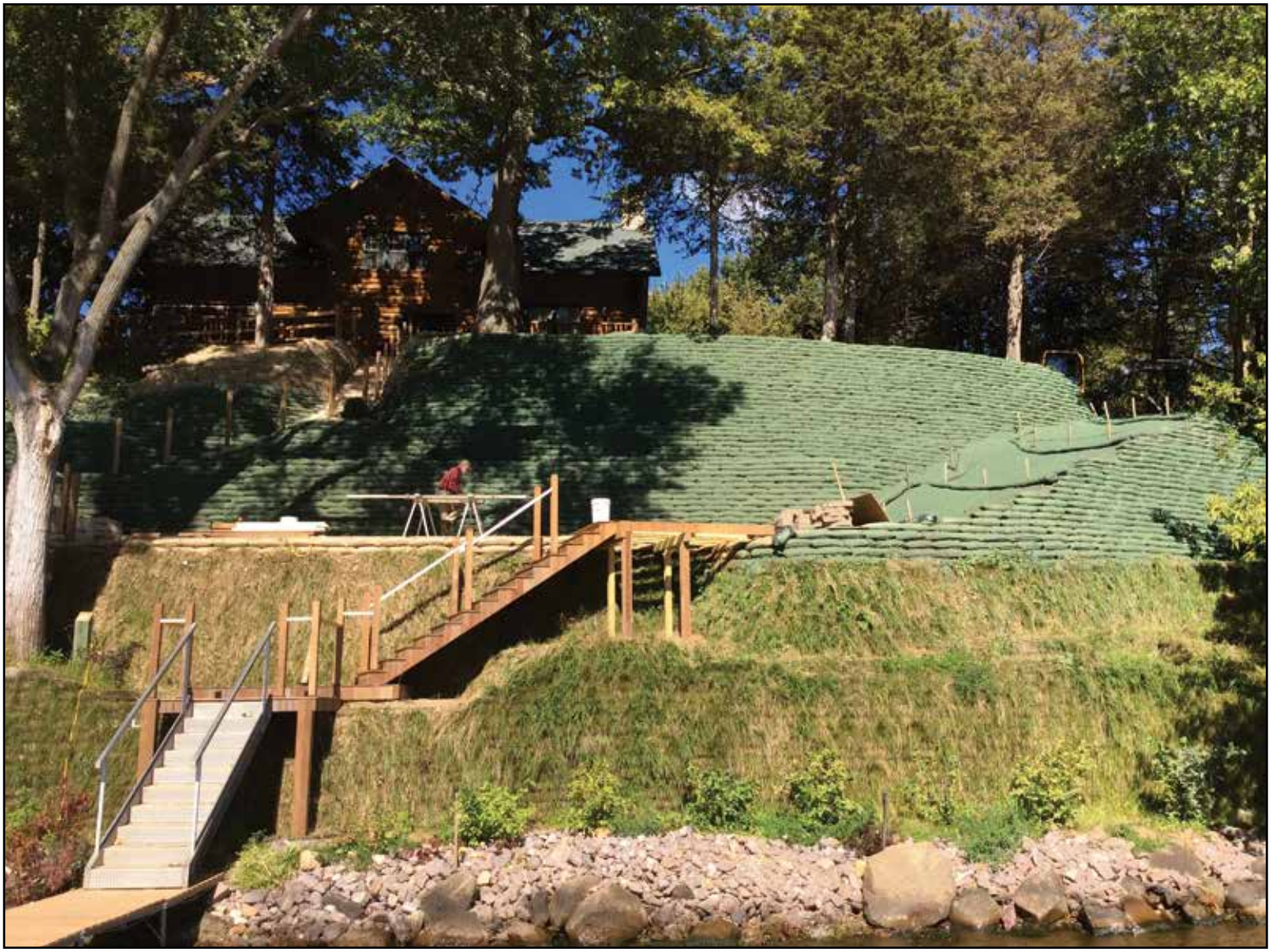
Working with Mother Nature - Not Against Her



Completed Envirolok progress from the fall of 2015.

In late July of 2014, Dixon Shoreline Landscaping, Portage, Wisconsin, was contacted to evaluate the existing condition of a hillside at a private residential property located on Lake Wisconsin in Columbia County. The owner wanted to repair the failing timber walls and eroding slope before adding on to his house. A site visit and soil tests confirmed the need for added slope stability. Working around state shoreline regulations and existing site features, it was decided that an engineered vegetated wall was the best solution.

