Wetland Ways

6

Interim Guidelines for
Wetland Protection and Conservation in British Columbia

March 2009

Chapter Six

MINING

Wetland Stewardship Partnership

These interim guidelines will be updated using experience from pilot testing and feedback from user groups. If you would like to comment on these guidelines, please send your comments to wsp@gov.bc.ca

Cover photos: Judith Cullington

CHAPTER 6: MINING

Wetlands complex.
PHOTO: DOUG BIFFARD

6.1. INTRODUCTION

This chapter provides guidelines for the protection and management of wetlands when resource extraction activities—notably mineral exploration and mining—take place nearby. It is intended to be read in conjunction with CHAPTER 2: GENERAL GUIDELINES.

Mining activities including exploration and associated access as well as reclamation activities, may destroy or damage wetlands in their immediate vicinity or downstream. For the purposes of this document, mineral exploration and mining includes coal and placer activities.

- **Direct loss and/or fragmentation**: Major site development (mines, processing facilities) can destroy or damage wetlands through clearing and excavation. Road and trail access and associated drainage, if improperly sited and installed, may cause infilling and drying out of wetlands, as well as creating a barrier to wildlife movement that impacts breeding and feeding activities.
- **Sedimentation**: Initial soil disturbance from site preparation and road construction exposes soil and makes it more susceptible to erosion. This is more severe where roads are on steeper slopes, soils are easily erodible, and where activities are carried out during wet periods. Ongoing erosion and sedimentation can occur from road surfaces, ditches, and road crossings. Sedimentation in wetlands can reduce biological productivity, stress wildlife (changing feeding and breeding behaviours), and may also affect downstream habitats.
- **Water Quality**: Metal leaching and acid rock drainage can kill aquatic organisms and stunt or destroy plants. Changes to water quality in or near wetlands and riparian areas can result in effects such as *eutrophication*[1], oxygen depletion, and impacts to plants and animals and their habitats.

HANDBOOK FOR MINERAL AND COAL EXPLORATION

In 2004 government and industry jointly produced the *Handbook for Mineral and Coal Exploration in British Columbia*. The Handbook is a compilation of recommended management practices that, subject to site-specific assessment and adaptation, can be implemented in the field and complement good planning and execution of the work program, as well as subsequent closure and reclamation activities on an exploration site. http://www.amebc.ca/mineralshandbook.htm

[1] *Definitions* can be found in the GLOSSARY.

- **Other impacts**: Resource extraction activities can result in direct disturbance of species from encroachment and excessive noise. New roads create a distribution system for invasive, non-native species (by humans and vehicles) and provide opportunities for recreational impacts to spread (e.g., boating and ATV use on wetlands).

6.2. LEGISLATION

See **CHAPTER 2** for legislation that applies to all land managers. Legislation that applies to mining and exploration land use and activities includes the following.

All B.C. legislation can be found at http://www.bclaws.ca/. Federal legislation can be found at http://laws.justice.gc.ca/.

- *Mines Act* and Mineral Exploration Code: The *Mines Act* manages the permitting, health and safety and reclamation for mining activities including exploration and mine development; allows for specific conditions for protection and mitigation of damages to watercourses affected by mining activities. Section 9 of the Health Safety and Reclamation Code (Mineral Exploration Code) identifies specific requirements for mineral exploration.
- *Mineral Tenure Act*: The Act provides the legal framework for the administration of mineral claims/tenures in B.C.. 'Minerals' include metal ores, dimension stone, rock or other natural products, but do not include coal, oil and gas and aggregate products.
- *Coal Act*: The Act establishes the legal authority, including leases and licences, for licensees to access, enter onto, and occupy lands for the purpose of coal exploration and production. Certain lands such as parks and ecological reserves are excluded.
- *Geothermal Resources Act*: Regulates activities including drilling to access geothermal resources and can set requirements for drilling in and around water covered areas and controlling release of 'geothermal resources water'.
- *Environmental Assessment Act*: sets out procedures and requirements for major project reviews. Legislation is managed by the Environmental Assessment Office.

