



## Breakwater Systems & Solutions

### **Before Wavebrake**



### **After Wavebrake**





# Introduction to Wavebrake Technology

***Wavebrake is an innovative, affordable Floating Wave Attenuator System that is custom engineered, designed, sized and configured to effectively protect any Waterfront Property***

## **CHALLENGES & PROBLEMS:**

- The unstoppable forces of Mother Nature
- Wind, waves and sun
- Currents and undertow
- Constant wakes from boats

## **RESULTS OF CONSTANT STRESS FROM WAVE ACTION:**

- Bluffs that drop into the water and wash away
- *Storm surges that eat forty feet of land...in an afternoon!*
- Breakwalls undermined and collapse
- Pilings loosened and boat lines snapped

Until recently, stone breakwaters, seawalls, jetties and groins were the preferred structures used to diminish wave energy, reduce erosion and control depositions. These conventional structures are permanent, costly, often unsightly, limited in their effectiveness and seriously compromise the immediate and surrounding environment due to the rebound energy created.

Wavebrake was originally developed to attenuate waves, that is, weaken or reduce the force, intensity and effect of wave energy and provide shoreline stabilization.

Wavebrake provides a long lasting and highly effective solution to these tedious problems and serious challenges, at a fraction of the cost and without any adverse effects on the environment.

Wavebrake wave attenuator is the only floating tethered attenuator capable of adjusting and adapting to the numerous variables. The system can be made wider, larger in size and configured to the required mass dimensions. All our systems are custom engineered and site-specific, which ensures unsurpassed performance and success.



## *Understanding Wavebrake and its numerous advantages & benefits*

Wave attenuators, acting as floating “breakwaters” are designed and engineered to significantly reduce wave and wake action.

The Wavebrake system is an ideal solution for numerous applications with significant benefits, such as no water depth limitations nor negative environmental impact(s).

One of the greatest advantages of the Wavebrake is its flexibility. In the event that not just weather, but coastal condition(s) should ever change in the future, which is inevitable with Mother Nature, Wavebrake systems can be reconfigured and/or relocated to accommodate such changes. The system will not be compromised by the effects of erosion over time, as opposed to other attenuators and conventional breakwaters.

Wavebrake’s floating advantage allows the system to rise vertically to meet tide, high wave activity and storm surge, ensuring wave mitigation and peak performance in all conditions. The meticulously engineered related anchoring system provides the required flexibility and tensioning to keep the Wavebrake system “in the wave.” In addition, Wavebrake will not inhibit tidal fluctuations nor disturb the marine ecology.

Wavebrake systems are low profile and visually unobtrusive, allowing for easy viewing of the waterfront and minimal intrusion on the horizon.

### **Technical Advantages:**

There are four primary variables that affect attenuator performance. They are the mass, the width, the depth and the configuration of the attenuator. Each of these variables must be strategically calibrated to meet the specific design wave criteria for every site. All our systems are individually engineered to specific site conditions, also taking into consideration wind, wave, surge, boat wake and transmitted wave criteria. These factors contribute to providing the highest level of mitigation.

The aim is to protect the area against wave, wake and wind energy and related coastal erosion, presenting an alternative solution to conventional fixed breakwaters. Wavebrake system(s) is extremely effective in coastal areas with mild to heavy wave activity.

While Wavebrake acts as an effective wave barrier, it is porous and open to minimal wave energy, necessary for avoiding water stagnation and minimizing interference with water circulation and marine life migration, as well as working in tandem with the natural flush and flow of the environment.



## Wavebrake vs. Concrete Pontoon Systems

Wavebrake was designed specifically for wave attenuation. The initial design was a single wall utilizing 3/16" material. The current module is a double wall design that increases durability by combining two 3/16" walls. Wavebrake Technology and design allows for the energy in the wave to be dissipated through friction and at the same time hold the Wavebrake in the wave to work as long as energy is present.

The material selected is LLDPE with a range of tolerance of (-40 to + 180). The plastic has 15% UV additives. The black color was selected for longevity. The specific gravity is .92 to water, which makes the module naturally buoyant. The module is flexible and highly resistant to wave impact.

