QUICKREEF

Living Shorelines


Fort Pierce, FL


Gloucester, VA


Pine Knoll Shores, NC


Wilmington, NC

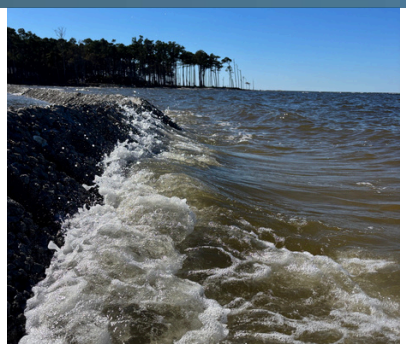
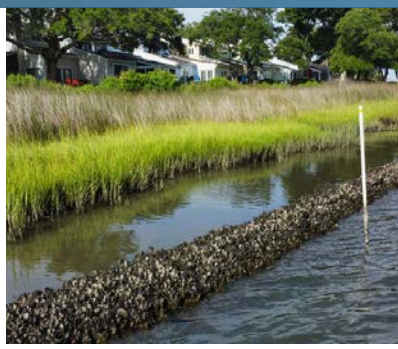
NATIVE SHORELINES
a DAVEY company

July 2026

Davey Resource Group, Inc.
1101 Haynes St, Suite 211
Raleigh, NC 27604
MaryMargaret.McKinney@davey.com

QuickReef® Living Shoreline Materials



QuickReef® is Davey Resource Group, Inc's proprietary line of patented and patent-pending living shoreline materials. Comprised primarily of coastal limestone marl, ***QuickReef®'s patented arrangement attenuates wave energy comparably to a rubble mound structure, provides surface roughness for improved attenuation and oyster attachment, and has extensive connected interstitial space for oyster, crab, fish, and invertebrate habitat. QuickReef®*** has been shown in independent research studies to recruit more and larger oysters than oyster shell bags AND that its wave attenuation increases over time as oysters colonize the structure. ***As such, QuickReef® provides erosion control, wave attenuation, habitat enhancement, and water quality enhancement.*** Our QuickReef® Carbon+™ line of materials (currently in testing) also incorporates landscaping waste-generated biochar into the concrete mixture for carbon sequestration and potential nutrient uptake.

The QuickReef® product line ranges from volunteer-deployable QuickReef® SHU™ living shorelines and oyster reefs to QuickReef® Defender® sills and semi-sills that can replace rubble mound structures. QuickReef® Defender® semi-sills are ideal replacements for revetments and bulkheads where fill material is needed, while QuickReef® Defender® offshore sills can replace rock sills in the harshest in-shore conditions. **QuickReef® structures are fully customizable to ensure that the right structure is installed at every site.**

To date, 32,595 linear feet (LF) of QuickReef® living shorelines have been installed across 48 municipalities in seven states (Florida, South Carolina, North Carolina, Virginia, Maryland, New Jersey, and California). An additional 6,658+ LF of QuickReef® is currently permitted which will bring that total to nearly 40,000 LF of installed QuickReef® living shoreline materials across 54 municipalities.

QuickReef® living shoreline materials are designed for estuarine intertidal waters and have been deployed on sites with fetches ranging 0.01 miles to 30+ miles. The connected nature of QuickReef® living shoreline materials distributes the ground pressure allowing for deployment on soft, sticky, and unstratified/unconsolidated fine sediments without engineered underlayment. A regular bottom across the width profile of the chosen QuickReef® structure is required, so QuickReef® is not ideal when bathymetry drops off very close to shore or there is excessive woody or rocky debris along the alignment.

QuickReef® living shoreline materials many unique advantages
- including composition, design, surface roughness, customization ability, and proven results - make it ideal for a wide variety of projects.

For more information, please contact Mary-Margaret McKinney (marymargaret.mckinney@davey.com, 252.333.9852) or Worth Creech (worth.creech@davey.com, 919-389-3888).

TABLE OF CONTENTS

Why QuickReef 4

QuickReef® Compostion & Production 5

QuickReef® Design 6

QuickReef® Deployment & Longevity 7

QuickReef® Intellectual Property 8

QuickReef® Living Shoreline Product Lines 9
- Original QuickReef® Sills 10
- QuickReef® Shoreline Habitat Units (SHU™) 11
- QuickReef® Defender® Sills & Semi-Sills 12

