

BC Placer Mining Best Management Practices

Technical Guide



November 2019



Ministry of Energy, Mines and Petroleum Resources

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Preface

The Ministry of Energy, Mines and Petroleum Resources (EMPR) is committed to ensuring that BC remains a world leader in mine health and safety practices. This includes ensuring that mining activities are planned, designed, implemented and maintained in a manner that respects and protects land, water, current land use and cultural values.

Placer mining is regulated by the Provincial Government primarily under the *Mines Act*, the *Water Sustainability Act*, and the *Environmental Management Act*. Miners are responsible for obtaining all necessary authorizations before commencing work. The best practices described in this document do not authorize anyone to conduct or participate in activities that are contrary to any statute, nor do the best practices establish any legal requirements.

This guide aims to assist placer miners in conducting environmentally responsible and safe mining activities that are in compliance with regulatory requirements. It provides current legislative and technical reference materials regarding exploration, water management, settling ponds, reclamation, Indigenous engagement, and fish and wildlife impact mitigation. The best practices are informed by applicable legislation and regulations, expert experience, existing best management documents, and scientific knowledge and literature. However, they do not represent an exhaustive list of available and appropriate best practices. This guide is subject to change based on changes in regulations, the results of effectiveness monitoring, new science and trial results.

THESE BMPS ARE GUIDANCE ONLY. PROPONENTS ARE RESPONSIBLE FOR REFERRING TO THE ACTUAL LEGISLATIVE PROVISIONS FOR THEIR EXACT LEGAL OBLIGATIONS AND FOR ENSURING THAT THEY ARE REFERRING TO THE MOST CURRENT VERSION OF THE BMPS.

Acknowledgements

We would like to thank the Atlin Placer Mining Joint Initiative Working Group for the work done on the development of the Atlin Placer Mining Best Management Practices (BMP) Guidebook, from which this technical guidance was adapted.

The Atlin Placer Mining Joint Initiative Working Group includes members from the Province of BC, Taku River Tlingit Indigenous Nation and Atlin Placer Miners' Association. Upon request from the British Columbia & Taku River Tlingit Government to Government Forum in 2015, the working group produced the Atlin Placer Mining Best Management (BMP) Practices Guidebook. A number of groups and individuals dedicated a tremendous amount of time and energy to ensure the successful delivery and development of these best management practices, including representatives from the Atlin Placer Miners' Association (APMA), the Taku River Tlingit Indigenous Nation (TRTFN), the Ministry of Energy and Mines (MEM), the Ministry of Forests Lands and Natural Resource Operations (FLNRO), the Ministry of Environment (ENV), individual placer miners and consultants.

Since that time, an internal working group of mine inspectors and specialists has worked through the document to improve the information and specifications, and develop a set of BMPs that could be implemented across the province. Reviewers included Jennifer McConnachie, Reclamation Manager James Robinson, Mechanical Inspector from EMPR, as well as Eric Smith and Karen Diemert from FLNRO. The guidebook was vetted through Nalaine Morin, of the Tahltan Nation, and Cathy Conroy, of Ktunaxa Nation Council, to ensure the accuracy regarding cultural and wildlife concerns as part of bringing the best management practises to a provincial stage.

Jason Jacobs of the East Kootenay Chamber of Mines has provided input and collaborated on this guide.

Countless other individuals have been involved in the creation of this document. Thank you to everyone who contributed.

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1 Introduction

The intent of the BC Placer Mining Best Management Practices Technical Guide (“Guide”) is to provide placer mine operators with legislative and technical information to ensure their operations are safe, environmentally responsible, and respectful of other values on the land. These best management practices (BMPs) aim to provide the placer mining industry in British Columbia with tools and knowledge for achieving regulatory efficiency, certainty and timeliness.

The Guide is designed to be a practical, user-friendly tool for placer mine operators requiring a *Mines Act* permit. It provides a chance for the Province of British Columbia, Indigenous Nations and placer miners to work as partners, with an equal understanding of the steps, requirements and expectations for placer mining today in the province.

The objectives of the Guide are to:

- Encourage responsible mining in British Columbia to facilitate the longevity of the placer mining industry;
- Provide knowledge and tools to assist the placer mining industry in limiting and mitigating its impacts on other land use values, such as recreation and cultural practises; and,
- Provide guidance to new and experienced placer miners on the best ways to conduct their mining activities in conformance with accepted practices, the *Mines Act* and the Code.

1.1 Why Use this Guide

The information in this Guide will help to ensure that placer mining activities are planned and carried out in compliance with applicable legislation, regulations, and policies. Consistent, timely, and effective implementation of the BMPs outlined in the Guide can provide significant benefits for the placer mining industry, allowing miners to:

- Build positive relationships with local Indigenous Nations, communities and other land users;
- Build positive relationships with neighbouring placer miners;
- Reduce conflicts through planning and proper environmental protocols; and,
- Be efficient, effective and consistent in working on their mine sites.

1.2 How to Use this Guide

The Guide is a tool for mine owners, managers and all levels of workers. Placer miners are encouraged to review the Guide in its entirety before planning their next field season and/or submitting a *Mines Act* Notice of Work (NOW) application, to assess how they can incorporate BMPs into their planning, operation and reclamation activities.

In preparing a mine plan, reclamation plan or NOW application, applicants are encouraged to reference specific, relevant BMPs. As this document is anticipated to evolve over time, it is recommended that applicants also refer to the year or version of the BMPs that they are referencing (e.g. “I will use existing roads to access the site, as per BMP 4.2A (2019).”). This demonstrates that

these BMPs have been considered in the planning of the operation. Additionally, where it is deemed relevant, inspectors may reference a specific aspect of the BMPs and request that the application show how that practice is being incorporated into the operation.

Chapters 3 through 7 of the Guide are all organized into five sections:

- The Overview defines the subject, explains how that aspect of mining operations fits into the stages of placer mining (as described in Appendix 1), and why BMPs are important for this subject.
- The Background provides additional material and a more detailed explanation of the topic at hand.
- The Current Regulatory Requirements section provides a summary of provincial and/or federal regulatory obligations and links to relevant documents and references. **This summary is not all encompassing, and it is the responsibility of placer miners to be well versed in their regulatory obligations.**
- The Best Management Practices section comprises a table identifying the specific BMPs relevant to the topic of the chapter to undertake during placer mining. It is anticipated that placer miners will accept and use these BMPs in addition to their field experience, knowledge and ingenuity.

It is always important to ensure that you are working within your expertise. In some chapters of the Guide, BMPs advise placer miners to obtain technical advice and assistance from qualified professionals. Qualified professionals are required to design and implement some aspects of mining operations. However, it may also be necessary to consult a professional to validate that your plans will work as you expect or to identify solutions for particularly challenging site conditions. Often the cost of professional consultation offsets potential expenditure on operational changes due to the finding of regulatory non-compliance, failure of mitigation measures, or administrative monetary penalties due to repeated or serious non-compliance.

1.3 For Further Information

The placer mining industry is regulated on behalf of the Province mainly by the Ministries of Energy, Mines and Petroleum Resources (EMPR), Environment and Climate Change Strategy (ENV) and Forest, Land, Natural Resource Operations and Rural Development (FLNRORD). Placer miners are encouraged to consult these ministries with any questions or to determine what permits and authorizations are required for mining.

Consult FrontCounter BC for further details at: <http://www.frontcounterbc.ca/>

2 Permitting

2.1 Provincial Legislation and Regulations

Mines Act

British Columbia's mineral exploration and mining industry is an integral part of the provincial economy. EMPR, FLNRORD and ENV regulate the extraction of BC's substantial mineral resources on behalf of the Province. The ministries implement policies and programs that encourage the responsible development of mineral resources and ensures that all mining activities respect the health and safety of workers, the public and the environment.

The *Mines Act* and the accompanying Code provide the regulatory framework for mining activities in BC, although other legislation may also apply to individual projects. Section 10 of the Code outlines the permitting steps associated with placer mine exploration and development. To obtain a permit under the *Mines Act* for a placer mine or exploration project, proponents must submit an application to FrontCounter BC. Proponents are responsible for ensuring their application meets the requirements of the current version of the *Mines Act*, the Code, and other relevant legislation. The *Mines Act* and Code, along with guidance documents, can be found at:

<http://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/health-safety/health-safety-and-reclamation-code-for-mines-in-british-columbia>

It is the responsibility of the mine manager to be familiar with and adhere to the conditions in its permit, the *Mines Act* and the Code. It should be noted that section 10.1.19 of the Code exempts placer mines from compliance with sections 10.1.2 to 10.1.17 of the Code, unless required by the Chief Inspector. A recent change in the Code (section 10.4.1) now requires every placer mine to submit a mine and reclamation plan every 5 years.

Water Sustainability Act

Responsible use of British Columbia's valuable water resources is a primary objective of provincial environmental regulations. The primary provincial statute regulating surface and ground water resources is the *Water Sustainability Act* (WSA). Under the WSA, a "stream" is defined as "a natural watercourse, including a natural glacier course, or a natural body of water, whether or not the stream channel of the stream has been modified, a natural source of water supply, including, without limitation, a lake, pond, river, creek, spring, ravine, gulch, wetland or glacier, whether or not usually containing water, including ice, but does not include an aquifer."

A water authorization under section 6 of the WSA may be required to divert, use or store water for placer mining processing activities. The requirement to obtain authorization to use water is dependent upon the type of mining or exploration that is planned, and in some cases, the expected volume of pay dirt. Further information can be found at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/water-rights/info_update_mineral_exploration_and_small_scale_placer_2019.pdf

Currently, individuals conducting "mineral exploration activities" or "placer mining activities", as defined in the Water Sustainability Regulation, may use unrecorded water without an authorization

subject to certain requirements. These requirements are listed in section 56 of the Water Sustainability Regulation and summarized below:

- The person must hold a permit under section 10 of the *Mines Act* in relation to the placer mining activity or mineral exploration activity;
- The person may only divert unrecorded water;
- The person must not divert or use unrecorded water from:
 - A stream where there is a treaty water reservation or the Nisga'a water reservation;
 - A sensitive stream designated under section 17, and listed in Schedule B, of the Water Sustainability Regulation¹;
 - A point of diversion within a protected area, as defined in section 46 of the Water Sustainability Regulation;
 - A stream of aquifer dedicated for agricultural use; or,
 - A stream when a temporary protection order under the WSA applies.
- The person must not construct, install or place any permanent or semi-permanent works in the stream channel and must remove the works for diverting water from the stream after the placer mining activity or mineral exploration activity is completed;
- The water supply intake must be equipped with a screen, or otherwise modified, to:
 - Prevent potential loss of fish due to entrainment or impingement; and,
 - Minimize disturbance or removal of sand and gravel from the stream channel;
- The person must ensure that any disturbance of the stream channel and riparian areas are minimized when accessing water from the stream;
- The person must ensure that any water that is diverted is discharged without causing a significant risk of harm to public safety, the environment, land or other property;
- The person must ensure that the water supply and works of persons who are lawfully diverting or using water under the WSA are not adversely affected; and,
- The person must ensure that the diversion or use of water does not cause a risk of significant harm to fish, wildlife or the aquatic ecosystem of a stream.

WSA authorizations are available through FrontCounter BC.

Note: The provisions described in section 56 of the Water Sustainability Regulation currently expire on December 31, 2019.