The module surface is smooth and resistive to biologic attachments. The black module is selected for high UV protection applications and the dark blue for high UV and also for greater visibility in daylight. By comparison, Wavebrake modules are soft and forgiving if run into or bumped by watercraft, as they are designed to absorb the energy.

An innovative stabilizer bar is placed, generally every 25 feet, to hold the shape of the system and prevent any buckling. The stabilizer is used to attach anchor lines front and back and/or solar lighting requirements, as well as to connect sections that can be removed and replaced in the event of damage or upgrading configuration size of the Wavebrake system(s).

The flotation component is unique and made of a copolymer XL20 black material. It is inserted at the waterline and secured by the connection lines. The foam exerts 64 lbs. of buoyancy with a total reduction of 2 lbs. over the life of the foam.

Anchor load requirements are calculated taking into account the bottom material and load resistance to mitigate the energy in the wave. Usual calculations range from 1500 to 3000 water weight per 25 feet. Each front anchor will meet or exceed the calculated requirement and the rear anchor lines maintain strategic positioning.

Wavebrake system(s) will not lift out of the water as experienced with conventional concrete pontoons, which are prone to lift and shift.

Nautical knots are used to secure anchors and internal connections.



## Stop The Unstoppable Forces of Mother Nature

Wavebrake's unique technology utilizes the power of Mother Nature to cancel out the forces of Mother Nature!

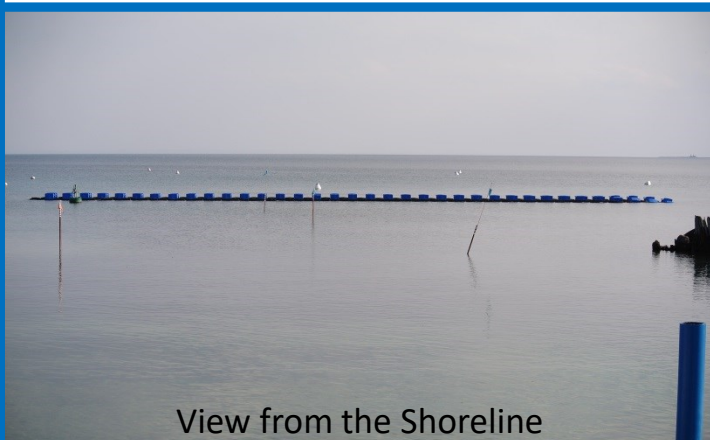
- Fully custom designed, engineered and configured floating Wave Attenuator system.
- Positively reduces energy in the wave, creating an environment that promotes the protection and potential accretion, that is the process of growth or increase, typically by the gradual accumulation of additional layers of sediment.
- The Wavebrake system consists of several rows of heavy duty energy absorbing modules.
- The design is all dependent on the conditions and requirements at each specific site. The lower modules fill with water, and the upper modules are utilized for buoyancy, as the water moves in and out of the modules.
- ***Wavebrake poses absolutely NO risk or disturbance to the environment and/or the marine eco system and can actually be considered a "fish hotel"***
- Wavebrake systems are modular and fully scalable for solving any type of waterfront challenge, no matter how big or small the disturbance, or depth of the water.

### Wavebrake can be used for :

- Wake, Wind and Wave Barriers
- Wave Attenuation
- Effective Erosion Control
- Beach Accretion
- Take Wave energy off Shore Line
- Safe Boating in Rough Conditions
- Marina Breakwalls
- Floating Breakwater
- Establishment of Safe Harbors
- Fish Habitats
- Platforms and Flotation Devices

### Wavebrake is:

- **Site-Specific**
- Flexible, Modular & Scalable
- Environmentally Friendly
- Engineered for any Wave Size & Type
- Easily Installed
- Easily Anchored
- Available in any Length
- Maintenance Free
- Endorsed by Coastal Engineers
- Able to Withstand the Elements
- Seasonally Adjustable



View from the Shoreline



View from the Oceanside



## ***The Wavebrake System - Applications & Advantages***

### ***Beach and Marina Breakwaters***

- Create calm environment for swimming and sunbathing
- Eliminate wake & chop from the mooring area
- Eliminate costly repair due to storm driven waves