QuickReef® Testing, Evidence, and Publications 13

QuickReef® Implementation Metrics 14

QuickReef® Oyster Recruitment 15

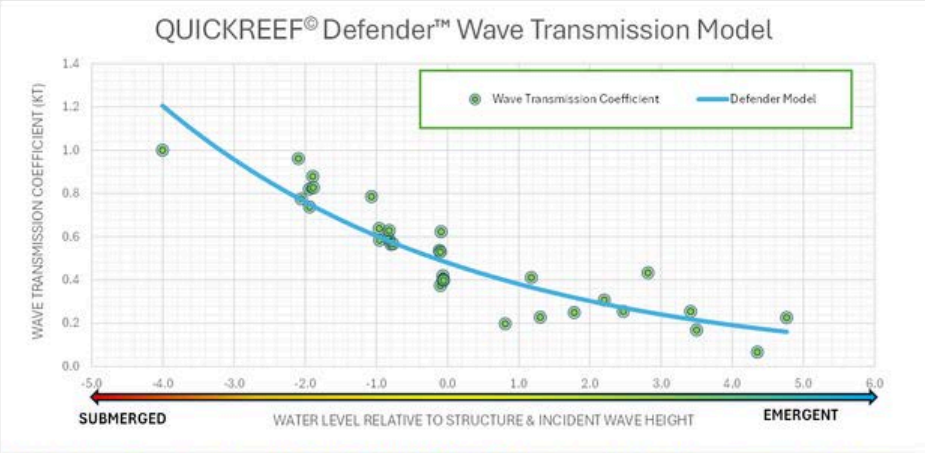
References 16

Davey Resource Group, Inc.
1101 Haynes St, Suite 211
Raleigh, NC 27604
MaryMargaret.McKinney@davey.com

Why QuickReef®?

Comprised primarily of native coastal materials such as limestone marl and oyster shells, QuickReef® living shorelines are proven to provide an ideal substrate for oyster recruitment and aquatic environment enhancement. QuickReef® units are arranged in the shallow waters of the intertidal zone in a configuration that attenuates wave energy, encourages marsh accretion behind the structure, and creates aquatic habitat both on AND within the structure. Due to its outstanding ability to attract and grow native oysters in estuarine waters, QuickReef® living shorelines can naturally grow with sea level rise (Rodriguez et al. 2014), providing long-term resilient protection for shorelines. QuickReef® living shorelines create habitat for fish, blue crabs, oysters and more, while absorbing and reducing the energy from waves and boat wakes that erodes coastal shorelines.

Over 300 wave cases were tested at the University of South Alabama wave flume on QuickReef® configurations and that data has been used to inform and calibrate FLOW3D computational fluid dynamic models. In wave flume testing, wave reflection coefficients across all QuickReef® products were typically equivalent to or much less than values often attributed to rubble mound structures. All designs tested performed well, maintaining 50% or less wave energy transmission under design conditions. Further, accelerometer monitoring showed that testing configurations were mostly unable to motivate significant movement of the QuickReef® panels.*



Note: KT = The wave transmission coefficient defines the ratio of the transmitted (resulting) wave height to the incident (incoming) wave height for waves encountering a coastal structure. Smaller transmission coefficients are indicative of greater energy reductions.

QuickReef® stands alone in the living shoreline materials market in the following ways:

Composition
QuickReef® is 95%+ coastal calcium carbonate

Design
Unlike individual "plopper" units, QuickReef®'s patented, interconnected design distributes ground pressure and wave energy, reduces scour, and provides connected interstitial space for aquatic habitats.

Surface Roughness
QuickReef®'s marl aggregate & recycled shell surface is ideal for BOTH oyster recruitment AND wave attenuation.

Customization
QuickReef® is fully customizable to meet individual site parameters.

Proven Results
QuickReef® has undergone rigorous physical, computational, and field testing AND is proven in the field with nearly 30,000 linear feet of installations and permits in 53 municipalities across seven states.

**Engineering test reports are provided in this brochure under QuickReef® Testing, Evidence, and Publications*






QuickReef® Composition & Production

QuickReef® is comprised primarily (95%+) of limestone marl aggregate and manufactured limestone marl sand quarried in eastern North Carolina. Each QuickReef® unit is wet cast and finished in various wooden forms, giving us the ability to quickly make design changes and be highly customizable. In our QuickReef® concrete mix, there is no river sand, granite, or fiberglass fibers - just a nearly 100% calcium carbonate finished product. When support is needed within QuickReef® units, all rebar used is non corrosive Fiberglass Reinforced Polymer (FRP). Units are produced weekly with turnaround time on orders typically less than six weeks.

Original QuickReef® units, QuickReef®SHU™s, and the top units of QuickReef® Defenders® can be veneered with all limestone marl aggregate or a combination of limestone marl aggregate and recycled oyster shells. Both options create a surface with high rugosity for both oyster attachment (Kendall et al. 2026) and wave attenuation (Tso et al. 2026) and with known nutrient reduction capabilities (Gubernat et al. 2022).

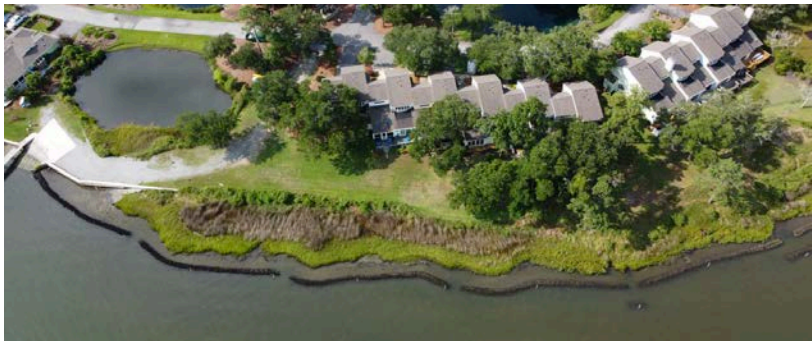
When large units are needed, the base units can be made from locally sourced standard concrete to reduce shipping costs. For large-scale projects, locally quarried materials can potentially be substituted for North Carolina quarried materials, and units can be produced locally. Our forms are not sold for production, however, they can be shipped to a qualified QuickReef® manufacturer so that units can be made locally. All materials are proprietary to and sold by Native Shorelines (Davey Resource Group, Inc. (DRG)).

