APPENDIX G
BEST MANAGEMENT PRACTICES

Best Management Practices

Best Management Practices (BMPs) are the primary mechanism to enable the achievement of water quality standards (Environmental Protection Agency 1987). This Appendix describes the Forest Service's BMP process in detail, lists the key Soil and Water conservation Practices (comparable to BMPs) that have been selected to be used on this project, and describes each BMP that will be refined for site-specific conditions in order to arrive at the project level BMPs that protect beneficial uses and meet water quality objectives.

BMPs include, but are not limited to, structural and nonstructural controls, operations and maintenance procedures. BMPs can be applied before, during and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters (40 CFR 130.2, EPA Water Quality Standards Regulation). Usually BMPs are applied as a system of practices rather than a single practice. BMPs are selected on the basis of site specific conditions that reflect natural background conditions and political, social, economic and technical feasibility.

The Lewis and Clark National Forest Plan (Chapter II, page 50) states that the Forest will "utilize adequate soil and water conservation practices to protect soil productivity and to control nonpoint water pollution from project activities, using as a minimum, practices specified in any State developed Best Management Practices". A project which causes excessive water pollution, soil erosion, or site deterioration will be corrected where feasible, or the project will be reevaluated or reconsidered. Montana State Water Quality Standards require the use of reasonable land, soil and water conservation practices (analogous to BMPs and SWCPs) as the controlling mechanism for nonpoint pollution. Use of BMPs is also required in the Memorandum of Understanding between the Forest Service and the State of Montana as part of our responsibility as the Designated Water Quality Management Agency on National Forest System (NFS) lands.

The practices described herein are tiered to the practices in FSH 2509.22. They are developed as part of the NEPA process, with interdisciplinary involvement, and meet Forest and State water quality objectives.

BMP Implementation Process

In cooperation with the State, the USDA Forest Service's primary strategy for the control of nonpoint sources is based on the implementation of preventative practices (BMPs) determined necessary for the protection of the identified beneficial uses.

The Forest Service Nonpoint Source Management System consists of:

1. BMP selection and design based on site-specific conditions; technical, economic and institutional feasibility; and the designated beneficial uses of the streams.
2. BMP application.

3. BMP monitoring to ensure that they are being implemented and are effective in protecting designated beneficial uses.
4. Evaluation of BMP monitoring results from "steps" 2 and 3.
5. Feeding back the results into current/future activities and BMP design.

The District Ranger is responsible for insuring that this BMP feedback loop is implemented on all projects.

1) BMP Selection and Design. Water quality goals are identified in Forest Plans. These goals meet or exceed applicable legal requirements, including State water quality regulations, the Clean Water Act and the National Forest Management Act. Environmental assessments for projects are tiered to Forest Plans, using the NEPA process.

Appropriate BMPs are selected for each project by an interdisciplinary team. Each time BMPs are applied to a new location, there is flexibility to design different BMPs depending on the local conditions and values, and the downstream beneficial uses of water.

BMP selection and design are dictated by water quality objectives, soils, topography, geology, vegetation and climate. Environmental impacts and water quality protection options are evaluated and alternative mixes of practices are considered. A final collection of practices are selected that not only protect water quality but meet other resource needs. These final selected practices constitute the BMPs.

2. BMP Application. The BMPs are translated into contract clauses, special use permit requirements, project plan specifications and other tools. This ensures that the operator or person responsible for applying the BMP actually is required to apply it. The site-specific BMP prescriptions are taken from plan-to-ground by a combination of project layout and resource specialists (hydrology, fisheries, soils, geology etc.) Final adjustments to fit the BMP prescriptions to the site are made before implementing the resource activity.

3. BMP Monitoring. BMP implementation monitoring is done before, during and after resource activity implementation. Once BMPs have been implemented, further monitoring is done to evaluate if BMPs are effective in meeting management objectives and protecting beneficial uses of water.

4. BMP Monitoring Evaluation. The evaluation/monitoring described above will determine how effectively BMPs protect and/or improve water quality. Water quality standards and conditions of the beneficial uses of water will serve as one evaluation criteria. If the evaluation indicates that water quality standards are not being met and/or beneficial uses are not being protected, corrective action will consider the following three components:

a. Is the BMP technically sound? Is this the best BMP or are there better practices?

b. Was the BMP applied entirely as designed? Was it fully implemented?

c. Do the parameters and criteria that constitute water quality standards adequately reflect human induced changes to water quality and beneficial uses?

5. Feedback of the results of BMP evaluations is both short and long-term. Where corrective action is needed, immediate action can occur. The BMP can be modified, the activity changed

or the timing of the activity can be modified. Cumulative effects over the long-term may also lead to the need for possible corrective actions.

BMP Format

Each Soil and Water Conservation Practice (SWCP) is described as follows:

Title: Includes the sequential number of the SWCP and a brief title

Objective: Describes the SWCP objective(s) and the desired results for protecting water quality.

Effectiveness: Provides a qualitative assessment of expected effectiveness that the applied measure will have on preventing or reducing impacts on water quality. The SWCP effectiveness rating is based on literature and research, administrative studies, and professional experience. The SWCP is rated either High, Moderate or Low based on the following criteria:

1. Literature/Research (must be applicable to area)
2. Administrative studies (local or within similar ecosystem)
3. Experience (judgment of an expert by education and/or experience)
4. Fact (obvious by reasoned, logical response)

Implementation: This section identifies: 1) the range of site-specific water quality protection measures to be implemented and 2) how the practices are expected to be applied.

Key Soil and Water Conservation Practice List

The following table displays the Soil and Water Conservation Practices (comparable to BMPs) required in Forest Service Handbook 2509.22. Note that not all the SWCPs are listed here. The Forest Service requires adherence to all practices outlined in the handbook.

Identification Number	SWCP Title
15.02	General Guidelines for the Location and Design of Roads and Trails
15.03	Road and Trail Erosion Control Plan
15.04	Timing of Construction Activities
15.05	Slope Stabilization and Prevention of Mass Failures
15.06	Mitigation of Surface Erosion and Stabilization of Slopes
15.07	Control of Permanent Road Drainage
15.09	Timely Erosion Control Measures on Incomplete Roads and Stream-crossing Projects
15.10	Control of Road Construction Excavation and Sidecast Material
15.11	Servicing and Refueling of Equipment
15.12	Control of Construction in Riparian Areas
15.13	Controlling In-Channel Excavation

Identification Number	SWCP Title
15.16	Bridge and Culvert Installation
15.17	Regulation of Borrow Pits, Gravel Sources and Quarries
15.19	Streambank Protection
15.20	Water Source Development Consistent with Water Quality Protection
15.21	Maintenance of Roads
15.23	Traffic Control During Wet Periods
15.25	Obliteration of Temporary Roads
15.27	Trail Maintenance and Rehabilitation

Soil and Water Conservation Practice Descriptions

Practice 15.02—General Guidelines for the Location and Design of Roads and Trails

OBJECTIVE: To locate and design roads and trails with minimal soil and water resource impact while considering all design criteria.

EFFECTIVENESS: High

IMPLEMENTATION: The following listed items are incorporated in general road location and design guidelines for minimizing impacts on water quality:

Design-

1. Roads shall be planned no wider than necessary to safely accommodate the anticipated use and equipment needs. Cut and fill volumes shall be minimized by designing the road to fit natural terrain features as closely as possible. As much of the excavated material as possible shall be used in fill sections. Minimum cuts and fills shall be planned, particularly near stream channels.

Location-

1. Utilize natural benches, follow contours, avoid long, steep road grades. Balance cut/fill where possible to avoid waste areas.

2. Embankments and waste shall be designed so that excavated material may be disposed of on geologically stable sites.

3. Avoid slumps and slide-prone areas, and steep sidehills.

4. Road construction shall be minimized within stream protection zones. Areas of vegetation shall be left or re-established between roads and streams [Standard Road Specifications-Special Project Specification 204.01].

5. Where possible, locate turn-outs and turn-arounds at least 200 feet from water bodies or riparian zones. Where placement within 200 feet is necessary due to safety considerations,

emphasize erosion control measures to protect water quality; i.e., additional windrowing, seeding, etc.

Road Drainage-

1. Locate and design roads and trails to drain naturally by appropriate use of out-sloping, rolling dips, and grade changes, where possible. Dips, water bars and/or cross drainage will be planned when necessary. Cross drains will be installed in ditched areas to 1) carry intercepted flow across constructed areas; 2) to relieve the length of undrained ditch; and 3) to reduce disruption of normal drainage patterns. Road and trail drainage should be channeled to effective buffer areas, either natural or manmade, to maximize sediment deposition prior to entry into live water.

2. Ditch lines and road grades will be designed to minimize unfiltered flow into streams. A rolling dip, relief culvert or similar structure will be installed as close as practical to crossings to minimize direct sediment and/or water input directly into streams. Route the drainage through SMZ, buffer strips, or sediment settling structures where possible.

3. Relief culverts and roadside ditches shall be planned whenever reliance upon natural drainage would not protect the running surface, excavation, or embankment. Culvert installations shall be designed to prevent erosion of the fill. Drainage structures shall be planned to achieve minimum direct discharge of sediment into streams.

Practice 15.03—Road and Trail Erosion Control Plan

OBJECTIVE: To prevent, limit and mitigate erosion, sedimentation, and resulting water quality degradation prior to the initiation of construction and maintenance activities through effective contact administration during construction and timely implementation of erosion control practices.

EFFECTIVENESS: High

IMPLEMENTATION: Erosion control objectives and detailed mitigation measures are developed using an interdisciplinary approach during the environmental analysis. These measures and objectives shall be reflected in the contract specifications and provisions for the road or trail. When standard specifications do not provide the degree of mitigation required, special projects specifications will be developed by the interdisciplinary team.

Prior to the start of construction, the Purchaser shall submit a schedule for proposed erosion control work as required in the Standard Specifications. The schedule shall include all erosion control items identified in the specifications. The schedule shall consider erosion control work necessary for all phases of the project. The Purchaser's construction schedule and plan of operation will be reviewed in conjunction with the erosion control plan to insure their compatibility before any schedules are approved. No work will be permitted on the project until all schedules have been approved by the Contracting Officer.

The Contracting Officer or Engineering Representative shall ensure that erosion control measures are implemented according to the approved schedule and are completed in a acceptable fashion. Field reviews and on-site inspection by the Line Officer and/or Forest

Engineer will identify any additional erosion control measures required to protect the streams that were not recognized during planning or design. Necessary correction measures shall be implemented immediately through normal administrative channels.

An interdisciplinary team should review selected road construction projects or existing roads to evaluate the effectiveness of erosion control measures and proper maintenance in protecting the water resource. Knowledge gained through these evaluations will improve future contract specifications and provisions.

The following items may be considered as erosion control measures when constructed in a timely manner. To maximize effectiveness, erosion control measures must be in place and functional prior to seasonal precipitation or runoff.

a. Measures to reestablish vegetation on exposed soils.
b. Measures which physically protect the soil surface from detachment or modify the topography to minimize erosion.
c. Measures which physically inhibit the downslope movement of sediments to streams.
d. Measures that reduce the amount of soil disturbance in or near streams.
e. Measures that control the concentration and flow of surface and subsurface water.

Practice 15.04—Timing of Construction Activities

OBJECTIVE: To minimize erosion by conducting operations during minimal runoff periods.

EFFECTIVENESS: Moderate-High

IMPLEMENTATION: Erosion and sedimentation are directly related to runoff. Scheduling operations during periods when the probabilities for rain and runoff are low is an essential element of effective erosion control. Purchasers shall schedule and conduct operations to prevent erosion and sedimentation. Equipment shall not be operated when ground conditions are such that excessive impacts will result. Such conditions are identified by the Contracting Officer or Engineering Representative with assistance from technical staffs as needed. Temporary erosion control measures may be required to prevent, control and mitigate erosion and sedimentation.

In addition, it is important to keep permanent erosion control work as current as practicable with ongoing operations. Construction of drainage facilities and performance of other contract work which will contribute to the control of erosion and sedimentation shall be carried out concurrent with earthwork operations or as soon thereafter as practicable. Limitation of the amount of area being graded at a site at any one time, and minimization of the time that an area laid bare should be a consideration in contract preparation. Erosion control work must be kept current when road construction occurs outside of the normal operating season.

Detailed erosion control measures are developed by an interdisciplinary team during the environmental analysis and are incorporated into the contract specifications. Compliance with plans, specifications, and the operating plan is assured by the Contracting Officer and/or Engineering Representative.

Practice 15.05—Slope Stabilization and Prevention of Mass Failures

OBJECTIVE: To reduce sedimentation by minimizing the chances for road-related mass failures, including landslides and embankment slumps.

EFFECTIVENESS: High

IMPLEMENTATION: Road construction in mountainous terrain requires cutting and loading natural slopes which may lead to landslides and/or embankment failures depending on the soil strength, geology, vegetation, aspect and groundwater regime. Landslides and embankment failures are undesirable because they interrupt traffic, are costly to repair, are visually unacceptable and generate large quantities of erosion and sedimentation.

Roadways may drastically change the subsurface drainage characteristics of a slope. Since the angle and height of cut and fill slopes increase the risk of instability, it is often necessary to provide subsurface drainage to avoid moisture saturation and subsequent slope failure.

In areas with intrinsic slope stability problems, appropriate technical resource staffs must be involved in an interdisciplinary approach to route location. Sufficient subsurface investigation and laboratory testing must be performed to generate design parameters and mitigating features which will meet the constraints and requirements developed through the NEPA process.

Practice 15.06—Mitigation of Surface Erosion and Stabilization of Slopes

OBJECTIVE: To minimize soil erosion from road cutslopes, fillslopes and travelway.

EFFECTIVENESS: Moderate-High

IMPLEMENTATION: Road construction exposes fresh, loose soil to the erosive force of wind, water and traffic. Surface erosion from roads is greatest during the first year following construction. It is desirable to minimize erosion due to the adverse impacts on water quality, vehicle maintenance, road maintenance and safety. Erosion can occur on cutslopes, fillslopes and/or travelway. Establishing effective vegetation on cut and fill slopes, installing mechanical filters on cut and fill slopes (slash windrows, straw bale dams, erosion netting or terraces) and surfacing the travelway are effective measures in reducing erosion.

During the NEPA process, detailed mitigation measures and slope stabilization techniques are incorporated into the design package by the interdisciplinary team. Compliance with environmental analysis controls and requirements is obtained by the Contracting Officer and/or Engineering Representative through the Standard Specifications.

Practice 15.07—Control of Permanent Road Drainage

OBJECTIVE: To minimize the erosive effects of concentrated water and the degradation of water quality by proper design and construction of road drainage systems and drainage control structures.

EFFECTIVENESS: High

IMPLEMENTATION: Degradation of water quality by sediment and the erosive effects of surface runoff can be minimized by stabilizing the road prism and adjacent disturbed areas from erosion. Velocities in the road drainage system can be dissipated before entry into the natural system by design and construction of control structures.

A number of measures can be used alone or in combination to control the detrimental effects of road drainage. Methods used to control water and reduce erosion may include: properly spaced culverts, cross drains, water bars, rolling dips, energy dissipaters, aprons, gabions and armoring of ditches and drain inlets and outlets. Dispersal of runoff can also be accomplished by rolling the grade, insloping, outsloping, crowning, contour trenching and installation of water spreading ditches.

Project location, design criteria, drainage control features and detailed mitigation measures are determined during the NEPA process by an interdisciplinary approach. Compliance with plans, specifications and operating plans is assured by the Contracting Officer or Engineering Representative.

Practice 15.09-- Timely Erosion Control Measures on Incomplete Roads and Stream-Crossing Projects

OBJECTIVE: To minimize erosion of and sedimentation from disturbed ground on incomplete projects.

EFFECTIVENESS: High

IMPLEMENTATION: The best drainage design and erosion control measure can be useless if projects are incomplete at the end of the growing season. Affected areas can include roads, fills, tractor trails, skid trails, landings, stream crossings, bridge excavations and fire lines. Preventative measures include:

a. The removal of temporary culverts, culvert plugs, diversion dams, or elevated stream crossing causeways.
b. The installation of temporary culverts, side drains, flumes, cross drains, diversion ditches, energy dissipaters, dips, sediment basins, berms, debris racks, or other facilities needed to control erosion.
c. The removal of debris, obstructions, and spoil material from channels and floodplains.
d. Grass seeding, planting deep rooted vegetation, and/or mulching.

Protective measures must be applied to all areas of disturbed, erosion-prone, unprotected ground that is not to be further disturbed in the present year. When conditions permit

operations outside the Normal Operating Season, erosion control measures must be kept current with ground disturbance, to the extent that the affected area can be rapidly "closed" if weather conditions deteriorate. Areas must not be abandoned for the winter with remedial measures incomplete.

Project location and mitigation measures are developed in the NEPA process using an interdisciplinary approach. Compliance with environmental analysis controls and requirements, contract specifications, and operating plans are assured by the Contracting Officer or Engineering Representative.

Practice 15.10—Control of Road Construction Excavation and Sidecast Material

OBJECTIVE: To reduce sedimentation from unconsolidated excavated and sidecast material caused by road construction, reconstruction or maintenance.

EFFECTIVENESS: Moderate-High

IMPLEMENTATION: Unconsolidated material from road construction is frequently exposed on cut and fill slopes, can be difficult to stabilize and represents a major sediment source. End hauling and retaining structures may be necessary to prevent thin layers of unconsolidated material from being sidecast on steep slopes where compaction is impractical. Prior to commencing construction, reconstruction, or maintenance activities, waste areas should be located where excess material can be deposited and stabilized. Normal erosion control such as seeding should be implemented with special mitigation measures such as jute netting, erosion cloth, mulching, slash windrows, sediment ponds, hay bale dams and rock gabions where such measures are determined to be necessary for local conditions.

Project location, selected disposal areas, and mitigation measures are developed through the NEPA process, using an interdisciplinary approach. Forest Service supervisors are responsible for insuring that In-Service projects meet design standards and project requirements. For contracted projects, compliance with specifications and operating plans is assured by the Contracting Officer and/or Engineering Representative.

Practice 15.11—Servicing and Refueling of Equipment

OBJECTIVE: To prevent contamination of waters from accidental spills of fuels, lubricants, asphalt, raw sewage, wash water and other harmful materials.

EFFECTIVENESS: High

IMPLEMENTATION: During servicing or refueling, pollutants from logging or road construction equipment may enter a watercourse. This threat is minimized by selecting service and refueling areas well away from wet areas and surface watercourses and by using berms around such sites to contain spills.

The Contracting Officer, Engineering Representative, or certified Sale Administrator will designate the location, size and allowable uses of service and refueling areas. They will be aware of actions to be taken in case of a hazardous spill, as outlined in the Forest Hazardous Substance Spill Contingency Plan (SWCP 11.07).

Practice 15.12—Control of Construction in Riparian Areas

OBJECTIVE: To minimize the adverse effects on riparian areas from roads and trails.

EFFECTIVENESS: High

IMPLEMENTATION: Except at designated stream crossings, road and trail construction will avoid placing fill materials or structures in riparian areas that will directly affect the ecological values of the stream. Occasionally exceptions may occur. These instances should be identified by the interdisciplinary team in the NEPA process and the final location designed to create the minimum impact possible.

Riparian area requirements are identified during the environmental analysis by the interdisciplinary team. The road or trail project is designed to include site specific recommendations for the prevention of sedimentation and other stream damage from road/trail activities. As appropriate, monitoring and evaluation will be identified in the NEPA documentation. Forest Service supervisors are responsible for insuring that In-Service projects meet design standards and project requirements. On contract projects, compliance with project requirements, contract specifications and operating plans is assured by the Contracting Officer or Engineering Representative.

Practice 15.13—Controlling In-Channel Excavation

OBJECTIVE: To minimize stream channel disturbances and related sediment production.

EFFECTIVENESS: High

IMPLEMENTATION: Construction equipment may cross, operate in, or operate near stream courses only where so designated by the Forest Service or as necessary in the construction or removal of culverts and bridges. This will be done in compliance with the specifications and mitigation required in the SPA (124) permit and included in the project specifications.

Unless otherwise approved, no in-channel excavation shall be made outside of de-watered areas, and the natural stream bed adjacent to the structure shall not be disturbed without approval of the Engineer. If any excavation or dredging is made at the site of the structure before caissons, cribs, or cofferdams are sunk in place, all such excavations will be restored to the original ground surface or the stream bed will be protected with suitable stable material. Material from foundation or other excavation shall not be discharged directly into live streams but shall be pumped to settling areas shown on the drawings or approved by the Engineer. If the channel is damaged during construction, it should be restored as nearly as possible to its original configuration without causing additional damage to the channel. Excavations for stream crossings will conform to the SPA (124) permit criteria, including timing restrictions (as well as Std. FS Spec 206, 206A, and applicable SPS's).

Practice 15.16—Bridge and Culvert Installation (Disposition of Surplus Material and Protection of Fisheries)

OBJECTIVE: To minimize sedimentation and turbidity resulting from excavation for in channel structures.

EFFECTIVENESS: Moderate-High

IMPLEMENTATION: Excavation in or near stream courses is a common requirement for the installation of bridges, culverts, and other streamside structures such as weirs, check dams, riprapping or fish passage structures. Surplus material should not obstruct the stream course including the floodplain nor the efficiency of the associated structure. Preventative measures include:

a. Diverting stream flow around project sites during construction in order to minimize erosion and downstream sedimentation.
b. Easily erodible material shall not be deposited into live streams.
c. Any material stockpiled on floodplains shall be removed before rising waters reach the stockpiled material.
d. During excavation in or near stream courses, it may be necessary to use suitable coffer dams, cribs or sheet piling.
e. Water pumped from foundation excavation shall not be discharged directly into live streams, but shall be pumping into settling ponds.
f. When needed, bypass roads should be located to have minimal disturbance on the stream course.
g. The construction activity in or adjacent to the stream will be limited to specific times to protect beneficial water uses.
h. Operation of mechanical equipment in live streams shall be kept to the amount necessary to avoid impacts to aquatic resources.

Project location and detailed mitigation measures are developed in the environmental analysis and are detailed in the appropriate NEPA document using an interdisciplinary approach. Forest Service supervisors are responsible for insuring that In-Service projects meet the design standards. For contracted projects, compliance with contract specifications and operating plans is assured by the Contracting Officer or Engineering Representative.

Practice 15.17—Regulation of Borrow Pits, Gravel Sources and Quarries

OBJECTIVE: To minimize sediment production from borrow pits, gravel sources and quarries and limit channel disturbances in those gravel sources suitable for development in floodplains.

EFFECTIVENESS: Moderate

IMPLEMENTATION: Borrow pits, gravel sources and quarries are often susceptible to erosion due to steep side slopes, lack of vegetation and/or their proximity to water courses. Whenever possible, the topsoil should be removed and stockpiled for use as surface dressing during the reclamation phases, prior to excavation of the site.

Drainage design for the excavation should consider temporary erosion control measures during the life of the material source and permanent drainage control measures after the site has been rehabilitated. When excavation of the site has been completed on all or part of the area, and the site will not be used again, the sides will be sloped, graded or scaled and the general pit area smoothed and stabilized. Oversize material, if planned for future use as riprap or derrick rock, should be stockpiled. If not, is should be scattered or buried. Finer material, if available, should be spread over the bottom of the pit prior to spreading stockpiled topsoil. Seeding,

mulching and/or planting should be initiated. If the site will be used again, the above requirements would be limited to those essential to resource protection between uses. Access roads to the site should also have temporary or permanent drainage design for erosion control depending on the life of the pit or the roads should be ripped, drained, blocked to traffic and seeded, mulched and/or planted unless other uses are planned.

Wash water or waste from concrete batching or aggregate operations shall not be allowed to enter streams prior to treatment by filtration, flocculation, settling or other means. The potential pollution of adjacent water resources by blasting agents in quarry operations shall be addressed in the pit operation plan.

Practice 15.19—Streambank Protection

OBJECTIVE: To minimize sediment production from streambanks and structural abutments in natural waterways.

EFFECTIVENESS: Moderate-High

IMPLEMENTATION: The stabilization of stream embankments disturbed by the construction of a water crossing or a roadway fill parallel to a streamcourse, is necessary to prevent erosion of the material during natural stream flow. To reduce sediment and channel bank degradation, it is necessary to incorporate "armoring" in the design of a structure to allow the water course to stabilize after construction. These measures must be sized and installed in such a way that they effectively resist erosive water velocities. Stone used for riprap should be free from weakly structured rock, soil, organic material and materials of insufficient size. Outlets for drainage facilities in erodible soils commonly require riprapping for energy dissipation.

Practice 15.20—Water Source Development Consistent with Water Quality Protection

OBJECTIVE: To supply water for road construction and maintenance and fire protection while maintaining water quality.