6.3. OBJECTIVES

As outlined in CHAPTER 2, there are three major objectives for the protection and management of wetlands:

- Protect and maintain water quantities;
- Protect and maintain water qualities; and,
- Protect and maintain habitats and species.

This can be achieved by:

- Knowing what you have (inventory and mapping) (see CHAPTER 2);
- Protecting wetlands with buffer zones; and,
- Minimizing impacts from human activities, such as resource extraction.

Following the guidelines in this document will help landowners and land managers demonstrate that they have applied due diligence. Monitoring the impacts of activities will assist in meeting the objectives. For more information, see CHAPTER 12: MONITORING AND REPORTING.

Small mineral exploration drill. PHOTO: MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES

6.4. GUIDELINES

6.1.1. Exploration

Initially, resource exploration activities generally occur broadly across the landscape. However, as exploration progresses to later stages impacts can be more localized and intensive. Mining activities require extensive access networks including trails and roads. Where practical operations try and take advantage of existing access networks. Later-stage mineral exploration may use small-scale on-site processing. Impacts of these activities are discussed in CHAPTER 2.

General

PLAN TO AVOID IMPACTS TO WETLANDS

☐ Identify the location, size and type of wetlands from topographic maps, aerial photos, and other available information. Include information on vegetation types, the 100-year flood plain, and the presence of threatened or endangered species where available.

Groundtruth this information when conducting reconnaissance surveys.

- ☐ Plan operations to avoid wetlands as much as possible.
- ☐ Ensure that you have all the necessary legislative approvals and permits before commencing any work.
- ☐ Schedule activities to avoid critical breeding and rearing seasons. Conduct exploration activities when these will have the least impacts on wetland habitat (e.g., winter or dry periods). Regional least-risk windows for fish and wildlife are available at the Ministry of Environment website.

MINIMIZE IMPACTS FROM EXPLORATION CAMPS

- ☐ Locate camps and sewage disposal facilities at least 100 m from the normal high water mark of wetlands to prevent possible pollution or siltation. Never discharge wastes directly to wetlands.
- ☐ Minimize disturbance to wetland wildlife and habitat by limiting or preventing access to wetlands, including riparian areas.

DISPOSE OF HAZARDOUS WASTES SAFELY

- STOP Never discard special wastes on or near wetlands.
- ☐ Transport any special wastes such as paint and paint cans, waste oil, and filters solvents to an authorized disposal site.

Reclaimed settling ponds from coal mining operation. PHOTO: ROBERT COX

Portable geo-physical drill. PHOTO: ROBERT COX

Mineral Exploration

More detailed information related to mineral exploration activities can be found in the *Handbook for Mineral and Coal Exploration in B.C.*

AVOID OR MINIMIZE IMPACTS FROM DRILLING

- ☐ Design surface drainage structures based on the expected flow, sub-grade soil conditions and the expected duration of their use. Surface drainage structures (e.g., interceptor ditches) should be constructed to intercept and divert runoff, preventing erosion of the drill pad and sump.
- ☐ Limit the production of excess muds, additives and process water.
- ☐ Provide oil-absorbent matting to catch grease and oil around the drill rig. This is important if drilling occurs in environmentally sensitive areas where the potential contamination of soil, surface water, or groundwater is of particular concern.
- ☐ Use more environment-friendly drilling fluids and additives to reduce toxicity such as organic or synthetic additives, lubricants (e.g., lubra beads and gilsonite-based additives), and low solids non-dispersed drilling fluid systems.