Further information on water licences and approvals is available at:

<http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/water-licences-approvals>

The *Water Sustainability Act* is available at:

<http://www.bclaws.ca/civix/document/id/complete/statreg/14015>

Environmental Management Act

Pollution prevention in British Columbia is regulated under the *Environmental Management Act* (EMA). The EMA and relevant regulations prescribe requirements for effluent discharges to air, land, and water from industrial activities, including placer mining. The Placer Mining Waste Control Regulation

¹ http://www.bclaws.ca/civix/document/id/complete/statreg/36_2016

(PMWCR) broadly authorizes waste associated with placer mining operations to be introduced to the environment, providing that processing does not include mercury or chemicals, make-up water extraction is limited to a 38 mm diameter intake, tailings pond freeboard is maintained at no less than 0.5m, and water from the tailings pond is recycled back to the operation or left in the pond to seep into the ground in a manner that does not result in suspended solids entering a body of water. There is currently an exemption in section 3(c)(i) of the regulation that exempts operations on 14 named streams from these conditions, as long as neither mercury or chemical are used to recover a placer mineral. At the time of release of these BMPs, the exemption of these named creeks is under review.

It is important to note that PMWCR does not allow discharges from placer mining activities within the province, except for mines on creeks noted in section 3(c)(i) of the PMWCR. The regulation does not allow any placer mining operations to introduce waste into the environment in a manner or quantity to cause pollution, as stated under section 6(4) of the EMA. This means the discharges from placer mining operations on creeks identified in section 3(c)(i) must still be monitored and managed by miners in a manner that prevents pollution of the receiving environment.

Placer miners are encouraged to consult the ENV if they require further clarification or direction.

The *Environmental Management Act* is available at:

http://www.bclaws.ca/civix/document/id/lc/statreg/03053_00

The Placer Mining Waste Control Regulation is available at:

http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/39_107_89

3 Indigenous Engagement

3.1 Overview

The Provincial Government encourages mineral exploration and mine development proponents to engage with Indigenous Nations at an early stage and throughout the life of a project. Applicants are encouraged to use the Consultative Area Database (CAD)² to identify Indigenous Nations that may have an interest in the area of the proposed project. The CAD provides preliminary contact information for those nations and could be a starting point for early engagement. It is important to note that the CAD is a preliminary reference, and the information provided may vary from that used during the formal consultation that occurs as part of the permitting process. Additionally, some nations prefer to only be engaged during the formal consultation process. If you have questions, you can receive advice from the mine inspector of the region on how to determine which Indigenous Nation(s) are impacted by the project and how to best engage each Indigenous Nation.

Indigenous Nation engagement³ involves communication and information sharing between the proponent and the local Indigenous Nation regarding a proposed placer project. Early establishment of a mutually respectful working relationship with the Indigenous Nation(s) within whose territory mining is proposed can lead to an improved understanding of the project scope and phases of work, and provide opportunities to anticipate and resolve concerns that may arise. The sharing of relevant information and timely communication should be continued throughout the life of the mine.

3.2 Background

Early and meaningful engagement with the Indigenous Nation and the local community is now widely accepted as part of standard operating procedures for hard rock mineral exploration and lode mining⁴. Encouraging communities, the Indigenous Nation, and placer miners to work together helps to ensure that mining provides long-term benefits to all.

For developers and investors, the business case for early engagement with Indigenous Nations is strong, particularly regarding ensuring social licence, establishing certainty, and avoiding potential delays in the exchange of information and decision-making.

More information, guidelines and procedure manuals on consulting with Indigenous Nations are available at: <http://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/consulting-with-first-nations>.

² <http://maps.gov.bc.ca/ess/hm/cadb/>

³ <https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/consulting-with-first-nations>

⁴ Several Canadian mining associations offer guidance regarding Corporate Social Responsibility (CSR) and engagement with Indigenous communities. See, for example, publications by the Association for Mineral Exploration: <https://amebc.ca/wp-content/uploads/2017/04/aboriginal-engagement-guidebook-revised-may-2015.pdf> or The Prospectors and Developers Association of Canada: <http://pdac.ca/e3plus/>

3.3 Context and Management

Benefits of Early Engagement

Establishment of a working relationship between a proponent and relevant Indigenous Nations while planning and proposing a project complements and potentially streamlines the formal consultation processes between the Indigenous Nation and the Crown. Early engagement may therefore:

- Facilitate communication and foster the building of trust;
- Clarify expectations and understanding related to the location, nature and extent of a proposed project;
- Provide opportunities to identify common values, shared interests and concerns that need to be addressed in project design and planning, and to discuss proposed mitigation strategies for potential impacts;
- Allow the Indigenous Nation to indicate its support for a proposed project (e.g. through a letter of support or a mutually acceptable agreement outlining possible concerns and mitigation resolutions); and,
- Identify opportunities for partnership or other benefits or strategies.

3.4 Current Regulatory Requirements

Provincial agencies issue provincial authorizations for placer operations under the Mines Act, the Water Sustainability Act and other applicable statutes in accordance with applicable laws. Government to Government (G2G) agreements between the Province and Indigenous Nations may set out processes for how the Province will consult, collaborate with, or otherwise engage Indigenous Nations in relations to Provincial decisions. These Agreements are designed to be implemented in accordance with existing statutory and regulatory frameworks.

3.5 Best Management Practices

Management Practices	Methods and Approaches
3.1 Engage with local Indigenous Nations that may be affected by proposed land use activities at the earliest stage and throughout the life of a placer mining project, in a spirit of mutual respect.	<p>A. Make formal contact with Indigenous Nations through the relevant Indigenous Nation government before land use activities begin and maintain open, honest and transparent communication.</p> <p>B. Share mining plans related to the project and work cooperatively with Indigenous Nations to identify</p> <ul style="list-style-type: none"> i. Concerns related to project design, planning and implementation. ii. Mitigation measures to be used to address potential social, ecological, environmental or cultural impacts.

	<p>C. Establish mutually agreeable expectations and understandings regarding proposed activities and ongoing engagement with Indigenous Nations.</p>
<p>3.2 Explore benefit sharing opportunities for Indigenous Nations and communities.</p>	<p>A. Consider partnership or joint venture opportunities with Indigenous Nations and local communities.</p> <p>B. Acquire goods, services and labour locally, where available.</p> <p>C. Create opportunities for training and capacity building for Indigenous Nations and local community members.</p>

4 Exploration

4.1 Overview

Exploration is a vital part of any placer mine pre-development and planning process and is ongoing at most operating mines. Accurate sampling and deposit evaluation enables cost-effective mining and reclamation. More placer mine failures can be attributed to a lack of appropriate exploration and sampling than any other cause. This could be due to intentional and accidental contamination, small sample sizes, splitting samples and fire assaying.

4.2 Background

A variety of exploration methods are used in placer mining. In areas with placer gold potential, initial low-impact and relatively low-cost geophysical techniques, such as electrical resistivity, ground-penetrating radar and seismic refraction surveys, may provide valuable information regarding the depth of overburden and gravels, as well as the location of buried channels over large areas. These methods often need to be calibrated with deep excavations, such as shafts and pits, or with drilling. Other methods such as sonic drilling and reverse circulation drilling may also provide depth information and a small pay gravel sample for analysis. In most cases, geophysical and drilling data will need to be confirmed with bulk testing. All placer gravel samples should be processed in their entirety on small sampling sluices, which can be cleaned easily between samples to replicate operational scale equipment.

4.3 Context and Management

The goal of exploration is to discover and develop a mine. In addition to determining the quantity, location and value of pay gravels in a placer deposit, initial exploration can provide valuable information regarding surface drainage patterns, stream flows, and depths and types of soils. This information can be used in the evaluation of access roads, mine pits, overburden storage and settling pond locations, and potentially result in more cost-efficient mining.

4.4 Current Regulatory Requirements

No authorization is required for most geophysical surveys, excavation of hand-dug test pits or hand panning. Exploration must only occur on placer claims where you hold title or have written permission from the holder.

Authorization under the *Mines Act* is required for any mechanized disturbance of the ground or any excavation to explore for or produce placer minerals. This requires filing of a Notice of Work (NOW) application. Activities requiring a NOW include, but are not limited to, excavation of test pits with machinery, drilling, site reclamation and construction or rehabilitation of access trails. Prior to commencing activities, a permit under the *Mines Act* must be issued, with securities in place. Reclamation securities are assessed based on the amount of site disturbance associated with the proposed activities and potential impact on other land values. A WSA authorization may also be required if using water with mechanical equipment.

4.5 Best Management Practices

Management Practices	Methods and Approaches
4.1 Complete geological and other research prior to staking or acquiring a placer claim or lease.	<p>A. Research the placer history and geological potential of the area from published reports (e.g. reports available on the EMPR website) and talk to local placer miners and residents in the area.</p> <p>B. Stake placer claims online in designated placer staking areas only.</p> <p>C. Obtain the most recent air-photos, satellite and Google Earth images, as well the largest scale maps of the area to assist with site assessment and management planning. These data will allow you to plan your exploration program and may alert you to specific physical features that may affect exploration and mining in the area.</p>
4.2 Minimize disturbance due to access roads and trails.	<p>A. Use existing roads and trails for access where possible. If new roads are required, a permit under the <i>Mines Act</i> (for roads on a mine site) or <i>Forest Practices Code of British Columbia Act</i> (for access roads) must authorize them.</p> <p>B. Construct roads and trails consistent with the guidance identified in the Technical reference for Mineral and Coal Exploration in British Columbia⁵ and the Forest Engineering Manual⁶.</p> <p>C. If using off-road vehicles, use low-impact vehicles and stay on existing trails, especially in environmentally sensitive areas such as wetlands, riparian, ungulate winter range, and alpine areas.</p> <p>D. Plan exploration activities to limit the number of stream crossings and avoid critical or high value fish habitats.</p> <p>E. Do not drive vehicles or heavy equipment down or across active stream beds or backchannels.</p>
4.3 Apply low-impact exploration methods.	<p>A. Use geophysical methods such as electrical resistivity, ground penetrating radar and seismic refraction surveys to explore large areas with relatively low costs and low environmental impacts.</p> <p>B. Use low-impact tracked drilling equipment (where available) to obtain samples from depths greater than 6 m and to confirm/calibrate geophysical information.</p> <p>C. Minimize drill pad size and leave the topsoil as intact as possible.</p>

⁵ <http://www2.gov.bc.ca/assets/gov/business/natural-resource-industries/mineral-exploration-and-mining/handbookformineralexploration0809.pdf>

⁶ <http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/resource-roads/eng-manual.pdf>

