

Government of Yukon

Former Clinton Creek Mine Emergency Drop Structure Repairs Construction Activity Report - 2009

Prepared by:

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Project Number:

6029 015 02 (4.6.1)

Date:

May, 2010

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April 4, 2011

Mr. Brett Hartshorne
Assessment and Abandoned Mines Branch
Department of Energy, Mines and Resources
Yukon Government
Box 2703, K-419
Whitehorse, Yukon Y1A 2C6

Dear Brett:

Project No: 6029 015 02 (4.6.1)
**Regarding: Former Clinton Creek Mine
Emergency Drop Structure Repairs
Construction Activity Report**

AECOM Canada Ltd. (AECOM) is pleased to submit the final construction activity report for the repair works to the gabion drop structures at the Former Clinton Creek Asbestos Mine.

If you have any questions or comments, please call or email.

Sincerely,
AECOM Canada Ltd.



Andrew Smith, P.Eng
Water Resources Engineer
Andrew.smith3@aecom.com

AS:sw
cc: Rolf Aslund - AECOM

Distribution List

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	1	Government of Yukon

Revision Log

Revision #	Revised By	Date	Issue / Revision Description
1	Andrew Smith	December 11, 2009	Draft
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AECOM Signatures

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1. Introduction

During the fall of 2009, work took place at the Former Clinton Creek Asbestos Mine (the site) to repair damage sustained at the four drop structures during the 2009 spring run-off. Work began on September 8 and continued until October 16, an approximate six-week period. An initial repair plan was developed based on the condition of the structures observed during AECOM's site inspection on July 16, 2009 (AECOM 2009). After a more detailed inspection by AECOM and on-site discussions with the Contractor in September 2010, some modifications to the repair plan were made and all damage that could compromise the integrity of the structures was subsequently repaired.

Construction was undertaken by Han Construction Ltd. (the Contractor) from Dawson City, Yukon. Han Construction Ltd. is owned by Chief Isaac Inc., which is a business unit of the Tr'ondëk Hwëch'in First Nation. Han Construction was the Contractor responsible for the construction of the original drop structures from 2002 to 2004. Resident inspection services were provided by AECOM.

This report details the construction activities including:

- Progress of Work;
- Summary of Work completed;
- Air quality sampling conducted during construction, and the laboratory results; and
- Equipment and excess material remaining.

2. Original Construction of Gabion Drop Structures

Based on evidence of on-going deterioration of the Hudgeon Lake outlet, creek stabilization measures consisting of four gabion drop structures were constructed from 2002 to 2004 (Figure 01). Because the waste rock was still undergoing creep movements, and may do so for many more years, gabion drop structures were selected for the channel stabilization measures because they can accommodate some movements of the waste rock pile and remain functional. The gabion drop structures serve as grade control points connecting nearly flat channel sections. The exception is Drop Structure #4 which does not have a tailwater pond as it discharges directly into the steep channel downstream. The result is shallower and higher channel flow velocities than would occur between the other drop structures.

The use of rock sills constructed of large boulders were considered during the initial assessment, but rejected due to the lack of large boulders in the area and the inherent instability of rock sills.

Each drop structure step has a rise of 0.5 m and a run of 2.0 m. The structures were constructed of 0.5 m thick, 1.0 m wide and 3.0 m long gabions with 1.0 m gabion overlap between steps. Each gabion basket has three 0.5 x 1.0 x 1.0 m compartments separated by partition walls made of the same material as the gabion basket. The top lid of the

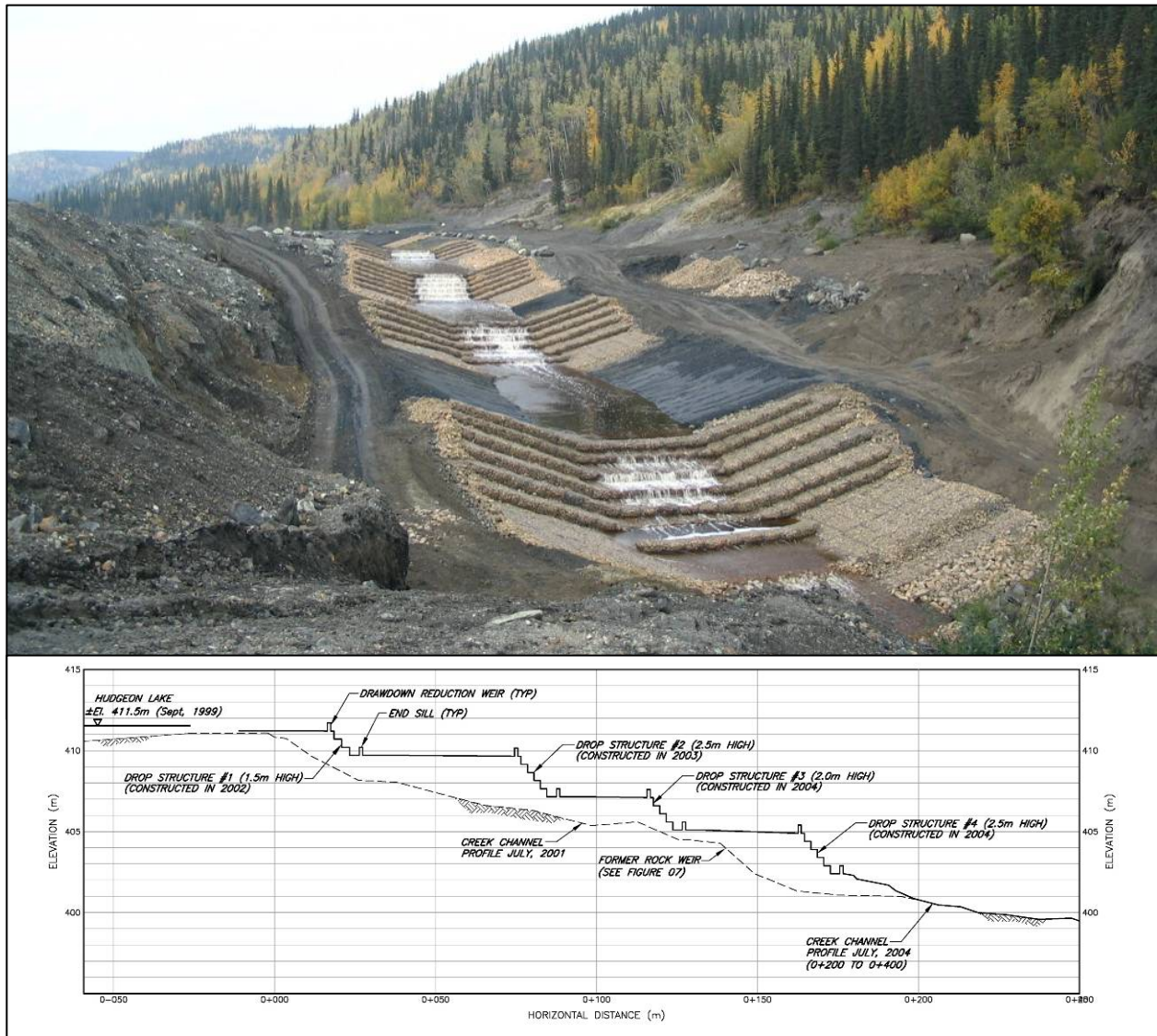


Figure 1: Clinton Creek Channel Stabilization Works (2004)

basket can be opened, to place the rock fill, and the lid is “hinged” along the long side of the gabion basket.

During construction, the gabions for each step were placed side-by-side with the long sides parallel to the direction of flow and tied together using C-rings. The C-rings are C-shaped stainless steel wire fasteners that are crimped into a ring using a pneumatic crimping tool. After the adjacent gabion baskets were tied together, the baskets were filled with rock and the lids were folded down and the three free sides of the gabion lids secured with either C-rings. In addition, the lids are secured with C-rings to the internal partition walls that separate the gabion compartments.

Some minor loss of gabion fill material from the baskets was observed following the first spring freshet event after construction. The problem was most notable on the flat section of each tier subject to high flow velocities in the spring. The loss of fill was believed attributable to consolidation of the rock fill within the baskets in combination with the loss of some of the smaller pieces of rock (less than 75 mm diameter) through the basket openings. This problem was alleviated opening up the baskets and topping them off with rock fill at least 100 mm in diameter. The last such maintenance work was carried out in 2007.

3. Damage Assessment

3.1 General

Although the discharge over the drop structures during the 2009 freshet was not measured, it is believed it may have been in the order of 57 m³/s based on stream flow information provided by The Yukon Water Board. This compares with the design discharge of 28.9 m³/s for the drop structures as reported in the Environmental Liability Report for the Clinton Creek Mine, June 2003.

Overall, the damage to the gabion drop structures was more severe on the north side of the structures with the most significant damage occurring at Drop Structure #4 (DS #4). Less damage occurred at DS #2 and relatively minor damage occurred at DS #1 and DS #3. Photographs taken in May 2009 during the spring freshet suggest that the lower parts of the channel, which are shaded from direct sunlight due to the height of the waste rock pile to the south, may have been constricted by snow and ice build-up (Figure 02). The effect of the shading of the south side of the channel can be seen in the aerial photograph taken by the Department of Fisheries and Oceans in March 2008 (Figure 03). On Figure 02, erosion channels in the snow pack are visible on the south side of the channel at DS #3 and DS #4 indicating that the channel was not fully open at some point during the spring freshet and some water may have flowed around the snow and ice. This scenario is supported by reports that the spring thaw in 2009 was delayed by unseasonably cold temperatures followed by a rapid rise in temperatures and prolonged rainfall. A potential consequence of concentrated flow on the north side of the channel would be a higher unit discharge (per metre width of channel) than the drop structures were designed for, in particular at DS #4 which is in the shadow of the waste rock dump (Figure 02).



Figure 2: Gabion Drop Structures in May 2009 (DS#2 on Right Hand Side of Photo)

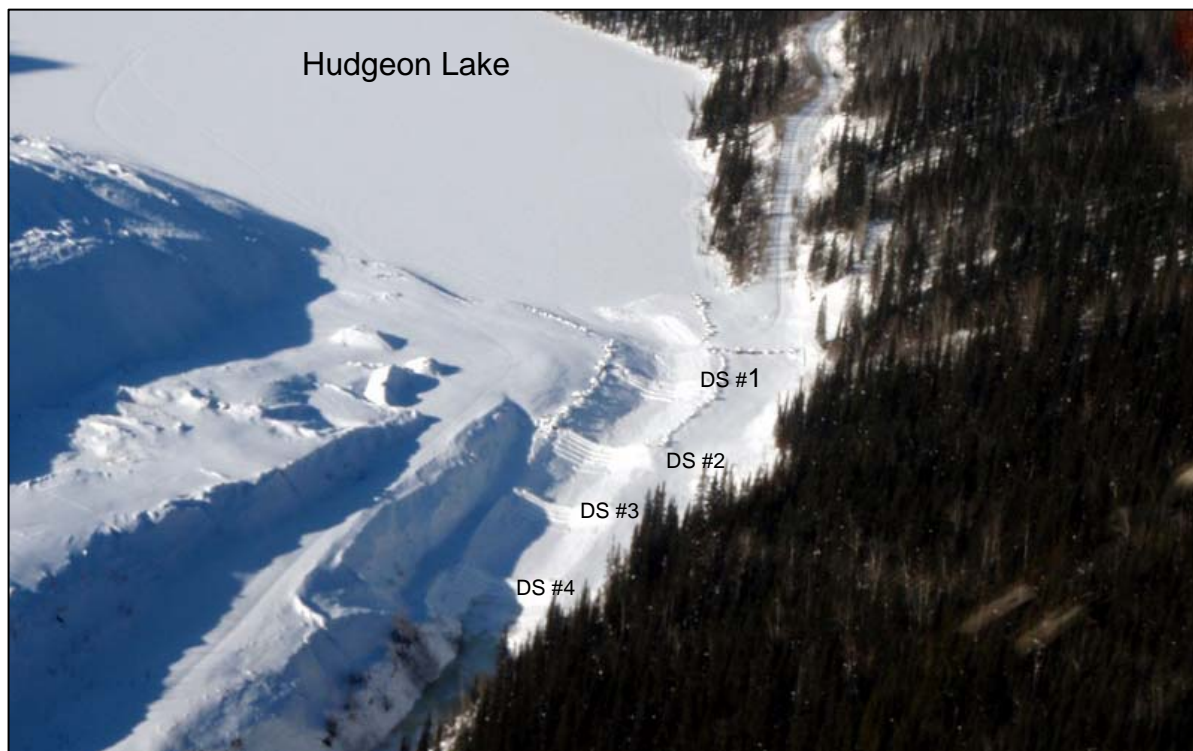


Figure 3: Hudgeon Lake Outlet in March 2008 (Courtesy of DFO-AI von Finster)

The Drawings in Appendix A present the damage at each drop structure. Most of the damage is believed to have occurred due to the partial loss of gabion rock fill in downstream baskets. As a result, the rock fill remaining in these baskets was forced by the water flow against the downstream wall of the compartment. In this case, it is apparent that the gabion fill loss has caused a force on the downstream end wall that was sufficient to open the C-rings and release the remaining fill material. Once the material had been washed out of the downstream gabion compartment, a similar series of events is thought to have occurred in the next upstream gabion compartment, resembling an incremental domino effect. Failure of the stainless steel C-rings is surprising since they are very difficult to open when clamped. It is considered possible that force pulsations caused by the turbulent flow over and through the gabions over a prolonged time may have gradually stretched some of the rings open.

