

Intended for  
ALUK Limited

Document type  
Report

Date  
June 2021

# ALUK CHEPSTOW EFFLUENT CHARACTERISATION

## ALUK CHEPSTOW EFFLUENT CHARACTERISATION

Project name ALUK Environmental Support  
Project no. 1620009139  
Recipient ALUK Limited  
Document type Report  
Version 1  
Date 18/06/2021  
Prepared by Richard Wood  
Checked by Greg Roberts  
Approved by Greg Roberts

Ramboll  
1 Broad Gate  
The Headrow  
Leeds  
LS1 8EQ  
United Kingdom

T +44 113 245 7552  
<https://uk.ramboll.com>

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Ramboll UK Limited  
Registered in England & Wales  
Company No: 03659970  
Registered office:  
240 Blackfriars Road  
London  
SE1 8NW

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## EXECUTIVE SUMMARY

Ramboll was instructed by ALUK to undertake an assessment of the waste water generated within their processes prior to treatment through the on-site effluent treatment plant.

The processes generating the inputs to the effluent treatment plant were reviewed and determined to form three main streams: Effluent from regeneration of ion exchange resins; Chrome-free process (acid and alkali sumps); and Anodising process (acid and alkali sumps). The effluent from ion exchange resin regeneration is identified as an absolute non-hazardous classification, whilst the rinsing effluents from the two processes were identified with mirror entries. Further assessment of the waste streams, the chrome-free and anodising process rinsing effluents, were undertaken to determine the nature of the effluent streams.

Ten samples of effluent from the rinse stages of each process were sent for chemical analysis to determine their composition. The results have then been analysed using the Environment Agency's WM3 methodology and determined to be non-hazardous.

The relevant codes for the inputs to the on-site effluent treatment plant are considered to be:

11 01 12 aqueous rinsing liquids other than those mentioned in 11 01 11

19 09 06 solutions and sludges from regeneration of ion exchangers

## 1. INTRODUCTION

### 1.1 Background

Ramboll was instructed by ALUK Limited (ALUK) (the “Client”) to undertake an assessment of the effluent generated at their facility at Newhouse Farm Industrial Estate, Chepstow, NP16 6UD.

The assessment is required to discharge Improvement Condition 1 of their Environmental Permit, which states:

“The Operator shall provide the European Waste Catalogue (EWC) code(s) for the waste water input being introduced into the Effluent Treatment Plant. The operator shall ensure enough representative samples of the waste water input are taken to allow for statistically significant testing and analysis. The EWC code(s) will be determined in accordance with guidance outlined in Technical Guidance WM3. The EWC code(s) for the waste water input shall be provided to Natural Resources Wales in the form of a written report by the date specified.”

The Effluent Treatment Plant consists of four (4) buffer tanks feeding into a physico-chemical treatment process. Two of the buffer tanks are for the collection of the effluent from the regeneration of the ion exchanger (resins), with the remaining two tanks handling acid and alkaline rinse water from the production process.

Wastewater from the buffer tanks is then channelled into the first compartment of the process (coagulation). The wastewater is then gravity fed into the second compartment (neutralisation) and then onto the third compartment (flocculation). The processed wastewater then flows into the decantation tank before discharge to sewer under trade effluent consent.

### 1.2 Objectives

The primary objective of the investigation is to classify the wastewater input to the effluent treatment in relation to the European Waste Catalogue and in accordance with the Environment Agency's Technical Guidance Note WM3<sup>1</sup>.

The wastewater input to be classified consists of the following main sources

- 1) Input type 1: Effluent from regeneration of ion exchange resins
- 2) Input type 2: Chrome-free process (acid and alkali sumps)
- 3) Input type 3: Anodising process (acid and alkali sumps)

It is noted that waste waters are normally excluded from the Waste Directive (and therefore from the requirement to classify the waste in accordance with the EWC).

<sup>1</sup> Waste Classification: Guidance on the classification and assessment of Waste (1<sup>st</sup> Edition v1.1 GB). January 2021

## 2. INITIAL REVIEW OF EWC CODES

A review of the three identified input sources suggests the following codes can be applied.

### Input type 1: Effluent from regeneration of ion exchange resins

The ion exchange regeneration effluent can be readily classified from the EWC as

19 09 06 solutions and sludges from regeneration of ion exchangers

This is an absolute non-hazardous entry so does not require further assessment to determine the specific nature of the input.

### Input types 2 & 3: Chrome-free and anodising processes

Wastes derived from these activities would be classified as 11 01 of the EWC list:

Wastes from chemical surface treatment and coating of metals and other materials (for example galvanic processes, zinc coating processes, pickling processes, etching, phosphating, alkaline degreasing, anodising)

As the wastewater is generated from rinse processes, the following codes are considered most likely to apply:

11 01 11\* aqueous rinsing liquids containing hazardous substances

11 01 12 aqueous rinsing liquids other than those mentioned in 11 01 11

The asterisk on code 11 01 11 identifies the waste code as a 'mirror code' i.e. one that has the potential to be either hazardous or non-hazardous waste, dependent upon the specific chemical composition and nature of the waste. This can be determined either through a review of safety data sheets where the composition of the material is well known, or through chemical analysis of the rinsing liquids.

Due to the nature of the rinsing process, the exact composition and concentration levels of chemicals within the rinse water is not easily determined, so analysis of the generated waste streams is proposed to understand the potential for the waste to be classified as hazardous.

## 3. WASTE INVESTIGATION STRATEGY

### 3.1 Waste Water Sampling

Sampling of the representative effluent treatment plant inputs were taken on 15<sup>th</sup> March 2021 (for the chrome-free process) and 27<sup>th</sup> April 2021 (for the anodising process). Activities on these days were considered to be representative of normal processes at the installation. Ten samples of process effluent from each of the two processes were taken (five from the acid rinse tank and five from the alkaline rinse tank).

### 3.2 Analytical Strategy

The analytical strategy for the waste water was based upon a standard suite for assessment of contamination in relation to environmental consequences. This included both organic and inorganic constituents. Aluminium is not part of the standard suite, but due to the use of aluminium as the key manufacturing component, analysis for this determinand was also included.

The sample data was then analysed using the methodology set out in Appendix D of Technical Guidance WM3, which is based primarily upon:

- determining the mean concentration (or 50th percentile)
- calculating confidence intervals around that mean, and
- comparing the confidence intervals to hazardous waste thresholds

The uncertainty of the mean is derived from the standard error (SE) of the mean calculated from the number of samples (in the case of each process assessed here, 10) and the standard deviation (s):

$$S / (\sqrt{n})$$

The upper and lower confidence intervals for the mean are calculated from:

Sample Mean  $\pm$  Margin of error (ME)

ME = SE x critical value of the t-distribution

The critical values of the t-distribution are determined using a one-tailed t-test using:

- (n-1) degrees of freedom (in this scenario, 9 degrees of freedom)
- probability = 0.95 / 0.05

## 4. ANALYTICAL RESULTS

### 4.1 Chrome-free Process Analytical Results

A full summary of the sample results is provided in Appendix 1.

The following were returned as below level of detection for all samples analysed:

- All speciated Polycyclic Aromatic Hydrocarbons (PAHs)
- Total PAH
- Monoaromatics and Oxygenates
- Petroleum Hydrocarbons
- Total Cyanide
- Beryllium
- Hexavalent Chromium
- Mercury

For the determinands where results above the limit of detection were returned, the results have been assessed using the approach set out in Section 3.2. The output of the assessment is presented in Table 4.1.

### 4.2 Anodising Process Analytical Results

A full summary of the sample results is provided in Appendix 2.

The following were returned as below level of detection for all samples analysed:

- All speciated Polycyclic Aromatic Hydrocarbons (PAHs)
- Total PAH
- Monoaromatics and Oxygenates

## Effluent Characterisation

- Petroleum Hydrocarbons
- Total Phenols
- Total Cyanide
- Beryllium
- Hexavalent Chromium
- Mercury
- Selenium

For the determinands where results above the limit of detection were returned, the results have been assessed using the approach set out in Section 3.2. The output of the assessment is presented in Table 4.2.

