Appendix 2

FOREST CARBON INITIATIVE

SILVICULTURE REHABILITATION OF ROADS

ENGINEERING STANDARDS

FOREST CARBON INITIATIVE (FCI)
SILVICULTURE REHABILITATION OF ROADS
ENGINEERING STANDARDS
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SECTION 1: DEFINITIONS

For the purposes of this document

"access road" means any forest road that provides vehicle access from the public highway system to the closest boundary of the silviculture rehabilitation area;

"construction specialist" means a person who possesses the necessary experience and skills to plan for and direct hired equipment utilized to carry out road construction/maintenance;

“culvert” means a pipe, arch or box, or a log structure, not greater than 6 m in span that is located below the surface of a road and is designed to carry water from one side of the road to the other;

"deactivation" means placing a road in a self-maintaining state that will indefinitely protect adjacent resources. Road deactivation requirements typically include restoring natural drainage, removing bridges and stream culverts, and stabilizing the road prism.

"deactivation prescription" means a document that contains professional work which provides road standards, design specifications, and other information to facilitate the deactivation of a road.

“discontinue and close” means a formal notification by the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) that the ministry no longer administers a road as a forest service road, in accordance with section 121 (9) of the *Forest Act*;

"field review" means review of the constructed works at the road site considered necessary, in the QRP's opinion, to ascertain whether or not the significant aspects of the works are in general compliance with the road plan, maintenance plan or deactivation prescription.

"final surface treatment" means road maintenance or deactivation activities applied to access roads at the conclusion of the silviculture rehabilitation project, commensurate with the timing and types of future use, if any.

“ford” means a natural or constructed shallow place in a stream where one can cross in a vehicle

“forest resource” means a resource or value associated with the forests of British Columbia and includes: soils; visual quality; timber; forage and associated plant communities; water; fish; wildlife; biodiversity; recreation resources; resource features; and cultural heritage resources.

"forest road" means a road as defined in the Forest Planning and Practices Regulation.

“forest service road” means a road owned by FLNRORD, and as defined in section 1 of the *Forest Act*.

“Global Positioning System (GPS)” means a navigational system using satellite signals to fix the location of a radio receiver on or above the earth’s surface.

“hazard” (in general terms) means a source of potential harm, or a situation for causing harm, in terms of human injury; damage to health, property, the environment, and other elements of value, or some combination of these (e.g., a landslide);

"maintenance plan" means a document that contains professional work which provides road standards, design specifications, and other information to facilitate the maintenance of a road.

“non-status road” means an existing road on Crown land that is not being used under any authorization by a government agency;

"professional assurance statement" means a professional document signed/sealed by the Qualified Registered Professional (QRP), that assures general conformance of the road works associated with the silviculture rehabilitation project to the approved plans and prescriptions.

"risk" (in general terms) means the chance of injury or loss as defined as a measure of the probability and severity of human injury; an adverse effect to health, property, the environment, or other elements of value, or some combination of these;

"professional engineer" means the same as given in the *Engineers and Geoscientists Act*;

"Qualified Registered Professional (QRP)" means a person who is a professional engineer, professional forester or registered forest technician, registered in BC, and possesses the necessary education, experience and skills to lead, coordinate and take responsibility for professional work related to road planning, restoration, maintenance and deactivation;

"registered professional forester" means the same as given in the *Foresters Act*;

"silviculture rehabilitation" means restoring the growing capacity of degraded forest land on an existing road section that has been deactivated; typically, silviculture rehabilitation may include activities such as soil decompaction, replacement of topsoil and other processes to facilitate regeneration.

"road" includes roads and bladed and excavated trails;

"road permit" is a permit issued under section 115 of the *Forest Act* to authorize road construction and maintenance by someone who has a right to harvest timber.

"road restoration" means allowing project vehicle traffic to safely use an access road for the intended time period, by carrying out repairs applied to road surfaces and subgrades that, because of the condition of the roadway and its drainage, cannot be otherwise used by those vehicles.

"road use permit" is a permit issued to an industrial user under section 115 of the *Forest Act* to authorize use of a forest service road.

"road prism" means the width bounded by the top of the road cut slope on one side and the toe of the road fill on the other side;

"road tenure means those licenses or permits issued by FLNRORD under the *Forest Act* to authorize forest companies to construct and use roads, and includes road permits, road use permits, cutting permits and various timber harvesting licenses;

"safe fish passage" means passage of fish through culverts for the purposes of spawning, rearing or migration.

"special use permit" means a permit issued by FLNRORD under the *Provincial Forest Use Regulation* for road construction and use by non-forest users;

