# ANNUAL REPORT

| | |
|---|---|
| Date | Nov 2 2005 |
| Year being reported | 2005 |
| Licence number | NWB2PEL0507 |
| Licensee | BHP Billiton |
| Mailing address | PO Box 49223<br>Van Stn Bentall Centre<br>Vancouver, BC<br>V7X 1L2 NOTE - THIS IS A NEW ADDRESS! |
| Location of undertaking | 45 km south of Kugaaruk<br>90 4' 29" W 68 7" 43" |
| Name of Undertaking (if applicable): | Amaruk Project |

The Licensee ***must*** provide the following information:

| | |
|---|---|
| i | A summary report of water use and waste disposal activities, including, but not limited to: methods of obtaining water; sewage and greywater management; solid and hazardous waste management. |
| | General: Water use was confined to the camp for the purposes of washing and drinking.<br>Water Aquisition System: A gasoline centrifugal pump was periodically used to fill 2 - 200 gallon tanks linked in series. These tanks fed an electric pump tha pressurised the camp's internal plumbing. The centrifugal pump had a inch footvalved suction sealed in two layers of standard aluminum window screening. Pump capacity was 70 gallons per minute.<br>Greywater: greywater from kitchen and ablution facilities was contained in a passive sumpexcavated in sand This sand assisted the regular percolation of sump fluids. Just prior to seasonal camp closure and in anticipation of possible cold-weather operations in 2006, an insulated and heaat-traced tank was set into the ground in place od the original open depression. This will eventually be outfitted with a discharge line to allow periodic pumping of the tank contents to a surface location further upland. ( A scope of workoutline for 2006, to be submitted later, will detail these together).<br>Sewage: Septic sewage was confined to two latrine pits excavated in deep sand. Latrine pits were periodically treated with a commercial lye product designed for the purpose and buried at the seaonal close fo the camp at the end of August.<br>Solid waste: Food leftovers and packaging was burned in a simple burning barrel and non-flammables were bagged and sent to Kugaaruk.<br>Hazardous Waste: Hydrocarbon spills were the only potential source of hazardous waste. Three 45 gallon spill kits were provided at the camp while the helicopters carried portable units. All crew members were trained on site in effective spill managment. |

| | | |
|---|---|---|
| ii | A list of unauthorized discharges and a summary of follow-up actions taken | |
| | No spills or unauthorised discharges occurred. | |
| iii | Revisions to the Spill Contingency Plan and Abandonment and Restoration Plan | |
| | Revisions were submitted earlier at the request of the Waterboard. | |

| | | |
|---|---|---|
| iv | Progressive reclamation work undertaken | |
| | Latrine pits used for the 2005 program were buried prior to seasonal abandonment of the camp at the end of August.<br>Empty fuel drums were progressively removed from site and flown to Churchill whenever backhaul space was available. | |
| v | Results of the Monitoring Program including: | |
| | 1 | A summary, in cubic metres, of the daily quantities of water utilized for domestic and industrial operations. |
| | | All consumption was domestic.<br><br>July average = 2.284 cu m per day<br>August average = 2.223 cu m per day |
| | 2 | The GPS co-ordinates (in degrees, minutes and seconds of latitude and longitude) of all locations where sources of water are utilized. |
| | | Camp Supply Pump -90 4' 30"W 68 7' 42" |

| | | |
|---|---|---|
| | 3 | The GPS co-ordinates (in degrees, minutes and seconds of latitude and longitude) of all locations where wastes associated with industrial operations are deposited. |
| | | Sump -90 4' 33"W 68 7' 42"N<br>Outhouses -90 4' 38" W 68 7' 44"N |
| | 4 | Any additional sampling and/or analysis that was requested by an Inspector. |
| | | Though it was not requested, two water tests were conducted for drinking water pathogens<br>See attachments |
| vi | Any other details on water use or waste disposal requested by the Board by November 1 of the year being reported | |
| | | |