	<p>D. If water is used, excavate a small sump to collect and settle any drill cuttings, and backfill upon completion of drilling.</p> <p>E. Follow setbacks from watercourses as outlined in Table 9.1 of the Code.</p>
4.4 Reduce impact of sampling pits.	<p>A. Use hand methods or excavators that are sized to minimize ground disturbance.</p> <p>B. Locate sample pits in a systematic manner in a line across the expected pay gravel channel.</p> <p>C. Strip and stockpile vegetation and soil layers separately for use in reclamation. Where possible leave roots intact or layer shrubs with roots intact for later use.</p> <p>D. Limit sample pit depths to the length of the excavator arm, where practical.</p> <p>E. Backfill and reclaim test pits (as per Reclamation BMPs, Section 7) as soon as possible. Pits are to be reclaimed prior to leaving property for the season.</p> <p>F. Temporary camps need to be completely removed along with any fuel barrels or machinery.</p> <p>G. Exploration pits are considered temporary excavations under the Code. If exploration pits or trenches are to be entered, they must adhere to sections 4.17.1, 4.17.2, 4.17.3, 4.17.4, 4.17.5 of the Code; excavations greater than 1.2m deep are to have side slopes no steeper than 3H:4V, excavations greater than 6m deep are to be designed by a professional engineer.</p>
4.5 Protect cultural landscapes, sites and features of significance ⁷ .	<p>A. Develop an awareness of cultural heritage resources⁸ that may be in the area.</p> <p>B. Develop a procedure for archaeological chance finds⁹ as per <i>Mines Act</i> permit condition(s).</p> <p>C. In some areas an archaeological assessment may be required¹⁰.</p>
4.6 Reduce the impact of sample processing.	<p>A. Use a small portable sampling sluice to process pay gravel samples.</p> <p>B. Use groundwater for a water source if possible and settle and/or recycle process water from a small sump.</p>

⁷ The protection and conservation of heritage resources in BC is governed by the *Heritage Conservation Act*: http://www.bclaws.ca/civix/document/id/complete/statreg/96187_01

⁸ Available at <https://www2.gov.bc.ca/gov/content/industry/natural-resource-use/archaeology>

⁹ <http://www.frontcounterbc.ca/pdf/ArchaeologicalChanceFindProcedure.pdf>

¹⁰ <https://www2.gov.bc.ca/gov/content/industry/natural-resource-use/archaeology/assessments-studies>

5 Water Management and Placer Settling Ponds

5.1 Overview

Settling ponds and water management are vital components of placer mining operations. Settling ponds are required in the initial mine development to control sediment-laden run-off water due to seepage or erosion, and in placer mine production phases to treat sluice box effluents. The volume of run-off water that requires settling can be reduced through establishment of ditches or berms to divert surface water flow away from mine workings, and through maintenance or re-establishment of vegetation outside of active mine areas.

For process water, the volumes requiring storage and settling can be minimized through careful management of water used during wash plant operation, recycling of water from settling ponds for processing and other appropriate uses, and allowing settling ponds water levels to lower prior to restarting processing. The mine plan must outline how this will be achieved

Settling ponds can be constructed in old mine pits, as below grade pits, or with impoundments that allow sediment-laden water to slow down and particulate sediments in the water to drop out of suspension. Proper design, construction, operation, monitoring, and maintenance of settling ponds are integral to responsible water management on all mine sites, including placer.

5.2 Background

Settling ponds are important tools for effective water management on placer mine sites. However, there are several limitations that placer miners must be aware of prior to designing their water management systems:

- Very small improvements in effluent quality may require very large increases in settling pond size.
- Settling aids, such as coagulants or flocculants, can be employed to increase settling efficiency. However; a qualified professional should be directing the use of settling aids, as improper use can result in water quality that may be toxic to aquatic receptors¹¹. Dosage must be carefully controlled and ongoing water quality monitoring implemented to ensure that the use of these products is effective to both enhance sedimentation and ensure environmental protection. The qualified professional will need to provide EMPR the information in the mining plan submitted with the application.
- Filter dams and discharge of large volumes of sediment-laden water into the ground are not as effective as a primary sediment removal technique, except where highly porous soils or

¹¹ Boffa Miskell 2004. Overview of the Effects of Residual Flocculants on Aquatic Receiving Environments. Boffa Miskell Ltd. report to Auckland Regional Council. Technical Publication 226. Available at: <http://www.knowledgeauckland.org.nz/assets/publications/TP226-Overview-effects-of-residual-flocculants-aquatic-receiving-environments-2004.pdf>

abundant (large-scale dredge) tailings are available. This must be described by the qualified professional in the management plan.

- Recycle systems reduce freshwater demands and allow mining during low flow periods or in drainages where water is scarce. However, placer miners should be aware of the following:
 - A recycle system for process water must consider the water gain from surface and sub-surface inflows as well as the build-up of settled solids in the pond.
 - More process water may be required for washing pay gravels in recycle systems due to the increased suspended solids concentration.
 - Specialized pumps may be required, and greater pump wear should be expected.
- Recycle systems can cost more due to longer piping networks, frequent pond cleaning, and potential loss of fine gold due to riffle packing.
- The main components of settling ponds are the inlet, pre-settling pond, main settling pond, polishing pond (if required) and outlet. To effectively employ settling ponds to manage water, proper planning, site selection, construction, shape, size, inspection and maintenance are required.

5.3 Context and Management



Responsible placer mining and maintaining water quality go hand in hand.

Water is a concern for communities and wildlife in active placer mining areas. Maintaining water quality downstream of placer operations protects aquatic habitat and drinking water resources and enables a placer operation to remain compliant with provincial water quality guidelines¹². Water management is necessary through the projected life of the mine to minimize ground disturbance, minimize runoff from disturbed sites, provide erosion control, remove sediment from flowing water, and keep the ground stable. Water management is also a critical aspect of successful reclamation, particularly for long-term stability of the land and watercourses. It is critical to maintain a responsible water management plan on the mine site.

5.4 Current Regulatory Requirements

Water withdrawals should be limited so sufficient water flows can be maintained within watercourses to protect aquatic life. In times of low stream flow, the Regional Water Manager may limit water extraction in order to protect fish and aquatic life values. This is regulated under the WSA.

An EMA permit is required to discharge into watercourses. Exemptions in place under the PMWCR are currently under review¹³. Discharges that cause pollution are not authorized and proper water management on site is required to prevent pollution of the receiving environment.

¹² Provincial water quality guidelines are available at: <http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines/approved-water-quality-guidelines>

¹³ Placer Mining Waste Control Regulation is available at: http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/39_107_89

It is contrary to the WSA to work below the high-water mark of streams and lakes. If work within this area is required, an authorization under the WSA is required. A water licence must be in place and volume of associated stored water must be identified if proponents intend to:

- Build a water intake/stilling trench;
- Construct works to transport water from the source location to a storage facility; or
- Use the site or conduct any other work that disturbs or damages any soil, trees, stream bank or lakeshore.

“Riparian setback” means an area of land adjacent to a stream, wetland, or lake. Provincial policy is to maintain a 10m riparian setback on all streams. Riparian management setbacks are minimum widths intended to protect surface water, based on the size of the watercourse, lake or wetland. In practice, riparian setbacks and vegetation buffers should be established with the objective of preventing the introduction of sediment-laden water or other pollution mechanisms to surface waters and habitats. This means that wider setbacks may be required as a matter of best practice.

The federal *Fisheries Act* protects fish and their habitat. Where activities are anticipated in watercourses, placer miners should consult the Department of Fisheries and Oceans Canada (DFO). DFO has developed a webpage to help proponents comply with *Fisheries Act* requirements and to evaluate projects for potentially harmful impacts to fish and fish habitat. Visit DFO’s Pacific Region Working near Water webpage for further direction: <http://www.pac.dfo-mpo.gc.ca/habitat/index-eng.htm>.

5.5 Best Management Practices

Management Practices	Methods and Approaches
5.1 Prevent overland transport of sediment into watercourses and surface water drainages.	<p>A. Divert clean surface water away from disturbed areas.</p> <p>B. Design and construct bypass channels and/or berms to divert surface water away from mined, stripped or stockpile areas and settling ponds.</p> <p>C. Locate the bypass channel:</p> <ul style="list-style-type: none"> i. Where the ground is stable and not on loose or fine soils. ii. Far enough away from pits and settling ponds so that sediment-laden seepage does not enter from these sources. <p>D. Construct the bypass channel with sufficient armour, grade and cross-section area to handle seasonal floods from the area that it drains and maintain quality of the diverted water.</p> <p>E. Avoid storing waste rock piles or sources of hazardous materials within 10m of watercourses and surface water drainages.</p>
5.2 Reduce water requirements.	A. Use vibrating screen decks or rotating trommel screens to increase gold recovery and dramatically decrease the

	amount of water required for treatment. The use of a recycling water system should be considered.
5.3 Clearly identify 10m riparian setback (or a wider setback where required or necessary).	A. Survey and stake 10m riparian setback. B. Setback should be clearly visible from all types of equipment used on the mine site.
5.4 Install intakes for water supply pumps in a manner that is permanent, protected from erosion and requires as little subsequent instream ¹⁴ work as possible.	A. If an intake/stilling trench ¹⁵ is required, design and construct the trench so that: <ul style="list-style-type: none"> i. The trench is pointed in a downstream direction such that active flows from the creek do not enter the intake with erosive force Appendix ii. All disturbed bank surfaces are covered in large angular rock. iii. Sediment and silts are not introduced into the stream. iv. The trench is positioned in relation to the wash plant and other equipment such that multiple trenches are not created or required. B. Once the intake/stilling trench is no longer needed, reclaim it in a manner that does not introduce sediment into the stream, or cause future erosion or evulsion of the bank, and restores land capability.
5.5 Prevent petroleum products or other hazardous materials (e.g. acids, antifreeze) from entering streams.	A. Prior to and during construction of settling ponds, confirm equipment and machinery is in good operating condition and free of leaks, excess oil, and grease. B. Fuel or service equipment a minimum of 30 m away from any watercourse or surface water drainage and ensure appropriate secondary containment is installed. C. Park machinery and store equipment at least 30 m from any watercourse or surface water drainage. D. Regularly inspect and maintain water pumps for oil and fuel leaks. E. Keep a spill containment kit on site and know how to use it effectively.
5.6 Plan, construct and maintain sound stream crossings to limit erosion.	A. Do not ford streams.

¹⁴ “Instream” refers to all areas below the high water mark of a watercourse or waterbody.

¹⁵ The construction of an intake/stilling trench requires an approval under the *Water Sustainability Act* or a water licence.

