

U.S. Fish and Wildlife Service Tools, Resources, and Best Management Practices (BMPs) for Material Sites

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I. Tools

Information Planning and Consultation (IPaC)

IPaC is a project planning tool that streamlines USFWS environmental reviews.

- To find out if protected species (e.g., Threatened or Endangered species, eagles) or other resources (e.g., migratory birds of conservation concern, wetlands, National Wildlife Refuges) are in the vicinity of or within the project footprint, go to ipac.ecosphere.fws.gov/, click on ‘Get Started’, and select the project area by manually drawing project boundaries or uploading a shapefile.
- Depending on the location and type of project, a permit under the Bald and Golden Eagle Protection Act (BGEPA) for the take of eagles or their nests or a Section 7 Consultation for federally Threatened or Endangered species under the Endangered Species Act may be needed.
 - If the project area includes Threatened or Endangered species, critical habitats, bald or golden eagles (listed under Migratory Birds in the Resources list to the left), please contact the local USFWS office for additional guidance (Northern Alaska: (907) 456-0203; Southern Alaska: (907) 271-2888).

II. U.S. Fish and Wildlife Service Technical Resources

Migratory Birds

IPaC will provide a list of USFWS Birds of Conservation Concern (BCC) expected to occur in the project area. However, this will not be a complete list of migratory birds in the area, and all projects should assume that additional migratory bird species are likely present.

- The USFWS has developed a timing guidelines table for migratory birds in Alaska to help avoid the take¹ of nesting birds based on location, habitat, and bird species. Visit fws.gov/alaska-bird-nesting-season to view the table online and download a PDF version.
- For activity-specific best management practices, visit the USFWS website for Avoiding and Minimizing Take for Migratory Birds (fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds).
- For additional guidance or questions about how to protect and avoid take of migratory birds, please contact the local USFWS office (Northern Alaska: (907) 456-0203; Southern Alaska: (907) 271-2888).

¹ “take” means to, or attempt to, pursue, hunt, shoot, wound, kill, trap, capture, or collect

Eagles

Both bald and golden eagles and their nests are protected under the Bald and Golden Eagle Protection Act (BGEPA). For any project that may result in take or disturbance of eagles or their nests, the USFWS recommends a survey by a qualified raptor biologist prior to conducting activities to document locations of nests and help inform avoidance and minimization measures and the need for a permit. Surveys should be conducted within the project footprint and extending 0.5 miles beyond the project footprint, including cliffs of tributary streams, to determine if and where eagles may be nesting. If nests are located within the survey area, USFWS recommends following the *National Bald Eagle Management Guidelines* for bald eagles (see below) and contacting the local USFWS office for golden eagles (see below) or for other questions about eagles and project activities, including the potential need for an incidental take permit.

Bald Eagles

- The Alaska Eagle Nest Atlas (eagle.abrinc.com/) is a useful first step to identify potential bald eagle nest locations in and around project areas. However, the Atlas should not be used as a replacement for the recommended, location-specific surveys to verify the presence of nests identified in the Atlas and document additional nests.
- The USFWS *National Bald Eagle Management Guidelines* (fws.gov/media/national-bald-eagle-management-guidelines) provide activity-specific buffers to help avoid disturbance to nesting bald eagles.
- USFWS in Alaska has provided additional information and guidance on bald eagle nesting windows and sensitivity to disturbance (fws.gov/Alaska-eagle-nesting).

Golden Eagles

- In general, golden eagles are more sensitive than bald eagles, and, in Alaska, USFWS recommends a 0.5-mile buffer for most, but not all activities. For more information on historical golden eagle nests in the project area or for additional questions or guidance on eagles, please contact the local USFWS office (Northern Alaska: (907) 456-0203; Southern Alaska: (907) 271-2888).

Eagle Permits

- The USFWS National Eagle Management webpage (fws.gov/program/eagle-management/what-we-do) provides an overview of the types of eagle take permits.
- If needed, permits are submitted through the USFWS ePermits portal (fwsepermits.servicenow.com/fws/).

Riparian Buffer Zones

- Recommendations for Riparian Management Zones (RMZ) for Interior Alaska can be found at www.fws.gov/node/378411.

