# Developing a More Resilient Future: Thriving - Come Rain or Come Shine

# Chesapeake Bay Foundation

Save the Bay ‘s waterways, and keep them saved, through: Education, Restoration and Advocacy.

# What impacts of climate change are we seeing in the Bay?

Photo Credit: Matt Rath/Chesapeake Bay Program

- Islands are disappearing.
- Coastal flooding is more frequent.
- Sea level is rising
- Intense storms are more frequent.
- Water temperatures are increasing in more than 92% of the Bay (Ding & Elmore 2015).
- Important Bay species are suffering (e.g. eelgrass; CBF 2007).

# What will climate change mean for the Bay?

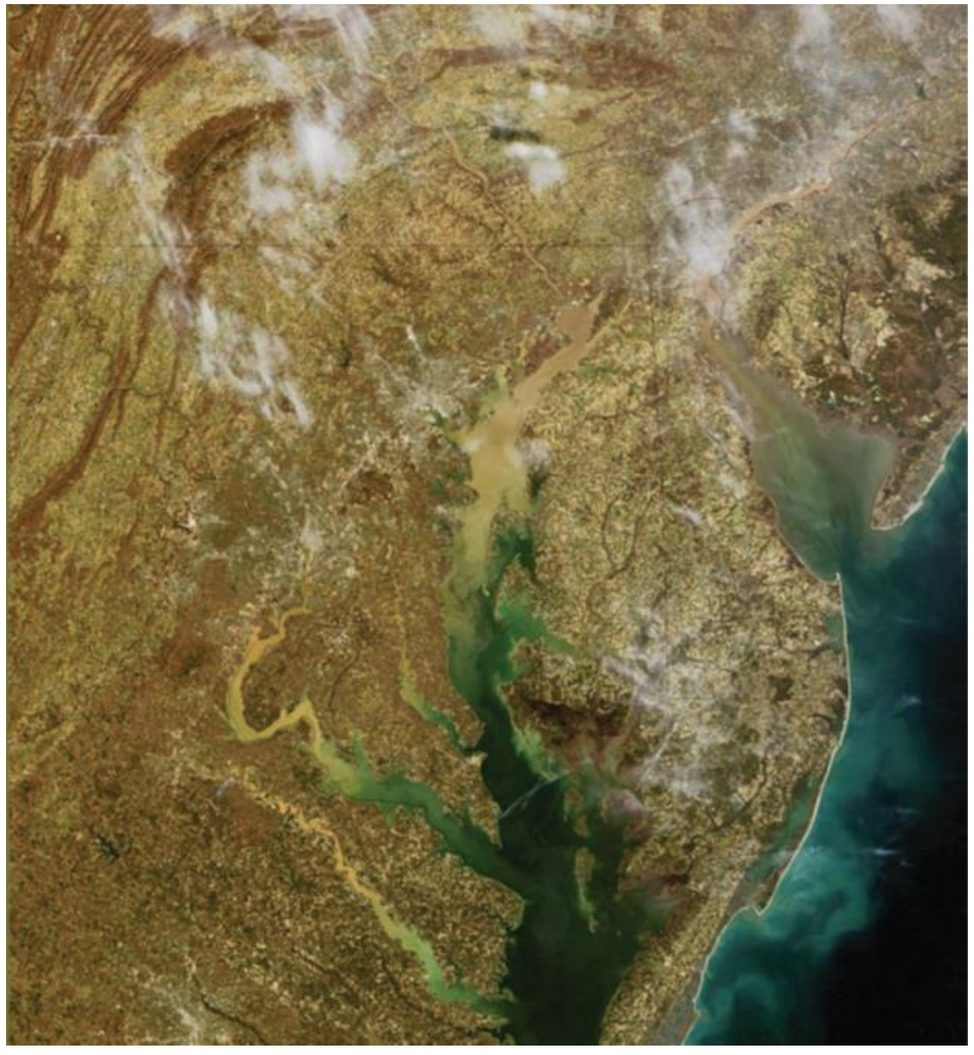


Photo Credit: NASA

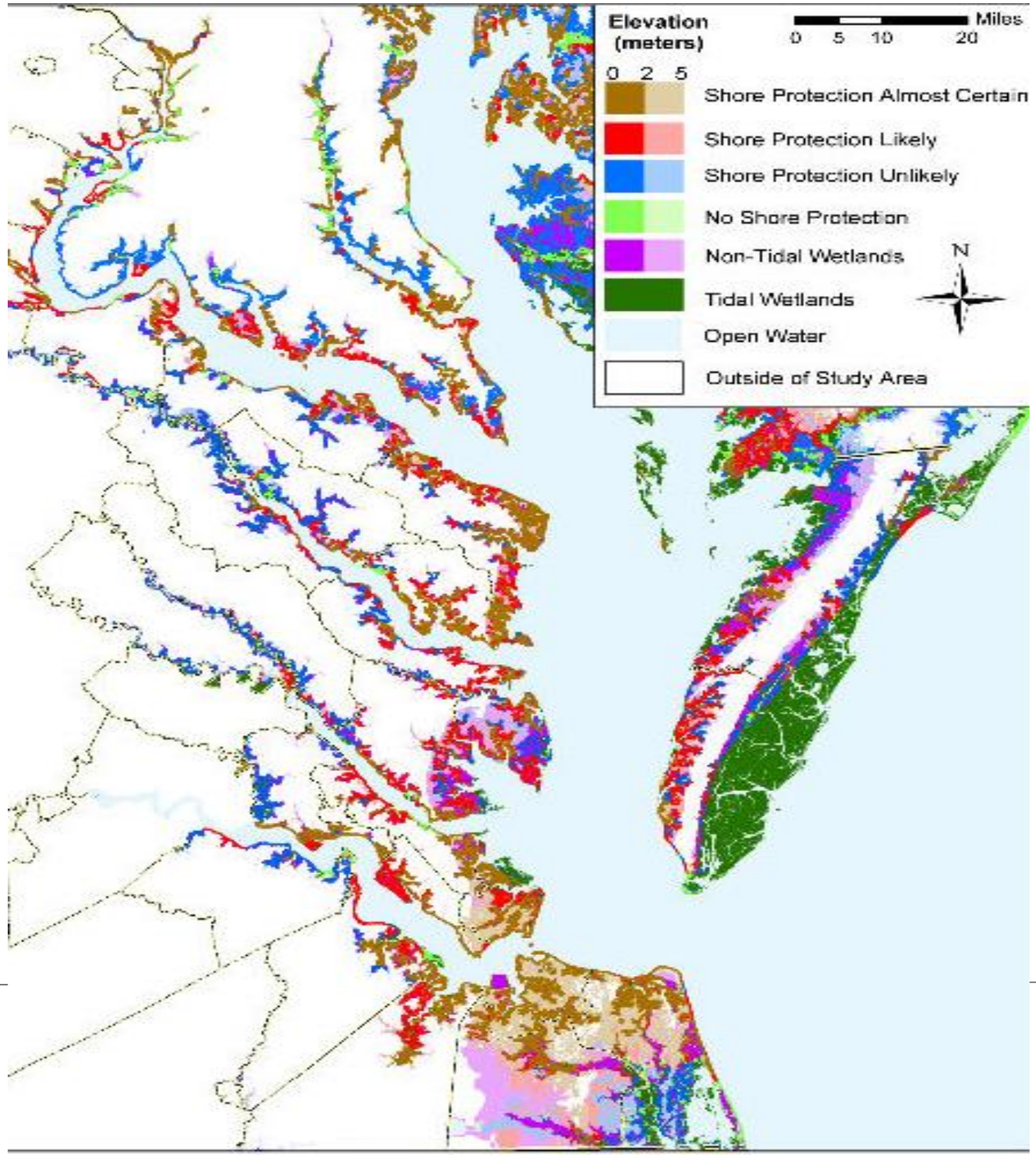
- Sea level rise (2 - 7 ft. in next 100 years)
- More flooding and drought
- Increasing water temperatures (3.6 to 10.8˚F)
- More precipitation, esp. in winter and spring
- Greater runoff into Bay from tributaries (*Pollution*), increases incidence of hypoxia
- More intense weather events

# What will climate change mean for the Bay?

Tangier Island, Photo Credit: tangierisland-va.com

- Reduction of wetland habitat, exacerbated by hardening of shorelines
- More harmful algae blooms
- Bay acidification, harms oysters
- Warmer water means less dissolved oxygen - less striped bass
- Reduced prevalence of eel grass
  - less Blue Crab habitat
- Warmer waters
  - less Brook Trout
- Favoring of warm-water fish and shellfish
- SLR will expose contaminated soils in industrial areas