EFFECTIVENESS: Moderate

IMPLEMENTATION: Water source development is normally needed to supply water for road construction, dust control, mixing surface, compaction, planting and for fire control. Water source development should aim toward the construction of durable, long term water sources rather than the construction of hasty, expedient developments. Permanently designed sources, such as tanks, will result in the lowest, long term impact to the affected streams.

Other considerations in the development of water sources should be:

a. Downstream flow should not be reduced so as to detrimentally affect aquatic resources, fish passage or other uses.
b. Temporary cofferdams should be constructed of sandbags containing sand or clean gravel, or other materials and means which will not induce sediment in the stream.
c. Overflow should go directly back into the stream.
d. All temporary facilities for gathering water will be removed prior to causing any resource damage.

Practice 15.21—Maintenance of Roads

OBJECTIVE: To maintain all roads in a manner which provides for soil and water resource protection by minimizing rutting, failures, side casting and blockage of drainage facilities.

EFFECTIVENESS: Moderate-High

IMPLEMENTATION: Roads normally deteriorate because of use and weather impacts. This deterioration can be minimized through proper and timely maintenance and/or restriction of use (SWCP 11.09). All system roads will be maintained to at least the following level: Provide the basic custodial care required protect the road investment and to insure that damage to adjacent land and resources is held to minimum. This level of maintenance often requires an annual inspection to determine what work, if any, is needed to keep drainage functional and the road stable. This level is the normal prescription for roads that are closed to traffic. As a minimum measure, maintenance must protect drainage facilities and runoff patterns. Higher levels of maintenance may be chosen to reflect greater use or resource administrative needs. Additional maintenance measures could include resurfacing, outsloping, clearing debris from dips and cross drains, armoring of ditches, spot rocking and drainage improvement.

In addition to timely performance of regular maintenance, each Forest should have an emergency action plan which identifies procedures to be used during periods of high runoff to protect facilities and reduce resource damage.

The work is controlled through the Forest Engineer who is responsible for the development of the annual road maintenance plan based on condition surveys. Maintenance levels are established for each road and maintenance performed in accordance with standards.

Practice 15.23—Traffic Control During Wet Periods

OBJECTIVE: To reduce the potential for road surface disturbance during wet weather and to reduce sediment probability.

EFFECTIVENESS: Moderate-High

IMPLEMENTATION: The unrestricted use of many National Forest roads during wet weather often results in rutting and churning of the road surfaces. Runoff from such disturbed road surfaces often carries a high sediment load. The damage/maintenance cycle for roads that are frequently used during wet periods can create a disturbed road surface and sediment source.

Roads that must be used during wet periods should have a stable surface and sufficient drainage to allow such use with a minimum of resource impact. Rocking, oiling, paving and armoring are measures that may be necessary to protect the road surface and reduce erosion potential. Roads not constructed for all weather use should be closed during the wet season. Where winter field operations are planned, roads may need to be upgraded and maintenance intensified to handle the traffic without creating excessive erosion and damage to the road surface.

Practice 15.25-- Obliteration of Temporary Roads

OBJECTIVE: To reduce sediment generated from temporary roads by obliterating them at the completion of their intended use.

EFFECTIVENESS: High

IMPLEMENTATION: Temporary roads are constructed for a specific short-term purpose. In order to prevent continued low level casual use, such roads are obliterated at the completion of their intended use. Temporary roads that are allowed to remain in use beyond their prescribed time are subject to continued, uncorrected damage and they can become chronic sediment sources.

Effective obliteration is generally achieved through a combination of the following measures:

a. Road effectively drained and blocked.
b. Temporary culverts and bridges removed and natural drainage configuration reestablished.
c. Road returned to resource production through relieving compaction and vegetation establishment.
d. Sideslopes reshaped and stabilized.

Practice 15.27—Trail Maintenance and Rehabilitation

OBJECTIVE: To minimize soil erosion and water quality problems resulting from trail erosion.

EFFECTIVENESS: Moderate-High

IMPLEMENTATION: Trails often have erosion problems due to poor location, improper maintenance and the amount or type of use. This deterioration can often be minimized by proper maintenance, restriction of certain types of use and /or relocation.

Mainline and heavy use trails should have a functional drainage system (waterbars, culverts, corduroy, puncheon or boardwalks). Additional measures (lateral ditching, trail relocation, reconstruction) may be required in heavy use or problem areas.