Landshore Enterprises, LLC

Streambank & Shoreline protection/stabilization/reclamation
Environmental Engineering, Erosion Control, Construction Management
d/b/a Erosion Restoration, LLC

Technical Engineering Memorandum
Trails at Monterey Community Development District
2501A Burns Road, Palm Beach Gardens, Florida 33410



Submitted via email:
July 18, 2023

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Table of Contents

Introduction – Trails at Monterey Community Development District: 3
Introduction – Landshore Enterprises, LLC: 6
Objective: 7
Existing Conditions: 7
Lake 1 – Photos and cross section(s) of recommended solution(s) 11
Lake 2 – Photos and cross section(s) of recommended solution(s) 14
Lake 3 – Photos and cross section(s) of recommended solution(s) 16
Lake 4 – Photos and cross section(s) of recommended solution(s) 18
Lake 5 – Photos and cross section(s) of recommended solution(s) 20
Stability Analyses 27
Estimated Volumes 29
Conclusion 31
Exhibit 1: Soil Classification 32

Introduction – Trails at Monterey Community Development District:

Trails at Monterey Community Development District (the "District") which is a local unit of special-purpose government of the State of Florida established in accordance with the Uniform Community Development District Act of 1980, Chapter 190, Florida Statutes. District lands consist of approximately 92.47 gross acres within the County and were developed as a residential community which consists of single-family home dwellings totaling 417 units.
Source: https://trailsatmontereycdd.org/

The District is one of Miami-Dade County's Community Development Districts and owns the five lakes.



Figure 1: Lakes 1, 2, and 3 aerials from Miami-Dade County Property Appraiser Records



Figure 2: Lake 4 aerial from Miami-Dade County Property Appraiser Records



Figure 3: Lake 5 aerial from Miami-Dade County Property Appraiser Records

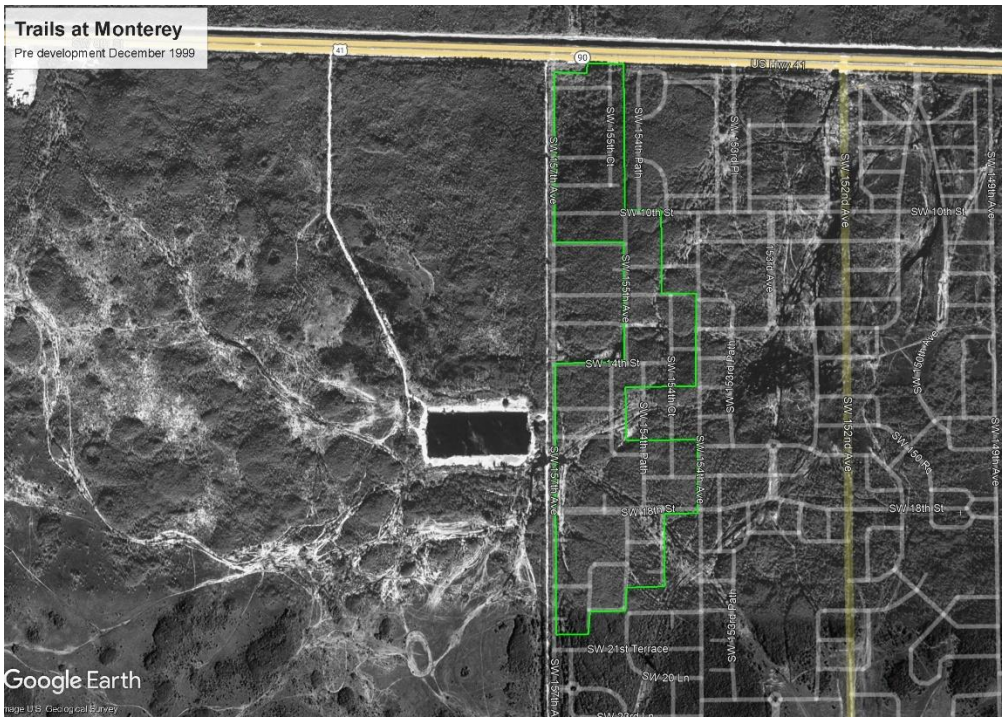


Figure 4: Initial Site Conditions of Trails at Monterey, 1999 (google earth)



Figure 5: Current Site Conditions of Trails at Monterey, 2023 (google earth)

Introduction – Landshore Enterprises, LLC:

Landshore Enterprises, LLC (Landshore®), with offices in Fort Lauderdale, Florida and headquartered in Venice, Florida, is a turnkey national design-build environmental company specializing in shoreline erosion control, repair and restoration challenges. Landshore® uses non-structural, bioengineering and bio- technical methods to fulfill the demands of our clients.

Established over two decades ago, we have provided our services of excellence to golf courses, homeowner associations (managed properties), private residences, and governments in more than 10 states.

Landshore® is very conscientious about completing projects that reflect professionalism to the highest degree. We take a great deal of pride in each contracted service, no matter how large or small the project is. Our engineering expertise ensures that we will provide you with the best possible solution at the best possible price based on thorough research, investigation, and data interpretation from the job site.

Because of our engineering practices, our clients are assured that their shoreline erosion solution will endure for the longest amount of time possible. Additionally, the number of construction hours required for job completion are billed accurately and even the precise amount of quality materials for the best solution are deployed.

Our talented group of employees research and investigate public records on the subject site, conduct surveys, perform various tests such as measuring soil density and analyze results. From all the compiled information and subsequent analysis, we gain an understanding of the historical and current nature of the erosion changes concerning water levels, the amount of erosion loss over time, the slope of the eroded shoreline, and the stability of the surrounding soil.

We have the expertise, resources, technology, and collaborative insight to create designs and solutions that far exceed our client's expectations. Due to our extensive experience in resolving various erosion problems around the nation, Landshore® is proud to guarantee complete satisfaction on ALL projects.

Objective:

Our firm was contracted by the District to perform engineering services with the purpose of quantity take-off and preliminary construction cost estimate. Our main goal is to compile a report with soil erosion challenges identification, calculated stability, and recommended solutions, if any, to restore the lake shorelines into compliance, wherever economically feasible.

Existing Conditions:

At the specific request of the District seeking possible solutions to address slope stability, public safety, and aesthetics issues of the shorelines, the subject site was assessed by our team of key professionals. It was found to exhibit signs of loss of valuable soil above the design water level, underwater shelf reposing itself where the shoreline has encroached closer to structures, change in embankment slopes, and unstable edge of embankment. Elements contributing to the embankment erosion are seepage, sheet flow, fluctuation of water levels, and wave action.

General:

- The soil type is USDA Type 58-Cooper Town muck, according to the US Department of Agriculture. Refer to Exhibit 1: Soil Classification.
- To convert from National Geodetic Vertical Datum 1929 (NGVD29) to North American Vertical Datum 1988 (NAVD88), substract 1.585 feet.
    - Per originally permitted set of drawings, the top of the bank is shown at elevation 9.35' NGVD29, which is converted to 7.77' NAVD88, for purpose of this report.

Lake 1:

- The shoreline length is approximately 1,560 linear feet.
- According to our survey, the top of the bank on the lot areas is approximately at elevation 7.32' NAVD88. According to our survey, the top of the bank on the common area is approximately at elevation 6.75' NAVD88. Per originally permitted set of drawings, the top of the bank should be at elevation 7.77' NAVD88.
- It is visible that there has been more than 2 feet of loss of land around the lake. This is due to the soil washing out over time and some factors contributing to the erosion, like water fluctuation, wave actions, sheetflow, and seepage soil erosion. To the naked eye, the soil reposing itself makes the embankment looks aesthetically pleasing, however the soil continues to erode.

Lake 2:

- The shoreline length is approximately 1,971 linear feet.
- According to our survey, the top of the bank on the lot areas is at elevation 7.77' NAVD88, which complies with the originally permitted set of drawings.
- The common area has an approximate 7:1 degree slope.
- It is visible that there has been a loss of land around the lake. The south section of the shoreline is more severe, with approximately a loss of 4'. The rest of the shoreline has lost approximately 1' to 2' of land.
- As the soil is lost it tends to repose itself, thus creating steeper angles on the embankment.