| | |
|---|---|
| Vii | Any responses or follow-up actions on inspection/compliance reports |
| | |
| viii | Any additional information as appropriate |
| | Work on the project in 2005 was confined to the construction of a camp, caching of fuel and helicopter-supported mapping and sampling. No drilling was performed.<br>All crew members were trained in spill management by BHPB's Health, Safety and Environment manager.<br>The generator was removed from site for the winter<br><br>Current drummed fuel inventories on site:<br>jet B - 168<br>p50 Diesel - 69<br>empty drums - 238<br><br>Attachments<br>- camp facilities plan<br>- camp photo |


Jeremy Howe — By:

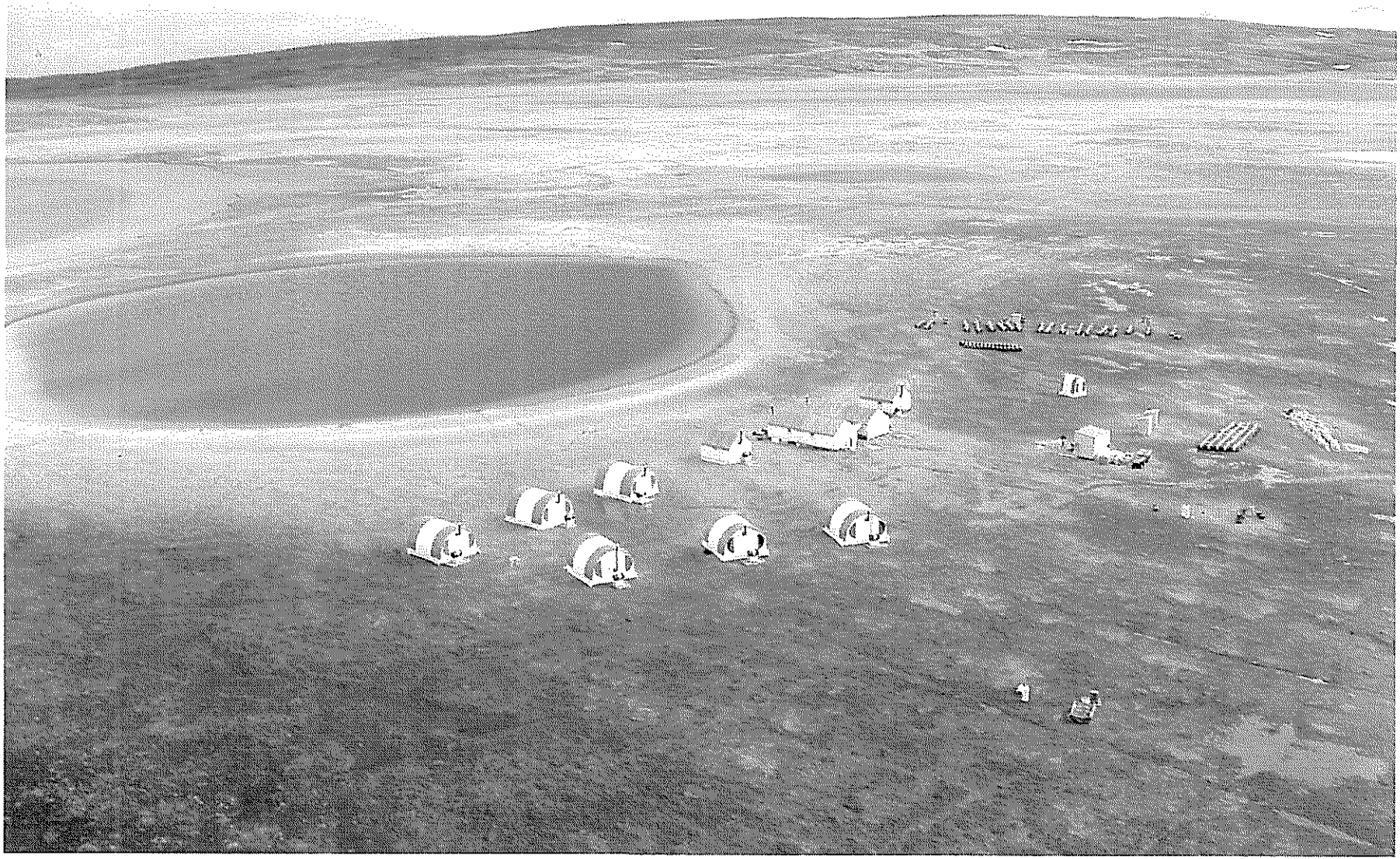
Oct 28, 2005 — Date:

jeremy.j.howe@bhpbilliton.com — Email:

604 632-1451 — Telephone:

# Layout of Amaruk Camp

# Aerial View of Camp



ALS Environmental

# CHEMICAL ANALYSIS REPORT

| | |
|---|---|
| **Date:** | **August 3, 2005** |
| **ALS File No.** | **W1692** |
| **Report On:** | **Pelly Bay J.V. Water Analysis** |
| **Report To:** | **BHP Billiton Diamonds Inc.**<br>**2300 - 1111 West Georgia Street**<br>**Vancouver, BC**<br>**V6E 4M3** |
| **Attention:** | **Mr. Martin H. Lenters** |
| **Received:** | **July 18, 2005** |

**ALS ENVIRONMENTAL**
**per:**

Can Dang, B.Sc. - Project Chemist
Andre Langlais, M.Sc. - Project Chemist

ALS CANADA LTD.
1988 Triumph Street, Vancouver, BC Canada V5L 1K5
**Phone: 604-253-4188** Fax: 604-253-6700 Website: www.alsenviro.com

File No. W1692

**REMARKS**

The water as represented by the samples submitted met the Canadian Drinking Water Guidelines for all parameters analysed with the exception of Manganese which is limited for aesthetic purposes rather than health considerations. See the guidelines attached or contact ALS Environmental if you require any additional information.

Please note that the samples were received at ALS Environmental 4 days later after collection. Since the recommended holding time for Coliform Bacteria analysis is 30 hours at maximum, the bacteriological analysis was not performed on the samples. Mr. Martin Lenters was notified.



*A Campbell Brothers Limited Company*

File No. W1692

## RESULTS OF ANALYSIS - Water

| Sample ID | | | Amaruk 101 | Amaruk 102 |
|---|---|---|---|---|
| Sample Date | | | 05-07-14 | 05-07-14 |
| Sample Time | | | 07:00 | 07:00 |
| *ALS ID* | | | *1* | *2* |
| **Physical Tests** | | | | |
| Colour | (CU) | | <5.0 | <5.0 |
| Conductivity | (uS/cm) | | 105 | 104 |
| Total Dissolved Solids | | | 46 | 46 |
| Hardness | CaCO3 | | 10.5 | 10.3 |
| pH | | | 7.08 | 6.86 |
| Turbidity | (NTU) | | 1.03 | 0.54 |
| **Dissolved Anions** | | | | |
| Alkalinity-Total | | CaCO3 | 4.9 | 4.8 |
| Chloride | Cl | | 28.9 | 29.0 |
| Fluoride | F | | 0.042 | 0.042 |
| Sulphate | SO4 | | <0.50 | <0.50 |
| **Nutrients** | | | | |
| Nitrate Nitrogen | | N | <0.10 | <0.10 |
| Nitrite Nitrogen | | N | <0.10 | <0.10 |

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except for pH, Colour (CU), Conductivity (umhos/cm), and Turbidity (NTU).
< = Less than the detection limit indicated.