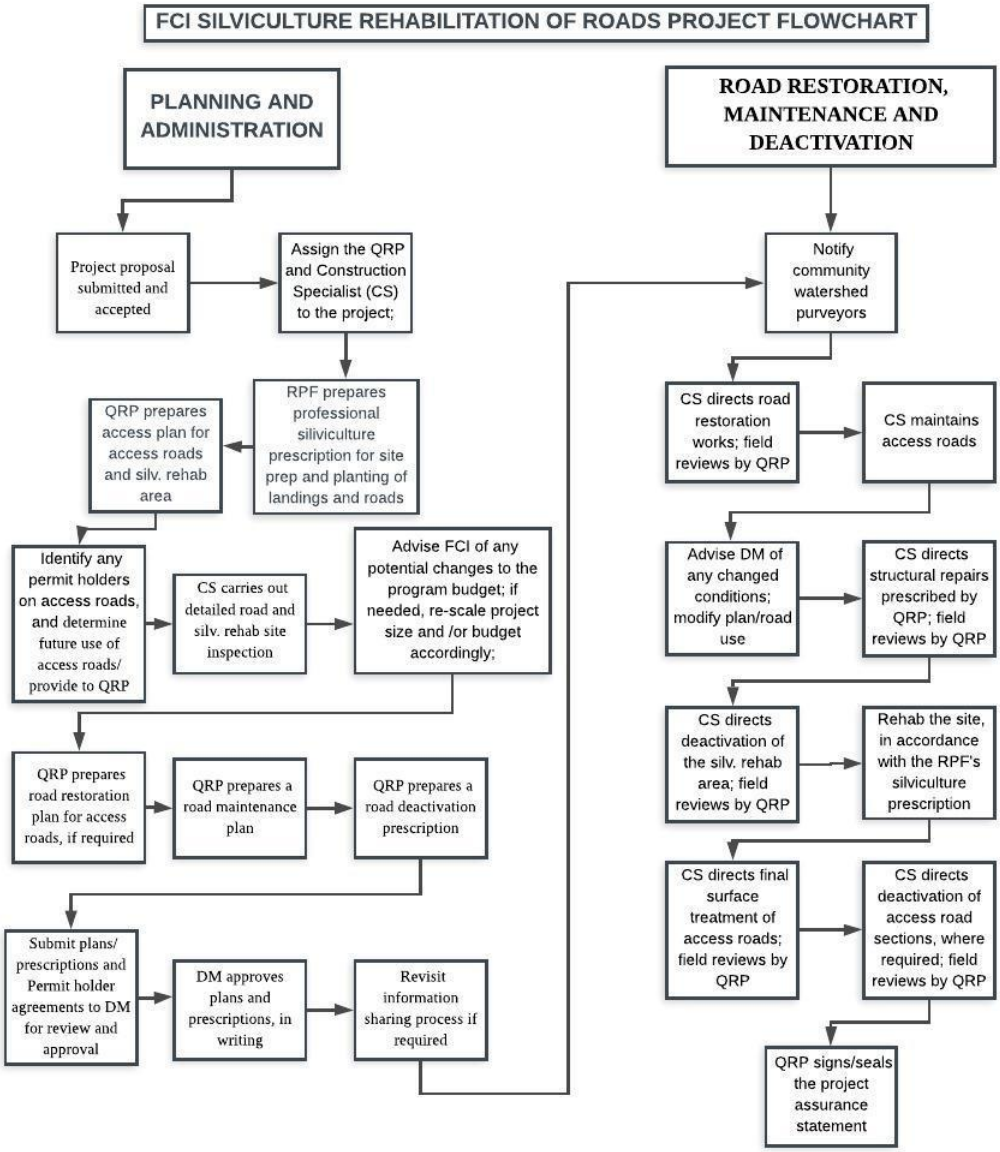
"structural maintenance" means repairs/remedial activities related to structural integrity of the road subgrade, including slope stability and load capacity.

"turnout" means a short auxiliary lane of sufficient width to provide space for safe passage of motor vehicles;

"wilderness road" means a road that is not being used by industrial users;

SECTION 2: ROAD PROJECT SUMMARY

2.1 Project Flow Chart



2.2 Engineering Tracking Checklist

Forest Carbon Initiative (FCI) Silviculture Rehabilitation of Roads Engineering Tracking Checklist

PROJECT ID:_____

Use this checklist to track key actions/decisions by the Proponent and Qualified Registered Professional, and place it in the project file. [DM = DISTRICT MANAGER; QRP = QUALIFIED REGISTERED PROFESSIONAL; CS= CONSTRUCTION SPECIALIST; PT = PROPONENT; RPF = Registered Professional Forester].
Sign and date the completed checklist at the conclusion of the project.

NAME OF QRP:_____

Engineering Element	Done by:	Mark as Complete (✓)
PLANNING AND ADMINISTRATION		
Project proposal submitted, together with stakeholder input and project budget estimate, and acceptance received;	PT	
Qualified Registered Professional (QRP) assigned to the project, to take professional responsibility for the project planning and implementation, and completing the assurance statement;	PT	
Construction Specialist (CS) retained for the project work, to plan the field work and direct equipment hired to carry out the work;	PT	
Proposed access plan prepared, along with silviculture rehabilitation project objectives, providing District Manager (DM) with a map and status of the road access up to the silviculture rehabilitation area, plus the silviculture rehabilitation area as well;	QRP	
Silviculture prescriptions prepared by Registered Professional Forester (RPF) for site prep and planting of any landings and roads;	PT	
Road Permit and Road Use Permit holders identified by district, and future use of access roads determined by district staff and approved by DM, and results provided to QRP;	PT	
Carry out detailed road and silviculture rehabilitation site inspections, locating potential work sites with GPS;	CS	
Advise FCI of any potential changes in the program budget; if needed, re-scale the project size and/or budget accordingly;	PT	
Prepare a road restoration plan for any access roads, if required;	QRP	
Prepare a maintenance plan for the access roads, if required;	QRP	
Prepare a road deactivation prescription for the silviculture rehabilitation area and any portions of the access roads that will no longer be required after the silviculture rehabilitation area is treated;	QRP	
Provide any road restoration plans, maintenance plans, Permit holder agreements, and deactivation and silviculture prescriptions to district staff for DM's review and approval;	PT	

Approve in writing any proposed plans and prescriptions for road works on access roads and silviculture rehabilitation site;	DM	
Revisit information sharing process if required;	PT	
FIELD ACTIVITIES: ROAD RESTORATION, MAINTENANCE AND DEACTIVATION		
Before commencing any road works, provide 48 hours notice to community watershed purveyors	PT	
Carry out access road restoration work in accordance with the approved road restoration plan, where required; QRP to carry out field reviews as required;	CS	
Maintain access roads in accordance with the approved maintenance plan;	CS	
Changed conditions: Advise DM of any structural maintenance issues; modify the maintenance plan and/or road use as required	QRP	
Carry out structural maintenance, if any, to the access roads as prescribed by QRP; QRP to carry out field reviews as required;	CS	
Carry out deactivation of the silviculture rehabilitation area, in accordance with the approved deactivation prescription; QRP to carry out field reviews as required;	CS	
Inspect the completed deactivation works on the silviculture rehabilitation area, and confirm the work's acceptability;	QRP	
Carry out silviculture rehabilitation of the proposed roads in accordance with the silviculture prescription;	PT	
Carry out final surface treatment of the access roads, in accordance with the approved maintenance plan; QRP to carry out field reviews as required;	CS	
Carry out road deactivation, if any, on the access roads, in accordance with the approved deactivation prescription; QRP to carry out field reviews as required;	CS	
Prepare and sign/seal the Project Assurance Statement to assure general conformance with the approved plans and prescriptions;	QRP	

SIGNED:	**DATE:**

SECTION 3: OBJECTIVES OF ACCESS

3.1 General

FCI silviculture rehabilitation of roads requires safe, environmentally sound access roads or road networks to fully meet the expected results of the silviculture rehabilitation work, with proper consideration of information sharing with First Nations and other stakeholders. Key elements in ensuring a successful access project include:

- suitable access planning, operational planning and field assessments by Proponents well in advance of field operations;
- assignment of professional responsibilities for assessments, prescriptions and oversight of implementation of road works;
- utilization of appropriately skilled personnel to carry out road activities, including road restoration, maintenance and deactivation/silviculture rehabilitation works;
- deactivation of non-status roads used for FCI access once their use is concluded, and the application of appropriate levels of inspections and maintenance until that time.