	<p>B. Select the appropriate stream crossing structure for the habitat present and stream gradient.¹⁶</p> <p>C. Design, install and maintain stream crossing structures to ensure that the crossings do not restrict the cross-sectional area below the high water mark, change the stream gradient, or reduce or restrict fish passage, and to ensure that the streambed characteristics are retained or replicated.</p> <p>D. Minimize or avoid disturbing soil and vegetation above and below the area required for actual construction of the stream crossing.</p> <p>E. Re-vegetate and stabilize the site to prevent erosion.</p> <p>F. Minimize sediment introduction during construction and maintenance of crossings for any stream.</p> <p>G. Minimize clearing width at the crossing site and retain streamside vegetation within the stream crossing right-of-way wherever possible.</p>
<p>5.7 Design, construct and maintain roads and trails to limit erosion.</p>	<p>A. Construct trails and roads to a standard identified in the guidebook for Mineral and Coal Exploration in British Columbia¹⁷ and the Ministry of Forest Engineering Manual¹⁸.</p>
<p>5.8 Construct the settling pond at the location that best fits the following BMPs.</p>	<p>A. Use previous mine pits where possible for settling ponds to reduce site disturbance.</p> <p>B. If constructing settling ponds at new mining site, the pond may be excavated in virgin ground and the pay gravels stockpiled for later processing. Care in location as not to disturb potential cultural or archaeological features should be also be considered.</p> <p>C. Locate settling ponds:</p> <ul style="list-style-type: none"> i. In the largest flattest areas available. ii. On gently sloping ground or in a depression that is underlain by impervious consolidated material such as glacial till or bedrock. iii. Outside the streambed and flood plain to avoid washouts during periods of high flow or floods and/or armour the settling pond bank nearest to the

¹⁶ Direction for selecting the appropriate stream crossing structure can be found in the Fish-stream Crossing Guidebook, which is available at https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/resource-roads/fish-stream_crossing_web.pdf

¹⁷ <https://www2.gov.bc.ca/assets/gov/business/natural-resource-industries/mineral-exploration-and-mining/handbookformineralexploration0809.pdf>

¹⁸ <https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/resource-roads/eng-manual.pdf>

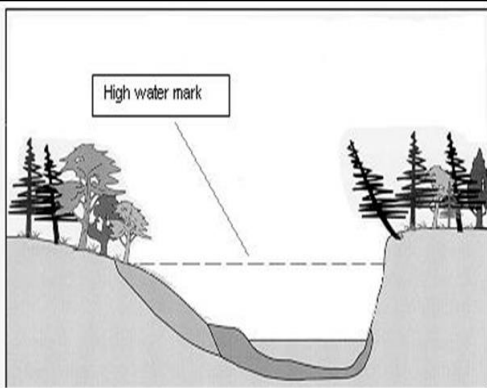


Figure 5.1: Depiction of high water mark

	<p>creek to prevent the creek from diverting into the settling pond.</p> <ul style="list-style-type: none"> iv. Above the high-water mark (Figure 5.1). v. A minimum of 10m away from the high-water mark of the stream. vi. Close to suitable embankment/dam construction materials and in a location appropriate for construction. <p>D. Further information on settling pond layout is available in Appendix 3.</p>
<p>5.9 Design and construct an adequately sized settling pond.</p>	<ul style="list-style-type: none"> A. Determine the flow rates of water sources into the pond (process and natural inflow). B. Measure the infiltration capacity of the ground where the pond will be located. C. Estimate the amount of sediment that will be washed into the pond over a given period of time. D. Determine the residence time needed to settle out the sediment that will be suspended, based on the inflow rate. E. Ponds should be designed so that water exfiltrates to ground and does not discharge to surface. F. Consider recycling pond water for process to reduce the pond size needed. G. If ponds cannot be constructed to exfiltrate sufficient amounts of water to prevent surface discharge, obtain an EMA permit prior to operation. Settling pond size should be based on the ENV EMA Technical Guidance 7¹⁹ and designed by a qualified professional. H. Design above-grade ponds as per BMP 5.13. I. Design with a minimum pond depth of 1.5m, with a minimum of 0.5m of water freeboard over the settled solids.
<p>5.10 Construct settling ponds to a shape and configuration for maximum settling efficiency.</p>	<ul style="list-style-type: none"> A. Construct settling ponds with optimum length to width ratio in the order 5:1. If the settling pond is too narrow, the higher velocity of the effluent will result in scouring and re-suspension of fine particles. B. Use an inlet structure that aids in distributing water so that it flows evenly across the width of the pond.

¹⁹ https://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/mining-smelt-energy/assessing_design_size_and_operation_of_sediment_ponds.pdf

	<p>C. Construct baffles at the pond inlet to spread out the flow of effluent across the pond.</p> <p>D. Where it is necessary to construct or use a pond with a length to width ratio of less than 5:1, incorporate berm baffles into the internal design to increase the effective flow length (e.g. residence time) and reduce short circuiting in the pond (e.g. serpentine flow through the pond). Berms will however, reduce the storage volume of the pond which will need to be considered in the calculations of pond size.</p> <p>E. Anchored or floating geotextile baffles can also enhance settling and they do not reduce the storage volume of the pond. These can be custom sized by the vendor.</p>
<p>5.11 Construct pre-settling ponds to greatly extend the life of the main settling pond and improve the final effluent.</p>	<p>A. Construct pre-settling ponds based on the desired frequency of excavation, approximately 1/5 to 1/10 the size of the main settling pond.</p> <p>B. Build pre-settling ponds to be shallow with a flat hard bottom:</p> <ul style="list-style-type: none"> i. Construct as a large depression in the channel between the sluice box and settling pond; or ii. Construct with a shallow berm of tailings across the channel between the sluice box discharge and the inlet to the settling pond. <p>C. Ensure pond is in an area with adequate space to drain and store tailings.</p>
<p>5.12 Properly design settling ponds in narrow valleys.</p>	<p>A. In extremely narrow valleys, it is often better to direct effluent through a ditch to lower wider areas of the valley where an effective settling pond can be constructed.</p> <p>B. If there is insufficient room for a long large settling pond, use a series of smaller settling ponds.</p> <p>C. In small areas requiring periodic pond clean out, allow sufficient space for an excavator or dragline to dig out the sediments and to pile and drain the sediments. Haul dry sediments to a stable location or use for spreading over coarse tailings where topsoil is not available.</p>
<p>5.13 Above grade settling ponds using embankments</p>	<p>A. The consequence of failure of all sediment pond embankments must be assessed and included in the</p>

	<p>NOW application (see the Code²⁰ and the FLNRO Dam Consequence of Failure Classification²¹).</p> <p>B. Sediment ponds with embankments that are greater than 2.5m high, or that have a consequence of failure rating greater than “low”, are considered “dams” under the Code. They need to be designed by a professional engineer and adhere to sections 10.1.5, 10.5.1, 10.5.2, 10.5.3 and 10.5.4 of the Code.</p> <p>C. For sediment ponds with embankments less than 2.5m high:</p> <ul style="list-style-type: none"> i. Strip the organic overburden from the embankment foundation and set it aside in a stable stockpile for later reclamation. ii. Construct a homogenous earth-fill embankment/dam using soils with a large range of particle sizes, ranging from silt to cobbles. If excessive seepage occurs from the embankment the sides may need to be lined with 0.15m thick layer of silt or clay. iii. Do not use organic material, organic soils, black muck or frozen materials for embankment construction. iv. Place construction materials in layers (lifts) no greater than 0.3m thick and compact each layer by running back and forth with heavy equipment until a dense structure is obtained (typically 4 to 8 passes of the heavy equipment will be required) v. Construct embankments to have a crest width of at least 3m, and upstream and downstream slopes no steeper than 5H:2V. vi. Construct an emergency overflow spillway with invert at least 0.3m below the crest. vii. Where permitted on deregulated streams, build pond outlets to limit the level of water to minimum 0.5m below the top of the embankment/dam. The outlet must be large enough to pass the flows generated by the 1:200-year 24hr flood event and maintain the 0.5m of freeboard. If a culvert outlet is used the pond should include an overflow spillway (Note: The
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²⁰ <http://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/health-safety/health-safety-and-reclamation-code-for-mines-in-british-columbia>

²¹ Downstream Consequences of Failure Classification Interpretation Guidelines are available at: http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/dam-safety/con_class_guidelines_for_owners-2017.pdf

	<p>exemption of streams under the PMWCR is under review).</p> <p>viii. Embankment slopes below emergency spillways or outlets must be protected from erosion by armouring with a minimum 0.6m thickness of angular rock averaging 20 cm in diameter. The armour should extend from 0.3m above the outlet invert to beyond the toe of the embankment.</p>
<p>5.14 Maintain your settling ponds.</p>	<p>A. A new settling pond should be constructed, or sediments should be removed from a settling pond when sediments accumulate to 50% of the design storage volume or when sediments are less than 0.6m from the water surface.</p> <p>B. If no areas are available for new settling pond construction, the existing settling pond will have to be cleaned out. A standard operating procedure should be developed to direct when sediment should be excavated (water level/timing frequency), how this will occur, how/where the sediments will be stored, and who does what, etc. This should be included in the mine plan.</p> <p>C. During cleaning, the pond should be dewatered, and all sediment-laden water should be diverted to another settling pond for treatment elsewhere or processing should stop until the pond capacity is restored.</p> <p>D. Use an excavator to remove the sediments.</p> <p>E. Stack sediments removed from ponds to drain in an area that is protected from floods and surface runoff.</p> <p>F. Grade, smooth and then cap sediment stockpiles with granular material to prevent erosion.</p> <p>G. Develop appropriate plans for permanent disposal of the sediments (e.g. backfilling), use in reclamation, or reclamation of the stockpiles based on reclamation objectives for the site.</p>
<p>5.15 Regularly monitor your settling ponds.</p>	<p>A. Inspect settling ponds weekly and during/after every major storm.</p> <p>B. Conduct a visual inspection of the cut slopes and dikes surrounding the pond, both upstream and downstream, for evidence of instability, overtopping, leaking, erosion or areas where water is seeping through the dam.</p> <p>C. Repair any damage noted as soon as possible to reduce the risk of erosion or failure.</p> <p>D. For ponds that are authorized to discharge, monitor pond effluent on a regular basis during discharge with an appropriate measurement portable turbidity sensor, or grab samples for total suspended solids analysis to</p>

	<p>determine if it is becoming ineffective due to fill up or short-circuiting²². Monitoring of pond water even when not discharging will also help direct water recycling practices (i.e. stopping water draw when turbidity is too high will protect against pump wear and riffle packing in recycle systems).</p>
<p>5.16 Reclaim settling ponds once they are no longer required.</p>	<ul style="list-style-type: none"> A. Breach settling ponds located higher in elevation than the stream channel and divert any sediment-laden water to another settling pond for treatment. B. Alternatively, divert any sediment-laden water to another settling pond for treatment, then backfill ponds, grade embankments and re-vegetate. C. Place/grade coarse (erosion-resistant) tailings over the pond to stabilize the sediments in place if the ponds are located in low-lying areas near the stream channel. D. Where soil has been salvaged, it should be placed over surfaces, prepared in a manner that will minimize erosion, and re-vegetated. Soil should be actively re-vegetated if natural re-vegetation will not prevent erosion in a timely manner. E. In areas where required, place riprap to protect the remaining settling pond from erosion by the stream. F. In areas with limited top soils for use in reclamation, it may be useful to spread the fine sediments from settling ponds over coarse tailings to assist in natural re-vegetation. This practice should be tested on smaller areas with 'clean out sediments' before being implemented on a large scale.

5.6 Mining Excavations and Waste Dumps

Modern placer mining often creates excavations with heights in excess of 6m. If not constructed properly, these excavation walls can be a hazard to worker safety or the environment. Sections 4.17, 6.23, 6.24.1 and 10.7.13 of the Code provide minimum standards for excavations that all placer operations must adhere to. The following presents the minimum design requirements based on the Code. These requirements are expected to result in a safe and stable operation under most circumstances. However, in some situations additional input from professional engineers may be required.

All excavations are to be designed by a qualified person who has experience with excavation stability, when the excavation:

²² Short-circuiting is a problematic circumstance in which water bypasses the normal flow path through the basin and reaches the outlet in less than the normal retention time.

- Is more than 6m deep;
- Uses timber shoring exceeding 3.7m in width;
- Has adjacent improvements or structures that could endanger a person; or,
- Is subject to vibration or hydrostatic pressure.

Excavations are to be developed with benches or steps, where:

- The maximum height of any step face does not exceed 2m above the reach of the excavation equipment in use;
- The angle of step face is selected to be stable over the expected life of the excavation; and,
- The minimum final width of the step is 8m. The minimum width must consider the expected back break across the crest.