Culverts

- The USFWS has developed culvert design guidelines for aquatic organism passage and floodplain connectivity for Alaska when stream crossings cannot be avoided. The USFWS *Culvert Design Guidelines for Ecological Function* can be found at [fws.gov/alaska-culvert-design-guidelines](https://www.fws.gov/alaska-culvert-design-guidelines).

Aquatic Invasive Species

- Inadvertent introductions of aquatic invasive species into an ecologically significant resource area could have significant, long-term impacts. USFWS developed *Guidelines for Preventing the Spread of Aquatic Invasive Species*, which can be found at: [fws.gov/media/aquatic-invasive-species-prevention-guidelines-pdf](https://www.fws.gov/media/aquatic-invasive-species-prevention-guidelines-pdf).

III. BMPs for Material Sites

Avoid and Minimize Ground Disturbance

Reduce the project footprint to the maximum extent practicable by implementing the following BMPs:

- Locate proposed projects and their associated activities in already disturbed areas or lower functioning/quality habitat.
- Collocate infrastructure whenever possible in permanently disturbed areas such as rights-of-way (e.g., place utilities and pipelines in existing road corridors, use existing pipeline or transportation corridors for new infrastructure construction, place new antenna on existing towers, or place new structures near existing structures whenever possible).
- Avoid wetlands, especially higher-functioning/high-value wetlands, whenever possible.
- If impacts to wetlands are unavoidable, restore wetlands to pre-existing condition (hydrology, grade, vegetation) to reduce subsidence, scarring, and habitat alteration.
- Avoid sensitive soils such as highly erosive soils and thaw-stable and thaw-unstable permafrost.
- Use ice or snow roads, temporary vegetation or access or rig mats, and stream and riparian buffers when possible.
- Avoid ground-disturbing activities during the bird nesting season when possible. Please see USFWS timing guidance table for Alaska at [fws.gov/alaska-bird-nesting-season](https://www.fws.gov/alaska-bird-nesting-season).
- Use erosion control measures that have minimal additional habitat impacts such as weed free gravel and hay bales (uaf.edu/ces/invasives/weed_free_certification.php), weed free erosion control materials, and erosion control materials without plastic mesh netting.
- Preserve stream and riparian buffers.
- Include measures to prevent the introduction and spread of invasive species (aquatic, terrestrial, and marine).
- Restore the project area to pre-existing conditions to the maximum extent possible (hydrology, grade, vegetation).
- Use native plant species to restore the project area to pre-existing conditions.

- Topsoil is a valuable resource for natural revegetation and should be salvaged and used to top-dress a site for more rapid revegetation.

Managing Topsoil

Minimize Disturbance of Topsoil

- Minimize the project footprint.
- Locate project footprint in pre-disturbed areas and co-locate disturbance corridors (e.g., utility and pipelines with roads) to the greatest extent possible.
- Avoid sensitive soils (e.g., highly erosive soils, thaw-stable, and thaw-unstable permafrost).
- Use ice/snow roads, temporary vegetation mats, and stream buffers.

Salvaging Topsoil

To improve reclamation outcomes, topsoil should be salvaged and properly stored for reuse during reclamation.

- Plan to sequence construction activities such that existing surface vegetation can initially be removed, followed by grubbing roots of trees (unless whole trees are needed for root wad work in stream restoration) and blading remaining organic and topsoil layers for stockpiling for use during reclamation.
- Salvage the maximum amount of organic material and topsoil practicable, even during winter construction, and store separately (e.g., away from other overburden) for use during reclamation.
- Salvage the organic and topsoil layers and stockpile separately. At sites where the organic (O) and topsoil (A) layers are hard to distinguish or are very limited, salvage the uppermost 6 inches of the soil profile (dnr.alaska.gov/mlw/mining/coal/pdf/coalreg_apr09.pdf).
- Direct haul topsoil from the salvage location to a site prepared for reclamation. Direct hauling is not only less expensive when practicable (minimizes additional transportation costs), but it also increases the viability of native seeds and propagules in the salvaged topsoil by allowing them to begin reestablishment as soon as site conditions permit.
- For linear projects (e.g., roads, utilities, pipelines), salvage and re-spread topsoil concurrently with construction to ensure topsoil is used in similar habitats (e.g., upland topsoil should not be re-spread on reclaimed wetlands).

