HRSD

A Risk-based Approach to Prepare Utility Infrastructure for Storms Ahead

Considerations of a Proactive Utility in Coastal Virginia

NEWEA
January 26, 2022

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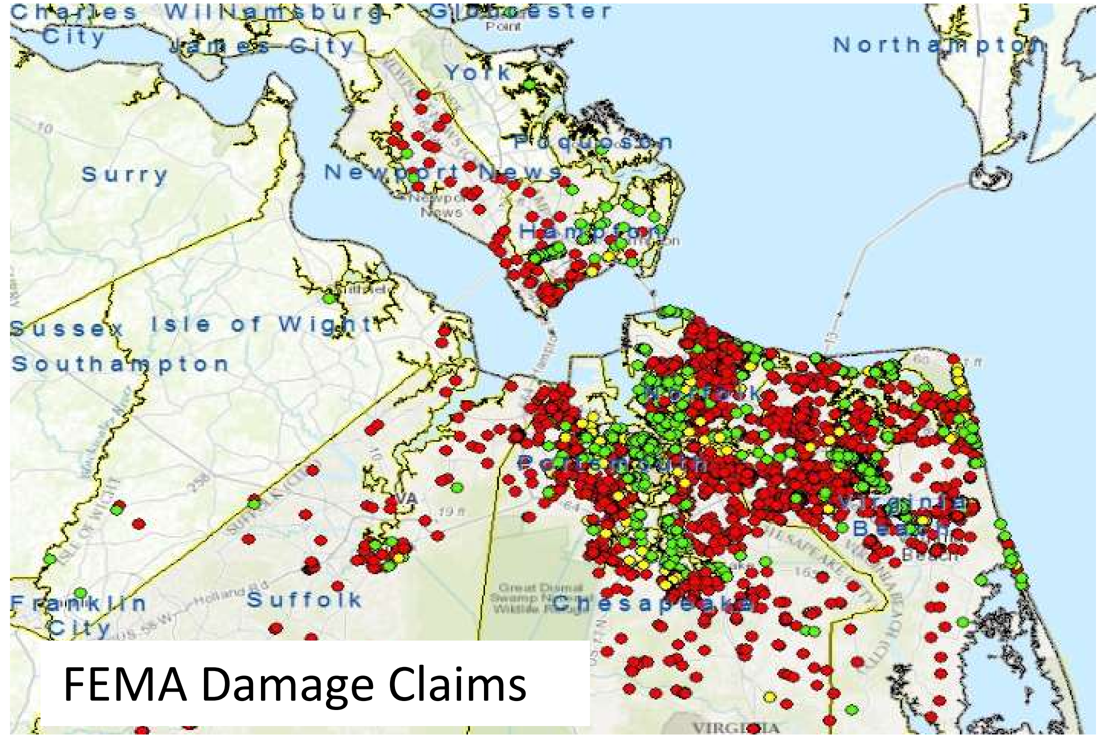
Irvington, NJ near Newark



FEMA Damage Claims

Tropical Storm Ida:
6.4” of rain in 3 hours (a 2000-year event)
8.4” total

Hurricane Matthew:
12 inches of rain, and
12 inches of rain 16 days prior to the event

Climate Change Planning is Long Range

- Climate Change Plan will address the next 80 years of climate change impacts
- This 1st version of the plan will be developed to provide a foundation for future updates and utilize varying levels of detail based on the timeframe and magnitude of facility vulnerability
- Focused on climate change related flooding impacts

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Climate Change Plan

Key Data Inputs
- Flood elevations database
- Vulnerability cost and losses database
- Mitigation costs, benefits, Benefit Cost Ratio (BCR) values

Decision Support Tools
- Visualization dashboard
- Aggregated view of vulnerability and mitigation
- Ability to modify the implementation schedule

Project Documentation
- Highly visual executive summary
- Technical report and appendices
- Product examples to support future implementation

Vulnerability Assessment and Flood Mitigation Analysis Approach

Characterize Critical Equipment: Core Functions / Assets and Costs

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Conduct Site Visits & Inspect Plans:
Elevation of Lowest Point of Entry of Water and Core Function Assets

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Flood Elevation & Hazard Determination

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Establish Site-Specific Flood Mitigation Measures and Costs

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Calculate Flood Risk: Annualized Losses Over Time / Benefit-Cost Ratio

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Fact Sheets & Dashboard Visualization for HRSD Stakeholders