The large quantities of overburden material from excavations must be placed in temporary or permanent dumps or stockpiles. Dumps and stockpiles must be designed by a qualified person and consistent with good engineering practices. Waste dumps should be founded on competent natural ground that slopes less than 20 degrees and does not cover over any streams. All organic material located beneath the dump footprint should be removed and stockpiled for future reclamation. Numerous sections of the Code outline the design and safety standards for dumps or stockpiles. These include, but are not limited to, sections 6.8, 6.10, 6.20, and 10.7.11.

Major dumps are dumps that are greater than 50m high, cover more than 1 ha, cover a stream, are on slopes greater than 20 degrees or contain more than 1 million m³. Major dumps are to be designed by a professional engineer.

No infrastructure should be placed, nor access allowed, within the potential runout zone at the toe of the dump.

The designs of excavations and dumps must be submitted with the NOW and kept at site for review, as per Section 6.8.1 of the Code. The expectation is that the designs will be updated during development of the excavations as actual field conditions are clarified and experience is gained. The Chief Inspector may require that the qualified person be a professional engineer.

Excavation slopes and dump faces are to be inspected by the shift boss at the start of every shift. The inspections are to be documented in the daily record book.

At completion of mining, excavations and dumps are to be reclaimed and left in a condition that prevents erosions and ensures long term stability (see section 10). Typically, this will require backfilling excavations and re-sloping pit and dump faces to an angle less than 2H:1V, followed by re-vegetation.

The above requirements may only be changed through an authorization under section 6.23.5 of the Code, or as a variance under section 1.2.1 of the Code. A request for authorization under 6.23.5 should include the following information supported by analysis and designs prepared by a professional engineer:

- Details of proposed pit wall configuration.
- Assessment of the consequences of pit wall failure.

- Assessment of bench, inter-ramp, and overall pit slope stability. Confirmation that the factor of safety, or probability of failure, meets generally accepted values.
- Details of methods of excavation to control bench face damage and rock fall potential.
- Procedures to minimize exposure of workers to potential instability.

A request for a variance under 1.2.1 of the Code must demonstrate that the proposed method affords protection for the workers equal to or greater than the protection established by the provision being varied, supported by analysis and designs prepared by a qualified professional engineer.

In addition to the above, sections 6.8, 6.9, 6.10, 6.19, and 6.20 of the Code spell out the requirements for planning and equipment operation to help ensure a safe operation.

6 Fish and Wildlife Management

6.1 Overview

The British Columbia *Wildlife Act* defines wildlife as all native and some non-native amphibians, reptiles, birds and mammals that live in BC. Impacts to fish and wildlife from placer mining can potentially occur throughout the life of a mine and until the reclaimed mine has regained its ecological productivity. Knowledge of mitigation strategies is imperative to minimizing negative impacts to fish and wildlife and their habitat.

6.2 Background



All human activity has the potential to impact fish and wildlife and their habitats. Placer miners should be aware of and strive to reduce human-wildlife conflicts.

If placer miners intend to work in or about a watercourse, they should determine whether fish are present at their proposed mine site and report to the DFO for further guidance²³.

6.3 Context and Management

Human disturbance impacts wildlife populations at both the individual and regional levels. Disturbance of wildlife during key times can result in:

- Increased vigilance and flight responses (behavioural responses);
- Reduced foraging efficiency, body condition, and growth rates;
- Interference with territory defence and mate choice (specifically songbirds);
- Increased mortality from predation, injury, disease or climate extremes;
- Physiological responses (increased heart rates, higher cortisone levels);
- Habitat shifts, including increased use of suboptimal habitat;
- Delayed new-born development and abandoned nests;
- Lower survival rates and life expectancies; or,
- Reduced reproductive success and population productivity (often across years).

When reclaimed, mine sites have the potential to provide functional habitat for wildlife.

Impacts to fish should be minimized by ensuring:

- Degradation of riparian areas that directly influence and provide habitat to fish is minimized.
- Aquatic habitats are not degraded, including those located downstream of the mine site.

6.4 Current Regulatory Requirements

²³ Note: Under the *Water Sustainability Act*, an authorization is required to make changes in and about a stream.

Wildlife is protected under the BC *Wildlife Act* and Canada’s *Migratory Bird Convention Act*, the Migratory Birds Regulation and the *Species at Risk Act*.

A list of species at risk is available at: https://wildlife-species.canada.ca/species-risk-registry/sar/index/default_e.cfm. If a species listed in the *Species at Risk Act* has been identified at a mine site, please see <http://www.sararegistry.gc.ca/>.

Fish are protected under the BC *Wildlife Act*, the BC *Fish Protection Act*, and the Federal *Fisheries Act*. DFO has developed a web page to help proponents comply with requirements of the *Fisheries Act* and evaluate projects for potentially harmful impacts to fish and fish habitat. Further guidance can be found on DFO’s Projects Near Water web page: <http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html>.

Provincial policy is to maintain a 10m riparian setback on all streams.

In addition, any placer miner considering any work within a stream should consult British Columbia’s Standards and Best Practices for Instream Works, which can be found here: <http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf>.

6.5 Best Management Practices

Management Practices	Methods and Approaches
<p>6.1 Assess fish values in the vicinity of the mine site prior to development, if the work will affect the watercourse.</p>	<p>A. Placer miners should research what aquatic values are present near their proposed operations before working in or about a creek. Information can be found by:</p> <ul style="list-style-type: none"> i. Contacting provincial wildlife biologists. ii. Searching government online databases: <ul style="list-style-type: none"> • Fisheries Inventory Data Queries (FIDQ): https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/fish/fish-and-fish-habitat-data-information/search-fish-fish-habitat-data-information/fisheries-inventory-data-queries • iMap BC: http://www2.gov.bc.ca/gov/content/governments/about-the-bc-government/databc/geographic-data-and-services/imapbc (look under all fish points). • DataBC: http://www2.gov.bc.ca/gov/content/governments/about-the-bc-government/databc (look under known fish observations).

	B. Use appropriately qualified professional biologists to determine fish presence prior to working within a stream.
6.2 Screen all water intakes.	A. Install a fish guard or screen to exclude fish on all water intakes, ditches, channels or canals. Follow DFO's Freshwater Intake End-of-Pipe Fish Screen Guideline ²⁴ in your design and operation of fish screens.
6.3 Limit adverse effects to riparian and aquatic habitats.	<p>A. Maintain at least a 10m or wider riparian buffer strip where vegetation will not be disturbed along all watercourses based on the bank full height (e.g. highwater mark) unless otherwise authorized.</p> <p>B. Prevent ground disturbance that could result in a direct effect to critical aquatic habitat²⁵ and immediately adjacent areas. If no feasible alternative exists, conduct an effects assessment and fully mitigate the impacts.</p> <p>C. Follow BC Standards and Best Practices for Instream Works²⁶.</p>
6.4 Assess wildlife values near the mine site prior to development.	<p>A. Placer miners should explore their claims for wildlife values present near their proposed operations before construction. This should identify species potentially utilizing the area.</p> <p>B. Evaluate the results of the site inspection to determine if a critical feature is present (e.g. mineral licks, denning areas, migratory bird nests) and whether your operation would cause an impact. Assistance can be provided through:</p> <ul style="list-style-type: none"> i. Contacting provincial ecosystems/wildlife biologists. ii. Hiring a qualified professional to conduct field investigation or desktop assessment for wildlife presence and habitat suitability.
6.5 Minimize the impacts of industrial access to ecological values.	<p>A. Plan to use existing industrial access and minimize new road construction.</p> <p>B. If new industrial access is required, operations should:</p>

²⁴ Available at <http://www.dfo-mpo.gc.ca/library/223669.pdf>

²⁵ Available at <http://www.dfo-mpo.gc.ca/species-especes/sara-lep/map-carte/index-eng.html>

²⁶ Available at <http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf>

	<ul style="list-style-type: none"> i. Plan and construct access routes to avoid impacts that have been identified during the site inspection. ii. Plan access routes to avoid through roads. iii. Avoid constructing roads across active floodplain fans. iv. Avoid constructing roads in dry floodplains. v. Deactivate and reclaim new roads when access is no longer required to support mining or other resource development activities.
6.6 Minimize impacts to wildlife.	<ul style="list-style-type: none"> A. Maintain the minimum riparian setback of 10m, unless otherwise authorized. B. Minimize the removal or disturbance of vegetation in the mine footprint. C. Avoid infrastructure and roads within 500m of mineral licks and trails linking high-value habitats. Do not disturb critical habitat features.²⁷ D. Yield to wildlife on trails and roads. Speeds should not exceed 30 km/h on trails. E. If animals are observed in the vicinity, temporarily suspend construction, blasting and other potentially disruptive activities until animals leave the area. F. Beyond the boundary of the mine site, maintain distances sufficient to prevent changes to the behaviour of wildlife (at least 500m in open areas is the default for large mammals). G. The removal of beaver dams and/or beavers requires a permit under the <i>Wildlife Act</i>. H. Follow best management practices for beaver dam removal when permitted: http://www.env.gov.bc.ca/wld/instreamworks/beaverdamremoval.htm I. Avoid the removal or disturbance of wildlife dens. J. Store animal attractants securely to prevent access, do not store food or food waste on site, and avoid seeding with browse species while operations are ongoing. K. Do not attempt to get close to wildlife when they are sighted.

²⁷ Critical habitat feature maps are available in the Atlin Taku Land Use Plan.

<p>6.7 Minimize the risk of bear/human interaction.</p>	<p>A. Locate camp facilities in areas that are not frequented by bears.</p> <p>B. Reduce bear/human interaction by following the information prescribed at:</p> <ul style="list-style-type: none"> • Yukon Guidelines for Industrial Activity in Bear Country: https://yukon.ca/sites/yukon.ca/files/env/env-guidelines-industrial-activity-bear-country.pdf • Get Bear Smart Society: http://www.bearsmart.com • Yukon Environment’s How you can stay safe in Bear Country: https://yukon.ca/en/outdoor-recreation-and-wildlife/wilderness-safety/stay-safe-bear-country#what-to-do-if-you-encounter-a-bear • Proponent’s Guide: Assessing and Mitigating the Risk of Human-Bear Encounters developed by the Yukon government: https://yukon.ca/sites/yukon.ca/files/env/env-proponents-guide-human-bear-encounters.pdf • Living with Predators Resource Guide: Practical electric fencing resource guide http://transbordergrizzlybearproject.ca/pdf/LWL%20Electric%20Fence%20Guide.pdf
<p>6.8 Wildlife timing windows²⁸ are to be utilized when removing buildings.</p>	<p>A. Clear old buildings in future mining areas in late summer, fall or early spring to avoid destroying barn swallows’ nests or bat roosts.</p> <p>B. In the event that timing windows cannot be followed, placer miners should hire a qualified professional to conduct bird nest surveys.</p> <p>C. If the removal of active bird nests is necessary, a permit under the <i>Wildlife Act</i> is required.</p>
<p>6.9 Use songbird and raptor timing windows when clearing land.</p>	<p>A. Clear future mining areas and test pits in late summer, fall or late winter to avoid tree removal during critical timing windows for songbirds and raptors. Riparian areas often contain songbird and raptor nests.</p>

²⁸ Consult regional FLNRO ecosystem staff for area specific timing windows. For placer mining in the North Area (Peace, Omineca and Skeena regions), consult the Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area, British Columbia found at <http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=12121>

	<p>B. If active nests of birds listed under the <i>Migratory Bird Convention Act</i>²⁹ or <i>Wildlife Act</i> are discovered:</p> <ul style="list-style-type: none"> i. Placer miners should postpone activities in the nesting area until nesting is completed (e.g. the young have left the vicinity of the nest). Miners are reminded that migratory bird species listed under the <i>Migratory Bird Convention Act</i> or <i>Wildlife Act</i> may nest on the ground, in ground cavities, in grasses, shrubs, cliffs, trees, tree cavities, etc. ii. Any nest found should be protected with a buffer zone³⁰ appropriate for the species and the surrounding habitat until the young have left the nest.
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²⁹ Additional information on reducing risks to and avoiding incidental take of migratory bird nests and eggs can be found here: <http://www.ec.gc.ca/paom-itmb>

³⁰ Information pertaining to appropriate buffers for raptors is available in Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia:

http://www.env.gov.bc.ca/wld/documents/bmp/raptor_conservation_guidelines_2013.pdf

7 Reclamation

7.1 Overview

In the mining context, “reclamation” refers to activities that are intended to restore the capability of land disturbed by exploration or mine activities to end land uses based on pre-mining land use and capability or establish new land uses that reflect future use of the land. Reclamation is a legislated requirement of the *Mines Act* and Code, as mining is considered to be a temporary use of the land. Reclamation is an essential and progressive component for all phases of exploration and mining programs, including placer.

