STREAMBANK STABILIZATION TECHNIQUES

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Streambank Stabilization Techniques

One of the biggest concerns when a new development occurs near a creek or stream is that modification of the landscape will result in significant erosion of the streambed and its shoreline, threatening wildlife and leading to a greater risk of flooding as the stream simply has less outlets within its banks and less options for water dissipation downstream. Increasingly, though, state environmental agencies and the Environmental Protection Agency are requiring developers to work with environmental professionals to create plans that will eliminate or severely lessen the amount of erosion along streams and creeks. Using both natural and manmade efforts to reduce waves and keep the streambed elevated.

Those in the environmental trades are likely aware that demand for their work along creeks and streams has increased dramatically over the past few decades, especially over the course of the past five to ten years. With increased demand for these efforts comes renewed interest in innovative ways of reducing wave heights, slowing down the water current, and protecting the existing hydrology of streams along today's new developments and existing residential or industrial areas. These new techniques merge nature with technology, giving environmental workers key new ways to get the job done.

Before starting on any project to preserve a stream's existing location or alter it sufficiently to reduce erosion, it's worth reviewing the latest and most popular methods used to reduce or eliminate erosion and other destructive forces that can come with increased development.

A Look at Stabilization Terms: Hard and Soft Erosion Prevention

The stream stabilization process generally uses two terms to describe its implementation of preventative erosion measures. These terms pertain largely to whether or not natural vegetation is part of the process, though there is some room for combining natural vegetation with more manmade measures or those that use beaches, shorelines, and even rocks. The key terms for developers and engineers pursuing this process:

- Soft Stream Stabilization: This refers to the exclusive use of vegetation along the shoreline, including its use is conveyance channels.

- Hard Stream Stabilization: These developments prefer sandy beaches, rocky wave reduction, or other hard elements that prevent erosion instead of softer soil and more natural vegetation.

- Combination Stabilization: Using a combination of both hard and soft development measures to reduce wave action and prevent against both erosion and streambed overflows.

These terms will become key when navigating the Environmental Protection Agency's list of best practices for stream stabilization, and they'll likely be used by any environmental engineers or other eco-minded professionals on the scene. Being familiar with these terms simply makes it easier to speak to the type and quality of the stabilization technique being undertaken.

Working with EPA Guidance: A Look at the Regulatory Agency's Best Practices

Over the years, the Environmental Protection Agency has worked to implement a series of guidelines and best practices for the protection and stabilization of streams and shorelines. This work has resulted in what can best be described a preferred "all-natural" approach to stabilization. In its National Management Measures Guidance documentation, the agency specifically recommends that environmental professionals work with developers to implement natural methods of controlling waves and stream erosion, citing vegetation as the primary method of reigning in these forces if at all possible.

Natural vegetation includes not only "soft" development of soil near the stream and planting of new shrubbery, but also the bundling of thatched sticks and other natural substances to break wave sand reduce erosion. The EPA recommends using these methods in all areas where they are both effective and affordable within the scale of the development. Furthermore, EPA guidance recommends using natural methods only if they positively impact the targeted stream and do not result in any adverse effects in any other part of the nearby watershed.

The focus on using natural methods, like planting added vegetation and using branches or limbs to disrupt waves, is primarily recommended by the EPA as a method of undoing previously manmade damage. In many cases, vegetation and wave disruption are removed from the shore of a stream during a development due to a high desire for waterfront viewed and easy access to the body of water. While designed to provide an extra amenity to builders and buyers, this process almost always causes frequent streambed overflows, a widening of the stream itself, and faster-moving currents that can be damaging to both human life and wildlife that lives in or otherwise depends on the stream.

In the event that manmade erosion control methods must be implemented, the Environmental Protection Agency's management guide and list of best practices recommends that developers use those methods in as limited a capacity as possible, filling in with vegetation and other natural

forms of stream stabilization wherever it is possible, ecologically sensible, and affordable within the scheme of the project taking place. Environmental professionals are advised to offer guidance about these best practices to developers, as well as to any local agencies that may be interested in stream stabilization outside of a major new development in the area.