# Sea Level Rise in the Bay – Areas at Risk



# Vision for the new Center: raising the bar again.

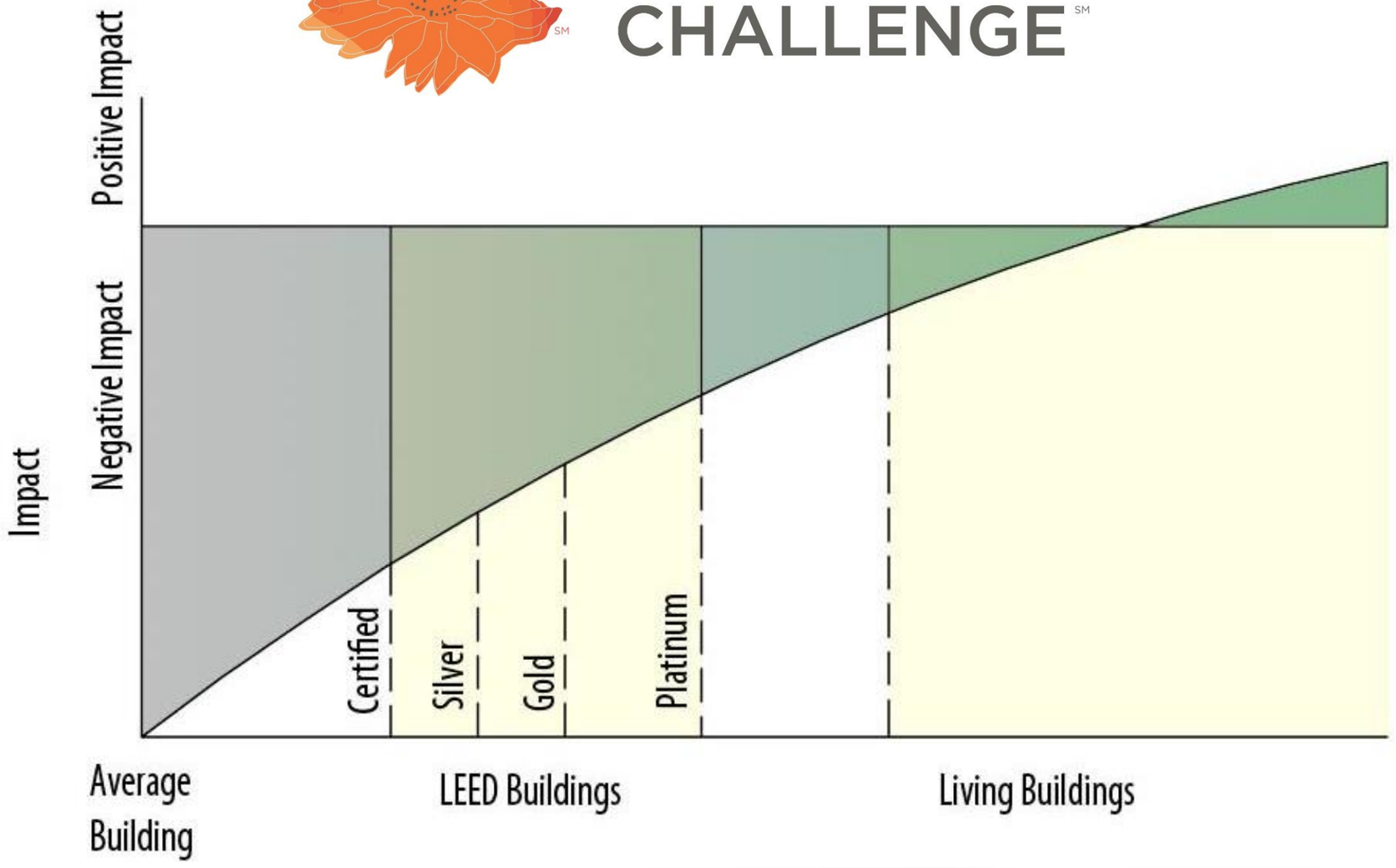
First LEED Platinum Building -2000
Chesapeake Bay Foundation
Philip Merrill Environmental Center
Annapolis, Maryland

