Orange County Board of County Commissioners Q&A Briefing Document

? Why didn't you object to placing riprap when we approved the original permit?

Our permit includes riprap, but that reflects necessity—not support. After Hurricane Ian, our seawall was breached by a neighbor's loose pontoon boat. We lost over 120 cubic yards of fill, and the foundation of our home was at risk. Our focus was immediate protection. Despite voicing concerns, the EPD stated riprap was mandatory for approval. We complied under duress. Today, we urge reconsideration—based on science, equity, and sustainability.

? Why are you challenging the current ordinance?

As far as we have been able to discern, the ordinance adopted in 2008 was based on EPD observations without engineering validation and stakeholder input. **Despite requests,** the EPD has not provided documentation to support the recommendation. We submitted over 20 peer-reviewed studies showing riprap's negative environmental impact and a similar number of research papers proving the effectiveness of environmentally friendly solutions. Since the ordinance was approved in 2008, tools for validating shoreline treatments have improved. Today, we have access to **dozens of peer-reviewed studies** and shoreline modeling. We propose a **scientifically supported, ecologically sustainable alternative**.

? What does the OC EPD work instruction EPD-WI-2000-25 state regarding riprap?

The work instructions state: "The placement of riprap is **generally** required for all new seawalls unless the placement of the riprap will cause damage to existing vegetation .... or may cause navigational concerns." The Orange County's riprap installation guidance on their official **Shoreline Alteration & Dredge and Fill Permit** page states: "unless these measures will cause navigation impairment or greater environmental harm."

? What are the concerns with riprap?

- **Increases water temperature and disrupts aquatic habitats.**
- **Reflects and absorbs wave energy, but does not eliminate it**, worsening erosion downstream.
- **It has a negative socio-economic impact**, unappealing, hardened shoreline.
- **Maintenance is a safety hazard,** boulders are heavy and can hurt workers when putting the boulders back in place, moreover operators will have to trample over established vegetation.
- Installation requires heavy equipment, not feasible for us and is not carbon neutral.
- Rarely maintained, settles unevenly — we observed that only 2 of 23 riprap installations on Lake Tibet are properly cared for or meet County specifications.
- **Invasive and expensive** to install, high maintenance costs.
- **Fails to self-adjust**, unlike vegetated systems that regenerate naturally.

? What makes a bioengineered alternative better?

- **Absorbs wave energy,** rather than deflecting it.
- **Lower wave reflection coefficient**
- **Supports native vegetation**, improving water quality.
- **Fully biodegradable**, enriching soil as they decompose.
- **Easy to install**, cost-effective, and ecologically sustainable.
- **Supports habitat, filtration**, and **water temperature control.**
- **Aesthetically pleasing** and **sustainable.**
- **Minimal maintenance costs once established.**
- **More resilient** to storm impacts, **self-healing.**

? Why should the BCC consider your alternative?

- It is **scientifically supported.**
- It is **sustainable.**
- It is **cost-effective** and **aesthetically pleasing.**
- It aligns with **Orange County's environmental goals.**
- Enforcement and application of current ordinance has been inconsistent.

? What is not consistent or being enforced?

- Of the 23 homes that need vertical walls on Lone Tree Lane (land donated in 1957 to the County for public use), we found in the Orange County Environmental records that all approved permits require plantings (the number of plantings vary widely), but:
  - 14 of the seawalls have no permit on record, most seawalls are made of Vinyl sheets.
  - 2 permits issued in 2004 for restoration require riprap, not in place today.
  - 1 owner withdrew the permit application; a seawall was installed.
  - 1 owner withdrew the permit application to replace a failing seawall, no failing seawall observed.
  - 1 owner was told by his contractor that he contacted the EPD and was advised that no permit was required.
  - 1 owner applied to build half of its seawall with riprap, the other half is made of Vinyl undulated sheets with no visible riprap waterward from the wall.
  - 1 owner has a permit, requires only plantings, not yet installed. Wall is mostly water facing contradicting EPD definition of a retention wall as "a structure that in **no time**, other than during extreme conditions, intercepts water levels of a lake, stream, or other waters in the County."
  - 1 house is being built, and has applied for permit, to be granted.
  - We have a permit and are asking for the BCC to consider sustainable environmentally friendly alternatives to riprap.

? Why should we take your word over EPD staff?

We are asking you to consider the evidence. We submitted to the EPD over **20 peer-reviewed studies** detailing the ecological drawbacks of riprap. We also submitted a letter from a Florida certified Engineer concluding that the undulated sheet we used in our seawall construction has a reflection coefficient like riprap.