Storing, Stockpiling, and Spreading Topsoil

If salvaged topsoil cannot be applied immediately, it should be properly stockpiled and stored separately from subsoil (e.g., away from other overburden) and labeled as topsoil for use in later reclamation.

- In a well-sequenced mining plan, stockpiling topsoil should only be required when opening the first cell, with salvaged topsoil from the next cell in the sequence used to

- reclaim the previous cell. The stockpiled topsoil salvaged from the first cell can later be used to reclaim the last cell (dec.alaska.gov/water/wastewater/stormwater/gravel/).
- Stockpiled materials that will not be used within the first year should be placed on a stable area, labeled as topsoil, left undisturbed and protected from the elements by seeding it with an interim seeding mix (dot.alaska.gov/stwddes/desenviron/assets/pdf/bmp/bmp_52_53_00.pdf).
 - If topsoil is stored for more than one growing season, where practicable, use topsoil for interim reclamation by spreading it over cut and fill areas, around outer boundaries of facilities, embankments, and drainage ditches.
 - Redistribute topsoil to a uniform and stable thickness and protect it from compaction and erosion wind and water until vegetation is established.

Grading and Reseeding

- Recontour slopes to blend with surrounding topography; consider using waterbars or contour furrowing on steeper slopes (dot.alaska.gov/stwddes/desenviron/assets/pdf/bmp/bmp_11_00.pdf)
- Create surface roughness to help control surface water runoff and reduce sedimentation (dot.alaska.gov/stwddes/desenviron/assets/pdf/bmp/bmp_30_00.pdf).
- Use native, weed-free seed (preferably locally collected) specific to the habitat type, applied at specified rates, and cover the seed to specified depth. See the Alaska Department of Natural Resources, Division of Agriculture and the Alaska Plant Materials Center for recommendations (plants.alaska.gov/RevegNativePlants.html).
- Interim seeding may be necessary to keep topsoil viable, control erosion, reduce surface runoff, and maintain other habitat characteristics (dot.alaska.gov/stwddes/desenviron/assets/pdf/bmp/bmp_52_53_00.pdf).
- Use tackifier, mulch, or other bonding agents to keep seed in place (dot.alaska.gov/stwddes/desenviron/assets/pdf/bmp/bmp_56_00.pdf).
- Use adequate erosion control measures to reduce sheet flow (dot.alaska.gov/stwddes/desenviron/assets/pdf/bmp/bmp_10_01.pdf).
- Use silt control measures to trap sediment and prevent it from being transported into surrounding water bodies (dot.alaska.gov/stwddes/desenviron/assets/pdf/bmp/bmp_07_00.pdf).
- All disturbed areas should be seeded or planted with native vegetation; however, ONLY when native vegetation is not available, choose species that provide the same seasonal characteristics of growth as the original vegetation.
- Vegetative cover should be capable of stabilizing the soil against erosion.
- After final grading and before replacing topsoil and other segregated materials, the regraded land should be ripped to promote root penetration.

Migratory Birds

General

- Minimize human presence and activity near nesting birds during construction and maintenance activities.

- Prior to removal of an inactive nest (i.e., a nest with no eggs or chicks), ensure the nest is not protected under the Endangered Species Act (ESA) or the Bald and Golden Eagle Protection Act (BGEPA) as these nests cannot be removed without a valid permit.
- Do not collect birds (live or dead), their parts (e.g., feathers), or nests without a valid permit. Contact the local USFWS office (Northern Alaska: (907) 456-0203; Southern Alaska: (907) 271-2888) or visit fws.gov/program/migratory-bird-permit/permit-types-and-forms for more information on permits.
- If you have questions about taking² of birds during project activities, contact the local USFWS office (Northern Alaska: (907) 456-0203; Southern Alaska: (907) 271-2888). If non-game migratory birds are *intentionally* taken, please report the incident to the **local USFWS Office of Law Enforcement** (fws.gov/law-enforcement/special-agent-charge-anchorage-alaska).
- Schedule any land-disturbing activities, including vegetation removal, mowing and trimming, placing fill, blasting, etc., outside of the peak bird breeding season for the project area. Breeding seasons and timing guidance can be found at fws.gov/alaska-bird-nesting-season.