Resilience

- Hurricanes
- Flooding
- Power outages
- Stormwater runoff
- Drought

# What is a Living Building?

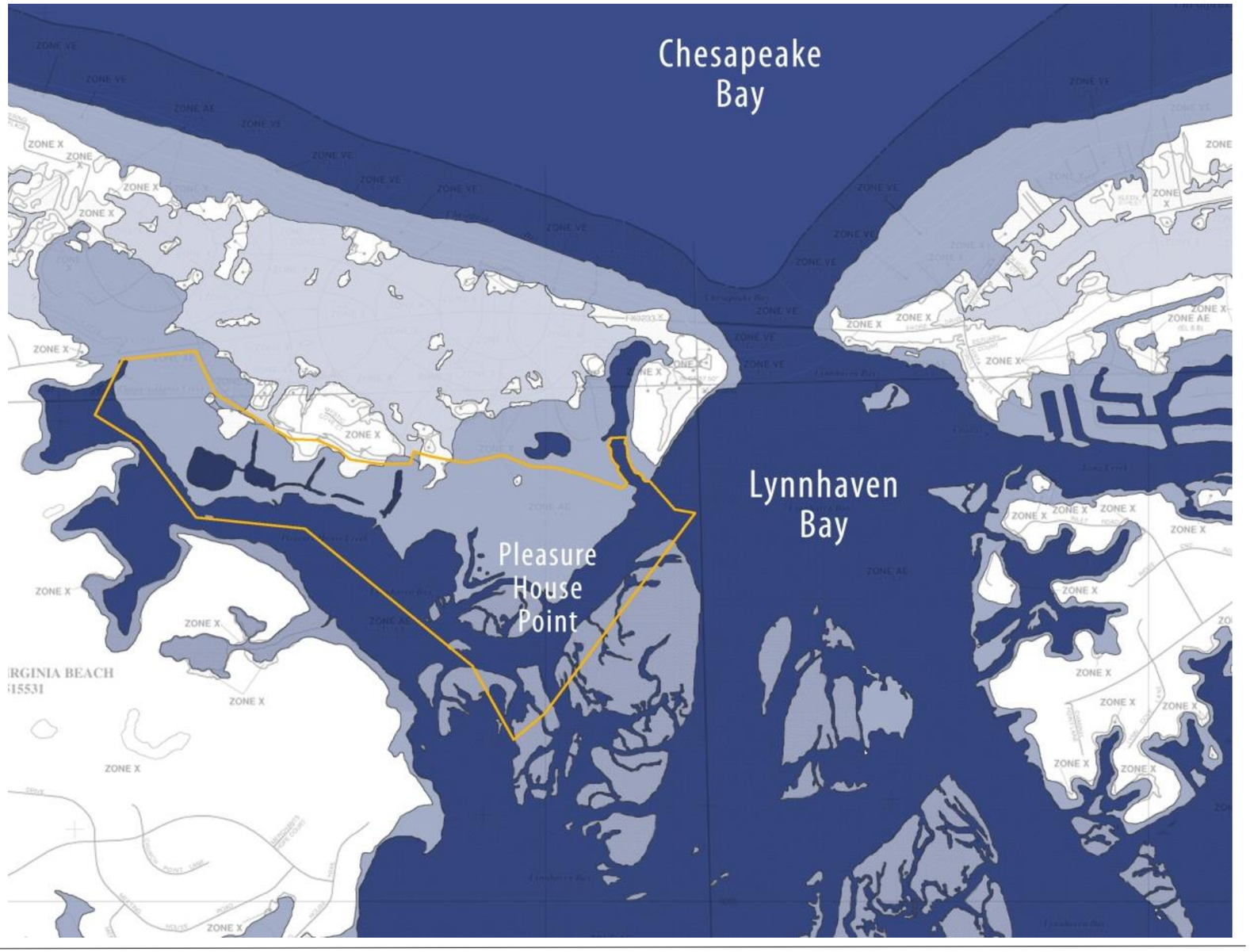
LIVING BUILDING CHALLENGE℠



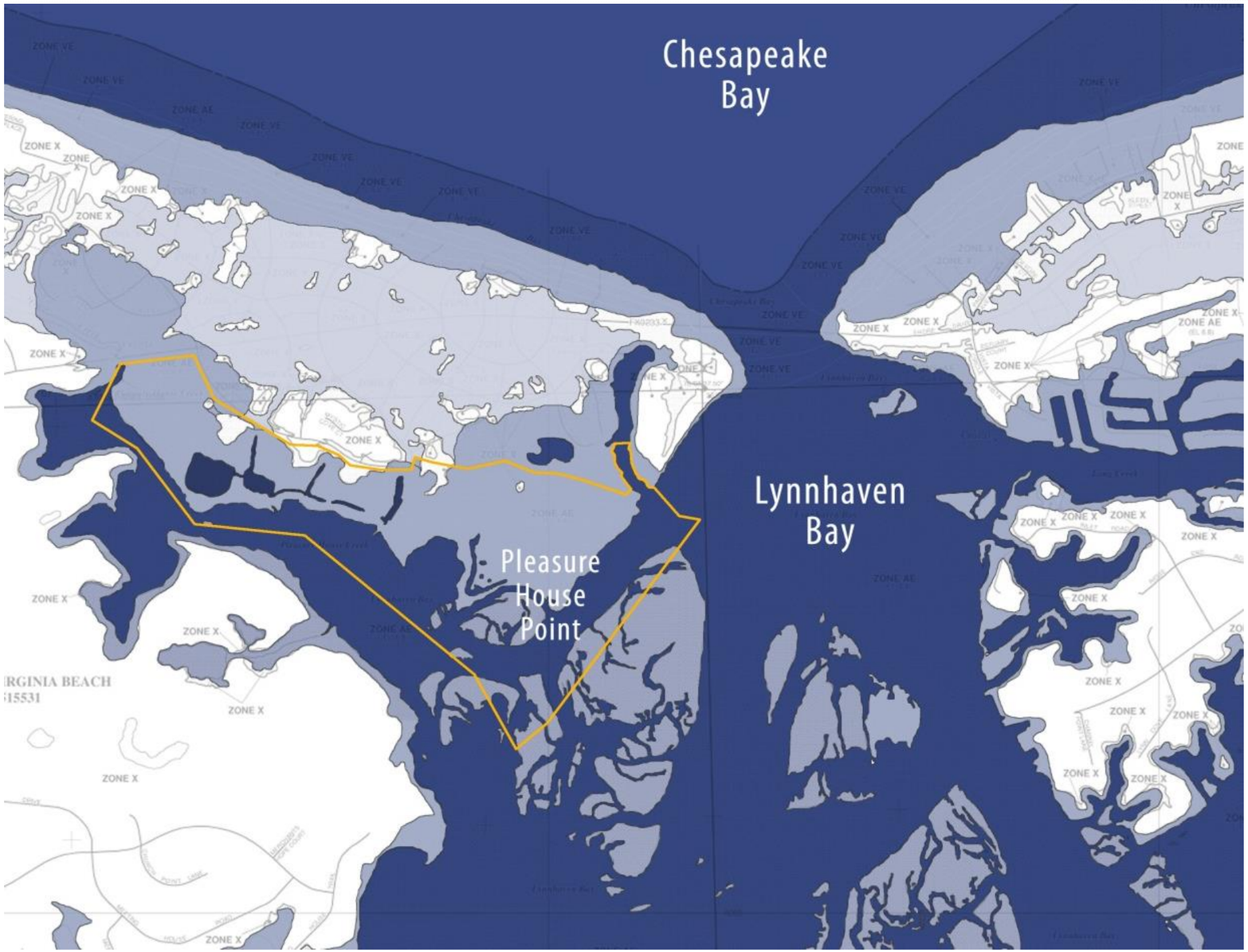

**Truly Sustainable Development:**

- Meets entire energy use through on-site renewable energy
- Meets entire water use through captured rainwater/waste water
- Treats all waste water and stormwater on site
- Enhances human health
- Enhances habitat & local ecology
- Is regenerative and **resilient**

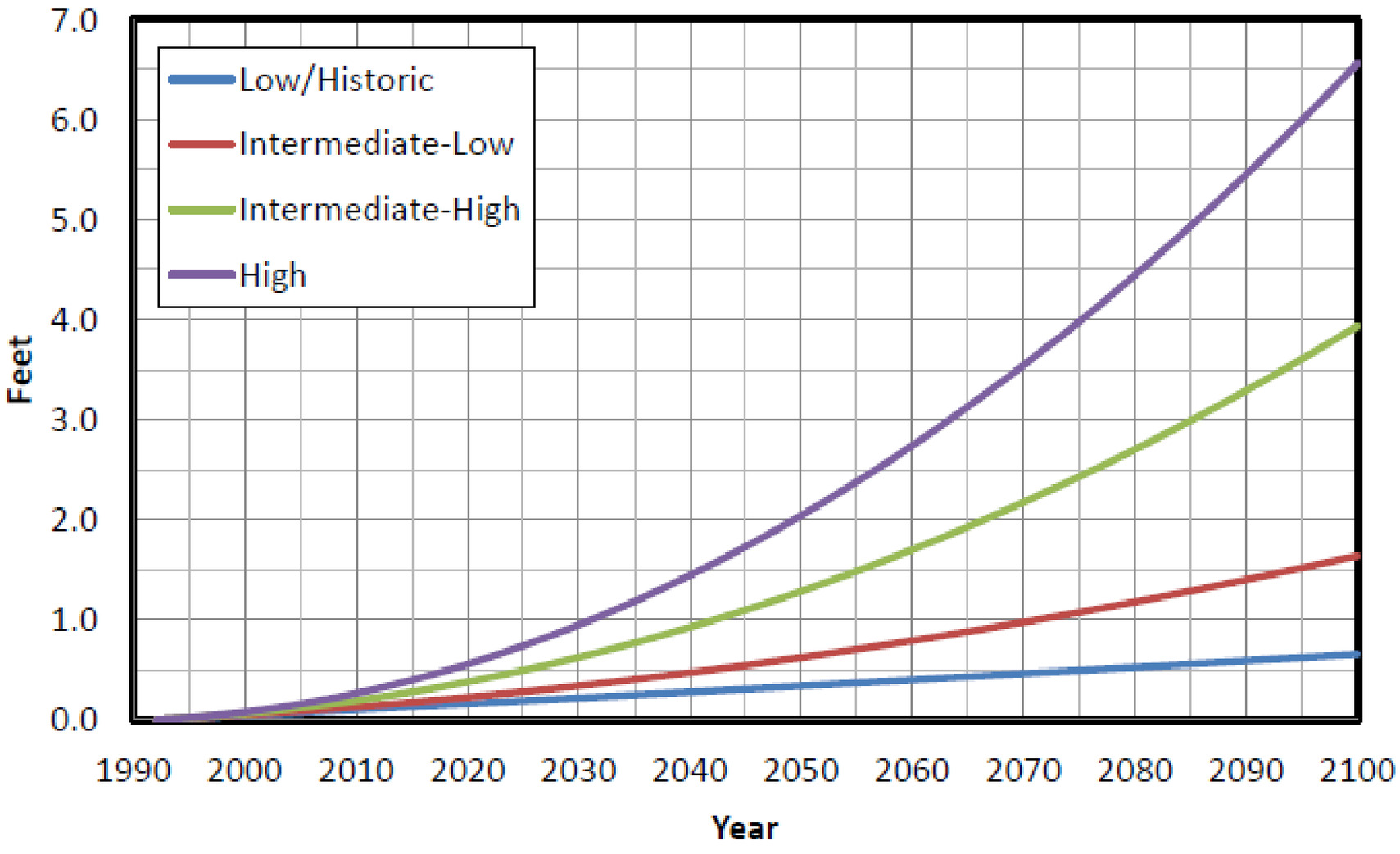
# Site Design – Building within the 100-year flood

