APPENDIX Q

SEDIMENT AND EROSION CONTROL BEST MANAGEMENT PRACTICES

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INTRODUCTION

This plan contains a description of Best Management Practices (BMP's) that are applicable to timber removal, road construction and other planned construction activities related to the Montanore Project. These practices may be used alone or in conjunction with each other to reduce erosion and sediment yield to streams. Which practice or practices may be suitable to a particular situation will be determined on a site specific basis. All construction activities will be conducted with the objective of minimizing sediment discharge to streams.

The format of this Plan lists the following three components for each management practice:

Practice
Objective
Planning Design and Construction Considerations

MANAGEMENT PRACTICES FOR TIMBER REMOVAL

PRACTICE:

Erosion Prevention and Control Measures During Timber Removal Operations.

OBJECTIVE:

To ensure that timber removal operations are conducted to minimize soil erosion.

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

Equipment will not be operated when ground considerations are such that excessive impacts will result. The kinds and intensity of control work done will be adjusted to ground and weather conditions and the need for controlling runoff. Erosion control work will be kept current immediately preceding expected seasonal periods of precipitation or runoff.

PRACTICE:

Erosion Control on Skid Trails During Timber Removal Operations

OBJECTIVE:

To protect water quality by minimizing erosion and sedimentation derived from skid trails.

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

This practice employs preventive controls to reach the objective. Site work involves constructing cross ditches and water spreading ditches. Spacing of cross drains and construction techniques will follow standard Kootenai National Forest guidelines.

PRACTICE:

Stream Channel Protection During Timber Removal Operations

OBJECTIVES:

1. To protect the natural flow of streams;
2. to provide unobstructed passage of storm flows;
3. to reduce sediment and other pollutants entering streams; and
4. to restore the natural course of any stream as soon as practicable.

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

1. All project debris will be removed from streamcourse in a manner that will cause the least disturbance.
2. When ground skidding systems are employed, logs will be end-lined out of streamside and Riparian Areas.
3. Water bars and other erosion control structures will be located to prevent water sediment from being channeled into streamcourses, and to dissipate concentrated flows.
4. Logs or products will be fully suspended above the ground when crossing streamcourses.

PRACTICE:

Erosion Control Structure Maintenance During Timber Removal Operations

OBJECTIVE:

To insure that constructed erosion control structures are stabilized and working effectively.

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

Erosion control structures are only effective when they are in good repair and stable condition. Erosion control structures will be inspected periodically during timber removal operations and at least seasonally following completion of the operation until they are stabilized or no longer needed.

MANAGEMENT PRACTICES FOR ROAD CONSTRUCTION AND MAINTENANCE

PRACTICE:

Location and Design of Roads

OBJECTIVE:

To locate and design roads to minimize soil and water resource impacts.

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

1. Roads and trails will be designed based on traffic and safety requirements of anticipated use. The design will incorporate features to prevent or minimize soil movement and sedimentation as well as undue disruption of water flow.
2. Locate and design roads and trails to drain naturally by appropriate use of out-sloping or in-sloping with cross drainages and grade changes, where possible. Relief culverts and roadside ditches will be designed whenever reliance upon natural drainage would not protect the surface, excavation, or embankment. Road drainage should be channeled to effective buffer areas to maximize sediment deposition prior to reaching flowing stream courses.

PRACTICE:

Road 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 timely implementation of erosion control practices.

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

Roads and trails require a variety of erosion control measures. Many erosion control practices not only protect water quality but also maintain road prism integrity, reduce maintenance costs, and improve trafficability. The location of the road or trail with respect to streams, soil characteristics, and geologic information and other site factors govern the degree of stabilization required. Stabilization usually includes a combination of practices that promotes the reestablishment of vegetation on exposed slopes, provides physical protection to exposed surfaces, prevents the downslope movement of soil, or controls road drainage.

Since a newly constructed road is most susceptible to erosion from seasonal precipitation, the timing of erosion control practices is a primary concern. Those practices that can be accomplished concurrent with road construction will be favored as a means of immediate protection of the water resource.

Prior to the start of construction, a schedule for proposed erosion control work and construction specifications will be prepared. The schedule will consider erosion control work necessary for all phases of the project.

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.