Lake 3:

- The shoreline length is approximately 801 linear feet, however it is recommended to repair only 742 linear feet, as 59 linear feet are considered wetlands.
- According to our survey, the top of the bank on the lot areas is at approximately elevation 6.77' NAVD88. Per originally permitted set of drawings, the top of the bank should be at elevation 7.77' NAVD88.
- The common area has an approximate 7:1-degree slope.
- This lake has a wetland that is in the Northwest corner of the lake and extends to the North along a residential lot. Landshore® had not proposed any restoration within this area or where the wetland intersects with the lake waterline and recommends that this area remains untouched.

Lake 4:

- The shoreline length is approximately 1,360 linear feet.
- The Landshore' s team found that the conditions surrounding lake 4 to the most severe of the 5 lakes within the community. The northern shoreline being the worst of the sections consisting of areas that have a 2:1 slope and appears to have lost 4 to 5 feet of shoreline due to erosion. Also, along the northern shoreline is a combination of soft edged and drop off measuring in at 1.5 to 2 feet. The soft edges can be described as thick fluffy grasses that could be misleading where people might think of the area as stable ground.
- The conditions along the West, East, and South shorelines are in better condition with loss of shoreline by about 1 to 2 feet width.
- Lake 4 has two common access areas:
    - The west access area could be described as a narrow canal leading towards the lake with no purpose other than providing additional stage storage for stormwater management. This narrow area is filled with soft muck, trash, and dead vegetation. This area is recommended to be cleaned.
    - The common access area to the East meets the 7:1 slope requirement but has lost the top berm elevation requirement of 7.77' NAVD88. Currently it is at elevation 7.18' NAVD88.
- Lake 4 also has a section along the south shoreline where a resident installed rock rip rap and a wood bulkhead. This does offer a means to protect against erosion but the other factors to consider, i.e., the

top berm elevation and slope requirement are not being met. Thus, it is recommended that this rock rip rap wall will have to be removed when repairing the shoreline.

Lake 5:

- The shoreline length is approximately 1,234 linear feet, however it is recommended to repair only 871 linear feet, as 363 linear feet are considered wetlands.
- According to our survey, the top of the bank on the lot areas is at approximately elevation 6.9' NAVD88. Per originally permitted set of drawings, the top of the bank should be at elevation 7.77' NAVD88.
- There are no common areas for lake 5.
- For the Northern section of the shoreline, we found that the top of the berm has several locations that have washed away material. These sections are found to be more prevalent in areas between the homes/buildings.
- The East and South shoreline are found to consist of uneven and potted terrain, possibly because of concrete stairs/steps that have been removed and other construction activities along the shoreline.
    - The soft muck found at the site is believed to be the cause of the shifting and settlement of material along the embankment.
- For the South shoreline, about 2 to 2.5 feet of shoreline land was lost with a drop of about 1.5 feet on average around the top of the berm.
- The West shoreline, consisting of a protected wetland, is Landshore's recommendation that no restoration be done for this area and any areas coming into proximity of the wetland be protected.

All lakes:

The following is the scale used to identify the conditions of the lakes and our recommendations:

5 – Attention needed now
4 – Attention needed within a year (1 year)
3 – Attention needed within the next couple of years (1 to 2 years)
2 – Attention needed within the next few years (2 to 3 years)
1 – Attention needed within the next few years (3 to 5 years)

Recommended priority of shoreline restoration:

Lake 4 - 5 rating
Lake 2 - 4 rating
Lake 1 - 3 rating
Lake 5 - 2 rating
Lake 3 - 1 rating

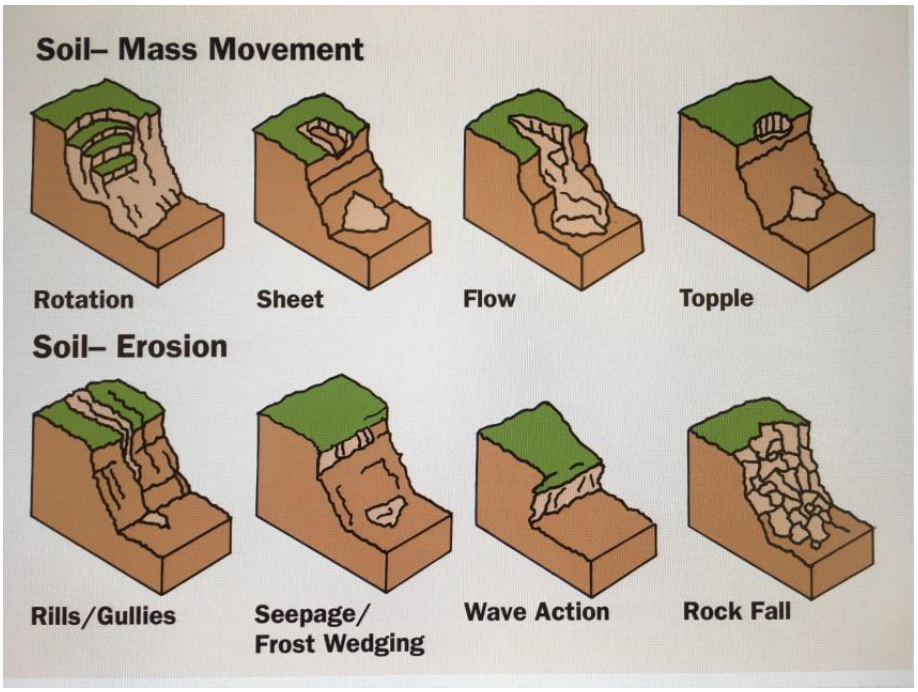


Figure 6: Types of soil erosion

Detachment and movement of soil or rock fragments by water, wind, ice, or gravity. The following terms are used to describe different types of soil erosion:

Accelerated Erosion – Erosion much more rapid than normal, or geologic erosion, primarily as a result of the influence of the activities of man, or in some cases, of other animals or natural catastrophes that expose base surfaces, for example, fires.

Gully Erosion – The erosion process whereby water accumulates in narrow channels and, over short periods, removes the soil from this narrow area to considerable depths, ranging from 1 to 2 feet to as much as 75 to 100 feet.

Natural Erosion – Wearing away of the earth's surface by water, ice, or other natural agents under natural environmental conditions of climate, vegetation, etc.; undisturbed by man.

Normal Erosion – The gradual erosion of land used by man which does not greatly exceed natural erosion.

Rill Erosion – An erosion process in which numerous small channels only several inches deep are formed; occurs mainly on recently disturbed and exposed soils.

Sheet Erosion – The removal of a fairly uniform layer of soil from the land surface by runoff water.

Splash (Seepage) Erosion – The spattering of small soil particles caused by the impact of rain drops on wet soils. The loosened and spattered particles may or may not be subsequently removed by surface runoff.

Lake 1 – Photos and cross section(s) of recommended solution(s)



Figure 7: Retaining wall failed, because of unsettled soils and saturated soils that increased the hydrostatic pressure.



Figure 8: Bank erosion, shown lost land and reposed embankment.

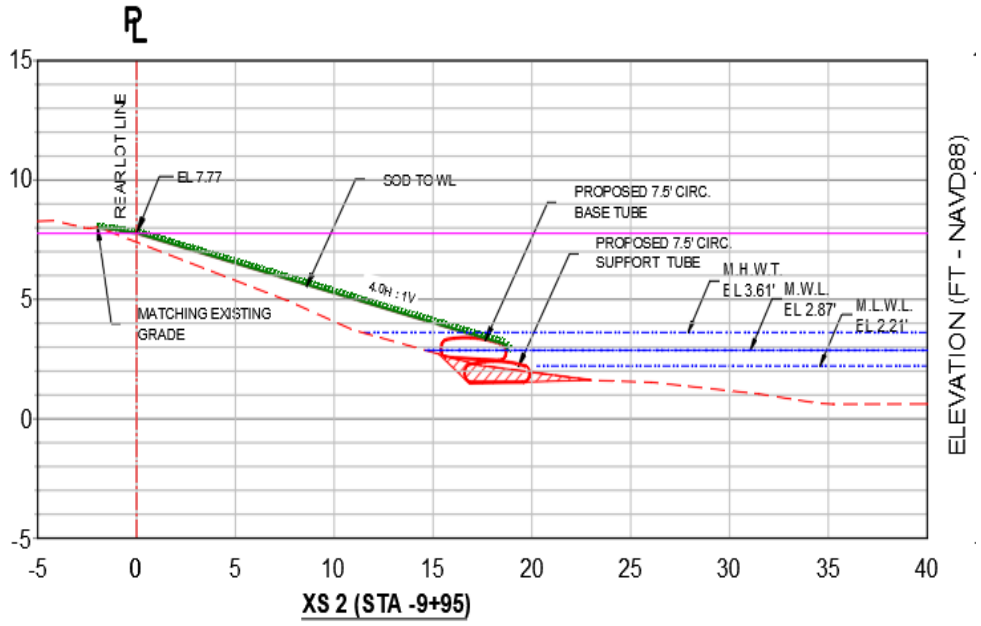


Figure 9: Cross Section 2 showing the recommended solution of installation of EFT® with two layers of permanent tubes
Scale: Not to Scale