The high water marks (HWM) visible on the channel banks between drop structures were surveyed to estimate flow depths during the 2009 freshet. A HWM, consisting of woody debris on the left side and immediately upstream of Drop Structure #3 was 0.79 m above the weir crest. A 0.2 m high vertical erosion face along the left channel side slope upstream of Drop Structure #3 also provides an indication of the high water level during the flood event. The bottom edge of the erosion face was 0.91 m above the weir crest upstream of Drop Structure #3. At the downstream end of the riprap at Drop Structure #2, the bottom edge of the erosion face was 0.78 m above the weir crest at Drop Structure #3. At Drop Structure #4, a woody debris HWM was found approximately 0.8 m below the top of the side slope gabions on the left side of the structure. This indicates that the water level upstream of Drop Structure #4 was approximately 1.2 m above the weir crest of Drop Structure #4.

The surveyed high water marks indicate that the water level upstream of Drop Structure #4 was approximately 0.4 m higher at Drop Structure #4 than at Drop Structure #3 during the same discharge. This observation confirms that the right half of the channel at Drop Structure #4 was obstructed, possibly by ice and snow.

3.2 Drop Structure #1

Drop Structure #1 is a 1.5 m high 3-step structure. The rock fill was lost from the two downstream gabion basket compartments on the gabion on the left side of the floor of Step 2 up from the basin floor. Several gabions, especially downstream of the low flow notch in the upstream weir, had lost a part of the rock fill through the gabion mesh openings leaving the gabions only partly filled. The floor jet sill was deformed but was generally intact and no channel bed erosion was detected downstream of the structure. The depth of flow at the downstream end of the apron was approximately 0.5 m at the time of inspection.

3.3 Drop Structure #2

Drop Structure #2 is a 2.5 m high 5-step structure. Drop Structure #2 suffered damage to the gabions on Steps 2 and 4 from the apron and some damage to the gabions on Step 1. At Step 1, one of the gabions appeared to have lost its end wall and several gabions had lost parts of the gabion fill material through the gabion mesh. One gabion appeared to be on the verge of breaking open along the C-ring clamped edge and spilling the remainder of the gabion fill that was pushed against the downstream gabion end wall. On Step 2, the gabions on the left side of the floor were split open along the C-ring clamped downstream gabion edges and rock fill had discharged from the downstream compartments of the gabions. On the right side of the same step, one gabion edge was partly open. The second compartment of all floor gabions appeared to be partly filled. The gabions on Step 3 of the structure appeared to be intact but all floor gabions had lost part of the fill through the gabion mesh openings.

On Step 4 from the apron, all floor gabions except for the gabion farthest to the right had opened up along the downstream edges with loss of rock fill in the downstream gabion basket compartments. All of the downstream gabion end walls appeared to be in place. At the floor gabion farthest to the right, the gabion was partly open along the downstream edge and three C-rings were seen hanging from the lid edge. The 3.4 mm diameter edge wire in the lid was also broken. There were two elongated holes (approximately 0.25 x 0.60 m) with rounded upstream and downstream edges in the lid suggesting it may have been pierced by debris. Step 5 appeared to be in generally good condition. The floor jet impact sill on the apron was breached but no erosion was evident on the channel bed downstream of the structure.

3.4 Drop Structure #3

Drop Structure #3 is a 2.0 m high 4-step structure. The damage to Drop Structure #3 consisted of open gabion baskets on the floor of Step 3, total loss of gabion fill in the downstream compartments of the gabions at the toe of the side slopes on Step 3 and partial loss of gabion fill from several gabions on the floor and at the toe of the side slopes. The floor jet impact sill on the apron was deformed but still in place and no channel bed erosion was evident downstream of the structure. Deposition of gabion fill material extended from just inside the structure to approximately 2 m downstream of the structure.

3.5 Drop Structure #4

Drop Structure #4 is a 2.5 m high 5-step structure. Drop Structure #4 suffered significant damage during the 2009 spring runoff event but then primarily along the left (north) half of the structure. Along the right half of the structure, some gabion basket edges on the structure floor were opened with subsequent loss of gabion fill and some partial loss of fill material through the gabion mesh openings in other gabions on the structure floor.

Along the left half (four gabions wide) of the structure, all gabions on the structure floor had opened up and discharged the gabion fill in the two downstream compartments of the gabions on Steps 2, 3 and 4 from the apron. In addition, the fill in a large part of the apron floor had been lost. The gabions on Step 5 were generally intact and the weir across Step 5 was damaged in the left half of the structure.

The most significant damage to Drop Structure #4 was the damage to the apron floor. The lids, interior partitions and gabion fill had been lost, leaving a 5 m wide and 3 m long hole in the apron floor. The bottoms of the gabions were still in place over the geotextile that was placed below the structure during the construction. Two compartments at each end of the sill were still in place but the rest of the sill had been lost. The edges of the gabions on Step 1 were intact and the floor gabions had only suffered partial loss of fill through the gabion mesh openings.

4. Construction Activities

Construction Activities included:

- Removal of debris that had accumulated at the drop structures;
- Screening new rock fill to remove fine material prior to use;
- Repairing and refilling empty gabion baskets within each drop structure;
- Removal and replacement of the damaged end sill at Drop Structure #2;
- Removal of the damaged end sill at Drop Structure #4;
- Fill and cover with gabion mat material, the hole within the basin at Drop Structure #4;
- Placing new 0.5 m gabion baskets overtop the basin at Drop Structure #4;
- Covering the existing drops at Drop Structure #4 using 2 rolls of gabion mesh;
- Hand stitching of all top edges, previously closed using C-rings, at all drop structures;
- Removal of historical signs from the abandoned mine site and at Wolverine Creek; and
- Removal of debris from the culvert inlets at the Wolverine Creek crossing.

Work at the site, each week, is described below. A total of 34 days were spent at the site, a breakdown is presented in Table 4.1. Pictures taken during construction are presented in Appendix A.

Table 4.1 Summary of Working Days

Location / Activity	Time (days)
Mobilization and debris removal from drop structures	4
Drop Structure #1	4
Drop Structure #2	4
Drop Structure #3	4
Drop Structure #4	16
Sign removal and culvert cleanup	2
Total	34

Week 1 – week ending September 12

- Construction began on September 8th with the mobilization of equipment including the Loader, Bobcat and Grizzly Screener;
- Mobilization of material to the site including 4 rolls of gabion mesh (30 m by 3 m each), 65 - 0.3 m gabion baskets and an unknown quantity of 0.5 m gabion baskets (excess material from the original construction);
- Removal of debris from the drop structures;
- Screening rock fill material at the site to remove fine material. The stockpiled material was put through the grizzly screener three times; and
- Began the repairs at Drop Structure #4 which included removal of the damaged end sill and repair of gabions at the drops in the right half of the structure.

By Friday, all debris had been removed from the drop structures and the damaged end sill at Drop Structure #4 was removed. Work to repair the damaged gabion compartments began Saturday morning.

Week 2 – week ending September 19

- Continued screening existing rock fill material;
- Continued work at Drop Structure #4, repairing the gabion drops and filling in empty gabion baskets in the left half of the structure; and

- Filled in and repaired baskets along the waters edge at all drop structures, when flow in the channel was too high.

On Thursday night, September 17, a significant amount of rain fell and by the following morning the lake level increased by 22 cm from the previous night (17:00). Flows had increased in the channel such that work could not be completed safely. Friday, work continued above the waters edge. By 17:00 on Friday, the lake water level was 33 cm above the level recorded 24 hours earlier.

Saturday the contractor and AECOM arrived at the Clinton Creek ford near Wolverine Creek but could not access the site as flow in the creek was too high to cross with vehicles or wade. No work was conducted on Saturday so AECOM and the HAN Crew Boss decided to wait until Monday to assess conditions at the site, with a reduced construction crew.

Week 3 – week ending September 26

No work was conducted at the site on Sunday, September 20. Monday morning the contractor, the equipment operator and AECOM arrived on-site by 9:00. Flow in the creek was still above that of the previous week, but AECOM and the contractor crossed the creek in the operator's truck to access the site. Flows were still too high to work instream so the following work was completed:

- Constructed the gabion baskets that were to be placed at the downstream end of Drop Structure #4 (two 3-compartment baskets and seven 5-compartment baskets);
- Moved enough rock fill material to each drop structure to complete the repairs without equipment on-site; and
- Demobilized the bobcat from the site and moved the loader to the west side of the Forty Mile Bridge. The loader was demobilized the following day.

By 17:00 on Monday, September 21 the lake water level had dropped to 21 cm above the water level recorded Thursday September 17th, four days prior. As flows were still too high to work instream, AECOM and the HAN Crew Boss decided to suspend construction and assess conditions at the site on Wednesday, September 23.

Wednesday, AECOM and the contractor's Crew Boss arrived onsite at 12:30. The lake water level dropped 10 cm in two days and was now at 11 cm prior to the rain event Thursday night. AECOM and the Crew Boss decided to begin work again the following day.

Work continued on Thursday and Friday and included:

- Hand stitching at each drop structure, along the banks above the flow; and
- Repairing and filling baskets within the drops at Drop Structure #1.

Week 4 – week ending October 3

As the work proceeded into Week 4, no substantial amount of rain fell and the lake water level continued to drop. By Saturday at 9:00 am the lake water level was 8 cm above the level prior to the rain event and work continued instream, including:

- Filling and repairing gabion baskets at drops within Drop Structure #1, including hand stitching the baskets closed;
- Filling and repairing gabion baskets at drops within Drop Structure #2, including hand stitching the baskets closed; and

- Filling and repairing gabion baskets at drops within Drop Structure #3, including hand stitching the baskets closed.

By the end of the week, except for minor filling and repair at Drop Structure 1, 2 and 3, all baskets had been repaired. Major work left at these three drop structures included the removal and installation of the new end sill at Drop Structure #2 and hand stitching baskets throughout each drop structure that were previously closed using C-rings.

Week 5 – week ending October 10

At the beginning of Week 5, the contractor was back at Drop Structure #4 and work continued through the week including:

- Infilling the hole within the basin at Drop Structure #4. The hole, which was filled towards the beginning of the job, was recreated due to the higher flow in the channel after the rain event;
- Gabion Mesh material was placed ovetop of the filled hole at Drop Structure #4. All four edges of the cover were hand stitched to the existing gabions below;
- Placed the 9 gabion baskets at the basin of Drop Structure #4. The edges were hand stitched to the existing baskets, where possible. In addition, the baskets were fastened to each other and to the existing baskets below using C-rings;
- Filled all new gabion baskets and hand stitched them closed;
- Began to lay gabion mat material ovetop of the drops at Drop Structure #4;
- Debris blocking the culvert inlets at the Wolverine Creek Crossing were cleared; and
- Historical signs at the Wolverine Creek Crossing and at the site were removed.

Beyond the original scope of work, an additional day was taken to remove the historical signs and clear the culvert inlets at Wolverine Creek.

Week 6 – week ending October 17

Work finished at the site on Friday, October 16 and included:

- Finished laying the gabion mat material ovetop of the drops at Drop Structure #4;
- Removed what was left of the existing end sill at Drop Structure #2;
- Installed, filled and hand stitched closed a new end sill at Drop Structure #2. The new end sill was made of four gabions baskets, 0.3 m x 1 m x 2 m;
- Finished the minor filling within gabion compartments at drop structures #1 and #2; and
- Finished hand stitching the downstream edge of all drops and end sills perpendicular to the flow that were previously closed using C-rings;

Another additional day was taken to clear brush that had overgrown at one of the Wolverine Creek Culvert inlets, to place rock riprap at both culvert inlets and to remove the remaining garbage from the site. By Friday, October 16, all work was completed at the site and all equipment and material removed.