Core Functions and Critical Assets

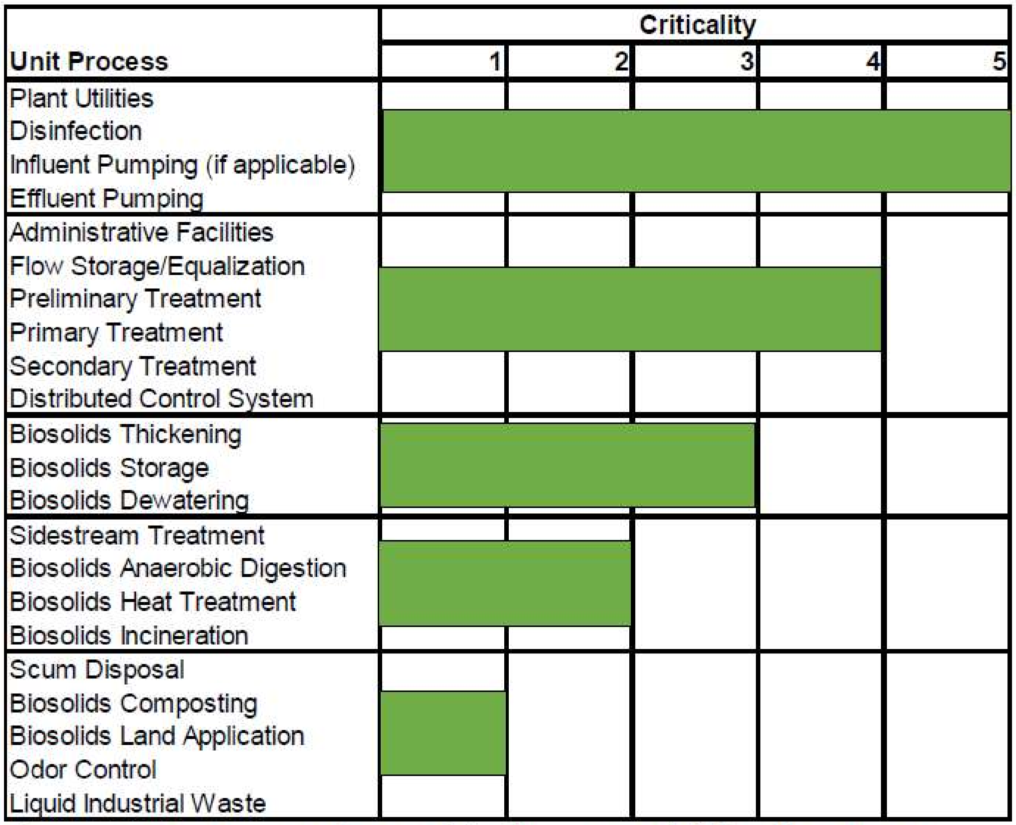
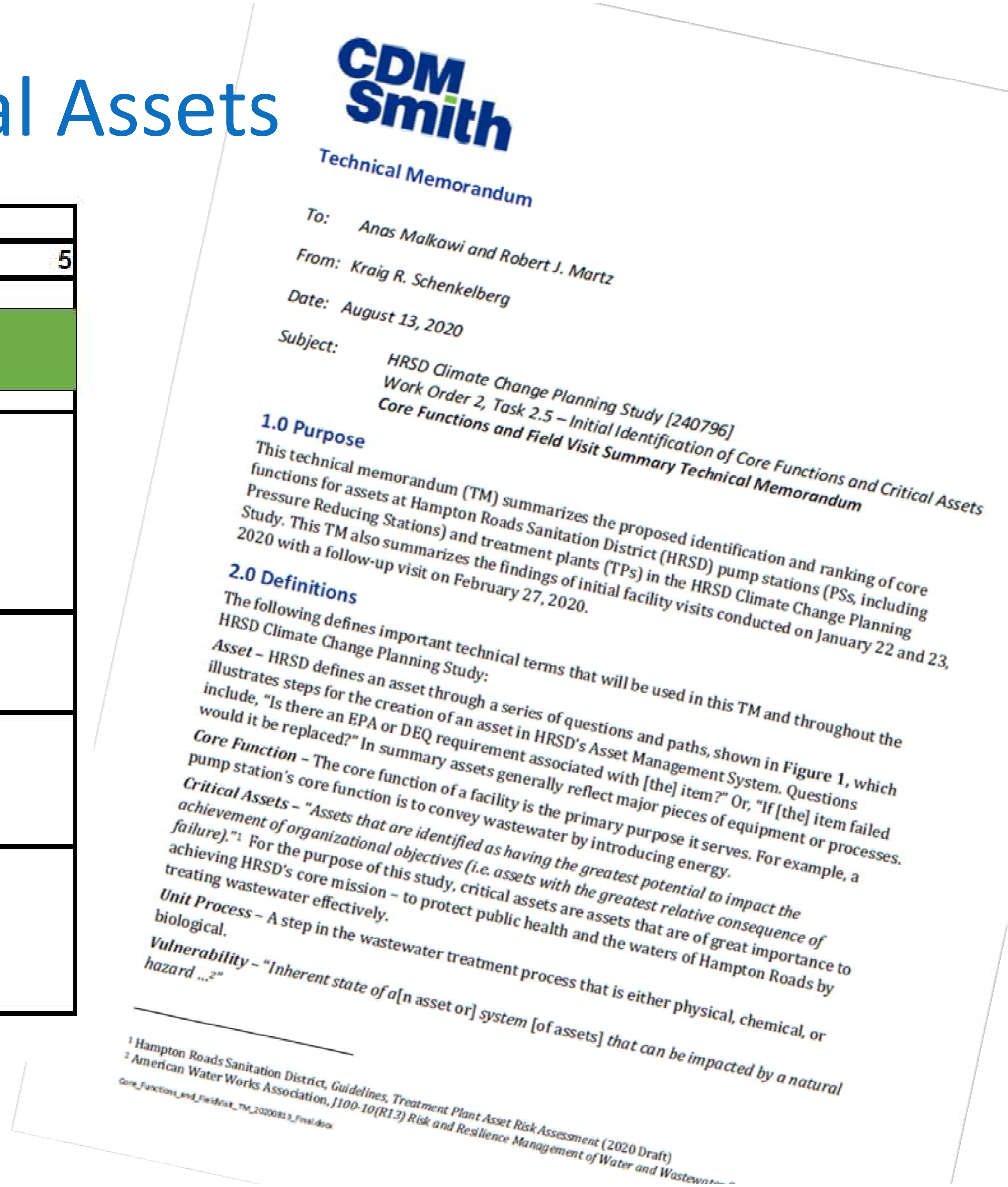


