundated represents acres inundated above present-day HAT.

Table 7: Sand Dune Boundaries Flood Exposure Summary

Scenario	1	2	3	4	5	6	7	8	9	10	Area/ Number in Study
Area Inundated above HAT, acres	11	21	44	63	79	89	100	203	230	261	279
Number of Sand Dunes Impacted	7	7	7	9	9	10	11	12	12	12	12

Notes: Asset information (location, area, etc.) from the Sand Dune Boundaries GIS layer (Maine DACF, 2024a). Area inundated represents acres inundated above present-day HAT.

Table 8: Sand Dune Erosion Hazard Areas Flood Exposure Summary

Scenario	1	2	3	4	5	6	7	8	9	10	Area/ Number in Study
Area Inundated above HAT, acres	2	4	9	14	21	24	26	72	82	93	96
Number of Erosion Hazard Areas Impacted	4	4	4	6	6	6	6	6	6	6	6

Notes: Asset information (location, area, etc.) from the Sand Dune Erosion Hazard Areas GIS layer (Maine DACF, 2024b). Area inundated represents acres inundated above present-day HAT.



$$\text{Flood Risk} = \text{Flood Exposure} \times \text{Consequences}$$

Exposure: How likely is it to flood?

- Captured in Flood Vulnerability Results

Consequences (example):

- # of Buildings Impacted
- Public Safety
- Damage Potential



Initial Prioritization of Roads

$$\text{Flood Risk} = \text{Flood Exposure} \times \text{Consequences}$$

EXAMPLE MATRIX

Consequence Score	Area Impacted (# Buildings)	Public Safety Impact	Damage Potential, Relative Cost
5	Town-wide (>200 buildings)	Very High: -Evacuation Route	Very High: - Has experienced damage - Within wave action zone - Utility infrastructure below roadway
4	Multi-Neighborhood (75-200 buildings)	High: - No alternate route - Access to critical infrastructure (e.g., pump stations)	High: - Within wave action zone
3	Neighborhood (25-75 buildings)	Medium: - Alternate access, but long travel time - Dead-end street, cul-de-sac, etc.	Medium: - Revetment along roadway (e.g., scour potential)
2	Sub-neighborhood (5-25 buildings)	Low: - Alternate access available, minor added travel time - No alternate access, but impacts property that would already be flooded	Low: - Stillwater inundation
1	Property- Level (<5 building)	None - No impact (e.g., end of dead-end street)	None: - High-tide inundation, no revetments or other coastal structures



Initial Prioritization of Roads

$$\text{Flood Risk} = \text{Flood Exposure} \times \text{Consequences}$$

Example Consequences (score out of 5): Bayview Avenue

- 96 buildings impacted (4 for area impacted)
- No alternate route & access to pump station (4 for public safety)
- Subject to wave action, history of damage, utilities underneath (5 for potential damage cost)

$$\text{Consequence Score} = (4 + 4 + 5) / 15 \times 100 = 87$$



Initial Prioritization of Roads

Flood Risk = Flood Exposure x Consequences

Example Exposure: Bayview Avenue (Consequence Score 87)

Exposure: How likely is it to flood?

- 1% chance present-day (100-yr storm event)
- 10% chance in 2030 (10-yr storm event)
- 60%* in 2050 (HAT)
- 100% in 2100 (Mean Higher-High Water)

**value still being refined*



Initial Prioritization of Roads

Flood Risk = Flood Exposure x Consequences

Flood Risk =
consequences x (% chance present-day flooding x weighting factor)
+ (% chance 2030 flooding x weighting factor)
+ (% chance 2050 flooding x weighting factor)
+ (% chance 2100 flooding x weighting factor)

Weighting Factor: higher weight present-day risk, lower weight in future
example: 40% present-day, 35% in 2030, 20% in 2050, 5% in 2100

Example: **Bayview Ave** preliminary Flood Risk Score = 1811

Example: **Avenue 1-4** preliminary Flood Risk Score = 975



Task 3 and 4 Updates

Task 3: Drone Survey: will be scheduled in anticipation of winter storms

Task 4: Ordinance Review: work has begun



Task 5: Adaptation Strategies

Pilot Project Selection

- Up to 3 sites- concept-level design
- How should we make this selection process?



