Forest Road Maintenance

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Introduction

The Oregon Department of Forestry has made a significant investment to develop and improve the road system on state-owned forest land. The road system provides access to the forest for a full range of activities, including timber management, fire protection, recreational use, and many others.

There are a number of reasons to maintain the road system on state-owned forest lands and to keep it in good condition. The first is that properly maintained roads will have a minimum impact on natural resources. The commitment to good stewardship will be a driving force for any road maintenance program. Secondly, a good road maintenance program will ensure that the roads are available for their intended use. The third reason is to protect the investment that has been made in the development and improvement of

the road system on state-owned forest land. Finally, the Oregon Forest Practices Act establishes a regulatory obligation to maintain forest roads.

Goals of Forest Road Maintenance

The goals of road maintenance are to:

1. Minimize the adverse impacts to water quality, fish habitat, wildlife habitat and other natural resources that may be caused by the presence of the road system on state-owned forest land.
2. Ensure continued access to state-owned forest lands for the planned uses.
3. Protect the State's investment in the infrastructure.
4. Comply with the regulatory requirements of the Oregon Forest Practices Act.

Objectives of Forest Road Maintenance

1. Maintain existing roads and structures to the intended design standards.
2. Maintain a fully functional drainage system.
3. Minimize soil disturbance during maintenance activities.
4. Minimize impacts to water quality, aquatic habitat, wildlife habitat, and other natural resources during maintenance.
5. Combine professional level expertise and operator experience in the formation of on-the-ground decisions.
6. Provide a protocol for identifying and responding to immediate maintenance needs.

Road Maintenance Strategies

Road maintenance strategies are the specific actions and standards that will lead to achieving the goals and objectives of this section of the manual.

Planning and implementation of a road maintenance program is a complex task. Districts will designate a person in each district with the overall responsibility for road maintenance. This person will be responsible for identifying maintenance needs, developing a plan to accomplish the maintenance, and ensuring that the plan is properly implemented.

Inventory

The basis for the development of a road maintenance plan is a thorough understanding of the road system, its characteristics, and its needs. This is accomplished by establishing and maintaining an intensive inventory of the road system. The inventory provides the information necessary for identifying and prioritizing required maintenance. In addition, the inventory will also provide the basis for the development of road improvement plans.

Each district will maintain an intensive inventory of the road system on state-owned forest lands in the district. As a minimum, this inventory will categorize roads, identify

drainage structures and rate their condition, identify and assess potential slope stability problems, and maintain information related to the condition of the road surface.

As of January 2000 the minimum level inventory system that will be used for roads on state-owned forest land will be the **Road Hazard Inventory Protocol** developed as part of the Oregon Coastal Salmon Recovery Initiative. This inventory system gathers information related to fish passage barriers where roads cross streams, information related to road drainage systems and their condition, and information related to slope stability problems. This information will be useful in describing some but not all of the current conditions of roads. In the future, a more comprehensive inventory system will be developed and added to this section of the manual. Until the new inventory system is in place, districts may gather additional information on the current condition of roads on state-owned forest land that the district determines to be necessary to efficiently and effectively maintain the road system.

Information for the inventory can be gathered and kept in many different forms, but it makes sense to take advantage of available technology to manage the data. Data can be recorded electronically, transferred to appropriate data management programs, and extensively queried using existing technology. Data will ultimately reside in the Department's GIS database, where it can be seamlessly integrated with all resource information.