### ***Beach Stabilization***

- Create offshore shoals to slow wave energy
- Slow sand migration and re-build beach mass

### ***Erosion Control***

- Perpendicular Structures; jetty, groin, or pier
- Parallel Structure; offshore breakwaters

### ***Wave & Wake Barriers***

- Protection for Docks and Lifts
- Facilitates safe and easy Boarding of vessels
- Eliminate Chop from Heavy Boat Traffic
- Always in use, no Matter the Weather
- Can use Docks for Mooring without Damage

### ***Residential Harbours***

- Create quiet water in rough wave conditions
- Promotes safe boating under all conditions

### ***Marine Habitat***

- Creates a fish haven for the area
- May impact speed of weed growth
- Does not impede littoral drift
- No negative environmental impact

### ***Wetlands***

- Protect plantings in restored shore areas
- Protect exposed areas from storms
- Protect marshes without fill and debris



## ***DURING & AFTER WAVEBRAKE INSTALLATION*** ***NO Negative Repercussions!***

- \* NO Physical Damage to roadways and marine vegetation, creatures living in and on the sand environment, to any sensitive resources and life, turtle nesting etc., be it from anchors, heavy equipment usage, vehicles, etc.
- \* NO Dust and Noise pollution during assembly and installation.
- \* NO need for facility to be closed during installation.
- \* NO displacement of recreational and watersport activities like diving snorkeling, tour boat loading and unloading, etc.
- \* NO sensitive resources near to, on-site, or along nourishment areas will be affected by sediment.
- \* NO oil pollution via fuel spills from boat engines and/or debris from construction equipment. Wavebrake assembly and installation does not require the use of any heavy equipment, such as barges, cranes, etc.
- \* NO negative impacts on the eco/marine environment, the immediate or adjoining properties, etc. either during and/or after Wavebrake assembly and installation.





## **Understanding Wavebrake and its numerous benefits**

### **How does Wavebrake work?**

*Wavebrake utilizes the force of Mother Nature to solve the issues and challenges created by Mother Nature* and works by disrupting the laminar flow of the wave. The resulting turbulence extracts the energy from the wave via a “canceling” effect. The energy is mitigated by this “friction” action and the wave is attenuated. The multi-faceted shape of the individual module, when connected, provide a porous face that accepts the wave and channels the energy into the porous cavities between the modules. This space contains the turbulence and extracts the wave forces by forming a “canceling effect”.

### **What are the environments and applications for the Wavebrake?**

The journals of the USACE indicate the amount of wave attenuation is scalable to the size of the Wavebrake structure. The ability to configure Wavebrake does not limit the size nor application of the system. The more cavities the water passes through, the more friction and wave attenuation. A study involving a conventional system recorded upper limits of 6 foot waves and 4 to 6 second periods with a 50% reduction. Another project described in the journals involved a system with an extended porous fence deeper into the water and it realized an 85% reduction. The more width and depth of a Wavebrake system, the better the wave attenuation. Wavebrake could also be used as an artificial reef system to create shoals or promote accretion or used in support of living shorelines, wetland protection, shoreline protection from beach erosion, etc...the possibilities and resulting positive benefits are endless!

### **What are the reflective/rebound benefits of Wavebrake?**

There is little, if any, reflective action from our Wavebrake system(s), as the system is engineered and configured to absorb wave/wake energy. This is one of the greatest characteristics of the Wavebrake technology. It does not create collateral damage caused by reflective/rebound activity. This feature makes Wavebrake unique and differentiates it from any industry competitors. Most all coastal interventions and solutions have proven to create more turbulence and eventual damage to immediate and surrounding areas, due to their significant unavoidable reflective/rebound action(s).





## ***Understanding Wavebrake and its numerous benefits***

### **What about large storms?**

Independent research indicates a possible 85% (or more) reduction in wave height for a porous floating wave attenuator such as Wavebrake. Conventional stone breakwaters are designed to achieve an 80% reduction, but are extremely expensive and usually have a negative impact on the immediate environment and surrounding areas, due to the rebound energy created when a wake/wave hits the breakwater.

