

Lake Lorelei Property Owners Association

Rip Rap Standards

Recommendations

Revision 0

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Purpose and scope:

This document provides recommendations for standards of structural systems (i.e. rip rap) in order to provide the Lake Lorelei membership with a consistent guide for inlet and shoreline protection.

The information and recommendations provided in this document are intended for use by the Lake Lorelei Property Owners as best practices to maintain the inlets and lakeshores to minimize erosion and infiltration of soil and silt into the lakes.



This picture was taken in Cove C – south shore in January 2018. Note the silt build-up and the shadow where the embankment has significant erosion issues.



This picture above is the inlet to Cove C in January 2018. Note the lack of rip rap in the inlet.

These are issues that can be minimized with proper inlet and shoreline design and maintenance.

Selecting streambank and shoreline protection measures:

After deciding rehabilitation is needed, a variety of remedies are available to minimize the susceptibility of streambanks or shorelines to disturbance-caused erosive process. They range from vegetation-oriented remedies, such as soil bioengineering, to engineered grade stabilization structures.

There are 3 lakes at Lake Lorelei, the main lake and 2 smaller lakes. This document is primarily focused on shoreline and inlet protection (rip rap standards) for the main lake since the smaller lakes do not experience the same conditions (e.g. large wakes from watercraft). The smaller lakes benefit more from vegetation-oriented remedies.

Vegetation-oriented remedies are covered in a separate recommendation document.

As a first priority, consider those measures for all Lake Lorelei waters that:

- Are self-sustaining or reduce requirements for future human support;
- Use native, living materials for restoration;
- Restore the physical, biological, and chemical functions and values of streams or shorelines;
- Improve water quality through reduction of temperature and chronic sedimentation problems;
- Provide opportunities to connect fragmented riparian areas;
- And retain or enhance the stream corridor or shoreline system.

For the areas around Lake Lorelei, various designs and approaches have been utilized over the years by our members and the LLPOA. These approaches range from rip rap applications, silt ponds, poured concrete walls, and different kinds of vegetation. There may be options for other structures such as Gabion baskets and/or check dams to assist with erosion control.

Rip Rap Intallation

The information provided in this document should be used for a newly developed shoreline, for repair of a deteriorated shoreline, or for maintenance. For existing shoreline it is suggested that the proper rock size, using the charts on following pages, be used to determine what you need for your particular situation. In addition it is advised that you use a topping rock to help lock in the larger rock and act as a buffer filter between your grassed areas and the rip-rap. This will also help in erosion control.

Rock Rip Rap General Information

Rock rip rap, properly designed and placed, is an effective method of streambank and shoreline protection.