# Resilient Motivations

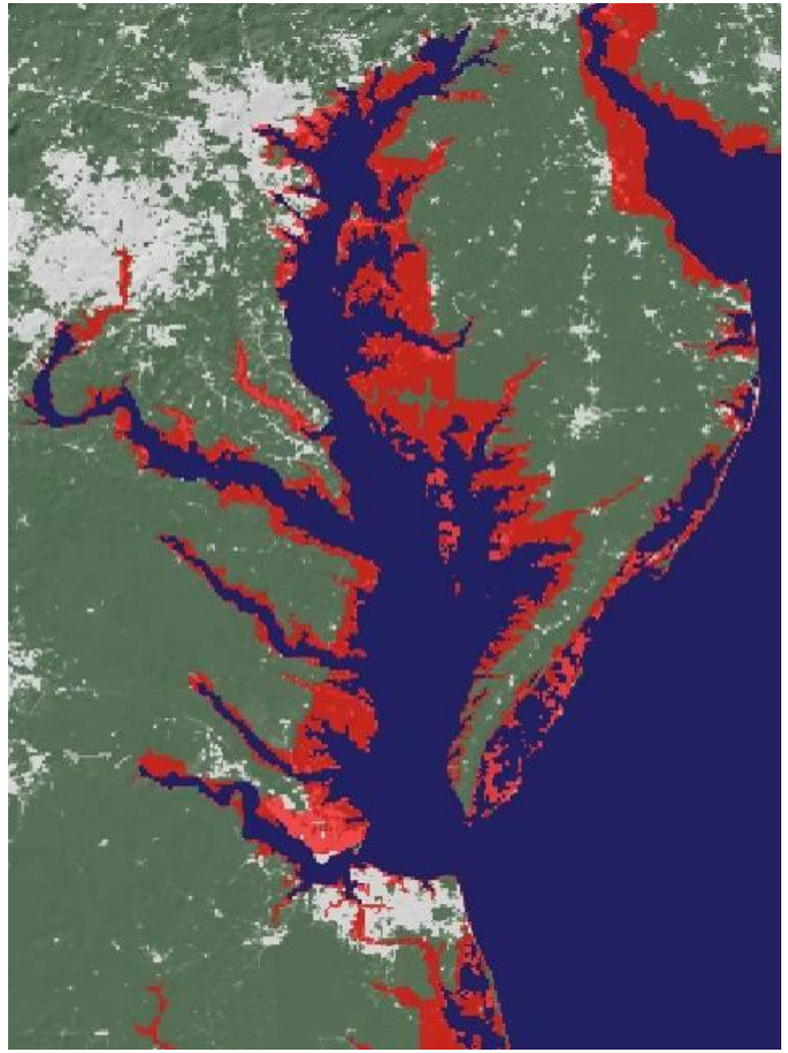



# Projected Global Sea Level Rise: 1992 -2100



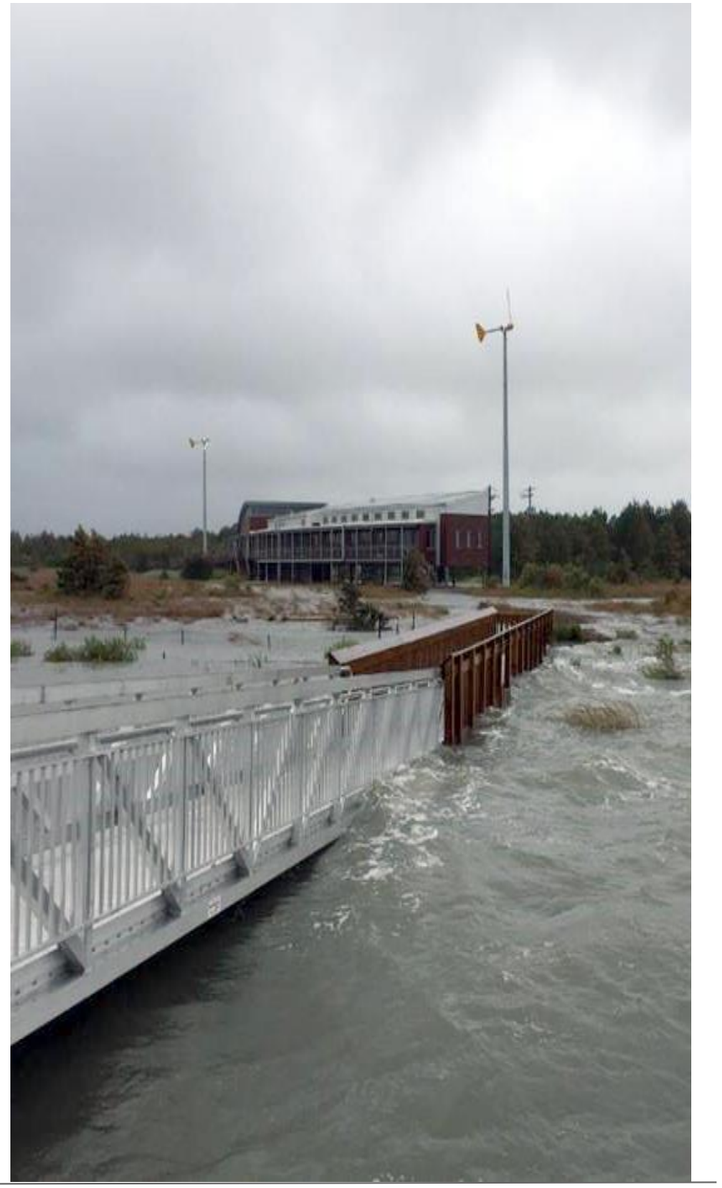
# Anticipating Sea-Level Rise


Pleasure House Point Site Plan

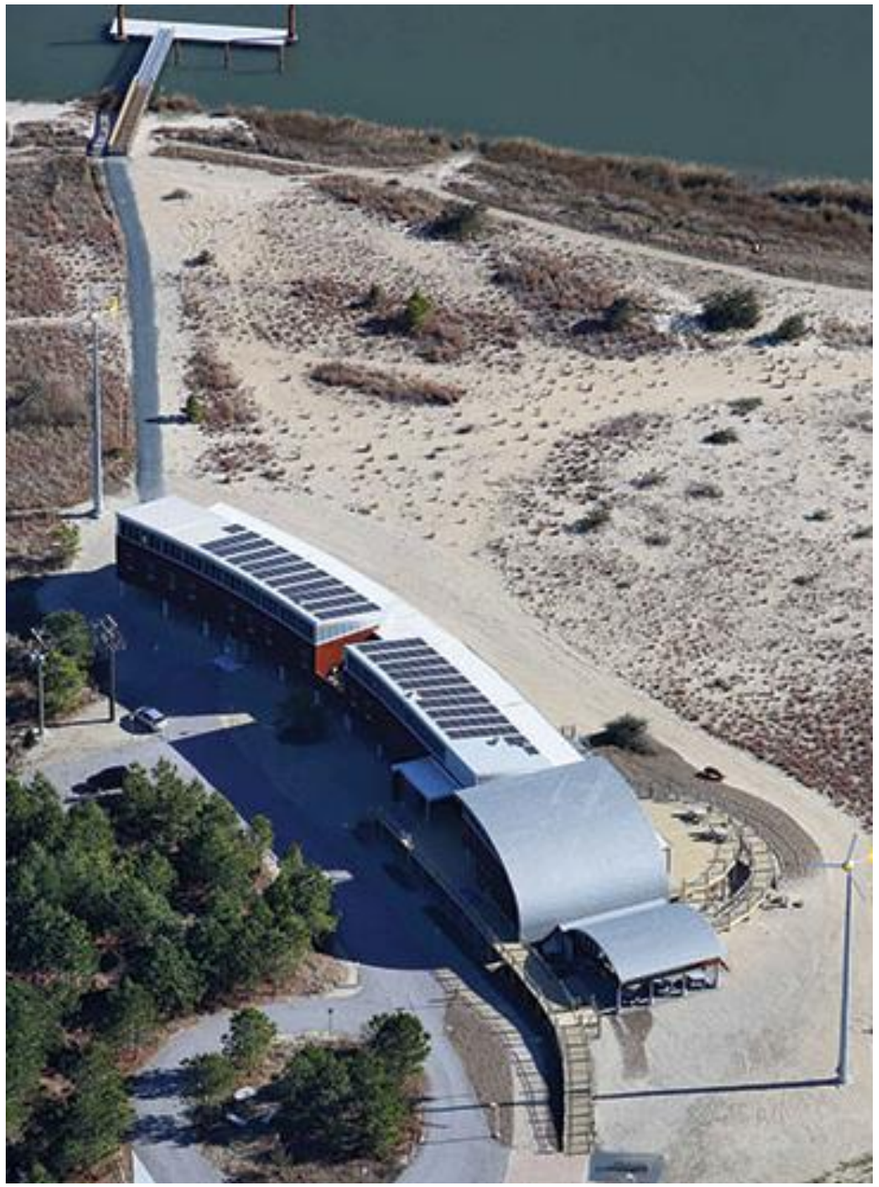


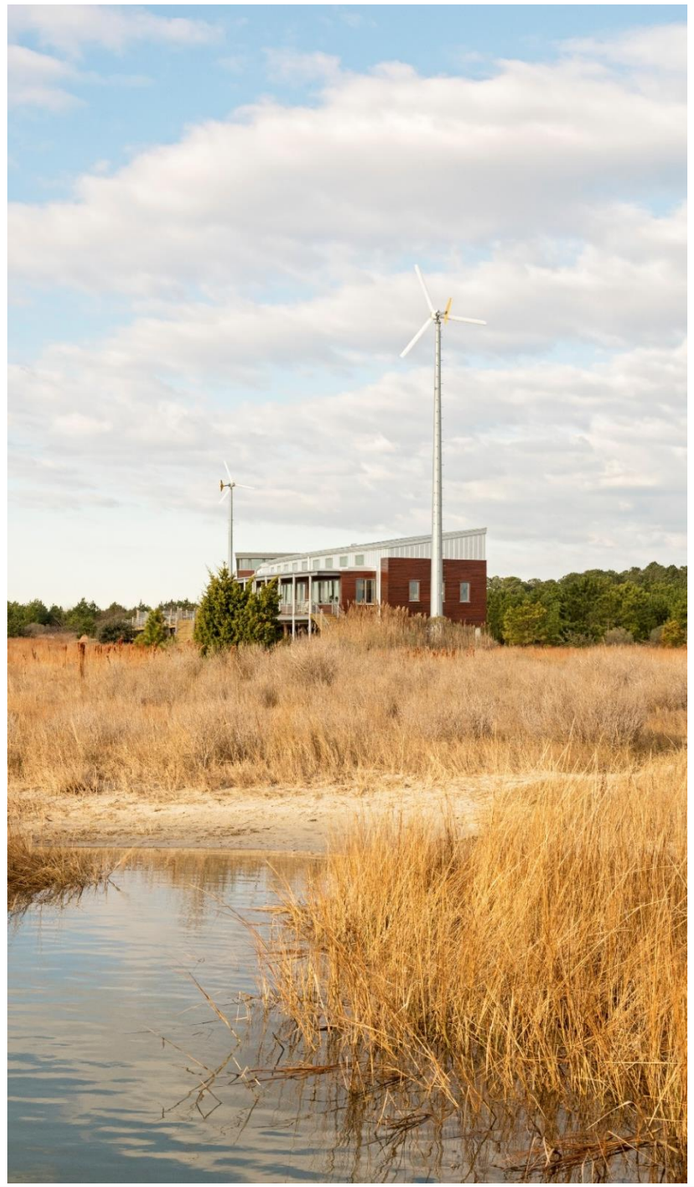
Sea Level +1M
Anticipated Shoreline in 2100

