

**APPENDIX D –
AS-BUILT REPORTS**

FLUMES



M2C1 Construction and Engineering

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P.O. Box 1750 Delta Junction, Alaska 99737 | tel: 907-895-5441 | fax: 907-895-5443

July 10, 2013

Ms. Sally S. McLeod, CEM, REM
Environmental Superintendent
Sumitomo Metal Mining Pogo LLC
P.O. Box 145
Delta Junction, AK 99737

RE: As-Built Report for Installation of the 4-Ea Flumes in Liese Creek, Pogo Mine.

Dear Ms. McLeod,

This correspondence has been prepared to provide a record of construction for the installation of the 4-*ea* flumes in the Liese Creek drainage at the Pogo Mine located approximately 40 miles northeast of Delta Junction, Alaska and operated by Sumitomo Metal Mining Pogo LLC.

This report summarizes the design coordination, construction, quality assurance testing and inspection, and the completed configuration of the weirs including:

1. As-built drawings of the completed containments (Attachment 1);
2. Photographs taken during construction (Attachment 2).

DESIGN – Flumes

The need for flumes to be installed at various stages of the Liese Creek drainage was driven by the need to update Pogo's site wide water balance. It was determined by Aspen Hydrologic that 4-*ea* flumes were needed at various points along Liese Creek to monitor the flow characteristics of the Stream.

The overall concept/design for the flumes consisted of the following components and persons/companies:

Design/Consulting Role	Designer of Record	Company
Environmental Coordinator	Luke Walker	Sumitomo Metal Mining Pogo LLC
Flume Hydrologic Designer	Sherry L Gaddy	Aspen Hydrologic Services LLC
Flume Designer	N/A	TRACOM
Contractor / Install Engineer	Stephen Hammond PE	M2C1 Construction & Engineering



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Pogo provided the following information to guide the final design and installation:

Design/Install Guidance Documents	Issue Date
Aspen: Memorandum for Placement	07/22/11 & 5/2/12
Aspen: H Flume Installation Guidelines	5/2/12
TRACOM: H-Flume Installation Instructions	5/2/12
TRACOM: Master Dims Drawing	5/2/12
M2C1 Construction Drawings	8/19/12

Following award the installation contractor supplied a design drawing for the flume support structure.

CONSTRUCTION ACTIVITIES – General

Following award of a construction contract to M2C1 Construction and Engineering the following sequence of construction was followed:

- Pogo Surface Group provided access into the sites and provided Civil Materials as needed to support the flume installation's;
- 4-Ea fiberglass flume inserts manufactured by TRACOM and supplied to site by Pogo
- 3-Ea fiberglass flume replacement inserts manufactured by TRACOM and supplied to site by M2C1.
- Contractor mobilized the following equipment: a John Deere (JD) 135C Excavator (with thumb), G&R 4" De-Water Pump (stream diversion), Concrete Mixer (1/4 CY Drum), and Work Trucks/Trailers;
- Bagged Concrete (FMI-4000 PSI) and Bagged Grout (Advantage 1107) were mixed on-site to construct the Flume bases, headwalls, and to grout the fiberglass insert's into place;

CONSTRUCTION ACTIVITIES – Original Placement (Summer 2012)

- A Sump was excavated and lined with plastic ~20' ahead of the flume locations. The 4" de-watering pump was used to move the stream around the weir construction site;
- The excavator was used to move large boulders and to level the area where the flumes were to be located. A trench was dug for the below grade portion of the headwall;
- The headwall and flume base slab was formed, rebar and inserts installed, and concrete mixed and poured;
- The fiberglass insert was then set into place, leveled, and anchored to the base slab;
- The headwall upper section formwork was then custom fitted to the fiberglass insert, rebar installed, and concrete mixed and poured. This effectively secured the flume insert into place using the headwall concrete and all thread insert anchors;



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- The Sidewalls formwork was then installed to support grouting operations;
- All flume fiberglass inserts were prepared and grouting occurred as one event;
- Grout was mixed and poured into the formwork that consisted of wood forms on one side and the fiberglass insert as the other;
- NOTE: Grouting installation procedures were not followed by the grouting crew. Thus the fiberglass insert bottom and side wall deflected due to being over pressured;
- Three of the four fiberglass forms were required to be replaced.