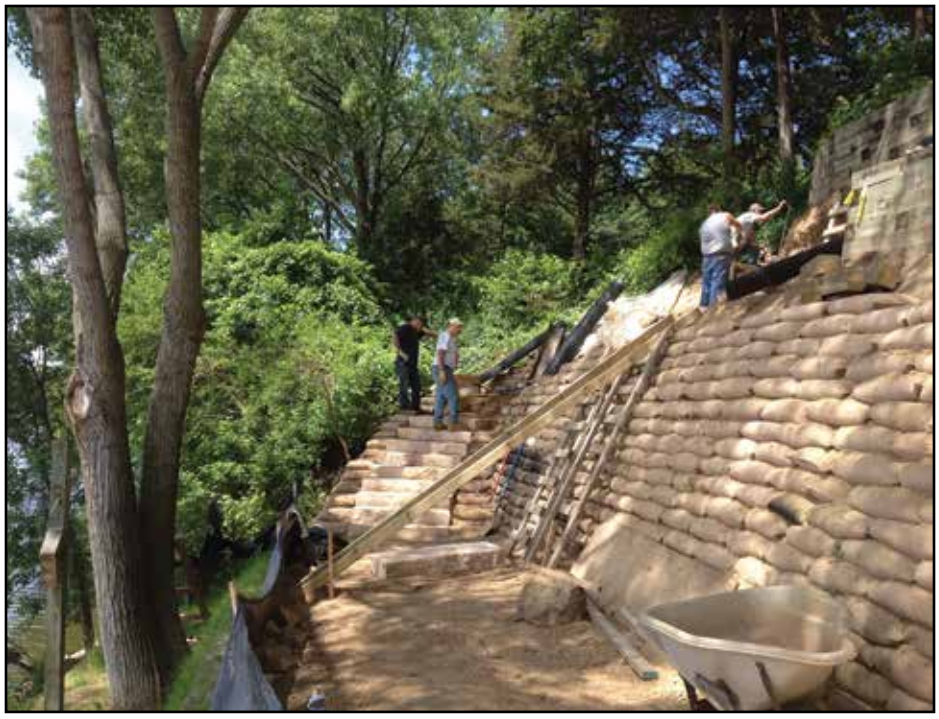
Existing Wall

In 1996, the slope from 4' above the ordinary high water mark was shored up using treated pine timbers. The area that was shored up consisted of ten 120' wide retaining walls that had various heights going all the way to the top of the fifty-foot slope. The material below the wood walls was built using 24" diameter granite boulders for shoreline erosion protection from the large lake fetch and ice push during the spring thaw. At the top of the slope, sitting 20 feet back from the face, sits a beautiful log home. Attached to the house were recessed timber stairs giving access to the lake. On one side of the recessed stairs is a five-foot-diameter white oak tree and on the other side a large diameter Red cedar tree. These trees were two big obstacles that needed to be considered in planning any construction. Growing on the face of the slope, in and through the timber walls, were many invasive shrubs and trees, which would be replaced with native shrubs.

Finding a Solution

Understanding the possibility of failure within the timber wall as they were shifting and coming apart annually, the owner looked into a solution. The repairs to the slope need to be completed before the addition to the cabin reduced the accessibility and use of any machinery. During the multiple site visits, photos were taken and run- and drop-elevation measurements were made in order to generate preliminary sketches.

The next step was to contact an engineering firm to take a 50' soil bore test at the top of the hill. This is a 1.2 to 1 slope with general dimensions of 50' height x 48' depth x 120' width. As this project was within 75' of a Wisconsin waterway, the laws require contacting Wisconsin DNR and Columbia County Zoning Department for permits, fees, erosion/sediment control plans, and drawings. The results of the testing showed the existing wall should have failed due to bulging, rotting wood and insect damage. This information was conveyed to the homeowner who was told that a solution was available, but it would take time to complete. The need for additional soil testing, engineer review, meetings, and financial review were discussed.



Above: During mid-summer of 2015, installation of steps and removal of timbers were taking place. Below: During early spring of 2014, tube system shown was used to transport native plugs for planting.

After reviewing the sketches with the regulating agencies and discussing options for sediment control, slope stabilization and erosion control, options were limited. The project is within the 75' shoreline setback and structures are not allowed to be replaced using more than 50% of the cur-

rent material. Replacement of the wood timbers with poured concrete retaining walls and interlocking concrete blocks was not allowed. The Wisconsin Shoreline standards do not allow these shorelines to be certified in accordance with Columbia County's Shoreland – Wetland Protection Ordinance. The ordinance is created to comply with Wisconsin Statues and regulate shoreline impacts. The Ordinance requires a certificate of compliance from the Director of Planning and Zoning with a stated purpose to further the maintenance of safe and healthful conditions and prevent and control water pollution by limiting structures to those areas where soil and geological conditions provide a safe foundation and controlling shoreline alterations. The certification requirements removed the option of concrete or segmented concrete structures. The option to stabilize the slope by cutting the top of the hill back to reduce the angle would not work because the