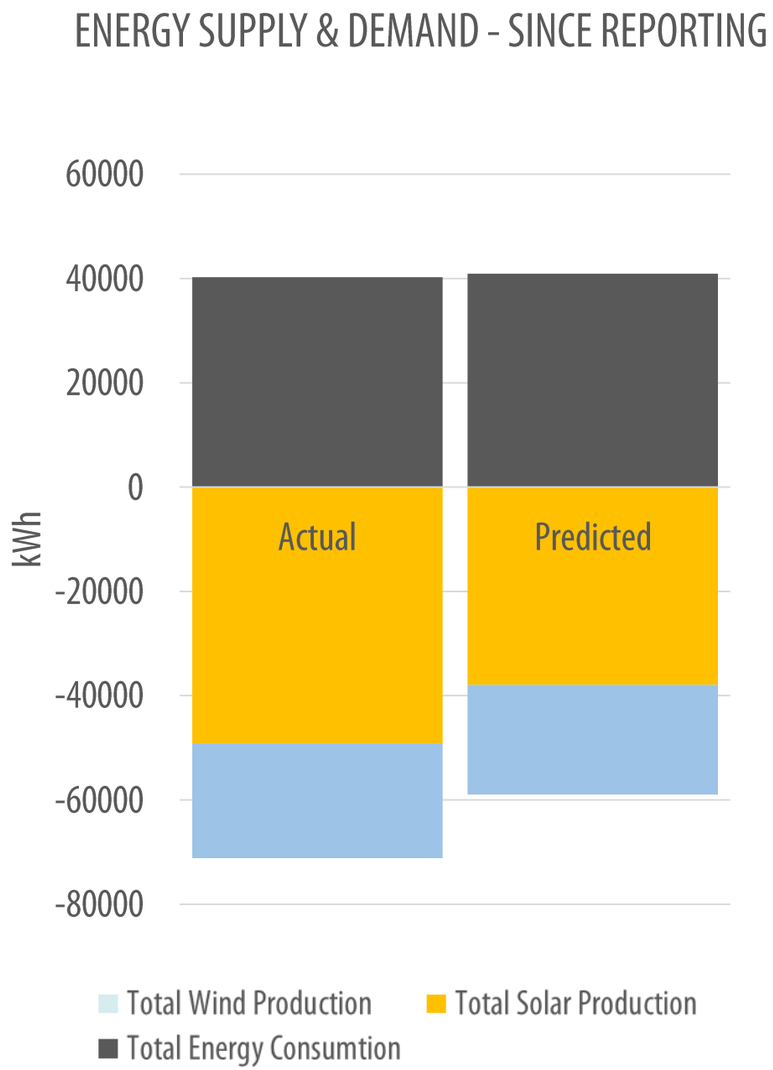
# Weathering the Storm



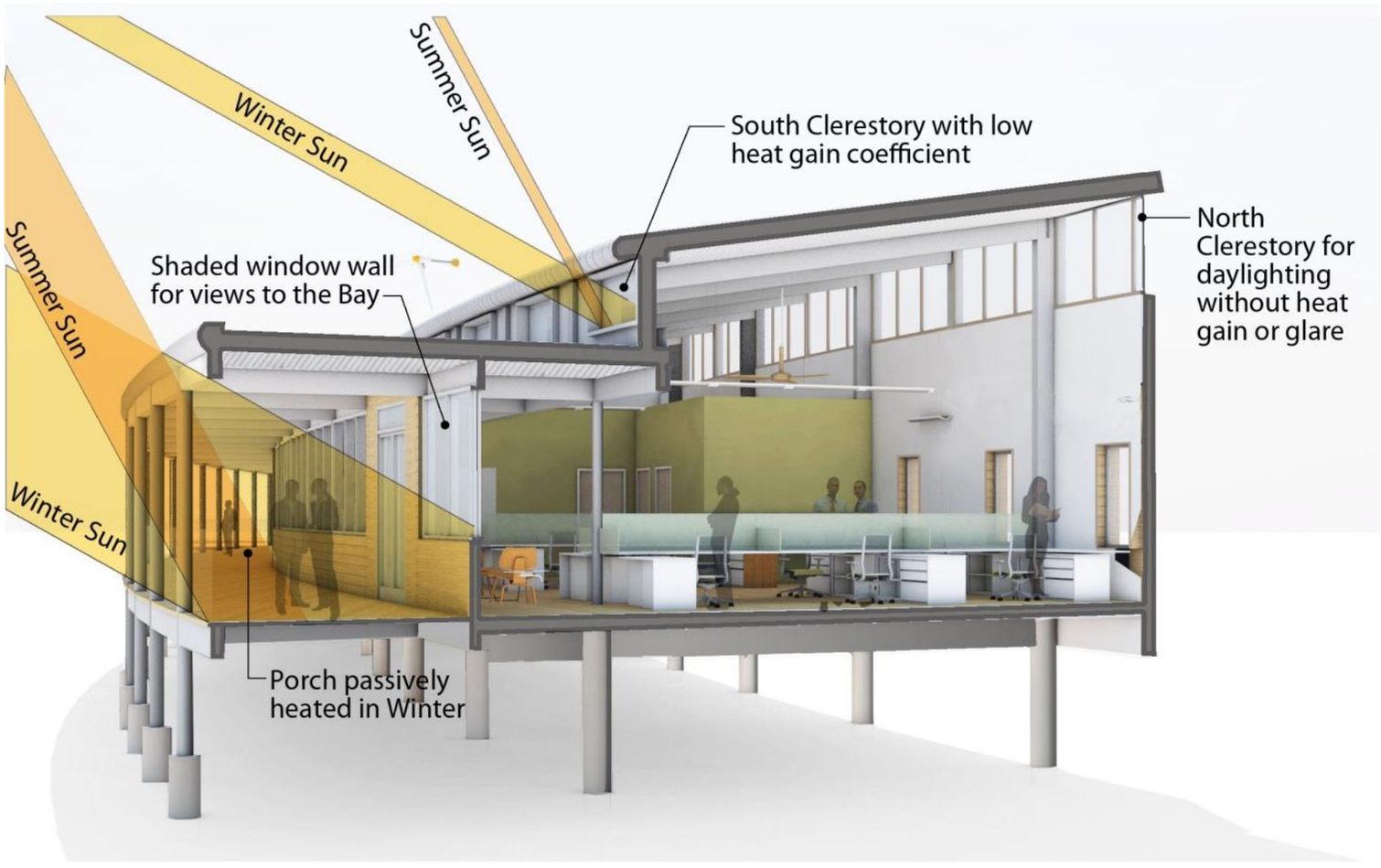
# Energy Independence: Net-Zero Energy

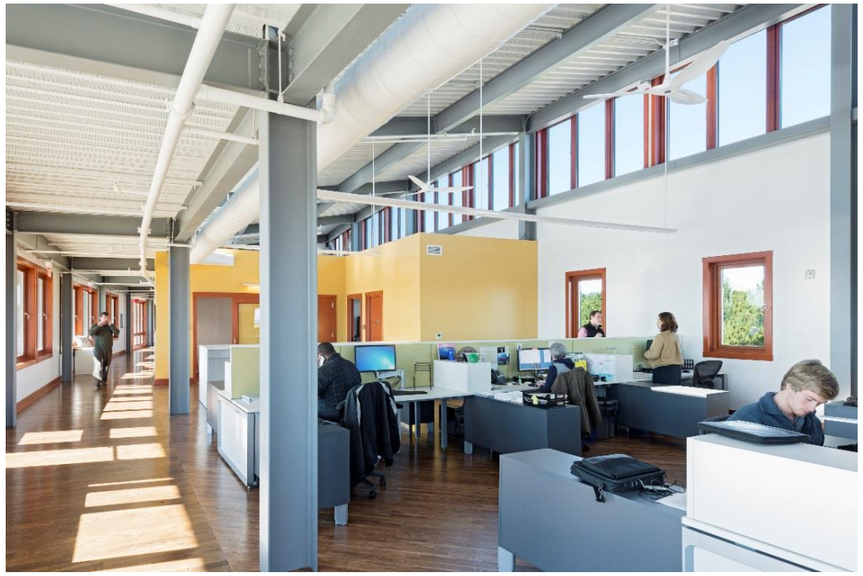




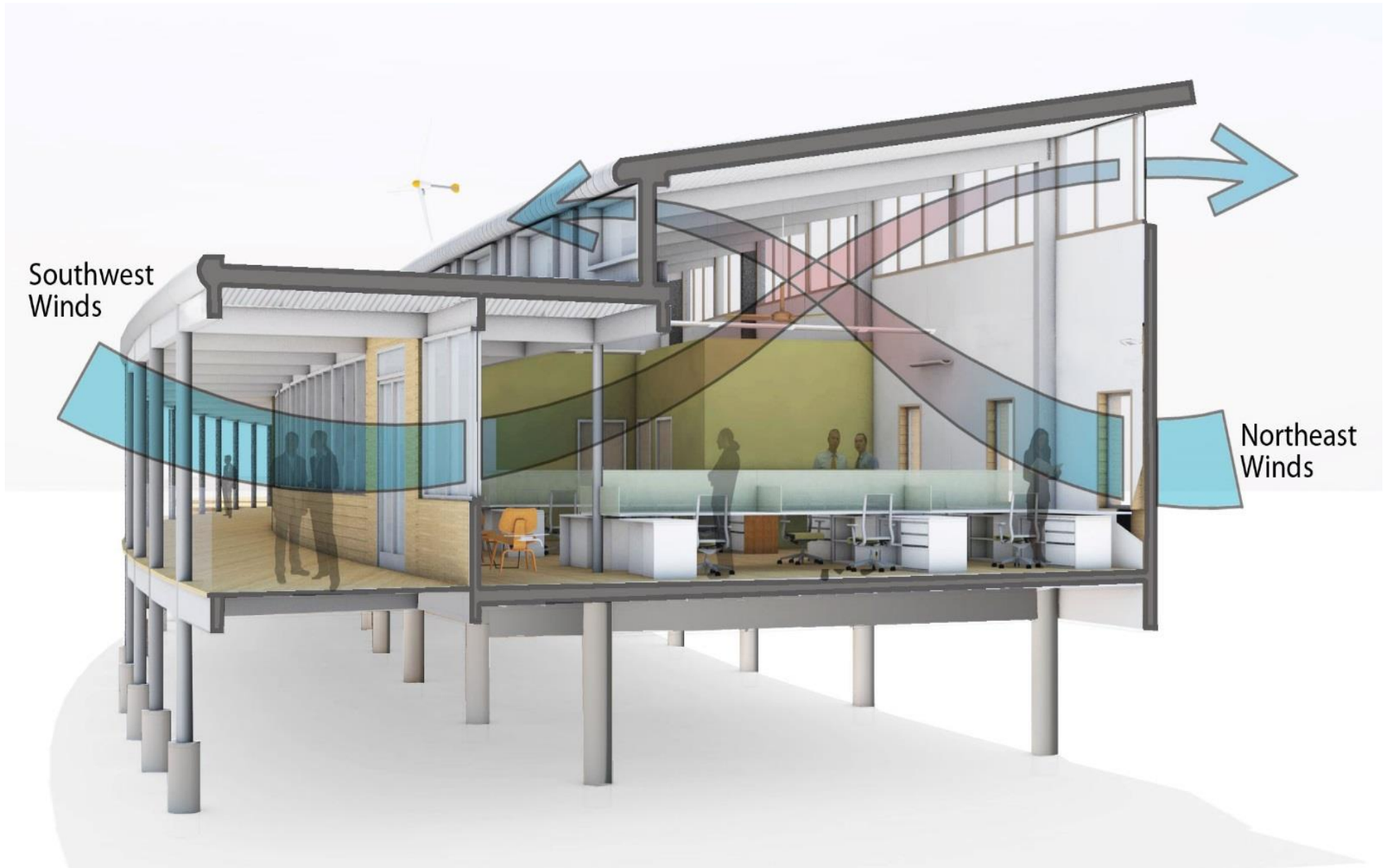


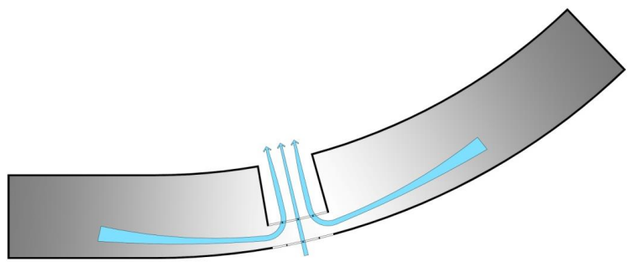
# Energy Independence: Daylighting



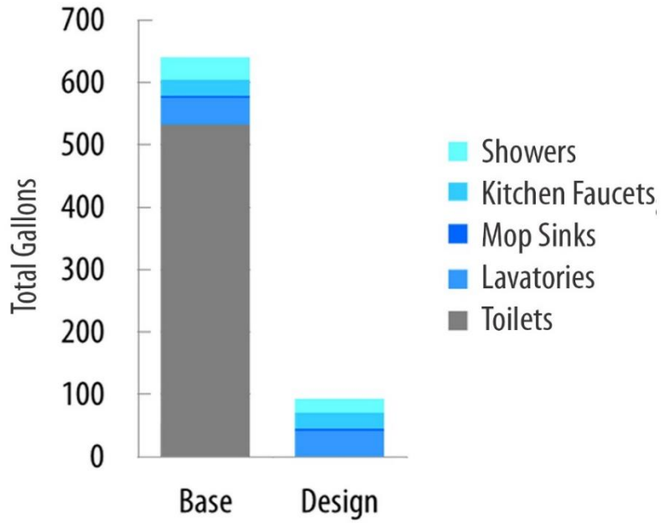



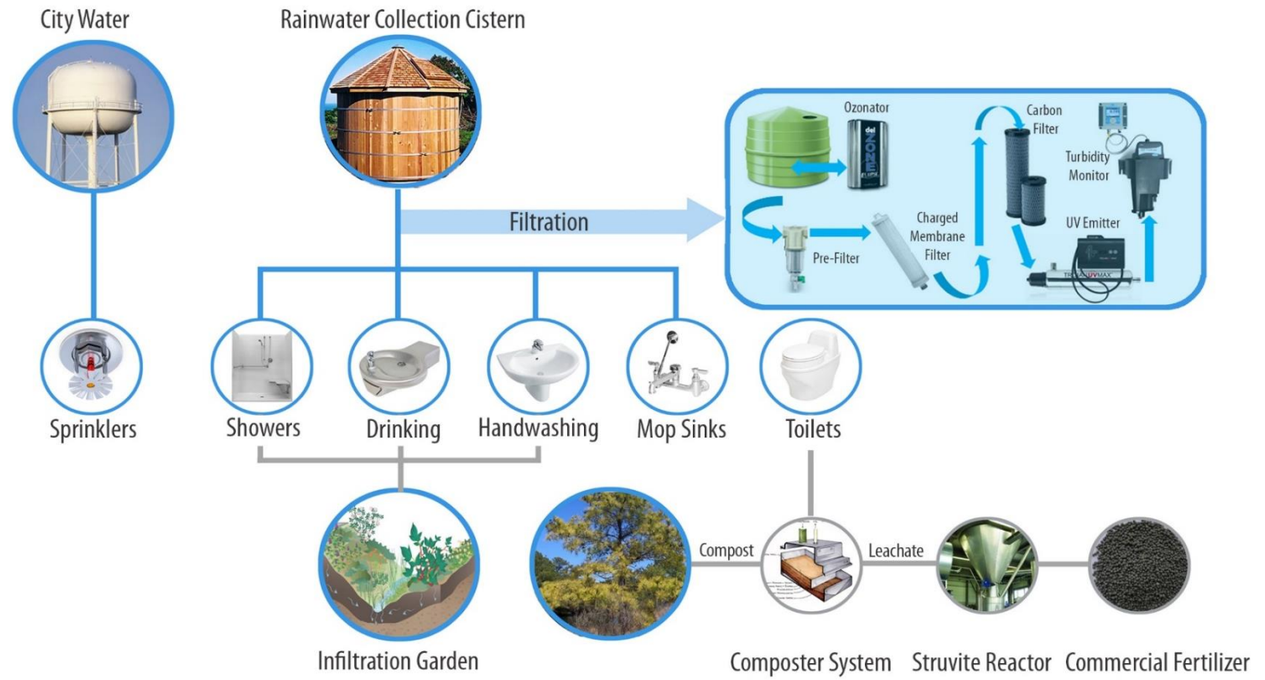
# Energy Independence: Staying Cool

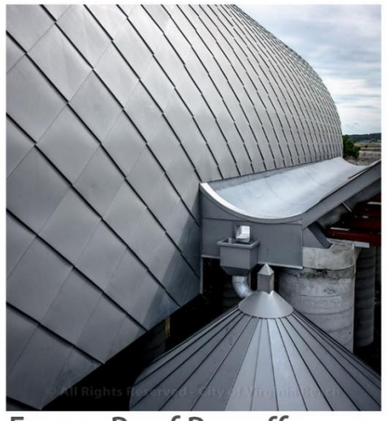


# Water Independence: Net-Zero Water





Excess Roof Runoff

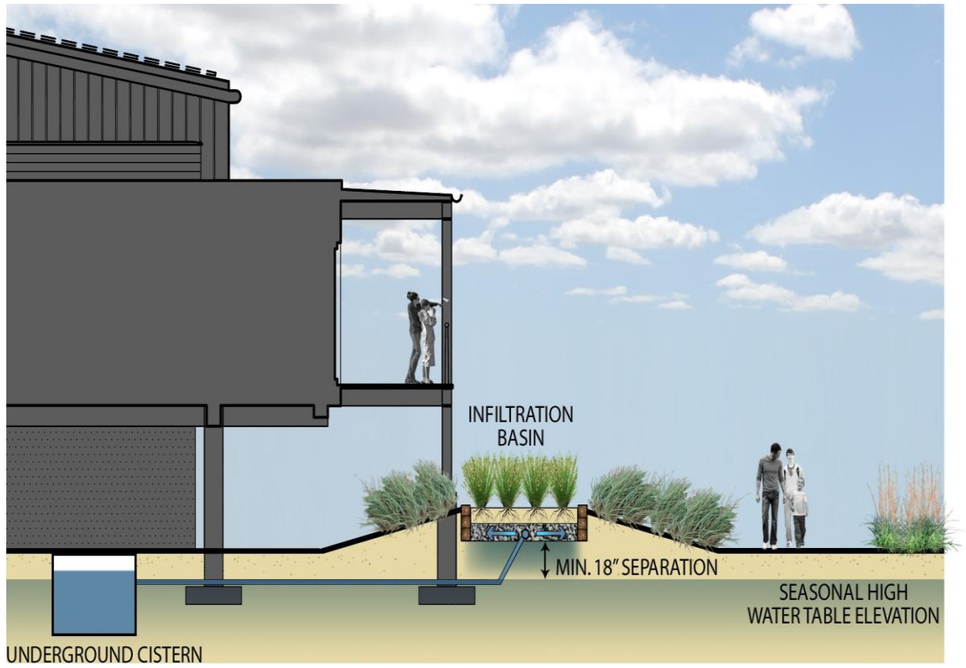

First Flush Diverter

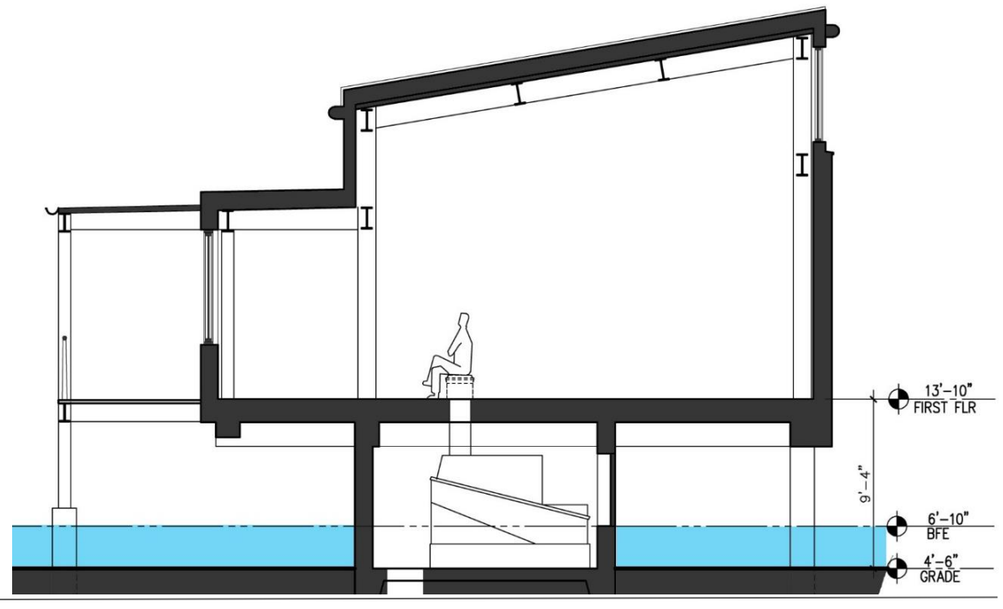

Filtration System


Rainwater Tanks


Composter Tanks

# Anticipating Sea-Level Rise



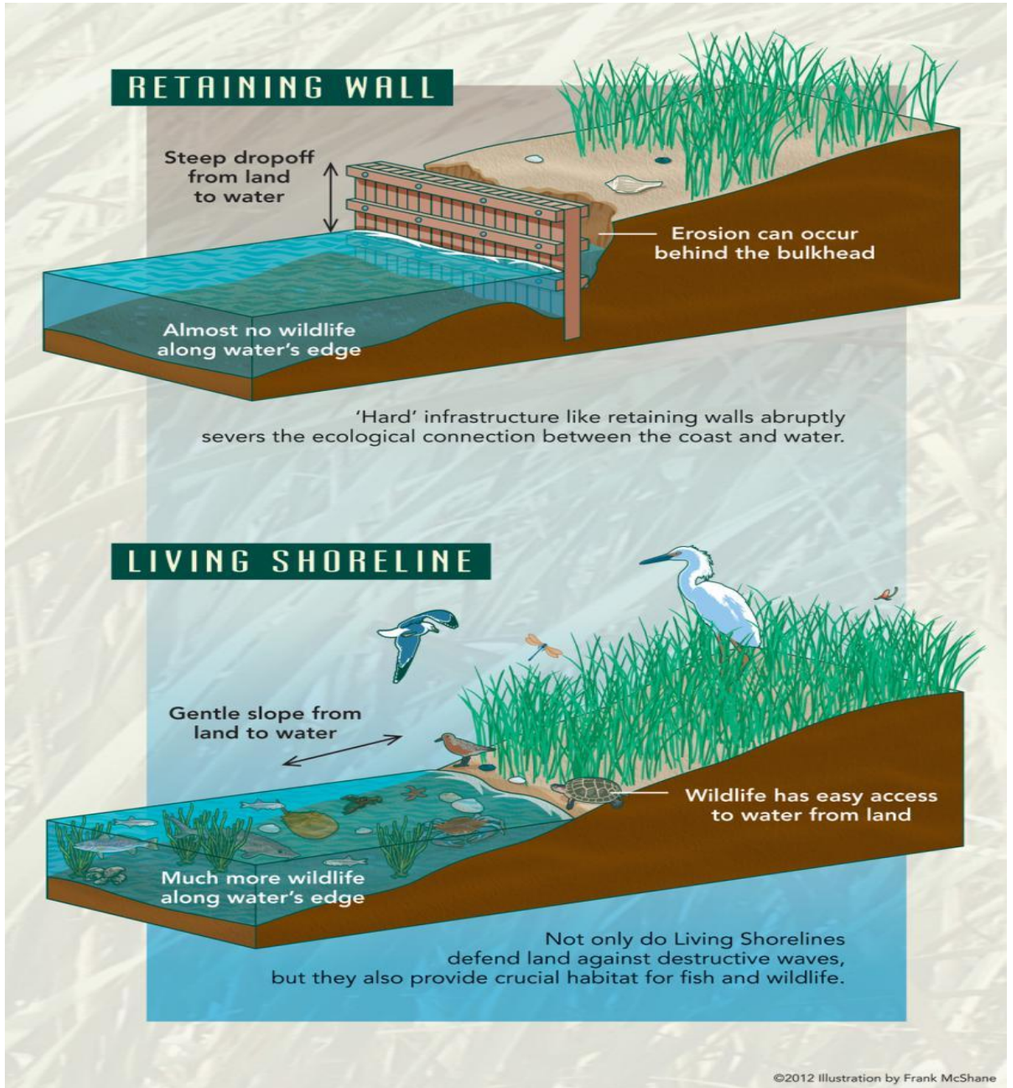



