



## Ice Mass & Sea Level Change Unit 5: Models of Change - How communities are adapting to sea level rise

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### Responses to port damage from sea level rise

#### The Maeslant Barrier, Rotterdam

Because of its low-lying elevation and resulting vulnerability to sea level rise, the Netherlands has emerged as a world leader in adapting to sea level changes. The Maeslant Barrier is an example of a structure designed to protect the port city of Rotterdam from increased storm surges as sea level rises. Completed in the late 1990s, the barrier consists of two large gates (each one almost as wide as 3 football fields) that close if a storm surge approaches. Unlike the Thames Barrier, which is activated daily with the tides, the Maeslant Barrier is designed for extreme surge events and is anticipated to be used only 1-2 times each decade.

#### The Northern Sea Route, Arctic Ocean

The Northern Sea Route (NSR) is a trans-Arctic shipping lane north of Canada and Russia that is currently open 50 days per year. Because of continued sea ice decreases in the Arctic, the International Panel on Climate Change (IPCC) estimates that by 2050, the NSR should be navigable for 125 days of the year and will lead to substantially shorter shipping routes than those currently available. Establishment of new ports as a result of this new shipping pattern may decrease the productivity of existing ports that are particularly vulnerable to sea level rise.

### Responses to problems related to power plants and waste disposal

#### Deer Island Sewage Treatment Plant, Boston

Designers of Boston's Deer Island sewage treatment plant (Figure 1) took future sea level rises into consideration and built the plant approximately 2 feet higher than necessary to accommodate predicted 2050 sea level rises. Although this initial increase in elevation of the plant was costly, it was considerably less expensive and risky than making sea level rise-induced modifications to the complex in the future.



**Figure 1:** Deer Island sewage treatment plant, Boston, MA. Image from Wikipedia.

## Responses to problems related to damages and loss of coastal roads and railways

### Norfolk, Virginia

Norfolk, Virginia is a coastal town located on Chesapeake Bay that is experiencing frequent flooding due to sea level rise. Watch the video clip entitled *Rising Tide* to learn about how Norfolk, VA is rising to the challenge in dealing with sea level changes.

### Relocating Highway 1 in California

The Pacific Coast Highway (Highway 1) is one of the most famous coastal drives in the world and is the only major road along the California coastline. Unfortunately, coastal erosion being hastened by sea level rise periodically damages Highway 1, causing major traffic delays and costly repairs. Starting in May 2015, approximately 3 miles of Highway 1 in San Luis Obispo County in Central California will be moved further inland to prevent continued damage from coastal erosion. To accommodate the highway relocation, 2 houses will be demolished, and natural wetlands and coastal prairie environments in the vicinity of the project will be destroyed.

## Responses to problems related to loss of land from sea level rise

### Thames Barrier, London

In an attempt to protect London from sea level rise-induced flooding (Figure 6), Britain constructed a series of steel gates known collectively as The Thames Barrier in the 1970s. Completed in 1982, the Thames Barrier extends for roughly 1700 feet across the Thames River in East London. It consists of 10 steel gates that, when open, lie at the bottom of the river, allow boats to navigate the river, and permit the free movement of water (Figure 2). To close, the gates rotate upward over 75-90 minutes and block water from moving upstream toward the city during high tide and storm events.



**Figure 2:** Thames Barrier, London. Wikipedia.

### England—giving up and letting go

As winter storm waves and rising sea levels accelerate coastal erosion at alarming rates, Britain's Environment Agency has decided to adopt a policy called managed coastal realignment on the Manhood Peninsula in southern England. This controversial strategy involves making the decision to abandon coastal fortifications such as seawalls, stopping beach nourishment, and allowing the coastline to migrate inland. Prior to making the decision to "let it flood", repairs for a single seawall had cost over \$300,000 annually. However, stakeholders had to consider that allowing the seawall to fail would endanger hundreds of homes, a water treatment plant, and a major road. The decision was made to cut a channel into the seawall, partially compromising its integrity, allowing farms and a nature preserve to be overtaken by the ocean, and construct a

curved embankment of clay to reshape the coastline. This plan came at a cost of \$46.5 million. The preliminary results of the project are encouraging—no surface flooding occurred during the first winter after coastal realignment.