



Appendix IR1-09-B

Fall 2017 Field Visit Report

Red Mountain Underground Gold Project
IDM Mining Ltd. Responses to
Canadian Environmental Assessment Information Request #1



November 16, 2017

Max Brownhill
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Dear Mr. Brownhill:

**Re: Fisheries and Oceans Canada (DFO) Additional Information Request
Bitter Creek Dolly Varden Spawning Assessments, Fall 2017**

1. Introduction

This letter describes IDM Mining's Dolly Varden fall spawning assessment on Bitter Creek, conducted by Palmer Environmental Consulting Group Inc. (PECG) on October 18, and November 8, 2017. The objective of this field program was to target the Dolly Varden (*Salvelinus malma*) spawning period, and to record potential spawning activity, and collect supporting data (e.g. stream velocities, water temperature, substrate).

IDM Mining (IDM) submitted a request for review to the Fisheries Protection Program of Fisheries and Oceans Canada (DFO) on March 29, 2017, for the proposed Access Road for the Red Mountain Gold Project. On November 10, 2017, IDM received a letter from DFO requesting additional information to complete their review and determine if construction of the proposed road is a work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal (CRA) fishery, or to fish that support such a fishery, which is prohibited under the subsection 35(1) of the *Fisheries Act*. One of the items requested was: A report detailing the Dolly Varden spawning assessments conducted on Bitter Creek during the fall of 2017. This report has been prepared to fulfill that request.

2. Spawning Assessment Methods

Spawning assessments were conducted on two days in fall 2017: October 18 and November 8. Dave Green (IDM Mine Manager and local Stewart resident) made regular visits to Bitter Creek at the Highway 37A bridge during October and early November, to assess water clarity, which informed the timing of the spawning surveys. On each date of the spawning assessment, the crew of two (one fisheries biologist from PECG, and Dave Green) conducted an aerial survey of Bitter Creek, from the confluence with Bear River upstream to the fish passage barrier. The aerial surveys involved a helicopter overflight to observe potential

spawning activity, such as the presence of adult Dolly Varden or Dolly Varden redds. The crew noted weather conditions, and water clarity (visibility), and took photos. Following the aerial survey, the crew conducted a ground survey at six locations along Bitter Creek (Table 1). Five of these locations were identified as potential spawning habitat during baseline studies, based on the influence of tributary inflows on water clarity and substrate. A sixth location (Encroachment Area Side Channel) corresponding to Station 4+550 to 4+840 of the proposed road, was also flagged as having potential spawning habitat by PEGC during a May 2017 site visit. A minor realignment of Bitter Creek is proposed at this location.

On October 18, fish habitat assessment forms were completed for each site in Table 1. On both dates, water quality (temperature, pH, dissolved oxygen, conductivity) were measured *in situ* using a YSI Proplus digital meter. Water and air temperature was measured using a handheld mercury thermometer (November 8 only). Stream velocity measurements were collected with a Marsh MacBirney flow meter. The crew walked 100-300 m along the creek at each site looking for evidence of spawning, took aerial and ground photos, and noted habitat suitability for spawning.

On November 8, the crew visited known coho salmon (*Oncorhynchus kisutch*) spawning areas in the Bear River Valley (Table 2). These areas are not within the Red Mountain Access Road project area, but were investigated because Dolly Varden have been known to spawn in these areas in previous years (Dave Green, pers comms., November 8, 2017).

Table 1: Spawning Assessment Ground Survey Locations, Bitter Creek, October-November 2017

Site (downstream to upstream)	UTM Location		Description
	(Zone 9V: Easting, Northing)		
Lower Bitter Creek – Side Channel	0442987	6210706	Bitter Creek at Bear River, side channel of alluvial fan.
Encroachment Area – Side Channel	0447082	6208661	Bitter Creek side channel approximately 1.5 km downstream from Swarm Creek (left bank tributary) confluence.
Swarm Creek	0448263	6209202	Confluence of Swarm Creek (left bank tributary) with Bitter Creek
Roosevelt Creek	0448979	6209215	Area at and downstream of Roosevelt Creek (right bank tributary) inflow; largest of Bitter Creek's tributaries.
Cambria Creek	0450937	6208631	Area at and downstream of Hartley Gulch (right bank tributary) inflow.
Hartley Gulch	0451731	6207080	Area at and downstream of Hartley Gulch (right bank tributary) inflow.

