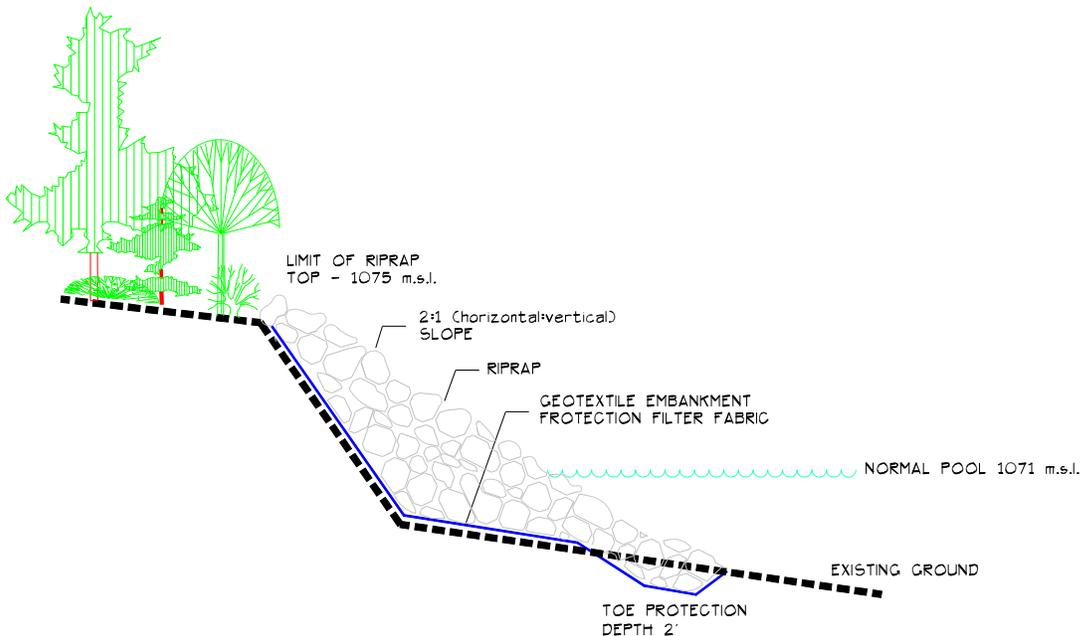


# Riprap

Riprap is a layer of loose stone over the soil. The layer relies entirely on the weight of the stones to prevent displacement by waves; there is no binding force other than surface friction. After installation, the bank shall have a slope of 2:1 or flatter.

**Advantages:** A riprap structure is flexible and is not impaired by differential settlement. Limited damage is easily repaired.

**Disadvantages:** (1)On shores with waves greater than 3 feet in height, sufficiently large stone sizes may be difficult to obtain from local suppliers. (2)Heavy equipment may be required for grading the bluff and placing large stones. (3)The rough stone surface limits access to the water.



It is essential that the rock be large enough to be immovable even by the largest expected waves. The sizes in the following tables are from Moulton (1991, Table 12.8):

| Wave height (ft) | Size of graded riprap stone (in.) |         |         | Thickness of riprap layer (in.) |
|------------------|-----------------------------------|---------|---------|---------------------------------|
|                  | Maximum                           | Average | Minimum |                                 |
| 1                | 15                                | 10      | 5       | 16                              |
| 2                | 18                                | 12      | 6       | 20                              |
| 3                | 21                                | 14      | 7       | 22                              |
| 4                | 24                                | 16      | 8       | 26                              |
| 5                | 27                                | 18      | 9       | 30                              |

To prevent movement of underlying soil through the stone layer, a layer of filter cloth must be placed under the riprap. The filter prevents the soil from being dragged and pumped out between the interstices of the rocks, undercutting the riprap. Riprap is the most economical of the shoreline protection methods approved in the Lakeshore Management Plan. A Specified Acts Permit must be obtained from the Corps of Engineers prior to commencement of work. Contact the Corps office at 770-945-9531 for additional information.