CONSTRUCTION ACTIVITIES – Re-Placement (Winter 2013)

- Following the darkest and coldest part of the winter yet prior to spring breakup M2C1 re-mobilized to re-place 3 of the 4 flumes installed in the Fall of 2012;
- Additional equipment mobilized to support a winter re-install is as follows: a John Deere (JD) 135C Excavator (with thumb), Light Plant (generator also), 2-Ea 500,000 BTU Frost Fighter Heaters, Concrete Mixer (1/4 CY Drum), and Work Trucks/Trailers;
- The JD-135C excavator was again used this time to remove the weir fiberglass inserts and the grouted side-walls. The floor grout would not delaminate from the concrete slab so it was left in place;
- Once removed the entire structure and immediate surrounding area was tented and heat applied for 24-48 hours prior to performing additional work;
- The new fiberglass inserts were then installed on top of the grout base and re-secured using drilled in concrete anchors and all thread. The inserts were leveled using the all thread with nuts and washers;
- The sidewall formwork was then installed to support grouting operations;
- One fiberglass insert was prepared and grouted before advancing to the next;
- Grout was mixed and poured into the formwork that consisted of wood forms on one side and the fiberglass insert as the other;
- NOTE: Grouting installation procedures were followed by the grouting crew. Thus no over pressuring occurred and all weirs were installed without deformation;
- During the re-installation heat was maintained on the newly placed grout for 5 days following grouting.
- Existing soils, extruded geotextile, and armor rock was finally placed at the flume entrances to allow for stream channel to feed the flume and to protect the entrance from scour and erosion.

The construction of the flumes was monitored by the Pogo Environmental Group.



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AS-BUILT DRAWINGS

The As-built drawings are provided as [Attachment 1](#) to this report.

SUMMARY OF QUALITY CONTROL PROCEDURES CARRIED OUT DURING CONSTRUCTION

Quality Control and Quality Assurance activities during construction included:

- Field location of flume placement verified by Pogo Environmental;
- Observation of excavation and site preparation by M2C1 and Pogo Environmental;
- Inspection of formwork and reinforcing steel by M2C1;
- Hand mixing and placement for concrete inspected by M2C1;
- Hand mixing and placement of grout (not inspected on original placement);
- Removal of 3- ea flumes and preparations for re-installation inspected by M2C1;
- Installation of new flumes inspected by M2C1;
- Re-installation of 3- ea flumes during the early Spring required heating and temperature monitoring during field work with concrete mixing and maintenance of heat for 3-5 days per ACI Cold weather concrete requirements;
- Site cleanup and flume project punch-out inspected by M2C1 and Pogo Environmental.

OBSERVATIONS AND TEST RESULTS

The following was observed during construction:

- Proper care was taken to minimize streambed disturbance and sediment disturbance during in-stream work;
- The flume foundation areas were excavated to the specified standard;
- Concrete formwork and rebar installation were installed in accordance with the engineered drawing and manufactures recommendations;
- No concrete testing was taken, yet the concrete batching and mixing process were controlled and resulted in quality concrete;
- The 1st grouting effort was a failure in 3 of the 4 flumes due to the planned grouting process not being followed and thus was determined that replacement was needed;
- Re-installation of 3- ea flumes during the early Spring required temperature monitoring during field work with concrete mixing and maintenance of heat for 3-5 days per ACI Cold weather concrete requirements;
- All temperatures were maintained per ACI cold weather concrete requirements;



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- Site was cleaned up in the Winter and in the Spring to ensure the site was left clean and free of removal debris.

Following the re-installation of the 3-Ea flumes the project was constructed per the design drawings, fabricator shop drawings, and manufacturer instructions for the components supplied.

Please call me at (907) 895-5441 if you have any questions or require further assistance.