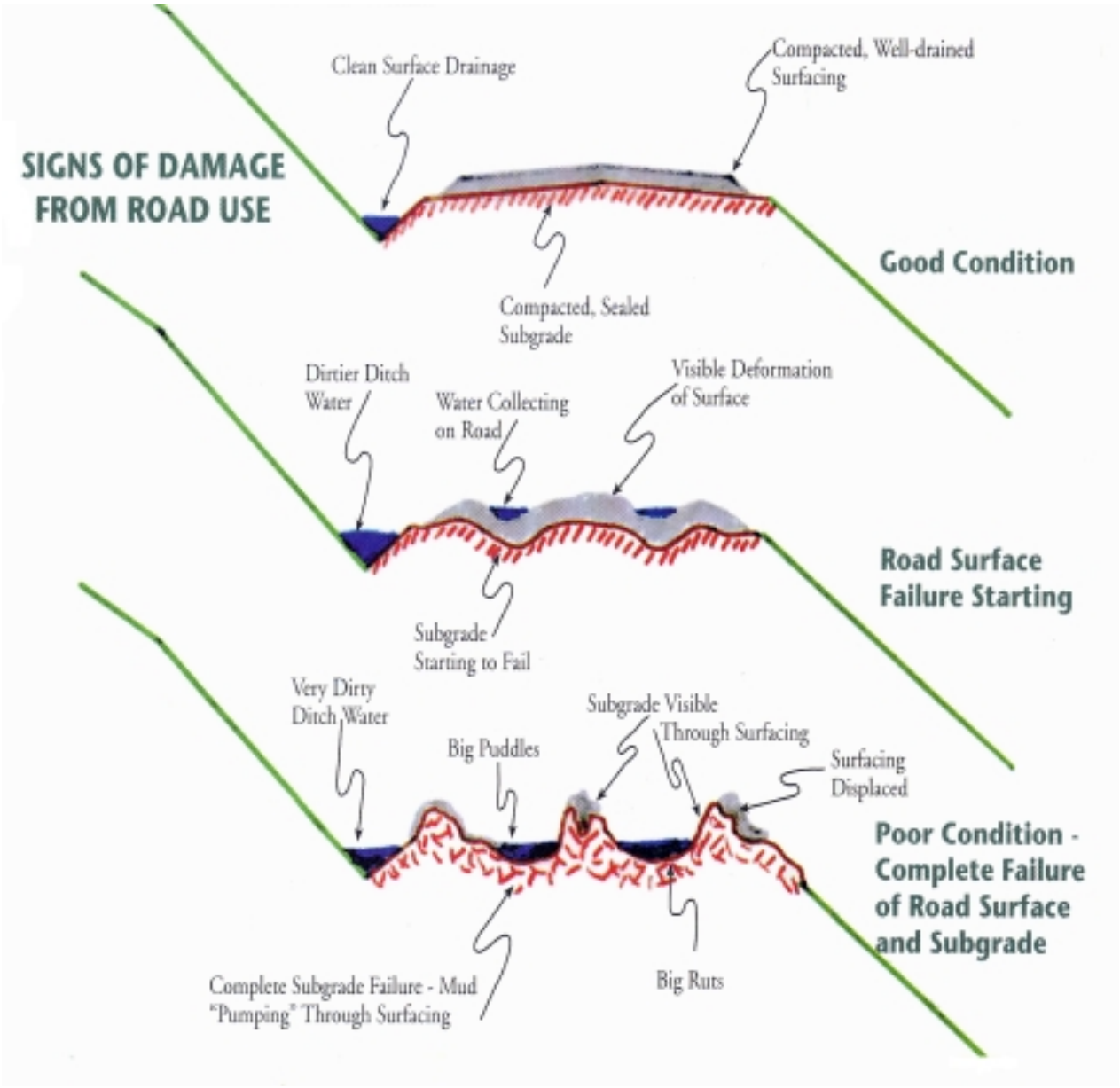
Since the road system is dynamic and constantly changing, regular updates to the inventory are essential. These updates will reflect new roads that have been added to the infrastructure, changes made to a road through maintenance or road improvement work, damage caused by storms or other environmental factors and changes caused by road use.

Inspection

Roads will be inspected on an annual basis or more frequently as the level of road use varies or local conditions warrant. The inspection will assess the condition of the road, identify any maintenance activity that is required, and provide information necessary to update the inventory. Particular attention will be paid to culvert inlets and outlets, ditches, road surface drainage and cut slope or fill slope stability. The inspection will take place early enough that any work identified can be completed prior to the start of the fall rains.

Roads will also be inspected regularly during periods of heavy hauling in order to detect early signs of damage. Standing water or ruts indicate that the strength of the road subgrade and/or the road surface is deteriorating and that immediate attention is needed. Often, a small amount of maintenance early can save thousands of dollars in road repairs later.

