Shoreline Condition and Changes in Delaware Inland Bays, 2012 - 2022

Presented by Lydia Franks and Andrew Homsey
UD Water Resources Center
to the
CIB Scientific and Technical Advisory Committee
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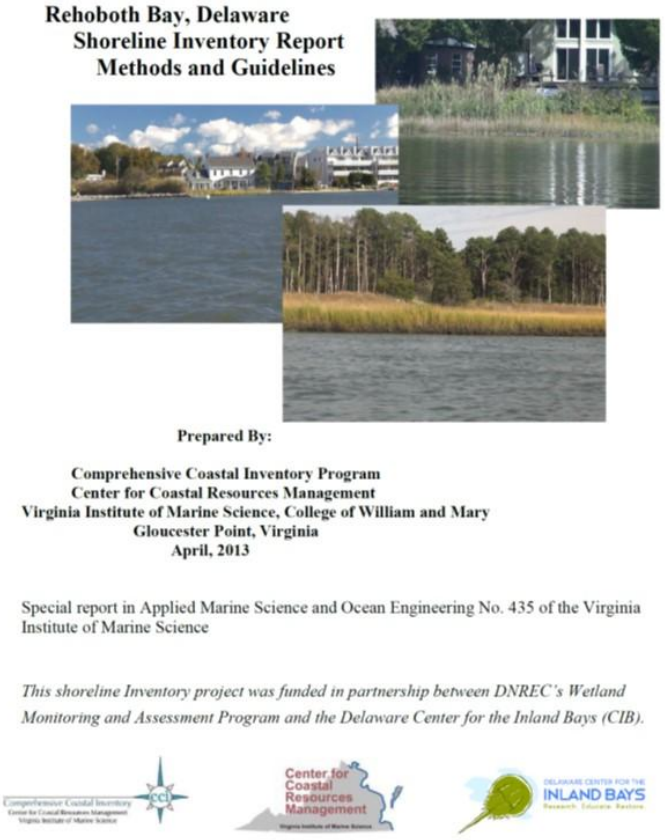
Background

- Extending/refining results of two previous studies by the Virginia Institute of Marine Science (VIMS) at William & Mary University (2006, 2012)
- Funded through the UD's Delaware Water Resources Center internship program supported by the USGS/National Institutes for Water Resources (NIWR)
- In support of the Living Shoreline Initiative
- Collaboration with the CIB
  - **Andrew McGowan**, **Meghan Noe Fellows**
  - Graduate student intern: **Lydia Franks**

Background

- Began late in 2022, refined over time to meet the needs of the Center and the Bays
- **Not** replicating VIMS efforts or methods
- Focus on shoreline condition to inform future resiliency efforts in face of challenges (SLR, storm intensity, development, erosion)



VIMS Study

Comprehensive Coastal Inventory Program

- Detailed shoreline assessment
- Boat-based assessment
- Videography
- Inventory of shoreline structures
- Characterization of interior land use
- Characterization of shore material AND function
- Estimate of elevation

Refinement of VIMS Approach

- Assessed VIMS report for most relevant data products and procedures
- Simplified 2012 VIMS classes to focus on shoreline **condition**, not **function**
- **Reduced** number of categories for artificial shorelines and **added** categories for natural shorelines
- Added Little Assawoman Bay
- Used previous (2012) and latest (2022, when it became available) aerial photography to detect changes

Refinement of VIMS Approach

- This inventory is NOT
  - An assessment of shoreline loss, but rather condition and change in condition
  - An assessment of upland land use/land cover or changes
  - Inventory of structures such as piers, jetties, groins, etc.
  - Field-based approach

Current Status

- Extending analysis 10 years to 2022
- Includes the three bays, all completed except Rehoboth for 2022
- Presenting methodology and preliminary results
- Will develop an accuracy assessment protocol
- Seeking feedback and direction on potential uses for the data to help guide policy related to the Living Shoreline Initiative, as well as overall coastal resilience.

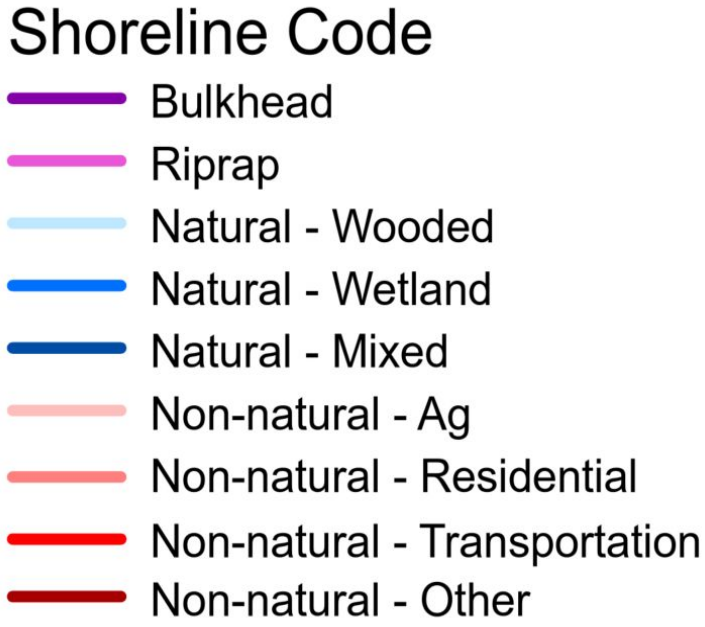
Methods

Collaboratively developed between CIB and UD WRC:

- **Step 1** Develop procedures which incorporate prior 2012 shoreline condition inventories and establish guidelines for categorization.
- **Step 2** Using 2012 aerial imagery (DNREC) and previous shoreline assessments (VIMS), classify 2012 shoreline conditions using the established shoreline types.
- **Step 3** Using 2022 aerial imagery, reclassify 2022 shoreline conditions using the same shoreline types.
- **Step 4** Group shoreline types into four categories and calculate summary statistics.
- **Step 5** QC using aggregation grids and error matrix for shoreline identification.

Step 1: Procedures and Guidelines

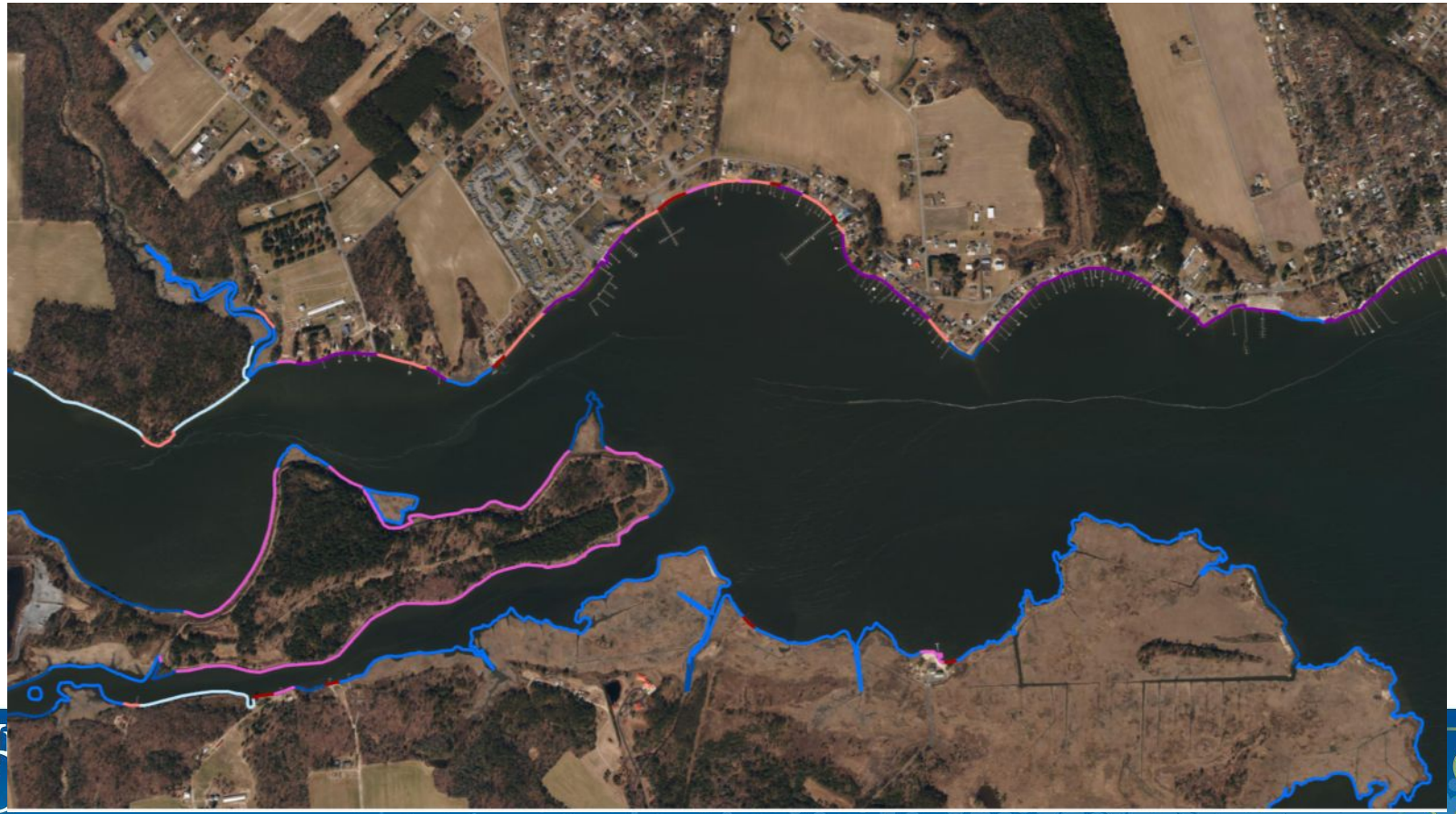
- Do not alter original VIMS delineations unless necessary
- Focus on composition of shoreline behind structures (interested in composition/materials rather than function)
  - Did not incorporate VIMS point structures
  - Wharf, marinas, jetty, seawall, breakwater, groin field, marsh toe revetment, debris, dilapidated bulkhead, unconventional → new categories
- Consider adjacent types
- Focus on parcel scale and consider land use
- 30m rule