Construction and Operational Lighting

Every year, billions of birds migrate north in the spring and south in the fall, the majority of which fly at night, navigating with the night sky. However, birds can become disoriented by bright artificial lights and skyglow, often causing them to collide with buildings or windows. While lights can throw birds off their migration paths, bird fatalities are more directly caused by the amount of energy the birds waste flying around and calling out in confusion. The exhaustion can then leave them vulnerable to other urban threats (audubon.org/lights-out-program).

- To the maximum extent practicable, limit construction activities to the time between dawn and dusk to avoid the illumination of adjacent habitat areas.
- If construction activity time restrictions are not possible, use down shielding or directional lighting (i.e., use a 'Cobra' style light rather than an omnidirectional light system to direct light down to the roadbed). To the maximum extent practicable, while allowing for public safety, low intensity energy saving lighting (e.g., low pressure sodium lamps) should be used.
- Minimize use of high-intensity lighting, steady-burning, or bright lights such as sodium vapor, quartz, halogen, fluorescent, or other bright spotlights.
- Minimize illumination of lighting on associated construction or operation structures by using motion sensors or heat sensors. Use switches to keep lights off when not required.
- Avoid installing lights offshore or within 0.5 miles of the coast.

Prevent Entrapment and Nesting in Unwanted Places

- Install anti-perching devices on facilities and equipment where birds may commonly nest or perch.

² “take” means to, or attempt to, pursue, hunt, shoot, wound, kill, trap, capture, or collect

- Cover or enclose all potential nesting surfaces on structures with mesh netting, chicken wire fencing, or other suitable exclusion material prior to the nesting season to prevent birds from establishing new nests. The netting, fencing, or other material should have no opening or mesh size greater than 19 millimeters and should be maintained until the structure is removed. When work is complete, all netting used to deter nesting birds should be removed from structures and properly disposed of.
- Cover or seal all small dark spaces where birds and other small wildlife may enter and become trapped.
- During the time that birds are trying to build or occupy nests (generally between April and August depending on geographic location), monitor potential nesting surfaces at least once every 3 days for nesting activity. It is preferable to remove non-active nests (nests without eggs or chicks) or partially completed nests as they are built but prior to occupation. If birds have started to build nests, the nests should be removed before they are completed. Water should not be used to remove the nests if nests are located within 50 feet of any surface waters.
- Avoid construction activities that may displace birds after they have laid eggs and before the young have fledged.
 - If a nest becomes active (i.e., there are eggs or chicks in the nest) within the project area, avoid work that could result in abandonment or destruction of the nest until the young have fledged or the nest is unoccupied. If this is not possible, please contact the local USFWS office (Northern Alaska: (907) 456-0203; Southern Alaska: (907) 271-2888).
- **Swallows and peregrine falcons** may nest on exposed rock faces or sand or gravel stockpiles. Make these sites less suitable for nesting before the nesting season if swallows and peregrine falcons occur in the area. To discourage nesting on rock faces, consider covering ledges and overhangs to prevent falcons and other bird species from nesting on ledges, and swallows from nesting under overhangs. Remove any vertical faces and slope all sides of the stockpile to discourage swallows from building cavity nests in stockpiles. Surveys for nesting falcons and swallows at these locations if work is scheduled during the nesting season can be useful to help avoid impacts. If birds are found nesting on rock faces or in sand or gravel stockpiles, contact local USFWS office (Northern Alaska: (907) 456-0203; Southern Alaska: (907) 271-2888) for technical assistance.
- Alaska is home to many “species of concern” such as **horned grebes, rusty blackbirds, solitary sandpipers, Aleutian terns, and Kittletz’s murrelets**. These species are on one or more “watch lists” for declining populations and are vulnerable to habitat loss, environmental contaminants, and threats during the breeding season or at other critical times throughout the year. Avoid disturbing habitats these species rely on to the maximum extent possible. Refer to IPaC for a list of USFWS Birds of Conservation Concern that may be present in the project area.