Figure 1. Signs of Damage From Road Use



Planning

As the inventory, supplemented by frequent inspections, reveals the required maintenance needs, it becomes important to develop a plan for accomplishing the required work. The plan will identify the work to be accomplished, the timing, the resources required to efficiently complete the work, and the methods for implementing the plan. Priorities will be assigned to each task, with the highest priority being assigned to sites that have the highest potential for damage to the road or damage to downslope natural resources.

When allocating road maintenance resources, it is important to match the type and size of maintenance equipment to the maintenance activity being performed, and to ensure that operators are properly trained to perform the function. For example, using a 1-1/2 cubic yard hydraulic excavator to clean culvert catch basins is generally not efficient, and can easily cause more damage than a more appropriate piece of equipment such as a tractor-mounted backhoe. Conversely, the larger hydraulic excavator would be a more appropriate choice when excavating and loading large amounts of material as opposed to the backhoe. If adequate resources are not available, plans must be made to secure the necessary resources.

It must be remembered that because forest road systems exist in a dynamic environment, any plan for road maintenance must also be dynamic. Rather than a static plan that covers a specific period of time, the plan must constantly adjust to changing conditions. Enough flexibility and adaptability must be built into the plan to allow for changing conditions and needs.

Factors that need to be considered when planning maintenance include:

1. Design Standards. Earlier sections in this manual related to the planned use and selection of appropriate design standards for any given road. Once the design standard has been established and the road has been constructed accordingly, that road will be maintained to the original design standard. If the road is not to be maintained to the original design standard, it must be due to a conscious decision to alter the design standard.

Equally as important as maintaining a road to its original design standard is limiting its use to the designed standard. This will prevent maintenance problems from developing and prevent damage to natural resources. A road that is surfaced with a minimal amount of crushed rock will not support timber hauling in the winter months, and will not be expected to do so. Likewise, heavy hauling on well surfaced roads will not be permitted during periods of heavy rains, melting snow, or during thawing periods. Care must be taken during the planning process to ensure that roads are adequately designed, constructed, and maintained for the planned use. If a road is not capable of supporting its planned use, then the plan will be modified or the road standard will be upgraded accordingly.

2. Frequency of Maintenance. Several factors help determine how frequently road maintenance activities will need to be performed:

A. Planned Use and Design

A road that has been planned and designed to accommodate a large volume of traffic will require more frequent maintenance. This applies to routine maintenance as well as the replacement of surfacing material. These roads might be mainline logging roads or roads that will carry a high level of recreational traffic. A road that is designed for occasional use, such as a short spur to access a timber sale will require less frequent maintenance. To reduce the maintenance load, roads that are seldom or occasionally used become good candidates for road vacation or closure at the end of their primary use.

B. Position on Slope

Roads located on ridge tops will require less frequent maintenance due to fewer drainage structures, shorter cut banks, and a higher degree of slope stability. Roads located in valley bottoms require somewhat more frequent maintenance, due to the greater number of drainage structures and their proximity to larger streams. Depending upon their proximity to valley slopes, roads in valley bottoms may or may not have greater cut and fill slope stability than roads on ridge tops. Roads located on side hills require the greatest maintenance frequency. Cut banks are higher and more prone to raveling, cut and fill slope stability issues are more frequent, and there are generally a large number of drainage structures.

C. Local Knowledge of Chronic Problem Areas

Local conditions may dictate more frequent maintenance on certain roads or at certain sites, such as culverts that are prone to beaver activity, recurring slide areas, or streams that carry unusually high sediment loads. The knowledge and experience of district employees are important in identifying these sites and ensuring that they get the attention they need. Solutions will also be explored to determine if the particular chronic problem could be mitigated.

Timing

Regular and timely road maintenance helps to ensure that the forest road system remains fully functional. Conversely, poorly timed maintenance can create problems that might have greater consequences than not maintaining a road. As examples, cleaning ditches during wet weather can cause excessive sedimentation, and grading a road during a hard rain event can lead to the contamination of the surfacing material. On the other hand hand cleaning culvert inlets and minor blockages of ditches during rain events can prevent more serious damage.

It is extremely important that any maintenance activity be conducted at a time when weather conditions allow for a minimal amount of soil disturbance and sediment movement. It is essential to maintain the integrity of the road surface and subgrade while conducting maintenance activities.