Task 5: Adaptation Strategies

Potential Pilot Project Options (an incomplete list)

Roads Projects:

- Black Point Road
- Pine Point Road
- Bayview Avenue
- Old Neck Road
- Ocean Avenue
- Spurwink Road

Other Projects:

- Dune Restoration (Higgins, Pine Point)
- Temporary Sea Wall Planning/Installations
- Sand Dune Rule conversations/meetings with DEP to understand true limits/exemptions
- Pine Point Fire Station
- Emergency Action Plan, Flood Alert System, Neighborhood Organization, etc....
- Buy Back / Long-Term Relocation/Retreat planning



Public Meeting Recap

Concerns/Thoughts/Ideas:

- Sand Dune Zones
- Flood Alert Systems
- Re-zoning
- Sewer System
- Beach Nourishment, Dune Restoration
- Retreat planning
- Relocate, re-think Bayview Avenue
- Pine Point Road
- Ocean Avenue



Themes, photos, etc. will be captured in StoryMap and Adaptation Recommendations memo.



StoryMap

ArcGIS StoryMap

- Draft available early 2025
- First draft will show flood exposure
- Adaptation recommendations, etc. will be included by end of the project



Project Schedule - 2024

																																	3	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
TASK	4/8/24	4/15/24	4/22/24	4/29/24	5/6/24	5/13/24	5/20/24	5/27/24	6/3/24	6/10/24	6/17/24	6/24/24	7/1/24	7/8/24	7/15/24	7/22/24	7/29/24	8/5/24	8/12/24	8/19/24	8/26/24	9/2/24	9/9/24	9/16/24	9/23/24	9/30/24	10/7/24	10/14/24	10/21/24	10/28/24	11/4/24	11/11/24	11/18/24	11/25/24	12/2/24	12/9/24	12/16/24	12/23/24	12/30/24																											
Meeting: Project Kick-Off Meeting																																																																		
Task 2: Data Review and Collection																																																																		
a) Data review and memo																																																																		
b) GIS data																																																																		
c) DEM																																																																		
d) Initial flood inundation layers																																																																		
Meeting: Project Update Meeting #1															#1																																																			
Public Meeting #1 (range of dates)																																																																		
e) Field survey																																																																		
f) Revised GIS layers																																																																		
g) Draft vulnerability assessment memo																																																																		
Meeting: Project Update Meeting #2																																																																		
Neighborhood Public Meetings (#2 & #3) (range of dates)																																																																		
Meeting: Project Update Meeting #3																																																																		
Task 4: Ordinance Review																																																																		
Task 5: Adaptation Strategies																																																																		
a) Draft adaptation strategies memo																																																																		
b) Pilot project concept designs																																																																		
Meeting: Project Update Meetings #4,#5, #6																																																																		
Task 8: StoryMap and Executive Summary																																																																		
a) ArcGIS StoryMap																																																																		
b) Executive Summary																																																																		
Meeting: Project Update Meetings #7																																																																		
Final Public Meeting at Town Council (range of dates)																																																																		



Project Schedule - 2024

TASK	4/8/24	4/15/24	4/22/24	4/29/24	5/6/24	5/13/24	5/20/24	5/27/24	6/3/24	6/10/24	6/17/24	6/24/24	7/1/24	7/8/24	7/15/24	7/22/24	7/29/24	8/5/24	8/12/24	8/19/24	8/26/24	9/2/24	9/9/24	9/16/24	9/23/24	9/30/24	10/7/24	10/14/24	10/21/24	10/28/24	11/4/24	11/11/24	11/18/24	11/25/24	12/2/24	12/9/24	12/16/24	12/23/24	12/30/24		
Meeting: Project Kick-Off Meeting																																									
Task 2: Data Review and Collection																																									
a) Data review and memo																																									
b) GIS data																																									
c) DEM																																									
d) Initial flood inundation layers																																									
Meeting: Project Update Meeting #1															#1																										
Public Meeting #1 (range of dates)																																									
e) Field survey																																									
f) Revised GIS layers																																									
g) Draft vulnerability assessment memo																																									
Meeting: Project Update Meeting #2																																									
Neighborhood Public Meetings (#2 & #3) (range of dates)																																									
Meeting: Project Update Meeting #3																																									
Task 4: Ordinance Review																																									
Task 5: Adaptation Strategies																																									
a) Draft adaptation strategies memo																																									
b) Pilot project concept designs																																									
Meeting: Project Update Meetings #4,#5, #6																																									
Task 8: StoryMap and Executive Summary																																									
a) ArcGIS StoryMap																																									
b) Executive Summary																																									
Meeting: Project Update Meetings #7																																									
Final Public Meeting at Town Council (range of dates)																																									

We are here.