The following types of hazards can develop on roads:

- An unsafe road surface for transporting workers due to lack of proper brushing, grading or other surface maintenance treatments, or as a result of washouts or uncontrolled surface erosion;
- failed or damaged drainage structures that may need remediation work before they can safely transport workers and equipment;
- an unstable road prism or clearing width, or non-functioning road drainage system, that could result in a landslide or adverse gully erosion process;
- a non-functioning road drainage system that could result in sediment transport from the road prism and clearing width.

3.2 Condition of the Access

When an FCI project or project phase has been completed, the access road or road network may need to be deactivated, or treated in such a way that the road can be maintained as a wilderness road for periods of inactivity, or returned to a condition similar to that at the outset of the road use if the road is needed for ongoing use by others.

3.3 Shared Benefits

To increase the efficiency of program delivery, there may be benefits in carrying out fish passage restoration projects or other habitat restoration projects where other funding sources can be leveraged to do so. Project Proponents should consult with and be aware of any other habitat restoration work being done in the area that is funded by other sources such as the Habitat Conservation Trust Foundation.

SECTION 4: PROJECT ADMINISTRATION

4.1 General

As part of the overall FCI project plan, the Proponent must determine the location and extent of existing road access to the silviculture rehabilitation sites. This information normally is obtained using current map information supplemented by field reconnaissance and surveys. Each road or trail must be at or improved to one of the following levels:

- 2 wheel drive (usually roads currently being maintained by a road tenure holder or the Ministry)
- 4 wheel drive (usually roads on which access is to be restored prior to the commencement of the FCI project)
- ATV (usually non-bladed trails that service the actual silviculture rehabilitation sites from the junctions at the nearest roads)

4.2 Road Maps

Roads are originally established by the Proponent on a road map using existing spatial information. The road map must be at a scale of 1:20,000, and contain UTM coordinates on the axis. Mapping submissions may be PDF files derived from a hard copy map. Generally, no further map data will be required, except for maps related to vegetation surveys and the silviculture prescription.

4.3 Information Sharing

The Proponent must carry out all necessary consultation and information sharing with First Nations and other stakeholders including any known placer miners and free miners in the area and the BC Wildfire Service. The consultation results could make a road ineligible for silviculture rehabilitation if legitimate concerns are brought forward that require the road to be maintained.

4.4 Access Road Tenures

If an access road is an existing forest service road with no existing road use permit holder (maintainer):

- the Proponent will carry out required road maintenance and/or restoration to a standard that will enable the project works to be carried out safely and address environmental issues
- for those roads that will be deactivated at the conclusion of the FCI project, the Proponent will follow any local access planning processes, then the District Manager will discontinue and close the road at that time, and the Proponent will deactivate the road; if the decision is not to deactivate the road, there will be no change to the road tenure

If an access road is an existing forest service road with a Road User Permit (RUP) holder in place who is responsible for carrying out the road maintenance:

- normally, no maintenance and/or restoration work will be carried out by the Proponent; for such roads, a Proponent must enter into an agreement with the RUP holder regarding such work in accordance with the approved plans, as well as joint road use and safety issues.
- if no road use agreement can be worked out with the road use permit holder, the District Manager may consider shifting the maintenance responsibilities to the Proponent for the duration of the Proponent's activities.

If an access road is an existing road within an area under license, cutting permit, road permit or special use permit:

- normally, no maintenance and/or restoration work will be carried out by the Proponent; for such roads, a Proponent must enter into an agreement with the license/permit holder regarding such work in accordance with the approved plans, as well as joint road use and safety issues.

If an access road is an existing non-status road:

- for the rare situations where such a road will remain in use for forest management purposes after the completion of the FCI project, the District Manager may either establish the road as a Forest Service Road (FSR) or issue a road permit to a forest company;
- the Proponent will carry out required road maintenance and/or restoration to a standard that will enable the Proponent to carry out its project works safely

4.5 Restoration and Maintenance Plans

For those roads requiring maintenance and/or restoration work, the Proponent may be required to spatially locate individual works sites such as drainage structures using GPS instrumentation.

All GPS data must be captured in such a manner to yield positional accuracy results that are plus or minus 10 meters in x, y. Existing roads are to be submitted as single line strings (centerline). Each section from tie to tie point, (road intersections) is to be a discreet line string. All roads must intersect with a connecting road at a noded point.

SECTION 5: PROFESSIONAL RESPONSIBILITIES

Oversight for the road works carried out as part of the FCI silviculture rehabilitation of roads are considered to be professional forestry or engineering practices under the *Foresters Act* and the *Engineers and Geoscientists Act*.

5.1 Project Implementation

For FCI silviculture rehabilitation of roads, the applicable plans and any professional assessments or designs needed for the project activities must be carried out by a Qualified Registered Professional (QRP). Note that the QRP will also prepare a deactivation prescription for the road section(s) that are being rehabilitated (see Section 6.7).

Works that are required to be carried out on the road sections to be rehabilitated and the roads that will serve as access for FCI silviculture rehabilitation of roads include:

- detailed initial road inspection (including GPS locations of specific drainage structures or other works sites, restoration report and deactivation prescriptions) – carried out by the Construction Specialist (CS) under the oversight of the QRP;
- access road restoration – carried out by the CS under the oversight of the QRP;
- access road structural maintenance – carried out by the CS under the oversight of the QRP;
- routine access road surface maintenance – carried out by the CS under the oversight of the QRP;
- access road treatment at project conclusion – carried out by the CS under the oversight of the QRP;

While road implementation plans are being developed by the QRP, a silviculture prescription will be prepared by a Registered Professional Forester (RPF) for the silviculture rehabilitation area. Such a prescription will address site preparation and planting requirements, following completion of the road deactivation.

