A premier steel foundation supplier serving the U.S., Canada, Mexico, the Caribbean, Central America, and Colombia markets, Skyline Steel, LLC is a wholly-owned subsidiary of Nucor Corporation, the largest producer of steel in the United States. Nucor’s backing complements and synergizes Nucor Skyline’s internal strengths and empowers it to service its customers and the industry.

We have over twenty sales offices across two continents and a robust infrastructure comprised of manufacturing, coating, and fabrication facilities; dozens of stocking locations; an efficiently-coordinated supply chain; and exclusive engineering support. Collectively, these functions support a dynamic sales team that supplies hundreds of thousands of tons of steel foundation products to the industry every year.

Our flagship products include hot rolled and cold formed steel sheet piles, h-piles, spiralweld and rolled & welded pipe piles, threaded bar, micropiles, accessories, structural shapes and connectors. This product portfolio supports a variety of applications, including bridges, buildings, levees, locks and dams, ports, retaining walls, underground parking garages, environmental barrier walls, and wind towers. Of the products we manufacture and supply, 80% are made from recycled steel and are 100% recyclable.

Customer focus, our core philosophy

A strong customer focus has always been a legacy at Nucor Skyline. In fact, with us, customer service goes beyond the salesperson-contractor relationship and steel delivery— it continues beyond project completion. Our well-connected network of stockyards allows our sales team to supply customers with the materials needed to continue working and contractors can feel assured that steel will be available as needed, and on schedule.

Nucor Skyline, your true project partner

Nucor Skyline’s knowledgeable engineering team works with owners, engineers, and contractors long before projects are advertised. To ensure seamless project coordination and completion, engineers propose solutions through all aspects of design, material selection, installation, and construction sequencing. Engineering support is extended even further to include provision of onsite assistance to ensure effective resolution after a project has started. Our relationship with the industry extends beyond sales—we are your true project partner.

Nucor Skyline’s manufacturing capabilities include spiralweld pipe, rolled and welded pipe, cold form sheet piling, and threaded bar. To customize and protect these products, we own and operate fabrication and coating facilities throughout the United States.
Storms cause billions of dollars of damage each year, and water is responsible for the majority of the destruction. Whether the ruin comes as a result of a stream that overtops its levee or from a coastal surge, water damage at its most basic level is a result from one of two things: flooding and/or erosion. This document will examine various construction options that can alleviate problems caused by soil erosion and flooding, reduce future costly expenditures and bring peace of mind to commercial and residential property owners.

**Erosion**

Soil erosion takes place when moving water has enough energy to remove more soil than it deposits. The faster the water is moving, the more soil it can hold in suspension. Soil is constantly being redistributed by water, and as long as it does not affect infrastructure or create disturbances in busy shipping lanes, it is not a problem. However, when erosion occurs in an inopportune place, the effects can be devastating. More than half of all bridge failures in the United States are due to scour problems. The famous Louisiana levee breach that took place during Hurricane Katrina happened because flood waters over topped the wall and then eroded the soil that was resisting the water pressure. All structural foundations ultimately rest on soil or rock. Therefore, in order to protect the infrastructure from the negative effects of erosion, the supporting soil must be protected.

**Flooding**

Simply stated, flooding occurs when water is somewhere it should not be. Minor floods happen regularly and are little more than a nuisance. Major floods are similar to other natural disasters, causing major damage and significant loss of life. Rivers flood when heavy rainfall causes the water level to overtop natural or artificial levees and flow into the flood plain. The only ways to prevent flood damage caused by rivers is to keep the water contained, protect the infrastructure locally or move. Coastal flooding is usually the result of a hurricane or earthquake. High winds from tropical storms push water up against the coastline, which coupled with large waves can result in the inundation of coastal areas. Earthquakes or underwater volcanic activity can create tsunamis that threaten coastal developments.
Levees

For centuries, civilizations have settled around rivers to take advantage of their benefits. The biggest problem with developing near a river is a potential for flooding. Levees are naturally formed by flooding rivers: Heavier deposits — sands and gravels — settle on the riverbank while the silts and clays spill out over the flood plain. Over thousands of years, soil left by flooding rivers slowly creates levees on the river banks and good farmland in the flood plain. Cyclical flooding also tends to slowly raise the river in relation to the flood plain, and eventually the height difference is enough to fail the natural levee. As a result, the river changes course (an oxbow lake may also form). Modern navigation requirements and nearby development make avoiding arbitrary levee failure imperative. To protect resources from floods, levees are often raised and, in some cases, also reinforced.

Steel bearing piles and sheet piles placed within a levee increase global stability, decrease permeability, add height and prevent damage from burrowing animals. The steel piles and earthen levees work together to support the earth and water pressure. As was seen in the New Orleans levee system breach during Hurricane Katrina in 2005, it is vital for many reasons to protect the soil on the levee from scour.
Seawalls and Floodwalls

Storm surge is the result of offshore winds pushing water up against the coastline amid decreasing barometric pressure. The surge, combined with heavy wave action, has a devastating effect on low-lying coastal development, both residential and commercial. Tsunamis and tidal waves resulting from earthquakes are as equally-damaging and often occur with little advance warning. The only realistic way to prevent the damage is to keep the water away from the infrastructure. Steel sheet piles are designed to carry the loads from earth and water pressure, while also creating a nearly impermeable barrier.

