

Project Stats

Client: Town of Aquinnah, Massachusetts

Location: Aquinnah, Massachusetts

Gay Head Lighthouse Relocation

Originally constructed in 1799 and reconstructed in 1856 after it was destroyed by fire, the Gay Head Lighthouse had been a treasured landmark on Martha's Vineyard long before it was placed on the National Register of Historic Places in 1987. Perched atop the Gay Head Cliffs on the western tip of the island, the lighthouse stood threatened by the receding cliffs. In 2013, the National Trust for Historic Preservation designated the lighthouse as one of the 11 most endangered historic places in the country. Thanks to the efforts of community members and the team of experts who rallied to move the 465-ton, 159-year-old structure to safety, the lighthouse is no longer endangered.

GEI served as geotechnical consultant for the Gay Head Lighthouse Relocation project. Our work contributed to the study of the erodin cliffs, the evaluation and ultimate selection of the new location for the lighthouse, the design and construction of the haul path and new foundation, and restoration of the site after completion of the move.

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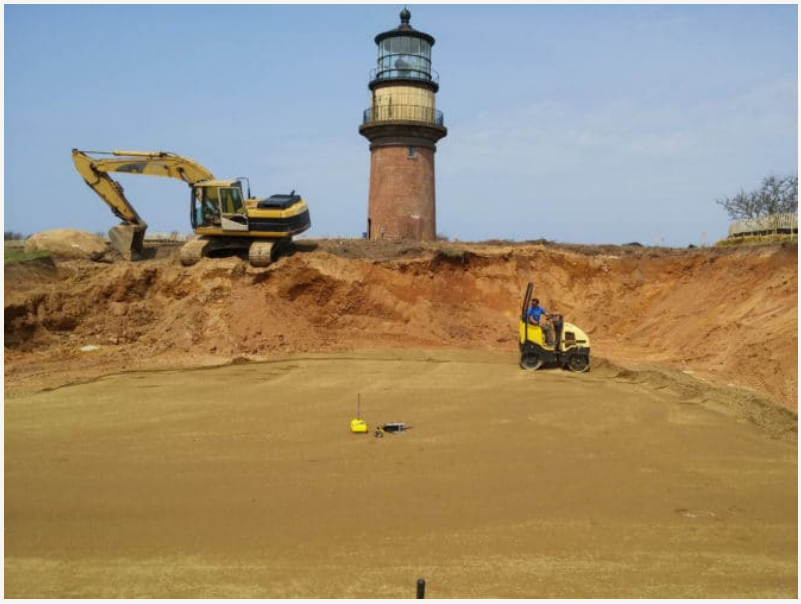

KEY CHALLENGES

The Town of Aquinnah took notice that the cliffs were receding toward the lighthouse at a rapid rate, creating the realization that if nothing were done, the lighthouse would eventually topple into the Atlantic Ocean. In 2012, the town was informed that if the cliffs were to come within another 17 feet of the lighthouse, it would not be possible to move the lighthouse. In 2013, five more feet of the cliff collapsed, accelerating the urgency to relocate the lighthouse.

Although previous studies of the shallow geology at the site predicted variable soil and ground-water conditions, the complex glacial soils and their probable relationship to perched ground-water zones and related landslide activity were not fully realized.

In order to find an appropriate property for the lighthouse, GEI performed subsurface explorations at three proposed lighthouse relocation sites, and along the haul paths between the lighthouse's current and proposed relocation sites. Waterless drilling procedures using lightweight drilling equipment and borehole backfilling measures were employed to not further aggravate the ongoing cliff erosion.

To maintain the Lighthouse's status as an active aid to navigation, the focal point of the light needed to remain at the same elevation. Through surveying the ground conditions and evaluating the soils encountered in the borings, a suitable relocation site was selected that would both maintain the elevation of the focal point and situate the lighthouse over an area aligned with a dense clay aquitard that was exposed between erosion-prone sandy zones in the bluff.

Once the relocation site was selected, activities for the move commenced quickly. Specialty contractors mobilized personnel and equipment to the island. A local contractor began site clearing and preparing the haul path and new foundation pad. Special measures were taken in constructing the 129-foot-long haul path to ensure that that the lighthouse would remain stable during the move. These measures included using well-compacted pervious dense grade aggregates, geotextile reinforcement, and proper grading and drainage side ditches to convey surface runoff.

Another challenging consideration was the social, economic, and sustainable development of the Gay Head Lighthouse project. The Gay Head Cliffs and surrounding lands have a sacred ancestral and significant cultural importance to the Wampanoag Tribe. To respect this connection between the land and the Tribe, excavations were kept to a minimum and similar soils were stockpiled separately as they were removed so that an attempt could be made to replace the soil in "reverse" order after completion of the project.

After 2-1/2 days, the Gay Head Lighthouse was successfully moved a distance of 129 feet away from the eroding cliff and onto its new foundation, 12 days ahead of schedule. Island residents, tourists, and lighthouse supporters were present during the move, cheering on the project team and witnessing the engineering feat.

In August 2015, the USCG declared the lighthouse fit for duty and light was relit with hundreds of advocates on site for the relighting ceremony. The new location should provide another 150+ years of protection for the lighthouse. The Gay Head Cliffs and surrounding lands, which are owned by the native Wampanoag Tribe, did not experience any adverse damage during the relocation. The cliffs have shown no signs of accelerated erosion as a result of the project.

This project provides future value to the engineering profession by emphasizing a process for analysis of site subsurface and erosion conditions that are critical for relocating historic structures, or constructing new ones, in the populous coastal zone of the northeastern U.S., a region underlain by complex glacial deposits, stretching from Maine to New Jersey.

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> GEI's role was paramount to the project, supporting the relocation by helping us to select the site of the relocation and how we would get it there by way of a stable haul road. Another large concern of the project was for the restoration of the Wampanoag owned cliffs site after the move. GEI did a meticulous job in ensuring the excavated soils were replaced into the areas from where they were originally taken and properly compacted. This aspect of the project was just as important as saving the lighthouse. "
>
> - Len Butler, Chair of the Save the Gay Head Lighthouse Advisory Committee

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HIGHLIGHTS

ACEC Engineering Excellence Awards – Honor Award 2017

ACEC Massachusetts – Silver Award 2017

Professional Services

- Protection and Preservation of Historic Structures
- Permitting Assistance
- Subsurface Explorations
- Geotechnical Engineering Analyses
- Design Construction Phase Services

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