A Campbell Brothers Limited Company

File No. W1692

## RESULTS OF ANALYSIS - Water

| Sample ID | | Amaruk 101 | Amaruk 102 |
|---|---|---|---|
| Sample Date | | 05-07-14 | 05-07-14 |
| Sample Time | | 07:00 | 07:00 |
| *ALS ID* | | *1* | 2 |
| **Total Metals** | | | |
| Aluminum | T-Al | 0.022 | 0.022 |
| Antimony | T-Sb | <0.00050 | <0.00050 |
| Arsenic | T-As | 0.00012 | 0.00011 |
| Barium | T-Ba | <0.020 | <0.020 |
| Boron | T-B | <0.10 | <0.10 |
| Cadmium | T-Cd | <0.00020 | <0.00020 |
| Calcium | T-Ca | 1.69 | 1.63 |
| Chromium | T-Cr | <0.0020 | <0.0020 |
| Copper | T-Cu | 0.0021 | 0.0020 |
| Iron | T-Fe | 0.044 | 0.039 |
| Lead | T-Pb | 0.0017 | 0.0017 |
| Magnesium | T-Mg | 1.53 | 1.50 |
| Manganese | T-Mn | 0.0521 | 0.0518 |
| Mercury | T-Hg | <0.00020 | <0.00020 |
| Potassium | T-K | 1.03 | 1.01 |
| Selenium | T-Se | <0.0010 | <0.0010 |
| Sodium | T-Na | 16.6 | 16.5 |
| Uranium | T-U | <0.00010 | <0.00010 |
| Zinc | T-Zn | <0.050 | <0.050 |

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except for pH, Colour (CU), Conductivity (umhos/cm), and Turbidity (NTU).
< = Less than the detection limit indicated.



A Campbell Brothers Limited Company

File No. W1692

## Appendix 1 - REGULATORY CRITERIA

**Health Canada**

Summary of Guidelines for Canadian Drinking Water Quality, April 2003. Please see the guidelines for further details.
All limits are Maximum Acceptable Concentration (MAC) unless otherwise indicated. Limits are expressed as mg/L except for pH, Turbidity, Colour and Bacteriolgical Tests.

| | | | Lower Limit | Upper Limit | | Notes |
|---|---|---|---|---|---|---|
| **Physical Tests** | | | | | | |
| Colour | (CU) | | - | 15 | CU | 1 |
| Total Dissolved Solids | | | - | 500 | mg/L | 1 |
| pH | | | 6.5 | 8.5 | | 1 |
| Turbidity | (NTU) | | - | 5 | NTU | 1, 2 |
| **Dissolved Anions** | | | | | | |
| Chloride | Cl | | - | 250 | mg/L | 1 |
| Fluoride | F | | - | 1.5 | mg/L | |
| Sulphate | SO4 | | - | 500 | mg/L | 1, 3 |
| **Nutrients** | | | | | | |
| Nitrate Nitrogen | | N | - | 10 | mg/L | |
| Nitrite Nitrogen | | N | - | 1 | mg/L | |
| **Total Metals** | | | | | | |
| Antimony | T-Sb | | - | 0.006 | mg/L | 4, 5 |
| Arsenic | T-As | | - | 0.025 | mg/L | 4 |
| Barium | T-Ba | | - | 1 | mg/L | |
| Boron | T-B | | - | 5 | mg/L | 4 |
| Cadmium | T-Cd | | - | 0.005 | mg/L | |
| Chromium | T-Cr | | - | 0.05 | mg/L | |
| Copper | T-Cu | | - | 1 | mg/L | 1, 6 |
| Iron | T-Fe | | - | 0.3 | mg/L | 1 |
| Lead | T-Pb | | - | 0.01 | mg/L | 6, 5 |
| Manganese | T-Mn | | - | 0.05 | mg/L | 1 |
| Mercury | T-Hg | | - | 0.001 | mg/L | |
| Selenium | T-Se | | - | 0.01 | mg/L | |
| Sodium | T-Na | | - | 200 | mg/L | 1 |
| Uranium | T-U | | - | 0.02 | mg/L | 4 |
| Zinc | T-Zn | | - | 5 | mg/L | 1, 6 |

1 Aesthetic Objective (AO) (taste, odour, appearance, etc.)
2 1 NTU maximum allowed for water entering distribution systems.
3 There may be a laxative effect in some individuals when sulphate levels exceed 500 mg/L.
4 Interim Maximum Acceptable Concentration (IMAC)
5 First drawn water may be high, flush system before sampling.
6 At point of consumption.