5.2 Road Project Assurance Statement

At the conclusion of the FCI silviculture rehabilitation of roads, the Proponent must notify the QRP that the project is complete, and that the Proponent has addressed all of its road responsibilities. The QRP will carry out a final field review of the access roads and the area being rehabilitated, and provide the Proponent with:

- a remediation order to properly complete its road obligations, if not satisfied with the Proponent's road works; and
- a Road Project Assurance Statement (see Appendix II attached) when satisfied with the Proponent's road works;

SECTION 6: ROAD WORKS

6.1 Project Implementation

Works that are required to be carried out on the road sections to be rehabilitated and the roads that will serve as FCI silviculture rehabilitation of roads access include:

- detailed initial road inspection (including GPS locations of specific drainage structures or other works sites, restoration report and deactivation prescriptions) – carried out by the CS;
- access road restoration – carried out by the CS;
- access road structural maintenance – carried out by the CS;
- routine access road surface maintenance – carried out by the CS;
- access road treatment at project conclusion – carried out by the CS;

The applicable plans and any professional assessments or designs needed for the above activities will be carried out by a Qualified Registered Professional (QRP). Note that the QRP will also prepare a deactivation prescription for the road section(s) that are being silviculturally rehabilitated (see Section 6.7).

While road implementation plans are being developed by the QRP, a silviculture prescription will be prepared by a RPF for the silviculture rehabilitation area. Such a prescription will address site preparation and planting requirements.

6.2 Road Inspection

The CS will undertake a detailed field inspection of the road sections to be rehabilitated and the roads that are expected to provide access to the FCI silviculture rehabilitation of roads. This may be done as part of or in conjunction with a joint site visit with the Proponent to ensure that the restoration plan is compatible with the Proponent's expectations of access. It would be advisable to have the RPF on the site visit to confirm any silvicultural requirements at the site.

Inspection records must ensure that key road elements are covered and any deficiencies noted. Where major problems exist, it is recommended that photographs be taken to accompany the inspections records. Information on the following items should be recorded on the FCI Road Inspection Report (see Appendix I attached) when an inspection is carried out:

- structural integrity of the road prism
- drainage systems
- road and bridge surfaces
- safe fish passage at stream crossings
- road safety

Based on the field inspection information, the QRP will prepare a restoration plan, where restoration work is required, as well as a deactivation prescription, and together with the CS, will also prepare a cost estimate for the road restoration and the deactivation work and the comparison with the original budget figures will be submitted to FCI. If necessary, the project size and /or budget may need to be re-scaled by FCI. Based on the agreed upon project scope and size, the CS will proceed to restoration of some or all of the proposed road access, and eventually to completion of the road deactivation works.

6.3 Road Restoration

(a) Overview:

Road restoration work is the responsibility of the Proponent and may include both surface and structural maintenance activities to improve the condition of the access. The program's objectives are that, consistent with the proposed lifespan of the road, the restoration work:

- provides the Proponent with timely road machinery and vehicle access (may be limited to ATV access) for the FCI silviculture rehabilitation of roads;
- meets safety requirements associated with the implementation of project operations, which include use by equipment, service and crew vehicles supporting the Proponent's operations;
- protects the structural integrity of the road prism and cleared area;
- ensures that drainage systems are functional;
- minimizes the transport of sediment from the road and its effects on other forest resources;
- ensures that safe passage for fish is provided at stream crossings;

Based on the restoration plan, the CS will carry out any required restoration work on those non-status roads required for access to the silviculture rehabilitation project.

In keeping with program objectives, the Proponent will encourage First Nations engagement in the delivery of on the ground activities. Where suitable equipment and operators are available, Proponents will negotiate with First Nations for competitive hired equipment hourly rates to carry out road works.

(b) General Requirements:

Restoration work will normally involve some or all of the following:

- brushing of the road clearing width to achieve vegetation control and to provide safe sight distances;
- removal of snags and leaning or overhanging trees that are a safety concern for road users;
- cleaning and grading ditches;

- cleaning and repairing culverts (including restoring fish passage) and fords;
- stabilizing road cut and fill slopes, landslides, rockfalls, and other sites of significant hazard;
- repairing of minor scours and washouts;
- repairing and grading the running surface of the road;
- repairing or replacing bridges;
- repairing or replacing cattleguards; and
- repairing or replacing damaged or missing signs.

(c) Detailed Road Restoration Standards:

Brushing

Brushing is to be minimized and carried out only when one or more of the following conditions occurs:

- The sight distance (the distance at which oncoming vehicles can be seen) and/or the usable road width are dangerously impeded or reduced. For example, potential hazards exist where brush limits visibility at the inside of a curve or at bridge approaches.
- The useable road width is dangerously reduced to the point that vehicles cannot safely pass each other at road widenings or turnouts.
- Drainage systems are functioning below acceptable levels and roadside vegetation is a major contributing factor.

Manual methods for removing trees, brush, and other vegetation may include the use of axes, machetes, sandvik axes, chainsaws, or gasoline- or air-powered circular saws. These methods are labour-intensive and require close supervision to ensure good production and worker safety.

Mechanical methods may include the use of crawler tractors, graders, hydro-axes, hydro-mowers or attachments for graders, front-end loaders, and excavators. The higher cost of operating mechanical equipment is usually offset by increased brushing productivity and user safety when compared to manual brushing and vegetation control methods.

Where feasible to do so, it is preferable to remove the residue after brushing and re-use it in the manufacture of wood products such as OSB or pulp, or for bioenergy. Otherwise, chipping and spreading will usually be carried out.

Brushing projects can create several hazards that must be taken into account during operations:

- Accumulated cut vegetation can plug culvert intakes and should be cleaned by hand concurrently with the brushing operation.
- Accumulated vegetation can plug ditchlines and should be either cleaned by hand or by a follow-up machine concurrent with brushing operations.
- Serious physical injury or equipment damage can occur when debris being cut by a machine shatters and flies in unpredictable directions. Appropriate roadway control (such as warning signs) should be used during operations.

