

Presentation for:

Town of Fenwick Island

FLOOD RESILIENCE PLANNING STUDY

*October 14, 2025
10:00 AM – 12:00 PM*



Meet the Presenters



Larry Trout, Jr., PE
Project Manager

- ✓ Extensive experience leading mitigation planning and implementation as well as climate adaptation/resiliency.
- ✓ Led multiple coastal assessment, green infrastructure and restoration projects in Delaware since 2010.
- ✓ Expert in preparing grant applications and implementing and managing grant funding once it has been secured.



Shellie DeMoss, PE
Stormwater Engineer/H&H

- ✓ Design professional specializing in shoreline restoration, SWM, and watershed assessment projects.
- ✓ Conducted multiple watershed studies with H&H analyses and 2D modeling.
- ✓ Supported Larry on numerous project implementations once grant funding has been secured

Who is Straughan Environmental?

- Women-owned company of over 90 water resources engineers and environmental conservation professionals
- 30-year history of supporting environmental and restoration projects throughout the Mid-Atlantic region
- Offer a wide range of services to support flooding resiliency projects:

- ✓ watershed, flooding, shoreline and geomorphic assessments
- ✓ stream and wetland restoration; outfall stabilization
- ✓ shoreline management
- ✓ forest planting
- ✓ soil amendment
- ✓ hydrologic and hydraulic (H&H) modeling (1D/2D)

- ✓ NPDES/TMDL permit management and compliance and crediting
- ✓ environmental permitting and delineations involving wetlands/Waters of the US and forests
- ✓ erosion and sediment control (ESC)
- ✓ preparation of engineering plans, cost estimates, and specifications for construction.

Phase 2 Resiliency Planning Updates

- ✓ Design Computations
 - Tidal Analysis and Sea Level Rise Predictions
 - Wind Computations
 - Wave Computations
- ✓ Point of Interest (POI) Identification
 - Individual closed drainage outfall locations and aggregate outfall locations (canals)
- ✓ Drainage Area Delineations
- ✓ Bulkhead Vulnerability Mapping
 - Based on existing tidal data, wind/wave comps, and known bulkhead elevation data
- ✓ Sea Level Rise Mapping
- ✓ Green Infrastructure Feasibility
- ✓ Existing Roadway and Storm Drain Profiles
 - Sourced from LiDAR elevation data and as-built plan data (SR 1)
 - Compared to tidal analysis and SLR results
- ✓ Flood Resiliency Implementation Concepts
 - Structural asset improvements and upstream stormwater mitigation techniques
 - High-level plan details
 - Proprietary solutions
- ✓ Multi-Criteria Prioritization Framework
 - Preliminary priority assessment criteria list and data procurement

Data Source Summary

Tide	Location	Source
Tidal Summary	Ocean City, MD*	USGS

Wave	Location	Source
Average Fetch	Fenwick Island, DE	N/A
Boat Wake Calculations	Fenwick Island, DE	USACE
Fetch Wave Heights	Fenwick Island, DE	USACE
Wave Crest Elevation	Fenwick Island, DE	USACE

Wind	Location	Source
Wind Data	Ocean City, MD	National Data Buoy Center - NOAA
Return Intervals	Ocean City, MD	National Data Buoy Center - NOAA

Tidal Analysis

Current Tidal Calculations

Avg Tidal Range	Elev (ft) (NAVD88)
MLLW	-1.08
MLW	-0.93
MHW	0.91
MHHW	1.11

Straughan Tidal Epoch
Ocean City Inlet 2014-
2025 (ft, NAVD88)
(Storms Removed)