Project Schedule - 2024

TASK	4/8/24	4/15/24	4/22/24	4/29/24	5/6/24	5/13/24	5/20/24	5/27/24	6/3/24	6/10/24	6/17/24	6/24/24	7/1/24	7/8/24	7/15/24	7/22/24	7/29/24	8/5/24	8/12/24	8/19/24	8/26/24	9/2/24	9/9/24	9/16/24	9/23/24	9/30/24	10/7/24	10/14/24	10/21/24	10/28/24	11/4/24	11/11/24	11/18/24	11/25/24	12/2/24	12/9/24	12/16/24	12/23/24	12/30/24		
Meeting: Project Kick-Off Meeting																																									
Task 2: Data Review and Collection																																									
a) Data review and memo																																									
b) GIS data																																									
c) DEM																																									
d) Initial flood inundation layers																																									
Meeting: Project Update Meeting #1																																									
Public Meeting #1 (range of dates)																																									
e) Field survey																																									
f) Revised GIS layers																																									
g) Draft vulnerability assessment memo																																									
Meeting: Project Update Meeting #2																																									
Neighborhood Public Meetings (#2 & #3) (range of dates)																																									
Meeting: Project Update Meeting #3																																									
Task 4: Ordinance Review																																									
Task 5: Adaptation Strategies																																									
a) Draft adaptation strategies memo																																									
b) Pilot project concept designs																																									
Meeting: Project Update Meetings #4,#5, #6																																									
Task 8: StoryMap and Executive Summary																																									
a) ArcGIS StoryMap																																									
b) Executive Summary																																									
Meeting: Project Update Meetings #7																																									
Final Public Meeting at Town Council (range of dates)																																									

This Week

We are here.



We are here.

This Week



Project Schedule - 2024

~ 1 month behind schedule, but buffer room was built into remaining tasks.



This Week

We are here.