5. Equipment and Material Remaining

All left over material was taken to either Rick Gillespie's Yard or the Mackenzie Yard (HAN Construction Yard), both in the Callison Subdivision east of Dawson City. Table 5.1 presents a description of the material left, including quantity and location. The two pneumatic crimping tools were delivered to the Assessment and Abandoned Mines Branch Office of the Yukon Government.

Table 5.1 Construction Material Inventory

Description	Material Remaining	Location	UTM Coordinates (Zone 7)	
			Northing	Easting
0.3 m Gabion Baskets (2 x 1 x 0.3 m)	62	Gillespie Yard	7102241	580483
PVC Coated Mesh Rolls (30 x 3 m)	2	Gillespie Yard	7102241	580483
Box of C-rings (1600 per box)	9	Gillespie Yard	7102251	580587
0.5 m Old Gabion Baskets (3 x 1 x 0.5 m)	150 (approximately)	Mackenzie Yard, HAN Construction	7101839	580251

It should be noted that the two pneumatic crimping tools delivered to the Yukon Government require either repair or replacement before being used again. Towards the end of the job, the Contractor was unable to maintain a tight seal between the tools and the air hose, and one of the tools became unusable. It is believed that the threads at the hose fitting are stripped and require repair. If repairs cannot be made, it will be necessary to replace the crimping tools for any future repair works.

6. Asbestos Air Quality Testing

Air quality samples were taken throughout the duration of the project. Two, Model 224 PCXR4 AirChek samplers were available to sample at the site. Each air sample was collected using a 25 mm Asbestos PCM Cassette with a 0.8 µm filter material.

Samples were taken at locations where the Contractor was working during the day. Usually the Contractor was working at one location each day and so typically only one daily sample was taken. Four different sets of samples from each sampling interval were couriered to ALS Laboratories in Edmonton for PCM analysis for Asbestos. A summary of the results are presented in Table 6.1. All samples are below the Yukon Personal Exposure Limit of 0.5 fibres per ml of air. Laboratory results are presented in Appendix B.

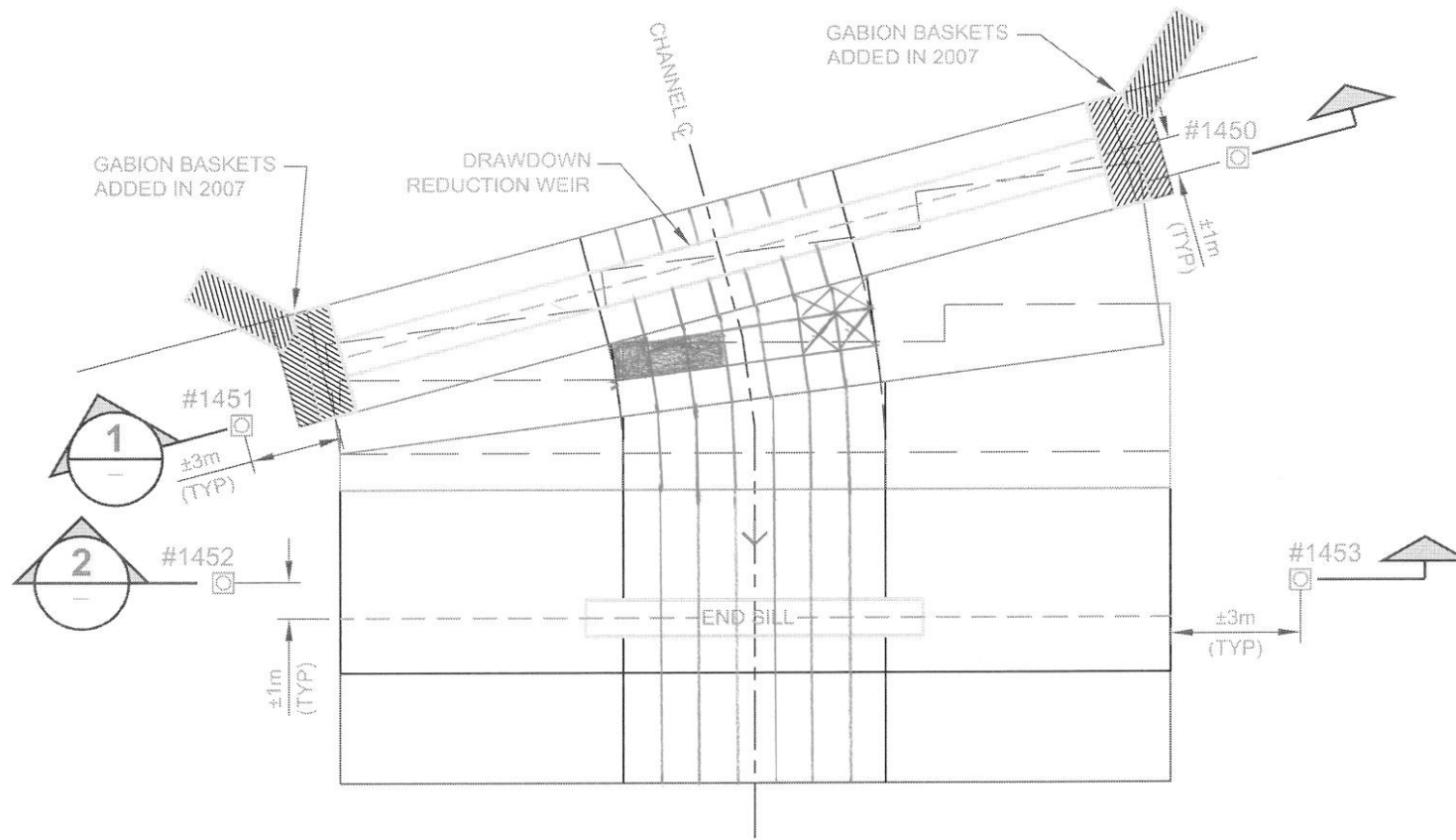
Table 6.1 Summary of Asbestos Air Quality Results

Identification #	Date	Duration (min)	Location	Results* (fibres/ml)	Weather
BF355444	15-Sept-09	412	Drop Structure #4	0.002	Clear Sky, Dry, No Wind
BF355565	15-Sept-09	403	Drop Structure #1	0.004	Clear Sky, Dry, No Wind
BF355452	16-Sept-09	300	Top of Waste Rock Pile, Adjacent Creek	0.001	Cloudy, Light Rain, No Wind, Ground Wet
BF355457	16-Sept-09	220	Drop Structure #4	0.006	Cloudy, Light Rain, No Wind, Ground Wet
BF355577	25-Sept-09	375	Drop Structure #3	0.005	Cloudy, No Wind, Ground Wet
BF355549	25-Sept-09	403	Drop Structure #1	0.003	Cloudy, No Wind, Ground Wet
BF355402	26-Sept-09	313	Drop Structure #1	0.002	Cloudy, No Wind, Ground Wet
BF355483	27-Sept-09	480	Drop Structure #2	0.003	Partly Cloudy, Light Wind, Ground Frozen
BF355580	27-Sept-09	480	Drop Structure #1	0.002	Partly Cloudy, Light Wind, Ground Frozen
BF355543	28-Sept-09	480	Drop Structure #2	0.002	Cloudy, No Wind, Ground Frozen
BF355515	29-Sept-09	471	Drop Structure #2	0.005	Cloudy, No Wind, Ground Frozen
BF355510	30-Sept-09	469	Drop Structure #3	0.005	Clear Sky, No Wind, Ground Frozen in Morning
BF355405	1-Oct-09	349	Gabion Structure #3	0.005	Clear Sky, No Wind, Ground Frozen in Morning
BF355435	2-Oct-09	321	Drop Structure #4	0.004	Cloudy, No Wind, Ground Frozen
BF355590	2-Oct-09	320	Gabion Structure #3	0.008	Cloudy, No Wind, Ground Frozen
BF355433	3-Oct-09	470	Drop Structure #4	0.005	Partly Cloudy, Light Wind, Ground Frozen
BF355503	4-Oct-09	371	Gabion Structure #4	0.005	Clear Sky, Light Wind, Ground Frozen
BF355574	10-Oct-09	339	Drop Structure #4	0.004	Cloudy, No Wind, Ground Frozen
BF355548	12-Oct-09	420	Drop Structure #4	0.004	Clear Sky, No Wind, Ground Frozen

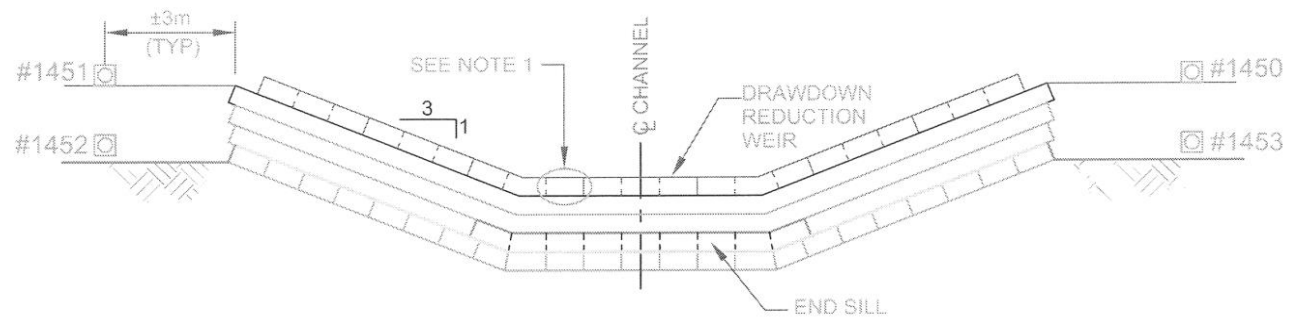
*Analysis Detection Limit is 0.001 fibres/ml

Appendix A

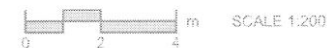
Drawings of Damage to Drop Structures



DROP STRUCTURE PLAN VIEW



DROP STRUCTURE END VIEW

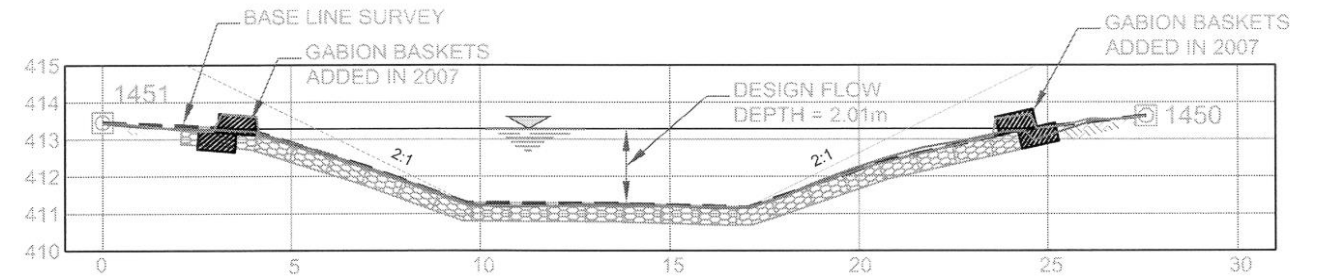


□ CHANNEL CLOSURE MOVEMENT MONITOR (19mm Ø STEEL PIN) INSTALLED DURING 2006 SURVEY.

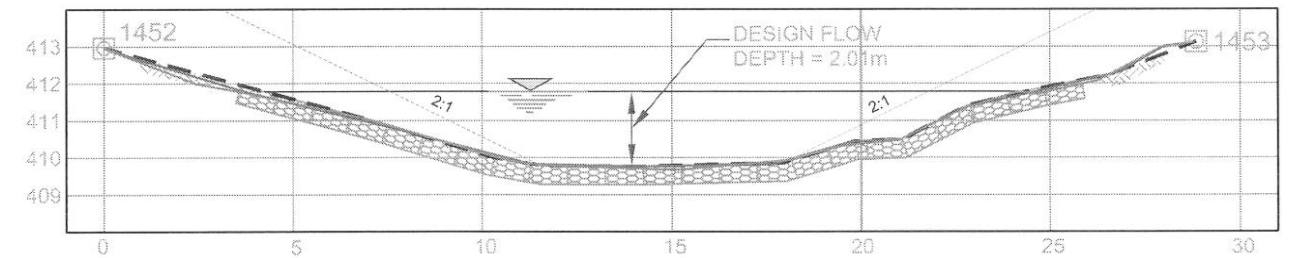
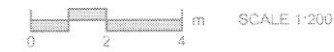
NOTE 1: GABION FILL REMOVED FROM THIS CELL OF THE DRAWDOWN WEIR IN 2007 TO AID IN DRAWING DOWN THE LEVEL IN HUDGEON LAKE DURING LOW FLOW PERIODS.