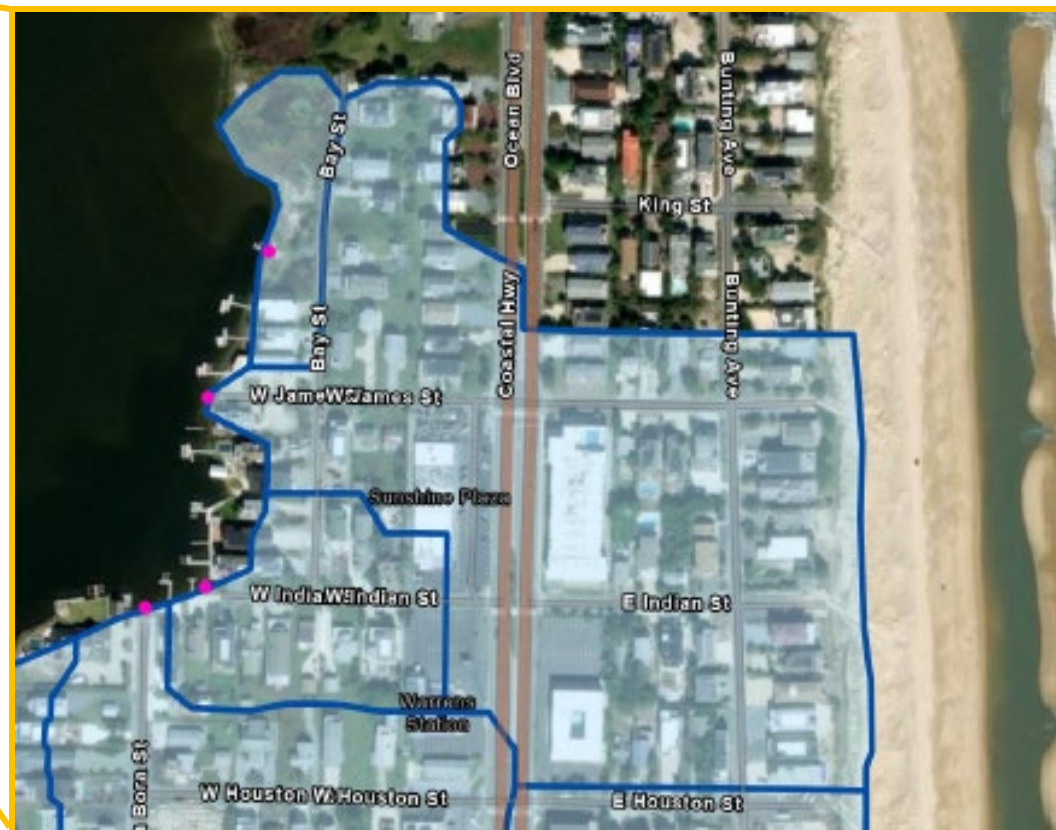
Future Tidal Projections

Year	Delaware SLR Planning Scenarios		
	Low	Intermediate	High
2030	0.11 m / 0.36 ft	0.22 m / 0.72 ft	0.33 m / 1.08 ft
2050	0.22 m / 0.72 ft	0.40 m / 1.31 ft	0.58 m / 1.90 ft
2080	0.42 m / 1.38 ft	0.74 m / 2.43 ft	1.11 m / 3.64 ft
2100	0.52 m / 1.71 ft	0.99 m / 3.25 ft	1.53 m / 5.02 ft

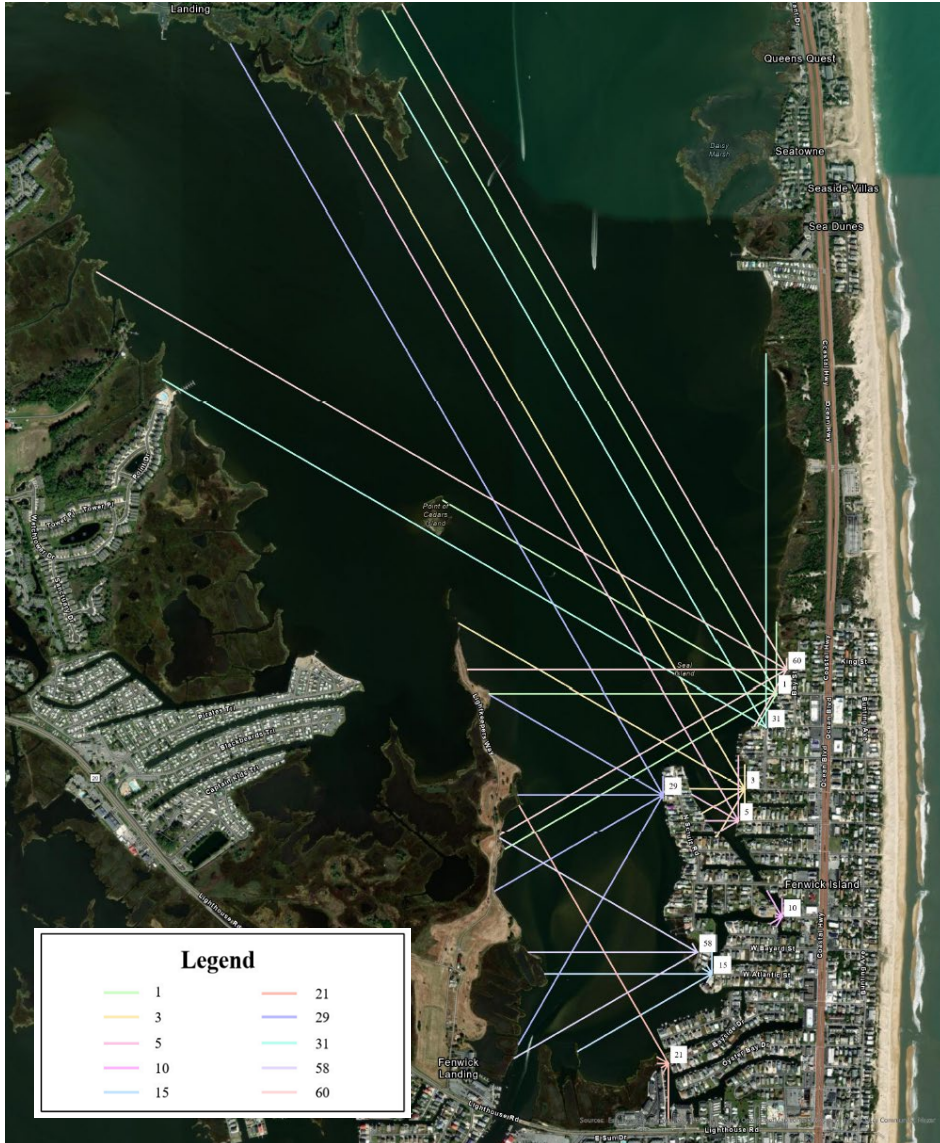
Delaware SLR Technical
Report (2017)

Drainage Area Delineations

67 Individual Drainage Areas and Points of Interest (POI)



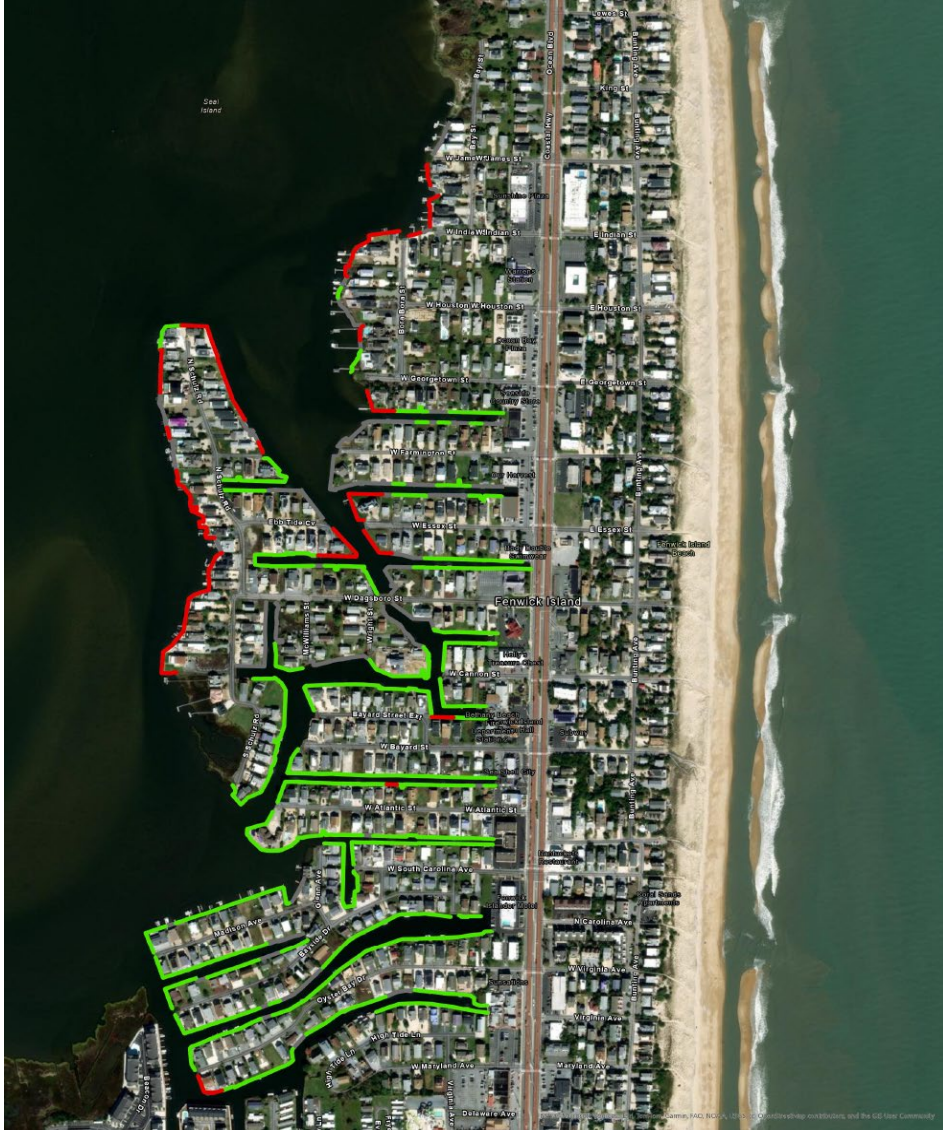
Fetch Lengths & Wave Heights



Maximum Wave Heights (Representative POIs)

	Point of Interest	Wave Height (ft)	Direction
21	Bayside Dr	1.03	NNW
15	W Atlantic Ave	0.73	WSW
29	N Schulz Rd	1.75	NNW
10	W Cannon St	0.33	NNW
3	Georgetown St	1.66	NNW
1	W James St	1.67	NNW
31	Bora Bora St	1.61	NNW
5	Farmington St	1.69	NNW
58	S Schulz Rd (LOI)	0.24	WNW
60	West Bay St (LOI)	1.65	NNW

Bulkhead Vulnerability Evaluation

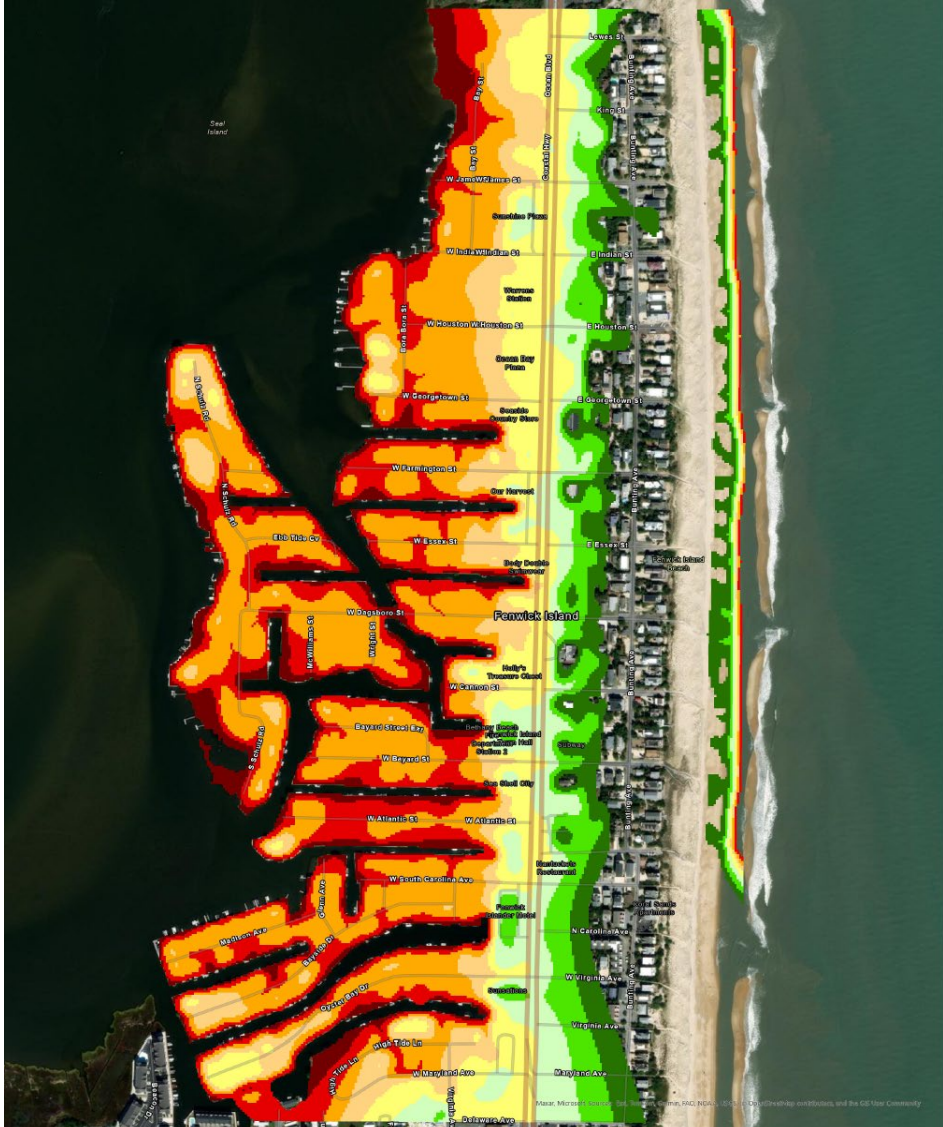


Legend

- No Data Available
- Bulkhead > MHHW & Storm Wave
- Bulkhead < MHHW & Storm Wave

- Evaluated at MHHW and the maximum fetch wave height to display if a bulkhead will breach
- Many crucial properties do not have bulkhead elevations in our internal survey

Sea Level Rise Evaluation



Legend

MHHW (1.11 ft)	MHHW + 3'
MHHW + 2030 SLR (0.72 ft)	MHHW + 4'
MHHW + 2050 SLR (1.31 ft)	MHHW + 5'
MHHW + 2'	MHHW + 6'

- Identified areas prone to current tidal flooding (at MHHW)
- Estimated areas susceptible to future tidal flooding based on intermediate SLR predictions

Green Infrastructure Feasibility Assessment



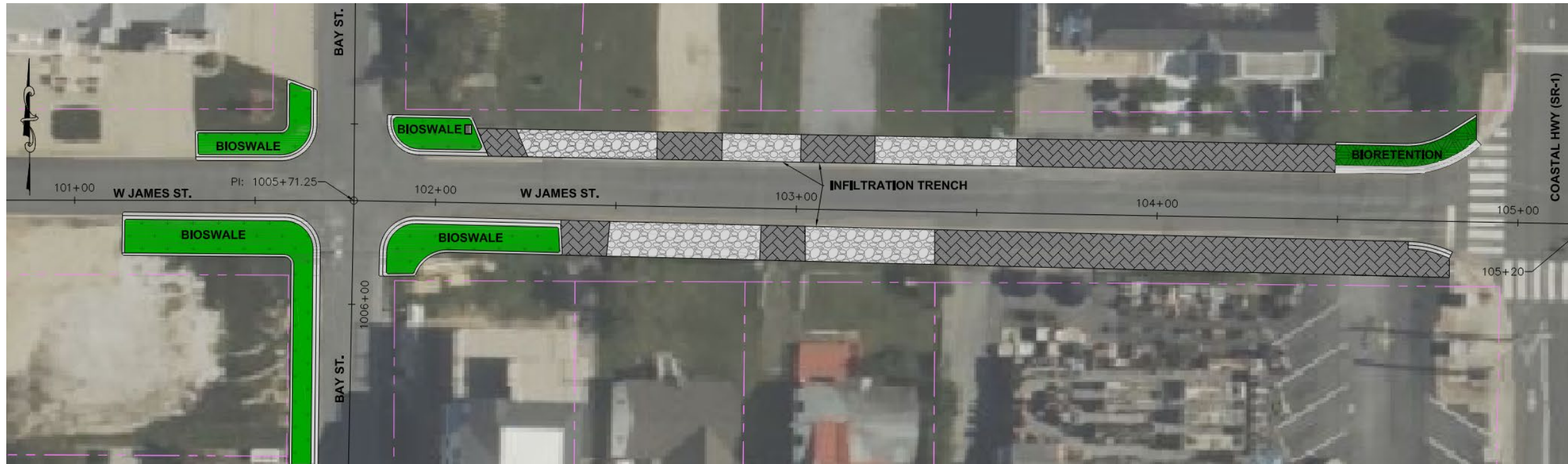
Legend

Range of Depth (ft)

0-3	6-9
3-6	9-16

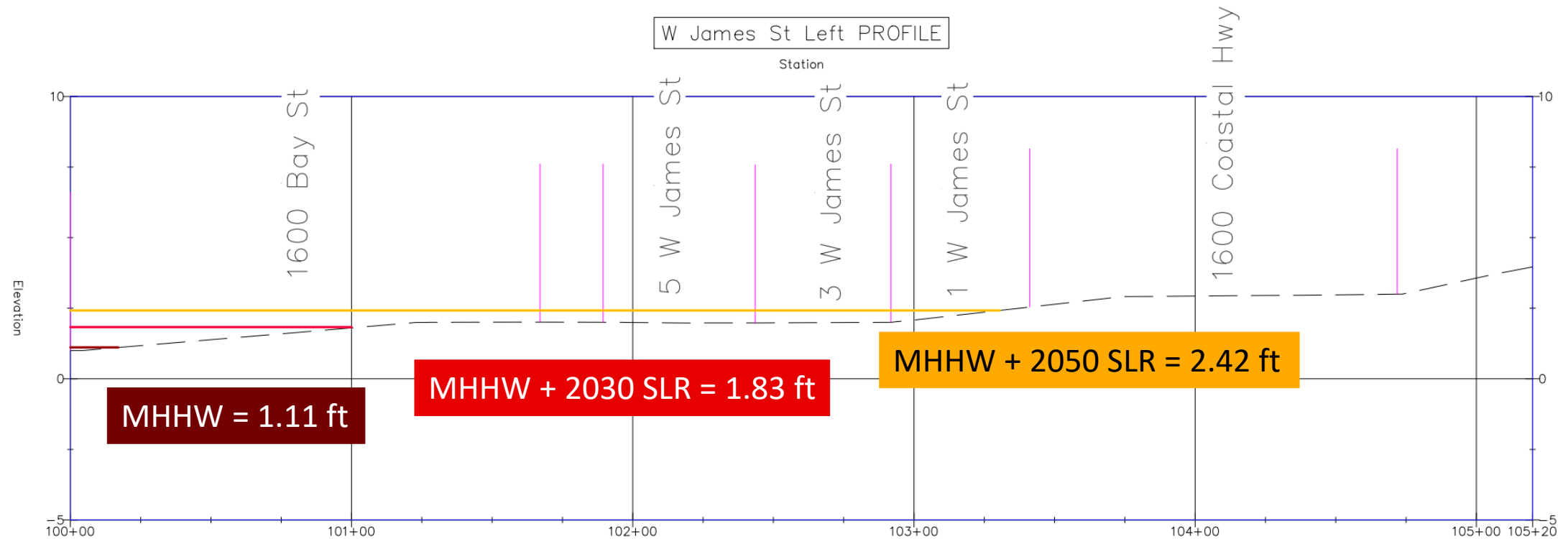
- Most of the Town to the west of SR 1 has minimal separation from existing grade to estimated groundwater table
- Green Infrastructure techniques primarily applicable near or east of SR 1

Taking a Closer Look: James St



- Largest contributory drainage area of those delineated for this project
- Ample available right-of-way
- Bulkhead vulnerability from wave action
- Sea level rise susceptibility
- Deficient tidal protections on existing storm drains
- Number of impacted properties

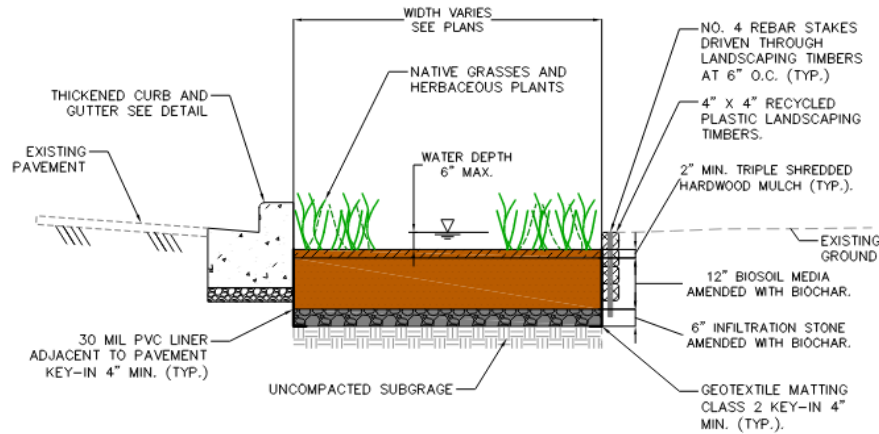
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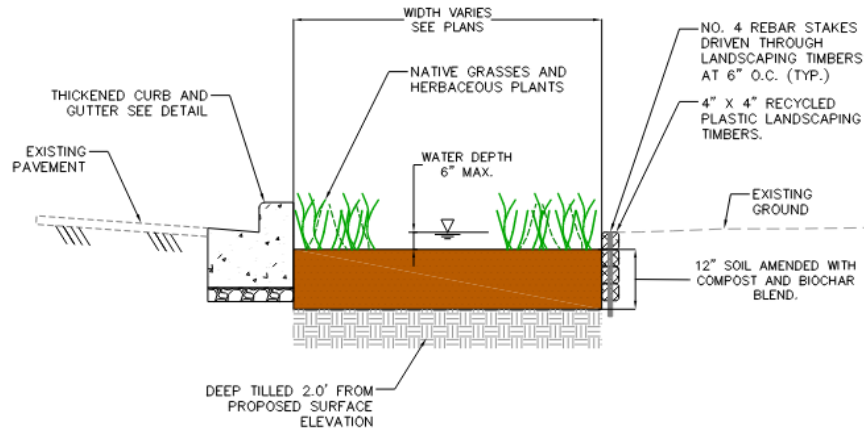
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James St Green Infrastructure Concepts

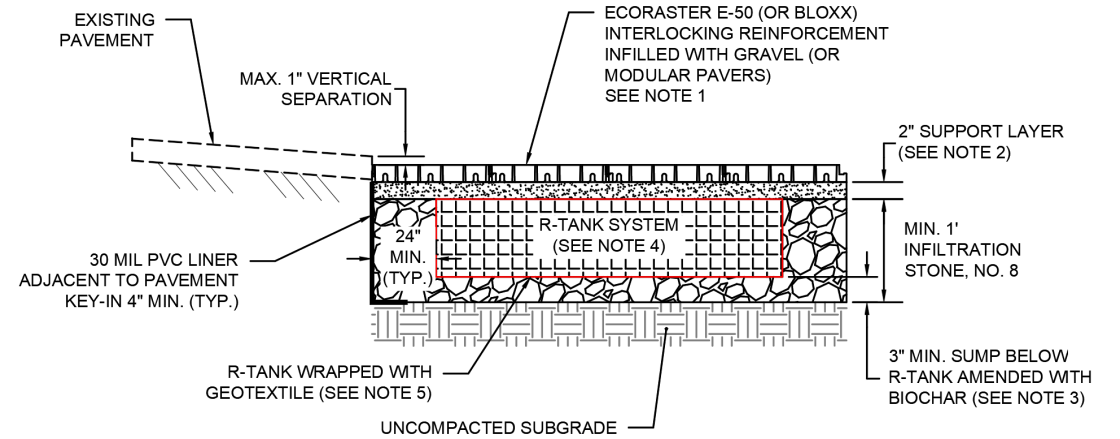
BIORETENTION



BIOSWALE

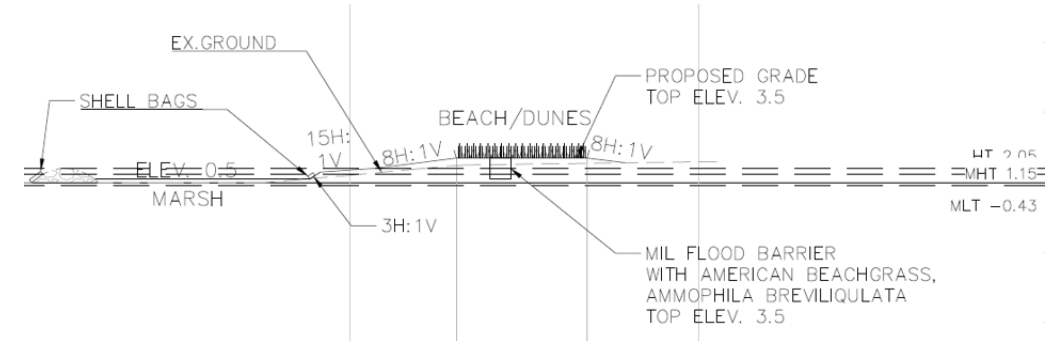
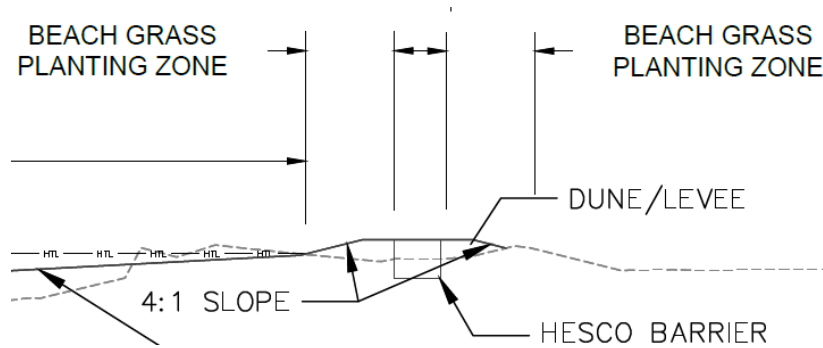


Streetscape Bioretention



Stabilized Infiltration Trench

James St Shoreline and Street End Concepts



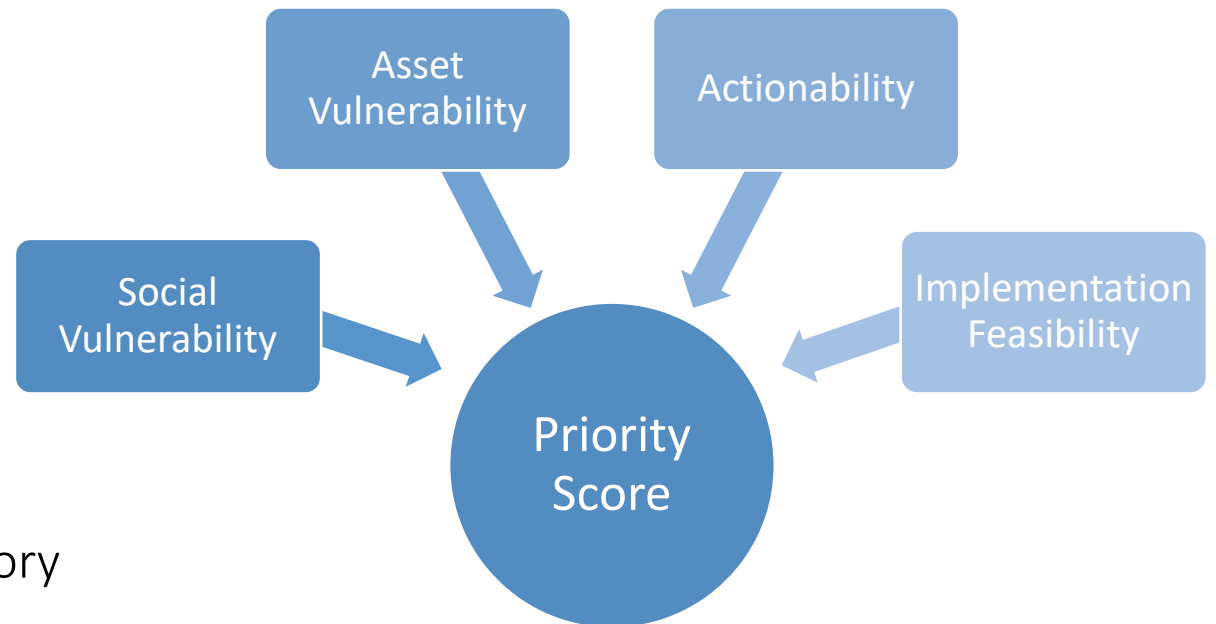
Levee/Dune



Living Shoreline

Multi-Criteria Decision Matrix: Prioritization Framework

- ✓ Prioritization of flood resilience implementations is dependent upon various criteria
- ✓ Multi-criteria decision tool intended to standardize criteria, assign weights based on community needs and precedence, and rank priority locations accordingly
 - Four draft categories identified for the Town of Fenwick Island
 - **Social Vulnerability** – threat to people & property
 - **Asset Vulnerability** – threat to infrastructure
 - **Actionability** – conditions suitable for construction
 - **Implementation Feasibility** – potential for BMP or resiliency infrastructure
 - Two to six criteria currently assigned per category



Multi-Criteria Decision Matrix: Decision Criteria

- ✓ Current list of decision criteria applicable to Fenwick

Social Vulnerability	Asset Vulnerability	Actionability	Implementation Feasibility
Total Population	Unmanaged Impervious Coverage	Actionable ROW Area for BMPs	Bioretention Facility
Population Density	Watershed Flooding from High Tide/SLR	Depth to Water Table	Bioswale
Properties Affected	Roadway Flooding from High Tide/SLR		Infiltration Trench
	Wave Action Vulnerability		Living Shoreline
	Existing Outfall Protection		Impervious Reduction
	Existing Tidal Valve		Structural (Bulkhead/Levee/Dune)



We want to hear from you!

Prioritization Framework in Action

Criteria	Metric Notes	Category	Criteria Weight (max Score)*	Oxon Run										
				1	2	3	4	5	6	7	8	9	10	11
Social Vulnerability Index	Weighted average/FA Acre	Social Vulnerability and Equity	4.5	3.4	3.3	3.7	3.9	4.1	3.6	4.0	4.2	4.5	4.1	3.3
Equity emphasis Area	Weighted average/FA Acre		4.5	3.2	2.8	1.8	3.2	4.3	2.3	4.1	3.2	4.1	3.2	1.8
Assets for Socially Vulnerable Population	Count/FA Acre		9	4.9	3.5	1.0	5.9	9.0	3.3	6.7	2.0	2.4	2.9	1.4
Total Population	Weighted average/FA Acre		9	6.0	6.9	8.6	6.4	6.6	7.9	6.9	6.4	8.0	8.9	6.2
Population Density	Weighted average/FA Acre	Actionability	3	1.4	1.5	0.8	2.2	3.0	1.7	2.5	1.6	1.8	1.3	0.5
Buildings Footprint within FEMA Flood Hazard Area	Count x Factor Total/FA Acres		8	3.3	1.4	1.0	1.0	8.0	1.5	1.5	1.7	0.7	1.3	0.0
Impervious Road Surface Area within FEMA Flood Hazard Area - 100-year and DPIE	Acre/FA Acre		3	1.3	0.5	1.1	0.7	1.2	0.3	0.8	0.2	0.7	0.8	1.6
Impervious Road Surface Area within Bluespots/IFM	Acre/FA Acre		2	0.2	0.3	0.1	0.5	0.5	0.2	0.4	0.4	0.2	0.1	0.4
FEMA Flood Hazard Area - 100-year and DPIE	Acre/FA Acre	Watershed-wide Impact	2	0.7	0.3	0.9	0.4	2.0	0.2	0.8	0.2	0.3	0.3	0.6
Bluespots/IFM	Acre/FA Acre		2.7	1.0	0.9	1.3	0.5	0.6	0.5	0.7	2.7	0.0	0.9	0.0
Critical & Community Assets	Count x Factor Total/FA Acres		2.7	1.0	0.5	1.1	0.8	0.3	2.6	2.6	1.2	2.3	0.7	0.0
Bridge and Culvert Modifications (BCM)	Count/FA Acre		2.7	1.7	1.4	1.4	1.0	1.0	0.9	1.4	1.7	2.0	2.0	0.6
Green Stormwater Infrastructure (GSI) (Point Count)	Count/FA Acre	Priority Score	2.7	1.7	1.1	0.5	0.9	0.4	0.8	0.9	0.6	2.1	0.5	0.6
Green Stormwater Infrastructure (GSI) (Polygon Acre)	Acre/FA Acre		2.7	0.2	1.0	0.0	0.6	1.6	0.5	1.0	0.0	0.0	0.6	0.0
Storm Drain Outfall Retrofits (OUT)	Count/FA Acre		2.7	0.0	0.9	0.0	1.6	1.0	1.3	0.8	0.4	1.8	0.7	2.7
Blue Green Street (BGS)	Linear Feet/ FA Acre		2.7	1.5	1.3	0.9	0.9	1.5	1.3	0.9	0.7	0.9	0.7	0.0
Stream Daylighting (DAY)	Linear Feet/ FA Acre	SUBTOTAL	2.7	0.8	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.5	1.4	0.0
Stream, Wetland, and Floodplain Restoration (STR)	Linear Feet/ FA Acre		2.7	0.2	0.5	0.3	0.3	0.2	0.5	0.3	0.2	0.5	0.3	1.8
Multi-Purpose Floodable Recreational Spaces (FRS)	Acre/FA Acre		2.7	1.1	0.8	2.1	1.1	2.7	0.8	0.5	1.3	0.9	1.0	0.7
Impervious Reduction (IMP)	Acre/FA Acre		2.7	10.0	5.0	10.0	5.0	0.0	10.0	0.0	5.0	10.0	10.0	0.0
Pond Retrofits (PND)	Acre/FA Acre	SUBTOTAL	30	19.0	17.8	15.9	21.5	27.1	18.8	24.2	18.0	20.8	20.4	13.2
Tree Planting (TRP)	Acre/FA Acre		30	6.8	3.7	6.3	4.1	14.5	3.9	5.7	4.4	2.6	4.3	4.0
Watershed-wide Impact	Watershed-wide Impact		30	12.8	8.2	13.7	10.1	12.6	11.5	9.6	10.5	12.4	10.9	7.9
			10	10.0	5.0	10.0	5.0	0.0	10.0	0.0	5.0	10.0	10.0	0.0
		SUBTOTAL	100	48.6	34.8	45.8	40.8	54.2	44.3	39.6	38.0	45.9	45.7	25.1

Decision criteria are assigned a metric of measurement and designated into a category

Each POI is assigned a score based on the criteria's metric of measurement, with larger scores indicating higher need or potential

Each decision criteria is weighted within its respective category, and each category is weighted relative to the total maximum priority score

Sum of all weighted criteria inform the total Priority Score for each POI

Next Steps

- » Obtain feedback from the Town on prioritization criteria and preferences regarding weighting
- » Continue to develop Prioritization Framework
- » ANYTHING ELSE?

QUESTIONS?

