

## Municipal Vulnerability Preparedness Program Action Grant Case Study

**Municipality:** Wellfleet, Barnstable, Bourne, Brewster, Eastham, Truro

**Project Title:** Cape Cod Low Lying Roads 1

**Award Year (FY):** 2022

**Grant Award:** \$ 332,091

**Match:** \$ 114,860

**Match Source:** Cape Cod Commission salaries and cash

**One or Two Year Project:** two year project

**Municipal Department Leading Project:** Wellfleet

**Project Website URL:** <https://www.capecodcommission.org/our-work/low-lying-roads-project/>

### Community Overview:

- The Low Lying Roads (LLR) 1 project was conducted in six Cape Cod communities ranging in size from Truro (population 1,575) to Barnstable (population 48,556).
- Five of the six participating communities have EJ populations, all due to income measures, and in Barnstable due also to minority communities and/or English isolation. Addressing vulnerabilities in transportation infrastructure on Cape Cod also benefits workers who commute to the Cape from off-Cape residences. We know that many of these commuters are members of EJ populations.
- Cape communities have low lying roads that currently flood or are expected to flood under future sea level rise and worsening storm conditions. Some of these problem sites are due to undersized culverts, or road segments at very low elevations. Some road segments pass through or are dangerously close to salt marshes, beaches, or other wetland resource areas.

### Project Description and Goals:

- **Where was the project located?** This project included a town-wide analysis of all roadway transportation infrastructure vulnerable to flooding, including public and private roads, local and state owned. It included the towns of Barnstable, Bourne, Brewster, Eastham, Truro, and Wellfleet.
- **What climate change impacts did the project address?** The project used the Massachusetts Coast Flood Risk Model (MC FRM) to examine vulnerabilities from coastal storm related flooding, and high-tide flooding resulting from sea level rise, under three future time horizons: 2030, 2050, and 2070.
- **Specific goals and tasks of the project:**
  - The Cape Cod Commission and Woods Hole Group conducted a vulnerability assessment of roads in each community using the MC FRM. The team then applied a criticality framework to the vulnerable roads in order to identify priority road segments. The criticality framework used regionally available data to assess each road segment's importance with respect to use, proximity to business or activity centers, emergency access, proximity or importance to vulnerable populations, and other sensitivity factors.

- Each of the participating towns held a public forum to present the vulnerability analysis and the prioritized roads; the attendees discussed how to prioritize two road segments for the next phase of the project.
- The WHG conducted a feasibility analysis to identify potential solutions for these sites and address flooding scenarios anticipated over a 50-year planning horizon. The team developed 2 or more conceptual solutions for each of 2 road segments in each community. They included both nature-based solutions (NBS) and traditional solutions to determine the best options for each individual site. Potential solutions included abandonment, dune creation, culvert openings, traditional roadway engineering approaches such as elevation, as well as hybrid approaches that incorporated green and gray solutions together.
- The town held a second public informational forum to report on the potential solutions and related tradeoffs for the two sites in each town. The forum was an opportunity for community feedback on the options.
- **The project met the goals set forth in the application in terms of:**
  - The team identified possible nature-based solutions for many of the vulnerable road segments selected for the second phase of the project. Not all low lying road sites were conducive to a NBS; in those cases traditional and hybrid solutions were presented. In some cases, options for abandoning the road segment and restoring the site, or creating an alternative use such as a park, were also presented.
  - The project is not a conventional regional project, but it has regional benefits as roads make linkages between communities, and provide access and egress to and from regional activity centers. One road segment examined included a portion of Route 6A linking Dennis and Brewster. Towns also discussed whether to examine other regionally significant roads that are owned by MassDOT.
  - We successfully implemented many strategies to engage the public: flyers were created and distributed on town websites and through social media; press releases were distributed to local media, with resulting articles and public service announcements; a comprehensive website was created ([Low Lying Roads Project | Cape Cod Commission](#)) where the process for developing the analyses is detailed, and nearly all project deliverables are posted, including recordings of the workshops, slide decks, map viewers (with a public comment tool) and conceptual drawings of the solutions identified for each of the two road segments in each town. The flyer for the town of Barnstable was translated into Portuguese, and a translator was present for the first of the workshops.
  - Staff from multiple town departments including public works, planning, conservation, and emergency services participated in the workshops and review of the outputs of the vulnerability and criticality analyses.
  - We finished the project on time.

The project partially met the goals identified with regard to improving equitable outcomes for and fostering strong partnerships with EJ and other Climate Vulnerable Populations:

- In general, it was difficult to engage the public on this project, including EJ and climate vulnerable populations. Based on our efforts to engage the community in the various towns, it appears that few people were interested in this work unless the vulnerable roads directly affected access to their personal property. There were various methods for providing feedback, including during workshop discussions and via the public comment form on the website. The Commission hosted a project website ([Low Lying Roads Project | Cape Cod Commission](#)), and in most cases towns posted links to this website on their own websites and via social media. There were good discussions in the workshops, but few comments on the design solutions, and only a few comments on flooding and erosion made via the public comment tool in the map viewer.
- Although strong partnerships were not established with EJ and other Climate Vulnerable Populations, the criticality framework helped ensure that vulnerable roadways that are significant to EJ populations were prioritized. The team identified critical roadways as those providing access to emergency services and critical facilities, to EJ neighborhoods or vulnerable populations, and those which have high travel volume and provide access to activity and business centers. By this effort, roadways which are significant both generally and to EJ populations were highlighted for inclusion for the design phase of the project.