### **What are the details of the Wavebrake system?**

Each module weighs approximately 25lbs. with a 3/16" double wall thickness made of LLDPE polyethylene, which is 92% of specific gravity water. Even though the modules may be full of water, they will still float. This material is extremely tough in cold or heat and does not become brittle. Blue is utilized for high visibility on the top rows & black for the modules that are located underwater. The blue top modules have a UV inhibitor added into the manufacturing process and urethane can also be used to increase UV blocking. The black modules in the water are not exposed to UV rays, providing a longer life expectancy.

### **What are the competitive advantages of the Wavebrake?**

There is no one design configuration, but rather, many, based solely on the application(s) and related condition(s) at each potential project site, geared towards solving specific challenges and effectively achieving the client's desired objectives.

### **Is the Wavebrake system aesthetically pleasing?**

The colors selected blend well into the environment. One Third of the system is designed to sit at the surface and is only slightly visible. It is low profile, while maintaining functionality and does not compromise visibility, nor interfere with the scenic view. Wavebrake is more aesthetically pleasing than any other attenuator or breakwater structure. Markers and compatible solar powered lighting are available for applications requiring high visibility and compliance with marine safety protocols.

### **Is Wavebrake a permanent or temporary system?**

Both! Wavebrake can also be installed as a semi-permanent structure and its floating configuration also allows easy movement or repositioning.



## ***Understanding Wavebrake and its numerous benefits***

### **What sort of Maintenance is required with Wavebrake?**

The system is assembled in 25' sections for ease of handling and does not require any routine maintenance. It may be readily removed to inspect the connections, anchor lines and to clean any growth from the system, if ever required. The system is in constant motion and washes itself. The added weight of any growth (barnacles, algae, etc.) will only make the system perform better. Provisions are also made to remove a section, clean or repair it, if necessary, then quickly put it back in service.

### **How is Wavebrake installed?**

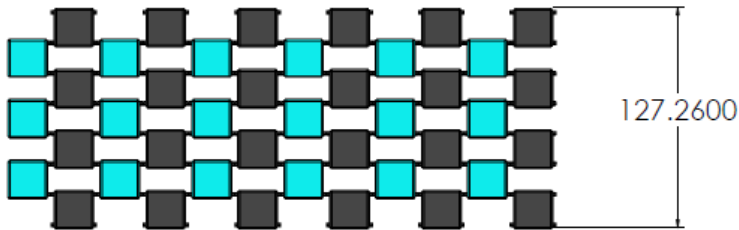
Wavebrake components are assembled in 25' sections which are launched and then connected to the anchoring system with tethers/stainless steel shackles. Beachfront access, or a ramp and a personal water craft or small boat is sufficient for launching or retrieving the system. No barges, cranes, heavy equipment, or piling is utilized in the installation process. Wavebrake does not disturb or negatively affect the natural eco/marine system. In addition, all materials utilized in the manufacturing process of Wavebrake components are environmentally friendly and recyclable.

### **How is Wavebrake anchored?**

The key factor with ocean or high flow rate installations is the anchoring. Anchoring is site-specific and usually via elliptical anchors, concrete blocks, etc. Any proven anchoring method is adequate, as long as the breakout point of the anchor system selected exceeds the wind, current and wave loads of the site. Generally, this is determined through data acquired during site visit/evaluation(s). The Wavebrake system's anchoring is then engineered for the specific environment, application and desired objectives. Determining proper loads and the type of anchor and attachments to be utilized is crucial. Our engineering team has developed a superior anchoring engineering and design method that has resulted in Wavebrake's high effectiveness and continued overall success.

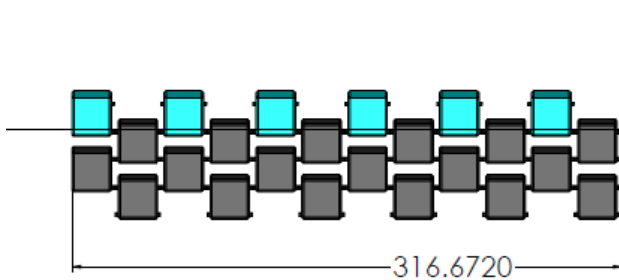
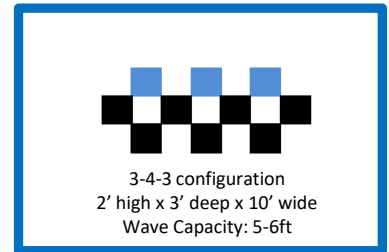
# Typical Wavebrake Configuration