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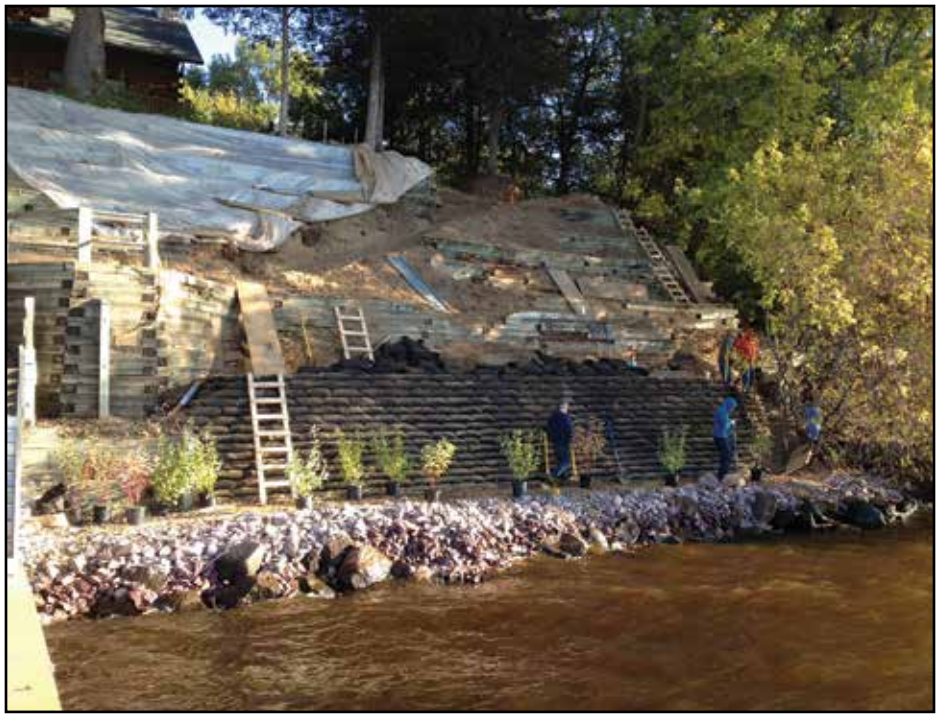
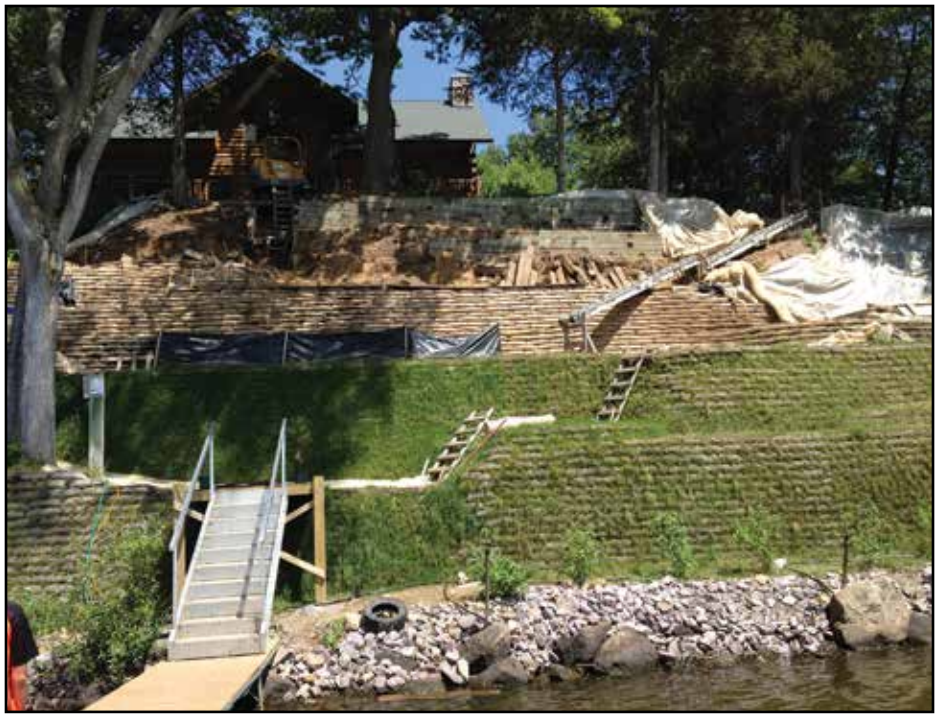


During the fall of 2014, native shrubs were being prepared for planting while soil bag installation was underway.

cabin is too close to the top of the hill and there are several large old growth trees at the top as well.