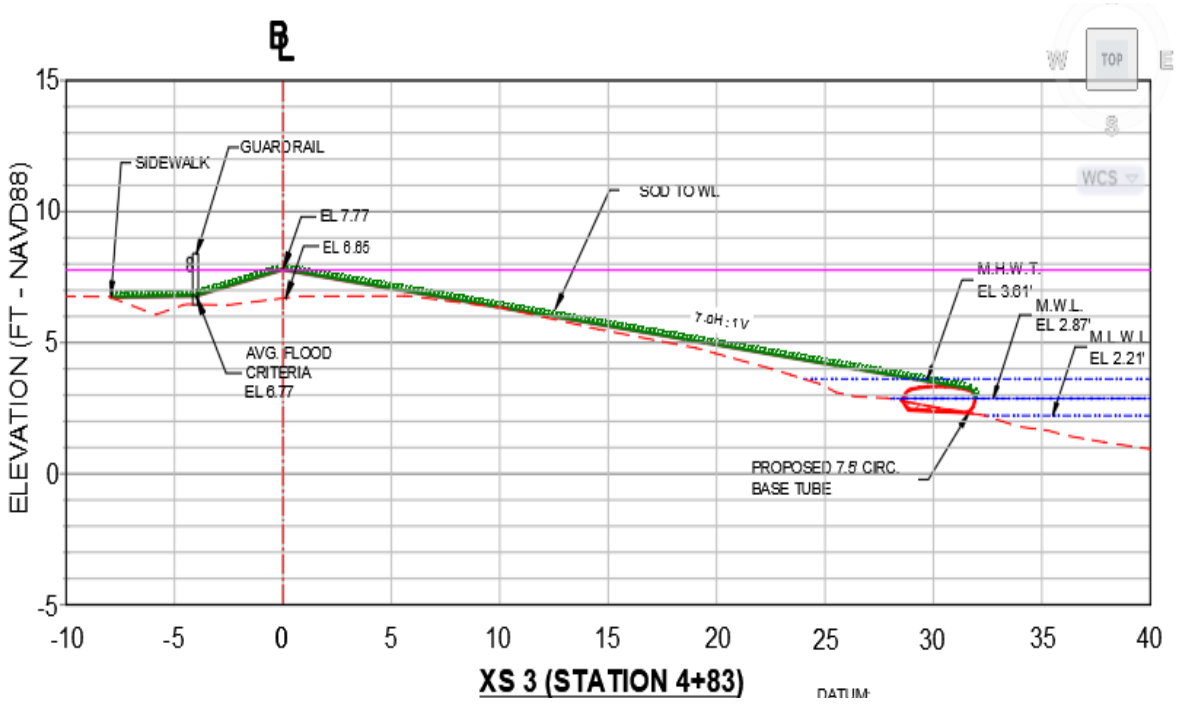


Figure 10: Cross Section 3 showing the recommended solution of installation of EFT® with one layer of permanent tubes
Scale: Not to Scale



Figure 11: Aerial of recommended erosion control elements

Lake 2 – Photos and cross section(s) of recommended solution(s)

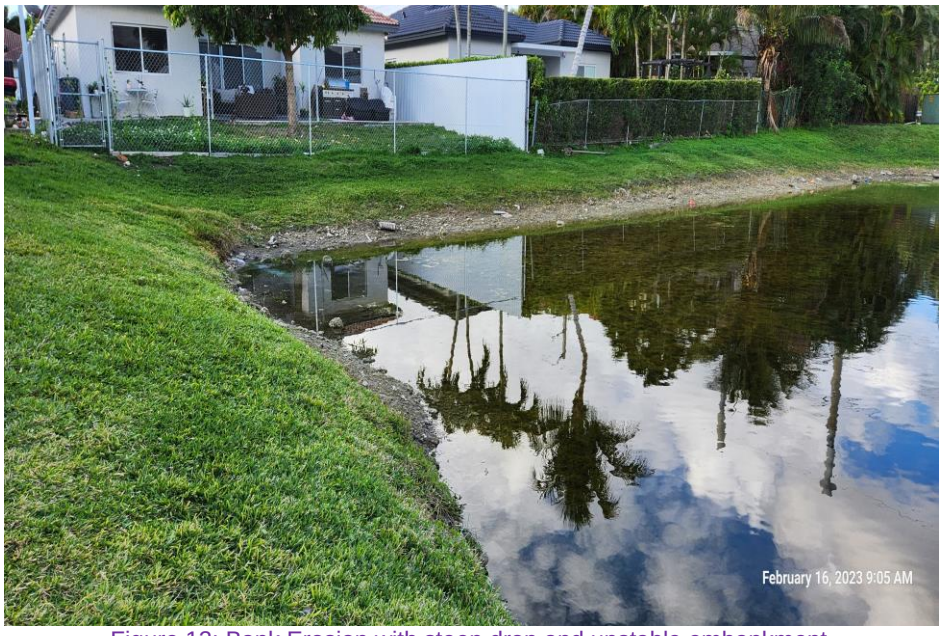


Figure 12: Bank Erosion with steep drop and unstable embankment.



Figure 13: Bank Erosion shown lost soil over the years

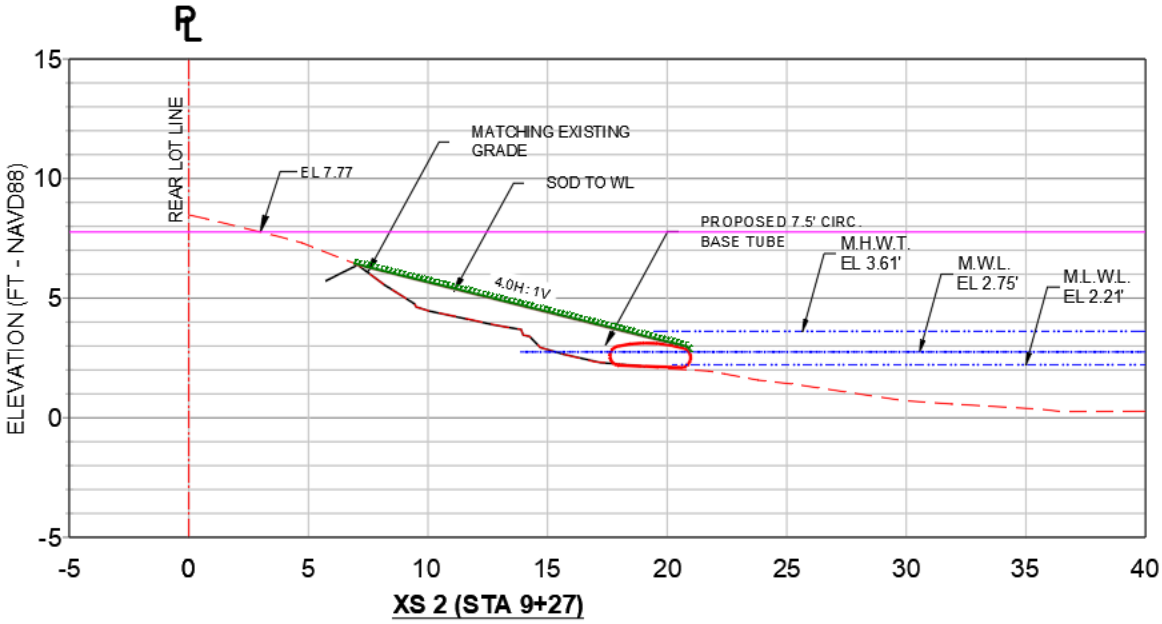


Figure 14: Cross Section 2 showing the recommended solution of installation of EFT® with one layer of permanent tubes
Scale: Not to Scale