Table 4.1. Statistical analysis of Chrome-free Rinse effluent samples

| Analytical Parameter<br>(Water Analysis) | Units       | Min  | Max    | Avg     | Std Dev | Std<br>Error | Critical<br>values | Confidence<br>interval | Upper<br>Range | Lower<br>range | % content<br>(upper<br>range) |
|------------------------------------------|-------------|------|--------|---------|---------|--------------|--------------------|------------------------|----------------|----------------|-------------------------------|
| General Inorganics                       |             |      |        |         |         |              |                    |                        |                |                |                               |
| pH                                       | pH<br>Units | 1.6  | 10.2   | 6.55    | 3.727   | 1.178        | 0.907              | 1.069                  | 7.62           | 5.48           | n/a                           |
| Sulphate as SO <sub>4</sub>              | mg/l        | 17.5 | 35.5   | 28.28   | 7.305   | 2.310        | 0.907              | 2.095                  | 30.37          | 26.19          | 0.0304                        |
| Ammoniacal Nitrogen as N                 | µg/l        | 15   | 29000  | 11407.5 | 12119   | 3832         | 0.907              | 3476                   | 14883          | 7932           | 0.0149                        |
| Total Phenols                            |             |      |        |         |         |              |                    |                        |                |                |                               |
| Total Phenols (monohydric)               | µg/l        | 10   | 28     | 12.7    | 5.515   | 1.744        | 0.907              | 1.581                  | 14.28          | 11.12          | <0.0001                       |
| Heavy Metals / Metalloids                |             |      |        |         |         |              |                    |                        |                |                |                               |
| Boron (dissolved)                        | µg/l        | 110  | 340000 | 62270   | 107520  | 34001        | 0.907              | 30835                  | 93105          | 31435          | 0.0931                        |
| Calcium (dissolved)                      | mg/l        | 10   | 59     | 26.4    | 15.30   | 4.838        | 0.907              | 4.387                  | 30.79          | 22.01          | 0.0308                        |
| Chromium (III)                           | µg/l        | 2.1  | 40     | 9.35    | 12.54   | 3.966        | 0.907              | 3.596                  | 12.95          | 5.75           | <0.0001                       |
| Magnesium (dissolved)                    | mg/l        | 2.1  | 9.5    | 4.44    | 2.27    | 0.717        | 0.907              | 0.650                  | 5.09           | 3.79           | 0.0051                        |
| Aluminium (dissolved)                    | mg/l        | 52.3 | 209    | 125.26  | 44.58   | 14.096       | 0.907              | 12.784                 | 138.04         | 112.48         | 0.1380                        |
| Arsenic (dissolved)                      | µg/l        | 0.15 | 1.53   | 0.529   | 0.43    | 0.136        | 0.907              | 0.124                  | 0.65           | 0.41           | <0.0001                       |
| Cadmium (dissolved)                      | µg/l        | 0.02 | 7.4    | 2.62    | 2.86    | 0.906        | 0.907              | 0.821                  | 3.44           | 1.80           | <0.0001                       |
| Chromium (dissolved)                     | µg/l        | 2.1  | 40     | 9.35    | 12.54   | 3.966        | 0.907              | 3.596                  | 12.95          | 5.75           | <0.0001                       |
| Copper (dissolved)                       | µg/l        | 9.5  | 23     | 13.63   | 4.77    | 1.508        | 0.907              | 1.368                  | 15.00          | 12.26          | <0.0001                       |

Ramboll - ALUK Chepstow

Effluent Characterisation

|                      |      |     |     |       |       |        |       |        |       |       |         |
|----------------------|------|-----|-----|-------|-------|--------|-------|--------|-------|-------|---------|
| Lead (dissolved)     | µg/l | 3.9 | 19  | 9.52  | 4.60  | 1.455  | 0.907 | 1.319  | 10.84 | 8.20  | <0.0001 |
| Nickel (dissolved)   | µg/l | 0.5 | 23  | 7.62  | 8.27  | 2.617  | 0.907 | 2.373  | 9.99  | 5.25  | <0.0001 |
| Selenium (dissolved) | µg/l | 0.8 | 2   | 1.47  | 0.40  | 0.125  | 0.907 | 0.113  | 1.58  | 1.36  | <0.0001 |
| Vanadium (dissolved) | µg/l | 4.1 | 23  | 12.96 | 6.00  | 1.898  | 0.907 | 1.722  | 14.68 | 11.24 | <0.0001 |
| Zinc (dissolved)     | µg/l | 2.6 | 120 | 31.27 | 36.86 | 11.656 | 0.907 | 10.570 | 41.84 | 20.70 | <0.0001 |

Table 4.2. Statistical analysis of Anodising Rinse effluent samples

| Analytical Parameter<br>(Water Analysis) | Units       | Min    | Max    | Avg    | Std Dev | Std<br>Error | Critical<br>values | Confidence<br>interval | Upper<br>Range | Lower<br>range | %<br>content<br>(upper<br>range) |
|------------------------------------------|-------------|--------|--------|--------|---------|--------------|--------------------|------------------------|----------------|----------------|----------------------------------|
| General Inorganics                       |             |        |        |        |         |              |                    |                        |                |                |                                  |
| pH                                       | pH<br>Units | 1.90   | 10.60  | 6.68   | 4.229   | 1.337        | 0.906889           | 1.21                   | 7.89           | 5.46           | n/a                              |
| Sulphate as SO4                          | mg/l        | 34.60  | 53.60  | 42.18  | 7.810   | 2.470        | 0.906889           | 2.24                   | 44.42          | 39.94          | 0.0444                           |
| Ammoniacal Nitrogen as N                 | µg/l        | 15     | 1300   | 553    | 603.789 | 190.935      | 0.906889           | 173.16                 | 725.93         | 379.62         | 0.0007                           |
| Heavy Metals / Metalloids                |             |        |        |        |         |              |                    |                        |                |                |                                  |
| Boron (dissolved)                        | µg/l        | 330    | 310000 | 131579 | 146358  | 46283        | 0.906889           | 41973                  | 173552         | 89606          | 0.1736                           |
| Calcium (dissolved)                      | mg/l        | 8.40   | 62.00  | 29.29  | 22.575  | 7.139        | 0.906889           | 6.47                   | 35.76          | 22.81          | <0.0001                          |
| Chromium (III)                           | µg/l        | 4.20   | 56.00  | 29.56  | 25.200  | 7.969        | 0.906889           | 7.23                   | 36.79          | 22.34          | <0.0001                          |
| Magnesium (dissolved)                    | mg/l        | 1.20   | 13.00  | 6.58   | 5.745   | 1.817        | 0.906889           | 1.65                   | 8.23           | 4.93           | 0.0082                           |
| Aluminium (dissolved)                    | mg/l        | 147.00 | 336.00 | 228.44 | 71.383  | 22.573       | 0.906889           | 20.47                  | 248.92         | 207.97         | 0.2489                           |
| Arsenic (dissolved)                      | µg/l        | 0.15   | 1.54   | 0.62   | 0.519   | 0.164        | 0.906889           | 0.15                   | 0.77           | 0.47           | 0.0008                           |
| Cadmium (dissolved)                      | µg/l        | 0.02   | 0.10   | 0.06   | 0.034   | 0.011        | 0.906889           | 0.01                   | 0.07           | 0.05           | <0.0001                          |
| Chromium (dissolved)                     | µg/l        | 4.20   | 56.00  | 26.84  | 24.971  | 7.897        | 0.906889           | 7.16                   | 34.01          | 19.68          | <0.0001                          |
| Copper (dissolved)                       | µg/l        | 9.30   | 26.00  | 15.17  | 6.024   | 1.905        | 0.906889           | 1.73                   | 16.89          | 13.44          | <0.0001                          |
| Lead (dissolved)                         | µg/l        | 13.00  | 22.00  | 16.33  | 3.055   | 0.966        | 0.906889           | 0.88                   | 17.21          | 15.46          | <0.0001                          |

Effluent Characterisation

|                      |      |       |        |       |        |        |          |       |       |       |         |
|----------------------|------|-------|--------|-------|--------|--------|----------|-------|-------|-------|---------|
| Nickel (dissolved)   | µg/l | 0.80  | 34.00  | 15.32 | 15.605 | 4.935  | 0.906889 | 4.48  | 19.80 | 10.85 | <0.0001 |
| Vanadium (dissolved) | µg/l | 13.00 | 39.00  | 24.33 | 11.795 | 3.730  | 0.906889 | 3.38  | 27.72 | 20.95 | <0.0001 |
| Zinc (dissolved)     | µg/l | 2.40  | 190.00 | 77.10 | 74.278 | 23.489 | 0.906889 | 21.30 | 98.40 | 55.80 | 0.0001  |

## 5. WASTE CLASSIFICATION ASSESSMENT

As described in section 2, only effluent from the Chrome-free and anodising processes required further analysis. As the analysis undertaken does not specify compounds, potential specific hazard codes cannot be easily ascribed to the effluents analysed. Therefore, a conservative position is proposed whereby all determinands are assessed against the lowest threshold of 0.1% content (with the exception of pH, where a criteria of <2 and >11 is considered to represent a Corrosive or Irritant definition).