DRG, the Florida Institute of Technology, and Florida SeaGrant have been awarded a one million dollar Florida Department of the Environment (FDEP) Innovative Technologies Grant to study the nutrient reduction capabilities of our newly-developed QuickReef® Carbon+™ and the application of incorporating other innovative techniques such as heat-treated oyster shells, shown to remove up to 98% of phosphates (Lee et al. 2021).







QuickReef® Design

QuickReef® was initially developed to respond to dwindling oyster shell supplies during the COVID-19 pandemic. Our goals were simple:

- recruit oysters as well or better than shell,
- be as natural as possible,
- resemble an oyster shell bag sill as close as possible upon installation,
- attenuate wave energy instantly,
- work in coastal waters where spat was not available, and
- enhance habitat.

From those straightforward goals has grown a range of products spanning from 37-pound to 5,000-pound units. Fully customizable, we currently produce over 100 different QuickReef® components. Unlike "plopper" units, individual QuickReef® components interconnect and overlap in all arrangements to form continuous revetment and sill structures. Plan sheets, details, and specifications for specific QuickReef® configurations are available upon request.

The first QuickReef® living shoreline was installed in August 2021 at the NC Center for Coastal Protection and Restoration in Newport, North Carolina. This project was initially only six LF of test material. It was expanded over time to 300 LF of QuickReef® in 2023, and an additional 2,931 LF of QuickReef® has been permitted for this site for installation in 2027. As of May 2026, 29,857 LF of QuickReef® materials have been deployed for non-research purposes on over 112 projects (see QuickReef® Installation Metrics).

Our three primary QuickReef® product lines are highlighted in this brochure Original QuickReef® Sills, QuickReef® Shoreline Habitat Units (SHUs™), and QuickReef® Defender® Sills and Semi-Sills.

Original QuickReef® Sills	QuickReef® Shoreline Habitat Units (SHUs™)	QuickReef® Defender® Sills	QuickReef® Defender® Semi-Sills











QuickReef® Deployment & Longevity

QuickReef® is comprised primarily of limestone marl and is 95% coastal calcium carbonate. This fossilized material does not readily deteriorate in salt water, and all support material inside larger units is Fiberglass Reinforced Polymer (FRP) that does not react with salt water (see QuickReef® Composition & Production). As such, QuickReef®'s expected lifespan is greater than 50 years.

Approximately 66,000 individual QuickReef® units have been installed in salt water to date. There has been no discernible deterioration or any damage to any of those structures.

QuickReef® materials recruit oysters quickly (within two weeks under ideal environmental conditions) and can be fully covered by oysters in less than 12 months (see QuickReef® Oyster Recruitment). Once covered in oysters, the system is a functioning oyster reef with an indefinite lifespan. QuickReef® SHUs™ and original QuickReef® units may require some minor maintenance prior to oyster recruitment in large fetch and/or high energy environments.

Original QuickReef® and QuickReef® SHUs™ are hand-deployable without the optional base units and require a combination of manual labor and machines to deploy when utilizing the optional base units.

QuickReef® Defenders® are fully machine deployable - base units for Original QuickReef®, QuickReef® SHUs™, and QuickReef® Defenders® sills are easily deployed by excavator with a barrier lifter attachment; QuickReef® Defender® tops and semi-sill bases have integrated lifting points for excavator deployment. Operators report being able to deploy 100s of feet of material per day when environmental conditions are favorable.











QuickReef® Intellectual Property

QuickReef® is a registered trademark of the Davey Tree Expert Co.

The following intellectual property listings apply to QuickReef® materials*:

Issued Patents

- US 11,946,215 - Shoreline Stabilization Device, Issued April 2, 2024
- US 12,507,675 - Restoration Height Cap Unit and Method, Issued December 30, 2025
- US 12,534,864 - Shoreline Stabilization Device, Issued January 27, 2026

Allowed Applications

- US 29/969,088 - Construction Unit, Application Allowed April 21, 2026
- US 18/913,011 - Restoration Unit and Method, Application Allowed April 24, 2026

Published Applications

- US 19/295,080 - Shoreline Habitation Construction Units, Structures made Therefrom and Uses Thereof, Application Published February 12, 2026
- US 19/306,033 - Wave Attenuation Structure Construction Units, Uses Thereof and Methods of Making the Same, Application Published February 26, 2026
- US 19/440,767 - Shoreline Stabilization Device, Application Published May 7, 2026