Table 2: Coho salmon spawning locations in the Bear River Valley, November 8, 2017

UTM Location (Zone 9V: Easting, Northing)		Description
442654	6211518	Bear River backwater channel accessed by helicopter. Approximately 700 m upstream from the Bitter Creek confluence with Bear River.
441212	6206311	Slow-moving watercourse conveyed through culvert under Highway 37A with large beaver pond on upstream side. Approximately 5 km south of Bitter Creek confluence with Bear River.
448702	6218799	Watercourse conveyed through culvert under Highway 37A. Approximately 12 km upstream from Bitter Creek confluence with Bear River.
444864	6216633	Bear River side channel accessed from Highway 37A. Approximately 8 km upstream from Bitter Creek confluence with Bear River.

3. Spawning Assessment Results

The crew did not observe fish, or other evidence of spawning activity (e.g. redds) during aerial and ground surveys on Bitter Creek. Water visibility was poor on October 18, due to high turbidity, which is typical of Bitter Creek. Visibility was better (moderate to good) during ground surveys on the same date, near the tributary inflows. On November 8, water visibility was moderate to good for both aerial and ground surveys, as turbidity was relatively low and the weather was clear. Water quality and stream velocities measured at each site are shown in Table 3. Discussion of conditions at each site during both spawning assessments follow.

Coho salmon in spawning colours were observed in the Bear River Valley (Table 2) on November 8, but Dolly Varden were not observed at those areas. Dolly Varden were observed spawning in these areas in previous years, typically during and after the coho spawning period (Dave Green, pers comms).

Table 3: *In situ* water quality measurements and stream velocities, Bitter Creek, October-November 2017

Site	Water Temperature (°C)		pH		Conductivity (µS/cm)		Stream Velocities* (m/s)	
	18/Oct	08/Nov	18/Oct	08/Nov	18/Oct	08/Nov	08/Nov	18/Oct
Lower Bitter Creek	3.3	0.2	8.21	8.14	156.5	332.1	0.20-0.63	0.11-0.80
Encroachment Area	3.3	0.5	8.16	8.10	165.3	347.9	0.42-0.84	n/c
Swarm Creek	3.1	0.3	8.25	8.10	183.9	363.8	0.36-0.70	n/c
Roosevelt Creek	3.6	0.4	8.15	7.90	121.3	227.6	0.17-0.93	0.14-1.27
Cambria Creek	3.2	0.5	8.19	7.83	129.6	241.7	0.01-0.35	n/c
Hartley Gulch	2.6	-0.1	8.12	7.76	193.3	368.5	0.10-0.13	0.21-0.60

*Range across two to eight measurements; measurements taken at 40% depth; measurements of 0 m/s (measured near stream edges and still water areas) not included.

3.1 Lower Bitter Creek

The Lower Bitter Creek spawning survey was conducted on the side channel along the left bank. The side channel was shallower compared to the main channel, consisting of primarily of riffle/run habitat (Photo 1 and Photo 2). Substrate within the channel was cobble dominant, with some gravel (subdominant). Small gravel beds were observed in a slower moving area of the side channel.

3.2 Road Encroachment Area – Side Channel

The side channel located near the road encroachment area on the left side of the channel was flagged as potential spawning habitat for Dolly Varden in May 2017. The side channel was shallower compared to the main channel, consisting primarily of riffle/run habitat (Photo 3 and Photo 4). Substrate within the channel was cobble dominant with approximately equal amounts of gravel and boulder. It appeared that some of the gravel observed within the side channel in May had been washed out during high flows, such that the side channel was dominated by larger substrate in October/November. Some small gravel areas were noted near the middle and downstream end of the side channel (Photo 5 and Photo 6).

3.3 Swarm Creek

The Swarm Creek spawning survey was conducted along Bitter Creek on river right where Swarm Creek enters. The outlet of Swarm Creek is a steep drop to a small section of gravel beds on Bitter Creek (Photo 7). The gravel bed section was approximately 20 m in length by 2 m wide with an average depth of 5 cm on October 18 (Photo 9). However much of this area was under ice/snow on November 8. Substrate within the main channel of Bitter Creek was cobble dominant (Photo 8 and Photo 10).

3.4 Roosevelt Creek

The Roosevelt Creek spawning survey was conducted on a 250-m section starting at the confluence with Bitter Creek. The downstream section (~80 m) consisted of boulder dominant riffle habitat (Photo 11 and Photo 12). The upstream section (~170 m) consisted of cobble dominant riffle/run habitat with some gravel areas (Photo 13 and Photo 14).

3.5 Cambria Creek

The Cambria Creek spawning survey was conducted on a 200-m section starting at the confluence with Bitter Creek. The surveyed section consisted of boulder dominant riffle habitat (Photo 15 and Photo 16) with a small cascade section at the confluence with Bitter Creek.