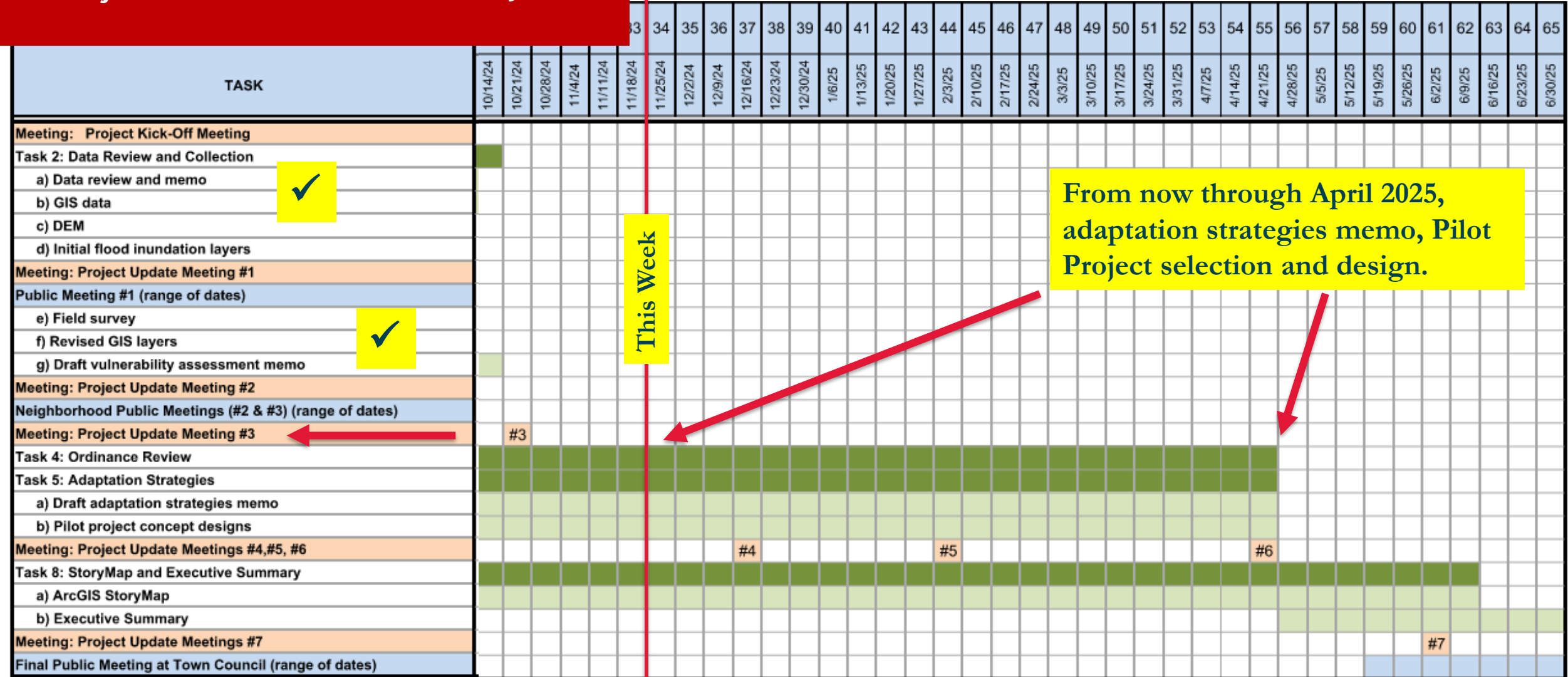
Project Schedule – Now to July 2025

																																	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65
TASK	10/14/24	10/21/24	10/28/24	11/4/24	11/11/24	11/18/24	11/25/24	12/2/24	12/9/24	12/16/24	12/23/24	12/30/24	1/6/25	1/13/25	1/20/25	1/27/25	2/3/25	2/10/25	2/17/25	2/24/25	3/3/25	3/10/25	3/17/25	3/24/25	3/31/25	4/7/25	4/14/25	4/21/25	4/28/25	5/5/25	5/12/25	5/19/25	5/26/25	6/2/25	6/9/25	6/16/25	6/23/25	6/30/25																											
Meeting: Project Kick-Off Meeting																																																																	
Task 2: Data Review and Collection																																																																	
a) Data review and memo																																																																	
b) GIS data																																																																	
c) DEM																																																																	
d) Initial flood inundation layers																																																																	
Meeting: Project Update Meeting #1																																																																	
Public Meeting #1 (range of dates)																																																																	
e) Field survey																																																																	
f) Revised GIS layers																																																																	
g) Draft vulnerability assessment memo																																																																	
Meeting: Project Update Meeting #2																																																																	
Neighborhood Public Meetings (#2 & #3) (range of dates)																																																																	
Meeting: Project Update Meeting #3																																																																	
Task 4: Ordinance Review																																																																	
Task 5: Adaptation Strategies																																																																	
a) Draft adaptation strategies memo																																																																	
b) Pilot project concept designs																																																																	
Meeting: Project Update Meetings #4,#5, #6																																																																	
Task 8: StoryMap and Executive Summary																																																																	
a) ArcGIS StoryMap																																																																	
b) Executive Summary																																																																	
Meeting: Project Update Meetings #7																																																																	
Final Public Meeting at Town Council (range of dates)																																																																	