? What qualifies you to challenge EPD's recommendation?

We are not challenging EPD's authority — we are requesting that the BBC consider current materials and research. We have done extensive research and analysis to support our recommendation.

While the individuals involved demonstrate strong credentials and experience in environmental policy and permitting, their qualifications do not extend to the engineering disciplines necessary to assess wave dynamics or erosion control design. The technical evaluation of riprap or vegetative installations placed waterward of a seawall—particularly regarding wave reflection, attenuation, and energy dissipation—requires expertise in coastal engineering and hydrodynamics. To date, the EPD has not produced documentation confirming that its recommendations and specifications have received engineering validation.

? Is riprap the standard for erosion control?

It is a common method, but not always the best or optimal. Riprap has a **higher wave reflection coefficient** than other modern materials and lakeshore protection methods. There is a substantial amount of peered reviewed research concluding that riprap causes harm to the environment. Research shows there are now better nature-friendly strategies. With the correct design, undulated sheets and established vegetation in lake environments achieve lower reflection coefficients than riprap and plantings. We have also found that combining vegetation with biodegradable coir logs support the establishment of seedlings and offer **better energy absorption**, **support biodiversity**, and align with modern ecological standards.

? How do coir logs compare in durability?

Coir logs last **2–5 years**, during which vegetation establishes and takes over stabilization. Unlike riprap, which requires heavy machinery and ongoing maintenance, coir logs **biodegrade naturally**, leaving behind a rooted, resilient shoreline that is gentler on surrounding habitats.

? Where has riprap been replaced with nature-friendly strategies?

Based on testing and successful shoreline case studies in Florida and other states, riprap has been replaced with nature-based strategies around the USA. A list of some communities that use coir logs and vegetation buffers is attached at the end of this Q&A.

? Is this about aesthetics?

No — it is about **function, sustainability, and a better, more environmentally friendly solution**. Coir logs and mature vegetation reduce wave energy more effectively than riprap, support native ecosystems, and require less invasive installation and maintenance. They also meet shoreline protection goals without compromising environmental integrity.

? Why is lush vegetation better at attenuating wave energy than riprap?

Vegetation **absorbs** wave energy rather than deflecting it, offering superior attenuation. Riprap **deflects** and absorbs but, in the process, creates turbulence and thermal pollution. According to the U.S. Army Corps of Engineers, vegetation absorbs wave energy by bending and flexing, converting kinetic energy into mechanical resistance. In contrast, riprap's solid surface creates turbulence and reflects wave energy, often redirecting it to adjacent shorelines and causing secondary erosion. Vegetation also **improves water quality** by filtering runoff, **supports biodiversity** by providing habitat and r**educes thermal pollution** compared to sun-heated riprap. These findings are echoed in studies from FEMA, Springer Nature, and the Coastal Engineering Research Center, all of which advocate for nature-based shoreline solutions over hard armoring.

? What, in your view is Orange County EPD function?

The Orange County Environmental Protection Division (EPD) plays a vital role in reviewing shoreline stabilization permits. However, their primary function is **regulatory compliance**, not **scientific evaluation** of shoreline engineering alternatives. According to EPD's own shoreline stabilization guidance, **vegetation-based solutions are often preferred when practicable**. Determining the most effective method for wave energy absorption and ecological benefit typically requires input from **coastal engineers, hydrologists, and restoration ecologists** — professionals trained in modeling wave dynamics, sediment transport, and habitat restoration.

? What happens with coir logs in a hurricane?

Both, coir logs and riprap may be displaced during severe storms. Established plantings are vulnerable, but regenerate naturally and cause less damage when they fail. This is evident from all the plantings that now cover our lakefront.

? Why aren't contractors here supporting your proposal?

Contractors have expressed themselves to be in a difficult position. Some contractors suggest not pulling a permit. Most shoreline contractors in Orange County work closely with the EPD and rely on timely permit approvals to keep their businesses running. Challenging the status quo — even respectfully — risks delays, scrutiny, or lost work.

? What are the current best practices for lakeshores if riprap is used?