(for illustration purposes only)

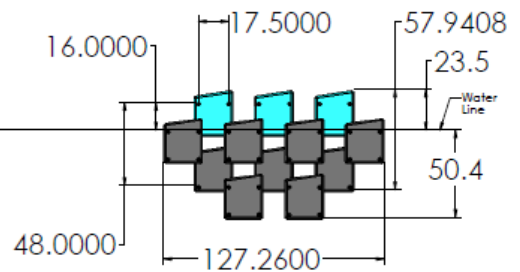


Overhead View

## 3-4-3 Configuration



View from Shore



Side View





## **Wavebrake Modules & Components**

### **Information on Modules:**

- The primary application of the module is as a floating breakwater for marina protection, erosion control of the shore line and reef imitation or restoration.
- The system is mostly submerged in fresh or salt water.
- UV inhibitors are integrated into the formulation of modules above the surface
- Thickness: 3/16" (based on a rotational molded unit of LLDPE) – 3/8" Double Wall
- Temperature: Withstands Indian Ocean heat & Great Lakes cold (+180 to -40)
- Density: Based on LLDPE of .93 gravity to water. Material is naturally buoyant.
- Impact: Resistant to wave impact and highly flexible.
- Surface: Hard and smooth to resist biologic attachments.
- Color: Black for UV and Blue for UV and visibility selected. Others colors possible.

### **Information on Connection Components:**

- Polyester DB rope for tethers, connecting and anchor lines are standard.
- 3/4" to 1" diameter lines are utilized depending on load forces. The break point of the 3/4" is 17,600 lbs. These sizes are well within the working loads of the rope.
- Polyester double braid has slightly higher strength as compared to nylon, but there the similarity ends.
- Opposite to nylon, polyester has the lowest stretch of any conventional synthetic fiber. With low stretch, double braid polyester is ideal for controlled lifting and pulling applications such as use with winches, capstans, chives, block and tackle. Other benefits of double braid polyester include limited creep, and high abrasion resistance.
- Double braiding builds in a safety component by its very nature. The cover and core can carry about 70% of the total load.
- Strands are twisted to maximum allowable to increase abrasion resistance. Other braiding techniques allow for higher tensile strength if needed.
- Polyester is hydrophobic and hence does not absorb water like nylon. This maintains its flexibility even in freezing conditions.
- The working energy absorption is only surpassed by nylon.
- Knot-holding ability is excellent especially after being exposed to water which has a slight swelling effect that helps hold the knot.

### **Information of Connection tubing:**

- A HDPE tubing material as the module is used to connect the system.



About US – History & Evolution of Wavebrake

## **The story of how Wavebrake evolved**

In 1990, our inventor, John Clark, purchased his first waterfront property on the shore of Lake Ontario. His neighbors and himself initiated a project to protect their properties from wave and wake erosion. In 1993 flood waters came to the Lake and they lost 40' of property in one storm. Afterwards, they were successful in securing a permit in 1994 for a porous rubble mound revetment 750' long. They then bonded with other shore associations and became advocates for the shore and good regulatory practices to mitigate storm erosion damage from regulated high water.

They educated themselves on U.S. Army Corp of Engineers (USACE) recommended practices and state regulations. There were no contractors who followed these practices or who offered a reasonable price to install armor stone revetments. They became those much needed contractors and serviced over 120 individual properties on Lake Ontario.

It was during this time, seeing how the stone revetments worked and their many shortcomings, that the concept for a floating offshore wave attenuator came to mind. They knew that they would have to allow for natural forces to work on the beach area, thus restoring balance to the eco system. Whatever they came up with would need to be moved to the near shore and a “plastic rock revetment” could be installed. This would allow the beach to remain natural while damaging storm energy is absorbed...all leading up to the birth of Wavebrake!



*\*Photos are provided solely for reference purposes & do not represent actual design, configuration, etc.*