A Campbell Brothers Limited Company

## Appendix 2 - METHODOLOGY

Outlines of the methodologies utilized for the analysis of the samples submitted are as follows

### Colour in Water

This analysis is carried out using procedures adapted from APHA Method 2120 "Color". Colour (true colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method. The analysis is carried out without pH adjustment.

Recommended Holding Time:
Sample: 2 days
Reference: APHA
For more detail see ALS Environmental "Collection & Sampling Guide"

### Conductivity in Water

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

Recommended Holding Time:
Sample: 28 days
Reference: APHA
For more detail see ALS Environmental "Collection & Sampling Guide"

### Solids in Water

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) and total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius, TSS is determined by drying the filter at 104 degrees celsius. Total solids are determined by evaporating a sample to dryness at 104 degrees celsius. Fixed and volatile solids are determined by igniting a dried sample residue at 550 degrees celsius.

Recommended Holding Time:
Sample: 7 days
Reference: APHA
For more detail see ALS Environmental "Collection & Sampling Guide"

### Conventional Parameters in Water

These analyses are carried out in accordance with procedures described in "Methods for Chemical Analysis of Water and Wastes" (USEPA), "Manual for the Chemical Analysis of Water, Wastewaters, Sediments and Biological Tissues" (BCMOE), and/or "Standard Methods for the Examination of Water and Wastewater" (APHA). Further details are available on request.



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## Appendix 2 - METHODOLOGY - Continued

### pH in Water

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode.

Recommended Holding Time:
Sample: 2 hours
Reference: APHA
For more detail see ALS Environmental "Collection & Sampling Guide"

### Turbidity of Water

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

Recommended Holding Time:
Sample: 2 days
Reference: APHA
For more detail see ALS Environmental "Collection & Sampling Guide"

### Alkalinity in Water by Colourimetry

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

Recommended Holding Time:
Sample: 14 days
Reference: APHA
For more detail see ALS Environmental "Collection & Sampling Guide"

### Dissolved Anions in Water by Ion Chromatography

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions are determined by filtering the sample through a 0.45 micron membrane filter and injecting the filtrate onto a Dionex IonPac AG17 anion exchange column with a hydroxide eluent stream. Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

Recommended Holding Time:
Sample: 28 days (bromide, chloride, fluoride, sulphate)
Sample: 2 days (nitrate, nitrite)
Reference: APHA and EPA
For more detail see ALS Environmental "Collection & Sampling Guide"



A Campbell Brothers Limited Company

**Appendix 2 - METHODOLOGY - Continued**

### Metals in Water

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" 20th Edition 1998 published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotplate or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by atomic absorption/emission spectrophotometry (EPA Method 7000 series), inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B), and/or inductively coupled plasma - mass spectrometry (EPA Method 6020).

Recommended Holding Time:

| | |
|---|---|
| Sample: | 6 months |
| Reference: | EPA |
| For more detail see: | ALS "Collection & Sampling Guide" |

### Mercury in Water

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" 20th Edition 1998 published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).