Habitat Enhancement for Migratory Birds (Specifically Waterbirds)

- Floating Islands and Weed-free Gravel (technical discussion needed between USFWS and ADNR)
- Shallow Littoral Zones and Gravel Site Reclamation (guidelines forthcoming in a separate document)
- Shallow Water Areas for Wildlife (guidelines forthcoming in a separate document)

Habitat Protection

- If foam insulation will be used to protect the permafrost, use closed-cell extruded polystyrene or other closed cell foams (e.g., “blue board”) rather than non-extruded expanded polystyrene foam. Non-extruded expanded polystyrene foam can breakdown into small pieces (e.g., small pellets like those from an inexpensive foam cooler), which are easily spread across the landscape by wind and water, potentially becoming an ingestion hazard for fish and wildlife. These small pieces may be generated when trimming the foam during construction or when the foam is disturbed during reconstruction or reclamation several years later.
- Avoid the use of sediment and erosion control materials that contain plastic. Prior to degradation, plastic materials, especially mesh netting found in erosion control mats, can entangle wildlife, including amphibians, birds, small mammals, and fish. These materials also contribute to plastic debris pollution ranging from large sections of dislodged netting to small bits of plastic fragments entering the environment and posing secondary hazards to fish and wildlife. Therefore, use temporary erosion and sediment control products that either do not contain netting or contain netting manufactured from 100% biodegradable non-plastic materials such as jute, sisal, or coir fiber. (Note: degradable, photodegradable, UV-degradable, oxo-degradable, or oxo-biodegradable plastic netting, including polypropylene, nylon, polyethylene, polyester, poly-jute, etc., are *not* acceptable alternatives as all these materials contain plastics.) If netting is used, it should have a loose-weave, wildlife-safe design with movable joints between the horizontal and vertical twines, allowing the twines to move independently and thus reducing the potential for wildlife entanglement. Additionally, avoid silt fences reinforced with metal or plastic mesh, which can also cause an entanglement hazard to wildlife. Finally, to further minimize hazards to fish and wildlife, temporary erosion and sediment control products, when no longer required, should be promptly removed before removal becomes too difficult, potentially damaging new vegetation. For more information, please refer to [documents.coastal.ca.gov/assets/water-quality/permits/Wildlife-Friendly Netting in Erosion & Sediment Control-Factsheet r5 Sept 2016.pdf](https://documents.coastal.ca.gov/assets/water-quality/permits/Wildlife-Friendly%20Netting%20in%20Erosion%20&%20Sediment%20Control-Factsheet%20r5%20Sept%202016.pdf).

Invasive Species

Invasive plant species are introduced species that out-compete native plants for light, water, and nutrients. They often grow rapidly, mature early, spread seeds that survive a long time, and have no natural controls. When invasive plants displace native plants, habitats may be altered and become no longer suitable for some wildlife. Unlike most of the country, the Alaska climate and limited access to remote areas previously minimized the potential for introducing and proliferating invasive species in the state. However, these barriers are no longer as effective due to a warming climate and improved access. Special precautions are now needed to ensure protection from invasive species.

- Equipment must arrive and leave the project clean without visible soil clumps, plant, or animal material.
 - Use a pressure washer paying special attention to wheel wells, areas behind the bumper, trailers and other areas that are likely to catch vegetation or seeds.

- Equipment washing should occur at the same location during project operations; this site should then be surveyed regularly and treated as necessary. Do not clean equipment in or near waterways as it may promote the spread of invasive plant species downstream.
- Use certified weed-free and 100% plastic-free erosion control materials.
- Revegetate with native and local plant species. Vigorous non-invasive perennial grass species can also be considered since they can minimize the potential of invasive species to become established. Alaska Division of Agriculture's Plant Material Center (plants.alaska.gov/) is a good reference for appropriate seed mixes.
- Re-vegetate bare soils as soon as feasible to minimize the possible establishment of invasive plant species.
- Stabilize disturbed soils using appropriate erosion and sediment control procedures as soon as possible. Use certified weed-free materials.
- Identify locations of known invasive plant infestations and plan maintenance activities accordingly. Visit accs.uaa.alaska.edu/invasive-species/non-native-plants/ to view infestations in your area.
- Record and report locations of invasive plants that are new to a particular area. Visit plw.man.mybluehost.me/ to record and report your finding.
- To enhance on-the-ground knowledge of invasive species management, we recommend project contractors review a free self-paced training course on invasive species control, which can be found at weedcontrol.open.uaf.edu/. Additional BMPs can be found at the UAF Cooperative Extension Service by searching for "invasive" at cespubs.uaf.edu/publications.