This Week



Project Schedule – Now to July 2025

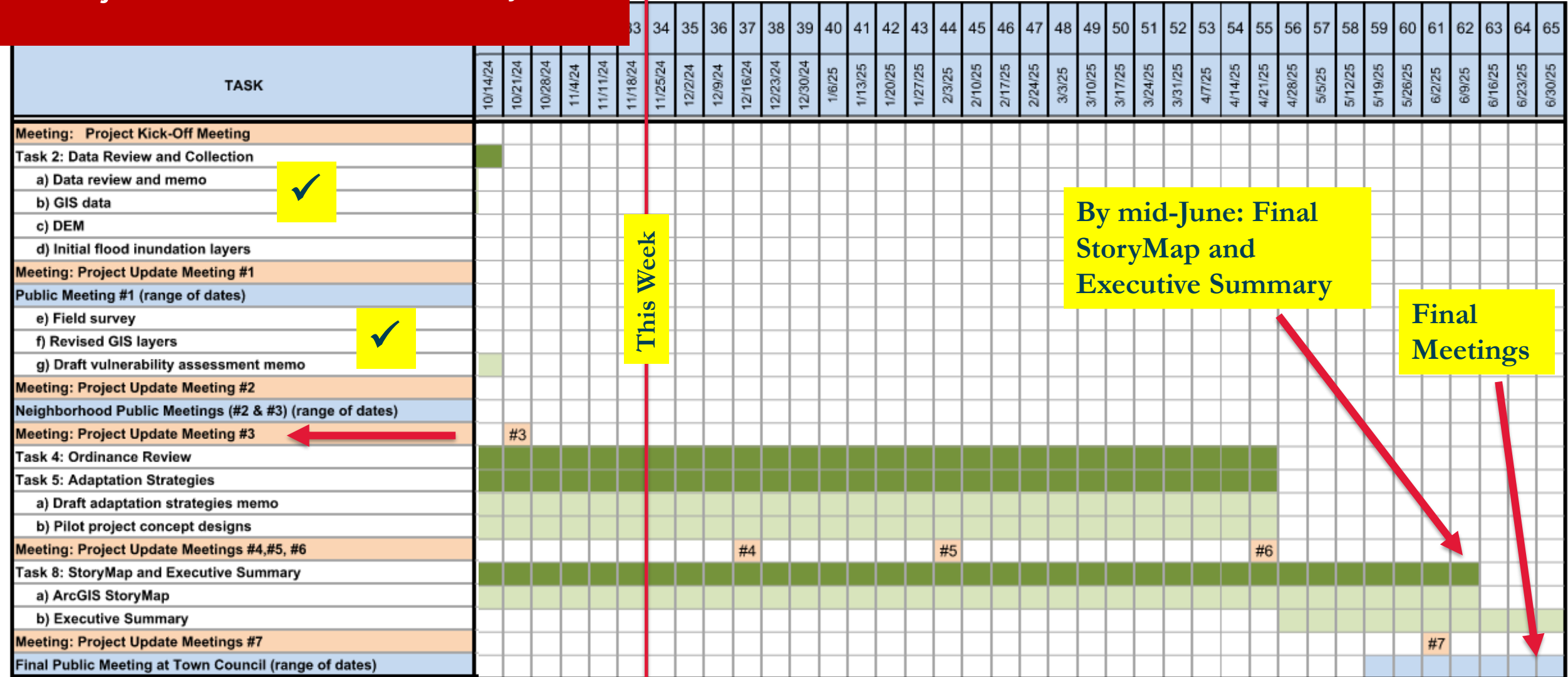


This Week

From now through April 2025, adaptation strategies memo, Pilot Project selection and design.



Project Schedule – Now to July 2025



This Week

By mid-June: Final StoryMap and Executive Summary

Final Meetings



Current Deliverables

Data Review Memo: Task 2.1

- Summary of flood vulnerability data reviewed and used as part of this study.



Initial Web-Based Flood Inundation Viewer (not for public)

- To convey flood extents to project team.



Flood Risk Memo: Task 2.7 (will be sent this week)

- Summary of flood exposure methodology and results



Next Deliverables / Community Events

Next Deliverables:

Draft ArcGIS StoryMap: Task 7

- Draft ArcGIS StoryMap of flood vulnerability analysis and results for review by the Project Working Group
- Goal deadline: Early 2025

Next Community Events:

End of Project Public Presentation – June/July 2025



Next Project Meeting

Project Update Meeting #3/4:

- Virtual meeting near end of December or early January.

Purpose:

- Draft ArcGIS StoryMap.
- Review roadway prioritization framework and results.
- Decide upon Pilot Projects.



Thank you!
Questions?



GEI
Consultants

Consulting
Engineers and
Scientists

Leila Pike, P.E. (GEI)
lpike@geiconsultants.com

Ilan Gasko, E.I. (GEI)
igasko@geiconsultants.com