Dangerous Tree Removal

All snags and leaning or overhanging trees that are a safety concern for road users or workers are defined by the Workers' Compensation Board of BC (WorkSafeBC) as "dangerous trees" in their OHS Regulation section 26.11. That regulation also **requires** that such trees must be felled; this is usually accomplished by hand falling.

Ditch and Culvert Repairs

One of the most critical aspects of any road restoration project is maintenance of the drainage system. Depending on the life of the road for the FCI silviculture rehabilitation of roads, the following types of works usually help to minimize the likelihood of clogged or damaged drainage systems which can potentially cause road washouts:

- Clean and grade ditches.
- Replace or repair ditchblocks, small culverts, flumes and rip rap, head walls, and spillways, particularly during and after major storms and after yarding and loading operations.
- Shape and grade off-take ditches to drain away from the road prism.
- Clean and repair culvert inlets, outlets, catch basins, trash racks, flumes, and transition areas from the ditchline to catch basins.

The primary function of road side ditches is to collect moisture from the road surface and the road base, directing the water to suitable discharge locations.

The following steps will be carried out as appropriate for the life of the road:

- Ditch maintenance will normally be limited to removing rock falls and any slumping or ravelling material, while maintaining as much grass cover or other low vegetative cover as is practicable.
- For those roads that will remain in service beyond the life of the FCI work, clean and grade ditches to keep them clear of obstructions that might seriously impede drainage flow. Debris that is hindering the flow of water should be removed. However, grass or low vegetation lining the ditches is desirable to minimize scour and sediment transport.
- Ensure that ditch water can enter culverts freely and directly. Ditches should be free of large pools of standing water to prevent saturation and weakening of the road subgrade, which can result in surface rutting.
- Keep the ditch elevation below the level of the subgrade to ensure the free drainage of the road base. The ditch gradient must be sufficient to maintain a continuous flow.
- When cleaning ditches, do not undermine ditch slopes, cutbanks, road shoulders, and culvert catch basins, and do not block the ends of culverts.

Material excavated during ditch cleaning that is unsuitable as surfacing or sidecast should be hauled to a designated spoil site. Ditches must be unobstructed by tall vegetation, so that maintenance equipment operators can prevent damage to culvert ends while they are cleaning the ditches.

A critical element with closed bottom culverts is their propensity for hindering fish passage, particularly over time. Culverts must be assessed, and appropriate actions taken to restore fish passage. This may require reconstruction of the culvert or modification of the site by backwatering or through baffle or weir installation to achieve passage flows.

Culvert maintenance operations must be carried out at a time and in such a way as to minimize the potential for sediment transport to streams, and include:

- cleaning and repairing culverts and ancillary drainage works (including outlet scour holes, the inlet settling basin, debris barriers and trash racks) to provide for flow of water; during cold weather operations, hot water generators, steam generators, or compressed air may be required to thaw culverts to provide for flow;
- replacing cross-drain culverts, flumes, and rip rap;
- installing additional cross-drain culverts and ditch blocks where required (usually evident where standing water or scour is observed in the bottom of the ditches).

If an existing cross-drain culvert cannot be unplugged in place, consideration should be given to removing and cleaning it, and then re-installing the culvert. Irreparable culverts must be replaced and the old culverts disposed of properly, and not left on the site.

Road Subgrade

Road subgrade restoration is necessary to ensure that the road system will fulfill its designed function until deactivation. The measures that might be suitable, depending on the remaining life of a road, are:

- stabilizing the road cut and fill slopes, repairing minor scours and washouts;
- removing loose rocks and stumps, or other unstable materials that present a hazard to road users;
- cleaning up slides, slumps, rock falls, and other sites where potential hazards are evident; and implementing professional measures to stabilize the site (if materials generated by the work cannot be otherwise used or sidecast on site, they should be removed and disposed of in designated disposal sites);
- correcting the potential failure of approach fills at stream crossings.

For roads that will remain in service beyond the FCI silviculture rehabilitation of roads, additional measures may include:

- repairing chronic soft subgrade areas and problematic frost sections by excavating and replacing the weak soils with suitable granular material, including use of geosynthetics where appropriate;
- replacing or repairing the running surface if the road has chronic problems with ruts, potholes, and a broken surface that renders the road unable to support design loads;
- relocating the road (may require an approved road layout and design);

Road Surface (Grading)

Roads must be graded to prevent water from standing or running down the road in wheel ruts or because of a lack of crowning, to maintain structural integrity or help protect the subgrade from damage. Grading to remove wash-boarding or pothole formation can also help reduce the costs of maintenance for those vehicles using the road and can improve the safety of road users.

Road grading must take place when moisture conditions are suitable, and not when the road is either too wet or too dry. Grading material over the banks or into ditches must be minimized, as this material is difficult to retrieve.

6.4 Routine Road Surface Maintenance

(a) Overview:

Routine road surface maintenance is the responsibility of the Proponent until the site planting is complete.

This type of maintenance incorporates regular inspections, and both regularly scheduled and remedial works carried out to ensure that road users can operate safely and forest resources are suitably protected.

(b) General Requirements:

Brushing of the road clearing width must be carried out to achieve vegetation control and to provide safe sight distances.

Grading must be carried out to facilitate traffic and provide proper road surface drainage.

Ditches must be cleaned and graded as necessary so that there is no serious impediment to water flow.

Other required works may include the maintenance/repair of stream culverts, bridge surfaces, signs, cattleguards, and fences.

(c) Detailed Routine Surface Maintenance Standards:

Brushing

This work consists of cutting all vegetative growth, including trees and other vegetation on roadway surfaces and roadsides. In addition to the following, ensure that any "dangerous trees" that may reach the road surface are felled.

Brushing is required when one of the following conditions occurs:

- Usable road width may be reduced to the point that vehicles cannot safely pass each other at road widenings or turnouts, or brush dangerously impedes sight distance at the inside of a curve or at bridge approaches or where heavy snow loads, on roadside trees, may cause the trees to bend over the road surface, both restricting use of the road and creating a safety hazard. In addition, where snow removal is an issue, brushing must be sufficient to accommodate snow placement beyond the road shoulder without impeding sight distance.
- Drainage systems are functioning below acceptable levels and roadside vegetation is a major contributing factor.