Rivers, Streams, and Wetlands

General

- Adhere to permit construction timing windows to avoid impacts to sensitive fish life stages such as spawning, incubation, or migration.
- Avoid the use of pelletized Styrofoam insulation for instream work, including culvert installation to prevent pellets creating an ingestion hazard for fish, mammals, and birds (see the foam insulation BMP in the Habitat Protection section of this document).
- Use screened intake for water withdrawals. The ADF&G Habitat Division adfg.alaska.gov/static/license/uselicense/pdfs/97_08.pdf (PDF 2,558 kB) contains additional information on screening criteria for various species and life stages of fish as well as methods for design and fabrication of cylindrical water intakes. Appropriate screening prevents suction entrapment and entrainment injury to small and juvenile fish present in the area of the withdrawal.
- Use cantilevered walkways adjacent to rivers that can be seasonally removed or raised during the winter ice-up months and lowered during ice-free conditions to prevent bank erosion, scour, and ice jams from permanently damaging fixed

structures along the bank.

- Protect wetlands from construction-generated sediment and pollutants (i.e., soil sediments, fuels, grease, oil) with properly installed silt fencing to avoid and minimize water quality degradation.
adfg.alaska.gov/static/lands/habitatrestoration/streambankprotection/pdfs/csbs_siltfence.pdf
- Maintain a minimum 200-foot setback from waterways when storing hazardous or toxic material and stage oil-spill response equipment (i.e., containment booms) adjacent to vulnerable fish-bearing wetlands, streams, and rivers during major construction activities.
- When available, maintain at least the minimum State, municipality, and locally recommended riparian stream buffer distances adjacent to all waterways to retain natural bank stabilizing vegetation, maintain the floodplain, improve water quality, and to promote terrestrial invertebrate and nutrient inputs.
- Maintain a riparian zone developmental buffer of at least 50 feet to maintain water quality, filter contaminants, provide invertebrate and vegetative inputs, and promote vegetative bank stabilization. See multi agency (Alaska Department of Natural Resources (DNR), ADF&G, and Service) recommendations may be found at fws.gov/node/378411.
- Use light-penetrating materials for docks and access ramps along streambanks and lakeshores to protect riparian vegetation (board spacing of 0.5 inch or more is preferred over water). This will allow sunlight penetration for vegetative growth (i.e., grasses, sedges, shrubs, and trees) and vegetative bank stabilization provided by plant roots.

Sedimentation/Pollutants

- Stabilize disturbed areas in the construction site and install silt curtains or other measures to direct storm water away from adjacent water bodies to prevent sedimentation and water turbidity and to maintain water quality for fish and wildlife habitat.
- Install silt curtains, cofferdams, temporary diversion channels, or use bypass pumping to isolate the work area from stormwater runoff and the flowing water of a stream or river to prevent water quality degradation from sedimentation and erosion, and to maintain water quality for fish.

IV. North Slope-specific BMPs

Habitats

Project developments on the North Slope of Alaska may result in impacts to fish, wildlife, and their habitats. Early collaboration during project planning and design helps proponents and permitting agencies streamline both planning and implementation of habitat restoration activities to avoid, minimize, and mitigate impacts resulting from ground-disturbing projects. The following recommendations and conservation measures minimize impacts to fish and wildlife habitats such as tundra wetlands, rivers, streams, and coastal landscapes.