Figure 2 –Treatment Plant Criticality as Established by HRSD



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Technical Memorandum

To: Anas Malkawi and Robert J. Martz

From: Kraig R. Schenkelberg

Date: August 13, 2020

Subject: HRSD Climate Change Planning Study [240796]
Work Order 2, Task 2.5 – Initial Identification of Core Functions and Critical Assets
Core Functions and Field Visit Summary Technical Memorandum

1.0 Purpose

This technical memorandum (TM) summarizes the proposed identification and ranking of core functions for assets at Hampton Roads Sanitation District (HRSD) pump stations (PSs, including Pressure Reducing Stations) and treatment plants (TPs) in the HRSD Climate Change Planning Study. This TM also summarizes the findings of initial facility visits conducted on January 22 and 23, 2020 with a follow-up visit on February 27, 2020.

2.0 Definitions

The following defines important technical terms that will be used in this TM and throughout the HRSD Climate Change Planning Study:

Asset – HRSD defines an asset through a series of questions and paths, shown in **Figure 1**, which illustrates steps for the creation of an asset in HRSD's Asset Management System. Questions include, "Is there an EPA or DEQ requirement associated with [the] item?" Or, "If [the] item failed would it be replaced?" In summary assets generally reflect major pieces of equipment or processes.

Core Function – The core function of a facility is the primary purpose it serves. For example, a pump station's core function is to convey wastewater by introducing energy.

Critical Assets – *"Assets that are identified as having the greatest potential to impact the achievement of organizational objectives (i.e. assets with the greatest relative consequence of failure)."*[1] For the purpose of this study, critical assets are assets that are of great importance to achieving HRSD's core mission – to protect public health and the waters of Hampton Roads by treating wastewater effectively.

Unit Process – A step in the wastewater treatment process that is either physical, chemical, or biological.

Vulnerability – *"Inherent state of a[n asset or] system [of assets] that can be impacted by a natural hazard ...[2]"*

[1] Hampton Roads Sanitation District, *Guidelines, Treatment Plant Asset Risk Assessment* (2020 Draft)
[2] American Water Works Association, *J100-10(R13) Risk and Resilience Management of Water and Wastewater ...*

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Flood Elevation & Hazard Determination

Flood Sources		Description
Coastal (storm surge)		Elevation estimated based on North Atlantic Coast Comprehensive Study (NACCS) modeling completed by USACE, includes sea level rise estimates (NOAA 2017).
Fluvial (riverine)		Elevation estimated based on FEMA Flood Insurance Study riverine profiles including sea level rise estimates (NOAA 2017).
Pluvial (rainfall)		Changes in future rainfall conditions based on Global Climate Models + local hydrology and conveyance capacity local drainage features, such as topography, pipes, ditches and culverts

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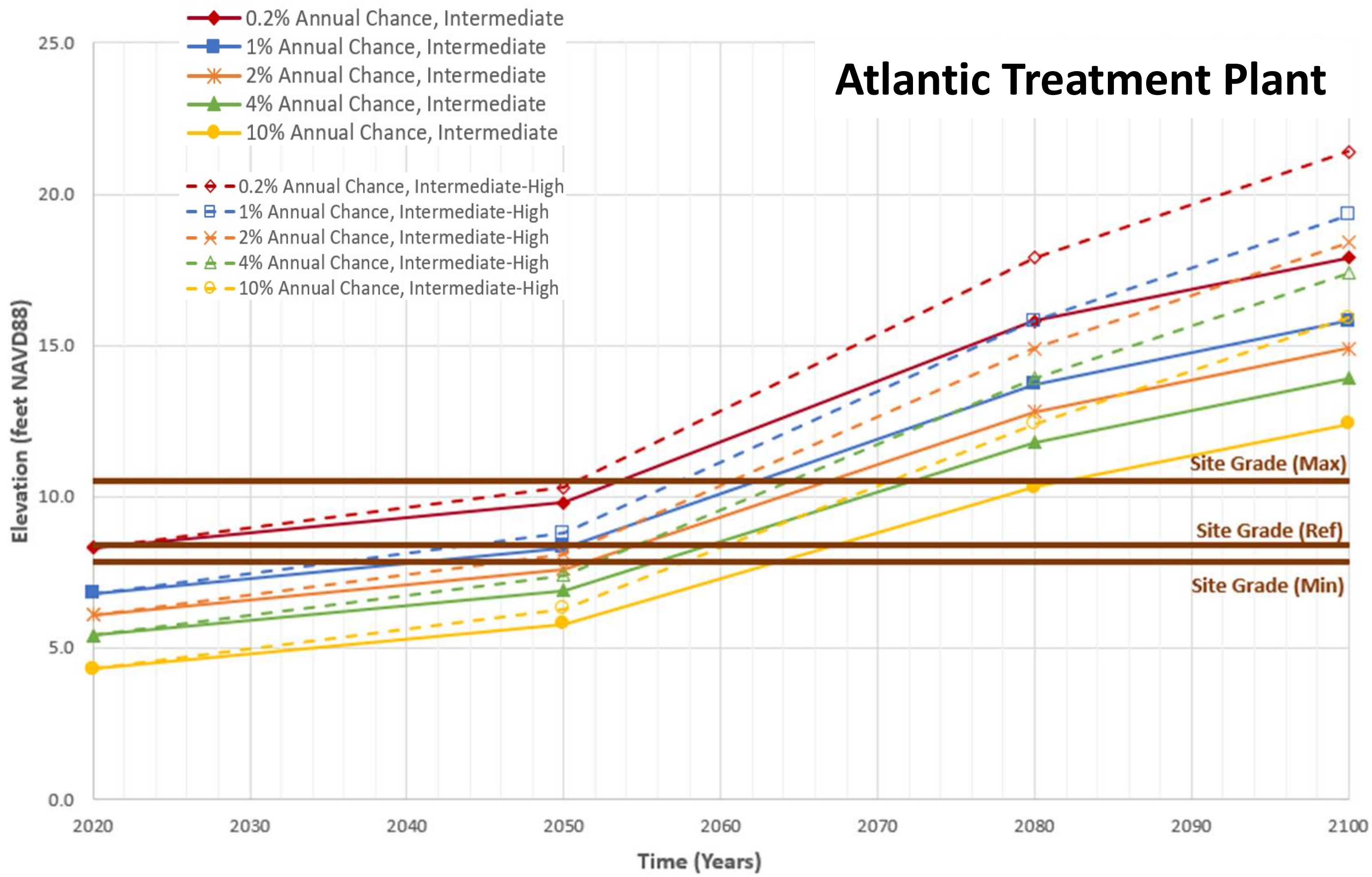
Flood Frequency Graph Example