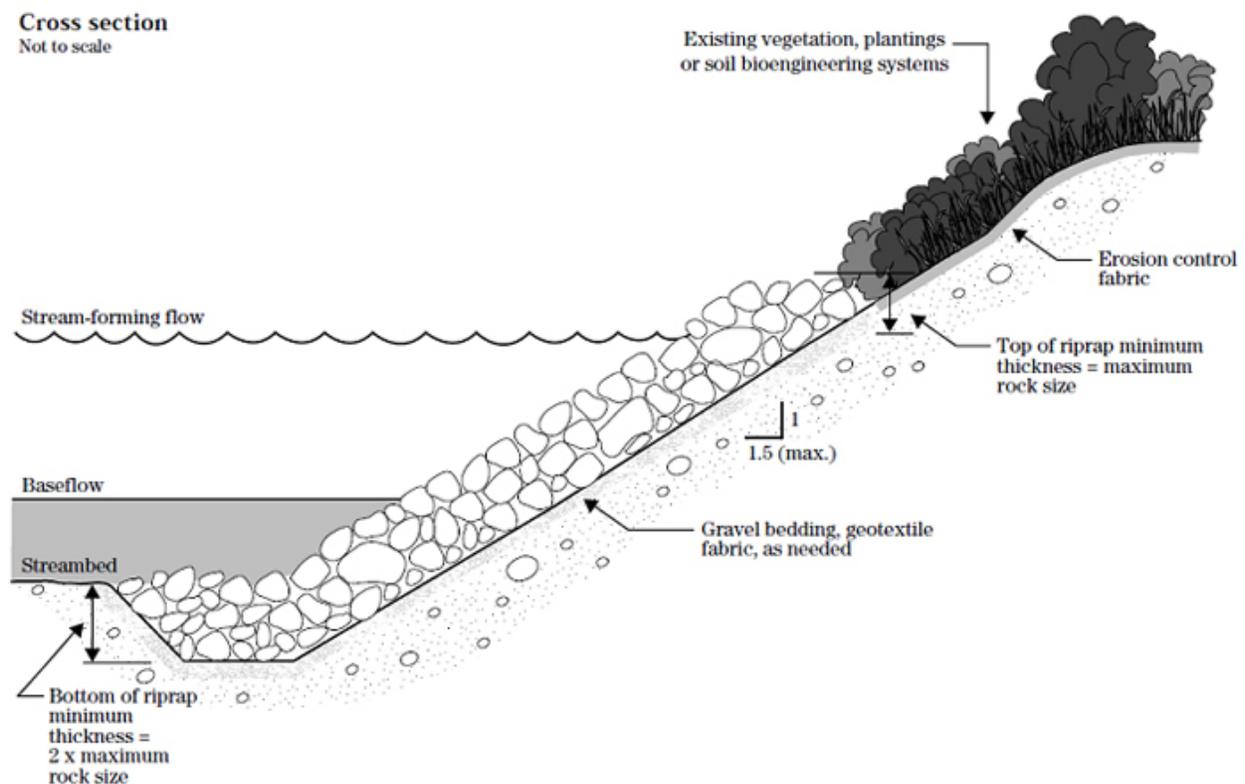
Applications and effectiveness

- Provides long-term stability.
- Has structural flexibility. It can be designed to self-adjust to eroding foundations.
- Has a long life and seldom needs replacement, low maintenance.
- Is inert so does not depend on specific environmental or climatic conditions for success.
- May be designed for high velocity flow conditions.

It is important to note that these recommendations are not a “one size fits all” solution. Each application should be analyzed for any unique characteristics that may affect the selection of the best erosion control (e.g. slope of the shoreline, wake activity, velocity of flow, etc.).

Rip rap is classified as either graded or uniform. Graded rip rap contains a mixture of stones which vary in size. A sample of uniform rip rap would contain stones which are all fairly close in size. For most applications, graded rip rap is preferred to uniform rip rap. Graded riprap forms a flexible self-healing cover, while uniform rip rap is more rigid and cannot withstand movement of the stones. Graded rip rap may be cheaper to install, requiring only that the stones be dumped so that they remain in a well-graded mass.

Figure 16-32 Rock riprap details



Slope

The diagram above indicates a slope of 1.5 to 1 (max.). A slope of 3 to 1 is recommended.

Thickness

Recommended thickness for rip rap installation is 1.5 times (average) the thickness of the largest rock being used (minimum). Example: if the largest rock being used is 12 inches, the thickness of the wall should be 18 inches (minimum).

Rip Rap And Aggregate Sizes

There are some different ways to identify rip rap sizes. This chart gives a general description of sizes, types and classes of rock:

Size Range Largest Diameter of Rock	Ohio Department of Transportation (ODOT) designations	Surface mining definition
4" - 12"; average 6"	(ODOT Type D)	Class 1 rip rap
6" - 18"; average 12"	(ODOT Type C)	Class 2 rip rap
12" - 24"; average 18"	(ODOT Type B)	Class 3 rip rap
18" - 30"; average 24"	(ODOT Type A)	Class 4 rip rap

Filter bedding stone

ASTM D-448 TABLE 1	Normal Sizes (inches)
3	2" - 1"
4	1 1/2"-3/4"
5	1" - 1/2"
6	3/4"-3/8"
57	1" - No. 4

Filter bedding stone should be used under the rip rap wall to prevent loss of underlying soil or finer materials because of moving water (Geotextile fabric is also recommended to aid in prevention of soil loss). Smaller stones can also be integrated throughout the rip rap wall to aid in the stability of the wall.

Place smaller stones in voids to form a dense, uniform, well-graded mass.

Selective loading at the quarry and some hand placement may be necessary to obtain an even distribution of stone sizes.

Maintenance

A rip rap shoreline is susceptible to displacement and deterioration of the rock. When displacement and deterioration occur the effectiveness of the structure is greatly reduced. Rip rap

shorelines need to be inspected periodically and after high flow events. Any displaced or deteriorated rock should be replaced as needed.

General Recommendations

Main Lake:

Due to high wake activity it is recommended that larger rip rap (Class 2 or 3) be used as a base with smaller stone integrated throughout the installation. A “toe” should be installed at the base of the rip rap wall similar to the diagram on page 5 of this document.



Examples: Larger stone integrated into the wall

Coves:

Since the coves are in a “no wake zone” smaller rip rap (such as Class 1) should be adequate. Integration of smaller stone into the wall is also recommended. A “toe” is recommended to be installed at the base of the rip rap wall similar to the diagram on page 5 of this document.



Example: Smaller rip rap at the end of Cove A

Inlets:

The inlet streams that have the potential to produce high velocities of water flow should be protected with larger rip rap (Class 2 or 3) integrated with smaller stones to provide slow down the velocity and provide a better chance for the rip rap to stay in place.

For small ditches or other inlets where groundwater that doesn't have a great potential for high velocity of water flow, smaller rip rap (such as Class 1) may be adequate for erosion control.

Additional consideration is advised where riprap is used for inlet protection, the riprap should be placed before or in conjunction with the construction of the pipe or channel so that it is in place when the pipe or channel begins to operate.



Cove A inlet



Cove B rocked in drainage ditch.

References

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