# Planning for Sea Level Rise: Green & Grey Infrastructure

- CBF recommends a holistic approach examining all options on a case-by-case basis, integrating green infrastructure at every opportunity.
    - Engineered techniques that retain, store, and infiltrate water at its source, e.g. downspout disconnections, rainwater harvesting, rain gardens, tree boxes, bioswales, infiltration trenches, and permeable paving.
    - Engineered wave attenuation techniques that protect land, hold flood water, and prevent erosion, while also filtering water, providing habitat for wildlife, and reducing pollution, e.g. living shorelines, living breakwaters and oyster reefs.
- Many community benefits: reduces polluted runoff, improves habitat, improves air quality, reduces urban heat island, reduces atmospheric $CO_2$, improves aesthetics, and improves community livability.
- **Flood protection costs could be reduced by nearly 50% by integrating marsh restoration into a new, multi-purpose hybrid flood protection system** - *Source*: San Francisco's Bay Institute

# What are the advantages of “living shorelines”?

- Wildlife access
- Wetlands able to migrate inland over time as sea level rises
- Improve habitat for aquatic and terrestrial species
- Filter pollutants
- More attractive, less costly
- Attenuate wave energy effectively



# Greener Communities Can Be More Profitable

- **Improves Real Estate Values**
- **Ridgefield Community – Wilmington, NC**

  Project redesigned with low impact development techniques - reduced development infrastructure from $2 million to $899,000 and added open space, 4 additional lots (+$500K profit), and reduced stormwater maintenance costs.