- 5 Recurrence Intervals
- 1 Existing Condition
- 3 Planning Horizons (near term, medium term, long term) with 2 sea level rise conditions (intermediate and intermediate-high)
- 35 elevations



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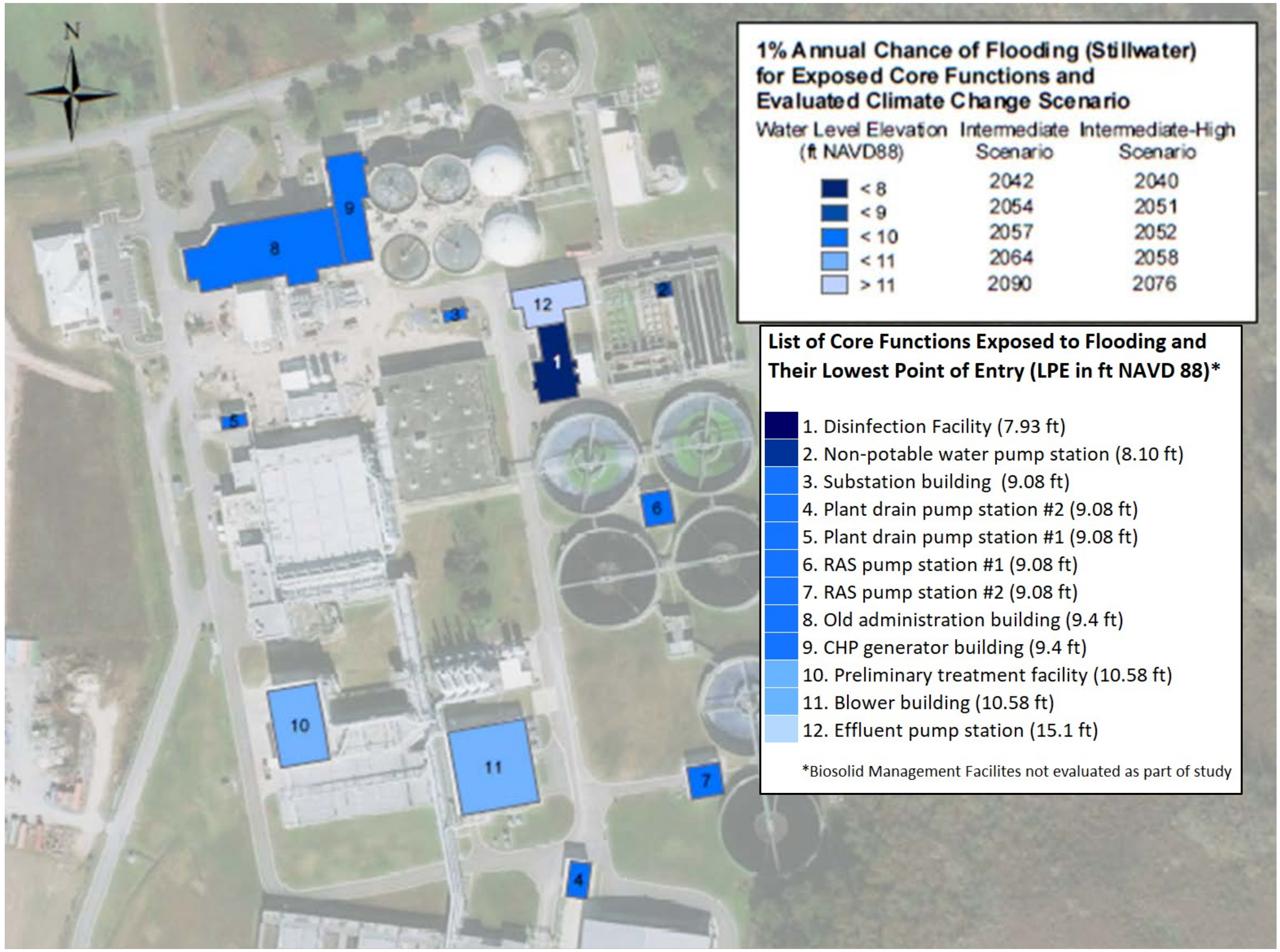
Core Function Stillwater Flooding Exposure to the 1% Annual Chance Events



