ATTACHMENT A

Supporting Environmental Report for the Marian River Bridge Crossing at the NICO Mine Site

Submitted to:

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EXECUTIVE SUMMARY

The scope of this report includes a review of potential impacts and mitigations for bridge construction and operation to the air, terrestrial, and aquatic environments, and a discussion of the regulatory and environmental review processes and requirements associated with this type of project.

The key potential impacts to the air environment include dust and emissions from heavy equipment during construction. There is also the potential for noise impacts during construction. Both of these effects can be controlled to some level during construction but would be higher than current noise, dust, and emission levels in the areas around the bridge. Following construction these effects would be negligible.

The terrestrial ecosystem potentially impacted by the project includes the areas around the bridge, laydown, and abutments. The largest potential impact from the bridge project is related to soil disturbance or soil and groundwater contamination during construction when a large amount of heavy equipment and fuel is needed in the area. This impact could affect both vegetation and wildlife habitat. Best management and construction practises should limit these types of disturbances. Based on the present plan there would also be some habitat loss in areas used for new road construction and laydown areas. Fortune Minerals Limited (Fortune) will limit disturbed areas and re-vegetate where possible, to reduce the amount of disturbed habitat. Once the bridge is in place, the structure would have a negligible impact to the terrestrial ecosystem over the long term.

Several potential impacts to wildlife were also identified and can likely be limited. The overall impact to the terrestrial environment should be short-term and primarily associated with construction and potential decommissioning of the project, when activity in and around the area would be greatest.

The aquatic ecosystem potentially impacted by the project includes the areas around the bridge as well as areas upstream and downstream of the bridge. The most deleterious potential impact of the bridge project is related to the release of sediments during construction and the possible effect this may have on fish habitat. Best management and construction techniques should limit the amount of sediment that is released. Once the bridge is in place it is expected there would be negligible impacts over the long term. The overall impact is predicted to be short term and primarily associated with construction and potential decommissioning of the project, when activity in and around the river would be greatest

As part of the planning process for any new project, it is important to clearly identify the regulatory and environmental review processes. These processes can have a significant effect on the costs and schedule for a project. The proponent must meet the requirements

of the regulatory body conducting the assessment, as well as provide required information to the regulatory authorities issuing permits, approvals and authorizations in order to receive project approval. For the Marian River bridge, the *Mackenzie Valley Resource Management Act* would guide the regulatory and environmental review processes. In addition to this act, various other acts and regulations apply because a number of permits, licences and authorizations may be required.

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1.0 INTRODUCTION

1.1 Background

1.2 Scope and Methods

To complete this supporting document, information from a variety of sources was reviewed. This information included Environmental Assessment (EA) reports for other bridge and transportation projects (Environment Canada 1974; Given 1980; Stanley 1993; Golder Associates 1996; GeoNorth and Golder Associates 1997).

To support the Fortune plan to construct a clear span bridge over the Marian River, 40 km northeast of the community of Wha Ti, NWT, Golder Associates Ltd. has prepared the following document. This document was intended to identify potential environmental impacts that may result from the construction of the bridge over the Marian River and outline mitigations to limit these impacts. This biophysical environmental impact review included:

- examination of the project scope, construction approach and potential environmental concerns;
- identification of regulatory authorities to determine their key concerns, the likely approval process, and any additional requirements related to construction and operation of the bridge;
- identification of current environmental concerns related to the Nico area; and,
- preparation of the report outlining environmental concerns, mitigation measures, and likelihood of/conditions for regulatory approval.

There are socio-economic considerations in the environmental review process that are not described or discussed in this report. The information presented here deals primarily with the biophysical impact assessment and mitigations. However, socio-economic impact assessment is also an integral part of the environmental review process.

2.0 BIOPHYSICAL ISSUES SCOPING

This section outlines the potential issues and impacts that have been identified related to the following:

- geology;
- soils;
- groundwater;
- vegetation;
- wildlife;
- aquatic ecosystems;
- river hydrology and hydraulics;
- water quality;
- and fish habitat and fish populations.

2.1.1 Geology

Alteration of permafrost and geological features by erosion and excavation are potential impacts related to geology resulting from all phases of the bridge development. Mitigation measures involve identifying and avoiding areas of permafrost during construction, limiting areas of disturbance by maximizing the use of existing roadway, approaches and laydown areas, and implementing erosion control measures during all phases of the project. Fortune will use best management practices so that the effectiveness of the erosion control measures are monitored, and replaced/redesigned as necessary. Standard erosion control measures used in bridge construction include re-vegetation of banks and riprap armouring.

Table 1 summarizes potential impacts and mitigation measures related to geology.

2.1.1.1 Potential Marian River Bridge Construction Impacts to Geology

There does not appear to be any issues associated with permafrost degradation related to the immediate area of the planned crossing location. The proposed location of the bridge is at a natural portage with bedrock abutments on each side of the river. As a result, no excavation will occur during construction and therefore; no new impacts from the bridge approaches to permafrost should occur. This would need to be revaluated in the design stage of the project but provided that no excavation occurs, then it is likely that there will be no impacts to permafrost.

Table 1
Geology Impact Scoping for Bridge Construction, Operation, and Decommissioning

Project Activity	Potential Impact	Mitigation
		Fortune will:
Construction and Decommissioning Phases	Alteration of permafrost.	Avoid highly sensitive areas. Use the natural bedrock approach to limit areas of disturbance. Grade roadsides and abutments (if necessary) optimally to promote stabilization.
	Slope instability and erosion during construction.	Use standard erosion control measures (*e.g.,* vegetated riparian areas, riprap armouring). Comply with regulations. Monitor and evaluate erosion control success; employ adaptive management if necessary.
Operations Phase (life of the bridge)	Bridge approaches act as a natural barrier to permafrost.	Monitor permafrost; employ adaptive management if necessary.
	Slope instability and bank failure over time.	Monitor and evaluate erosion control success; employ adaptive management if necessary.

Because of the presence of bedrock along each shoreline, slope stability would not likely be affected by the construction of a bridge. As long as appropriate bridge design and erosion control and monitoring measures are implemented, negligible environmental impacts should result from its construction.

2.1.2 Soils

Bridge construction can result in disturbance to the soil profile in construction and laydown areas during all phases of the proposed project. This in turn can affect vegetation, which has the potential to influence wildlife and wildlife movements. Mitigation measures include limiting the bridge construction footprint, use of low impact equipment as much as possible, maximizing the use of existing disturbed areas for roadway, bridge approaches and laydown areas, and using appropriate erosion control and re-vegetation measures.

Soil contamination could result from fuel or chemical spills associated with construction. Mitigation measures include identifying proper storage location, methods and handling procedures, having appropriate spill response equipment on site, and provide adequate spill response training for personnel so that immediate spill response takes place if an incident occurs.

Table 2 summarizes the potential impacts and mitigation measures related to soil disturbances.

Table 2
Soils Impact Scoping for Bridge Construction, Operation, and Decommissioning

Project Activity	Potential Impact	Mitigation Fortune will:
Construction and Decommissioning Phases	Disturbance to the soil profile (bridge site and lay down areas).	Determine soil profile. Use low impact equipment. Limit area of disturbance and limit work to only required areas.
	Increased erosion potential.	Use standard erosion control measures (*e.g.,* vegetated riparian areas, riprap armouring). Comply with regulations. Monitor and evaluate erosion control success; employ adaptive management if necessary. Prepare reclamation plan for quarry areas.
	Soil contamination from spills and waste.	Secured fuel storage away from the river and/or areas with potential to drain into the river (*e.g.,* double walled containers). Isolate and clean spills immediately. Have available spill response equipment. Provide appropriate spill training.
Operations Phase (life of the bridge)	Soil contamination from spills and waste from maintenance equipment.	Secure fuel storage away from the river or areas with potential to drain to the river (*e.g.,* double walled containers). Isolate and clean spills immediately. Have available spill response equipment. Provide appropriate spill training.
	Increased erosion potential.	Promote re-establishment of natural vegetation. Monitor and evaluate erosion control success; employ adaptive management if necessary.

2.1.2.1 Potential Marian River Bridge Construction Impacts to Soils

Disturbance to soil profile from construction of the bridge is anticipated to be negligible. Because the bedrock abutments will be used to approach the bridge, no new disturbance to soil profiles would be expected in the immediate vicinity of the bridge crossing. However, there will be new disturbances from the use of a new road access and laydown areas. Fortune will limit the amount of disturbed areas for these activities as much as practical to help decrease soil disturbance impacts resulting from bridge construction activities.

During construction, there will be a possibility of soil contamination from spills. This will be mitigated by proper fuel storage and handling, as well as training of personnel. The possibility for spills associated with other maintenance activities would likely be negligible, but the possibility of contamination resulting from traffic would likely be greater and depend on traffic volume.

2.1.3 Groundwater

New bridge construction activities have the potential to alter groundwater flow by disrupting the natural pattern it follows under the soil surface. Because of plant sensitivity to changes in water level, the result can be a decrease in vegetation around riverbanks. Mitigation measures include identification and avoidance of areas where groundwater feeds sensitive habitat adjacent to the river. Limiting areas of disturbance is also an important method to mitigate against altering groundwater flows. This will be accomplished by using the natural bedrock outcroppings for the bridge approaches and, as much as possible, use of these areas during construction.

Fuel and chemical spills have potential to contaminate groundwater if there is a delayed response to the incident or if they occur in well-drained soils. This could result in the discharge of contaminated water into the Marian River. Mitigation measures include identifying proper storage location, methods and handling procedures, having appropriate spill response equipment on site, and provide adequate spill response training for personnel so that immediate spill response takes place if an incident occurs.

Table 3 summarizes potential impacts and mitigation methods related to groundwater.

Table 3
Groundwater Impact Scoping for Bridge Construction, Operation, and Decommissioning

Project Activity	**Potential Impact**	**Mitigation** **Fortune will:**
Construction and Decommissioning Phases	Change in groundwater flow.	Identify and avoid any areas where groundwater feeds sensitive habitat adjacent to the river or drains directly to the river. Limit the amount of disturbed areas.
	Groundwater contamination from spills and waste.	Provide a secured fuel storage location (*e.g.,* double walled containers). Isolate and clean spills immediately. Have available spill response equipment.
Operations Phase (life of the bridge)	Groundwater contamination from spills and waste.	Provide a secured fuel storage location (*e.g.,* double walled containers). Isolate and clean spills immediately. Have available spill response equipment.

2.1.3.1 Potential Marian River Bridge Construction Impacts to Groundwater

Due to the presence of bedrock at the bridge abutments, there should be negligible groundwater alteration issues associated with the planned bridge construction location. Construction of the bridge approaches could potentially alter groundwater flows; however, with appropriate bridge design and the implementation of mitigation measures during all phases of the bridge project, negligible disturbance to groundwater flow should occur.

During construction, there would be a possibility of groundwater contamination from spills. This will be mitigated by proper storage, handling, training and clean-up procedures. The possibility for ground water contamination associated with other maintenance activities would likely be negligible.

2.1.4 Vegetation

Bridge construction has the potential to impact vegetation through direct loss of habitat. Mitigation methods include the following:

- identifying plant communities prior to construction to avoid disturbance of rare or sensitive pant species;

- limiting areas of disturbance during construction; maximizing use of existing disturbed areas (*i.e.*, existing approaches and laydown areas);
- and developing a re-vegetation plan if necessary.

In addition, there is the potential to change vegetation communities as a result of dust deposition. Mitigation measures would be to implement dust control measures, especially during construction activities.

The possibility of soil contamination due to spills can also lead to loss of vegetation. Mitigation measures include identifying proper storage location, methods and handling procedures, having appropriate spill response equipment on site, and provide adequate spill response training for personnel so that immediate spill response takes place if an incident occurs.

Table 4 summarizes potential impacts and mitigation measures related to vegetation.

2.1.4.1 Potential Marian River Bridge Construction Impacts to Vegetation

Vegetation loss would be associated with the construction of the new road access and laydown areas for bridge construction. This loss will be limited through the implementation of mitigation measures.

Table 4
Vegetation Impact Scoping for Bridge Construction, Operation, and Decommissioning

Project Activity	Potential Impact	Mitigation Fortune will:
Construction and Decommissioning Phases	Loss of vegetation in disturbed areas (at the bridge site as well as for road access).	Identify surrounding plant communities and habitat types to avoid sensitive areas. Limit disturbance of new areas. Re-vegetate disturbed areas not required after construction is completed.
	Loss of habitat for vegetation.	Limit disturbance of new areas. Avoid disturbance to sensitive vegetation habitat. Limit soil disturbance in areas that can be reclaimed after construction. Provide secured fuel storage away from the river or areas with potential to drain into the river (*e.g.,* double walled containers). Isolate and clean spills immediately. Have available spill response equipment. Provide appropriate spill training.
	Loss of rare plant species.	Identify surrounding plant communities and avoid rare plant species and habitats.
Operations Phase (life of the bridge)	Change in vegetation community.	If necessary - implement dust and erosion control measures as part of long-term maintenance. Develop a plan for re-vegetation.

Dust impacts to vegetation would be greater during the construction and potential decommissioning phases of the bridge, and will be reduced by dust control measures. During operation, dust impact control will be similar.

During construction, there will be a possibility of vegetation loss from spills. This will be mitigated by proper storage, handling, training and clean-up procedures. The possibility of vegetation loss as a result of spills from traffic will be dependent on traffic volume, but will be mitigated by proper training and clean-up procedures.

2.1.5 Wildlife Habitat

Wildlife habitat loss is considered an area of major concern for people in the Tli Cho region. Consequently, Fortune has contracted Golder to determine the types of wildlife and wildlife habitat that are present in the region (Golder 2006). For example, lynx, snowshoe hare, caribou, black bear, marten, porcupine, muskrat, beaver, ptarmigan, sharp-tailed grouse, moose, red fox, river otter, raven, red squirrel, boreal chickadee, short-tail weasel, whiskey jack and gray jay have been recorded in the area. This information has been used to better assess the potential impacts of bridge construction and associated access on wildlife and wildlife habitat.

Similar to reducing the impacts on vegetation, mitigation measures to limit wildlife habitat loss include identification and avoidance of sensitive habitat in the area, limiting disturbance of new areas; and maintain a small construction footprint to reduce habitat loss and fragmentation.

2.1.5.1 Potential Marian River Bridge Construction Impacts to Wildlife Habitat

Disturbance to wildlife habitat from construction of the bridge is anticipated to be negligible. Because a new road alignment would be required to access the bridge there would be some new disturbance to wildlife habitat. Although fragmentation of habitat will occur immediately around the bridge, the narrow road way combined with limited traffic should result in a non-measurable change in fragmentation. The habitat loss associated with the construction of the new road and laydown areas will be limited through the mitigation measures outlined in Table 5.

Table 5
Wildlife Habitat Impact Scoping for Bridge Construction, Operation, and Decommissioning

Project Activity	Potential Impact	Mitigation Fortune will:
Construction and Decommissioning Phases	Loss of wildlife habitat (at the bridge site as well as new road access).	Ensure that surrounding habitat types, which have been previously identified, contain no sensitive areas that will be impacted as a result of the bridge construction. Limit disturbance of new areas and limit construction activities to designated areas. Any disturbed areas not required after construction is completed will be re-vegetated.
	Habitat fragmentation and creation of barriers that will impede movement	Limit disturbance of new areas and limit construction activities to designated areas. Any disturbed areas not required after construction is completed will be re-vegetated.
Operations Phase (life of the bridge)	Loss of wildlife habitat.	Any disturbed areas not required after construction is completed will be re-vegetated.
	Habitat fragmentation and creation of barriers that will impede movement	Any disturbed areas not required after construction is completed will be re-vegetated.
	Redistribution of wildlife, allowing movement across the river as well as changing migrations routes along the river.	Incorporate features in the bridge design to reduce impacts.

2.1.6 Wildlife Populations

The project area supports a variety of wildlife species (Golder 2006), and a number of individuals from populations may potentially be disturbed or impacted by activities associated with the construction and operation of the bridge and access road. These include changes in movement and behaviour, habitat fragmentation, and increased access that may result in mortality from hunting and trapping. Injury or mortality from animal-vehicle collisions may also impact wildlife populations.

Noise, lights, and dust generated by construction activities may cause temporary displacement and stress on individuals of wildlife species that utilize habitats within and adjacent to the project area. The geographic extent of the disturbance will likely be site-specific due to the limited clearing requirements and intended use of the existing access road. Further, the physical presence of machinery and workers may also cause individuals to alter their behaviour and movement patterns during the construction activities and operation period. The use of mufflers, dust control, and best work practices should partially mitigate these effects. Because construction activities will occur in a localized area, individuals should be able to temporarily move to other areas of their home range without being completely restricted from bridge and road construction activities.

Typically, for avian species of concern, the sensitive period extends from early spring to mid-summer, with inter-species differences related to arrival times and nesting periods. Because construction of the bridge is scheduled to take place in late summer / early autumn, it is likely that impacts to breeding songbirds and waterfowl will be negligible.

The project area provides year-round habitat for numerous wildlife species and seasonal habitat for many others during the spring to fall. Although habitat fragmentation is a potential concern, the use of existing disturbance areas and corridors will limit further fragmentation to the landscape. In addition, site restoration methods and the reclamation plans for vegetation should also limit the potential long-term impacts to the fragmentation of wildlife habitat, and associated changes in movement and behaviour of individuals.

Increased access associated with the bridge may lead to a potential increase in mortality from hunters and trappers. Because access to the bridge will be along a winter road, the increase in mortality is not expected to be measurable relative to previous conditions (i.e., the Marian River could still be crossed by snow machine and ATV during winter at locations with slow moving water). A policy will be in place where on-site workers will not be allowed to harvest wildlife.

Wildlife mortality could also result from attraction to the site (i.e., food garbage) and through vehicle collisions. Mitigation measures include establishing policies and restrictions for site workers regarding the harassment and feeding of wildlife, and setting and obeying speed limits along the road. In addition, implementation of a waste management plan would decrease the possibility of wildlife being drawn to the area in search of food.

Spills could occur that might be toxic to wildlife. Mitigation measures include identifying proper storage location, methods and handling procedures, having appropriate spill response equipment on site, and provide adequate spill response training for personnel so that immediate spill response takes place if an incident occurs.

Table 6 summarizes potential impacts and mitigation measures related to wildlife populations.

2.1.6.1 Potential Marian River Bridge Construction Impacts to Wildlife Populations

The geographic extent of impacts to wildlife from the project is expected to be site-specific and have a negligible impact on wildlife populations. Although effects are anticipated to occur throughout the life of the bridge, the greatest effects will occur during construction and decommissioning. Overall the potential impacts resulting from the project are anticipated to have a negligible influence on the persistence of wildlife populations.

Table 6
Wildlife Population Impact Scoping for Bridge Construction, Operation, and Decommissioning

Project Activity	Potential Impact	Mitigation
		Fortune will:
Construction and Decommissioning Phases	Harassment and habituation of wildlife resulting in direct mortality.	Keep work areas clean and abstain from feeding and harassment. Establish a firearms policy. Enforce driving restrictions (*e.g.,* speed limits). Staff training on wildlife avoidance procedures. Wildlife will have “right of way” in the construction area.
	Chemical spills toxic to wildlife (*e.g.,* antifreeze)	Establish secured fuel storage away from the river or areas with potential to drain to the river (*e.g.,* double walled containers). Isolate and clean spills immediately. Available spill response equipment. Appropriate spill training.
Operations Phase (life of the bridge)	Harassment and habituation of wildlife resulting in direct mortality.	Reclaim any work areas not required after construction and prevent human access off the main road.
	Mortality of migrating birds striking the bridge.	Design bridge features to limit the possibility of this occurring (*e.g.,* lighting, location of any powerlines associated with the bridge).
	Chemical spills toxic to wildlife (*e.g.,* antifreeze)	Use safe storage and handling practices should be in used (*e.g.,* chemicals or fuel to be stored a safe distance from the river). Use appropriate containment (*e.g.*, berms surrounding fuel storage) and spill response plans.

2.2 Aquatic Ecosystems

The aquatic ecosystem associated with proposed bridge footprint and areas downstream of the crossing has the potential to be effected by the proposed project (Sections 2.2.1 to 2.2.4). However, the overall impact is predicted to be short-term and primarily associated with construction and potential decommissioning of the project, when activity in and adjacent to the river would be greatest. Four main aspects of the aquatic ecosystem have been considered as part of the scoping process for this project. These include river hydraulics, water quality, fish habitat in the form of substrates and shorelines, and fish populations.

2.2.1 Hydrology/Hydraulics

Hydrology and hydraulics relate the flow of the river and the integrity of the river channel in the vicinity of the bridge crossing. Potential impacts from a bridge include changes to channel hydraulics upstream and downstream of the structure. Any narrowing of the channel can restrict flows and increase river velocity at the crossing site. This increase in velocity can lead to erosion around the bridge abutments. The channel restrictions can also impede the movement of ice at break-up, and lead to ice jams if the bridge is not designed properly. During construction, depending on construction techniques, the river may be constricted to allow construction to occur away from the flow of the river. Overall, these types of changes may lead to erosion of the banks or channel bed, increased sedimentation, changes in river velocity in the vicinity of the bridge, deposition of sediments in new areas of the channel (*e.g.,* sandbar formation) and restriction of fish movements.

Various construction techniques have been incorporated into this project to limit hydrological changes, and are outlined in Table 7.

Table 7
Hydrology/Hydraulic Impact Scoping for Bridge Construction, Operation, and Decommissioning

Project Activity	Potential Impact	Mitigation Fortune will:
Construction and Decommissioning Phases	Changes in channel hydraulics preventing fish movement.	Complete river hydraulics study prior to finalizing bridge design and placement; apply appropriate mitigation measures. Construct clear span bridge. Choose appropriate timing for construction (late summer – early fall). Design bridge to not inhibit fish passage. Ensure any construction requiring additional flow restrictions will be well planned and occur at low flow times.
	Changes in channel hydraulics resulting in downstream erosion.	Complete river hydraulics study prior to finalizing bridge design and placement; apply appropriate mitigation measures. Bridge alignment will be compatible with river morphology.
	Channel aggredation/degradation or channel blockage (ice jams) as a result of flow restrictions during construction.	Complete river hydraulics study prior to finalizing bridge design and placement; apply appropriate mitigation measures. Limit narrowing of the channel during construction.
Operations Phase (life of the bridge)	Channel blockage (ice jams, flow restriction).	Complete river hydraulics study prior to finalizing bridge design and placement; apply appropriate mitigation measures. Ensure deck height will account for annual high water events that not only allow for continued navigation, but reduces the potential for complete channel blockage by ice jams under severe flood conditions (minimum 2.0 m above annual high water mark).
	Channel aggredation/degradation over time.	Bridge alignment is compatible with river morphology.

2.2.1.1 Potential Marian Bridge Construction Impacts to Hydrology/Hydraulics

Constructing a clear span bridge on top of the natural bedrock outcroppings, at a minimum distance of approximately 2.0 m above the annual high water mark, should reduce the potential for the structure to impact channel hydraulics and/or impede navigation. As no constriction of the natural channel will occur as a result of the bridge construction, there is also less likelihood for any increase in ice jam frequency.

2.2.2 Water Quality

The primary water quality issue related to the bridge project is the potential release of sediments or chemicals into the river channel. If sediments were released during construction, the main impacts would occur downstream of the bridge. Sediment loading resulting from bridge construction would be short-term, and a variety of construction techniques may be used to decrease or eliminate the possibility of large sediment releases. Mitigation measures may include: building coffer dams to isolate abutments during construction; complete construction of abutments and approaches during winter conditions; maximizing construction during frozen river conditions. The appropriate mitigation measures are dependent on the specific bridge design and river conditions

Sediment release can also occur during the operation period of the bridge as a result of shoreline erosion, from surface run-off along ditches, and from fine sediments washing off the bridge deck into the river (*e.g.*, sand, gravel, and dust from road maintenance activities and traffic). Mitigation measures include implementing standard erosion control measures, monitoring and evaluating their success, and using adaptive management practices as necessary.

Other potential water quality impacts include the release of contaminants into the river from fuel or chemical spills. This could occur during construction when heavy equipment is working on or near the river, as well as during operations from traffic or maintenance activities. Mitigation measures include identifying proper storage location, methods and handling procedures, having appropriate spill response equipment on site, and provide adequate spill response training for personnel so that immediate spill response takes place if an incident occurs.

Table 8 summarizes potential impacts and mitigation measures related to water quality.

Table 8
Water Quality Impact Scoping for Bridge Construction, Operation, and Decommissioning

Project Activity	Potential Impact	Mitigation
		Fortune will:
Construction and Decommissioning Phases	Sediment loading during in-stream construction.	Use construction and decommissioning methods designed to decrease or avoid release of sediments; no in-stream use of machinery will occur during construction. Follow best practices for construction, such as: no soil materials or debris to be placed in or adjacent to the stream channel; only clean fill (*i.e.*, washed rock) will be used for abutments (if necessary) or riprap construction. Use in-stream sediment control measures (banks lined with silt fence) to contain the release of sediments from construction areas.
	Release of sediments from surface runoff.	Use pre-project surveys to identify areas sensitive to erosion for avoidance or proper stabilization. Ensure graded slopes are recontoured and stabilized (*i.e.,* rock riprap, seeding). Construct sediment traps (if necessary) to capture surface runoff from construction site; allowing for settling before water is released. Erosion control measures are monitored throughout the life of the project and adaptive management strategies used as necessary.
	Water contamination from spills.	Use safe storage and handling practices (*e.g.,* chemicals or fuel to be stored a safe distance from the river). Use appropriate containment (*e.g.*, berms surrounding fuel storage) and spill response plans.
Operations Phase (life of the bridge)	Sediment or contaminant release during maintenance.	Implement proper maintenance of erosion control measures. Implement appropriate dust control procedures.
	Sediments release from bank erosion or surface run-off.	Implement proper maintenance of erosion control measures such as ditch re-vegetation and riprap armouring.
	Water contamination from spills.	Design bridge to allow adequate spill containment. Provide safe transport practices, proper maintenance and spill response plans.

2.2.2.1 Potential Marian River Bridge Construction Impacts to Water Quality

Although the installation of the clear span bridge at the Marian River site should result in minimal amounts of sediment being released into downstream environments, some material will inevitably enter the river from construction activities. The amount likely to be released is difficult to predict and difficult to compare to the current level of sediment entering the river. However, it is possible to schedule construction activities to limit the amount of sediment released (late summer) and to complete some of the construction activities during non-sensitive time periods for fish and other aquatic life. The background level of natural sediment (turbidity) in the river will also be taken into account. This way, any increase in sediment load resulting from the bridge installation can be compared to the natural range of variability. Guidelines for sediment release will also be set and monitored during construction so that the suspended sediment load does not reach levels that would cause significant water quality problems in the area. During construction, there is increased potential of a spill contaminating the river because of the amount of heavy equipment operating in the area. The potential for a spill will be reduced by following proper construction practices (*i.e.*, spill contingency plan).

During the operation period for the bridge, the amount of sediment released annually to the river will likely be minimal.

2.2.3 Fish Habitat

A bridge installation has the potential to impact fish habitat through both the loss of habitat directly associated with the bridge itself and through changes to the surrounding habitat. Direct habitat loss can also occur if abutments are extended into the river and at the points where the bridge piers are installed. This impact could be significant if sensitive habitat (*e.g.*, spawning areas) is present directly under the new pier or abutment locations. However, as Fortune intends to place a clear span bridge atop the bedrock outcroppings at the site, no physical fish habitat will be lost as a result of the bridge construction.

The greatest potential for impacts to fish and fish habitat from the bridge construction will come from increased sediment loading during construction and decommissioning of the bridge structure. During these periods sediment loading may increase through the addition or removal of fill on each side of the river where ramp construction/deconstruction will occur.

Table 9 summarizes potential impacts and mitigation measures related to fish habitat.

Table 9
Fish Habitat Impact Scoping for Bridge Construction and Operation

Project Activity	Potential Impact	Mitigation
Construction and Decommissioning Phases	Alteration or loss of fish habitat as a result of the installation of the bridge.	No in-stream construction or activity will occur as part of this clear span bridge construction. Fortune will use best management practices are followed for construction to limit sediment release and prevent water contamination.
Operations Phase (life of the bridge)	Alteration of fish habitat as a result of the presence of the bridge.	Fortune will use best management practices are followed during all maintenance activities to limit sediment release and prevent water contamination.

2.2.3.1 Potential Marian River Bridge Construction Impacts to Fish Habitat

The installation of the clear span bridge atop the bedrock outcroppings should result in negligible impacts to fish habitat as a result of construction. The construction of the approaches and bridge may result in an increased potential for the release of sediments into downstream environments. This will be mitigated by properly designing and constructing the bridge, using best management practices and monitoring effectiveness during open water periods.

2.2.4 Fish Populations

The potential of the bridge project to impact local fish populations can be divided into two main categories; the effect of sediment on fish or fish habitat and the effect of the bridge construction possibly impeding fish movements up or downstream.

The effect of sediment load is related to direct mortality of eggs, young, or adults. For example, there is a possibility that sediments could cover eggs or spawning substrate. To reduce the possibility of this occurring, information on the location of any known spawning habitats will be important, as the scheduling of construction activities to avoid sensitive times periods. Overall, the effect of sediment release during construction or potential decommissioning would be short-term and local.

The construction and operation of a bridge has the potential to limit the migration or movements of fish in the river. During bridge construction, the river channel will be likely be narrowed somewhat (installation of silt fences) to reduce the release of sediments into the river. However, fish passage will still be able to occur, as construction will only block off a small portion of the channel, and will be reviewed so that any river velocity changes will not impact fish. The Marian River is too large a river to restrict the flow to any great extent. There will still be an increase in traffic during construction, as well increased noise associated with equipment. These activities may deter some fish from areas of the river where construction is occurring.

During all phases of the project, there is the possibility of fish mortality resulting from a chemical spill into the river. Mitigation measures include identifying proper storage location, methods and handling procedures, having appropriate spill response equipment on site, and provide adequate spill response training for personnel so that immediate spill response takes place if an incident occurs.

Table 10 summarizes potential impacts and mitigation measures related to fish population.

Table 10
Fish Population Impact Scoping for Bridge Construction, Operation, and Decommissioning

Project Activity	Potential Impact	Mitigation
Construction and Decommissioning Phase	Impacts to fish or fish habitat caused by the construction and the movement of equipment (sediment impacts to fish health).	A late summer and fall assessment has been carried out to determine the presence or absence of spawning, nursery or rearing habitats within the area potentially affected by construction (areas where fish would be sensitive to sediment effects). Construction activities will be conducted in late summer/early fall; when only white sucker (a spring spawning species) have been observed in the immediate area of the crossing location.
	Restriction or blockage of fish passage.	Review of construction plans to ensure that no restrictions to the flow will occur.
	Fish mortality as a result of sediment release or chemical spills.	Secured fuel storage away from the river or areas with potential to drain to the river (*e.g.,* double walled containers). Isolate and clean spills immediately. Available spill response equipment. Appropriate spill training.
Operations Phase (life of the bridge)	Restriction or blockage of fish passage.	Review of bridge design so that any restrictions to the flow will not affect fish movement in the river.
	Fish mortality as a result of sediment release or chemical spills.	Use best practices for bridge maintenance. Secured fuel storage away from the river or areas with potential to drain to the river (*e.g.,* double walled containers). Isolate and clean spills immediately. Available spill response equipment. Appropriate spill training.

2.2.4.1 Potential Marian River Bridge Construction Impacts to Fish Populations

The riffle habitat located in the immediate vicinity of the proposed bridge crossing does have the potential to provide spawning habitat for spring (*e.g.*, walleye) and fall (*e.g.*, whitefish sp.) spawning species. Fisheries sampling programs conducted by Golder Associates Ltd. in September 2005 and 2006, found only one white sucker (spring spawning species) in the vicinity of the proposed crossing location. Therefore, provided the bridge construction is completed during late summer or early fall, no direct impacts to spawning activities are expected.

Although there is a potential for direct fish mortality from a spill during construction or as a result of a traffic accident, the likelihood of such an event is very low. The potential impact to the fish populations in the Marian River will be substantially reduced by good planning and preparation.

3.0 PERMIT REQUIREMENTS

Identification of the likely permits, licences and authorizations needed a number of assumptions that were made about the nature of the construction activities required. It has been assumed that the following activities would take place:

- no in-water construction;
- blasting;
- quarrying;
- use of heavy equipment; and,
- right-of-way clearing.

Table 11 lists the permits likely to be required for all phases of the bridge project.

Table 11
Authorizations, Permits, Licences or Approvals that may be Required for Construction of the Marian River Bridge

AUTHORIZATION, PERMIT, LICENCE, APPROVAL	LEGISLATION	AGENCY
Planning, Design and in Preparation for Environmental Assessment Phase		
NWT Archaeologists Permit **(Completed)**	*Northwest Territories Archaeological Site Regulations*	Prince of Wales Northern Heritage Centre, Department of Education, Culture and Employment, Government of the Northwest Territories
Wildlife Research Permit **(Completed)**	*Northwest Territories Wildlife Act*	Department of Resources, Wildlife and Economic Development, Government of the Northwest Territories
Scientific Research Permit **(Completed)**	*Northwest Territories Research Act*	Aurora Research Institute
Fisheries Research Licence **(Completed**)	*Fisheries Act*	Department of Fisheries and Oceans
Construction Phase		
Water Licence	*Northwest Territories Waters Act and Regulations*	Tli Cho Land and Water Board
Land Use Permit	*Northwest Territories Waters Act and Regulations*	Tli Cho Land and Water Board
Fisheries Letter of Advice (OP) **(Completed)**	*Fisheries Act*	Department of Fisheries and Oceans, Fish Habitat Management
Constructing Works in a Navigable Water	*Navigable Waters Protection Act*	Transport Canada
Explosives Permit	*Explosives Act*	Department of Natural Resources Canada

3.1 Permit Review Process

The major permits required for the bridge proposal would be a Type A Land Use Permit, Type A Water Licence, both issued by the TCLWB and the approvals required under the *Fisheries Act* and *NWPA*, issued by DFO and Transport Canada. A number of other permits would likely be required and are also briefly discussed.

3.1.1 Review Process for Type A Water Licence Applications

The newly established TCLWB reviews and issues both Type A and Type B Water Licence applications. The bridge proposal would require a Type A Water Licence. Water Licences are regulated by the *Northwest Territories Waters Act and Regulations* under the *MVRMA*. There is no legislated timeframe associated with a Type A Water Licence, however these applications are generally completed within six months or less.

Upon submission of the application by the proponent, it is distributed for review to determine if the information in the application is complete and if reviewers have enough information upon which to screen the application. The TCLWB may decide to form a Technical Advisory Committee. Once comments are received and additional information is submitted (if required), a Preliminary Screening Report is prepared. The purpose is to determine if the proposal might have significant adverse effects or might cause significant public concern. If the answer to either of these questions is yes, then the proposal is referred to the MVEIRB for them to conduct an EA. If the answer is no to both of these questions, then the TCLWB would proceed with the regulatory process and issue the Water Licence.

The TCLWB can also request further studies be completed or can determine that the proposal can proceed to the mandatory public hearing phase of the review. After the public hearing, a draft Water Licence is developed and circulated for comment. Once finalized and approved by the TCLWB, it is forwarded to the Minister of DIAND for final approval or rejection. No other regulatory body can issue a permit or approval related to the proposal until the TCLWB and the Minister makes a decision to approve the Water Licence, or until the subsequent reviews conducted by the MVEIRB are completed and approved.

3.1.2 Review Process for Type A Land Use Permit Application

The TCLWB reviews and issues both Type A and Type B Land Use Permit applications. The bridge proposal would likely require a Type A Land Use Permit. Once the application has been submitted to the TCLWB, the application is reviewed for completeness. Two aspects of the application that are closely scrutinized for completeness is the proof that meaningful community consultation has occurred on the project and the proof that traditional knowledge have been taken into consideration.

If the application is not complete, the TCLWB will return the application to the applicant with a letter outlining the areas of deficiency. If the application is complete, notification will be sent to the applicant and the review period would begin.

Applications are distributed for review based on the comments received, a Preliminary Screening Report is prepared. The purpose is to determine if the proposal might have significant adverse effects or might cause public concern. If the answer to either of these questions is yes, then the proposal is referred to the MVEIRB for them to conduct an EA. If the answer is no to both of these questions, the TCLWB would proceed with the regulatory process and issue the Land Use Permit. The local, territorial or federal governments and the MVEIRB can also refer the proposal to EA regardless the TCLWB's decision.

3.1.3 Approvals Under the Fisheries Act

DFO administers the *Fisheries Act* and would issue fisheries authorizations and/or letters of advice regarding the protection of fish and fish habitat. If, during the review of the permit applications it were determined that habitat alterations would occur after mitigation, one or more authorizations would be required. In the case of this bridge proposal, a fisheries authorization will not be required; however Fortune Minerals must abide by the Clear Span Bridge Construction Operational Statement, issued by DFO. The DFO Operational Statement is found in Appendix I of this document.

3.1.4 Approvals Under the Navigable Waters Protection Act

Transport Canada administers the *Navigable Waters Protection Act* (*NWPA*) and its regulations. Under the *NWPA*, approval must be obtained for the placement of bridges, dams or pipes or for any structure that may interfere with navigation if it is to be constructed in, on, over, under, through or across any navigable water. In the case of this bridge proposal, approval under the *NWPA* would be required and the bridge must be a minimum of 2.0 m above the annual high water mark.

3.1.5 Research Permits

Field studies conducted to provide baseline information for the permit and licence applications and environmental review would require specific research permits. The likely research permits required are: Wildlife Research Permit; NWT Archaeologists Permit; Fisheries Research Licence; and Scientific Research Licence. Since all baseline data required for the application process has already been collected, further research permits for the bridge construction should not be required.

3.1.6 Explosives Permit

Natural Resources Canada (NRCan) administers the *Explosives Act*. Under the *Explosives Act* permits are required for blasting, manufacture of explosives, overnight storage of explosives or daily use storage at a work site. The use of explosives would be only one activity associated with the bridge proposal and the review of this activity would occur during the Preliminary Screening or EA stages. Further details on the bridge proposal would be required to determine if an explosives permit would be required.

3.2 Information Required in the Permit Application

3.2.1 Project Description

Before the exact mitigations can be planned to limit or prevent potential impacts, it will be necessary to know the type of activities that will be involved in the bridge construction. This should include details about activities involved in the construction and operation of the bridge, describing what would be involved, where it would happen, and when it is planned to occur. The project description should provide a complete picture of all the elements and activities considered to be within the scope of the bridge development. Some components that may be included are:

- the description of the bridge structure;
- construction approach, techniques, and timing for all phases of the project;
- physical description of camps and other infrastructure and their surroundings;
- the use of water and the handling of waste water and other waste materials;
- transportation methods;
- equipment being used;
- planning for contingencies such as spills, or poor weather and river conditions; and,
- storage of fuel, explosives, and other hazardous materials.

Because environmental scoping for the bridge is being conducted appropriately early in the development, the design of the bridge is able to incorporate environmental considerations. The project description should outline how this was done. The document should explain how environmental considerations affected the bridge during the design process.

4.0 SUMMARY AND CONCLUSIONS

Bridge construction is not considered an experimental type of development. There are many examples of bridges that have been constructed over large rivers. Construction techniques, potential environmental impacts and their mitigation measures are well documented for this type of project. It is expected that, although there may be potential environmental impacts as a result of this bridge installation over the Marian River, most can be partially or fully mitigated within known technologies, and best management and construction practices.

5.0 REFERENCES

The following documents were used in the preparation of this report.

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Department of Fisheries and Oceans (DFO). 1986. Policy for the management of Fish Habitat. Ottawa.

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Given, Robert. 1980. Mackenzie River Bridge Study: Cost Benefit Analysis of a Permanent Crossing of the Mackenzie River at Fort Providence, Northwest Territories

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Mackenzie Valley Environmental Impact Review Board (MVEIRB). 2001. Guidelines for Environmental Impact Assessment in the Mackenzie Valley: Draft. Spring 2001. Yellowknife.

6.0 CLOSURE

We trust the above meets your present requirements. If you have any questions or require additional details, please contact the undersigned.

GOLDER ASSOCIATES LTD.

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APPENDIX I

DFO OPERATIONAL STATEMENT FOR CLEAR SPAN BRIDGE INSTALLATION IN THE NWT

CLEAR-SPAN BRIDGES

VERSION 2.0
Valid until March 31, 2007

This Operational Statement applies to the construction of only those small-scale bridge structures that completely span a watercourse without altering the stream bed or bank, and that are a maximum of two lanes wide. A clear-span bridge is often more preferred than a culvert as no structures are placed on the stream bed or banks.

Clear-span bridge construction has the potential to negatively affect riparian habitat. Riparian vegetation occurs adjacent to the watercourse and directly contributes to fish habitat by providing shade, cover, and spawning and food production areas. Only the vegetation required to be removed to meet operational and safety concerns for the crossing structure and the approaches should be removed.

Fisheries and Oceans Canada (DFO) is responsible for protecting fish and fish habitat across Canada. Under Section 35 of the *Fisheries Act* no one may carry out a work or undertaking that will cause the harmful alteration, disruption or destruction (HADD) of fish habitat unless it has been authorized by DFO. By following the conditions and measures set out below you will be in compliance with Subsection 35(1) of the *Fisheries Act*.

The purpose of this Operational Statement is to describe the conditions under which it is applicable to your project and the measures to be incorporated into the design and construction of small-scale, clear-span roadway or railway bridges in order to avoid negative impacts to fish habitat. **You may proceed with your Clear-Span Bridge project without a DFO review when you meet the following conditions:**

- your planned work is not located in a critical area, as identified in a NWT Community Conservation Plan or other applicable land use plan,
- the bridge is no greater than two lanes in width and does not encroach on the natural channel width by the placement of abutments, footings or armouring (e.g., rock and concrete) below the ordinary high water mark (see definition below) so that there is no restriction to natural channel processes,
- the work does not include realigning the watercourse,
- disturbance to riparian vegetation is minimized,
- the work does not involve dredging, infilling or excavating the bed or bank of the watercourse,
- this Operational Statement is posted at the work site and is readily available for reference by workers, and
- you incorporate the *Measures to Protect Fish and Fish Habitat when Constructing Clear-Span Bridges* listed below.

If you cannot meet all of the conditions listed above and cannot incorporate all of the measures listed below then your project may result in a violation of Subsection 35(1) of the *Fisheries Act* and you could be subject to enforcement action. In this case, you should contact the DFO office in your area (see Northwest Territories DFO office list) if you wish to obtain DFO's opinion on the possible options you should consider to avoid contravention of the *Fisheries Act*.

This Operational Statement does not release you from the responsibility of obtaining any other permits or approvals that may be required under local, municipal, territorial and federal legislation (e.g., *Navigable Waters Protection Act*) that apply to the work being carried out in relation to this Operational Statement.

We ask that you notify DFO, preferably 10 working days before starting your work, by filling out and sending in, by mail or by fax, the Northwest Territories notification form to the DFO office in your area. This information is requested in order to evaluate the effectiveness of the work carried out in relation to this Operational Statement.

Measures to Protect Fish and Fish Habitat when Constructing Clear-Span Bridges

1. Avoid building on meander bends, braided streams, alluvial fans or any other area that is inherently unstable and may result in the erosion and scouring of the bridge structure.
2. Construct the bridge structure (including any approaches, abutments, armouring (rock and concrete) or footings) entirely above the ordinary high water mark (see definition below) and away from areas with eroding or unstable banks.
3. Construct the bridge structure with sufficient freeboard to pass floating objects at high flows.
4. Design the bridge so that stormwater runoff from the bridge deck, side slopes and approaches is directed to a collection basin or vegetated area having suitable features to remove suspended solids, dissipate velocity and prevent sediment and other deleterious substances from entering the watercourse. In areas with permafrost, care should be exercised to ensure these measures do not cause thawing or frost heave.
5. Generally, there are no restrictions on timing for the construction of clear-span structures as they do not involve in-water work. However, if there are any activities with the potential to disrupt spawning fish, their incubating eggs and larval life stages (e.g., in-water crossing of watercourse by machinery), adhere to territorial fisheries timing windows (see the attached *Northwest Territories In-Water Construction Timing Windows*) or alternatively, carry out the project when the waterbody is frozen to the bottom or is dry.
6. Machinery fording the watercourse to bring equipment required for construction to the opposite side of the watercourse should be limited to a one-time event (over and back) and occur only if an existing crossing at another location cannot be used. If the stream bed and banks are highly erodible (e.g., dominated by organic materials and silts) and erosion and degradation is likely to occur as a result of equipment crossing, then a temporary crossing structure or other practices should be used to protect these areas. The fording should also occur during the timing window specified in Measure 5.
7. Install effective sediment and erosion control measures before starting work to prevent the entry of sediment into the watercourse. Pay particular attention to the ditches of road approaches. Inspect measures regularly during the course of construction and until any required re-vegetation has established to ensure they are functioning properly. Make all necessary repairs if any damage is discovered or if these measures are not effective at controlling erosion and sedimentation.
8. Operate machinery from outside of the water and in a manner that minimizes disturbance to the banks of the watercourse.

    8.1. Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks.

- **8.2.** Wash, refuel and service machinery and store fuel and other materials for the machinery away from the water to prevent deleterious substances from entering the water.
- **8.3.** Keep an emergency spill kit on site in case of fluid leaks or spills from machinery.

9. Use measures to prevent deleterious substances, such as new concrete (i.e., it is pre-cast, cured and dried before use near the watercourse), grout, paint, ditch sediment and preservatives from entering the watercourse.

10. While this Operational Statement does not apply to the clearing of riparian vegetation, the removal of select plants may be required to meet operational and/or safety concerns for the crossing structure and the approaches. This removal should be kept to a minimum and will not occur outside of the road right-of-way.

11. Stabilize any waste materials removed from the work site, above the ordinary high water mark (see definition below) to prevent them from entering any watercourse. Spoil piles could be contained with silt fence, flattened, covered with biodegradable mats or tarps, and/or planted with preferably native grass or shrubs.

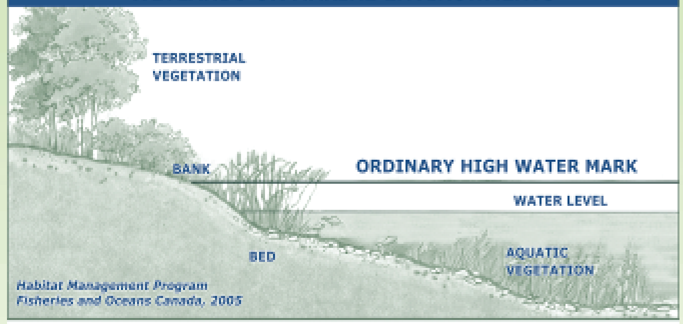
12. Vegetate any disturbed areas by planting and seeding preferably native trees, shrubs or grasses and cover such areas with mulch to prevent soil erosion and to help seeds germinate. If there is insufficient time in the growing season remaining for the seeds to germinate, stabilize the site (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and then vegetate the following spring. If re-vegetation is not possible due to climatic extremes and/or lack of appropriate seed or stock, the site should be stabilized using effective sediment and erosion control measures. In areas with permafrost, care should be exercised to ensure these measures do not cause thawing or frost heave.

13. Maintain effective sediment and erosion control measures until complete re-vegetation of disturbed areas is achieved or until such areas have been permanently stabilized by other effective sediment and erosion control measures, in the event that re-vegetation is not possible.

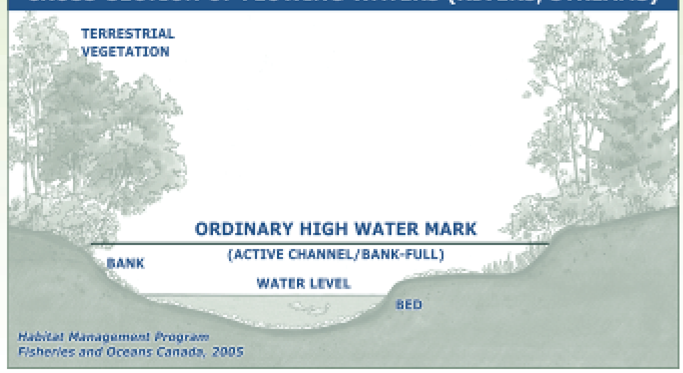
Definition:

Ordinary high water mark – The usual or average level to which a body of water rises at its highest point and remains for sufficient time so as to change the characteristics of the land. In flowing waters (rivers, streams) this refers to the "active channel/bank-full level" which is often the 1:2 year flood flow return level. In inland lakes, wetlands or marine environments it refers to those parts of the water body bed and banks that are frequently flooded by water so as to leave a mark on the land and where the natural vegetation changes from predominately aquatic vegetation to terrestrial vegetation (excepting water tolerant species). For reservoirs this refers to normal high operating levels (Full Supply Level).

CROSS-SECTION OF INLAND LAKES, WETLANDS OR MARINE ENVIRONMENTS



CROSS-SECTION OF FLOWING WATERS (RIVERS, STREAMS)



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NORTHWEST TERRITORIES IN-WATER CONSTRUCTION TIMING WINDOWS FOR THE PROTECTION OF FISH AND FISH HABITAT

Restricted activity timing windows have been identified for the Northwest Territories lakes, rivers and streams to protect fish during spawning and incubation periods when spawning fish, eggs and fry are vulnerable to disturbance or sediment. During these periods, no in-water or shoreline work is allowed except under site- or project-specific review and with the implementation of protective measures. Restricted activity periods are determined on a case by case basis according to the species of fish in the water body, whether those fish spawn in the spring, summer or fall, and where the water body is located.

Timing windows are just one of many measures used to protect fish and fish habitat when carrying out a work or undertaking in or around water. Be sure to follow all of the measures outlined in the Operational Statements to avoid negative impacts to fish habitat.

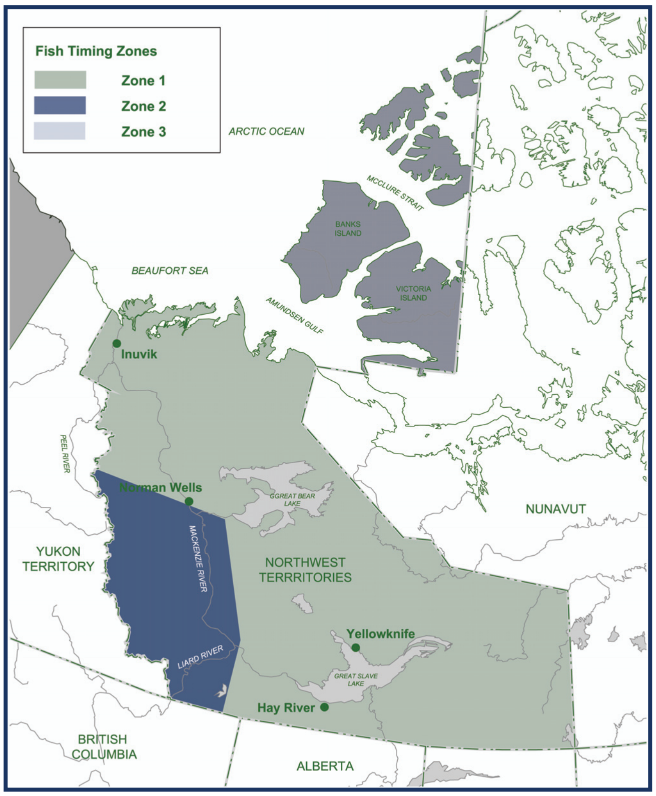

Figure 1: Fish Timing Zones for the Northwest Territories.

How To Determine Timing Windows

1. Determine the fish species living in the water body where you wish to do work. Consult with local organizations such as hunters and trappers committees, Renewable Resource Councils or your local Fisheries and Oceans Canada (DFO) office.

2. Determine if the fish living in the water body spawn in the spring, summer, fall or winter according to Table 1. There may be one or more spawning types in any given water body. For most water bodies in the NWT there are at least two spawning types. The spawning windows for multiple species should be observed.

3. Determine if the water body is in Zone 1, 2 or 3 according to Figure 1.

4. Using Tables 2 and 3, determine the in-water work timing restrictions according to the location of a water body (Zone 1, 2 or 3) and the type (spring/summer, fall or winter) of spawning fish. During these periods, in-water work (below the ordinary high water mark) is not permitted without site or project-specific review by DFO.

Table 1. General Range of Spawning and Incubation Times in the NWT:

Fall Spawners

Species	Range of Spawning Timing	Incubation/Hatch Time
Lake Whitefish	Mid-September to mid-October	Late winter-early spring
Broad Whitefish	November	April-May
Round Whitefish	October-November	April-May (123-140 days)
Least Cisco	Late September to early October	May or June (break-up)
Arctic Cisco	Mid-September to early October	Spring under ice
Lake Cisco	September to November	Spring
Inconnu	Late September to early October	Spring
Lake Trout	Mid to late August	May-June
Bull Trout	Mid-August to October	Spring (around break-up)
Dolly Varden Char	September to early October (Rat River - August 15 to late September)	8 months (May or June)
Arctic Char	Late September to early October	April
Chum Salmon	September-October	122-173 days

Spring/Summer Spawners

Species	Range of Spawning Timing	Incubation/Hatch Time
Arctic Grayling	Mid-May to early June	8-32 days
Northern Pike	Early May to mid-June	Approximately 2 weeks
Walleye	April-June	4-34 days
Yellow Perch	March-July	8-20 days
Goldeye	Early May to early July	Approximately 2 weeks
Rainbow Smelt	April-May	About 29 days
Longnose Sucker	June	Approximately 2 weeks
White Sucker	June	Approximately 2 weeks

Winter Spawners

Species	Range of Spawning Timing	Incubation/Hatch Time
Burbot	December to mid-January	30 days to 3 months

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Table 2. Timing Windows when In-water Activities are NOT Permitted, by Type of Spawning

Zone	Spring/Summer	Fall	Winter
NWT Zone 1	April 1 to July 15	September 15[1, 2] to June 30	December 1 to April 15
NWT (SW corner) Zone 2	April 1 to July 15	August 15 to June 30	December 1 to April 15
NWT offshore islands Zone 3	n/a	September 15[1] to June 30	n/a

NOTES:
[1] For lakes with spawning Lake Trout populations, the timing window begins earlier, starting August 15.
[2] Dolly Varden in the Rat River begin spawning in mid-August and therefore the fall window for this system should be August 15 to June 30.

Timing Windows for Water bodies Where All Spawning Types are Present or Fish Species NOT Known:

If all spawning types are present, or if you don't know which species are in the water body, then Table 3 can be followed.

Table 3. Fish Timing Windows using All Spawning Types

Zone	When In-water Activity Not Permitted	When In-water Activity May Occur
NWT Zone 1	September 15 to July 15[1, 2]	July 16 to September 14[3]
NWT Zone 2	August 15 to July 15	July 16 to August 14
NWT Zone 3	September 15 to June 30[1]	July 1 to September 14

NOTES:
[1] For lakes with spawning Lake Trout populations, the timing window begins earlier, starting August 15.
[2] Dolly Varden in the Rat River begin spawning in mid-August and therefore the fall window for this system should be August 15 to June 30.
[3] For the Rat River and for lakes with spawning Lake Trout populations, the timing window when in-water activities may occur in July 16 to August 14.

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