Figure 15: Aerial of recommended erosion control elements

Lake 3 – Photos and cross section(s) of recommended solution(s)



Figure 16: Bank Erosion with soil repose itself and at the same time slope become steeper


Figure 17: Bank Erosion with soil been lost and steep slope

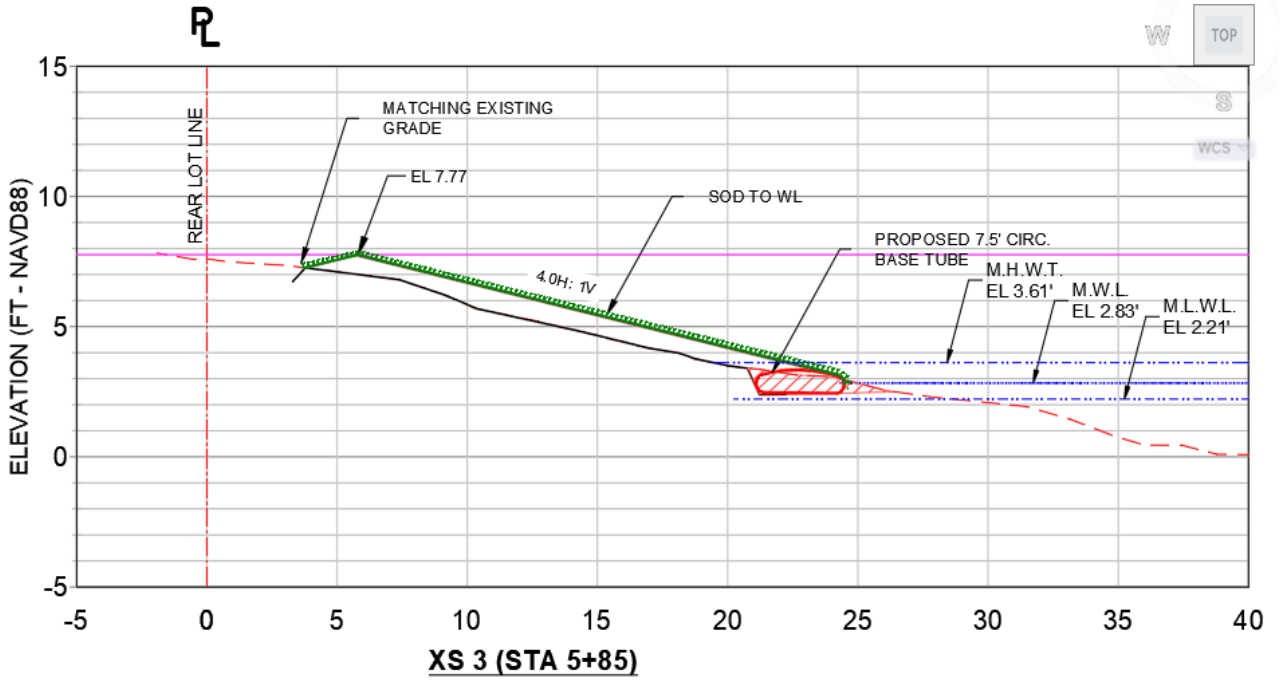


Figure 18: Cross section 3 showing the recommended solution of installation of EFT® with one layer of permanent tubes
Scale: Not to Scale



Figure 19: Aerial of recommended erosion control elements

Lake 4 – Photos and cross section(s) of recommended solution(s)



Figure 20: Bank erosion with steep drop off at the embankment



Figure 21: Bank erosion with uneven shoreline at water's edge

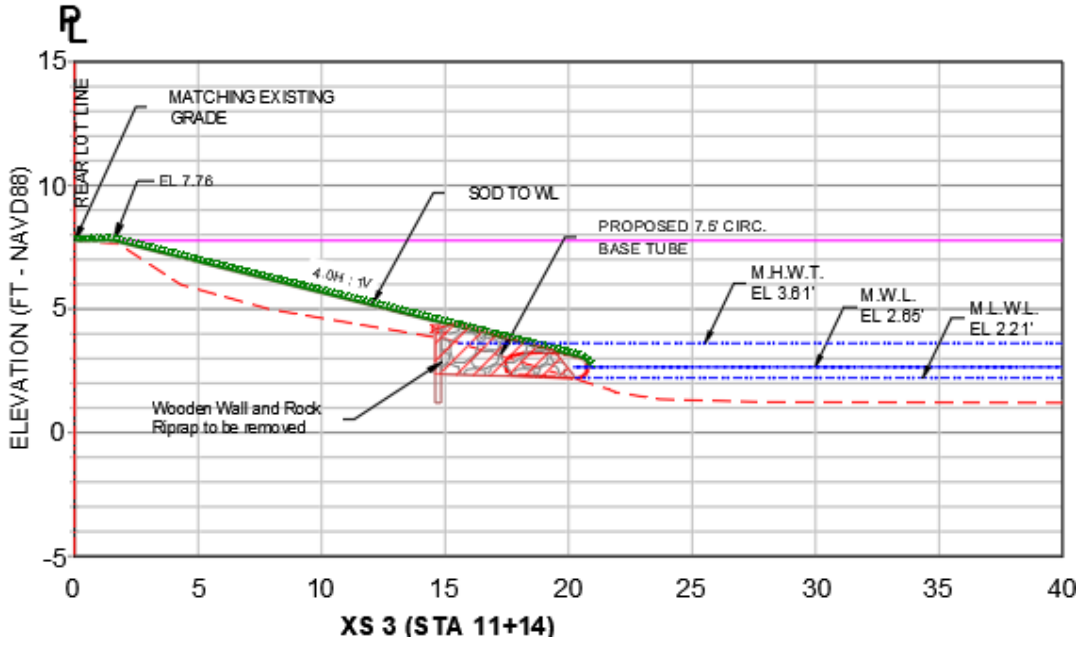


Figure 22: Cross Section 3 showing the recommended solution of installation of EFT® with one layer of permanent tubes
Scale: Not to Scale



Figure 23: Aerial of recommended erosion control elements

Lake 5 – Photos and cross section(s) of recommended solution(s)



Figure 24: Bank Erosion getting closer to structures

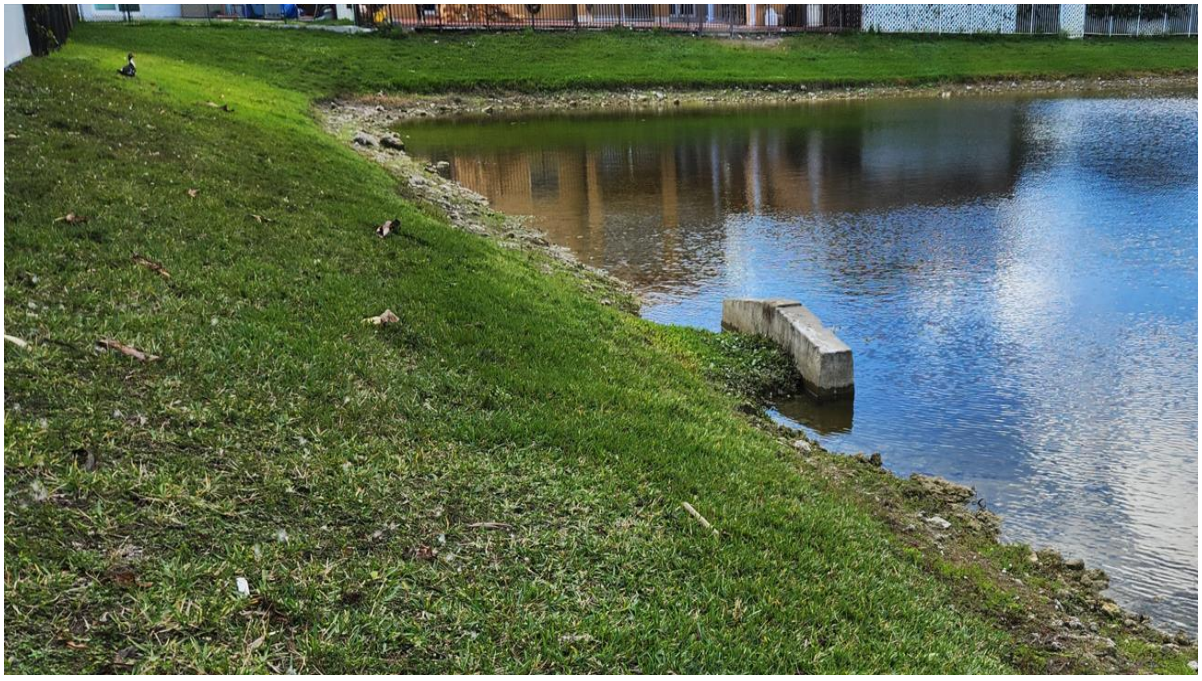


Figure 25: Bank Erosion showing loss of material and headwall is a good indication of where the soil supposed to be at.