Recommended Holding Time:

| | |
|---|---|
| Sample: | 28 days |
| Reference: | EPA |

For more detail see ALS Environmental "Collection & Sampling Guide"

**Results contained within this report relate only to the samples as submitted.**

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**End of Report**



*A Campbell Brothers Limited Company*

ALS Environmental

# CHEMICAL ANALYSIS REPORT

| | |
|---|---|
| **Date:** | **September 20, 2005** |
| **ALS File No.** | **W3523** |
| **Report On:** | **Amaruk Camp Water Analysis** |
| **Report To:** | **BHP Billiton Diamonds Inc.**<br>**2300 - 1111 West Georgia Street**<br>**Vancouver, BC**<br>**V6E 4M3** |
| **Attention:** | **Mr. Martin H. Lenters** |
| **Received:** | **August 26, 2005** |

**ALS ENVIRONMENTAL**
**per:**

Can Dang, B.Sc. - Project Chemist
Andre Langlais, M.Sc. - Project Chemist

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Phone: 604-253-4188 Fax: 604-253-6700 Website: www.alsenviro.com

File No. W3523

**REMARKS**

The water as represented by the samples submitted met the Canadian Drinking Water Guidelines for all parameters analysed. See the guidelines attached or contact ALS Envrionmental if you require any additional information.



*A Campbell Brothers Limited Company*

File No. W3523

## RESULTS OF ANALYSIS - Water

| Sample ID | | | Amaruk 103 | Amaruk 104 |
|---|---|---|---|---|
| Sample Date | | | 05-08-25 | 05-08-25 |
| Sample Time | | | 10:00 | 10:15 |
| *ALS ID* | | | *1* | 2 |
| **Physical Tests** | | | | |
| Colour | (CU) | | <5.0 | <5.0 |
| Conductivity | (uS/cm) | | 112 | 117 |
| Total Dissolved Solids | | | 62.0 | 66 |
| Hardness | CaCO3 | | 10.0 | 12.0 |
| pH | | | 7.93 | 7.93 |
| Turbidity | (NTU) | | 0.17 | 0.24 |
| **Dissolved Anions** | | | | |
| Alkalinity-Total | | CaCO3 | 5.1 | 7.9 |
| Chloride | Cl | | 29.0 | 28.8 |
| Fluoride | F | | 0.069 | 0.075 |
| Sulphate | SO4 | | <0.50 | <0.50 |
| **Nutrients** | | | | |
| Nitrate Nitrogen | | N | <0.10 | <0.10 |
| Nitrite Nitrogen | | N | <0.10 | <0.10 |
| **Bacteriological Tests** | | | | |
| E. coli | | | <1.0 | <1.0 |
| Coliform Bacteria - Fecal | | | <1 | <1 |
| Coliform Bacteria - Total | | | <1.0 | <1.0 |

Remarks regarding the analyses appear at the beginning of this report.
< = Less than the detection limit indicated.
Coliform results are expressed as Colony Forming Units (CFU) per 100 mL.
Results are expressed as milligrams per litre except for pH, Colour (CU), Conductivity (umhos/cm), and Turbidity (NTU).



A Campbell Brothers Limited Company

File No. W3523

## RESULTS OF ANALYSIS - Water

| Sample ID | | Amaruk 103 | Amaruk 104 |
|---|---|---|---|
| Sample Date | | 05-08-25 | 05-08-25 |
| Sample Time | | 10:00 | 10:15 |
| *ALS ID* | | *1* | *2* |
| **Total Metals** | | | |
| Aluminum | T-Al | <0.010 | <0.010 |
| Antimony | T-Sb | <0.00050 | <0.00050 |
| Arsenic | T-As | <0.00010 | <0.00010 |
| Barium | T-Ba | <0.020 | <0.020 |
| Boron | T-B | <0.10 | <0.10 |
| Cadmium | T-Cd | <0.00020 | <0.00020 |
| Calcium | T-Ca | 1.56 | 1.54 |
| Chromium | T-Cr | <0.0020 | <0.0020 |
| Copper | T-Cu | 0.0027 | 0.0047 |
| Iron | T-Fe | <0.030 | 0.041 |
| Lead | T-Pb | 0.0010 | 0.0014 |
| Magnesium | T-Mg | 1.50 | 1.98 |
| Manganese | T-Mn | 0.0021 | 0.0025 |
| Mercury | T-Hg | <0.00020 | <0.00020 |
| Potassium | T-K | 1.04 | 1.05 |
| Selenium | T-Se | <0.0010 | <0.0010 |
| Sodium | T-Na | 14.7 | 14.8 |
| Uranium | T-U | <0.00010 | <0.00010 |
| Zinc | T-Zn | <0.050 | <0.050 |