- **Somerset Subdivision, Prince George County, Maryland**

Half of this D.C. subdivision installed bioretention cells (rain gardens) and vegetated swales to replace conventional stormwater management systems. The LID portion of the neighborhood saw 20% less runoff compared to areas with conventional stormwater management. Metal concentrations in runoff were also reduced in the LID area. The project resulted in over $785,000 in savings, and a 32% price decrease from conventional development.

# Creative Adaptation and Redesign

Photo Credit: Google Earth

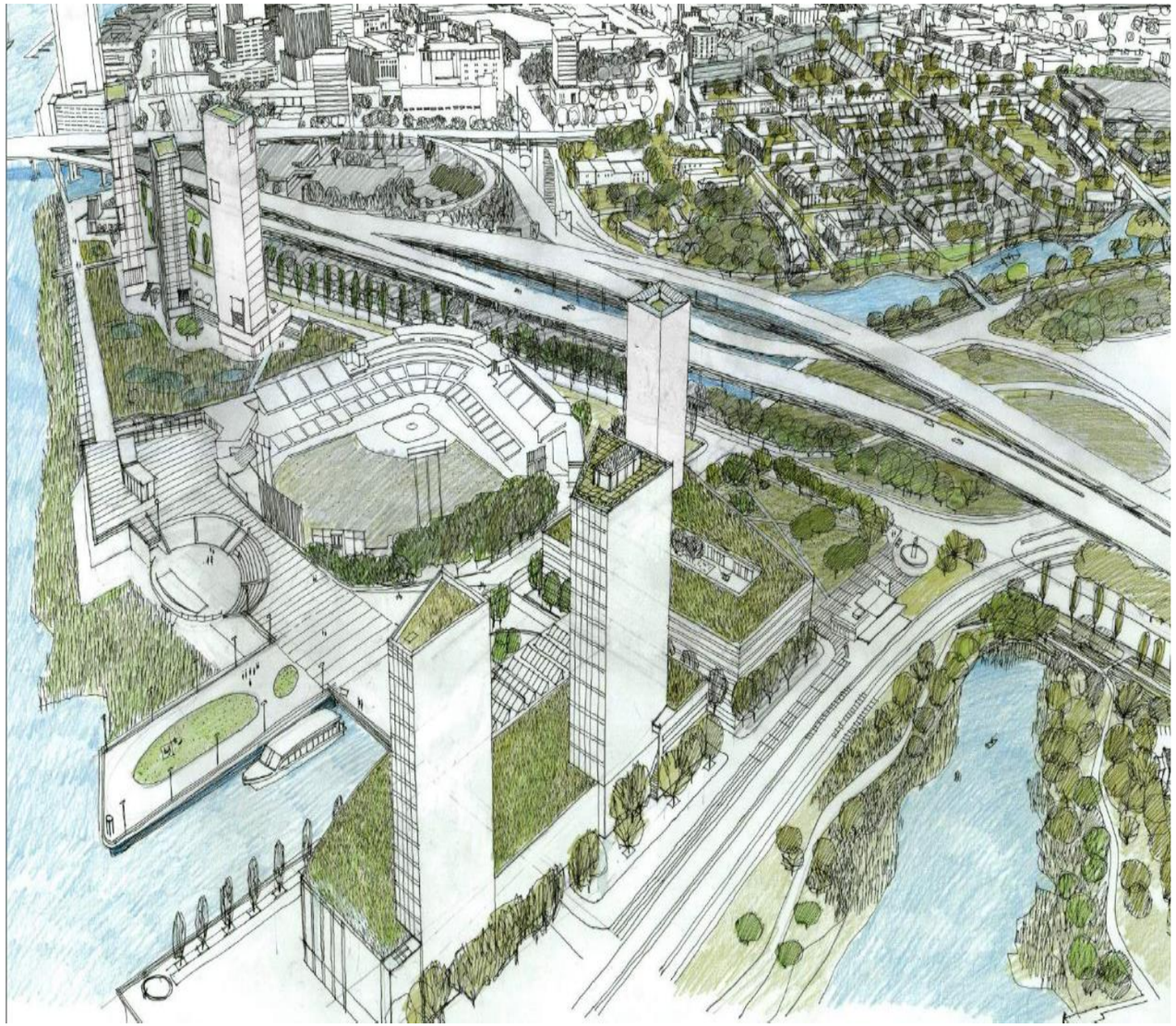


Photo Credit: Image Borrowed From Dutch Dialogues 2015

# Learn more about Brock

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