Grading

Roads must be graded to improve vehicle efficiency and ensure user safety. A properly graded road will also reduce the chance of sediment transport from the road surface. As such, roads must be graded before the surface:

- reaches severe stages of washboarding or pothole formation
- begins to trap water in windrows or ruts (windrows can result in water flowing down the road, scouring the surface, and causing a washout when it reaches a dip in the road).

Grading, including the shaping of the road shoulders, should take place only when moisture conditions are suitable, and not when the road is either too wet or too dry. Preferably, no windrows should remain after the final pass; at the very least, those that do remain should be breached to provide for drainage. Surfacing material should not be graded over the banks or into ditches, as this material is difficult to retrieve onto the road.

Ditch and Cross Drain Culvert Maintenance

The following types of maintenance works must be carried out where required to minimize the likelihood of clogged or damaged drainage systems which can potentially cause road washouts:

- clean and grade ditches; care must be taken to prevent undercutting of the cut slopes—a practice that will reduce their stability.
- clean and repair culvert inlets, outlets, catch basins, trash racks, flumes, and transition areas from the ditchline to catch basins.
- replace or repair ditchblocks, small culverts, flumes and rip rap, head walls, and spillways, particularly during and after major storms.

Particular care must be taken to minimize sediment when maintaining roads near fish streams or streams that are within domestic or community watersheds.

Installation of additional cross-drain culverts may be required to reduce ponding of water or scour in ditches.

Ditches must be kept unobstructed by vegetation, so that operators of maintenance equipment can see the drainage structures.

Stream Culvert Maintenance

In addition to the guidelines for maintenance related to fish habitat set out in the Fish-stream Crossing Guidebook, stream culvert maintenance must be carried out to ensure that a structure maintains its capability to convey stream flow. Such works include:

- repairing damaged inlets and outlets;
- repairing armouring around inlets and outlets to reduce sediment transfer, particularly in community watersheds; and
- removing debris blocking or obstructing culvert inlets;

Before beaver dams are removed, the Ministry of Environment must be contacted for permission and advice. Installation of beaver protection devices should also be considered.

Bridge Surface Maintenance

The maintainer must repair or protect parts of the bridges and approaches that do not directly affect structural integrity, including:

- repairing and replacing bridge signage including delineators;
- keeping the waterway opening free of logs and debris;
- resetting nails protruding from running planks;
- replacing missing or damaged running planks;
- repairing or replacing damaged guardrails or curbs; and
- minimizing pot holes on bridge approaches.

Sign Maintenance

Sign maintenance includes cleaning, replacing, and reconditioning signs, posts, and markers that currently exist or are the maintainer's responsibility to install. These may include radio frequency call signs, information signs, kilometer markers, traffic control signs and bridge delineators, where road use requires such items.

Sign maintenance includes regular hand brushing around them to ensure they are fully visible.

Maintaining Fences

Range fences that have been damaged as a result of activities on the road must be repaired or replaced. The Range staff in the local Natural Resource District office can advise on acceptable fence construction specifications and practices.

Maintaining Cattleguards

Cattleguard maintenance includes:

- keeping rails, fences, posts, and gates in good condition to ensure that the cattleguard fulfills its function.
- repairing broken welds or members promptly.

Road Shut Down criteria

The maintainer must cease vehicle traffic on the road or sections of the road that exhibit any or all of the following:

- rutting to the point that there is mixing of subgrade material with surfacing material (this can occur during thawing of the road or during periods of road saturation).
- damage to the subgrade is occurring
- surfacing material is eroding due to flowing water on the road

and must not resume use until the road is able to support vehicle loads and sedimentation has abated.

6.5 Road Structural Maintenance

(a) Overview:

The CS will carry out any required structural maintenance of the roads serving FCI silviculture rehabilitation of roads during the life of the project.

(b) General Requirements:

Structural maintenance is necessary to ensure that the road subgrade and drainage structures will fulfill their designed functions until deactivation. Measures may include:

- repairing the road subgrade and drainage structures where problems are occurring
- road modifications (may require a road design)
- cleaning up slumps and rockfalls and other sites of significant hazard and stabilizing the site where necessary.

(c) Detailed Structural Maintenance Standards:

Repairs to the road subgrade and drainage structures are normally specific to the element at risk and its shortcomings. As such, the site specific requirements must be detailed in the maintenance plan prepared by the QRP.

6.6 Access Road Treatment at Project End

(a) Overview:

Three options are available to deal with access roads at the conclusion of the FCI silviculture rehabilitation of roads, based on the district's determination of future needs for the roads. Any selected option(s) will be a project cost for the FCI program.

Future Use	Actions to be Taken
No future use is contemplated	QRP to prepare a deactivation prescription for the road, and the CS will deactivate at conclusion of silviculture rehabilitation work.
Further use is required, but not immediately	district will establish the road as an FSR; QRP will prepare plan to construct water bars and cross ditches to back up cross drain and stream culverts as part of wilderness road level of maintenance
Further use is required soon after completion of silviculture rehabilitation work	district will establish the road as an FSR; Proponent will return the road in a state that is at least equivalent to when the Proponent commenced work on the FCI silviculture rehabilitation of roads

(b) General Requirements:

Deactivated Road

For access roads maintained by the Proponent that will not be required when the Proponent concludes operations on an FCI silviculture rehabilitation of roads, the CS will deactivate the roads (these areas may be fully rehabilitated as well).

Self-Maintaining Road

For those access roads maintained by the Proponent that will be left as wilderness roads when the Proponent suspends or concludes operations on an FCI silviculture rehabilitation of roads, the CS will construct cross ditches and water bars, and take other actions as required to provide environmental protection while the road is a wilderness road (according to a plan similar to a ***Type 1 deactivation prescription*** described below and with hired equipment as per restoration and deactivation works). The district, timber sales office or licensee, as applicable, will then take on the ongoing responsibilities for road inspections and maintenance.

Final Surface Treatment

At the conclusion of the FCI silviculture rehabilitation of roads, for those access roads that will be required for continuing access by others, the Proponent must return the road to a state that is at least equivalent to when the Proponent commenced work on the FCI silviculture rehabilitation of roads. The Proponent's work will generally consist of a final grading together with ensuring that drainage structures and ditches are functional.