Filed Applications

- US 63/942,680 - Shoreline Construction Units Containing Biochar, Structures Made Therefrom and Uses Thereof, Application Filed December 17, 2025

Trademarks

- QuickReef®
- QuickReef Defender®
- QuickReef SHU™
- QuickReef Hive™
- QuickReef Carbon+™

**Additional US patents may apply or be pending*






Original QuickReef® Sills

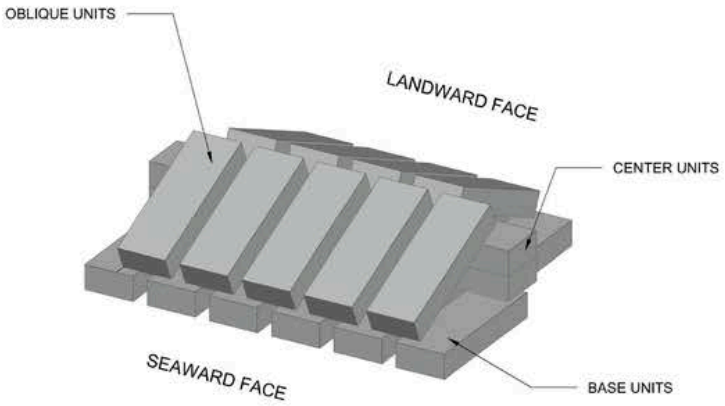
Original QuickReef® was designed to provide an environmentally-friendly alternative to oyster-filled plastic bags, perform consistently and immediately, whether oysters are present or not, add in sediment accretion, and provide unparalleled habitat for fish, oysters, and other marine life.

Due to its calcium carbonate composition, unique arrangement that creates creates connected interstitial space, and rough texture, original QuickReef® shorelines have been shown to recruit larger and more oysters than oyster shell bags on the same sites (50.86 oysters/m^2 with an average length of 4.35cm (QuickReef®) vs 20.09 oysters/m^2 with an average length of 3.71cm (oyster shell bags)) (Tso et al. 2024).

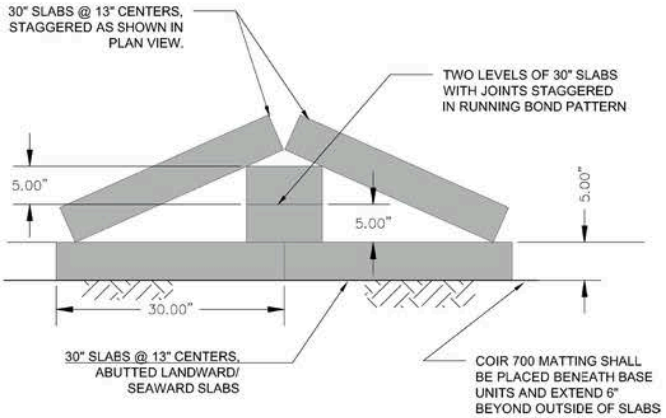
Orignial QuickReef®'s patented arrangement has been tested in wave flumes and across miles of shorelines,and can be installed on most low to moderate energy, shallow-water estuarine sites.

It is 15" x 60", 21" x 60", and 24" x 80" configurations. Optional base units can be substituted for individual units on the base and spine to provide greater stability in higher energy environments and/or on unconsolidated sediments, or when a primarily equipment-based installation is preferred.

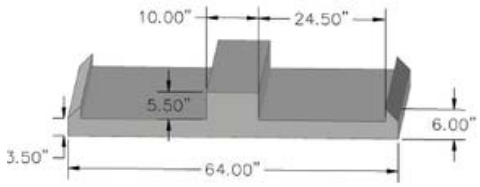


ORTHOGONAL VIEW - 21"x60" MID REEF SECTION
N.T.S.



SECTION VIEW - 21"x60" MID REEF SECTION
N.T.S.



NOTE: COIR 700 MATTING NOT UTILIZED WITH OPTIONAL BASE UNIT

ORTHOGONAL VIEW - OPTIONAL BASE UNIT
N.T.S.

U.S. patents may apply to these products. U.S. Patent Nos. 11946215 and 12507675. Additionally, U.S. patents are pending on these products.



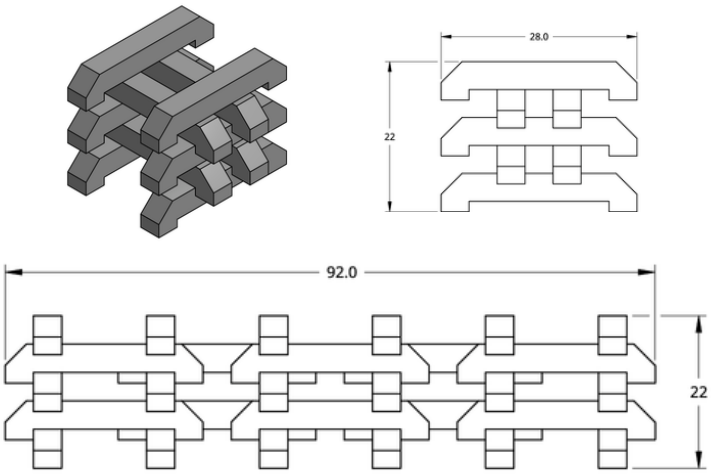



QuickReef® Shoreline Habitat Units (SHUs™)