7.2 Background

Reclamation should be progressive and ongoing throughout the life of the mine. The goal of reclamation is to enhance protection of the environment, safety on site and function of land, ecosystems and habitats. The key components of reclamation include re-establishment of natural drainage patterns, erosion control, de-compaction, re-contouring, replacement of growth medium and appropriate re-vegetation.

Progressive reclamation will be easier and less expensive to complete than if all reclamation is done at the end of the mining operation. For example, it is much easier and less expensive to proactively manage erosion than it is to stop gully and stream channel erosion once these processes have begun. A well-planned work program including stripping, stockpiling, mining and water management will facilitate successful site reclamation.

7.3 Context and Management

Placer mining has taken place in British Columbia for well over a century. Over this time, society’s approach to and understanding of land use has changed. Until the latter part of the 20th century, no legislation was in place to ensure that land disturbed by industrial activities was reclaimed. Since 1969, miners in BC have been legally required to reclaim disturbance caused by mining activities.

Historic mining practices have resulted in several areas where much of the finer-textured soils and growth medium have been washed away, hindering natural vegetation from re-establishing. Where environmental disturbance occurred prior to enactment of the 1969 reclamation legislation, the current miner is not responsible for re-vegetating this portion of the mine site³¹ unless further work is conducted in that location. When a miner works an area, they assume the responsibilities to reclaim it. Mine sites are required to be reclaimed to a similar capability that existed prior to the current mining activity. Proper salvage and stockpiling of surficial soils that contain organic matter and fines during the site preparation phase, and re-application of these following mining operations, are key to ensuring successful reclamation.

³¹ As noted in Part 10.7.2 of the Health, Safety and Reclamation Code for Mines in British Columbia.

Historic mining has established trail access, which has facilitated use of lands within and proximal to placer areas for hunting and other recreational purposes. As these access trails often pre-date the 1969 legislation and are a valued resource for other land users, reclamation of these trails should be discussed with the Mines Inspector and part of the reclamation plan submitted with the NOW.

7.4 Current Regulatory Requirements

The reclamation of placer mines falls under the legislative umbrella of the *Mines Act*. Mine operators are legally required to reclaim their sites in accordance with the *Mines Act*, the Code, and their operation's specific permit conditions. Prior to the commencement of mining activities, proponents have to post a financial security. The amount of this security is determined by the provincial inspector of mines and is based on an estimate of how much it would cost the Province to reclaim the site, should responsibility to reclaim a mine site revert to the Crown. Securities are not returned to proponents until they can demonstrate to inspectors of mines that their sites have been appropriately reclaimed. Reclamation includes the removal of equipment, buildings, and miscellaneous debris as well as contouring, re-establishing site drainage and stability, and re-vegetating the surface with plant species appropriate to the site. Evidence of successful vegetation recovery and long-term stability (e.g. erosion control) must be present prior to return of securities. This will require, at a minimum, a full growing season to demonstrate success.

The Code outlines the need to file a NOW, including the proposed mine plan, reclamation program, and other information that the inspector may require. No mining activities which include mechanical surface disturbance may proceed without the inspector issuing a permit or authorization.

It is a condition of *Mines Act* permits for placer mining that an annual summary of activities³² be filed, which details site disturbance and reclamation.

The objectives of the portions of the Code that address reclamation are to:

- Ensure long-term stability of land, watercourses and access roads;
- Ensure previous land uses are maintained and/or potential future uses are considered; and,
- Within the context of the approved end land use, provide an average land capability that is equivalent to or better than that which existed prior to the mining activity.

The Code and the BC *Weed Control Act* describe requirements to control designated noxious plants on mine sites and ensure that plant species that are planted or otherwise established are appropriate (e.g. not invasive) for the end land uses. Information on noxious plants can be found here:

<http://www2.gov.bc.ca/gov/content/environment/pesticides-pest-management/business-industry/sector-specific-tools-guides/noxious-weeds-vegetation-management>

³² https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/mineral-exploration-mining/documents/permitting/annual_summary_for_placer_activities.pdf

7.5 Best Management Practices

Management Practices	Methods and Approaches
<p>7.1 Plan for progressive reclamation, including ongoing monitoring.</p>	<ul style="list-style-type: none"> A. Develop a reclamation plan prior to the start of development that incorporates applicable BMPs and addresses all the reclamation standards outlined in the Code and <i>Mines Act</i> permit. B. Budget adequate time and resources for reclamation. C. Collect information about pre-mining site conditions, which may include soil testing (e.g. nutrients and water holding capacity) and vegetation information (e.g. native species). D. Take a phased approach to site reclamation, limiting areas of disturbance to what is needed for operations in any given season, and reclaiming as soon as possible when mining is completed in each area. E. Where permitted instream work is expected, plan to minimize disturbance to instream and riparian vegetation and other features, including mats of floating vegetation; overhanging vegetation; natural large woody debris; large boulders; and, trees, bushes, shrubs, weeds or tall grasses along any stream bank.
<p>7.2 Monitor reclamation throughout the life of the mine.</p>	<ul style="list-style-type: none"> A. Monitor progressive reclamation throughout the life of the mine. If reclamation is not successful, return to the site and reclaim it using alternate methods and/or consult a professional. B. Miners are encouraged to provide geo-referenced photo documentation of reclamation and re-vegetation progress. C. Document all activities in detail as they are conducted so that details are not lost. D. Survey all areas disturbed and reclaimed to keep a running inventory. E. Establish performance objectives that are based on reference ecosystems to provide comparison to support conclusions of success.
<p>7.3 Stockpile stripped soils and surface materials to facilitate reclamation.</p>	<ul style="list-style-type: none"> A. Strip surface soils and fines to the greatest depth possible and stockpile separately from other overburden. B. Salvage the soils from the footprints of waste dumps before placing waste materials (overburden, tailings, sediments). C. Strip and set aside pods of vegetative mat where available and stockpile root side down, in a single layer if feasible, or use this material to cover stockpiled soil for later use.

	<p>D. Pile small trees, shrubs and grasses with the top layer of organic soil to provide some protection of the stockpile from wind and surface water erosion, reduce root disturbance, and maintain natural seed stock.</p> <p>E. Contour the stockpiles or keep the slopes shallow when placing materials, and leave the surfaces roughened to assist in minimizing erosion on slopes and pooling of water on the crest.</p> <p>F. Stockpile large trees removed during site preparation for later placement to limit site access and provide protection for re-establishment of natural vegetation.</p> <p>G. Cover newly re-contoured land with available recently stripped surface soils for maximum reclamation effectiveness.</p>
<p>7.4 Prevent the introduction of invasive species.</p>	<p>A. Clean all equipment before it arrives on the mine site. Equipment cleaning helps to prevent the spread of weeds that could be lodged in equipment and will minimize the cost of invasive species control later.</p> <p>B. Promote natural re-vegetation in order to minimize the introduction of noxious weeds.</p> <p>C. If necessary to re-vegetate, use appropriate species and monitor re-vegetation success.</p> <p>D. Familiarize yourself with invasive species, and if you find them on your mine site, contact the mines inspector, range officer or BC Invasive Plant Council³³, or use the BC Report-A-Weed app³⁴.</p> <p>E. Remove noxious weeds on the mine site consistent with the Code and the <i>Weed Control Act</i>.</p>
<p>7.5 Backfill pits and trenches.</p>	<p>A. Ensure that backfilled material does not contain any materials that are deleterious to the environment (e.g. treated wood, hydrocarbons, etc.).</p> <p>B. Apply a top layer of stockpiled soil, growth medium, and/or tailings fines where available.</p> <p>C. Minimize compaction of replaced growth medium.</p> <p>D. Replace stockpiled vegetation if available.</p>

³³ Noxious weeds can be reported to the Northwest Invasive Plant Council at 1-866-449-3337 or at <http://nwipc.org/>.

³⁴ App available on Google Play and iTunes. See <https://www.for.gov.bc.ca/hra/plants/raw.htm>.

<p>7.6 Remove all buildings, machinery and debris from the mine site.³⁵</p>	<p>A. Remove and properly dispose of all buildings, machinery, equipment, cables, culverts and other debris located on the mine site.</p> <p>B. Remove and/or deactivate all utilities and septic systems, including drain fields and holding tanks.</p> <p>C. Obtain written permission from the inspector of mines to bury material onsite with suitable overburden and growth media only where removal of large machinery or foundations is not practical, and where the material will not create an environmental hazard.</p> <p>D. Ensure the removal and safe disposal of petroleum products and any other chemicals used in the mining operation. Disposal should utilize local recycling facilities and must comply with local landfill requirements. Where materials cannot be properly disposed of locally, alternative disposal at appropriate facilities must be arranged.</p> <p>E. Arrange to properly recycle scrap metal and any other materials that are recyclable (e.g. tires).</p>
<p>7.7 De-activate or reclaim roads and trails where required by permit conditions.³⁶</p>	<p>A. Scarify (roughen the surface), excavate and/or rip road surfaces to minimize compaction.</p> <p>B. Re-establish natural gullies and swales that occur above and below the old road so that surface drainage patterns are re-established.</p> <p>C. Fill road cuts that may be barriers to wildlife in a manner that permits animal movement.</p> <p>D. Re-contour road grades and pull back side-cast materials to re-establish pre-mining drainage and blend in with natural landforms, to enhance long-term stability and vegetation establishment.</p> <p>E. Remove culverts and bridges.</p>
<p>7.8 Establish landforms and structures to reduce potential for erosion.</p>	<p>A. Design drainage so as to avoid water erosion and to minimize disturbance to vegetation, including re-vegetated areas.</p> <p>B. Design drainage channels for maximum (peak) flow events, and armour turns and drops in elevation with rock.</p> <p>C. Utilize earth, rocks, logs and brush to assist in stabilization of reclaimed slopes. Bioengineering practices can be</p>