**Results and Deliverables:**

- **Describe, and quantify (where possible) project results (e.g. square footage of habitat restored or created, increase in tree canopy coverage, etc.). Report out on the metrics outlined in your application.**

The project team held 2 workshops in each of the 6 participating towns. Participation numbers are as indicated below. In addition, comments were received on flooding and erosion within the map viewers for each town, and comments were made on the adaptation designs via the public comment form that was available on each town page of the LLR website:

Town	Workshop #1 attendance	Workshop #2 attendance	Comments in map viewer	Comments on adaptation designs
Barnstable	13	7	7	0
Bourne	7	52	1	1
Brewster	9	15	0	16
Eastham	13	10	2	2
Truro	6	26	3	0
Wellfleet	29	19	6	0

- **Provide a brief summary of project deliverables with web links, if available.**
  - The project process and deliverables are all detailed and available to view on the Low Lying Roads website: <https://www.capecodcommission.org/our-work/low-lying-roads-project/>. Individual town pages are available from the project overview page; links found at the bottom.
  - For each town, the team conducted a vulnerability and criticality analysis and outputted map results for three future time horizons: 2030, 2050, and 2070. These materials are all presented in the map viewers on each town project page. The team identified priority road segments based on a calculation of risk using the vulnerability and criticality scores. The priority road segments are also identified on the map viewers. The viewers are interactive and allow users to mark the map and comment on problem flooding or erosion areas within the town.
  - As part of the 2<sup>nd</sup> phase of the project, the team identified 2-3 adaptation solutions for each of 2 road segments in each town. The solutions included gray, green and hybrid alternatives. PDFs of each site, with aerial existing conditions and proposed concept level designs, and cross sections of alternative solutions, are posted on each town webpage.
  - Recordings of the workshops, as well as slide decks, are posted on each town webpage.

#### **Lessons Learned:**

- **What lessons were learned as a result of the project? Focus on both the technical matter of the project and process-oriented lessons learned.**
  - One of the objectives of this project was to raise awareness and understanding about the threats from climate change to our transportation networks. With that in mind we designed our initial workshops to cover more details about the MC FRM and potential adaptation solutions than the general public may have been interested to hear. It took a little while to figure out the right level of content to share without being too overwhelming. We felt it was important to the future discussions around which roads to prioritize to have participants understand and trust the MC FRM outputs, and so we invested some time in explaining that tool. Based on our assessments of some of the early meetings, we believe it's more important to establish that the methods being used to identify risk come from a trusted model and good data sources than giving an overview of climate change threats and solutions. A community with different climate literacy and acceptance might feel differently.
  - As a separate item, and key to the success of the workshops, was our presentation of the vulnerability and criticality analyses. We did not present the analyses as the definitive assessment of vulnerability and criticality. We made it clear that this was *one* way of looking at the problem, and that we wanted to

hear from the community what their experiences are with flooding roads, and what roadways are most important from the community perspective.

- For a future project designed very closely to how this one was, it may make sense to rethink the public engagement component and adjust expectations. For a townwide screening of roads with few to no significant flooding problems at the present time, it may be hard to engage the public on this topic alone. It could make sense to incorporate the presentation into another forum on a similar topic, or as part of a standing committee meeting (planning board, board of selectmen). If there is a significant road segment that currently floods, that may generate concern and interest in managing continued access and be a way to organize a meeting on a wider screening analysis of roads townwide.
- **What is the best way for other communities to learn from your project/process?**
  - Please visit the website for the Low Lying Roads project at <https://www.capecodcommission.org/our-work/low-lying-roads-project/>

Questions regarding the project process and outcomes may be directed to Heather McElroy [hmcelroy@capecodcommission.org](mailto:hmcelroy@capecodcommission.org) Questions regarding the MC FRM and design solutions may be directed to Joe Famely [jfamely@woodsholegroup.com](mailto:jfamely@woodsholegroup.com)

#### **Partners and Other Support:**

- Heather McElroy, Natural Resources Manager, Cape Cod Commission. Project management, meeting facilitation.
- Anne Reynolds, GIS Director, Cape Cod Commission. Data management and map viewer development.
- Martha Hevenor, Liz Kellam, Tara Lewis, Kathleen Mason, Colleen Medeiros, Michele White, Cape Cod Commission. Coordination with towns, design support, transportation technical assistance, website development.
- Joe Famely, Sustainability and Climate Team lead, Woods Hole Group. Project management, and presenter at all town workshops.
- Brittany Hoffnagle, Adam Finkle, Linnea Laux, Lindsay Pisapio, Kirk Bosma, and others at WHG. GIS, design, engineering, and application of the MC FRM model.
- SumCo, project costing and constructability input.
- Hillary Lemos, Jay Norton, Town of Wellfleet. Participation in workshops, road selection, and community outreach.
- Shana Brogan, Paul Lagg, Town of Eastham. Participation in workshops, road selection, and community outreach.
- Emily Beebe, Jarrod Cabral, Town of Truro. Participation in workshops, road selection, and community outreach.
- Tim Lydon, Stevie Fitch, Town of Bourne. Participation in workshops, road selection, and community outreach.
- Amber Unruh, Town of Barnstable. Participation in workshops, road selection, and community outreach.

- Chris Miller, Griffin Ryder, Peter Lombardi, Town of Brewster. Participation in workshops, road selection, and community outreach.

**Project Photos:**

- In your electronic submission of this report, please attach (as .jpg or .png) a few high-resolution (at least 300 pixels per inch) representative photos of the project. Photos should not show persons who can be easily identified, and avoid inclusion of any copyrighted, trademarked, or branded logos in the images. MVP may use these images on its website or other promotional purposes, so please also let us know if there is someone who should receive credit for taking the photo.