Determine Site-Specific Flood Mitigation Measures

Considerations:

- Understand site features (e.g. outside generator or bypass pump)
- Review site layout and physical constraints
- Consider site aesthetics and community acceptability

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Considered Two Mitigation Measure Alternatives

Building Level/Process Level Mitigation Measures ($20M)

- Dry floodproofing of buildings (e.g., stop logs)
- Raise outdoor equipment
- Floodwalls that surround each building (includes stormwater pumps)
- ➢ Protects critical assets only

Sitewide Flood Mitigation Measure ($25M)*

- Berm
- Wall
- Stormwater Pump Stations
- ➢ Protects all assets, including biosolids processing and non-critical assets

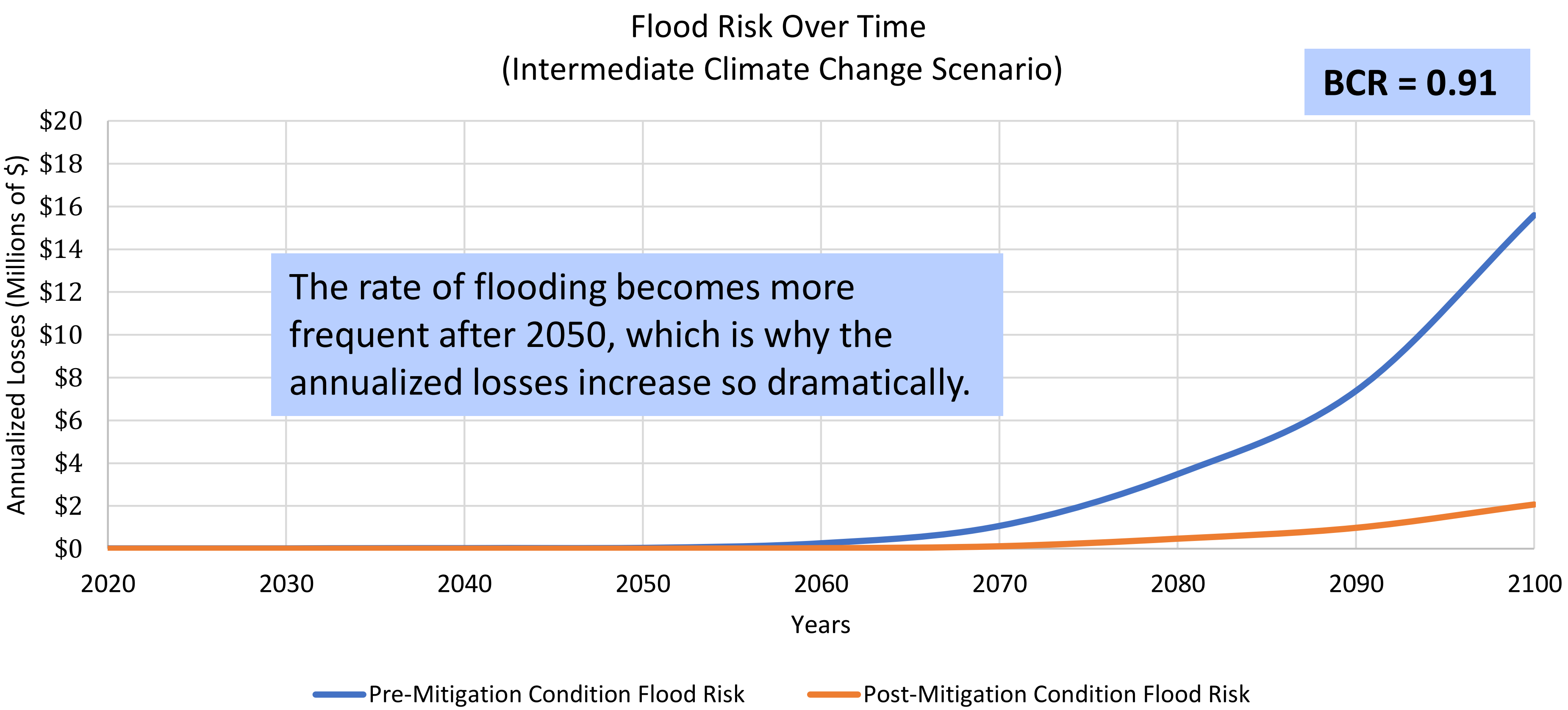
**Smith*

Selected mitigation measure for the Atlantic Treatment Plant. Feedback from HRSD was that the building level mitigation measure may significantly pose daily operational challenges for staff and disrupt subsurface utilities during construction activities.