☒ Partially Full Gabion Compartments

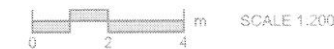
■ Empty Gabion Compartments with No Rock Fill



SECTION 1

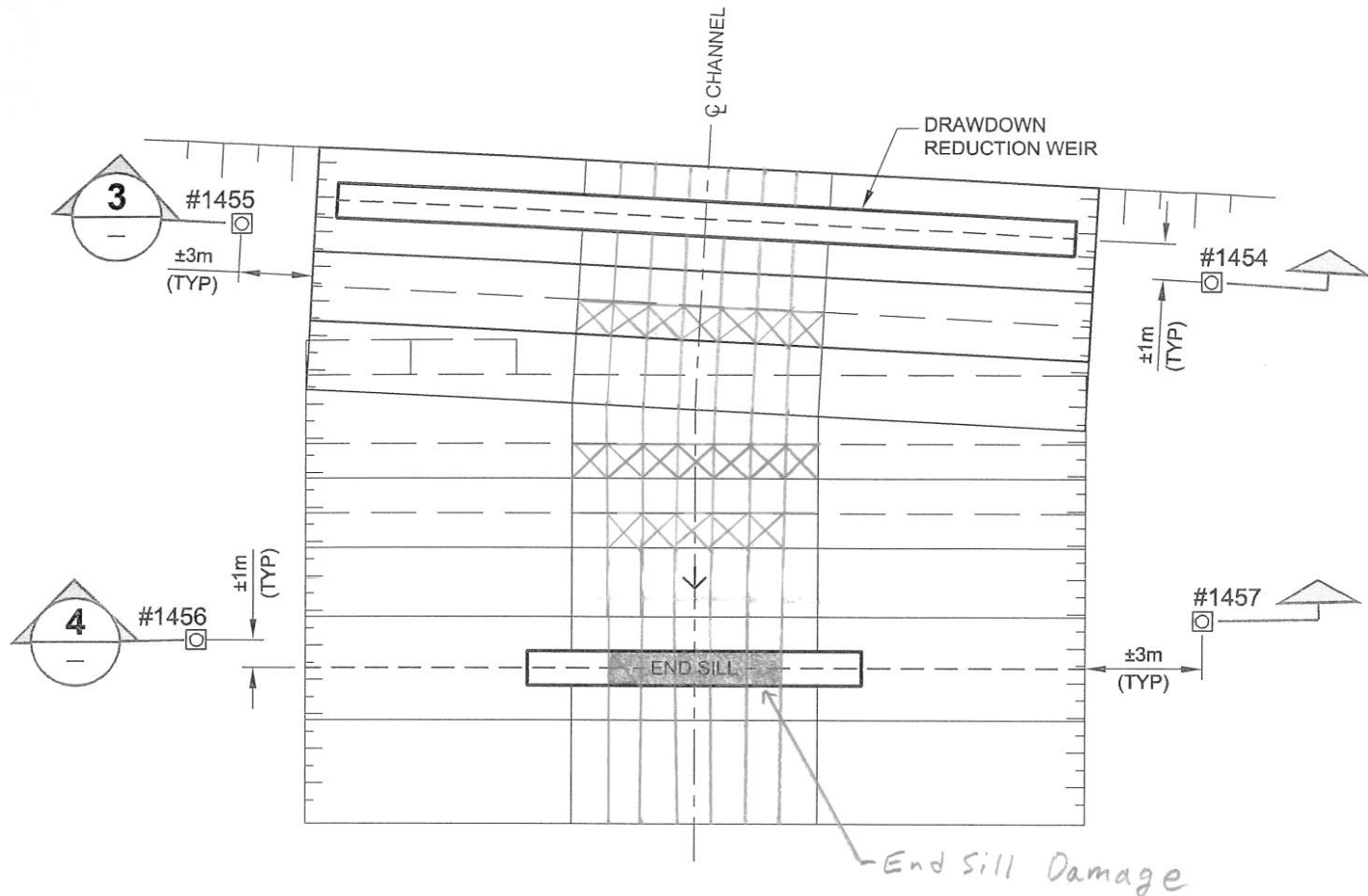


SECTION 2

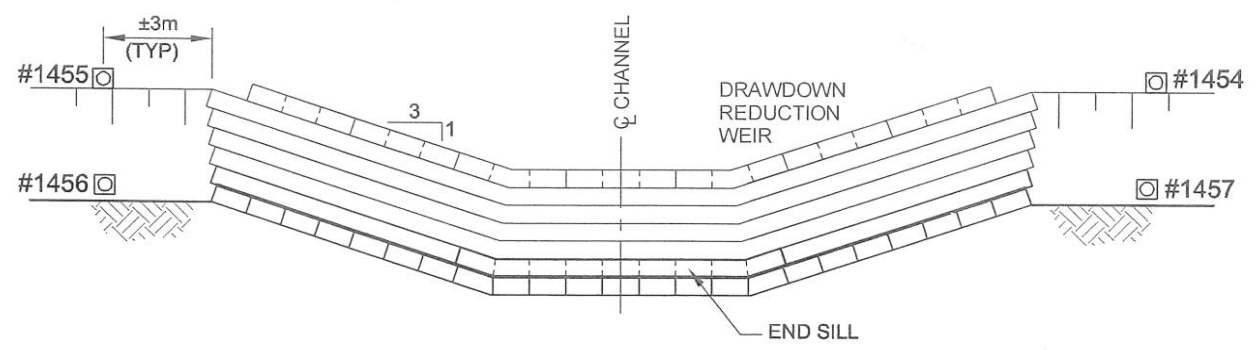


- - - BASE LINE SURVEY (2006)
 — SURVEY (2007)
 — SURVEY (2008)

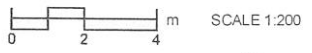
ISSREV: A
 AECOM FILE NAME: 2940-044-00_01-B-F005_RX.dwg Saved By: vibergj PLOT: 09/05/04 2:25:04 PM B SIZE 11" x 17" (279.4mm x 431.8mm)
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DROP STRUCTURE PLAN VIEW

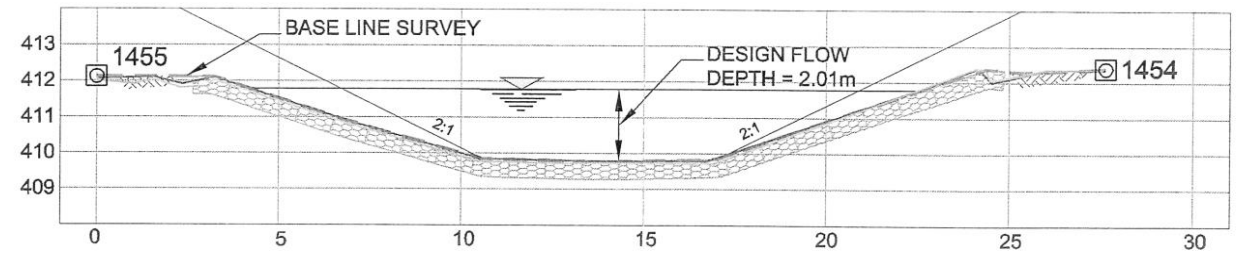


DROP STRUCTURE END VIEW

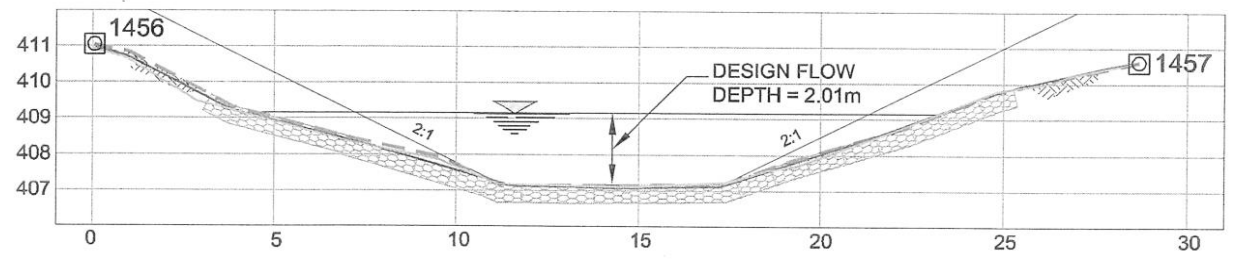
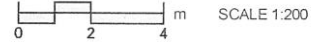


☐ CHANNEL CLOSURE MOVEMENT MONITOR (19mm Ø STEEL PIN) INSTALLED DURING 2006 SURVEY.

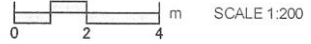
☒ Partially Full Gabion Compartments
 ■ Empty Gabion Compartments with No Rock Fill



SECTION 3



SECTION 4



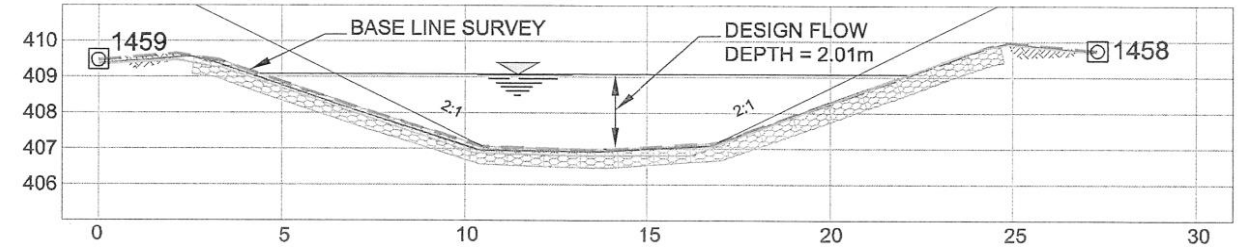
--- BASE LINE SURVEY (2006)
 — SURVEY (2007)
 — SURVEY (2008)



Government of Yukon
 Former Clinton Creek Asbestos Mine
 Long Term Performance Monitoring – 2008
Drop Structure #2