- Never release drill fluids, additives and cuttings into waterways or allow them to run uncontrolled. Use an adequately sized closed-circuit facility for drilling mud and flocculating agents.
- Dispose of solid waste, such as additive containers, rags, domestic refuse, and drill core boxes at an approved off-site facility. Provide suitable collection containers for use by drill contractors.
- Return opened but unused chemicals, additives and drilling muds to the supplier/vendor.
- Ensure that any groundwater flowing from boreholes doesn't negatively affect wetlands by impacting water quality or normal hydrologic functioning. Test water quality prior to any release.
- Assess the drill core for the potential for mineral leaching and acid rock deposition, as this will assist further exploration and planning to avoid, prevent, or manage these impacts.

6.1.2. Construction and Operation

Although mine and well site development are often focussed on upland areas, they can have significant wetland impacts such as direct loss through site clearing and excavation, pollutant impacts on water quality, and increased road and infrastructure development leading to increased human disturbance. Mine and well sites typically have an operating life of approximately 20–25 years.

Mining Operations

PROTECT REMAINING WETLANDS

- Protect remnant wetlands that have not been impacted by mine activities. Eliminate or minimize erosion and sedimentation and hydrologic impacts by retaining riparian buffers and diverting surface water to settlement ponds. Prevent infilling by placing and protecting fill or disturbed soils so that they cannot be transported into wetlands.

CONTROL METAL LEACHING AND ACID ROCK DRAINAGE

- ☐ Divert surface water away from mine operations, including buildings and tailings piles.
- ☐ Cap in-place contaminated material with clean material.
- ☐ Prevent acid rock drainage from entering wetlands by diverting the water to treatment ponds.

Wyoming's best management practices for mining can be found at http://gf.state.wy.us/wildlife/nongame/LIP/BestMgmtPractices/index.asp

AVOID IMPACTS FROM PRODUCED WATER FROM COAL BED METHANE OPERATIONS

Coal bed methane (CBM) is natural gas that is found in most coal deposits. As part of the production process, pressure in the coal seam is reduced by 'dewatering', allowing the gas to flow more freely. The water removed from the coal seam is referred to as 'produced water'. Produced water may contain contaminants such as salts and metals.

- ☐ Locate drill sites at least 100 m from wetlands.
- STOP Do not discharge produced water to wetlands or streams. Produced water should be re-injected back into the well bore.
- ☐ Ensure that the dewatering production process does not impact wetland hydrological processes by affecting groundwater recharge.

REDUCE NOISE DURING SENSITIVE TIMES

- ☐ Locate or manage constant noise generators (e.g., drill rigs, bulk sampling operations) to minimize the effects of continuous noise on sensitive bird populations, particularly during the bird nesting season.

6.1.3. Reclamation

General

AIM TO RECREATE NATURAL, PRE-DEVELOPMENT VEGETATION

- ☐ Re-vegetate exposed soils adjacent to wetlands with a mix of native species that will re-establish the site complexity that existed prior to disturbance. Seed mixes should be certified weed-free.
- ☐ Plant directly by hand to minimize further impacts to wetland soils

ACID ROCK DRAINAGE

Acid rock drainage (ARD) is the outflow of acidic water from abandoned metal mines or coal mines. ARD occurs due to the action with water and oxygen on freshly exposed material, usually containing an abundance of sulphide minerals. The acidic nature of the water leaches metals from the rock which are transported along with the acidic water. ARD and leached metals can kill fish and aquatic insects and stunt plant growth as well as contaminate groundwater.

and remaining vegetation.

- ☐ Maintain the site to prevent the establishment and spread of weeds and invasive species until native vegetation is self-sustaining.

Mine Site Reclamation

Mine permitting under the *Mines Act* requires the development of a mine site reclamation plan. Each reclamation plan will be unique to the type of operation, location and the end use that has been determined for the reclaimed lands. Where wetlands have been lost or damaged the reclamation plan will identify the steps that the mine operator will be required to carry out to enhance, restore or potentially create wetlands to accommodate impacts form the mining operations.

Ecosystem features are physical attributes that create many different types of habitat for different species. Examples include snags (standing dead trees), ground cover, and large woody debris in streams.