Risk Results: Annualized Losses and BCR

Intermediate Climate Change Scenario

Atlantic Treatment Plant



Note: Risk results include the annualized losses and BCR for ~$50M of critical assets at ATP (only). The flood risk would increase if all assets at ATP were included in this study (additional ~$114M in non-critical asset value.

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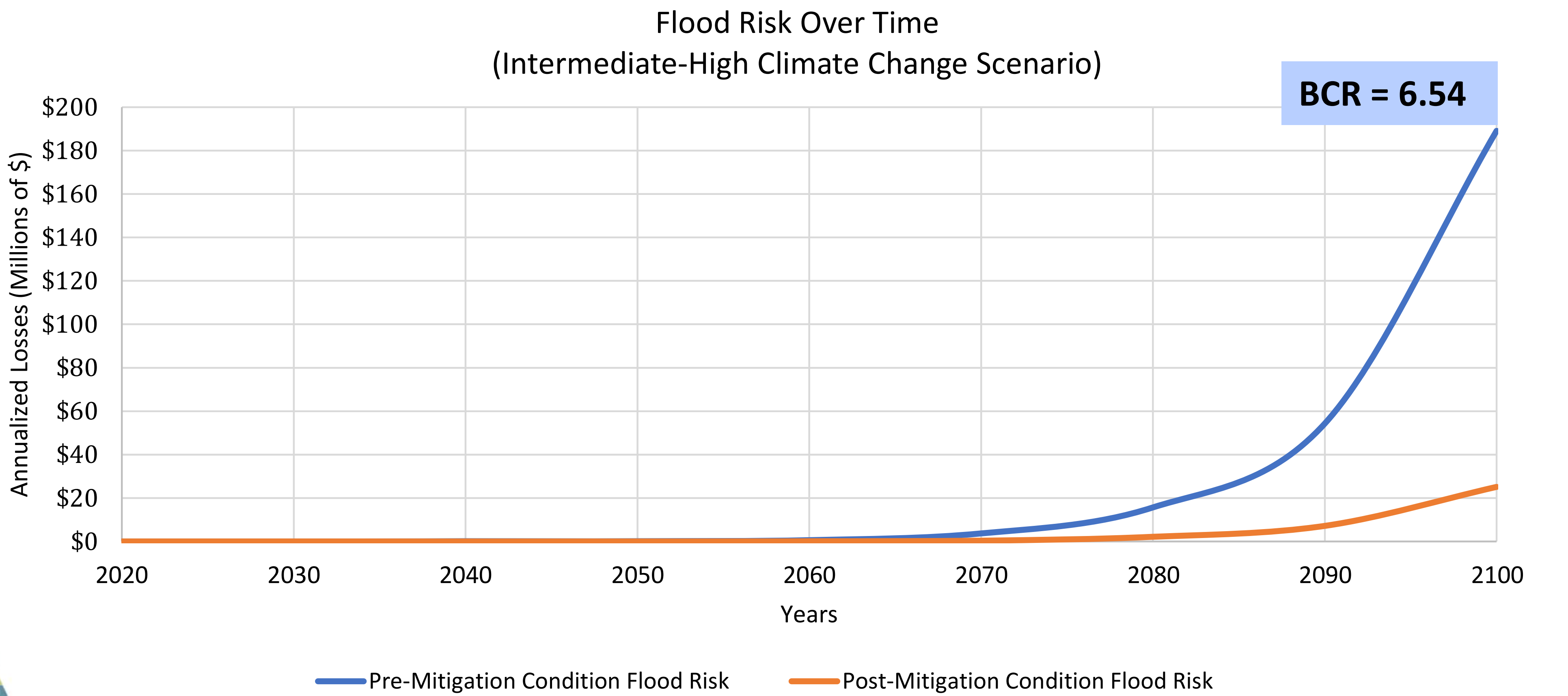
Risk Results: Annualized Losses and BCR

Intermediate-High Climate Change Scenario

Atlantic Treatment Plant



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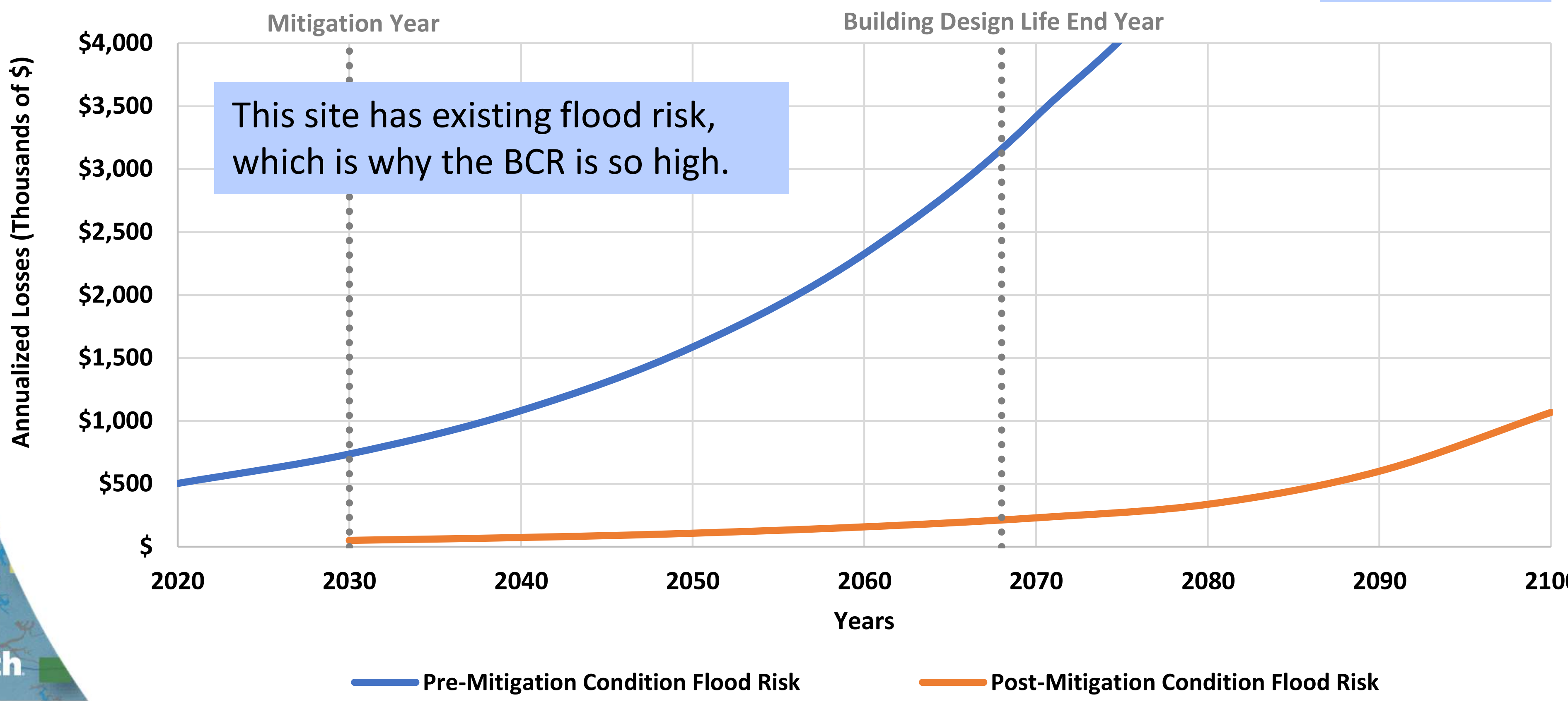
Risk Results: Annualized Losses and BCR

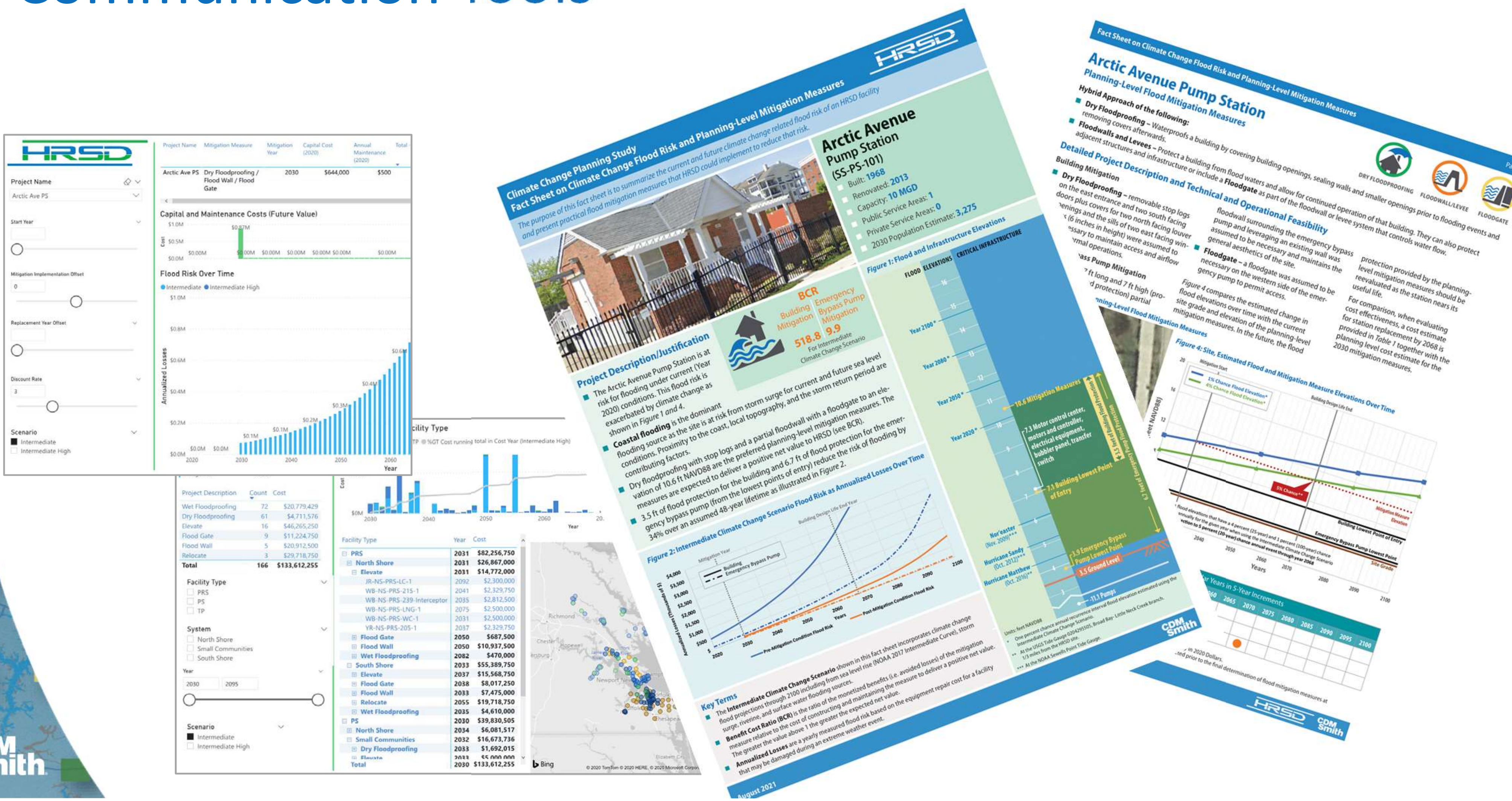
Arctic Avenue
Pump Station Building

Intermediate Climate Change Scenario

BCR = 518.8

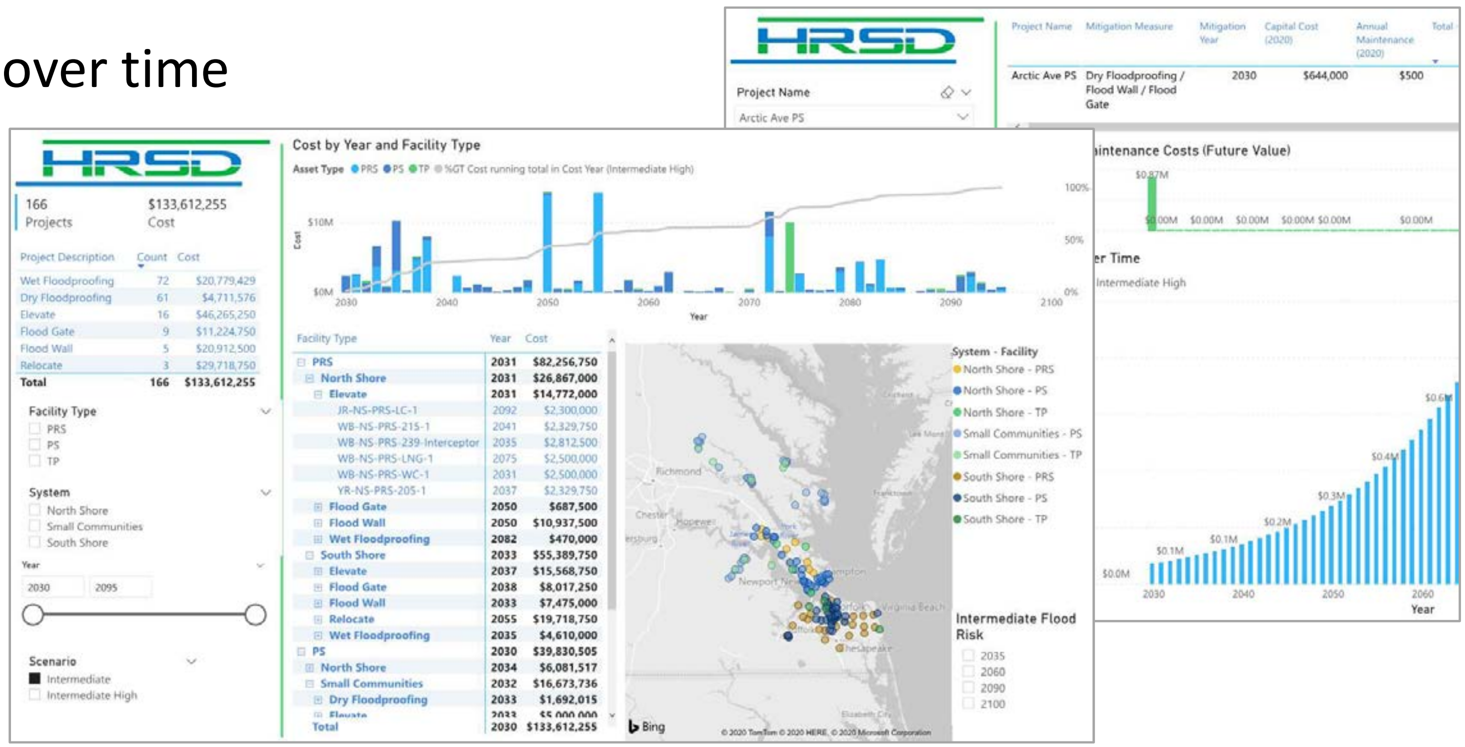


Communication Tools



Dashboard using PowerBI will Visualize Results for Decision Makers

- ✓ Visualizes, summarizes, and sorts by geography, system, asset type, or utility-wide: Customizable views for the user's needs
- ✓ Displays flood risk over time
- ✓ Conceptual level cost, schedule, and flood risk for selected flood mitigation measures



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Questions | Thoughts | Comments

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