- Place culverts within long linear roads in sufficient number to prevent ponding of sheet-flow and maintain natural flow throughout break-up and summer and fall rain events.
- Watering of gravel roads should occur during summer to prevent dust impacts to vegetation and ponds adjacent to roads.
- Road crossings of creeks and rivers should entail bridges (spanning the entire drainage) or sufficiently sized square-bottom culverts to provide fish passage and allow for natural stream flow during break-up, flood-stage flows, and minimal flow. Culverts should be maintained or replaced if water passage is impeded due to subsidence, upheaval, or blocked due to debris. USFWS detailed recommendations for stream crossings can be found at [fws.gov/alaska-culvert-design-guidelines](https://www.fws.gov/alaska-culvert-design-guidelines).
- Place erosion control material (supersacks, revetment) on banks of river under and adjacent to bridges and adjacent to and on bottom of stream approach and exit of large culverts (when necessary) to prevent high-water erosion of road/pad and stream bottom.

Mine Site Development and Restoration

Mine Site Development

- Use of existing gravel mine sites or cells rather than the development of new “individual, one-time only use” pits is preferable. Opening a new cell within a permitted mine site is an option if the cell is developed as a multi-use cell and is constructed with applicable BMPs.
- Determine the efficacy of using existing material sites for projects on the North Slope prior to the development of new sites. It is preferable to identify a potential layout of mine sites across the landscape, rather than develop a specific mine site for each project.
- Mine sites should be developed with a 3:1 (preferable) or at most 2.5:1 side slope. Mine pits with side slopes steeper than 3:1 are unstable and prone to thermokarst, erosion, and eventual failure, usually within the first year of excavation. Mining with steep side slopes (<2.5:1) allows for a smaller footprint; however, the risk of side slope failure due to thermokarst and erosion, especially on south and west facing slopes, is greatly enhanced with steep side slopes.
- Place overburden along the top edge of the entire cell to insulate the sides from thermokarst or melting of exposed ice wedges. Without insulation, exposed ice wedges will melt during spring and summer thaw and erode away from the edge of the pit, resulting in potential drainage of adjacent wetlands. Once side-slope erosion ensues, it is very difficult and expensive to mitigate or repair.
- Upon opening a new cell, organic soil should be separated from the inorganic overburden and stored separately for vegetation rehabilitation projects. Alternatively, organic sod blocks can be harvested and stored for later wetland restoration use.
- Salvaging frozen topsoil: Salvaging frozen topsoil is practicable; the technology is available, and there are several benefits from using topsoil for reclamation. Equipment, such as a frozen topsoil cutter, specifically designed to remove frozen topsoil, has been used by the pipeline industry for more than a decade in western Canada to meet mandated topsoil conservation requirements (apps.cer-rec.gc.ca/REGDOCS/File/Download/2968333). The initial effort required to salvage

and replace the topsoil will facilitate recolonization of native species, and therefore decrease impacts associated with slower revegetation (e.g., colonization by invasive non-native species, erosion, maintenance and associated costs, long-term impacts to aesthetic value, reseeding, fertilizing, and slower return of wetland functions).

Mine Site Restoration

Mine site restoration, to include the creation of wetlands or littoral areas on the North Slope is a long-term, expensive endeavor and in many situations has not been successful.

Experience has shown overburden material, when placed back into a pit to create shallow wetlands, does not subside or subsides too much, resulting in either perched piles of overburden or a deep pit with no littoral zone. In situations where overburden is limited (single cell pits), modification of failed restoration plans may be especially difficult to accomplish. Lastly, a pit may take 15 to 20 years or more to fill with water depending upon its location. Alternatives to the placement of overburden within a mine cell to create littoral zones are as follows:

- Place berms along the top edge of the entire cell for safety and to prevent thermokarst and additional erosion.
- Side slopes should be at least 2.5:1 or 3:1 (preferable). Overburden should be placed along the exposed side slopes if mined at a steeper gradient (i.e.: <2.5:1) to prevent erosion.
- The site should be monitored annually, from spring breakup to fall freeze-up, to ensure stability of the slopes and the adjacent wetlands, until the pit has stabilized with water.
- Once the pit has filled with water, remove the berm material by pushing it onto the ice during winter.

Migratory Birds

- Bird nesting season for the North Slope is June 1 to July 31. No gravel placement or tundra disturbance should occur during this time.
- Construction/placement of gravel for roads and pads should occur in winter to avoid damage to nesting birds, eggs, and hatchlings and adjacent tundra habitats.