Vegetation and Plantings: The First Method of Stream Stabilization

As recommended by the Environmental Protection Agency, the first method that should be used in stream stabilization is to plant vegetation that can serve a few key purposes, not the least of which is to reduce erosion by minimizing wave energy in developed areas. Generally, both state and federal guidelines require developers and environmental professionals to identify plants that are native and local to the area, so as to restore as much of the original habitat to the stream's shore as possible. These plantings are usually quite affordable, making them a logical starting point and a good way to judge whether or not their use will be sufficient when seeking to minimize erosion. When picking plants to reduce erosion and solidify the stream's shore, it's worth noting that there are three general goals that should be met by these plants. Among these goals are the following:

- Reduce erosion of the stream's shore and streambed by breaking up waves

- Create an aesthetically pleasing area that does not take away from the character of a new or existing residential or commercial development

- Reduce the ability of local pollutants to enter the stream by serving as a sort of natural filter

The most common way of meeting all three of these goals is to go with a long grass, planted in a narrow channel that extends along the area where erosion has been the most severe. Such plantings should be done on both sides of the stream in order to encourage a consistent reduction in erosion that does not favor one particular side or put either side of the stream at increased risk of flooding and other damage.

While planting long grasses alongside the stream can reduce a great deal of erosion, some areas are actually not friendly to this kind of approach. In particularly developed areas, even planting long grasses on the land surrounding the stream will not reduce wave action, nor will it stop the stream from frequently overflowing its banks and negatively impacting surrounding residential or commercial developments. In this case, planting vegetation can actually be combined with conveyance in order to reduce the damage inflicted by bank overflows.

Water Conveyance: The Next Step Up in Natural Reduction of Erosion and Flooding

The conveyance process is one that has become increasingly popular in particularly developed areas, including suburbs and more urbanized environments, where even long grasses cannot be effectively used to control the erosion affecting the streambed and nearby areas. Simply put, conveyance of a stream involves digging channels or trenches that abut the flow of water. These channels are used to catch stream overflow and reduce wave action, largely by being filled with natural vegetation or riprap that can break up waves while protecting local homes or businesses.

These channels are almost always used in more developed areas, largely as a buffer zone that protects from the damage of stream overflows. Conveyance is also useful to reduce the erosion symptomatic of these overflows, and it can help keep the area aesthetically pleasing while reducing flood risks.

As with the planting of vegetation in flat areas, professionals should ensure that they're using riprap local to the area or plants that are native to the surrounding area. This provides the best chance at stabilizing not only the stream, but also local ecology, while ensuring that plants will remain healthy and hearty through all seasons. The only exception to this rule would occur if the conveyance system was constructed using concrete flutes or channels, as is done in many urban areas where local rivers and streams need to be contained and kept away from highways, railroad tracks, and commercial buildings.

It should also be noted that conveyance is best used when there is some type of slope surrounding the stream. In a purely flat landscape, a conveyance system would have relatively little impact on the stream's tendency to overflow. While it would contain some of the water, the lack of a slope would cause the channel itself to erode in almost every flooding event. The presence of a slope is just one deciding factor when developing a water conveyance system, however. Developers and environmental professionals should also keep a few other considerations in mind:

- Understand the conveyance channel's ability to reduce pollutants that enter the stream or the surrounding areas. Most channels filled with natural vegetation have no method of controlling pollutant concentrations in floodwaters, so other manmade methods should be used.

- Work with local engineers to ensure that the conveyance system is developed at the proper slope for both catching and containing water, as well as reducing erosion of either the stream or the conveyance system during period of high water.

- Create a channel with the proper shape for the area where it's placed, with urban conveyance systems using more of a trapezoidal shape and suburban or exurban systems using a flatter shape.

- Determine the maximum water velocity supported by the conveyance system and, by analyzing past flooding or erosion events, determine whether the conveyance system's design will yield positive results or a mere mitigation of this process. Redesign the system if necessary.

- Be sure that any conveyance channel is developed in accordance with state and local regulations, as many states do impose restrictions on the use, size, and length of conveyance channels, as well as their maximum velocity and the type of vegetation that can be used in natural trenches. Furthermore, ensure that the stream's conveyance meets state minimum standards and falls within the acceptable range for width, flow, and water containment.

With these concerns met, environmental professionals can meet with developers to discuss the nature of the conveyance system, its installation as either a natural or concrete setup, and its location within the development. This will affect how building proceeds, of course, by potentially reducing the usable property owned by the developer. By conveying the necessity of conveyance channels and working with developers to show them exactly how the system will reduce flooding and thereby reduce damage costs, environmental professionals or engineers can make installing this system more straightforward.

Channelization: A More Controversial Way to Reduce Erosion Near Streams and Rivers

Several decades ago, the channelization of streams and rivers was actually encouraged by a number of environmental groups and state agencies. It was viewed as an effective way to control the flow of major rivers and streams, all while containing them and controlling their path through developments, agricultural lands, and wetlands. Since channelization went mainstream, though, studies have been conducted into its effects on those wetlands, as well as the net positive impact that it has on stream erosion and the protection of the streambed. The results of those studies are decidedly mixed, and channelization has become a far more controversial development method as a result.