1. Measures to reestablish vegetation on exposed soils.
    a) This is usually accomplished by seeding suitable grass and forb species in conjunction with mulching and fertilization. In some situations, treatments may include tree seedling planting or sprigging of other woody species.
2. Measures which physically protect the soil surface from detachment or modify the topography to minimize erosion.

a) These treatments may include the use of surface treatment or gravel on the road travelway and ditches and the use of mulches, riprap, erosion mats, and terracing on cuts, fills, and ditches. Temporary waterbars in areas of uncompleted roads and trails can be effectively utilized to reduce sedimentation.

3. Measures which physically inhibit the downslope movement of sediments to streams.
   a) These may include the use of slash filter windrows may be utilized in live water drainages where fish passage is not required and where peak flows are low.
4. Measures that reduce the amount of soil disturbance in or near streams.
   a) These measures may include dewatering culvert installation or other construction sites, and immediate placement of permanent culverts during road pioneering. Temporary pipes should not be allowed unless positive control of sedimentation can be accomplished during installation, use, and removal.
5. Measure that control the concentration and flow of surface and subsurface water.
   a) These may include insloping, outsloping, ditches, cross drains, under drains, trenches, etc.

PRACTICE:

Timing of Construction Activities

OBJECTIVE:

To minimized erosion by conduction operations during minimal runoff periods.

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

Erosion and sedimentation are directly related to runoff. Scheduling operations during periods when the probabilities from rain and runoff are low is an important element of

effective erosion control. Construction will be scheduled and conducted to minimize potential for erosion and sedimentation. 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 or other contract work which will contribute to the control of erosion and sedimentation will be carried out concurrent with earthwork operations 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 is laid bare should be considered. Erosion control work must be kept current when road construction occurs outside of the normal operation season.

PRACTICE:

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.

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

Road construction in steep 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.

Roadways may change the subsurface drainage, 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 subsequent slope failure. Where necessary, horizontal drains, drainage trenches, or drainage blankets may be used to lower the subsurface water levels and to prevent groundwater from entering embankments.

In areas with high landslide potential, the composition and characteristics of embankments may be controlled since they are essentially engineered structures. Care must be taken to prevent the incorporation of construction slash or other organic material.

Embankment material placement should consider the following methods:

1. Layer placement.
2. Controlled compaction.
3. Controlled compaction using density controlled strips.
4. Compaction controlled with a special project specification.

PRACTICE:

Mitigation of Surface Erosion and Stabilization of Slopes.

OBJECTIVE:

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

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

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 futslopes, fillslopes, and/or travelways. Each of the three surfaces has unique erosion considerations including:

Surface	General Characteristics	Stabilization-Mitigation Measures
Cutslope	Steeper, undisturbed, and more sterile soil	Vegetative and mechanical stabilization
Fillslope	Flatter, loose, and more fertile soil	Vegetative and mechanical stabilization
Travelway	Flattest, compact (due to traffic)	Surface Stabilization

Vegetative measures include seeding herbaceous species (grass legumes, or browse species) or the planting of brush or trees.

Fertilization, mulching, watering, and/or erosion netting and fabrics may be required to ensure success.

Mechanical measures include construction of slash windrows, straw bale dams, erosion netting and fabrics, terraces, or benching, riprapping, tackifiers, and gunnite.

Surface stabilization includes watering, dust oiling, dust palliatives, aggregate layer, bituminous surface treatment, or asphalt paving depending on traffic, soils, and climatic factors.

An integrated system of collection control, and dispersion of concentrated surface water is very important in order to prevent erosion on fillslopes, travelways, and natural slopes below cross drains and culverts.

PRACTICE:

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.

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

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 dissipators;
- 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;
- Installation of water spreading ditches, etc.

PRACTICE:

Pioneer Road Construction

OBJECTIVE:

To minimize sediment production and mass associated with pioneer road construction.

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

Pioneer roads are built to allow equipment access for construction of planned roadways. Pioneering is usually done within the corridor of the planned road. To meet the objective of minimizing sediment, the following constraints should be followed:

1. Construction of pioneer roads will be confined to the roadway disturbance limits except where safety or other considerations outweigh the benefits of this practice.
2. Pioneering will be conducted so as to prevent undercutting of the designated final cut slope, prevent avoidable deposition of materials outside the designated roadway limits, and accommodate drainage with temporary culverts or log crossings unless approved otherwise.
3. Erosion control work will be completed concurrent with construction activity or prior to the wet season.
4. Live streams crossed by pioneer roads will be dewatered by diversion devices.

PRACTICE:

Timely Erosion Control Measures on Incomplete Roads and Streamcrossing Projects

OBJECTIVE:

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

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

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 areas can be rapidly "closed," if weather conditions deteriorate. Areas must not be abandoned for the winter with remedial measures incomplete.

Preventive measures include:

1. The removal of temporary culverts, culvert plugs, diversion dams, or elevated streamcrossing causeways;
2. The installation of temporary culverts, side drains, flumes, cross drains, diversion ditches, energy dissipators, dips, sediment basins, berms, debris racks, or other facilities needed to control erosion;
3. The removal of debris, obstructions, and spoil material form channels and floodplains;
4. Grass seeding, planting deep rooted vegetation, and/or mulching.

PRACTICE:

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.

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

Unconsolidated material from road construction is exposed on cut and fillslopes, can be difficult to stabilize, and may represent a major sediment source. In some cases layer placement and/or benching may be necessary for stabilization and to obtain the proper

dimensions and fill slope ratios. 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. If waste areas are located on steep slopes, sidecast materials should be consolidated and stabilized. Disposal of slide debris should be in areas where it can be stabilized.

Normal erosion control such as seeding should be supplemented with special mitigation measures such as jute netting, erosion cloth, mulching, slash windrows, sediment ponds, hay bale dams, silt fences and rock gabions, when such measures are determined necessary for local conditions.

PRACTICE:

Controlling In-Channel Excavation

OBJECTIVE:

To minimize stream channel disturbances and related sediment production

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

During the construction of roads and the installation, it may be necessary for construction equipment to cross, operate in, or operate near streamcourses.

Excavation during the installation of streamside structures should be accomplished in the following manner in order to protect water quality. Unless otherwise approved, no excavation will be made outside of caisson, cribs, cofferdams, or sheet piling, and the natural stream bed adjacent to the structure will not be disturbed. 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 deposited within the stream

area from foundation or other excavation will not be discharged directly into live streams but will be pumped to settling areas. Excavations for stream crossings should be started early enough in the summer so that the installation is complete before winter.

PRACTICE:

Diversion of Flows Around Construction Sites

OBJECTIVE:

To minimize downstream sedimentation by insuring that all stream diversions are carefully planned.

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

Flow must sometimes be guided or piped around project sites. Typical examples are bridge and dam construction. Such a diverted flow will be restored to the natural streamcourse as soon as practicable and, in any event, prior to the major storm season or fish migration season. Stream channels impacted by construction activity will be restored to their natural grade, condition, and alignment as soon as possible.

PRACTICE:

Streamcrossing on Temporary Roads

OBJECTIVE:

To minimize downstream sedimentation by insuring that all stream diversions are carefully planned.

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

Culverts, temporary bridges, low water crossings, or fords will be required on temporary roads at all locations where it is necessary to cross streamcourses. Such facilities will be

designed and installed to provide unobstructed stream flow and fish passage, and to minimize damage to the streamcourse.

Channel crossing should generally be as perpendicular to streamcourses as possible. Streambank excavation will be kept to the minimum needed for use of the crossing.

Crossing facilities will be removed when the facility has served its purpose and is no longer needed. Fills associated with these facilities will also be removed.

PRACTICE:

Bridge and Culvert Installation

OBJECTIVE:

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

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

- Excavation in or near streamcourses 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 streamcourse including the floodplain. Preventive measures include: Diverting stream flow around project sites during construction in order to minimize erosion and downstream sedimentation.
- Easily erodible material will not be deposited into live streams.
- Any material stockpiled on floodplains will be removed before rising waters reach the stockpiled material.
- During excavation in or near the streamcourse, it may be necessary to use suitable coffer dams, caissons, cribs, or sheet piling. This will usually be the case where groundwater is contributing a significant amount of water to the immediate excavation area. If any of the aforementioned devices are used, they will be

practically watertight and no excavation will be made immediately outside of them. If water from subsurface strata is not significant, pumping may be used, provided the sediment from the pumped water can be disposed of where it will not re-enter the stream during high flows.

- Water pumped from foundation excavation will not be discharged directly into live streams, but will be pumped into settling ponds.
- When needed, bypass roads should be located to have the minimal disturbance on the streamcourse.

PRACTICE:

Disposal of Right-of-Way and Roadside Debris

OBJECTIVE:

To insure that debris generated from road construction is kept out of streams and to prevent slash and debris from subsequently obstructing channels.

PLANNING DESIGN, AND CONSTRUCTION CONSIDERATIONS:

As a preventive measure, construction debris and other newly generated slash developed along roads near streams will be disposed of by the following means as applicable:

1. On-Site
    a. Windrowing
    b. Scattering
    c. Burying
    d. Chipping
    e. Piling and Burning
    f. Removal to approved disposal area
2. Large limbs and cull logs may be bucked into manageable lengths and piled alongside the road for fuelwood.

PRACTICE:

Streambank protection

OBJECTIVE:

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

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

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. Riprap, gabion structures, and other measures are commonly used to armor stream banks and drainage ways from the erosive forces of flowing water. 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, all of which are not resistant to stream flow and would only serve as sediment source. Outlets for drainage facilities in erodible soils commonly require riprapping for energy dissipation.

PRACTICE:

Maintenance of Roads

OBJECTIVE:

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

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

Roads normally deteriorate because of use and weather impacts. This deterioration can be minimized through proper and timely maintenance. All project roads will be maintained to protect the road prism land surface and to insure that damage to adjacent land and water resources is held to a minimum. This level of maintenance requires, at a minimum, an annual inspection to determine what work, if any, is needed to keep drainage functional and the road stable. Maintenance must protect drainage facilities and runoff patterns.

Additional maintenance measures could include:

- Resurfacing,
- Outsloping,
- Clearing debris from dips and cross drains,
- Armoring of ditches,
- Spot rocking, and
- Drainage improvement.

Maintenance needs will be reflected in an annual road maintenance plan.

PRACTICE:

Road Surface Treatment to Prevent Loss of Materials

OBJECTIVE:

To minimize the erosion of road surface materials and consequently reduce the likelihood of sediment production.

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

Unconsolidated road surface material is susceptible to erosion during precipitation events. Likewise, dust derived from road use may settle onto adjacent water bodies.

Road surface treatments may include:

- Water;
- Dust oiling;
- Penetration oiling;
- Sealing;
- Aggregate surfacing;
- Chip-sealing; or
- Paving.

PRACTICE:

Snow Removal Controls

OBJECTIVE:

To minimize the impact of snow melt on road surfaces and embankments and to reduce the probability of sediment production resulting from snow removal operations.

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

This is a preventive measure used to protect resources and indirectly to protect water quality. The following measures are employed to meet the objectives of this practice.

1. During snow removal operations, banks will not be undercut nor will gravel or other selected surfacing material be bladed off the roadway surface. Ditches and culverts will be kept functioning during and following roadway use. If the road surface is damaged, the Purchaser will replace lost surface material with similar quality material and repair structures damaged in blading operations.
2. Snow berms will not be left on the road surface or will be placed to avoid channelization or concentration of melt water on the road or erosive slopes. Berms left on the shoulder of the road will be removed and/or drainage holes opened at the end of winter operations and before the spring breakup. Drainage holes will be spaced as required to obtain satisfactory surface

drainage without discharge on erodible fills. On insloped roads, drainage holes will also be provided on the ditch side, but care taken to insure that culverts and culvert inlets are not damaged.

GENERAL CONSTRUCTION PRACTICES

PRACTICE:

Servicing and Refueling of Equipment

OBJECTIVE:

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

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

During servicing or refueling, pollutants from 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.

PRACTICE:

Control of Construction in Riparian Areas

OBJECTIVE:

To minimize the adverse effects on Riparian Areas.

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

Except at designated stream crossings, road building and other construction activities will avoid placing fill materials or structures in Riparian Areas that could potentially affect the ecological values of the stream. Factors such as stream class, channel stability, sideslope steepness, slope stability, resources dependent on these areas and standards, guidelines, and direction from Forest Plans are considered in determining the management of activities and width of Riparian Areas. Mitigation measures should be used to the optimum to insure minimum impact.

PRACTICE:

Surface Erosion Control at Facility Sites

OBJECTIVE:

To minimize the amount of erosion and sedimentation at developed sites.

PLANNING DESIGN AND CONSTRUCTION CONSIDERATIONS:

Lands developed for project facilities, parking areas, or construction lay down will be cleared of vegetation. Erosion control methods need to be implemented to stabilize the soil and to reduce the potential for stream sedimentation. Some examples of erosion control methods that could be applied include:

- Grass seed;
- Jute mesh;
- Silt Fencing;
- Tackifiers;
- Hydromulch;
- Paving or rocking of roads;
- Water bars;
- Cross drains; or
- Retaining walls.

The control erosion and sedimentation, the natural drainage pattern of the area should not be changed. Sediments basins and sediment filters should be established to filter surface runoff. Diversion ditches and berms should be built to divert surface runoff around disturbed areas. Construction activities should be scheduled, where possible, to avoid periods of heavy precipitation or runoff.