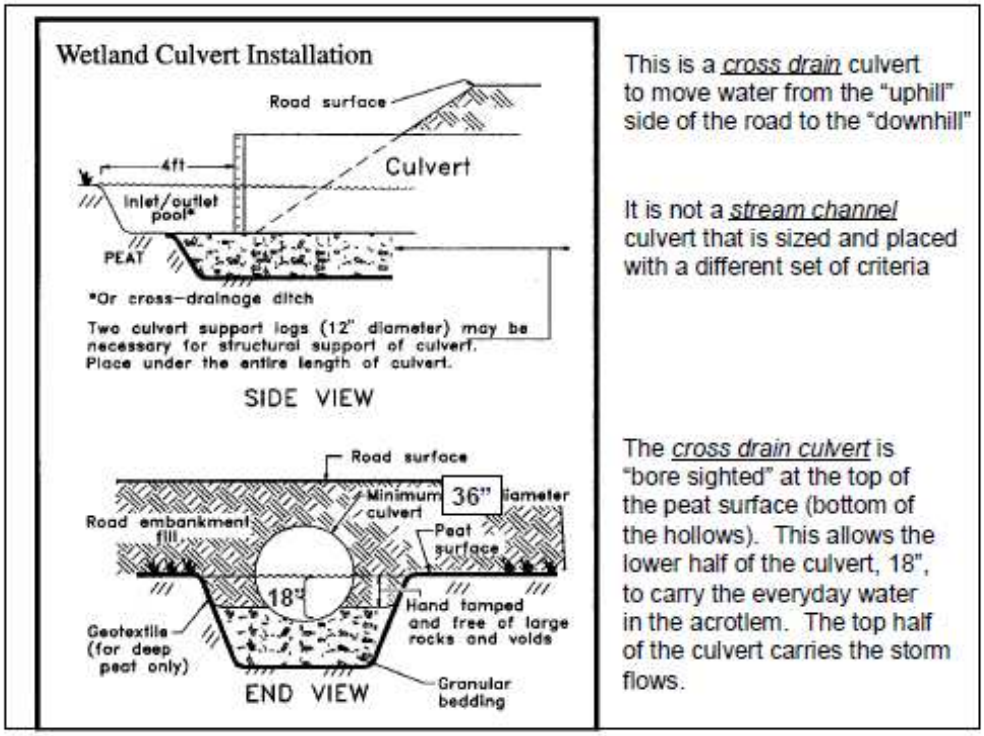

Figure 26. An Example of a 36-inch Diameter Cross Drain Culvert Used for a Road Constructed in a Wetland Area.

13. FOREST ROADS - CONTROLLING SEDIMENT MOVEMENT AND TRANSPORT DURING RAIN EVENTS

During rain events, excessive water flows can erode a forest road, causing sediment to be eventually transported into a stream or other water body. Described below are various devices that can help mitigate erosion and sediment movement. These devices work by interrupting the flow of water and sediment, causing the sediment to be deposited, trapped or filtered out before reaching an open water body. Following a routine maintenance schedule which takes into account rain events is key to the proper functioning of these devices. Generally, this is the responsibility of the logger during an active timber sale and the landowner's responsibility before and after such sales.

Described below are examples of such control devices:

- **Erosion Barriers** – Pre-seeded erosion control products at the toe slope of a road and at the outlets of culverts, diversion ditches, water bars, or broad-based dips, or the use of rock or large stone (an average diameter of 6 inches) placed on the toe of road and outlet of the diversion structures should be the first choices. Although it's cheap and handy, laying down slash is not very good in reducing the velocity and erosive impacts of concentrated flows during significant rainfall events.

- **Silt Fence** – A geotextile fabric, when installed properly, has the capability of retaining most suspended materials, (e.g. sediment) and releasing the filtered runoff through the fabric. Do not use in permanent flowing streams or in any location with concentrated flows. See Figure 5 for an illustration of how to properly install a silt fence. It is most commonly installed at or beyond the toe of a slope to trap sediment coming from overland sheet flows during a storm event. Silt fence must be installed along the same elevation contours across the slope to prevent runoff from flowing around the fence. For

long slopes or large areas, silt fence should be installed parallel to each other in a series with an average spacing of 200 feet and drain no more than one-half acre per 100 feet of fence.

- **Armoring/Energy Dissipation** – This term refers to rock installed at the outlet of diversion devices and drainage culverts to prevent erosion from occurring at the outlet. The rock must be large enough (ranging from 3 to 12 inches in diameter) to stay in place at the outlet during times of strong concentrated flows. The length of the riprap should be at least 5 feet long and 3 feet wide, to ensure concentrated flows have an adequate space to slow down and filter into the soil or vegetation.

- **Check Dams -** Check dams (see Figure 27), generally constructed of rock, may be necessary to reduce the velocity of flow in roadside ditches or other concentrated flow areas. Check dams can reduce the potential for erosion and protect vegetation in the early stages of growth by reducing water flow to non-erosive velocities. See Figure 28 for proper spacing of check dams. For rock based check dams, construct the check dam using rock having a range of sizes from 3-12 inches in diameter (average 6 inches). The key is that the rock stays in place to withstand strong concentrated runoff flows.