Coordination

At times, multiple users will be utilizing the same segment of road, each with its own maintenance obligation. For example, purchasers of State timber sales and third party users of roads under easement or permit are responsible to perform road maintenance activities related to their use of the road. When the use is simultaneous, it is necessary to coordinate the maintenance activities. Each district will coordinate these maintenance activities to ensure that there is no duplication of effort, and more importantly, that there are no gaps in the maintenance effort. All responsibilities for road maintenance must be fully identified, understood and fulfilled.

In the conduct of their normal day-to-day activities, district employees may observe or identify road maintenance needs. Districts will develop a methodology for recording the information and forwarding it to person or party responsible for maintaining that segment of road.

Districts will utilize geotechnical specialists, biologists, or other professionals to provide design input for mitigation of chronic maintenance problem areas.

Implementation Options

Three options are available to accomplish needed road maintenance. Each district will analyze its maintenance requirements and select the option or combination of options to efficiently accomplish the work.

1. Department of Forestry Personnel and Equipment

This road maintenance option provides the greatest flexibility. Personnel and equipment are in place and can easily be allocated to projects. Employees' experience and local knowledge can be invaluable in identifying chronic problem areas and developing appropriate road maintenance solutions. In addition, the personnel and equipment are available to support other functions, such as fire suppression.

The greatest advantage of Department personnel and equipment is the ability to react promptly to high priority situations, especially when unplanned emergencies arise.

The cost of maintaining the staff and heavy equipment that is required to accomplish the work is the biggest disadvantage of this option.

2. Timber Sale Purchasers

Purchasers of timber sales are responsible for the normal maintenance of all roads used in connection with a given sale during those periods that there is activity on the sale. While timber sales are a good way of accomplishing road maintenance, they may not meet all of a district's maintenance needs. The district is still responsible for maintaining roads during periods of inactivity and maintaining those roads not associated with a timber sale.

3. Service Contracts

Road maintenance can also be accomplished by entering into agreements with contractors who have the experience, equipment, and personnel necessary to properly do the work. Large districts with enough maintenance to provide full-time work for a contractor enjoy the same degree of flexibility that having district crews and equipment might provide. However, districts with a smaller workload will not provide full-time work to a contractor and may have to compete with the contractor's other commitments. Care must be taken to ensure that the contract is constructed with enough flexibility to satisfy the contractor and enough certainty to meet the district's needs.

Advantages to using service contracts include the ability to accomplish required maintenance at a lower cost by not incurring the full-time cost of personnel and equipment and by taking advantage of competitive bidding to minimize the cost. Disadvantages are the risk of reduced flexibility and the extra workload and costs associated with administration of the contract.

Knowledge, Skills, and Abilities for Maintenance Personnel

Regardless of the method employed, the road maintenance knowledge, skills, and abilities (KSA's) of supervisors, contract administrators, and equipment operators, are crucial to the successful maintenance of the road system. The following KSA's are the minimum for Department personnel involved in road maintenance:

Department of Forestry Maintenance Supervisors and Maintenance Personnel

- Knowledge of the Departments road maintenance standards for roads on state-owned forest lands and the ability to maintain roads according to the standards.
- Knowledge of good road maintenance practices and the ability to apply them in the proper situations.
- Ability to recognize unusual conditions that may require the use of specialized equipment and/or input from technical specialists.
- Knowledge of the road maintenance requirements of the Oregon Forest Practices Act.

Contract Administrators (Timber Sale Contracts and Service Contracts)

- Knowledge of the contract specifications and the policies and procedures related to administering the contracts.
- Knowledge of road maintenance standards and practices and the ability to apply them properly.
- Ability to recognize unusual conditions that may require the use of specialized equipment and/or input from technical specialists and the ability to initiate appropriate action.
- Knowledge of the road maintenance requirements of the Oregon Forest Practices Act.

Documentation

An important aspect of a road maintenance program is documentation. Maintenance activities will be documented for a number of reasons such as planning future maintenance needs and the tracking of maintenance costs. Documentation can also provide some protection in the event that there is a legal dispute relating to road maintenance. Each district will develop and use an interim system that documents road maintenance activities. When the Information Management section of this manual is completed, it will contain guidance on the documentation of road maintenance activities.