The proposed solution to naturalize the hillside would be to replace the timber wall with geosynthetic encapsulated soil bags; a system of filling a soil bag with an engineered soil designed to support vegetation while stabilizing the face of the slope. Envirolok was the product chosen, and then other important decisions had to be made: where to start, what to do with the base near the lake, how to access the lake during construction, what equipment would be necessary, whether different soil was needed for different levels, how to keep lake access for owners, what type of stair system would be installed, and what type of reinforcement would be needed. Reinforcement options included geogrid and cable earth anchors; both would need soil samples. Approval from the DNR to strengthen the boulder (rip/rap) base was needed to support the new soil bag wall. There was also a concern of large sheets of ice breaking up in the spring thaw and piling up close to the soil bag walls.



Different stages of the project show the following: vegetated slope on the bottom, constructed wall in the middle, and old existing wall being removed at the top.

Construction

On August 20, 2014, with all required permits approved and posted, a contract was signed and construction began. Starting at the base, 50 cubic yards of 6"-8" granite quartzite was installed to fill the cracks and gaps from the large boulders. Then 15 cubic yards of clean stone was laid on top to create a level base to lay soil bags. With the base strengthened, removal of 20' sections of the timber was done. Removal of the timbers was complicated because only hand tools were used and excess soil had to be removed by hand or with a steel barrel system to make room for the soil bag installation. To remove large timbers and soil, an 8' wide path with 40 degree slope was cut down the slope. This allowed access for a Volvo mini excavator and rubber track skid steer to work on debris removal.

Three 24" x 20' PVC conduits were bolted together and installed to transport material to the different levels, with a steel plate at the end to be used as a backstop. Once material was transported, installation of the bags started. Earth anchors, BMX polypropylene geogrid, and coated rebar were specified in the engineering plans for stabilization. The earth anchors were installed every 2' vertically and 6' horizontally. The earth anchor process connects a 3/16" cable to an anchor that is driven 12' to 14' into the ground and connects the other side to rebar which is then placed on the bags. Geogrid was used every 2' lift, cut into 3' x 4' pieces and installed the entire length of the wall. Since this was such a large project, it was split into multiple sections. After the bags were all placed on the first section, 4,000 2" native plant plugs were installed and the section was hydroseeded, resulting in established plants the following spring. Since this section was finished in November of 2014, winter preparation was required. This involved 2-mil plastic sheets tented over the already seeded site creating a greenhouse effect. Twelve inch wood fiber wattles and silt fencing were installed at the top of the hill to alleviate the pressure from service run-off of melted snow and spring rain.

In April, 2015, the plastic sheeting on the hillside was uncovered, revealing very good plant germination and no soil loss. The soil was dry, which was good for construction, but also resulted in poor traction for the mini excavator. With poor traction almost eliminating the use of the excavator, Dixon researched the use of a Mini Conveyor System to transport material upslope. Cost of the conveyor system would significantly increase the progress as well as job site safety, making it a good investment. Ordering and complete setup of the conveyor was done within 6 days of getting the property owners approval. This made removal of timbers, soil and any other debris much easier.

Lake access was a challenge due to zoning restrictions. Staying close to the original path was a must, not to create an erosion path down the stone stairs, which would have to have railings. The original drawing for the path proposed above ground stairs throughout. On the lower level, a 5.5' wide by 40' long paver walkway was created 8' up from the soil bag wall. This allowed access to an above ground set of stairs down to the

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Stone steps and hand rail ascending the slope.

Stone steps and hand rail descending the slope.

View of a paver patio amongst the beautiful stair system.

pier. To ascend the hill 8' to the next small paver level, composite stone stairs with geotextile fabric on the underside were installed. From this small level to the top of the hill, 38 stone stairs were put in. The stairs were a challenge because they had to be recessed like the old wood stairs. After 3 weeks of stairway construction, a handrail was installed to meet building codes. With all of the construction complete, a heavy native seed mix was hydroseeded onto the soil bags. Preparation for winter included installation of wood fiber sediment logs, Curlex net free rolled blankets, Recylex permanent BMPs, silt sox, straw blankets, and silt fence. A mild winter resulted in excellent seed germination.

The final step to this project, which will take place spring of 2016, will be to install 10,000 1 to 2" native plants and shrubs and an irrigation system. This site will continue to be monitored for years to come.

The project was made possible thanks to the following: Agrecol Native Nursery, Envirolok, Race Engineering Firm, The Rock Step Corporation, Belgard Pavers, Mini Conveyors Company, Gil Layton of NASECA, Columbia Zoning, Wisconsin DNR, Earth and Road Corporation, and Black Bear Enterprises World Class Log Homes. Special thanks go to the homeowner, who understands the value of working with Mother Nature and finding new solutions to manage our natural resources! **L&W**

by Pat Dixon, Rob Walker and Dylan McCullick

For more information, please contact www.dixonshoreline.com, www.envirolok.com, or www.agrecol.com.