Procedures and Guidelines: 30m Rule

Step 2: Alter 2012 layers to fit new classes

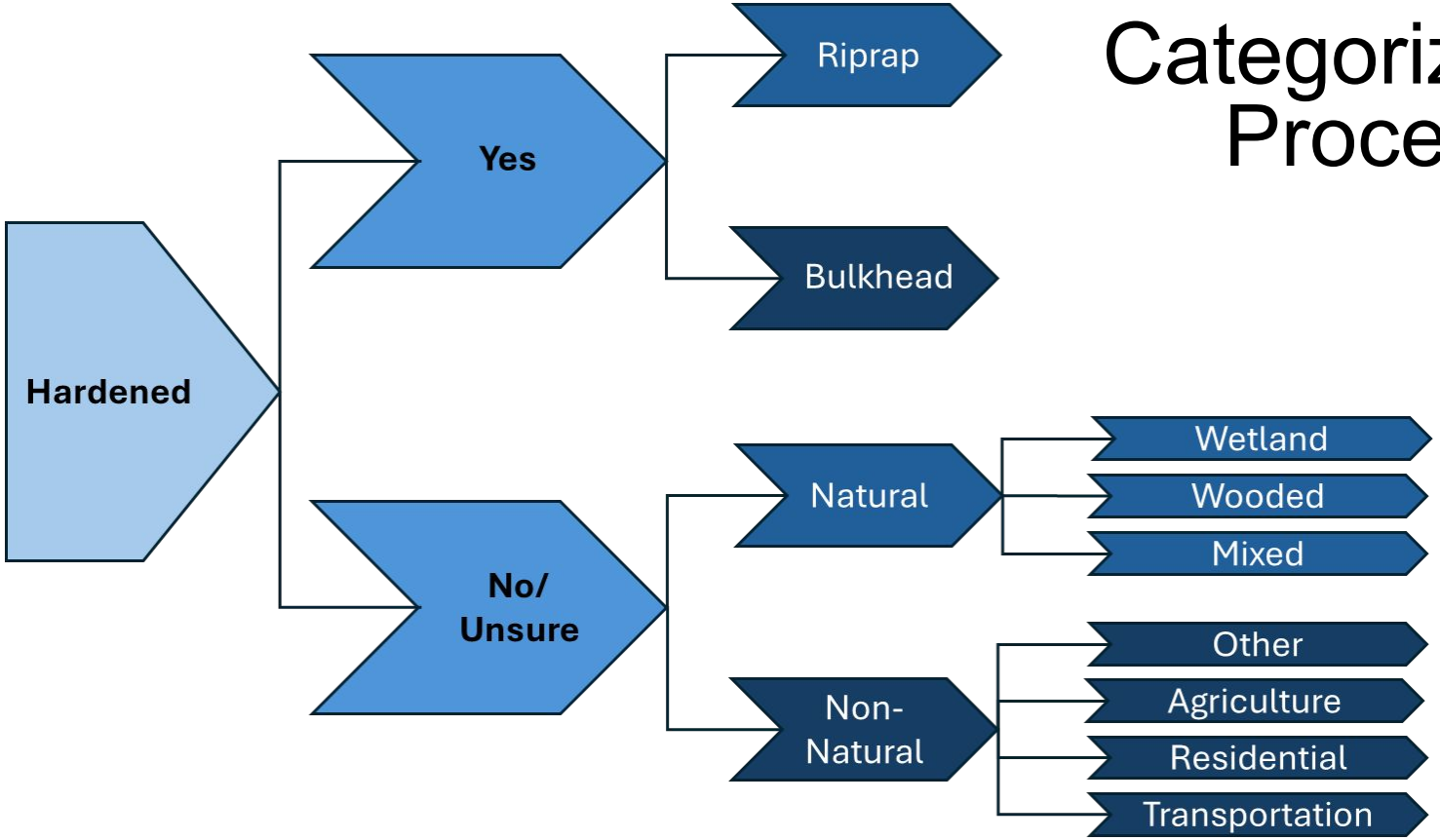
Step 3: Update 2012 shoreline using 2022 aerials



Class Descriptions (Category 1)

Bulkhead	Bulkhead or similar hardened materials (marinas, seawalls, wharf, jetty)
Riprap	Riprap (jetties, breakwaters, groin fields, etc.)
Natural-Wetland	Marsh edge or other wetland fringe
Natural-Wooded	Wooded or forested, no wetland fringe
Natural-Mixed	Any mix of any natural types (including sandy beach, scrub-shrub, and/or minimal man-made materials)
Non-natural Agriculture	Farm or agricultural land
Non-natural Residential	Residential homes or neighborhoods not categorized as Artificial
Non-natural transportation	Roadways, parking lots, or vehicle bridges not categorized as Artificial
Non-natural Other	Other man-made materials not residential or transport. (industrial, commercial)