According to the U.S. Army Corps of Engineers (EM 1110-2-1614) riprap in the 1-to-3-foot range (12–36 inches) is considered oversized for most inland lake applications in Florida such as Lake Tibet. Typical riprap for moderate wave energy zones — like lakes — ranges from 6 to 18 inches in diameter. Larger stones are used for coastal zones, high-velocity channels, or steep embankments. Using oversized riprap increases cost and installation complexity. Reduced interlocking efficiency leads to voids and instability and limits vegetation growth, which is critical for ecological function. Also, placing riprap directly on sand without a geotextile underlayment is not best practice. According to the EPA's Riprap BMP Guide and ASTM D6825-21, proper installation requires a filter layer to prevent soil migration.

? Will this open the floodgates for everyone to demand exceptions?

Not if the County sets clear performance standards — erosion control, wave attenuation, habitat value. We are not asking for a loophole. We are offering an alternative that exceeds those standards with a better ecological outcome.

? Is maintenance or repairs problematic?

Besides the cost, it is a risk to workers as heavy boulders can fall on their feet, or they may injure their backs. Boulders can weigh from 80 to 1800lbs (for boulders 1-3ft in diameter). For our property, due to space, we cannot bring in heavy machinery. It is also problematic when 5 feet of mature vegetation is planted waterward at the toe of the riprap— disturbing that buffer to repair riprap undermines its ecological value and wave attenuation capacity.

? Does permit SADF-23-01-000 comply with FL Administrative Code Rules?

We understand that Florida Administrative Code Rule 62.330.431 only authorizes 100 square feet of impact under a general permit for riprap installations. Permit SADF-23-01-00 requires 500 square feet of coverage, it exceeds the state threshold.

? Who determines the technical effectiveness of shoreline stabilization methods

Determining the technical effectiveness of shoreline stabilization methods — such as comparing riprap to vegetated systems — typically falls within the realm of **coastal engineers, ecologists, and hydrologists**. These professionals conduct field studies, model wave dynamics, and evaluate long-term ecological impacts. In fact, recent research from FEMA (their engineering with nature initiative), Watersheds Canada, and the U.S. Army Corps of Engineers shows that vegetated shorelines outperform riprap in wave energy absorption, habitat restoration, and water quality improvement. encourages alternatives to vertical seawalls and riprap, stating that vegetation and softer stabilization methods may be more environmentally beneficial. This underscores the need for **site-specific, science-based evaluations**, not blanket mandates.

? What is the best practice regarding wave energy reflection?

The Army Core of Engineers and NOAA consider sustainable, low-impact shoreline stabilization best practice a wave energy reflection coefficient lower than 0.5. Our modeling shows that both riprap and plantings meet the requirement (0.44); however mature vegetation 10ft deep and coir logs and 10 ft mature vegetation have even lower coefficients (0.41 and 0.24 respectively). For reference, a concrete seawall has a coefficient of 0.90, the undulated vinyl sheet 0.78. A natural shoreline 0.15.

? What are you asking the BCC to do? We are asking the BCC to:

- Be open to alternatives that have a scientific foundation and are ecologically sustainable.
- Set precedent and lead for smarter, greener shoreline protection.
- Approve vegetation and/or biodegradable coir logs native plantings as an alternative to riprap.

Key Studies Supporting Our Ask

Study/Publication	Key Findings
University of Delaware – Vegetation-Induced Attenuation of Waves	Vegetation like *Phragmites australis* reduced wave energy flux by **at least 30%**, outperforming riprap in erosion control and habitat preservation.
Springer Nature – Impacts of Riprap on Wetland Shorelines	Riprap led to **coarser substrates**, reduced plant diversity, and lower fish abundance compared to natural vegetated shorelines.
FEMA – Alternative Techniques to Riprap Bank Stabilization	Riprap increases downstream erosion and disrupts riparian zones. Vegetation-based methods offer better long-term resilience and ecological benefits.
30 Mile River Watershed Association	Riprap deflects wave energy to neighboring properties, causes thermal pollution, and disrupts aquatic habitats. Vegetation buffers are more effective and sustainable.
Resilient Florida Program – Living Shorelines (DEP site)	Promotes **living shorelines** that absorb wave energy, improve habitat, and reduce nutrient pollution. Includes examples of successful vegetated shoreline projects across Florida.
Maine DEP – NRPA Chapter 305 (30 Mile River summary)	Updated policy **prohibits traditional riprap** in shoreline stabilization. Endorses nature-based solutions like coir logs and vegetation.

📚 **Validated Sources Supporting High Reflection from Riprap**

U.S. Army Coastal Engineering Research Center (CERC) In *Technical Paper No. 81-1*, Seelig and Ahrens analyzed over **4,000 laboratory measurements** of wave reflection from beaches, revetments, and breakwaters. They found that **riprap revetments typically reflect 60–70% of incident wave energy**, depending on slope, wave height, and armor configuration.

