

public water. New constructed storm water outfalls to public waters must provide filtering or settling of suspended solids and skimming of surface debris before discharge.

- R. Erosion control measures shall be provided where necessary in the opinion of the Engineer. All areas disturbed during any grading shall be covered with topsoil and seeded. Areas subject to concentrated runoff or steeper than 3:1 shall be sodded or seeded and protected with appropriate mulch cover as directed by the Engineer.
- S. Riprap. The City of Nisswa encourages the use of riprap as a last resort to control shoreline erosion. Other methods are generally preferred, including the planting of native, deep rooted vegetation. The use of riprap and retaining walls for ornamental purposes or for terracing natural slopes is discouraged within the shore and bluff impact zones. Where riprap is used, the installation shall be done to the following standards:
1. Gradation. A well-graded mixture of rock sizes should be used instead of one uniform size.
 2. Quality of stone. Riprap must be durable so that freeze/thaw cycles do not decompose it in a short time; most igneous stones such as granite have suitable durability.
 3. Riprap depth. The thickness of riprap layers should be at least 2 times the maximum stone diameter.
 4. Vegetation.
 - a. Existing vegetation on the shoreline should be maintained without disturbance.
 - b. All bare soil on the slope above the riprap should be stabilized with seed and mulch, or sod.
 - c. Wooded, deep rooted vegetation should be planted among the riprap to help stabilize and create wildlife habitat.
 5. Filter material. Filter material is usually required between riprap and the underlying soil surface to prevent soil from moving through the riprap; a filter cloth material or a layer of gravel is usually used for the filter.
 - a. Leaching Protection. Leaching can be controlled by installing a riprap gradation small enough to act as a filter against the channel base material, or a protective filter can be installed between the riprap and the base material.
 - b. Riprap Limits. The riprap should extend for a maximum flow depth, or to a point where vegetation will be satisfactory to control erosion.
 - c. Curves. Riprap should extend to five times the bottom width upstream and downstream of the beginning and ending of the curve as well as the entire curved section.
 - d. Riprap Size. The size of riprap to be installed depends on site-specific conditions.
 - e. Riprap Prohibitions. Slopes on which riprap is used to stabilize shorelines shall be no steeper than 2:1.
 - f. Maintenance. It shall be the property owner's responsibility to perform maintenance on installed rip rap. Inspections shall be made of all sites immediately after the first rainfall following installation of riprap. Thereafter, rippapped sites should be checked following large storms, especially those which are near or exceed the storm frequency used in the design.