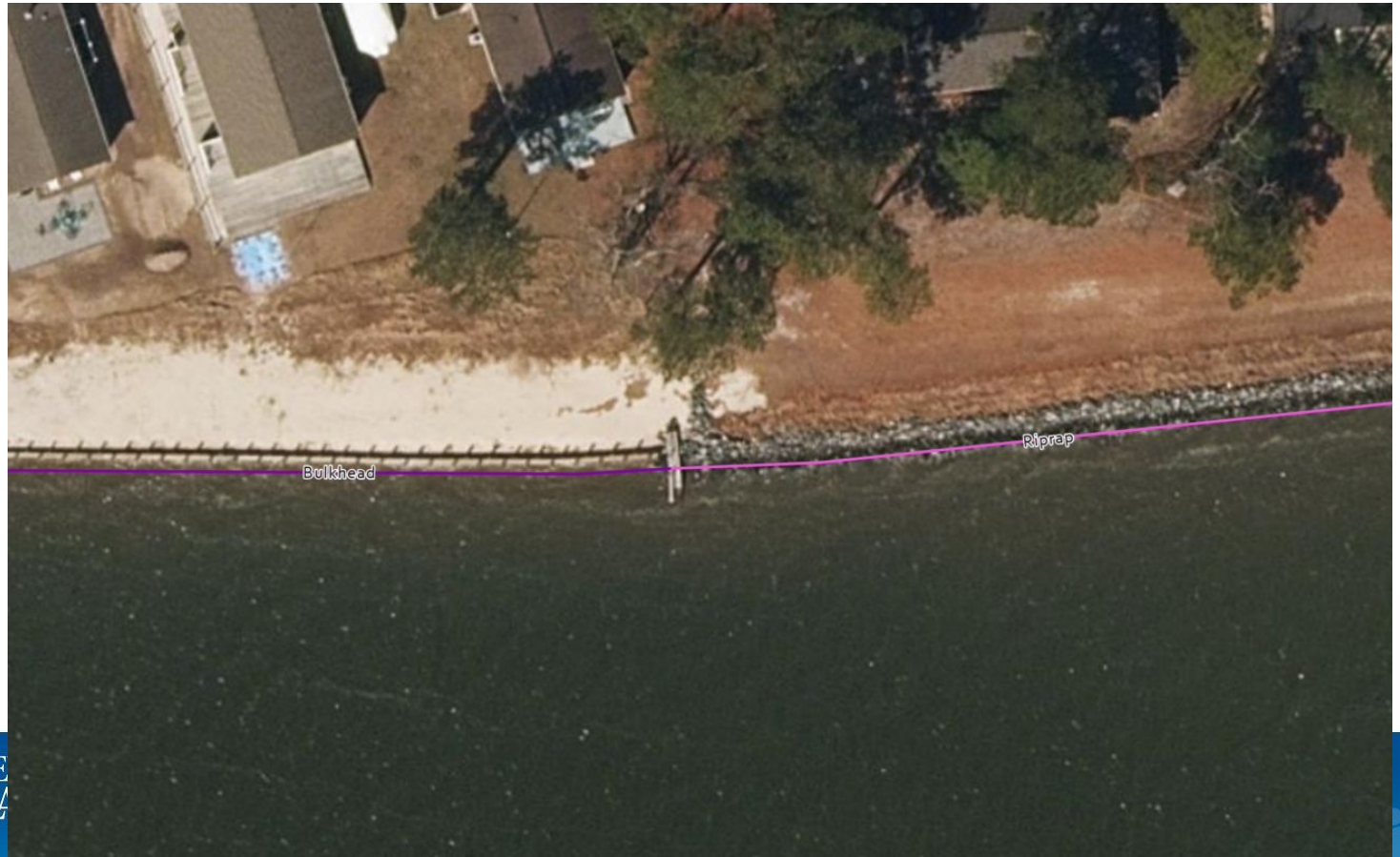
Categorization Process



Categorization Example

Reference Grid

Examples: Bulkhead and Riprap



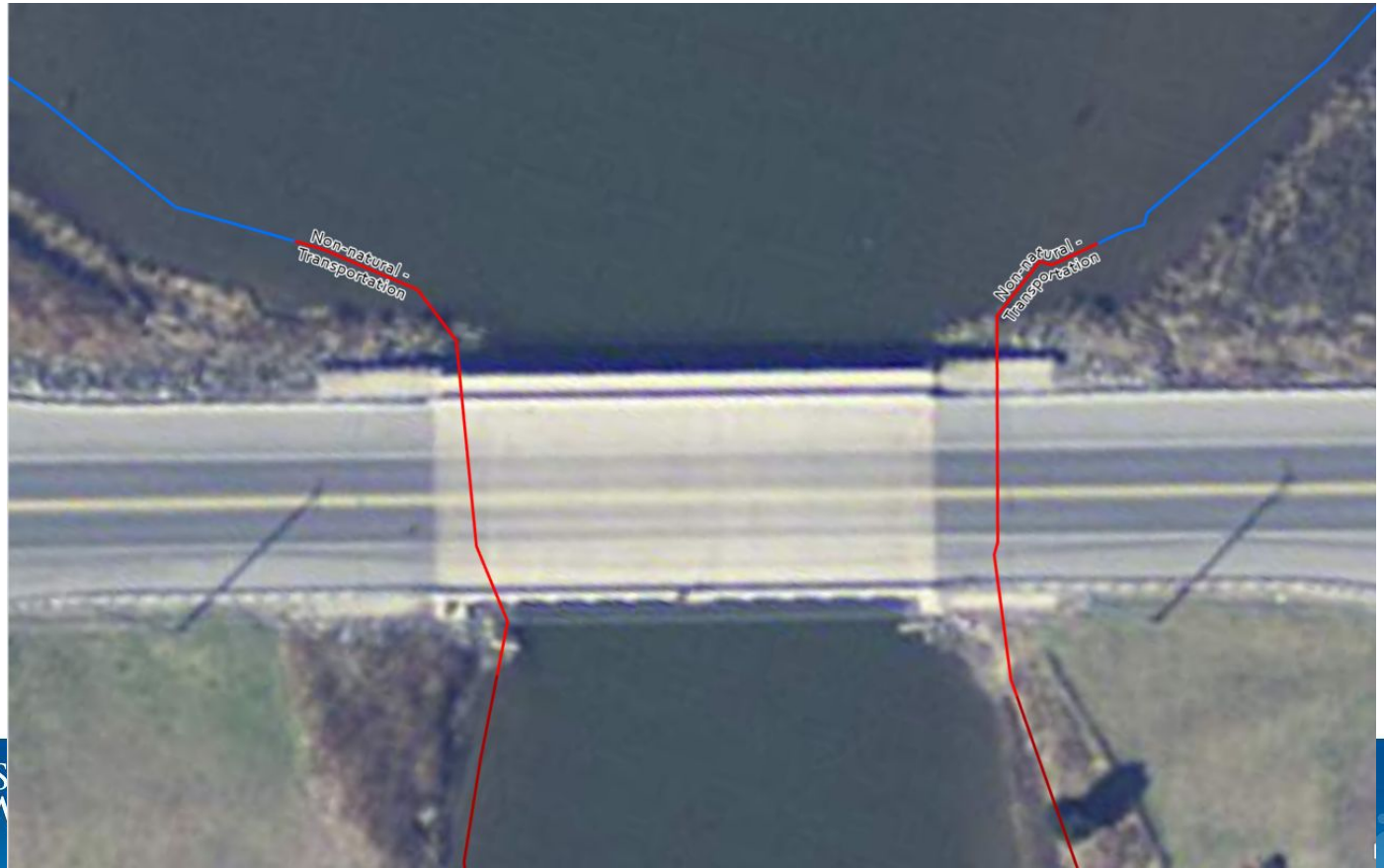
Examples: Natural - Wetland and Wooded

Examples: Natural - Mixed

Examples: Non-natural Residential & Other

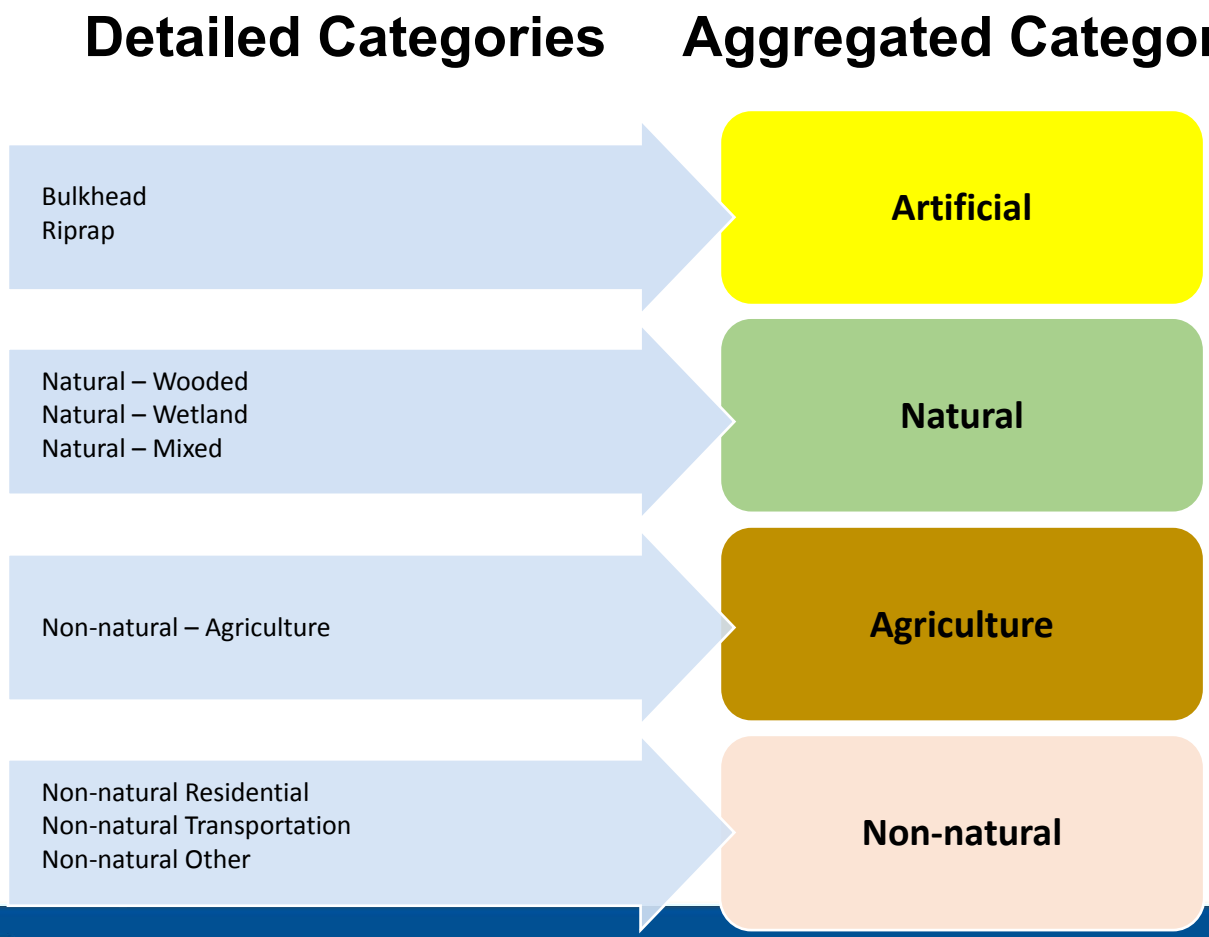
Examples: Non-natural Ag