Design of Riprap Revetments for Protection Against Wave Attack (TP 81-5) This publication by the U.S. Army Corps of Engineers confirms that **riprap reflects significant wave energy**, especially when placed on steep slopes or without vegetation buffers.

TR-69 Riprap for Slope Protection Against Wave Action – USDA NRCS This technical release outlines that riprap is designed to resist wave attack but **does not absorb wave energy**. Instead, it **deflects and reflects** it, often increasing erosion in adjacent areas.

Experimental Study on Wave Attenuation by Vegetation (Hu, 2020) This study found that **vegetation has a much lower reflection coefficient** than riprap, and that **dense vegetation fields reduce wave height more effectively** than hard structures.

✅ **Best Practice Threshold**

📚 **Supporting References:**

U.S. Army Corps of Engineers – EM 1110-2-1614 *Design of Coastal Revetments, Seawalls, and Bulkheads* States that **vegetated shorelines and natural slopes** typically achieve **R values between 0.3 and 0.5**, while vertical walls exceed 0.9.

DTIC Technical Paper 81-1 – Seelig & Ahrens Found that **natural beaches and vegetated systems** reflect **less than 50%** of incident wave energy, while riprap and vertical structures reflect **60–95%** depending on slope and roughness.

NOAA Living Shorelines Guide Recommends **nature-based solutions** with **low reflection coefficients** to reduce erosion and improve ecological resilience.

✅ **Case support on argument technical specifications and hydrodynamic evaluations, like wave reflection, requires engineering expertise**

- **Hayes v. Bowman, 91 So. 2d 795 (Fla. 1957)** Addresses the complexity of **riparian line determinations**, reinforcing that **technical shoreline modifications** require expert analysis.
- **Save Our Beaches, Inc. v. Florida DEP, 2006 WL 1112700 (Fla. 1st DCA)** Highlights the need for **scientific and engineering validation** in shoreline stabilization projects, especially when public trust lands are involved.

Locations Using Coir Logs for Shoreline Protection

Below is a list of some locations across the U.S. where **coir logs** are used in shoreline protection projects, especially in residential or community-scale efforts. These projects typically involve erosion control, habitat restoration, and vegetated buffers:

	Location	Water body	Description
1	Chesapeake Bay, MD/VA	Estuary	Living shorelines with coir logs and marsh grasses.
2	Lake Minnetonka, MN	Freshwater Lake	Residential stabilization with coir logs and native plants.
3	Keweenaw Peninsula, MI	Lake Superior	Seeded coir logs for wetland restoration.
4	Sand Point, MI	Protected Bay	Experimental wave breaks using coir logs.
5	Portage Waterway, MI	River Channel	Coir logs supporting emergent aquatic vegetation.
6	Galveston Bay, TX	Estuary	Coir logs and oyster shells for erosion control.
7	Charleston, SC	Tidal Creek	Marsh edge stabilization with coir logs.
8	Tampa Bay, FL	Estuary	Living shoreline installations with mangroves.
9	Pensacola, FL	Bayfront	Residential shoreline restoration using coir logs.
10	Lake Champlain, VT	Freshwater Lake	Stabilization and revegetation with coir logs.
11	Lake Washington, WA	Freshwater Lake	Erosion control along residential slopes.
12	Lake Tahoe, CA/NV	Alpine Lake	Hybrid seawalls with coir logs and vegetation.
13	Lake Travis, TX	Reservoir	Coir logs stabilize steep lake banks near homes.
14	Lake Norman, NC	Reservoir	Pilot projects with coir logs and native plants.
15	Lake Erie, OH/PA/NY	Great Lake	Riprap and coir logs used together.
16	Mobile Bay, AL	Estuary	Living shoreline buffers with coir logs.
17	Barnegat Bay, NJ	Estuary	Coir logs and oyster castles in canal communities.
18	Rockport, TX	Coastal Bay	Marsh plantings are supported by coir logs.
19	Biloxi, MS	Gulf Coast	Hybrid seawalls with vegetated buffers.
20	Cape Cod, MA	Coastal Inlets	Coir logs used in dune and marsh restoration.
21	Newport Beach, CA	Harbor	Bioengineered seawalls with coir logs.
22	Port Aransas, TX	Gulf Coast	Living shoreline retrofits with coir logs.
23	Beaufort, SC	Estuary	Marsh sills and coir logs in historic neighborhoods.
24	Savannah, GA	Riverfront	Coir logs and oyster bags for erosion control.
25	Virginia Beach, VA	Estuary	Incentivized coir log installations.
26	Ocean City, MD	Coastal Bay	Shoreline restoration with coir logs.
27	Lake Winnebago, WI	Freshwater Lake	Brush layering and coir log stabilization.
28	Lake Martin, AL	Reservoir	Coir fascines and buffer plants.
29	Lake Sinclair, GA	Reservoir	Biodegradable logs and native grasses.
30	Lake Hartwell, GA/SC	Reservoir	Coconut fiber and native vegetation.
31	Lake Havasu, AZ	Reservoir	Sediment mesh and coir logs.
32	Lake of the Ozarks, MO	Reservoir	Living shoreline retrofits.
33	Lake Murray, SC	Reservoir	Brush matting and coir logs.

34 Lake Ray Hubbard, TX	Reservoir	Trench packing and coir wattling.
35 Lake Ontario, NY	Great Lake	Vegetated buffers and coir logs.
36 Onondaga Lake, NY	Freshwater Lake	Native grasses and coir logs.
37 Cayuga Lake, NY	Freshwater Lake	Living shoreline pilot projects.
38 Seneca Lake, NY	Freshwater Lake	Bioengineered buffers and erosion mesh.
39 Grand Traverse Bay, MI	Bay	Vegetated buffers and stabilization.
40 Lake Macatawa, MI	Freshwater Lake	Living shoreline installations.
41 Lake Mendota, WI	Freshwater Lake	Coir logs and native grasses.
42 Lake Bemidji, MN	Freshwater Lake	Vegetated buffers and erosion mesh.
43 Gull Lake, MN	Freshwater Lake	Living shoreline pilot projects.
44 Detroit Lake, MN	Freshwater Lake	Native plantings and biodegradable logs.
45 Lake Hayward, WI	Freshwater Lake	Brush layering and stabilization.
46 Mirror Lake, NY	Freshwater Lake	Vegetated buffers and coir fascines.
47 Lower Saranac Lake, NY	Freshwater Lake	Living shoreline retrofits.
48 Lake George, NY	Freshwater Lake	Hybrid bulkheads and native grasses.
49 Lake Marion, MN	Freshwater Lake	Restoration with native vegetation.
50 Prior Lake, MN	Freshwater Lake	Living shoreline pilot projects.
51 White Bear Lake, MN	Freshwater Lake	Bioengineered buffers and erosion mesh.
52 Lake Elmo, MN	Freshwater Lake	Vegetated buffers and coir logs.
53 Lake McKusick, MN	Freshwater Lake	Living shoreline installations.
54 Staring Lake, MN	Freshwater Lake	Stabilization with native grasses.
55 Lake Ann, MN	Freshwater Lake	Bioengineered shoreline retrofits.
56 Pokegama Lake, MN	Freshwater Lake	Living shoreline pilot projects.
57 Lake Irving, MN	Freshwater Lake	Coir fascines and shoreline restoration.
58 Lake Carlos, MN	Freshwater Lake	Bioengineered buffers and erosion mesh.
59 Lake Waconia, MN	Freshwater Lake	Vegetated buffers and native plantings.
60 Lake Winona, MN	Freshwater Lake	Living shoreline retrofits.
61 Lake Orion, MI	Freshwater Lake	Hybrid bulkheads and native buffers.
62 Deer Lake, MI	Freshwater Lake	Vegetated buffers and erosion control.
63 Woodland Lake, MI	Freshwater Lake	Coir logs and shoreline restoration.
64 Union Lake, MI	Freshwater Lake	Living shoreline pilot projects.
65 Cass Lake, MI	Freshwater Lake	Bioengineered buffers and native grasses.
66 Pine Lake, MI	Freshwater Lake	Hybrid seawalls and vegetation.
67 Wing Lake, MI	Freshwater Lake	Shoreline stabilization with coir logs.
68 Walled Lake, MI	Freshwater Lake	Living shoreline installations.
69 Barton Pond, MI	Freshwater Pond	Vegetated buffers and erosion mesh.
70 Austin Lake, MI	Freshwater Lake	Bioengineered shoreline retrofits.
71 Lake Springfield, IL	Reservoir	Living shoreline pilot projects.
72 Stephens Lake, MO	Freshwater Lake	Vegetated buffers and coir fascines.
73 Clinton Lake, KS	Reservoir	Shoreline restoration with native plants.