QuickReef® Shoreline Habitat Units (SHUs™) are a smaller version of our original patented offshore sill arrangement. Weighing in at approximately 37 pounds each, SHUs™ are a modular, DIY- friendly living shoreline material that reduces wave energy while also providing habitat for both fish and oysters

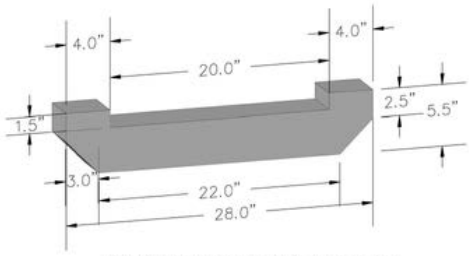
SHUs™ are ideal for lower-energy environments where castles or shell bags would typically be used. Unlike both castles and shell bags, QuickReef® SHUs™ provide connected interstitial space for motile fauna such as fish, crabs, and shrimp.

QuickReef® SHUs™ ship by the pallet with one pallet creating 6 to 7 LF of 15" or 21" high x 44" wide living shoreline. They can also be configured as a SHUs™ box reef - for single or connected habitat-only units.

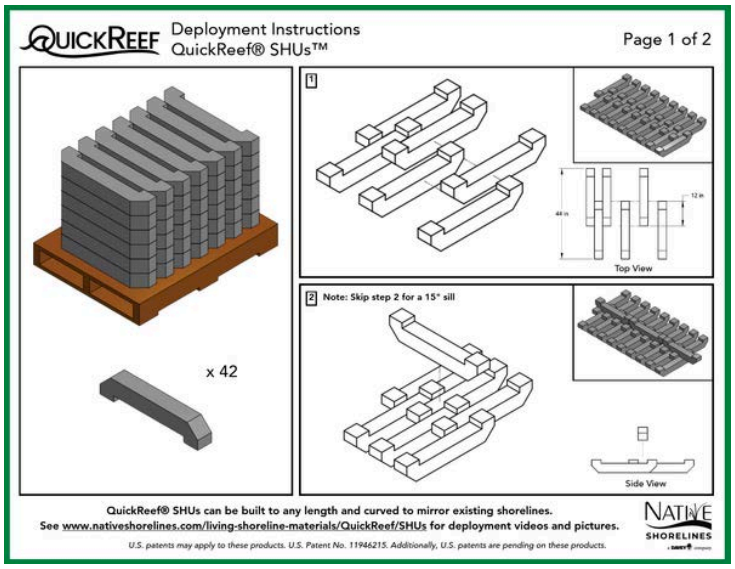


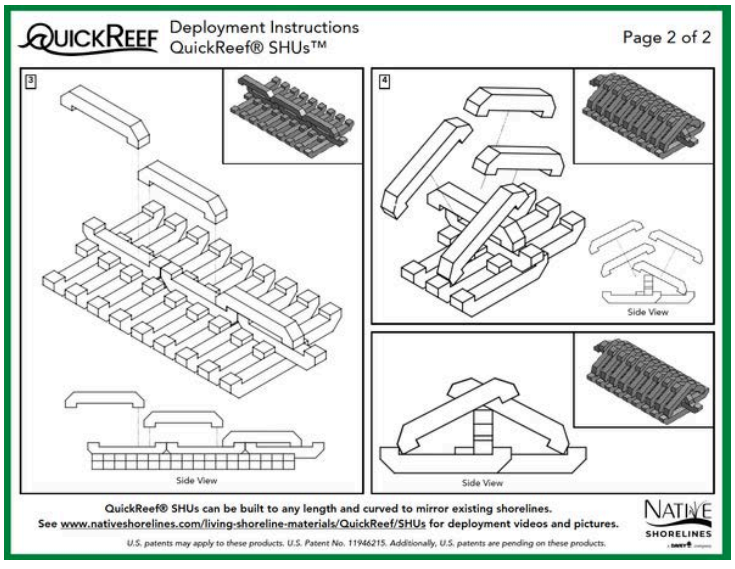
QuickReef® SHU™ Box Reef Configuration



ORTHOGONAL VIEW - TYPICAL SHU UNIT
N.T.S.





Easy to follow QuickReef® SHUs™ Instructions

U.S. patents may apply to these products. U.S. Patent No. 11946215. Additionally, U.S. patents are pending on these products.






QuickReef® Defender® Sills & Semi-Sills

QuickReef® Defender® sills and semi-sills extend our living shoreline capabilities to the deepest in-shore waters and highest wave energies. Fully machine-deployed, QuickReef® Defenders® mimic the same patented arrangement that has been proven to reduce wave energy, aid in sediment accretion, create outstanding habitat, and promote oyster growth. Designed for both stability and ease of installation, QuickReef® Defenders® are an ideal replacement for rip rap and rubble mound structures. Wave flume testing and computational fluid dynamic modeling has been completed and show that QuickReef® Defenders® attenuate wave energy comparably to rubble mound structures.