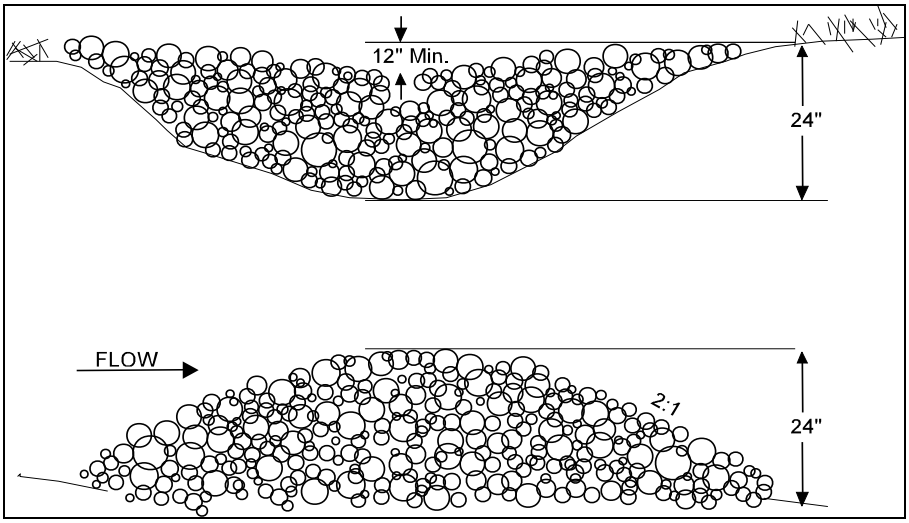

Figure 27. Cross Sectional Views of a Check Dam.

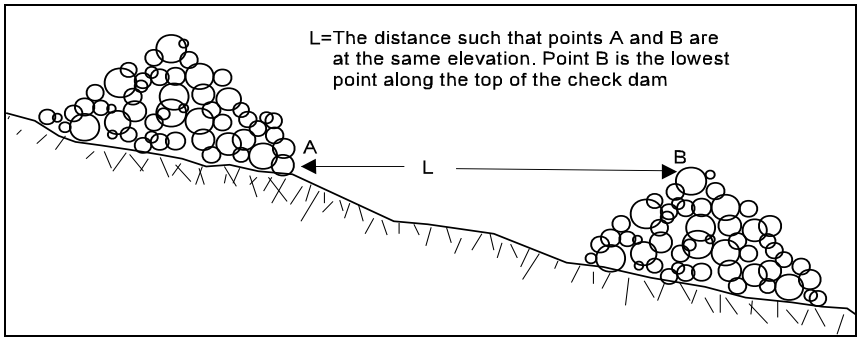

Figure 28. Check Dam Spacing.

14. SITE PREPARATION, REFORESTATION AND FOREST PROTECTION

The long-term management of forest land includes a commitment to a sustainable forested landscape. It is necessary for management plans that include timber harvesting to also include consideration of site preparation work and regeneration efforts. Site preparation can include mechanical means, prescribed burning, and chemical treatments. Reforestation can occur naturally or be established using mechanical seeding and planting techniques.

For all forested land where timber products are harvested, the landowner should consider regenerating stands by either natural or mechanical means. Site preparation refers to methods that establish desired tree species, control undesirable competing vegetation, reduce organic debris and logging residue and reduce wildfire risks.

Pay special attention to avoid any unnecessary surface disturbances, especially in areas of steep slopes or in areas subject to periodic flooding, such as spring break up flooding.

Mechanical Preparations

The following are recommended specifications for various mechanical means:

- General Considerations:
  - Use mechanical site preparation techniques which cause the least disturbance to the site and still achieve the owner's objective.
  - Recognize adequate RMZs.
  - To minimize erosive impacts, mechanical treatment should be oriented along the contours of the site.
  - Evaluate site for saturated soil conditions. Avoid operations during periods of saturated soil conditions that may cause rutting or accelerated soil erosion.

- Shearing and Raking:
  - Avoid dumping or concentrating residues from shearing and raking operations in flood plains or wetland areas. These residues should be deposited in stable areas so they do not interfere with drainage or cause erosion.
  - Locate windrows and piles to minimize interference with natural drainage patterns.
  - Locate windrows outside the RMZs.
  - Give preference to locating windrows along contours to mitigate the effects of overland flow.
  - Minimize incorporation of soil material into windrows and piles. Two examples of preferred practices are: a) shearing and raking under frozen soil conditions, and b) light raking which would only remove slash.
  - Avoid shearing and raking operations on organic soils, except under frozen soil conditions.

- Disking (and other scarification treatments, such as chain drags and land breakers):
  - Limit to slopes of less than 10%, for all highly erodible soils.
  - Follow the land contours with proper consideration given to equipment operator safety.
  - Advantageous because it reduces soil compaction and incorporates organic matter.

- Patch and Row Scarification:
  - Use patch or row scarification as the preferred mechanical site preparation method for artificial regeneration where terrain or soil type necessitate minimum soil disturbance.
  - Follow the contours of the land to maintain operator safety.