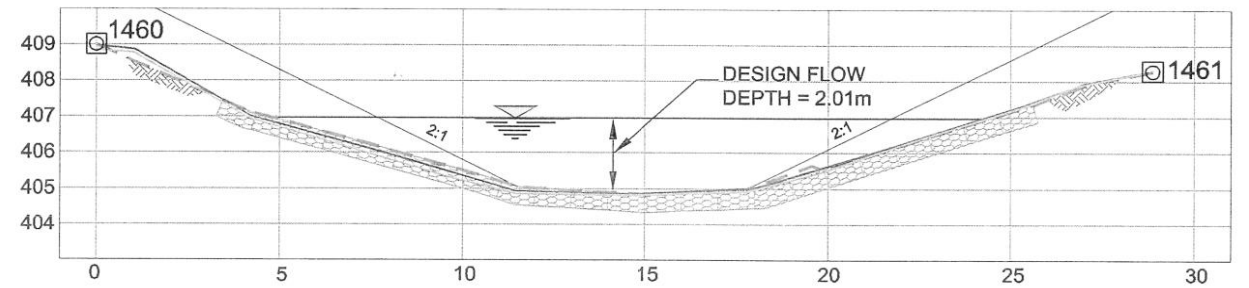
☒ Partially Full Gabion Compartments

■ Empty Gabion Compartments with No Rock Fill



SECTION 5

SCALE 1:200



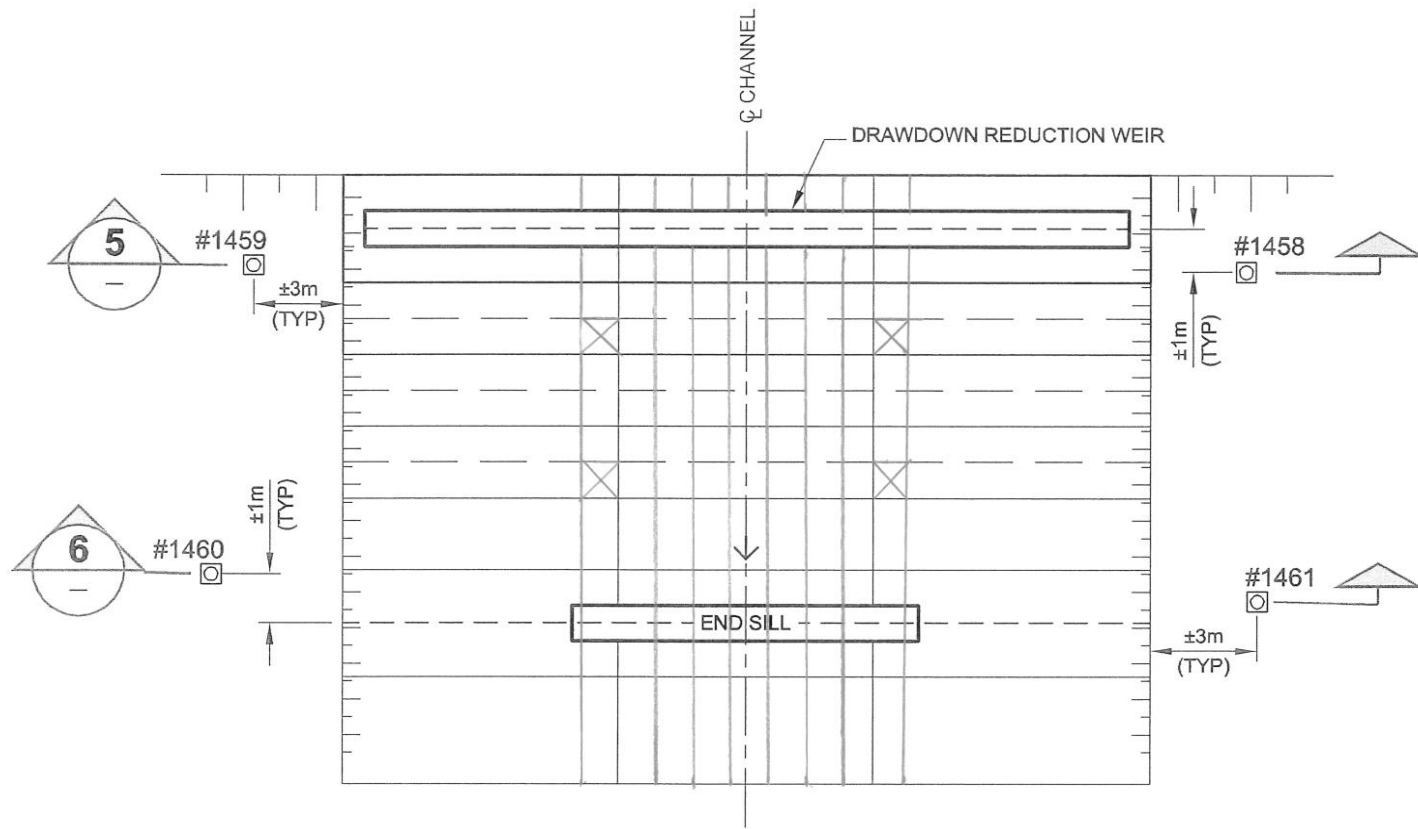
SECTION 6

SCALE 1:200

- BASE LINE SURVEY (2006)
- SURVEY (2007)
- SURVEY (2008)

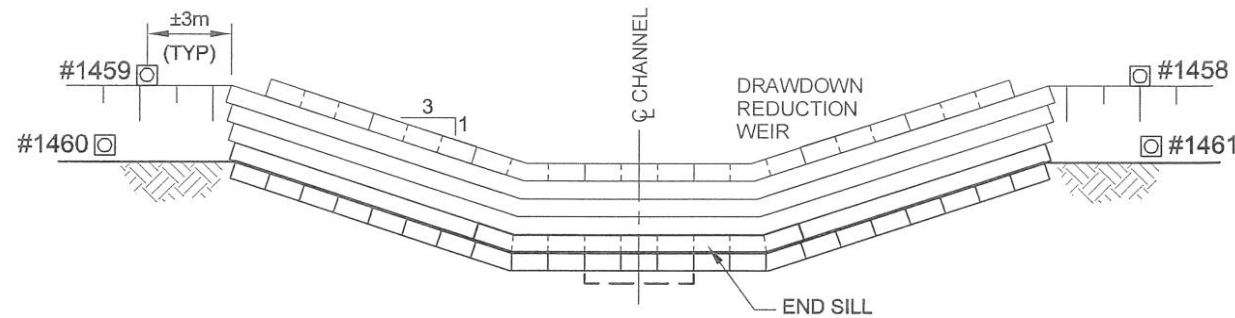
Government of Yukon
Former Clinton Creek Asbestos Mine
Long Term Performance Monitoring – 2008
Drop Structure #3

B SIZE 11" x 17" (279.4mm x 431.8mm)
 PLOT: 09/05/04 2:45:22 PM
 AECOM FILE NAME: 2940-044-00_01-B-F006_RX.dwg
 Saved By: vibergj
 ISS/REV: A
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DROP STRUCTURE PLAN VIEW

SCALE 1:200



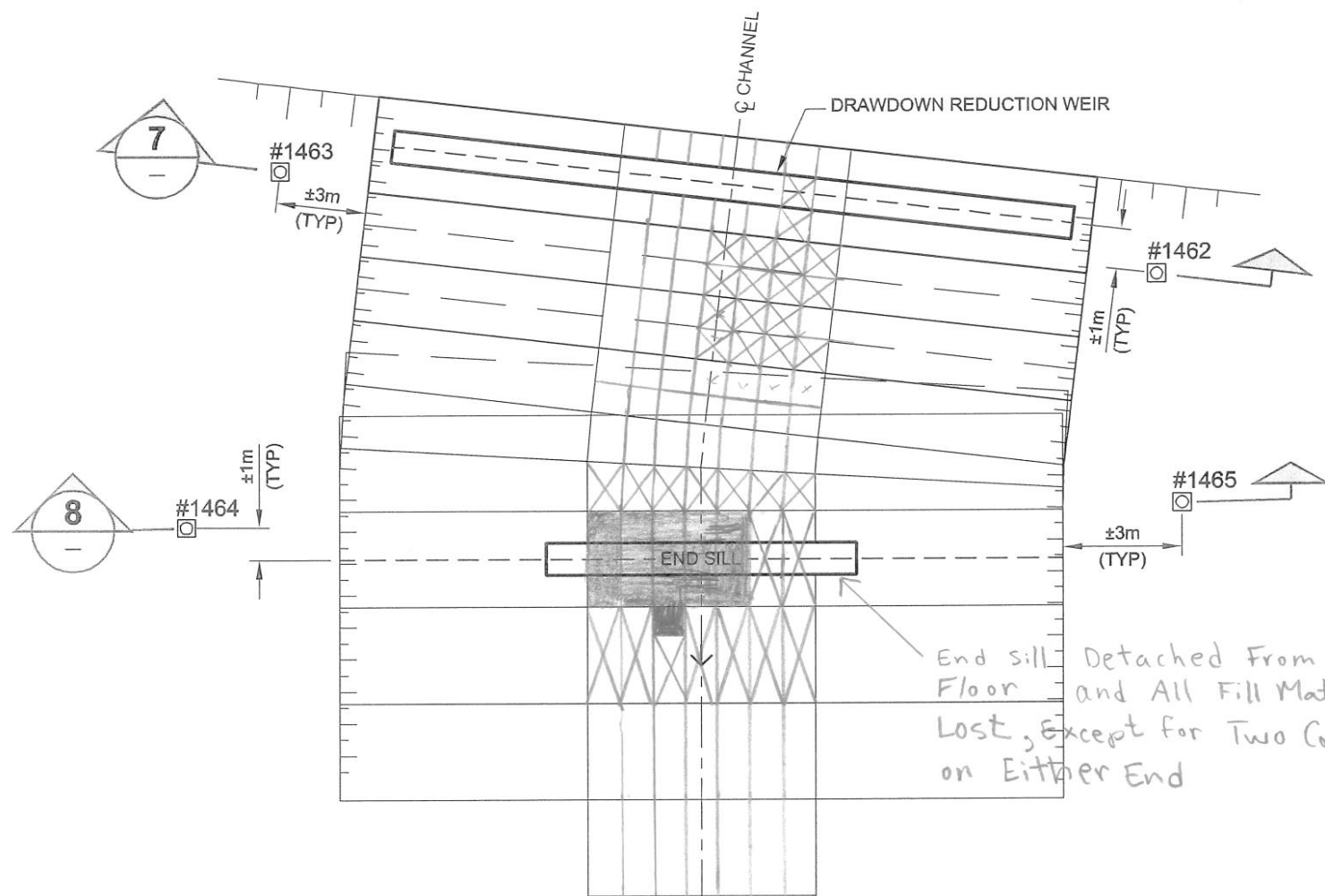
DROP STRUCTURE END VIEW

SCALE 1:200

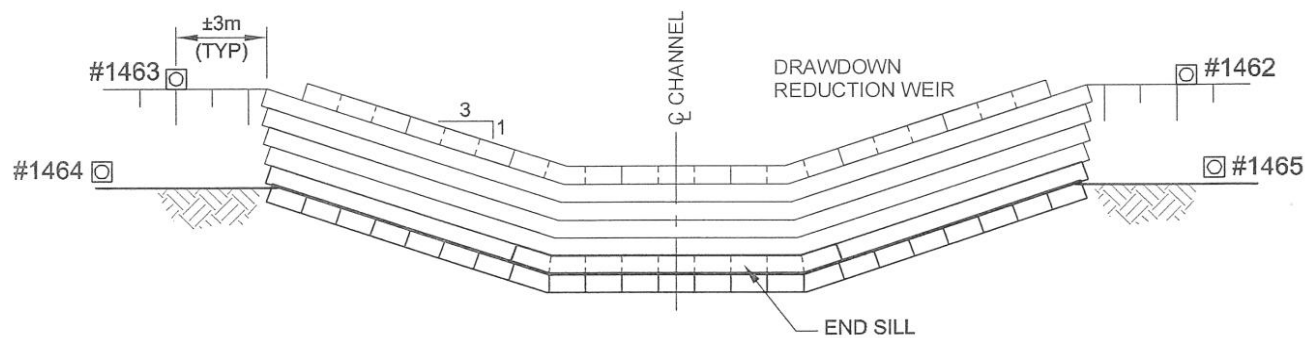
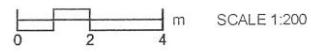
☒ CHANNEL CLOSURE MOVEMENT MONITOR (19mm Ø STEEL PIN) INSTALLED DURING 2006 SURVEY.

B SIZE 11" x 17" (279.4mm x 431.8mm)
 PLOT: 09/05/04 3:07:35 PM
 Saved By: vibergj
 AECOM FILE NAME: 2940-044-00_01-B-F007_RX.dwg

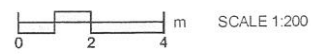
ISSREV: A
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DROP STRUCTURE PLAN VIEW

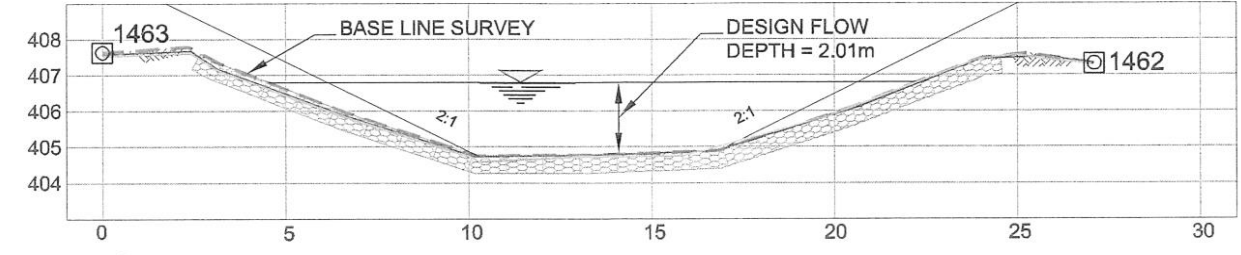


DROP STRUCTURE END VIEW

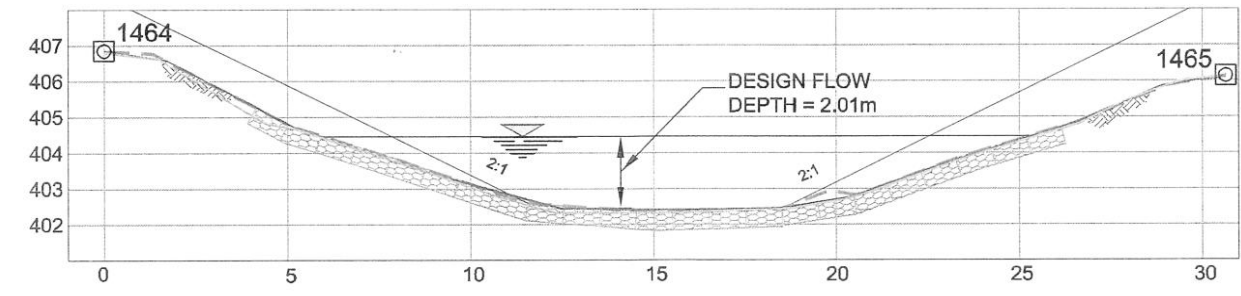


☐ CHANNEL CLOSURE MOVEMENT MONITOR (19mm Ø STEEL PIN) INSTALLED DURING 2006 SURVEY.