For the Chrome-free process, only aluminium has a content >0.1% (0.14%). Assessment of pH provides a range around the mean of 5.48 to 7.62, although it is recognised that there are significant variations with levels between 1.6 and 10.2 depending upon the stage of the rinse process.

For the Anodising process, aluminium (0.25%) and boron (0.17%) are detected at >0.1% content. Assessment of pH provides a range around the mean of 5.46 to 7.89 although it is recognised that there are significant variations with levels between 1.9 and 10.6 depending upon the stage of the rinse process.

The Health and Safety Executive's Mandatory Classification List<sup>2</sup>, which provides a ready assessment of key health and environmental impacts from chemicals, identifies a range of aluminium products (primarily organic complexes) as of potential significance. None of the complex compounds identified in the MCL are anticipated to be present within the effluent (as evidenced by the lack of presence of any significant organic content) and therefore the potential for the presence of aluminium at up to 0.25% content will not trigger a hazard classification.

Boron compounds of concern relate to the boron trihalogen compounds which are primarily gaseous in form, and nickel boride (a catalyst). Nickel presence in the effluent is less than 0.0001%, indicating that the potential for boride to be present as nickel boride is extremely small.

Based upon this assessment, the most appropriate EWC code for the input from the Chrome-free and Anodising processes is considered to be:

11 01 12 aqueous rinsing liquids other than those mentioned in 11 01 11

<sup>2</sup> <https://www.hse.gov.uk/chemical-classification/assets/docs/mcl-list.xlsx>

## 6. SUMMARY

Ramboll was instructed by ALUK to undertake an assessment of the waste water generated within their processes prior to treatment through the on-site effluent treatment plant.

The processes generating the inputs to the effluent treatment plant were reviewed and determined to form three main streams: Effluent from regeneration of ion exchange resins; Chrome-free process (acid and alkali sumps); and Anodising process (acid and alkali sumps). The effluent from ion exchange resin regeneration is identified as an absolute non-hazardous classification, whilst the rinsing effluents from the two processes were identified with mirror entries. Further assessment of the waste streams, the chrome-free and anodising process rinsing effluents, were undertaken to determine the nature of the effluent streams.

Ten samples of effluent from the rinse stages of each process were sent for chemical analysis to determine their composition. The results have then been analysed using the Environment Agency's WM3 methodology and determined to be non-hazardous.

The relevant codes for the inputs to the on-site effluent treatment plant are considered to be:

11 01 12 aqueous rinsing liquids other than those mentioned in 11 01 11

19 09 06 solutions and sludges from regeneration of ion exchangers

APPENDIX 1  
MARCH 2021 SAMPLING RESULTS



**Rob Hodgson**  
Ramboll UK  
8 Village Way  
Cardiff  
CF15 7NE

i2 Analytical Ltd.  
7 Woodshots Meadow,  
Croxley Green  
Business Park,  
Watford,  
Herts,  
WD18 8YS

**t:** 01923 225404  
**f:** 01923 237404  
**e:** reception@i2analytical.com

**e:** rhodgson@ramboll.com

## **Analytical Report Number : 21-63458**

|                             |                  |                                                        |            |
|-----------------------------|------------------|--------------------------------------------------------|------------|
| <b>Project / Site name:</b> |                  | <b>Samples received on:</b>                            | 17/03/2021 |
| <b>Your job number:</b>     |                  | <b>Samples instructed on/<br/>Analysis started on:</b> | 17/03/2021 |
| <b>Your order number:</b>   |                  | <b>Analysis completed by:</b>                          | 23/03/2021 |
| <b>Report Issue Number:</b> | 1                | <b>Report issued on:</b>                               | 23/03/2021 |
| <b>Samples Analysed:</b>    | 10 water samples |                                                        |            |

**Signed:** *Karolina Marek*

Karolina Marek  
PL Head of Reporting Team  
**For & on behalf of i2 Analytical Ltd.**

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting  
leachates - 2 weeks from reporting  
waters - 2 weeks from reporting  
asbestos - 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.  
Application of uncertainty of measurement would provide a range within which the true result lies.  
An estimate of measurement uncertainty can be provided on request.



Analytical Report Number: 21-63458

| Lab Sample Number                        |       |                    |                         | 1807770       | 1807771       | 1807772       | 1807773       | 1807774       |
|------------------------------------------|-------|--------------------|-------------------------|---------------|---------------|---------------|---------------|---------------|
| Sample Reference                         |       |                    |                         | A             | B             | C             | D             | E             |
| Sample Number                            |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m)                                |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Date Sampled                             |       |                    |                         | Deviating     | Deviating     | Deviating     | Deviating     | Deviating     |
| Time Taken                               |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Analytical Parameter<br>(Water Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |               |               |               |

#### General Inorganics

|                             |          |       |           |      |      |      |      |      |
|-----------------------------|----------|-------|-----------|------|------|------|------|------|
| pH                          | pH Units | N/A   | ISO 17025 | 10.2 | 10.2 | 10.2 | 10.2 | 10.2 |
| Total Cyanide               | µg/l     | 10    | ISO 17025 | < 10 | < 10 | < 10 | < 10 | < 10 |
| Sulphate as SO <sub>4</sub> | mg/l     | 0.045 | ISO 17025 | 34.4 | 35.4 | 35.5 | 34.4 | 35.1 |
| Ammoniacal Nitrogen as N    | µg/l     | 15    | ISO 17025 | < 15 | < 15 | < 15 | < 15 | < 15 |

|                  |                        |   |           |      |      |      |      |      |
|------------------|------------------------|---|-----------|------|------|------|------|------|
| Hardness - Total | mgCaCO <sub>3</sub> /l | 1 | ISO 17025 | 33.5 | 41.0 | 42.6 | 49.5 | 49.4 |
|------------------|------------------------|---|-----------|------|------|------|------|------|

#### Total Phenols

|                            |      |    |           |      |      |      |      |    |
|----------------------------|------|----|-----------|------|------|------|------|----|
| Total Phenols (monohydric) | µg/l | 10 | ISO 17025 | < 10 | < 10 | < 10 | < 10 | 12 |
|----------------------------|------|----|-----------|------|------|------|------|----|

#### Speciated PAHs

|                        |      |      |           |        |        |        |        |        |
|------------------------|------|------|-----------|--------|--------|--------|--------|--------|
| Naphthalene            | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Acenaphthylene         | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Acenaphthene           | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Fluorene               | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Phenanthrene           | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Anthracene             | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Fluoranthene           | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Pyrene                 | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(a)anthracene     | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Chrysene               | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(b)fluoranthene   | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(k)fluoranthene   | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(a)pyrene         | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Indeno(1,2,3-cd)pyrene | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Dibenz(a,h)anthracene  | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(ghi)perylene     | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |

#### Total PAH

|                   |      |      |           |        |        |        |        |        |
|-------------------|------|------|-----------|--------|--------|--------|--------|--------|
| Total EPA-16 PAHs | µg/l | 0.16 | ISO 17025 | < 0.16 | < 0.16 | < 0.16 | < 0.16 | < 0.16 |
|-------------------|------|------|-----------|--------|--------|--------|--------|--------|

#### Heavy Metals / Metalloids

|                       |      |       |           |       |       |       |       |       |
|-----------------------|------|-------|-----------|-------|-------|-------|-------|-------|
| Boron (dissolved)     | µg/l | 10    | ISO 17025 | 200   | 130   | 130   | 130   | 110   |
| Calcium (dissolved)   | mg/l | 0.012 | ISO 17025 | 10    | 12    | 13    | 15    | 15    |
| Chromium (hexavalent) | µg/l | 5     | ISO 17025 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Chromium (III)        | µg/l | 1     | NONE      | 2.6   | 3.0   | 2.8   | 2.6   | 2.6   |
| Magnesium (dissolved) | mg/l | 0.005 | ISO 17025 | 2.1   | 2.5   | 2.6   | 3.1   | 3.1   |

|                       |      |       |           |        |        |        |        |        |
|-----------------------|------|-------|-----------|--------|--------|--------|--------|--------|
| Aluminium (dissolved) | mg/l | 0.001 | ISO 17025 | 149    | 129    | 137    | 142    | 127    |
| Arsenic (dissolved)   | µg/l | 0.15  | ISO 17025 | 0.20   | < 0.15 | 0.31   | 0.18   | 0.15   |
| Beryllium (dissolved) | µg/l | 0.1   | ISO 17025 | < 0.1  | < 0.1  | < 0.1  | < 0.1  | < 0.1  |
| Cadmium (dissolved)   | µg/l | 0.02  | ISO 17025 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 |
| Chromium (dissolved)  | µg/l | 0.2   | ISO 17025 | 2.6    | 3.0    | 2.8    | 2.6    | 2.6    |
| Copper (dissolved)    | µg/l | 0.5   | ISO 17025 | 10     | 11     | 10     | 9.5    | 9.8    |
| Lead (dissolved)      | µg/l | 0.2   | ISO 17025 | 5.6    | 8.2    | 7.0    | 7.3    | 7.2    |
| Mercury (dissolved)   | µg/l | 0.05  | ISO 17025 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Nickel (dissolved)    | µg/l | 0.5   | ISO 17025 | < 0.5  | 0.6    | 0.8    | < 0.5  | < 0.5  |
| Selenium (dissolved)  | µg/l | 0.6   | ISO 17025 | 1.9    | 2.0    | 1.7    | 1.8    | 1.7    |
| Vanadium (dissolved)  | µg/l | 0.2   | ISO 17025 | 14     | 14     | 12     | 12     | 13     |
| Zinc (dissolved)      | µg/l | 0.5   | ISO 17025 | 2.9    | 3.6    | 5.7    | 4.9    | 2.6    |



Analytical Report Number: 21-63458

| Lab Sample Number                        |       |                    |                         | 1807770       | 1807771       | 1807772       | 1807773       | 1807774       |
|------------------------------------------|-------|--------------------|-------------------------|---------------|---------------|---------------|---------------|---------------|
| Sample Reference                         |       |                    |                         | A             | B             | C             | D             | E             |
| Sample Number                            |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m)                                |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Date Sampled                             |       |                    |                         | Deviating     | Deviating     | Deviating     | Deviating     | Deviating     |
| Time Taken                               |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Analytical Parameter<br>(Water Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |               |               |               |

#### Monoaromatics & Oxygenates

|                                    |      |   |           |       |       |       |       |       |
|------------------------------------|------|---|-----------|-------|-------|-------|-------|-------|
| Benzene                            | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Toluene                            | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Ethylbenzene                       | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| p & m-xylene                       | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| o-xylene                           | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| MTBE (Methyl Tertiary Butyl Ether) | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |

#### Petroleum Hydrocarbons

|                                |      |    |           |       |       |       |       |       |
|--------------------------------|------|----|-----------|-------|-------|-------|-------|-------|
| TPH-CWG - Aliphatic >C5 - C6   | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aliphatic >C6 - C8   | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aliphatic >C8 - C10  | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aliphatic >C10 - C12 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aliphatic >C12 - C16 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aliphatic >C16 - C21 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aliphatic >C21 - C35 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aliphatic (C5 - C35) | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |

|                               |      |    |           |       |       |       |       |       |
|-------------------------------|------|----|-----------|-------|-------|-------|-------|-------|
| TPH-CWG - Aromatic >C5 - C7   | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aromatic >C7 - C8   | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aromatic >C8 - C10  | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aromatic >C10 - C12 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aromatic >C12 - C16 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aromatic >C16 - C21 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aromatic >C21 - C35 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aromatic (C5 - C35) | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number: 21-63458

|                                          |       |                    |                         |               |               |               |               |               |
|------------------------------------------|-------|--------------------|-------------------------|---------------|---------------|---------------|---------------|---------------|
| Lab Sample Number                        |       |                    |                         | 1807775       | 1807776       | 1807777       | 1807778       | 1807779       |
| Sample Reference                         |       |                    |                         | F             | G             | H             | I             | J             |
| Sample Number                            |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m)                                |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Date Sampled                             |       |                    |                         | Deviating     | Deviating     | Deviating     | Deviating     | Deviating     |
| Time Taken                               |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Analytical Parameter<br>(Water Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |               |               |               |

#### General Inorganics

|                             |          |       |           |       |       |       |       |       |
|-----------------------------|----------|-------|-----------|-------|-------|-------|-------|-------|
| pH                          | pH Units | N/A   | ISO 17025 | 4.3   | 3.9   | 1.6   | 1.9   | 2.8   |
| Total Cyanide               | µg/l     | 10    | ISO 17025 | < 10  | < 10  | < 10  | < 10  | < 10  |
| Sulphate as SO <sub>4</sub> | mg/l     | 0.045 | ISO 17025 | 18.2  | 17.5  | 21.3  | 29.2  | 21.8  |
| Ammoniacal Nitrogen as N    | µg/l     | 15    | ISO 17025 | 29000 | 28000 | 20000 | 13000 | 24000 |

|                  |                        |   |           |      |      |     |     |     |
|------------------|------------------------|---|-----------|------|------|-----|-----|-----|
| Hardness - Total | mgCaCO <sub>3</sub> /l | 1 | ISO 17025 | 94.2 | 95.3 | 130 | 188 | 119 |
|------------------|------------------------|---|-----------|------|------|-----|-----|-----|

#### Total Phenols

|                            |      |    |           |      |      |    |    |      |
|----------------------------|------|----|-----------|------|------|----|----|------|
| Total Phenols (monohydric) | µg/l | 10 | ISO 17025 | < 10 | < 10 | 17 | 28 | < 10 |
|----------------------------|------|----|-----------|------|------|----|----|------|

#### Speciated PAHs

|                        |      |      |           |        |        |        |        |        |
|------------------------|------|------|-----------|--------|--------|--------|--------|--------|
| Naphthalene            | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Acenaphthylene         | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Acenaphthene           | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Fluorene               | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Phenanthrene           | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Anthracene             | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Fluoranthene           | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Pyrene                 | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(a)anthracene     | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Chrysene               | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(b)fluoranthene   | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(k)fluoranthene   | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(a)pyrene         | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Indeno(1,2,3-cd)pyrene | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Dibenz(a,h)anthracene  | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(ghi)perylene     | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |

#### Total PAH

|                   |      |      |           |        |        |        |        |        |
|-------------------|------|------|-----------|--------|--------|--------|--------|--------|
| Total EPA-16 PAHs | µg/l | 0.16 | ISO 17025 | < 0.16 | < 0.16 | < 0.16 | < 0.16 | < 0.16 |
|-------------------|------|------|-----------|--------|--------|--------|--------|--------|

#### Heavy Metals / Metalloids

|                       |      |       |           |       |       |        |        |       |
|-----------------------|------|-------|-----------|-------|-------|--------|--------|-------|
| Boron (dissolved)     | µg/l | 10    | ISO 17025 | 10000 | 14000 | 180000 | 340000 | 78000 |
| Calcium (dissolved)   | mg/l | 0.012 | ISO 17025 | 31    | 31    | 40     | 59     | 38    |
| Chromium (hexavalent) | µg/l | 5     | ISO 17025 | < 5.0 | < 5.0 | < 5.0  | < 5.0  | < 5.0 |
| Chromium (III)        | µg/l | 1     | NONE      | 2.1   | 2.4   | 27     | 40     | 8.4   |
| Magnesium (dissolved) | mg/l | 0.005 | ISO 17025 | 4.3   | 4.2   | 7.2    | 9.5    | 5.8   |

|                       |      |       |           |        |        |        |        |        |
|-----------------------|------|-------|-----------|--------|--------|--------|--------|--------|
| Aluminium (dissolved) | mg/l | 0.001 | ISO 17025 | 52.3   | 53.3   | 209    | 153    | 101    |
| Arsenic (dissolved)   | µg/l | 0.15  | ISO 17025 | 0.59   | 0.53   | 1.06   | 1.53   | 0.59   |
| Beryllium (dissolved) | µg/l | 0.1   | ISO 17025 | < 0.1  | < 0.1  | < 0.1  | < 0.1  | < 0.1  |
| Cadmium (dissolved)   | µg/l | 0.02  | ISO 17025 | 7.4    | 7.0    | 4.2    | 3.0    | 4.5    |
| Chromium (dissolved)  | µg/l | 0.2   | ISO 17025 | 2.1    | 2.4    | 27     | 40     | 8.4    |
| Copper (dissolved)    | µg/l | 0.5   | ISO 17025 | 14     | 15     | 22     | 23     | 12     |
| Lead (dissolved)      | µg/l | 0.2   | ISO 17025 | 3.9    | 8.0    | 16     | 19     | 13     |
| Mercury (dissolved)   | µg/l | 0.05  | ISO 17025 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Nickel (dissolved)    | µg/l | 0.5   | ISO 17025 | 8.6    | 8.7    | 21     | 23     | 12     |
| Selenium (dissolved)  | µg/l | 0.6   | ISO 17025 | 1.2    | 1.3    | 1.4    | 0.9    | 0.8    |
| Vanadium (dissolved)  | µg/l | 0.2   | ISO 17025 | 4.1    | 4.9    | 23     | 23     | 9.6    |
| Zinc (dissolved)      | µg/l | 0.5   | ISO 17025 | 25     | 30     | 73     | 120    | 45     |



Analytical Report Number: 21-63458

| Lab Sample Number                        |       |                    |                         | 1807775       | 1807776       | 1807777       | 1807778       | 1807779       |
|------------------------------------------|-------|--------------------|-------------------------|---------------|---------------|---------------|---------------|---------------|
| Sample Reference                         |       |                    |                         | F             | G             | H             | I             | J             |
| Sample Number                            |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m)                                |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Date Sampled                             |       |                    |                         | Deviating     | Deviating     | Deviating     | Deviating     | Deviating     |
| Time Taken                               |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Analytical Parameter<br>(Water Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |               |               |               |

#### Monoaromatics & Oxygenates

|                                    |      |   |           |       |       |       |       |       |
|------------------------------------|------|---|-----------|-------|-------|-------|-------|-------|
| Benzene                            | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Toluene                            | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Ethylbenzene                       | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| p & m-xylene                       | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| o-xylene                           | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| MTBE (Methyl Tertiary Butyl Ether) | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |

#### Petroleum Hydrocarbons

|                                |      |    |           |       |       |       |       |       |
|--------------------------------|------|----|-----------|-------|-------|-------|-------|-------|
| TPH-CWG - Aliphatic >C5 - C6   | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aliphatic >C6 - C8   | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aliphatic >C8 - C10  | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aliphatic >C10 - C12 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aliphatic >C12 - C16 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aliphatic >C16 - C21 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aliphatic >C21 - C35 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aliphatic (C5 - C35) | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |

|                               |      |    |           |       |       |       |       |       |
|-------------------------------|------|----|-----------|-------|-------|-------|-------|-------|
| TPH-CWG - Aromatic >C5 - C7   | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aromatic >C7 - C8   | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aromatic >C8 - C10  | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aromatic >C10 - C12 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aromatic >C12 - C16 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aromatic >C16 - C21 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aromatic >C21 - C35 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aromatic (C5 - C35) | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number : 21-63458

Project / Site name:

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

| Analytical Test Name                   | Analytical Method Description                                                                                                                                              | Analytical Method Reference                                                                                     | Method number | Wet / Dry Analysis | Accreditation Status |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------|--------------------|----------------------|
| Metals in water by ICP-MS (dissolved)  | Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.                                  | In-house method based on USEPA Method 6020 & 200.8 "for the determination of trace elements in water by ICP-MS. | L012-PL       | W                  | ISO 17025            |
| Boron in water                         | Determination of boron in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW                                                                        | In-house method based on MEWAM                                                                                  | L039-PL       | W                  | ISO 17025            |
| Metals in water by ICP-OES (dissolved) | Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW, PrW.(Al, Cu,Fe,Zn).                                                 | In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.                            | L039-PL       | W                  | ISO 17025            |
| Hexavalent chromium in water           | Determination of hexavalent chromium in water by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.                                                 | In-house method by continuous flow analyser. Accredited Matrices SW, GW, PW.                                    | L080-PL       | W                  | ISO 17025            |
| Total Hardness of water                | Determination of hardness in waters by calculation from calcium and magnesium. Accredited Matrices SW, GW, PW.                                                             | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton          | L045-PL       | W                  | ISO 17025            |
| Monohydric phenols in water            | Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW                                                                               | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar) | L080-PL       | W                  | ISO 17025            |
| Speciated EPA-16 PAHs in water         | Determination of PAH compounds in water by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards. Accredited matrices: SW PW GW | In-house method based on USEPA 8270                                                                             | L102B-PL      | W                  | ISO 17025            |
| Sulphate in water                      | Determination of sulphate in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW, PrW.                                                               | In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.                            | L039-PL       | W                  | ISO 17025            |
| TPHCWG (Waters)                        | Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.                                                                 | In-house method                                                                                                 | L070-PL       | W                  | NONE                 |
| Total cyanide in water                 | Determination of total cyanide by distillation followed by colorimetry. Accredited matrices: SW PW GW                                                                      | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar) | L080-PL       | W                  | ISO 17025            |
| BTEX and MTBE in water (Monoaromatics) | Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW                                                                                  | In-house method based on USEPA8260                                                                              | L073B-PL      | W                  | ISO 17025            |
| Ammoniacal Nitrogen as N in water      | Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the discrete analyser (colorimetric) salicylate/nitroprusside method. Accredited matrices SW, GW, PW.            | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton          | L082-PL       | W                  | ISO 17025            |
| Cr (III) in water                      | In-house method by calculation from total Cr and Cr VI.                                                                                                                    | In-house method by calculation                                                                                  | L080-PL       | W                  | NONE                 |
| pH at 20oC in water (automated)        | Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW                                                                                   | In house method.                                                                                                | L099-PL       | W                  | ISO 17025            |

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

## Sample Deviation Report



**Analytical Report Number : 21-63458**

**Project / Site name:**

| Sample ID | Other ID      | Sample Type | Lab Sample Number | Sample Deviation | Test Name                              | Test Ref | Test Deviation |
|-----------|---------------|-------------|-------------------|------------------|----------------------------------------|----------|----------------|
| A         | None Supplied | W           | 1807770           | ad               | BTEX and MTBE in water (Monoaromatics) | L073B-PL | d              |
| A         | None Supplied | W           | 1807770           | ad               | Ammoniacal Nitrogen as N in water      | L082-PL  | d              |
| A         | None Supplied | W           | 1807770           | ad               | TPHCWG (Waters)                        | L070-PL  | d              |
| B         | None Supplied | W           | 1807771           | ad               | BTEX and MTBE in water (Monoaromatics) | L073B-PL | d              |
| B         | None Supplied | W           | 1807771           | ad               | Ammoniacal Nitrogen as N in water      | L082-PL  | d              |
| B         | None Supplied | W           | 1807771           | ad               | TPHCWG (Waters)                        | L070-PL  | d              |
| C         | None Supplied | W           | 1807772           | ad               | BTEX and MTBE in water (Monoaromatics) | L073B-PL | d              |
| C         | None Supplied | W           | 1807772           | ad               | Ammoniacal Nitrogen as N in water      | L082-PL  | d              |
| C         | None Supplied | W           | 1807772           | ad               | TPHCWG (Waters)                        | L070-PL  | d              |
| D         | None Supplied | W           | 1807773           | ad               | BTEX and MTBE in water (Monoaromatics) | L073B-PL | d              |
| D         | None Supplied | W           | 1807773           | ad               | Ammoniacal Nitrogen as N in water      | L082-PL  | d              |
| D         | None Supplied | W           | 1807773           | ad               | TPHCWG (Waters)                        | L070-PL  | d              |
| E         | None Supplied | W           | 1807774           | ad               | BTEX and MTBE in water (Monoaromatics) | L073B-PL | d              |
| E         | None Supplied | W           | 1807774           | ad               | Ammoniacal Nitrogen as N in water      | L082-PL  | d              |
| E         | None Supplied | W           | 1807774           | ad               | TPHCWG (Waters)                        | L070-PL  | d              |
| F         | None Supplied | W           | 1807775           | ad               | BTEX and MTBE in water (Monoaromatics) | L073B-PL | d              |
| F         | None Supplied | W           | 1807775           | ad               | Ammoniacal Nitrogen as N in water      | L082-PL  | d              |
| F         | None Supplied | W           | 1807775           | ad               | TPHCWG (Waters)                        | L070-PL  | d              |
| G         | None Supplied | W           | 1807776           | ad               | BTEX and MTBE in water (Monoaromatics) | L073B-PL | d              |
| G         | None Supplied | W           | 1807776           | ad               | Ammoniacal Nitrogen as N in water      | L082-PL  | d              |
| G         | None Supplied | W           | 1807776           | ad               | TPHCWG (Waters)                        | L070-PL  | d              |
| H         | None Supplied | W           | 1807777           | ad               | BTEX and MTBE in water (Monoaromatics) | L073B-PL | d              |
| H         | None Supplied | W           | 1807777           | ad               | Ammoniacal Nitrogen as N in water      | L082-PL  | d              |
| H         | None Supplied | W           | 1807777           | ad               | TPHCWG (Waters)                        | L070-PL  | d              |
| I         | None Supplied | W           | 1807778           | ad               | BTEX and MTBE in water (Monoaromatics) | L073B-PL | d              |
| I         | None Supplied | W           | 1807778           | ad               | Ammoniacal Nitrogen as N in water      | L082-PL  | d              |
| I         | None Supplied | W           | 1807778           | ad               | TPHCWG (Waters)                        | L070-PL  | d              |
| J         | None Supplied | W           | 1807779           | ad               | BTEX and MTBE in water (Monoaromatics) | L073B-PL | d              |
| J         | None Supplied | W           | 1807779           | ad               | Ammoniacal Nitrogen as N in water      | L082-PL  | d              |
| J         | None Supplied | W           | 1807779           | ad               | TPHCWG (Waters)                        | L070-PL  | d              |

Ramboll - ALUK Chepstow

Effluent Characterisation

## APPENDIX 2

### APRIL 2021 SAMPLING RESULTS



**Rob Hodgson**  
Ramboll UK  
8 Village Way  
Cardiff  
CF15 7NE

i2 Analytical Ltd.  
7 Woodshots Meadow,  
Croxley Green  
Business Park,  
Watford,  
Herts,  
WD18 8YS

**t:** 01923 225404  
**f:** 01923 237404  
**e:** reception@i2analytical.com

**e:** rhodgson@ramboll.com

## **Analytical Report Number : 21-72391**

|                             |                  |                                                        |            |
|-----------------------------|------------------|--------------------------------------------------------|------------|
| <b>Project / Site name:</b> | ALUK GB LTD      | <b>Samples received on:</b>                            | 29/04/2021 |
| <b>Your job number:</b>     | 1620003133       | <b>Samples instructed on/<br/>Analysis started on:</b> | 04/05/2021 |
| <b>Your order number:</b>   | 1620039951       | <b>Analysis completed by:</b>                          | 10/05/2021 |
| <b>Report Issue Number:</b> | 1                | <b>Report issued on:</b>                               | 10/05/2021 |
| <b>Samples Analysed:</b>    | 10 water samples |                                                        |            |

*Izabela Wójcik*  
**Signed:**

Izabela Wójcik  
Technical Reviewer (Reporting Team)  
**For & on behalf of i2 Analytical Ltd.**

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting  
leachates - 2 weeks from reporting  
waters - 2 weeks from reporting  
asbestos - 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.  
Application of uncertainty of measurement would provide a range within which the true result lies.  
An estimate of measurement uncertainty can be provided on request.



Analytical Report Number: 21-72391

Project / Site name: ALUK GB LTD

Your Order No: 1620039951

|                                          |  |  |  |               |                    |                      |               |               |
|------------------------------------------|--|--|--|---------------|--------------------|----------------------|---------------|---------------|
| Lab Sample Number                        |  |  |  | 1857006       | 1857007            | 1857008              | 1857009       | 1857010       |
| Sample Reference                         |  |  |  | Acid Rinse A  | Alkaline A         | Acid Rinse C         | Alkaline C    | Acid Rinse E  |
| Sample Number                            |  |  |  | None Supplied | None Supplied      | None Supplied        | None Supplied | None Supplied |
| Depth (m)                                |  |  |  | None Supplied | None Supplied      | None Supplied        | None Supplied | None Supplied |
| Date Sampled                             |  |  |  | 27/04/2021    | 27/04/2021         | 27/04/2021           | 27/04/2021    | 27/04/2021    |
| Time Taken                               |  |  |  | None Supplied | None Supplied      | None Supplied        | None Supplied | None Supplied |
| Analytical Parameter<br>(Water Analysis) |  |  |  | Units         | Limit of detection | Accreditation Status |               |               |

#### General Inorganics

|                             |          |       |           |      |      |      |      |      |
|-----------------------------|----------|-------|-----------|------|------|------|------|------|
| pH                          | pH Units | N/A   | ISO 17025 | 2.0  | 10.6 | 1.9  | 10.5 | 1.9  |
| Total Cyanide               | µg/l     | 10    | ISO 17025 | < 10 | < 10 | < 10 | < 10 | < 10 |
| Sulphate as SO <sub>4</sub> | mg/l     | 0.045 | ISO 17025 | 53.6 | 35.5 | 51.8 | 34.6 | 51.7 |
| Ammoniacal Nitrogen as N    | µg/l     | 15    | ISO 17025 | 1200 | < 15 | 1300 | < 15 | 1300 |

|                  |                        |   |           |     |      |     |      |     |
|------------------|------------------------|---|-----------|-----|------|-----|------|-----|
| Hardness - Total | mgCaCO <sub>3</sub> /l | 1 | ISO 17025 | 189 | 28.4 | 180 | 31.7 | 174 |
|------------------|------------------------|---|-----------|-----|------|-----|------|-----|

#### Total Phenols

|                            |      |    |           |      |      |      |      |      |
|----------------------------|------|----|-----------|------|------|------|------|------|
| Total Phenols (monohydric) | µg/l | 10 | ISO 17025 | < 10 | < 10 | < 10 | < 10 | < 10 |
|----------------------------|------|----|-----------|------|------|------|------|------|

#### Speciated PAHs

|                        |      |      |           |        |        |        |        |        |
|------------------------|------|------|-----------|--------|--------|--------|--------|--------|
| Naphthalene            | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Acenaphthylene         | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Acenaphthene           | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Fluorene               | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Phenanthrene           | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Anthracene             | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Fluoranthene           | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Pyrene                 | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(a)anthracene     | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Chrysene               | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(b)fluoranthene   | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(k)fluoranthene   | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(a)pyrene         | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Indeno(1,2,3-cd)pyrene | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Dibenz(a,h)anthracene  | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(ghi)perylene     | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |

#### Total PAH

|                   |      |      |           |        |        |        |        |        |
|-------------------|------|------|-----------|--------|--------|--------|--------|--------|
| Total EPA-16 PAHs | µg/l | 0.16 | ISO 17025 | < 0.16 | < 0.16 | < 0.16 | < 0.16 | < 0.16 |
|-------------------|------|------|-----------|--------|--------|--------|--------|--------|



Analytical Report Number: 21-72391

Project / Site name: ALUK GB LTD

Your Order No: 1620039951

| Lab Sample Number                        |  |  |  | 1857006       | 1857007            | 1857008              | 1857009       | 1857010       |
|------------------------------------------|--|--|--|---------------|--------------------|----------------------|---------------|---------------|
| Sample Reference                         |  |  |  | Acid Rinse A  | Alkaline A         | Acid Rinse C         | Alkaline C    | Acid Rinse E  |
| Sample Number                            |  |  |  | None Supplied | None Supplied      | None Supplied        | None Supplied | None Supplied |
| Depth (m)                                |  |  |  | None Supplied | None Supplied      | None Supplied        | None Supplied | None Supplied |
| Date Sampled                             |  |  |  | 27/04/2021    | 27/04/2021         | 27/04/2021           | 27/04/2021    | 27/04/2021    |
| Time Taken                               |  |  |  | None Supplied | None Supplied      | None Supplied        | None Supplied | None Supplied |
| Analytical Parameter<br>(Water Analysis) |  |  |  | Units         | Limit of detection | Accreditation Status |               |               |

#### Heavy Metals / Metalloids

|                       |      |       |           |        |       |        |       |        |
|-----------------------|------|-------|-----------|--------|-------|--------|-------|--------|
| Boron (dissolved)     | µg/l | 10    | ISO 17025 | 270000 | 330   | 280000 | 780   | 310000 |
| Calcium (dissolved)   | mg/l | 0.012 | ISO 17025 | 55     | 9.4   | 51     | 10    | 49     |
| Chromium (hexavalent) | µg/l | 5     | ISO 17025 | < 5.0  | < 5.0 | < 5.0  | < 5.0 | < 5.0  |
| Chromium (III)        | µg/l | 1     | NONE      | 51     | 4.2   | 55     | 4.6   | 56     |
| Magnesium (dissolved) | mg/l | 0.005 | ISO 17025 | 12     | 1.2   | 13     | 1.4   | 13     |

|                       |      |       |           |        |        |        |        |        |
|-----------------------|------|-------|-----------|--------|--------|--------|--------|--------|
| Aluminium (dissolved) | mg/l | 0.001 | ISO 17025 | 242    | 195    | 310    | 147    | 298    |
| Arsenic (dissolved)   | µg/l | 0.15  | ISO 17025 | 1.54   | < 0.15 | 1.26   | < 0.15 | 1.14   |
| Beryllium (dissolved) | µg/l | 0.1   | ISO 17025 | < 0.1  | < 0.1  | < 0.1  | < 0.1  | < 0.1  |
| Cadmium (dissolved)   | µg/l | 0.02  | ISO 17025 | 0.09   | < 0.02 | 0.09   | < 0.02 | 0.09   |
| Chromium (dissolved)  | µg/l | 0.2   | ISO 17025 | 51     | 4.2    | 55     | 4.6    | 56     |
| Copper (dissolved)    | µg/l | 0.5   | ISO 17025 | 20     | 12     | 26     | 9.3    | 22     |
| Lead (dissolved)      | µg/l | 0.2   | ISO 17025 | 13     | 13     | 13     | 22     | 13     |
| Mercury (dissolved)   | µg/l | 0.05  | ISO 17025 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Nickel (dissolved)    | µg/l | 0.5   | ISO 17025 | 32     | 2.3    | 32     | 1.0    | 34     |
| Selenium (dissolved)  | µg/l | 0.6   | ISO 17025 | < 0.6  | < 0.6  | < 0.6  | < 0.6  | < 0.6  |
| Vanadium (dissolved)  | µg/l | 0.2   | ISO 17025 | 36     | 13     | 37     | 14     | 39     |
| Zinc (dissolved)      | µg/l | 0.5   | ISO 17025 | 99     | 44     | 130    | 4.9    | 160    |

#### Monoaromatics & Oxygenates

|                                    |      |   |           |       |       |       |       |       |
|------------------------------------|------|---|-----------|-------|-------|-------|-------|-------|
| Benzene                            | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Toluene                            | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Ethylbenzene                       | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| p & m-xylene                       | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| o-xylene                           | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| MTBE (Methyl Tertiary Butyl Ether) | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |

#### Petroleum Hydrocarbons

|                                |      |    |           |       |       |       |       |       |
|--------------------------------|------|----|-----------|-------|-------|-------|-------|-------|
| TPH-CWG - Aliphatic >C5 - C6   | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aliphatic >C6 - C8   | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aliphatic >C8 - C10  | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aliphatic >C10 - C12 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aliphatic >C12 - C16 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aliphatic >C16 - C21 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aliphatic >C21 - C35 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aliphatic (C5 - C35) | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |

|                               |      |    |           |       |       |       |       |       |
|-------------------------------|------|----|-----------|-------|-------|-------|-------|-------|
| TPH-CWG - Aromatic >C5 - C7   | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aromatic >C7 - C8   | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aromatic >C8 - C10  | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aromatic >C10 - C12 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aromatic >C12 - C16 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aromatic >C16 - C21 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aromatic >C21 - C35 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aromatic (C5 - C35) | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |

U/S = Unsuitable Sample I/S = Insufficient Sample

\*U/S due to high variances between chromium (hexavalent) and chromium (dissolved) caused by method differences.



Analytical Report Number: 21-72391

Project / Site name: ALUK GB LTD

Your Order No: 1620039951

|                                          |       |                    |                      |               |               |               |               |               |
|------------------------------------------|-------|--------------------|----------------------|---------------|---------------|---------------|---------------|---------------|
| Lab Sample Number                        |       |                    |                      | 1857011       | 1857012       | 1857013       | 1857014       | 1857015       |
| Sample Reference                         |       |                    |                      | Alkaline E    | Acid Rinse G  | Alkaline G    | Acid Rinse I  | Alkaline I    |
| Sample Number                            |       |                    |                      | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m)                                |       |                    |                      | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Date Sampled                             |       |                    |                      | 27/04/2021    | 27/04/2021    | 27/04/2021    | 27/04/2021    | 27/04/2021    |
| Time Taken                               |       |                    |                      | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Analytical Parameter<br>(Water Analysis) | Units | Limit of detection | Accreditation Status |               |               |               |               |               |

#### General Inorganics

|                             |          |       |           |      |      |      |      |      |
|-----------------------------|----------|-------|-----------|------|------|------|------|------|
| pH                          | pH Units | N/A   | ISO 17025 | 10.4 | 2.0  | 10.4 | 2.0  | 10.4 |
| Total Cyanide               | µg/l     | 10    | ISO 17025 | < 10 | < 10 | < 10 | < 10 | < 10 |
| Sulphate as SO <sub>4</sub> | mg/l     | 0.045 | ISO 17025 | 35.0 | 50.5 | 35.3 | 49.5 | 35.7 |
| Ammoniacal Nitrogen as N    | µg/l     | 15    | ISO 17025 | < 15 | 1100 | < 15 | 1200 | < 15 |

|                  |                        |   |           |      |     |      |     |      |
|------------------|------------------------|---|-----------|------|-----|------|-----|------|
| Hardness - Total | mgCaCO <sub>3</sub> /l | 1 | ISO 17025 | 28.1 | 189 | 26.7 | 208 | 31.8 |
|------------------|------------------------|---|-----------|------|-----|------|-----|------|

#### Total Phenols

|                            |      |    |           |      |      |      |      |      |
|----------------------------|------|----|-----------|------|------|------|------|------|
| Total Phenols (monohydric) | µg/l | 10 | ISO 17025 | < 10 | < 10 | < 10 | < 10 | < 10 |
|----------------------------|------|----|-----------|------|------|------|------|------|

#### Speciated PAHs

|                        |      |      |           |        |        |        |        |        |
|------------------------|------|------|-----------|--------|--------|--------|--------|--------|
| Naphthalene            | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Acenaphthylene         | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Acenaphthene           | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Fluorene               | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Phenanthrene           | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Anthracene             | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Fluoranthene           | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Pyrene                 | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(a)anthracene     | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Chrysene               | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(b)fluoranthene   | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(k)fluoranthene   | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(a)pyrene         | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Indeno(1,2,3-cd)pyrene | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Dibenz(a,h)anthracene  | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(ghi)perylene     | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |

#### Total PAH

|                   |      |      |           |        |        |        |        |        |
|-------------------|------|------|-----------|--------|--------|--------|--------|--------|
| Total EPA-16 PAHs | µg/l | 0.16 | ISO 17025 | < 0.16 | < 0.16 | < 0.16 | < 0.16 | < 0.16 |
|-------------------|------|------|-----------|--------|--------|--------|--------|--------|



Analytical Report Number: 21-72391

Project / Site name: ALUK GB LTD

Your Order No: 1620039951

| Lab Sample Number                        |       |                    |                         | 1857011       | 1857012       | 1857013       | 1857014       | 1857015       |
|------------------------------------------|-------|--------------------|-------------------------|---------------|---------------|---------------|---------------|---------------|
| Sample Reference                         |       |                    |                         | Alkaline E    | Acid Rinse G  | Alkaline G    | Acid Rinse I  | Alkaline I    |
| Sample Number                            |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m)                                |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Date Sampled                             |       |                    |                         | 27/04/2021    | 27/04/2021    | 27/04/2021    | 27/04/2021    | 27/04/2021    |
| Time Taken                               |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Analytical Parameter<br>(Water Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |               |               |               |

#### Heavy Metals / Metalloids

|                       |      |       |           |       |        |       |        |      |
|-----------------------|------|-------|-----------|-------|--------|-------|--------|------|
| Boron (dissolved)     | µg/l | 10    | ISO 17025 | 1100  | 300000 | 1000  | 290000 | 1000 |
| Calcium (dissolved)   | mg/l | 0.012 | ISO 17025 | 8.8   | 55     | 8.4   | 62     | 10   |
| Chromium (hexavalent) | µg/l | 5     | ISO 17025 | < 5.0 | < 5.0  | < 5.0 | < 5.0  | U/S* |
| Chromium (III)        | µg/l | 1     | NONE      | 4.4   | 55     | 4.3   | 53     | U/S* |
| Magnesium (dissolved) | mg/l | 0.005 | ISO 17025 | 1.5   | 13     | 1.4   | 13     | 1.7  |

|                       |      |       |           |        |        |        |        |        |
|-----------------------|------|-------|-----------|--------|--------|--------|--------|--------|
| Aluminium (dissolved) | mg/l | 0.001 | ISO 17025 | 150    | 336    | 202    | 270    | 148    |
| Arsenic (dissolved)   | µg/l | 0.15  | ISO 17025 | < 0.15 | 1.23   | 0.18   | 1.17   | 0.16   |
| Beryllium (dissolved) | µg/l | 0.1   | ISO 17025 | < 0.1  | < 0.1  | < 0.1  | < 0.1  | < 0.1  |
| Cadmium (dissolved)   | µg/l | 0.02  | ISO 17025 | 0.06   | 0.09   | < 0.02 | 0.10   | < 0.02 |
| Chromium (dissolved)  | µg/l | 0.2   | ISO 17025 | 4.4    | 55     | 4.3    | 53     | 5.1    |
| Copper (dissolved)    | µg/l | 0.5   | ISO 17025 | 9.8    | 19     | 10     | 19     | 9.4    |
| Lead (dissolved)      | µg/l | 0.2   | ISO 17025 | 18     | 16     | 20     | 15     | 17     |
| Mercury (dissolved)   | µg/l | 0.05  | ISO 17025 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Nickel (dissolved)    | µg/l | 0.5   | ISO 17025 | 0.8    | 33     | 2.0    | 32     | 0.8    |
| Selenium (dissolved)  | µg/l | 0.6   | ISO 17025 | < 0.6  | < 0.6  | < 0.6  | < 0.6  | < 0.6  |
| Vanadium (dissolved)  | µg/l | 0.2   | ISO 17025 | 14     | 37     | 14     | 37     | 14     |
| Zinc (dissolved)      | µg/l | 0.5   | ISO 17025 | 2.4    | 190    | 8.5    | 150    | 4.1    |

#### Monoaromatics & Oxygenates

|                                    |      |   |           |       |       |       |       |       |
|------------------------------------|------|---|-----------|-------|-------|-------|-------|-------|
| Benzene                            | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Toluene                            | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Ethylbenzene                       | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| p & m-xylene                       | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| o-xylene                           | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| MTBE (Methyl Tertiary Butyl Ether) | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |

#### Petroleum Hydrocarbons

|                                |      |    |           |       |       |       |       |       |
|--------------------------------|------|----|-----------|-------|-------|-------|-------|-------|
| TPH-CWG - Aliphatic >C5 - C6   | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aliphatic >C6 - C8   | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aliphatic >C8 - C10  | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aliphatic >C10 - C12 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aliphatic >C12 - C16 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aliphatic >C16 - C21 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aliphatic >C21 - C35 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aliphatic (C5 - C35) | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |

|                               |      |    |           |       |       |       |       |       |
|-------------------------------|------|----|-----------|-------|-------|-------|-------|-------|
| TPH-CWG - Aromatic >C5 - C7   | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aromatic >C7 - C8   | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aromatic >C8 - C10  | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| TPH-CWG - Aromatic >C10 - C12 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aromatic >C12 - C16 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aromatic >C16 - C21 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aromatic >C21 - C35 | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |
| TPH-CWG - Aromatic (C5 - C35) | µg/l | 10 | NONE      | < 10  | < 10  | < 10  | < 10  | < 10  |

U/S = Unsuitable Sample I/S = Insufficient Sample

\*U/S due to high variances between chromium (hexavalent) and chromium (dissolved) caused by method differences.



Analytical Report Number : 21-72391

Project / Site name: ALUK GB LTD

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

| Analytical Test Name                   | Analytical Method Description                                                                                                                                              | Analytical Method Reference                                                                                     | Method number | Wet / Dry Analysis | Accreditation Status |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------|--------------------|----------------------|
| Metals in water by ICP-MS (dissolved)  | Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.                                  | In-house method based on USEPA Method 6020 & 200.8 "for the determination of trace elements in water by ICP-MS. | L012-PL       | W                  | ISO 17025            |
| Metals in water by ICP-OES (dissolved) | Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW, PrW.(Al, Cu,Fe,Zn).                                                 | In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.                            | L039-PL       | W                  | ISO 17025            |
| Boron in water                         | Determination of boron in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW                                                                        | In-house method based on MEWAM                                                                                  | L039-PL       | W                  | ISO 17025            |
| Hexavalent chromium in water           | Determination of hexavalent chromium in water by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.                                                 | In-house method by continuous flow analyser. Accredited Matrices SW, GW, PW.                                    | L080-PL       | W                  | ISO 17025            |
| Total Hardness of water                | Determination of hardness in waters by calculation from calcium and magnesium. Accredited Matrices SW, GW, PW.                                                             | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton          | L045-PL       | W                  | ISO 17025            |
| Monohydric phenols in water            | Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW                                                                               | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar) | L080-PL       | W                  | ISO 17025            |
| Speciated EPA-16 PAHs in water         | Determination of PAH compounds in water by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards. Accredited matrices: SW PW GW | In-house method based on USEPA 8270                                                                             | L102B-PL      | W                  | ISO 17025            |
| Sulphate in water                      | Determination of sulphate in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW, PrW.                                                               | In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.                            | L039-PL       | W                  | ISO 17025            |
| TPHCWG (Waters)                        | Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.                                                                 | In-house method                                                                                                 | L070-PL       | W                  | NONE                 |
| Total cyanide in water                 | Determination of total cyanide by distillation followed by colorimetry. Accredited matrices: SW PW GW                                                                      | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar) | L080-PL       | W                  | ISO 17025            |
| BTEX and MTBE in water (Monoaromatics) | Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW                                                                                  | In-house method based on USEPA8260                                                                              | L073B-PL      | W                  | ISO 17025            |
| Ammoniacal Nitrogen as N in water      | Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the discrete analyser (colorimetric) salicylate/nitroprusside method. Accredited matrices SW, GW, PW.            | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton          | L082-PL       | W                  | ISO 17025            |
| Cr (III) in water                      | In-house method by calculation from total Cr and Cr VI.                                                                                                                    | In-house method by calculation                                                                                  | L080-PL       | W                  | NONE                 |
| pH at 20oC in water (automated)        | Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW                                                                                   | In house method.                                                                                                | L099-PL       | W                  | ISO 17025            |

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

## Sample Deviation Report



**Analytical Report Number : 21-72391**

**Project / Site name: ALUK GB LTD**

| Sample ID    | Other ID      | Sample Type | Lab Sample Number | Sample Deviation | Test Name                         | Test Ref | Test Deviation |
|--------------|---------------|-------------|-------------------|------------------|-----------------------------------|----------|----------------|
| Acid Rinse A | None Supplied | W           | 1857006           | c                | Ammoniacal Nitrogen as N in water | L082-PL  | c              |
| Acid Rinse A | None Supplied | W           | 1857006           | c                | pH at 20oC in water (automated)   | L099-PL  | c              |
| Acid Rinse C | None Supplied | W           | 1857008           | c                | Ammoniacal Nitrogen as N in water | L082-PL  | c              |
| Acid Rinse C | None Supplied | W           | 1857008           | c                | pH at 20oC in water (automated)   | L099-PL  | c              |
| Acid Rinse E | None Supplied | W           | 1857010           | c                | Ammoniacal Nitrogen as N in water | L082-PL  | c              |
| Acid Rinse E | None Supplied | W           | 1857010           | c                | pH at 20oC in water (automated)   | L099-PL  | c              |
| Acid Rinse G | None Supplied | W           | 1857012           | c                | Ammoniacal Nitrogen as N in water | L082-PL  | c              |
| Acid Rinse G | None Supplied | W           | 1857012           | c                | pH at 20oC in water (automated)   | L099-PL  | c              |
| Acid Rinse I | None Supplied | W           | 1857014           | c                | Ammoniacal Nitrogen as N in water | L082-PL  | c              |
| Acid Rinse I | None Supplied | W           | 1857014           | c                | pH at 20oC in water (automated)   | L099-PL  | c              |
| Alkaline A   | None Supplied | W           | 1857007           | c                | Ammoniacal Nitrogen as N in water | L082-PL  | c              |
| Alkaline A   | None Supplied | W           | 1857007           | c                | pH at 20oC in water (automated)   | L099-PL  | c              |
| Alkaline C   | None Supplied | W           | 1857009           | c                | Ammoniacal Nitrogen as N in water | L082-PL  | c              |
| Alkaline C   | None Supplied | W           | 1857009           | c                | pH at 20oC in water (automated)   | L099-PL  | c              |
| Alkaline E   | None Supplied | W           | 1857011           | c                | Ammoniacal Nitrogen as N in water | L082-PL  | c              |
| Alkaline E   | None Supplied | W           | 1857011           | c                | pH at 20oC in water (automated)   | L099-PL  | c              |
| Alkaline G   | None Supplied | W           | 1857013           | c                | Ammoniacal Nitrogen as N in water | L082-PL  | c              |
| Alkaline G   | None Supplied | W           | 1857013           | c                | pH at 20oC in water (automated)   | L099-PL  | c              |
| Alkaline I   | None Supplied | W           | 1857015           | c                | Ammoniacal Nitrogen as N in water | L082-PL  | c              |
| Alkaline I   | None Supplied | W           | 1857015           | c                | pH at 20oC in water (automated)   | L099-PL  | c              |