- Drum Chopping:
  - Limits soil exposure as residual trees and debris are knocked down.
  - Maximum benefit comes from drum chopping up and down the slope so that blade depressions are on the contour, reducing the occurrence of channeled surface flow.

Prescribed Burning

Using fire under controlled conditions can have benefits including: reduction of slash, reduction or elimination of undesired and competing vegetation encroachment, and creation of a seed bed or surface condition for natural or artificial regeneration of desired tree species. To achieve desired conditions and protect water quality, prescribed use of fire must be carefully planned and executed under strict weather and fuel conditions.

- After the prescribed burn is complete and a significant rain event has occurred, inspect the fire lines on hilly or steep terrain where a stream or small body of water is close by to determine if these fire lines are eroding away and sediment is being transported down to a stream or water body. If this is occurring, install earth-berm water bars (probably only requiring a shovel) and during inspection, determine if any other areas of bare mineral soil (a result of the burn) are eroding into a water body. Inspect the site and determine if the bare areas will re-vegetate quickly from the surrounding area or if the soil will require the application of grass seed that establishes quickly and require the application of mulch (see Appendix E).

- If the prescribed burn is adjacent to an intermittent or perennial water body, the staff in charge should establish an RMZ, if it has not been done so already. The use of fire retardant foam at the boundary of the RMZ is permitted. Note that fire retardant foam is not toxic to aquatic life.

Chemical Treatment

Use of chemicals to control vegetation (herbicide), insects (insecticide), small animals (rodenticide), and molds and fungus (fungicide) can be an efficient and effective means of site preparation. Herbicides have advantages over mechanical means because there is no soil disturbance and can be used where steep slopes prevent use of machinery. Herbicides can also be used in an existing stand for pre-harvest treatment. Rodenticides and fungicides can be applied to seeds or seedlings before or during planting to increase planting survival. However, water quality impacts must be a consideration in all use of chemicals to prevent their reaching ground water and surface water bodies.

Potential water quality impact varies widely from one chemical to another and depends primarily on the: a) chemical's mobility, b) chemical’s persistence, c) accuracy of the chemical’s placement, and d) orientation of site to streams. Water quality can be protected by knowledge of the chemical being used and adherence to the manufacturer's specification and directions. The label contains information regarding the safety of the applicator, species for which the chemical is registered, the pesticide rate or concentration, appropriate weather conditions for application, environmental impact and proper container disposal. Material Safety Data Sheets providing toxicological data are available from a chemical's manufacturer.

Reforestation

All of the above-described means of site preparations are designed to meet the objective of maintaining a healthy and vigorous forest which aids in maintaining water quality of adjacent water bodies. Regeneration of desired tree species and associated plant communities occurs through natural process and by seeding and tree planting.

Use of Pesticides

Use of chemicals to control forest pests and to eliminate vegetative competition with desired tree species may be the most effective and efficient means of accomplishing those management functions. If you have any questions about pesticide application, please contact the Michigan Department of Agriculture, Pesticide and Plant Pest Management Division at 517-373-1087, or online at www.michigan.gov/mda.

The forest manager must be aware of the risk of water contamination and apply the following considerations:

- The basic federal law regulating pesticides and their use is the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). The Michigan Pesticide Control Act further regulates use, handling and application of pesticides. Additional laws pertaining to pesticide uses, transport and application exist.

- All pesticides are classified for either "general" or "restricted" use. Restricted pesticides may be used only under supervision of certified applicators. Pesticide users need to be familiar with the laws and regulations pertaining to certification and proper use of pesticides.

- Follow directions and heed all precautions on the label. Store pesticides in original containers in secured areas, out of reach of children and animals, and away from food and feed.

- Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

- Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment, as specified on the container/label.

- Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

- The use of returnable pesticide containers is recommended. Otherwise, dispose of empty pesticide containers promptly, in a landfill licensed to accept toxic materials.

- Special precautions should be taken around RMZs.

Wildfire Damage Control and Reclamation

When wildfire strikes, the primary purpose is to control and suppress the fire, as quickly as possible. However, forest fire suppression measures themselves can add to the problem of water quality protection.

The loss of vegetative cover, destruction of soil holding features such as roots, the creation of a carbon layer in place of the organic top layer of soil, and the exposure of bare mineral soil, are combinations that make the burned area highly erodible. The effects of suppression efforts and equipment operations necessary to control and stop the fire can magnify the erosion problem. The following are specifications for reclamation of burned areas.

- Unless further activity would create problems, bare mineral soil should be actively re-vegetated, particularly if soil could erode into a nearby stream or other water body.

- First priority for re-vegetation is all areas of bare soil adjacent to banks of surface water bodies so that the RMZ function is re-established. Until site stabilization occurs, the use of silt fences or erosion mats or blankets may be necessary.

- Fire lines should be stabilized and re-vegetated, if soil is being transported to a nearby stream or other open water body. Other areas altered by suppression equipment operations should be repaired and re-vegetated as necessary. Where fire lines cause surface water to channelize and flow directly toward or into a water body, water bars should be placed in the fire line, at the spacing indicated in Table 3.