3.6 Hartley Gulch

The Hartley Gulch spawning survey was conducted on a 300-m section starting at the confluence with Bitter Creek. The surveyed section consisted of cobble dominant riffle habitat (Photo 19). Upstream of riffle habitat the gradient begins to increase with coarser (cobble and boulder) substrate. On November 8, the survey was limited by ice cover (Photo 20).

4. Discussion

Baseline studies found Dolly Varden throughout the fish bearing sections of Bitter Creek and its tributaries (Triton 2016; Rescan 1994). The sampling data suggested that higher densities of Dolly Varden occur near tributary inflows, which provide clear waters and refugia from the high current velocities and turbidity of mainstem Bitter Creek. Rescan (1994) found that overall Dolly Varden abundance in the Bitter Creek area remained relatively constant between summer and fall sampling periods, but decreased to almost zero during winter. The spawning grounds of the Dolly Varden found in Bitter Creek remains unknown, however; the results of the 2017 spawning surveys indicates Dolly Varden are not likely spawning in Bitter Creek. The primary deterrents to spawning are low water temperatures, high turbidity in the mainstem of Bitter Creek, and limited areas with suitable spawning gravel.

Dolly Varden spawning sites typically occur at the emergence of tributaries and springs/upwellings with a main channel (ADFG 1985), or at the downstream ends of pools where water breaks into riffle habitat (McPhail and Taylor 1995). Spawning substrate varies from fines to boulders (Griffith 1979; Leggett 1980; ADFG 1985) with medium-coarse gravel (25-50 mm) identified as essential for Dolly Varden (Griffith 1979; Leggett 1980). Average depth of spawning varies between 0.15 - 0.84 m (Griffith 1979; Armstrong and Morrow 1980) with maximum observed depths at 1.0 m (Griffith 1979) and 4.5 m (ADFG 1985). The preferred water temperature for spawning reported in the literature was less variable, with spawning occurring at >5.0°C (Griffith 1979; ADFG 1985). Typical water velocity for spawning of Dolly Varden ranges from 0.2 to 0.6 m/s (Griffith 1979; Armstrong and Morrow 1980; ADFG 1985; Hagan and Taylor 2001). Spawning has been observed in velocities up to 1.3 m/s (Griffith 1979; ADFG 1985).

Of the six potential spawning sites that were surveyed, Roosevelt Creek, Swarm Creek and Hartley Gulch had some habitat characteristics preferable for Dolly Varden spawning. The sites occurred at the confluence of tributaries to Bitter Creek, and had appropriate substrate composition, depths and velocities for spawning, although depths and velocities were near the higher end of their preferred range (Table 3). Preferred coarse gravel substrate was lacking at Cambria Creek, the road encroachment area (side channel), and at lower Bitter Creek (side channel), where cobble and/or boulder dominated the substrate. Water temperature was below the threshold (5°C) reported for Dolly Varden spawning, on both survey dates and at all sites.

5. References

- Alaska Department of Fish and Game (ADFG). 1985. Arctic Char Life History and Habitat Requirements. In Alaska Habitat Management Guide. Prepared for Fish Habitat Improvement Section, British Columbia Ministry of Environment.
- Armstrong, R.H., and J.E. Morrow. 1980. The Dolly Varden Charr, *Salvelinus malma*. In Charrs. E.K. Balon (ed.). Kluwer Boston Inc., Hingham, MA. 928p.
- Griffith, R.P. 1979. The Spawning and Rearing Habitat of Dolly Varden Char and Yellowstone Cutthroat Trout in Allopatry and in Sympatry with Selected Salmonids.

- Hagan, J., and E.B. Taylor. 2001. Resource Partitioning as a Factor Limiting Gene Flow in Hybridizing Populations of Dolly Varden char (*Salvelinus malma*) and Bull Trout (*Salvelinus confluentus*). *Canadian Journal of Fisheries and Aquatic Sciences* 58: 2037-2047
- Leggett, J.W. 1980. Reproductive Ecology and Behavior of Dolly Varden Charr in British Columbia. In Charrs. E.K. Balon (ed.). Kluwer Boston Inc., Hingham, MA. 928p.
- McPhail, J.D., and E.B. Taylor. 1995. Skagit Char Project (Project 94-1). Final Report to Skagit Environmental Endowment Commission, North Vancouver, BC. 39p
- Northlink Consultants Limited Partnership (Triton). 2017. Red Mountain Underground Gold Project: Baseline Fisheries and Aquatic Resources. Report prepared for IDM Mining Inc. January, 2017.
- Rescan Consultants Inc. 1994. Red Mountain M.D.C. Application Volume II - Environmental Setting. Report prepared for Lac North America Ltd.