Monitoring

The success of a maintenance program can be determined only through observation. Roads will be checked on a regular basis to see if the maintenance work has been effective. For example, an inspection of a road during the first fall rains will determine if the culverts have been properly cleaned, whether or not the ditches are functioning properly, and if the road surface is properly crowned. Where monitoring identifies an ongoing maintenance need, actions will be taken to correct the situation.

Priority Maintenance

Each district will develop plans for patrolling roads during periods when there is a high potential for damage to the road system such as periods of high intensity rainfall. The plan will include established patrol routes and a protocol to report observed problems. Conditions that represent high risk of imminent damage to waters of the state will be repaired as soon as safety and weather conditions allow. These conditions include; actively failing road sidecast; blocked drainage structures; and repeated road cut slope failure areas.

Established patrol routes ensure that there is no duplication or skips in the patrol effort. Patrol routes will be mapped and available on short notice to the personnel that will be doing the patrolling. Routes will be prioritized to emphasize attention to areas where there is a prior history of problems.

A reporting protocol will be specified and will contain the following elements:

- Who receives the report. This will usually be the person on the district that is responsible for coordinating normal road maintenance.
- The nature and location of the problem.
- Other resources that might be threatened.
- What will it take to correct the problem, including an estimate of the equipment and time required to do the work.

Because of the severe nature of the weather usually associated with these periods, safety of personnel must be given the highest priority.

Road Closure or Vacation

One strategy that can be used to minimize the amount of maintenance required and the associated costs is to close or vacate roads that are not necessary for planned activities. See the section on Forest Road Vacating in this manual for additional information.

Road closure involves limiting access to the road while keeping the road in a useable condition. Road closure reduces the amount of traffic on a road and the amount of maintenance required due to wear and tear. It does not completely eliminate the maintenance obligation, but may reduce the frequency of maintenance. Road closure can be accomplished either by the installation of a gate or by the construction of a physical barricade. When choosing one of these methods, keep in mind that gates are themselves a high maintenance item, while barricades require extra effort to open when access is needed for maintenance or some other management activity.

Vacating a road involves leaving it in a condition where traffic cannot use the road and where erosion is unlikely. Road vacating is a semi-permanent/permanent technique that, if done properly, completely eliminates the need to maintain a road.

Maintenance Functions

Road maintenance activities can be divided into five basic categories: drainage, surface maintenance, cut and fill slopes, erosion control, and vegetation control. Each district will ensure that these categories are properly addressed during maintenance work. Improper maintenance of a road will reduce the useful life of the road, increase erosion and sediment transport to streams, and may represent a safety hazard to the road's users.

Drainage Maintenance

Culverts, catch basins, and ditches will be cleaned as necessary to ensure proper drainage. Often, culvert cleaning is done in the summer months as part of routine maintenance. Culverts also need to be inspected and cleaned during high rainfall events to prevent plugging. Problems found during high rainfall events must be corrected immediately, because delay can result in serious road damage and costly repairs.

During cleaning, floatable debris and accumulated sediment will be removed from the catch basin and placed where it cannot reenter the drainage system. Culvert ends that have been bent or damaged will be straightened and opened. Culvert outlets that show signs of erosion will be armored with riprap, fitted with a downspout, or use some other erosion control technique.

Ditch maintenance is important in order to maintain the flow capability required to remove surface runoff. Inspecting ditches during periods of high rainfall is a good time to determine if ditches need cleaning to improve their capacity, or if ditches are carrying too much water. Ditches that show signs of erosion or down cutting will have additional culverts installed or be armored with riprap to prevent further erosion.

Frequent grading or "pulling" of ditches is usually unnecessary, and can actually cause excessive erosion, undermine cut slopes, and expose the toe of cut slopes to erosion. If cut slope failures have blocked the ditch, clear out the material and place it in a stable disposal site. Remove other debris and vegetation only if obvious drainage problems are

evident. Do not remove any more grass or vegetation than is necessary, as they prevent scouring and filter out sediment.

When "pulling" a ditch, avoid pulling the material across the road surface. This can lead to contamination of the surfacing material and increased erosion, especially during the first rains. Material pulled from the ditch can be windrowed on the inside road shoulder and hauled away for proper disposal.