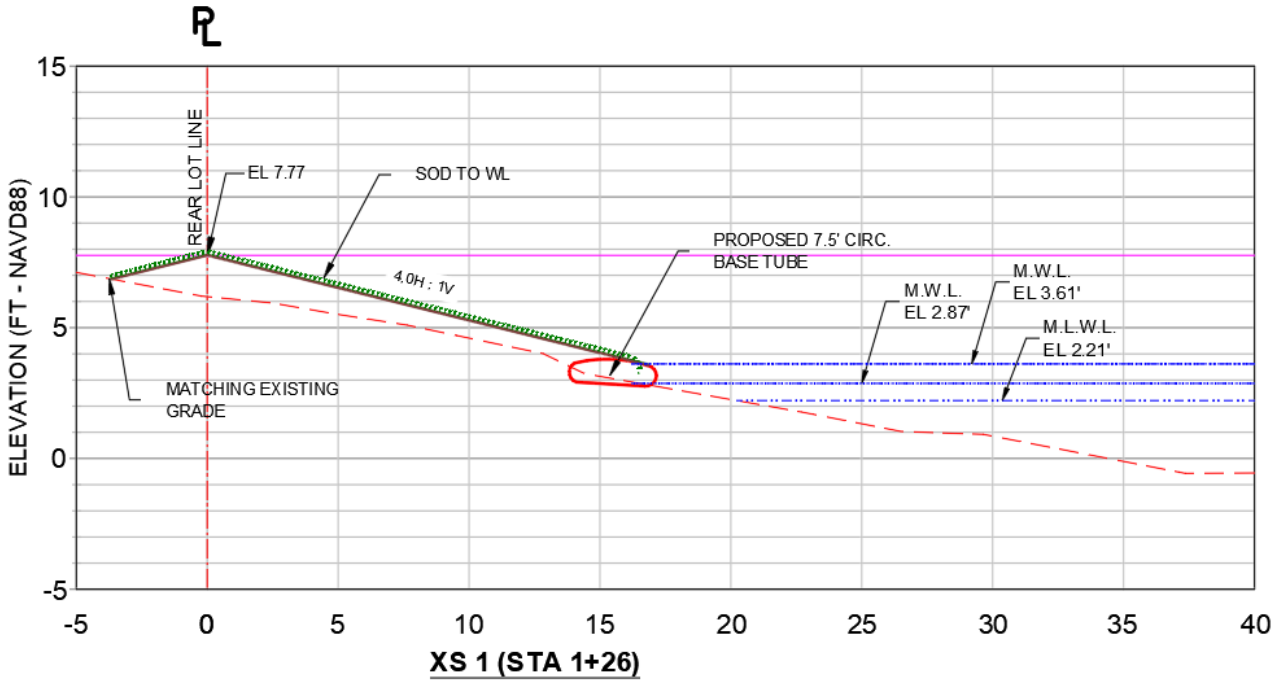


Figure 26: Cross Section 1 showing the recommended solution of installation of EFT® with one layer of permanent tubes
Scale: Not to Scale



Figure 27: Aerial of recommended erosion control elements

Recommended Erosion Control Element

Landshore® has expertise in design and installation of different remediation applications for slope stabilization and erosion control, including Articulating Concrete Block mat, bulkhead, Concrete Cloth™, Eco-Filter Tube®, Erosion Control Panel, Flexamat®, Flex MSE®, Geo Web®, gabions, Hydrotex™, reinforced concrete wall, rip-rap, sand cement wall, sheet piling, Turf Reinforcement Mat, littoral planting and others.

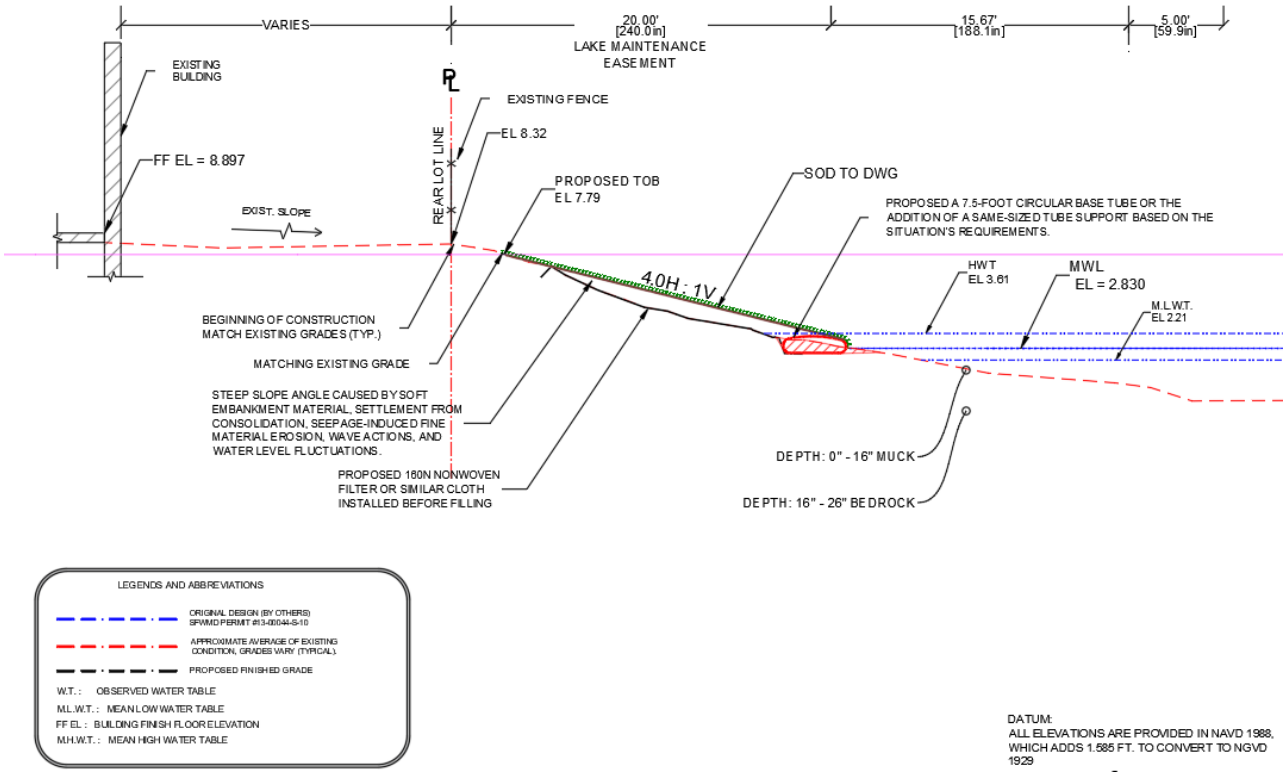
After performing a cursory review of several alternatives, it is our professional opinion, to the best of our knowledge and belief that present slope condition may be remedied by utilizing Eco-Filter Tube® and Concrete Block Mat (Flexamat® or ShoreFlex®), which installation is hereby recommended as most viable solutions and are described below.

Eco-Filter Tube (EFT®):

EFT® or approved by Engineer equal product construction uses a woven or non-woven geotextile fabric that is formed into the shape of a tube. The tube container is filled with sand by direct coupling to a hydraulic dredge. The EFT® is designed to retain the granular fill portion of the dredge slurry, while appropriately sized openings in the material allow the excess water in the slurry to permeate through the tube walls. The procedure can be implemented in both dry and underwater conditions. The tubes can be fabricated in various circumferences, which, when inflated, will form a roughly elliptical shape. The EFT® system consists of a spun bound polyester filter fabric that is sewn together to form a tube which is placed along the water's edge and filled with sand to form an erosion barrier that after consolidation has the characteristics of a permeable, gravity type retaining wall.