Prepared by,

Stephen Hammond, P.E. | President

M2C1 Construction and Engineering

PO Box 1750 * Delta Junction * AK * 99737

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Email: shammond@m2c1llc.com

Attachments: Attachment 1: Drawings
Attachment 2: Photographs



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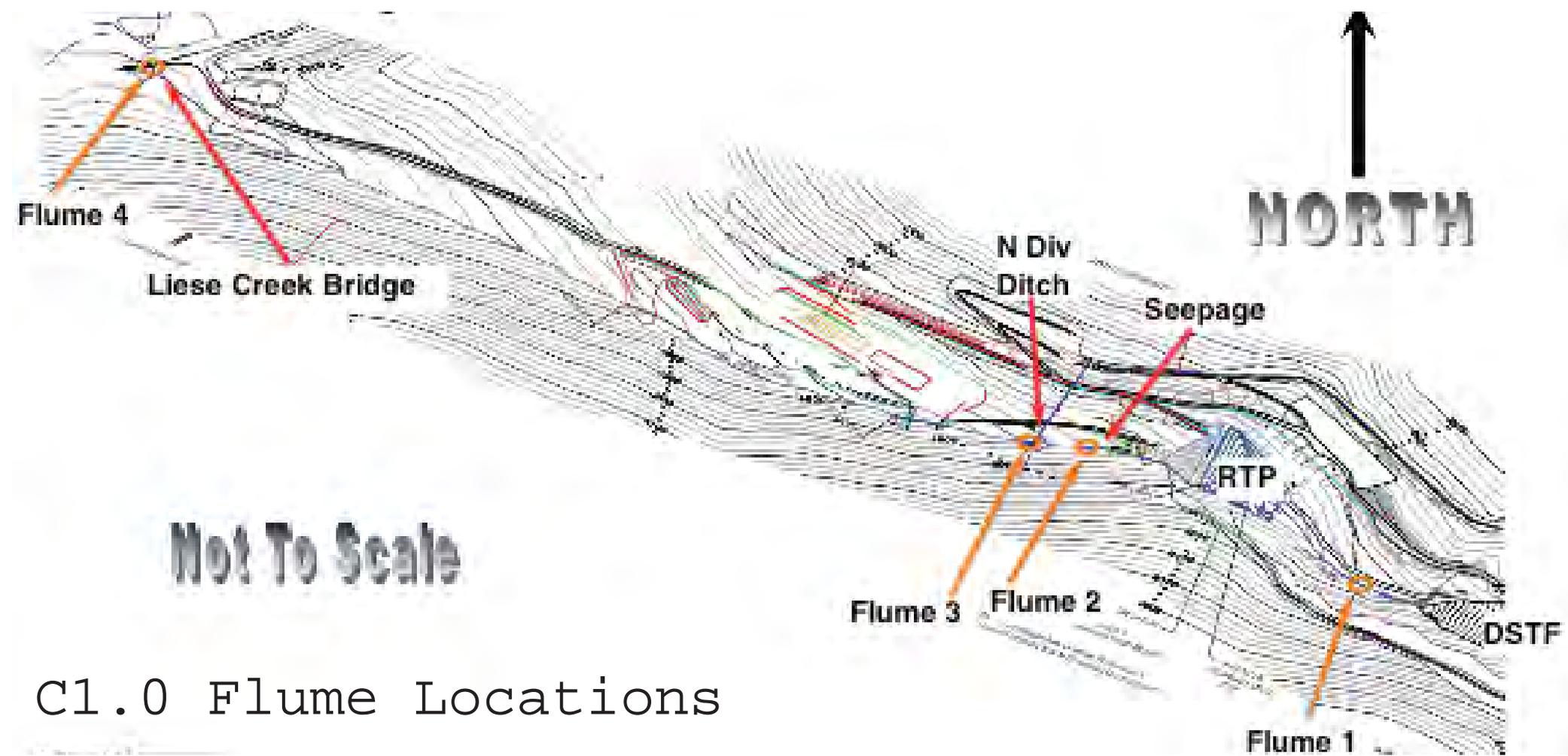
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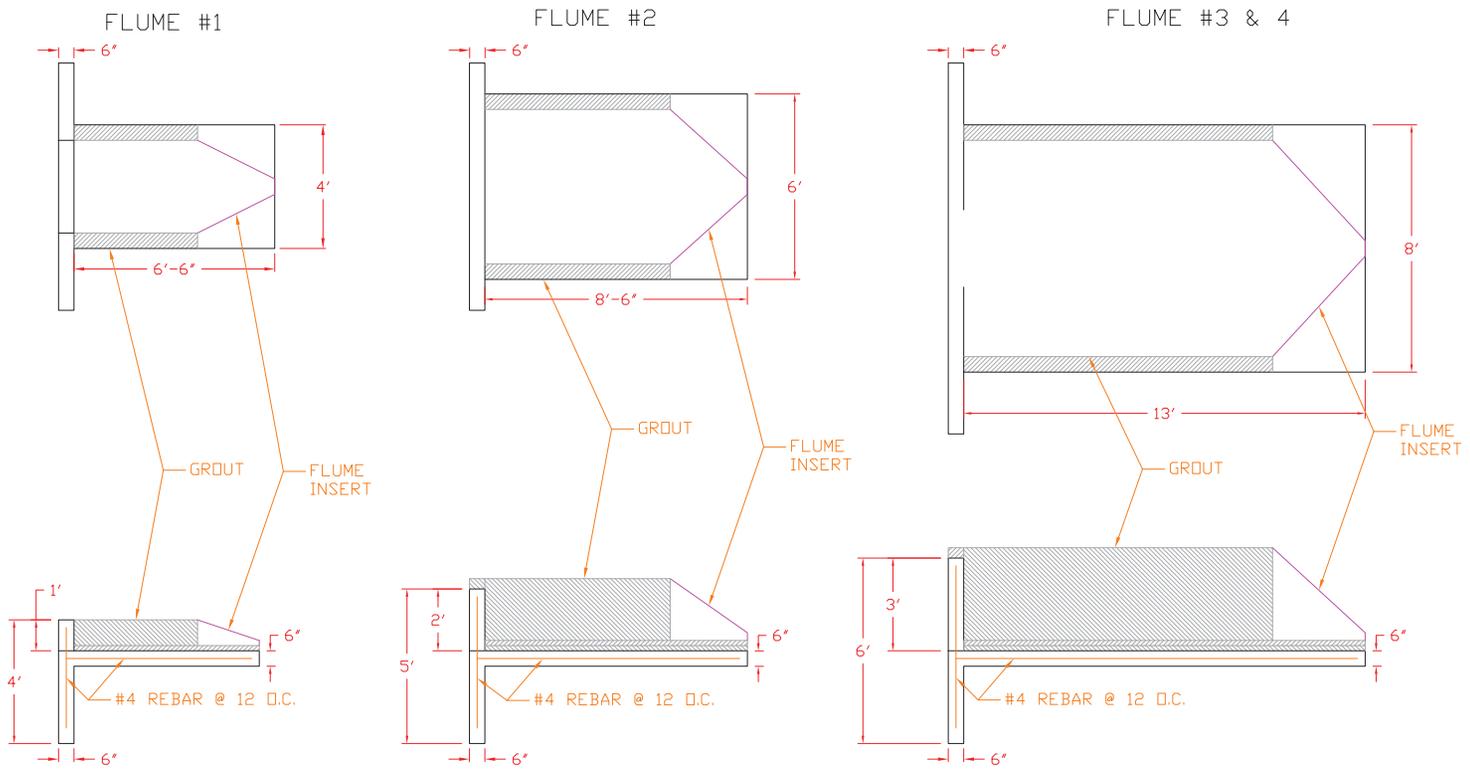
ATTACHMENT 1