Road Surface

Road surfaces should be graded only when needed to maintain a smooth, stable running surface and to retain the original surface drainage. Excessive grading can result in increased rock wear and loss and can actually lead to unnecessary erosion.

Grading should cut deep enough into the surfacing material so that loosened material will mix, compact, and bind with underlying materials. If deep chuckholes or ruts cannot be graded out, the surface will be ripped and then graded and re-compacted to achieve proper binding. Otherwise, holes and ruts that are just filled or patched will quickly reform in the same locations.

Oversized material that is brought to the surface during grading can be moved off to the side of the road.

Berms from road grading will concentrate water and prevent the drainage system from working properly. In most cases berms will be removed either by grading or by hauling the material away to a disposal sites. Where roads cross high-risk sites, berms may be used on the outer edge of the road to keep drainage water from flowing over the high-risk site and to direct the water on to stable ground.

Over a prolonged period of use and maintenance, surfacing materials gradually break down or are lost to the side of the road. Steep road segments and curves experience the highest rate of rock loss. Eventually, the road will not match its designed standard. At such a time, it will be necessary to add surfacing material in order to bring the road back into standard.

Cut and Fill Slopes

The key to maintaining cut and fill slopes, including sidecast materials, is to regularly observe them and note when and how changes to these features occur. Often, small slope failures can be symptoms of larger slope stability issues. Left untreated, these unstable features can fail suddenly and develop into debris flows and landslides that cause considerable downslope damage. When changes to cut or fill slopes are noticed or suspected, consultation with geotechnical specialists can help ensure that the real problem is identified and the proper solution is formulated. Proper corrective measures can then be planned and implemented.

Typical cutslope problems include raveling, erosion, or slumping, each of which can lead to blocked ditches or contaminated surfacing. These areas often require more frequent ditch cleaning and maintenance. Long-term solutions might be to flatten the cut slope, revegetate areas of bare soil, widen the ditch so it doesn't plug as easily, or build a retaining structure to contain or prevent slope movement. Often, simply loading the toe of

a small cutbank slump with heavy riprap can provide sufficient support to stabilize the feature. Again, consultation with a geotechnical specialist may be needed to ensure that the real problem is identified and the proper solution is formulated.

Local slides and slumps in the road bed or shoulder often occur where material was placed or pushed over groundwater springs or seeps, where the road crosses deep draws, where organic material such as stumps, logs, or other organic debris has been buried, or where material has been sidecast onto steep slopes. Instability in fill slopes and sidecast materials often shows up on the surface or outer shoulder of the road as tension cracks and small scarps along the boundary of the unstable material. Some settling of recently placed sidecast can be expected, but if movement persists and scarps continue to develop, appropriate action needs to be taken before the slope fails. These actions might include improved drainage (extra culverts and ditches, free-draining structures), retaining structures, or the excavation and removal of unsuitable or excess materials. Any materials that have been excavated must be properly placed in a waste disposal area. For older roads on slopes over 65 percent, however, cracks in the road are likely evidence of a potential landslide. If drainage does not arrest movement immediately, or if the slope is directly above a stream, pullback may be required very quickly to prevent damage. Consultation with the geotechnical specialist may be needed.

Erosion Control

Erosion and sediment control structures will be maintained or repaired as necessary to ensure their proper function. Culvert downspouts will be inspected regularly to see if they are long enough and are carrying all the water passing through the culvert. Silt fences (used only for temporary measures) will be inspected to see if they are properly located and functioning. Fences that have trapped considerable sediments may have to be cleaned or replaced. Filtering devices such as straw bales or “bio-bags” may also need to be cleaned or replaced. Exposed soil on cut or fill slopes needs to be reestablished with appropriate vegetation such as grass seed and mulch.

Vegetation Control

Over time various species of trees and shrubs will be established on the surface of the road prism. This vegetation may cause safety problems by reducing visibility. In some cases the vegetation may also reduce the effectiveness of the drainage system or the stability of slopes. Where these conditions exist, some form of vegetation control may be needed.

Vegetation can be controlled manually, mechanically, or chemically. The method used will depend upon the characteristics of the vegetation, its location, and other factors.

When using chemicals, precautions will be used to avoid harm to non-target plants to prevent any of the pesticide from contaminating water.