- ☒ Partially Full Gabion Compartments
- Empty Gabion Compartments with No Rock Fill



SECTION 7
 SCALE 1:200



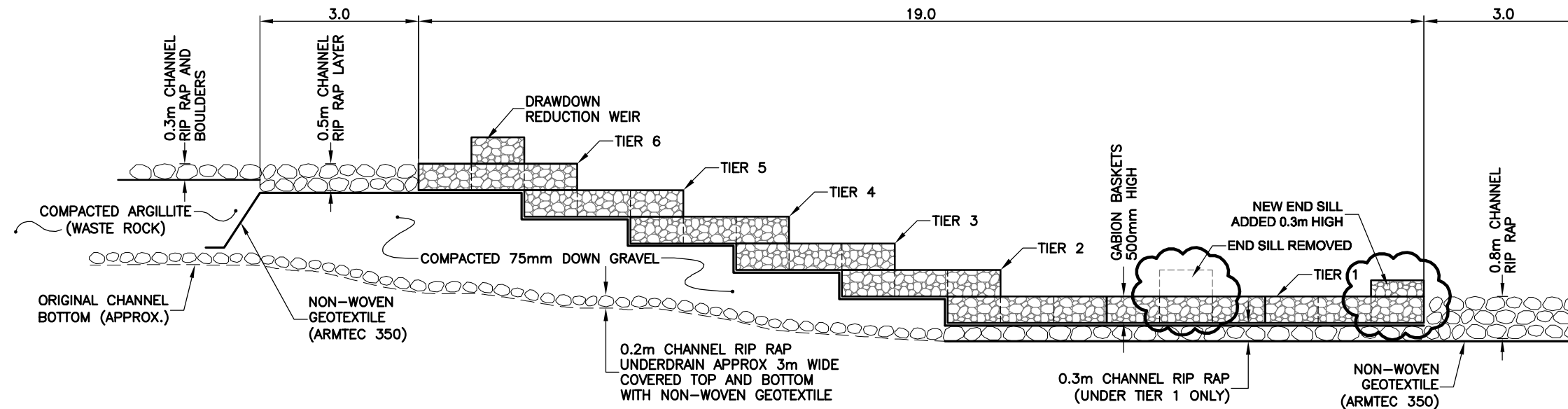
SECTION 8
 SCALE 1:200

- - - BASE LINE SURVEY (2006)
- SURVEY (2007)
- SURVEY (2008)

Government of Yukon
 Former Clinton Creek Asbestos Mine
 Long Term Performance Monitoring – 2008
Drop Structure #4

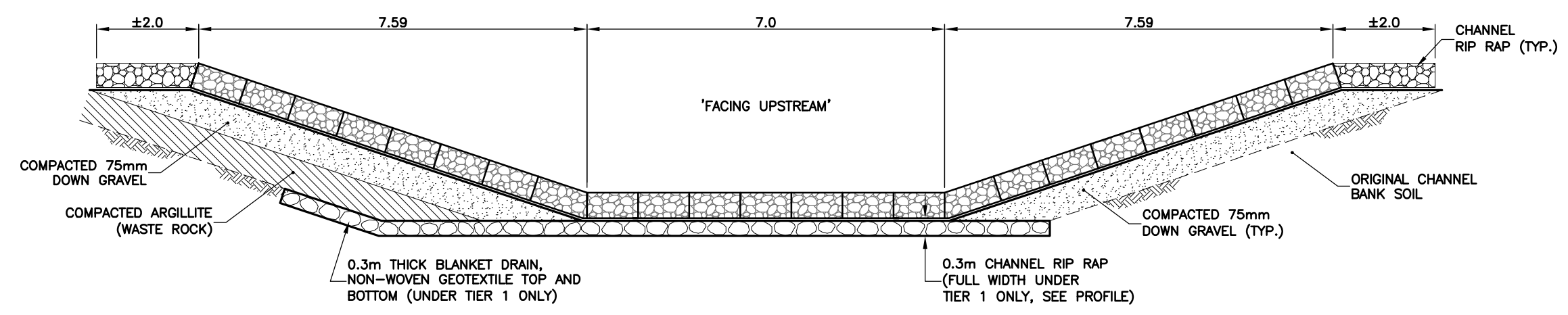
Appendix B

Drawings of Changes to Drop Structures #2 and #4



TIER	TOP OF BASKET ON ϕ
1	406.84
2	407.48
3	408.03
4	408.52
5	409.03
6	409.60
END SILL	407.20
DRAWDOWN WEIR	410.10

CENTERLINE PROFILE
1:50 A-A
05



SECTION
1:50 B-B
05

OCT 17/03 1=2 ps
 Plot Scale: 1=2 ps
 L:\Earth & Water\Projects\6029 Government of Yukon\6029-004-00 Clinton Creek Channel Stabilization (Stage 2)\Drafting\A_04stage2.dwg

METRIC
WHOLE NUMBERS INDICATE MILLIMETRES
DECIMALIZED NUMBERS INDICATE METRES

HALF SIZE REDUCTION

REV.	DESCRIPTION	DWN.	APP.	DATE
A	RECORD DRAWING / REPLOTED	LJV		17Oct03
B	2009 EMERGENCY REPAIR WORK	LJV		10Dec09

UMA Engineering Ltd.
Consulting · Engineering · Construction · Management Services

APPROVED BY: _____ DATE: OCTOBER 2003

DRAWN BY: LJV DESIGNED BY: GR/RA

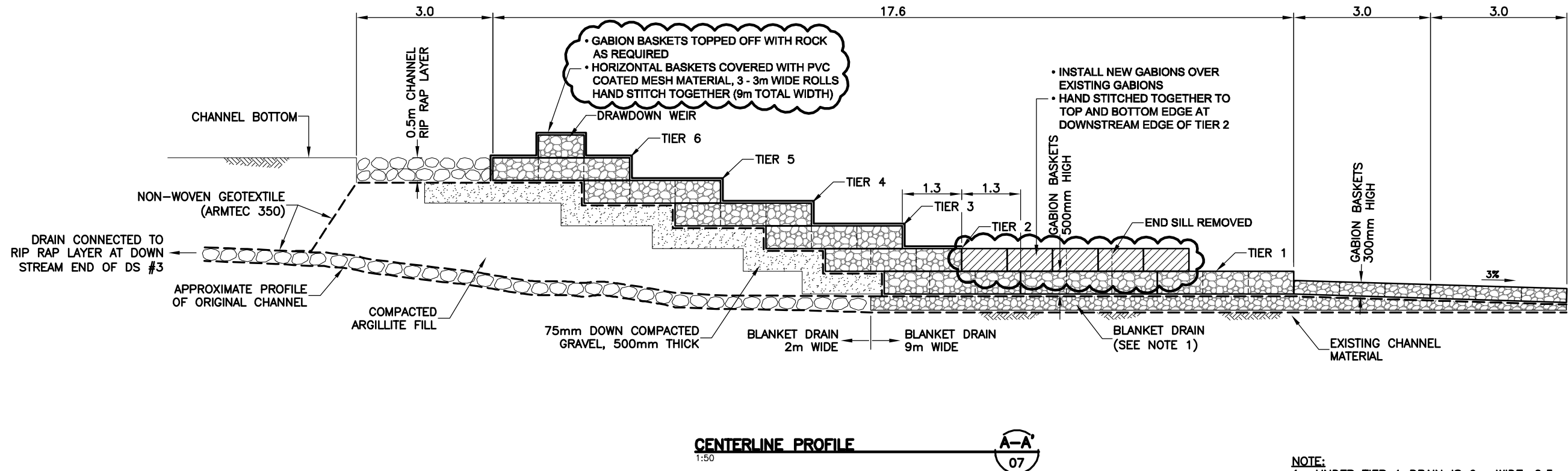
CHECKED BY: GR CHECKED BY: KMS

SCALE: AS NOTED JOB No. 6029-004-00-05

GOVERNMENT OF YUKON
ABANDONED CLINTON CREEK ASBESTOS MINE
CLINTON CREEK CHANNEL STABILIZATION - STAGE 2

DROP STRUCTURE #2 - DETAILS

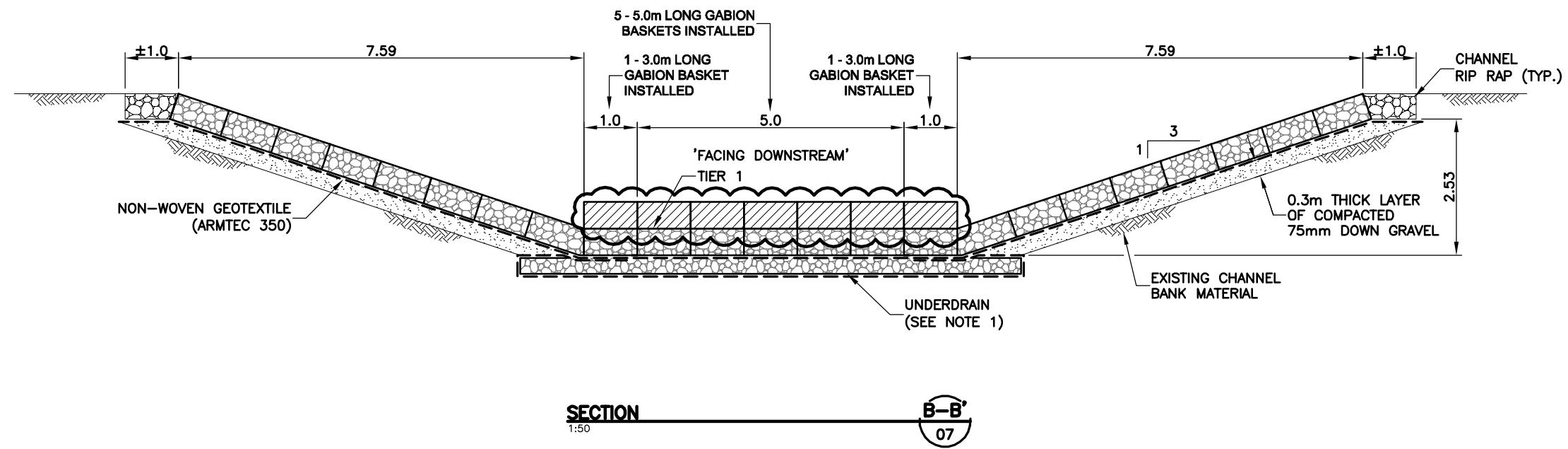
04 B
DWG. No. REV.



TIER	TOP OF BASKET ON ϕ
1	402.1
2	402.6
3	403.1
4	403.6
5	404.1
6	404.6
END SILL	N/A
DRAWDOWN WEIR	405.1

CENTERLINE PROFILE
1:50
A-A'
07

- NOTE:**
- UPSTREAM OF DS #4 THE DRAIN IS LOCATED ON THE RHS OF THE CHANNEL AND IS ABOUT 2m WIDE. DRAIN CONSTRUCTED USING GABION FILL MATERIAL AND IS COVERED TOP AND BOTTOM WITH NON-WOVEN GEOTEXTILE.
 - MESH MATERIAL HAND STITCHED TO UNDERLYING BASKETS.