Remarks regarding the analyses appear at the beginning of this report.
< = Less than the detection limit indicated.
Coliform results are expressed as Colony Forming Units (CFU) per 100 mL.
Results are expressed as milligrams per litre except for pH, Colour (CU), Conductivity (umhos/cm), and Turbidity (NTU).



A Campbell Brothers Limited Company

File No. W3523

## Appendix 1 - REGULATORY CRITERIA

**Health Canada**

Summary of Guidelines for Canadian Drinking Water Quality, April 2003. Please see the guidelines for further details.
All limits are Maximum Acceptable Concentration (MAC) unless otherwise indicated. Limits are expressed as mg/L except for pH, Turbidity, Colour and Bacteriolgical Tests.

| | | | Lower Limit | | Upper Limit | | Notes |
|---|---|---|---|---|---|---|---|
| **Physical Tests** | | | | | | | |
| Colour | (CU) | | - | | 15 | CU | 1 |
| Total Dissolved Solids | | | - | | 500 | mg/L | 1 |
| pH | | | 6.5 | | 8.5 | | 1 |
| Turbidity | (NTU) | | - | | 5 | NTU | 1, 2 |
| **Dissolved Anions** | | | | | | | |
| Chloride | Cl | | - | | 250 | mg/L | 1 |
| Fluoride | F | | - | | 1.5 | mg/L | |
| Sulphate | SO4 | | - | | 500 | mg/L | 1, 3 |
| **Nutrients** | | | | | | | |
| Nitrate Nitrogen | | N | - | | 10 | mg/L | |
| Nitrite Nitrogen | | N | - | | 1 | mg/L | |
| **Bacteriological Tests** | | | | | | | |
| E. coli | | | 0 | MPN | - | | 4, 5 |
| Coliform Bacteria - Total | | | 0 | MPN | - | | 4, 5 |
| **Total Metals** | | | | | | | |
| Antimony | T-Sb | | - | | 0.006 | mg/L | 6, 7 |
| Arsenic | T-As | | - | | 0.025 | mg/L | 6 |
| Barium | T-Ba | | - | | 1 | mg/L | |
| Boron | T-B | | - | | 5 | mg/L | 6 |
| Cadmium | T-Cd | | - | | 0.005 | mg/L | |
| Chromium | T-Cr | | - | | 0.05 | mg/L | |
| Copper | T-Cu | | - | | 1 | mg/L | 1, 8 |
| Iron | T-Fe | | - | | 0.3 | mg/L | 1 |
| Lead | T-Pb | | - | | 0.01 | mg/L | 8, 7 |
| Manganese | T-Mn | | - | | 0.05 | mg/L | 1 |
| Mercury | T-Hg | | - | | 0.001 | mg/L | |
| Selenium | T-Se | | - | | 0.01 | mg/L | |
| Sodium | T-Na | | - | | 200 | mg/L | 1 |
| Uranium | T-U | | - | | 0.02 | mg/L | 6 |
| Zinc | T-Zn | | - | | 5 | mg/L | 1, 8 |

1 Aesthetic Objective (AO) (taste, odour, appearance, etc.)
2 1 NTU maximum allowed for water entering distribution systems.
3 There may be a laxative effect in some individuals when sulphate levels exceed 500 mg/L.
4 For Semi-public and Private Drinking Water Systems - no sample should contain E. coli or Total Coliform Bacteria.
5 For Public Drinking Water Systems - no sample should contain E. coli and no consectutive sample or no more than 10% should show the presence of Total Coliform Bacteria.
6 Interim Maximum Acceptable Concentration (IMAC)
7 First drawn water may be high, flush system before sampling.
8 At point of consumption.