Some EFT® benefits include:

- ✓ Sand and geo-textile materials used in the tubes are essential to allow proper drainage and ensuring an environmentally friendly erosion control solution.
- ✓ The sand in the tubes functions as a filter for underwater seepage.
- ✓ The EFT® solution enhances the quality of the lake water as it keeps environmental threats from entering the body of water.
- ✓ EFT® installation bypasses the need to bring heavy equipment to the job site, preventing the possibility of damage from the large weight of the equipment.
- ✓ EFT® is one of the most economical embankment restoration solutions.



Scale: Not to Scale

Figure 28: EFT® Typical Section



Figure 29: Example of EFT® Landshore's Installation

Proper EFT® Design & Installation:

The main reasons for failure for geo-synthetic container application – are improper design or installation.

Landshore® developed software, patented technologies, trained professionals, laborers, and special survey crews who all work together as one team providing design, calculations, measurements, production and inspection to ensure stability and safety in compliance to local municipal codes, manufacturer's specifications and minimum engineering standards.

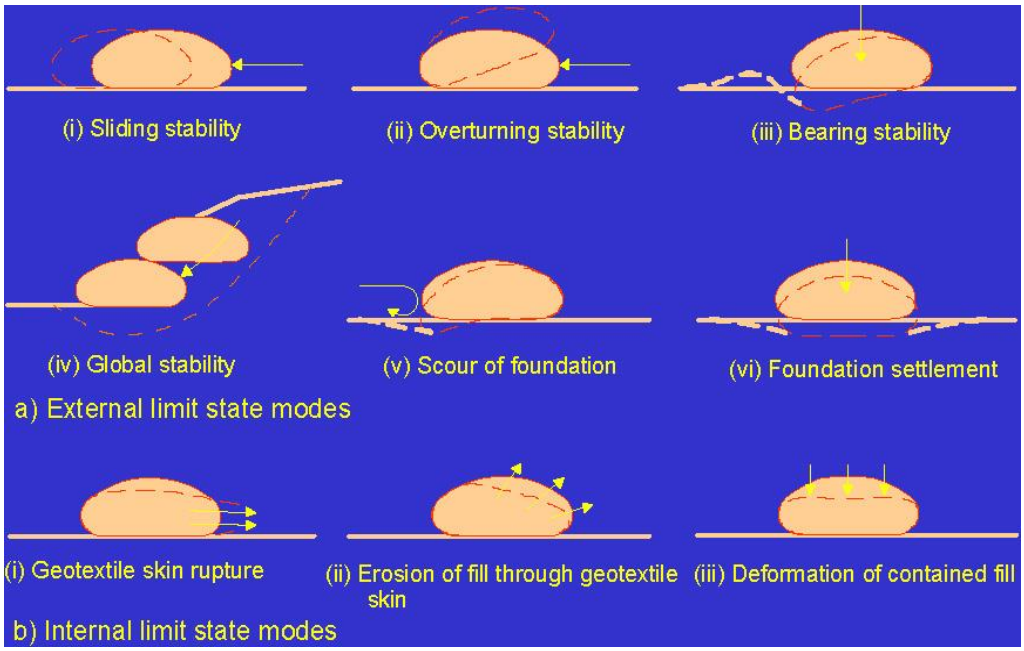


Figure 30: Geo-tube failure mechanisms

Concrete Block Mat:

Concrete Block Mats are designed to prevent soil erosion and promote vegetation establishment in a wide variety of applications.

Flexamat®: Flexamat® is a vegetated concrete block mat utilized for stabilizing slopes, channels, low water crossings, inlet/outlet protection, and shorelines. It consists of concrete blocks (6.5″ x 6.5″ with a 2.25″ profile) locked together and embedded into a high strength geogrid. There is 1.5″ spacing between the blocks that gives the mat flexibility and allows for optional vegetation growth. The mat is packaged in rolls, making transporting and installing Flexamat® efficient. *Source:* www.flexamat.com

ShoreFlex® is a permanent erosion prevention system that can be installed to shield channel side slopes and beds, pipe and culvert inlets/outlets, shoreline, and almost any place you may have hydraulic erosion protection needs. ShoreFlex® consists of a concrete block erosion control mat designed to be vegetated. ShoreFlex® comes in various customizable sizes and erosion control backing choices. Shoreflex® performs better than rock riprap and is easy to install and maintain. In addition, ShoreFlex® is environmentally friendly, grows green and can be mowed. *Source:* www.shoreflex.com