Ecosystem functions are processes that keep an ecosystem operating. Examples include infiltration of surface water, evapo-transpiration and nutrient cycling.

RE-ESTABLISH WETLAND FEATURES AND FUNCTIONS

- ☐ Re-establish fully functional wetlands where wetlands have been impacted by mine development or operation. Wetland restoration, enhancement or creation will generally be a component of any approved mine development plan where wetlands will be impacted during development or operation. Each situation will be unique but the general principles outlined in CHAPTER 11: ENHANCEMENT, RESTORATION AND CREATION should apply.
- ☐ Monitor the wetland component of mine site reclamation and carry out necessary works to ensure that wetland features and functions are stable and self-supporting.

AVOID ACID ROCK DRAINAGE

Acid rock drainage (ARD) from abandoned mines can cause extensive ecological damage if not properly managed. Acid mine drainage introduces high levels of acidity and heavy metals into the wetland environment through runoff and through direct drainage from mines into wetlands. Natural wetlands have the capacity to buffer some of the acidity and absorb a certain amount of the pollutants, but over time, assimilative capacity will be exceeded.

- ☐ Prevent ARD and leached metals from impacting wetlands by applying and maintaining appropriate control and treatment processes for the level of contamination and sensitivity and value of adjacent wetlands. In many circumstances ARD control and management is a long-term liability for mine operators.

6.1.4. Roads and Trails

Road and trail construction and use can be a major source of sediment delivery to wetlands. Roads in or close to wetlands can cause habitat loss through infilling or dewatering. Roads and crossings can also lead to habitat fragmentation. Once in place, roads can also facilitate the distribution of invasive, non-native species and provide opportunities for increased recreational impacts. Building roads in or near wetlands is difficult and expensive.

For information on minimizing impacts from road and trail building, see **CHAPTER 9: ROADS AND CORRIDORS**.

Mineral exploration trail. PHOTO: ROBERT COX

Road and Trail Design

DESIGN ROADS TO AVOID OR MINIMIZE WETLAND IMPACTS

- ☐ Ensure you have all necessary permits and authorizations prior to working in or about wetland areas. Crossings for operations are regulated under Part 9 of the *Water Act*. (The *Water Act* regulations stipulate that mineral exploration activities follow requirements in the Mineral Exploration Code—see SECTION 6.2: LEGISLATION).
- ☐ Keep roads and trails outside riparian areas except at designated stream or wetland crossings.
- STOP Avoid constructing roads through wetlands unless there are no reasonable alternatives. Constructing roads in areas where the soil is

prone to erosion and compaction (i.e., fine and wet soils) leads to soil erosion, wetland pollution, and destruction of wildlife habitat.

- ☐ If wetlands must be crossed, select a route that minimizes the area impacted by construction and operation. Use existing roads or trails wherever possible. New crossings should be parallel to the direction of water flow to the degree practical.

MINIMIZE THE NUMBER OF WETLAND AND STREAM CROSSINGS.

- ☐ Minimize the width of roads consistent with maintaining safety and road design considerations.
- ☐ Design to avoid erosion and sedimentation
- ☐ Design the road to follow the natural contour of the land, as this will avoid the need for extensive cut and fill.
- ☐ Minimize the changes in the natural stability of the land—place roads on high ground, keep out of streamside management zones and wet areas, and keep off the toe of banks and slopes.
- ☐ Design approaches to wetlands so that surface runoff carrying potential sediment is diverted before entering the wetland.
- STOP Avoid steep downhill approaches to prevent erosion from high velocity runoff.
- ☐ Determine the type and depth of wetland subsoil to ensure proper design and construction.

Road Construction

PROTECT WILDLIFE AND WILDLIFE HABITAT

- ☐ Design, install and maintain wetland road crossings to provide for passage of fish and other aquatic organisms.
- ☐ Carry out construction activities during periods of least risk windows to minimize impacts to wildlife during critical periods (migration, breeding, etc.). Contact your local Ministry of Environment office for information on timing windows.