A Campbell Brothers Limited Company

## Appendix 2 - METHODOLOGY

Outlines of the methodologies utilized for the analysis of the samples submitted are as follows

### Colour in Water

This analysis is carried out using procedures adapted from APHA Method 2120 "Color". Colour (true colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method. The analysis is carried out without pH adjustment.

Recommended Holding Time:
Sample: 2 days
Reference: APHA
For more detail see ALS Environmental "Collection & Sampling Guide"

### Conductivity in Water

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

Recommended Holding Time:
Sample: 28 days
Reference: APHA
For more detail see ALS Environmental "Collection & Sampling Guide"

### Solids in Water

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) and total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius, TSS is determined by drying the filter at 104 degrees celsius. Total solids are determined by evaporating a sample to dryness at 104 degrees celsius. Fixed and volatile solids are determined by igniting a dried sample residue at 550 degrees celsius.

Recommended Holding Time:
Sample: 7 days
Reference: APHA
For more detail see ALS Environmental "Collection & Sampling Guide"

### pH in Water

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode.

Recommended Holding Time:
Sample: 2 hours



A Campbell Brothers Limited Company

Reference: APHA
For more detail see ALS Environmental "Collection & Sampling Guide"

**Turbidity of Water**

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

Recommended Holding Time:
Sample: 2 days
Reference: APHA
For more detail see ALS Environmental "Collection & Sampling Guide"

**Alkalinity in Water by Colourimetry**

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

Recommended Holding Time:
Sample: 14 days
Reference: APHA
For more detail see ALS Environmental "Collection & Sampling Guide"

**Dissolved Anions in Water by Ion Chromatography**

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions are determined by filtering the sample through a 0.45 micron membrane filter and injecting the filtrate onto a Dionex IonPac AG17 anion exchange column with a hydroxide eluent stream. Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

Recommended Holding Time:
Sample: 28 days (bromide, chloride, fluoride, sulphate)
Sample: 2 days (nitrate, nitrite)
Reference: APHA and EPA

Laboratory Location: ALS Environmental, Vancouver

**E. coli and Total Coliform Bacteria in Water by Enzyme Substrate**

This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.



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Recommended Holding Time:
Sample: 1 day
Reference: APHA
For more detail see ALS Environmental "Collection & Sampling Guide"

**Coliform Bacteria in Water by Membrane Filtration**

This analysis is carried out using procedures adapted from APHA Method 9222 "Membrane Filter Technique for Members of the Coliform Group". Coliform bacteria is determined by colony counting. A known sample volume is filtered through a 0.45 micron membrane filter. The test involves an initial 24 hour incubation of the filter with the appropriate growth medium, positive results require further testing (up to an additional 48 hours) to confirm and quantify the total and fecal coliform. This method is used for non-turbid water with a low background bacteria level.

Recommended Holding Time:
Sample: 1 day
Reference: APHA
For more detail see ALS Environmental "Collection & Sampling Guide"

**Metals in Water**

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" 20th Edition 1998 published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotplate or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by atomic absorption/emission spectrophotometry (EPA Method 7000 series), inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B), and/or inductively coupled plasma - mass spectrometry (EPA Method 6020).

Recommended Holding Time:

| | |
|---|---|
| Sample: | 6 months |
| Reference: | EPA |
| For more detail see: | ALS "Collection & Sampling Guide" |

**Mercury in Water**

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" 20th Edition 1998 published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).



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**Appendix 2 - METHODOLOGY - Continued**

Recommended Holding Time:

| | |
|---|---|
| Sample: | 28 days |
| Reference: | EPA |

For more detail see ALS Environmental "Collection & Sampling Guide"

**Results contained within this report relate only to the samples as submitted.**

**This Chemical Analysis Report shall only be reproduced in full, except with the written approval of ALS Environmental.**

**End of Report**



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