



to: Andrew Mitchell, Project Manager, Zinifex
from: Leslie Gomm, Senior Environmental Engineer
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ref: 71021
re: **High Lake Mine Site – Diversions & Alterations**

As part of their scoping and conformity review of the Wolfden High Lake Project Proposal, Transport Canada identified that any stream flow diversions and alterations to navigable watercourses be identified, specifically at the High Lake Mine Site. Alterations to navigable watercourses along the road are covered by a separate submission being developed by TBT. At the High Lake Mine Site, the following diversions / alterations to watercourses are proposed, none of which are thought to be navigable waters:

- Re-routing of the outflow of L21 (Stream S38);
- Diversion of L18 to Kennarctic River;
- Cutoff of the natural outflow of High Lake (Streams S33 and S34); and
- Diversion of Outflow of L15 to L4.

A summary of each of the proposed diversions / alterations is provided below along with the stream characteristics for each of the streams.

Re-routing of Outflow of L21 (Stream S38)

As part of the project development Stream S38 will be re-directed around the north edge of the process plant and related stockpile areas. During operations surface flow from S38, along with drainage from the northern part of the process plant and that exiting lake L21 will be collected in a ditch and conveyed to High Lake either via a ditch around the south side of the AB open pit or via a ditch along the side of the main haul road to the D zone open pit. At closure the drainage from L21 (via S38) will be restored.

The outflow of lake L21, stream S38, is an ephemeral stream that flows out of the Upper High Lake drainage basin towards High Lake via Core Shack Lake (L19). The stream flows through a screen field of very large boulders and is often hidden from view. The channel is approximately 556 m long with an average channel width of 1 m and depth of 0.10 m with an approximate discharge of 0.01 m³/s. It provides negligible fish habitat. Stream characteristics are presented in Table 1 and photos are presented in Figure 1.

Diversion of L18 to Kennarctic River

As part of the mine development there will be a dam constructed between L17 and L18 (Figure 3.7-4 in Volume 5 Section 3) to:

- Divert the clean L18 drainage away from the site towards the Kennarctic River;
- Minimize surface water flow through waste rock storage areas;
- Prevent fish migration out of L18 into the High Lake impoundment area; and
- Provide overall protection to the L18 drainage.

L18, also known as Contact Lake, is located just south of High Lake and drains a small area south of High Lake. L18 has two outlets: S36 and S46. S36 flows north to a very small lake (L17) and S46 flows directly to the Kennarctic River. S36 is an alluvial channel which runs sub-surface near the outlet of L18 and contains the majority of the L18 outflow for most of the year. The flow in S36 decreases over the course of the summer, and can be dry by the end of summer.. It is approximately 120 m long with an average width of 1.0 m and average depth of 0.05 m. S46 is ephemeral and flows only during high flows in spring. S46 is approximately 862 m long with an average width of 1.0 m and average depth of 0.10 m. There is a significant elevation change in S46 as it flows down the Kennarctic River. Both streams are impassible to fish. Stream characteristics are presented in Table 1 and photos are presented in Figures 2, 3 to 4.

Cutoff of Natural Outflow of L16 to Kennarctic River (Streams S33 and S34)

The natural outflow of High Lake discharges to the Kennarctic River at the south east end of the lake via Streams S34 and S33. As part of the development of the High Lake Tailings Containment Area, a dam will be constructed across this location (East Dam) permanently cutting off this discharge to the Kennarctic River. Stream S34 exit High Lake and flows down the steep cliff side to a small lake (L25) on the bench of the cliff, which then flows out S33 into the Kennarctic River. Typically S33 goes to ground by mid-July after which there is no direct discharge from High Lake to the Kennarctic River. Both streams are impassible to fish. Stream characteristics are presented in Table 1 and photos are presented in Figures 5 to 6.

Diversion of Outflow of L15 to L4

At the north end of the High Lake drainage area, water from L15 seasonally flows into the north end of High Lake via an unconfined channel. The hydrological connection between L15 and L16 has not been classified as a stream and is considered to offer no fish habitat (Volume 5, Sections 4.5.3.1 and 4.7.2.3). In 2005, continuous flow were present during June and July, however the channel was dry by mid-August. Photographs of this channel can be found in Volume 5, Section 4, Appendix F (F 5.4.1 and F 5.4-2).

To provide protection of this fish bearing lake, two dams will be built to isolate it from High Lake: Northwest Dam and Northwest Channel Dam. Once the dams are in place, drainage water from the L15 catchment will be diverted north to L4 via a rock drain buried beneath the main access road (Volume 5, Section 3, Figure 3.7-4). The proposed location of the rock drain is on the height of land between L15 and L4 and is shown in Figures 7 and 8.

Table 1 Stream Habitat (from Volume 5, Section 4, Table a 5.4-1)

Waterbody	S33	S34	S36	S46	S38
Channel Length (m)	162	236	120	862	556
Average Channel Width (m)	4.0	43	17.5	1.0	1.0
Average Wetted Width (m)	0.0	12	1.0	1.0	1.0
Channel Area (m ²)	648	10135	210.	862	556
Average Depth (m)	0	0.10	0.05	0.01	0.10
Max. Depth (m)	-	-	-	-	-
Volume (m ³)	-	-	-	-	-
Approx. Discharge (m ³ /s)	-	0.01	0.01	0.25	0.01
Percent Gradient (%)	13	22	4	12.5	7
Channel Character	Continuous	Continuous	Continuous	Continuous	Continuous
Flow Type	Ephemeral	Continuous	Intermittent	Intermittent	Ephemeral
Average Hydraulic Character					
% Pool	-	0	0	5	0
% Riffle	-	0	90	40	30
% Run	-	0	10	55	70
% Other	-	100	0	0	2
% Total Cover	-	0	5	30	20
Substrate					
% Fines	T	3	10	T	20
% Gravel	10	7	20	T	5
% Cobble	20	20	40	40	5
% Boulder	70	30	30	50	30
% Bedrock	0	40	0	10	40

Figure 1 Stream S38 Looking Downstream from Lake L21 Outlet



Figure 2 Stream S36 Looking Downstream from Lake L18 Outlet



Figure 3 Stream S46 Looking Downstream from Lake L18 Outlet



Figure 4 Stream S46 and Kennarctic River (foreground)



Figure 5 Stream S34 at High Lake Outflow



Figure 6 Streams S34 and S33 at outflow to Kennarctic



Figure 7 Height of Land between L4 and L15



Figure 8 Connection between High Lake (left) and Lake L15 (right)