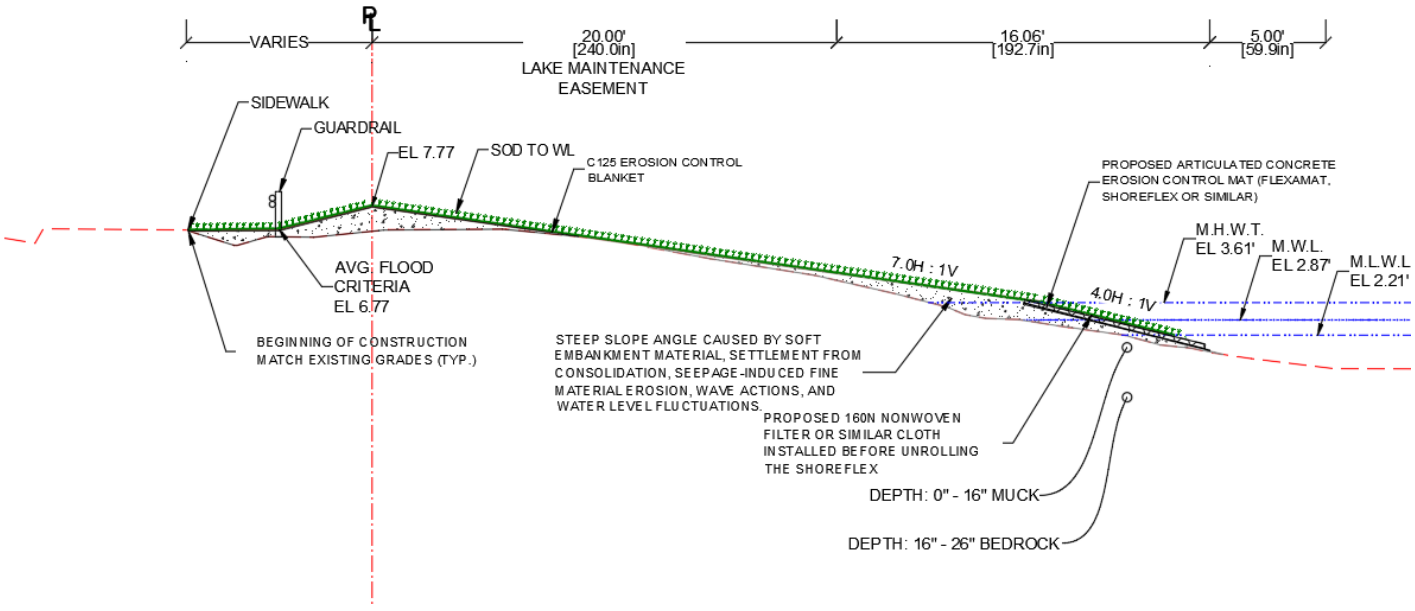


Figure 31: Concrete Block Mat Typical Section



Figure 32: During Landshore's installation of Flexamat®



Figure 33: After Landshore's installation of Flexamat®

Stability Analyses

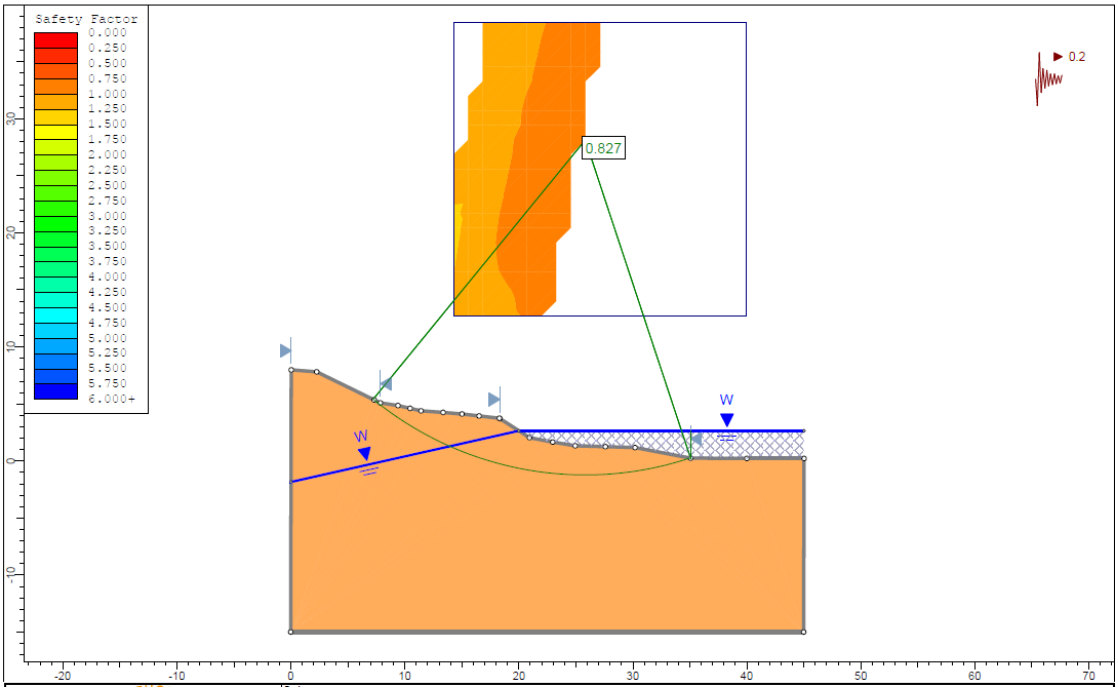


Figure 34: Stability Analysis before installation of eco-filter tubes

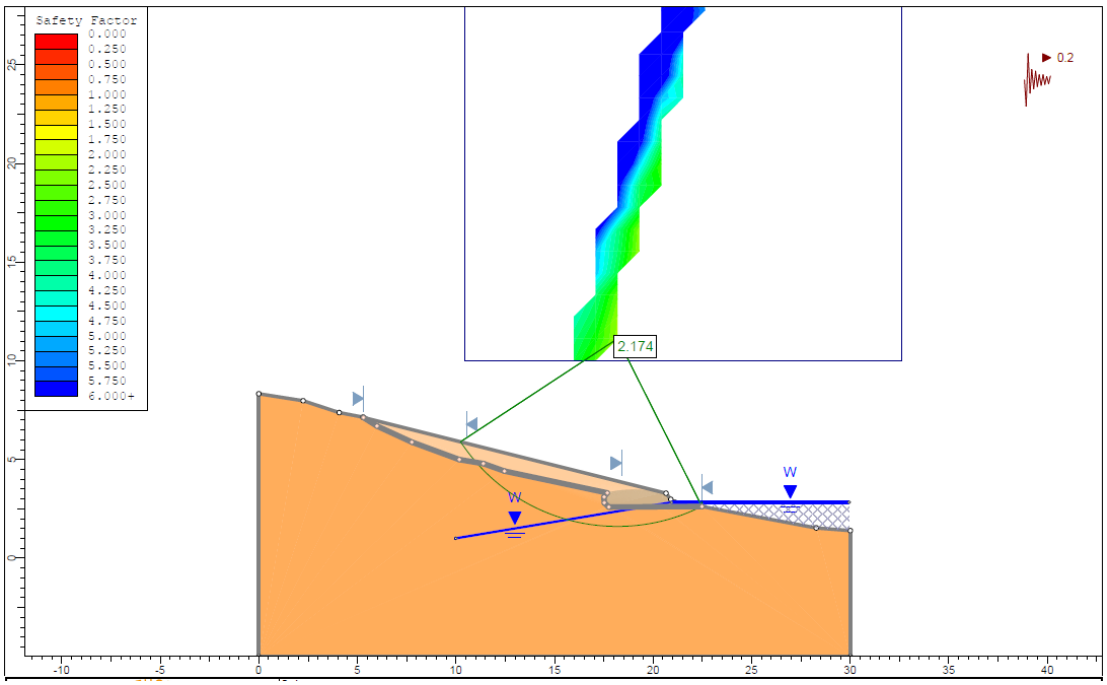


Figure 35: Stability Analysis after installation of eco-filter tubes

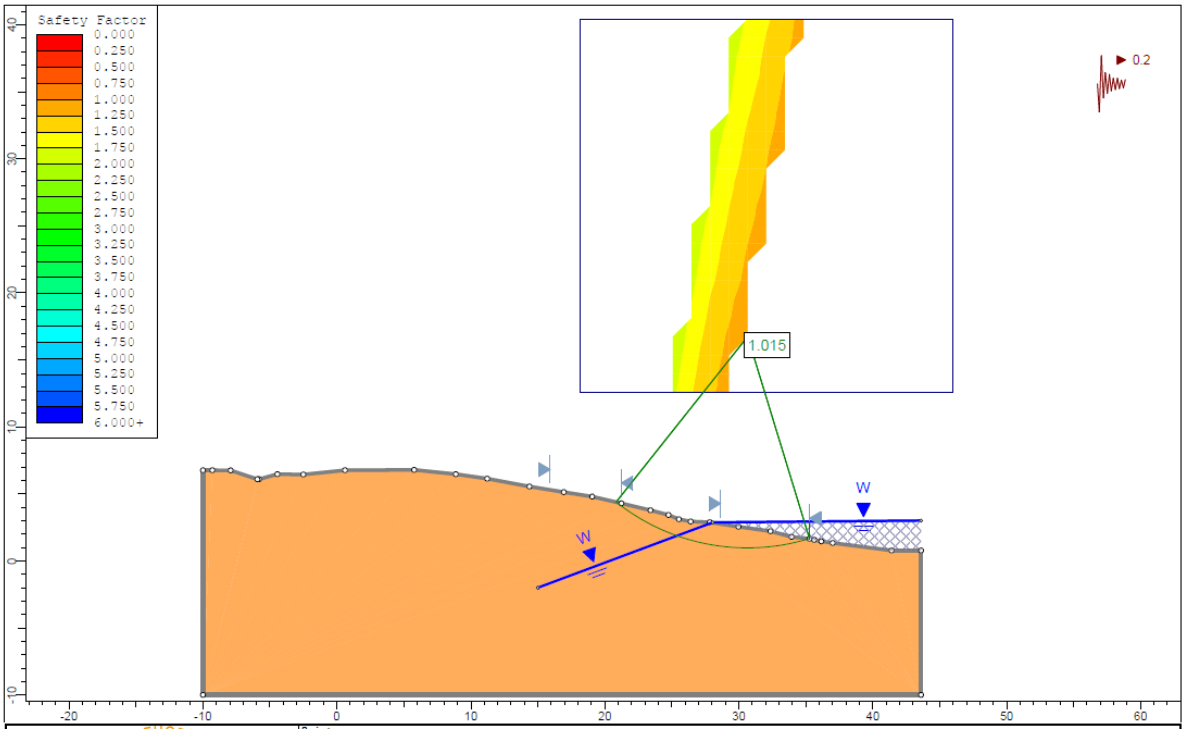


Figure 36: Stability Analysis before installation of concrete block mat

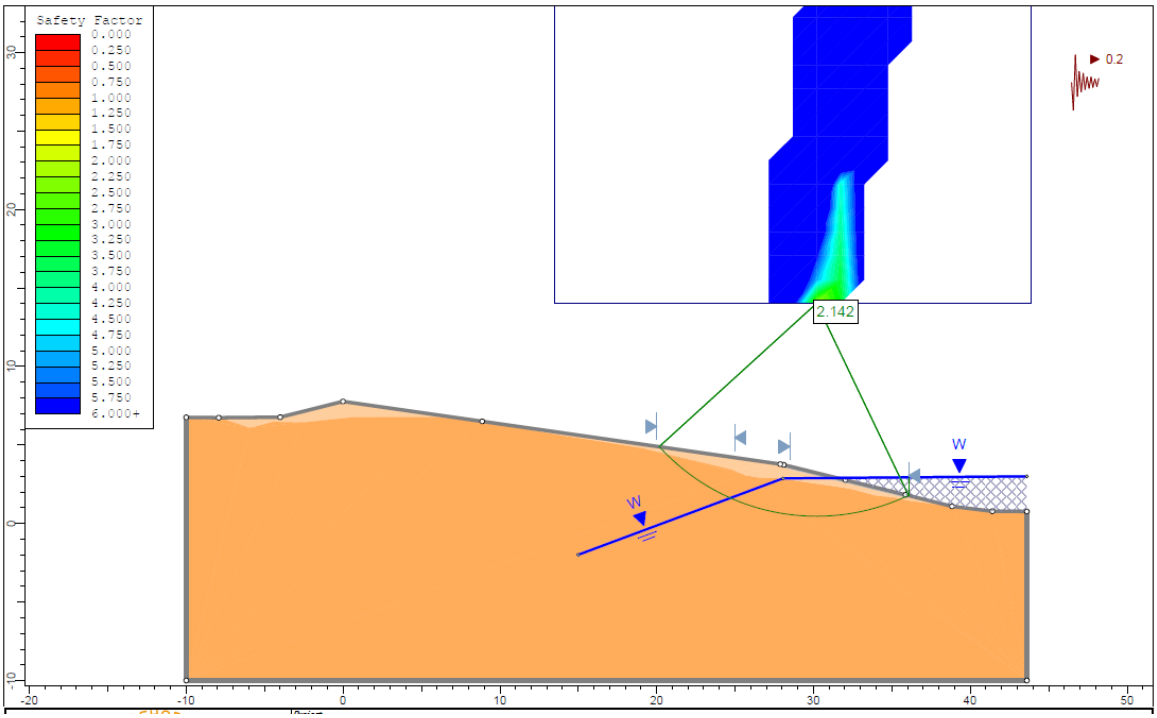


Figure 37: Stability Analysis after installation of concrete block mat

Estimated Volumes

Geo-synthetic container material, concrete block mat system, imported fill, site excavation and grading amounts were measured and calculated using Computer Aided Design software, based on average end area method using drawings, sections, details and manufacturer specifications as references.

Lake 1:
1,560 linear feet of shoreline repair
- 1,010 sf of concrete block mat
- 1,478 lf of 7.5' circumference supporting eco-filter tube
- 1,435 lf of 7.5' circumference base eco-filter tube
- 800 cy of imported fill material to meet the berm requirement of 7.77' NAVD88
- 493 cy of imported fill material to fill in the eco-filter tubes

LAKE 1 - Preliminary Opinion of Probable Costs: $314,414

Lake 2:
1,971 linear feet of shoreline repair
- 1,880 sf of concrete block mat
- 1,735 lf of 7.5' circumference base eco-filter tube
- 1,052 cy of imported fill material to meet the berm requirement of 7.77' NAVD88
- 294 cy of imported fill material to fill in the eco-filter tubes

LAKE 2 - Preliminary Opinion of Probable Costs: $348,120

Lake 3:
742 linear feet of shoreline repair
- 680 sf of concrete block mat
- 662 lf of 7.5' circumference base eco-filter tube
- 398 cy of imported fill material to meet the berm requirement of 7.77' NAVD88
- 112 cy of imported fill material to fill in the eco-filter tubes

LAKE 3 - Preliminary Opinion of Probable Costs: $128,607

Lake 4:
1,360 linear feet of shoreline repair
392 sf of concrete block mat
1,309 lf of 7.5' circumference base eco-filter tube
671 cy of imported fill material to meet the berm requirement of 7.77' NAVD88
222 cy of imported fill material to fill in the eco-filter tubes

LAKE 4 - Preliminary Opinion of Probable Costs: $214,172

Lake 5:
871 linear feet of shoreline repair
871 lf of 7.5' circumference base eco-filter tube
415 cy of imported fill material to meet the berm requirement of 7.77' NAVD88
148 cy of imported fill material to fill in the eco-filter tubes

LAKE 5 - Preliminary Opinion of Probable Costs: $131,521

FIVE LAKES - Preliminary Opinion of Probable Costs: $1,136,834

NOTE: Please note that these estimates are based on current prices and inflation should be considered for budgetary purposes, if the community would like to repair their shorelines over an extended period of time.

Conclusion

Landshore® is devoted to thoroughly study each individual project from every perspective and strive to perform the best possible design that solves the erosion problem.

We suggest that the District consult with our Company for all future development and shoreline repair projects, in order to avoid predictable dangerous conditions and save money via preventative actions.

Landshore is a turn-key multi-discipline design-build environmental company which focuses on erosion issues using non-structural, bioengineering and bio-technical methods for shoreline restoration, erosion control and coast protection.

Established more than two decades ago we employ civil, structural, geo-technical, surveying, environmental and other professionals, providing viable customized solutions and highest level of service through innovation in engineering design, advancement and patenting of materials, scientific research and development of new construction technologies.

If you have any additional questions, or require further information, do not hesitate to contact us at (954) 327-3300 or via email at info@landshore.com.

We look forward to having the pleasure of continuing doing business with you.

Sincerely,
Nicolas Valles-Negrette
Senior Engineer
Qualified Stormwater Management Inspector Number 41451

André van den Berg
President
Qualified Stormwater Management Inspector Number 37843

Landshore Enterprises, LLC

Exhibit 1: Soil Classification