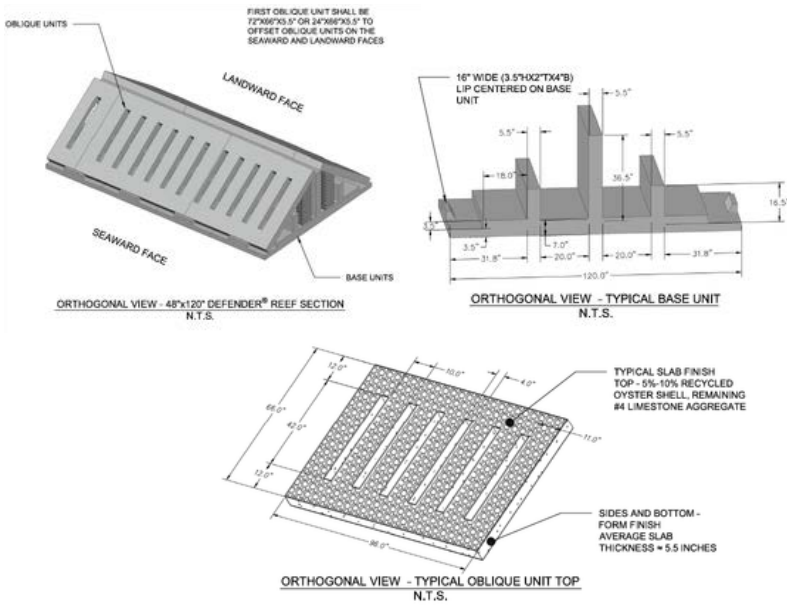
Unlike unconnected "plopper" structures, the overlapping nature of QuickReef® Defenders® enables the entire structure to act as a single unit - dispersing wave energy comparably to a rubble mound structure, distributing ground pressure, and providing connected interstitial space for fish and invertebrates.

QuickReef® Defender® semi-sills are ideal for installations that require backfill and planting. By providing habitat that rip rap revetments cannot, QuickReef® Defender® semi-sills create a true living shoreline instead of merely an armored one. They are available with and without an integrated backsplash.

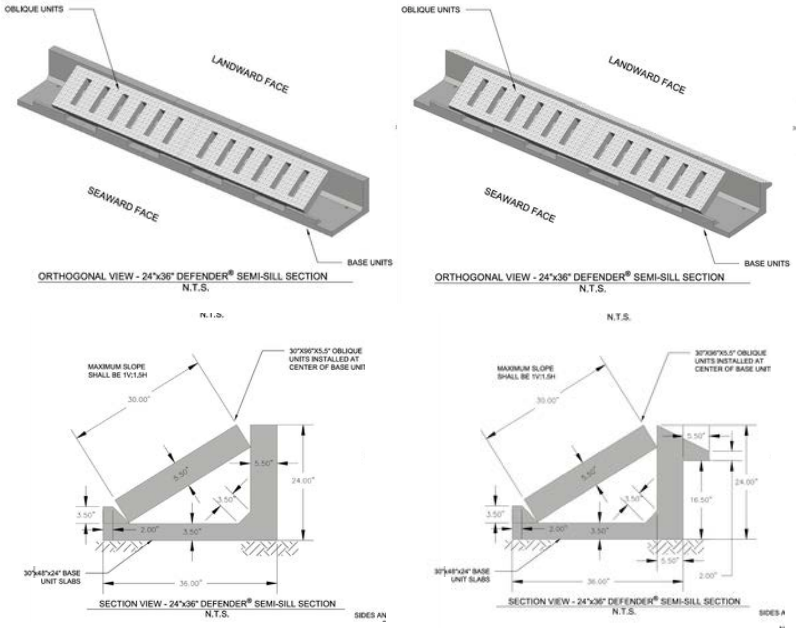
Current Defender® production sizes range from 15" to 48" high. Custom configurations up to 96" high are readily available with notice for production time.




QuickReef® Defender® Offshore Sill

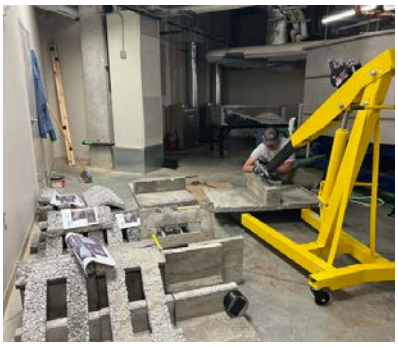
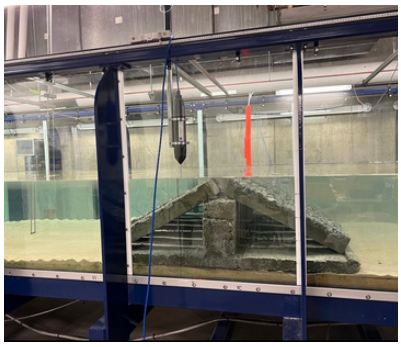


QuickReef® Defender® Semi-Sill with (right) & without (left) integrated backsplash



U.S. patents may apply to these products. U.S. Patent Nos. 11946215 & 12534864. Additionally, U.S. patents are pending on these products.