6. Photo Log – Ground Photos



Photo 1: Lower Bitter Creek Side Channel, looking upstream, October 18, 2017.



Photo 2: Lower Bitter Creek Side Channel, looking downstream, November 8, 2017.



Photo 3: Road encroachment side channel, looking upstream, October 18, 2017

Photo 4: Road encroachment side channel, looking upstream, November 8, 2017



Photo 5: Small (0.3 m x 0.6 m) gravel bed near road encroachment side channel on Bitter Creek, October 18, 2017

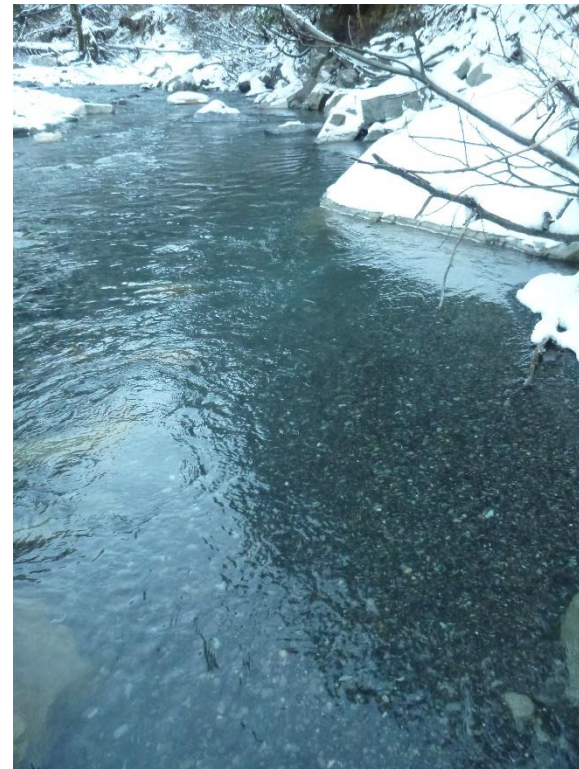


Photo 6: View of gravel area at road encroachment side channel, looking upstream, November 8, 2017



Photo 7: Outlet of Swarm Creek to Bitter Creek, October 18, 2017



Photo 8: Outlet of Swarm Creek to Bitter Creek, November 8, 2017



Photo 9: Shallow gravel bed on the side of Bitter Creek at Swarm Creek outlet, October 18, 2017



Photo 10: Gravel area at outlet of Swarm Creek to Bitter Creek, November 8, 2017



Photo 11: Downstream section of Roosevelt Creek near outlet to Bitter Creek, October 18, 2017



Photo 12: Downstream section of Roosevelt Creek near outlet to Bitter Creek, November 8, 2017



Photo 13: Gravel substrate at the upstream section of Roosevelt Creek, October 18, 2017



Photo 14: Gravel substrate at the upstream section of Roosevelt Creek, November 8, 2017



Photo 15: Cambria Creek at Bitter Creek, October 18, 2017



Photo 16: Cambria Creek at Bitter Creek, November 8, 2017



Photo 17: Cobble substrate on Cambria Creek, October 18, 2017



Photo 18: Upstream on Cambria Creek, where it flows into the Bitter Creek channel, November 8, 2017



Photo 19: Hartley Gulch shallow channel, October 18, 2017



Photo 20: Hartley Gulch shallow channel, November 8, 2017



Photo 21: Gravel substrate in Hartley Gulch, October 18, 2017



Photo 22: Hartley Gulch where it enters the Bitter Creek channel, November 8, 2017

7. Photo Log – Aerial Photos



Photo 23: Bitter Creek Road Encroachment Area – Side Channel, November 8, 2017



Photo 24: Swarm Creek at Bitter Creek, November 8, 2017



Photo 25: Roosevelt Creek at Bitter Creek, November 8, 2017



Photo 26: Cambria Creek at Bitter Creek, November 8, 2017



Photo 27: Hartley Gulch at Bitter Creek, November 8, 2017

We trust that this letter satisfies the request for a report detailing the Dolly Varden spawning assessments conducted on Bitter Creek during the fall of 2017. Should you have any questions or concerns, please do not hesitate to contact the undersigned.

Yours truly,
Palmer Environmental Consulting Group Inc.

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