The soil classification system that we used was the US Department of Agriculture classification based on soil textures, which defines twelve major soil texture classifications (sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay). Soil textures are classified by the fractions of sand, silt, and clay in a soil. Classifications are typically named for the primary constituent particle size or a combination of the most abundant particles sizes (e.g., sandy clay, silty clay). Loams are soils having roughly equal proportions of sand, silt, and/or clay in a soil sample.

According to the U.S. Department of Agriculture, the soil is type Cooper Town muck, which consists of very deep, poorly drained, slowly permeable soils on broad and low flats. Slopes range from 0 to 1 percent.

Understanding the context of shoreline stabilization for five lakes, the presence of USDA Type 58-Cooper Town muck, pounded-urban complex, 0 and 1 percent slopes with a typical profile of 0 – 16 inches: muck and 16 to 26 inches: bedrock, and the soil around the shoreline classified as silty sand with gravel, presents a unique set of challenges.

The first concern is the muck layer, which is soft and compressible due to its high organic content. This layer, combined with a factor of safety of less than 1, indicates that the current soil conditions are not stable enough to resist the forces exerted by the lake water, particularly during periods of high-water levels or storm events. The presence of silty sand with gravel around the shoreline also suggests a high potential for erosion, which could further destabilize the shoreline and lead to loss of land.

To mitigate these issues, we could contemplate a variety of shoreline stabilization strategies. These might encompass the deployment of robust structures like seawalls, articulating concrete blocks, rock riprap, among others, which serve as tangible blockades against wave action and erosion. Nonetheless, these approaches can incur substantial costs and potentially inflict adverse effects on the natural environment, compromising the aesthetic appeal of the lakeshore. As a solution, the use of Eco-filter tubes could be considered. These tubes not only serve the purpose of shoreline protection but are also environmentally friendly, cost-effective, and maintain the natural beauty of the lakeshore, thus offering a sustainable alternative to traditional methods.

Soft stabilization techniques, such as beach nourishment, vegetation planting, or the creation of living shorelines, could also be considered. These methods work with natural processes to enhance shoreline stability and can provide additional benefits such as habitat creation and improved water quality. However, they may require ongoing maintenance and may not be suitable for all sites or conditions.

Given the presence of muck and the shallow bedrock, it may also be necessary to consider ground improvement techniques to increase the soil's strength and stability. This could involve the removal and replacement of the muck layer, soil compaction, or the use of geosynthetic materials to reinforce the soil. The use of geosynthetic materials like geotextiles is particularly recommended due to their ability to provide immediate stabilization of the soil. Geotextiles are permeable fabrics that, when used in association with soil, have the ability to separate, filter,

reinforce, protect, or drain. They help in preventing soil erosion and in maintaining the structural integrity of the soil, especially in areas with muck and shallow bedrock. Their use can significantly improve the soil's strength and stability, making it more suitable for construction or other uses.

In all cases, a thorough geotechnical investigation will be necessary to understand the soil properties and determine the most appropriate stabilization techniques. The factor of safety will need to be recalculated after implementing any stabilization measures to ensure it is above 1.3 indicating a stable and safe shoreline.

In conclusion, while the current soil conditions present significant challenges for shoreline stabilization, with careful planning, investigation, and the implementation of appropriate engineering solutions, it is possible to stabilize the shoreline of these five lakes. The chosen solution should balance the need for stability and safety with the desire to preserve the natural environment and beauty of the lakeshore.