SECTION
1:50
B-B'
07

RECORD DRAWING

Plot Scale: 1=2 ps
L:\Earth & Water\Projects\6029 Government of Yukon\6029-006-00 2004 Engineering Services\Drafting\AS BULLTS_Z_D8stage3.dwg

METRIC
WHOLE NUMBERS INDICATE MILLIMETRES
DECIMALIZED NUMBERS INDICATE METRES

HALF SIZE REDUCTION

REV.	DESCRIPTION	DWN.	APP.	DATE
A	REVISED TO RECORD DRAWING / REPLOTTED	LJV	GR	05Jan14
B	2009 EMERGENCY REPAIR WORK	LJV	GR	09Dec10

Original Signed By:
T. Wingrove
04/07/08

UMA Engineering Ltd.	
Consulting - Engineering - Construction - Management Services	
APPROVED BY:	JANUARY 2005
DATE:	
DRAWN BY: LJV	DESIGNED BY: GR/RA
CHECKED BY: GR	CHECKED BY: KMS
SCALE: AS NOTED	JOB No. 6029-006-00

GOVERNMENT OF YUKON	
FORMER CLINTON CREEK ASBESTOS MINE CLINTON CREEK CHANNEL STABILIZATION - STAGE 3	
DROP STRUCTURE #4 - DETAILS	
08	B
DWG. No.	REV.

Appendix C

Photographs taken during Construction Activities



Photo 1: Drop Structure #1, looking to the left bank prior to construction. Debris has accumulated in the drop structure and one gabion compartment is open along the downstream top edge.



Photo 2: Drop Structure #1, looking upstream. All compartments have been filled with rock and closed. Flow in Creek partially blocked using plywood and plastic sheets.



Photo 3: Drop Structure #1, looking upstream to left bank. All compartments have been filled with rock and closed.



Photo 4: Drop Structure #1. New gabion tops hand stitched on the upstream and downstream edges.



Photo 5: Drop Structure #2 prior to construction. Gabion compartments are open and partially full to empty.



Photo 6: Drop Structure #2 prior to construction. Middle section of the downstream sill has been damaged.



Photo 7: Drop Structure #2. All compartments have been filled with rock and closed. The new end sill has been placed at the downstream end of the structure.



Photo 8: Drop Structure #2. New 0.3 m end sill placed at the downstream end of the structure.



Photo 9: Drop Structure #2. Top of new 0.3 m end sill hand stitched closed.



Photo 10: Drop Structure #3 prior to construction. A hole on the top of a gabion basket can be seen on the far back midway up the structure. Some basket repair and some gabion fill is required.



Photo 11: Drop Structure #3 prior to construction. The downstream top edge of a gabion basket as come open.



Photo 12: Drop Structure #3. All compartments have been filled with rock and closed. The end sill is deformed a little but is still intact and attached to the gabions below.



Photo 13: Drop Structure #4 prior to construction. Empty baskets along the bottom width.



Photo 14: Drop Structure #4 prior to construction. The downstream sill has been damaged.



Photo 15: Drop Structure #4. Empty baskets within the structure.



Photo 16: Drop Structure #4. Baskets being filled with large rock.



Photo 17: Drop Structure #4. Placement of the mat at the location of the filled hole, downstream end of the structure.



Photo 18: Drop Structure #4. The upstream bottom end of the new 0.5 m baskets were hand stitched to the existing structure.



Photo 19: Drop Structure #4. Hand stitching at the downstream end of the structure.



Photo 20: Drop Structure #4. Wire mesh placed overtop of existing gabions.



Photo 21: Drop Structure #4. Construction complete including the installation of new 0.5 m gabion baskets at the downstream end of the structure.

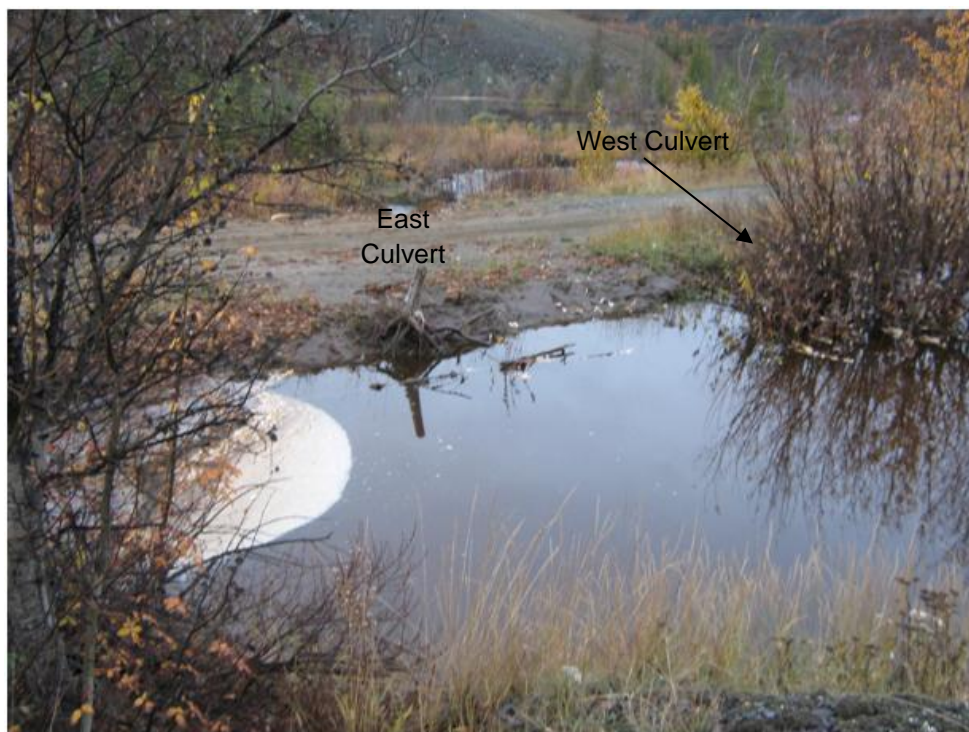


Photo 22: Wolverine Creek Road Crossing. Existing culvert inlets blocked by debris.



Photo 23: Wolverine Creek Road Crossing. Existing west culvert inlet cleared of debris.



Photo 24: Wolverine Creek Road Crossing. Existing east culvert inlet cleared of debris.



Photo 25: Air quality pump and sample cartridge.



Photo 26: Leftover screened rock material. Approximately 60 % left of what was screened.

Appendix D

Asbestos Air Sample Results – ALS Laboratory Group



Environmental Division

Certificate of Analysis

AECOM CANADA LTD.
ATTN: GIL ROBINSON
99 COMMERCE DRIVE
WINNIPEG MA R3P 0Y7

Report Date: 06-OCT-09 14:43 (MT)
Version: FINAL

Lab Work Order #: **L825643**

Date Received: **01-OCT-09**

Project P.O. #:
Job Reference: 6029-01500-0300
Legal Site Desc:
CofC Numbers:

Other Information:

Comments:

Nicole Thibault
Account Manager

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY.
ALL SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU
REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L825643-1 BF355444 (412 MIN DURATION AT 5 L/MIN) Sampled By: ANDREW SMITH on 15-SEP-09 @ 09:40 Matrix: AIR							
Fibre Density							
Field Blank Correction	<0.5		0.5	f/field		05-OCT-09	R971083
Sample Volume	2060		0	L		05-OCT-09	R971083
Fibres/Filter	4000		3000	Fibres		05-OCT-09	R971083
Fibre Density	11		7	Fibres/mm2		05-OCT-09	R971083
Fibre Concentration	0.002		0.001	fibres/mL		05-OCT-09	R971083
L825643-2 BF355565 (403 MIN DURATION AT 5 L/MIN) Sampled By: ANDREW SMITH on 15-SEP-09 @ 09:53 Matrix: AIR							
Fibre Density							
Field Blank Correction	<0.5		0.5	f/field		05-OCT-09	R971083
Sample Volume	2015		0	L		05-OCT-09	R971083
Fibres/Filter	8000		3000	Fibres		05-OCT-09	R971083
Fibre Density	20		7	Fibres/mm2		05-OCT-09	R971083
Fibre Concentration	0.004		0.001	fibres/mL		05-OCT-09	R971083
L825643-3 BF355452 (300 MIN DURATION AT 5 L/MIN) Sampled By: ANDREW SMITH on 15-SEP-09 @ 09:18 Matrix: AIR							
Fibre Density							
Field Blank Correction	<0.5		0.5	f/field		05-OCT-09	R971083
Sample Volume	1500		0	L		05-OCT-09	R971083
Fibres/Filter	<3000		3000	Fibres		05-OCT-09	R971083
Fibre Density	<7		7	Fibres/mm2		05-OCT-09	R971083
Fibre Concentration	0.001		0.001	fibres/mL		05-OCT-09	R971083
L825643-4 BF355457 (222 MIN DURATION AT 5 L/MIN) Sampled By: ANDREW SMITH on 15-SEP-09 @ 09:32 Matrix: AIR							
Fibre Density							
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Sample Volume	1100		0	L		06-OCT-09	R971083
Flow Rate Based On						06-OCT-09	R971083
Fibres/Filter	6000		3000	Fibres		06-OCT-09	R971083
Fibre Density	17		7	Fibres/mm2		06-OCT-09	R971083
Fibre Concentration	0.006		0.001	fibres/mL		06-OCT-09	R971083

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ASBESTOS-FBRS/FLT-ED	Filter	Fibre Density	NIOSH 7400A

Sample results are corrected using field blank results. A comment will appear at the end of each sample result section if no field blank was submitted.

Sr values:

5-20 0.11

>20-50 0.075

>50-100 0.10

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
ED	ALS LABORATORY GROUP - EDMONTON, ALBERTA, CANADA

Chain of Custody Numbers:
GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mk/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Report To			Report Format / Distribution			Service Requested (Rush for routine analysis subject to availability)																									
Company: AECOM Canada			<input type="checkbox"/> Standard <input type="checkbox"/> Other			<input type="radio"/> Regular (Default)																									
Contact: Gil Robinson			<input type="checkbox"/> PDF <input checked="" type="checkbox"/> Excel <input type="checkbox"/> Digital <input type="checkbox"/> Fax			<input checked="" type="radio"/> Priority (Specify Date Required → →) 8-Oct-09 Surcharges apply																									
Address: 99 Commerce Drive Winnipeg, Manitoba, R3P 0Y7			Email 1: gil.robinson@aecom.com			<input type="radio"/> Emergency (1 Business Day) - 100% Surcharge																									
Phone: 204-928-9266 Fax: _____			Email 2: rolf.aslund@aecom.com , andrew.smith3@...			<input type="radio"/> For Emergency < 1 Day, ASAP or Weekend - Contact ALS																									
Invoice To Same as Report ? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			Client / Project Information			Analysis Request																									
Company: _____			Job #: 6029-01500-0300			Please indicate below Filtered, Preserved or both (F, P, F/P)																									
Contact: _____			PO / AFE: _____																												
Address: _____			LSD: _____																												
Phone: _____ Fax: _____			Quote #: _____																												
Lab Work Order # (lab use only) L825643			ALS Contact: _____		Sampler: Andrew Smith		PCM test for Asbestos																								
Sample #			Sample Identification (This description will appear on the report)		Date (dd-mmm-yy)	Time (hh:mm)							Sample Type	Number of Containers																	
BF355444 (412 min duration at 5 L/min)			15-Sep-09		09:40 Start	Air							x							1											
BF355565 (403 min duration at 5 L/min)			15-Sep-09		09:53 Start	Air							x													1					
BF355452 (300 min duration at 5 L/min)			16-Sep-09		9:18 Start	Air							x																		
BF355457 (222 min duration at 5 L/min)			16-Sep-09		9:32 Start	Air	x	1																							
Special Instructions / Regulations / Hazardous Details																															
Originally from Bottle Request # BR55897. If have any questions please call Andrew Smith at 780-918-3242 or email at andrew.smith3@aecom.com . Please also email results to andrew.smith3@aecom.com																															
Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.																															
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.																															
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.																															
SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)																								
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF																					
Andrew Smith	28-Sep-09	08-00	<i>[Signature]</i>	01-Oct-09	16:08	/ °C																									

AECOM
 17007 – 107th Avenue, Edmonton, AB, Canada T5S 1G3
 T 780.486.7000 F 780.486.7070 www.aecom.com

Transmittal Form

Date: October 1, 2009 **Project Number:** 6029-015-00-0300-3.1

Contact: _____

Company: ALS Laboratory Group **Telephone # :** 780-413-5227

Address: 9936 – 67 Avenue Nw **Sent By :** Rolf Aslund, P.Eng.