Seawalls, constructed at the natural crest of the beach, protect the foundations of the buildings immediately adjacent to the beach from erosion and prevent water from moving further inland. Furthermore, sheet piles provide vertical support for a boardwalk. In cases where the wall is particularly high or the scour is expected to be deep, the sheet pile walls can be anchored to a secondary wall.

During storm (without seawall): The erosion caused by the storm weakens the foundation of the building and could cause it to collapse.

During storm (with seawall): The soil still erodes, but the sheet pile wall protects the foundation of the building.
Sheet piles are also very effective in the protection of individual installations. Waste water treatment plants, power plants, refineries and public utilities are the parts of infrastructure that are most critical to protect during major storms. Sheet pile walls have been built around such facilities to keep them fully operational when the population needs services the most. In most cases, a simple sheet pile wall can hold back 15 feet of water without the need for bracing or anchors. If the soils are too weak to support a high cantilevered wall, battered piles can be placed on the inside of the enclosure — or a double wall or gravity wall can be used.

Double wall systems are relatively easy to build and the sheet piles act as a cutoff wall, decreasing the amount of water that leaks under the wall. Double walls are typically two parallel walls of normal Z piles — with the interior filled — tied together with a tie rod. A gravity wall is built with flat sheets and is made of circular or diaphragm cells. Cellular construction is more difficult to perform, but the sheet piles tend to be shorter and there is no anchorage system. Gravity walls are better on sites with shallow rock. The top of double walls or gravity walls, with the vertical load capacity of the sheets, can also be used as roads.
Natural harbors are rare, and as coastal development continues to increase, the space suitable for marinas and shipping terminals becomes increasingly difficult to find. Artificial harbors are created to protect moored vessels from large storm driven waves. One of the ways to protect coastal areas is with sheet pile wave barriers. These wave barriers are effective at dissipating wave energy, and have many benefits over rock jetties. Sheet pile wave barriers have minimal impact on the local environment since they have almost no physical footprint and allow water and marine life to pass through them. They are also quick and easy to install, and can be removed with ease. Sheet pile wave barriers are constructed using king piles (beam or pipe) with intermediary sheet piles. The king piles are driven deep into the soil, but the sheet piles stop several feet above the ocean floor. The gap under the bottom of the sheets allows the hydrostatic pressure to equalize and marine life to pass back and forth.
Bridge Abutments and Piers

Although most storm damage is associated with major river flooding and coastal storm surges, the overflow of smaller streams can cause significant damage as well. The remnants of Hurricane Irene brought heavy rains and caused widespread damage in Vermont — mainly collapsed bridges and washed out roadways — a state rarely associated with hurricanes or tropical storms.

More than half of all bridge failures in the United States can be attributed to water. Higher-than-normal flow in a river creates scour holes around bridge abutments and piers. Bearing piles exposed by scour holes are susceptible to buckling, which is not a concern when the piles are fully supported by the soil. The typical solution to the problem is to use stronger bearing piles and deeper pile caps, while another solution is to construct a temporary cofferdam from steel sheet piles — used to build the initial bridge — as the permanent scour protection for the pier. The sheet piling can even be used as the form work for the concrete.

Soil removal from the front of a bridge abutment may expose the bearing piles — as in a pier — but it will also reduce the passive resistance of the soil and the abutment may fail. Abutments can be built deeper or they can be placed further up the stream bank to avoid the water. Yet, moving up the stream bank increases the span of the bridge, which in turn, increases the overall cost of the project. Sheet pile bridge abutments are excellent at supporting lateral earth pressures, taking vertical load from the bridge and preventing scour from becoming a problem. Using steel sheets allows the abutment to be placed as close to the water as possible, shortening the bridge and reducing the cost of the overall project.
Slope Stabilization

Two of the more common methods of slope failure during a storm occur when swollen streams undercut their banks and when hillsides fail as rain saturates the soil and loosens the ground. Structures and roads next to the failed slopes are under obvious risk, but more damage may also occur in other areas as debris from a mudslide moves downstream.

Sheet piling can protect stream banks most prone to scour or in areas that have at-risk infrastructure. The outside curve of a river is always more vulnerable to erosion than the straight sections or inside curve. Slopes of rivers can also be stabilized with soil nails or other piling to interrupt the failure plane.

Hillsides and rock faces can be reinforced with soil and rock anchors. In some cases, micropiles and driven piles can be used if the loads and the soil conditions warrant it.
For technical questions and engineering support, please contact us via our technical hotline at: 866.875.9546 or email us at: engineering@nucorskyline.com.

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