B.C. Ministry of Environment offices: see http://www.env.gov.bc.ca/main/regions.html

Fisheries and Oceans Canada offices: see http://www.pac.dfo-mpo.gc.ca/pages/default_e.htm

MINIMIZE EROSION

- ☐ Install and maintain erosion control measures if exposed soils might cause sedimentation in nearby wetlands.
- ☐ Apply straw, mulch, or fibre mats on exposed soils until the area can be vegetated to prevent erosion. This protects and holds soil particles from the erosive effects of rainfall and also helps to prevent the spread of noxious weeds.

- ☐ Direct ditch waters onto undisturbed forest floor or other vegetated areas at frequent intervals prior to reaching wetlands to allow water to infiltrate and sediment to settle out. Never drain road side ditches directly into wetlands or streams.
- ☐ Suspend or limit operations when soils become saturated. Check weather forecasts make sure operations are not at a critical stage when wet weather arrives.

MAINTAIN NATURAL WATER FLOWS

- ☐ Maintain the natural hydrograph. Provide cross drainage to maintain natural surface and subsurface flows. Ensure that drainage systems continue to function during construction.

Open pit coal mine. PHOTO: ROBERT COX

- ☐ Construct ditches in wetland crossings, where necessary, to intercept and carry surface and subsurface water (the top 30 cm) to, through, and away from culverts.
- STOP Avoid having ditches create outlets that will result in drainage of the wetland.
- STOP Do not constrict wetland drainage (inlets or outlets) with undersized culverts. Clear span bridges are the preferred crossing method.
- ☐ Place culverts at the low points of the wetland to pass surface water flows through the road embankments.

USE CLEAN MATERIAL FOR FILL

- ☐ Construct road fills in wetlands only when absolutely necessary. Use clean gravel or crushed rock as fill to provide for water movement.
- STOP Do not side cast road construction material into riparian areas. Place sidecast or fill material above the ordinary high water mark of any wetland. Use fill from upland sources to minimize impacts on wetland habitat.

AVOID IMPACTS FROM WINTER ACCESS

Activities are often conducted during the winter in areas where wet ground conditions make summer operations difficult. Once winter conditions are acceptable snow crossings of wetlands may be done by pushing and compacting clean snow fill onto frozen wetlands to provide a level crossing for equipment. In sites with deeper water, ice bridges may be used to provide access. In both cases care must be taken not to introduce sediment and debris into the wetland during construction, operating and decommissioning.

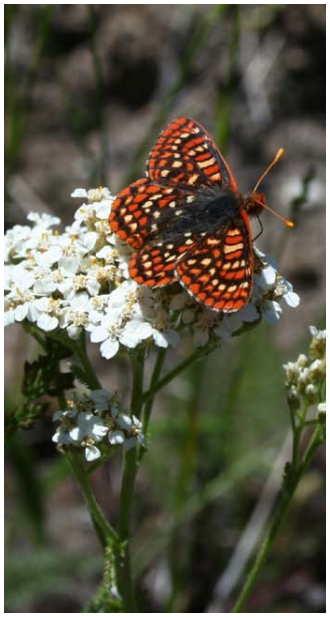

PHOTO: SARMA LIEPENS

- ☐ Locate ice bridges so as to minimize cutting into the wetland or streambank during construction of the approaches
- ☐ Use only clean snow to construct winter snow roads across wetlands. Ensure the surface is clean and free of any debris when road use is finished or prior to thaw.
- ☐ Construct approaches with clean compacted snow and ice and build to a thickness adequate to protect wetland and streambanks and riparian vegetation. Construction should begin from the ice surface. Where limited snow is available, locally available gravel from approved pits can be used to build up approaches, but this should be removed when the ice bridge is deactivated.
- ☐ Clear snow in a manner that leaves the surface of the ground undisturbed. This will help avoid damage to the natural soil surface and excessive soil loss in the spring as the ground thaws.
- ☐ Remove any accumulated debris and dirt from the bridge and place at a stable location above the high water mark of the wetland. Ensure erosion protection measures are in place where required.
- ☐ Remove all ice bridge approaches during deactivation. Where streambanks have been exposed to mineral soil, they should be re-contoured and re-vegetated using all appropriate measures to stabilize the site and facilitate its return to a vegetated state.