³⁵ Further information is available in the BC Guidelines for Industrial Camps Regulation at https://www2.gov.bc.ca/assets/gov/health/keeping-bc-healthy-safe/industrial-camps/bc_guidelines_for_industrial_camps_regulation.pdf

³⁶ For more information, see the road deactivation chapter in the Forest Road Engineering Technical reference at <https://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/Road/FRE.pdf>

	<p>beneficial both from a re-vegetation and a stabilization perspective³⁷. Professional advice is strongly recommended when dealing with steep gradients and erodible materials.</p> <p>D. Remove culverts and use water-diversion means, such as slope drains, to return drainage patterns to their original patterns.</p> <p>E. Provide coarse drain rock with appropriate filter materials in areas where bank seepage occurs to carry seepage safely.</p> <p>F. Cut through roads and dikes that pose a threat to watercourses in the event of their failure, and route drainage away from the watercourses.</p> <p>G. Reduce the exposure of soil, silt and sediments to water by diverting surface drainage away from erodible slopes and surfaces.</p> <p>H. Utilize sediment control measures³⁸ while constructing the final drainage system to reduce the effects of erosion. Use the coarsest available materials (rock) to control the force of water. Use rock to:</p> <ol style="list-style-type: none"> i. Cover slopes that are difficult to re-vegetate. ii. Line ditches that might easily erode. iii. Weigh the bottom of slopes to prevent slope failure. iv. Protect stream-crossing structures. v. Protect outlet areas such as culverts and drainage ditches from scour. vi. Protect stream banks.
<p>7.9 Roughen slope surfaces and re-contour waste piles and other disturbed areas.</p>	<p>A. Re-grade steep slopes in mining excavations and waste piles to a stable angle (typically less than 2H:1V);</p> <p>B. Contour side slopes and piles so that they blend with the natural topography of the surrounding area.</p> <p>C. Grooving, furrowing or making steps parallel to the slope is recommended on steep slopes (i.e. greater than 3H:1V) (Figure 7.1). Loosening of compacted (top) soils or light</p>

³⁷ Guidelines for streambank and lakeshore stabilization and soil bioengineering are available from BC Ministry of Environment: <http://www.env.gov.bc.ca/wld/instreamworks/bankstabilization.htm> and http://www.env.gov.bc.ca/wld/documents/bmp/BMPLakeshoreStabilization_WorkingDraft.pdf, or from the US Department of Agriculture Forest Services: <https://babel.hathitrust.org/cgi/pt?id=umn.31951d022485889;view=1up;seq=3>.

³⁸ Sediment control measures are techniques used to slow and minimize erosion and relate to a whole host of activities, including lining erodible areas around culverts or bridge abutments with coarse rock. Other erosion control measures include the use of mulch, rolled erosion control products, straw wattles, seeding, check dams, and polyethylene sheeting. Further information pertaining to the application of erosion and sediment prevention is available at <https://www.crd.bc.ca/education/our-environment/concerns/erosion>.

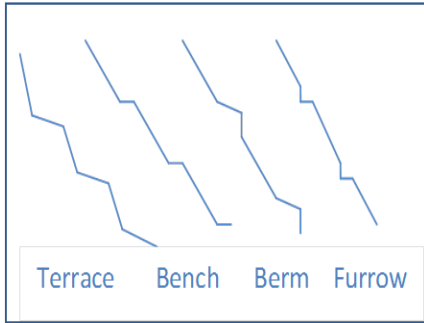


Figure 7.1: Terrace, bench, berm and furrow shapes



Figure 7.2: Tracking
(Source: Virginia Department of Forestry, 2003)

tracking to encourage moisture infiltration is sufficient for less steep slopes (i.e. less than 3H:1V).

- D. Where areas are highly compacted or where greater roughness is required to control erosion and run-off, an excavator may need to be used to create a rough and loose surface preparation.
- E. Rip terraces into soft rock slopes with a dozer crawler tractor (Figure 7.1). Terraces should achieve an overall slope of no steeper than 1H:1V unless soils or rock conditions will allow for a steeper stable slope.
- F. Tracked equipment should travel up and down the slope for safety and to ensure track cleat marks are parallel to the slope (Figure 7.2). Care must be taken to ensure that the up and down travel of the dozer does not create preferential pathways with the tracks.
- G. Ensure all mine site surfaces are not compacted during the roughening, contouring, and soil placement activities.
- H. Wherever equipment or tools are used to roughen the surfaces to promote infiltration and create good conditions for re-vegetation, care must be taken to ensure that preferential pathways are not created that will exasperate erosional processes.

7.10 Return growth media to ground surface.

- A. Replace stockpiled soil and surface materials once the placer mine site or part of the site has been re-graded.
- B. Use fine tailings strategically in reclamation to assist in providing a growth media in areas where historic placer mining activities have removed much of the natural soil and fine material.
- C. Ensure that applied soils:
 - i. Are rough and loose with lots of small depressions for seeds to lodge in and germinate.
 - ii. Incorporate roots, stumps and other woody debris to reduce erosion and create greater biological diversity.
- D. Create islands of vegetation in large stripped areas to act as a nearby seed source and promote vegetation.
- E. Avoid applying soil materials during significant wind or rain events.
- F. Use advanced erosion protection techniques in areas of high erosion (i.e. steeper gradients, areas exposed to water, etc).

<p>7.11 Re-vegetate to a self-sustaining state using appropriate plant species.</p>	<p>A. Maximize opportunities for re-vegetation by:</p> <ul style="list-style-type: none"> i. Assessing the effectiveness of natural re-vegetation resulting from replacement of salvaged soil materials, vegetative mat and other stockpiled organic materials. ii. Transplanting willow and other shrubbery into prepared ground³⁹ to create islands of vegetation in large cleared areas where there is adjacent natural vegetation. iii. Consulting with the inspector of mines to determine appropriate re-vegetation measures. It is essential that in areas that are to be seeded, ecologically suitable species are used⁴⁰. iv. Only using fertilizer under the direction of an appropriate BC government representative and in accordance with aquatic safety guidelines. <p>B. To ensure natural re-vegetation success, miners are encouraged to seek the advice of a qualified professional.</p> <p>C. In areas of minimal growth medium or poor natural re-vegetation, seeding with short-lived plant species should be considered. This will help secure the growth medium until such time as natural vegetation can re-establish itself.</p> <p>D. To maximize success of seeding, seeding is most suitable in spring or fall.</p> <p>E. Plant seedlings of propagated native species, especially conifers and native legumes, to enhance successional processes.</p>
<p>7.12 Restore aquatic habitats and riparian areas that have been disturbed during instream work (if applicable).</p>	<p>A. Follow the provincial Standards and Best Practices for Instream Works⁴¹.</p> <p>B. Grade disturbed areas to a stable angle of repose or shallower after work is completed. Planting on gentle slopes can provide greater re-vegetation success. In addition, re-vegetate areas to prevent surface erosion and subsequent siltation of the watercourse. Seek a qualified professional or take an approved bioengineering course for remediation and/or bioengineering when planning significant instream work.</p>

³⁹ Guidelines for streambank and lakeshore stabilization and soil bioengineering are available from BC Ministry of Environment: <http://www.env.gov.bc.ca/wld/instreamworks/bankstabilization.htm> and http://www.env.gov.bc.ca/wld/documents/bmp/BMPLakeshoreStabilization_WorkingDraft.pdf, or from the US Department of Agriculture Forest Services: <https://babel.hathitrust.org/cgi/pt?id=umn.31951d022485889;view=1up;seq=3>.

⁴⁰ All seeds are to meet or exceed Canada Common #1 specifications as defined by the *Canada Seed Act* to reduce the risk of noxious weed introductions. The “Certificate of Seed Analysis” should be reviewed to ensure that invasive plants are not accidentally introduced.

⁴¹ Available at <http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf>

	<p>C. Protect disturbed soil areas on the steep banks and immediately adjacent to the stream from surface erosion by:</p> <ul style="list-style-type: none"> i. Hydro seeding with a heavy mulch. ii. Using a tackifier and seed mix. iii. Installing erosion blankets. iv. Re-vegetating. <p>D. Where instream works have been approved, install aquatic habitat features in fish-bearing streams if prescribed by a qualified professional or as part of permit conditions.</p> <p>E. Use riprap to armour erosion-prone portions of the disturbed watercourse, such as the outside of stream bends.</p>
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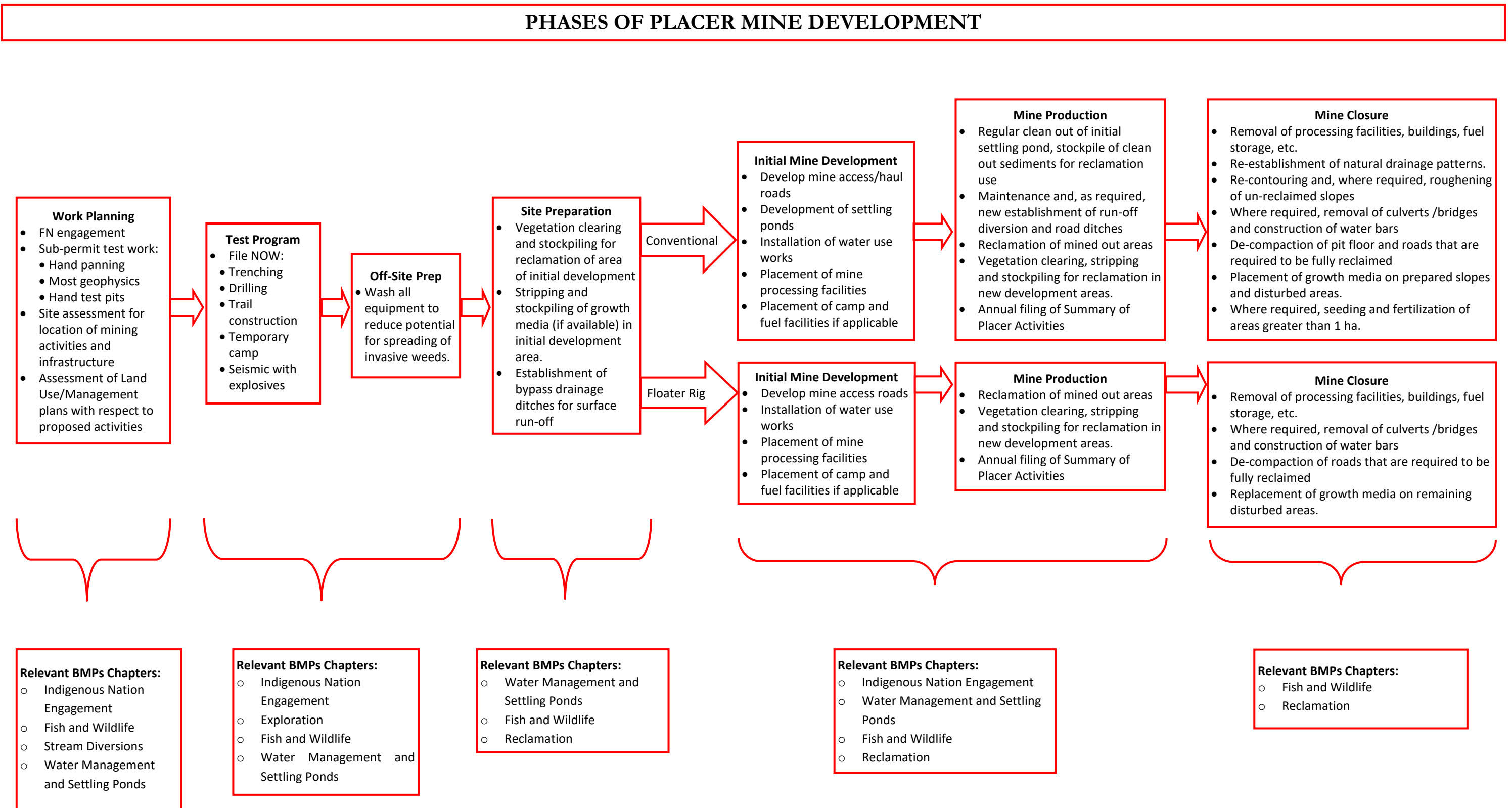
Recommended procedures for slope design vary, depending on the type of slope and soil characteristics. The below table lists some general considerations. However, additional input from professional engineers may be required.

Slope	Soil Characteristics	Recommended Procedure
Side Slope	Fine, poorly-drained soil	Grade slope to less than 3H:1V.
	Coarse, well-drained soil	Grade slope to less than 2H:1V. Bench or terrace if slope is over 15m high.
Pile	Coarse, well-drained soil	Grade slope to less than 2H:1V. Round off the top of the pile.
	Fine, poorly-drained soil	Grade slope to less than 3H:1V. Round off, reshape, re-contour top of pile.

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Appendix 1: Diagram Identifying the Phases of Placer Mining and the Corresponding Best Management Practice Chapters Most Relevant to Each Phase.



Appendix 2: Placer Mining Water Intake Guidelines.

Screening

Intakes must be screened according to DFO guidelines. The full document, Freshwater Intake End-of-Pipe Fish Screen Guideline can be found here: <http://www.dfo-mpo.gc.ca/library/223669.pdf>

Intake Structures

The preferred method of water intake pump installation is to screen the intake and place the weighted intake directly in the stream without any disturbance or damage to soils, trees, or other riparian features. Intake structures should cause as little disturbance to the bank of the stream as possible. In some locations, an excavated intake trench is necessary to maintain a stable intake. An approval authorizing changes in or about a stream (under Section 11 of the WSA), or a Water Licence is required to construct any intake trenches or ponds. In these cases, disturbance must be kept to a minimum and follow the suggested guidelines below and permit conditions.

Location

- Excavated intake trenches no closer than 20 m to an existing tributary on the same side of the stream.
- NOT on an outside bend of a stream – this is an active area for erosion.
- A permanent location must be chosen if an intake trench is used. If an intake is going to be moved, a floating or weighted intake that does not require excavation on the bank is required.
- Avoid cutting or removing vegetation when at all possible.
- The trench shall point in a downstream direction, so the force of the creek does not enter the intake trench.

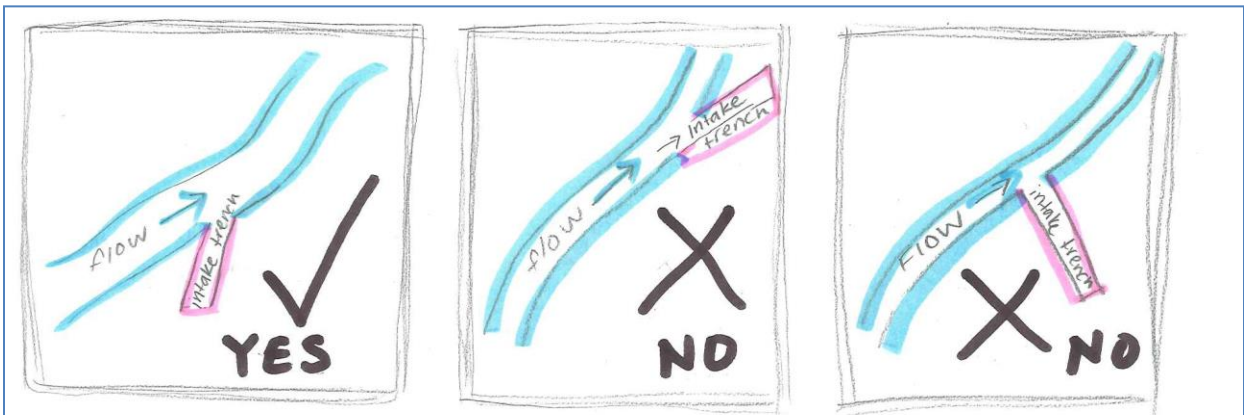


Figure 2: Schematic of water intake trench properly and incorrectly designed and constructed.

Timing

- Do not install intake trenches during high spring flows. It is best to install intakes when water levels have dropped and the banks can be properly protected from erosion.

Erosion Protection

- Any disturbed areas of an intake trench shall be protected from moving water by large, angular rock.
- Intakes shall be inspected and fully armoured with large, angular rock at the end of each operating season to ensure adequate protection from spring freshet flows.

Regular Inspection

- Regularly inspect the intake structure at least once per week and any time after high rainfall or snow melt. Address small erosion issues before they become large issues.

Closure Plan

- Fill intake trench and protect the bank from erosion when mining is complete.
- Re-vegetate intake area.

Activities NOT permitted as part of an intake structure under a section 6 WSA permit include:

- Gravity feed trenches that connect the stream to the wash plant workings;
- Excavation within the stream channel;
- Rock dams or constrictions on the creek that back up water or limit fish passage;
- Bank-to-bank constrictions or dams;
- Storage ponds;
- Instream work for maintenance or repair of an intake trench after initial construction;
- Any disturbance or damage to soil, trees, stream banks or lakeshores; or,
- Any removal of water from any beaver pond and/or damage or destruction of a beaver, muskrat or other aquatic furbearer dam, house or den.

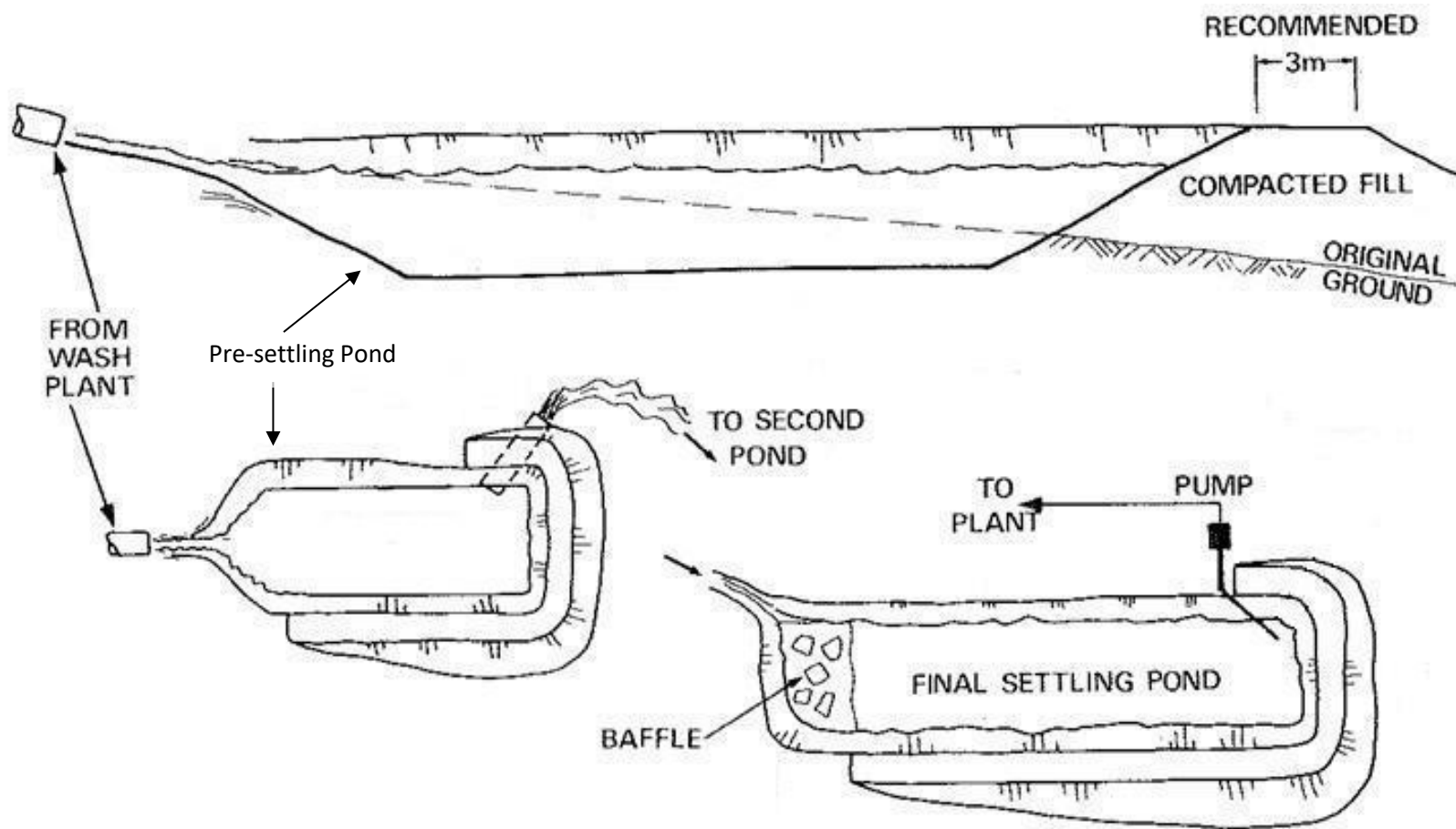
Activities that may be allowed if applied for under a Water Licence

- Off channel storage ponds;
- Dams; or,
- Regular maintenance of intakes, as per best practices.

More information on water licences and approvals can be found here:

<http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/water-licences-approvals>

Appendix 3: Schematic of Pre-settling Pond and Final Settling Pond Layout



(NOT TO SCALE)

Appendix 4 Stream Diversions Current Regulatory Requirements

Authorizations under the *Mines Act*, the Department of Fisheries and Oceans and the *Water Sustainability Act* are required for stream diversions.

The diversion of a stream into a constructed stream channel requires authorization under the *Water Sustainability Act*. A water licence specific to the stream diversion must be obtained prior to excavating a diversion channel and diverting water into the stream diversion channel. The water licence allows for works in and about a stream and diversion of water flow, and it provides the placer operator with the ability to construct and maintain the works authorized by the licence. Securities held under the *Water Sustainability Act* may be required. A *Water Sustainability Act* authorization is required prior to any stream diversion construction, even if the applicant already has a *Mines Act* permit.

A *Fisheries Act* authorization may be required and an application for review of the project should be submitted to Fisheries and Oceans Canada. Proponents should access Fisheries and Oceans Canada's "Projects Near Water"⁴² web page and follow the directions to evaluate the project for potentially harmful impacts to fish and fish habitat and to submit an application.

Placer miners considering any work within a stream should adhere to British Columbia's Standards and Best Practices for Instream Works, available here:

<http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf>

⁴²<http://www.pac.dfo-mpo.gc.ca/habitat/index-eng.htm>