Edmonton AB T6E 0P5

Copies To: _____

Urgent For Your Use For Review For Your Information Confidential

Project Name: _____

List of Drawings and Other Materials:

Quantity	Description	Date
1	Analytical Request form and samples	

Comments: _____

Sent Via: mail courier picked up by hand email fax other

Authorized Signature: _____

Name (please print): Rolf Aslund, P.Eng. **Title:** _____



Environmental Division

PRELIMINARY RESULTS

AECOM CANADA LTD.
ATTN: GIL ROBINSON
99 COMMERCE DRIVE
WINNIPEG MA R3P 0Y7

Report Date: 23-OCT-09 11:56 (MT)
Version: DRAFT

Lab Work Order #: **L828633**

Date Received: **09-OCT-09**

Project P.O. #:
Job Reference: 6029-01500-0300
Legal Site Desc:
CofC Numbers: 281009

Other Information:

Comments:

DRAFT

Maureen Olinek
Senior Account Manager

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY.
ALL SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU
REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L828633-1 BF355577 (375 MIN DURATION AT 5 L/MIN) Sampled By: ANDREW SMITH on 25-SEP-09 @ 10:00 Matrix: AIR							
Fibre Density							
Field Blank Correction	<0.5		0.5	f/field		15-OCT-09	R981004
Sample Volume	1875		0	L		15-OCT-09	R981004
Fibres/Filter	10000		3000	Fibres		15-OCT-09	R981004
Fibre Density	25		7	Fibres/mm2		15-OCT-09	R981004
Fibre Concentration	0.005		0.001	fibres/mL		15-OCT-09	R981004
L828633-2 BF355549 (403 MIN DURATION AT 5 L/MIN) Sampled By: ANDREW SMITH on 25-SEP-09 @ 10:05 Matrix: AIR							
Fibre Density							
Field Blank Correction	<0.5		0.5	f/field		15-OCT-09	R981004
Sample Volume	2015		0	L		15-OCT-09	R981004
Fibres/Filter	6000		3000	Fibres		15-OCT-09	R981004
Fibre Density	17		7	Fibres/mm2		15-OCT-09	R981004
Fibre Concentration	0.003		0.001	fibres/mL		15-OCT-09	R981004
L828633-3 BF355402 (420 MIN DURATION AT 5 L/MIN) Sampled By: ANDREW SMITH on 26-SEP-09 @ 09:15 Matrix: AIR							
Fibre Density							
Field Blank Correction	<0.5		0.5	f/field		15-OCT-09	R981004
Sample Volume	2100		0	L		15-OCT-09	R981004
Fibres/Filter	5000		3000	Fibres		15-OCT-09	R981004
Fibre Density	13		7	Fibres/mm2		15-OCT-09	R981004
Fibre Concentration	0.002		0.001	fibres/mL		15-OCT-09	R981004
L828633-4 BF355483 (480 MIN DURATION AT 5 L/MIN) Sampled By: ANDREW SMITH on 27-SEP-09 @ 08:55 Matrix: AIR							
Fibre Density							
Field Blank Correction	<0.5		0.5	f/field		15-OCT-09	R981004
Sample Volume	2400		0	L		15-OCT-09	R981004
Fibres/Filter	8000		3000	Fibres		15-OCT-09	R981004
Fibre Density	22		7	Fibres/mm2		15-OCT-09	R981004
Fibre Concentration	0.003		0.001	fibres/mL		15-OCT-09	R981004
L828633-5 BF355580 (480 MIN DURATION AT 5 L/MIN) Sampled By: ANDREW SMITH on 27-SEP-09 @ 08:59 Matrix: AIR							
Fibre Density							
Field Blank Correction	<0.5		0.5	f/field		15-OCT-09	R981004
Sample Volume	2400		0	L		15-OCT-09	R981004
Fibres/Filter	5000		3000	Fibres		15-OCT-09	R981004
Fibre Density	12		7	Fibres/mm2		15-OCT-09	R981004
Fibre Concentration	0.002		0.001	fibres/mL		15-OCT-09	R981004
L828633-6 BF355573 (BLANK) Sampled By: ANDREW SMITH on 28-SEP-09 Matrix: AIR							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L828633-6 BF355573 (BLANK) Sampled By: ANDREW SMITH on 28-SEP-09 Matrix: AIR Fibre Density Field Blank Correction Fibres/Filter Fibre Density	 <0.5 <3000 <7	 	 0.5 3000 7	 f/field Fibres Fibres/mm2	 	 15-OCT-09 15-OCT-09 15-OCT-09	 R981004 R981004 R981004
DRAFT							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ASBESTOS-FBRS/FLT-ED	Filter	Fibre Density	NIOSH 7400A

Sample results are corrected using field blank results. A comment will appear at the end of each sample result section if no field blank was submitted.

Sr values:

5-20 0.11
>20-50 0.075
>50-100 0.10

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
ED	ALS LABORATORY GROUP - EDMONTON, ALBERTA, CANADA

Chain of Custody Numbers:

281009

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mk/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

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UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

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Environmental Division

Certificate of Analysis

AECOM CANADA LTD.
ATTN: GIL ROBINSON
99 COMMERCE DRIVE
WINNIPEG MA R3P 0Y7

Report Date: 24-NOV-09 09:00 (MT)

Version: FINAL

Lab Work Order #: **L832565**

Date Received: **22-OCT-09**

Project P.O. #:
Job Reference: 6029-01500-0300
Legal Site Desc:
CofC Numbers:

Other Information:

Comments:

Maureen Olinek
Senior Account Manager

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ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L832565-1 BF355543 Sampled By: ANDREW SMITH on 29-SEP-09 @ 09:00 Matrix:							
Fibre Density							
Field Blank Correction	<0.5		0.5	f/field		19-NOV-09	R1070644
Sample Volume	2400		0	L		19-NOV-09	R1070644
Fibres/Filter	4000		3000	Fibres		19-NOV-09	R1070644
Fibre Density	11		7	Fibres/mm2		19-NOV-09	R1070644
Fibre Concentration	0.002		0.001	fibres/mL		19-NOV-09	R1070644
L832565-2 BF355515 Sampled By: ANDREW SMITH on 29-SEP-09 @ 09:09 Matrix:							
Fibre Density							
Field Blank Correction	<0.5		0.5	f/field		19-NOV-09	R1070644
Sample Volume	2355		0	L		19-NOV-09	R1070644
Fibres/Filter	11000		3000	Fibres		19-NOV-09	R1070644
Fibre Density	29		7	Fibres/mm2		19-NOV-09	R1070644
Fibre Concentration	0.005		0.001	fibres/mL		19-NOV-09	R1070644
L832565-3 BF355510 Sampled By: ANDREW SMITH on 29-SEP-09 @ 09:13 Matrix:							
Fibre Density							
Field Blank Correction	<0.5		0.5	f/field		19-NOV-09	R1070644
Sample Volume	2345		0	L		19-NOV-09	R1070644
Fibres/Filter	12000		3000	Fibres		19-NOV-09	R1070644
Fibre Density	31		7	Fibres/mm2		19-NOV-09	R1070644
Fibre Concentration	0.005		0.001	fibres/mL		19-NOV-09	R1070644
L832565-4 BF355405 Sampled By: ANDREW SMITH on 30-SEP-09 @ 09:15 Matrix:							
Fibre Density							
Field Blank Correction	<0.5		0.5	f/field		19-NOV-09	R1070644
Sample Volume	1745		0	L		19-NOV-09	R1070644
Fibres/Filter	10000		3000	Fibres		19-NOV-09	R1070644
Fibre Density	25		7	Fibres/mm2		19-NOV-09	R1070644
Fibre Concentration	0.005		0.001	fibres/mL		19-NOV-09	R1070644
L832565-5 BF355435 Sampled By: ANDREW SMITH on 01-OCT-09 @ 09:52 Matrix:							
Fibre Density							
Field Blank Correction	<0.5		0.5	f/field		19-NOV-09	R1070644
Sample Volume	1605		0	L		19-NOV-09	R1070644
Fibres/Filter	7000		3000	Fibres		19-NOV-09	R1070644
Fibre Density	18		7	Fibres/mm2		19-NOV-09	R1070644
Fibre Concentration	0.004		0.001	fibres/mL		19-NOV-09	R1070644
L832565-6 BF355590 Sampled By: ANDREW SMITH on 02-OCT-09 @ 09:57 Matrix:							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L832565-6 BF355590 Sampled By: ANDREW SMITH on 02-OCT-09 @ 09:57 Matrix:							
Fibre Density							
Field Blank Correction	<0.5		0.5	f/field		19-NOV-09	R1070644
Sample Volume	1600		0	L		19-NOV-09	R1070644
Fibres/Filter	12000		3000	Fibres		19-NOV-09	R1070644
Fibre Density	31		7	Fibres/mm2		19-NOV-09	R1070644
Fibre Concentration	0.008		0.001	fibres/mL		19-NOV-09	R1070644
L832565-7 BF355433 Sampled By: ANDREW SMITH on 03-OCT-09 @ 09:05 Matrix:							
Fibre Density							
Field Blank Correction	<0.5		0.5	f/field		19-NOV-09	R1070644
Sample Volume	2350		0	L		19-NOV-09	R1070644
Fibres/Filter	12000		3000	Fibres		19-NOV-09	R1070644
Fibre Density	31		7	Fibres/mm2		19-NOV-09	R1070644
Fibre Concentration	0.005		0.001	fibres/mL		19-NOV-09	R1070644
L832565-8 BF355503 Sampled By: ANDREW SMITH on 04-OCT-09 @ 09:37 Matrix:							
Fibre Density							
Field Blank Correction	<0.5		0.5	f/field		19-NOV-09	R1070644
Sample Volume	1855		0	L		19-NOV-09	R1070644
Fibres/Filter	10000		3000	Fibres		19-NOV-09	R1070644
Fibre Density	25		7	Fibres/mm2		19-NOV-09	R1070644
Fibre Concentration	0.005		0.001	fibres/mL		19-NOV-09	R1070644

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ASBESTOS-FBRS/FLT-ED	Filter	Fibre Density	NIOSH 7400A

Sample results are corrected using field blank results. A comment will appear at the end of each sample result section if no field blank was submitted.

Sr values:

5-20 0.11

>20-50 0.075

>50-100 0.10

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Laboratory Definition Code	Laboratory Location
ED	ALS LABORATORY GROUP - EDMONTON, ALBERTA, CANADA

Chain of Custody Numbers:
GLOSSARY OF REPORT TERMS

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mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

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< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

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Environmental Division

Certificate of Analysis

AECOM CANADA LTD.
ATTN: GIL ROBINSON
99 COMMERCE DRIVE
WINNIPEG MB R3P 0Y7

Report Date: 26-NOV-09 10:49 (MT)
Version: FINAL

Lab Work Order #: **L838998**

Date Received: **10-NOV-09**

Project P.O. #:
Job Reference: 60114506
Legal Site Desc:
CofC Numbers: 101209-1

Other Information:

Comments:

Maureen Olinek
Senior Account Manager

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ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L838998-1 BF355574 Sampled By: CLIENT on 10-OCT-09 @ 08:52 Matrix: AIR							
Fibre Density							
Field Blank Correction	<0.5		0.5	f/field		19-NOV-09	R1070644
Sample Volume	1695		0	L		19-NOV-09	R1070644
Fibres/Filter	6000		3000	Fibres		19-NOV-09	R1070644
Fibre Density	17		7	Fibres/mm2		19-NOV-09	R1070644
Fibre Concentration	0.004		0.001	fibres/mL		19-NOV-09	R1070644
L838998-2 BF355548 Sampled By: CLIENT on 12-OCT-09 @ 09:48 Matrix: AIR							
Fibre Density							
Field Blank Correction	<0.5		0.5	f/field		19-NOV-09	R1070644
Sample Volume	2100		0	L		19-NOV-09	R1070644
Fibres/Filter	9000		3000	Fibres		19-NOV-09	R1070644
Fibre Density	24		7	Fibres/mm2		19-NOV-09	R1070644
Fibre Concentration	0.004		0.001	fibres/mL		19-NOV-09	R1070644
L838998-3 BF355398 (BLANK) Sampled By: CLIENT Matrix: AIR							
Fibre Density							
Field Blank Correction	<0.5		0.5	f/field		19-NOV-09	R1070644
Flow Rate Based On						19-NOV-09	R1070644
Fibres/Filter	<3000		3000	Fibres		19-NOV-09	R1070644
Fibre Density	<7		7	Fibres/mm2		19-NOV-09	R1070644

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ASBESTOS-FBRS/FLT-ED	Filter	Fibre Density	NIOSH 7400A

Sample results are corrected using field blank results. A comment will appear at the end of each sample result section if no field blank was submitted.

Sr values:

5-20 0.11

>20-50 0.075

>50-100 0.10

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ED	ALS LABORATORY GROUP - EDMONTON, ALBERTA, CANADA

Chain of Custody Numbers:

101209-1

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mk/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

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D.L. - The reporting limit.

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