Typically, channelization involves "straightening" a stream or river in an effort to reduce erosion on one side of the shore or the other. As most environmental engineers know, the nature of a winding stream is that it tends to build up sand and sediment on side of a curve while significantly reducing the amount of sand and sediment on the opposing side. In addition to making the stream "portable" and shifting its path on a regular basis, such uneven erosion can cause the stream to overflow its banks on one side or the other quite frequently, threatening commercial developments and residential areas.

Channelization seeks to "fix" such uneven erosion by straightening out the stream and reducing the curves that are causing the issue. In theory, this actually solves a problem without sending the stream underground or using one of many other highly disruptive methods. The problem, though, is that channelization has had a tendency to reduce the presence of nearby wetlands. A prime example of this damage can be seen in the channelization of Florida's Kissimmee River, which to this day still suffers from a dramatically reduced wetland area compared to the era prior to channelization.

Even so, there are a number of positive benefits that keep channelization in active conversations about how to control a stream and prevent its overflows or erosive processes. Among those advantages:

- Channelization gives developers the opportunity to create a channel deep enough to contain flood waters, reducing the risk to nearby developments or agricultural lands that might otherwise experience significant loss.

- The depth of a channel enforced on a larger body of water can be deepened and widened to be far more suitable for navigational purposes and even shipping.

- Rich topsoil is preserved due to the straighter nature of the stream, and this also results in less erosion on one side of the water or the other.

EPA Guidance: New Laws Make Channelization a Bit Harder for Developers and Engineers

In recent years, the controversy surrounding channelization has reached into the highest levels of government and regulatory agencies. The Environmental Protection Agency responded to wetland loss studies and other controversies surrounding this process by implementing a new law that requires no net loss of wetlands when channeling or rerouting any stream, river or other body of water. For this reason, those developers or environmental engineers who propose channelization of a nearby body of water are required to submit a series of studies, proposals, and development plans, showing how the process will not negatively impact the wetlands surrounding the stream.

In most cases, any net loss of wetlands caused by the channelization of a stream or river will result in one of two outcomes. The first, and perhaps the most likely, is that the developer will simply not be permitted to pursue their channelized body of water at all. The second option is simply to build more wetlands downstream to compensate for any wetland loss along the channelized portion of the body of water. This has been done in quite a few cases, and the EPA has been friendlier to this approach in recent years than it was when the new no-net-loss guidelines were first issued some time ago.

As a general rule, developers and environmental engineers should pursue a wide array of alternatives before proposing channelization. The process requires a lot of studies, a great deal of red tape at the EPA, and therefore a high number of expenses and potential delays. Working with natural vegetation, conveyance, or other methods, would simply be more in the interest of the local environment, the EPA, and the developer's goals for their project.

Don't Forget State and Local Regulations Pertaining to Stream Developments and Erosion

While the Environmental Protection Agency is the entity most involved in developing policies for streambed preservation and wetland monitoring, the agency is not alone when it comes to regulating how new developments along creeks, streams, and rivers, should seek to reduce wave action and erosion. Virtually every state in the country has its own set of guidelines for how this process should be completed, and any stream stabilization project undertaken should be able to clear both state and federal regulatory hurdles.

Most state requirements have to do more with the use and loss of vegetation, as well as the proper implementation of conveyance techniques, than they do with the finer elements of a development. The Environmental Protection Agency will apply a series of more stringent tests, largely to ensure that any stabilization technique complies with the Clean Water Act, effectively reduces erosion, and does not negatively impact the presence of nearby wetlands or the ecology of the surrounding area.

In addition to the EPA's National Management Measures Guidance, engineers and developers should contact state environmental agencies for their own documentation and best practices guidance. This will serve as an instrumental way to speed up the development process without accidentally breaking state laws regarding preservation.

Prepare to Show How a Stream Stabilization Technique Will Benefit the Area

Finally, engineers and developers seeking a stabilization procedure should be prepared to show how such a development would positively impact the local area. This may involve showing how channelization does not disrupt wetlands, or how a conveyance system would protect both local residents and natural habitats or wildlife. Virtually all EPA reports and state regulations require an environmental impact study of some sort, and developers stand their best chance at approval if they are prepared to discuss the merits of their protect while compensating for any pitfalls or perceived negative factors.

With adequate preparation and an approach that, in accordance with EPA guidelines, uses natural vegetation and surfaces before it resorts to manmade alternatives, developers and engineers will find themselves able to quickly mitigate erosion, reduce flooding, and create a sustainable stream bank for generations to come. All it takes is careful planning, research into local ecology and hydrology, and studies into exactly what the benefits are of such a development and how undertaking stream bank stabilization would mitigate pollution and habitat destruction.