- ☐ Remove all snowfills and support materials before the spring melt. Removed snow should be placed above the normal high water mark of the stream to prevent it from contributing to sedimentation and erosion. Deactivation should include the use of all appropriate measures to stabilize the site and facilitate its return to a vegetated state.

Trail Construction

CONSTRUCT ACCESS TRAILS WITH CARE

- ☐ Avoid grubbing, grading and blading[2] whenever possible. Retain existing natural vegetation wherever possible as it provides the best and lowest cost runoff and erosion control.
- ☐ Limit or delay grubbing where clearing is required until grading and construction is to proceed; the root masses and associated organic matter provide substantial erosion control.

Road Operation and Maintenance

MANAGE ACCESS

- ☐ Manage entry to operational areas during and after extraction activities where unauthorized use is impacting wetland species and habitat (e.g., mud bogging).

OPERATE VEHICLES ONLY ON ESTABLISHED ROADS AND TRAILS.

- ☐ Minimize traffic on roads during wet conditions. Consider using geomat or rock to reduce road damage.

MAINTAIN ROADS AND DRAINAGE

- ☐ Inspect wetland crossings frequently during operations to determine if erosion is being controlled. Banks should be stable and soil movement into the wetland should be minimal.
- ☐ Maintain road running surfaces, ditches and cross drains to minimize erosion and sediment delivery. Correct any problems immediately.

MANAGE FUEL AND OTHER HAZARDOUS MATERIALS

- ☐ Follow appropriate fuel management regulations.
- ☐ Locate pumps and accompanying machinery in a manner that does not cause the wetland bank to erode or introduce sediment into the watercourse:

[2] Blading: exposing soils

Reclaimed placer mining settling ponds. PHOTO: ROBERT COX

- ☐ Provide fuel spill and leakage containment around the pump.
- ☐ Store fuel or other toxic fluids at least 100 m from wetlands. Provide containment so spills or other leakage will not be transported to wetlands.

Roads and Trail Reclamation

PUT UNUSED ROADS TO BED

- ☐ When all activities are completed, reshape the roadbed if needed. Open all drainage systems and stabilize erosion-prone areas.
- ☐ Remove temporary fills and structures in wetlands to the extent practical when use is complete.

RE-VEGETATE DISTURBED SITES

- ☐ Establish a vegetative cover planting on erodible areas that were cultivated in the fall but will not be planted until spring and where natural vegetation is not sufficient to stabilize the soil.
- ☐ Use native grasses or other plant species to reseed bare, erodible areas; never introduce invasive, non-native plants.

6.5. REFERENCES AND FURTHER READING

Government Offices

B.C. Ministry of Environment regional offices. http://www.env.gov.bc.ca/main/regions.html

Fisheries and Oceans Canada offices. http://www.pac.dfo-mpo.gc.ca/pages/default_e.htm

Websites

B.C. legislation. http://www.bclaws.ca/

Federal legislation. http://laws.justice.gc.ca/

Abandoned Mine Reclamation Clearing House. http://amrclearinghouse.org/

Association of Mineral Exploration in British Columbia. http://www.amebc.ca/default.htm

B.C. Environmental Assessment Office. http://www.eao.gov.bc.ca/ea_process.html

B.C. Ministry of Energy Mines and Petroleum Resources, Mines and Minerals Division. http://www.em.gov.bc.ca/subwebs/mining

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