QuickReef® Testing, Evidence, and Publications

QuickReef® living shorelines have been installed on over five miles of estuarine shorelines and are both qualitatively and quantitatively proven to recruit oysters, provide motile fauna habitat, aid in sediment accretion, and attenuate wave energy. DRG has commissioned physical, computational, and in situ testing of QuickReef® products. The results of these tests are provided, unabridged, in links below.

- **QUICKREEF® TESTING REPORT. (2024). University of South Alabama Center for Applied Coastal Engineering & Science ACES 24-003. https://nativeshorelines.com/wp-content/uploads/2024/10/ACES-24-003-QuickReef-Testing-Report-Complete-Final-26Sep2024-1.pdf** -*"This report describes the results of reduced scale physical experiments to evaluate the performance and hydrodynamic stability of QuickReef® products manufactured by Native Shorelines, a Davey Company. Experiments were carried out in the University of South Alabama's Large Wave Flume (LWF) facility within the Center for Applied Coastal Engineering and Science."*

- **Coastal Engineering Services for QuickReef® Product Development & Enhancement Summary of Findings Report. September 2025. Prepared for Native Shorelines by Southern Shores Engineering https://nativeshorelines.com/wp-content/uploads/2025/12/QuickReef-Product-Development-Final-Report.pdf** - *"In all three of the studies conducted [physical wave flume, FLOW-3D, and field analyses], QuickReef technologies showed strong wave attenuation capabilities. Physical modeling also showed that the structures were stable under a variety of conditions. Comparable results were observed both in numerical modeling and field data measured at deployment sites. Ecological benefits of the QuickReef Deployments are still being quantified, but qualitative observations suggest that erosion rates have been reduced behind the structures and significant oyster spat recruitment has occurred at many of the deployment sites."*

Independent research is on-going on multiple QuickReef® living shorelines. In order not unduly bias this research in any way, DRG does not see any of the data produced by these studies until/unless it is presented publicly at conferences, in thesis/dissertation defenses, or in peer-reviewed journals. Known independent, publicly available research that includes QuickReef® is provided below:

- Tso, G. L., Narayan, S., Geesin, M. E., Sirianni, H., Reidenbach, M. A., Figlus, J., & Gittman, R. K. (2025). Oyster recruitment and growth increases wave attenuation by breakwaters. Scientific Reports, 16(1), 17. https://doi.org/10.1038/s41598-025-29349-9
- Geesin, M., Sirianni, H., & Gittman, R. (2024). Utilizing UAS-SfM to assess the erosion control properties of a novel oyster breakwater substrate. 2024, EP42A-08. https://ui.adsabs.harvard.edu/abs/2024AGUFMEP42A..08G
- Tso et al. (2024, August 28). Wave attenuation performance of constructed oyster breakwaters across varying levels of oyster colonization. ASPBA Coastal Conference, Galveston, TX, USA. https://asbpa.org/2024-asbpa-national-coastal-conference/






QuickReef® Implementation Metrics

QuickReef® materials have been permitted and/or installed for non-research use on at least 132 living shoreline projects across six states – Florida (FL), South Carolina (SC), North Carolina (NC), Virginia (VA), Maryland (MD), and New Jersey (NJ) – totaling nearly 40,000 linear feet (LF, Table 1).

QuickReef® living shorelines installed and/or permitted by state for non-research purposes as of 25 July 2026 by both linear feet and number of projects.

	Installed		Permitted & Awaiting Installation*	
State	**LF**	**Projects**	**LF**	**Projects**
North Carolina	25,309	92	3,056	2
Virginia	3,170	20	2,065	10
South Carolina	1,525	2	672	1
Maryland	310	1	0	0
New Jersey	2,200	1	500	1
Florida	63	2	365	1
Total	**32,577**	**118**	**6,658**	**15**

**Only includes projects with confirmed DRG sales of QuickReef®. QuickReef® materials may also be specified in permitted projects that DRG has not been made aware of.*

Federal permits *for QuickReef® living shorelines have been issued by the Jacksonville, Charleston, Wilmington, Norfolk, Baltimore, and Philadelphia United States Army Corps of Engineers (USACE) districts, and a QuickReef® living shoreline is under review by the New York USACE district.*

State general and/or individual permits *have been issued for QuickReef® living shorelines in FL, SC, NC, VA, MD, and NJ. A New York state permit application is under review.*

Most localities that QuickReef® has been permitted do not require local permits for living shorelines, but ***local permits*** *have been obtained in FL, NC, VA, and MD..*

QuickReef® living shoreline materials have been deployed in ***research projects*** *in California (CA), Georgia (GA), NC, VA, and MD.*

QuickReef® living shorelines have been included in plans designed by Dewberry, RK&K, ACT Engineers, ATM Engineering, Marstel-Day, D&B Engineers & Architects, Ducks Unlimited, AnchorQEA, Brown & Caldwell, and others.

QuickReef® Oyster Recruitment

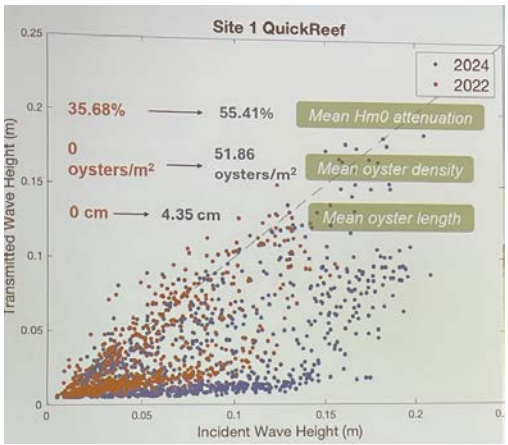
QuickReef® living shorelines deployed under the appropriate environmental conditions for recruitment in waters with sufficient natural spat recruit oysters quickly (Tso et al. 2026), forming a dense living reef with more and larger oysters than oyster shell bags on the same site (50.86 oysters/m^2, average length of 4.35cm (QuickReef®) vs 20.09 oysters/m^2, average length of 3.71cm (oyster shell bags)) (Tso et al. 2024).

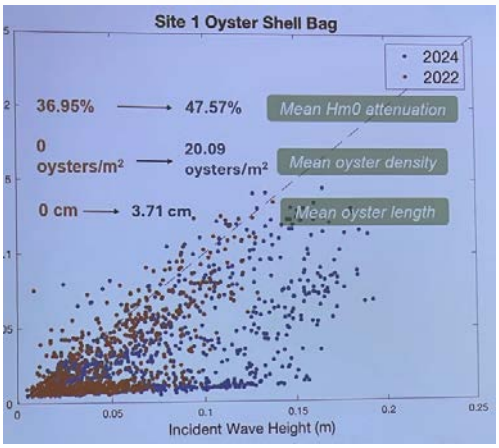












Tso, G. L., Narayan, S., Geesin, M. E., Sirianni, H., Reidenbach, M. A., Figlus, J., & Gittman, R. K. (2024, August 28). Wave attenuation performance of constructed oyster breakwaters across varying levels of oyster colonization. ASPBA Coastal Conference, Galveston, TX, USA. https://asbpa.org/2024-asbpa-national-coastal-conference/

References

Gubernat, S., Masłoń, A., Czarnota, J., & Koszelnik, P. (2022). Phosphorus removal from wastewater using marl and travertine and their thermal modifications. Desalination and Water Treatment, 275, 35–46. https://doi.org/10.5004/dwt.2022.28529

Kendall, M. S., Cahill, B. V., Siceloff, L., Congdon, V. M., Biggs, C., Swanson, K. M., & Palmer, T. A. (2026). Which attributes of restored oyster reefs provide the best habitat for sportfish? Restoration Ecology, n/a(n/a), e70430. https://doi.org/10.1111/rec.70430

Lee, J.-I., Kang, J.-K., Oh, J.-S., Yoo, S.-C., Lee, C.-G., Jho, E. H., & Park, S.-J. (2021). New insight to the use of oyster shell for removing phosphorus from aqueous solutions and fertilizing rice growth. Journal of Cleaner Production, 328, 129536.

Rodriguez, A. B., Fodrie, F. J., Ridge, J. T., Lindquist, N. L., Theuerkauf, E. J., Coleman, S. E., Grabowski, J. H., Brodeur, M. C., Gittman, R. K., Keller, D. A., & Kenworthy, M. D. (2014). Oyster reefs can outpace sea-level rise. Nature Climate Change, 4(6), Article 6. https://doi.org/10.1038/nclimate2216

Tso, G. L., Narayan, S., Geesin, M. E., Sirianni, H., Reidenbach, M. A., Figlus, J., & Gittman, R. K. (2025). Oyster recruitment and growth increases wave attenuation by breakwaters. Scientific Reports, 16(1), 17. https://doi.org/10.1038/s41598-025-29349-9

Tso, G. L., Narayan, S., Geesin, M. E., Sirianni, H., Reidenbach, M. A., Figlus, J., & Gittman, R. K. (2024, August 28). Wave attenuation performance of constructed oyster breakwaters across varying levels of oyster colonization. ASPBA Coastal Conference, Galveston, TX, USA. https://asbpa.org/2024-asbpa-national-coastal-conference/

QUICKREEF

NATIVE SHORELINES

a DAVEY company

Davey Resource Group, Inc.
1101 Haynes St, Suite 211
Raleigh, NC 27604
252.732.2935
MaryMargaret.McKinney@davey.com
www.nativeshorelines.com/living-shoreline-materials/quickreef/