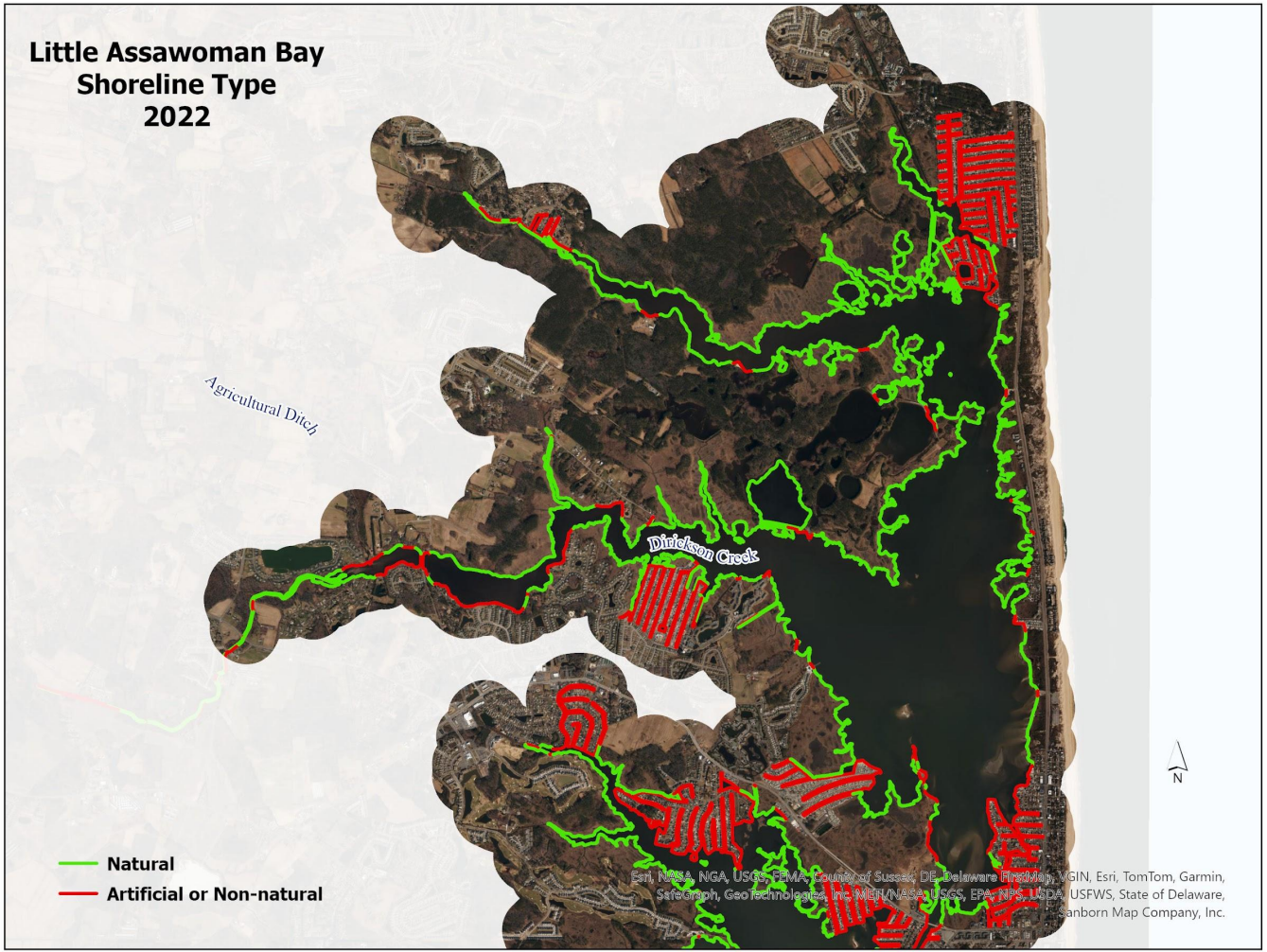
Examples: Non-Natural Transportation



Preliminary Results

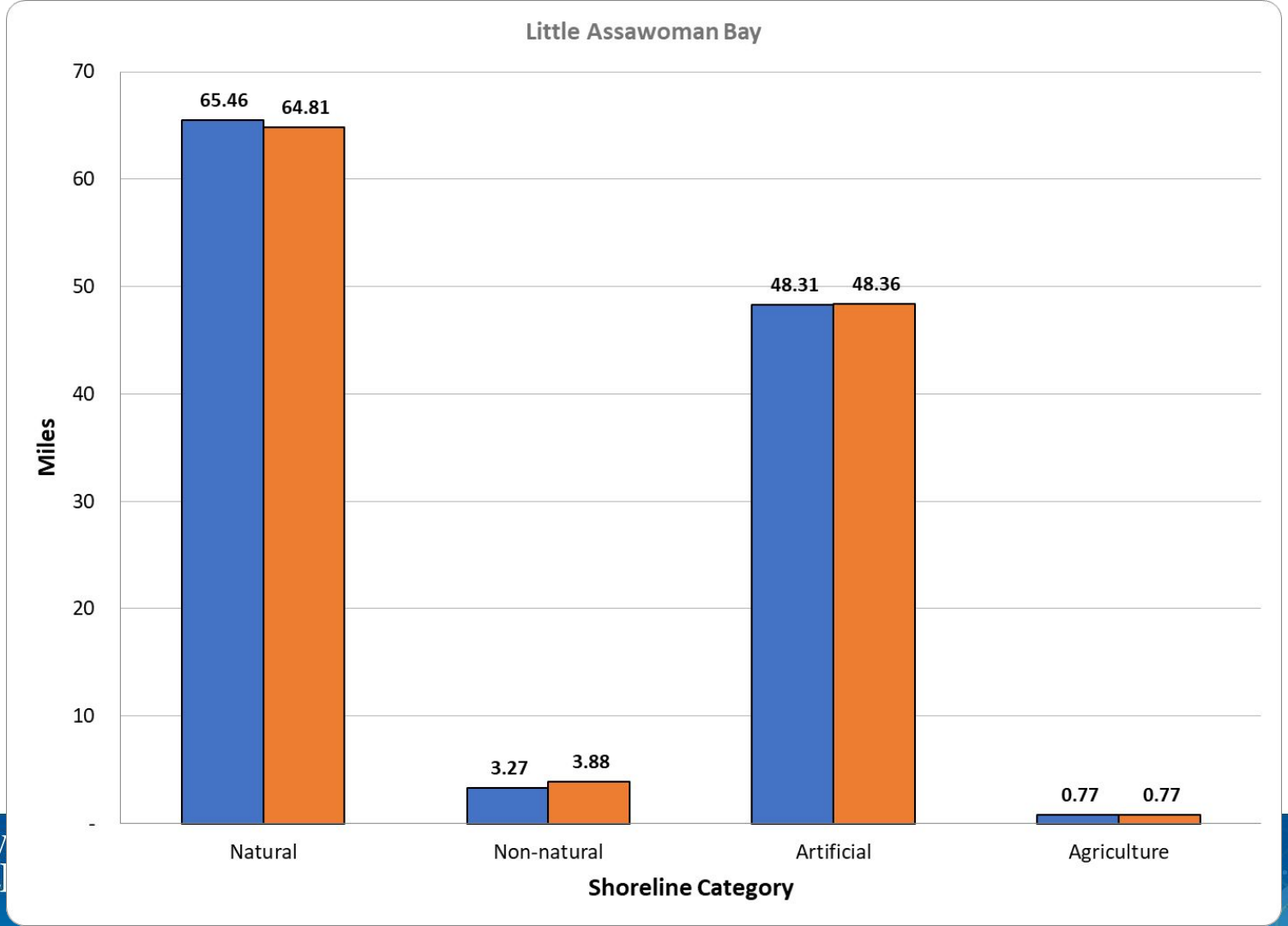
- Quantify results:
  - Use a simplified 4 category system based on shoreline character
  - Summarize lengths of each category by Bay and year (2012, 2020)
  - Use an aggregation grid (60 m square) to summarize and map changes

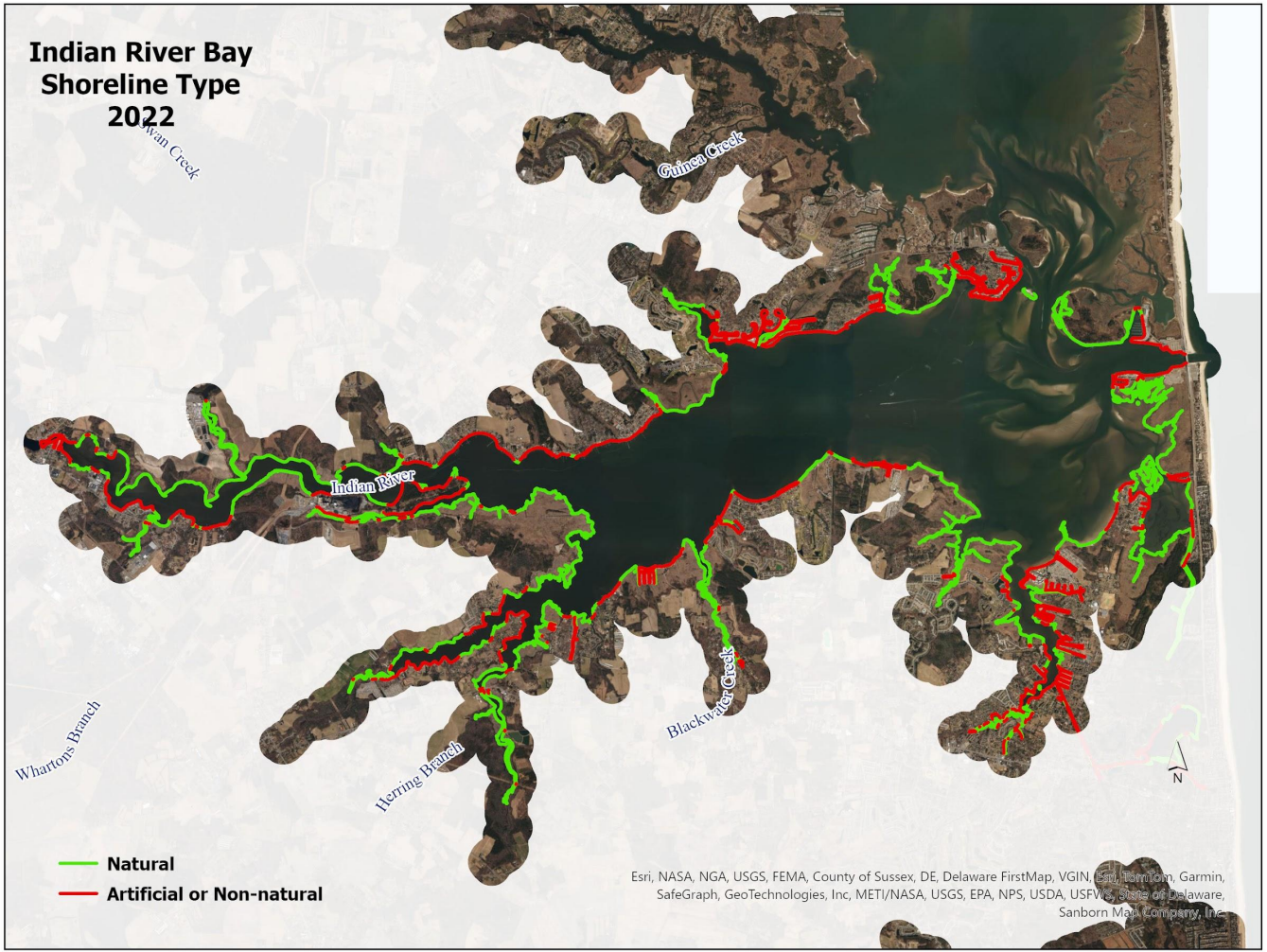

Detailed Categories
Aggregated Categories
Bulkhead
Riprap
Artificial
Natural – Wooded
Natural – Wetland
Natural – Mixed
Natural
Non-natural – Agriculture
Agriculture
Non-natural Residential
Non-natural Transportation
Non-natural Other
Non-natural


Little Assawoman Bay
Shoreline Type
2022
Agricultural Ditch
Dirickson Creek
N
Natural
Artificial or Non-natural
Esri, NASA, NGA, USGS, FEMA, County of Sussex, DE, Delaware FirstMap, VGIN, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, USFWS, State of Delaware, Sanborn Map Company, Inc.

Little Assawoman Bay

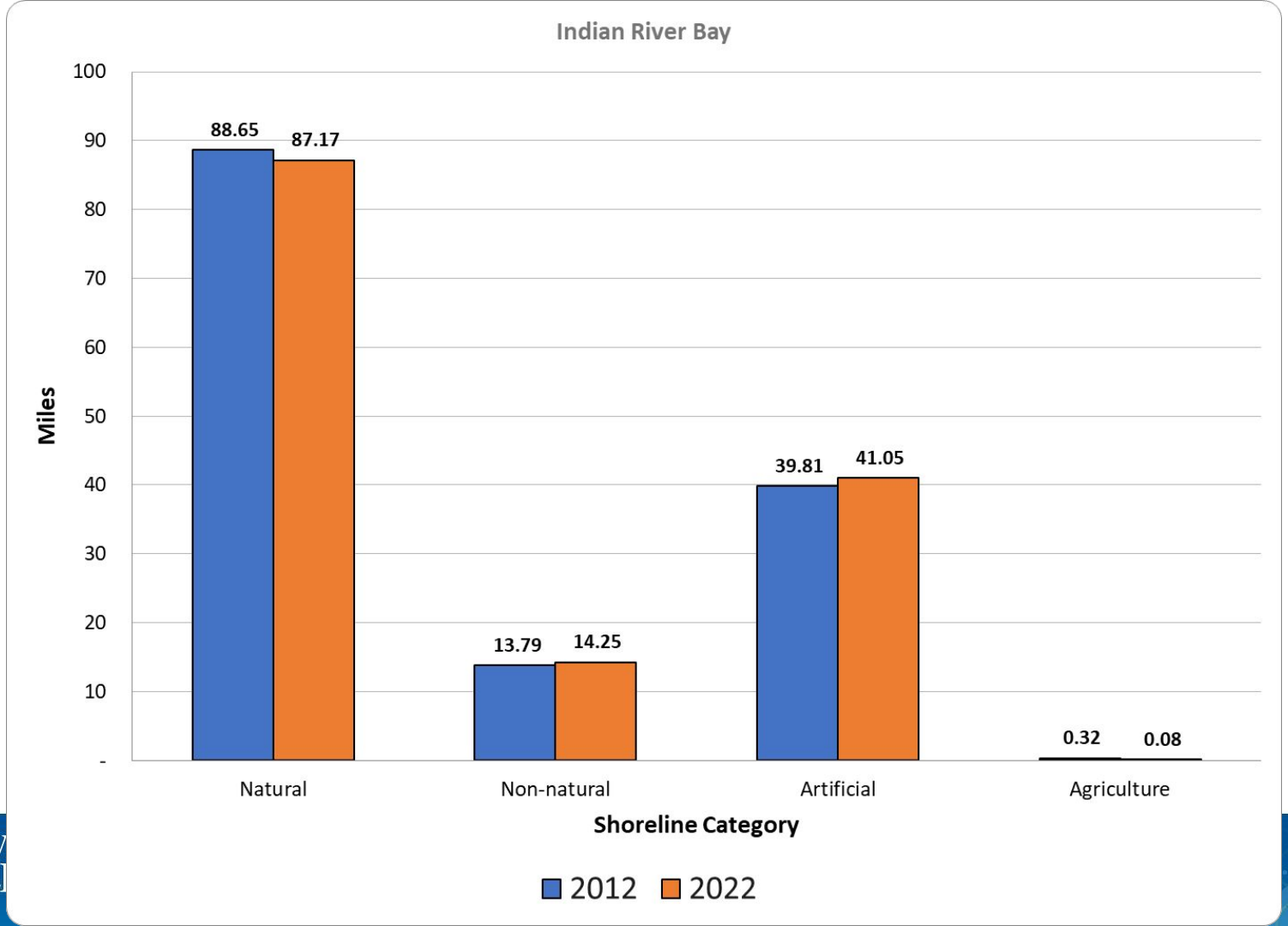
	Length (mi)			
Category	2012	2022	Change (2012-2022)	% Change
Natural	65.46	64.81	(0.66)	-0.56%
Non-natural	3.27	3.88	0.61	0.51%
Artificial	48.31	48.36	0.05	0.04%
Agriculture	0.77	0.77	-	0.00%
	117.8	117.8		

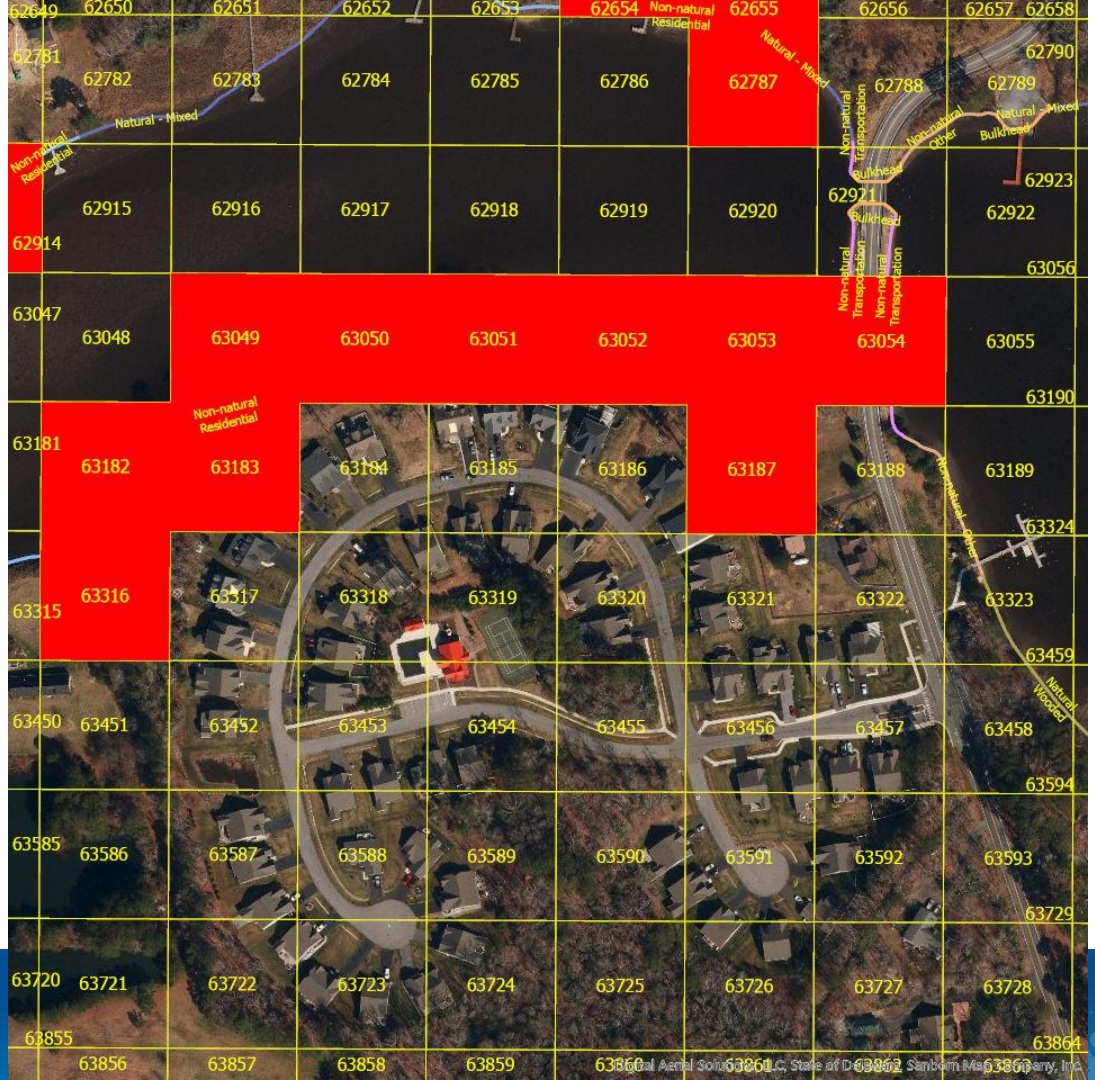

Little Assawoman Bay
70
60
50
40
30
20
10
-
Miles
65.46
64.81
3.27
3.88
48.31
48.36
0.77
0.77
Natural
Non-natural
Artificial
Agriculture
Shoreline Category


Indian River Bay
Shoreline Type
2022
Swan Creek
Guinea Creek
Indian River
Whartons Branch
Herring Branch
Blackwater Creek
N
Natural
Artificial or Non-natural
Esri, NASA, NGA, USGS, FEMA, County of Sussex, DE, Delaware FirstMap, VGIN, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, USFWS, State of Delaware, Sanborn Map Company, Inc

Indian River Bay

	Length (mi)			
Category	2012	2022	Change (2012-2022)	% Change
Natural	88.65	87.17	(1.47)	-1.03%
Non-natural	13.79	14.25	0.46	0.32%
Artificial	39.81	41.05	1.25	0.87%
Agriculture	0.32	0.08	(0.25)	-0.17%
	142.6	142.6		


Indian River Bay
100
90
80
70
60
50
40
30
20
10
-
Miles
88.65
87.17
13.79
14.25
39.81
41.05
0.32
0.08
Natural
Non-natural
Artificial
Agriculture
Shoreline Category
2012
2022



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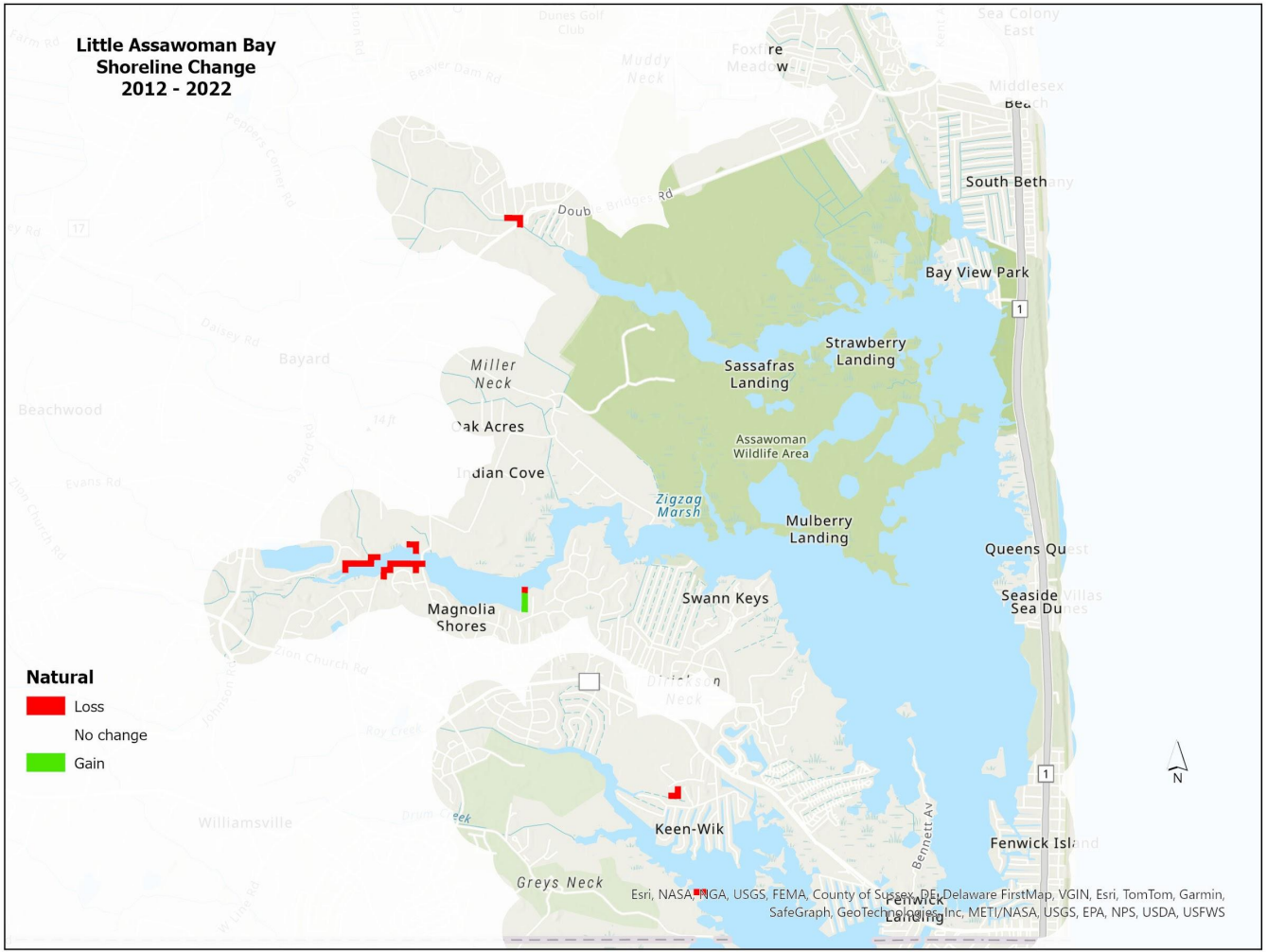
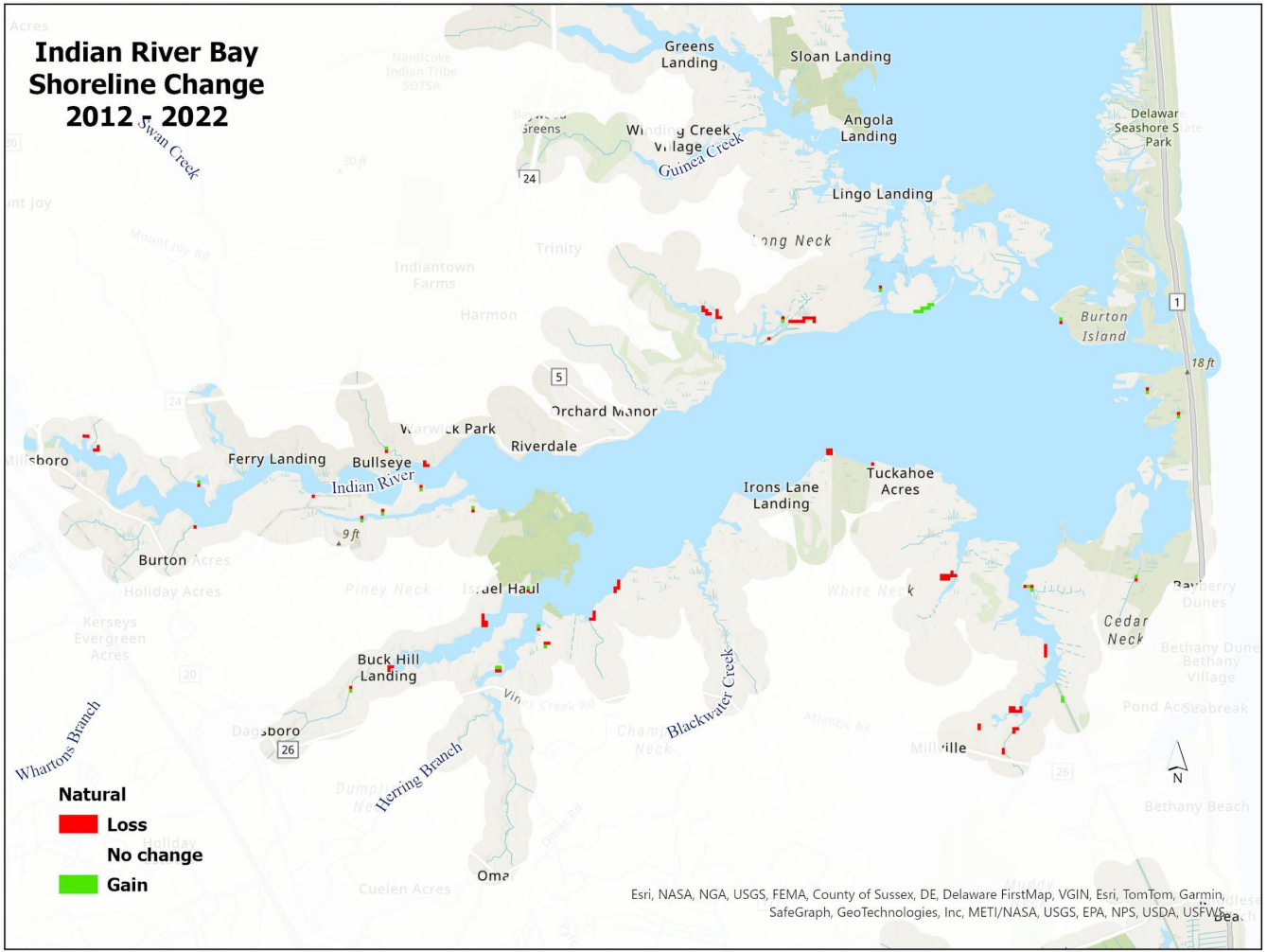
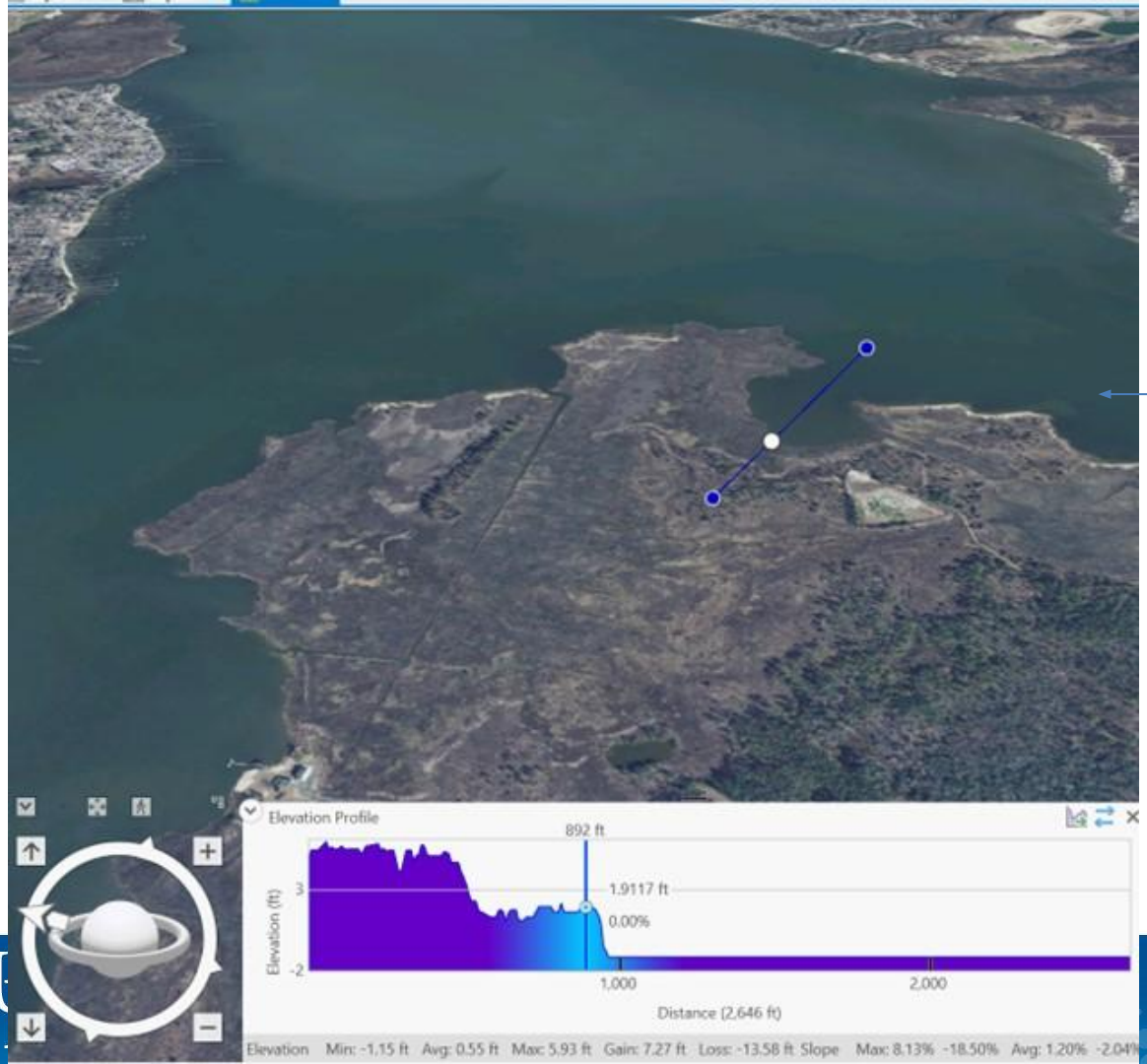

Little Assawoman Bay
Shoreline Change
2012 - 2022
Natural
Loss
No change
Gain
South Beth
Bay View Park
Strawberry
Landing
Sassafras
Landing
Miller
Neck
Assawoman
Wildlife Area
Zigzag
Marsh
Mulberry
Landing
Swann Keys
Magnolia
Shores
Keen-Wik
Fenwick
Landing
Greys Neck
Bayard
Beachwood
Williamsville
Middlesex
Queens Qu
Seaside
Sea Du
Fenwick Isl
Bennett Av
N
Esri, NASA, NGA, USGS, FEMA, County of Sussex, DE, Delaware FirstMap, VGIN, Esri, TomTom, Garmin,
SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, USFWS

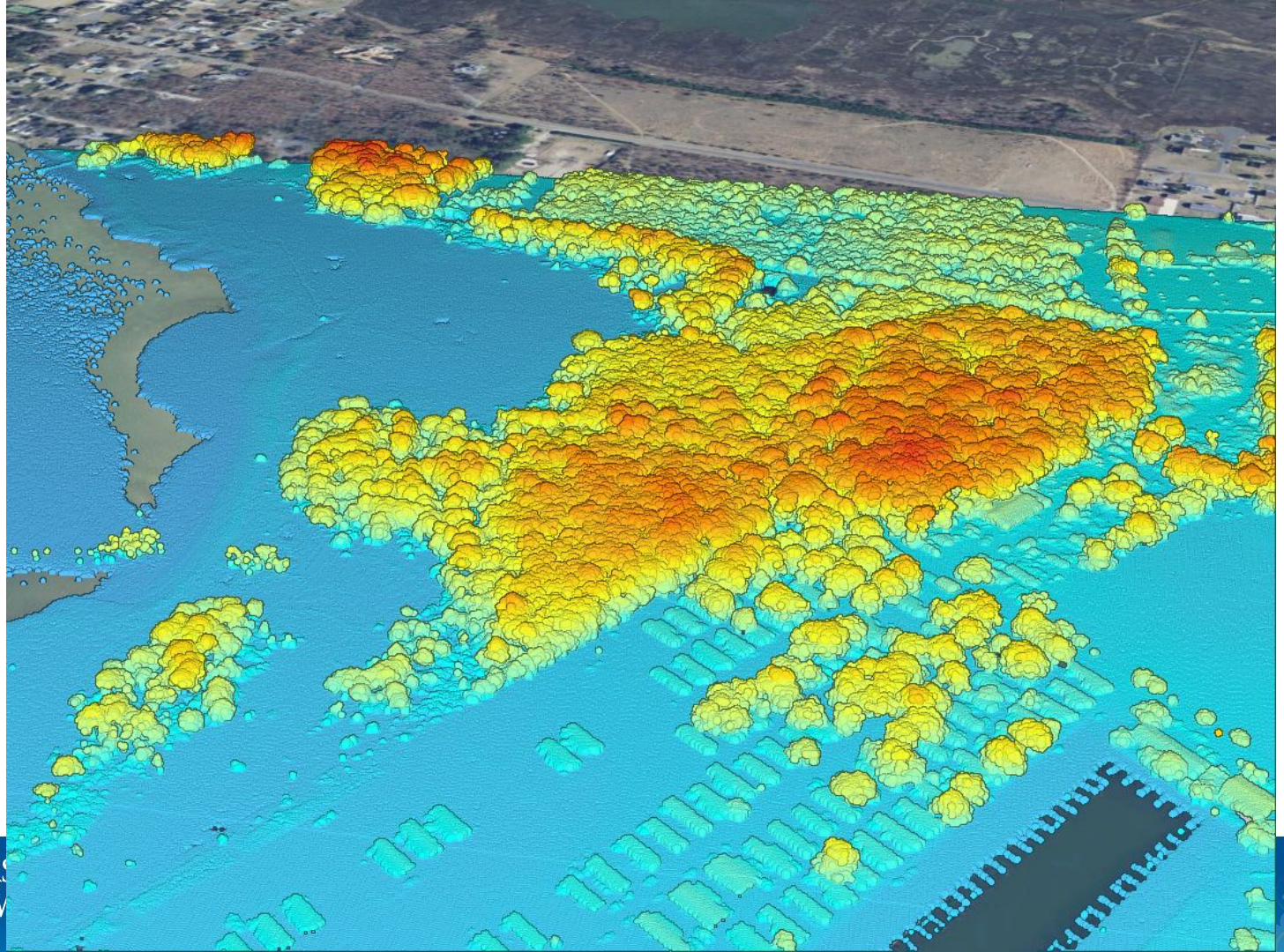

Indian River Bay
Shoreline Change
2012 - 2022
Natural
Loss
No change
Gain
Greens Landing
Sloan Landing
Angola Landing
Lingo Landing
Burton Island
Orchard Manor
Riverdale
Ferry Landing
Bullseye
Indian River
Irons Lane Landing
Tuckahoe Acres
Burton
Buck Hill Landing
Cedar Neck
Blackwater Creek
Herring Branch
Whartons Branch
Guinea Creek
Swan Creek
Esri, NASA, NGA, USGS, FEMA, County of Sussex, DE, Delaware FirstMap, VGIN, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, USFWS



Possible enhancements

- Land use
- LU Change
- Elevations
- Structures

Resilience?



Discussion/Future Direction

1. Living Shoreline Initiative
   - How does this study and/or VIMS relate to the initiative?
2. Data applicability to planning efforts (CCMP)
   - Is this helpful within the overall management plan framework?
   - Does it relate to other areas such as water quality, buffer work, etc.?
3. Recommendations?

E.g.: Google poll for feedback?