Drawings

<u>CIVIL</u>	
C1.0	Flume LOCATIONS
C1.1	Flume PLANS & Details



C1.0 Flume Locations



- NOTES:
- 1) ALL REBAR #4 @ 12" O.C.
 - 2) HEADWALL DOWELS #4 AT 12" O.C.
 - 3) 1' FLUMES ONLY REQUIRED 1 LAYER OF GROUT
 - 4) 2' AND 3' FLUMES REQUIRED 2 LAYERS OF GROUT DUE TO REPLACEMENT OF INSERT

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POGO MINE
 FLUME PLAN & DETAILS
 DELTA JUNCTION, ALASKA

DATE:	...
PROJECT NO.:	...
DRAWN:	SPH
CHECKED:	SPH
TITLE:	SITE PLAN
SHEET:	C1.1
REVISION:	AS-BUILT



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ATTACHMENT 2

Photographs

- 1) Excavation & Water Transfer Activities at Flume #4
- 2) Excavation & Water Transfer Activities at Flume #3
- 3) Base Forming Rebar, and Water Stop Flume #2 (Typ)
- 4) Form Removal and Fiberglass Insert Anchored to Base Flume #4 (Typ)
- 5) Side View of Anchors and Base Flume #4 (Typ)
- 6) Headwall and Insert Concrete Flume #4 (Typ)
- 7) Geotextile Wrap at Entrance Flume #4
- 8) Geotextile Wrap Flume #3
- 9) Rock Armor Finish Flume #3
- 10) Geotextile Wraps and Anchor Rock Flume #2
- 11) Wrap and Rock Armor Finished Flume #2
- 12) Geotextile and Rock Armor Finish Flume #1



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Photo 1: Excavation & Water Transfer Activities at Flume #4



Photo 2: Excavation & Water Transfer Activities at Flume #3

LIESE CREEK Flume's AS-BUILT

July 07, 2013

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Photo 3: Base Forming Rebar, and Water Stop Flume #2 (Typ)



Photo 4: Form Removal and Fiberglass Insert Anchored to Base Flume #4 (Typ)



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Photo 5: Side View of Anchors and Base Flume #4 (Typ)



Photo 6: Headwall and Insert Concrete Flume #4 (Typ)



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Photo 7: Geotextile Wrap at Entrance Flume #4



Photo 8: Geotextile Wrap Flume #3



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Photo 9: Rock Armor Finish Flume #3



Photo 10: Geotextile Wraps and Anchor Rock Flume #2



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Photo 11: Wrap and Rock Armor Finished Flume #2



Photo 12: Geotextile and Rock Armor Finish Flume #1