6.7 Road Deactivation

The intent of road deactivation is to place a road in a self-maintaining state that will indefinitely protect adjacent resources at risk. Road deactivation requirements typically include removing bridges and stream culverts, stabilizing the road prism, and, at the FLNRORD district's discretion, barricading the road surface width in a clearly visible manner to prevent access by motor vehicles (other than all-terrain vehicles).

The decision to deactivate access roads is made by the district manager, who identifies the roads as being candidates for road deactivation because there is no future use required, or to reduce risk, or the cost of deactivating plus eventually reactivating these roads is less than the cost of carrying out maintenance to a wilderness road level of maintenance over the period of expected closure.

For access roads that will no longer be required for use once the FCI silviculture rehabilitation of roads is completed, and for the road sections being rehabilitated, the CS must deactivate the road so as to place the road in a self-maintaining state, to meet the following objectives:

- stabilizing the road prism and clearing width.
- maintaining natural surface drainage patterns on the area within the road right-of-way and in adjacent or connected areas affected by the works both during and after construction.
- minimizing the impact of silt and sediment transport on other forest resources.
- in a fish stream, providing for safe fish passage and protection of fish habitat immediately upstream and downstream, and ensure the timing and description of the work are also aimed at achieving those objectives.

To achieve these objectives, the CS will carry out the works as required by the deactivation prescription prepared by the QRP, and in accordance with statutory requirements.

Deactivation Prescription

Deactivation work must be carried out in accordance with the QRP's deactivation prescription. A deactivation prescription is a written document that clearly communicates the objectives and the works to be performed. A deactivation prescription must:

- define the objectives of the planned deactivation work, the vehicle access requirements

(if an exemption under legislation has been granted to permit access by motor vehicles), and the techniques to be performed by station; and

- report special requirements (e.g., worker safety issues and other important requirements explained below).

A terrain stability professional must carry out a terrain stability assessment and prepare a road deactivation prescription if any of the following apply:

- terrain stability mapping indicates that the road is located on terrain that is unstable or potentially unstable;
- terrain stability mapping has not been done, and the road is located on terrain with slopes greater than 60%;
- the road is located on terrain where there are indicators of slope instability;
- the areas downslope or upslope of the road (or adjacent to or connected to it) contain elements at risk of damage or loss from a landslide, and the road crosses areas having a moderate or high likelihood of landslide occurrence;
- the road crosses areas where the product of the likelihood of a landslide occurring within a given period of time, and the likelihood will reach or affect the site occupied by a specific element of concern, is greater than low.

Following are the types of deactivation prescriptions:

Type 1 deactivation prescription: *The road traverses gentle terrain with no landslide hazard. There are a few crossings of S6 streams and some cross-drain culverts on the road. The risk of damage to adjacent resources is low or minimal. Deactivation measures are limited to water management techniques (such as installation of cross-ditches or waterbars and back-up of some stream culverts) and revegetation of exposed soils using a suitable grass seed and legume mixture.*

- The prescription requirement is a 1:5000 scale topographic map (or other suitable scale) showing the locations of recommended actions (and corresponding to the chainages of field markings) suitable for communication of the required works to field crews (and review and acceptance by the District).

Type 2 deactivation prescription: *The road traverses gentle to moderate terrain with no landslide hazard. There are culvert and bridge crossings of S5 and S4 streams, and cross-drain culverts along the road. Deactivation measures may include water management techniques (such as installation of cross-ditches or waterbars, removal or back-up of cross-drain culverts, and removal or back-up of stream culverts) and other measures such as repair of bridges and revegetation of exposed soils using a suitable grass seed and legume mixture.*

- The prescription requirements are a 1:5000 scale map (or other suitable scale) showing the locations of the actions corresponding to the chainages of field markings, and a tabular summary (spreadsheet) to accompany and complement the map. The tabular summary will provide more detailed information such as general site conditions, the size of existing culverts and bridges, sediment transport hazards and consequences, and methods to control sediment transport, including the measured chainages along the road and the corresponding actions. In this case, the prescription must clearly identify the fish streams and the timing windows for working in and about a stream.

Type 3 deactivation prescription: *The road is located on a mid-slope and traverses steep terrain and areas having a moderate to high likelihood of landslides. There may be visual indicators of road fill instability, surface soil erosion, and previous road fill washouts along the road.*

- This is a complex project, involving deactivation prescriptions for unstable terrain and the services of a Terrain Stability Professional. The deactivation prescription would include a

1:5000 scale map showing the locations of the actions corresponding to the chainages of field markings, a tabular summary (spreadsheet) to accompany and complement the map, and a detailed letter or report. The prescription should clearly identify the timing windows for working in and about streams. The prescription should also specify the need for any professional field reviews during the deactivation work.

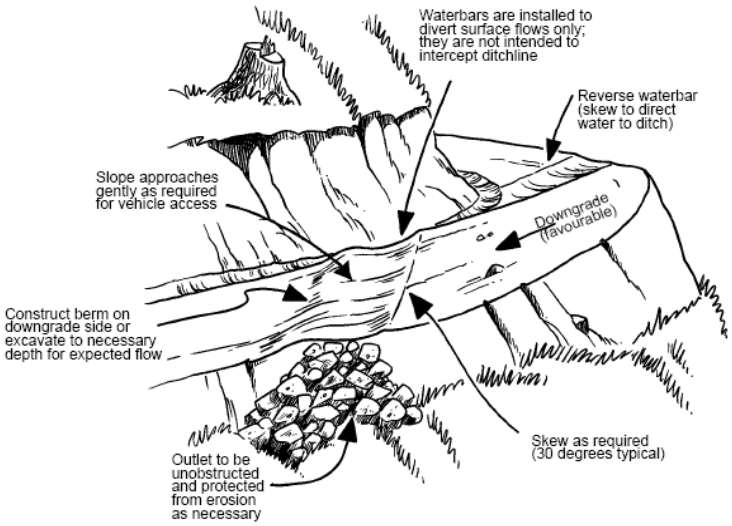
Deactivation Works

In accordance with the deactivation prescription, mandatory requirements for road deactivation include:

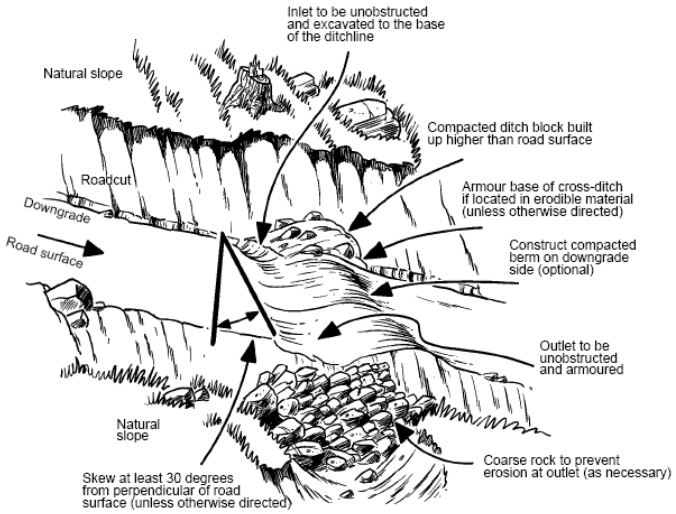
- removing all bridge and log culvert superstructures and all stream pipe, pipe-arch, and box culverts, and restoring channel and bank stability as required;
- removing bridge and log culvert substructures, if the failure of these substructures would have a material adverse effect on downstream property, forest resources, or other social and economic values;
- stabilizing the road prism or the clearing width of the road if stabilization (through water management, road fill pullback, and revegetation techniques) is necessary to reduce the likelihood of a material adverse effect on forest resources and other social and environmental values; and
- subject to District Manager exemption, barricading the road surface width (in a clearly visible manner) to prevent access by motor vehicles (other than all-terrain vehicle) using the installation of the most appropriate of the following barriers:
    - gate;
    - a soil or rock berm;
    - concrete blocks;
    - an excavation; and
    - other suitable barrier.

To assure drainage and stability, the following practices may be employed in the appropriate locations:

- constructing water bars along the road as shown below to intercept water on the road surface and convey it onto stable slopes below the road, in the following situations:
    - there is surface flow on the road grade (road scour)
    - relatively steep road grades
    - throughcut with steep grades, and surface erosion is expected
    - upgrade of a switchback to keep water off steep road grades at the switchback



and constructing cross ditches as shown below to back up cross drain and stream culverts, or to divert ditch water where there are insufficient cross drains and convey it onto stable slopes below the road:



- removal of stream culverts
- drains
- swales
- armoured fords
- insloping/outsloping road surfaces
- pullback of road or slope material

Only in areas where surface soil erosion and sediment transport are likely to occur without seeding, exposed soils that will support vegetation must be seeded. This should be undertaken in the first growing season.

In accordance with the Eligibiliy Criteria, warning signs must be erected during the period of road deactivation activities. Before the activities begin, hazard-warning signs should be installed at

appropriate locations to explain the purpose of the project, and warn potential users of the road of the hazards that can be expected on the whole road or at a particular location.

Where remedial works are required after deactivation has been carried out, FCI funding, if available, may be used to carry out those works.

APPENDIX I

SAMPLE DOCUMENTS

FOREST CARBON INITIATIVE (FCI)
SILVICULTURE REHABILITATION OF ROADS

PROJECT COMPLETION CERTIFICATE

PROPONENT NAME	FILE NO.
FCI PROJECT NAME AND LOCATION	PROJECT NO.
PROPONENT'S ADDRESS	

DESCRIPTION OF ROAD WORK (CHECK APPLICABLE BOXES)

- ☐ ACCESS ROAD RESTORATION
- ☐ ROUTINE SURFACE MAINTENANCE OF ACCESS ROADS
- ☐ ACCESS ROADS FINAL SURFACE TREATMENT
- ☐ ROAD DEACTIVATION AND SILVICULTURE REHABILITATION OF SITES

This is to certify that, as of _____, 20____, the work has been carried out to FCI'S satisfaction in accordance with the Engineering Standards, and the signed/sealed Road Project Assurance Statement is attached.

DATED THE _____ DAY OF _____, 20_____.	FCI REPRESENTATIVE'S SIGNATURE

ROAD PROJECT ASSURANCE STATEMENT

*TO BE COMPLETED BY QUALIFIED REGISTERED PROFESSIONAL **AFTER** COMPLETION OF A PROJECT*

Project Name	Project #	Forest District/Business Area

This assurance statement is for a project that includes (check one or more as applicable):

☐ road restoration	☐ access road final treatment
☐ routine road maintenance	☐ road deactivation on sites

This is to advise that I am the responsible Qualified Registered Professional (QRP) for the activities included above, and I am a: (check only one as appropriate)

☐ Registered Forest Technician (RFT) registered with the Association of British Columbia Forest Professionals (ABCFP)

☐ Registered Professional Forester (RPF) registered with the Association of British Columbia Forest Professionals (ABCFP)

☐ Professional Engineer (PEng), registered with the Association of Professional Engineers and Geoscientists of BC (APEGBC).

I have led, coordinated and taken responsibility for professional work related to road planning, restoration, maintenance and deactivation, including any necessary field reviews* and reviews of office works and outputs. I have completed the work as required under the Legislation for my profession, the Guidelines for Professional Services in the Forest Sector - Forest Roads as applicable to this project and by good practice.

Based on the above, I give my assurance** that:

- the work substantially complies in all material respects with the intent reflected in any approved documents and assessments; and
- any significant modifications from those documents or assessments have been approved by the professional that prepared the documents or assessments, OR the undersigned takes full responsibility for the modifications, and these modifications have been documented and marked on the as-built drawings.

* "Field reviews" means reviews conducted at the site of any field works by the QRP as appropriate or his or her subordinate acting under his or her direct supervision, that the QRP in his or her professional discretion considers necessary to ascertain whether the implementation of the work substantially complies in all material respects with the intent reflected in any approved documents and assessments.

** "Assurance" means that the QRP has undertaken the field and documentation reviews that, in his or her professional judgment, are considered necessary to ascertain whether the significant aspects of the project are in general conformance with approved plans, designs or other documents.

Signature of Qualified Registered Professional

Name of Qualified Registered Professional (please print)

affix seal here: