

A wide-angle photograph of a long, multi-lane concrete bridge spanning a large body of water. The bridge features a series of concrete piers supporting the deck. In the distance, a cable-stayed bridge section is visible against a sunset sky with orange and blue hues. The water is calm with some ripples.

# NATRAX

Adaptive Infrastructure



NatrX changes the way we use the most widely used material on earth. We make concrete lower cost, more effective, and more sustainable.

# What are the options for protection today?





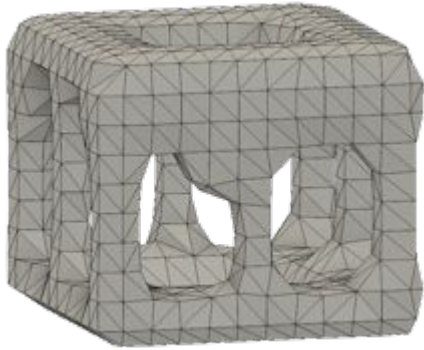
# Approach Validation Hurricane Laura



- Intact Shoreline
- Channelized & Damaged Shoreline
- Precast designs installed by NATRX co-founders
- NATRX modules utilize the same design principles

# The Solution:

## NatrX Adaptive Infrastructure



**An new approach to concrete, a new approach to infrastructure.**

Lower cost than rock or cast concrete

Rapid digital production

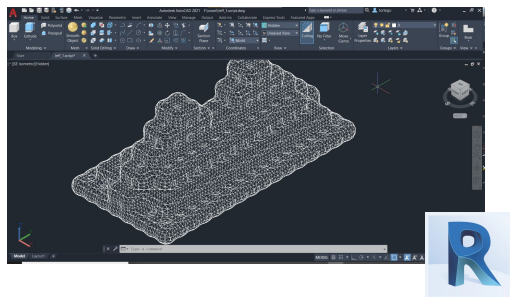
Adaptive to conditions

Habitat friendly & low CO<sub>2</sub>

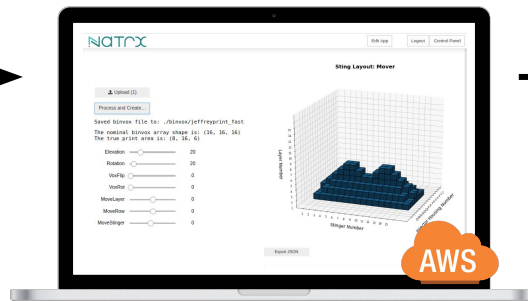
Naturalistic Aesthetics

Resilient to Impact

# Cloud Software & Production Automation



*Design for Solution in CAD*



*Natrx cloud: Upload for Print Prep*

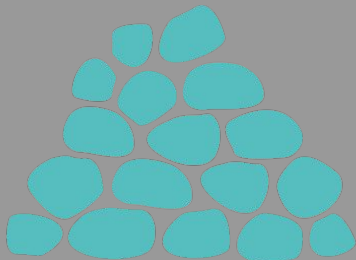


*Send to Printer for Production*

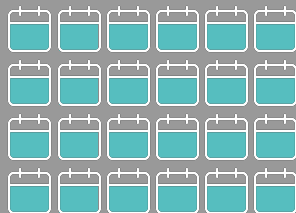


## CUSTOMER PROBLEM REVISITED

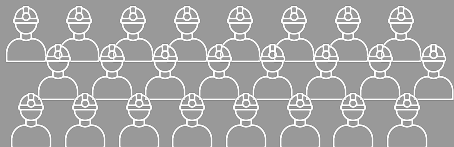
**Rock: \$200,000**



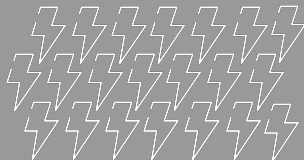
**280 tons of rock**



**2 years to permit**

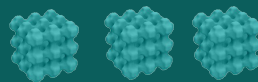


**24 crew days**



**325 tons CO<sub>2</sub>**

**NATRX: \$85,000**



**27 tons Natrx modules**



**60 day permit**



**6 crew days**



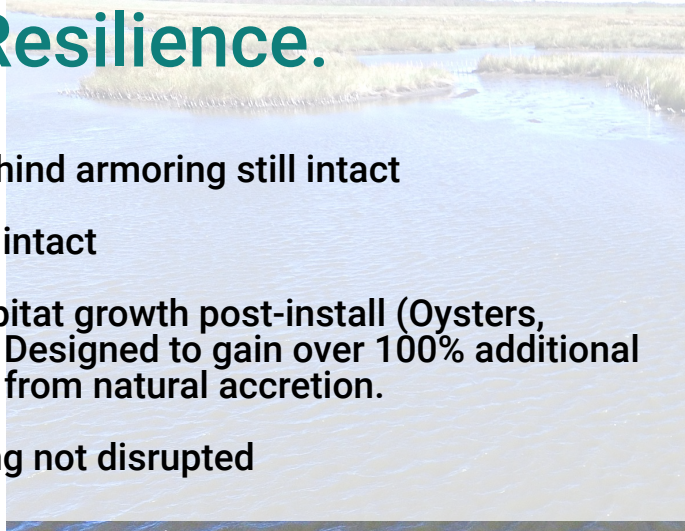
**28 tons CO<sub>2</sub>**





# Post-Storm Resilience.

- Marsh segments behind armoring still intact
- Armoring itself fully intact
- Evidence of rapid habitat growth post-install (Oysters, biofilms, sediment). Designed to gain over 100% additional mass within 3 years from natural accretion.
- Shoreline and landing not disrupted





# Local Contractor Coordination



**Past work conducted in counties with median family incomes 49% and 31% less than national and state incomes, respectively.**

Past work completed resulted in \$8M primary and \$60M secondary impact to coastal areas.



# Economic Impact

Primary Economic Benefits	Year 1	Year 2	Year 3	Year 4	Year 5
Utilization - DPU	10.0%	25.0%	40.0%	60.0%	70.0%
Direct Rev	1,478,400	3,696,000	5,913,600	8,870,400	11,088,000
Full Time Local Employees DPU	4	5	7	7	7
Additional Local Contractor Revenue	\$2,217,600	\$5,544,000	\$8,870,400	\$13,305,600	\$16,632,000
Local Eng. & Env. Services Revenue	\$554,400	\$1,386,000	\$2,217,600	\$3,326,400	\$4,158,000
Total Primary Local Jobs Estimate*	18	41	64	92	114
Private Investment**	\$2,225,456	\$563,640	\$901,824	\$1,352,736	\$1,690,920
<b>Total Primary Impact</b>	<b>6,475,856</b>	<b>11,189,640</b>	<b>17,903,424</b>	<b>26,855,136</b>	<b>33,568,920</b>

\*Assumes 30% of revenue in employment costs and \$46.8K/yr. mean wages construction, 91.7K eng., 2019 US BLS Virginia State Occupational Employment and Wage Estimates Virginia ([https://www.bls.gov/oes/current/oes\\_va.htm](https://www.bls.gov/oes/current/oes_va.htm))

\*Based on direct non-governmental CAPEX contributions from Natrx, and ongoing CAPEX from construction services & production using 2.8% of topline revenue re-invested (NYU Stern, [tinyurl.com/836lmtip](https://tinyurl.com/836lmtip))





# Ecological Services Value

Ecological Services	Year 1	Year 2	Year 3	Year 4	Year 5
Benthic Habitat (cy)	2,688	6,720	10,752	16,128	20,160
Benthic Habitat (sqft)	161280	403200	645120	967680	1209600
Bivalve Viability Curve*	0.15	0.175	0.2	0.225	0.25
Estimated Bivalve Count (Millions)	1.0	3.8	9.0	17.7	29.8
Water Filtration (Bil Gallons Annually)	18	69	163	322	543
Acres of Reef Habitat	2.08	6.07	11.11	18.74	26.03
Ecological Services Value **	\$83,306	\$242,975	\$444,298	\$749,752	\$1,041,322

\*Based on surface area and bivalve viability literature, adjusted for pollution & storm damage in Chesapeake Bay region.

\*\*Estimated at \$40k /acre (Grabowski et al., 2012)



# Secondary Impact: Fisheries & Tourism



Per CCA estimates from published studies, fisheries can add as much as **\$1B+ per year to the tourism industry** by attracting additional fishing and wildlife tourism and retaining more of the VA recreational anglers spend fishing out of state.





# What do we need to grow regionally?

- Streamline permitting for advances in resilience
  - Fight the Flood is doing this!
- Innovative financing programs
  - Landowners will pay, but long term problems need financing
- Create opportunities for business growth
  - Middle Peninsula Planning District
  - RISE Resilience Innovations
  - VA DHCD
- Incentives for expansion in the region
  - Natrx has a revenue-based loan from VA DHCD and Rise Resilience to supply mobile manufacturing of nature-based infrastructure in Hampton Roads. Economic impact is shared in the serviced area across coastal Virginia.

